STATUS RECONSTRUCTION

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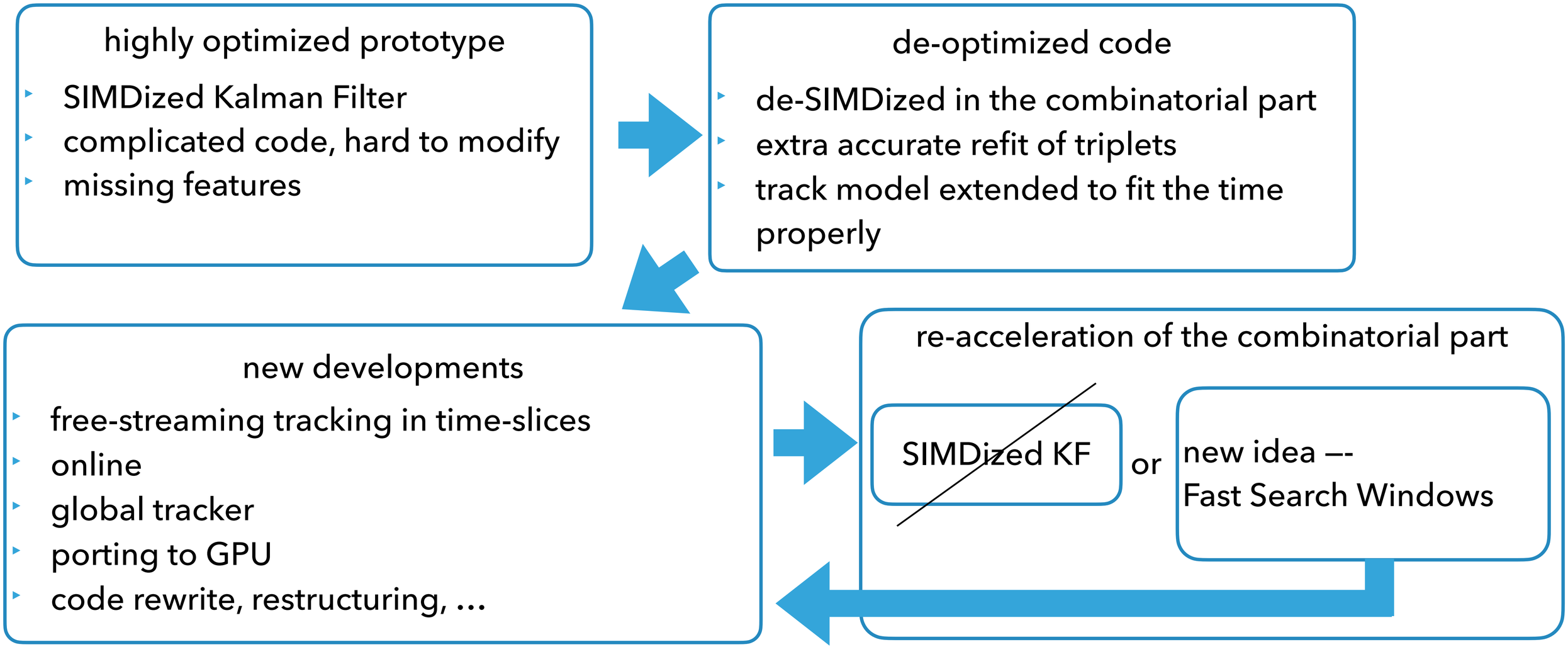
CA tracker development path



