

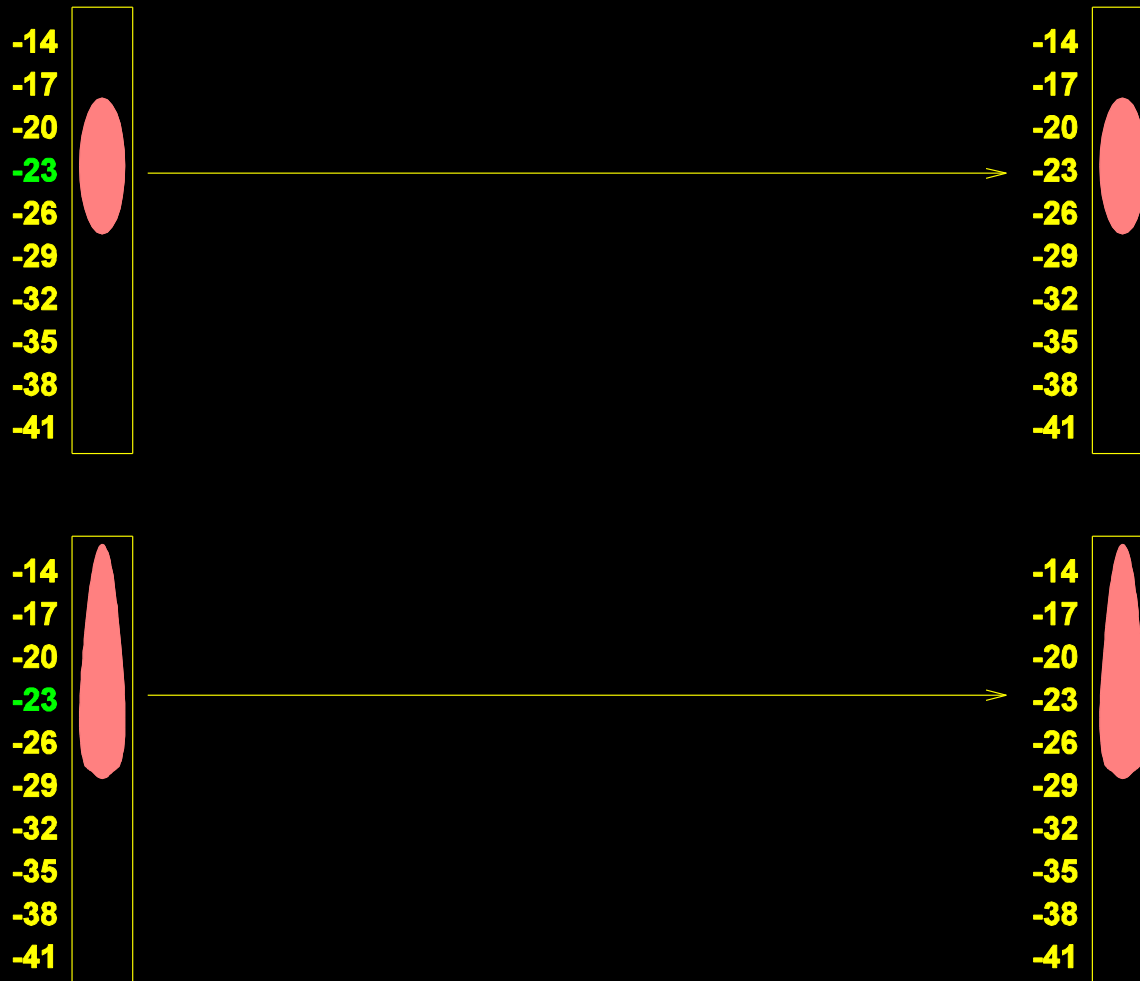
CE Devices

Andrew Mason & Andrew Cotton

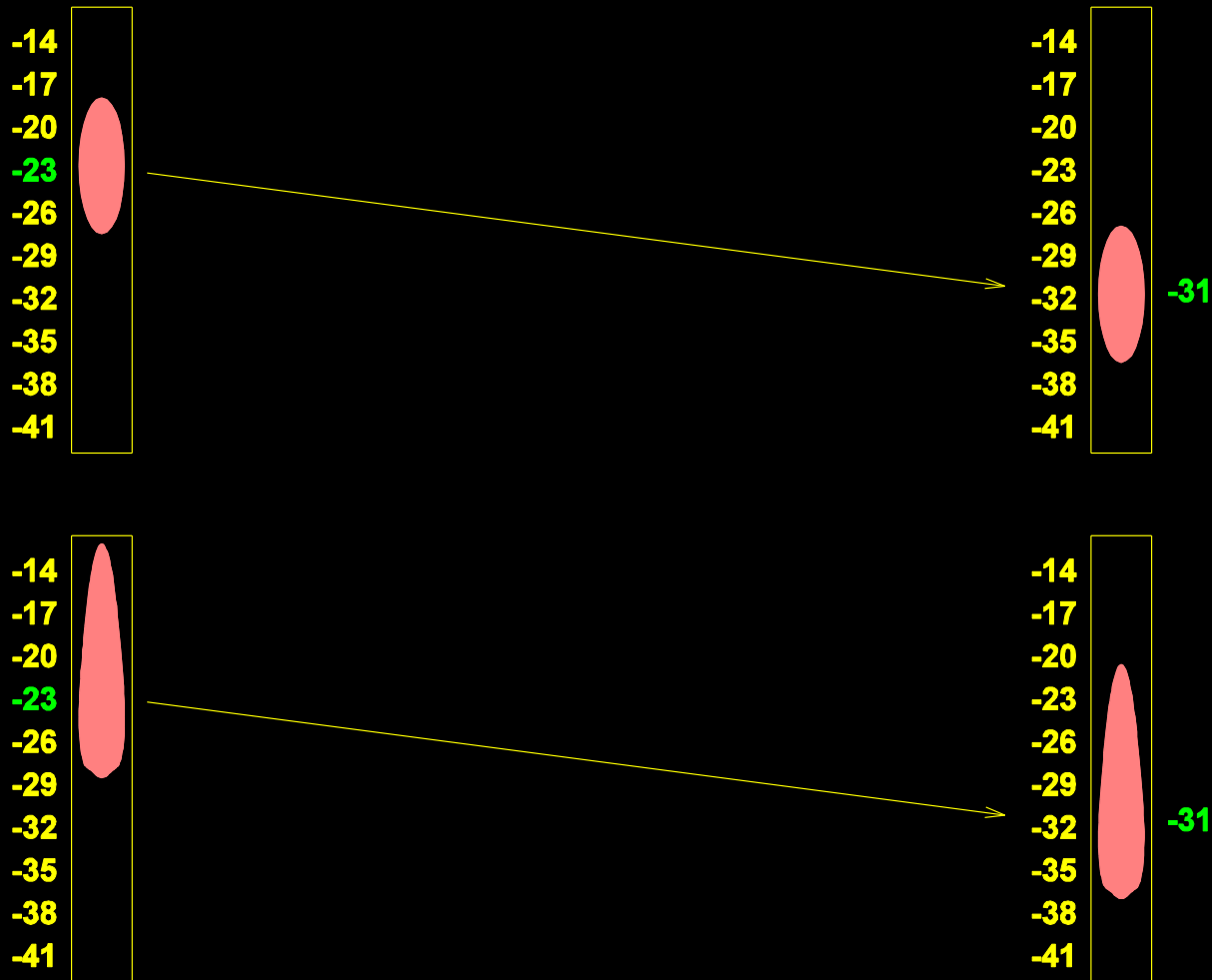
EBU Loudness in Distribution Workshop
8th/9th December 2011

Overview

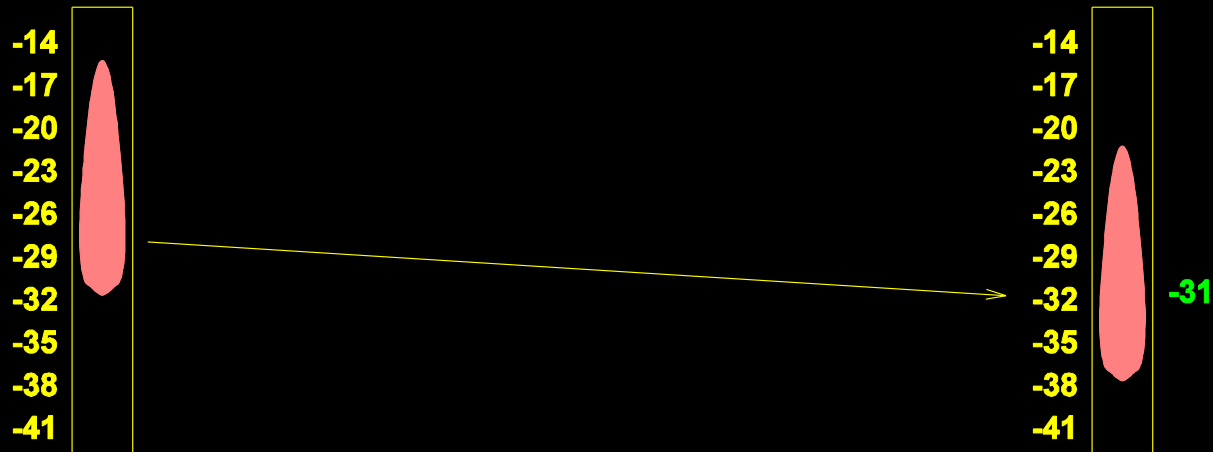
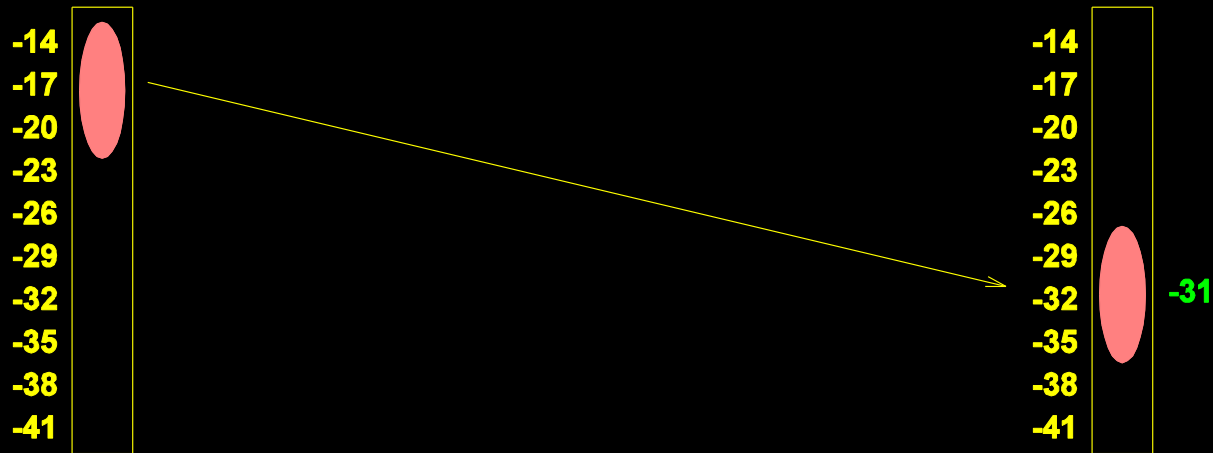
- Review of causes of level differences
- Managing loudness in receivers
- Summary



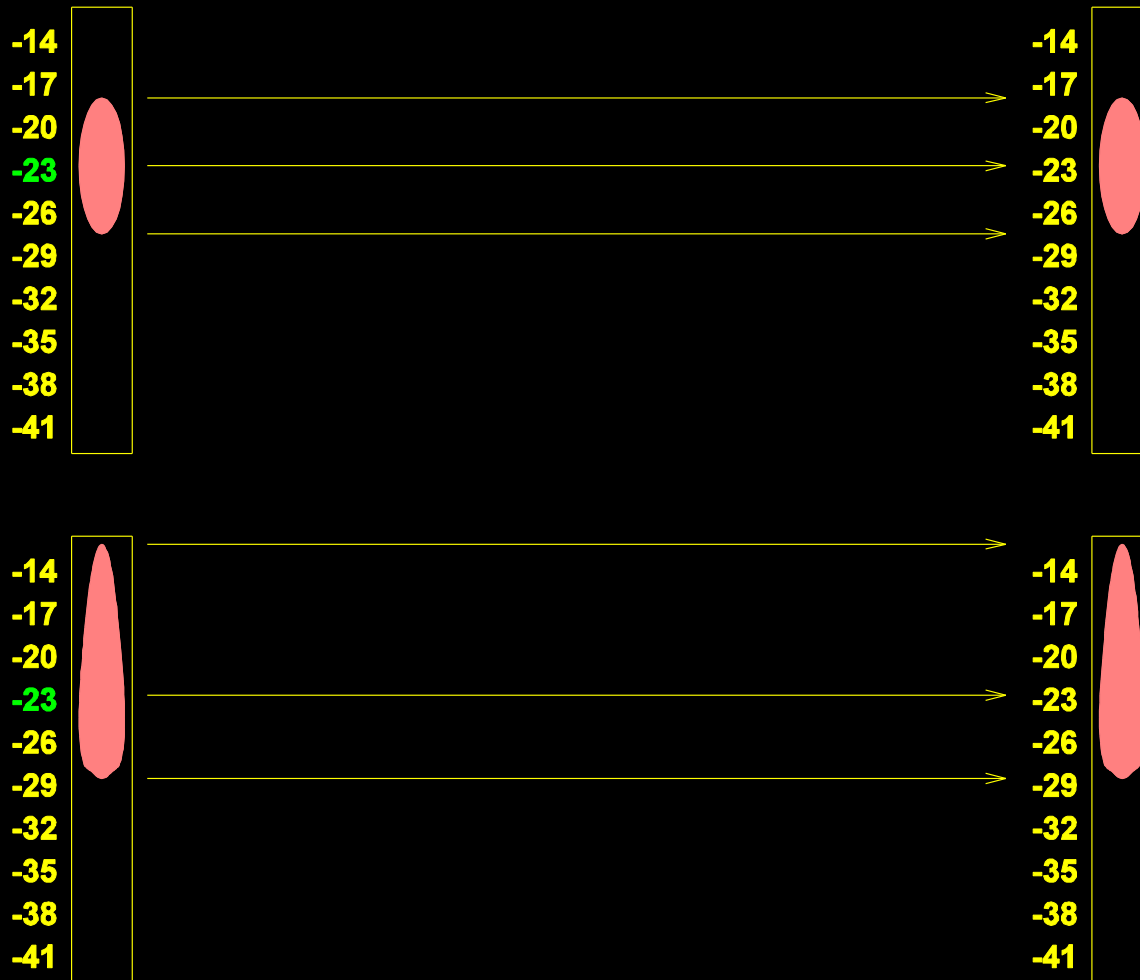
Unity gain (MPEG Layer II)



