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Spatial Audio Object Coding

Binaural rendering
Effects processing
Test results

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Binaural rendering mode

Rationale

- Loudspeaker systems are a compromise between spatial imaging capabilities, cost and esthetics
  - Limited positioning capabilities
    - Front/back panning is problematic
  - Restrictions on listener
    - Sweet spot
    - Orientation
  - Timbre changes
    - Comb-filter effects from amplitude panning
  - Room acoustics
    - Reflections, standing waves

- Headphone listening becoming more popular

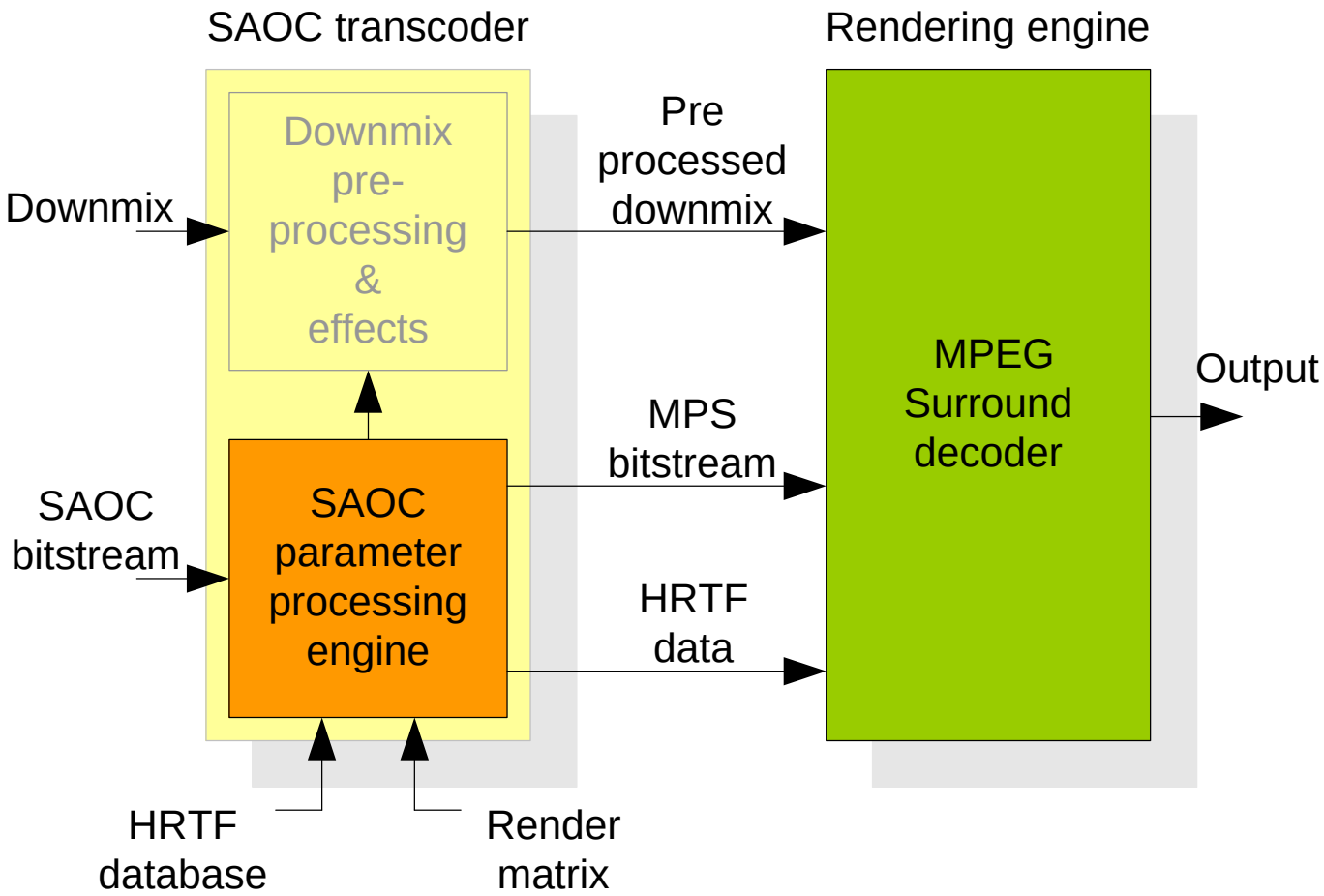
Binaural rendering mode

Rationale

