

# PHILIPS

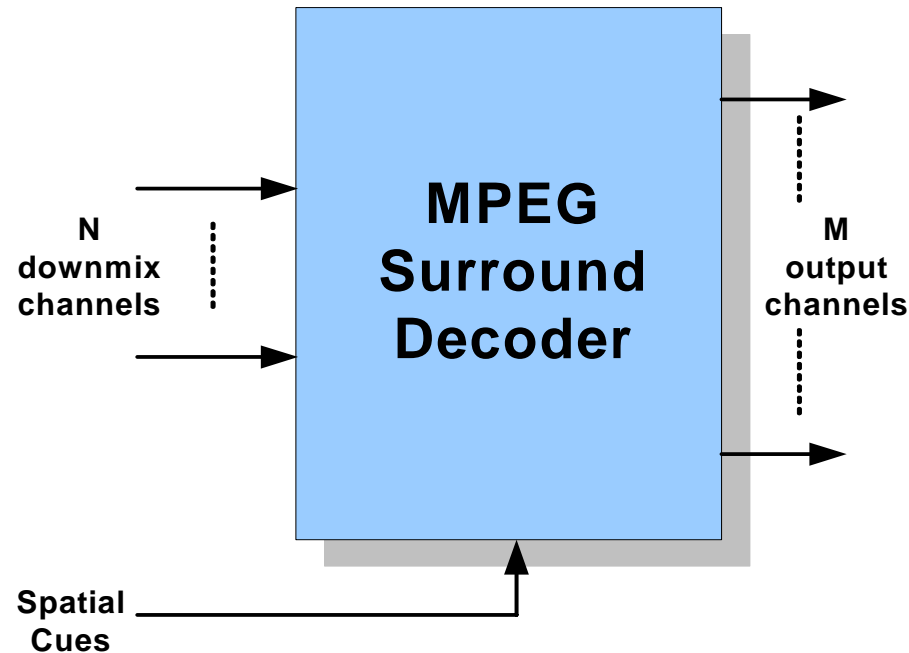
## MPEG Surround Technology Overview

Werner Oomen

Philips Applied Technologies

AES121 San Francisco, October 2006

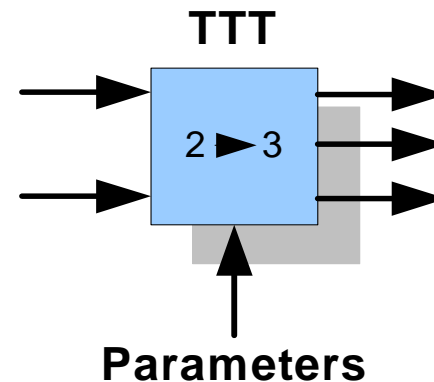
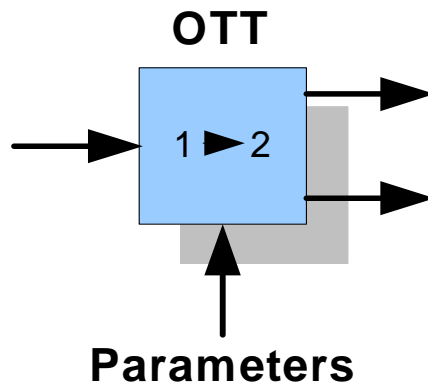
# Problem Statement



- Create **M** channels based on **N** downmix signal and “**spatial cue**” parameters (**M**>**N**)
- Downmix can be encoded using **any core coder** (e.g. mp3, AAC, HE-AAC, Layer II, ...)

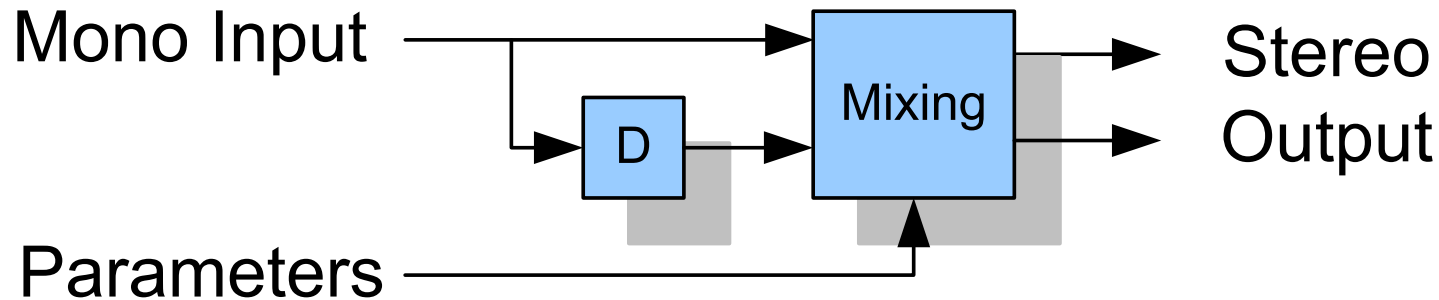
# Approach

- Modular, using simple building blocks
  - One-To-Two (OTT) box
  - Two-To-Three (TTT) box