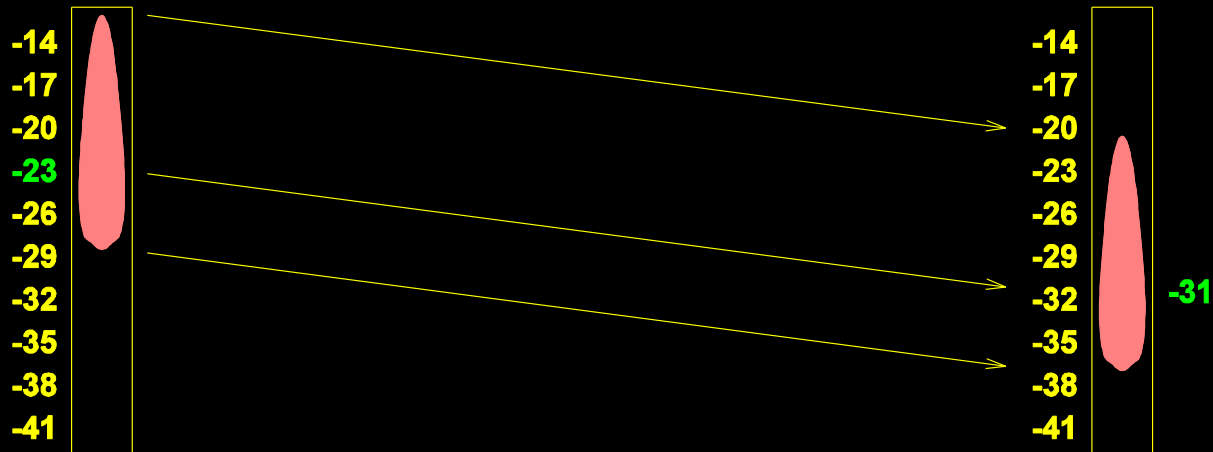
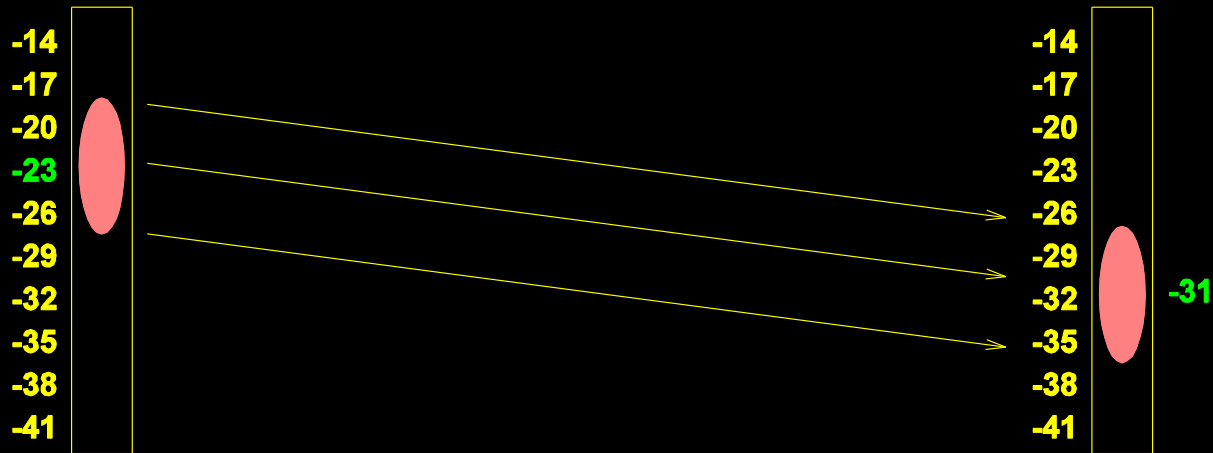
Non-unity gain (Dolby Digital)



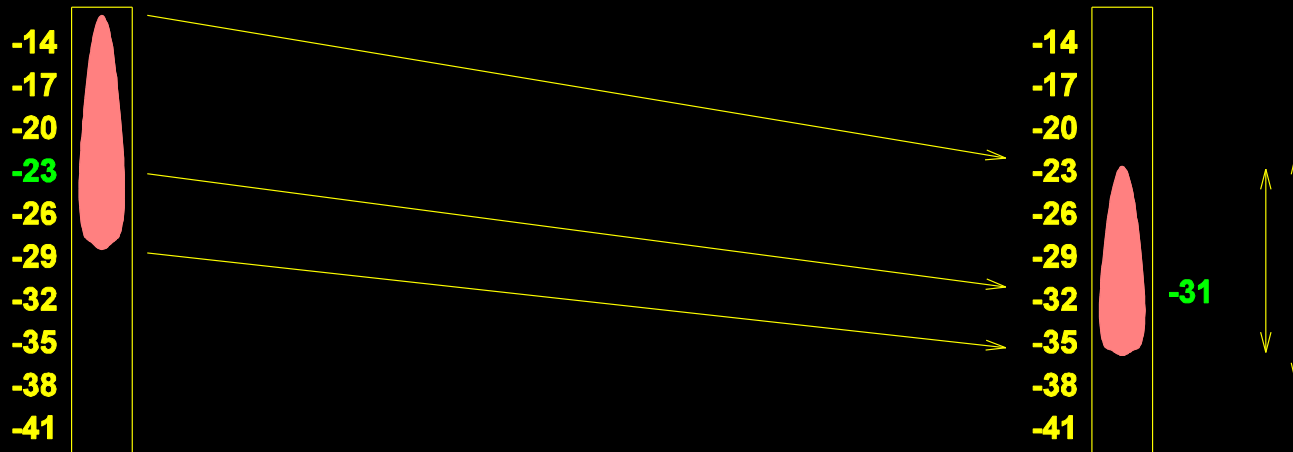
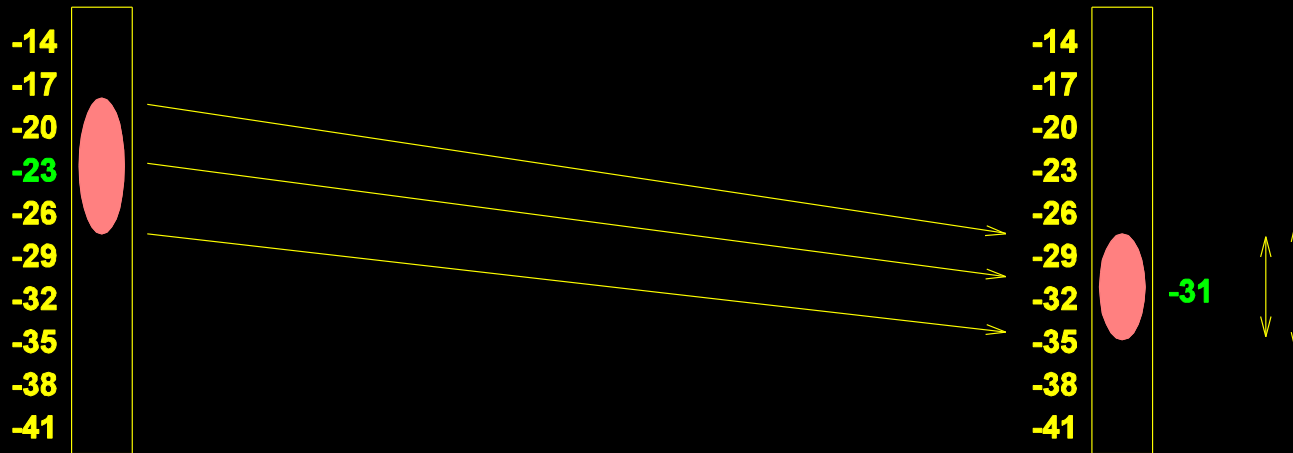
Non-unity gain (Dolby Digital)



