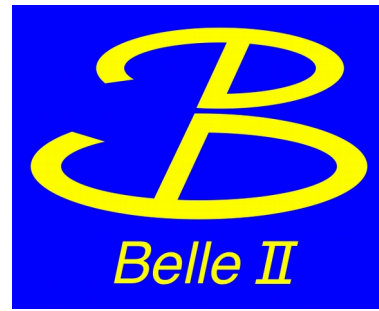




MAX-PLANCK-GESELLSCHAFT



Summary of the F2F tracking meeting

Vienna, April 22nd – 23rd

And very few other things

Luigi Li Gioi

Max-Planck-Institut für Physik, München

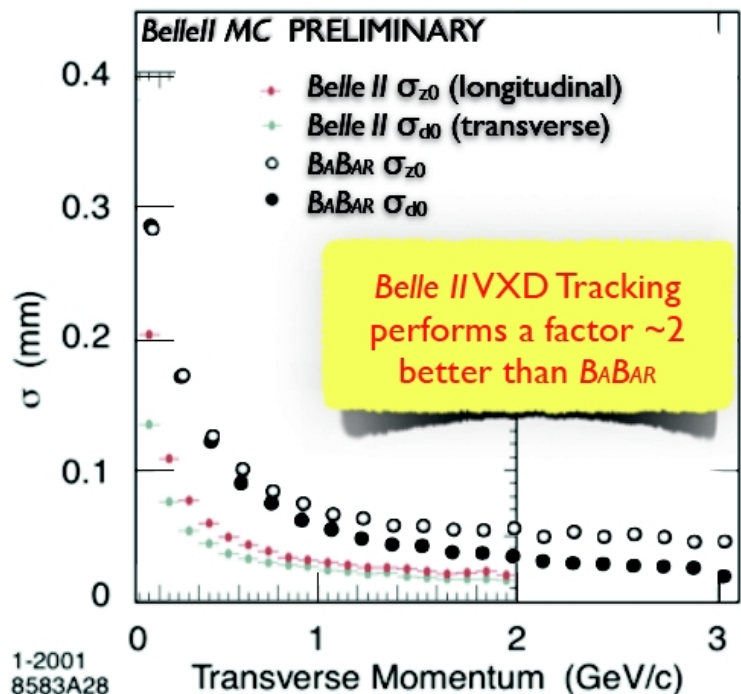


Max-Planck-Institut für Physik
(Werner-Heisenberg-Institut)

19th International Workshop on DEPFET Detectors and Applications
Kloster Seeon, May 11th 2015

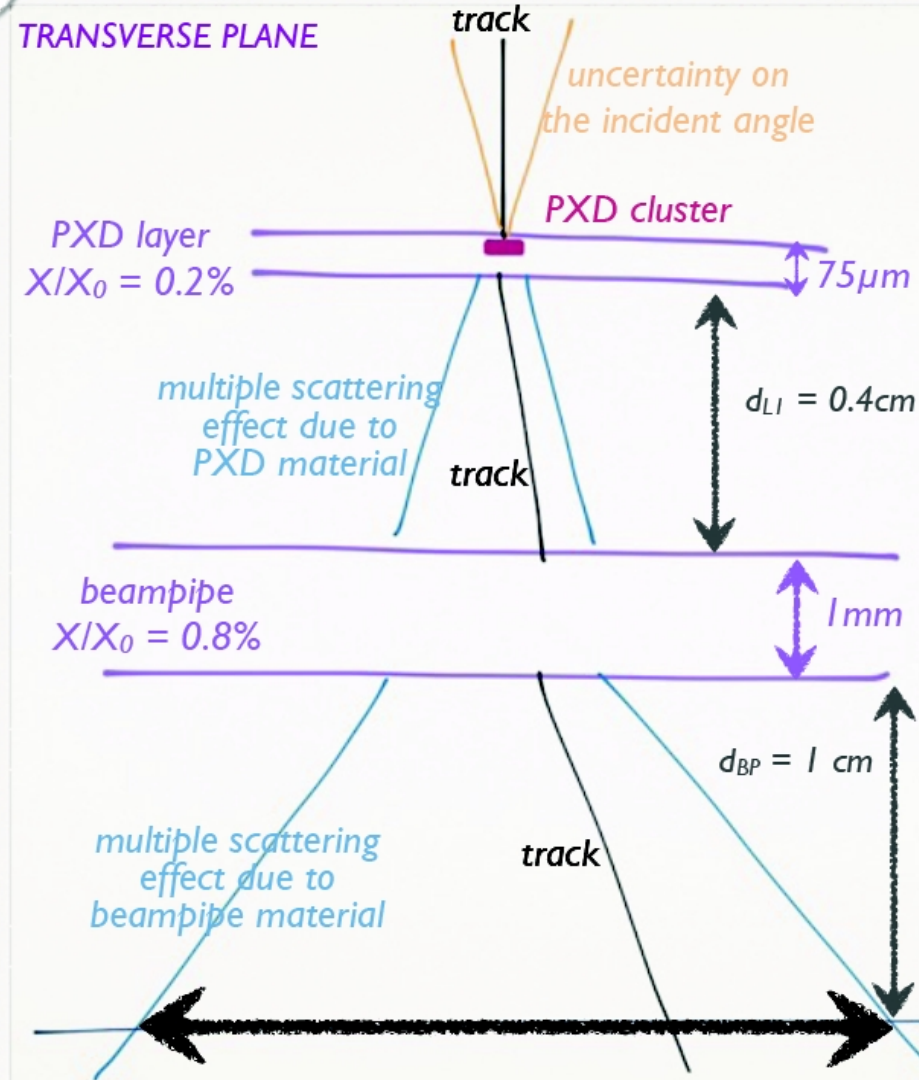
VXD tracking

G. Casarosa



naively, the uncertainty on the longitudinal impact parameter (z_0) is due to:

