SVD Commissioning cosmics analysis

PRELIMINARY RESULTS

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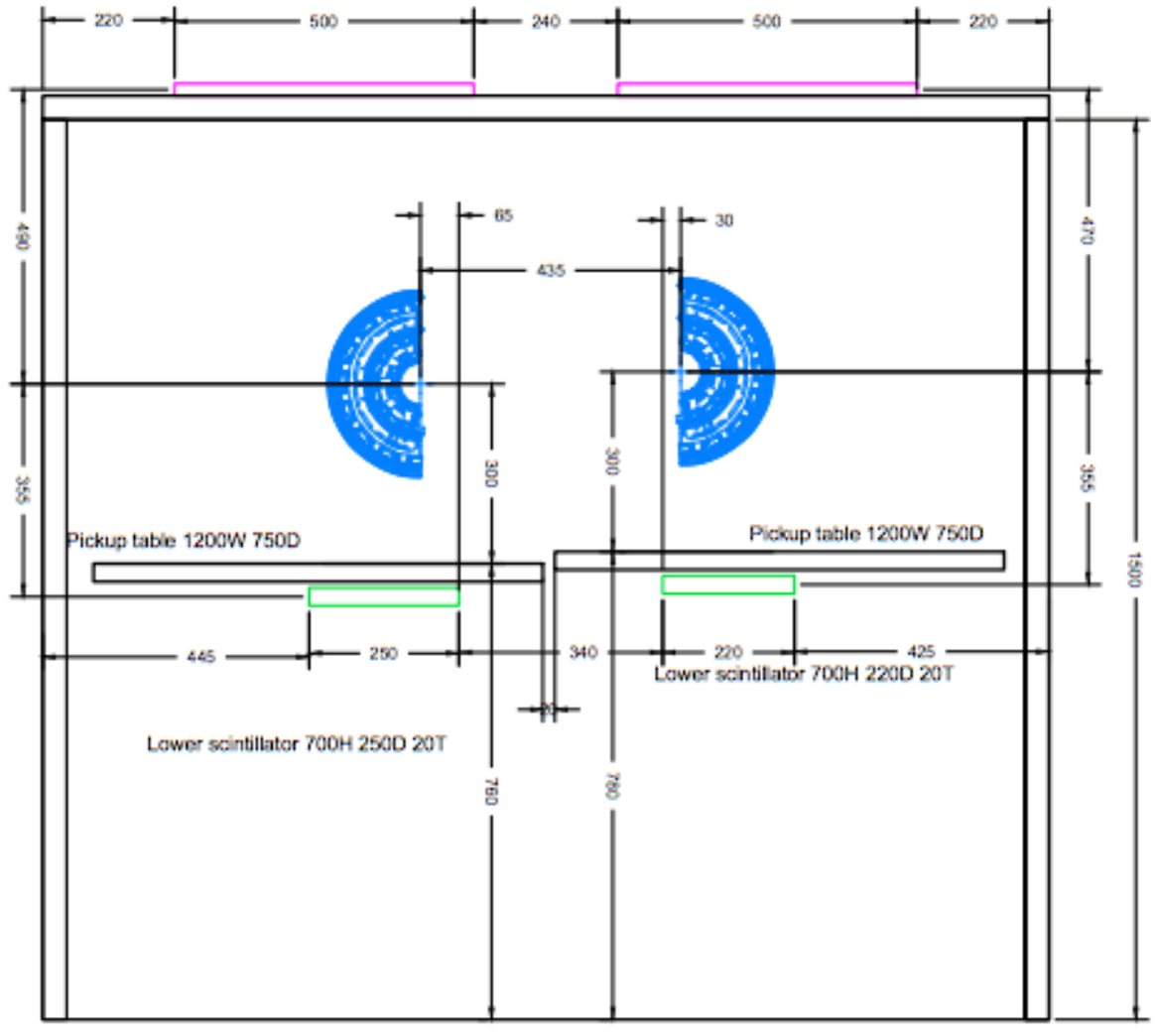
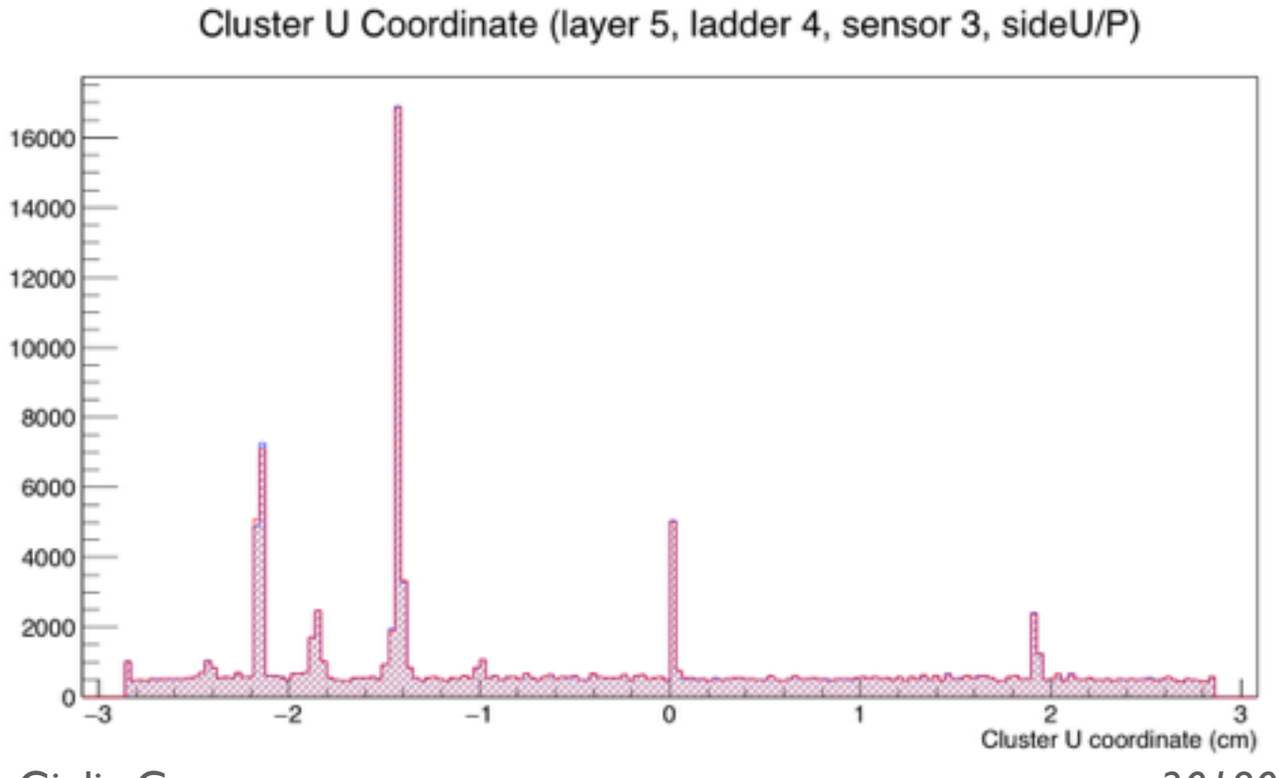
Tracking Meeting ~ September, 14th 2018