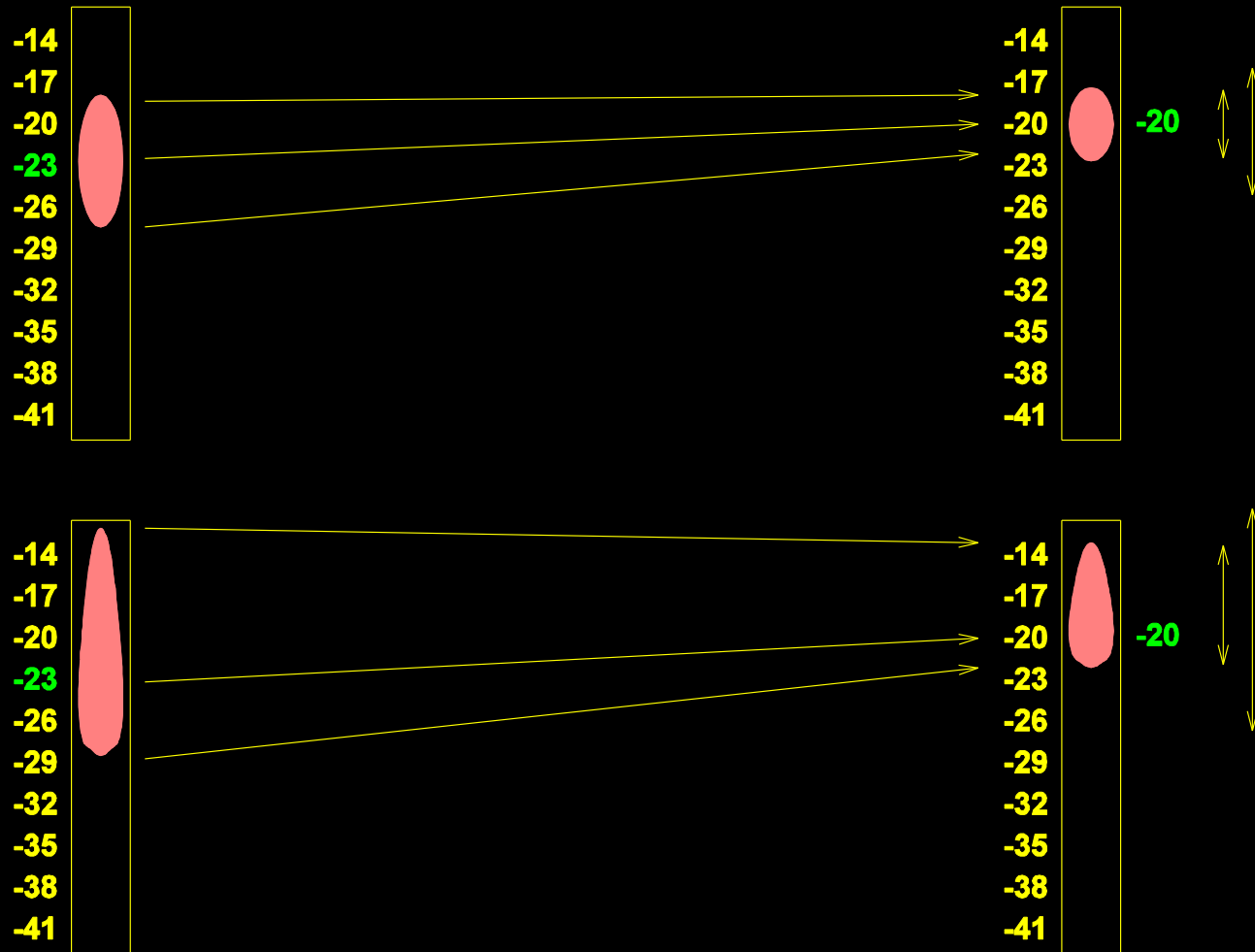
Unity gain; no DRC



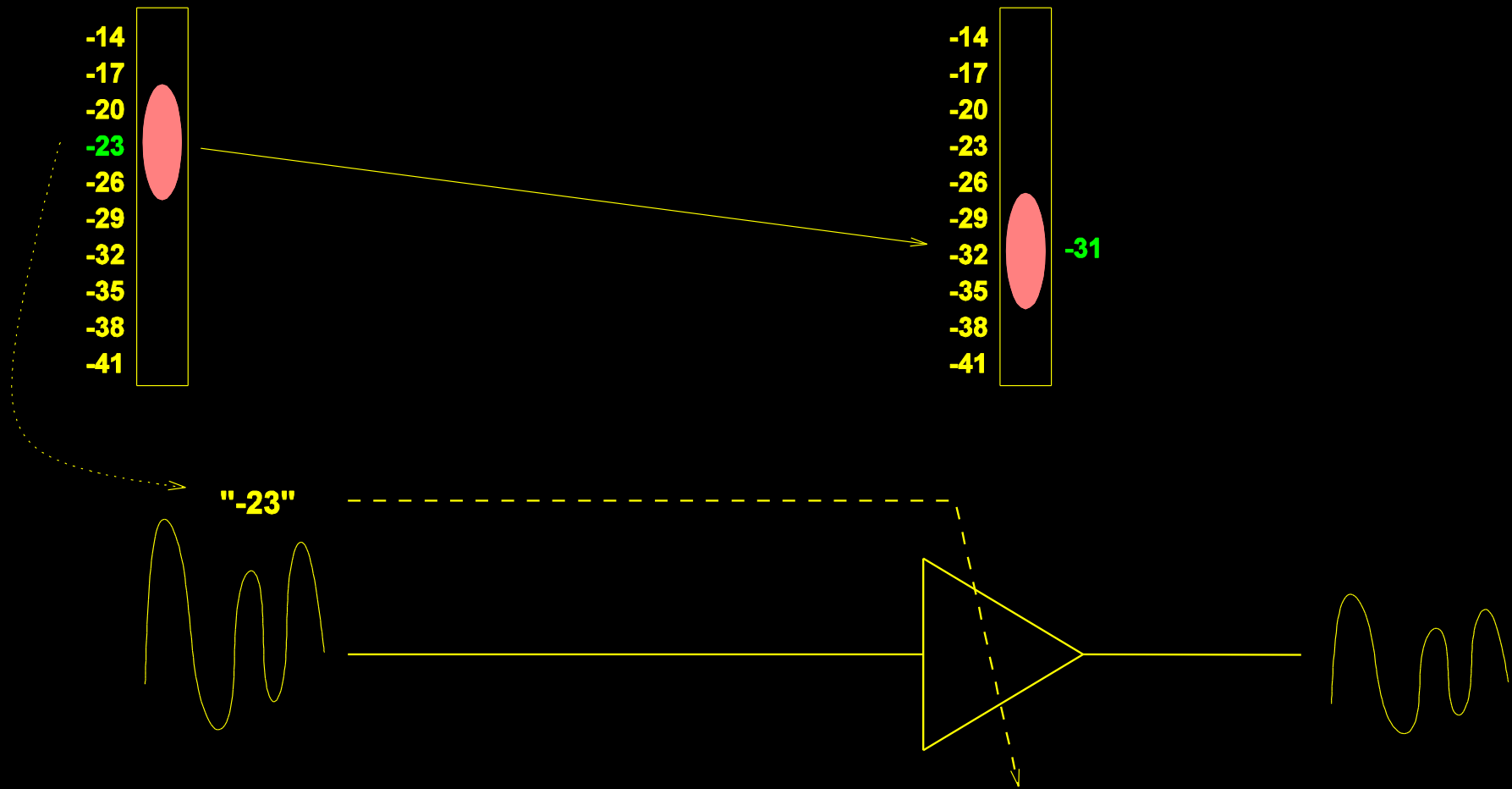
Non-unity gain; no DRC



**Non-unity gain; a little DRC
(Line Mode)**

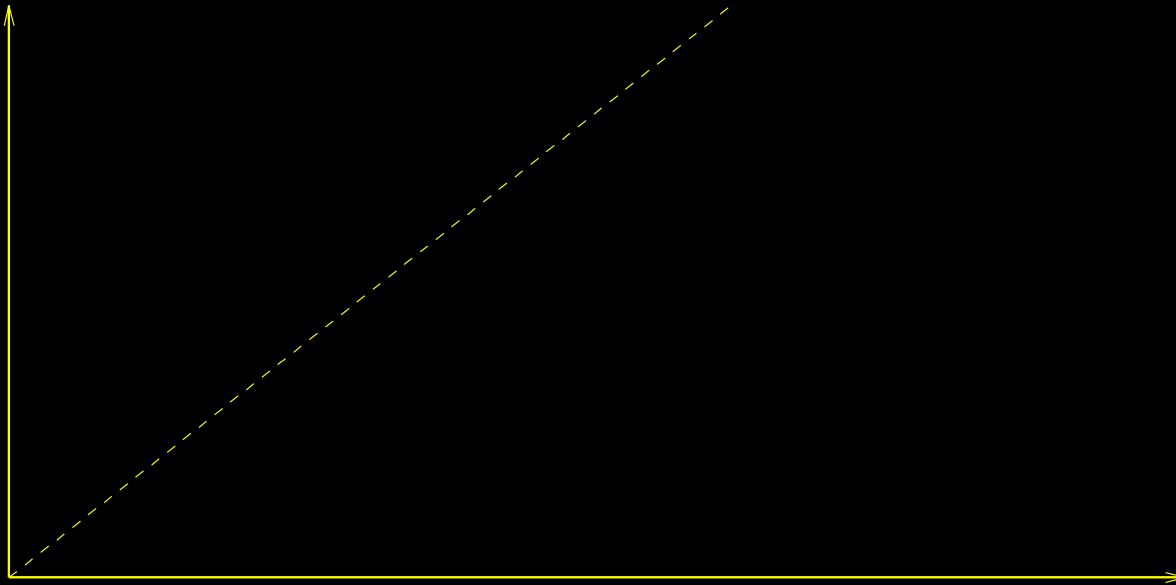


**Non-unity gain; a lot of DRC
(RF mode)**



Non-unity gain: metadata

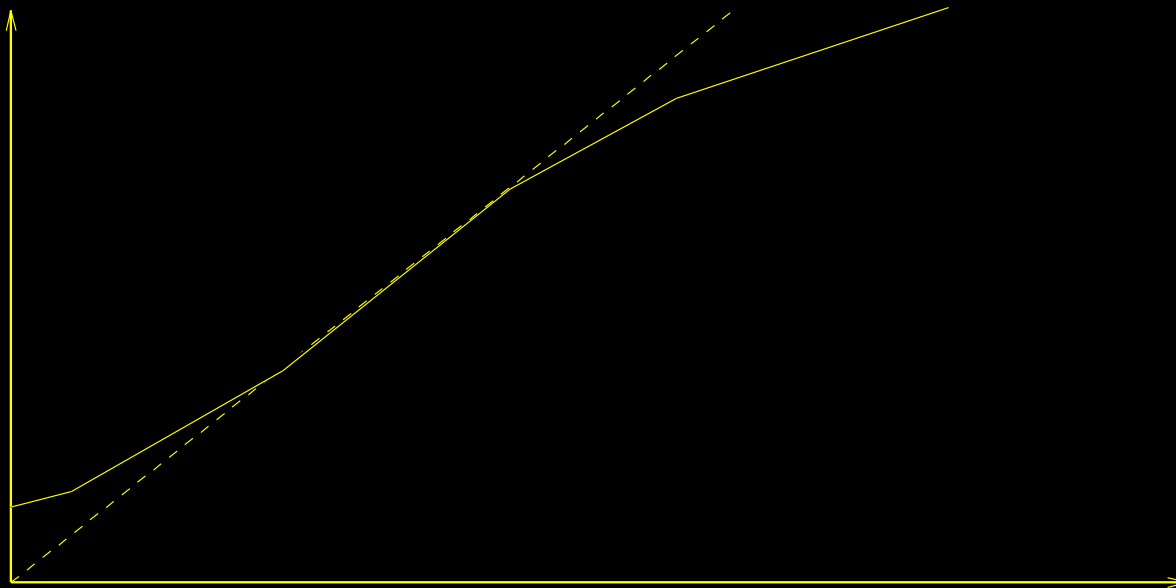
output
level



input
level

DRC

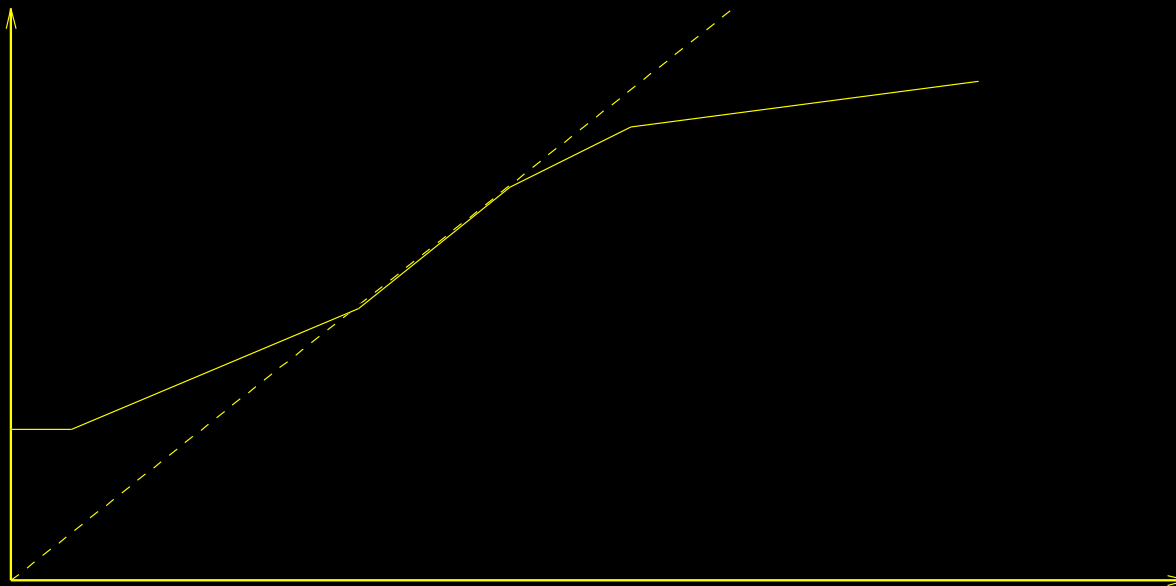
output
level



input
level

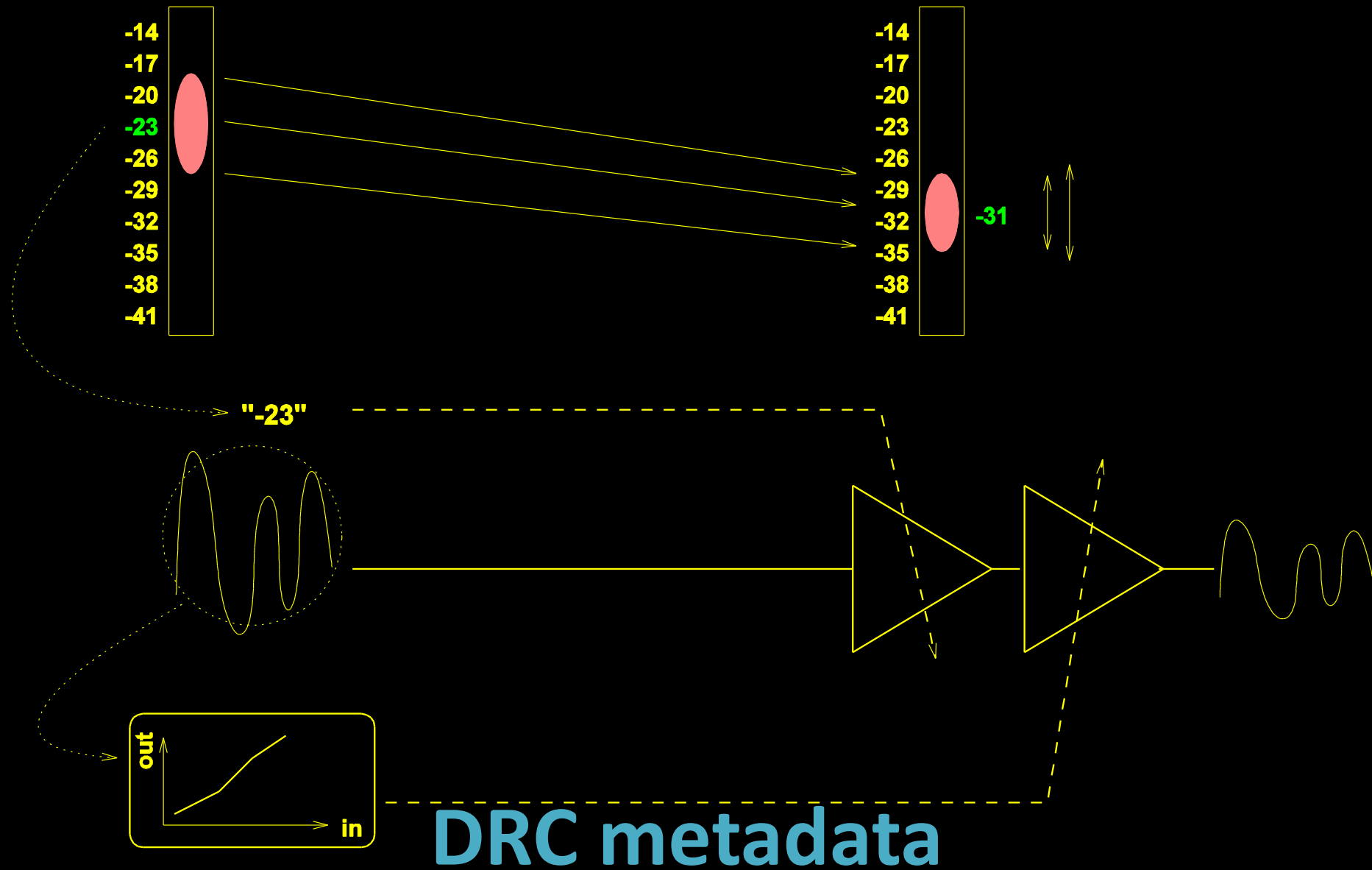