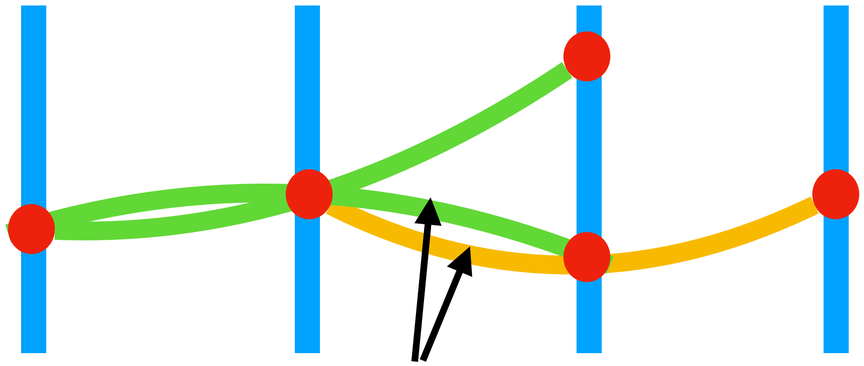
Ca tracker with the fast search windows

track category	last optimized	cbmroot master	Search Windows
LongFastPrim	99.8%	99.9%	99.9%
FastPrim eff	97.8%	98.2%	98.3%
FastSec eff	92.6%	94.9%	95.1%
Fast eff	97.2%	97.8%	98.0%
All tracks eff	91.0%	94.8%	94.4%
SlowPrim eff	85.6%	94.9%	93.5%
SlowSec eff	63.1%	76.0%	73.8%
Slow eff	77.8%	88.6%	86.9%
Ghost prob.	1.3%	0.5%	0.7%
Clone ratio	0.6%	0.4%	0.8%
Time/event	0.0078 s	0.0326 s	0.0089 s

matter of fine tuning

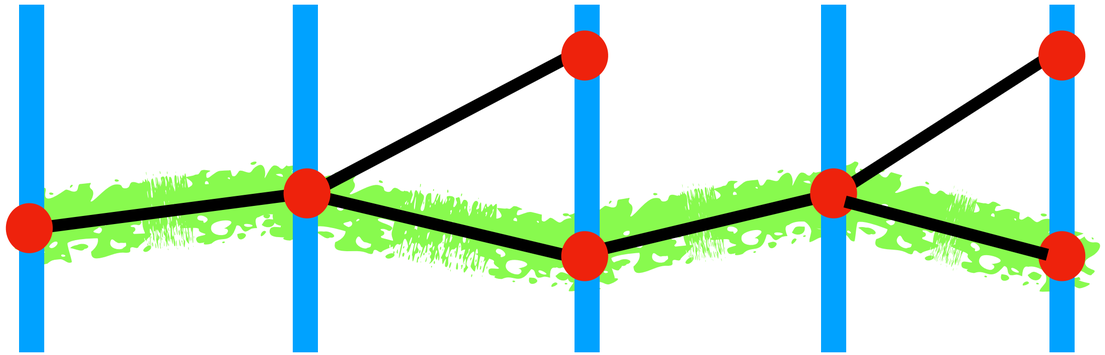
further speedup feasible

- STS-only setup, min. bias
- lxi110.gsi.de: AMD EPYC 7551
- „last optimized“ has efficiency problems. Nevertheless, it is fast.



link

(triplets may belong to the same track)