SVD Commissioning Status

- The two half-shells of SVD are being commissioned in B4: taking cosmic data at a rate of ~12 Hz
  - set of scintillators provide the trigger on cosmics
  - no B-field

- The data taking continues smoothly, taken more than 10M events
  - no big issues observed up to now with the detector
  - observed regions of high occupancy, due to cross-talk





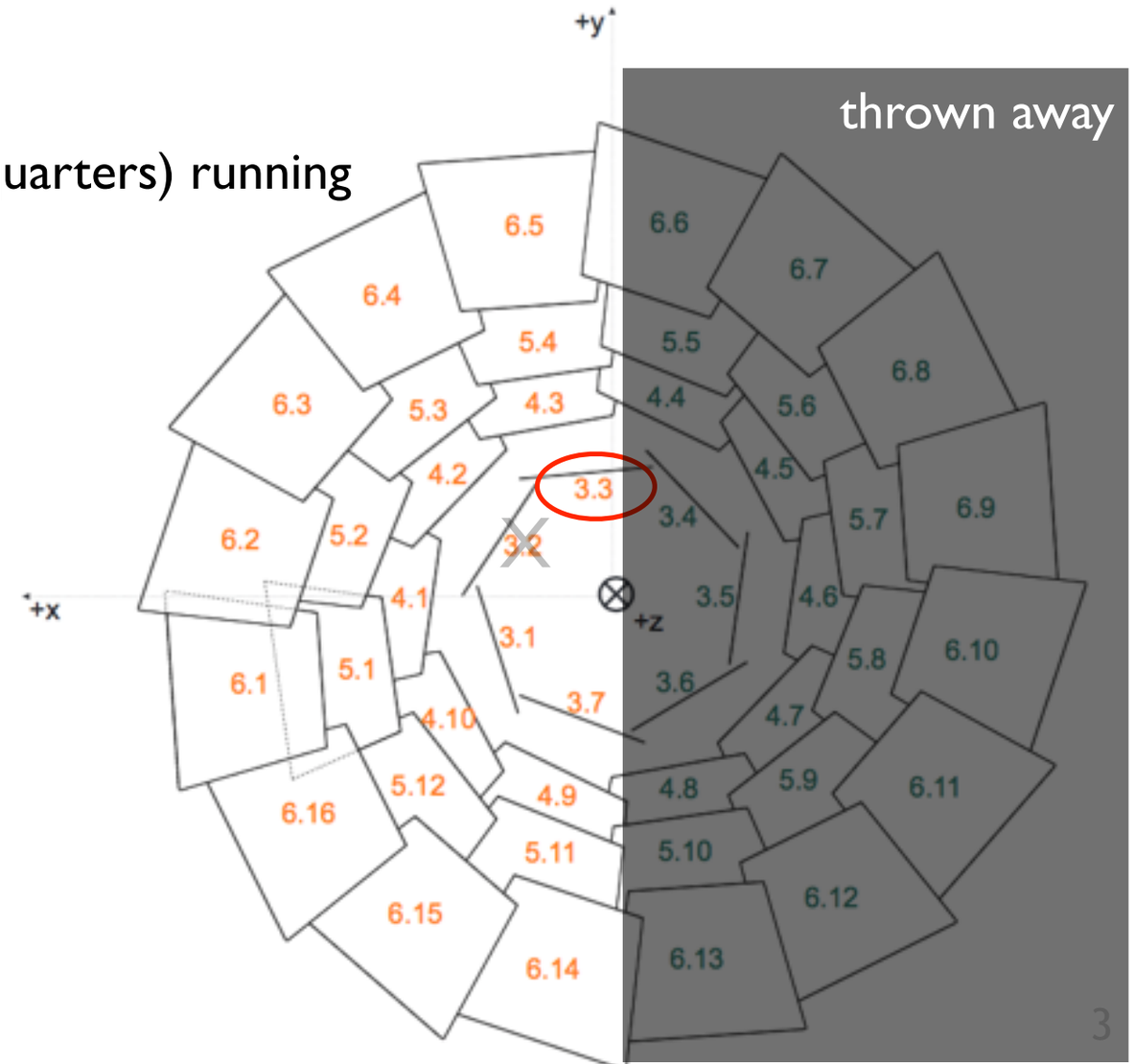
Dataset & Reconstruction

run	# events
275	526k
291	628k
293	511k
294	1046k
375	142k
392	463k
402	576k
total = 3840361	

- All cosmic runs taken with both +X/–X until end of August, with at least 400k events, already unpacked
- Choose a sensor (DUT) and then filter SVD clusters into 3 categories:
  - ones belonging to the other X-shell of the DUT → *thrown away*
  - ones belonging to the DUT → *used later*
  - ones <u>not</u> belonging to the & of the following (→ *used for tracking*):
    - DUT ladder L = 3,4,5,6
    - DUT Y-Shell: ±Y
- In total we have 16 reconstructions (4 layers x 4 SVD quarters) running in parallel

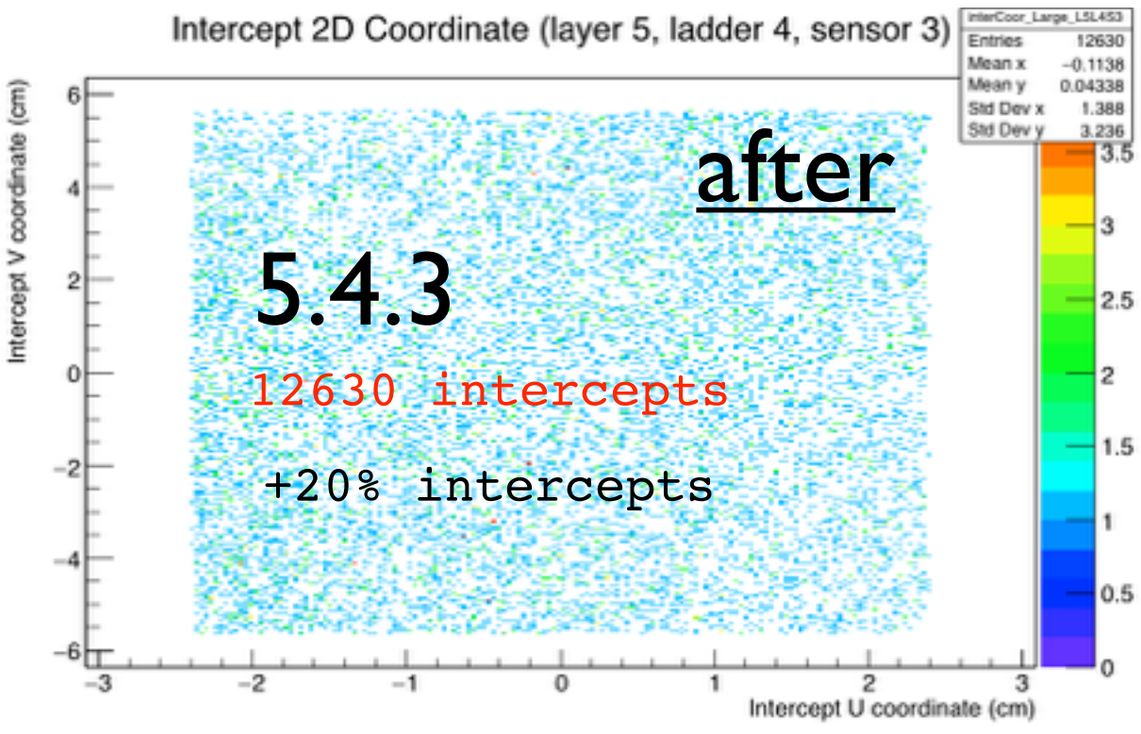
<u>example</u>:

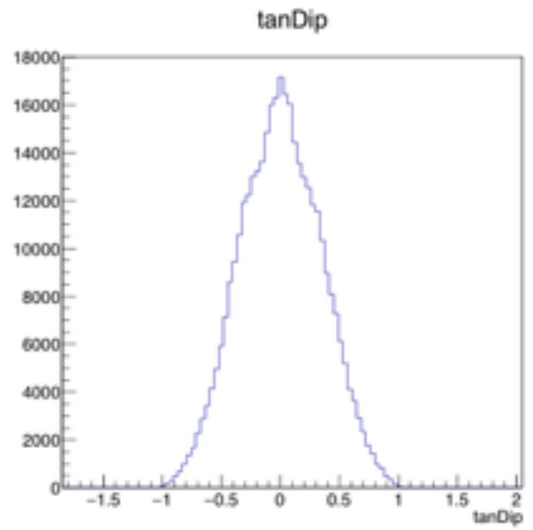
- DUT = L3.3.2 (L3, +X, +Y)
- clusters used in reconstruction:
  - L3.1.1, L3.1.2
  - L3.7.1, L3.7.2
  - all other clusters belonging to +X of L4, 5, 6

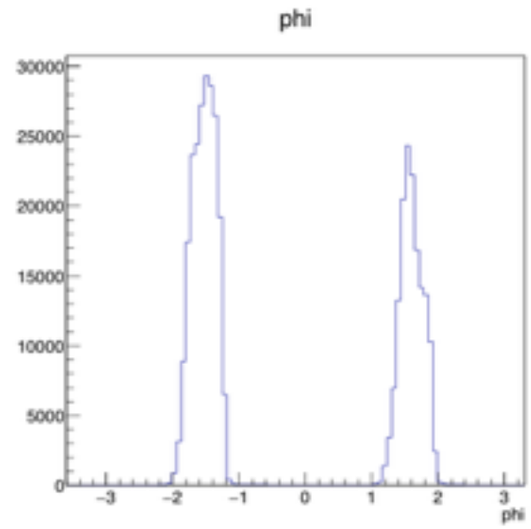


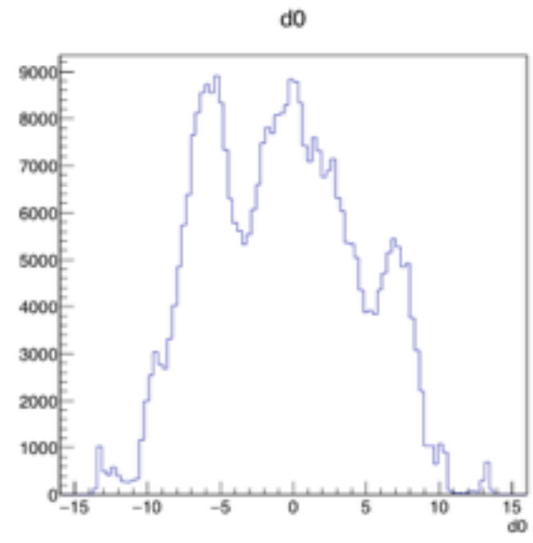
Tracking Setup

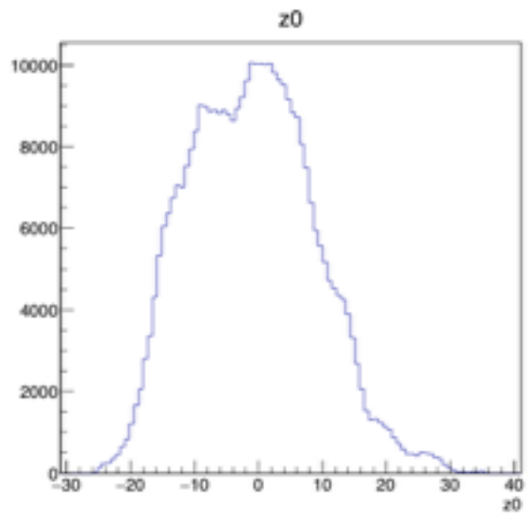
- Pattern Recognition done by TrackFinderVXDCosmicsStandalone, with: MaxRejectedSPs = 8, MinSPs =3, QualityCut = 0.0001
- Use DAF to fit the tracks
- *Manual* selection to remove fakes and define a fiducial region:
  - cluster total SNR > 10
  - fiducial area definition: 0.5 cm from the border
  - other cuts may be applied (# SVD hits, momentum, …)





