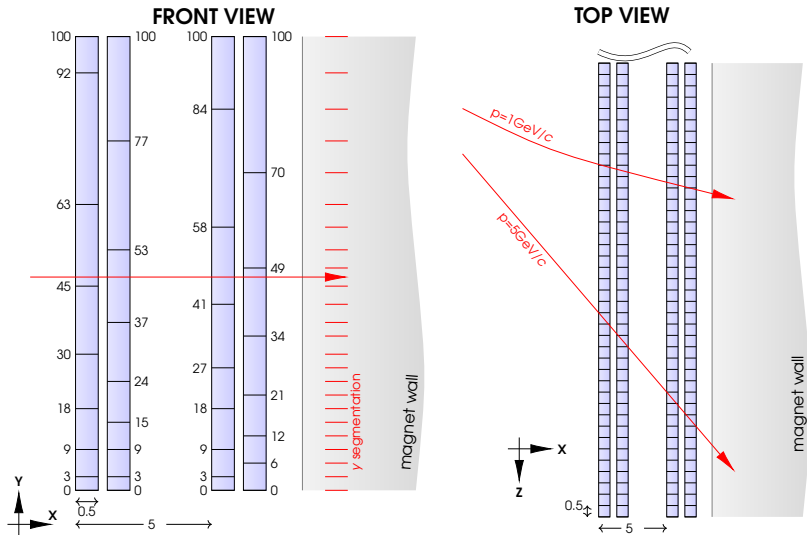
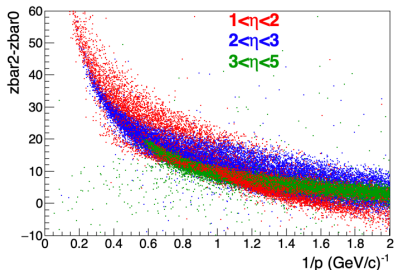
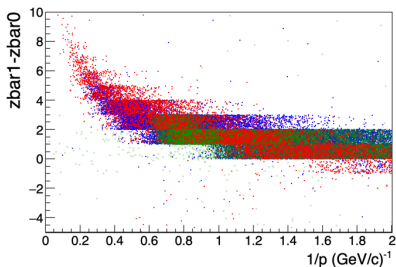


Readout for Magnet Station

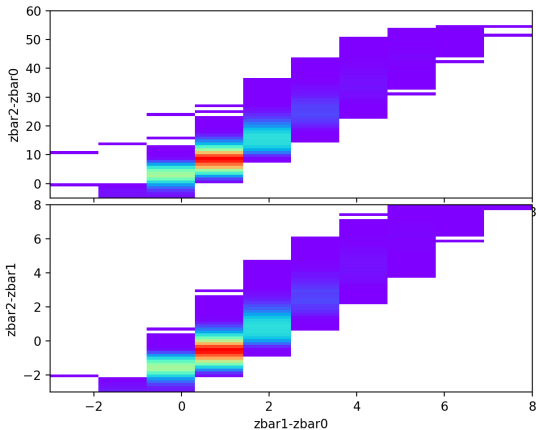
Cesar L. da Silva
Los Alamos National Lab



- particles don't bend in Y-direction
- a combination of 4 Z-position hits in the same Y direction determine a track

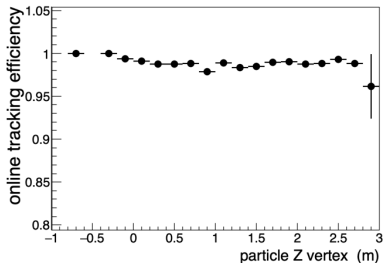
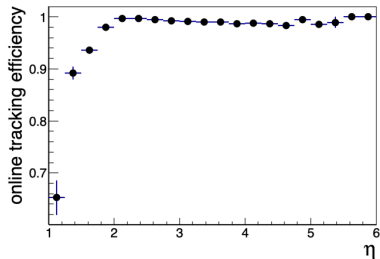
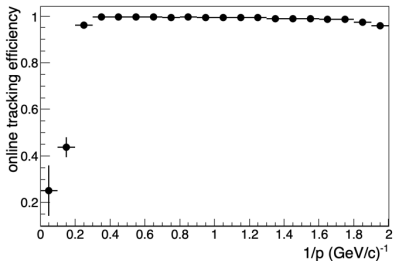


- simulation done with all particles depositing at least one hit in UT
- including off-vertex particles (like kaon decays)
- $z_{\text{bar}j}$ is the 10 most significant bits of the cluster Z position (3.5 mm segments)