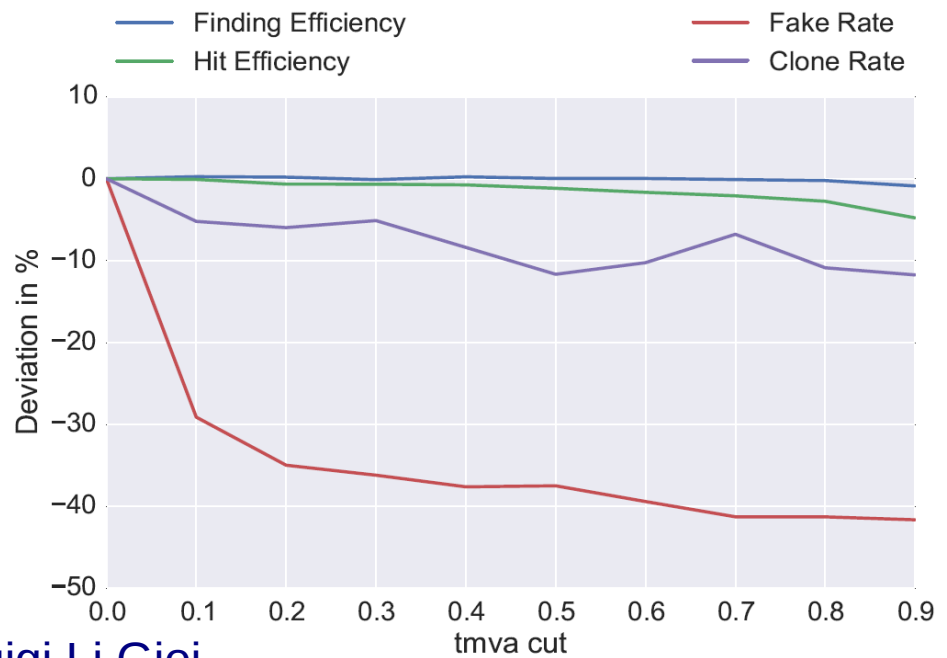
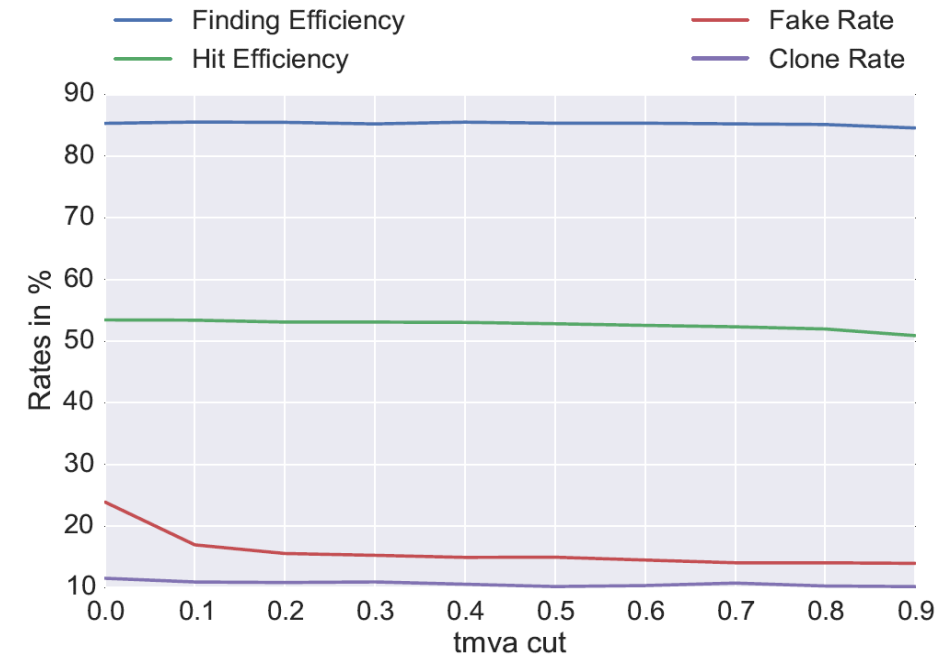
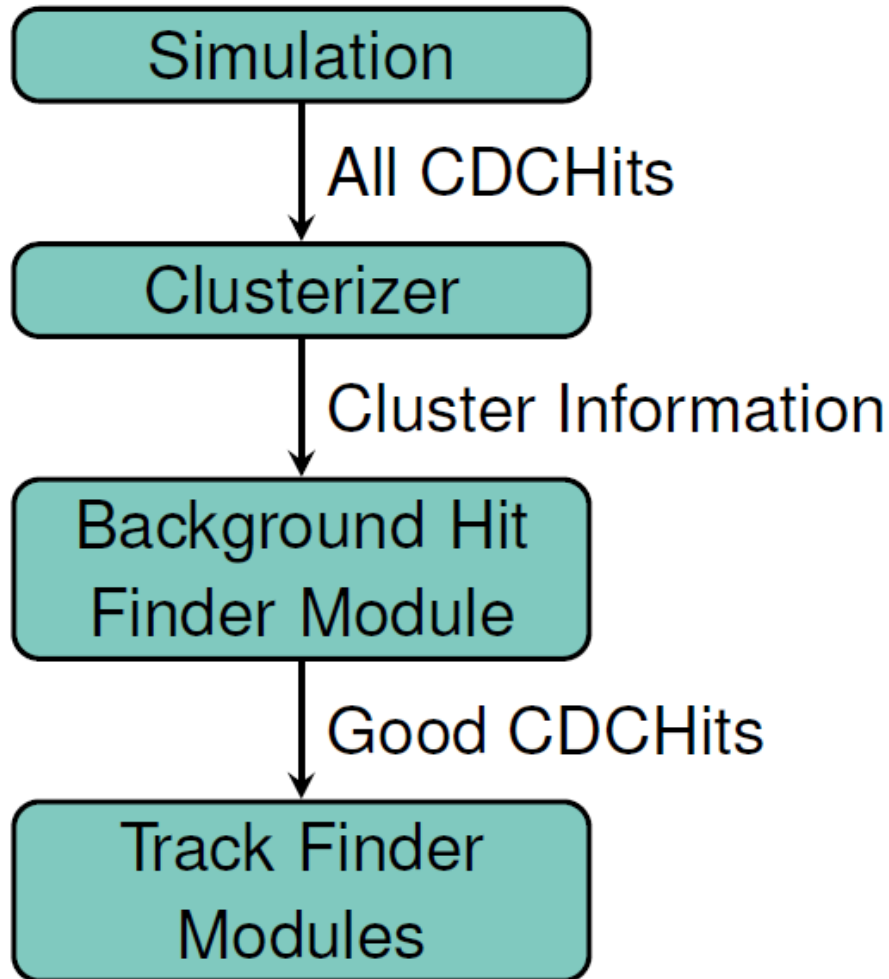
- ▶ hit position
 $\sigma_{\text{hit}} \approx \text{pixel pitch} / \sqrt{12} = 75\mu\text{m} / \sqrt{12} \approx 20\mu\text{m}$
- ▶ multiple scattering from material
 $\sigma_{\text{MS}} \approx d \theta_{\text{MS}} \propto d_{\text{LI}} \sqrt{X/X_0}$
 $\sigma_{\text{MS}} (\text{layer I}) = 32\mu\text{m}$ (for a 1 GeV pion)



