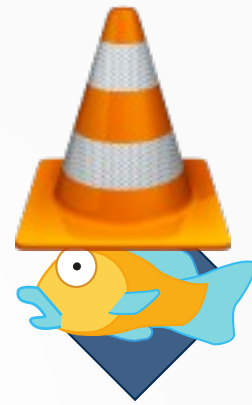


rav1e



xiph.org

Thomas Daede

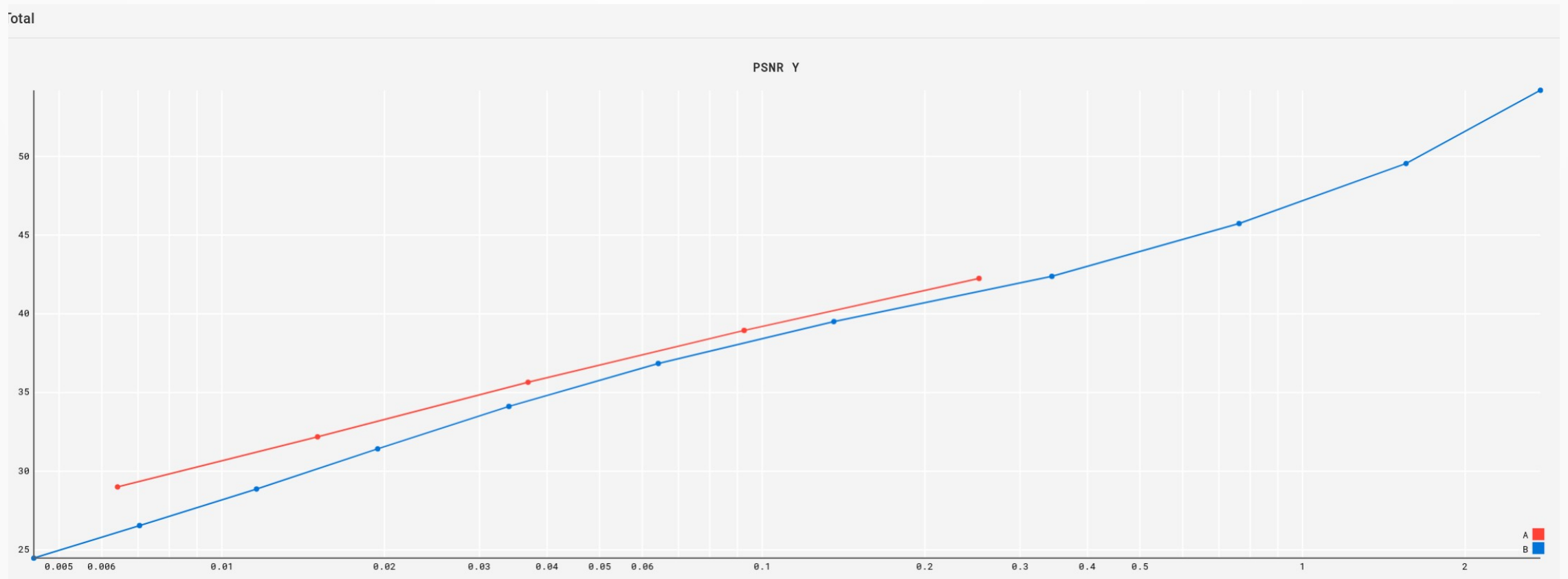
VideoLAN Dev Days Sept 22, 2018

<https://github.com/xiph/rav1e>

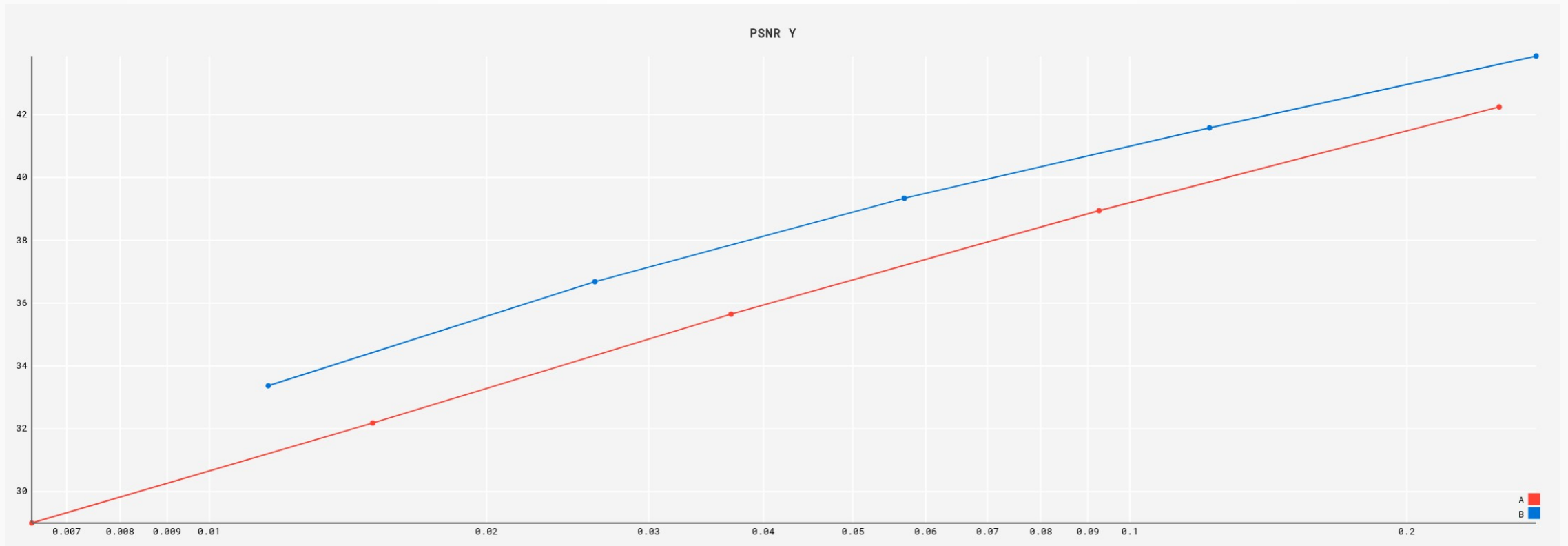
What is this

- New, experimental AV1 encoder
- Goals:
 - Faster than libaom
 - Better quality than libaom
 - Ideally at the same time

Status since my lightning talk



~15%-30% smaller than x264



~70% bigger than libaom

Background on libaom

- Derived from libvpx codebase
- Reference implementation, “sort of usable”
- Much encoder behavior is inherited from previous VPx codecs
 - multiple frame passes
 - weird rate control

Background on libaom

- SIMD is nice, but not enough

	Encoding Time (seconds)	Times Real Time
AV1	226,080	45,216
x265	289	58
LibVPx	226	45
x264	18	4

<http://www.streamingmedia.com/Articles/Editorial/Featured-Articles/AV1-A-First-Look-127133.aspx>

