PHASE2 FIRST SVD DATA

FIRST THINGS TO CHECK WITH COSMIC RAYS AND FIRST COLLISIONS

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F2F Tracking Meeting ~ KEK, February, 3rd 2017

Priority List

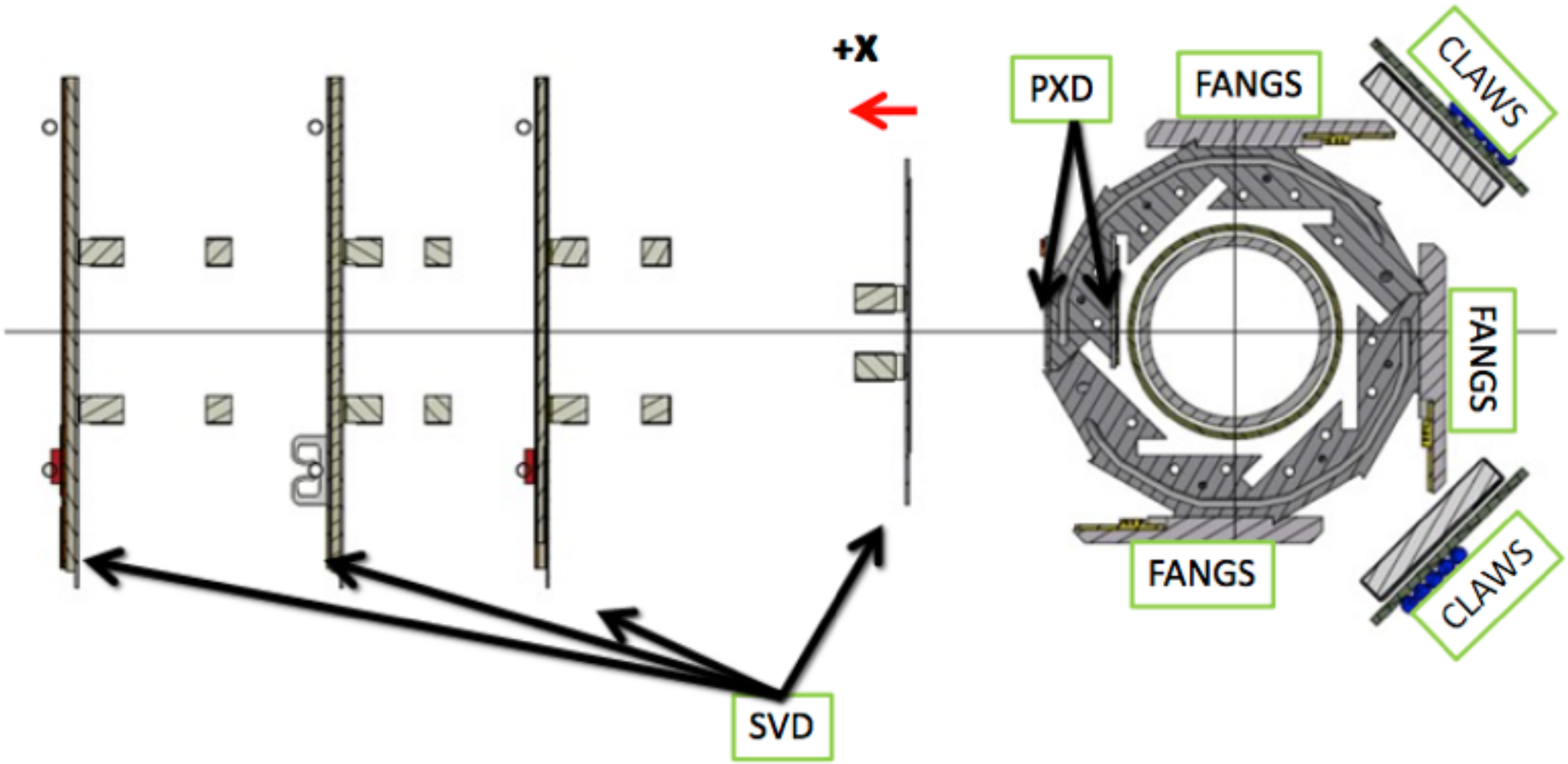
- ☑ *SVD Channel Mapping*
- ☑ *SVD Latency Calibration*
- ☑ *SVD Noise studies*
- ☑ *CoG Calibration & Performance on Data*
- ☑ *Clusterizer Calibration & Performance on Data*

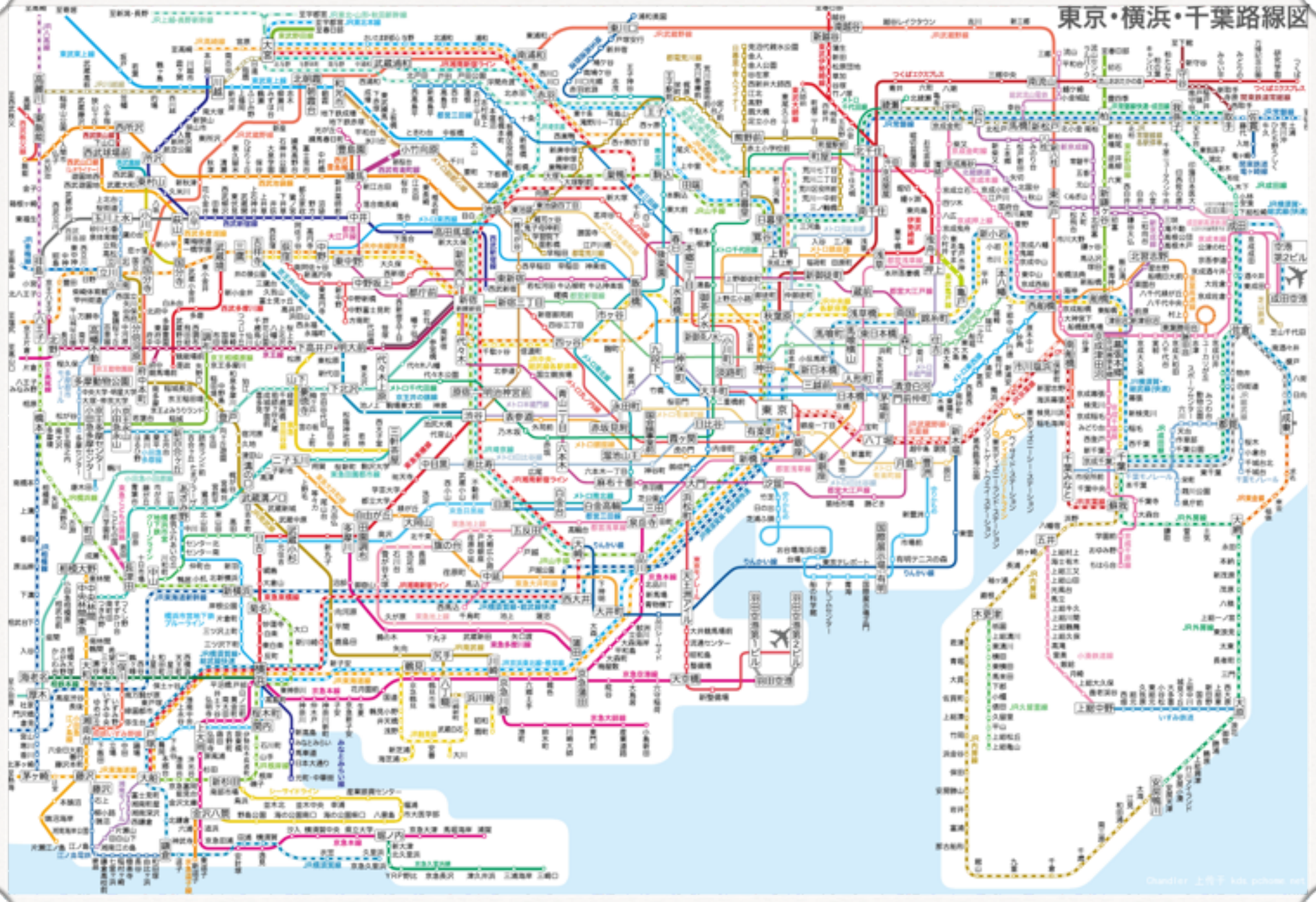
Phase2 SVD Cartridge

VXD Detector Systems in phase 2

- FANGS: Covering 90° , 180° , 270° in ϕ, *full* acceptance in θ
- CLAWS: Covering 135° , 225° in ϕ, *full* acceptance in θ
- PLUME: Covering 135° , 225° in ϕ, *partial* acceptance in θ