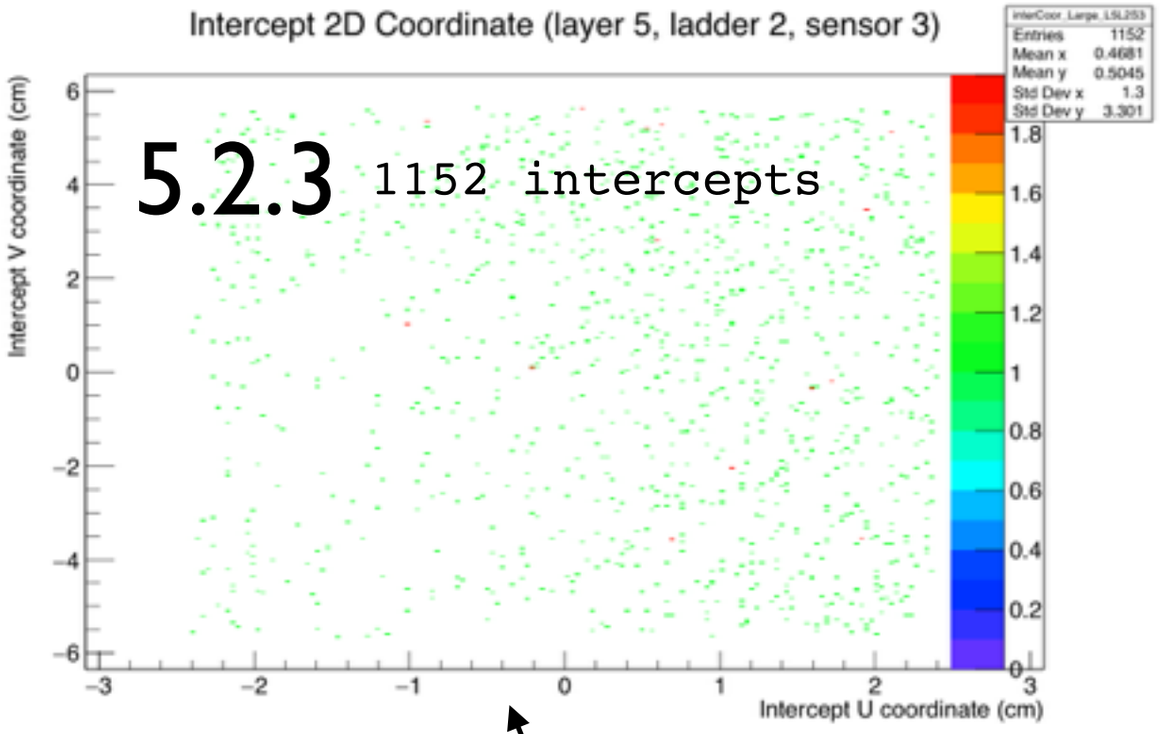


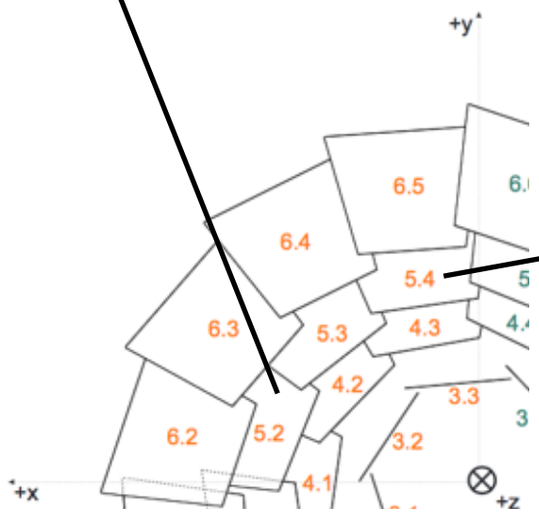


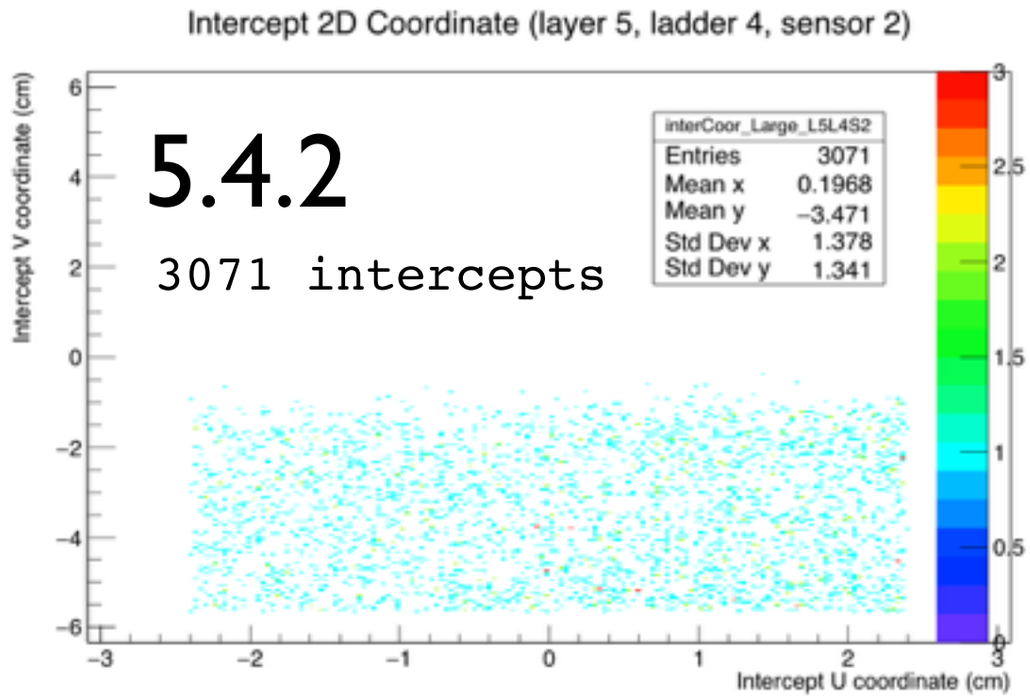


Track Coverage

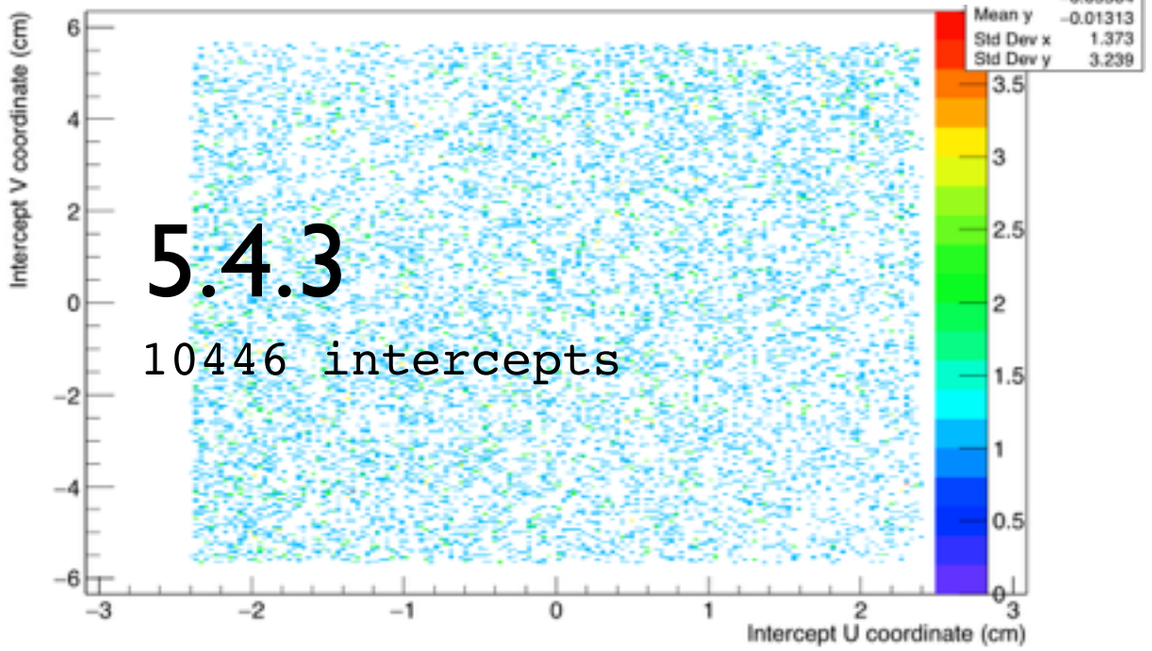
- *Natural* selection:
  - horizontal and central (in the direction of Z/V) sensors are much more likely to be crossed by a reconstructed track
  - regions "inside" the half also

