Intel[®] Video Pro Analyzer

Version 2.3.0

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Revision History:

Revision Number	Date	Description
1.0	10/2/13	Initial Draft
1.1	1/2/14	Updated text and screenshots for new features
1.2	7/11/14	Updated text for C++ version
1.2.1	8/28/14	Added descriptions for new feature, updated pictures
1.3.0	10/3/14	Updated documentation for 1.3.0 release
1.3.5	12/10/14	Updated documentation for 1.3.5 release
1.4.0	02/23/15	Added description for AVC
1.5.0	03/27/15	Added description for MPEG2, updated AVC/HEVC/VP9 descriptions
1.5.2	05/25/15	Updated index, small corrections
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2.0.0	08/18/15	Updated AVC description and screenshots with new GUI and options
2.1.0	11/11/15	Added description of dual view mode and other updates
2.2.0	03/18/16	Updated manual with new features
2.3.0	07/18/16	Added descript of indexing mode and some new features

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1 Overview

Intel Video Pro Analyzer is a graphical coded video bitstream analysis tool, supporting the following coding standards:

- HEVC: (ISO/IEC 23008-2 MPEG-H Part 2 or ITU-T H.265) , 8/10-bit
- HEVC: RExt extension, 8/10/12-bit, 4:0:0/4:2:0/4:2:2/4:4:4
- HEVC: SCC extension, conform to HM + SCM 8.0 in reference code
- HEVC Scalable/Multiview Extension
- Google's VP9, profiles 0,1,2,3, 4:2:0/4:2:2/4:4:0/4:4:4, 8/10/12-bit
- AVC: (H.264/AVC, ISO/IEC 14496-10, MPEG-4 Part 10), except SVC/MVC
- MPEG2 (ISO/IEC 13818-2 Part 2), 4:2:0/4:2:2, 8-bit
- MKV container
- MP4 container
- MPEG2 TS/PS container
- AVI container
- Mpeg Media Transport container

Once a bitstream is loaded, the tool allows the user to inspect each major step of the decode process visually and numerically, and the structure of the coded image can be explored. This data can be used as a visual reference when learning about HEVC/VP9/AVC/MPEG2 or when debugging a particular encoder or decoder.

Intel Video Pro Analyzer is written in C++. There are separate packages for each supported operation system – Windows*, Linux*, Mac* OS X*.

Term	Definition
CABAC	Context-adaptive binary arithmetic coding
СТВ	Coding Tree Block
CU	Coding Unit
CVC	Coded Video Stream
GUI/UI	(Graphical) User Interface
HEVC	High Efficiency Video Coding
NAL	Network Abstraction Layer
PPS	Picture Parameter Set
PU	Prediction Unit
QM	Quantization Matrix
SAO	Sample adaptive offset
SEI	Supplemental Enhancement Information
SPS	Sequence Parameter Set
TU	Transform Unit
VP9	Google video codec, VP9 is a successor to <u>VP8</u> .
VPS	Video Parameter Set
YUV	Color space (YUV)

2 Document Conventions, Symbols and Terms

3 HEVC

The following sections describe all available features when loading an HEVC bitstream. The supported format of a bitstream is the raw bitstream with no surrounding container. Output from the publicly available HEVC reference software HM is in this format and can be opened directly. Intel Video Pro Analyzer supports Main, Main 10, and Main Still Picture profiles, HEVC RExt profiles (including SCC), SHVC profile and HEVC MultiView profiles. Sequences that go beyond the profile limits maybe be supported as well.

0	output.hevc Intel Video Pro Analyze	r 2017 2.3.0.4470 110008	_ 🗆 🗙
File Mode YUVDiff Options View Help			
Stream View HEVC D:/video_vpa/output.hevc			đ×
Thumhnails * 1 Picture-8 Display ActiveRefs			
Humanans V Picture. V Display Acaverters			
0/0-IDR W RAD 1/3-TRAIL_R 2/2-TRA 2/2-TRA 0 POC = 0 0 POC = 3 0 0 POC =	ALR. 3/1-TRAIL. 4/7-TRAIL.R. 5/5-TRAIL.R. 2 0 POC = 1 10 POC = 7 0 10 POC = 5	6/4-TRAIL_N 0 POC = 4 0 POC = 6 0 POC = 11	9/9-TRAIL_R Click to decode Click to decode L0 POC = 9 L0 POC = 8 L
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delta_poc_s0_minus1		A NUP Mage S 00	
used_by_curr_pic_s0_flag		ANVP S	
delta_poc_s0_minus1	10 A A M M M M M M	M A Skip AMVP A A	
delta pos s0 minus1	3		
used by curr nic s0 flag	1 A A A A M M	Skip Skip AA A S AA	
slice temporal myp enabled flag		ANYP I I I I I I I I I I I I I I I I I I I	
slice sao luma flag			
slice sao chroma flag			
num ref idx active override flag	1 MAAA ANNE ALA MARTIN DA AR AN AND A MARTIN		
num_ref_idx_I0_active_minus1	2		
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chroma_weight_I0_flag[2]	0	A NUMBER OF A STREET	
five_minus_max_num_merge_cand	3		
slice_qp_delta			
slice_loop_filter_across_slices_enabled_flag	1		
NAL VPS SPS PPS Slice CU TU QM Ref Lists	SEI HRD (+++) ≡ + FS - + R YUV + Pic Info Details H △ +++ ++	HH +H -	Right-click selection for details
Selection Info # ×	Unit Info	# × Status	6 ×
Width: 640 CTB address: 45 PU shape: 2Nx2N	CU at x, y 320, 272	Complete. Found 100 pictures, 104 NAL units.	~
Height: 480 CTB col, row: 5,4 PU size: 16x16	Total bits: 87 (11 bytes)	Decoding picture 0done.	
Pictures: 100 CU X,Y: 320, 272 TU depth: N/A	Bypass bins: 24 (23.8%)	Decoding picture 7 done.	
Bitdenth Y C 8 8 CI i pred mode: Intra MV10:-	Starting at position [byte:bit] 90711:3 (0x16257:3) in file:	Decoding picture 6 done.	
Tile col, row: 0.0 Pixel X,Y: N/A MV L1:-	09 fe f5 d7 04 20 f5 68 58 d6 e6	Decoding picture 3done.	
Slice #:0 - P 4x4 Z-scan idx: 209 CU QpY: 28		second procure o done.	
		A Peady	134M9 / 130M9 / 33546M9
		and recently	12-100 / 1304D / 32040MD

3.1 UI Components

The following sections describe the various components in the UI when an HEVC bitstream is loaded.

3.1.1 Top Filmstrip



The top filmstrip is a horizontally scrolling overview of the pictures in the bitstream. When a new sequence begins (CVS from the HEVC spec), the top info label is highlighted in green. The current picture is highlighted with a red border. On top is the picture number - the decode order index in the bitstream - and the first slice in the picture type as indicated by the NAL unit types, and on bottom there are layerId shown as Lx where is x gives layerId itself and the POC value. Referenced pictures for the current picture are indicated with arrows. Green arrows indicate the long term references. The bar filmstrip has underline green band under those frames that begin new CVS. Picture type is core coded: red – intra picture (I), blue – P-picture, green – B-picture. Red dots show how often picture is used as reference picture. Size of the dot is proportional to such usage index. By using this information you have a hint witch image is mostly important for prediction other images.

Title bar shows currently loaded stream and selected codec for it.

Clicking on a picture will cause Intel Video Pro Analyzer to decode it and mark it as the current picture, updating the rest of the UI correspondingly. If the new picture requires other pictures to be available as reference that have not yet been decoded, those will automatically be decoded.

Pictures are decoded on demand since it is impractical to store all details of all pictures in memory, especially for HD sequences. The current picture can also be selected by typing in a picture number in the box on the left of the panel. When using this box, the filmstrip is scrolled such that the newly selected current picture is visible.



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Application title bar shows currently loaded stream, selected codec for it and process ID for easier identification of dock widgets. When any dock widget is detached from the main window his title bar will show process ID of the main window also.

In Thumbnails and Bar mode it is possible to choose between Display/Decode order representation by click on additional. By right clicking on selected picture one can get popup submenu with a set of extract actions. An action called "Extract minimum CVS to this Picture" will write out a bitstream that contains the minimum number of pictures needed to decode the current picture. Typically this will consist of the current picture and all previous pictures that are reference pictures up to the nearest IRAP picture. This can be useful for debugging issues in long sequences. Other actions allow to save in the output file statistics and intermediate/final YUV planes.



Allow separate panels can be detached from them main window or hidden. To attach panels back double click on the titlebar. To unhide panel go to View menu and check appropriate panel.

3.1.2 Main Panel

	0	1	2	3	4	5	6	7	8	9	10	11	12
0	R CTB Idx 0 CTB Addr 0 Subset 0	CTB Idx 1 CTB Addr 1 Subset 0	CTB Idx 2 CTB Addr 2 Subset 0	CTB Idx 3 CTB Addr 3 Subset 0	R CTB Idx 16 CTB Addr 4 Subset 0	CTB Idx 17 CTB Addr 5 Subset 0	CTB Idx 18 CTB Addr 6 Subset 0	CTB Idx 19 CTB Addr 7 Subset 0	R CTB Idx 32 CTB Addr 8 Subset 0	CTB Idx 33 CTB Addr 9 Subset 0	CTB Idx 34 CTB Addr 10 Subset 0	CTB Idx 35 CTB Addr 11 Subset 0	CTB Idx 36 CTB Addr 12 Subset 0
1	CTB Idx 4	CTB Idx 5	CTB Idx 6	CTB Idx 7	CTB Idx 20	CTB Idx 21	CTB Idx 22	CTB Idx 23	CTB Idx 37	CTB Idx 38	CTB Idx 39	CTB Idx 40	CTB Idx 41
	CTB Addr 13	CTB Addr 14	CTB Addr 15	CTB Addr 16	CTB Addr 17	CTB Addr 18	CTB Addr 19	CTB Addr 20	CTB Addr 21	CTB Addr 22	CTB Addr 23	CTB Addr 24	CTB Addr 25
	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0
2	CTB Idx 8	CTB Idx 9	CTB Idx 10	CTB Idx 11	CTB Idx 24	CTB Idx 25	CTB Idx 26	CTB Idx 27	CTB Idx 42	CTB Idx 43	CTB Idx 44	CTB Idx 45	CTB Idx 46
	CTB Addr 26	CTB Addr 27	CTB Addr 28	CTB Addr 29	CTB Addr 30	CTB Addr 31	CTB Addr 32	CTB Addr 33	CTB Addr 34	CTB Addr 35	CTB Addr 36	CTB Addr 37	CTB Addr 38
	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0
3	CTB Idx 12	CTB Idx 13	CTB Idx 14	CTB Idx 15	CTB Idx 28	CTB Idx 29	CTB Idx 30	CTB Idx 31	CTB Idx 47	CTB Idx 48	CTB Idx 49	CTB Idx 50	CTB Idx 51
	CTB Addr 39	CTB Addr 40	CTB Addr 41	CTB Addr 42	CTB Addr 43	CTB Addr 44	CTB Addr 45	CTB Addr 46	CTB Addr 47	CTB Addr 48	CTB Addr 49	CTB Addr 50	CTB Addr 51
	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0
4	R CTB Idx 52 CTB Addr 52 Subset 0	CTB Idx 53 CTB Addr 53 Subset 0	CTB Idx 54 CTB Addr 54 Subset 0	CTB Idx 55 CTB Addr 55 Subset 0	R CTB Idx 68 CTB Addr 56 Subset 0	CTB Idx 69 CTB Addr 57 Subset 0	CTB Idx 70 CTB Addr 58 Subset 0	CTB Idx 71 CTB Addr 59 Subset 0	R CTB Idx 84 CTB Addr 60 Subset 0	CTB Idx 85 CTB Addr 61 Subset 0	CTB Idx 86 CTB Addr 62 Subset 0	CTB Idx 87 CTB Addr 63 Subset 0	CTB Idx 88 CTB Addr 64 Subset 0
5	CTB Idx 56	CTB Idx 57	CTB Idx 58	CTB Idx 59	CTB Idx 72	CTB Idx 73	CTB Idx 74	CTB Idx 75	CTB Idx 89	CTB Idx 90	CTB Idx 91	CTB Idx 92	CTB Idx 93
	CTB Addr 65	CTB Addr 66	CTB Addr 67	CTB Addr 68	CTB Addr 69	CTB Addr 70	CTB Addr 71	CTB Addr 72	CTB Addr 73	CTB Addr 74	CTB Addr 75	CTB Addr 76	CTB Addr 77
	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0
6	CTB Idx 60	CTB Idx 61	CTB Idx 62	CTB Idx 63	CTB Idx 76	CTB Idx 77	CTB Idx 78	CTB Idx 79	CTB Idx 94	CTB Idx 95	CTB Idx 96	CTB Idx 97	CTB Idx 98
	CTB Addr 78	CTB Addr 79	CTB Addr 80	CTB Addr 81	CTB Addr 82	CTB Addr 83	CTB Addr 84	CTB Addr 85	CTB Addr 86	CTB Addr 87	CTB Addr 88	CTB Addr 89	CTB Addr 90
	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0	Subset 0
7	CTB Idx 64	CTB Idx 65	CTB Idx 66	CTB Idx 67	CTB Idx 80	CTB Idx 81	CTB Idx 82	CTB Idx 83	CTB Idx 99	CTB Idx 100	CTB Idx 101	CTB Idx 102	CTB Idx 103
	CTB Addr 91	CTB Add: 92	CTB Addr 93	CTB Addr 94	CTB Addr 95	CTB Addr 96	CTB Addr 97	CTB Addr 98	CTB Addr 99	CTB Add: 100	CTB Add: 101	CTB Add: 102	CTB Add: 103

The main panel displays the selected picture with visual annotations. The type of annotations and associated interactive behavior depends on the current mode, see 3.1.8.1 HEVC Modes. Click-dragging moves the picture around, and the mouse wheel zooms in or out about the mouse cursor.

At the top left of the panel, the current mode is displayed. Along the top right the current scale is shown. In all modes, the CTB row and column values are displayed along the left and top border of the picture, slices are indicated with thick red lines, dependent slice boundaries are dashed red lines and tile boundaries are thick green lines. The screenshot above shows an example of a stream that is 13x8 CTBs, has 6 tiles and a number of slice segments, some of which are dependent. The selected CU is outlined with a pink box.

The information in the top right corner show current zoom factor and pixel length at selected zoom. By double clicking on zoom factor you can reset it to 1x factor.

The bottom left has a cluster of buttons:

≡ FS - + R | YUV **v** Pic Info Details H △ | I ← ← ▶ ▶ | Ref YUV Debug YUV Diff YUV Reload

- First submenu has special options to output the currently displayed information to the external image file with different scaling possibilities.
- FS: Toggles full-screen mode, which hides all UI elements except the main panel. Keyboard shortcut is F.
- +/-: Zooms in or out, centered on the center of the panel. Note that zooming with the mousewheel is much easier than using these buttons. Keyboard shortcuts are + and -.
- R: Resets the current zoom to fit the entire picture in the main panel. Keyboard shortcut is R.
- YUV, Y, U, V: Toggles between per-component image, or full-color YUV.

- Pic: Toggles the actual picture underneath the annotations. The picture is modedependent. For example in prediction mode, the picture is comprised of the prediction samples before the residual signal has been added in. It is often helpful to turn off the picture in order to make the annotation easier to read. Keyboard shortcut is P.
- Info: Toggles the annotations on or off. Keyboard shortcut is I.
- Details: Switches to the detail mode if it allowed of currently selected mode
- H/D: Toggles between hexadecimal and decimal display of the annotations. This applies to the values in the Left Tabs as well. Keyboard shortcuts are H and D.
- Delta sign: Switches to the difference mode with slave bitstream if it it loaded and difference mode is possible.
- There are five navigation buttons: first frame, previous frame, playback mode, next frame, last frame. The previous/last button will rewind, causing the current picture to be set to the first/last picture in the loaded bitstream. The "Play" button will start playback of loaded bitstream at a reasonable rate, limited by CPU performance. All normal mode operations are possible during playback. Note that playback mode always operates in currently selected order in the filmstrip.

3.1.3 Left Tabs

The left side of the UI is a resizable panel with several tabs that display information about the current selection in one way or another. The following subsections describe each tab.

3.1.3.1 NAL

Syntax I	nfo			ē×
120 NAL	units total			
Pos	NAL Idx: Type: Name	Lld	Tlo	Si: ^
25857	▷ 6: 1: TRAIL_R - Coded slice segment of a non-TSA, non-STSA trailing picture, VPS:(1) SPS:(1) PPS:(1)	0	0	28
54405	> 7: 40: SUFFIX_SEI - Supplemental enhancement information, suffix: Decoded Picture Hash (132)	0	0	12
54421	▷ 8: 0: TRAIL_N - Coded slice segment of a non-TSA, non-STSA trailing picture, VPS:(1) SPS:(1) PPS:(1)	0	4	26
81376	9: 40: SUFFIX_SEI - Supplemental enhancement information, suffix: Decoded Picture Hash (132)	0	4	12
81392	▷ 10: 1: TRAIL_R - Coded slice segment of a non-TSA, non-STSA trailing picture, VPS:(1) SPS:(1) PPS:(1)	0	0	25
106930	> 11: 40: SUFFIX_SEI - Supplemental enhancement information, suffix: Decoded Picture Hash (132)	0	0	12
106946	▷ 12: 1: TRAIL_R - Coded slice segment of a non-TSA, non-STSA trailing picture, VPS:(1) SPS:(1) PPS:(1)	0	0	27
134104	> 13: 40: SUFFIX_SEI - Supplemental enhancement information, suffix: Decoded Picture Hash (132)	0	0	18
134126	▶ 14: 1: TRAIL_R - Coded slice segment of a non-TSA, non-STSA trailing picture, VPS:(1) SPS:(1) PPS:(1)	0	0	25
159161	215: 40: SUFFIX_SEI - Supplemental enhancement information, suffix: Decoded Picture Hash (132)	0	0	54
159219	4 16: 1: TRAIL_R - Coded slice segment of a non-TSA, non-STSA trailing picture, VPS:(1) SPS:(1) PPS:(1)	0	0	24
	first_slice_segment_in_pic_flag		1	1
	slice_pic_parameter_set_id		1	3
	slice_type		0	1
	slice_pic_order_cnt_lsb		5	6
	short_term_ref_pic_set_sps_flag		0	1
	b short_term_ref_pic_set(13)			
	slice_sao_luma_flag		0	1
	slice_sao_chroma_flag		0	1
	num_ref_idx_active_override_flag		0	1
	ref_pic_list_modification_flag_l0		0	1
	ref_pic_list_modification_flag_l1		0	1
	mvd_l1_zero_flag		0	1
	cabac_init_flag		0	1
	pred_weight_table()			
	five_minus_max_num_merge_cand		1	15
184179	17: 40: SUFFIX_SEI - Supplemental enhancement information, suffix: Decoded Picture Hash (132)	0	0	54
184237	▷ 18: 0: TRAIL_N - Coded slice segment of a non-TSA, non-STSA trailing picture, VPS:(1) SPS:(1) PPS:(1)	0	2	25
210051	10. 10. SUEELY SEL Supplemental enhancement information suffix: Decoded Dicture Hack (122)	0	2	10
	No filter Extract selected NAL units			
ΝΔΙ	VPS SPS PPS Slice CI TU OM Reflists SET HRD Stats			

The NAL tab lists all NAL units found in the bitstream, in decode order. Above the list the total number of NAL units is displayed. The list has four columns: "Pos" is the byte position of the NAL unit in the file, "NAL Type" is the textual description of the NAL's type, "TID" is the Temporal ID of the NAL unit, and "Size" indicates the total number of bytes in the NAL unit. NAL description string contain header IDs used in decoding particular NAL unit.

Changes in coloring from white to grayscale and back show Access Unit borders. By clicking on branch sing you can roll out NAL unit syntax elements read from the bitstream. For each syntax element Intel Video Pro Analyzer shows the value of it and the number of bits it takes in the bitstream. Red colored elements will hint you about error syntax element.

Clicking on any NAL unit will display up to the first 500 raw bytes in the Raw Bytes panel. If a NAL unit is a VCL NAL unit, meaning it is a coded slice segment, it can be double-clicked in order to make the picture that it belongs to the current picture. Conversely, changing the current picture will highlight the NAL unit that contains the first slice segment of that picture. Selecting a CU in the Main Panel will highlight the NAL unit containing the slice that contains the selected CU.

At the bottom of the NAL tab is a button called "Extract selected NAL units". Clicking this will write all selected NAL units out to a file.

Filter combo box allows you to select which NAL types will be displayed inside NAL tab. "No filter" means all NALs are shown.

3.1.3.2 VPS, SPS, PPS, Slice, SEI

SE Name						Value
pps pic parameter set i		0				
pps_seq_parameter_set_i		0				
dependent_slices_enable	0					
output_flag_present_flag	0					
num_extra_slice_header_	0					
sign_data_hiding_flag						1
cabac_init_present_flag						1
num_ref_idx_I0_default_a	active_r	minus1				1
num_ref_idx_l1_default_a	active_r	minus1				1
init_qp_minus26						0
constrained_intra_pred_f	flag					0
transform_skip_enabled_	flag					1
cu_qp_delta_enabled_fla	g					1
diff_cu_qp_delta_depth						1
pps_cb_qp_offset						0
pps_cr_qp_offset						0
pps_slice_chroma_qp_of	fsets_p	resent_fl	ag			0
weighted_pred_flag						0
weighted_bipred_flag						0
transquant_bypass_enab	le_flag					0
tiles_enabled_flag						0
entropy_coding_sync_en	nabled_	flag				0
loop_filter_across_slice_f	lag					1
deblocking_filter_contro	l_prese	nt_flag				0
pps_scaling_list_data_pre	esent_fl	ag				0
lists_modification_prese	nt_flag					0
log2_parallel_merge_leve	el_minu	is2				0
slice_segment_header_ex	xtensio	n_presen	it_flag			0
pps_extension_flag						0
NAL VPS SPS	PPS	Slice	CU	TU	QM	Refl∮t

These tabs contain a list of every syntax element, in decode order, of the VPS, SPS, PPS, slice segment header and SEI messages that apply to the currently selected CU in the Main Panel. Syntax elements that come from a sub-function call are indented accordingly, and the function call itself appears in the list as a syntax element with no value. Any part of the list can be selected and copied for pasting in other programs.

3.1.3.3 CU, TU

	V	SE Name				v	/alue		
386	234	part_mode				0			
394	90	prev_intra_lui	ma_pred_	flag		1			
450	181	prev_intra_lui	ma_pred_	flag		1			
265	181	prev_intra_luma_pred_flag 0							
420	85	prev_intra_lui	ma_pred_	flag		1			
502	170	mpm_idx				0			
502	341	mpm_idx				1			
502	362	rem_intra_l	luma_pre	d_mode	2	2	3		
502	67	mpm_idx				0			
502	134	intra_chroma	_pred_m	ode		4			
ivlOffset: 181									
VICUITRange: 200									
iv	Offset: 1	81							
ivl ⊳ Sp	Offset: 1 lit flag:	81 3 active states							
ivl ⊳Sp ⊳Sk	Offset: 1 lit flag: ip flag: (81 3 active states) active states							
ivl ⊳Sp ⊳Sk	Offset: 1 lit flag: (ip flag: (erge flag	81 3 active states) active states 1: 1 active states							
ivl ▷ Sp ▷ Sk ▷ M ▷ M	Offset: 1 lit flag: 1 ip flag: (erge flag erge idx	81 3 active states) active states g: 1 active states 0 active states							
ivl ▷ Sp ▷ Sk ▷ M ▷ M	Offset: 1 lit flag: 1 ip flag: (erge flag erge idx art size: 1	81 3 active states) active states y: 1 active states 0 active states active states							
ivl ▷ Sp ▷ Sk ▷ M ▷ M ▷ Pa ▷ Pr	Offset: 1 ilit flag: (ip flag: (erge flag erge idx erge idx ed mod	81 3 active states) active states y: 1 active states 0 active states active states e: 0 active states							
ivl ▷ Sp ▷ Sk ▷ M ▷ M ▷ Pa ▷ Pr ▷ Int	Offset: 1 ilit flag: 1 ip flag: (erge flag erge idx irt size: 1 ed mode tra pred	81 3 active states 0 active states 1 active states 0 active states active states e: 0 active states 1 active states	ates						
ivl ▷ Sp ▷ Sk ▷ M ▷ Pa ▷ Pr ▷ Int	Offset: 1 ilit flag: i ip flag: (erge flag erge idx int size: 1 ed mode tra pred tra pred	81 3 active states 0 active states 1 active states 0 active states active states e: 0 active states luma: 1 active states luma: 2 active	ates states						
ivl ▷ Sp ▷ Sk ▷ M ▷ Pa ▷ Pr ▷ Int ▲ Int	Offset: 1 lit flag: 2 erge flag erge idx ort size: 1 ed mode tra pred tra pred	81 3 active states 0 active states 1 active states 0 active states active states e: 0 active states luma: 1 active states chroma: 2 active	ates states						
ivl ▷ Sp ▷ Sk ▷ M ▷ Pa ▷ Pr ▷ Int ▲ Int	Offset: 1 lit flag: 1 ip flag: (erge flag erge idx it size: 1 ed mod tra pred tra pred [0]: 24 [1]: 2	81 3 active states 0 active states 1 active states 0 active states active states e: 0 active states luma: 1 active states chroma: 2 active	ates states						
ivI ▷ Sp ▷ Sk ▷ M ▷ Pa ▷ Pr ▷ Int ▲ Int	Offset: 1 ilit flag: 1 ip flag: (erge flag erge idx int size: 1 ed mode tra pred tra pred [0]: 24 [1]: 2	81 3 active states 0 active states 9: 1 active states 0 active states active states e: 0 active states luma: 1 active states chroma: 2 active	ates states						
ivI ▷ Sp ▷ Sk ▷ M ▷ Pa ▷ Pr ▷ Int ▲ Int ▷ De	Offset: 1 ilit flag: (erge flag erge idx int size: 1 ed mod tra pred [0]: 24 [1]: 2 elta QP: 1	81 3 active states 0 active states 9: 1 active states 0 active states active states e: 0 active states e: 0 active states luma: 1 active sta chroma: 2 active	ates states						

These tabs contain a list of the CABAC syntax elements decoded, in decode order, of the currently selected CU or TU in the Main Panel. Note that only the syntax elements pertaining to the currently selected CU/TU are shown, not any of the syntax elements in a higher or lower nodes in the quadtree. So if a CU is selected that is split into 4 smaller CUs, only the split flag will be shown, not the syntax elements of CUs further down the quadtree. The left side of the list contains two columns, R and V, which denote the state of the CABAC engine's Range (ivICurrRange) and Value (ivIOffset) prior to the syntax element decoding process. Any part of the list can be selected and copied for pasting in other programs.