NOTE: the cartoon is not to scale

CDC Background hit finder

N. Braun

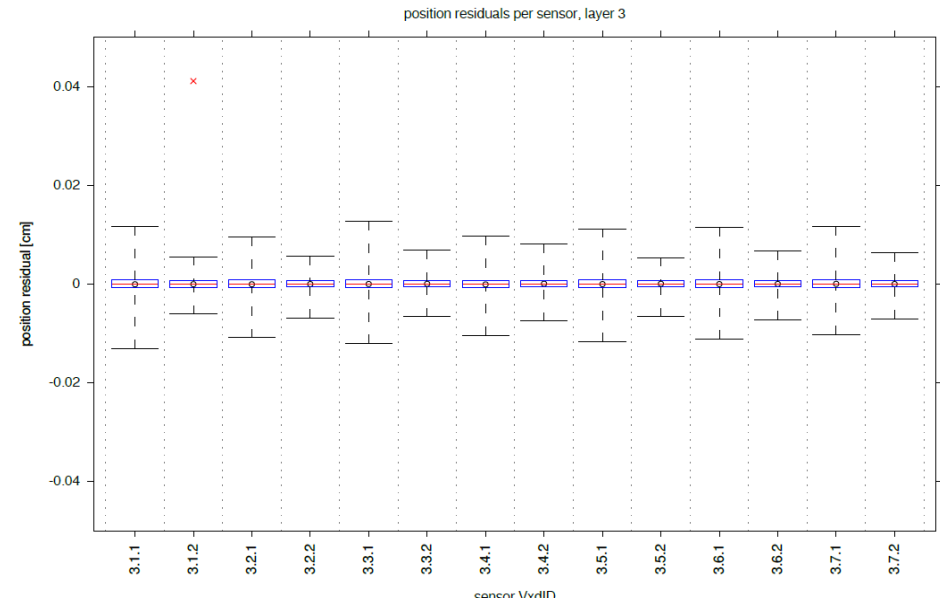


SpacePoint and TrueHit connection

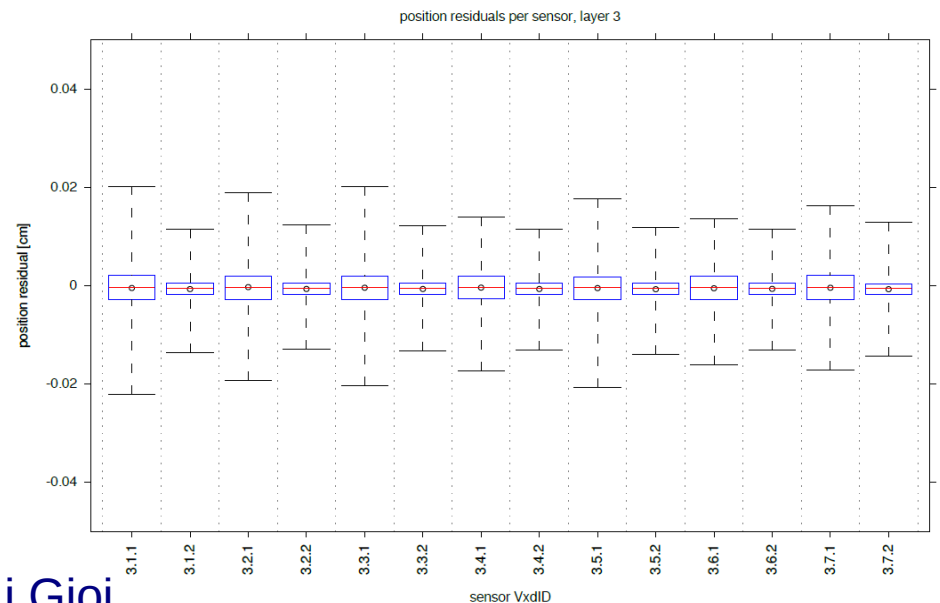
T. Madlener

- **Initial idea:** relate SpacePoints and TrueHits
 - > make MC information easily available for SpacePoints if needed
- **Problem:** not so straight forward as anticipated
- **Idea:** Check the positions of both, when we already have both of them at hand
 - > Possibility of discovering some hidden issues
 - > Position is the only information stored in SpacePoint (at the moment)

distribution per sensor, layer 3 U new Digitizer



distribution per sensor, layer 3 V new Digitizer

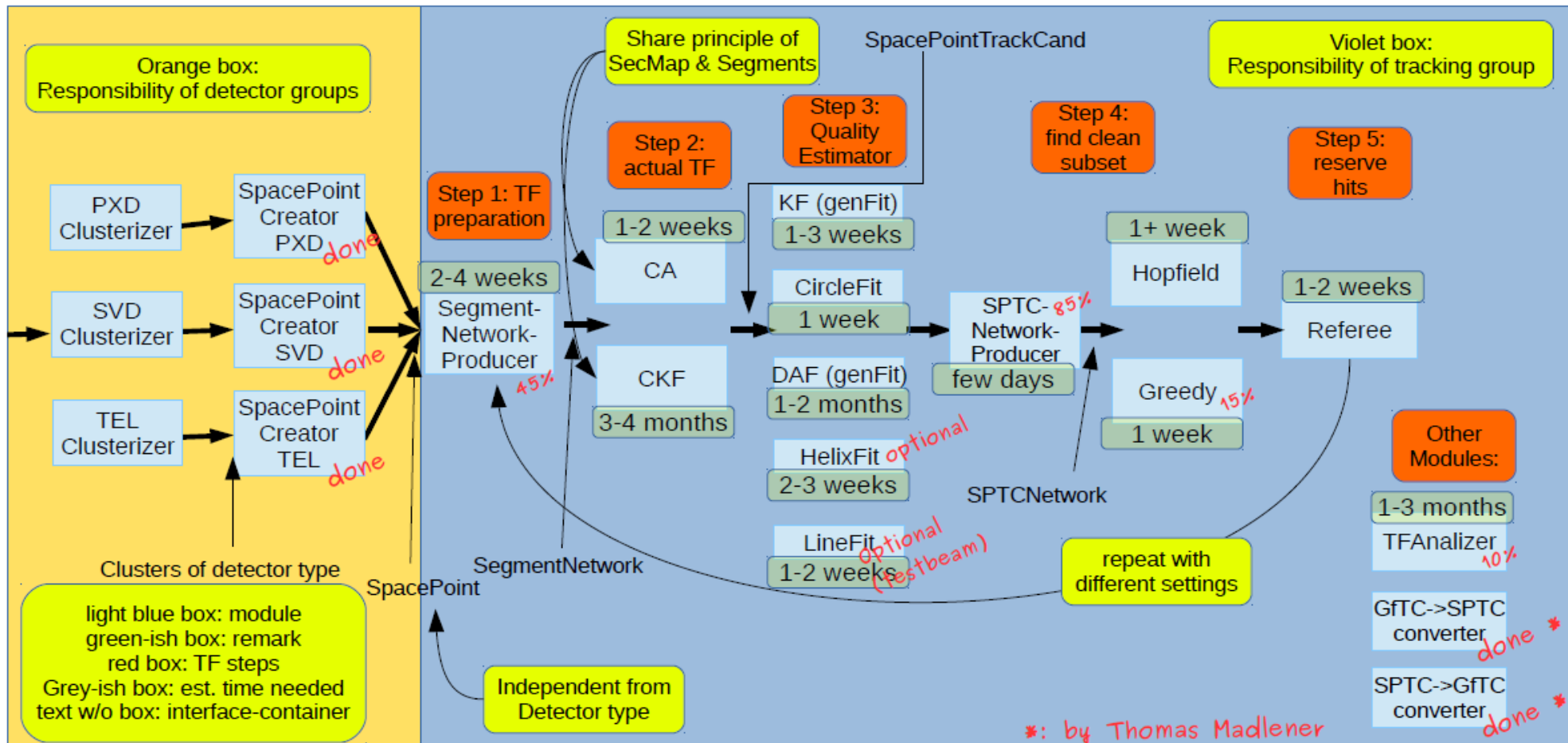


- Position Residuals do look reasonable
- Pulls seem off → looks like this is because of error estimates
- There seem to be errors in the SVD that are larger than the digital resolution
- Small errors seem underestimated, large errors seem overestimated
- Errors seem quantized some how → bug or feature?