- SAOC provides binaural rendering mode for headphones (similar to MPEG Surround)
  - Objects can be positioned at arbitrary (virtual) positions
  - Positions can be changed dynamically
    - Headtracking
  - Freedom to use various Head-Related Transfer Functions (HRTFs)
    - SAOC system does not prescribe HRTFs
    - Only HRTF interface standardized
    - Individualized HRTFs can be used
    - Flexible size of HRTF database (spatial resolution)

Binaural rendering mode

Approach



Effects interface

Rationale

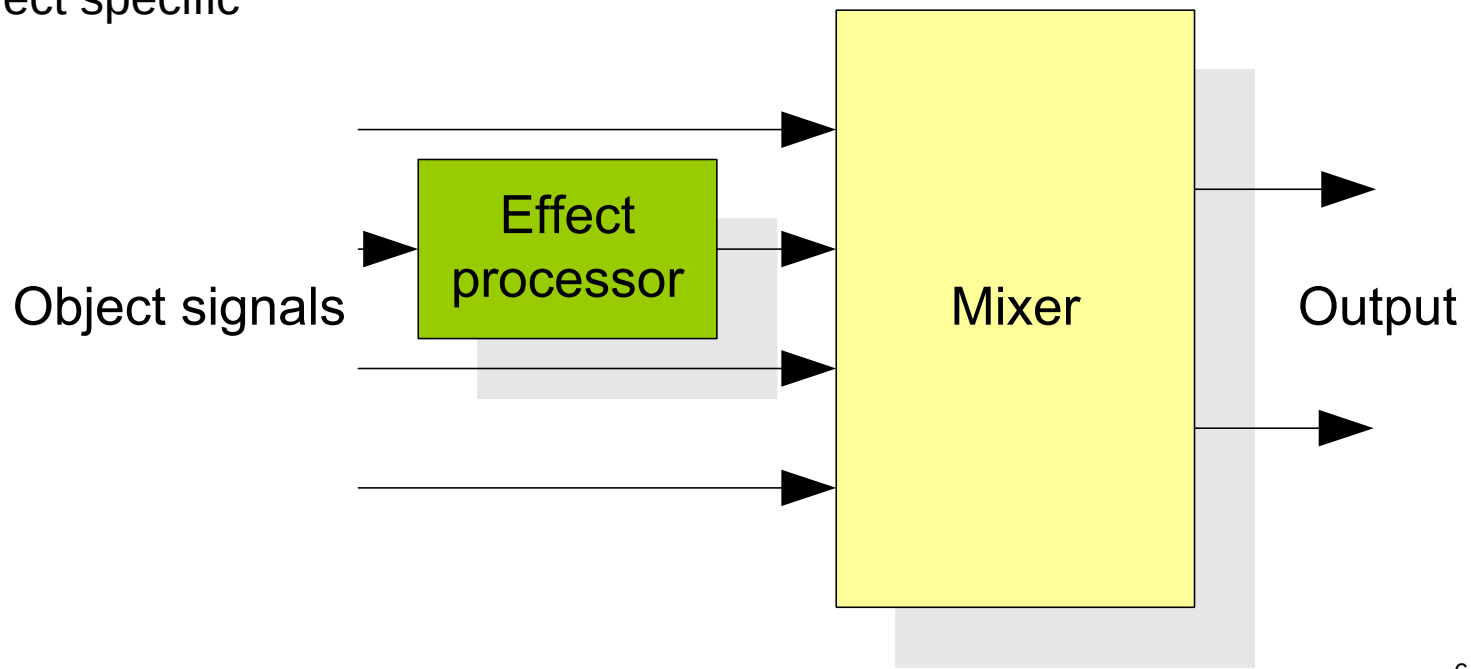
- Manipulation repertoire of SAOC transcoding approach limited
  - Level (+/- 12 dB)
  - Position (panning)
  - Equalization (frequency-dependent level)