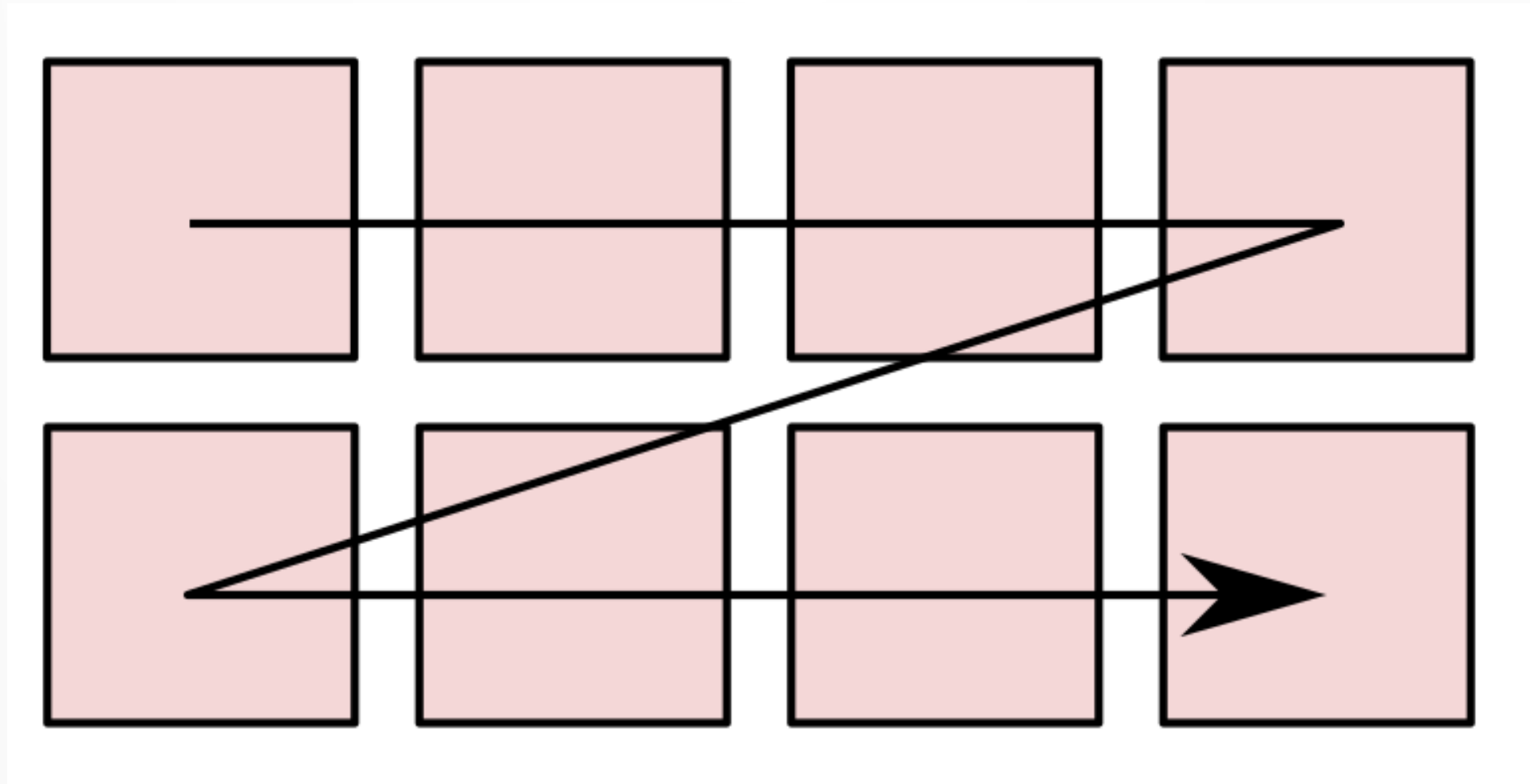
New (and old) ideas

- Accurate RDO
- Loop filters during RDO
- Alternative distortion metrics (psy-rd)
- Rate control techniques
 - mbtree
- Speed improvement
 - Alternative parallelization methods