VXD Track Finder

J. Lettenbichler

Future state of the trackFinderVXD-approach (event-part)

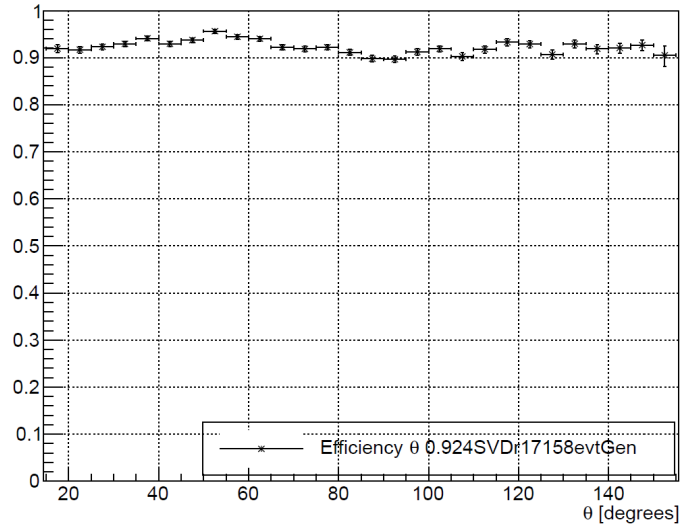
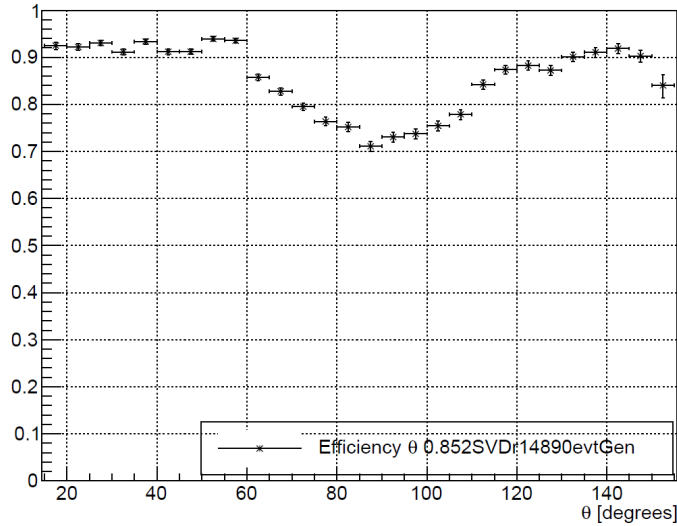


- done, but not directly listed above: observers (2-hit), B3Vector3, Filters
- estimated time needed for essential stuff: 8-15 months, redesign only: 4-9 months

VXD-TF: θ 90 efficiency issue fixed

J. Lettenbichler

Wrong default noise level/clustering cuts

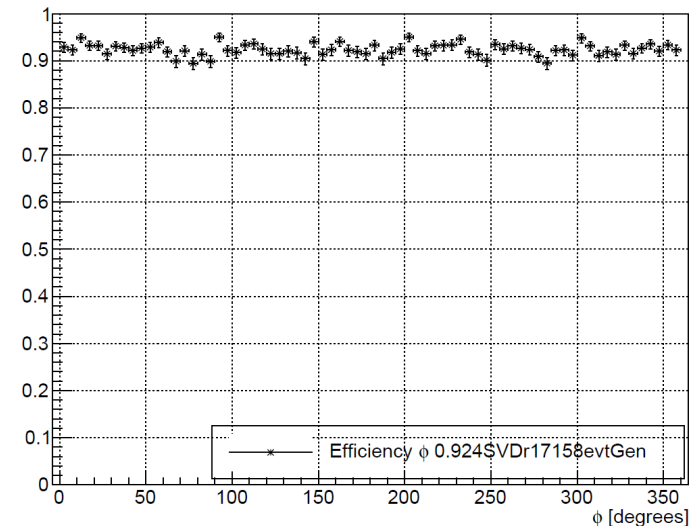
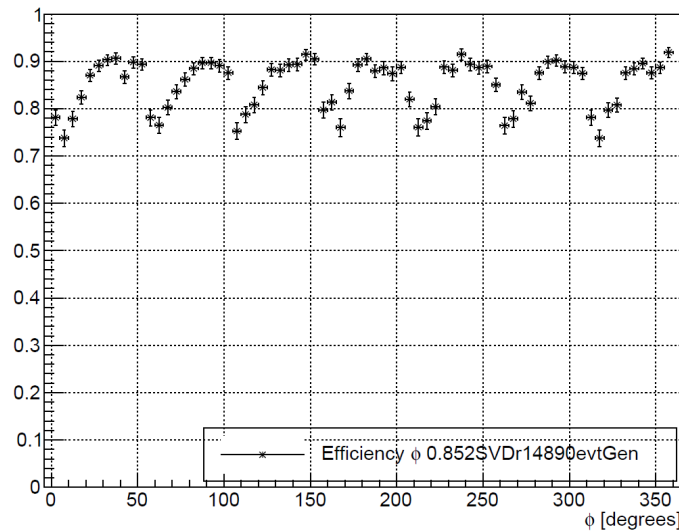


Efficiency of θ

Before the fix

After the fix

Efficiency of ϕ



Genfit: New P-value distribution

T. Schlüter

Ever since we introduced the new CDCRecoHit which has the realistic translators, P -values looked bad.

- ▶ Ozaki-san found that this is due to the mirror hits being mixed up
- ▶ which leads to small additional errors on them ($x-t$ relation different for mirror hits).

The reason: the L/R flags aren't documented and GENFIT's coordinate system made a different choice.