- Applications may benefit from extended effect possibilities
  - Room acoustic simulation
    - Binaural mode, to improve ‘out of head’ percept
  - Advanced effects processing on individual objects
    - Reverberation
    - Modulation effects
    - Compression
    - Vocoders, distortion, …

Effects interface

Approach

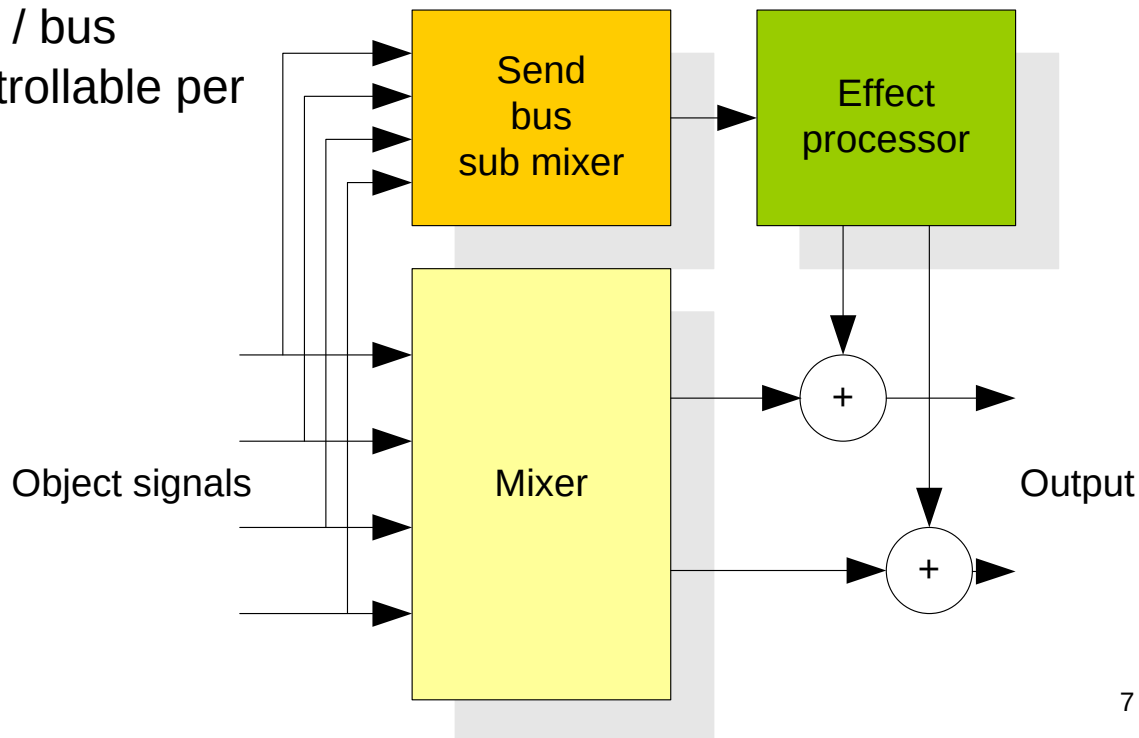
- Two effect processing methods
- Equivalent to mixing desk topology
  - Insert effect(s)
    - Effect inserted in object signal flow
    - Object specific