DRC

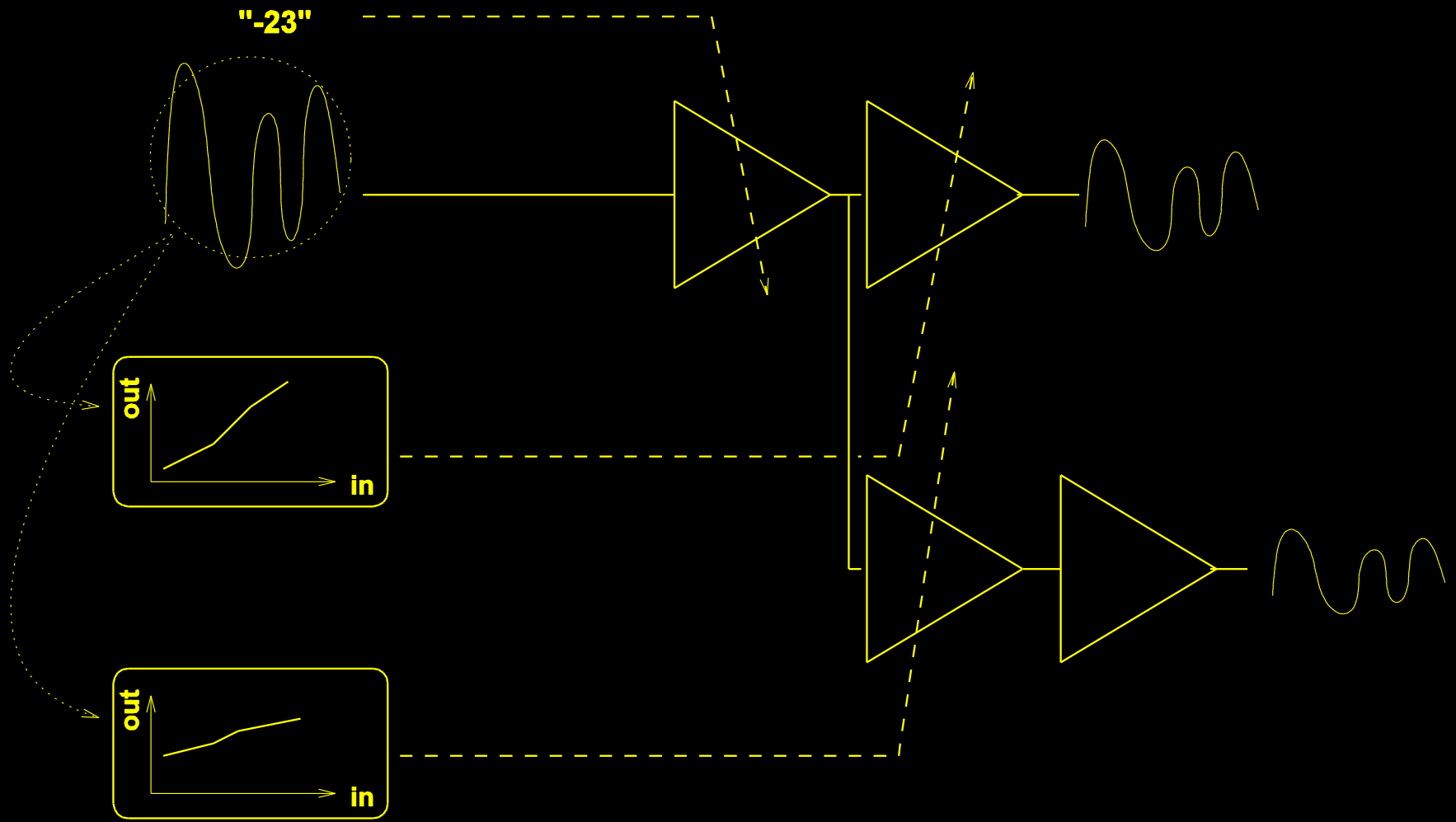
output
level



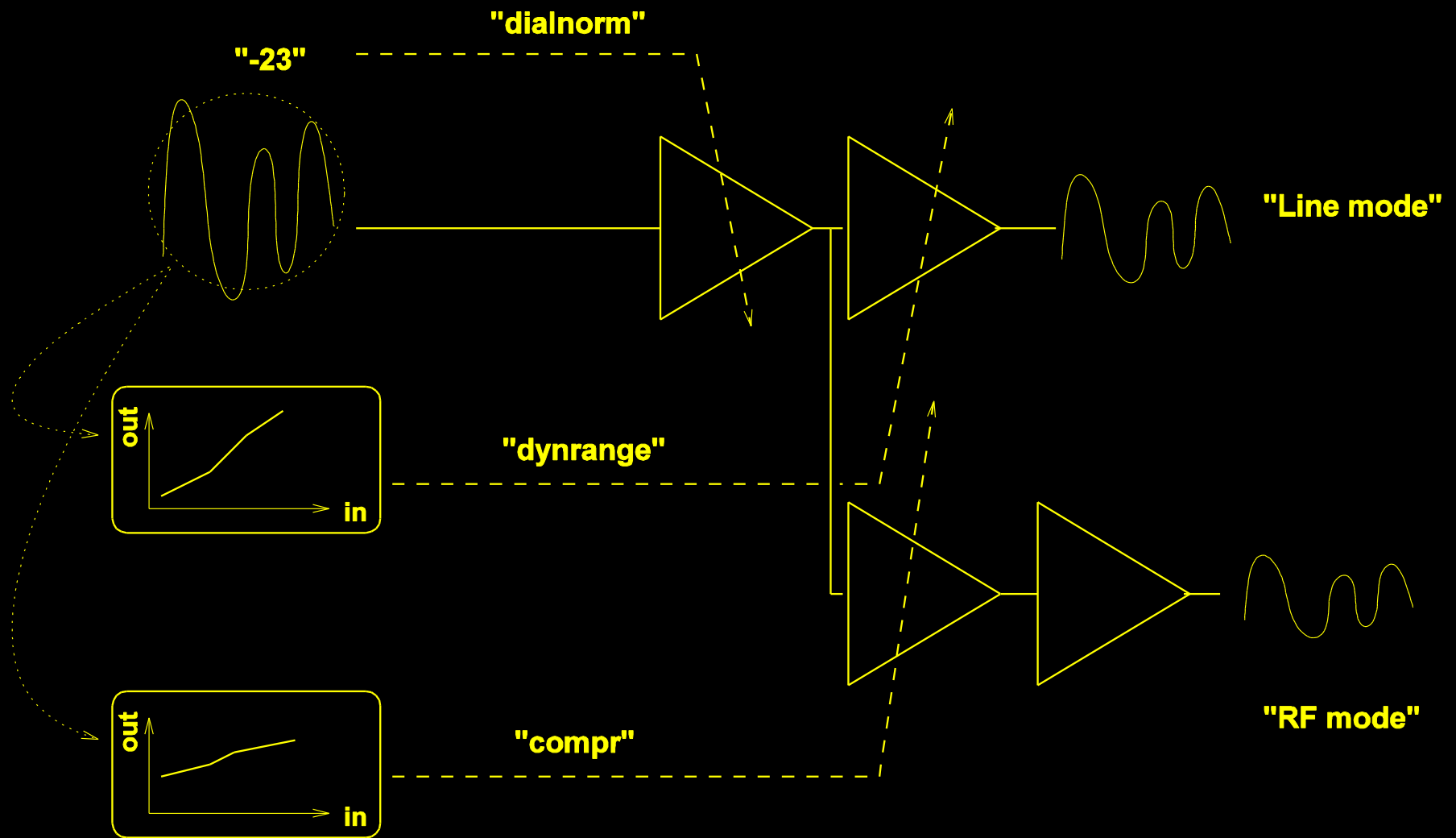
input
level

DRC

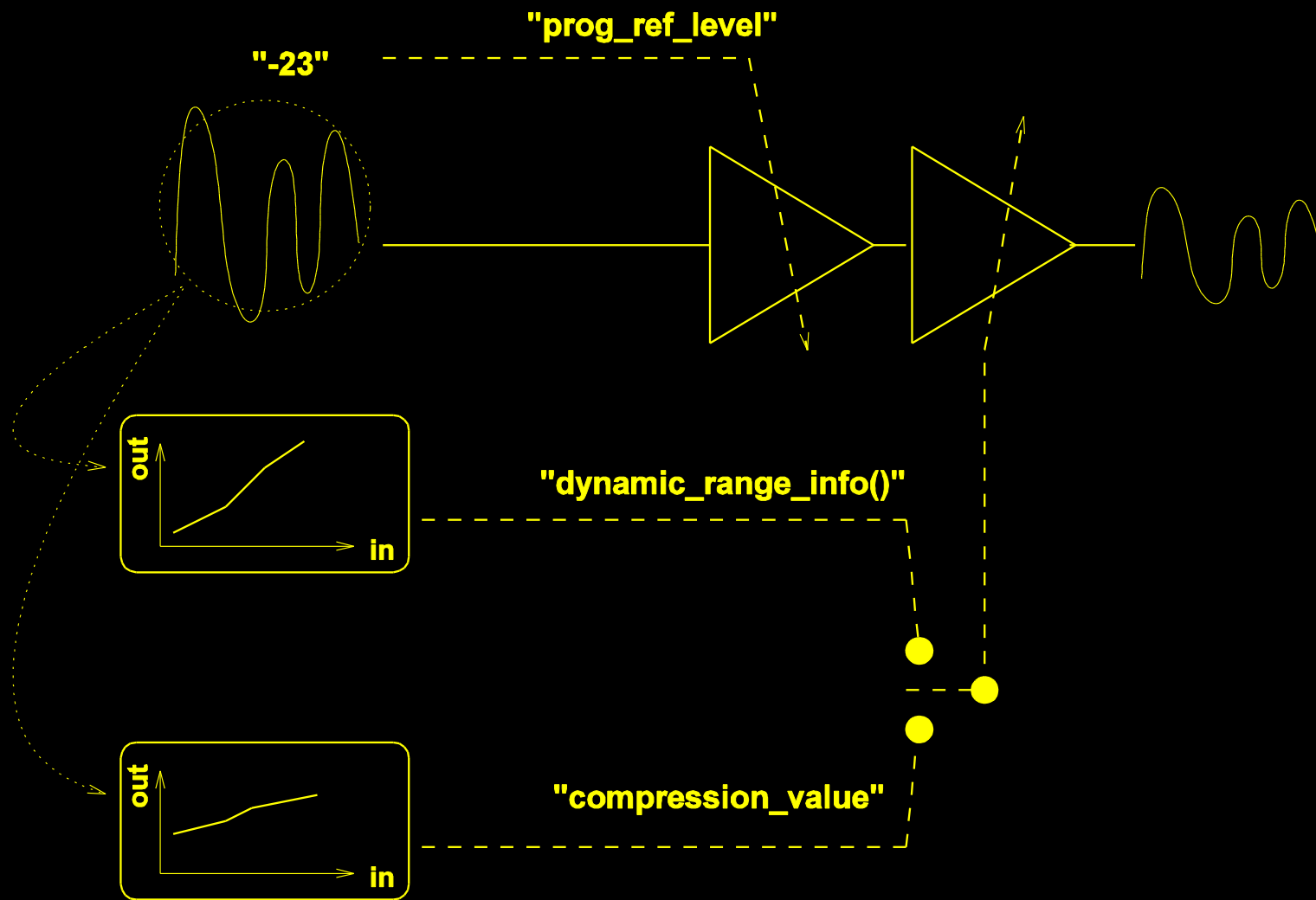




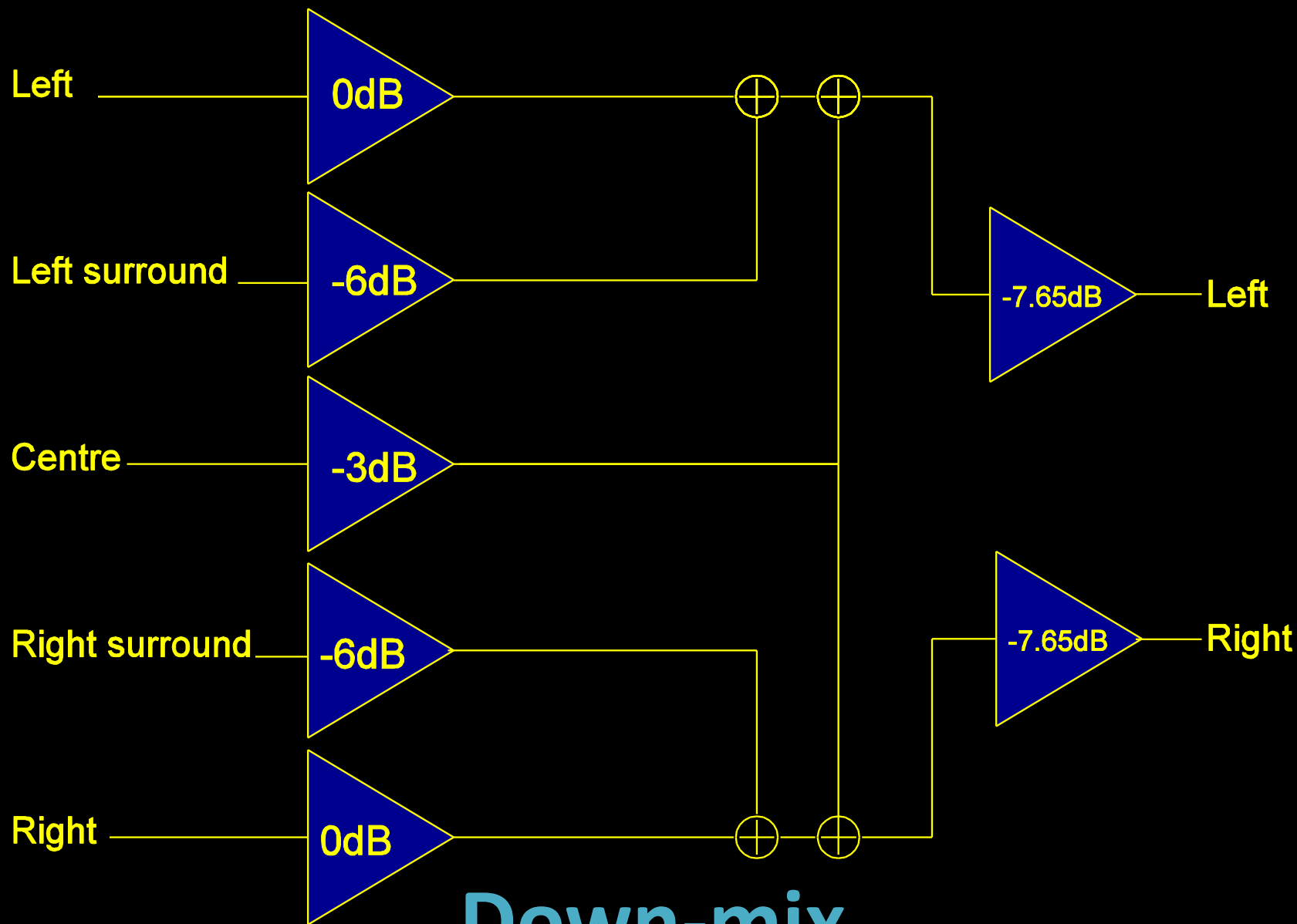
More metadata: System A

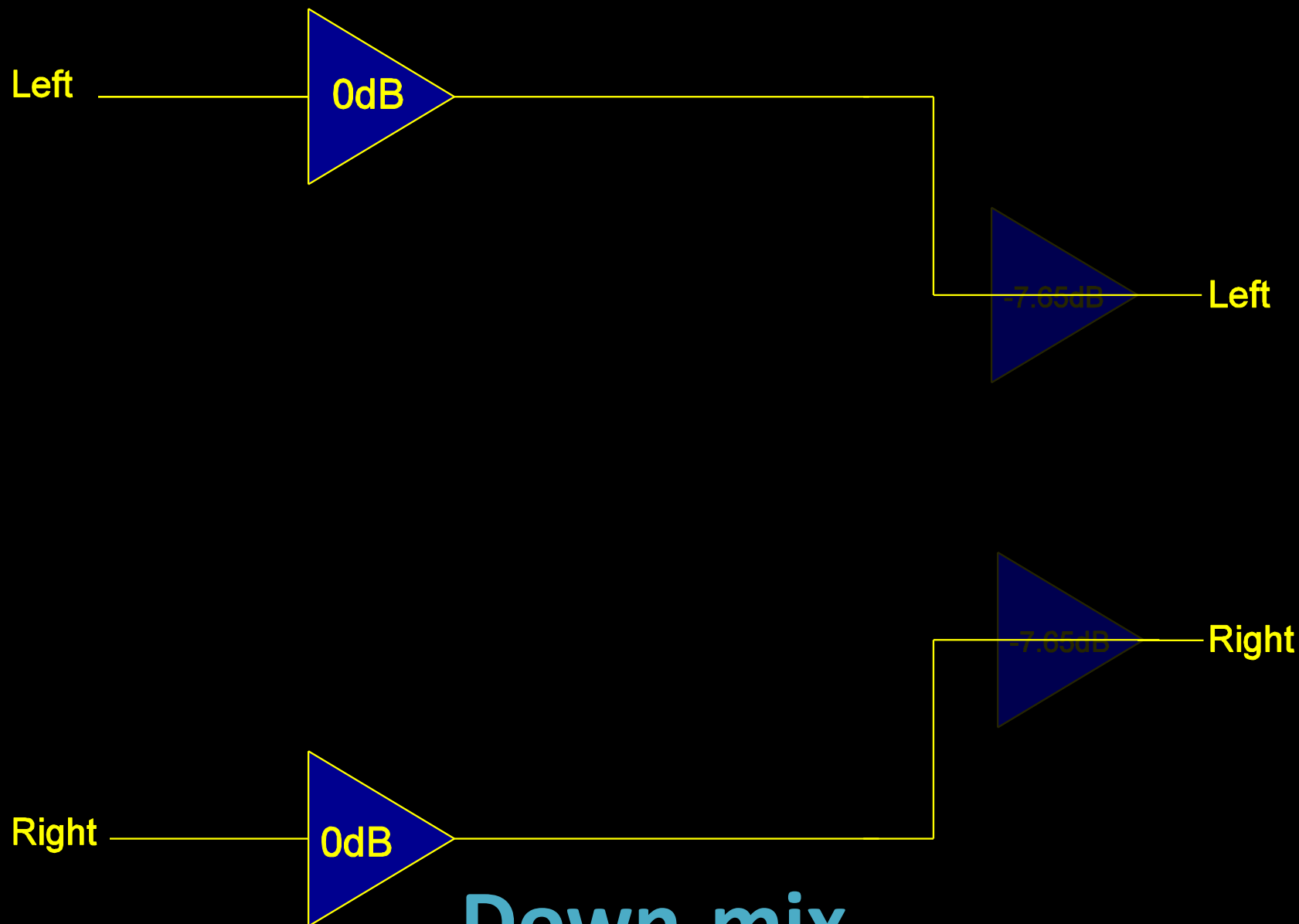


More metadata: System A

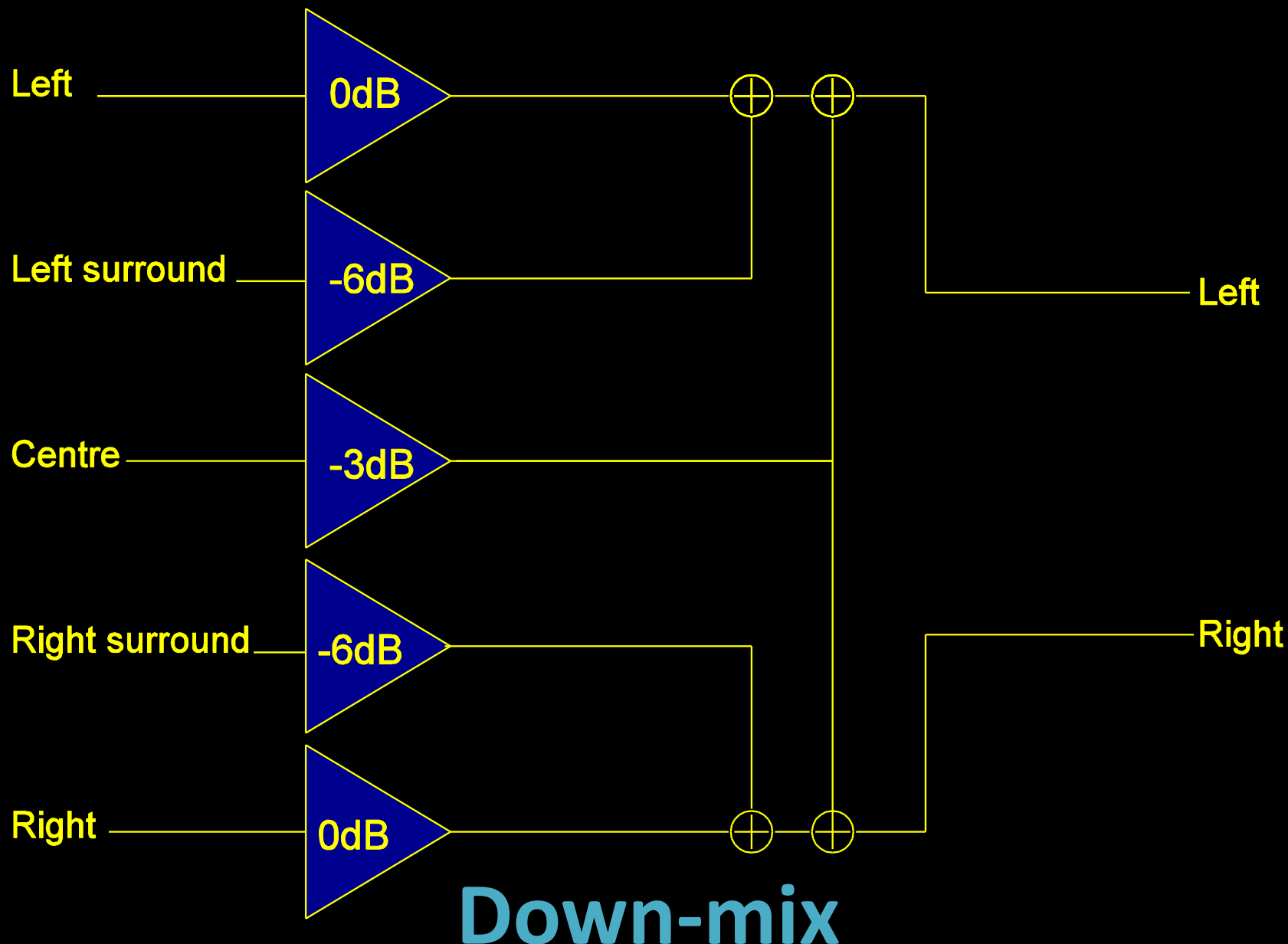


More metadata: System B





Down-mix



Set-top box, integrated receiver decoder
STB, IRD

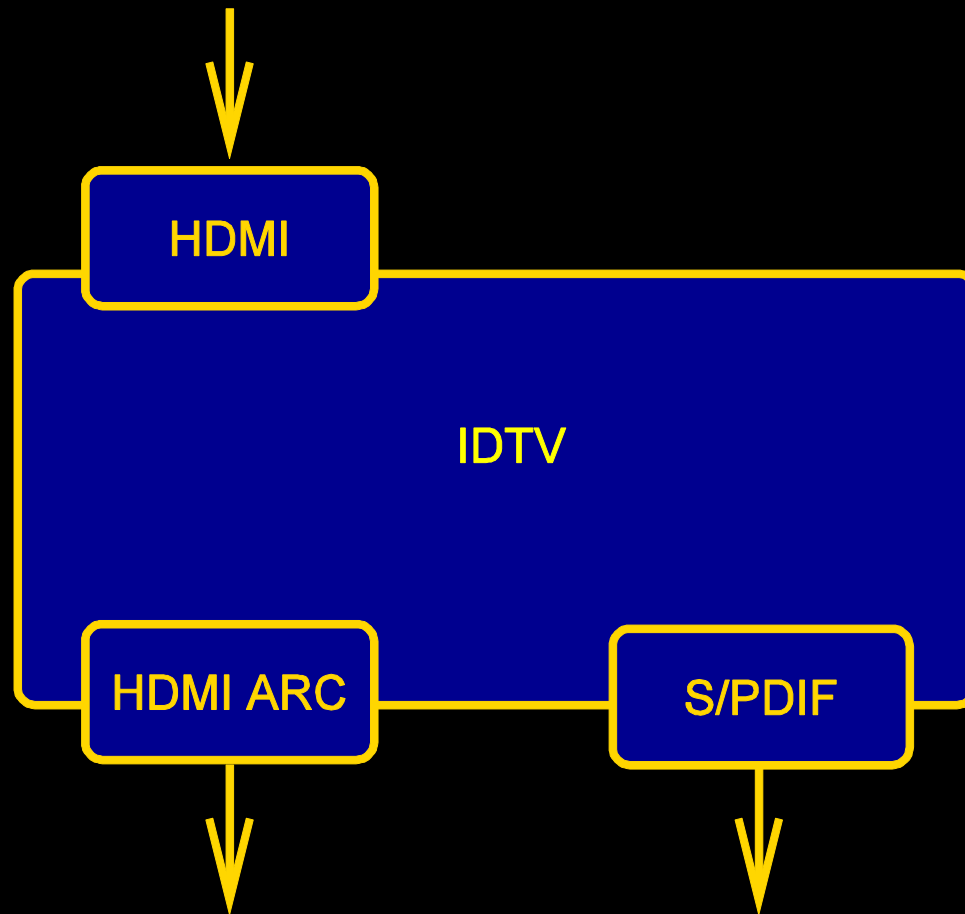
```
graph TD; A[Set-top box, integrated receiver decoder<br/>STB, IRD] --- B[HDMI]; A --- C[S/PDIF]; B --> D[ ]; C --> E[ ]
```

The diagram illustrates a set-top box (STB) or integrated receiver decoder (IRD) connected to two output ports: HDMI and S/PDIF. The STB is represented by a large blue rectangle. Below it, two smaller blue rectangles represent the HDMI and S/PDIF ports. Arrows point from these ports down towards the 'Devices' section.

