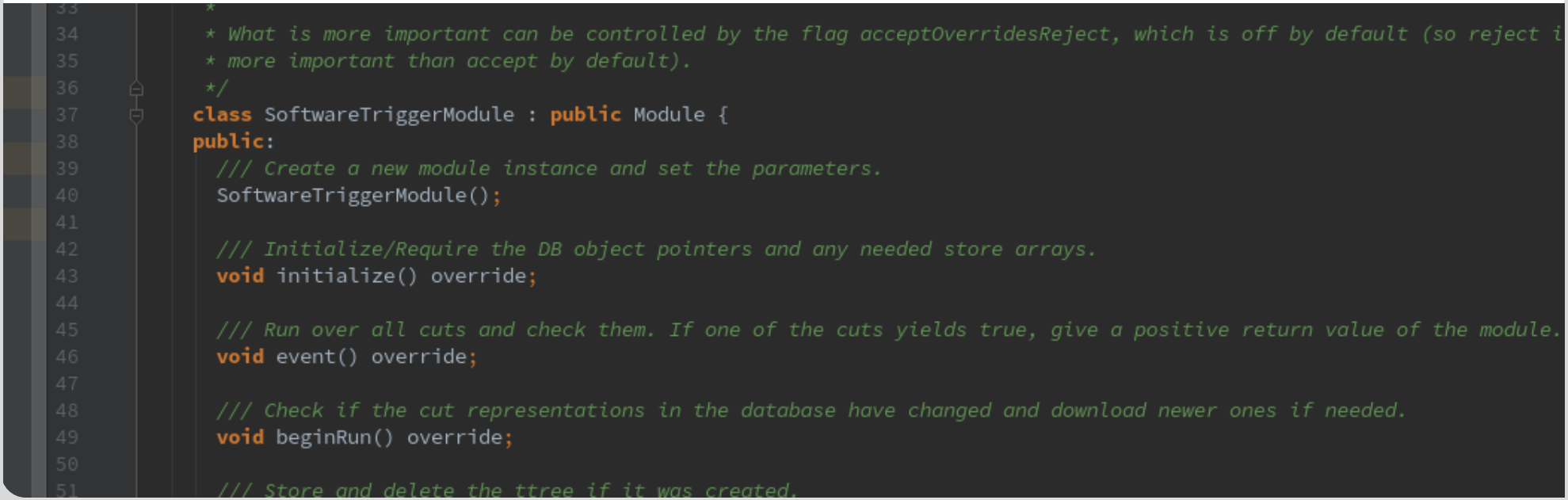
Karlsruher Institut für Technologie

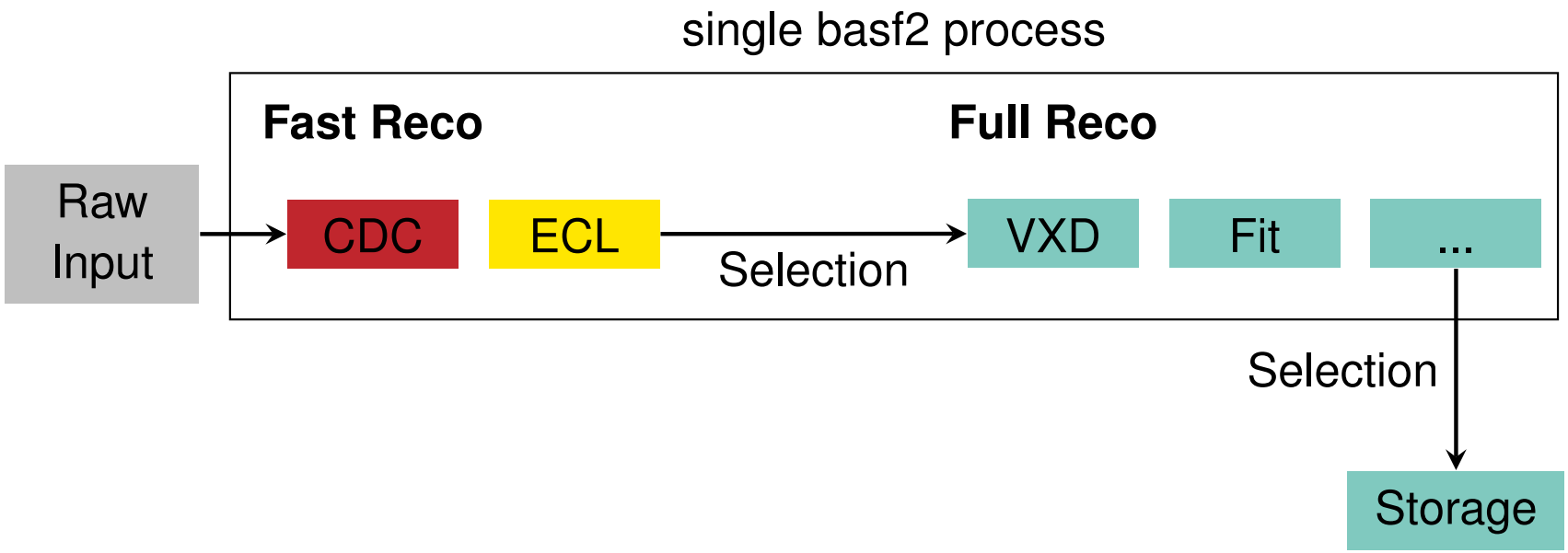
Phase 2 Readyness for Tracking at HLT

2017 Face 2 Face Tracking Meeting Mainz

Thomas Hauth | September 19, 2017



Software Trigger Processing Chain



Preparation of Online Reconstruction

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Fast Reconstruction

- As CDC and ECL algorithms are reused from the offline code, no special adaptations are required (and successfully used in Phase 2)
- The CDC track finding code uses MVA methods for background rejection which should be retrained with first measured background events

Full Reconstruction

- Alignment and calibration constants are loaded from the database
- Ensure the correct global tag is used and each sub-detector reconstruction will load the correct content
- Prepare a fixed software version (monthly build or specific release) used throughout data taking in phase 2 to ensure reproducibility of the trigger decision