4 complete SVD ladders: one ladder per layer





SVD Channel Mapping

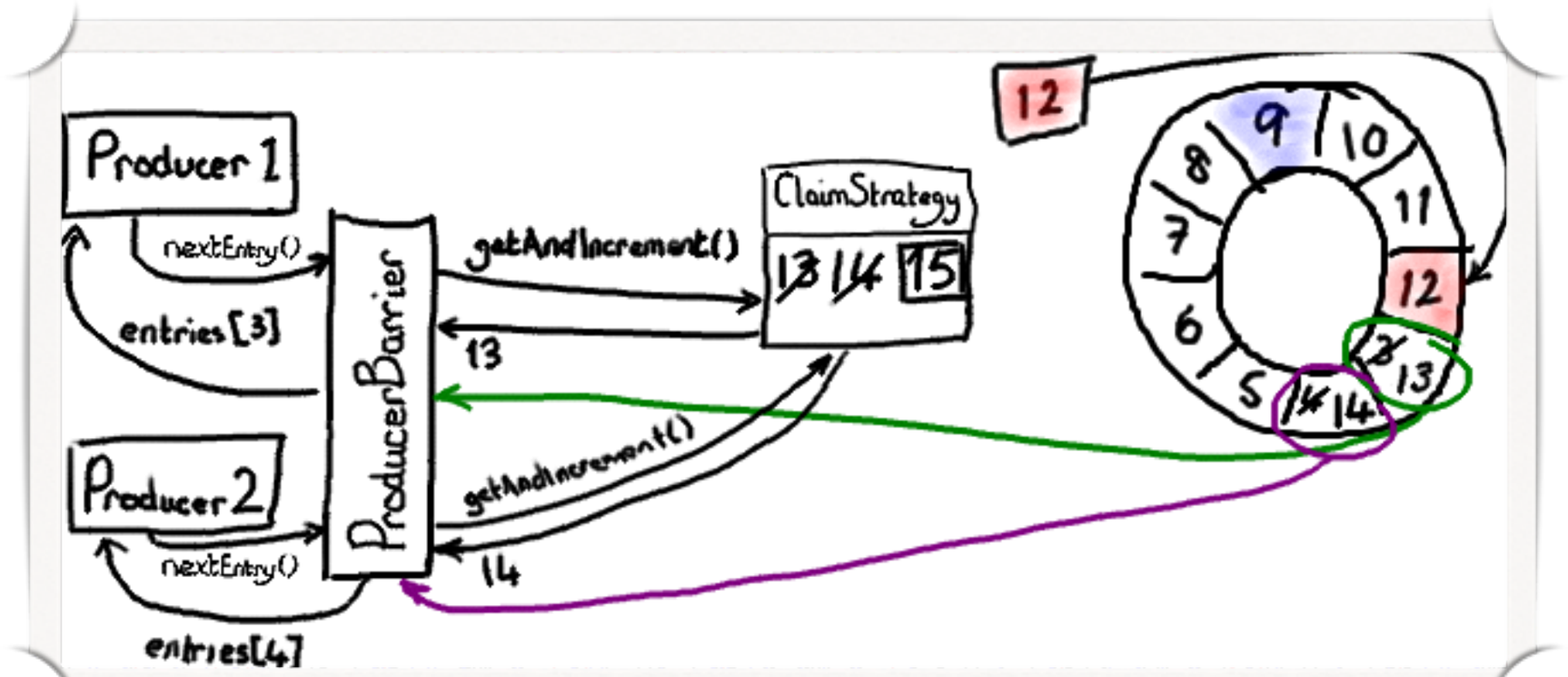
Channel Mapping

- All raw data (calibration constants and strip signals) are uniquely identified by an "hardware/electronic address", i.e.:
  1. FADC board number
  2. APV chip and channel numbers
- The channel map is an xml file (stored on the DB) that specifies how to translate the hardware/electronic addresses of the strips to the basf2 unique identifiers:
  1. sensor ID
  2. side
  3. local cell IDs.
- The channel map is needed to:
  - associate calibration constants measured in the local runs to the correct strip (sensorID, side, cellID) ← SVDDatabaseImporter class
  - assign the correct strip (sensorID, side, cellID) to the unpacked raw data, the SVDShaperDigit ← SVDUnpacker module

Mapping Check Plan

THE VALIDATION OF THE CHANNEL MAP XML FILE IS THE **FIRST** THING WE MUST DO BEFORE USING BASF2 RECONSTRUCTION

- ➡ We need dedicated global runs with special configurations of the FADC boards
- ➡ The idea would be to configure the APV chips in order to get a known pattern and check it on basf2
  - Katsuro has developed a program that allows to set special patterns on FADC. Big question: what is the pattern that we expect on the sensors?
    - if we can't answer the question, this plan does not help! What do we do?
  - we would like to check all 144 APV25 of Phase2
- ➡ Data taking time depends linearly with the trigger rate. Depending on the configuration it may require a short data taking, linearly depends on the trigger
- ➡ The analysis of the basf2 data can be done only after data are recorded on the Quick Analysis Server, or on kekcc (access?). Order of one day after data taking? Maybe we can ask for a fast transfer for a small amount of data. ExpressReco histograms may help, but they're not enough for a strict validation.

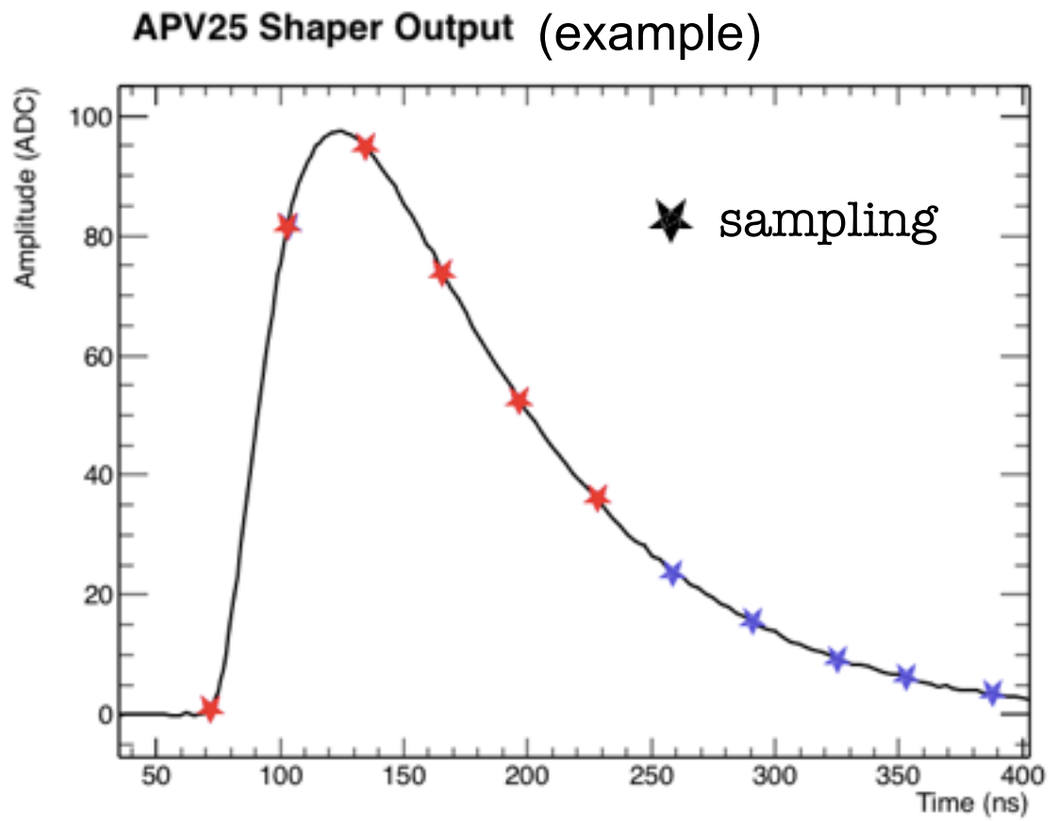


SVD Latency Calibration

SVD Signal Samples Retrieval

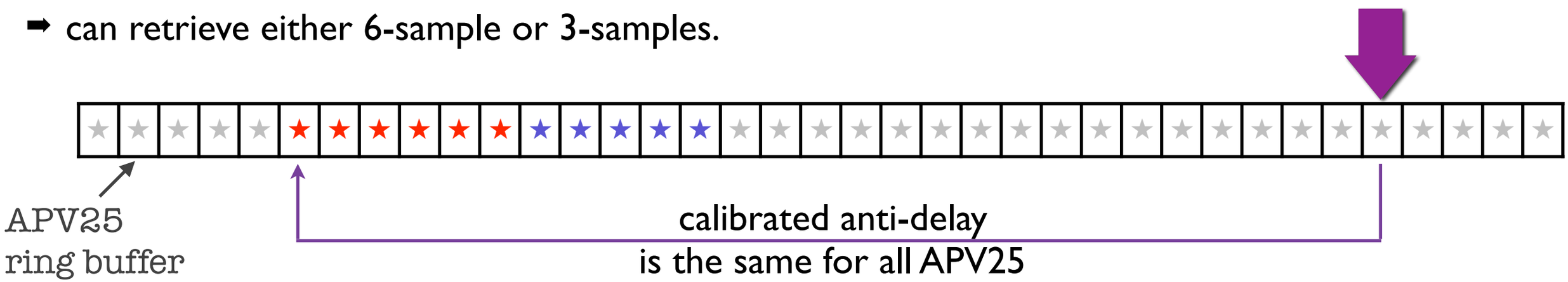
APV25 SAMPLING

- we operate the APV25 in multi-peak mode
- the APV shaping curve is sampled at ~32 MHz
- the samples are stored in a ring buffer on the APV25, waiting for the trigger



SIGNAL RETRIEVAL

- the trigger signal arrives with a fixed latency of 4.4 us
- the interesting samples are retrieved from the APV25 buffer going back for a *fixed number of cells* ← this is what we have to calibrate!
- can retrieve either 6-sample or 3-samples.