- Combining OTT and TTT boxes can build more complex configurations, such as stereo-to-surround

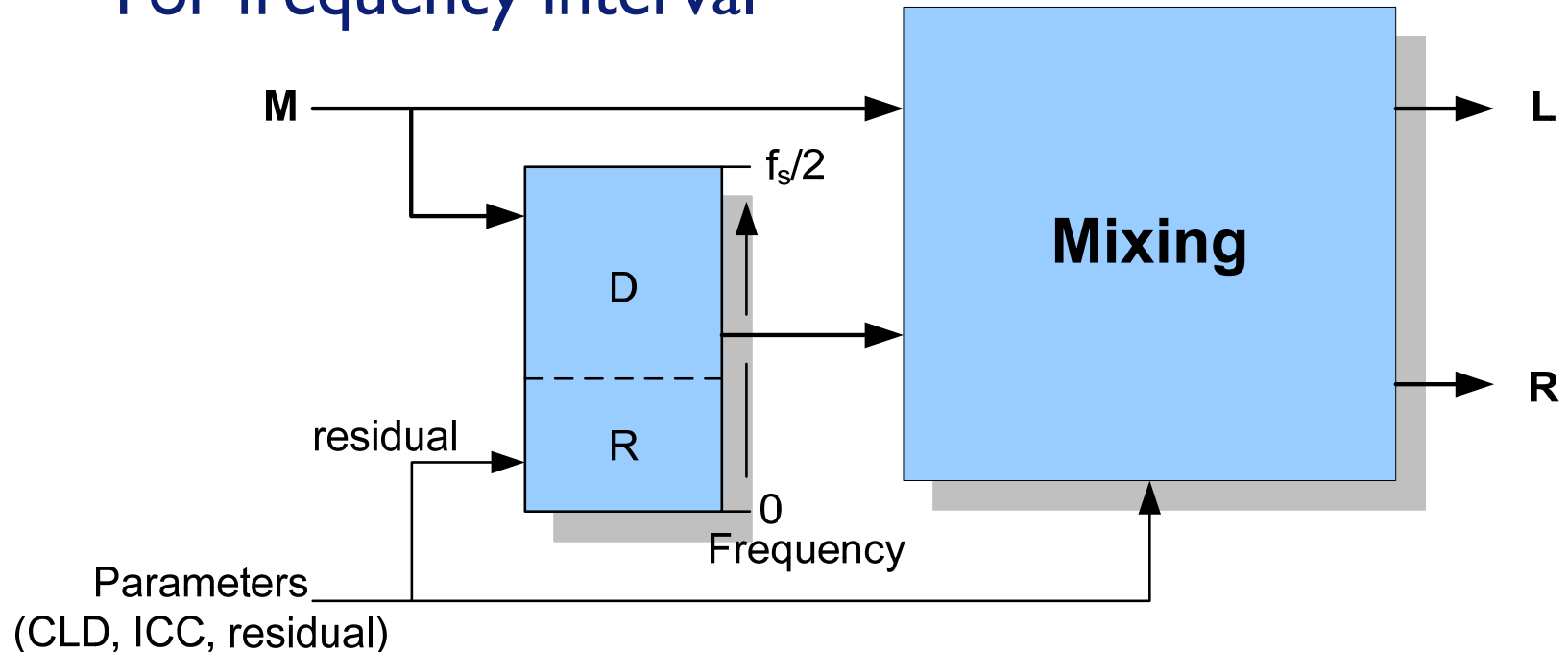
# One-To-Two (OTT) box



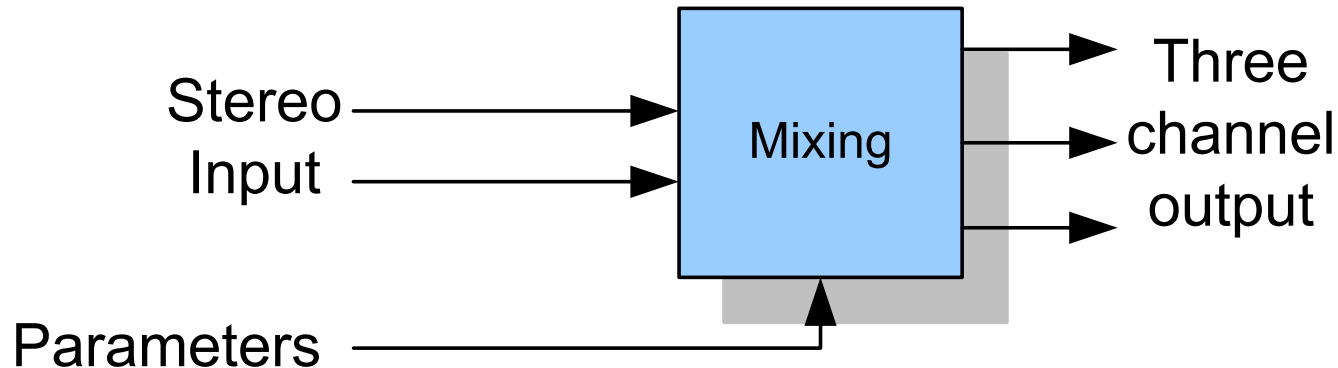
- Parameters (cues)
  - Channel Level Difference (CLD), “pan”
  - Inter-Channel Correlation (ICC), “source width”
- Mix mono signal with its **decorrelated** version
- Also known as ‘parametric stereo’ decoder
  - used in HE-AAC v2