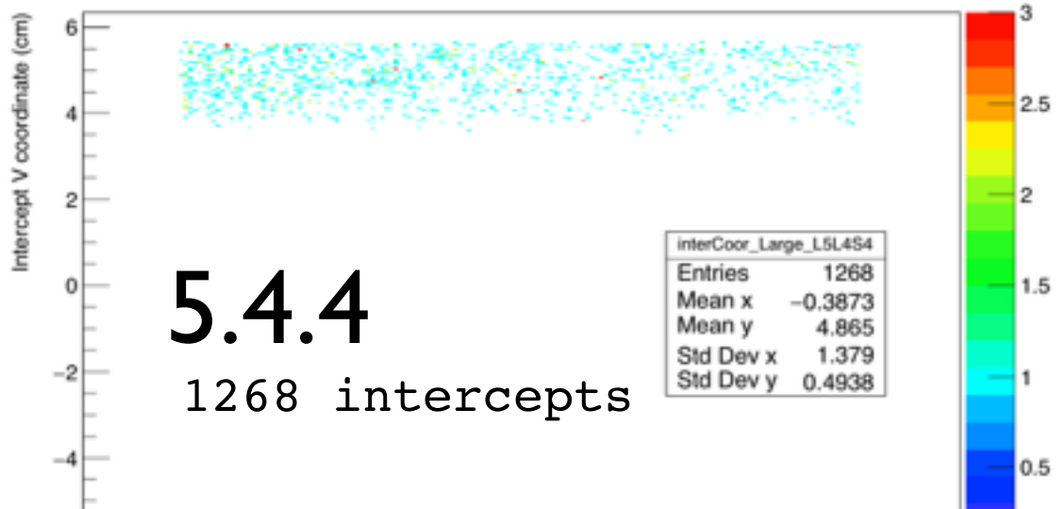






offline ZS5





Residual & Efficiency Computation

1. For each sensor, loop on intercepts:
   i. for each intercept, loop on all clusters:
      - for each cluster, evaluate the distance between cluster and intercept position (= residual)
   II. find the cluster with the minimum residual
   III. for each intercept, fill one residual (the smallest) in the TH1F corresponding to the sensor side
2. For each sensor, fit the residual TH1F with the sum of two gaussians, or, if the fit fails, with a single gaussian (`N2=0`):

   `N1·G(mean1, sigma1) + N2·G(mean2, sigma2)`
3. count the number of entries in the TH1F in the range: `mean1±5·sigma1`
4. compute the efficiency = (#entries evaluated at previous point)/(#intercepts)

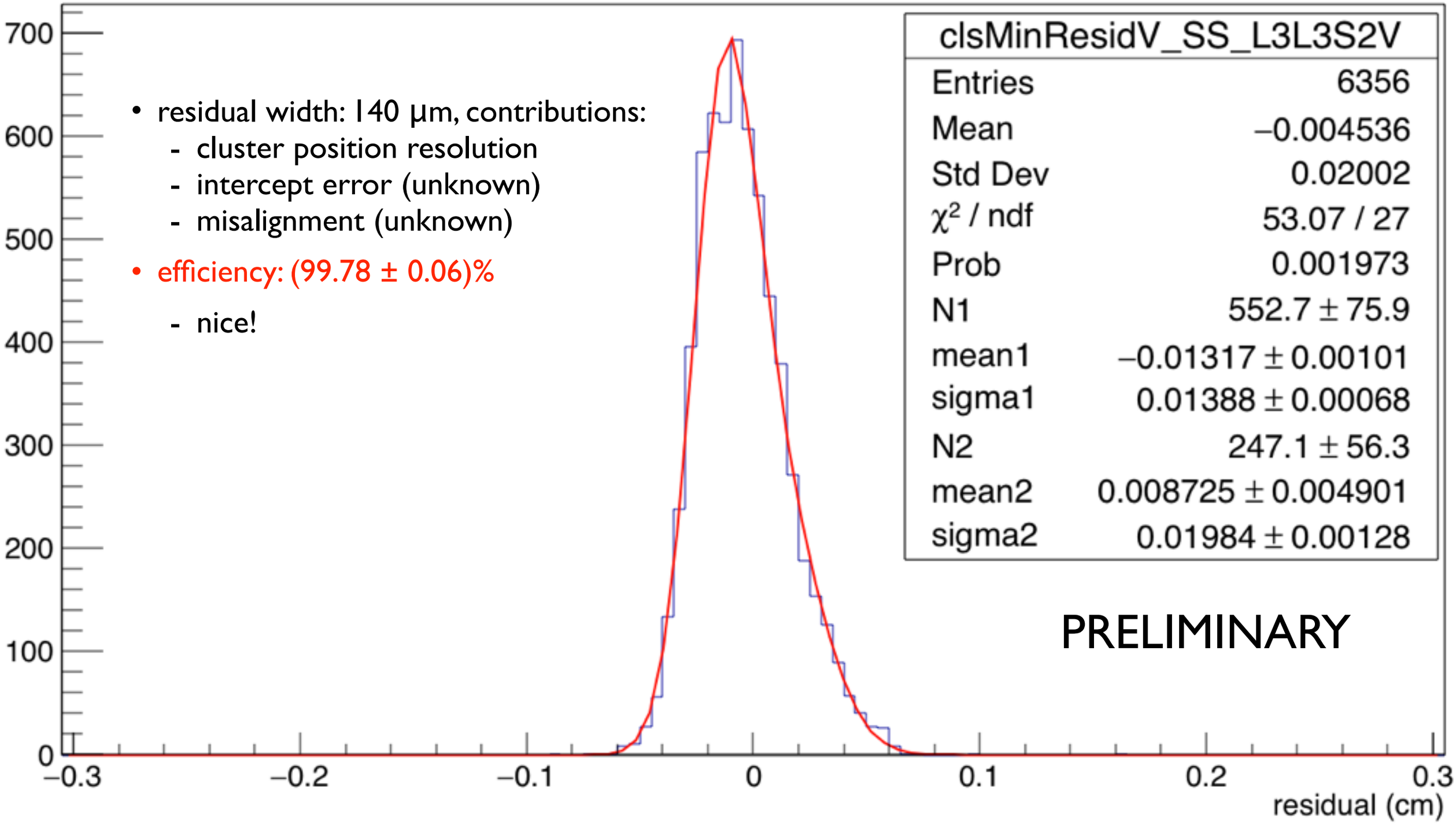
note: SVD reconstruction is done with offline ZeroSuppression = 5

intercepts = 6357

V Cluster Residuals (layer 3, ladder 3, sensor 2, sideV/N)

ZS5

- residual width: 140 μm, contributions:
  - cluster position resolution
  - intercept error (unknown)
  - misalignment (unknown)
- efficiency: (99.78 ± 0.06)%
  - nice!