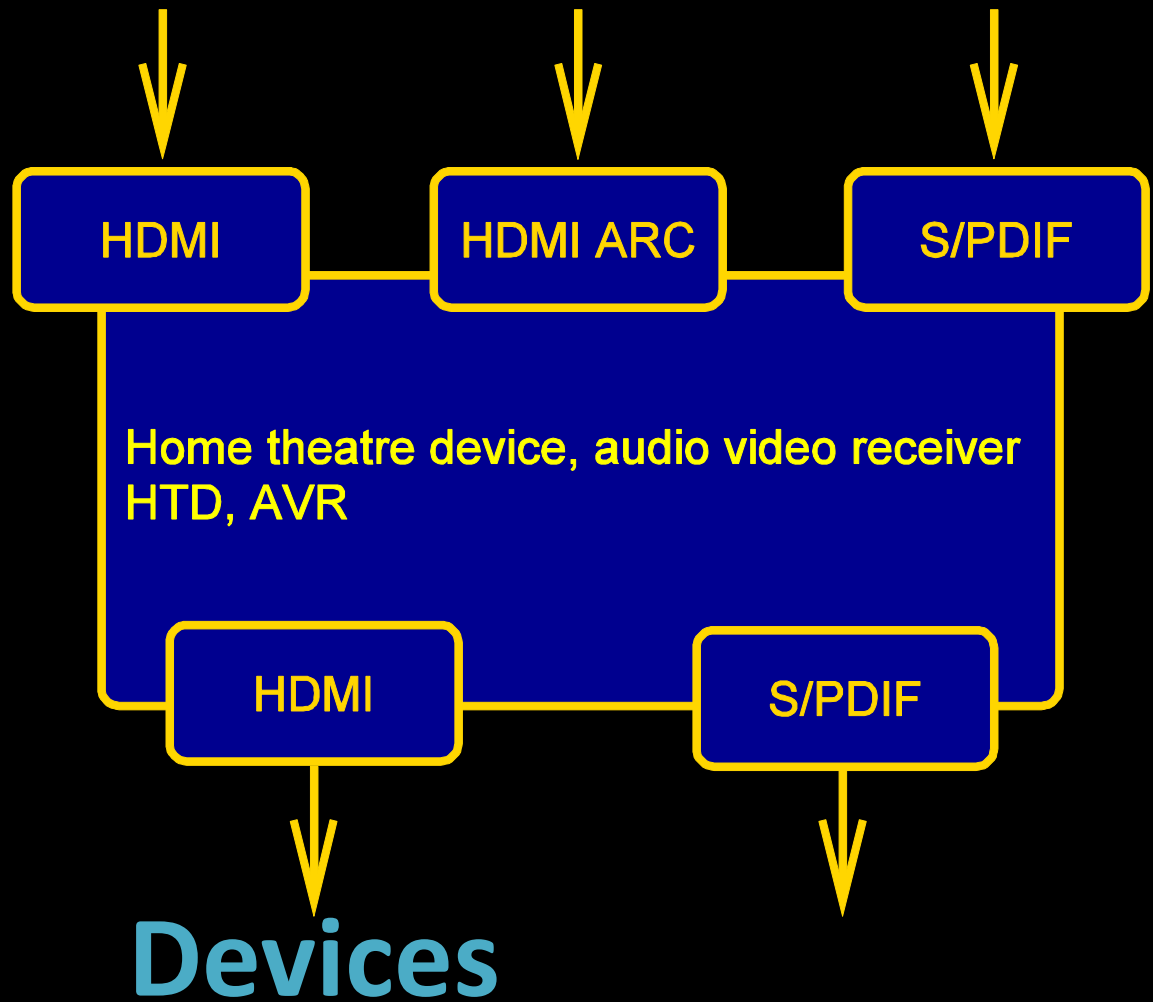
HDMI

S/PDIF

Devices



Devices



Managing loudness in receivers

- Aim to ensure perceived loudness consistent across audio codecs:
 - MPEG1 LII
 - Dolby Digital & Dolby Digital Plus
 - HE-AAC (AAC-LC)
- Applicable to:
 - set-top box & professional receiver/decoders (IRDs)
 - integrated digital televisions (IDTVs)

Defines two audio systems

- System A
 - MPEG1 LII
 - Dolby Digital or Dolby Digital Plus
- System B
 - MPEG1 LII
 - HE-AAC (and AAC-LC)
- Receivers can be System A, System B or both A and B

Dependent on accurate bitstream audio metadata

Parameter	DD/DD+	HE-AAC (AAC-LC)	MPEG1 LII
Programme loudness	Dialnorm	prog_ref_level	-23 LUFS (implicit)
Heavy compression	RF Mode compr	ETSI compression_value*	n/a
Light compression	Line Mode dynrng	ISO/IEC dynamic_range_info()	n/a
Down-mix	cmixlev, surmixlev	center_mix_level*, surround_mix_level*	n/a

*ETSI TS 101 154 metadata

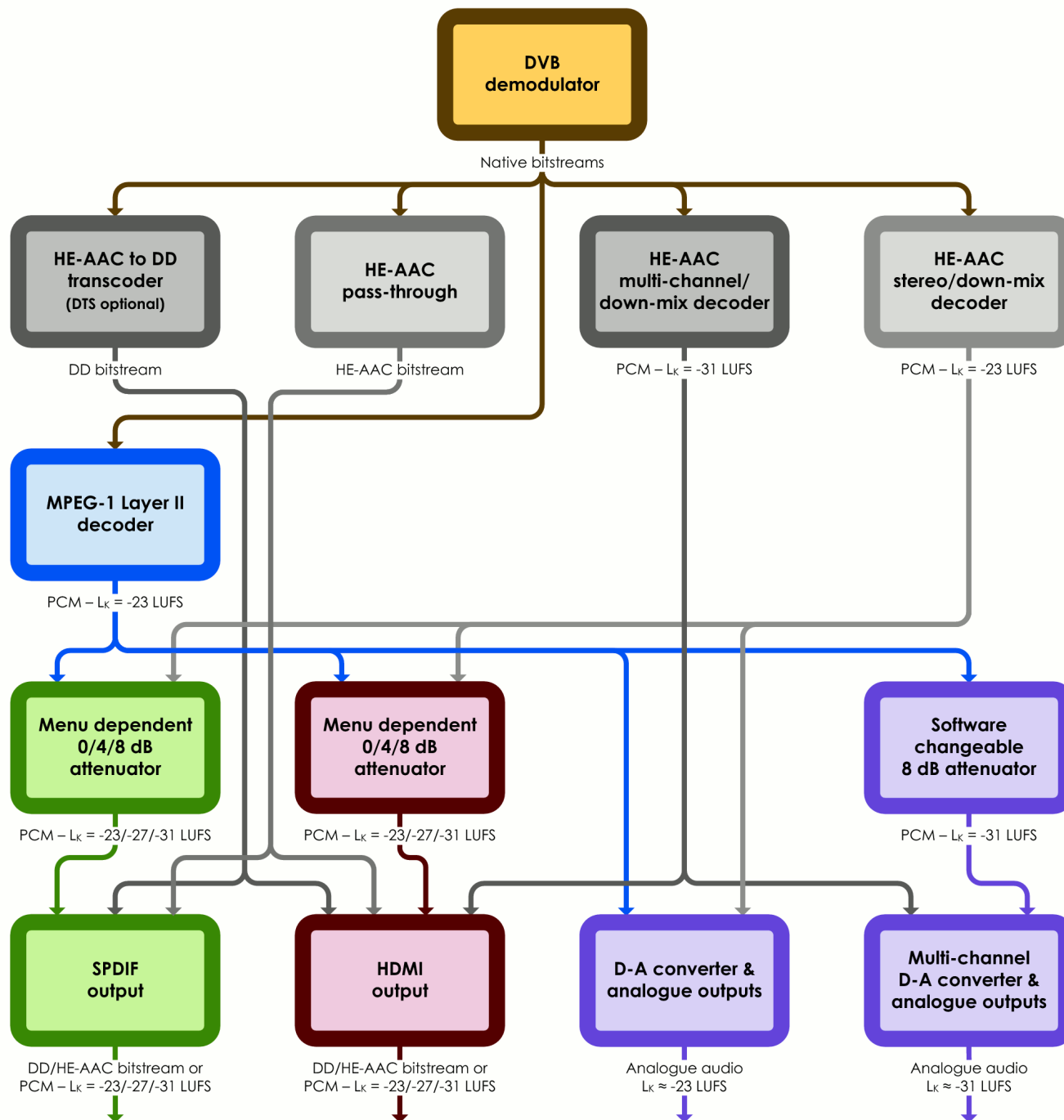
Effectively defines two output modes

- TV & stereo amplifier: -23 LUFS
 - consistent with IDTV internal MPEG1 LII decoders
- AV amplifier: -31 LUFS
 - consistent with internal DD bitstream decoders

(some exceptions covered later)

Covers many physical connectors

- Outputs to TVs (-23 LUFS)
 - HDMI (stereo pcm)
 - analogue SCART/RCA phono
 - internal (IDTVs)
 - RF modulated
- Outputs to AV amplifiers (-31 LUFS)
 - S/PDIF (pcm & bitstream)
 - HDMI (pcm & bitstream)
 - HDMI ARC (pcm & bitstream)
- Stereo amplifiers (-23 LUFS)
 - S/PDIF (stereo pcm)
 - analogue

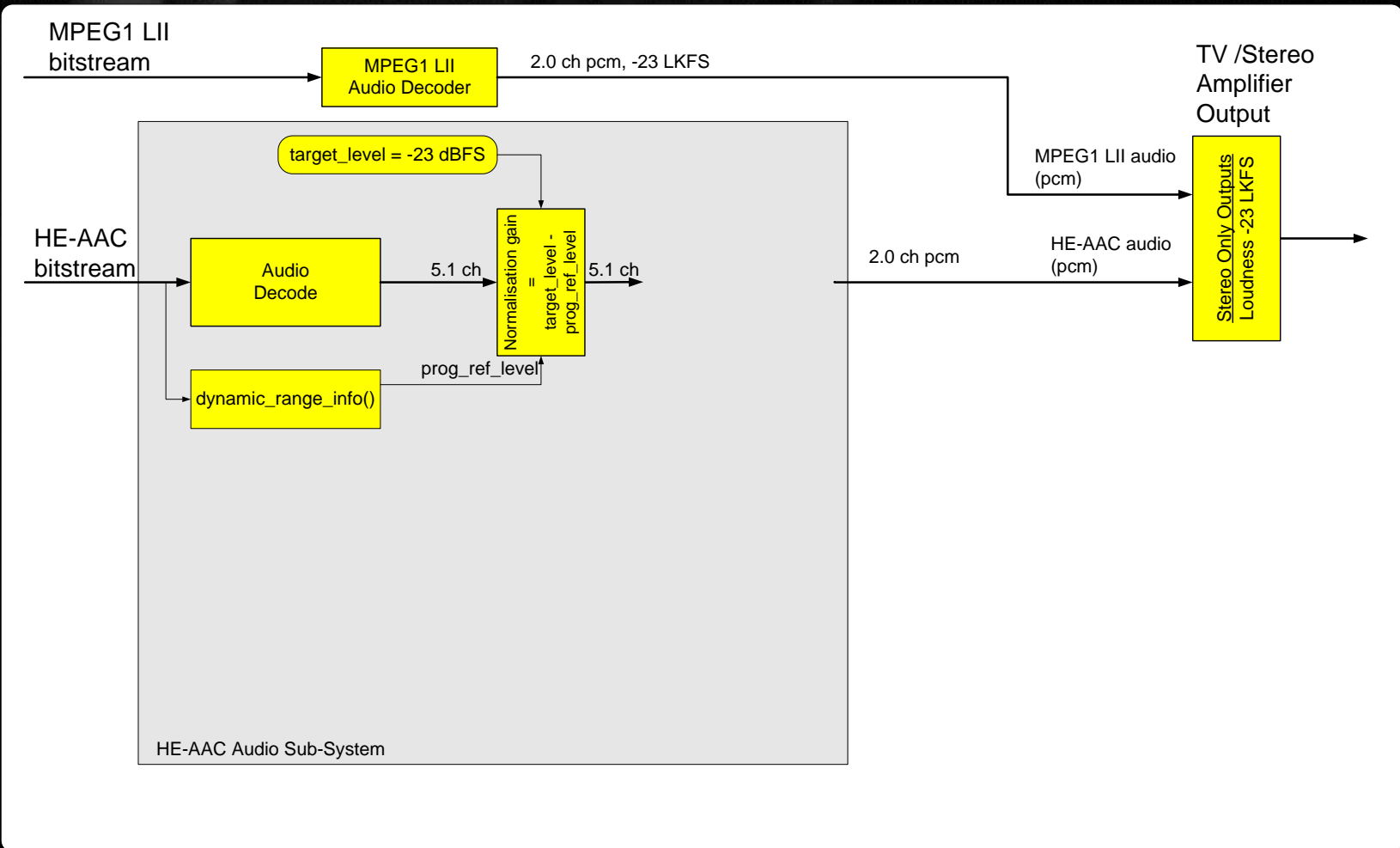


System B
“top-level”
diagram
(Fig 6.4.5.1)