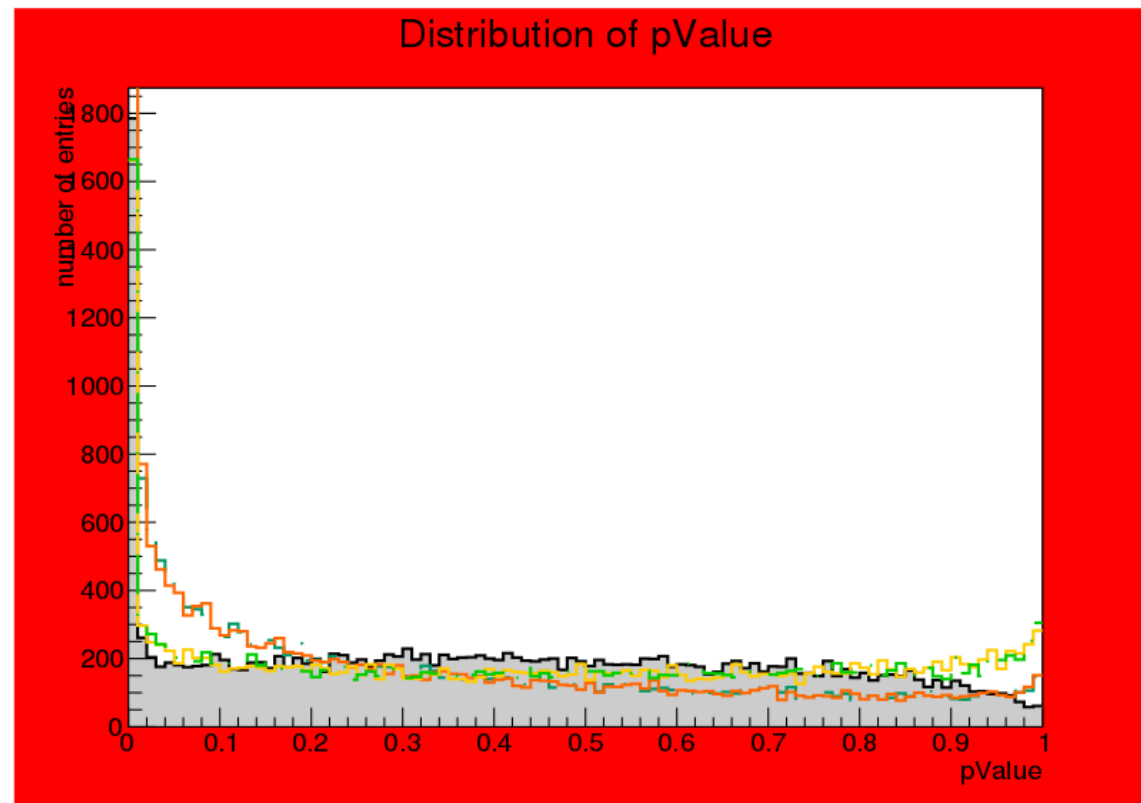
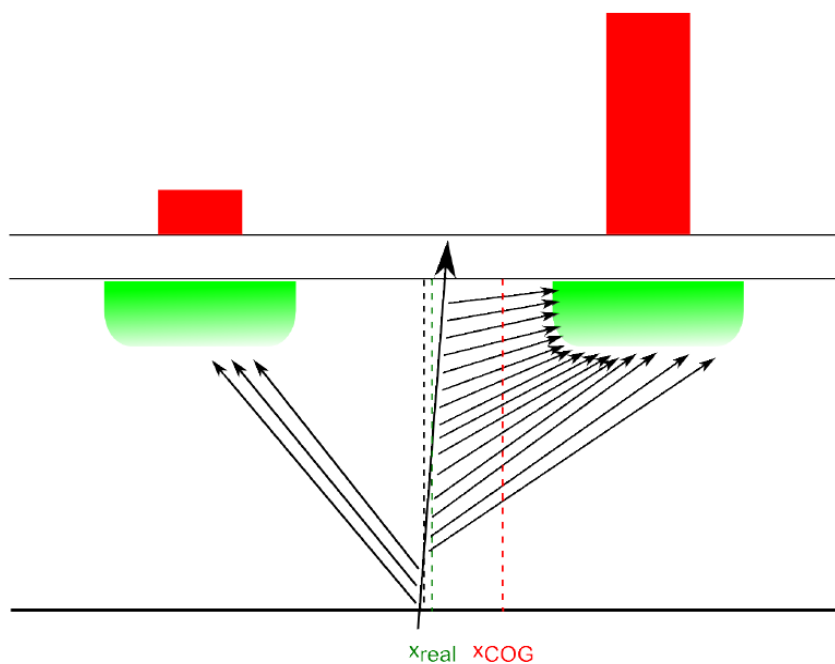


Figure: P -value distribution. Yellow and light green: fixed. Other colors: previous builds. Black: reference.

Plan for η correction

M. Valentan

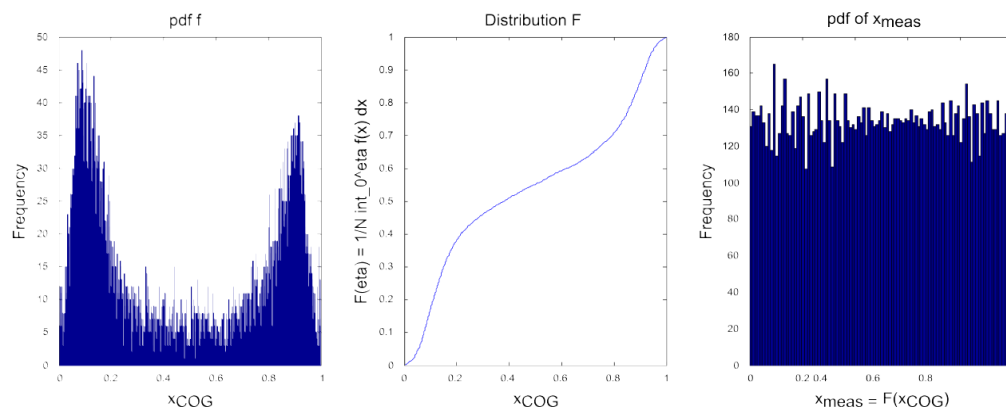
Correction of systematic measurement bias



Assumed benefits

- more reliable single tracks
not only statistical average
- better vertex fit
otherwise could be up to pitch/3 off
- improved fit quality
data better matches model

p values



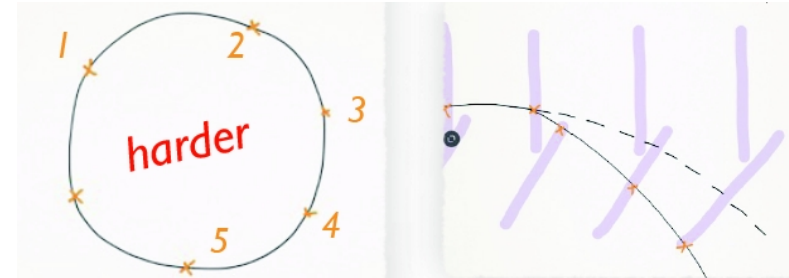
Tracks efficiency

G. Casarosa

- Develop a module to be placed after the TrackFinderMCTruth that produces 3 subsets of MCTrackCands:
 - tracks easy to find \rightarrow easyMCTrackCands
 - tracks hard to find \rightarrow hardMCTrackCands
 - tracks very hard to find \rightarrow veryhardMCTrackCands
- Estimate our pattern recognition efficiencies on the three lists separately