# Residual coding

- The decorrelated signals can be replaced by a 'residual signal'
  - scale towards transparency
  - For frequency interval



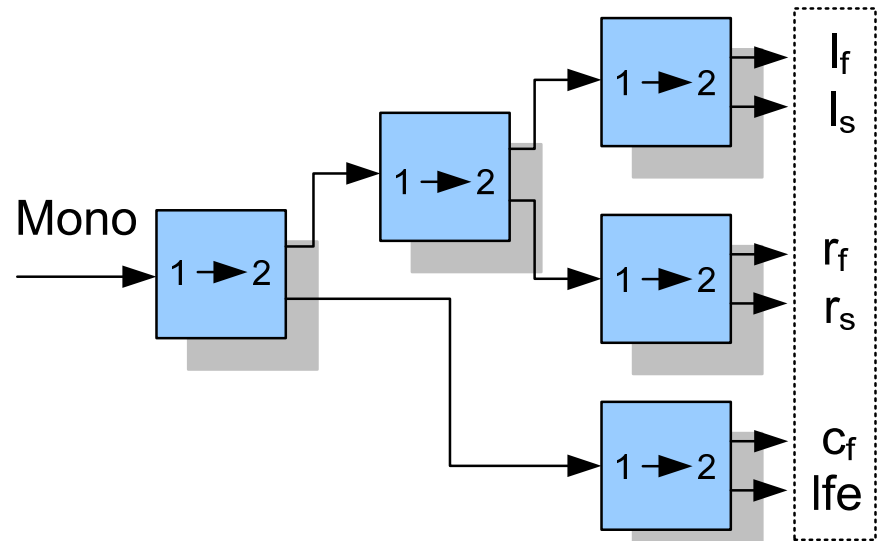
## Two-To-Three (TTT) box



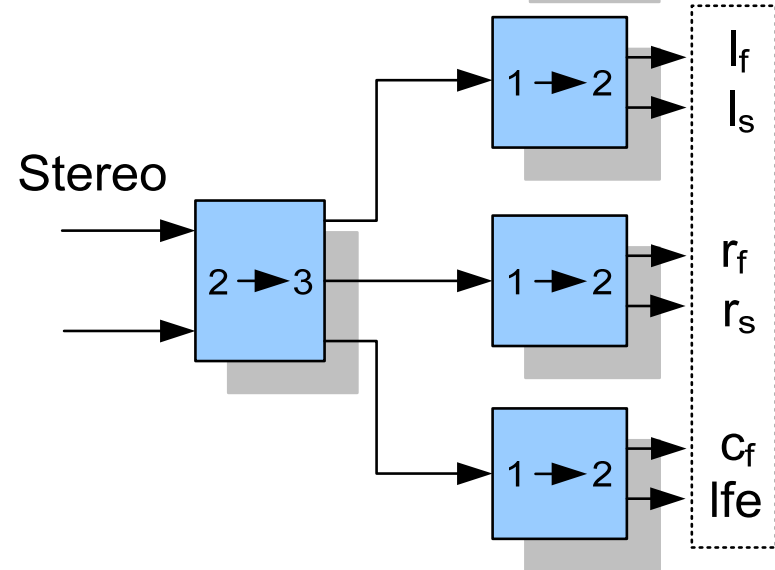
- TTT – derive Left/Center/Right from a L/R stereo pair
- Two operation modes (controlled by parameters)
  - Prediction-based mode (optional decorrelator and residual)
  - Energy-based mode (relevant for SBR)

# Building trees

- Mono to Surround (515)