Clicking a syntax element will update the tree in the lower half of this panel. This tree displays the values of all CABAC state variables prior to the decoding of the selected syntax element.

3.1.3.4 QM

Only	PPS coe	fficients	are use	ed in this	pictu	re			
Pick a matrix: PPS							ra Y	•	
26	21	23	15	8	22	12	2 20)	
12	25	16	8	9	9	18	3 16	5	
18	18	14	18	12	13	20) 1()	
25	22	8	20	11	20	8	21	1	
26	12	12	18	14	18	19	24	4	
23	23	20	15	23	19	10) 9		
24	16	8	15	22	24	20) 9		
22	12	8	12	22	10	21	13	3	
Synta SE N	x element lame	s used to	o code th	IS SET OT S	scaling I	ISTS:	Value	^	
scali	ng_list_d	elta_coe	eff[8]				-2		
scali	ng_list_d	elta_coe	ff[9]				-1		
scali	ng_list_d	elta_coe	ff[10]				11		
scali	ng_list_d	elta_coe	:ff[11]				-4	_	
scali	ng_list_d	elta_coe	ff[12]				-8	_	
scali	ng_list_d	elta_coe	eff[13]				-6	_	
scali	ng_list_d		0	_					
scali	ng_list_d		15	_					
scaling_list_delta_coeff[16] -11									
scali	ng_list_d	elta_coe	ff[17]				-4		
scali	ng list d	elta coe	ff[18]				10	~	
NAL	VPS	SPS	PPS	Slice	CU	TU	QM	4 ()	

This tab displays the scaling lists, or quantizer matrices used by the current picture. Scaling lists can be present in the SPS, PPS, or both. PPS scaling lists take precedence over SPS when present. The top of the panel shows in blue text how the various scaling lists are used in this picture. Below that, one of the 20 scaling list from either the SPS or PPS can be chosen for inspection, and the chosen matrix is displayed in the grid. Matrices for 16x16 and larger TUs have a separate DC coefficient, which is displayed below the grid. Also shown in this panel is the list of syntax elements that is used to code the scaling list set, and is identical to the syntax in the corresponding SPS or PPS tab.

3.1.3.5 Ref Lists

List 0:								
Idx	POC	LT	WΥ	ΟY	W Cb	O Cb	W Cr	O Cr
0	18432	N	65	-1	63	2	63	3
1	17920	N	64	0	63	3	65	-1
2	17408	N	65	-2	63	3	63	3
3	16896	N	65	-2	65	-2	65	-1
4	7680	Y	64	0	65	-2	65	-2
List 1:								
Idx	POC	LT	WY	OY	W Cb	O Cb	W Cr	O Cr
0	18432	N	64	0	65	-2	63	2
1	17920	N	64	0	65	-2	63	3
2	17408	N	65	-1	65	-1	63	2
3	16896	N	65	-1	65	-1	65	-2
4	7680	Y	65	-1	64	0	64	0
DPB List PocSt PocSt	DPB Lists: PocStCurrBefore[0] = 18432							
PocSt	CurrB	efore	[2] =	17408				
PocSt	Curr[0] =	[3] = 7680	10030	•			
								*
ΝΔΙ	PS SP	S PPS	Slice	си т	MO	Doflie	te SEL	Stats

This tab displays the details of the two reference lists L0 and L1, as well as the Reference Picture Set arrays used to construct the L0 and L1 lists. The L0 and L1 lists have the following columns:

- Idx: The index associated with the reference picture
- POC: The Picture Order Count of the reference picture
- LT: A Yes/No flag indicating if the reference picture is a long-term picture or not
- W Y: The derived luma weight used in the weighted prediction process of the reference picture
- Y: The derived luma offset used in the weighted prediction process of the reference picture
- W Cb: The derived chroma Cb weight used in the weighted prediction process of the reference picture
- Cb: The derived chroma Cb offset used in the weighted prediction process of the reference picture
- W Cr: The derived chroma Cr weight used in the weighted prediction process of the reference picture
- Cr: The derived chroma Cr offset used in the weighted prediction process of the reference picture

The third panel contains in textual form the contents of the Reference Picture Set arrays from section 8.3.2 in the HEVC specification.

3.1.3.6 Stats

	e Stats	•							
Pictur Synta Strea Tota Bins Bypa Bits Num qp m	e Stats e Stats m Stats i Dins l Dypa per b ss rat per p CU/PU/ in/max	30119 3764 34612 ss bins it: 1.1 io: 46. ixel: (TU: 204 /avg: 1	92 49 20 149 .7% 0.0961 40/415 L0/51/	.717 .2 33/6822 336.817	2 76				^
LO m LO m L1 m L1 m SEI Y : Cb: Cr: Calc MD5	W.X ml W.Y mi W.Y mi Pictur Digest 5a9c00 11f850 fla688 culated Y : 5a Cb 11	n/max/a n/max/a n/max/a e Diges in bit afle8f(306987b 5d43b30 digest 9c00af1 f850300	avg: - avg: - avg: - sts sts strea 04a62f 09b27b 539eed ss: Le8f04	-15899) -16041/ -15895/ -15991/ m is 1 56f7249 0c277b9 1765a99 1765a99	/15828 /15928 /27920 /15943 MD5: 9615df 9e5722 f5aa03 f72496 277b9e	(7-2.5899) (732.3255 (7-71.9342 (70.1581 (4-4 (4-4) (4-4) (4-4) (4-4) (15-4-4) (15-4-4) (5-722-4-8)	2		
MD5 CRC CRC	Cr: f1 Y : 6a Cb: ca	1850304 a6885d4 35 0d	13b363	9eed7(65a9f5	aa034d9			
									+
%	Raw valu	es				yntax elemen	t bin type	es	•
%	Raw valu	es <u>Oth</u> 72104	er 9192		▼ [S	yntax elemen	t bin type	25	•
%	PU	oth 72164	er 9192	26476	▼ S	yntax elemen	t bin type	25	•

This tab displays various statistics extracted from the current picture. The top half shows some picture size and compression stats as well as the image digest information. There are also some min/max/average information about some picture parameters, such as QP value, MVs and so on, in this window.

The bottom half displays pie charts for a number of metrics. Each pie chart can be drawn normalized or un-normalized. Normalized data is weighted by area or compressed bits. For example there may be a much lower number of 64x64 CUs than 8x8 CUs in the picture (smaller un-normalized pie wedge), but they could still make up the majority of the picture area, making the 64x64 pie wedge large. Normalized numbers in the pie chart are in units of pixels or bits, and un-normalized numbers are raw counts.

The pie chart can be moved by dragging the mouse, and zoomed with the mouse scroll wheel.

*Other names and brands may be claimed as the property of others.

Syntax Stats 🔻 %					
Syntax Element	Count	t	Bits		^
Slice header	48		116		
⊿ CU	21586	4	296386		
SAO	0		0		
⊿ PU	20903		62302		
⊳ MV	10587		46061		_
prev intra luma pred f	547		229		
rem intra luma pred	506		2530		
intra chroma pred mo	211		515		
merge_flag	3189		3169		
merge_idx	1973		4156		
mpm idx	41		64		
inter pred idc	1633		2688		
refidx 10	1108		1784		
ref_idx_I1	0		0		-
myp I0 flag	1108		1106		_
myp I1 flag	1081		1072 228442		_
⊳ TU	18753	6			_
Palette	0		0		_
split cu flag	0		0		_
end of slice segment flag	2040		105		_
cu transquant bypass flag	0		0		
Other 9192					
PU 72164					
26476	64				
	TU				
	10				
SPS PPS Slice CU TU	QM	RefLists	SEI	Stats	4 +

By selecting, different modes in the stats combo box you can explore different type of statistics in the bitstream. Namely, picture statistics, per syntax element statistics, overall stream statistics. Overall stream statistics is available only after full stream analysis and shows accumulated values overall the stream. Pie chart for stream statistics show accumulated value also.

Synta	ax Element		Count	Bits
⊳ s	lice header		9579	25848
⊿ CU			87709242	119408180
1	> SAO		0	0
1	> PU		1693727	4966519
1	> TU		85229565	113929334
1	> Palette		0	0
	split_cu_flag		15068	15022
	end_of_slice_s	egment_flag	171360	9421
	cu_transquant	_bypass_flag	120405	7794
	cu skip flag		173433	128639
	pred mode fla	aq	137296	78116
	palette mode	flag	0	0
	part_mode		156102	272459
	pcm flag		12286	876
	pcm alignmer	nt zero bit	0	0
	pcm sample I	uma	0	0
	pcm sample o	chroma	0	0
	end of subset	one hit	0	0
			[
%	Raw values	her	▼ Syntax eleme	nt bin types
%	Raw values Pl 57	her J 936387 22068	▼ Syntax eleme	nt bin types
% 1	Raw values Ot PI 57	ther 926387 22068 132205269 TU	▼ Syntax eleme	nt bin types

3.1.4 Selection Info

Selection Info		5 ×
Width: 640	CTB address: 28	PU shape: 2NxN
Height: 480	CTB col, row: 8,2	PU size: 16x8
Pictures: 100	CU X,Y:512, 176	TU depth:N/A
Color format: 4:2:0	CU Size,Depth: 16x16, 2	TU size: N/A
Bitdepth Y,C:8, 8	CU pred mode: Inter	MV L0:28,7=>0
Tile col, row: 0,0	Pixel X,Y:451,189	MV L1:-20,-8=>0
Slice #:0 - B	4x4 Z-scan idx:170	CU QpY: 22

This panel shows a few details about the current selection at a glance. All values are decimal:

- Picture height & width
- Number of pictures in the bitstream
- Color format of the current picture
- Bitdepth values for Luma and Chroma components
- Tile row/col position
- Slice segment number of the slice segment that contains the selected CU, and the slice type.
- CTB address and row/col position
- Size of the selected CU. Note it applies to the selection at any point in the quadtree, not necessarily just the leaf nodes.
- X/Y position of the selected CU in pixels
- CU prediction mode. Intra, Inter or Skip
- Depth in the quadtree of the selected CU
- Pixel X/Y position in the picture of the mouse cursor
- Z-order index at 4x4 granularity in the CTB at the mouse cursor location
- PU size and shape. Note that this will be equal to the size of the leaf CU in any mode other than Prediction.
- TU size and depth. Note that this will be equal to the size of the leaf CU (top of TU tree) in any mode other than Residuals.
- The L0 and L1 motion vectors, if any, of the selected PU. The MVs are shown with an arrow => followed by the reference index.
- The Luma QP value associated with the selected CU.

3.1.5 Raw Bytes

```
        Unit Info
        B ×

        CU at x,y 512,176
        Total bits: 248 (31 bytes)

        Total bits: 242 (1.137 bins per bit)
        Bypass bins: 95 (33.7%)

        Starting at byte position 74884:4 (0x12484:4) in file:
        2c 67 85 65 ef 21 01 21 69 26 2f 74 5b 7e ff d0 08 51 9d c3 0a c1 22 af f6 4b 18 f9 53 90 d7
```

The panel in the bottom center of the UI displays the raw bytes that were used to code the selected CU, or NAL unit. A few details about the selection are included as well.

3.1.6 NAL unit detail view

O NAL units total Pos NAL Idx: Type: Name 4 > 0: 32: VPS - Video parameter set 0 23 > 1: 32: SDS	e.e
Pos NAL ldx: Type: Name TID/ Size 4 > 0: 32: VPS - Video parameter set 0 23 > 1: 32: SPS	Inter 18 Mar (Inter
4 D 0: 32: VPS - Video parameter set 0 24	
22 N 1, 22; SDS Sequence parameter set 0, 20	
52 V I; 55; 57 5 - Sequence parameter set V 59	Sec. 1
75 ▷ 2: 34: PPS - Picture parameter set 0 6 = 2 ● POC = 1 POC = 7 ●	POC = 5 • POC = 4
84 b 3; 39; PREFIX SEI - Supplemental enhan 0 6	
93 ▷ 4: 19: IDR W RADL - Coded slice seam 0 27750	
27847 > 5: 1: TRAIL R - Coded slice segment of 0 18522	
46373 b 6: 1: TRAIL B - Coded slice segment of 0 8687	
55064 V T: 0: TRAIL N - Coded slice segment of 0 7186	
62254 8 1: TRAIL 8 - Coded slice segment of 0 10214 5 6 7 8 9	
72472 \triangleright 9 1 TRAIL R - Coded slice segment of 0 7192	
7968 b 10:0 TRAIL N - Coded clice segment o 0 103	
79775 h 11.0 TRUE N Coded size segment on 0 4770	
1459 N 12 11 TRAIL P - Coded disc segment o 0 4129	5 ×
05505 b 12 1 TRAIL R - Coded dice segment o. 0 6460	
102068 ALL OT TRAIL R - C	~
10600 P 14: 0 TRAL_N - Coded slice segment 0 0 400 forbidden_zero_bit 0	
106107 P 13: 0 TRAIL IN - Coded slice segment 0 0 120 nal unit type 1	
100251 PTOTISTICALE Coded site segment on 0 5406 publicaverid 0	
120995 P 17: 1: TRAIL R - Coded since segment 0 0 0490 http://www.compact.id.nlus1	
12/495 P 18: UTRAIL_N - Coded sities segment o U 5000 Inductemption in prost	
133049 P 19: U: TRAIL N - Coded slice segment o 0 b040 first_slice_segment_in_pic_flag	
139093 > 20: 0: TRAIL N - Coded slice segment o 0 146 > if(nal_unit_type >= BLA_W_LP && nal	
139243 21:1: IKAIL_R - Coded slice segment o 0 211/3 slice_pic_parameter_set_id 0	
160420 > 22: 1: TRAIL_R - Coded slice segment o 0 11031 > if(!first slice segment in pic flag)	
171455 23: 0: TRAIL_N - Coded slice segment o 0 6037	
177496 24: 0; TRAIL_N - Coded slice segment o 0 6468	
183968 25: 1: TRAIL_R - Coded slice segment o 0 19726	
203698 26: 1: TRAIL_R - Coded slice segment o 0 6954 slice_type 0	
210656 > 27: 0: TRAIL_N - Coded slice segment o 0 174 > if(output_flag_present_flag)	
210834 > 28: 1: TRAIL_R - Coded slice segment o 0 23715 > if(separate_colour_plane_flag == 1)	
234553 29: 1: TRAIL_R - Coded slice segment o 0 10709 if (nal unit type != IDR W RADL &&	
245266 > 30: 0: TRAIL_N - Coded slice segment o 0 6452 bif(sample adaptive offset enabled fl	
251722 31: 0: TRAIL_N - Coded slice segment o 0 5816	
257542 > 32: 1: TRAIL R - Coded slice segment o 0 20064	
277610 > 33: 1: TRAIL_R - Coded slice segment o 0 7399 slice_qp_delta -3	
285013 > 34: 0: TRAIL N - Coded slice segment o 0 125 > if(pps_slice_chroma_qp_offsets_prese	
285142 > 35: 0: TRAIL N - Coded slice segment o 0 5350 > if(deblocking_filter_override_enable	
290496 > 36: 1: TRAIL R - Coded slice segment o 0 21435 > if(deblocking filter override flag)	
311935 > 37: 1: TRAIL R - Coded slice segment o 0 9540 > if(pps loop filter across slices enabl	
321479 b 38: 0: TRAIL N - Coded slice segment o 0 6182	
· intuis_ciauco_iag effective_iag	
Extract selected NAL units	
Starting at byte position 46373 in file:	
NAL VPS SPS PPS Slice CU TU QM RefLists ◀ 🕩 02 01 e0 44 97 e0 87 88 16 39 df 6f b1 e5 b8 a6 8	86 21 88 df a8 bf 47 f9 💙

When one selects NAL unit in the NAL tab with single click Intel Video Pro Analyzer will display up to the first 500 raw bytes in the Raw Bytes panel and the controls for expanding NAL unit tree will appear from the left of "NAL unit" keyword. Control representation is system depended. >NAL unit #26, type 1: TRAIL_... Starting at byte position 203698 in file: 02 01 e2 c2 25 52 7f 70 87 88 16 47 8c 2d 0c ac 53 06 60 3d 88 e7 f8 e6 76 6b e0 86 43 0e 46 fe 71 9b ee 33 85 6b 75 21 13 ea a2 51 e9 cd eb 65 7b 49 56 4a af 3b 0d ea f8 34 70 d8 fb b8 56 2d b2 89 66 af 80 68 b5 d2 0e 10 4c 85 89 fe 38 46 ff 54 e0.eb 57 05 66 25 48 18 2e e2 1e c8 47 cf b0 b6 f9 55 f6 2e da 94 71 fa 88 4a 8a ae df 6c 13 50 fb 17 96 90 85 1d a7 76 82 f9 42 82 72 f5 a1 39 3b 18 7c 91 fb ee 67 32

By clicking on this control one can expand or collapse NAL unit tree items. The structure of this tree mostly replicate NAL unit definitions from the standard. There are items with statements and items with conditions. The items with conditions are grey out if the condition is false. In this case only underneath structure definition from standard is shown. Otherwise (in true case), real syntax values can be explored.



3.1.7 Messages

Status	₽×
Complete. Found 100 pictures, 104 NAL units. Decoding picture 0done. Decoding picture 6done. Decoding picture 3done. Decoding picture 6done.	<
Ready 94MB / 113MB / 8	3089MB

This panel in the lower right of the UI displays messages about the decoding process, and shows progress of any actions that may take a while to complete. If a decoded picture's digest does not match the SEI digest (when present), a warning will be displayed here.

The 3 numbers in the lower right of this panel represent the memory state of JVM. From left to right the 3 numbers are:

- Amount of memory used
- Peak used memory
- Maximum available memory

Error button at the bottom left of the window changes color to red if Intel Video Pro Analyzer detects any errors/warnings in the stream. By clicking on the button Intel Video Pro Analyzer switches to the list of detected problems and back. Double clicking on selected problem will navigate you the appropriate place in the header where the error occurs.

Status			8	×
NAL idx	Picld	Туре	Message	^
95	36	NAL	slice_gp_delta_cr shall be in range -12 to 12.	
109	41	NAL	The value of luma_offset_IX[i] shall be in the range of -WpOff	
109	41	NAL	SliceQpY shall be in the range of -QpBdOffsetY to +51	
120	46	NAL	The value of luma offset IX[i] shall be in the range of -WpOff	\mathbf{v}
A Ready			34MB / 34MB / 8089	MB

By right clicking inside error's list you can choose additional filtering of the errors

Status									₽×
Severity	Pos	NAL idx	Picld	CTB idx	Туре	Messag	je		^
Warning	435368	8	2		NAL	When s	ps_temporal_id_nesting_flag is	equal to 1 and Temp	
Warning	435389	8	2		SLH	When s	ps_max_dec_pic_buffering_min	us1[TemporalId] is eq	
Warning	855643	12	4		SLH	The <u>val</u>	<u>ie of luma log2 weight denon</u>	n shall be in the range	
Warning	855644	12	4		SLH	Chrc	Ignore messages by type	to be equal to luma_l	
Warning	855654	12	4		SLH	The	Error	inge of -QpBdOffset	
Warning	1273752	16	6		RPS	It is	LITOIS	mance that the RPS is	
Warning	1273752	16	6		RPS	It is	Show all	mance that the RPS is	×
A Ready								120MB / 257MB / 3264	46MB

"Error" submenu runs common error dialog where it is possible to select which errors will by displayed in the error's list.

Q			Error filter ?	×
Index	Severity	Туре	Message	^
▲ ✔ AVC				
⊿ 🗸 MB				
✓ 2000	Error	MB	Value of mb::intra_chroma_pred_mode is out of range	
2001	Error	MB	Value of mb::intra_chroma_pred_mode is not allowed	
✓ 2002	Error	MB	Value of mb::intra_8x8_pred_mode is not allowed	
✔ 2003	Error	MB	Value of mb::intra_4x4_pred_mode is not allowed	
✓ 2004	Error	MB	Value of mb::intra_16x16_pred_mode is not allowed	
✓ 2005	Error	MB	Value of mb::coded_block_pattern is out of range	
✓ 2006	Error	MB	Value of mb::mb_qp_delta is out of range	
✔ 2007	Error	MB	Value of reference index L0 is out of range	
2008	8 Error	MB	Value of reference index L1 is out of range	
✓ 2009	Error	MB	Value of mb::sub_type is out of range	
✓ 2010	Error	MB	Value of mb::mb_type is out of range	
✓ 2011	Error	MB	Value of mb::mb_skip_run is out of range	
✔ 2012	Error	MB	Value of mb::pcm_alignment_zero_bit should be zero	
🔺 🗹 SLH				
✓ 2013	Error	SLH	Value of slice::slice_type is out of range	
✓ 2014	Error	SLH	Value of slice::slice_type is not allowed	~
<			>	
			OK Can	cel

3.1.8 Extended modes

There are a set of extended modes that can be accessed via menus in the Stream View toolbar.

Stream View HEVC C:/work/video_vpa/outbawc	ē×
Thumbnails 🔻 🔕 🗊 Picture: 3 🔅 Display ActiveRefs	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	9/9
<	>

Then three possible modes with two sub-modes can be selected. Sub-modes of the currently selected mode changed dynamically depending on current mode.

3.1.8.1 Active/DPB refs

Sometimes, it may be that Intel Video Pro Analyzer shows reference on INTRA frame. It is not mistake because Intel Video Pro Analyzer shows DPB reference by default - all frames stored in DPB and marked as used for reference. But some of that frames could be inactive and as the result not used for motion estimation. For INTRA frame all such reference are inactive. To show only active references choose "ActiveRefs" sub-mode from popup toolbar.

3.1.8.2 Frame sizes view

When one choose "Buffer" menu from popup toolbar, frames size view will appear by default. This is a bar char plot with frame sizes. Each bar is colored according to the frame type. When you move the mouse along the bar current frame is highlighted and tooltip shows information about current frame. By clicking on selected frame you can decode it. When you press left mouse button and move it all plots move along both axes. Double click on canvas area resets plot into default state. You can zoom in/out with mouse wheel on both axis when the mouse inside canvas. If the mouse on some axis (below canvas, for example, x axis) you can zoom, pan or double click on only on that axis. In that case all actions applied to that axis only. The movement of the plots is restricted to the positive values only, you can't move or zoom in negative direction. Currently decoded frame is shown with vertical line and frame number on it.



On the right axis average slice QP values are shown. When full stream analysis is complete Intel Video Pro Analyzer adds average block QP plot that is also attached to right axis. By double clicking on 'Moving average' label item sliding window size can be adjusted in the separate dialog.

3.1.8.3 HRD buffer fullness view

If you choose "Buffer" mode then sub-mode "HRD" appears in sub-modes block. It is enabled if stream has HRD parameters in it, otherwise it is disabled (grey out). The interaction with buffer fullness plot works in the same way as for frame sizes plot. It is possible to get buffer state and picture parameters in each point of the plot where the monotonic behavior changes. With right click on central area of the plot Intel Video Pro Analyzer shows additional option for plot adjustment. In the same popup menu you can export HRD timings into .csv file.



3.1.8.4 B-pyramid visualization

Intel Video Pro Anayzer show B-pyramid visualization when option Hierarchy in the Stream View is selected. It show the level of mutual B-frame references, frame numbers in decoding /display orders, frame type coded by color and frame references. By clicking on each frame you can highlight particular frame references.



3.2 Modes

Mode		YUVDiff	Options
	Co	ding flow	F1
•	Pre	edictions	F2
	Re	siduals	F3
	Re	constructio	on F4
	De	blocking	F5
	SA	0	F6
	YU	V	F7
	Inf	o overlays	F8
	Sir	nple motio	on F9

With an HEVC bitstream loaded, Intel Video Pro Analyzer can be put into one of 9 modes using either the F1-F9 keys, or using the Mode menu. The mode selection affects only what is displayed in the Main Panel. Most modes can also show details of the current selection (CU/PU/TU). This can be toggled with the right mouse button or the main panel's button strip.

3.2.1 Coding Flow

	0	1	2	3	
О	R CTB Idx 0 Addr 0 Subset 0	CTB Idx 1 Addr 1 Subset 0	CTB Idx 2 Addr 2 Subset 0	CTB Idx 3 Addr 3 Subset 0	R CT Ac Sub
1	CTB Idx 4	CTB Idx 5	CTB Idx 6	CTB Idx 7	CT
	Addr 13	Addr 14	Addr 15	Addr 16	Ad
	Subset 0	Subset 0	Subset 0	Subset 0	Sub
2	CTB Idx 8	CTB Idx 9	CTB 10	CTB 11	CT
	Addr 26	Addr 27	Addr 28	Addr 29	Ad
	Subset 0	Subset 0	Subset 0	Subset 0	Sub
3	CTB 12	CTB 13	CTB 14	CTB 15	CT
	Addr 39	Addr 40	Addr 41	Addr 42	Ad
	Subset 0	Subset 0	Subset 0	Subset 0	Sub
	R CTB 52	СТВ 53	СТВ 54	СТВ 55	R CT

The coding flow mode gives a visual overview of the ordering of CTBs in the stream, and some information of the decoding process. The blue grid shows the boundaries of the CTBs in the picture. Each CTB contains 3 values:

- The decode index of the CTB, showing the order of decode in the picture.
- The CTB address, which is simply the raster scan index of the CTB.
- The substream that the CTB belongs to. This number will only be greater than 0 if tiles or wavefront tools are employed in the picture.