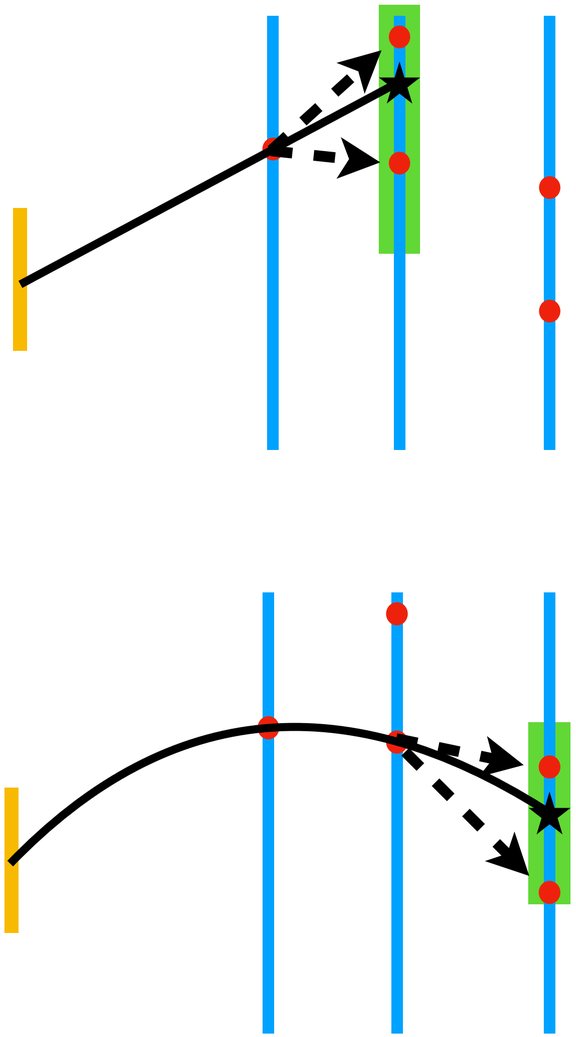


Triplet construction:

- Track following with the Kalman Filter

Search in combinatorial trees:

- Length and sum of triplet-match χ^2 for selection of the best track candidate
- Kalman Filter fit of the best candidate for the final quality check