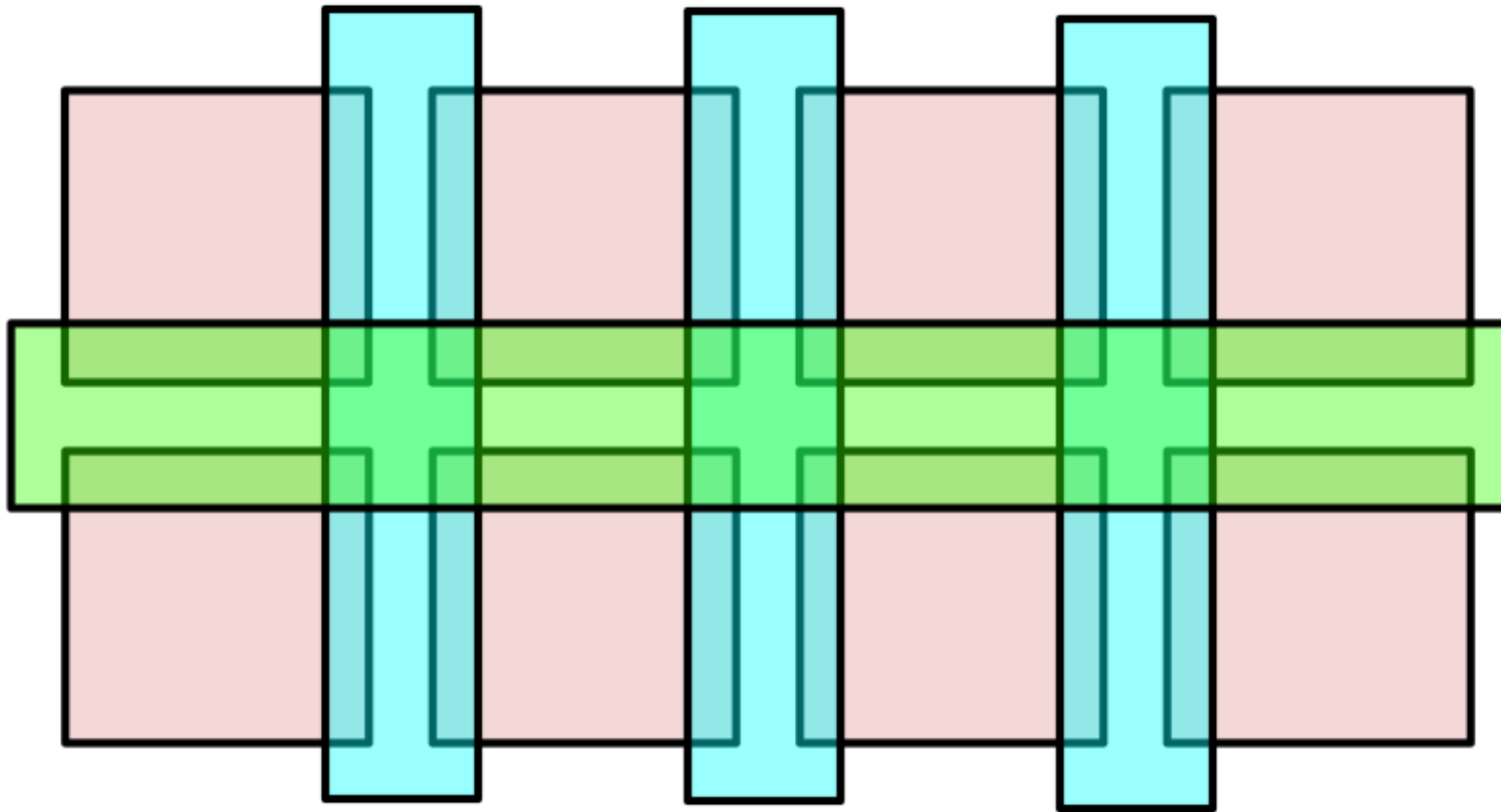
Brief “what is RDO” slide

- Rate-distortion optimization
- How to make an encoder:
 - Measure rate
 - Measure distortion
 - Compute RDO score
 - Try again until your video is good