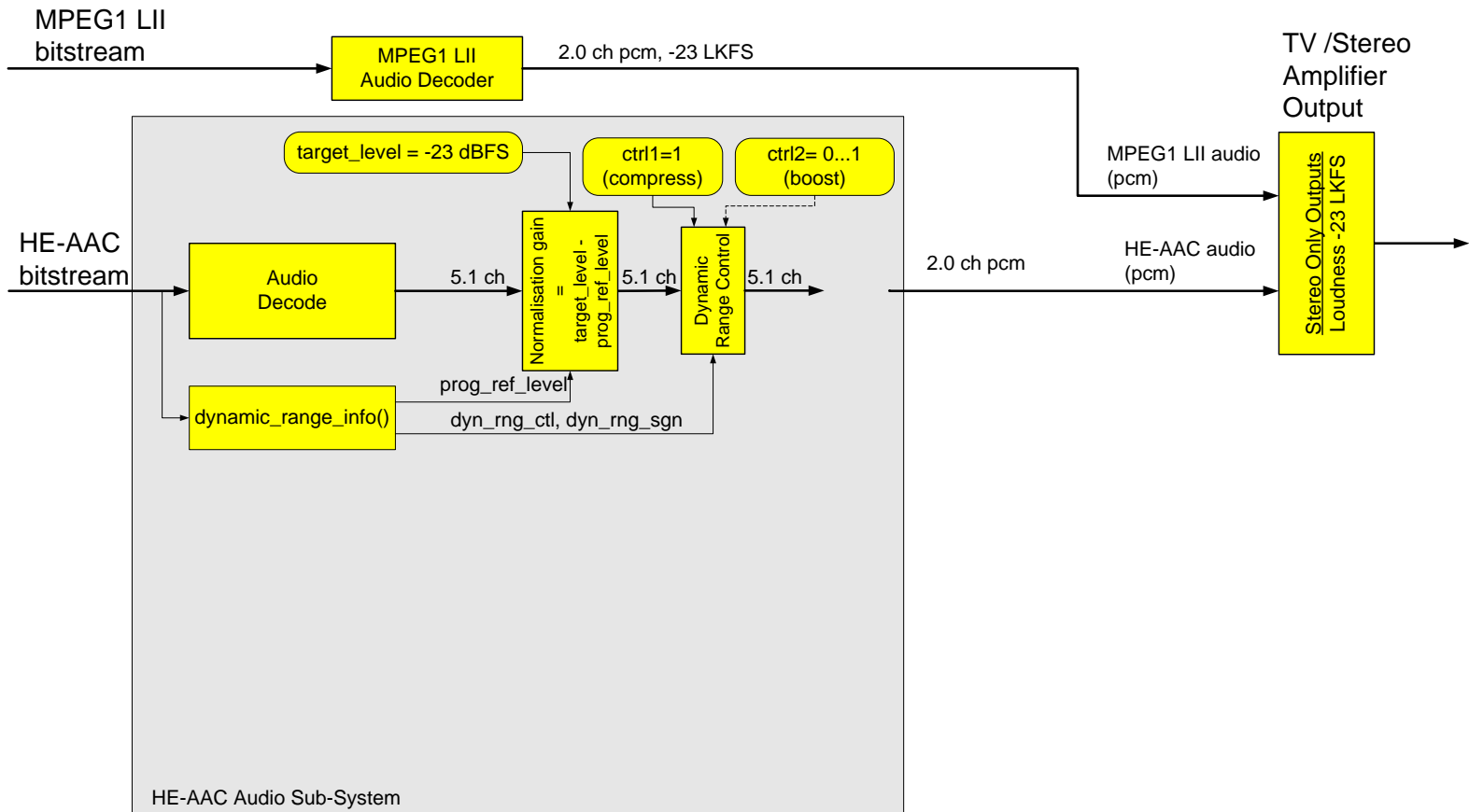
Mechanisms for loudness matching similar in System A and System B

- System A
 - Loudness MPEG1 LII as R128 = - 23 LUFS
 - Attenuated for -31 LUFS outputs
 - Loudness DD/DD+ signalled through “dialnorm”
 - Normalised to “target level” -23/-31 LUFS to match by applying gain:
 $Gain = (“target\ level” - dialnorm)$
- System B
 - Loudness MPEG1 LII as R128 = - 23 LUFS
 - Attenuated for -31 LUFS outputs
 - Loudness HE-AAC signalled through “prog_ref_level”
 - Normalised to a “target level” -23/-31 LUFS by applying gain:
 $Gain = (“target\ level” - prog_ref_level)$

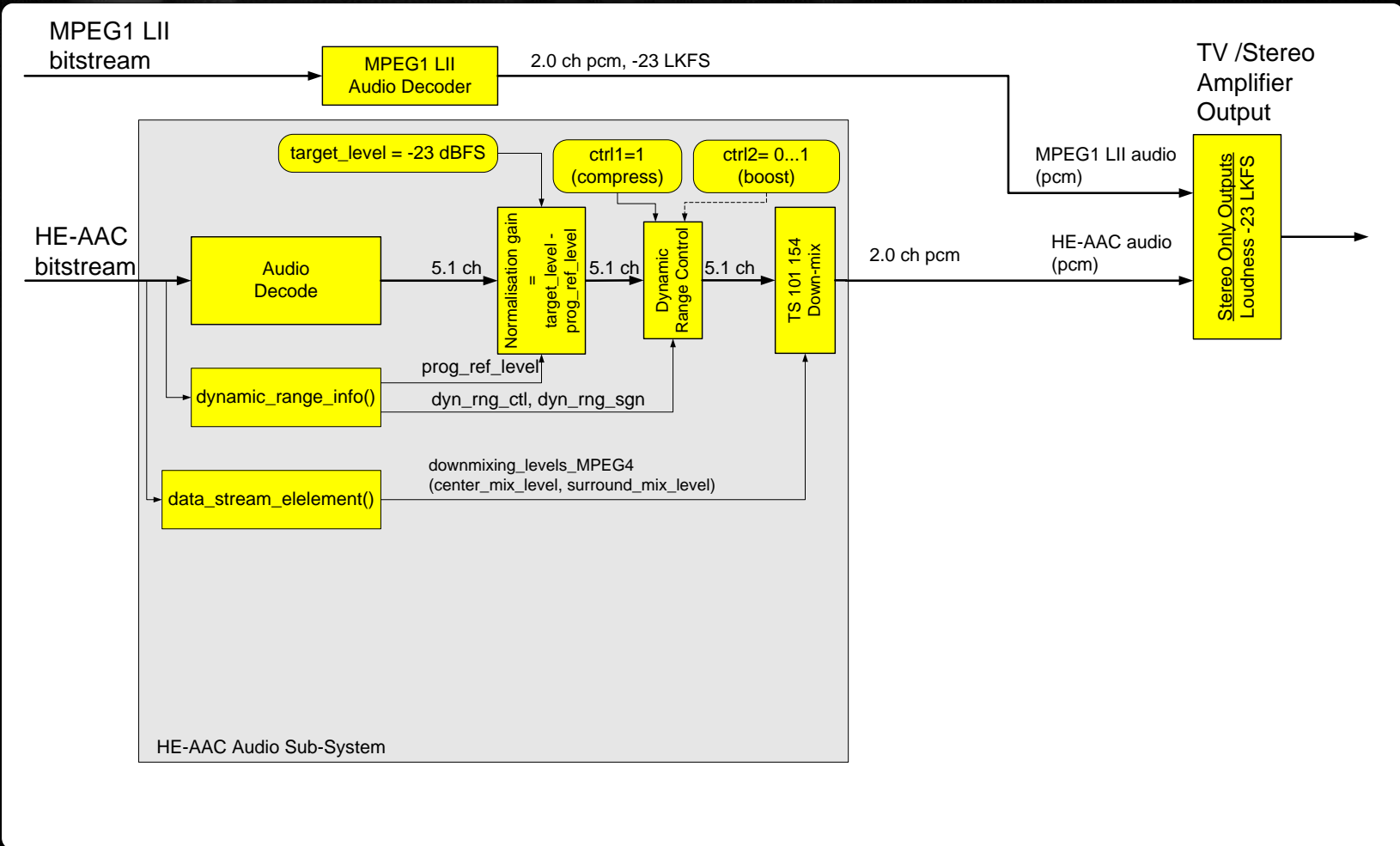
Simplified System B “logical” receiver: loudness normalisation