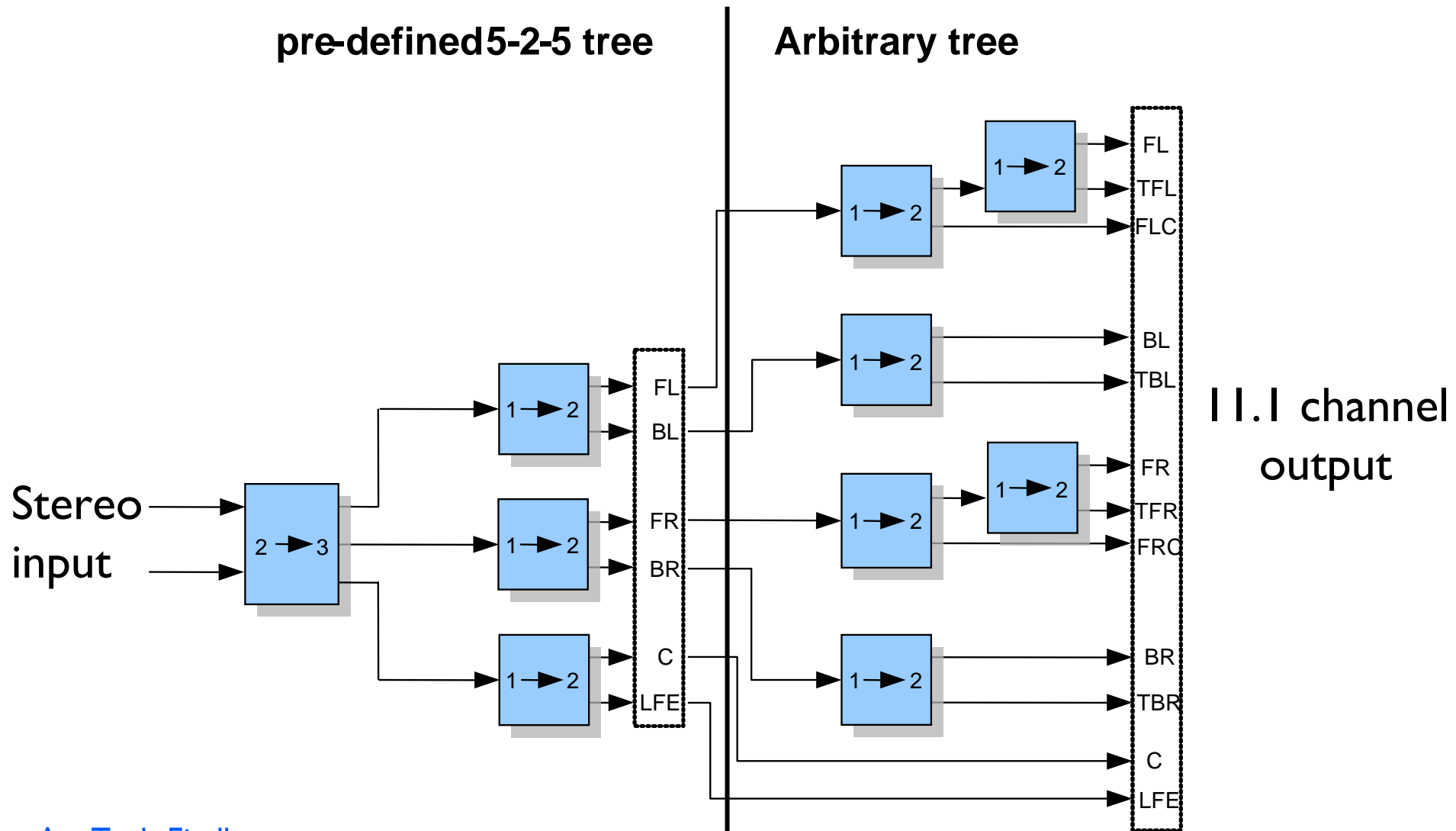


- Stereo to Surround (525)