Operations on the CABAC engine state are displayed as well. A small purple R at the top left of a CTB indicates the CABAC engine is reset before decoding that CTB. A small F indicates a CABAC flush at the end of a substream that is not the end of a slice. Purple arrows indicate CABAC engine state transfer or copy to dependent slices or wavefront rows:



*Other names and brands may be claimed as the property of others.

3.2.2 Predictions

This mode shows the PUs in each CU. CU quad tree splits are indicated with blue lines, which get darker as the split depth increases. When a CU split is implied by HEVC and not directly coded in the bitstream, the split lines are dashed.

Intra modes are indicated with green colors, and directional modes also show an arrow indicating the prediction direction. In the lower right corner of an intra PU the chroma mode is indicated in a darker green. When the prediction shape is not the same as the CU size, the prediction unit shapes are shown with green lines for intra blocks, cyan for inter blocks. Dashed green lines in intra blocks means the PU was split along with the transform tree.

Inter PUs are indicated with cyan colors showing the PU splits and mode. Additionally, skipped blocks are shaded with a lined texture. An inter PU is Skip, AMVP or Merge mode. The L0 motion vectors are drawn with an orange color, the L1 motion vectors (B slices only) are drawn with a purple color. The MV value is shown in the lower left corner along with the reference index.

Clicking a PU will select it, and the syntax elements used to code it and the CU it belongs to are displayed in the CU tab on the left. Clicking repeatedly on the same PU will cycle through the CU hierarchy, showing the parent and child relationship.

Below is shown Prediction mode on a zoomed-in selection along the top edge of a picture. The selected CU is surrounded with a pink box while the selected PU is surrounded with a yellow box.



*Other names and brands may be claimed as the property of others.

3.2.2.1 Prediction Detail Mode

In Prediction mode, the sample values of a particular PU can be viewed in detail.

Intra PUs are displayed in green, and the left, upper-left and above prediction arrays are drawn adjacent. Luma blocks show 3 versions of the predictions arrays. From furthest out to inner, they represent the arrays in 3 steps:

- 1. Initial neighboring samples. Unavailable samples are given with a red "X".
- 2. Samples after reference sample substitution process (section 8.4.4.2.2 from the HEVC spec).
- 3. Samples after filtering process (section 8.4.4.2.3 from the HEVC spec).

Chroma blocks only show the first two steps, since reference sample filtering is not applied to chroma intra prediction.



Inter PUs are displayed in cyan (turquoise). Each prediction sample can be clicked to display a window that contains the 8x8 or 4x4 sample array for luma or chroma respectively that are the inputs to the motion compensation filter for the selected pixel. In the case of a bidirectional PU, both arrays are shown the L0/L1 colors of orange/purple. Clicking the selected sample again or outside the PU closes this window. Underneath the prediction array values the motion vector predictor lists are displayed. In merge mode, the merge list is shown with the L0 predictor in orange and the L1 predictor in purple. An arrow indicates the merge candidate that is chosen by the bitstream (merge_idx).

When the inter PU does not code motion vectors in merge mode, it is considered AMVP mode (Advance Motion Vector Prediction). The 2-entry list for each motion vector (L0 and/or L1) is shown and the selected predictor is indicated with an arrow.





For HEVC screen content coding stream there is special detail mode exist – Palette mode. In this mode Intel Video Pro Analyzer shows palette predictor, currently used palette, coded indices, resulting indices and final pixel values.

Selec	elected PU (704,192) details										22x 8 pixels																								
			`		,	,																					co Da:	py_a shed	l bove mea	Palet e_pa	palet te in lette nplie	tte_ir dex pa _indi d, no	ndex adju: lette ices_ ot co	_idc sted Run _flag ded.	
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
	Y	0	192	255	102	175	4	72	0	142	217	177	201	75	229	50	118	248	36	187	123	168	251	201	131	64	208	162	238	208	212	77	88	128	188
	Сь	0	192	255	182	71	0	0	73	206	252	220	125	6	252	118	65	182	108	252	17	243	255	239	149	64	201	182	247	217	241	140	66	128	159
	Cr	0	192	255	0	239	87	156	0	57	186	142	255	206	155	24	171	255	10	104	228	129	178	165	138	64	212	148	229	201	190	50	43	128	246
		Pal	ette	pre	dict	or																													
		0	1	2	з	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
	Y	0	192	255	102	175	4	72		142	217	177	201		229	50	118	248	36	187	123	168	251	201	131	64	208	162	238	208	212	77	88	128	188
	Сь	0	192	255	182	71	0	0	73	206	252	220	125	6	252	118	65	182	108	252	17	243	255	239	149	64	201	182	247	217	241	140	66	128	159
	Cr	0	192	255	0	239	87	156	0	57	186	142	255	206	155	24	171	255	10	104	228	129	178	165	138	64	212	148	229	201	190	50	43	128	246
≣▼F	s ·	Cur	ren R	t pa	lette UV	e Y I	U	V P	lic	Info	De	etails	Н	Δ	14	• •	•	*	₩								Rig	ht-o	lick	any	whe	ere t	to gr	o ba	ck

3.2.3 Residuals

	32 -	52	52			32	52	52		32		12	32		
32	32	32	32	32	32	32	32	32	32	32	QP:32	32	32	32	
32	zh/))	32	32	32	32	32	32	32	32	32		32	32	32	
32	32	32//	65//	32	32	32	32	32	32	32	QP:32	32	32	QP:3	
32	64	32	32//		32	32	32	32	32	32	-	32	32		
32	32	32	32	32	32	32	QP11	32	32	32	QP:32	QP:	32	32	
32	32	32	32	32//	.32	62			2	32				32	
2	32	32	32	32	84.	32	32	32	32	32	QP:32			32	
	32	32	32	32	32	32	32	32	32	32	-			32	
2	QP:3	2	32	32	QP:	32	32	32	32	32				32	
			32	32	1		32	32	32	32				32	
				0.0	0.0	laa		-	0.0		0.0.00	la a	Loo		

In Residual mode the transform trees and accompanying residual signal of the picture can be seen. As in Predictions mode, CU boundaries are shown with blue lines. The transform

splits, when present, are indicated with yellow lines. A dashed yellow line indicates that the TU split was implied. QP values of each CU are shown in the upper-left corner. When this value is bright yellow, it means that a delta-QP was coded in the bitstream during the decode of that particular CU. Otherwise the number is dark. When DQP is enabled by the PPS, this helps visualize the DQP coding depth (diff_cu_qp_delta_depth). TUs that have transform_skip_flag set are shaded. CUs that are PCM coded are marked with "PCM" in white, and CUs that have cu_transquant_bypass_flag set have a white X through them.

If the "Pic" button is turned on, the raw residual signal is shown in image form. Residual values of 0 result in flat grey, negative values are darker and positive values are brighter.

Clicking on TUs causes that TU to be selected with a blue surrounding box and its syntax elements (when present) to be displayed in the TU tab of the left panel. Clicking a TU repeatedly causes the selection to move up and cycle though the TU, then CU quadtree hierarchy. Note that when the selected TU is a 4x4, the chroma coefficients are coded one level up in the TU hierarchy since HEVC doesn't specify a 2x2 chroma TU. So to view chroma TU syntax when the luma TU is 4x4, click the luma TU twice to move up to the 8x8 level where the chroma syntax is decoded.



Intel Corporation

QP:24	QP:24
QP:21	РСМ QP:21
QP:21	QP:21 QP:21
2:21	QP:21
3.2.3.1 Residual Detail Mode

To view the full details of a particular TU or group of TUs, make the TU selection and enter detail mode by right clicking or using the detail mode button at the bottom of the main panel. In this mode the selected TU structure is drawn three times, arranged in a column from top to bottom, showing the 3 major steps in recovering the residual signal:

 Coefficient decode. This diagram shows the scan order of the coefficients, the coefficient values and small icons indicating the syntax elements associated with coefficient decode. Refer to the legend shown in the top right of the main panel for the exact details. Coefficient groups are outlined with a green box. This box is bright if the coded_sub_block_flag was equal to 1, dark green if 0. A dashed line means the subgroup was implied to contain coefficients



2. Inverse quantization. In this diagram the coefficient values are displayed after the inverse quantization process 8.6.3 from the HEVC spec has been applied.



3. Inverse transformation. This diagram shows the recovered residual signal after the inverse transform process 8.6.4 from the HEVC spec.

Resi	duals	3				
10	18	31	27	5	-11	-14
25	24	21	4	-16	-21	-13
17	13	о	-22	-37	-30	-14
-3	12	17	9	-2	-4	0
17	13	4	-5	-11	-16	-19
3	-9	-22	-24	-17	-14	-17
6	17	12	5	о	-12	-25
8	21	11	-2	-3	-4	-8
	Resi 10 25 17 -3 17 3 6 8	Residuals 10 18 25 24 17 13 -3 12 17 13 3 -9 6 17 8 21	Residuals 10 18 31 25 24 21 17 13 0 -3 12 17 17 13 4 3 -9 -22 6 17 12 8 21 11	Residuals 10 18 31 27 25 24 21 4 17 13 0 -22 -3 12 17 9 17 13 4 -5 3 -9 -22 -24 6 17 12 5 8 21 11 -22	Residuals 10 18 31 27 5 25 24 21 4 -16 17 13 0 -22 -37 -3 12 17 9 -2 17 13 4 -5 -11 3 -9 -22 -24 -17 6 17 12 5 0 8 21 11 -2 -3	Residuals 10 18 31 27 5 -11 25 24 21 4 -16 -21 17 13 0 -22 -37 -30 -3 12 17 9 -2 -4 17 13 4 -5 -11 -16 3 -9 -22 -24 -17 -16 3 -9 -22 -24 -17 -14 6 17 12 5 0 -12 8 21 11 -2 -3 -4

	-		
Chroi	na Cb	Resi	idual:
-3	1	7	11
1	5	11	15
7	11	18	22
11	15	22	26

<u>Chroma Cr Residuals</u>

9	-10	-19	-9
-10	-11	-2	10
-19	-2	14	19
-9	10	19	9

*Other names and brands may be claimed as the property of others.

3.2.4 Reconstruction

In Reconstruction mode the reconstructed samples prior to deblocking can be inspected. As with Prediction/Residual mode, CU boundaries are shown with blue lines. CUs that have at least one TU with non-zero coefficients are marked with "Non-zero CBF". PCM-coded CUs are indicated with "PCM" in white.



3.2.4.1 Reconstruction Detail Mode

In detail mode, the reconstructed sample values can be inspected. The selection may be a single CU, or a group of CUs up to and including the entire encompassing CTB.

Luco	_															Chr	oma	CD					
	а															102	103	103	103	105	104	103	101
163	162	162	161	161	160	160	159	159	160	160	160	159	160	159	160	102	103	103	103	105	103	103	101
163	162	162	161	161	160	160	159	160	162	161	160	160	160	159	160	100	100	100	100	105	100	100	100
163	162	162	161	161	160	160	159	160	161	160	160	160	160	159	159	102	103	103	103	102	103	103	102
163	162	162	161	161	160	160	159	160	161	160	160	160	160	159	160	102	103	103	103	105	104	103	102
162	162	160	161	161	160	160	150	160	161	160	160	160	160	1 5 0	160	102	103	103	103	102	102	102	102
103	102	102	101	101	100	100	139	102	101	100	100	100	100	139	100	102	103	103	103	100	100	100	100
163	162	162	161	161	160	160	159	162	161	160	160	159	159	159	158	102	103	103	103	107	107	107	107
163	162	162	161	161	160	160	159	162	161	160	160	159	159	158	159	102	102	102	102	105	105	105	105
163	162	162	161	161	160	160	159	161	160	161	159	159	159	160	159	102	103	103	103	103	103	103	103
162	159	165	162	161	158	162	160	161	160	160	160	163	159	161	157	Chr	oma	Cr					
1.00	100	1.50	1.00	1.5.4	100	100	115			100	100	1.40		1.50	1.51	101	100	100	100	101	99	100	112
167	168	158	162	154	136	129	115	118	110	122	124	149	157	156	161	101	100	100	100	100	99	98	101
162	146	115	83	68	62	60	58	61	65	62	65	59	75	110	145	1.01	100	100	100	100	90	98	98
151	69	60	55	51	59	59	57	63	64	59	59	60	59	60	72	101	100	100	100	100		20	
155	63	58	60	58	59	58	59	61	64	64	58	51	64	62	70	101	100	100	100	100	99	98	99
161	68	62	63	58	58	59	57	58	64	56	58	61	58	62	59	101	100	100	100	98	98	98	98
	00						100								50	101	100	100	100	96	96	96	96
156	61	61	66	66	82	98	109	110	87	69	63	59	60	59	59	101	100	100	100	104	104	104	104
157	60	77	105	144	156	158	154	159	160	142	78	56	56	57	58	101	100	100	100	102	102	102	102

3.2.5 Deblocking

Deblocking mode shows all edges processed by the deblocking filter as described in the HEVC spec section 8.7.2. CU boundaries are not displayed in this mode, however CU selection still functions as in the other modes. Edges shown are for the luma deblocking process and are color coded in the following manner:

- Green: Strong luma filter applied
- Yellow: Weak luma filter applied
- Red: No filter applied (but edge was evaluated) • 2 3 4 5 6 0 R

3.2.5.1 Deblocking Detail Mode

The deblocked sample values can be inspected directly in detail mode. As with Reconstruction Details, the inspected area can consist of one or more CUs. Sample values are indicated in yellow if they were modified by the deblocking process. Sample values that cannot be modified due to pcm_flag or cu_transquant_bypass_flag are indicated in red. Filtered edges belonging to the selected CU are shown in thick dashed lines, color coded the same way as in the non-detail mode. Each edge can be selected and clicked, bringing up a window showing the input values to the edge filter. Note that these values may differ from the reconstructed samples for horizontal edges, as they may have been modified by a vertical edge filter. Additionally, the boundary strength is displayed. Edges that were processed but ultimately not filtered (red colored) will indicate the reason. Typically it is due to the boundary strength being 0, the threshold condition not being met, or a slice/tile edge when those edges shouldn't be processed.

																			133	124	119	114	127	134	138	137
	81	84		87	88		91	93	92	121	176	218	223	216	210	203			122	118	116	114	130	136	138	136
	83	86	87		89		92	93	100	134	186	218	214			202	10	1.00	1.1.7		110		100	100	100	100
	85	88			90	91	92	93	93	135	190	218	212	206	211	206	13	5 122	117	115	116	115	131	136	138	135
	88	90	91	92	92	93	93	94	95	137	191	219	213	209	213	210	12	9 119	115	116	116	117	132	137	138	136
82 84 86 87	89	91	93	93	94	95	96	98	100	145	197	221	215	213	215	214	12	7 118	116	116	117	118	133	137	138	137
04 05 07 07	00	01	0.2	0.2	0.4	05	06	05	107	1 5 7	204	222	21.0	216	216	216	12	7 118	115	116	117	119	134	137	138	139
84 86 87 87	89	91	92	93	94	95	96	97	107	157	204	223	218	216	210	216	11	9 119	118	118	118	118	121	121	121	120
85 87 88 88	89	91	92	93	94	95	96	97	115	166	212	225	219	217	217	217	11	9 119	118	118	118	118	121	121	121	121
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	Lum	ia																	Chr	oma	Cr					

3.2.6 SAO

In SAO mode the SAO filter parameters assigned to each CTB are shown. The mode and associated four offsets for each component are indicated with yellow text, and the merge_up / merge_left flags are indicated with an arrow. The CU quadtree boundaries are shown here as well.



3.2.6.1.1 SAO Detail Mode

Entering detail mode on a selected CU will show all samples after being processed by the SAO filter. Samples values that were actually modified by the SAO operation are highlighted in yellow. Each sample can be clicked, bringing up a 3x3 window that shows the input values to the filter process. In the screenshot below, the 45-degree edge filter inputs are the samples to the lower left and upper right. Samples that cannot be modified by the filter are indicated in red.

									Chror	na Cb	, 45-D	egree	e Edge (2, 1, -1, 0
Luma	, 45-D	egree	e Edge	(1,0	I, O, -2	2)			106	107	107	105	
148	145	142	140	143	136	130	130		100	207	101	100	
									106	106	106	105	
146	145	145	145	150	140	130	132						
									106	106	106	105	
146	145	145	145	144	123	103	106						
									106	106	106	105	
146	145	145	145	157	142	126	134						
162	1.46	137	146	162	1.45	134	1/18		Chror	na Cr,	45-D	egree	Edge (0, 1, -1, -1
102	140		140	102	140	104	140		111	111	111	111	
147	135	141	166	164	144	137	147						
									111	111	111	111	
144	155	183	206	163	144			132					
									111	111	111	111	
142	163	178	169	144	144		129						
								\mathbf{P}	111	111	111	111	
						140							

*Other names and brands may be claimed as the property of others.



3.2.7 YUV

YUV mode allows inspection of the final decoded sample values, without additional overlay data. In this mode, the YUVDiff feature is exposed. This feature allows for comparison of an external decoded YUV file with the decoded bitstream. Supported formats are 4:2:0 planar and NV12. Also, YUV files that are zipped or gzipped may be opened directly without the need to decompress separately. If a zip file contains more than one YUV file, only the first one is used. When a YUV file is loaded, any mismatches will be indicated with a red dot in the CU containing the mismatch. This allows the user to quickly identify the nature of the mismatch which can assist with debug.

When a file is opened, four additional buttons become visible on the lower left of the main window:

 \blacksquare FS - + R | YUV \checkmark Pic Info Details H \land | \bowtie \bigstar \blacktriangleright \blacktriangleright \bowtie | Ref YUV Debug YUV Diff YUV Reload

- Ref YUV: The original, expected YUV image.
- Debug YUV: The loaded debug YUV file.
- Diff YUV: The delta image. Like in Residual mode, areas with zero delta (i.e. Original and Debug image are identical) are flat gray. Areas where the debug YUV has a lower value are darker, and areas where the debug YUV has a higher value are brighter.
- Reload: Reloads the YUV file, which can be useful as a shortcut to loading via the YUVDiff menu.

3.2.7.1 YUVDiff Menu



- Open: Brings up a file chooser to open a YUV file. Intel Video Pro Analyzer considers YUV stream as having the same frame size, per frame bitdepth and color format as encoded bitstream.
- Close: Closes the currently opened YUV file. Any mismatch indicators will disappear.
- Planar: Causes Intel Video Pro Analyzer to interpret the loaded YUV file as Planar.
- Interleaved: Causes Intel Video Pro Analyzer to interpret the loaded YUV file as Y values followed by interleaved U and V values. This option is chosen automatically when the loaded YUV file has the file extension ".nv12".
- Display order: Causes Intel Video Pro Analyzer to use display order picture numbers when determining how far to seek into the YUV file to extract the image to compare with the current picture.
- Decode order: Causes Intel Video Pro Analyzer to use decode order picture numbers when determining how far to seek into the YUV file to extract the image to compare with the current picture.
- Use stream crop values: When checked, YUV files are assumed to contain samples only within the cropping window as defined by the loaded bitstream. Samples outside this window are not compared, and are assumed 0 when viewing the loaded YUV image directly.
- Set picture offset here: Shortcut for setting the picture offset to the current picture number. See bullet below.
- Use 16 bit YUV: this option allow you to load YUV file where both Luma and Chrome written in 16 bit (they could be normalized from actual bitdepth to 16 bit during encoding). This is useful when you have bitdepth changing across the stream. Intel Video Pro Analyzer will shift values to appropriate bitdepth on the current frame.
- Picture offset: This brings up a dialog allowing the user to enter the picture number of the first picture in the YUV file. For example if a 100-picture bitstream is loaded but the YUV file only contains pictures 80-99, the user would enter 80 to properly line up the YUV file with the decoded bitstream.
- Check for file changes: When checked, this option causes Intel Video Pro Analyzer to periodically check if the loaded YUV file has changed on disk since it was last loaded. If the file has indeed changed, a dialog pops up offering a chance to reload the YUV file.

3.2.7.2 YUV Detail Mode

In detail mode the expected YUV values can be inspected. Note that the displayed sample values are the same as those in SAO mode since SAO filtering is the last step in the decode process. When a YUV file is loaded, the debug and delta YUV values can be inspected as well. Mismatching values are shown in red.

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3.2.8 Info Overlays

There are a number of overlay that provides additional information about currently investigated picture. When you switch mode to "Info Overlays" mode several additional submenus will appear in the bottom-left panel of info window.

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U QpY:37	13	56	4u 6e	c8	e2	2e	8d	ef	a0	e0	52	8b	3e	86	b3	c3		PSNR
	3a	cd	78	e0	3c	f9	49	49	73	49	2d	3d	3f	33	9d	65	2a	b2 14 36

You can switch now between additional modes. PSNR mode is enabled if you have loaded reference YUV file.

3.2.8.1 Heat Map

Heat map mode shows visually how the compressed bits of the picture are distributed spatially. CUs with more bits per pixel are brighter than CUs with less. By zooming in actual CU sizes in bits will be displayed as soon as it size in the borders of the CU. By default this mode also shows the CU quadtree boundaries in blue. It may be useful to turn off this overlay using the "Info" button on the lower left of the main panel. Heat Map does not offer a detail mode.



The gradient used to display the heat map may be edited:

- Drag the gradient markers up and down to reposition them.
- Drag a marker away from the gradient to remove it. A red X indicates removal will take place.
- Double-click a marker to change the color.
- Double click the gradient bar to add a new marker.

*Other names and brands may be claimed as the property of others.

3.2.8.2 QP Map

QP Map show per CU QP. CUs with bigger QP are brighter than CUs with less. Coloring of the QP range can be adjusted with a gradient tool on the right top corner.



3.2.8.3 PU Type

PU Type overlay show color map of their types. Intra blocks is colored in red, inter skip is yellow colored, inter merge is in green and inter in blue. The legend on the right top corner show color types for blocks. Gradient band can adjust transparency when the Pic switch is on.



3.2.8.4 PU Reference Indices

PU reference indices shows reference indices for each PU. Orange color shows L0 reference index and purple color is for L1 reference index. When PU has only one reference missing reference index is displayed with dash. For blocks with no reference indices nothing is shown.

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3.2.8.5 **PSNR**

PSNR map shows per pixel PSNR value normalized on CU size. To enable this mode you have to load reference YUV file via DebugYUV menu. The value is calculated per CU. Bigger value has brighter color. The color range can be adjust with gradient tool on the right top corner. If the block has no difference with reference YUV a latter 'e' is shown which means exact match.

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12.5	11.4	10.4	12.7	22.3	18.5	16.5	15.4	14.5	16.4			12.8	12.2	10.6	8.2	6.95	11.2																		
12	11.7	11.4	11.8	17	7.7	14	1.3	13.1	13.9	13	.3	11.	3	10.1	13.5	20.3	14.4	1	2.7	1	2.7	11	6	12	.3	1	2	1	1.9	1	1.9	1	2.9	1	2.1
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			_			14.3	14.1			10						4.86	6.65	4.13	4.94	7.65	6.12	5.29	4.58	5.72	6.7	6.31	7.48	8.57	10.5			12.7	11.1	11.8	1
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13.6	8.91	8.82	11.9															4.73	3.7	3.97	3.16	3.72	4.5	7.24	8.48	7.6	9.22	9.76	8.44	7.44	9.7				
14.5	10.2	9.42	16.3	1	8	15.6	14	- 15	.9	13	.4	10.	7	1	10	5.	88	4.7	4.8	•.41	3.69	3.75	2.58	3.25	4.36	4.8	5.32	4	.3	4	19	5.31	3.91	4.33	4
13.5	12.8	13.1	19.2			22.6	11.7											4.63	5.62	4.77	4.46	4.05	2.65	3.38	3.9	3.32	3.73					5.04	3.74	3.86	4.
				14	15.8	18.3	11	12.3	12.5	11.8	12.7					4.93	6.86	3.95	5.24	4.68	4.38	4.45	3.33												

*Other names and brands may be claimed as the property of others.

3.2.9 Simple Motion



Simple Motion mode offers a way to quickly view the modes and motion of a picture at a glance. No overlays are present except a colored dot showing information about the PU's mode. Green dots indicate intra PUs, and purple/orange L0/L1 motion vectors for inter PUs are drawn as simple lines. When the motion vector is very small, a dot is drawn instead so that the mode is still easy to identify. When a motion vector does not point to the 0-th index of its respective list, the vector is drawn using a dashed line.

4 VP9

The following sections describe all available features when loading a VP9 bitstream. The bitstream must be containerized with either the WebM or IVF container format. The publicly available VP9 reference software can output both formats. Raw uncontainerized bitstreams are presently not supported due to the nature of the VP9 standard; there is no way to determine where each frame starts without doing a full decode of the sequence.

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-						Ready		117MB / 121MB / 32646MB

4.1 UI Components

The following sections describe the various components in the UI when an VP9 bitstream is loaded.

4.1.1 Top Filmstrip



The top filmstrip is a horizontally scrolling overview of the pictures in the bitstream. The current picture is highlighted. On top is the frame number in both decode and display order respectively and the picture type as indicated by the frame header. On bottom is indicated if the picture should be displayed or not. Arrows indicate the reference frames.

Clicking on a picture will cause Intel Video Pro Analyzer to decode it and mark it as the current picture, updating the rest of the UI correspondingly. If the new picture requires other pictures to be available as reference that have not yet been decoded, those will automatically be decoded.

When a frame from the IVF or WebM/MKV container is a super frame (meaning 1 or more non-displayed picture and one displayable), this collection of pictures has superscription with line over those frames belong to the super frame. The bar filmstrip has underline green band under those frames belong to the same super frame.

Pictures are decoded on demand since it is impractical to store all details of all pictures in memory, especially for HD sequences. The current picture can also be selected by typing in a picture number in the box on the left of the panel. When using this box, the filmstrip is scrolled such that the newly selected current picture is visible.