Effects interface

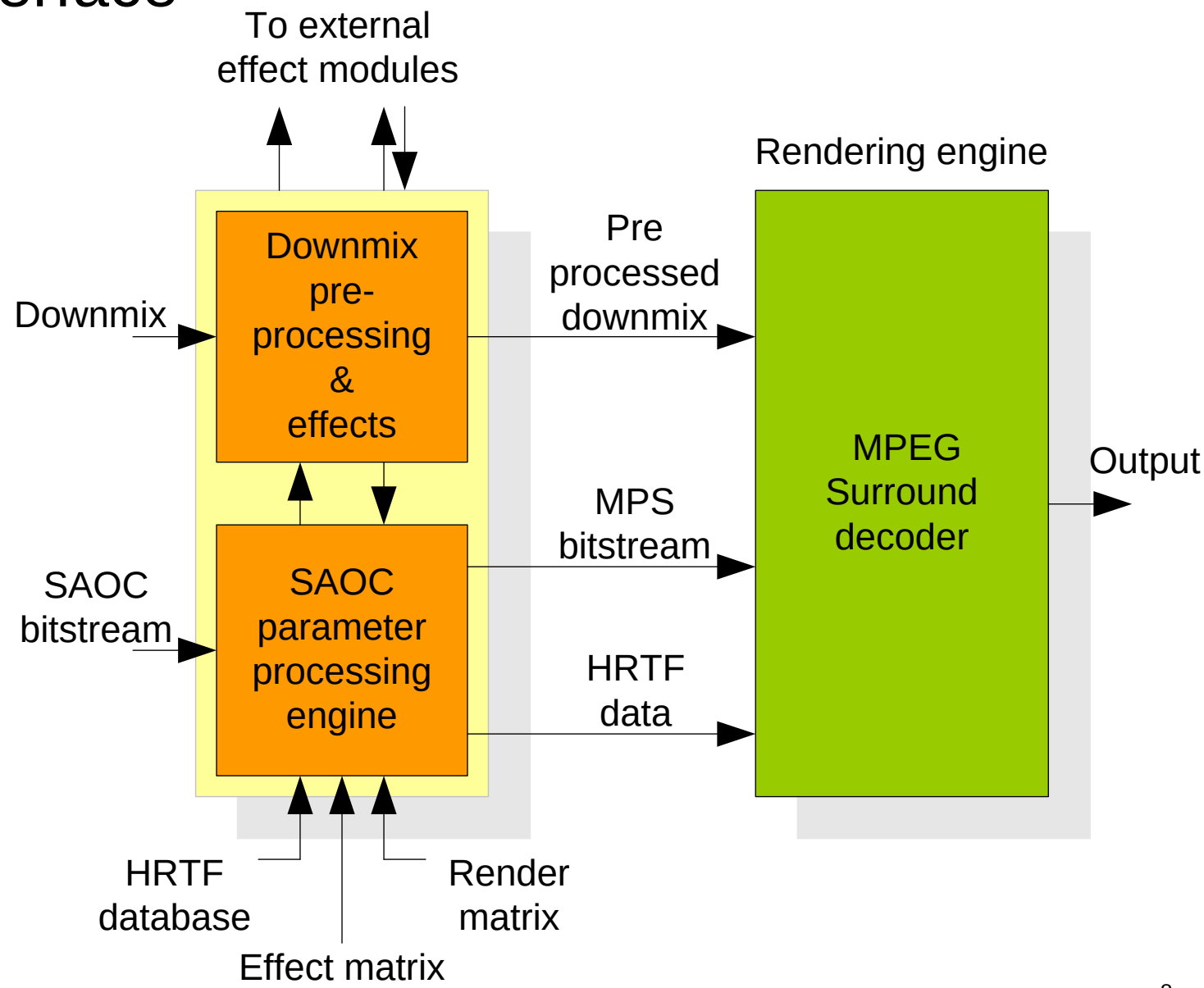
Approach

- Two effect processing methods
- Equivalent to mixing desk topology
  - Send effect(s)
    - Shared across objects
    - Parallel signal path / bus
    - Effect strength controllable per object