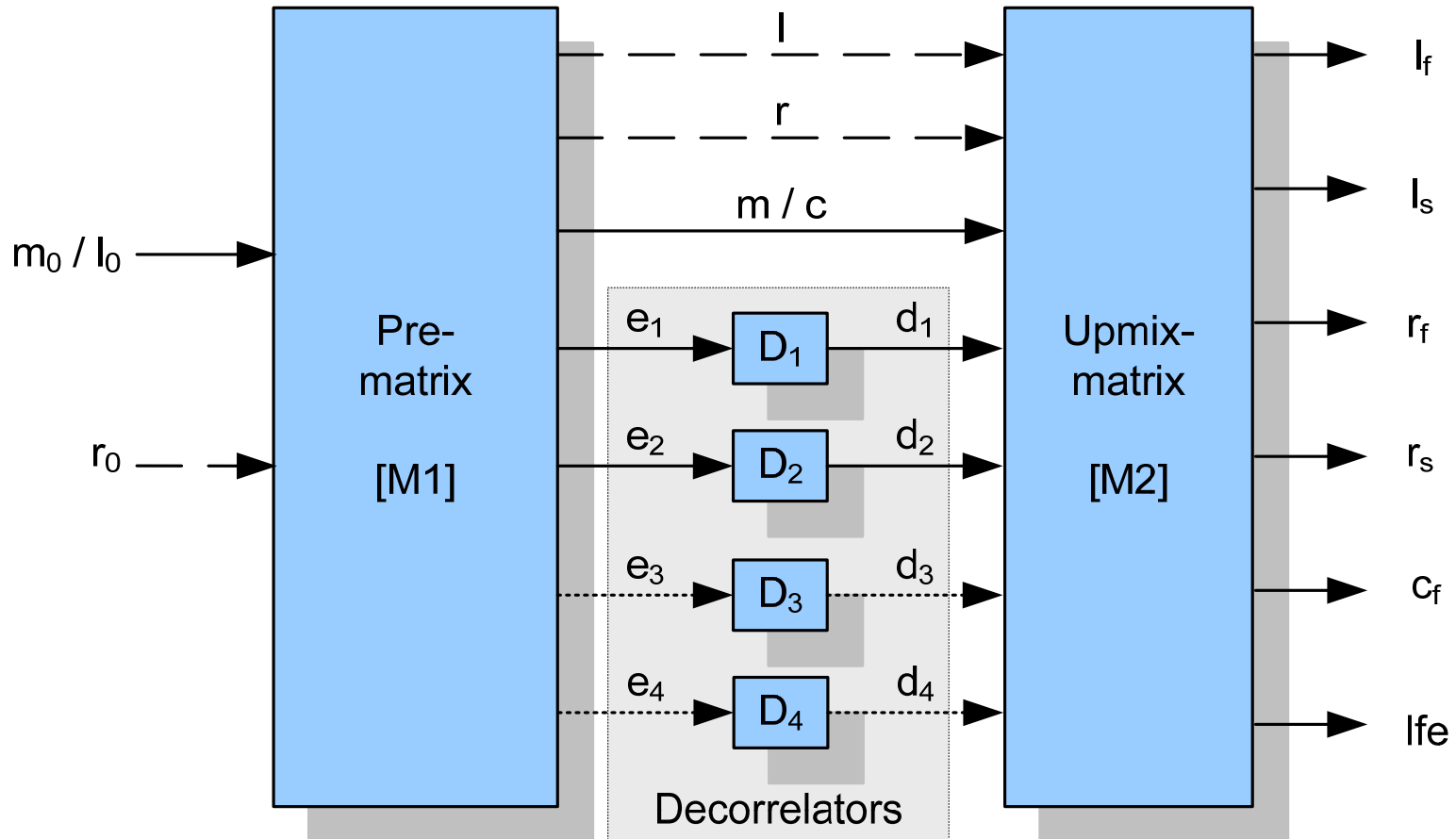
- Many other arbitrary trees (NMN)