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G				_	Ľ			Extract Pred	iction		
<								Extract Resid	duals		
Syntax Info				ē×	Heatomap, 1bits	p⊉era	area	Extract Reco	nstruction		
SE Name	Value	R	V	^	5 3 12	з	з	Extract YUV			
Frame marker	2			_	16	, , , , , , , , , , , , , , , , , , ,			13	173 22	
Profile	0				12	34 4	2 2 1	2 2 3	4	6 3	
Repeat previous frame	0										

By right clicking on selected picture one can get popup submenu with a set of extract actions. An action called "Extract pictures form last keyframe to the Picture" will write out a bitstream that contains the minimum number of pictures needed to decode the current picture. Typically this will consist of the current picture and all previous pictures that are reference pictures up to the nearest keyframe picture. This can be useful for debugging issues in long sequences. Other actions allow to save in the output file statistics and intermediate/final YUV planes.



Allow separate panels can be detached from them main window or hidden. To attach panels back double click on the titlebar. To unhide panel go to View menu and check appropriate panel.

4.1.2 Main Panel



■ FS - + R | YUV ▼ Pic Info Details H △ | H4 44 ▶ >> >>

The main panel displays the selected picture with visual annotations. The type of annotations and associated interactive behavior depends on the current mode, see 4.2 VP9 Modes. Click-dragging moves the picture around, and the mouse wheel zooms in or out about the mouse cursor.

At the top left of the panel, the current mode is displayed. Along the top right the current scale is shown. In all modes, the super-block row and column values are displayed along the left and top border of the picture and tile boundaries are thick green lines. The screenshot above shows an example of a stream that is 13x8 SBs.

The bottom left has a cluster of buttons:

 \blacksquare FS - + R | YUV \checkmark Pic Info Details H \land | \bowtie \blacklozenge \blacktriangleright \blacktriangleright \bowtie | Ref YUV Debug YUV Diff YUV Reload

- First submenu has special options to output the currently displayed information to the external image file with different scaling possibilities.
- FS: Toggles full-screen mode, which hides all UI elements except the main panel. • Keyboard shortcut is F.
- +/-: Zooms in or out, centered on the center of the panel. Note that zooming with the mousewheel is much easier than using these buttons. Keyboard shortcuts are + and -.
- R: Resets the current zoom to fit the entire picture in the main panel. Keyboard shortcut is R.
- YUV, Y, U, V: Toggles between per-component image, or full-color YUV.
- Pic: Toggles the actual picture underneath the annotations. The picture is modedependent. For example in prediction mode, the picture is comprised of the prediciton samples before the residual signal has been added in. It is often helpful to turn off the picture in order to make the annotation easier to read. Keyboard shortcut is P.
- Info: Toggles the annotations on or off. Keyboard shortcut is I.
- H/D: Toggles between hexadecimal and decimal display of the annotations. This applies to the values in the Left Tabs as well. Keyboard shortcuts are H and D.

• There are five navigation buttons: first frame, previous frame, playback mode, next frame, last frame. The previous/last button will rewind, causing the current picture to be set to the first/last picture in the loaded bitstream. The "Play" button will start playback of loaded bitstream at a reasonable rate, limited by CPU performance. All normal mode operations are possible during playback. Note that playback mode always operates in currently selected order in the filmstrip.

4.1.3 Left Tabs

The left side of the UI is a resizable panel with several tabs that display information about the current selection in one way or another. The following subsections describe each tab.

MKV File: 55 elements	7	IVE He	ader:					
EBML - 31 bytes.			uuci i					
 Segment - 174319 bytes. 		SE Na	ame	Value				
SeekHead - 84 bytes.		IVF si	gnature	DKIF				
Info - 76 bytes.		Versio	on	0				
Tracks - 50 bytes.		Head	er length	32				
 Cluster - 174015 bytes. 		Four	CC code	VP90				
Timecode: 0		Width	n	416				
 SimpleBlock: Binary, 49203 bytes. 		Heigl	nt	240				
Track 1		Fram	e rate	1000				
Timecode: 0		Time	scale	1				
Invisible: 0		Num	ber of frames	105				
Keyframe: 1		Unus	ed	0				
Discardable: 0								
No lacing								
Frame: 49199 bytes								
SimpleBlock: Binary, 22632 bytes.		#	Timestamn	Size (b)	Pos (b)			~
SimpleBlock: Binary, 5 bytes.			0	15010	22			-
SimpleBlock: Binary, 33639 bytes.		1	40	15102	15254			-
SimpleBlock: Binary, 5 bytes.		2	40	24	20440			-
SimpleBlock: Binary, 5 bytes.		2	120	1061	20449			-
SimpleBlock: Binary, 21572 bytes.		3	120	1901	22460			-
SimpleBlock: Binary, 11975 bytes.		4	200	4460	32430			- 1
SimpleBlock: Binary, 5 bytes.		6	200	22	26072			-
SimpleBlock: Binary, 21916 bytes.		0	240	23	30973			- 1
SimpleBlock: Binary, 12980 bytes.		/	280	1051	37008			- 1
SimpleBlock: Binary, 5 bytes.		8	320	22	38031			- 1
SimpleBlock: Binary, 5 bytes.		9	300	14100	50060			- 1
Cues - 34 bytes.		10	400	24	52857			- 1
		40	440	1573	52893			\sim
MKV Frame Probabilities Counts Refs Blo 4		IVF	Frame Pro	babilities	Counts	Refs	Block	

4.1.3.1 Container (IVF or MKV)

Depending on the container type of the loaded bitstream, either the MKV or IVF panel will be present in the UI.

VP9 streams using the WebM or Matroska container will cause the UI to display the container's EBML document in tree form. Clicking an element causes the raw bytes coding that element to be displayed in the Raw Bytes panel (bottom center of the UI). When decoding a particular frame, the corresponding element will be highlighted in this panel. Other tracks may be present in the MKV file (such as audio), but they are not processed. The raw bytes can still be viewed though.

• Streams containerized with the IVF format causes the UI to display the IVF information in this left-most tab. Selecting a frame causes the Raw Bytes panel to show the raw bytes of that frame, including the IVF frame header. Clicking a frame will causes that frame to be decoded.

SE Name			Value		R	V		^	St	art	pos	siti	.on:	: 50	0563	L ((xc5	81)										
Frame ma	arker		2						bits uncompressed: 80 bits compressed: 1053																			
Profile			0						86	00	40	96			37	80	01	08	SF :	24	FR	fe	10	-6	•6		74	76
Repeat pre	evious fram	e	0						d7	65	bf	51	d4	7e	ь4	ce	5e	b3	76 0	dd i	d3	34	b8	db	fa	e2	9e	75
Frame typ	e		1						7d	ЗЪ	e6	7ь	4f	75	ea	3d	a7	b1	ea i	Eb	c7	12	b8	84	e9	ba	d3	bf
Show fram	ne		1						f3	3d	23	a7	33	7f	58	b2	32	57	3f (:4	75	3f	43	89	3f	27	84	02
Error resilie	ient		0						8d	1e	f6	12	6b	5d	da	bb	5f	99	ba 1	Ef	d8	Зb	7d	86	e2	bf	d9	8e
reset_fram	ne_context		0						1e	ff	fb	23	fc	5f	c7	f2	3f	8f 5-	E3 1	7f	1f	f0	76	af	d9	f1	3f	67
refresh_fra	ame_flags[7]]	0						e5 60	10	ar	90	ee	63	Ie	63	85	se	55 1	5	ar	DI	IC	40	e/	ca	89	53
refresh_fra	ame_flags[6]]	0						100																			
refresh_fra	ame_flags[5]]	0																									
refresh_fra	ame_flags[4]]	0																									
refresh_fra	ame_flags[3]]	0																									
refresh_fra	ame_flags[2]]	0																									
refresh_fra	ame_flags[1]]	0																									
refresh_fra	ame_flags[0]]	1																									
active_ref_idx[1]		0																										
ref_frame_	_sign_bias[1]	0																									
active_ref_	_idx[2]		1																									
ref_frame_	_sign_bias[2]	0																									
active_ref_	_idx[3]		2																									
ref_frame_	_sign_bias[3]	1																									
Size from 1	ref[0]		1																									
Scaling act	tive		0																									
allow_high	h_precision_	mv	1																									
mcomp_fi	ilter_type		Switch	nable																								
refresh_fra	ame_context	t	1																									
frame_par	rallel_decodi	ing_mode	0																									
frame_con	ntext_idx		0																									
filter_level	I		28																									
sharpness_	_level		0																									
mode_ref_lf_delta_enabled 1							۷.																					
Total bools per bit in header: 1894/1053 = 1.799. 80 bits not coded.																												
MKV F	Frame H	Probabilities	Counts	Refs	Block	TX	S∢	ŧÞ	M	1KV	F	rame	Н		Pro	babili	ties	0	ount	ts	R	efs	E	Block		тх	5	4

4.1.3.2 Frame

The Frame tab shows all syntax elements decoded in the frame header, both the uncompressed and bool-coded partitions. A few stats about the size of the header are shown below the list.

Since the VP9 reference software does not always assign a variable name to each decoded token, a descriptive name has been assigned which conveys the meaning or usage of the token.

The two left columns R and V represent the value of the bool coder's range and value prior to decoding the token. For the uncompressed part of the frame header, these values are not present.

By pressing on 'H' button in the header tab one can show hexadecimal representation of the frame header. This representation show all bytes of the header, starting position, number of bytes in the compressed and uncompressed sections. Uncompressed bytes are highlighted in blue color.

4.1.3.3 Probabilities

Starting value -> Modified by header -> Adapted									
Frame probabilities	^								
coef_probs_4x4[2][4][6][6][11]									
coef_probs_8x8[2][4][6][6][11]									
coef_probs_16x16[2][4][6][6][11]									
coef_probs_32x32[2][4][6][6][11]									
kf_y_mode_prob[10][10][9]									
y_mode_prob[4][9]									
kf_uv_probs[10][9]									
if_uv_probs[10][9]									
partition_probs[16][3]									
intra_inter_prob[4]									
[0]: 5 -> 5 -> 4									
[1]: 95 -> 95 -> 83									
[2]: 187 -> 187 -> 187									
[3]: 225 -> 225 -> 225									
comp_inter_probs[5]									
comp_ref_probs[5]									
single_ref_probs[5][2]									
switchable_interp_prob[4][2]									
tx_probs_32x32[2][3]									
[0]: tx_probs_32x32[3]									
[0]: 3 -> 3 -> 3									
[1]: 136 -> 136 -> 136									
[2]: 37 -> 37 -> 37									
[1]: tx_probs_32x32[3]									
▷ tx_probs_16x16[2][2]									
▷ tx_probs_8x8[2][1]	~								
Total adapted probabilities: 855/7119									
IVF Frame Probabilities Counts Refs Block									

The probabilities used to decode the current frame are visible in this panel. They are organized hierarchically in the same way as the VP9 reference software. Each probability is given as three numbers. From left to right:

- 1. Probability as it was at the start of the frame decode process. For keyframes or when the reset_frame_context flag is equal to 1, this is the VP9 default value.
- 2. Probability value after modification by the bool-coded section of the frame header.

3. Probability value after modification by the adaptation process after frame decode.

When the probability adaptation process causes the value to actually change, the probability is shown in blue. The total number of probability values that were actually changed is given below the tree.

4.1.3.4 Counts



This tab shows the values of all the counters used for probability adaptation at the end of the frame decode. The counters are organized in hierarchical fashion in the same way as the VP9 reference decoder. Color bars give an indication of relative size of each counter in its group, and the parent icon contains the sum of the counts.

4.1.3.5 Refs

#	Frame	Ref		Refre	sh					^	
0	0	GOLD	EN	No						_	
1	1	Unus	ed	No						_	
2	2	ALTR	EF	No							
3	3	LAST		No							
4	0	Unus	ed	No							
5	0	Unus	ed	No							
6	0	Unus	ed	No						~	
Segmer	ntation data	a:									
ld	AltQ (d	elta)	Alt	LF (de	lta)	Ref		Skip		^	
0	24		Dis	abled		Disabled		No			
1	Disable	d	Disabled			Disal	oled	No			
2	Disable	d	Disabled			Disa	oled	No			
3	Disable	d	Dis	abled		Disa	oled	No			
4	Disable	d	Dis	abled		Disabled		No			
5	Disable	d	Dis	abled	Disab		oled	No			
6	Disable	d	Dis	abled		Disa	oled	No		\checkmark	
- rame (contexts:				Loop	filter	delta	s:			
ldx	From	Ada	apte	d	De	ta	Valu	Je			
0	Frame	Yes			Ref	0	1				
1	Frame	L Yes			Ref	1	0				
2	Frame	Yes			Ref	2	-1				
3 <	Frame -	J Yes			Ref 3		-1				
					Mode 0 0			0			
					Mo	de 1	0				

This panel displays the data that persists in the decoder between frames:

- The 8-entry pool of reference frames and which of each of these is considered the Last, Golden and AltRef frame. If any of the frames should be replaced with the current frame after decode (as specified by refresh_frame_flags), the right most column will indicate that.
- Segmentation data for each segment.
- The 4-entry frame context buffer as it applies to the current frame. The center column indicates the frame that generated that context, and the right column indicates whether or not it was the result of adaptation at that time.
- Loop filter deltas for all four references and both modes.

4.1.3.6 Block

Syntax Info					ē×
SE Name		Value	R	V	
partition		PART NONE	131	68	
mb skip coeff		0	196	137	
inter flag		1	165	137	
is_comp		0	188	77	
ref_frame[0]		LAST	184	77	
inter mode		NEWMV	129	77	
filter_type		0	169	66	
joint_nonzero_flags		3	222	132	
vertical sign		0	137	47	
vertical class		0	140	95	
vertical class0 integer	r delta	1	200	191	
vertical fractional delt	ta	3	196	161	
vertical high precision	n delta	0	144	75	
horizontal sign		1	164	150	
horizontal class		1	164	137	
horizontal integer de	lta	1	236	172	
horizontal fractional of	delta	1	212	84	
horizontal high precis	sion delta	1	154	107	
MKV Frame F	Probabilities	Counts	Refs	Block	T) ∢ ►

This panel displays the syntax elements associated with the currently selected block. Since the VP9 reference software does not always assign a variable name to each decoded token, a descriptive name has been assigned which conveys the meaning or usage of the token.

Note that only the syntax elements at the currently selected block hierarchy are shown. To see the PART_SPLIT tokens at higher levels in the recursive subdivision process, repeatedly click the same block in the main panel to navigate the hierarchy.

The two left columns R and V represent the value of the bool coder's range and value prior to decoding the token.

Syntax Info						đΧ		
Y	lb Cr							
SE Name	Value	R	V			^		
more coeffs [0]	1	220	127					
non-zero coeff [0]	1	216	123					
coeff > 1 [0]	1	174	81					
high val [0]	0	204	19					
coeff > 2 [0]	0	154	19					
sign[0]	0	160	79					
more coeffs [1]	1	160	79					
non-zero coeff [1]	0	141	60					
non-zero coeff [2]	1	252	241					
coeff > 1 [2]	1	140	129					
high val [2]	0	160	117					
coeff > 2 [2]	1	151	117					
coeff > 3 [2]	0	184	51					
sign[2]	0	140	103			-		
more coeffs [3]	1	140	103					
non-zero coeff [3]	1	218	144					
coett > 1 [3]	0	156	9					
sign[3]	0	142	18					
more coetts [4]	1	142	18					
non-zero coetf [4]	0	135	11					
non-zero coetf [5]	U	220	46			~		
IKV Frame Pro	obabilities	Counts	Refs	Block	TX	4 1		

4.1.3.7 TX

This panel displays the syntax elements associated with the currently selected transform block. Since the VP9 reference software does not always assign a variable name to each decoded token, a descriptive name has been assigned which conveys the meaning or usage of the token.

A particular transform block may be selected in the Main Panel (when in Residual mode), or by clicking in the diagram above the syntax list. Note that when not in detail mode, only the luma transform blocks are selectable from the Main Panel.

The two left columns R and V represent the value of the bool coder's range and value prior to decoding the token.

4.1.3.8 Stats



This tab displays various statistics extracted from the current picture. The top half shows some picture size and compression stats as well as the image digest information. The bottom half displays pie charts for a number of metrics. Each pie chart can be drawn normalized or un-normalized. Normalized data is weighted by area or bits. For example there may be a much lower number of 64x64 blocks than 8x8 blocks in the frame (smaller un-normalized pie wedge), but they could still make up the majority of the picture area, making the 64x64 pie wedge large. Normalized numbers in the pie chart are in units of pixels or bits, and un-normalized numbers are raw counts.

The pie chart can be moved by dragging the mouse, and zoomed with the mouse scroll wheel.

4.1.4 Selection Info

Selection Info		₽×
Width: 640	Block size: 8x8	Segment ID: 0
Height: 480	Block XY: 448,328	Transform size: 8x8 Y
Frames: 52	Block MI col, row: 56,41	Transform XY: 448,328
Tile col, row: 0, 0	Block part: PART_NONE	Transform type: DCT_DCT
SB col, row: 7,5	Prediction mode: NEWMV	First MV: -68,5=>L
Pixel X, Y: N/A	Prediction size: 8x8	Second MV: N/A

This panel shows a few details about the current selection at a glance:

- Frame height & width
- Number of frames in the bitstream
- Tile row and column number
- Current super-block row and column number
- X/Y position of the mouse cursor in the frame
- Size of the selected block
- X/Y position in pixels of the selected block's upper left corner
- MI (8x8 granularity) column and row number of the upper left of the selected block
- Selected block's partitioning mode
- Selected block's prediction mode
- Size of the selected prediction block
- Segment ID of the selected block
- Transform size used in the selected block (luma)
- X/Y position in pixels of the selected transform block (Residual Mode)
- Type of transform used on the selected transform block (Residual Mode)
- Value of the motion vector(s) used by the current prediction block in 1/8th pel. An arrow and letter indicate the reference frame: L for Last, G for Golden and A for AltRef.

4.1.5 Raw Bytes

Unit Info											
Matroska element SimpleBlock, type 'b', length 30472:											
Binary, 304/2 bytes.											
Starting at byte position 222530 in file:											
a3 20 77 08 81 00 00 80 82 49 83 42 00 27 f0 1d f4	4 18 38										
24 1c 18 66 00 03 f0 6f a9 ff 3f f1 7f d5 7f 97 f8	3 bf 07										
86 fc 5f 6c fb 67 c2 fe 7f b0 7c 2f ba 5f 8b fc 0	E 85 f8										
fe de fc 5f 6d fe 2f 0b f0 fd d1 f8 5f 87 ed 9d 70	57£17 🗸										
Unit Info											
Block at pixel position 584, 400 Bits (mode+coeff): 1+140 = 141 (18 bytes) Bools (mode+coeff): 7 + 178 = 185 (1.312 bools per bit) Starting at position 276136 in file: 2f 3c 53 1b 87 70 6a 61 3b fc b4 32 8f af a0 4d a9 bd											

This resizable panel displays raw bytes from the bitstream as it applies the current selection, as well as few extra details. The current selection can be a particular block, a Matroska element/frame or an IVF frame (depending on the current bitstream's container).

4.1.6 Messages

Status	8 C	×
Decoding frame 8 done.	,	~
Decoding frame 9 done.		
Decoding frame 6 done.		
Decoding frame 5 done.		
Decoding frame 6 done.		
Decoding frame 2 done.		~
A Ready 106	MB / 120MB / 8089M	1 B

This resizable panel in the lower right of the UI displays messages about the decoding process, and shows progress of any actions that may take a while to complete. The 3 numbers in the lower right of this panel represent the memory state of the proccess. From left to right the 3 numbers are:

- Amount of memory used by process
- Peak memory used by process
- Total memory claimed by system

4.2 Modes

Mo	de	YUVDiff	Options
	Сс	ding flow	F1
	Pre	edictions	F2
	Re	sidual	F3
	Re	constructi	on F4
	Lo	op filter	F5
•	ΥU	V	F6
	Inf	o overlay	s F7
	Eff	ficiency m	ap F8
	Sir	mple moti	on F9

With a VP9 bitstream loaded, Intel Video Pro Analyzer can be put into one of 9 modes using either the F1-F9 keys, or using the Mode menu. The mode selection affects only what is displayed in the Main Panel.

Most modes can also show details of the current selection (block, prediction/transform block). This can be toggled with the right mouse button or the main panel's button strip.

4.2.1 Coding Flow



Coding flow mode gives an overview of the way the frame is constructed. Each superblock's decode index is shown in yellow and block-partioning is indicated with blue boundaries. Tile boundaries, when present, are shown with thick green lines and the tile size as coded in the bitstream is shown at the top left of each tile that has a size coded. When segmentation is enabled, each segment is shaded with a unique color. No detail mode is available.

4.2.2 Predictions

							UVYV	Otro
8s V	8-tap smooth NEARESTMV	8-ta NEAR	p smooth MV	8s NEWMV	8s NstMV	8s NEWMV	8s NstMV	8s NrMV
۶L	74,0=>L	74,0=>L		74,2=>L	76,0=>L	68,0=>L	68,0=>L -68,0=>A	
8s IV	8-tap smooth NEWMV	8-ta NEAR	p smooth MV	8-tap NstMV	҄҂ӣӻѾ҉ӣ҉ӯҎ	8s 8s NrMV	H_PRED	^{8s}
۶L	78,0=>L	78,0=>L		74,2=>L	6NE WM&P		UV: DC	8s
8s	8-tap smooth	8-tap NEWMV	8-tap NstMV	NEARE	8-tap STMV	H_PRED	H_PRED	
v	NEARMV	78,2=>L	78,0=>L	74,2=>L		→ →	> UV: Н	0,6=
		8-tap NetMV	8-tap NstMV	NEARE	8-tap STMV	8s NstMV	тм тм	,
۶L	74,2=>L	78,2=>L	78,0=>L	74,2=>L	ſ	≯ 74 2=>I	TM TM UV: H	<u>а</u> 6=
tap		8-ta	p smooth	8-t:	ap smooth	V_P	RED	8s
	NEARI	STMV		NEARE	STMV			TN1_F
tap		;				>	/	
						V_P	RED	¥.
	74,2=>L			74,2=>L		Chroma:	M_PRED	y J Z
tap	8-tap 8-tap NstMV NstMV	8-tap NstMV	8-tap NstMV	8-tap NstMV	8-tur	NstMV		4.

This mode shows the details of the prediction blocks in the frame. Block splits are indicated with blue lines, the selected block is surrounded with a pink box and the selected prediction block is surrounded with a yellow box. When a prediction block is selected, the syntax used to code it is displayed in the Block tab of the Left Panel. Clicking a block repeatedly will navigate the recursive block hierarchy.

Intra prediction block contain the intra luma mode in bright green, and the chroma intra mode in dark green near the bottom of the block. When the intra prediction operation is split due the size of the transform blocks, the intra split boundaries are indicated with dashed green lines. Directional intra luma modes also contain a turquoise arrow indicating the prediction direction.

Inter prediction blocks show the inter mode in cyan, the first motion vector in orange and the second motion vector in purple. The motion vector value is in units of 1/8th pixels. After the motion vector value the reference frame it points to is indicated with a single letter: L for Last, G for Golden and A for AltRef. The motion compensation filter type that applies to the prediction block is indicated in yellow near the top right corner of the block.

*Other names and brands may be claimed as the property of others.

4.2.2.1 Prediction Detail Mode

Entering detail mode on a selected prediction block allows the sample values of the prediction process to be viewed directly.

Intra-predicted blocks display the intra prediction process of each component. The left, above-left and above reference sample arrays are shown as well. Current block prediction details



Inter-predicted blocks show the filtered prediction samples arrays of each component, the predictor list used for motion vector prediction (for each motion vector) and the filter type applied. To the left of the prediction sample arrays the impulse response of the applied filter is drawn (mostly decoratively). Each prediction sample can be clicked to display a window that contains the 8x8 or 4x4 sample array for luma or chroma respectively that are the inputs to the motion compensation filter for the selected pixel. The applicable filter phases are also indicated. In the case of compound prediction, both arrays & phase sets are shown with the first/second colors of orange/purple. Clicking the selected sample again or outside the block closes this window.



			99	102	103	104	105	105	106	106			
			13	15	17	18	19	19	20	20			
Luma inter sam			26	28	30	31	33	33	34	34	o inte	r san	nples
39	28	34	37	31	32	31	31	31	32	32	120	127	
36	28	39	41	34	33	31	29	29	30	31	128	127	
37	28	38	40	36	34	31	28	28	29	29	128	127	
20	29	26	26	26	25	22	27	27	20	20	128	128	
	20								20	20	inter sam		nples
39	28	36	35	34	34	36	56	93 Harto	108	113	128	128	
39	28	36	Horiz	zonal	pnas	e = 6	, ver	tical p	nase 128	9 = 4 128	128	128	

Final MV is -20,55 to ref AltRef.

4.2.3 Residuals



Residual mode allows inspection of the transform structure of each block. Block boundaries are displayed in blue, the currently selected block is outlined with a pink box and the selected transform block is outlined with a blue box. Blocks that code no residual signal are indicated with "Skip" in yellow. Blocks that use a transform size that is smaller than the block's own size show the transform boundaries within the block in yellow.

Clicking a particular transform block causes the syntax elements used to decode it to be visible in the "TX" tab of the Left Panel.

The residual image itself can be shown using the "Pic" button on the bottom button strip. Residual values of 0 are flat gray, negative values are darker and positive values are brighter.
Intel Video Pro Analyzer shows the number of non-zero coefficients with "Coeffs: 2" label on the corresponding block.

4.2.3.1 Residual Detail Mode

To view the full details of the transform blocks belonging to a particular block, selected a transform block and enter detail mode by right clicking or using the detail mode button at the bottom of the main panel. The currently selected transform block is highlighted with the sample grid. The transform structure of the selected block is drawn three times, arranged in a column from top to bottom, showing the 3 major steps in recovering the residual signal:

1. Decode and inverse scan process. In this diagram the scan pattern is drawn for each transform block. In an attempted to reduce clutter, larger scan pattern jumps are drawn with a darker color. The currently selected transform block is highlighted with the sample grid. Moving the mouse over a particular coefficient will highlight the previous and next coefficient in scan order.