Both reconstruction stages need to be tested and validated on the Phase II geometry.

VXDTF 2 Integration

- The rewritten track finder for the VXD (named VXDTF 2) is now available in the release
- Online ROI for PXD relies on the SVD tracks found via the VXDTF 2 on the HLT machines
- It has a superior performance and will replace the old VXDTF 1 in the near future
- VXDTF 2 needs to be integrated into the online reconstruction chain
  - First tests show runtime btw. VXDTF 1 and 2 close, but might be different for the relevant channels in the online use-case
  - Memory consumption of VXDTF 2 needs to be understood to be a ”good citizen” on the HLT nodes

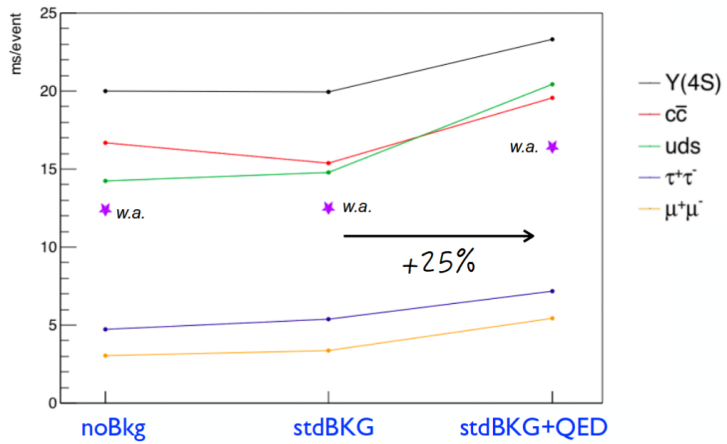
Open Questions:

- Which sector map will be used (has implications also on memory consumption)?
- Is a training of a sector map for the phase 2 geometry available (even if not the final one)?