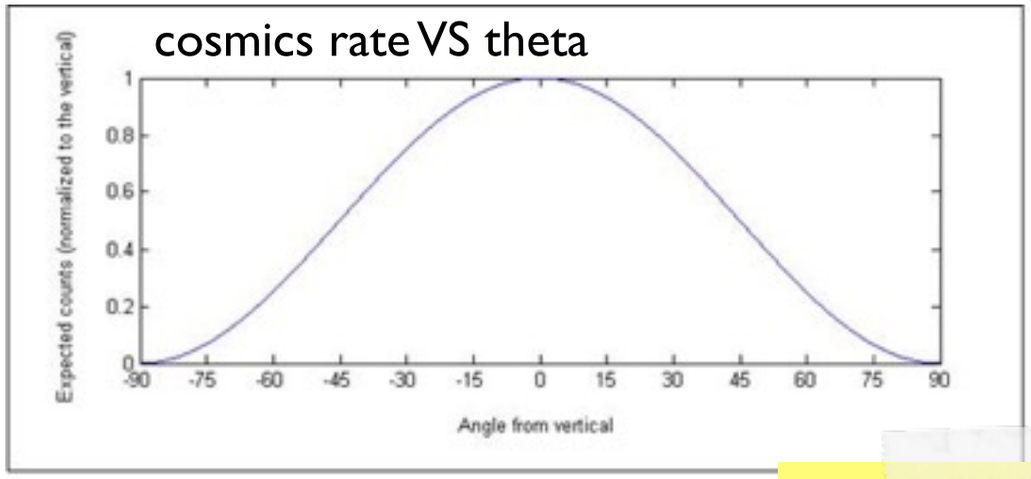


Working Conditions

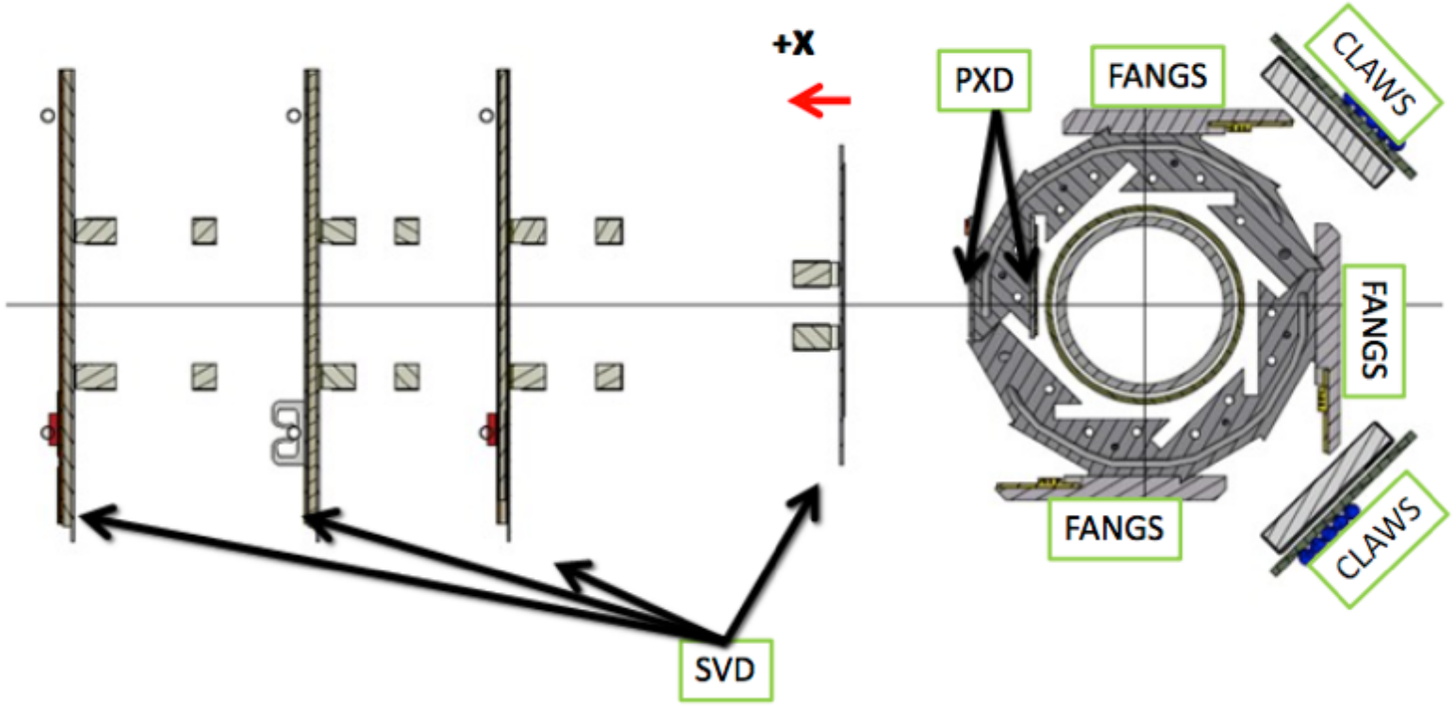
➡ Latency calibration requires particles crossing the SVD in triggered events:

- triggers by CDC (+ ECL and TOP triggers)
- CDC Tracks to be extrapolated towards the SVD sensors

the SVD sensors (except the FW sensors) are placed in the vertical plane while the rate of comics is maximum exactly for theta = 0… how many tracks do we expect? Enough be recognised among the noisy strips?



found on google: handle with care



SVD ROI Finding

- In order to select the strips actually crossed by a cosmic, an SVD ROI Finder module has been written
- The idea is the same of the PXD ROI Finder module:
  1. takes CDC tracks
  2. extrapolates towards SVD sensors and find the intercept with the sensor plane
  3. defines a rectangular region around the intercept
  4. overlaps this region with the sensor, translating the ROI in min and max U/V strips

Latency Calibration with Cosmics, feasibility Study:

- ✓ used the official CRY setup and simulation(*) of the GCR run
- ✓ no magnetic field, trigger jitter is not simulated in this study
- ✓ trigger simulation is included
- ✓ used the official reconstruction(*) of the GCR run
- ✓ SVDROIFinder module and the SVDShaperDigitFilter module are appended after reconstruction

(*)https://stash.desy.de/projects/B2P/repos/mc/browse/GCR1/release-00-09-02/DBxxxxxxxx/

Preliminary Results, SVDShaperDigits

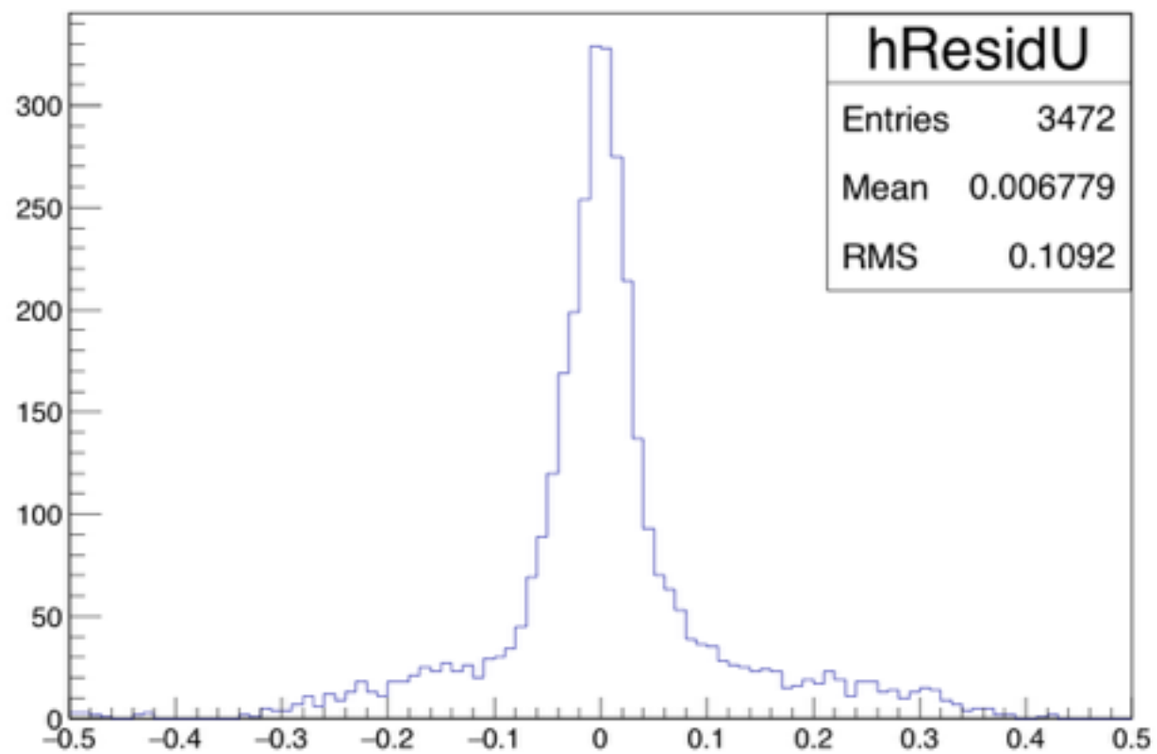
```
Total time simulated: 521.486s
Total number of triggers: 6951

simulated trigger rate = 13Hz
   (expected order of 100Hz)
```