clsMinResidV_SS_L3L3S2V	
Entries	6356
Mean	−0.004536
Std Dev	0.02002
χ^2 / ndf	53.07 / 27
Prob	0.001973
N1	552.7 ± 75.9
mean1	−0.01317 ± 0.00101
sigma1	0.01388 ± 0.00068
N2	247.1 ± 56.3
mean2	0.008725 ± 0.004901
sigma2	0.01984 ± 0.00128

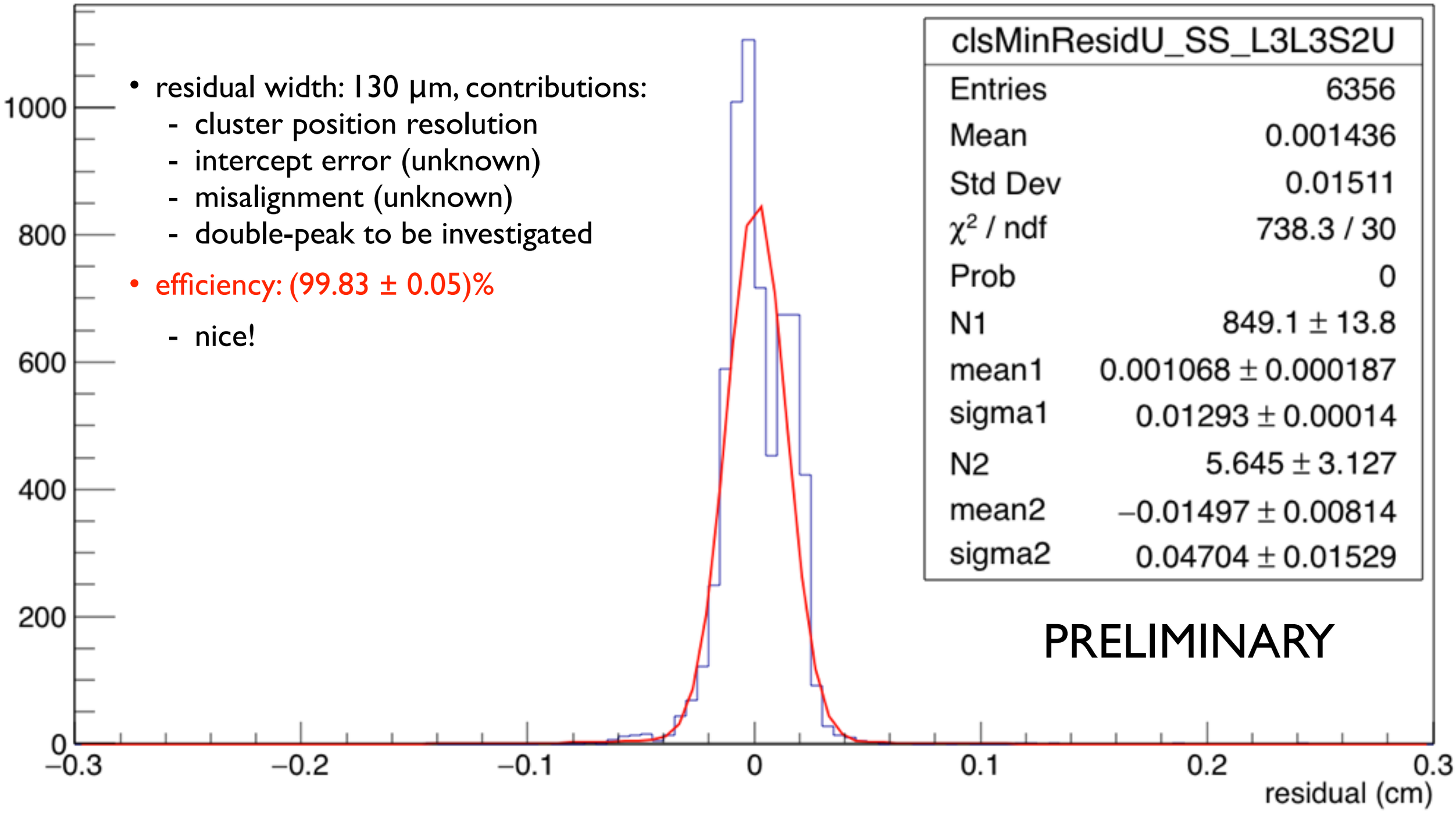
PRELIMINARY

intercepts = 6357

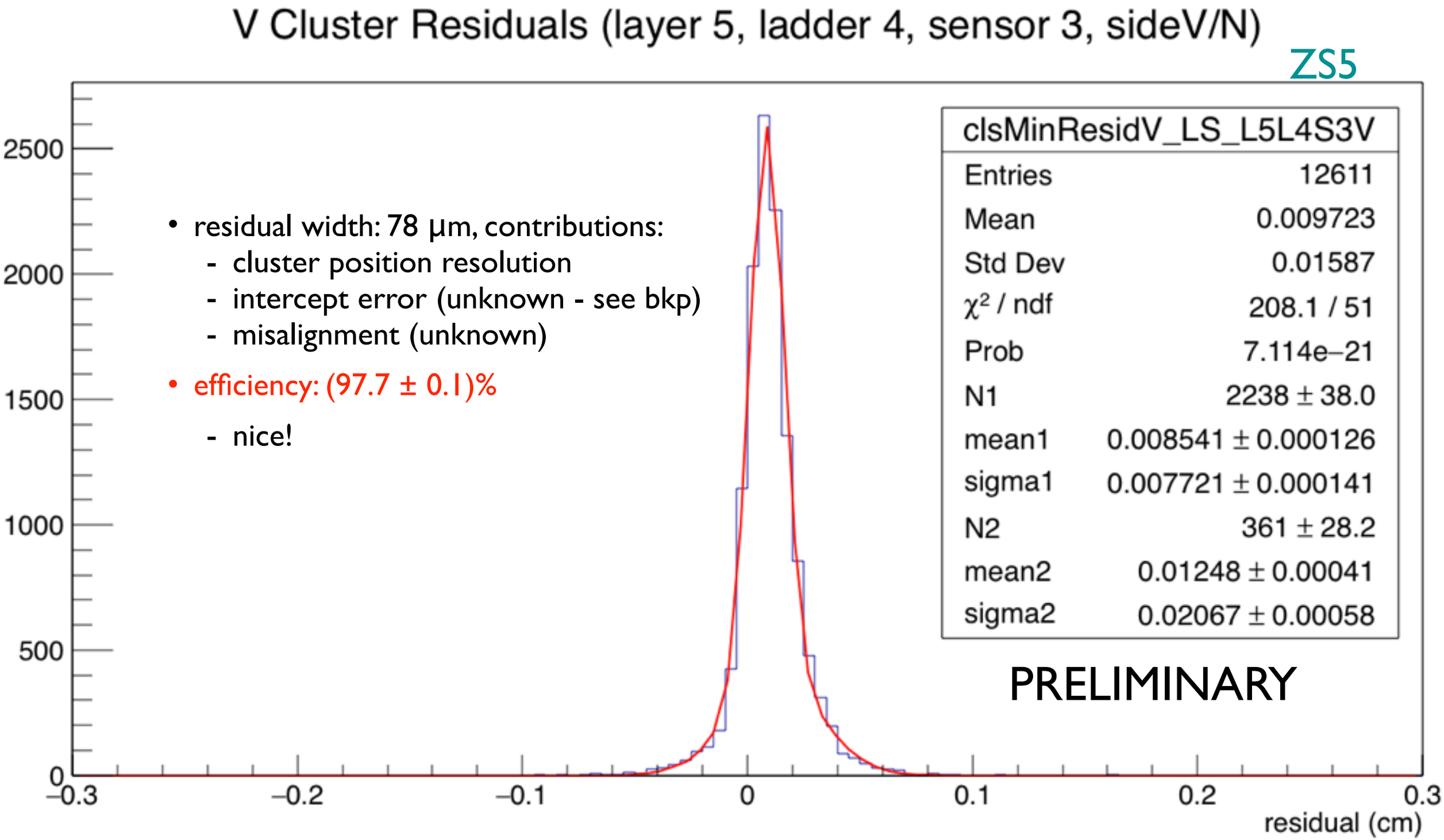
U Cluster Residuals (layer 3, ladder 3, sensor 2, sideU/P)