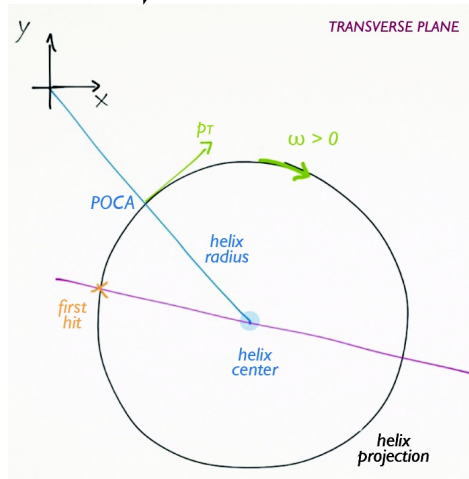
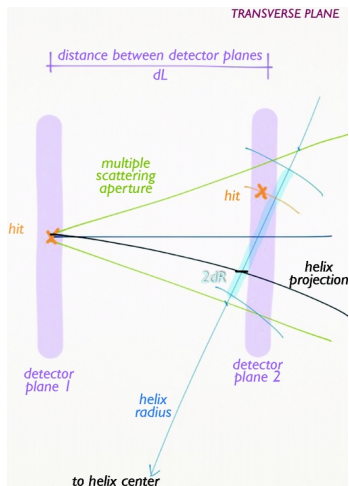
- kinks & large multiple scattering
- ⊙ tracking volume covering only partially the helix
- ⊙ hits in both outgoing and ingoing helix arms

2 criteria to reject non-easy-to-find MCTrackCands

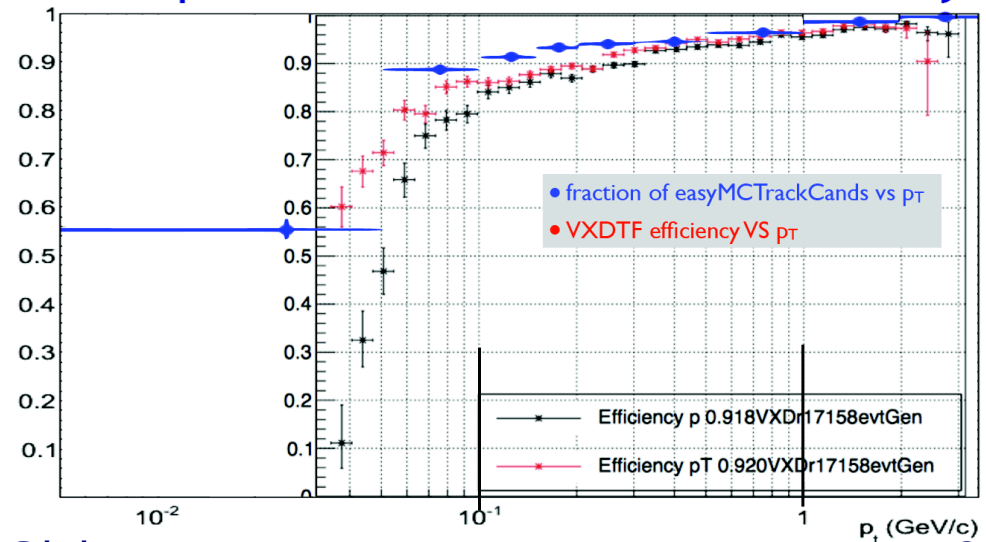


given the curvature ω and the relative position between the first hit and the helix center, predict the semi-plane where the next hit is expected to be

predict the position of the next hit on the expected detector plane, taking into account multiple scattering