2. Inverse scaling process. The scaled values and the scaling factors used to obtain them are shown in this diagram.

				Dequantize Scale DC 48, AC 55							Deq Scal	uanti e DC	ze 48, AC 55
			\backslash	/									
Luna					-				Chro	ma Cl	b de-	quan	tized values
Luma	sue-c	quariu	.izeu	value	5			1	240	-220	220	-55	
-528	1045	-165	330	165	-110	0	0		-110		-55	Ω	
330	330	275	275	-220	110	-55	-55					Ŭ	
110	110	165	-110	-110	55	-165	55		0	0	0	0	
						_			0	0	0	0	
	110	55	-110	U	-110	U	55		Chron	n o Ci	r do_c	ulant	izad valuac
55	0	0	0	-55	0	0	0				ue-u	luani	izeu values
-110	0	0	-55	-55	-55	-55	0		-336	385	-440	55	
	_110	0	0	0	0	0	0		220			55	
Ľ	-110	- 0	0		0	- 0	0		0			0	
0	55	55	-55	-55	-55	0	0						
									0	0	0	0	

3. Inverse transform process. This recovered residual values and the transform type used are displayed in this diagram.

				Inv iDC	erse T ho	trar riz, i	nsfor ADS	rm T ve	rt	Inverse transform iDCT horiz, iDCT ver					
Lum	a re:	sidua	als						Chro	ima.	co r	esia	uais		
4	24	8	-10	-8	-9	2	-3		4			12			
38	36	11	-4	-8	-10	3	-22		4		0	19			
48	33	4	-5	-11	-3	-3	-31		5			30			
32	12	-12	-4	-5	Д	-15	-45		-5	-1	7	37			
04	10	12		,	-1	10	40		Chro	ma	Cr re	esidu	ials		
34	14	-2	-5	-1	-1	-40	-47		-7	1	11	-12			
18	-3	-8	-5	8	-14	-51	-39		_13			-28			
з	5	-6	-9	-1	-39	-60	-46		10			-20			
4	-4	-8	2	2	-29	-41	-42		-10			-53			
									-1	12	-18	-71			

4.2.4 Reconstruction

In Reconstruction mode the reconstructed samples prior to loop filtering can be inspected. As with Prediction/Residual mode, block boundaries are shown with blue lines. Blocks with no coefficients are marked with "Skip" in white.



4.2.4.1.1 Reconstruction Detail Mode

In detail mode, the reconstructed sample values can be inspected. The selection may be a single block, or a group of blocks up to and including the entire encompassing super-block.

			L					unro	oma	CDI	ecor	istructe	a valu
Lum	a rei	cons	truci	iea v	alue	s		130	130	130	130		
61	61	61	45	12	73	204	162	100	100	100	100		
								130	130	130	130		
61	61	53	40	52	181	220	100	100	100	100	100		
61	61	45	35	132	238	175	62	130	130	130	130		
01	01	40		102	200			130	130	130	130		
61	53	40	53	207	235	109	69						
60		50	105	0.5.5	1.50	00		Chro	oma	Cr re	econ	structed	d value
62	54	52	135	255	150	46	66	125	125	125	125		
61	56	97	185	248	98	24	68						
								125	125	125	125		
60	60	143	234	179	57	37	76	125	125	125	125		
61	102	190	211	93	51	63	83	123	120	120	120		
								125	125	125	125		

4.2.5 Loop Filter

Loop filter mode shows all processed edges in the frame. Edges are 1 sample high/tall, and as color coded as follows:

- Green 16-tap filter
- Yellow 8-tap filter
- Orange 4-tap filter
- Red Not filtered, threshold not met (but processed).



4.2.5.1 Detail Loop Filter Mode

The filtered sample values can be inspected directly in detail mode. As with Reconstruction Details, the inspected area can consist of one or more blocks. Sample values are indicated in yellow if they were modified by the deblocking process. Samples to the left and above the current block need for the filter are shown as well. Filtered edges belonging to the selected blocks are shown in thick dashed lines, color coded the same way as in non-detail mode. Each edge can be selected and clicked, bringing up a window showing the input values to the edge filter. Note that these values may differ from the reconstructed samples, as they may have been modified by an earlier edge filter.

	81 82 82 85 94 a6 a3 9d
	85 85 85 <mark>87 93 a2 a1 9a</mark>
	85 86 85 87 93 a2 9f 9d
	87 86 85 88 97 a6 al 9e
	88 87 88 8e 9c a8 a4 a1
	87 87 8e 94 9d a3 a3 a2
	87 88 8e 97 a5 a6 9e 9e
	8c 8e 94 9b a5 a3 9b 97
	a4 a2 a1 99 8b 84 90 96 98 9c 9b a1 a8 a3 97 8f
	9b 97 93 8b 7d 7a 85 92 al a7 al a6 aa a3 94 89
	8f 87 80 7d 80 81 91 9f a6 a7 a6 a9 aa a1 91 85
	84 7e 7a 7c 86 8e 9d a6 a7 a6 a5 a6 a6 9f 91 86
	7f 7f 82 87 8d 99 a3 a5 a7 a6 a4 a3 a2 9c 90 88
	80 83 89 8f 91 9c a3 a3 a4 a4 a3 a1 9e 9a 8f 89
	80 83 89 8f 96 9c a3 a3 a5 a5 a2 9f 99 95 8d 8a
	7£ 82 88 8e 96 9c a3 a3 a5 a5 a3 9e 96 92 8c 88
	Chroma Cb filtered values
19 ec d3 d5 e0 ba 64 1e 57 51 59 54 55 58 58 57 56 55 58 5d 63 6a 73 78	7b 7a 7a 79 77 74 74 77
	7d 7c 7b 7a 77 74 74 77
	7d 7c 7c 7b 78 74 75 77
fe d0 71 37 3d 52 5a 5c 58 56 55 55 55 55 56 56 56 5a 5d 63 6a 6e 6e	7c 7c 7c 7b 78 74 75 74
	7c 7c 7b 7a 78 75 75 71
54 54 54 54 54 54 54 53 53 52 53 52 53 52 53 53 53 51 56 56 60 60 61 64 66 61	7c 7b 7a 78 76 76 75 71
54 54 54 54 54 54 54 53 53 52 52 51 51 51 52 52 51 56 56 65 68 66 63 66 65	7b 7a 79 76 75 77 7a 76
54 54 54 54 54 54 54 53 53 52 52 51 51 51 51 51 51 55 55 68 68 66 67 63 63	79 79 78 75 73 77 74 81
54 54 54 54 54 54 54 53 53 52 52 51 51 51 51 51 51 51 57 63 68 61 70 60 66 60	74 75 77 78 79 7a 79 77 78 76 75 72 70 76 82 92
54 54 54 54 54 54 54 53 53 52 52 51 51 51 51 51 51 58 65 66 71 70 66 69 60	76 76 78 79 7a 79 78 77 76 75 74 70 6f 76 85 9c
54 54 54 54 54 54 54 54 54 54 51 51 51 51 51 51 51 51 51 59 67 71 73 71 6d 6a 62	78 79 7a 7a 79 78 77 76 74 74 74 71 70 76 85 9f
<u>53 53 53 53 53 53 53 53 52 52 52 51 51 51 51 51 51 51 51 51 51 51 51 51 </u>	79 7a 7b 7a 79 78 76 75 73 72 72 70 6f 76 82 94
Luma filtered values	7a 7b 7a 79 77 76 75 73 72 71 72 71 72 76 76 83
	7b 7b 7a 78 76 74 73 72 72 71 72 72 73 76 7b 7f
	7c 7c 7a 78 75 73 71 71 71 71 73 74 76 77 78 76
	7c 7c 7a 78 75 73 71 71 71 71 72 74 76 77 78 73
	Chroma Cr filtered values



4.2.6 YUV

YUV mode allows inspection of the final decoded sample values, without additional overlay data. In this mode, the YUVDiff feature is exposed. This feature allows for comparison of an external decoded YUV file with the decoded bitstream. Supported formats are 4:2:0 planar and NV12. Also, YUV files that are zipped or gzipped may be opened directly without the need to decompress separately. If a zip file contains more than one YUV file, only the first one is used. When a YUV file is loaded, any mismatches will be indicated with a red dot in the CU containing the mismatch. This allows the user to quickly identify the nature of the mismatch which can assist with debug.

When a file is opened, four additional buttons become visible on the lower left of the main window:

Ξ▼ FS - + R | YUV ▼ Pic Info Details H Δ | I ← ← ▶ ▶ ⊨ | Ref YUV Debug YUV Diff YUV Reload

- Ref YUV: The original, expected YUV image.
- Debug YUV: The loaded debug YUV file.
- Diff YUV: The delta image. Like in Residual mode, areas with zero delta (i.e. Original and Debug image are identical) are flat gray. Areas where the debug YUV has a lower value are darker, and areas where the debug YUV has a higher value are brighter.
- Reload: Reloads the YUV file, which can be useful as a shortcut to loading via the YUVDiff menu.

4.2.6.1 YUVDiff Menu

YU۱	VDiff Options Help
	Open debug YUV Ctrl+Y
	Recent YUV files
	Close debug YUV
•	Planar
	Interleaved
•	Display order
	Decode order
~	Use stream crop values
	Set picture offset here
	Picture offset (0)
	Use 16 bit YUV
~	Check for file changes
	• Open: Brings up

- Open: Brings up a file chooser to open a YUV file
- Close: Closes the currently opened YUV file. Any mismatch indicators will disappear.
- Planar: Causes Intel Video Pro Analyzer to interpret the loaded YUV file as Planar.
- NV12: Causes Intel Video Pro Analyzer to interpret the loaded YUV file as NV12. This
 option is chosen automatically when the loaded YUV file has the file extension
 ".nv12".
- Display order: Causes Intel Video Pro Analyzer to use display order picture numbers when determining how far to seek into the YUV file to extract the image to compare with the current picture.
- Decode order: Causes Intel Video Pro Analyzer to use decode order picture numbers when determining how far to seek into the YUV file to extract the image to compare with the current picture.
- Use stream crop values: When checked, YUV files are assumed to contain samples only within the cropping window as defined by the loaded bitstream. Samples outside this window are not compared, and are assumed 0 when viewing the loaded YUV image directly.
- Set picture offset here: Shortcut for setting the picture offset to the current picture number. See bullet below.
- Picture offset: This brings up a dialog allowing the user to enter the picture number of the first picture in the YUV file. For example if a 100-picture bitstream is loaded but the YUV file only contains pictures 80-99, the user would enter 80 to properly line up the YUV file with the decoded bitstream.
- Use 16 bit YUV: this option allow you to load YUV file where both Luma and Chrome written in 16 bit (they could be normalized from actual bitdepth to 16 bit during encoding). This is useful when you have bitdepth changing across the stream. Intel Video Pro Analyzer will shift values to appropriate bitdepth on the current frame.
- Check for file changes: When checked, this option causes Intel Video Pro Analyzer to periodically check if the loaded YUV file has changed on disk since it was last loaded. If the file has indeed changed, a dialog pops up offering a chance to reload the YUV file.

4.2.6.2 YUV Detail Mode

In detail mode the expected YUV values can be inspected. Note that the displayed sample values are the same as those in Loop Filter mode since loop filtering is the last step in the decode process. When a YUV file is loaded, the debug and delta YUV values can be inspected as well. Mismatching values are shown in red.



4.2.7 Info Overlays

4.2.7.1 Heat Map

Heat map mode shows visually how the compressed bits of the picture are distributed spatially. Blocks with more bits per pixel are brighter than blocks with less. By default this mode also shows the block boundaries in blue. It may be useful to turn off this overlay using the "Info" button on the lower left of the main panel. Heat Map does not offer a detail mode.



The gradient used to display the heat map may be edited:

- Drag the gradient markers up and down to reposition them.
- Drag a marker away from the gradient to remove it. A red X indicates removal will take place.
- Double-click a marker to change the color.
- Double click the gradient bar to add a new marker.

4.2.7.2 Block Type

Block Type overlay show color map of their types. Intra blocks is colored in red, inter skip is yellow colored and inter is in blue.

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4.2.7.3 **PSNR**

PSNR map shows per pixel PSNR value normalized on Block size. To enable this mode you have to load reference YUV file via DebugYUV menu. The value is calculated per Block. Bigger value has brighter color. The color range can be adjust with gradient tool on the right top corner. If the block has no difference with reference YUV a latter 'e' is shown which means exact match.



4.2.8 Efficiency Map

Efficiency map mode shows visually how efficient the arithmetic coding of each block is. Blocks with more bools per bits are brighter than blocks with less. By default this mode also shows the block boundaries in blue. It may be useful to turn off this overlay using the "Info" button on the lower left of the main panel. Efficiency Map does not offer a detail mode.



4.2.9 Simple Motion



Simple Motion mode offers a way to quickly view the modes and motion of a picture at a glance. No overlays are present except a colored dot showing information about the prediction mode. Green dots indicate intra blocks, and purple/orange motion vectors for inter blocks are drawn as simple lines. When the motion vector is very small, a dot is drawn instead so that the mode is still easy to identify.

5 AVC

The following sections describe all available features when loading an AVC bitstream. The supported format of a bitstream is the raw bitstream with no surrounding container. Output from the publicly available AVC reference software JM is in this format and can be opened directly. Intel Video Pro Analyzer supports profiles up to High profile. Sequences that go beyond the profile limits maybe be supported as well.



5.1 UI Components

The following sections describe the various components in the UI when an VC bitstream is loaded.

5.1.1 Top Filmstrip



The top filmstrip is a horizontally scrolling overview of the pictures in the bitstream. When a new IDR starts new GOP, the top info label is highlighted in green. The current picture is highlighted with a red border. On top is the picture number - the decode order index in the bitstream - and the first slice in the picture type as indicated by the NAL unit types, and on bottom is the POC value. Referenced pictures for the current picture are indicated with arrows. Green arrows indicate the long term references. The bar filmstrip has underline green band on new GOP start. Picture type is core coded: red – intra picture (I), blue – P-picture, green – B-picture.

Clicking on a picture will cause Intel Video Pro Analyzer to decode it and mark it as the current picture, updating the rest of the UI correspondingly. If the new picture requires other pictures to be available as reference that have not yet been decoded, those will automatically be decoded.

Pictures are decoded on demand since it is impractical to store all details of all pictures in memory, especially for HD sequences. The current picture can also be selected by typing in a picture number in the box on the left of the panel. When using this box, the filmstrip is scrolled such that the newly selected current picture is visible.

File Mode YUVDiff Option	ns View Help			
Stream View				
Thumbnails 🔹 💓 Picture: 2 📮	Display ActiveRe	efs		
0/0 - IDR - Tid 0 1/	2-NON_IDR	2/1-NON_IDR	3/3-NON_IDR	4/4-NON_IDR
				Click to decode
POC = 0	POC = 4	POC - Ex	tract pictures from last ID	R to the Picture
	100-4	Ex	tract Statistics	
<		Ex	tract Prediction	
Syntax Info	ē×	Heat 203a4 Ex	tract Residuals	081
Slice #0 size in bits: 55224	SLICE_NONIDR	Q Ex	tract Reconstruction	
SE Name	Value	Ž Ex	tract YUV	
first mb in slice	0			

In Thumbnails and Bar mode it is possible to choose between Display/Decode order representation by click on additional. By right clicking on selected picture one can get popup submenu with a set of extract actions. An action called "Extract pictures from last IDR to the Picture" will write out a bitstream that contains the minimum number of pictures needed to decode the current picture. Typically this will consist of the current picture and all previous pictures that are reference pictures up to the nearest IDR picture. This can be useful for debugging issues in long sequences. Other actions allow to save in the output file statistics and intermediate/final YUV planes.



Allow separate panels can be detached from them main window or hidden. To attach panels back double click on the titlebar. To unhide panel go to View menu and check appropriate panel.

The main panel displays the selected picture with visual annotations. The type of annotations and associated interactive behavior depends on the current mode, see 3.1.8.1 AVC Modes. Click-dragging moves the picture around, and the mouse wheel zooms in or out about the mouse cursor.

At the top left of the panel, the current mode is displayed. Along the top right the current scale is shown. In all modes, the MB row and column values are displayed along the left and top border of the picture, slices are indicated with thick red lines, dependent slice boundaries are dashed red lines and tile boundaries are thick green lines. The screenshot above shows an example of a stream that is 10x8 MBs. The selected MB is outlined with a pink box.

The bottom left has a cluster of buttons:

 \blacksquare FS - + R | YUV \checkmark Pic Info Details H \land | \bowtie \bigstar \blacktriangleright \blacktriangleright \bowtie | Ref YUV Debug YUV Diff YUV Reload

- First submenu has special options to output the currently displayed information to the external image file with different scaling possibilities.
- FS: Toggles full-screen mode, which hides all UI elements except the main panel. Keyboard shortcut is F.
- +/-: Zooms in or out, centered on the center of the panel. Note that zooming with the mousewheel is much easier than using these buttons. Keyboard shortcuts are + and -.
- R: Resets the current zoom to fit the entire picture in the main panel. Keyboard shortcut is R.
- YUV, Y, U, V: Toggles between per-component image, or full-color YUV.
- Pic: Toggles the actual picture underneath the annotations. The picture is modedependent. For example in prediction mode, the picture is comprised of the

5.1.2 Main Panel

prediction samples before the residual signal has been added in. It is often helpful to turn off the picture in order to make the annotation easier to read. Keyboard shortcut is P.

- Info: Toggles the annotations on or off. Keyboard shortcut is I.
- H/D: Toggles between hexadecimal and decimal display of the annotations. This applies to the values in the Left Tabs as well. Keyboard shortcuts are H and D.
- There are five navigation buttons: first frame, previous frame, playback mode, next frame, last frame. The previous/last button will rewind, causing the current picture to be set to the first/last picture in the loaded bitstream. The "Play" button will start playback of loaded bitstream at a reasonable rate, limited by CPU performance. All normal mode operations are possible during playback. Note that playback mode always operates in currently selected order in the filmstrip.

5.1.3 Left Tabs

The left side of the UI is a resizable panel with several tabs that display information about the current selection in one way or another. The following subsections describe each tab.

5.1.3.1	NAL
---------	-----

Pos	NAL Type	TID	Size	^
722	39: 8: PPS - Picture parameter set	0	23	
749	40: 8: PPS - Picture parameter set	0	15	
769	41: 8: PPS - Picture parameter set	0	23	
796	42: 8: PPS - Picture parameter set	0	15	
816	43: 8: PPS - Picture parameter set	0	7	
827	44: 8: PPS - Picture parameter set	0	8	
839	45: 8: PPS - Picture parameter set	0	15	
858	46: 8: PPS - Picture parameter set	0	16	
	pic_parameter_set_id	45	11	
	seq_parameter_set_id	0	1	
	entropy_coding_mode_flag	1	1	
	bottom_field_pic_order_in_fram	0	1	
	num_slice_groups_minus1	0	1	
	num_ref_idx_I0_active_minus1	2	3	
	num_ref_idx_l1_active_minus1	2	3	
	weighted_pred_flag	0	1	
	weighted_bipred_idc	0	2	
	pic_init_qp_minus26	19	11	
	pic_init_qs_minus26	0	1	
	chroma_qp_index_offset	41	67	
	deblocking_filter_control_presen	1	1	
	constrained_intra_pred_flag	0	1	
	redundant_pic_cnt_present_flag	0	1	
	transform_8x8_mode_flag	0	1	
	pic_scaling_matrix_present_flag	0	1	
	second_chroma_qp_index_offset	8	9	
878	47: 8: PPS - Picture parameter set	0	7	
889	48: 8: PPS - Picture parameter set	0	13	
907	49: 8: PPS - Picture parameter set	0	15	
926	50: 8: PPS - Picture parameter set	0	8	
938	51: 8: PPS - Picture parameter set	0	23	
965	52: 8: PPS - Picture parameter set	0	8	
977	53: 8: PPS - Picture parameter set	0	15	
996	54: 8: PPS - Picture parameter set	0	16	
1016	55: 8: PPS - Picture parameter set	0	7	¥
	Extract selected NAL units			
		Links	OFT	

The NAL tab lists all NAL units found in the bitstream, in decode order. Above the list the total number of NAL units is displayed. The list has four columns: "Pos" is the byte position of the NAL unit in the file, "NAL Type" is the textual description of the NAL's type, "TID" is the Temporal ID of the NAL unit, and "Size" indicates the total number of bytes in the NAL unit.

Changes in coloring from white to grayscale and back show Access Unit borders. By clicking on branch sing you can roll out NAL unit syntax elements read from the bitstream. For each syntax element Intel Video Pro Analyzer shows the value of it and the number of bits it takes in the bitstream. Red colored elements will hint you about error syntax element.

Clicking on any NAL unit will display up to the first 500 raw bytes in the Raw Bytes panel. If a NAL unit is a VCL NAL unit, meaning it is a coded slice segment, it can be double-clicked in order to make the picture that it belongs to the current picture. Conversely, changing the current picture will highlight the NAL unit that contains the first slice segment of that picture. Selecting a MB in the Main Panel will highlight the NAL unit containing the slice that contains the selected MB. At the bottom of the NAL tab is a button called "Extract selected NAL units". Clicking this will write all selected NAL units out to a file.

SE Nan	ne				Value			
pic_para	ameter_s	set_id			0			
seq_par	ameter_	set_id			0			
entropy	_coding	_mode_	flag		1			
pic_ord	er_prese	nt_flag			0			
num_sli	num_slice_groups_minus1							
num_re	num ref idx 10 active minus1							
num_re	f_idx_l1_	active_m	inus1		0			
weighte	d_pred_	flag			1			
weighte	d_bipre	d_idc			2			
pic_init_	<u>qp_min</u>	us26			0			
pic_init_	qs_minu	us26			0			
chroma	_qp_ind	ex_offset	t		-2			
deblock	_flag	1						
constrai		0						
redunda	ant_pic_	cnt_prese	ent_flag		0			
transfor	m_8x8_	mode_fla	ag		1			
pic_scal	ing_mat	rix_prese	ent_flag		0			
second	_chroma	_qp_ind	ex_offset	•	-2			
ΝΔΙ	SDS	DDS	Slice	MR				

5.1.3.2 SPS, PPS, Slice, SEI

These tabs contain a list of every syntax element, in decode order, of the SPS, PPS, slice segment header and SEI messages that apply to the currently selected MB in the Main Panel. Syntax elements that come from a sub-function call are indented accordingly, and the function call itself appears in the list as a syntax element with no value. Any part of the list can be selected and copied for pasting in other programs.

5.1.3.3 QM

Only PPS coefficients are used in this picture											
Pick a mat	rix:	PPS	•	4x4 In	tra Y	•					
1	1		1	1							
1	1		1	1							
1	1		1	1							
1	1		1	1							
Syntax ele	ments u	ised to co	ode this s	set of so	aling li	sts:					
SE Name	9				Value	^					
seq_scali	ng_list_	present	flag[0]		1						
delta_sca	le[0]				-7						
delta_sca	le[1]				0						
delta_sca	le[2]				0						
delta_sca	le[3]				0						
delta_sca	le[4]				0						
delta_sca	le[5]				0						
delta_sca	le[6]				0						
delta_sca	le[7]				0						
delta_sca	le[8]				0						
delta_sca	le[9]				0						
delta_sca	le[10]				0						
delta_sca	le[11]				0						
delta_sca	le[12]				0						
delta_sca	le[13]				0						
delta_sca	le[14]				0						
delta_sca	le[15]				0						
seq_scali	ng_list_	present	_flag[1]		1						
delta_sca	le[0]				-7						
delta_sca	0										
delta_sca	0										
delta_sca	0										
delta_sca	le[4]				0	$\mathbf{\vee}$					
NAL	SPS	PPS	Slice	QM	4	₽					

This tab displays the scaling lists, or quantizer matrices used by the current picture. Scaling lists can be present in the SPS, PPS, or both. PPS scaling lists take precedence over SPS when present. The top of the panel shows in blue text how the various scaling lists are used in this picture. Below that, one of the 20 scaling list from either the SPS or PPS can be chosen for inspection, and the chosen matrix is displayed in the grid. Also shown in this panel is the list of syntax elements that is used to code the scaling list set, and is identical to the syntax in the corresponding SPS or PPS tab.

5.1.3.4 Ref Lists

Reord	lered								
ist 0:									
ldx	POC	Field	LT	WΥ	ΟΥ	W Cb	O Cb	W Cr	O Cr
0	4	N/A	N	1	0	1	0	1	0
1	4	N/A	N	1	-1	1	0	1	0
2	0	N/A	N	1	0	1	0	1	0
<									>
ldv	POC	Field	IT	WV	0 V	WCb	O Ch	WCr	00
lax	PUC	Field	LI	VV Y	01	VV CD	U CB	w Cr	00
<									>
PB List	ts:								-
PocSto	CurrBefo	re[0] = re[1] =	4 0						^
									~

This tab displays the details of the two reference lists L0 and L1, as well as the Reference Picture Set arrays used to construct the L0 and L1 lists. The L0 and L1 lists have the following columns:

- Idx: The index associated with the reference picture
- POC: The Picture Order Count of the reference picture
- LT: A Yes/No flag indicating if the reference picture is a long-term picture or not
- W Y: The derived luma weight used in the weighted prediction process of the reference picture
- Y: The derived luma offset used in the weighted prediction process of the reference picture
- W Cb: The derived chroma Cb weight used in the weighted prediction process of the reference picture
- Cb: The derived chroma Cb offset used in the weighted prediction process of the reference picture
- W Cr: The derived chroma Cr weight used in the weighted prediction process of the reference picture
- Cr: The derived chroma Cr offset used in the weighted prediction process of the reference picture

The third panel contains in textual form the contents of the Reference Picture Set arrays from section 8.3.2 in the HEVC specification.

By clicking on 'Reordered' button you will see reference lists state before reordering.



5.1.3.5 Stats

This tab displays various statistics extracted from the current picture. The top half shows some picture size and compression stats. The bottom half displays pie charts for a number of metrics. Each pie chart can be drawn normalized or un-normalized. Normalized data is weighted by area or compressed bits. Normalized numbers in the pie chart are in units of pixels or bits, and un-normalized numbers are raw counts.

The pie chart can be moved by dragging the mouse, and zoomed with the mouse scroll wheel.