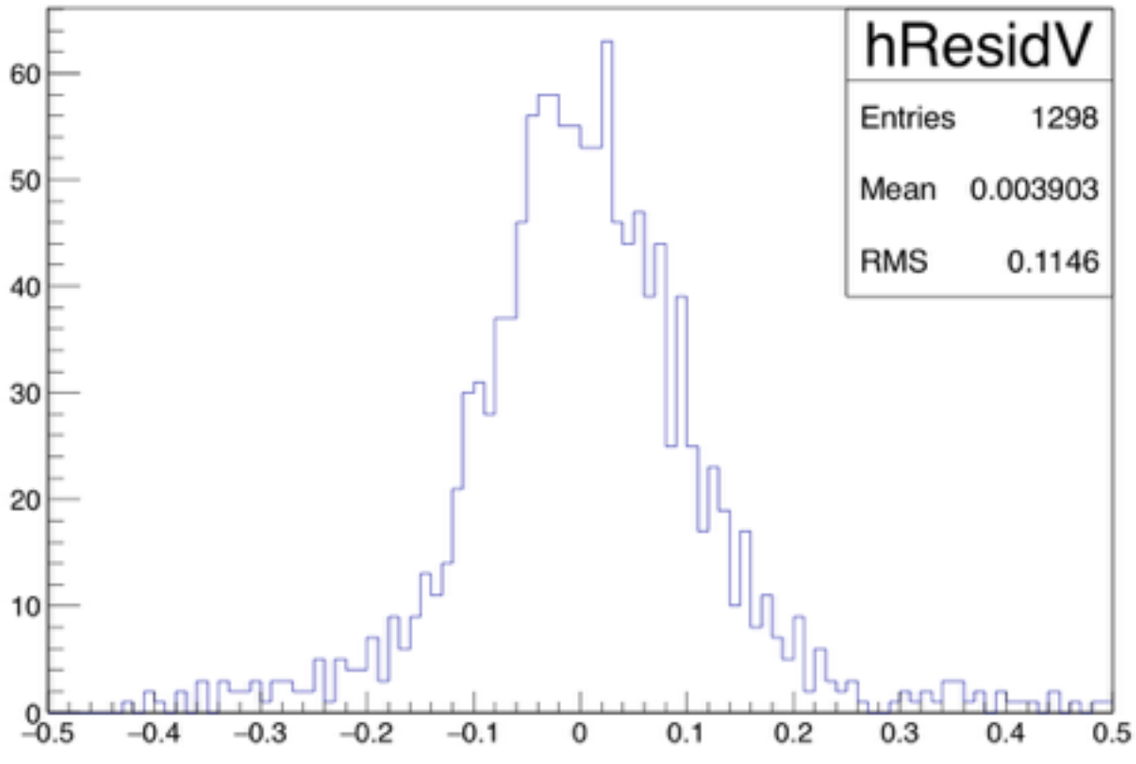
```
number of reco tracks = 8854
number of tracks = 6923
number of Intercepts = 1165
number of ROIs = 827
number of GOOD ROIs = 563
```

ROI Finding efficiency per strip: (42.5±0.5)%

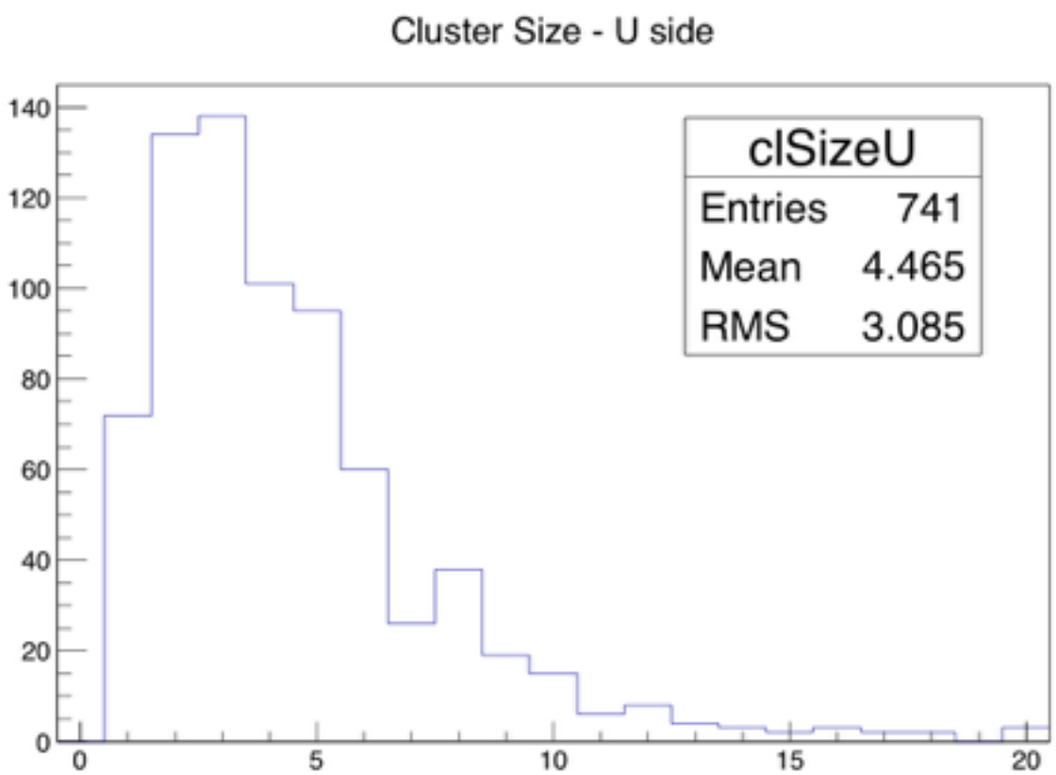
U resid for SVDShaperDigits contained in ROI

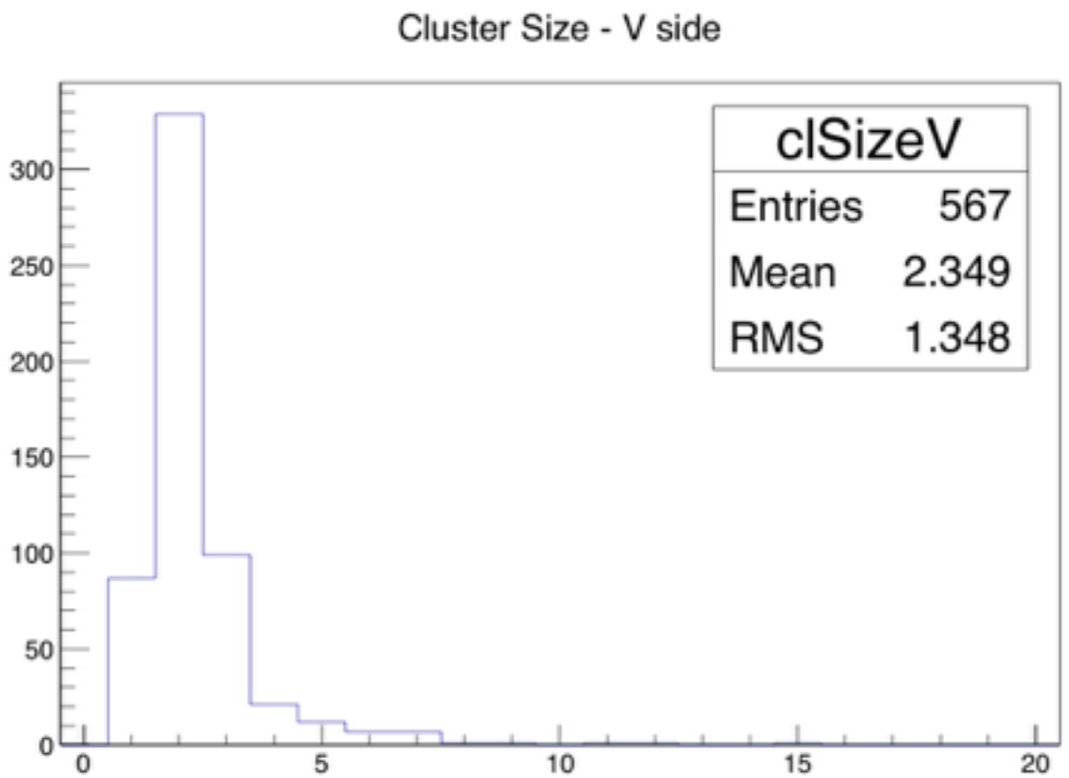


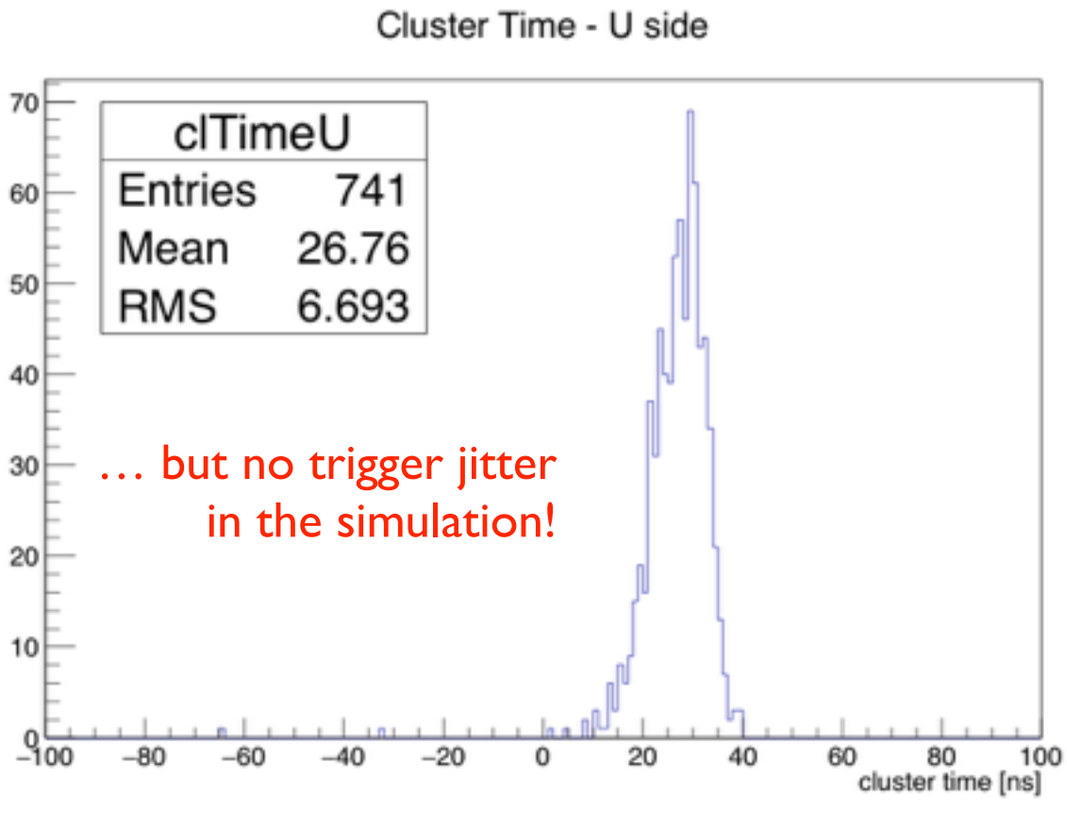
V resid for SVDShaperDigits contained in ROI