Effects interface

Approach



Current status of MPEG SAOC

Evaluation

- Reference model 0 (RM0) selected during 81st MPEG meeting (July 2007)
  - System proposed by CT/FhG/Philips
  - Baseline for further collaborative development

- Selection based on 3 evaluation scenarios
  I. Stereo down mix, 5.1 reproduction
     - Gaming, rich media, interactive AV content
  II. Mono down mix, binaural headphones reproduction
     - Telecommunication, mobile/networked gaming
  III. Stereo down mix, stereo reproduction
     - Re-mixing, interactive AV content, speech enhancement

Current status

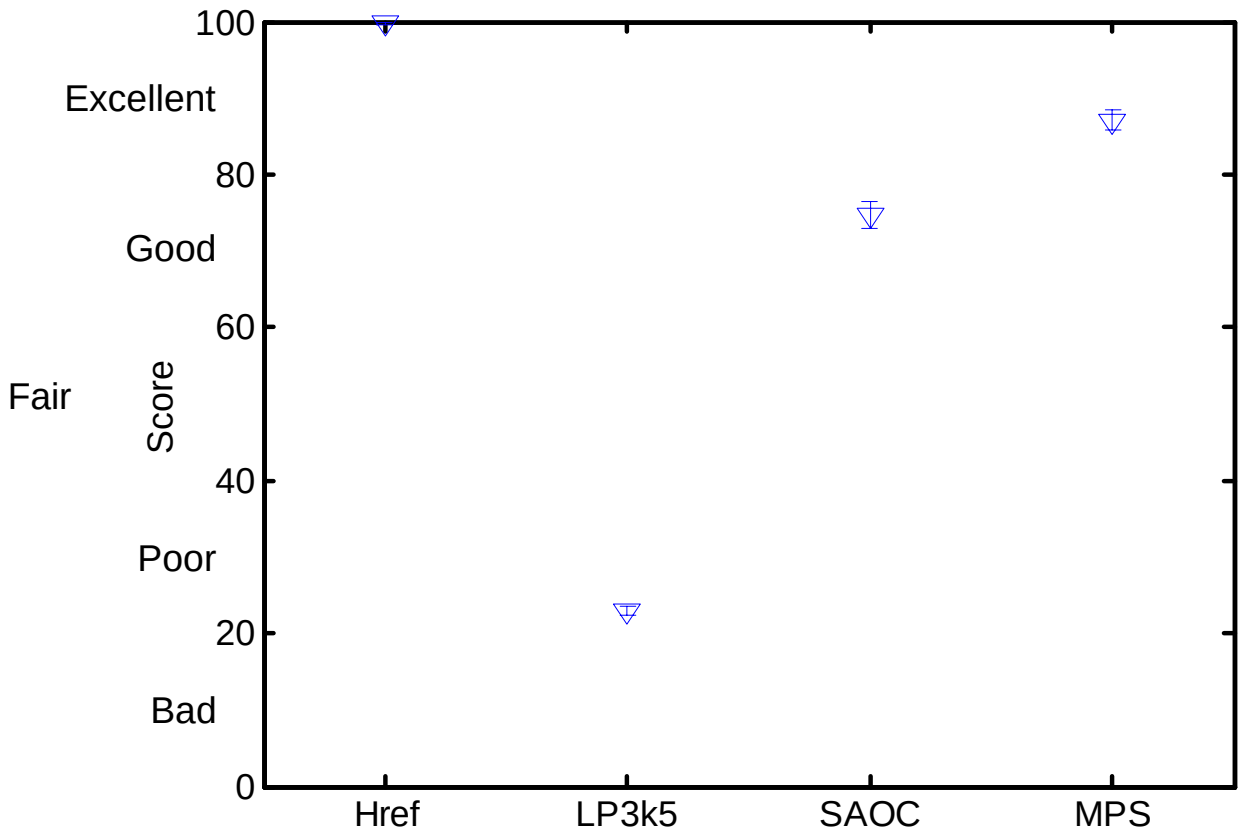
Evaluation

- Each evaluation scenario split up in test with different rendering functionalities
  - Object attenuation/amplification
  - Object repositioning/repanning
  - Complex (dynamic combinations of level and position adjustment)
  - Stream combination (only for scenario I)
- Bit rate and complexity constraints
- MPEG Surround as additional anchor (for scenario I)
- MUSHRA test methodology
- Several laboratories participated in listening