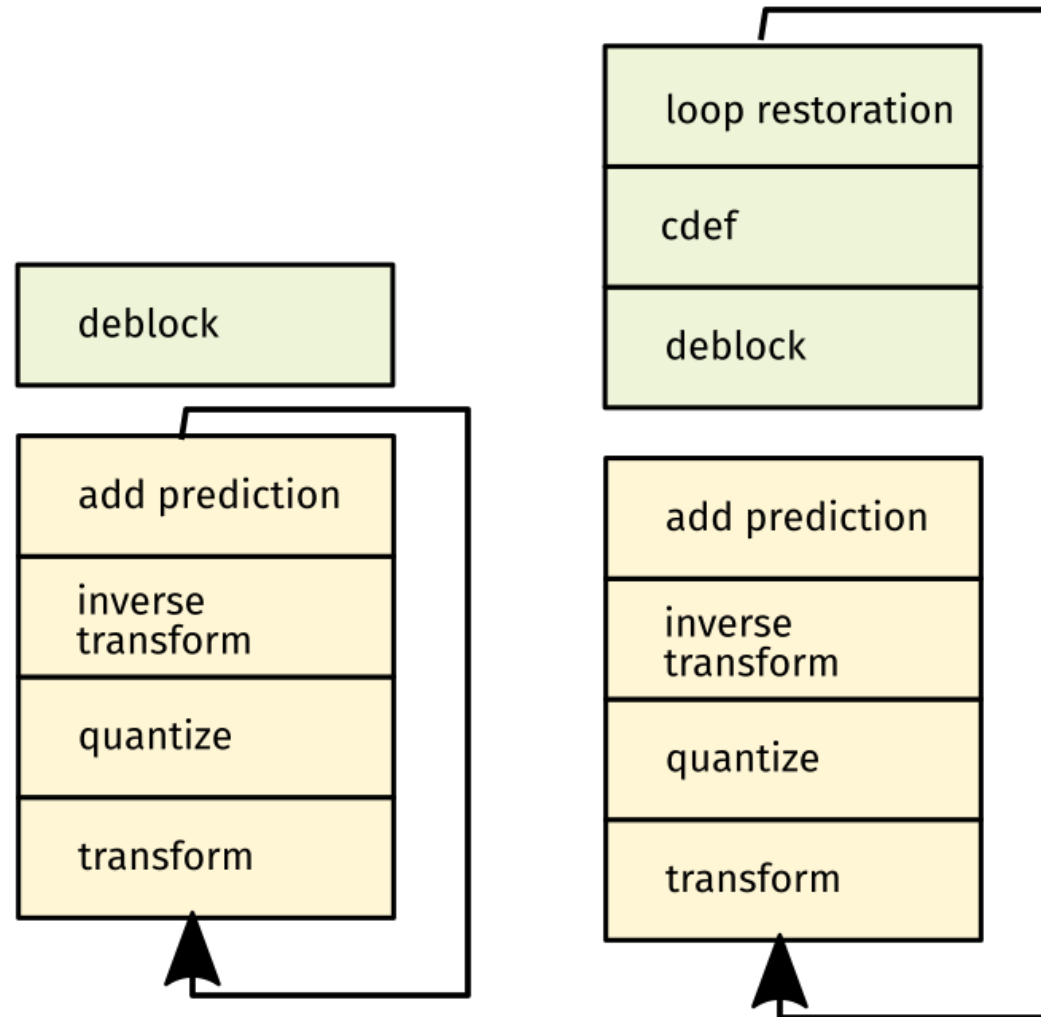
rav1e block order



rav1e filter inlining



rav1e filter RDO



Alternative distortion metrics

- Simple implementations of RDO used MSE as the distortion metric to maximize PSNR
- Swapping the distortion metric with a different one can make your video look better (at the cost of PSNR)
- x264 called this “psy-rd” and gave a tunable parameter controlling the distortion metric

Alternative distortion metrics

- rav1e currently has a distortion metric called “cdef-dist”
 - Runs on 8x8 blocks
 - Designed to maximize PSNR-HVS-M
 - Lots of tuning work needed!

Rate control techniques

- In AV1, you control bit allocation in a frame by using segments
- AV1 has better segment prediction than VP9, take advantage of this
 - choose quantizer in RDO (“aq”)
 - temporal rdo (“mbtree”)

Speed

- Iterative search space pruning
 - Search modes cheaply
 - pick 5 best
 - Search with more accuracy in RDO
 - pick 3
 - Search most accurate
 - pick 1

Speed

- Ultra-granular parallelism
- Work-stealing implementation with rayon
- Considers decisions on a sub-superblock level in parallel

Questions?