ZS5

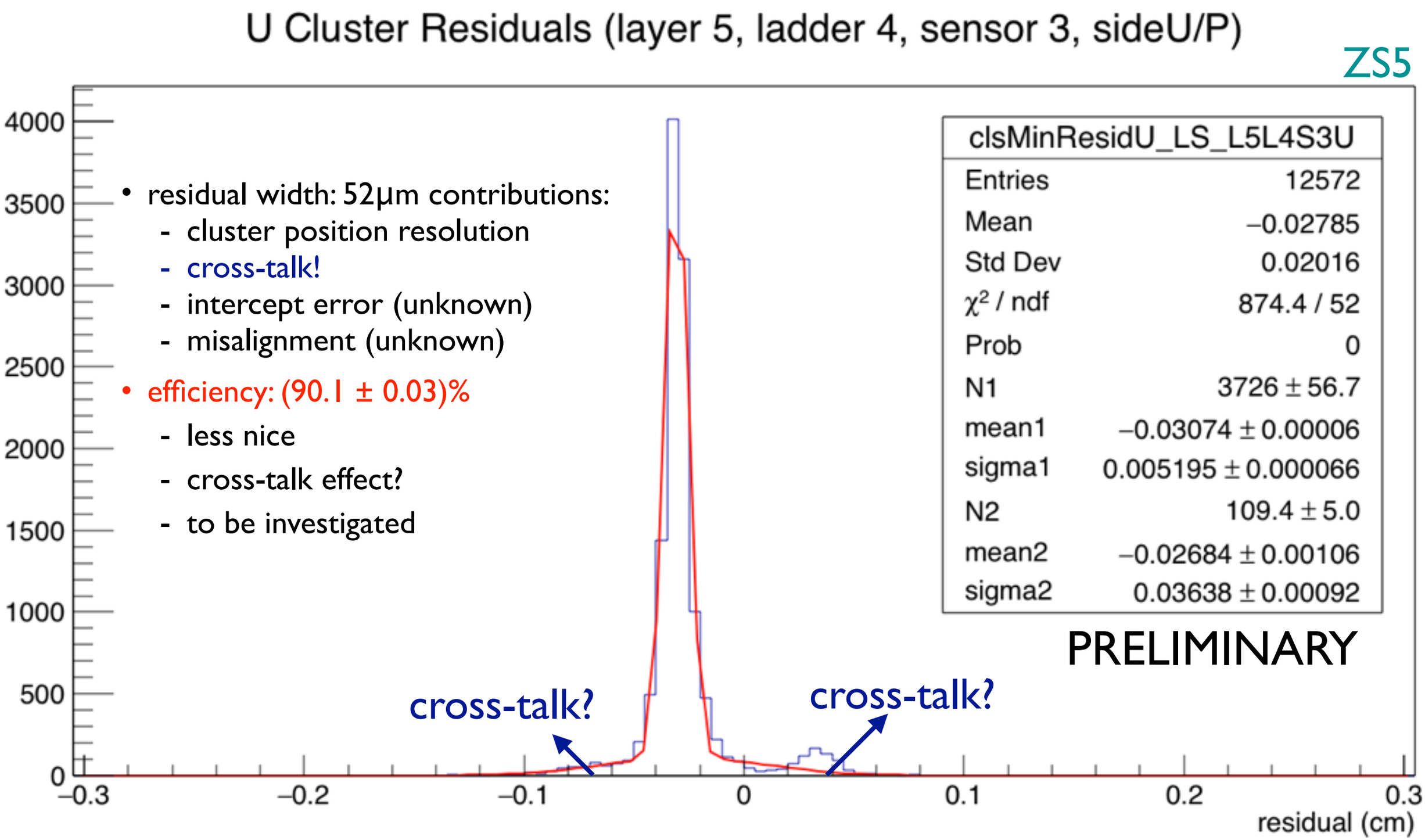
- residual width: 130 μm, contributions:
  - cluster position resolution
  - intercept error (unknown)
  - misalignment (unknown)
  - double-peak to be investigated
- efficiency: (99.83 ± 0.05)%
  - nice!