Current status

Evaluation

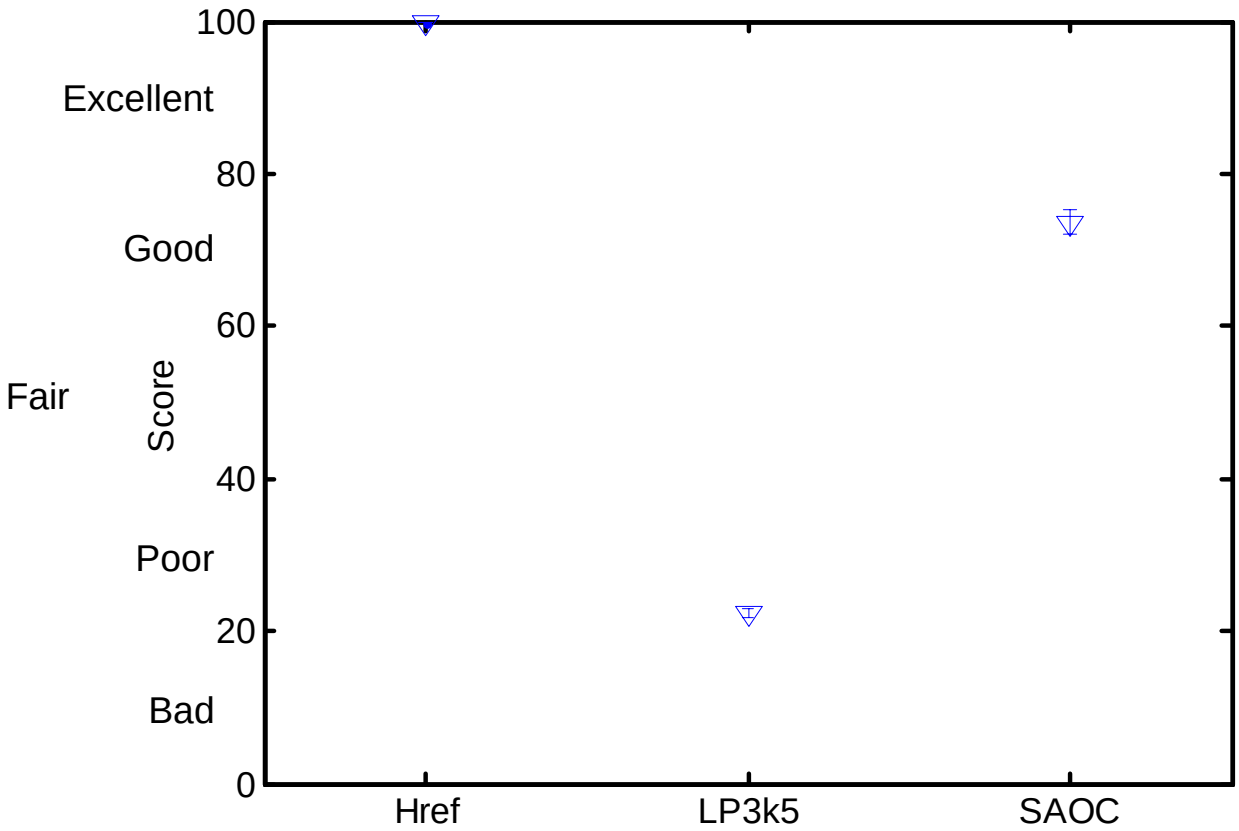
- Test I: Stereo down mix, 5.1 reproduction