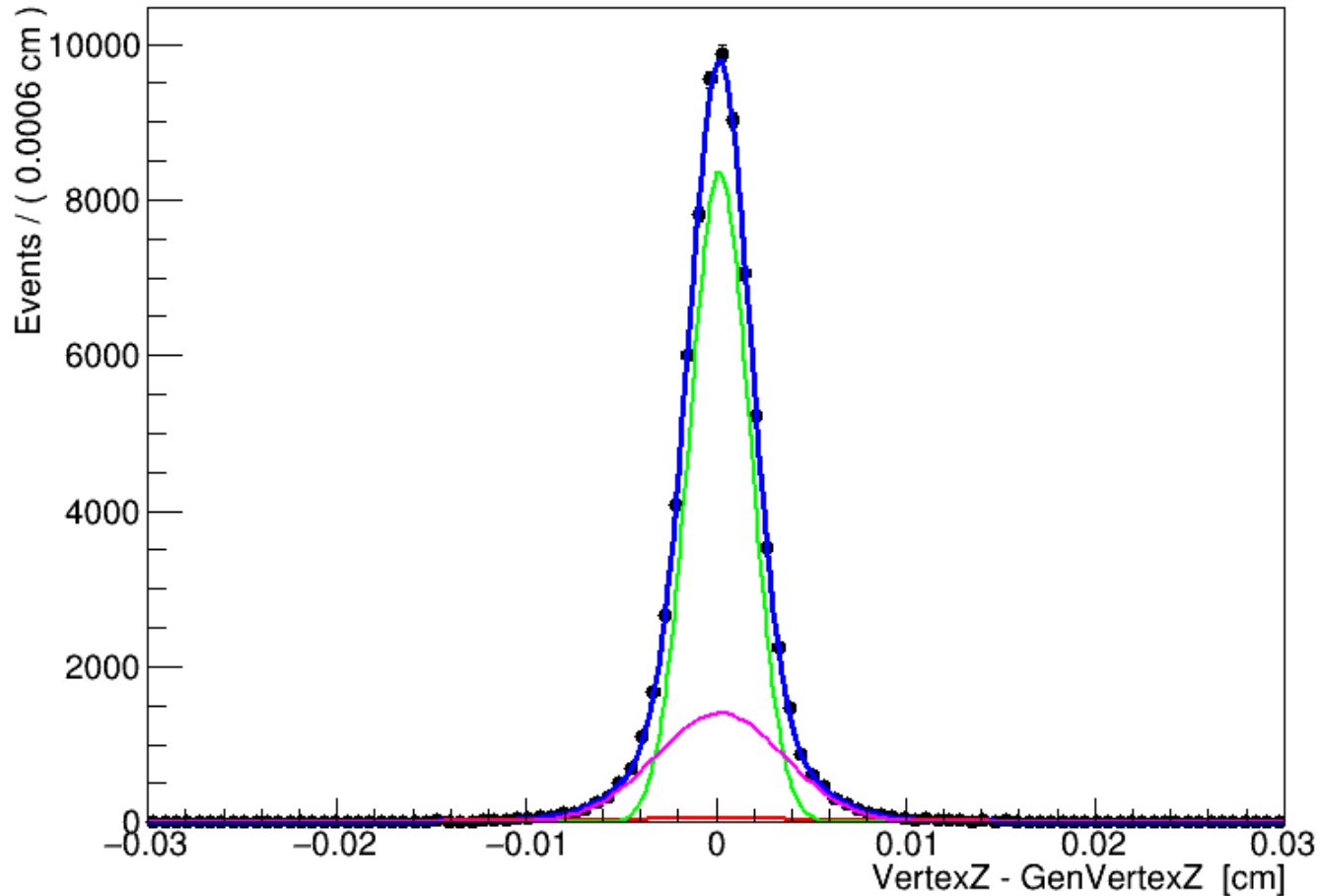
Comparison with the VXDTF efficiency



Vertexing

L. Li Gioi

Vertex: $J/\psi \rightarrow \mu \mu$

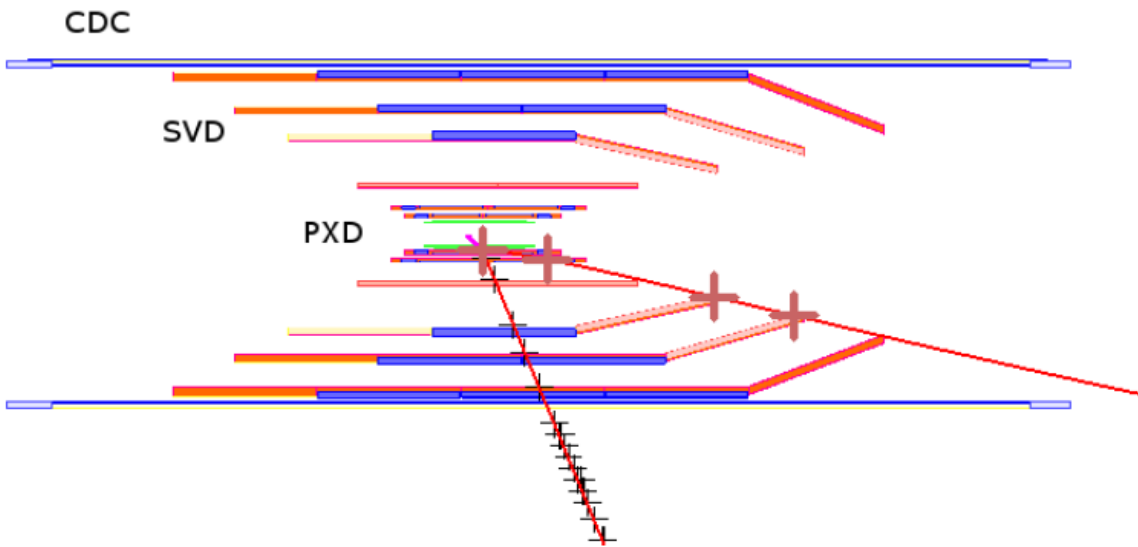


- Shift = 1.9 μm
- Resolution = 23 μm

Efficiency (both μ with at least one PXD hit) = 92.9 %

Non-prompt PXD Hit Rescue

L. Koch



- Only two hits in SVD
- \Rightarrow no ROI \Rightarrow PXD hits not stored
- Enough VXD hits for tracking

The Idea

6-Layer tracking for hit recovery

Platform:

FPGA

Track finding:

- 1 Filter out the background-like VXD hits
- 2 Choose hits in 3rd VXD layer as reference point for conformal transformation (secondary vertices)
- 3 fast hough transformation only with hits "fitting" the reference hit

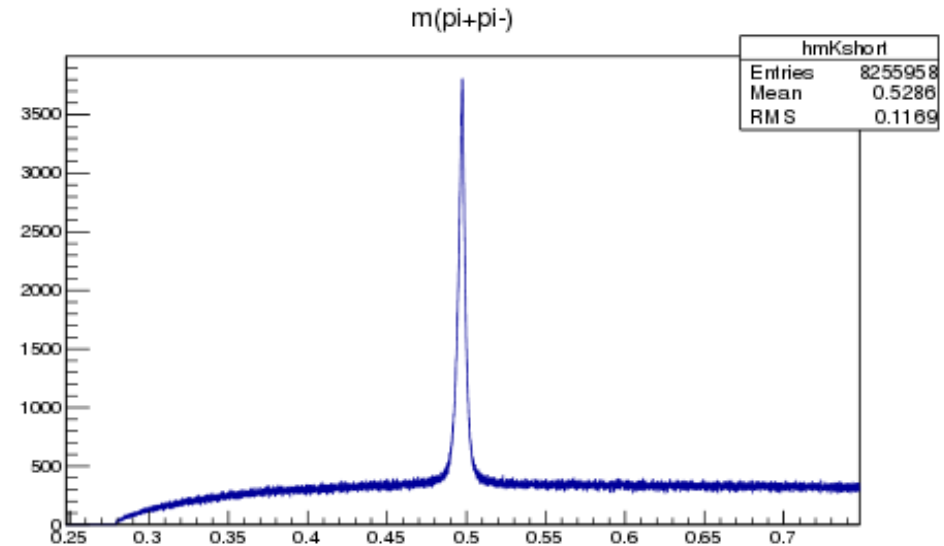
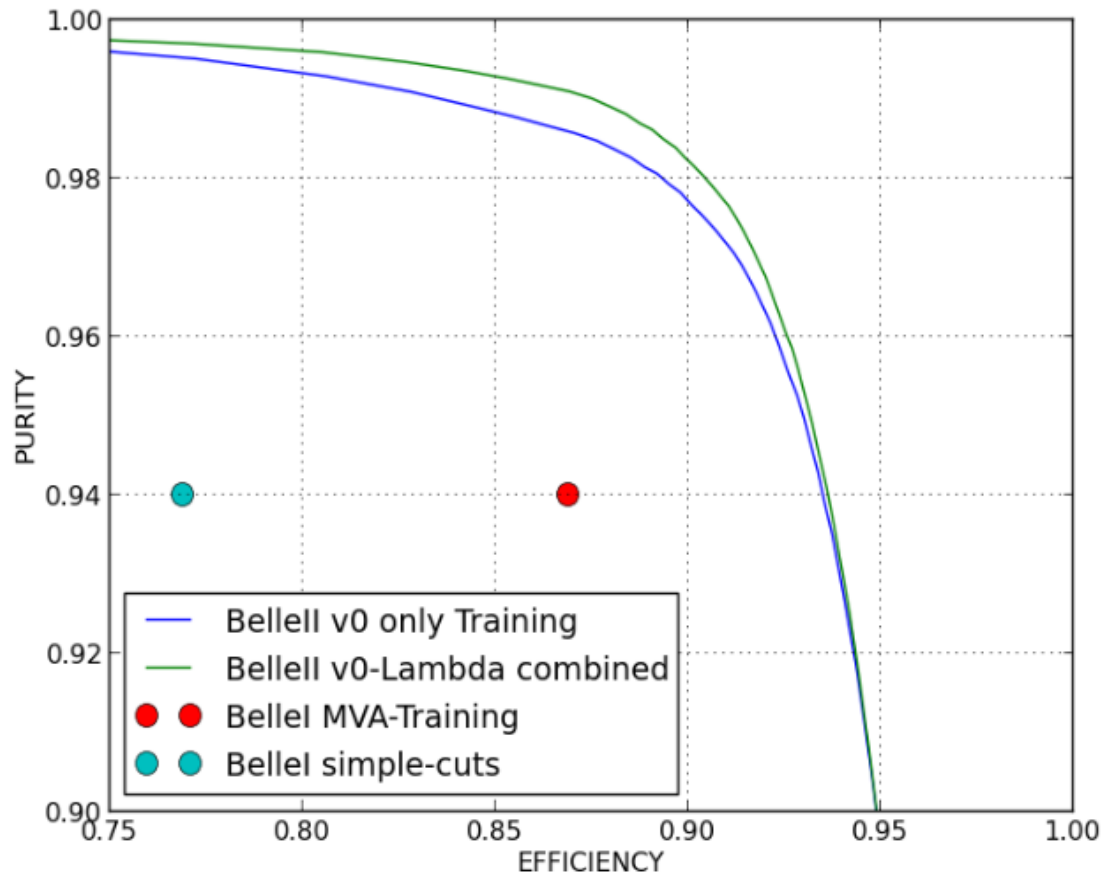
Definitions