# Example arbitrary tree (2 – 11.1)





# Flat implementation instead of tree



# Time-frequency tiling

- Filterbank for frequency selective processing
  - Based on 64-band complex QMF extended with hybrid filterbank for better resolution at low freq. (as employed in HE-AAC v2)
- Spatial parameters are time and frequency dependent
  - Signal adaptive parameter update (typically 45ms)

# Quantization, coding, and transport

- Quantization and coding
  - Non-uniform parameter quantization
  - Time or frequency differential coding
  - 1D and 2D Huffman coding
- Transport of MPEG Surround side-information
  - Embedded as ancillary data in bitstream of coded downmix (e.g. AAC, aacPlus, MPEG-I Layer II / III)
  - As additional bitstream in e.g. MPEG-4 System
  - Buried in LSB's of PCM samples

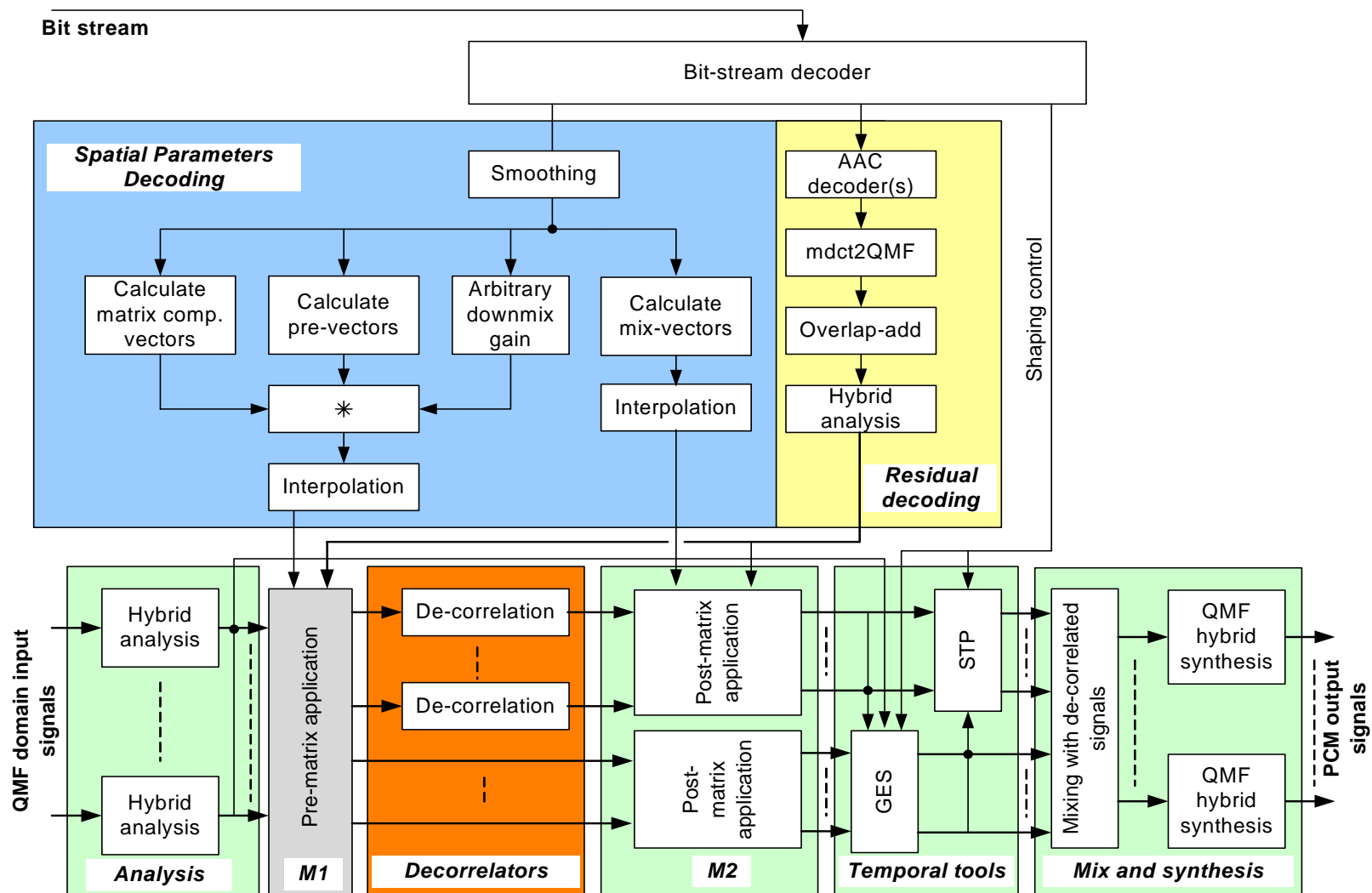
## Efficient implementation

- Low power version of MPEG surround decoder
  - Partially complex QMF, real-valued processing, ...
- MPEG Surround and HE-AAC
  - Redundant QMF synthesis and analysis

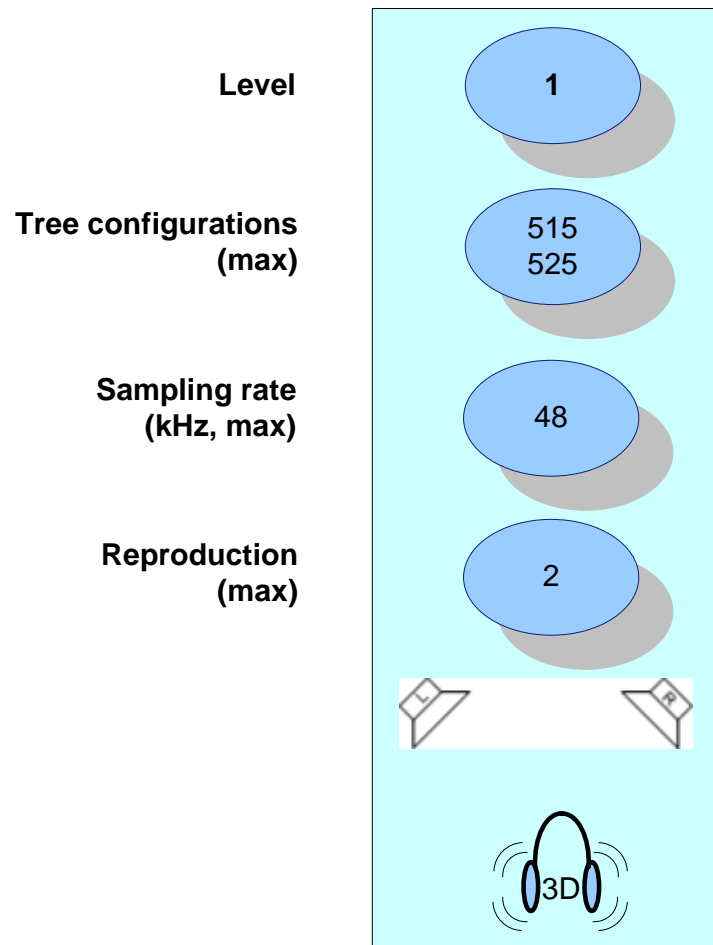
## Special tools / features

- Parameter smoothing
- Temporal processing tools
- Stereo out from 5.1.5 trees
- Binaural decoding
- More in next presentation