Syntax Stats	▼ %					
Syntax Eleme	nt	Count		Bits		^
Slice head	ler	1		7		_
⊿ MB		494		395		
⊳ MV		69		56		
coded	l_block_flag	0		0		
end_o	f_slice_flag	0		0		
signifi	icant_coeff_fl	145		95		
last_si	gnificant_co	90		13		
coeff_	abs_level_mi	95		136		
coeff_	sign_flag	95		95		
prev_i	ntra8x8_pred	0		0		
rem_ii	ntra8x8_pred	0		0		
prev_i	ntra4x4_pred	0		0		
rem_ii	ntra4x4_pred	0		0		
mb ty	/pe	0		0		
transf	orm_size_8x8	0		0		
intra (chroma pred	0		0		
coded	block_pattern	0		0		
mb_q	p_delta	0		0		
mb_sl	kip_flag	0		0	¥	
% Raw valu	es	•	Pred mode			•
Inter 62	Skip 4	47	<u>Direct</u>			
SPS PPS	Slice MB	QM	RefLists	SEI	Stats	•

By selecting, different modes in the stats combo box you can explore different type of statistics in the bitstream. Namely, picture statistics, per syntax element statistics, overall stream statistics. Overall stream statistics is available only after full stream analysis and shows accumulated values overall the stream. Pie chart for stream statistics show accumulated value also.

5.1.4 Selection Info

Selection Info		₽×
Width: 640	MB type: Skip	Pred type: Inter
Height: 480	MB X,Y:336,112	Pred size: 16x16
Pictures: 100	MB field: 0	MB cbp: 0(0)
Slice #:0 - P	MB tr8x8:0	
MB address: 301	MB Qp Y:18	MV L0:0,0=>0
MB col, row: 21,7	Pixel X,Y:N/A	MV L1:-

This panel shows a few details about the current selection at a glance. All values are decimal:

- Picture height & width
- Number of pictures in the bitstream
- Slice segment number of the slice segment that contains the selected CU, and the slice type.
- MB address and row/col position
- Selected MB type and flags for field MB coding and use 8x8 transform.
- X/Y position of the selected MB in pixels MB prediction mode. Intra, Inter or Skip

^{*}Other names and brands may be claimed as the property of others.

- Pixel X/Y position in the picture of the mouse cursor
- Prediction size and shape.
- The L0 and L1 motion vectors, if any, of the selected Prediction block. The MVs are shown with an arrow => followed by the reference index.
- The Luma and Chroma QP values associated with the selected MB.

5.1.5 Raw Bytes

The panel in the bottom center of the UI displays the raw bytes that were used to code the selected MB, or NAL unit. A few details about the selection are included as well.

5.1.6 Messages

Status	8 ×
Complete. Found 100 pictures, 104 NAL units. Decoding picture 0done. Decoding picture 6done.	^
Decoding picture 6done.	~
A Ready	94MB / 113MB / 8089MB

This panel in the lower right of the UI displays messages about the decoding process, and shows progress of any actions that may take a while to complete.

The 3 numbers in the lower right of this panel represent the memory state of JVM. From left to right the 3 numbers are:

- Amount of memory used
- Peak used memory
- Maximum available memory

Error button at the bottom left of the window changes color to red if Intel Video Pro Analyzer detects any errors/warnings in the stream. By clicking on the button Intel Video Pro Analyzer switches to the list of detected problems and back. By double clicking on selected error, you can highlight corresponding MB in central info window and corresponding NAL unit will be highlighted.

Status			8 ×			
NAL idx Picld Message						
53 Value of slice::chroma_offset_lx is out of range						
53		Value of slice::chroma offset lx is out of range				
53		Value of slice::luma offset lx is out of range				
50		Value of clicewebroma, offert by is out of range	· · ·			
A Read	iy	199MB / 974MB	/ 8089ME			

By right clicking inside error's list you can choose additional filtering of the errors

Status	tus Ø×										
Severity	Pos	NAL idx	Picld	MB idx	Туре	Mess	sage				^
Warning	1761736	73	33		HRD	HRD	issue:	: initial_cpb_removal_delay is	s out of range.		
Warning	3041360	142	66		HRD	HRD	issue:	: initial_cpb_removal_delay is	s out of range.		
Warning	4726360	211	99		HRD	HRD issuer initial cob removal delawis out of range.					
Warning	6136184	280	132		HRD	HRD	I I	Ignore messages by type	out of range.		
Warning	7315168	349	165		HRD	HRD		Friors	out of range.		
Warning	8422528	418	198		HRD	HRD	HRD		out of range.		
Warning	9650128	487	231		HRD	HRD	HRD Show all out of range.				
A Ready	Ready 106MB / 156MB / 32646MB										

"Error" submenu runs common error dialog where it is possible to select which errors will by displayed in the error's list.

Q			Error filter	<				
Index	Severity	Туре	Message	^				
⊿ ✓ AVC								
▲ ✓ MB								
✓ 2000	Error	MB	Value of mb::intra_chroma_pred_mode is out of range					
✓ 2001	Error	MB	Value of mb::intra_chroma_pred_mode is not allowed					
✓ 2002 Error MB Value of mb::intra_8x8_pred_mode is not allowed								
✓ 2003 Error MB Value of mb::intra_4x4_pred_mode is not allowed								
✓ 2004	Error	MB	Value of mb::intra_16x16_pred_mode is not allowed					
✓ 2005	Error	MB	Value of mb::coded_block_pattern is out of range					
✓ 2006	Error	MB	Value of mb::mb_qp_delta is out of range					
✓ 2007	Error	MB	Value of reference index L0 is out of range					
✓ 2008	8 Error	MB	Value of reference index L1 is out of range					
✓ 2009	Error	MB	Value of mb::sub_type is out of range					
✓ 2010	Error	MB	Value of mb::mb_type is out of range					
✓ 2011	Error	MB	Value of mb::mb_skip_run is out of range					
✓ 2012	2 Error	MB	Value of mb::pcm_alignment_zero_bit should be zero					
⊿ 🗸 SLH			•					
✓ 2013	Error	SLH	Value of slice::slice_type is out of range					
✓ 2014	Error	SLH	Value of slice::slice type is not allowed	\checkmark				
<	-		>					
			OK Canc	el				

5.1.7 Extended modes

There are a set of extended modes that can be accessed via menus in the Stream View toolbar.

Stream View AVC C:/wo	tream View AVC C:/work/video_ypa/output.h264												
Thumbnals 🔻 🕐 🕼 Picture: 6 🗧 Display Fields													
0/0 - IDR - Tid 0	1/2-NON_IDR	2/1-NON_IDR	3/3-NON_IDR	4/4-NON_IDR	5/6-NON_IDR	6/5-NON_IDR	7/8-NON_IDR	8/7-NON_IDR	9/9-NON_IDR				
			E.			E.	Click to decode	Click to decode	Click to decode				
POC = 0	POC = 4	POC = 2	POC = 6	POC = 8	POC = 12	POC = 10	POC = 16	POC = 14	POC = 18				

Field option gives special visualization capabilities for stream with fields. Namely, it shows references on per field base. Video Pro Analyzer shows top and bottom fields as the happens in the stream. Their position is shifted according to top or bottom flag is used for the field.

Then two possible modes with two sub-modes can be selected. Sub-modes of the currently selected mode changed dynamically depended on current mode.

5.1.7.1 Frame sizes view

When one choose "Buffer" menu from popup toolbar, frames size view will appear by default. This is a bar char plot with frame sizes. Each bar is colored according to the frame type. When you move the mouse along the bar current frame is highlighted and tooltip shows information about current frame. By clicking on selected frame you can decode it. When you press left mouse button and move it all plots move along both axes. Double click on canvas area resets plot into default state. You can zoom in/out with mouse wheel on both axis when the mouse inside canvas. If the mouse on some axis (below canvas, for example, x axis) you can zoom, pan or double click on only on that axis. In that case all actions applied to that axis only.

The movement of the plots is restricted to the positive values only, you can't move or zoom in negative direction. Currently decoded frame is shown with vertical line and frame number on it.



On the right axis average slice QP values are shown. When full stream analysis is complete Intel Video Pro Analyzer adds average block QP plot that is also attached to right axis. By double clicking on 'Moving average' label item sliding window size can be adjusted in the separate dialog.

5.1.7.2 HRD buffer fullness view

If you choose "Buffer" mode then sub-mode "HRD" appears in sub-modes block. It is enabled if stream has HRD parameters in it, otherwise it is disabled (grey out). The interaction with buffer fullness plot works in the same way as for frame sizes plot. It is possible to get buffer state and picture parameters in each point of the plot where the monotonic behavior changes.



With right click on central area of the plot Intel Video Pro Analyzer shows additional option for plot adjustment. In the same popup menu you can export HRD timings into .csv file.



5.2 Modes

Мо	de	YUVDiff	Options
	Сс	ding flow	F1
•	Pre	edictions	F2
	Re	siduals	F3
	Re	constructio	on F4
	De	blocking	F5
	YU	V	F6
	Inf	o overlays	F7
	Sir	mple motio	on F8

With an AVC bitstream loaded, Intel Video Pro Analyzer can be put into one of 8 modes using either the F1-F8 keys, or using the Mode menu. The mode selection affects only what is displayed in the Main Panel. Most modes can also show details of the current selection (MB,Prediction unit, Transform unit). This can be toggled with the right mouse button or the main panel's button strip.

	-													
ling	flow													
	0	1	2	3	4	5	6	7	8	9	10	11	12	13
0	MB 0	MB 1	MB 2	MB 3	MB 4	MB 5	MB 6	MB 7	MB 8	MB 9	MB 10	MB 11	MB 12	MB
1	MB 45	MB 46	MB 47	MB 48	MB 49	MB 50	MB 51	MB 52	MB 53	MB 54	MB 55	MB 56	MB 57	MB
2	MB 90	MB 91	MB 92	MB 93	MB 94	MB 95	MB 96	MB 97	MB 98	MB 99	100	101	102	10
3	135	136	137	138	139	140	141	142	143	144	145	146	147	14
4	180	181	182	183	184	185	186	187	188	189	190	191	192	19
5	225	226	227	228	229	230	231	232	233	234	235	236	237	23
6	270	271	272	273	274	275	276	277	278	279	280	281	282	28
7	315	316	317	318	319	320	321	322	323	324	325	326	327	32

5.2.1 Coding Flow

The coding flow mode gives a visual overview of the ordering of MBs in the stream, and some information of the decoding process. The blue grid shows the boundaries of the MBs in the picture. Each MB contains 3 values:

• The MB address, which is simply the raster scan index of the CTB.

5.2.2 Predictions

This mode shows the prediction units in each MB. MB splits are indicated with blue lines, which get darker as the split depth increased. When a MB split is implied by AVC (Direct mode for B slices) and not directly coded in the bitstream, the split lines are dashed.

Intra modes are indicated with green colors, and directional modes also show an arrow indicating the prediction direction. In the lower right corner of an intra MB the chroma mode is indicated in a darker green.

Inter Prediction unitss are indicated with cyan colors showing the Prediction unit splits and mode. Additionally, skipped blocks are shaded with a lined texture. The L0 motion vectors are drawn with an orange color, the L1 motion vectors (B slices only) are drawn with a purple color. The MV value is shown in the lower left corner along with the reference index.

Below is shown Prediction mode on a zoomed-in selection along the top edge of a picture. The selected MB is surrounded with a pink box while the selected Prediction Unit is surrounded with a yellow box.

Pr	ediction mo	des	٠	4		Y	0,2-20	0,2-20 0,2-20	4	A 16 p
ç	2:DC 0:Vert Chreșna Ø:DC	0,0=>0	-1,-2=>0 0,2=>0	- 1,0=>0 1,4=>0	0,0=>0	<mark>0,0=>0</mark> 0,2=>0	0,0≚>0 0,2=>0 0,0=>0	<mark>0,0≚>0</mark> ⊮ 0,2=>0 -2,4=>0	- <mark>2,0=>0</mark> 2,2=>0	1,1=>0 2,2=>0
	4 0:Vert		4	k	Direct	0 / 0 0 0 / 0 0	1,1=>0 -2,6=>0		*	0,0=>0 1,0≧>0
с	2:DC 0:Vert Chrøma &:DC	0,-1=>0 0,1=>0	1,2=>0 1,5=>0	0,-1=>0 -1,2=>0	0,0=>0 0,2=>0	2 0 0 8 2 Caroma 0:8	↓ 1,7=>0	0,0=>0	- <mark>2,0=>0</mark> 2,0=>0	0,0=>0 0,0¥>0 0,2=>0
	Direct ×	Direct	-1,-3=>₿ -3,4=>0	↓ -1, ,⊺=>0 0,8=>0 -3,8=>0	v 10,-8=> -1,5=>0	10, 8= -1,7=>0) 	→ ↔	↔ ∢	⊾ 2,2=>0
C 0	,- 1=>0 ,1=>0	0,0=>0 0,-1=>0 0,0=>0 0,1=>0	-1,-1=>ð	0,-1[*]=>0	0,0≚>0 0,2=>0 0,-5=>0	∠∕ 0,0≚>0 -10,5=>00,2=>0	-12,4=>0-5,1=>0 -4,4=>0_7,0=>0	- <mark>2,0=>0</mark> 6,0=>0 8,0=>0	-3,0=>0 -2,0=>0 8,0=>0	0,3=>0 ♥ 2,1=>0
	2:DC 5		0,-1 [≦] >0 0,-9 ⁼ >0 -1,2=>0 -1,2=>0	,∕ <mark>0,-7[⊈]>0</mark> -5,9=>0 3,3=>0	<mark>0,-1=>0≁≫ 6,1=>0</mark>		⊭ -4,4=>0	1:Horfz 2:DC		· · · · · · · · · · · · · · · · · · ·
с	0:Vert 0:Vert ⊻Chrøma &:DC	0,0=>0	0,-1¹=>0 5,-1⁴=>0 -1,2=>0 -3,3=>0	0,-1²≥0 1,-2¹≥0 5,1=>0 5,2=>0	1,-2=>0^⁴≜ 6,2=>0	- 5,2=>0 7,-1=>0	→ 1,1=>0	2:DC 1:Horîz Chrøma 0:DC	3,-1=>0	0,1=>0
	<	Direct	<mark>⊭ -1,0≰>0</mark> -2,3=>0 -3,4=>0	F	,M	-7µ8=>0 -5,2=>0 1,1=>0	F	L7	Direct	
0 -2	2,0=>0	0,0=>0 -1,2=>0	<mark>0,-1[⊭]≥0</mark> ⊭ -1,2=>0 -3,3=>0	-2,-1=>0 -1,2=>0	-7,8=>0 1,3=>0	-7#=>0 -5,2=>0 -2,8=>0 1,1=>0	-3,-1=>0	5,-5=>0 -3,2=>0	3,-1=>0 0,1=>0	2 2 1 0 4 (Brombi 0:12C)

5.2.2.1 Prediction Detail Mode

In Prediction mode, the sample values of a particular MB can be viewed in detail.

Intra MBs are displayed in green, and the left, upper-left and above prediction arrays are drawn adjacent.



Inter MBs are displayed in cyan (turquoise).

Selected MB Prediction details			29.88x 8 pixels
Selected MB Prediction details tuma inter prediction generalization 52 67 76 78 81 81 76 85 51 51 52 66 75 79 81 77 72 65 65 55 61 70 78 80 78 49 65 74 79 81 77 72 65 56 57 67 74 78 80 78 44 55 67 76 80 75 61 55 60 67 77 77 77 40 48 63 74 79 74 65 61 51 66 77 77 77 77 40 48 63 74 79 74 65 61 71 77 78 77 76 80 77 77 77 77 77 77 79	Chroma Cb inter prediction 128 128 126 125 126 127 128 128 126 126 126 127 127 129 128 126 125 125 127 129 128 13 122 120 121 127 123 123 127 123 123 127 131 111 111 112 131 121 131 121 111 112 128 </td <td>Chroma Cr inter prediction</td> <td>29.88x 8 pixels</td>	Chroma Cr inter prediction	29.88x 8 pixels
103 99 79 72 81 81 82 73 57 60 70 72 69 67 68 71 170152126113118124127105 81 92 11613012217111108 182158141129125123118111117149182197191188182178 176158138117 98 83 85 10614017219120020020520520	67 90 104 93 72 63 61 62	<u>146146144144145145145145</u>	
186166134 97 72 74 84 108149174191195190192189190 183163132 96 65 61 83 12015873187193189190187189 188169143102 63 62 91 135168175184191192193192192			
Final MV = -74,18 refldx = 0 MV Delta = 3,2 MV predictor = -77,16			Dicht click smuuhere to go back

Trai	nsform	struct	ures					1			
P:10	QP:1.0	QP:14	QP:14	QP:14	QP:14	QP:14	QP:14	QP:14	QP:6	QP:6	QP:
P:11	QP:1.1	QP:13	QP:13	QP:13	QP:15	QP:15	QP:13	QP:13	QP:7	QP:5	QP:
P:11	QP:11	QP:13	QP:13	QP:13	QP:19	QP:15	QP:10	QP:13	QP:6	QP:6	QP:
P:11	QP:13	QP:1.3	QP:13	QP:15	QP:15	QP:15	QP:12	QP:12	QP:S	QP:5	QP:
P:10	QP:14	QP:14	QP:14	QP:14	QP:12	QP:15	QP:15	QP:13	QP:6	QP:6	QP:
P:11	QP:11	QP:14	QP:14	QP:7	QP:14	QP:14	QP:16	QP:16	QP:5	QP:8	QP:
P:10	QP:8	QP:15	QP:15	QP:5	QP:15	QP:15	QP:13	QP:15	QP:15	QP:11	QP
P-11	- OP:8	OP:13	OP:13	OP:5	QP:13	QP:13	QP:13	QP:13	OP:13	OP:13	OP:

5.2.3 Residuals

In Residual mode the transforms and accompanying residual signal of the picture can be seen. As in Predictions mode, MB boundaries are shown with blue lines. The transform splits, when present, are indicated with yellow lines. QP values of each MB are shown in the upper-left corner. When this value is bright yellow, it means that a delta-QP was coded in the bitstream during the decode of that particular MB. Otherwise the number is dark. MBs that are PCM coded are marked with "PCM" in white.

If the "Pic" button is turned on, the raw residual signal is shown in image form. Residual values of 0 result in flat grey, negative values are darker and positive values are brighter.

Clicking on MBs causes that transform unit to be selected with a blue surrounding box. Clicking a transform unit repeatedly causes the selection to move up and cycle though the transforms in MB.

Transfo	rm structures					
	QP:13	QP:13	QP:15	QP:15	QP:10	QP:13
	QP:13	QP:15	QP:15	2 :15	QP:12	QP:12
	QP:14	QP:14	QP:12	QP:15	QP:15	QP:13
	QP:14	QP:7	QP:14	QP:14	QP:16	QP:16

5.2.3.1 Residual Detail Mode

To view the full details of a particular MB, make the MB selection and enter detail mode by right clicking or using the detail mode button at the bottom of the main panel. In this mode the selected TU structure is drawn three times, arranged in a column from top to bottom, showing the 3 major steps in recovering the residual signal:



*Other names and brands may be claimed as the property of others.

5.2.4 Reconstruction

In Reconstruction mode the reconstructed samples prior to deblocking can be inspected. As with Prediction/Residual mode, MB boundaries are shown with blue lines. MBs that have at least one transform with non-zero coefficients are marked with "Non-zero CBP". PCM-coded MBs are indicated with "PCM" in white.

Réconst	ructed pixels	prior to loop i	filtering ^{ro CBP}	Non-zero CBP	Non-zero CBP	Non-zero CBP	
zero CBP	Non-zero CBP	Non-zero CBP	Non-zero CBP	Non-zero CBP	Non-zero CBP	Non-zero CBP	
zero CBP	Non-zero CBP	Non-zero CBP	Non-zero CBP	Non-zero CBP	Non-zero CBP	Non-zero CBP	
zero CBP	Non-zero CBP	Non-zero CBP	Non-zero CBP	Non-zero CBP	Non-zero CBP	Non-zero CBP	
zero CBP	Non-zero CBP	Non-zero CBP	Non-zero CBP	Non-zero CBP	Non-zero CBP	Non-zero CBP	

5.2.4.1 Reconstruction Detail Mode

In detail mode, the reconstructed sample values can be inspected. The selection may be a single MB.

Luca	_														Chr	oma	СВ								
Lum	a															102	103	103	103	105	104	103	101		
163	162	162	161	161	160	160	159	159	160	160	160	159	160	159	160	102	103	103	103	105	103	103	101		
163	162	162	161	161	160	160	159	160	162	161	160	160	160	159	160	102	102	102	102	105	102	102	102		
163	162	162	161	161	160	160	159	160	161	160	160	160	160	159	159	102	105	103	105	105	103	103	102		
163	162	162	161	161	160	160	159	160	161	160	160	160	160	159	160	102	103	103	103	105	104	103	102		
163	162	162	161	161	160	160	159	162	161	160	160	160	160	159	160	102	103	103	103	102	102	102	102		
1.00	1.00	100	1.01	1.01	100	1.00	1.50	1.00	1.61	100	1.00	1.50	1.50	1.50	1.50	102	103	103	103	100	100	100	100		
163	192	162	191	191	190	190	128	162	191	190	100	128	129	129	158	102	103	103	103	107	107	107	107		
163	162	162	161	161	160	160	159	162	161	160	160	159	159	158	159	102	103	103	103	105	105	105	105		
163	162	162	161	161	160	160	159	161	160	161	159	159	159	160	159	Chr	Chrome Cr								
162	159	165	162	161	158	162	160	161	160	160	160	163	159	161	157		oma	l Ur							
167	168	158	162	154	136	129	115	118	110	122	124	149	157	156	161	101	100	100	100	101	99	100	112		
162	146	115	83	68	62	60	58	61	65	62	65	50	75	110	1.45	101	100	100	100	100	99	98	101		
102	140				02			01					70	110	143	101	100	100	100	100	99	98	98		
151	69	60	55	51	59	59	57	63	64	59	59	60	59	60	72	101	100	100	100	100	99	98	99		
155	63	58	60	58	59	58	59	61	64	64	58	51	64	62	70	1.01	100	100	100	98	98	98	98		
161	68	62	63	58	58	59	57	58	64	56	58	61	58	62	59	101	100	100	100	00	00	00	00		
156	61	61	66	66	82	98	109	110	87	69	63	59	60	59	59	101	100	100	100	96	96	96	96		
157	60	77	105	144	156	158	154	159	160	142	78	56	56	57	58	101	100	100	100	104	104	104	104		
																101	100	100	100	102	102	102	102		
5.2.5 Deblocking

Deblocking mode shows all edges processed by the deblocking filter as described in the MB boundaries are not displayed in this mode, however MB selection still functions as in the other modes. Edges shown are for the luma deblocking process and are color coded in the following manner:

- Green: Strong luma filter applied
- Yellow: Weak luma filter applied
- Red: No filter applied (but edge was evaluated)



5.2.5.1 Deblocking Detail Mode

The deblocked sample values can be inspected directly in detail mode. As with Reconstruction Details. Sample values are indicated in yellow if they were modified by the deblocking process. Sample values that cannot be modified due to PCM MB or bypass_flag are indicated in red. Filtered edges belonging to the selected CU are shown in thick dashed lines, color coded the same way as in the non-detail mode. Each edge can be selected and clicked, bringing up a window showing the input values to the edge filter. Note that these values may differ from the reconstructed samples for horizontal edges, as they may have been modified by a vertical edge filter. Additionally, the boundary strength is displayed. Edges that were processed but ultimately not filtered (red colored) will indicate the reason. Typically it is due to the boundary strength being 0, the threshold condition not being met, or a slice/tile edge when those edges shouldn't be processed.





5.2.6 YUV

YUV mode allows inspection of the final decoded sample values, without additional overlay data. In this mode, the YUVDiff feature is exposed. This feature allows for comparison of an external decoded YUV file with the decoded bitstream. Supported formats are 4:2:0 planar and NV12. Also, YUV files that are zipped or gzipped may be opened directly without the need to decompress separately. If a zip file contains more than one YUV file, only the first one is used. When a YUV file is loaded, any mismatches will be indicated with a red dot in the CU containing the mismatch. This allows the user to quickly identify the nature of the mismatch which can assist with debug.

When a file is opened, four additional buttons become visible on the lower left of the main window:

 \blacksquare FS - + R | YUV \checkmark Pic Info Details H \land | \bowtie \bigstar \blacktriangleright \blacktriangleright \bowtie | Ref YUV Debug YUV Diff YUV Reload

- Ref YUV: The original, expected YUV image.
- Debug YUV: The loaded debug YUV file.
- Diff YUV: The delta image. Like in Residual mode, areas with zero delta (i.e. Original and Debug image are identical) are flat gray. Areas where the debug YUV has a lower value are darker, and areas where the debug YUV has a higher value are brighter.
- Reload: Reloads the YUV file, which can be useful as a shortcut to loading via the YUVDiff menu.

5.2.6.1 YUVDiff Menu



- Open: Brings up a file chooser to open a YUV file. Intel Video Pro Analyzer considers YUV stream as having the same frame size, per frame bitdepth and color format as encoded bitstream.
- Close: Closes the currently opened YUV file. Any mismatch indicators will disappear.
- Planar: Causes Intel Video Pro Analyzer to interpret the loaded YUV file as Planar.
- Interleaved: Causes Intel Video Pro Analyzer to interpret the loaded YUV file as Y values followed by interleaved U and V values. This option is chosen automatically when the loaded YUV file has the file extension ".nv12".
- Display order: Causes Intel Video Pro Analyzer to use display order picture numbers when determining how far to seek into the YUV file to extract the image to compare with the current picture.
- Decode order: Causes Intel Video Pro Analyzer to use decode order picture numbers when determining how far to seek into the YUV file to extract the image to compare with the current picture.
- Use stream crop values: When checked, YUV files are assumed to contain samples only within the cropping window as defined by the loaded bitstream. Samples outside this window are not compared, and are assumed 0 when viewing the loaded YUV image directly.
- Set picture offset here: Shortcut for setting the picture offset to the current picture number. See bullet below.
- Picture offset: This brings up a dialog allowing the user to enter the picture number of the first picture in the YUV file. For example if a 100-picture bitstream is loaded but the YUV file only contains pictures 80-99, the user would enter 80 to properly line up the YUV file with the decoded bitstream.
- Check for file changes: When checked, this option causes Intel Video Pro Analyzer to periodically check if the loaded YUV file has changed on disk since it was last loaded. If the file has indeed changed, a dialog pops up offering a chance to reload the YUV file.