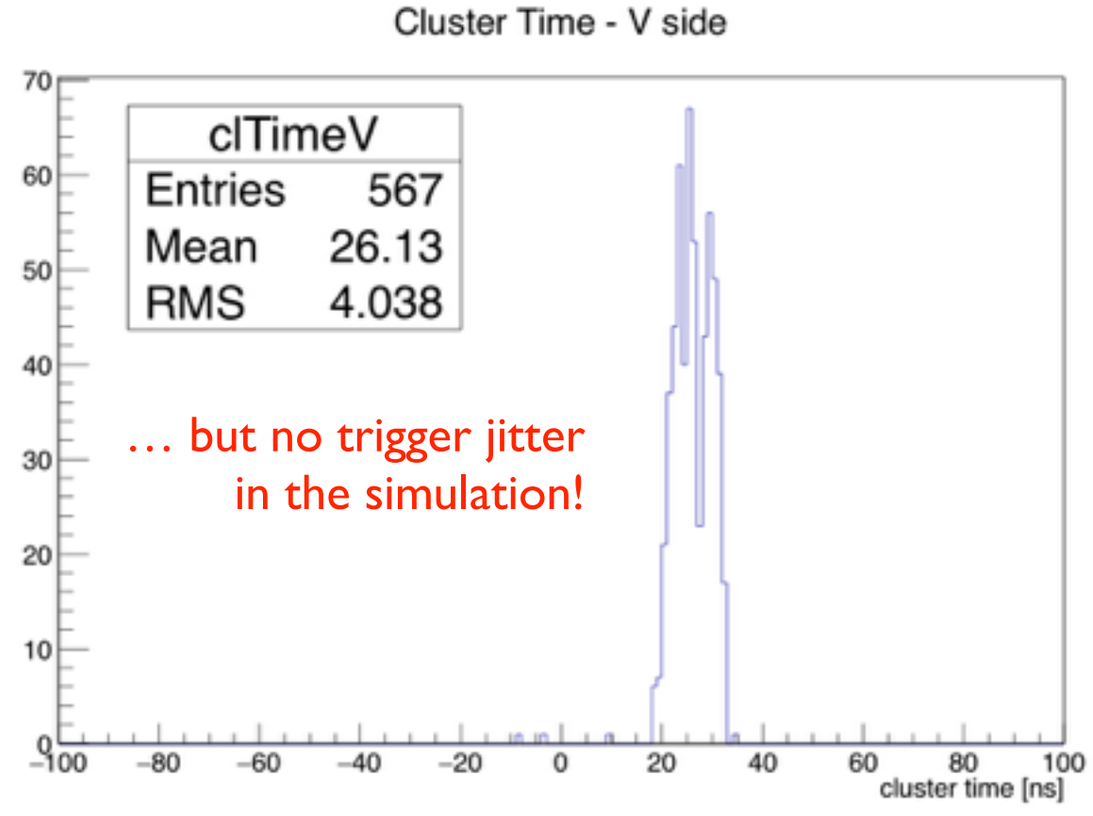


Preliminary Results, Clusters





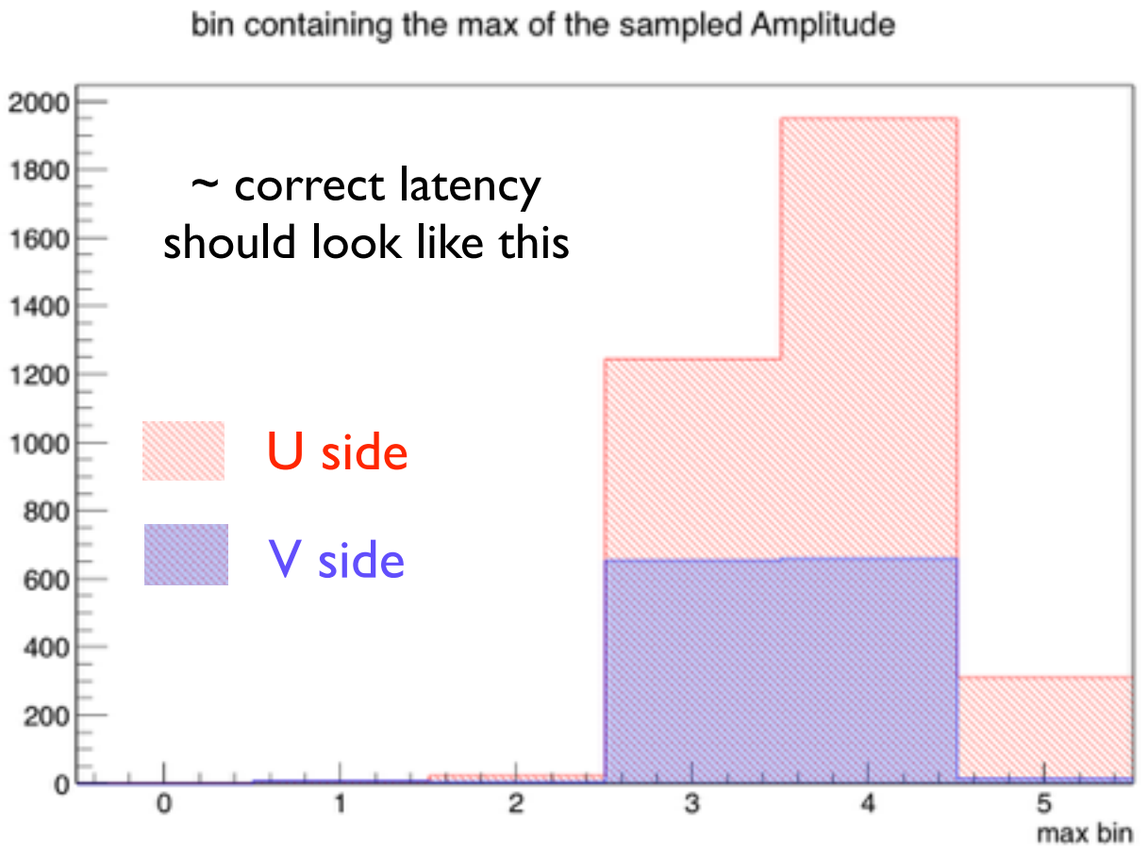




Simulation Summary

- 3550 U strips + 1300 V strips acquired in ~10 minutes running (assuming a trigger rate of 13 Hz)

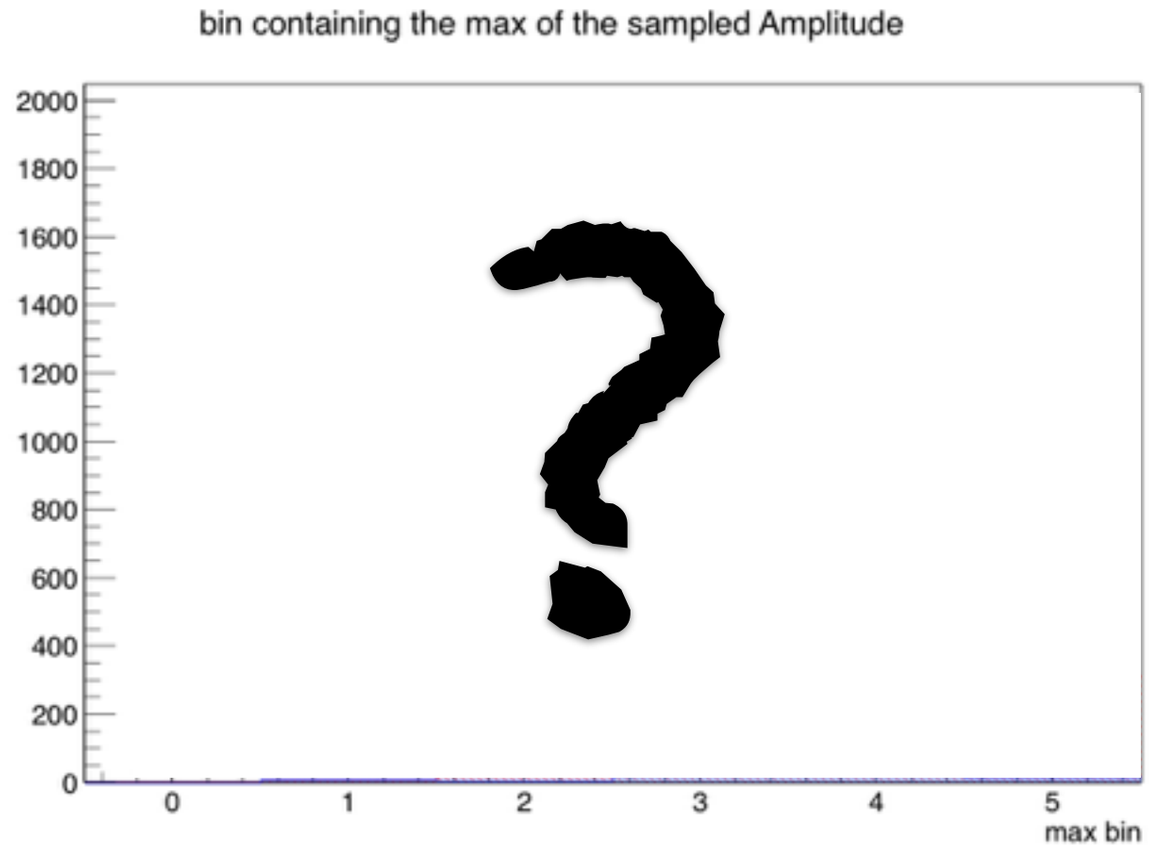
- in absence of beam background, the histogram of the max bin for U and V side clearly indicate the position of the maximum sample. What is the effect of Noise? are there available data to study the noise effect?