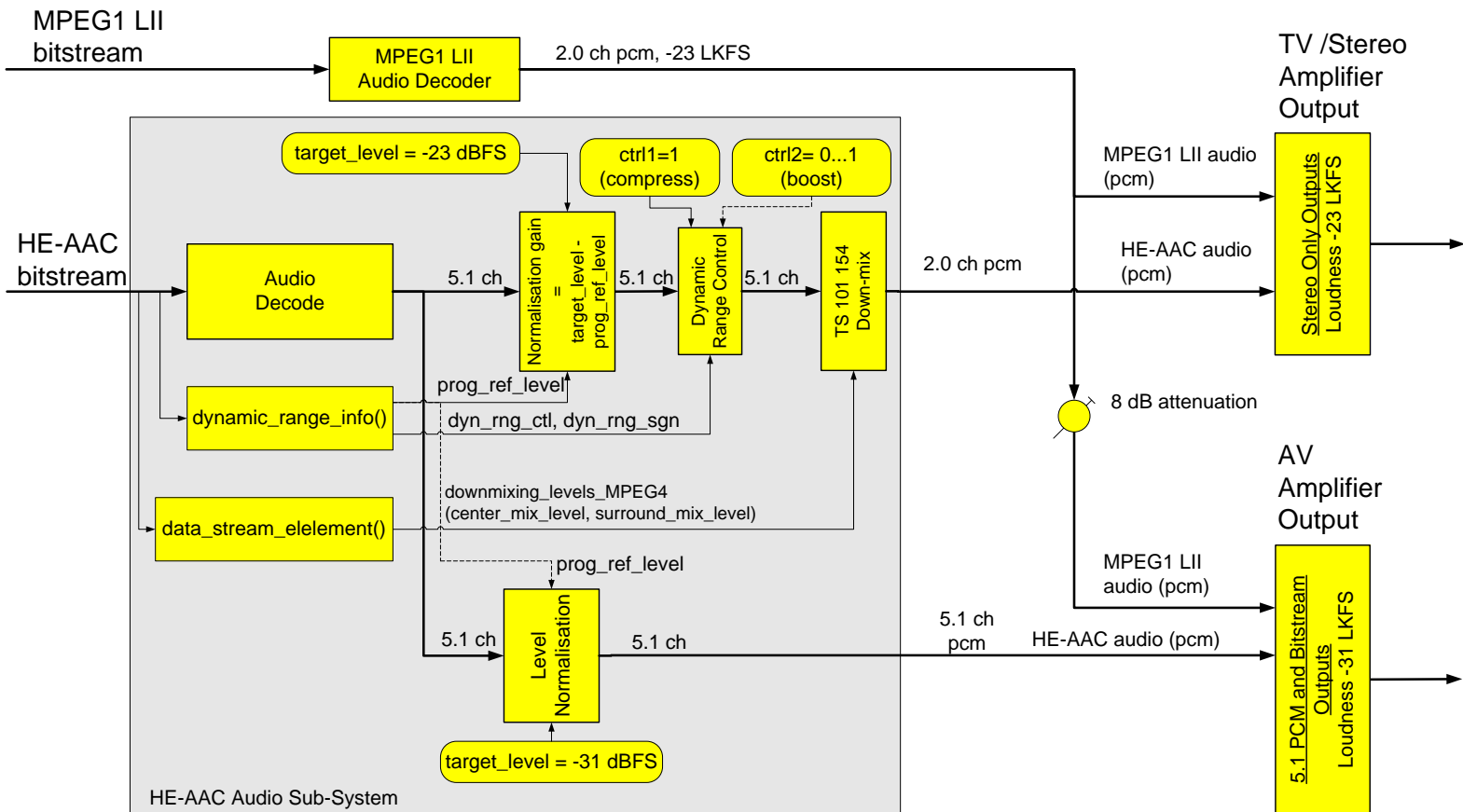
System B: dynamic range control



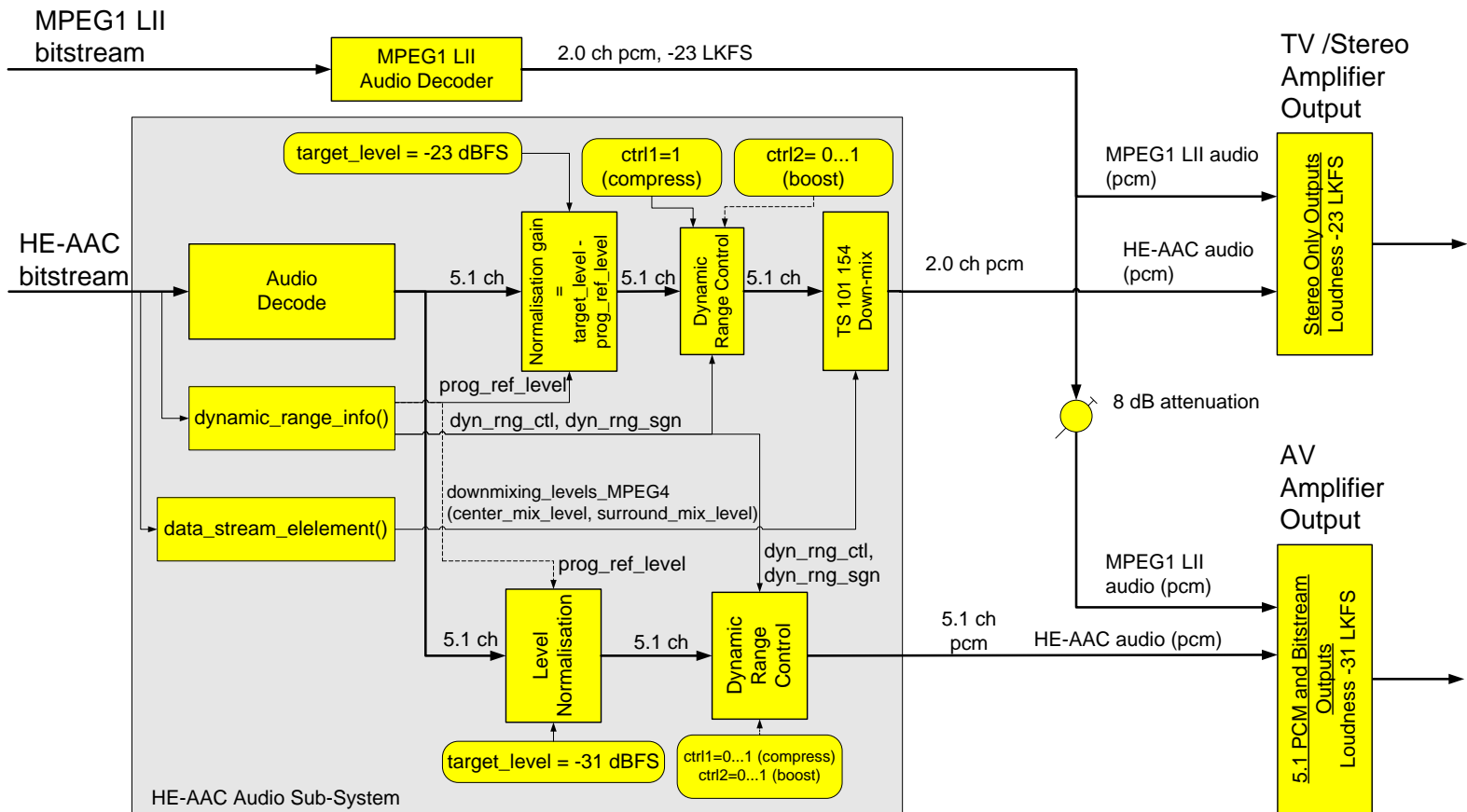
System B: down-mix



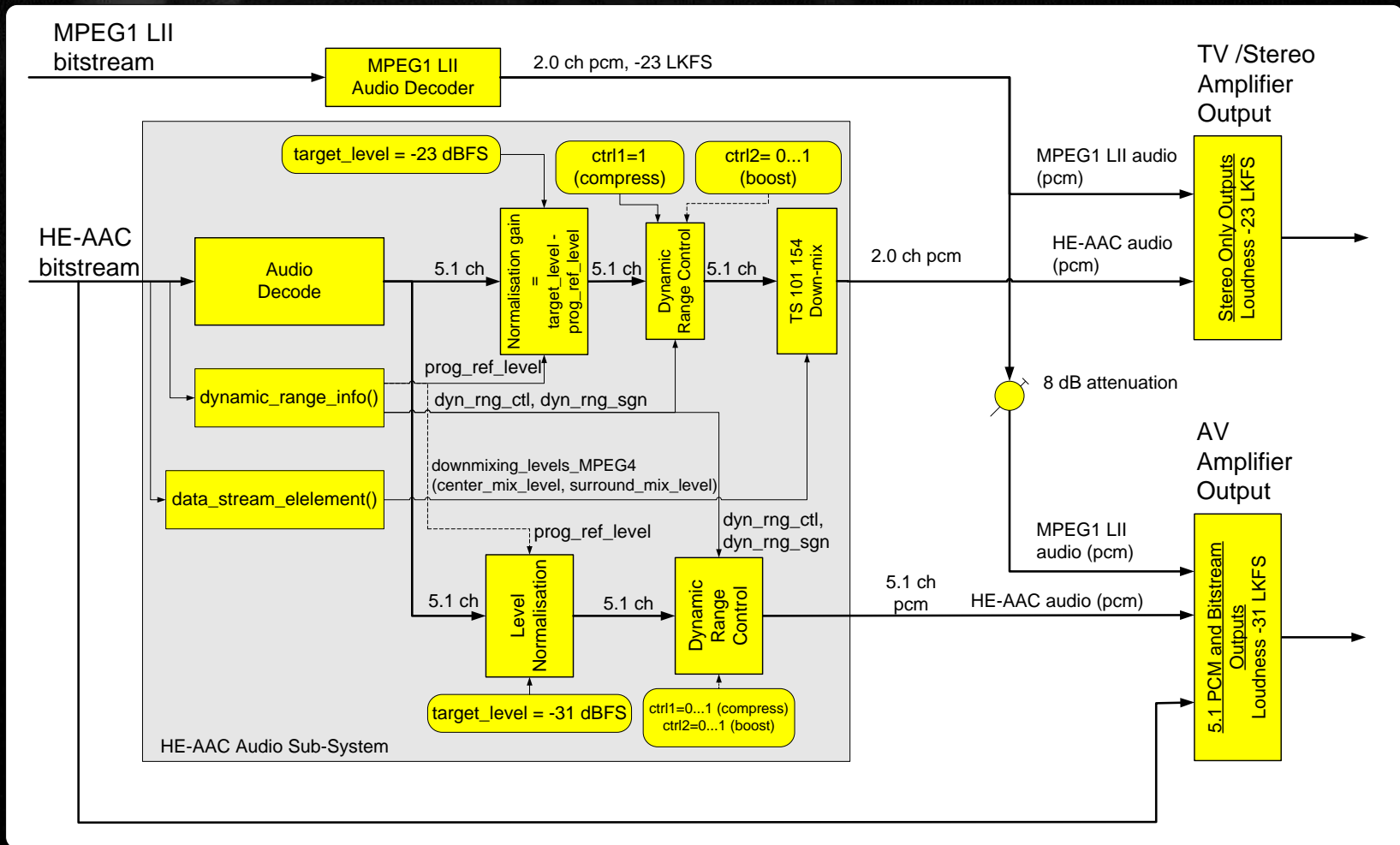
System B: AV amplifier PCM audio



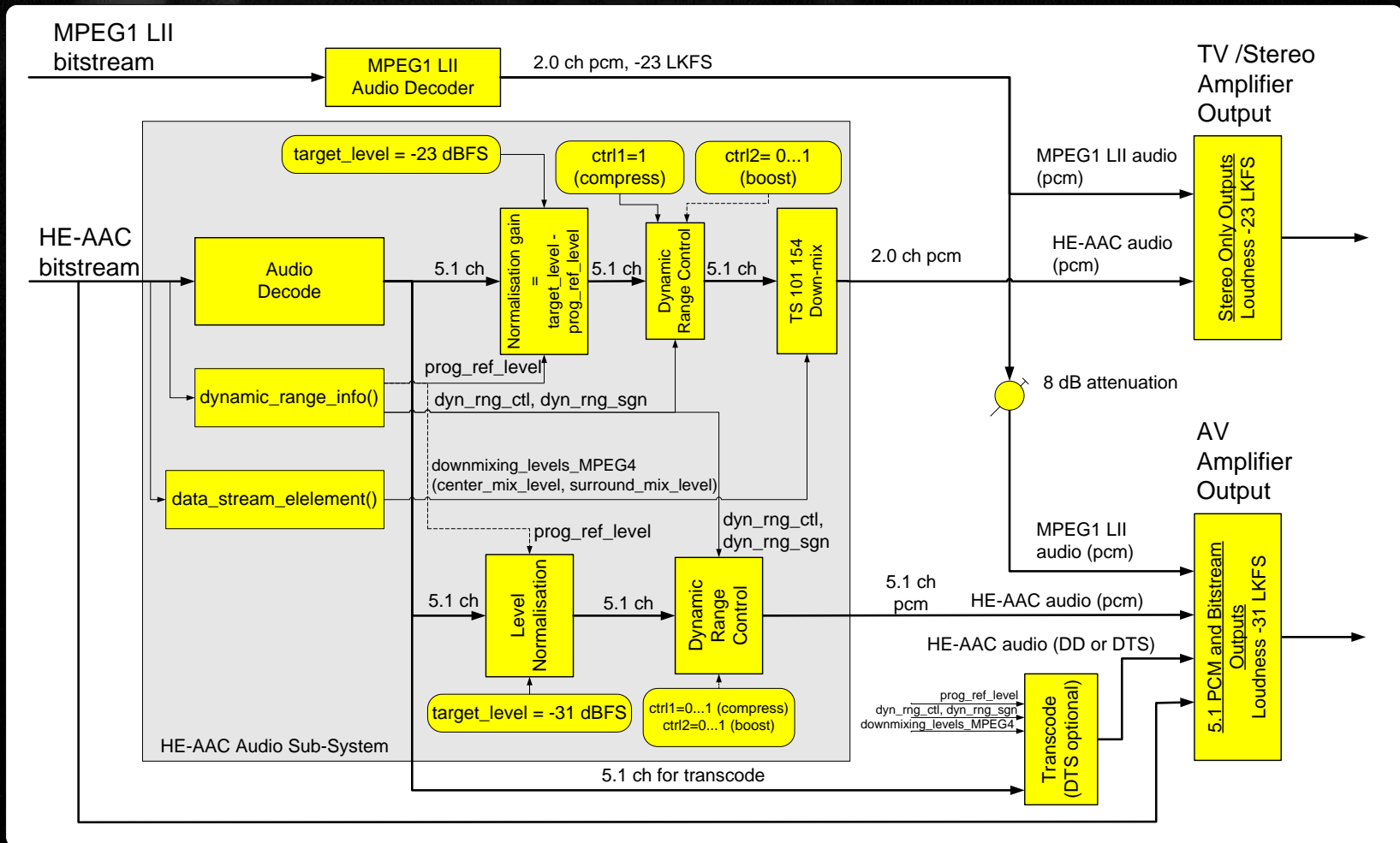
System B: AV amplifier DRC



System B: AV amplifier native bitstream

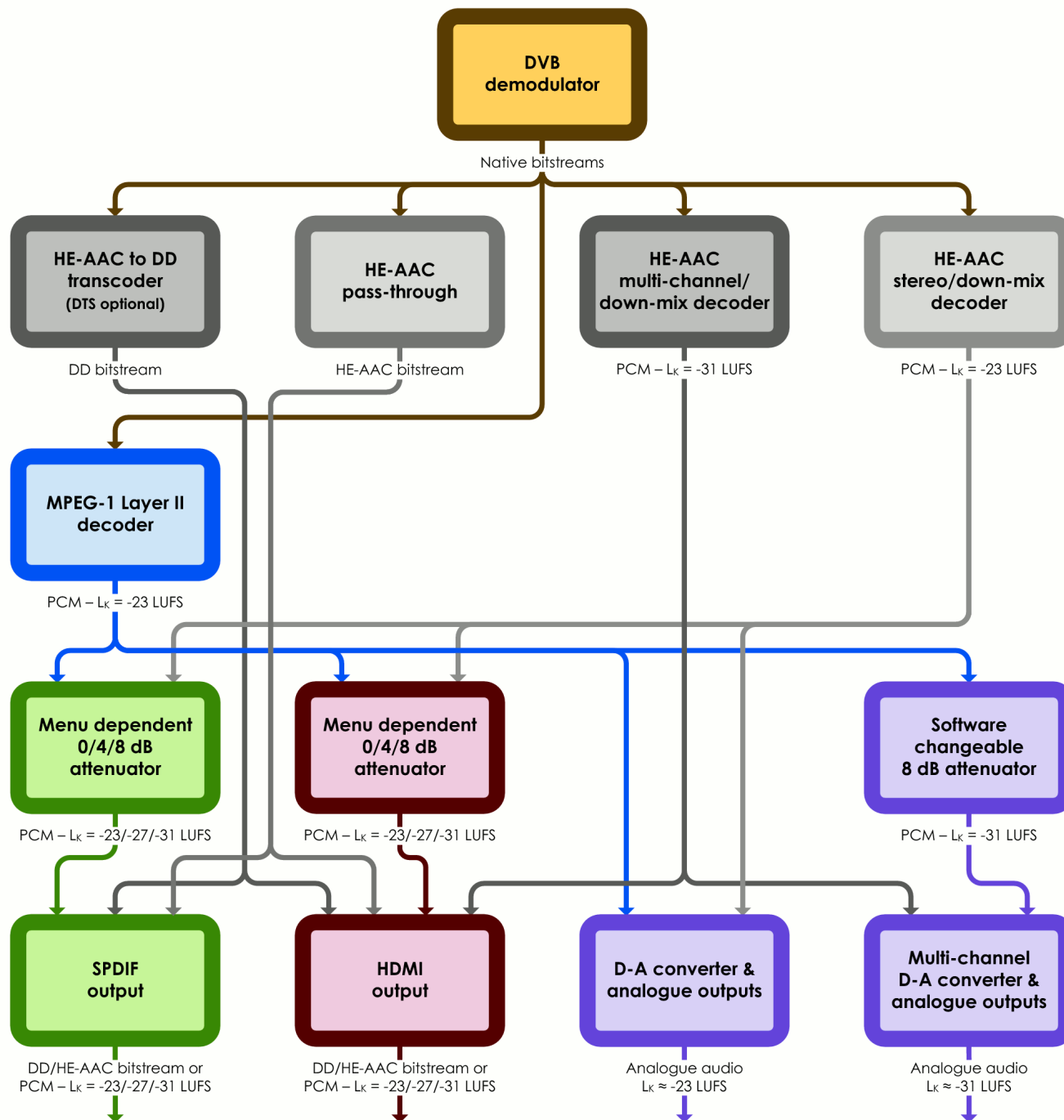


System B: AV amplifier transcoded bitstream



System A & B key difference

- System A (DD/DD+)
 - heavy “RF Mode” DRC applied to stereo (& mono) outputs at -23 LUFS
- System B (HE-AAC)
 - equivalent heavy “compression_value” DRC only applied to monophonic RF outputs (not shown)
 - stereo outputs at -23 LUFS subject to lighter “dynamic_range_info()”



System B
“top-level”
diagram
(Fig 6.4.5.1)

Summary

- Essential for reducing audience complaints
 - Understanding non-unity gain channels
 - Accurate metadata
 - Intuitive equipment set-up
 - Effective receiver testing