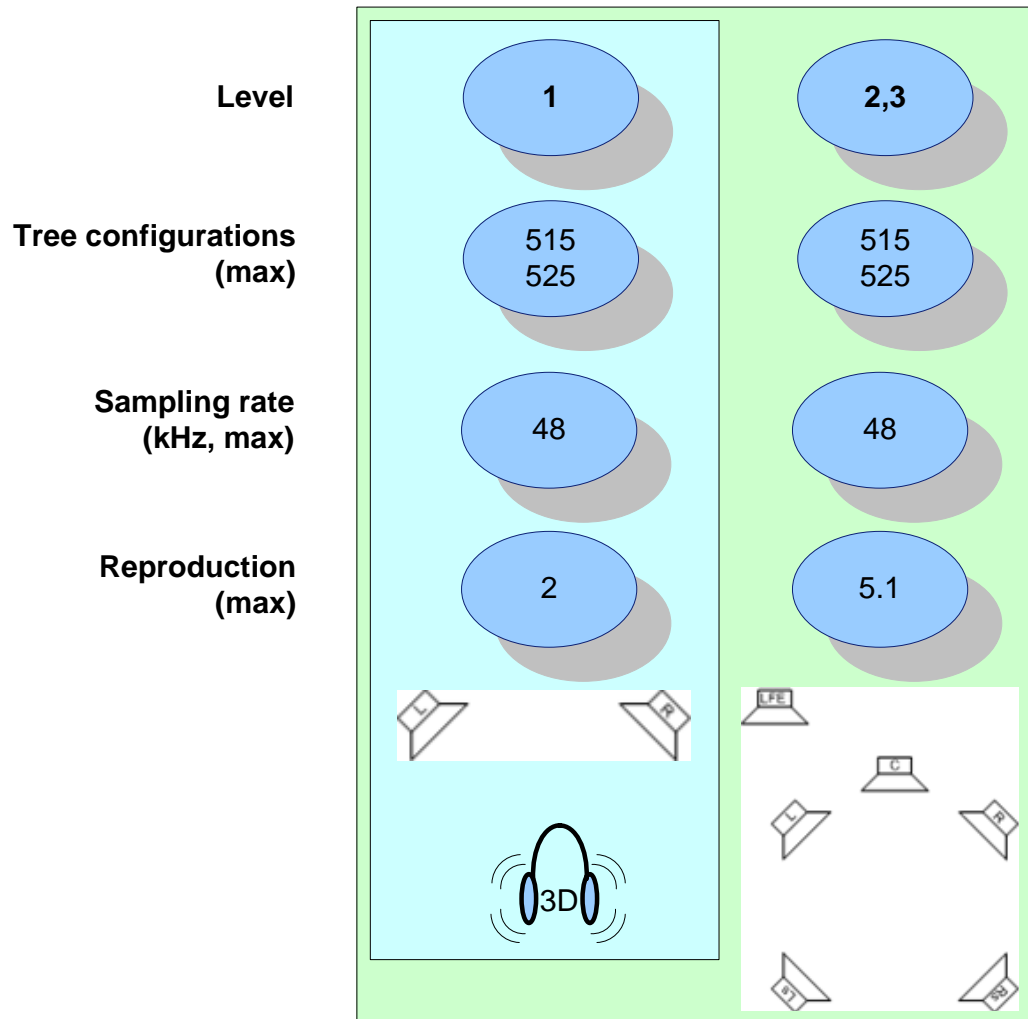
# MPEG Surround Tools Overview



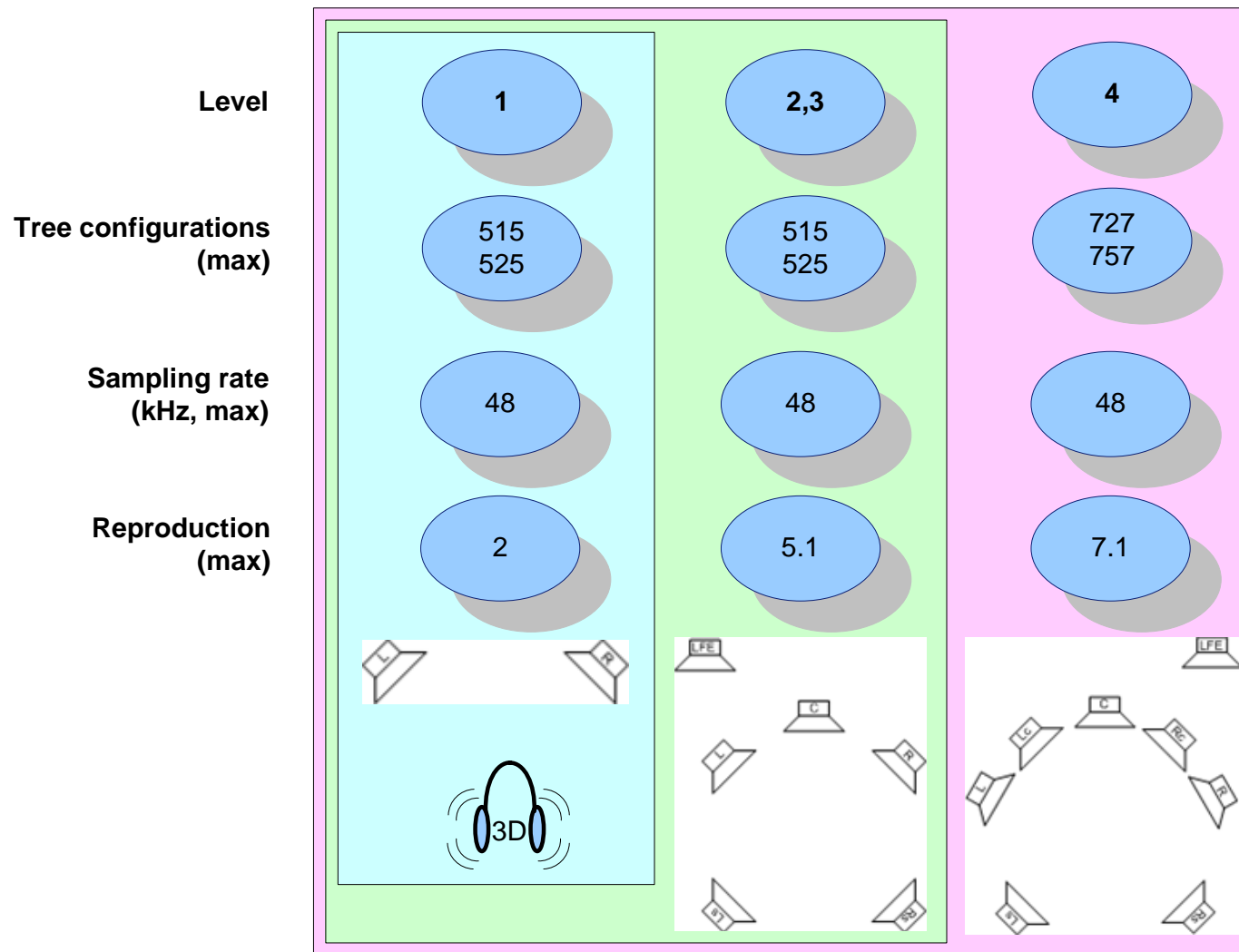
# Baseline MPS Profile



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