- trackable $\hat{=}$ ≥ 3 SVD hits
- lost $\hat{=}$ < 3 SVD hits
- only 6-layer trackable $\hat{=}$ < 3 SVD hits & SeedCharge_{PXDhits} < 45 & $\geq 3(4)$ VXD hits

830372 π^{\pm} s

- 736315 trackable (89%)
- 94057 lost (11%)
- 5363 only 6-layer trackable (3 hits) (0.65%)
- 2286 only 6-layer trackable (4 hits) (0.28%)

Ks reconstruction



Training	ϵ	<i>purity</i>
b2-goodKS	93.6%	94%
b1-MVA	86.9%	94%
b1-cuts	76.9%	94%

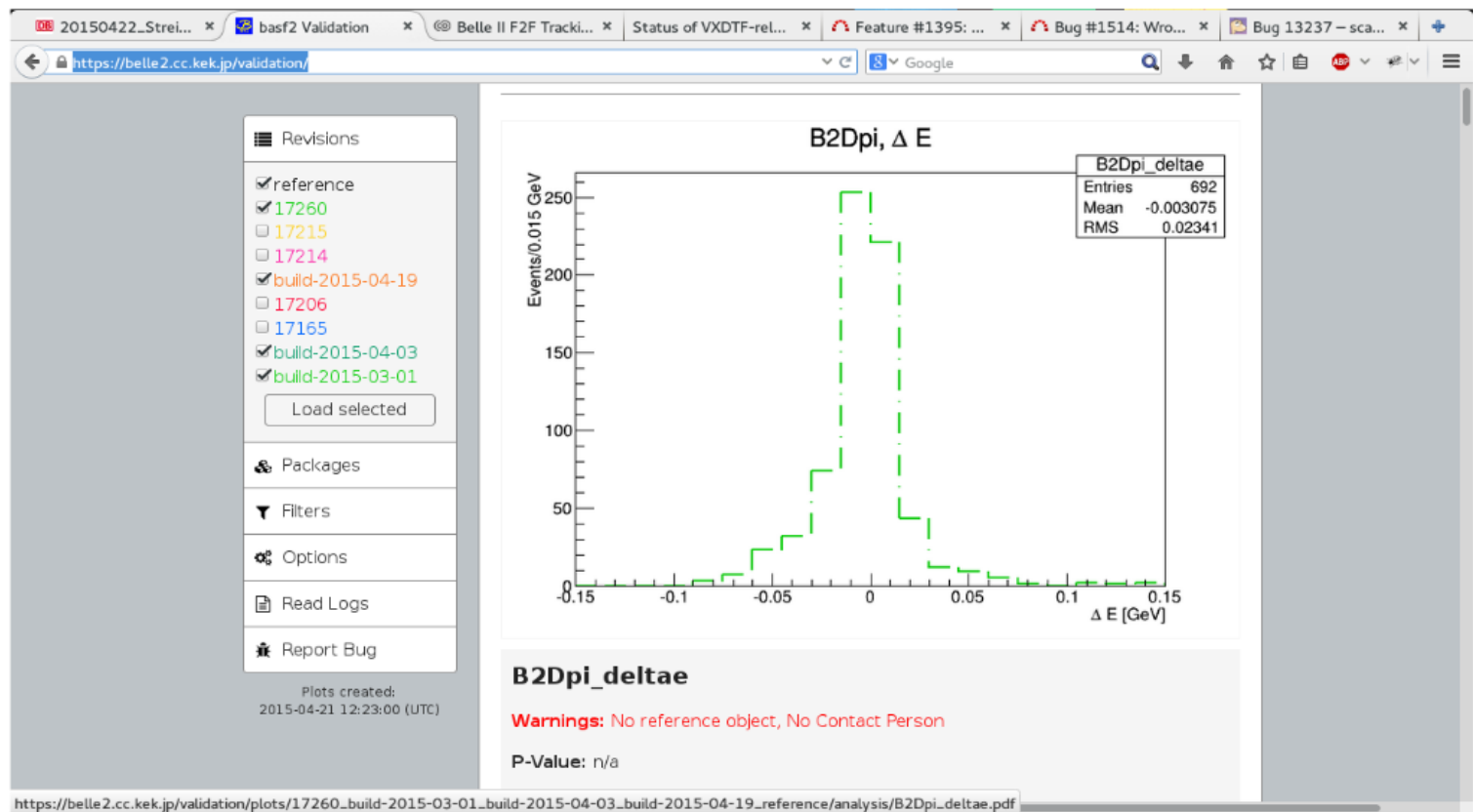
Ks efficiency improvement:

- Larger vertex detector acceptance
- New algorithm

Validation website

T. Hauth

<https://belle2.cc.kek.jp/validation/>



Summary

- Tracking performance is quite improving
- The VXDTF is undergoing a major re-engineering of the code.
- Interesting tasks are still available in tracking



Next F2F tracking meeting:
Karlsruhe, September 1st – 2nd 2015