Current status

Evaluation

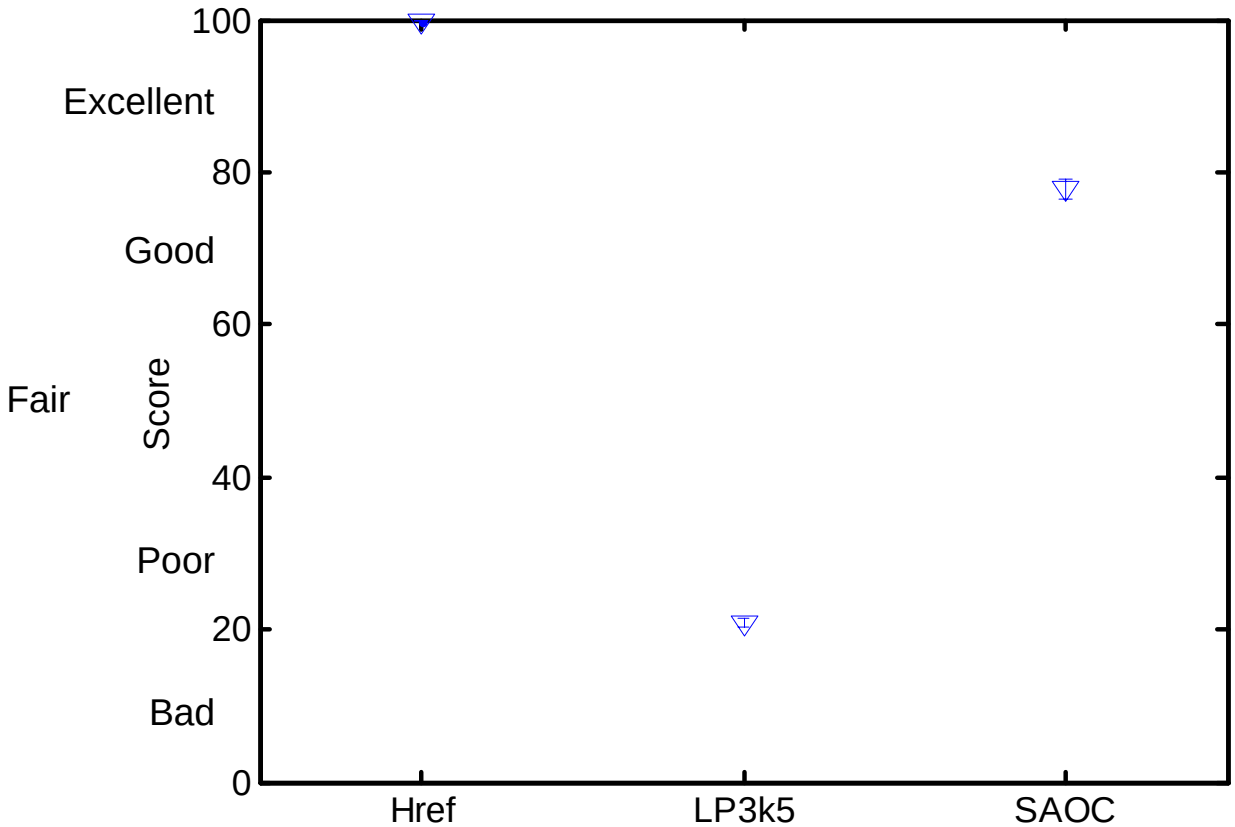
- Test 2: Mono down mix, binaural reproduction



Current status

Evaluation

- Test 3: Stereo down mix, stereo reproduction



Outlook

Future work

- Further quality improvements
  - Repositioning is already of high quality
  - Level adjustment more challenging
- Achieve enhanced object-signal separation
  - Karaoke?
  - Multilingual commentary?
- Low delay (telecommunication applications)

Questions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