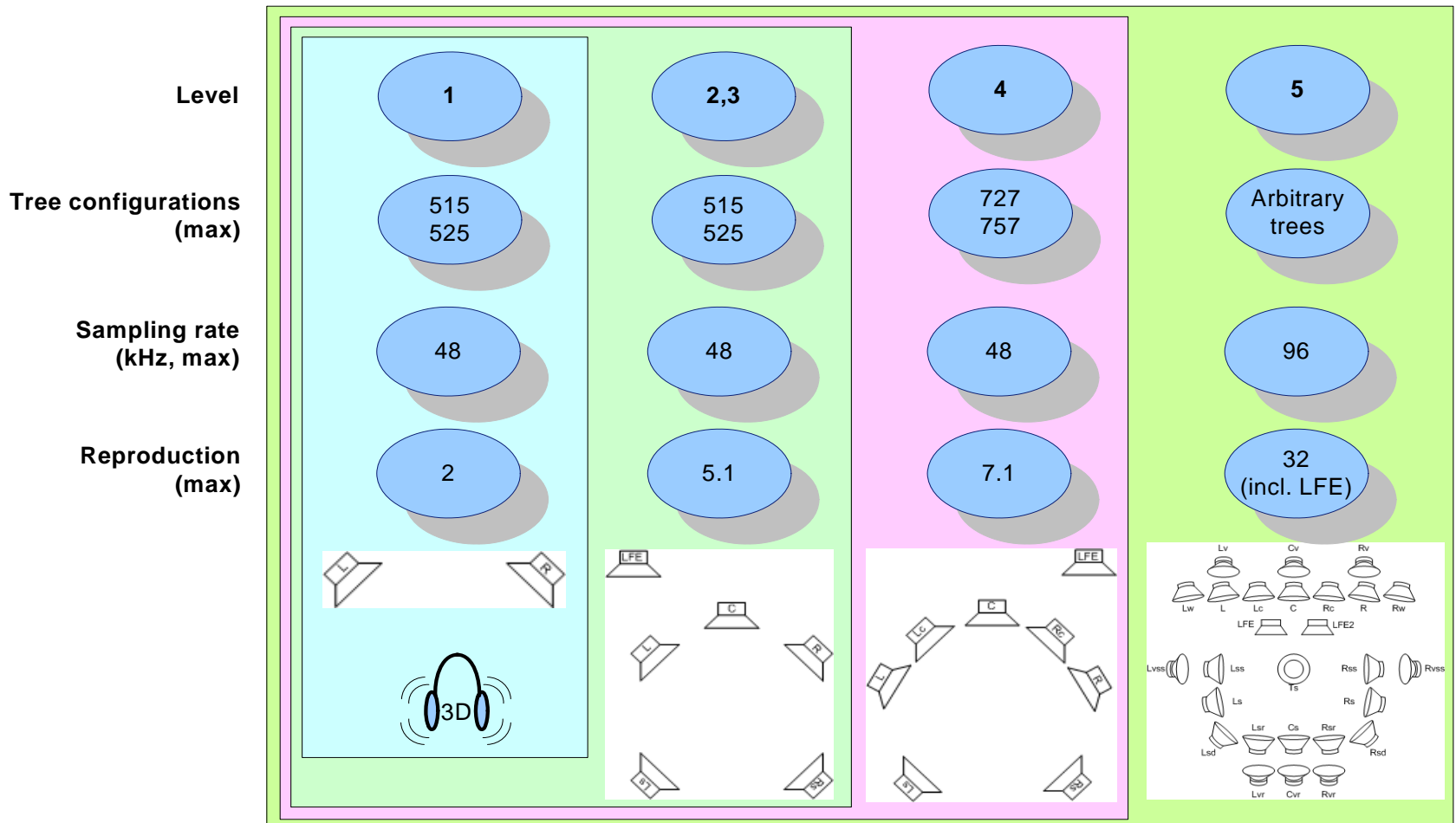


# Baseline MPS Profile





# Baseline MPS Profile



# Conclusions

MPEG Surround

‘The’ solution for all use cases