Region-of-Interest Finder

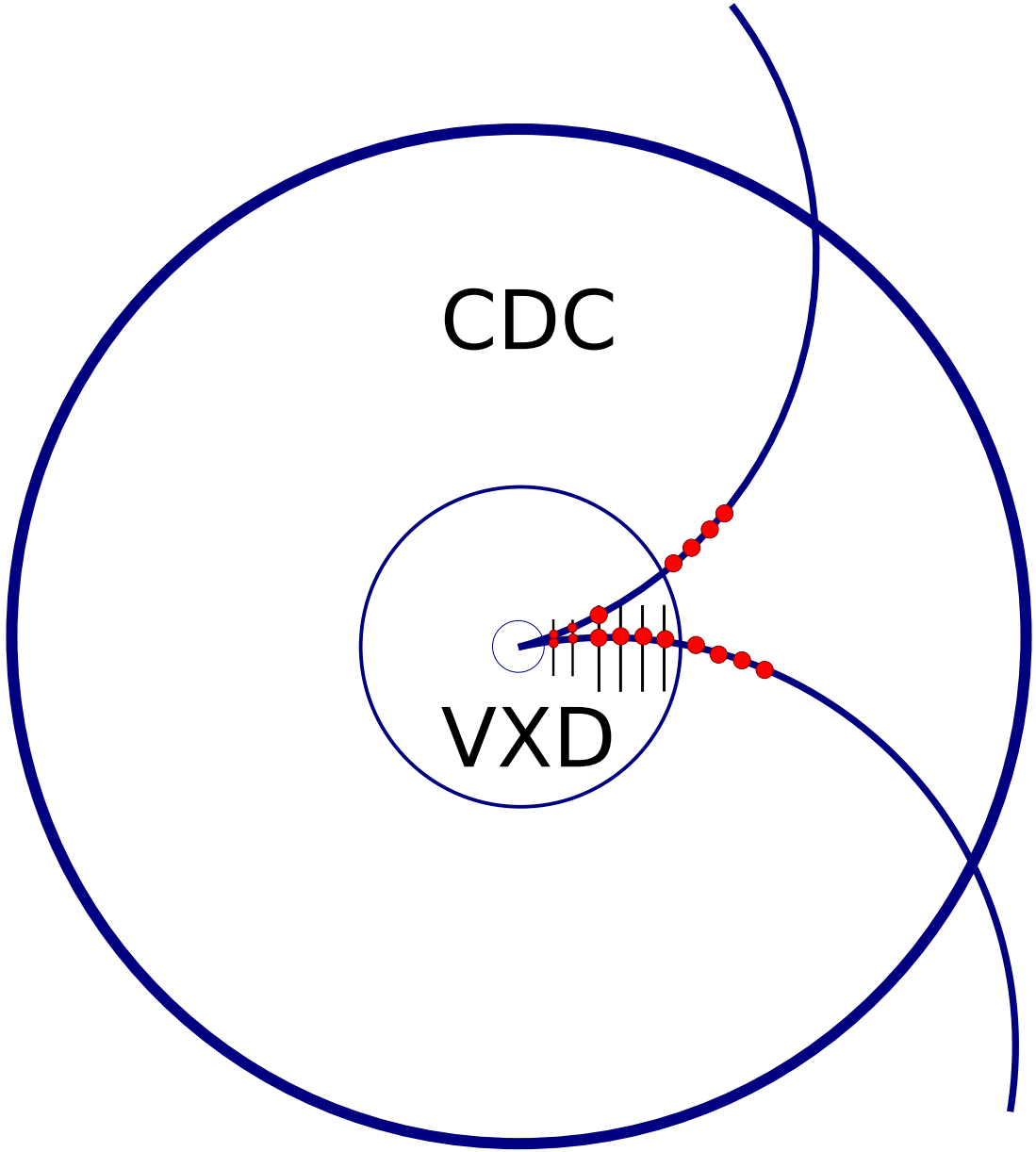
- Important software component to decide (based on SVD tracks) which part of the PXD sensor is read out
- Implemented by the `PXDDataReductionModule` and extensively tested at DESY testbeams in the past
- Runtime of this module was optimized by Giulia Casarosa and is now runtime below 25ms

  Open Questions:
- Will we always read-out all PXD hits?
- Do we need ROI generation of tracks with hits in the PXD but not (or too few) in the SVD?



`https://kds.kek.jp/indico/event/24276/session/2/contribution/56/material/slides/0.pdf`

Phase II Detector and Track Intercepts



Relevant Software Trigger Channels

	Cross Section (nb)	Background
BB	1.1000	False
BB charged	0.5643	False
BB mixed	0.5357	False
$B \to J/\psi K_s ee$		False
$B \to \nu\nu$		False
$B \to \pi_0\pi_0$		False
$B \to \rho_0\gamma$		False
Continuum ($s\bar{s}$)	0.3800	False
Continuum ($d\bar{d}$)	0.4000	False
Continuum ($c\bar{c}$)	1.3000	False
Continuum ($u\bar{u}$)	1.6100	False

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Relevant Software Trigger Channels

	Cross Section (nb)	Background
$ee \to ee$ (Bhabha)	74.4000	(False)
$ee \to eeee$	39.7000	True
$ee \to ee\mu\mu$	18.9000	True
$ee \to \gamma\gamma$	3.3000	False
$ee \to \mu\mu$	1.0730	False
$ee \to \pi\pi$		False
$ee \to \tau\tau$	0.9000	False
$\tau \to$ 1 prong 1 prong		False
$\tau \to e\gamma$		False

The numbers are taken from 'Overview of the Belle II Physics Generators' by P. Urquijo and T. Ferber.

FastReco

Idea: Run the the ECL reconstruction and the Legendre-based CDC track finding first

- Only around 10% of the runtime of the full reconstruction chain
- Produces ECL clusters and tracks, which can be used to reject the most copious background sources, esp. Bhabha radiation

The following variables are used for cuts after the FastReco

- energy sum of high energetic ECL ($> 0.05 GeV$)
- highest 2 ECL cluster energies summend, highest 3 ECL cluster energy summed
- max p_t in event
- mean(abs(z))
- mean(θ)