intercepts = 12630



intercepts = 12630



Conclusions

➡ **Efficiency**

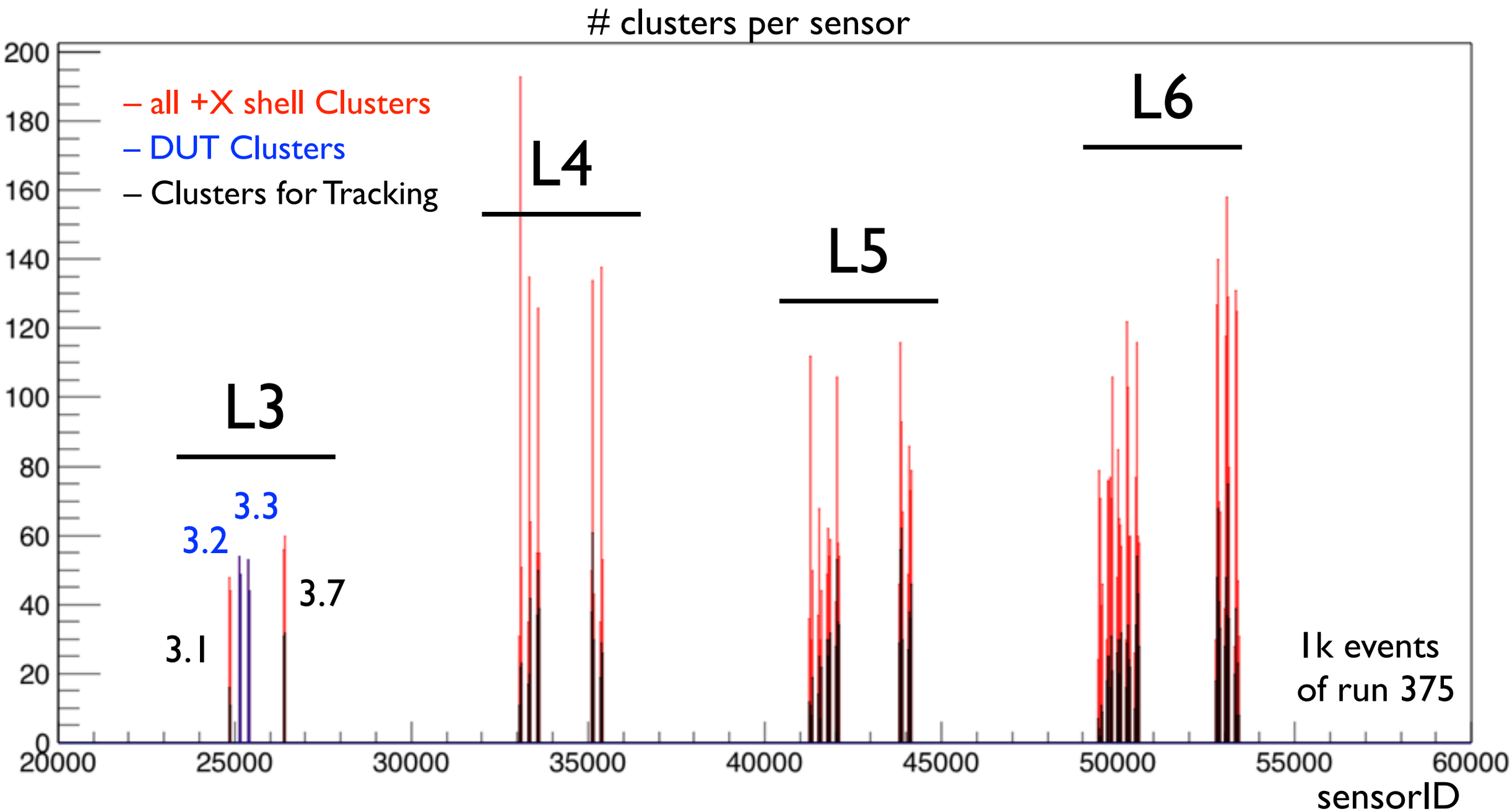
- Many sensors have high efficiencies (> 98%) on both sides, as expected
- U-sides of some sensors have lower efficiency with respect to the V side: to be understood
- A systematic look at the produced plots and numbers is still to be done
- Keep in mind that: if we have fake tracks, the measured efficiency is artificially low
- For the moment let's focus on efficiency measurement integrated on the sensor, measurement with finer granularity are second order

➡ **Plots of the Cluster Position Residual**

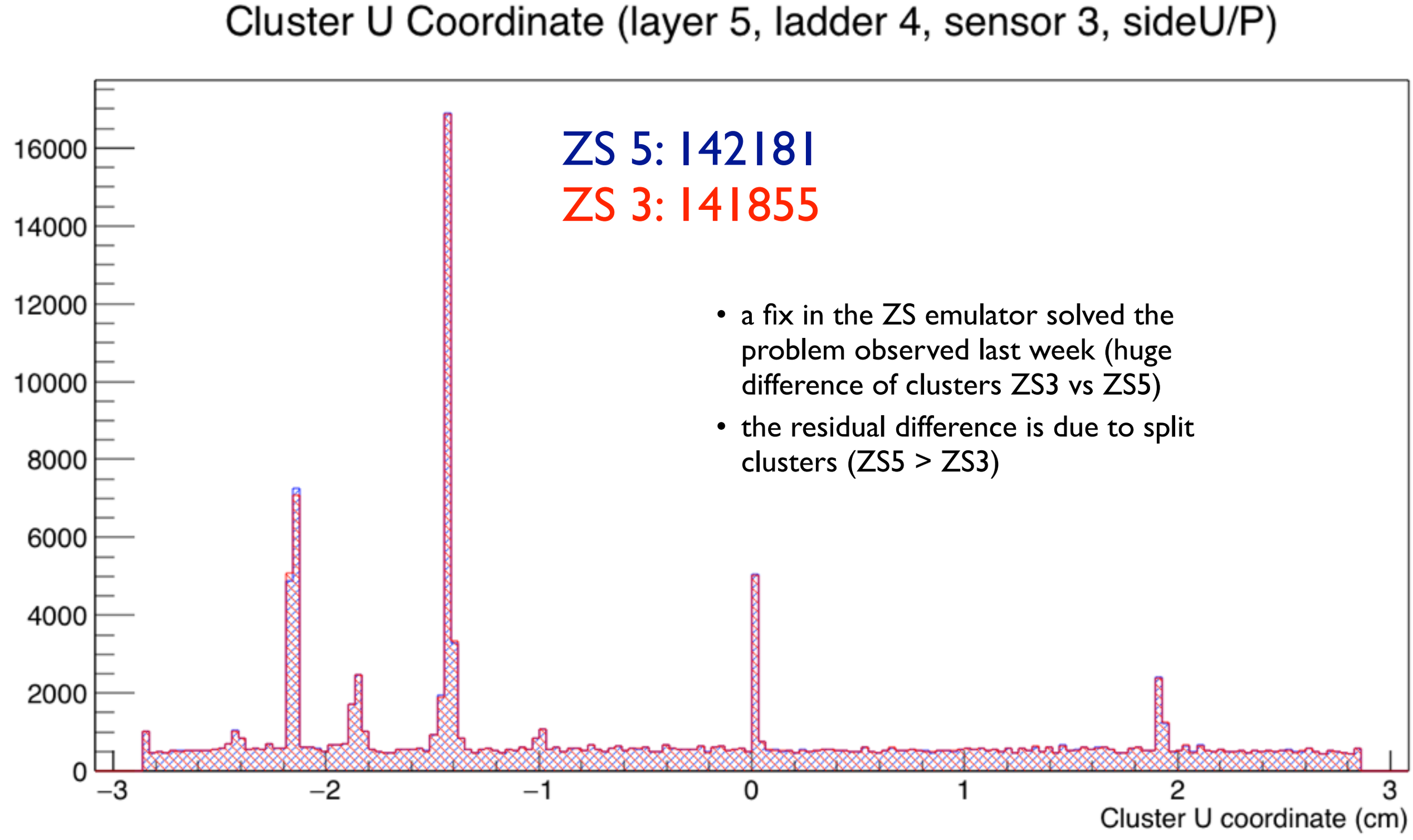
- Estimation of cluster position resolution is not possible at the moment
- Some sensors sides show some structures (double-peaks, ..) that should be understood.
- Width of the residual distribution

Issue with Cluster Filter

- There was an issue with cluster filter & filling of the smallest residual that have been solved:
  - example for analysis of L3, +X, +Y sensors (3.2, 3.3), <u>after the fix</u>:



Try Reconstruction with Offline ZS 3



ZS 5: 142181

ZS 3: 141855

- a fix in the ZS emulator solved the problem observed last week (huge difference of clusters ZS3 vs ZS5)
- the residual difference is due to split clusters (ZS5 > ZS3)