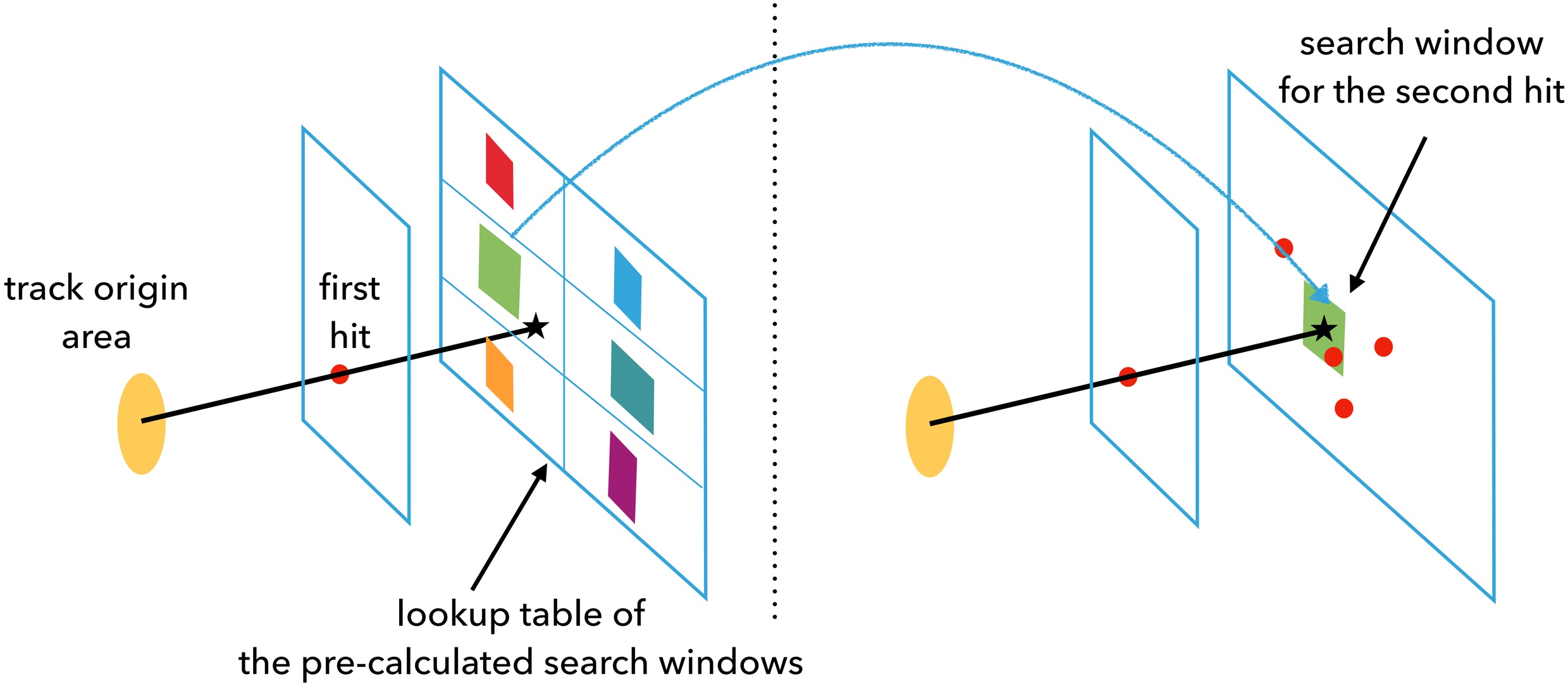


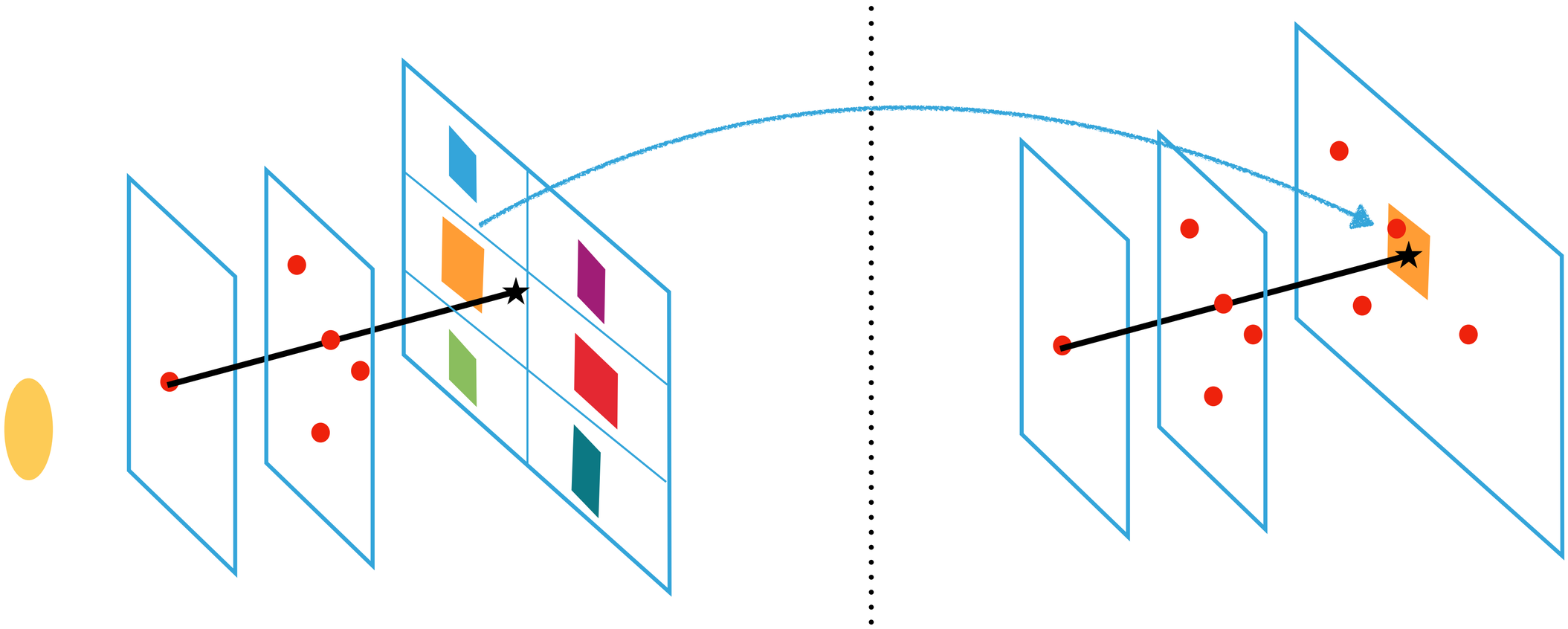
Triplet construction before:

- Track following with the Kalman Filter

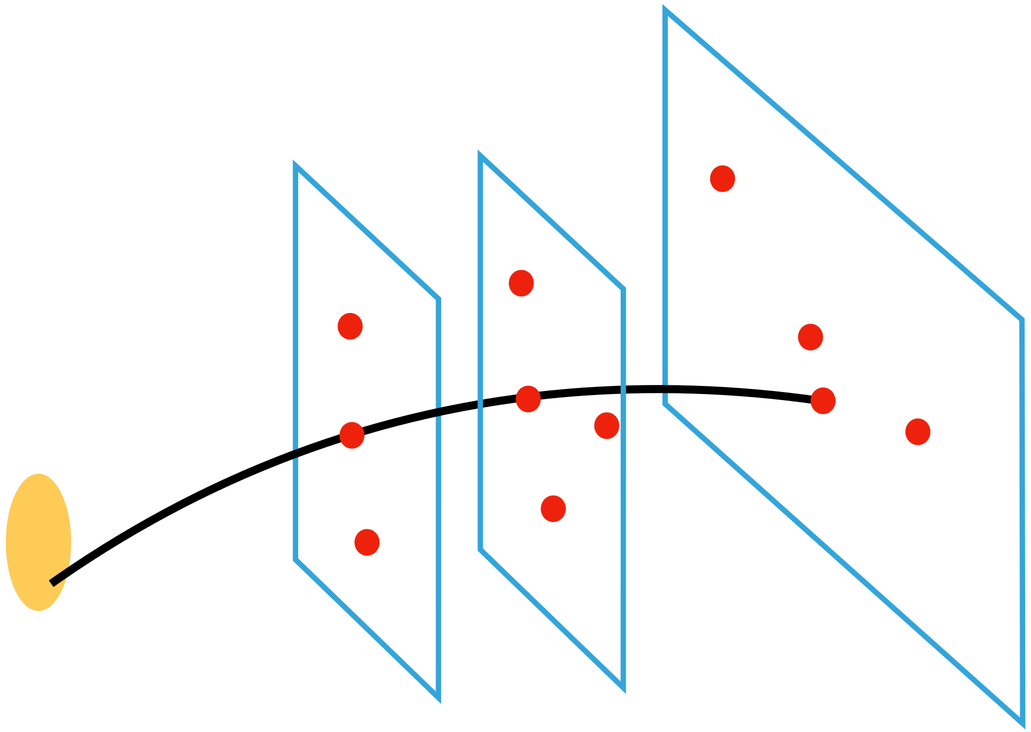
Triplet construction now:

- Fast search windows, **pre**-calculated with the Kalman filter


track origin
area
first
hit
lookup table of
the pre-calculated search windows
search window
for the second hit