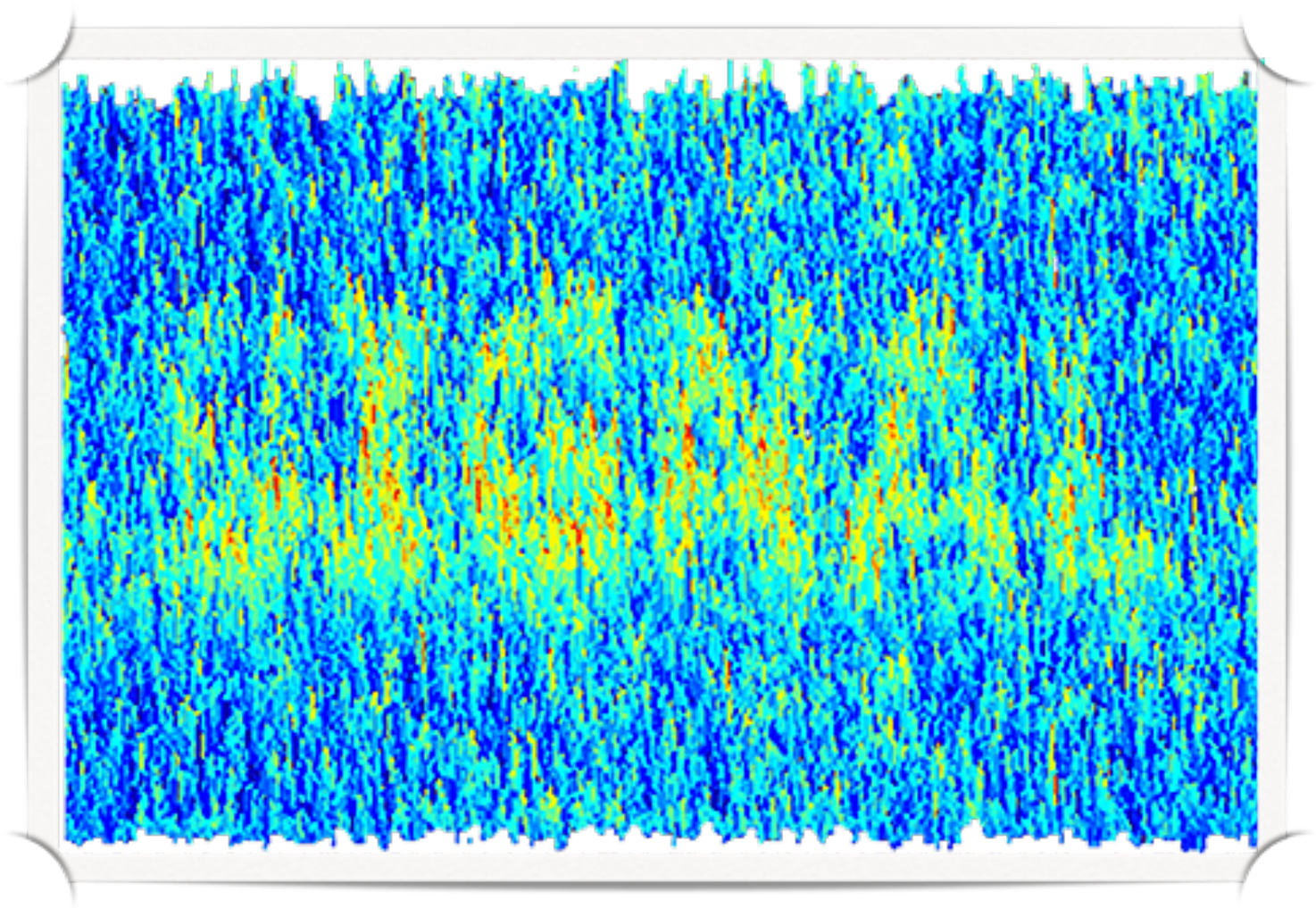
- with a trigger jitter of order of 40 ns the peak in the max bin distribution may be in 3 instead of 2 bins
- simulation with a trigger jitter of 40 ns should be done: not clear how to simulate both the trigger jitter and the trigger!

Operative Plan Proposal

- scan the latency in step of 4 cells to have a cell overlap between the different latency scans
- 192 cells, minimum latency is 4.4 us leaves us with ~60 cells (192 - 4.4us/31.4 ns)
- 60 cells / 4 = 15 runs, each one with a difference latency set
- 15 minutes running for each latency + 15 minutes setting the system (configuration, wait for global run control, …)
- 15 runs times 30 minutes for each run yields ~ 8 hours to complete the latency scans



- data analysis in basf2 can be done only after data are transferred on kekcc, once a day(?)
- We could: take data during night and analyze it the day after → latency calibrated within 24 hours.



SVD Noise Studies

Possible Noise Studies

note: Noise can be studied also if the latency is not calibrated

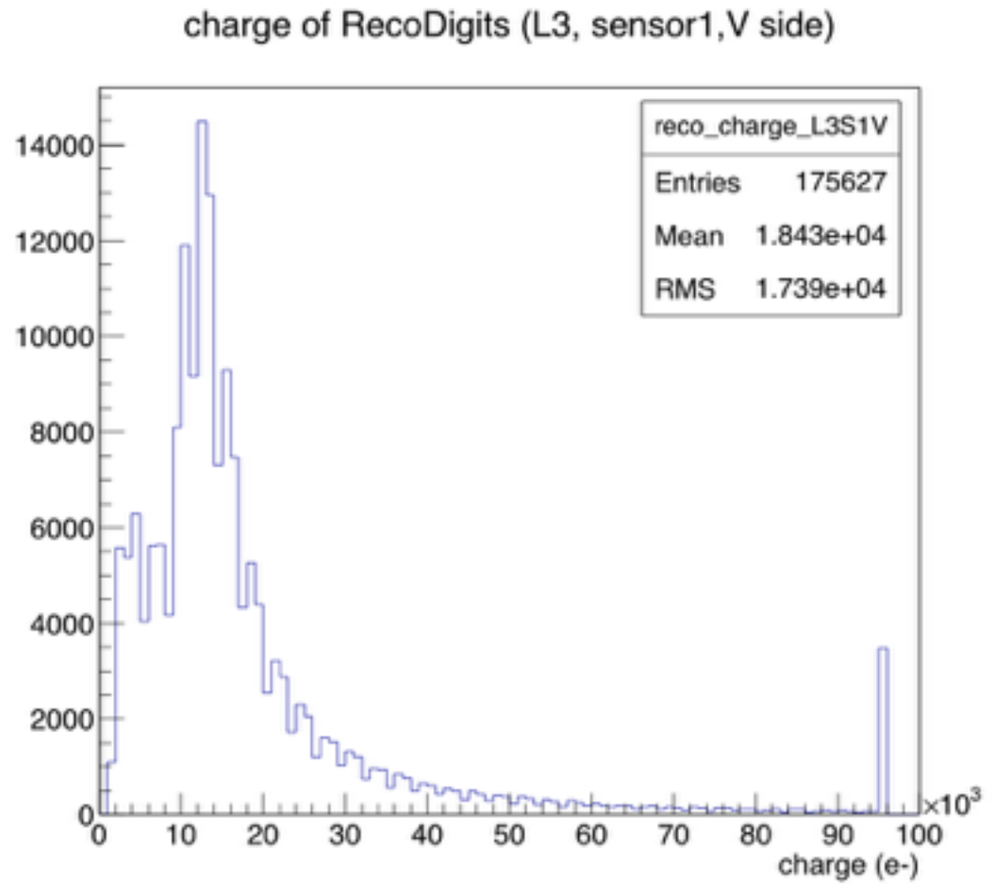
1. noise properties
   - RMS, average noise, dependence on the sensors.
2. occupancy due to noise:
   - how does it vary among different sensors?
   - how does it depend on the ZS cut?
3. correlations among the six-samples:
   - the 6 samplings of the APV25 pulse are not un-correlated, all noise signals pass through the shaper…