5.2.6.2 YUV Detail Mode

In detail mode the expected YUV values can be inspected. Note that the displayed sample values are the same as those in Deblocking mode since loop filtering is the last step in the decode process. When a YUV file is loaded, the debug and delta YUV values can be inspected as well. Mismatching values are shown in red.



5.2.7 Info Overlays

There are a number of overlay that provides additional information about currently investigated picture. When you switch mode to "Info Overlays" mode several additional submenus will appear in the bottom-left panel of info window.

Ξ ▼ FS - + R	YUV	Y U V Pic	Info	Details H ∆ ₩ ≪ ▶ ▶ ₩ RefYUV Debug Y	V Diff YUV Reload
---------------------	-----	-----------	------	--	-------------------

You can switch now between additional modes. PSNR mode is enabled if you have loaded reference YUV file.

5.2.7.1 Heat Map

Heat map mode shows visually how the compressed bits of the picture are distributed spatially. MBs with more bits per pixel are brighter than MBs with less. By default this mode also shows the MB boundaries in blue. It may be useful to turn off this overlay using the "Info" button on the lower left of the main panel. Heat Map does not offer a detail mode.



The gradient used to display the heat map may be edited:

- Drag the gradient markers up and down to reposition them.
- Drag a marker away from the gradient to remove it. A red X indicates removal will take place.
- Double-click a marker to change the color.
- Double click the gradient bar to add a new marker.

5.2.7.2 QP Map

QP Map show per MB QP. MBs with bigger QP are brighter than MBs with less. Coloring of the QP range can be adjusted with a gradient tool on the right top corner.

Q	^o ma	ap, d	qp p	er N	1B																	1.7x	128 p	ixels								—
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	3
0	12	12	12	12	-12-	12	12	12	12	12	12	-12-	12	12	12	12	12	12	12	-12	12	12	14	14	-14	-20-	18	18	23	23	23	2
1	13	13	13	13	-13-	13	13	13	13	13	13	13	13	13	13	13	13	-13	13	13	13	13	13	13	16	19	19	14	18	18	20	2
2	21	17	17	12	-12	12	12	12	19	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	18	18	20	20	20	20	20	1
3	22	19	19	19	-13-	-13	13	18	18	18	18	18	18	18	18	18	18	18	14	14	14	-14	14	-12-	18	12	12	12	17	20	20	2
4	20	18	20	18	-12-	14	18	18	18	18	18	18	18	18	15	15	13	13	13	13	13	13	13	13	-13	13	13	19	19	21	18	2
5	20	22	22	16	18	18	18	18	20	-10	10	10	10	-10-	14	14	14	14	14	14	14	14	14	14	14	-14	14	22	22	20	22	2
6	20	20	20	-20	15	19	-19	19	21	16	16	16	16	16	16	16	16	14	14	14	-14-	14	14	-14	12	12	19	21	18	18	21	1
7	19	19	-19	19	19	19	19	16	21	-25	25	-23	21	-25	25	22	22	19	19	17	-14-	-14	-23	-26	23	23	-26	26	26	-26	-26	2
8	21	19	19	19	19	17	8	20	25	22	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	26	26	24	24	17	2
9	20	20	17	-22	22	20	20	20	25	22	22	18	23	23	23	21	21	24	-22	26	20	24	24	24	22	22	-26	-26	26	19	15	1
10	22	22	20	-23	20	20	20	16	25	-23	23	23	25	21	14	17	20	18	25	25	-25	27	27	25	25	-25	25	-25	25	21	18	1 X
11	22	22	-22	20	20	20	20	16	24	21	21	24	24	22	25	23	26	26	26	-26	22	-22	18	18	16	16	-25	-25	25	27	21	23
12	21	21	21	21	21	21	17	19	24	20	20	-22	17	25	25	25	25	25	25	25	20	-24	24	24	24	-26	26	24	24	24	24	24
10	21	21	21	21	15	15	12	12	25	21	19	19	23	26	26	26	19	25	25	25	25	25	25	22	-20-	-26	26	23	21	25	25	20

5.2.7.3 MB Type

MB Type overlay show color map of their types. Intra blocks is colored in red, inter skip is yellow colored, B-Direct is in green and inter in blue.



5.2.7.4 MB Reference Indices

MB reference indices shows reference indices for each subblock 8x8. Orange color shows L0 reference index and purple color is for L1 reference index. When PU has only one reference missing reference index is displayed with dash. For blocks with no reference indices nothing is shown.

Reference	e in	dice	S																						1.7x	128	pixe	els⊢									
0 1	2	3	;	4	5	6		7	8	9	9	10	11	12	1	3	14	15	1	16	17	18	19	20	21	22	2	23	24	25	26	27	28	2	9	30	31
		1	•			•			• •		•					• •												2		•	•••	•	•	1	•	1	2 1 1
		1				•			•		•					•		20										2 2		1 1	•	0 0	•		•		2 0 0
	•					•			•		•					•							•					•		1 1	•		•		•		0 0 0
		1				•			• •		•					•							•					•		•	2	0 2	•			1	• • •
	• • •		•						0 1		•					•		•					2 2					•		•	2 2	2 2	•			1	•••
2 0 0 0 0		1	• 2	2					0 1		•					•		•					2 2					•		•	2 2		•			1 0	
	1 1 1	1	•						•		•					•		• •					0 0					2 1			•		•			1 1	
3 0 0 0		1	•			•		2	•							•							•					2 0								1	0 0 0
0 1 1 0			•	•				•	•		•					•												•								1	• • •
4 0 0 0	1 1	1	•	•		•	1		•		•					•												•				0 0	•			1	
1 1 0 0	1 1		•			•	1 0		• •		•					•												•				0 1		1		1	
5 1 1 0 0	1 1		•			•	1		•		2 0					•							0 0					•			0 0	0 1		1		1	
	1 1 1		1	•	•		1	•	2 2	2	2					•												•			•	•	0	1			• • •
6 🖬 🖬 🖬	1 1 1		•	•	•				88	1 🖬	2					•		2 2					•								•	•			1		1 1 1
• • • •		1	•		1			8	0 0		1					•							0 0							1 1	0 1	1 1			•		
7 0 0 0 0	1 1 1	1	•	•	1 0	•		8										1 1		•	1	•	•							1 1	0 8	1	•		8 6	1 0	
0 1 0 0	1 1 1	1	•	1					0 8		8	10								E				2 2					Ħ		88	1	1 1		E	8	88
8 0 0 0	1 1 1	1 1	•	1					0 2	8	8	1									8			88							8.0	0	1		E	8.8	88
0 0 0 0		1							2 2					•		1				F						0 0						8 0	1		F		
9		1 1							88							- 0					H											1 0	3 0		F		
1 1 1 1		1 1	1 0	•				8	88		•					- 1	HT					•		0.0	HH							0	0 8				E
10 🖬 🖬 🖬			•	•				8	2 2		•					• F	ĦŦ					•		0.0							1	1	•				E
0 0 0	1 1 1			•				٥	0 0				1 0	8 8					- 0	0 0	1.8	8.8		8 8			8	8					1		8		888
11 🖬 🖬 🗖		1				0.6		0					8 0							3	B						1	8					8 8				
0 0 1		1								1											H		8 8	88					H	0 8		8 8	H				
12 🔒 🖬 🔳		1 0		•												3								88	8 0			•		8 8		8 8					
	1 1 1	1	1	•					88	в	8				в	1								•	0 1					8.8	• •						

5.2.7.5 **PSNR**

PSNR map shows per pixel PSNR value normalized on MB size. To enable this mode you have to load reference YUV file via DebugYUV menu. The value is calculated per MB. Bigger value has brighter color. The color range can be adjust with gradient tool on the right top corner. If the block has no difference with reference YUV a latter 'e' is shown which means exact match.

PS	NR																					1.7x	128 p	ixels								
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	3
0	е	54	e	60	-55	-58	е	e	e	58	58	-56	58	64	57	53	54	52	57	-55	58	62	55	54	-52	45	44	45	41	41	42	-4
1	50	54	58	55	-58	58	56	53	72	51	56	60	54	54	53	56	54	-59	60	e	e	55	55	56	51	-44	45	52	48	49	45	4
2	44	47	48	55	-57	е	е	49	43	55	57	52	56	60	56	55	54	55	-50	56	е	55	64	56	48	47	45	50	55	44	44	-4
3	41	44	-46	69	-56	60	55	-46	45	46	-54	55	55	-55	53	52	-50	52	50	54	61	-59	59	55	48	51	-48	52	46	-43	42	4
4	41	43	45	48	-50	53	46	47	44	50	56	52	59	56	51	50	52	51	51	54	54	57	52	52	55	53	53	48	44	-44	44	4
5	42	40	42	-45	44	44	44	-44	40	-53	е	е	е	-56	53	51	52	-52	52	52	53	53	54	52	53	-51	49	44	43	42	41	4
6	43	42	41	41	46	43	-46	44	41	47	54	56	56	52	51	50	50	51	53	52	-51	51	52	51	52	51	43	44	46	-44	42	4
7	44	42	43	43	44	44	48	49	42	37	38	-44	47	45	43	46	46	50	48	48	-52	53	46	45	41	39	-37	37	39	-39	39	4
8	42	41	-43	43	44	49	64	48	40	40	39	38	39	39	41	41	41	40	41	40	40	-44	44	42	39	37	-36	37	38	42	47	4
9	41	41	42	42	43	-48	е	50	40	40	41	45	42	42	42	45	42	41	42	37	43	42	41	43	43	42	37	35	38	-44	50	4
10	39	41	42	42	44	45	46	50	39	-41	42	39	40	45	52	50	46	-45	40	38	-38	39	41	43	41	43	38	37	37	-44	47	4 X
11	40	40	40	42	43	41	45	-51	37	42	43	38	38	42	40	39	36	37	37	39	42	42	46	47	49	45	42	40	35	35	44	42
12	42	40	41	42	42	43	-48	52	38	42	-47	43	45	-39	40	36	37	40	41	41	42	-40-	40	40	39	37	36	35	41	41	39	40
12	41	42	43	43	49	54	51	50	42	47	49	48	42	35	37	39	44	41	40	40	36	38	39	41	-40	36	37	41	43	43	39	46

5.2.8 Simple Motion



Simple Motion mode offers a way to quickly view the modes and motion of a picture at a glance. No overlays are present except a colored dot showing information about the PU's mode. Green dots indicate intra prediction, and purple/orange L0/L1 motion vectors for inter prediction are drawn as simple lines. When the motion vector is very small, a dot is drawn instead so that the mode is still easy to identify. When a motion vector does not point to the 0-th index of its respective list, the vector is drawn using a dashed line.

6 MPEG-2

The following sections describe all available features when loading a MPEG-2 bitstream. The bitstream must be containerized with mpeg-2 container format.



6.1 UI Components

The following sections describe the various components in the UI when an VP9 bitstream is loaded.

6.1.1 Top Filmstrip



The top filmstrip is a horizontally scrolling overview of the pictures in the bitstream. The current picture is highlighted. On top is the frame number in both decode and display order respectively and the picture structure (frame- or field-picture) as indicated by the frame header. On bottom is indicated the picture coding type (I-, P- or B-frame).

Clicking on a picture will cause Intel Video Pro Analyzer to decode it and mark it as the current picture, updating the rest of the UI correspondingly. If the new picture requires other pictures to be available as reference that have not yet been decoded, those will automatically be decoded.

Pictures are decoded on demand since it is impractical to store all details of all pictures in memory, especially for HD sequences. The current picture can also be selected by typing in a picture number in the box on the left of the panel. When using this box, the filmstrip is scrolled such that the newly selected current picture is visible.



In Thumbnails and Bar mode it is possible to choose between Display/Decode order representation by click on additional. By right clicking on selected picture one can get popup

submenu with a set of extract actions. An action called "Extract pictures from last keyframe to the Picture" will write out a bitstream that contains the minimum number of pictures needed to decode the current picture. Typically this will consist of the current picture and all previous pictures that are reference pictures up to the nearest keyframe picture. This can be useful for debugging issues in long sequences. Other actions allow to save in the output file statistics and intermediate/final YUV planes.



Allow separate panels can be detached from them main window or hidden. To attach panels back double click on the titlebar. To unhide panel go to View menu and check appropriate panel.

6.1.2 Main Panel



The main panel displays the selected picture with visual annotations. The type of annotations and associated interactive behavior depends on the current mode, see 4.2 MPEG-2 Modes. Click-dragging moves the picture around, and the mouse wheel zooms in or out about the mouse cursor.

At the top left of the panel, the current mode is displayed. Along the top right the current scale is shown. In all modes, the macro-block row and column values are displayed along the left and top border of the picture and tile boundaries are thick green lines. The screenshot above shows an example of a stream that is 44x14 SBs.

The bottom left has a cluster of buttons

 \blacksquare FS - + R | YUV \checkmark Pic Info Details H \land | \bowtie \bigstar \blacktriangleright \blacktriangleright \bowtie | Ref YUV Debug YUV Diff YUV Reload

- FS: Toggles full-screen mode, which hides all UI elements except the main panel. Keyboard shortcut is F.
- +/-: Zooms in or out, centered on the center of the panel. Note that zooming with the mousewheel is much easier than using these buttons. Keyboard shortcuts are + and -.
- R: Resets the current zoom to fit the entire picture in the main panel. Keyboard shortcut is R.
- YUV, Y, U, V: Toggles between per-component image, or full-color YUV.
- Pic: Toggles the actual picture underneath the annotations. The picture is modedependent. For example in prediction mode, the picture is comprised of the prediciton samples before the residual signal has been added in. It is often helpful to turn off the picture in order to make the annotation easier to read. Keyboard shortcut is P.
- Info: Toggles the annotations on or off. Keyboard shortcut is I.
- H/D: Toggles between hexadecimal and decimal display of the annotations. This applies to the values in the Left Tabs as well. Keyboard shortcuts are H and D.

• There are five navigation buttons: first frame, previous frame, playback mode, next frame, last frame. The previous/last button will rewind, causing the current picture to be set to the first/last picture in the loaded bitstream. The "Play" button will start playback of loaded bitstream at a reasonable rate, limited by CPU performance. All normal mode operations are possible during playback. Note that playback mode always operates in currently selected order in the filmstrip.

6.1.3 Left Tabs

The left side of the UI is a resizable panel with several tabs that display information about the current selection in one way or another. The following subsections describe each tab.

6.1.3.1 Pictures (bitstream)

#	Struct	Position	n Size		*
3 P	T-Field	62744	64796		
4 P	B-Field	127540	16614		Ξ
5 P	T-Field	144154	30943		
6 P	B-Field	175097	28520		
7 P	T-Field	203617	32001		
8 P	B-Field	235618	30079		
9 P	T-Field	265697	31639		
10 P	B-Field	297336	29692		
11 P	T-Field	327028	31860		
12 P	B-Field	358888	30294		
13 P	T-Field	389182	31397		
14 P	B-Field	420579	30617		
15 P	T-Field	451196	31729		
16 P	B-Field	482925	29555		
17 P	T-Field	512480	32156		
18 P	B-Field	544636	29901		
19 P	T-Field	574537	31760		
20 P	B-Field	606297	29775		
21 P	T-Field	636072	32142		
22 P	B-Field	668214	29764		
23 P	T-Field	697978	31674		
24 P	R-Field	729652	301 59		Ŧ
Pictures	s Seq	uence	GOP	Picture 4	

In "Pictures" tab VPA presents raw picture sequence with type, offset and size.

6.1.3.2 Sequence

SE Name	Value	^
sequence_header		
Coded_Picture_Width	720	
Coded_Picture_Height	480	
Chroma_Width	360	
Chroma_Height	240	
block_count	6	
profile	0	Ξ
level	0	
horizontal_size	720	
vertical_size	480	
mb_width	45	
mb_height	30	
bit_rate	15.00 MB	
frame_rate	30	
aspect_ratio_information	2	
frame_rate_code	5	
bit_rate_value	37500	
vbv_buffer_size	112	
constrained_parameters_flag	0	
sequence_ext		
nrofile and level indication ∢ III	72	Ŧ
Pictures Sequence GOP	Picture	Þ

The Sequence tab shows all syntax elements decoded in the sequence header and sequence extention header, both the uncompressed and bool-coded partitions.

6.1.3.3 GOP

SE Name		Value		
gop_hea	der			
drop.	flag	0		
hour		0		
minu	te	0		
sec		17		
fram	e	3		
close	d_gop	0		
broke	en_link	0		
Pictures	Sec	juence	GOP	Picture 4

The GOP tab shows all syntax element decoded in GOP header, both the uncompressed and bool-coded partitions.

6.1.3.4 Picture

SE Name			Value		
picture_heade	r				
temporal_	referenc	e	14		
picture_co	ding_ty	pe	2 (P-fra	ame)	
vbv_delay			9100		
full_pel_fo	rward_v	ector	0		=
forward_f	code		7		
full_pel_ba	ackward_	vector	0		
backward	_f_code		0		
picture_codin	g_ext				
f_code[0][0]		2		
f_code[0][1]		3		
f_code[1][0]		15		
f_code[1][1]		15		
intra_dc_p	recision		0		
picture_st	ructure		1 (top 1	field)	
top_field_f	first		0		
frame_pre	d_frame	_dct	0		
concealm	ent_mot	ion_vectors	1		
intra_vlc_f	ormat		1		
repeat_firs	t_field		0		
chroma_4	20_type		0		-
	, 			ol:	
Sequence	GOP	Picture	User	Slice	• IP

The Picture tab shows all syntax element decoded in picture header, picture coding extension, picture display extension and picture spatial scalable extension, all of them are uncompressed and bool-coded.

6.1.3.5 Refs

SE Name			Value	
copyright	_ext			
copyr	ight_flag		0	
copyr	ight_ider	ntifier	0	
origin	al_or_co	ру	0	
copyr	ight_nun	nber_1	0	
copyr	ight_nun	nber_2	0	
copyr	ight_nun	nber_3	0	
1	COD	Distance		Cline A
sequence	GOP	Picture	User	Slice

This panel displays the data that is decoded in user extension.

6.1.3.6 Slice

SE Name			Value		
slice_vert_p	os_ext		0		
quantizer_s	cale_co	de	9		
	COD	Distance	Lines	ch:	
equence	GOP	Picture	User	Slice	

This panel displays the syntax elements associated with the currently selected slice.

6.1.3.7 TX

SE Name	Value
macroblock_type	8
frame_motion_type	2
dct_type	0
motion_code[0][0][0]	-1
motion_residual[0][0][0]	3
motion_code[0][0][1]	0
motion_residual[0][0][1]	0
coded_block_pattern	0
mb_addr_incr	1
P Picture User	Slice MB Stat

This panel displays the syntax elements associated with the currently selected macro block.

6.1.3.8 Stats



This tab displays various statistics extracted from the current picture. The top half shows some picture size and compression stats as well as the image digest information. The bottom half displays pie charts for a number of metrics. Each pie chart can be drawn normalized or un-normalized. Normalized data is weighted by area or bits. The pie chart can be moved by dragging the mouse, and zoomed with the mouse scroll wheel.

6.1.4 Selection Info

Selection 1	Selection Info &														
Width:	640	Pixel XY:	- 75, 95	FMV0:	-3,-11										
Height:	480	Block XY:	11, 12	BMV0:	-										
Frames:	100	Block #:	491	FMV1:	-										
Color:	4:2:0	Slice:	480-519	BMV1:	-										

This panel shows a few details about the current selection at a glance:

- Frame height & width
- Number of frames in the bitstream
- Chroma format (4:2:0, 4:2:2 or 4:4:4)
- X/Y position of the mouse cursor in the frame
- Current macro-block row and column number
- Current macro-block number in slice
- Macro-block numbers, which belong to current slice ("1st MB number" "last MB number")
- MV list (up to four) of currently selected MB, where FMV0, BMV0 are forward and backward MVs for the first field and FMV1, BMV1 are forward and backward MVs for the second field. If no MV is present in stream, "--" sign is displayed.

6.1.5 Raw Bytes

Unit Info	×
MPEG2 picture (P-Frame, frame picture): size 37679 bytes at position 119420 in stream:	~
00 00 01 00 01 97 ff fb 80 00 00 01 b5 84 4f f3 41 80 00 00 01 01 12 73 2a a2 4a fa 6b cf 39 95 6c ab 65 5b 29 24 ac c0 e5 7e e9 c8 9d 5b f8 03 2d 92 5e 2f a1 df f6 0e 79 1d cc 12 15 7a e9 03 25 25 32 33 58 d6 cb a4 86 81 7c 2e 3c 92 d6 83 02 bf 57 a2 e4 75 7d ed 34 10 01 a8 0c 18 06 1f a0 34 02 62 6b 05 c0 81 fa c1 a0 3a 28 04 00 26 c0 54 84 b2 89 bd db 44 20 10 96 92 fe 2b 19 e2 f8 06 20 55 04 c2 80 a2 7f e5 58 6a 3e 28 a0 d3 0b 48 04 03 ed a4 41 00 14 a4 06 20 50 34 04 01 a8 0d d8 06 fb fa 4b b2 a2 c8 79 21 84 de 57 35 6e 26 b6 6f ed 29 88 21 0d 25 62 5a fc 82 80 0f 40 a9 0f 10 83 14 18 ed	~
Unit Info	5 ×
Macroblock #778 (Intra) Size 190 bits at position 313198 in stream:	

This resizable panel displays raw bytes from the bitstream as it applies the current selection, as well as few extra details. The current selection can be a particular block or MPEG-2 frame.

6.1.6 Messages

Status				₽×
Decoding Decoding Decoding Decoding	frame frame frame frame	9 done. 5 done. 13 done. 4 done.		^
				\sim
Ready			111MB / 175MB / 808	39MB

This resizable panel in the lower right of the UI displays messages about the decoding process, and shows progress of any actions that may take a while to complete. The 3 numbers in the lower right of this panel represent the memory state of the proccess. From left to right the 3 numbers are:

- Amount of memory used by process
- Peak memory used by process
- Total memory claimed by system

6.2 Modes

	Prediction	F1
	Residuals	F2
۲	YUV	F3
	HeatMap	F4
	QP Map	F5
	Simple Motion	F6

With a MPEG-2 bitstream loaded, Intel Video Pro Analyzer can be put into one of 6 modes using either the F1-F6 keys, or using the Mode menu. The mode selection affects only what is displayed in the Main Panel.

Most modes can also show details of the current selection (block, prediction/transform block). This can be toggled with the right mouse button or the main panel's button strip.

6.2.1 Predictions

Predi	iction modes	5								
	0	1	2	3	4	5	6	7	8	
	MC_16X8	MC_16X8	MC_16X8	MC_16X8	MC_16X8	MC_16X8	MC_16X8	MC_16X8	MC_16X8	ŀ
0	4	63	← R >	2	\$	\$	4	4	←⇒	
	1.1 01	5,0 -1,-1 5.0 1,-1	3,0 -1,-1 -7.0 1.1	-1,1 0,-2	2,3 ³ 2,1 -4.0 -41	-1,0 1,0 1.0 1.0	1,0 -1,0 -1,0 1,-1	1,0 -1,-1 -1.0 -1,-1	1,0 -1,0 -4.0 1.0	0,0 1.0
	MC_16X8	MC_16X8	MC_16X8	MC_FIELD	MC_16X8	MC_16X8	MC_16X8	MC_16X8	MC_16X8	N
1	حي	्राज	4	А	4	4	æ ⁷	47	æ	
	0,1 2,0	0,-1 0,0	0,1 0,-1	0,-1	4 1 4 1	-1,0 1,-2	-1,0 1,0	-1,0 0,0	1,0 -1,-1	1,0
	MC_16X8	MC_16X8	MC_16X8	MC_FIELD	MC_16X8	MC_16X8	MC_16X8	MC_16X8	MC_16X8	1,0
2	~	А	\$	v	<i>←</i> ≠	A	A	NZ.	←	
	0,0 0,0	0,-1 0,-1	0,-1 0,-1	0,1	2,-1 2,-1	1,-2 1,-1	1,-1 1,-2	1,0 2,0	,0 2,0	-1,0
	MC_FIELD	MC_FIELD	MC_16X8	MC_16X8	MC_16X8	MC_16X8	MC_16X8	MC_16X8	MC_FIELD	10
3		А	Ţ	4	<i>←</i> ,75	4	~	د _	->	
	0,0	0,0 0 -1	D,1 1,-1	0,1 0,1	2,-1 2,-2	3,0 3,1	2,0 3,-1	3,0 -1,1	3,0	-2,-
	MC_FIELD	MC_FIELD	MC_16X8	MC_16X8	MC_16X8	MC_16X8	MC_16X8	MC_16X8	MC_16X8	1,0
4			л	~	A.	~ ⊷ ∠	<u>^</u>		K-1	÷
	0,0	0,0	0,-1 0,0	0,1 0,0	2,1 2,-1	3,0 1,0	2,1 1,-1	-1,3 -3,1	1,1 -3,-1	_
	MC_16X8	MC_16X8	MC_16X8	MC_16X8	MC_16X8	MC_16X8	MC_16X8	MC_16X8	MC_16X8	10,2
					7					

This mode shows the details of the prediction blocks in the frame. The selected block is surrounded with a pink box. When a prediction block is selected, the syntax used to code it is displayed in the Block tab of the Left Panel.

Intra prediction block contain the intra luma mode in bright green, and can contain so called "concealment" motion vectors if they are present in bitstream.

Inter prediction blocks show the inter mode in cyan. There are up to two pairs of MVs are drawn in block. Left pair corresponds with the first field? The right one – with the second one (if any). The forward motion vector in orange and the backward one in purple. The motion vector value is in units of $1/8^{th}$ pixels.