the same scheme for the third hit



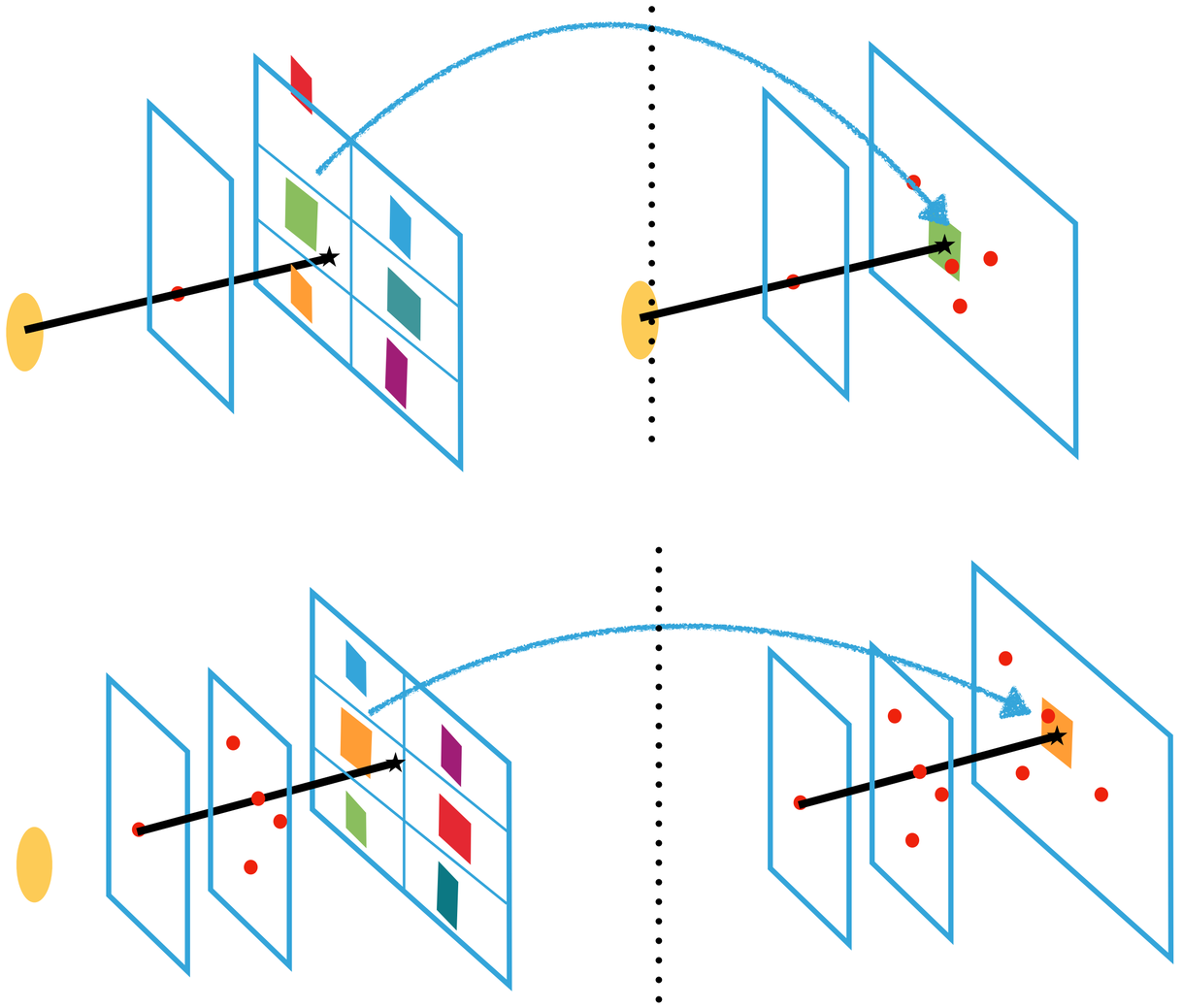
found triplets are fitted
with a simple fit:
chi2 in YZ, q/p in XZ
chi2 to the target

Simple Search Windows

Lighten the core by replacing the Kalman Filter with its pre-calculated results.

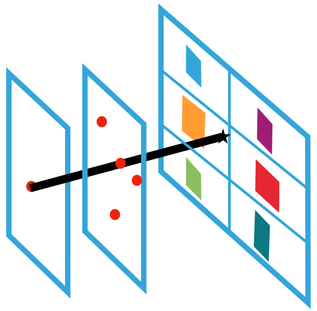
Advantages:

- extremely simple execution code,
  all the complexity is moved to initialization
- such code won't require SIMDization
- easy & efficient GPU porting
- easy to develop new features



Options for further speedup

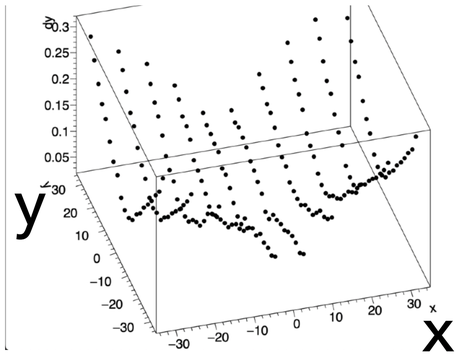
module	time	potential speedup	method
triplet construction	38.3 %	x 2 ??	adjust search windows to reduce combinatorics
triplet fit	12.9 %	x 3	SIMDization
track creation	29.5 %	-> 0	rewrite the old recursive algorithm
track fit	10.8 %	x 2	simplification
rest	8.5 %	x 1.8	code optimization