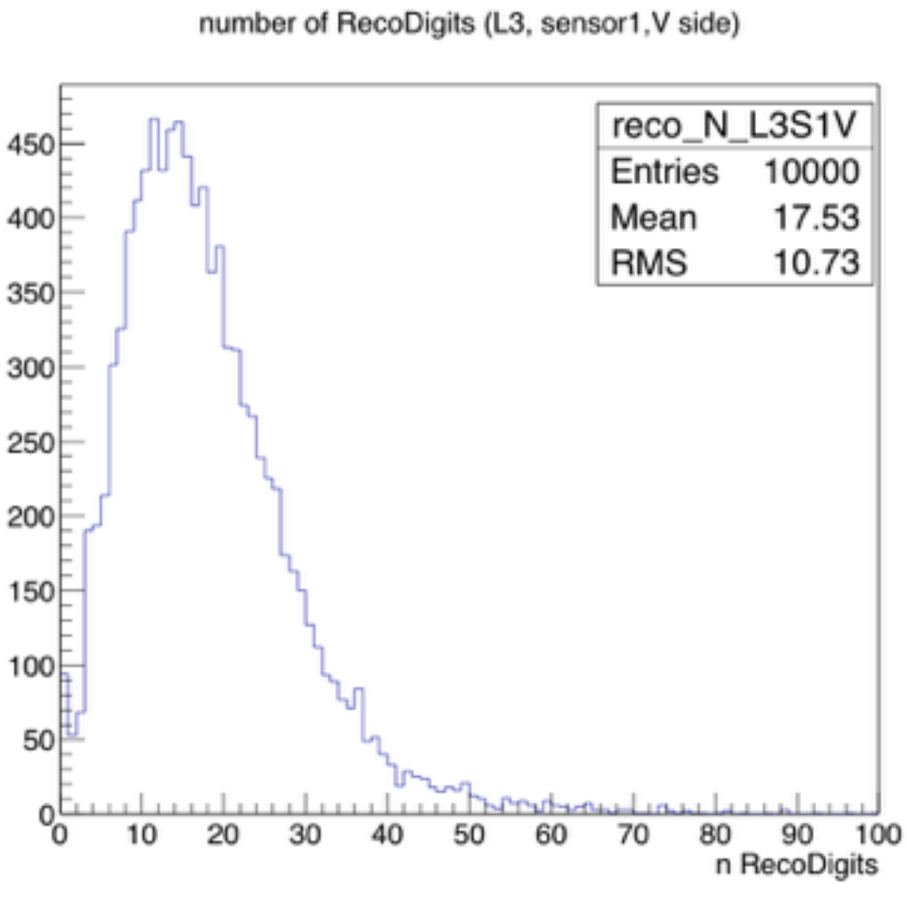
THESE STUDIES ARE NEEDED TO IMPROVE THE SIMULATION IN VIEW OF PHASE3

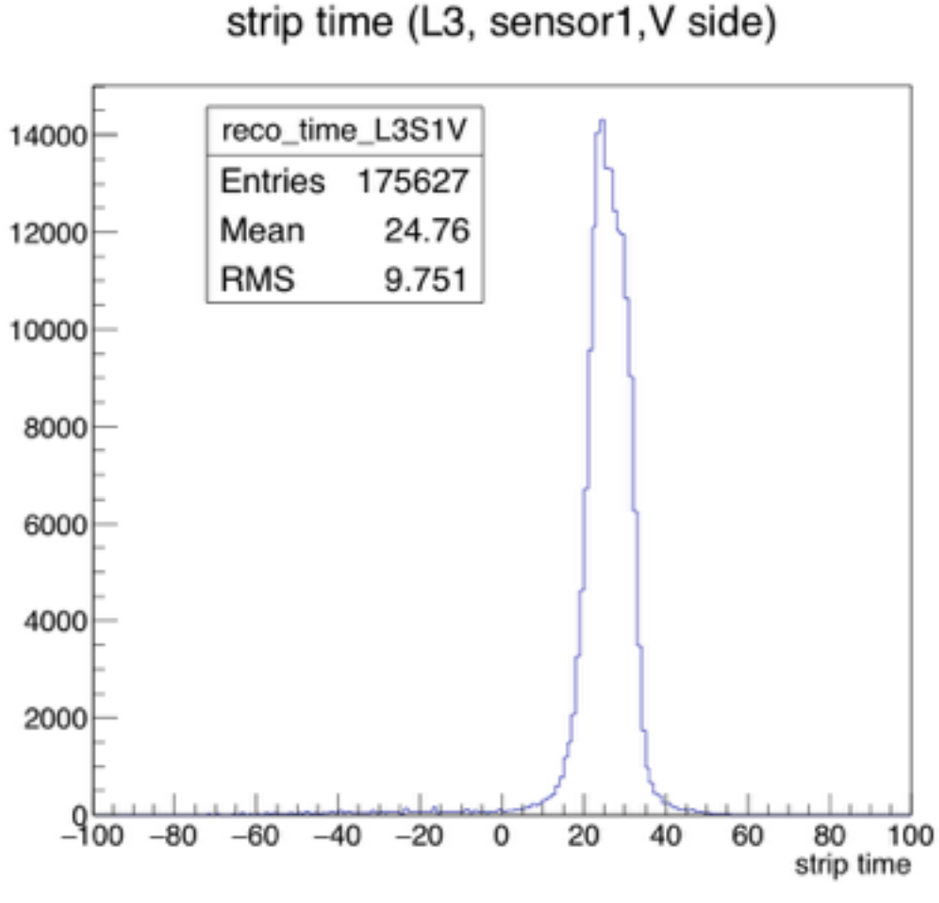
CoG Calibration & Performance

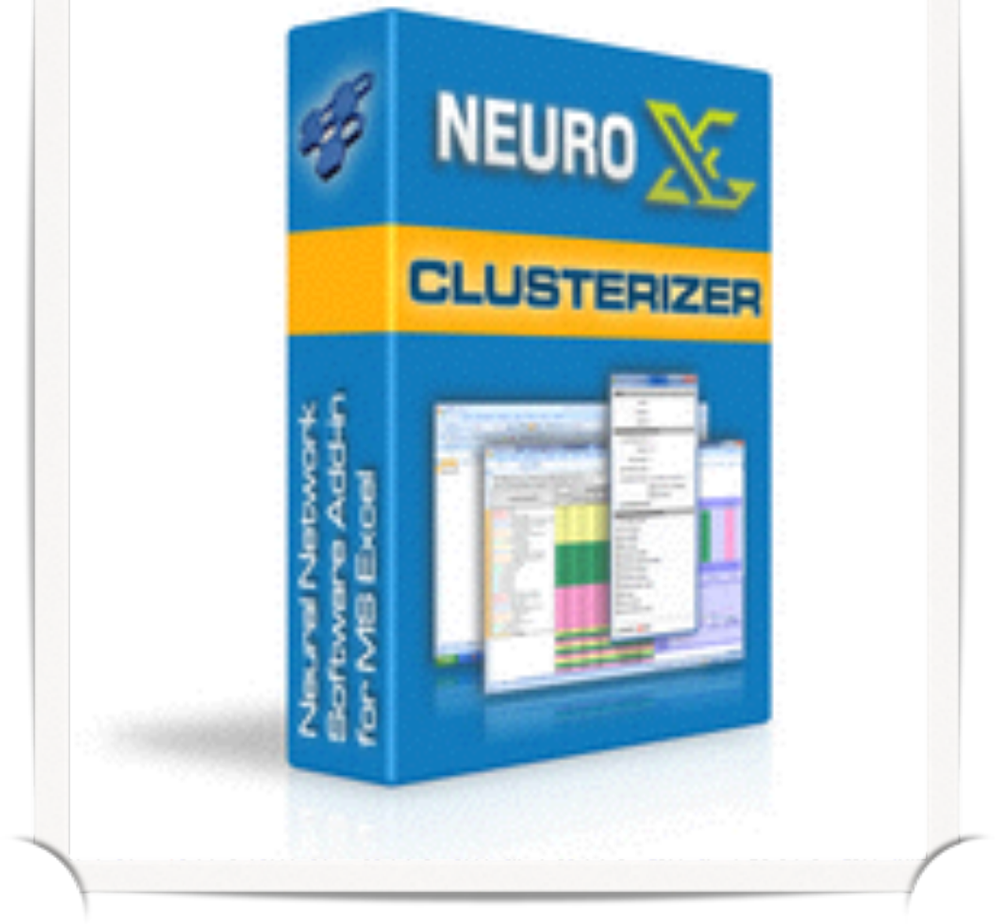
What's ready

- First we need to look at the CoG distributions, and check that they are somewhat similar to our simulation, and calibrate it (Michael's talk)
- SVDRecoDigits plots for each sensors side:
  - number of RecoDigits
  - charge distribution
  - time distribution