6.2.1.1 Prediction Detail Mode

Entering detail mode on a selected prediction block allows the sample values of the prediction process to be viewed directly. No details mode is available for intra blocks.

Inter-	predicted	blocks	display	contains	predicted	values	for	luma	and	chroma	com	oonents.
Selecter	MB (14 2) blo	ock predicti	on details									

	u iv		1-4,2	.) 01	OCIN	pic	arcu		acto	mJ																						
Lu	ma	pre	dicte	ed v	alue	es										Chro	oma	a C	b p	redi	cte	d va	lues	i	Ch	nron	na C	r pr	edio	cted	valu	les
123	123	123	122	121	121	121	121	121	121	121	121	119	120	119	119	166 17 [.]	71 1	70	164	167	165	140	119		120	126	141	147	138	153	164	168
120	121	121	120	122	123	120	121	122	123	120	121	122	121	119	119	163 169	59 1	75	170	163	160	140	118		117	123	140	149	139	147	156	171
122	121	120	119	118	120	122	122	118	120	122	122	121	120	120	119	178 16	58 1	68	173	170	151	124	118		114	134	156	151	135	144	153	164
118	116	115	114	116	120	122	121	116	120	122	121	120	120	119	119	164 173	73 1	75	179	178	146	115	120		120	138	155	152	141	145	155	166
118	117	117	116	116	117	119	119	116	117	119	119	120	119	120	118	171 17	75 1	76	180	162	125	107	110		136	157	165	162	159	164	165	170
117	115	115	115	116	116	116	118	116	116	116	118	119	119	118	119	174 16	58 1	78	180	151	126	118	112		134	152	163	159	169	166	156	164
116	116	115	114	115	116	116	116	115	116	116	116	118	119	119	119	172 16	67 1	74	160	133	130	123	104		152	154	159	160	165	161	157	165
116	116	114	114	114	113	114	116	114	113	114	116	118	118	118	118	173 179	79 1	65	131	110	114	115	109		152	157	160	161	174	164	160	165
118	117	117	116	116	117	119	119	116	117	119	119	120	119	120	118																	
117	115	115	115	116	116	116	118	116	116	116	118	119	119	118	119																	
116	116	115	114	115	116	116	116	115	116	116	116	118	119	119	119																	
116	116	114	114	114	113	114	116	114	113	114	116	118	118	118	118																	
116	116	115	114	114	114	114	114	114	114	114	114	116	118	119	118																	
116	115	115	113	112	112	111	113	112	112	111	113	117	118	118	117																	
117	117	116	115	114	114	112	112	114	114	112	112	113	115	115	117																	
119	117	115	114	114	113	112	111	114	113	112	111	112	114	116	117																	

6.2.2 Residuals

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
QP: 10	QP: 10	QP: 10	QP: 10	QP: 10	QP: 10	QP: 10			QP: 10	QP: 10	QP: 10					QP: 10				QP: 10	QP: 10
CBP: 0																					CBP: 0
QP: 6	QP: 6	QP: 6	QP: 6	QP: 6	QP: 6	QP: 6	QP: 6	QP: 6	QP: 6	QP: 6	QP: 6	QP: 6	QP: 6		QP: 6	07: 12	QP: 14				QP: 4
CBP: 32														CBP: 68	CBP						CBP: 43
QP: 4	QP: 4	QP: 4	QP: 4	QP: 4	QP: 4	QP: 4		QP: 4	QP: 4	QP: 4	QP: 4	QP: 4	QP: 4	QP: 4	QP:-6	QP: 4	QP: 4				QP: 4
CBP:62					CBP: 63	CBP: 63	CBP: 63							CEP. 63	CEH: 63						CBP; 43
QP: 6						QP: 6	QP: 6	QP: 6	QP: 6	QP: 6	QP: 6	QP: 6	QP: 6	Q	₽91 2	QP: 4			QP: 6	QP: 6	QP: 6
CBP: 29					CBP: 6.3	CBP: 63	(BP: 63							CBP 16	CBP: 53	BP1 63		CBP: 63			CBP: 43
QP: 2	QP: 2	QP: 2	QP: 2		QP: 2	Per 2	QP: 2	QP: 2	QP: 2	QP: 2	QP: 2	QP: 2	QP: 2	QP: 2	P: 4	2P: 2		QP: Z	QP: 2	QPt 2	QP: 2
CBP: 63					CBPt 63	G8P: 63								CBF 63		CBP: 63					CBP: 43.
QP: 2	QP: 2	QP: 2	QP: 2		QP: 2	QP: 4	QP: 2		QP: 2	QP: 2	QP: 2	QP: 2	QP: 2	12	QP: 2	QP; 2			QP: 2	QPt 2	QP: 2
CBP:63							CBP: 63	CBP: 63					62	(16) (60)	CER: 63	CBP: 63					CBP: 43
QP: 2	QP: 2	QP: 2	QP: 2			QP:2	QP: 4	QP: 2	QP: 2	QP: 2	QP: 2	QP: 2	@P: 4	QP: 2	OP.	QP. Z			QP; 2	QPt 2	QP: 2
CBP: 63					CBP: 64		CBP: 63					CBP: 60	UBP: 63	CBP: 55	Section.	CBP: 63					CBP: 59
QP: 2	QP: 2	QP: 2	QP: 2			QP: 2	QP: 2	QP: 2	QP: 2	QP: 2	QP: 2	QP: 2	QP: 2		QP: 4		QP; 2	QP; 2	QP: 2	QP; 2	QP; 2
CBP 63												CEP: 63	CBP: 63	CBP: 63	BP: 63						CBP: 43
QP: 2	QP: 2	QP: 2	QP: 2	QP: 2	QP: 2	QP: 2	QP: 2	QP: 2	QP: 2	QP: 2	QP: 2	QP: 2	100	PR A	2-2	QP: 2	QP: 2	QP: 2	QP: 2	QP: 2	QP: 2

Residual mode allows inspection of the transform structure of each block. Block boundaries are displayed in blue, the currently selected block is outlined with a pink box. Blocks that code no residual signal are indicated with "Skip" label.

Clicking a particular transform block causes the syntax elements used to decode it to be visible in the "MB" tab of the Left Panel.

The residual image itself can be shown using the "Pic" button on the bottom button strip. Residual values of 0 are flat gray, negative values are darker and positive values are brighter.

6.2.2.1 Residual Detail Mode

To view the full details of the transform blocks belonging to a particular block, selected a transform block and enter detail mode by right clicking or using the detail mode button at the bottom of the main panel. The currently selected transform block is highlighted with the sample grid. The transform structure of the selected block is drawn two times, arranged in a column from top to bottom, showing the 2 major steps in recovering the residual signal:

4. Inverse scaling process. The scaled values and the scaling factors used to obtain them are shown in this diagram.

Basi	c sc	amn	, QP	= 4											
Lu	ma	DC	coe	effs											
60	-84	-33	60	-6	-13	-7	17	-112	52	-9	5	13	-6	7	
4	24	-22	-18	60	-43		18	92	28	-5	12	6	-7		
-38	16	-19	20	-21		17	-9	4	-5	6		-14	-8	-8	
-11	16	-6	20	-21		18	-10	-16	-11	6	-13	-7			
-11			7	-8	8						-7	-8	-8		
		-7	8	-8						-7	-8	-8	-10		
		-7	8	-9						-7	-8				
		-8	9							-8	-9				
-48	-72	47	-16	-6	20	-14	8	-28	116	-9	-22	-6			
24	-48	16	18	-33	29	-17	9	-168	-68	16	24	6	7	8	
-14	16	-32	27	-21	17			33	-5	-13	-13	-21	-25	-8	
5	5	-13	6		-8	9	-10	22	16	6	13	14	8		
			7					-16	-6			8	8		
								6	-6	-7		8	10		
6								-6		-7					
								6	7	8					

Chroma Cb DC coeffs														
52	208	71	-27	-26	-13									
-44	-8	49	36	-13	-21									
9	5	-13		21		-8	-9							
			-6	-7		9								
16		-13	-7											
6	6			-8										
6														

Cł	nrom	na C	r D	C co	peff	S	
104	-124	-61	11	13	13		
28	8	-33	-30		14	8	
-4	-11	13	6	-14		8	
5	-5		6	7		-9	
-11		6	7				
-6				8			

5. Inverse transform process. This recovered residual values and the transform type used are displayed in this diagram.

									In	vers	se T	irans	sfori	m											
			0						/									0							
Г	Lu	ma	Res	sidu	als							_	_	_			1 1	Cr	nrom	na C	D R	esi	dua	S	
	-7	-11	-7	-9	38	30	-19	-23	2	21	11	-2	3	-5	-16	-11		50	53	16	-16	-21	-16	-24	-16
	-2	-5	-5	6	45	2	-7	25	30	7	-6	0	5	-2	-14	-17		49	44	1	-27	-27	-24	-26	-17
	-5	-3	-7	12	57	9	18	29	14	1	4	10	8	-9	-26	-22		51	49	12	-25	-25	-21	-18	-18
	-2	-3	-6	7	37	9	33	33	5	-3	-5	-7	-4	-12	-30	-23		45	52	33	-12	-21	-17	-14	-18
	1	-6	-8	1	24	27	33	16	-10	-21	-12	-12	-20	-26	-31	-23		39	45	41	-1	-18	-18	-16	-14
	-4	-2	-3	-7	10	44	34	1	-20	-29	-22	-21	-29	-31	-30	-25		43	46	44	7	-18	-19	-18	-14
	-9	-9	-9	-8	5	46	35	-9	-30	-24	-23	-28	-28	-30	-31	-29		44	49	45	24	-10	-22	-19	-18
-	16	-16	-13	-12	-5	40	42	-13	-25	-21	-25	-28	-28	-28	-29	-31		44	48	45	47	8	-22	-19	-12
-	16	-20	-16	-13	-13	19	44	-9	-19	-24	-25	-24	-25	-27	-30	-32	1 '								
-	18	-20	-15	-17	-18	1	44	7	-24	-10	-18	-35	-30	-25	-32	-30									
-	13	-15	-14	-18	-18	-12	41	29	-17	-16	-12	-23	-30	-29	-32	-33									
-	-11	-13	-17	-18	-17	-16	24	37	0	-23	-10	-4	-25	-29	-27	-31									
-	10	-9	-14	-13	-12	-13	4	33	39	13	11	6	-15	-25	-24	-25									
	11	-8	-9	-6	-10	-11	-11	20	44	40	36	29	10	-7	-16	-20									
-	13	-13	-10	-8	-13	-16	-17	-1	47	65	59	42	22	2	-2	-4									
	-9	-15	-11	-10	-12	-18	-13	-14	21	70	63	35	21	1	-7	-7									

Chroma Cr Residuals

-17	-18	12	31	29	33	32	25
-19	-11	24	36	30	35	32	25
-18	-13	20	36	30	28	24	23
-14	-16	4	29	30	22	20	20
-11	-11	-5	23	33	25	28	20
-11	-11	-10	18	33	27	31	25
-11	-15	-15	6	25	29	28	26
-11	-15	-15	-10	13	34	29	22

6.2.3 YUV



YUV mode allows inspection of the final decoded sample values, without additional overlay data. In this mode, the YUVDiff feature is exposed. This feature allows for comparison of an external decoded YUV file with the decoded bitstream. Supported formats are 4:2:0 planar and NV12. Also, YUV files that are zipped or gzipped may be opened directly without the need to decompress separately. If a zip file contains more than one YUV file, only the first one is used. When a YUV file is loaded, any mismatches will be indicated with a red dot in the CU containing the mismatch. This allows the user to quickly identify the nature of the mismatch which can assist with debug.

When a file is opened, four additional buttons become visible on the lower left of the main window:

 \blacksquare FS - + R | YUV \checkmark Pic Info Details H \land | \bowtie \bigstar \blacktriangleright \blacktriangleright \bowtie | Ref YUV Debug YUV Diff YUV Reload

- Ref YUV: The original, expected YUV image.
- Debug YUV: The loaded debug YUV file.
- Diff YUV: The delta image. Like in Residual mode, areas with zero delta (i.e. Original and Debug image are identical) are flat gray. Areas where the debug YUV has a lower value are darker, and areas where the debug YUV has a higher value are brighter.
- Reload: Reloads the YUV file, which can be useful as a shortcut to loading via the YUVDiff menu.

6.2.3.1 YUVDiff Menu

YU۱	VDiff Options Help												
	Open debug YUV Ctrl+Y												
	Recent YUV files												
	Close debug YUV												
•	Planar												
	Interleaved												
•	Display order												
	Decode order												
~	Use stream crop values												
	Set picture offset here												
	Picture offset (0)												
	Use 16 bit YUV												
~	Check for file changes												
	• Open: Brings up												

- Open: Brings up a file chooser to open a YUV file
- Close: Closes the currently opened YUV file. Any mismatch indicators will disappear.
- Planar: Causes Intel Video Pro Analyzer to interpret the loaded YUV file as Planar.
- NV12: Causes Intel Video Pro Analyzer to interpret the loaded YUV file as NV12. This
 option is chosen automatically when the loaded YUV file has the file extension
 ".nv12".
- Display order: Causes Intel Video Pro Analyzer to use display order picture numbers when determining how far to seek into the YUV file to extract the image to compare with the current picture.
- Decode order: Causes Intel Video Pro Analyzer to use decode order picture numbers when determining how far to seek into the YUV file to extract the image to compare with the current picture.
- Use stream crop values: When checked, YUV files are assumed to contain samples only within the cropping window as defined by the loaded bitstream. Samples outside this window are not compared, and are assumed 0 when viewing the loaded YUV image directly.
- Set picture offset here: Shortcut for setting the picture offset to the current picture number. See bullet below.
- Picture offset: This brings up a dialog allowing the user to enter the picture number of the first picture in the YUV file. For example if a 100-picture bitstream is loaded but the YUV file only contains pictures 80-99, the user would enter 80 to properly line up the YUV file with the decoded bitstream.
- Use 16 bit YUV: this option allow you to load YUV file where both Luma and Chrome written in 16 bit (they could be normalized from actual bitdepth to 16 bit during encoding). This is useful when you have bitdepth changing across the stream. Intel Video Pro Analyzer will shift values to appropriate bitdepth on the current frame.
- Check for file changes: When checked, this option causes Intel Video Pro Analyzer to periodically check if the loaded YUV file has changed on disk since it was last loaded. If the file has indeed changed, a dialog pops up offering a chance to reload the YUV file.

6.2.3.2 YUV Detail Mode

In detail mode the expected YUV values can be inspected. Note that the displayed sample values are the same as those in Loop Filter mode since loop filtering is the last step in the decode process. When a YUV file is loaded, the debug and delta YUV values can be inspected as well. Mismatching values are shown in red.



6.2.4 Heat Map

Heat map mode shows visually how the compressed bits of the picture are distributed spatially. Blocks with more bits per pixel are brighter than blocks with less. By default this mode also shows the block boundaries in blue. It may be useful to turn off this overlay using the "Info" button on the lower left of the main panel. Heat Map does not offer a detail mode.





The gradient used to display the heat map may be edited:

- Drag the gradient markers up and down to reposition them.
- Drag a marker away from the gradient to remove it. A red X indicates removal will take place.
- Double-click a marker to change the color.
- Double click the gradient bar to add a new marker.

6.2.5 Qp Map

Efficiency map mode shows visually how QP values are distributed on image..

QP	QP value map																					
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
0	6	6	6	6	6	6	6	10	8	7	8	6	7	10	7	6	6	10	22	10	6	6
1	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	8	20	8	7	6
2	6	6	6	6	6	6	6	6	6	6	6	6	6	6	8	10	6	6	18	6	6	6
3	20	20	20	20	20	6	18	6	20	20	7	6	7	18	20	8	20	14	12	6	20	20
4	8	7	8	8	18	7	20	16	8	8	8	8	8	7	20	8	7	10	7	6	8	8
5	12	12	12	12	12	6		20	7	12	6	12	12	7	16	10	12	8	7	6	12	12
6	12	12	12	6	8	7	10	12	18	12	5	12	12	6	12	8	7	12	12	12	12	6
7	10	10	6	10	7	6	8	6	5	10	10	10	10	6	14	16	7	6	8	6	10	10
8	8	8	8	8	7	6	10	8	6	8	5	8	8	8	14	20	8	7	8	8	8	8
9	7	7	6	7	5	7	5	7	7	7	7	7	7	7	12	6	7	7	6	7	7	6
10	8	5	8	8	8	8	8	8	6	5	6	16	8	18		8	12	14	5	8	8	8
11	5	5	5	5	5	5	5	5	5	5	5	8	5	6	5	5	5	5	5	5	5	5
12	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
13	5	5	5	5	5	5	5	5	5	5	5	5	5	5	8	12	7	5	5	5	5	5

6.2.6 Simple Motion



Simple Motion mode offers a way to quickly view the modes and motion of a picture at a glance. No overlays are present except a colored dot showing information about the prediction mode. Green dots indicate intra blocks, and purple/orange motion vectors for inter blocks are drawn as simple lines. When the motion vector is very small, a dot is drawn instead so that the mode is still easy to identify.

7 Find first difference with Debug YUV



This feature "Find first difference of reconstructed YUV with reference YUV" works for all codecs VP9, HEVC, AVC, MPEG2. By pressing on the button with magnifier icon you start sequential search in decode order for difference between reconstructed YUV and reference YUV that should be preloaded via YUVDiff menu. The search runs till the first difference will be found or to the end of the stream. If you don't want to wait search completion the process can be canceled it at any time with cancel button in info modal dialog. The search always starts from the first picture in decoder order.
8 Options menu

Opt	ions View Help			
	ITU Rec. 601			
	ITU Rec. 709 ITU Rec. 2020			
•				
	YUV as RGB			
	YUV as BGR			
~	Enable HEVC extensions			
✓	Enable HEVC stream index			
✓	Allow empty tiles			
	[HEVC]: Intra mode direction according to HEVC standard			
	Force digest calculation			
	No digest calculation			
•	As in bitstream			

Options menu allows to choose different types of operation modes. The first two options switch between ITU Rec. 601, ITU Rec. 709 and ITU Rec. 2020 color conversion standards used to map YUV data on RGB surface. Intel Video Pro Analyzer uses chosen type of YUV conversion on next picture conversion. Conversions that already has been made will remain unchanged.

For specific coding modes like HEVC screen content coding two additional mode can be used: "YUV as RGB" and "YUV as BGR". In this case decoded YUV values are directly mapped to RGB or BGR values for monitor.

Color conversion with accomplished the following transformation ($0.0 \le [Y,R,G,B] \le 1.0$); (-1.0 < [U,V] < 1.0)), where Y,U,V are normalized accordingly:

 $\begin{aligned} R &= Y + V^*(1-Kr) \\ G &= Y - U^*(1-Kb)^*Kb/Kg - V^*(1-Kr)^*Kr/Kg \\ B &= Y + U^*(1-Kb), \end{aligned}$

Where Kr, Kb, Kg have the following values:

	Kr	Kg	Kb
ITU Rec. 601	0.299	0.587	0.114
ITU Rec. 709	0.2126	0.7152	0.0722
ITU Rec. 2020	0.2627	0.6780	0.0593

"Enable HEVC extensions" option enables HEVC RExt extension support (by default). It might be required to disable HEVC extensions support if you decode stream in HEVC v.1 format with wrong headers.

"Enable HEVC stream index" option enables creating and reading index file for HEVC stream. If Intel Video Pro Analyzer finds ".idx" file with the same name as stream file including extension then it will use it as index file to accelerate decoding process. Intel Video Pro Analyzer creates index file during full stream analysis if the option enabled. This feature is useful for streams with long GOP where analyzer start decoding from the nearest IDR frame and need significant time to decoder target frame. If index file is used Intel Video Pro Analyzer will skip decoding process for frame found in index.

"Allow empty tiles" option allows Intel Video Pro Analyzer decode streams with empty tiles that is not valid case according to standard.

"[HEVC]: Intra mode direction according to HEVC standard" option changes intra mode vectors direction as it stated in the HEVC standard.

There are a set of option for different cases of hash calculations. Those possibilities could save wait time for decoded frame when digest value is not important to have: "Force digest calculation" – always calculate digest regardless of the digest presents in the bitstream

"No digest calculation" – forces VPA to skip digest calculations

"As in bitstream" – digest calculation is depended on the digest presents in the bitstreams. It only occurs when the bitstream has digest.

9 Dual view

Dual view mode allows you make direct visual comparison between two bitstreams. This feature is useful for codecs fine tuning with slight variation in coding parameters. Bitstreams itself should be coded with the same codec. Intel Video Pro Analyzer considers first opened stream as master stream. Depended stream you open just right after the master one by choosing "Open depended bitstream..." in File menu.



When the depended bitstream is opened it is synchronized with the master bitstream in frame position, chosen mode, offset and scaling factor in the central information window. Also, toolbar buttons in central info window work synchronously with master.

Intel Video Pro Analyzer provides new delta button [] in the toolbar of central window.

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The purpose of this button is to view visual comparision between master and depended bitstreams. When this mode is activated the blocks with the same structure and the same currently visualized modes will be in gray color. While the blocks with different parameters or blocks with different structure on both view still will be colored. In this way it simple for the user to see visually difference in the coding parameters. The delta mode can be used for the following modes: Prediction, Residuals, Reconstruction, Deblocking, SAO, Info overlays.



For heat map like modes that display one parameter visual difference is shown pre block in three colors: red – positive values, gray - zero difference, blue – negative difference. So you can easily locate increase or decrease in comparison with depended bitstream.

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Currently, dual view mode is supported for HEVC and AVC only.

10 Command Line Features

Intel(R) Video Pro Analyzer 2017 - version 2.3.0.4470
<file name="">: Open the indicated file immediatly after loading the UI.</file>
-h (-help): help for options
-hevc : force HEVC decoder
-vp9 : force VP9 decoder
-avc : force AVC decoder
-mpeg2 : force MPEG2 decoder
-o <file name="">: output file name (default is "output.yuv"). Must be used with -regress</file>
-n <frame number=""/> : position stream at this frame on startup
-yuv <file name="">: debug yuv file name to load on startup (for GUI mode) or debug yuv to measure some metrics (for command line)</file>
-regress: don't bring up the GUI, just decode the stream.
-frames <num_frames>: decode specified number of frames in decode order. Must be used with -regress</num_frames>
-md5: output pre frame md5 sums
-psnr: calculate PSNR for the debug yuv
-dump: write the decoded sequence to output.yuv (default is decode order). Must be used with -regress
-nocrop: don't crop the output according to stream parameters. Must be used with -regress and -dump
-errors <file name="">: write errors to file. Must be used with -regress</file>
-stats: write some stats to stats.csv. Must be used with -regress
-stream_stats <file name="">: write whole stream statistics information to specified file</file>
-stream_stats_level <level>: statistics level (should be between 1, 2 or 3, default is 1), the higher the level, the more information</level>
-norm_pix: Normalize stats by pixel area
-norm_bits: Normaluze stats by compressed bits
-percent: Output statistics in percentage
-fast: Skip reconstruction. Must be used with -regress and -stats, and cannot be used with -dump.
-display_order: if used with -dump, the output yuv is written in display order.
-dump_bitdepth <bitdepth>: set output bitdepth of yuv file to bitdepth. Should be in the range [816].</bitdepth>
-disable_hevc_ext: disable HEVC extensions
-enable_demo_mode: enable demo mode option
-fullversion: output full build information.

Intel Video Pro Analyzer has separate console application under Windows* to run in command line mode. GUI application under Windows* also accepts the same command line options but does not provide console output.

Intel Video Pro Analyzer has a few command line options:

- Adding -help prints the available command line options.
- Adding a file name to the command line will cause Intel Video Pro Analyzer to open that file in the UI right after startup, bypassing the file menu. This can be helpful as part of a debug script.
- -regress: This causes Intel Video Pro Analyzer to run without the UI. A file must be specified. This is mainly useful only for HEVC streams with digest SEI messages, as it will display an error message and abort if the digest mismatches. For VP9 and other HEVC streams, the decoder will simply run and exit with no output.

- -dump: Must be used with -regress and a file name. Causes Intel Video Pro Analyzer to decode the specified file and write the decoded output sequence to a file called output.yuv in decode order. The format written is planar YUV. To change the output order to display order, add the command line switch -display_order. By default Intel Video Pro Analyzer crops output according to display size specified by the bitstream. Adding -nocrop will no crop the output to the display size, as specified by the bitstream.
- -stats: Must be used with -regress and a file name. Causes Intel Video Pro Analyzer to write out a file called stats.csv. This file contains the statistics of each picture/frame as comma-separated values. Adding -fast causes the decoder to skip the reconstruction process (intra prediction, motion filtering, deblocking etc.) for faster statistics dumping. -dump may be combined with this switch if -fast is not used. To normalize statistics by area or compressed bits, use -norm_pix and -norm_bits, respectively.
- -o filename: sets output YUV file name. If the name is not specified "output.yuv" will be used.
- -md5: output per frame md5 checksums in batch mode.
- -fullversion: outputs detailed information about current build
- -n frame_number: specify frame to show on startup
- -yuv filename: load specified yuv file on startup
- -dump_bitdepth bitdepth: specify number of bits in output file. For example, if you want save 10 bit output as 16 bit yuv, just put -dump_bitdepth 16 (values will be shifted accordingly). It is useful when you decode file with variable bitdepth.
- -disable_hevc_ext: disables HEVC RExt extension support. This might be required if you decode stream in HEVC v.1 format with wrong headers.
- -errors <file_name> : write list of found errors in the file. Must be used with -regress option.
- -frames : decoder specified number of frames (in stream order). Must be used with -regress option.
- -hevc : force HEVC decoder
- -avc : force avc decoder
- -vp9 : force vp9 decoder
- -mpeg2 : force mpeg2 decoder

11 Miscellaneous

A few other features to keep in mind:

- Intel Video Pro Analyzer saves various settings upon exit. Settings include window size, recent files etc., and are restored on the next launch.
- If the loaded bitstream is modified or deleted while loaded, a dialog will pop-up asking to reload or close. This protects against unintended behavior.

12 Attributions

Qt

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Qwt

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