More ideas:

- more precise pointing (straight line -> curve in MF)
- more precise search windows (lookup tables -> polynoms)
- selective treatment of detector inefficiency
- optimize the clone merger: only important for MVD + STS setup
- focus on specific tracks (e.g. only ~fast ~primary tracks: x 2 faster)

search window size in Y



Important feature:

- Tracking can run in free-streaming mode, showing no degradation in speed or efficiencies

Other things to be done in tracking:

- replace the LIT tracker for the outer detectors
  - preparation work done (thanks S.Zharko & mCBM needs): the global setup is fully integrated into the CA framework, KF utilities are ready
- GPU version of the STS tracker
  - first port to GPU done by G. Kozlov. (port of the current deoptimized tracker).
- incorporate the TRD2D standalone tracking prototype
  - adjust it to the new CA core
  - include it to the new global tracking scheme w/o LIT

Reconstruction components before the tracking (see talk of S. Zharko):

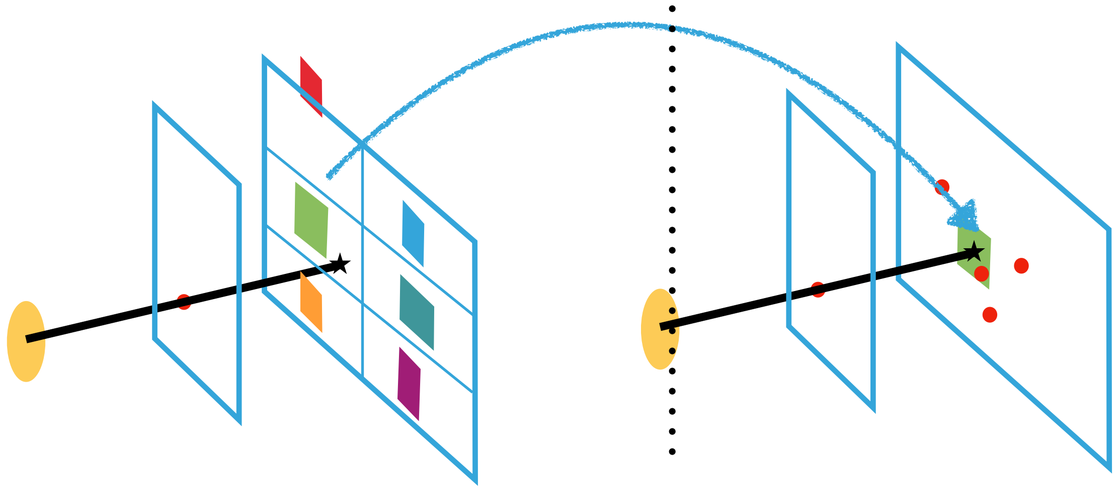
- all the hitfinders are covered with offline QA tasks
- STS, TRD, TRD2D, TOF, hitfinders are integrated into the online chain
- MVD, MUST hinfinders are in preparation
- BMON exists for mCBM, under development
- RICH reconstruction -> online: starting soon (see talk of Martin Beyer)
- MUCH, FSD hit finders - not yet online

Reconstruction components after the tracking

- Primary vertex finder
  - needs an inspection and port to the online chain
- Kalman filter utilities for track re-fit, propagation, and alignment
  - done, old code to be deleted
- KFParticle + Finder
  - integrated into the online library; the latest version has been ported to the official repository; the CBM-specific test suite is under development (V. Akishina)
- BBA alignment package
  - updated version with rotations, configs, coming soon (N. Bluhme, A. Senger)

Reconstruction components after the tracking

- Gamma-decay identifier
  - reconstruction of the second track of the electron+positron pair via the track following based on the first track
  - 80% done (S. Zharko)
- PID / event selection algorithms
  - none have been ported to the online chain so far
  - ongoing discussion on where to put them
- New online==offline data structures, setup representation, parameter handling, QA framework
  - (on a good track; see talk of S.Zharko)



Thank you for your attention!