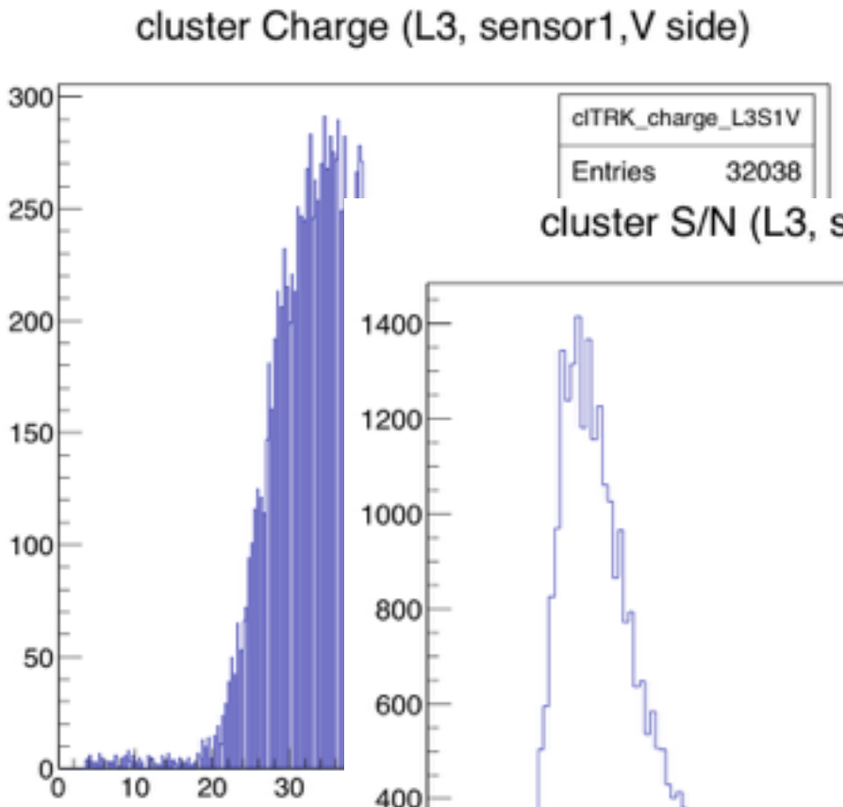


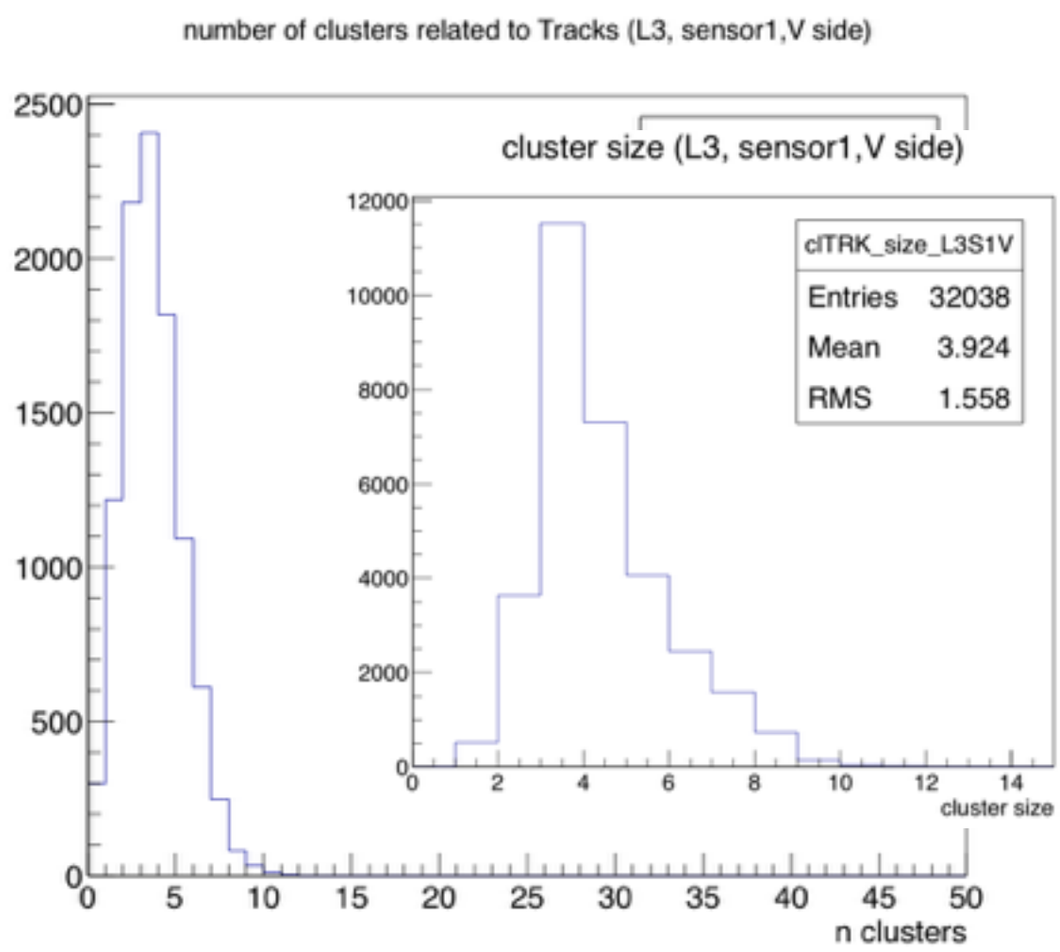


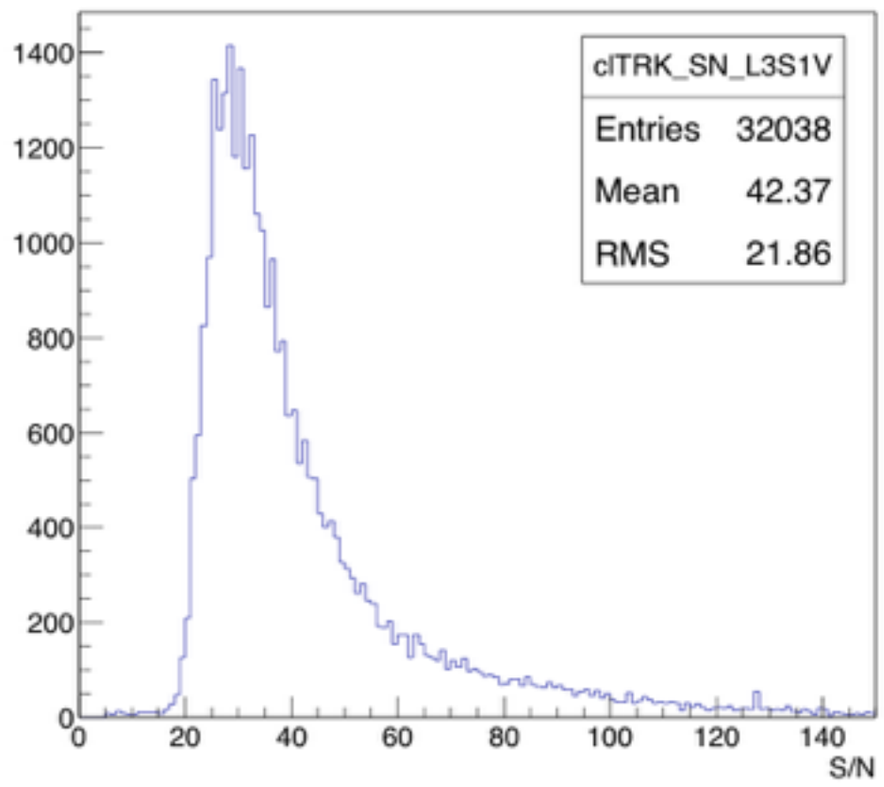
Clusterizer
Calibration & Performance

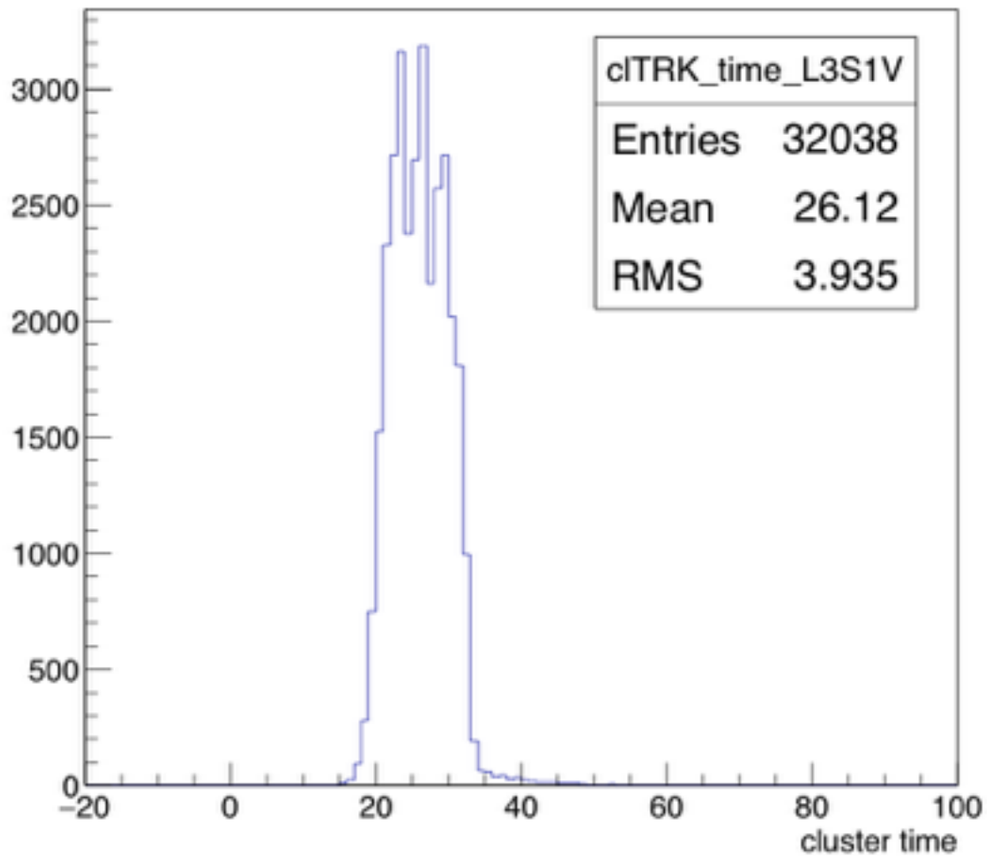
What's ready

- The Clusterizer is the last step, with the SpacePoint Creator
- we may optimise the Clusterizer parameters, although I think that they may be already OK
- We can, at any time, look at the clusters related to tracks (per sensor side) plots:









Conclusions

➡ Very first data will be used to calibrate the APV25 latency and check the channel mapping.

➡ Once we achieve these two goals, we will be ready to look at data.

➡ **Phase2** data will be used to:

1. improve and tune the simulation
   - ✓ noise
   - ✓ signal generation and sampling
2. understand how CoG behaves on data
   - ✓ calibration (see Michael's talk)
   - ✓ resolution (use CDC timing)
   - ✓ bias (& bias correction ?)
   - ✓ time jitter dependence
3. study Clusterizer and SpacePoint creation behaviours on data
   - ✓ energy and time correlations
   - ✓ …