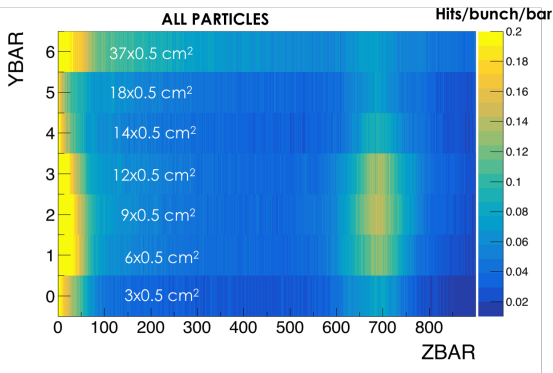


- 200 combinations per $zbar0$ combinations found from simulations

Online Tracking Efficiency

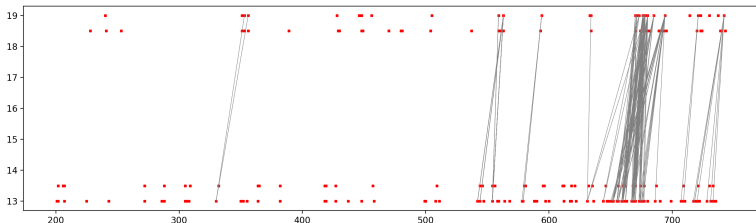


- maximized efficiency for $0.5 < p(\text{GeV}/c) < 5$



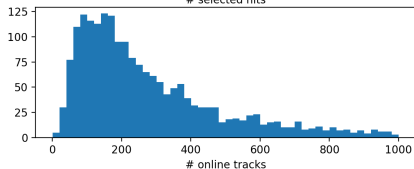
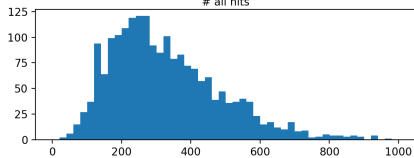
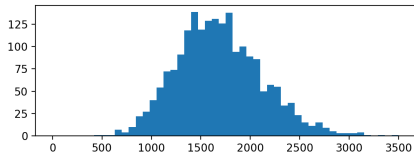
- coverage $100 < ZBAR < 850$
- all hits in the MS, including beam BG and secondary particles from the magnet walls and beam pipe
- hot occupancy spot at the magnet entrance has not been considered to be instrumented
- 1700 hits/panel/crossing \rightarrow 800 clusters/panel/crossing
- no clustering applied so far
- now we apply these hits to the LUT

PANEL 0



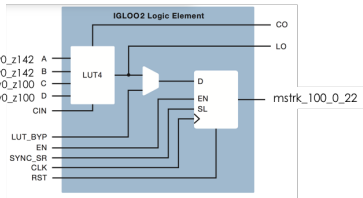
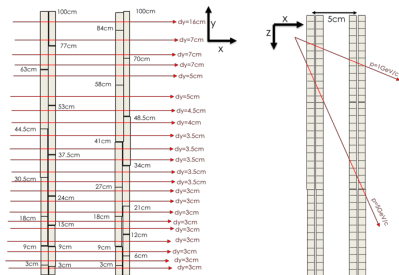
- lots of hits which are not going to be used for tracking are rejected in the front-end electronics
- still lots of fake tracks in the region with high occupancy caused by the flange in the beam pipe
- clustering should help reduce ghost tracks.

Multiplicities



hits/panel	average	top
selected hits	1700	3500
tracks/panel	330	1000
	312	1000

A factor of 5 reduction on the average number of streamed hits.
How much reduction can we get with clusters ?



- 200 combinations per zbar0 combinations
- 750 zbar0 units per panel
- 23 Y segments
- **total of 3.5M Logic Units per panel are needed**

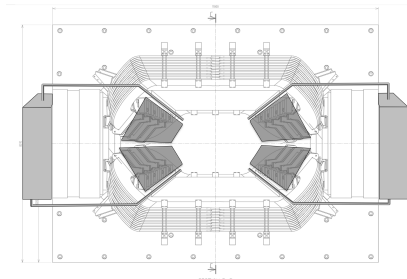
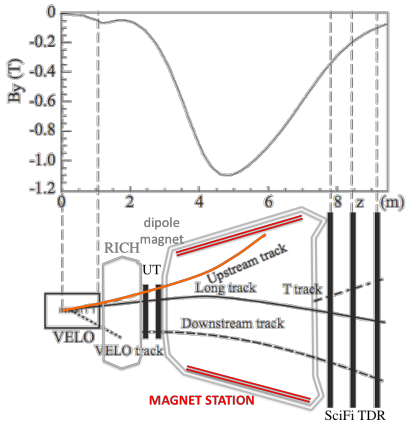
3 FPGAs per panel ?

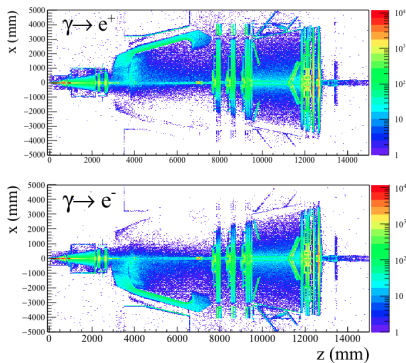
- the number of ID bits depends on how many optical links each online tracking board will have
- can we get $23 \times 4 = 92$ output links per panel ?
 - one per each y segment \times layer
 - that will save us 7 bits in the cluster bit pattern
- cluster bit pattern
 - 13 bits Z position (0.4 mm)
 - 2 bits cluster size (do we want clusters bigger than 4 Z bars ?)
 - 5 bits total ADC ?
 - **TOTAL 20 bit**

Data Streaming

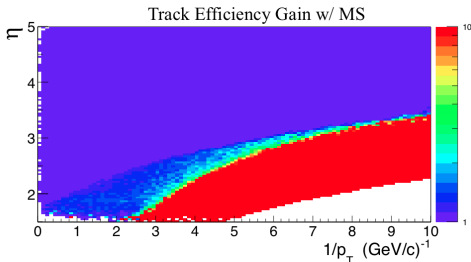
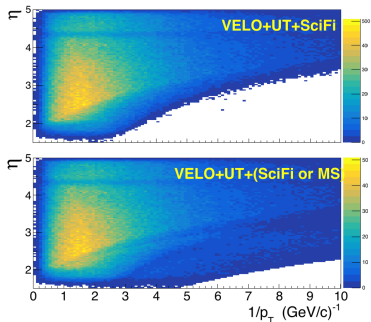
- top 1000 clusters / panel / crossing according to Jakub's simulation
- assume a factor of 5 reduction with the online tracking board \rightarrow 200 clusters/panel/crossing
- $40 \text{ MHz} \times 200 \text{ clusters} \times 20 \text{ bits} / 92 \text{ optical links} = \mathbf{1.7 \text{ Gb/s} / \text{optical link}}$

BACKUP SLIDES

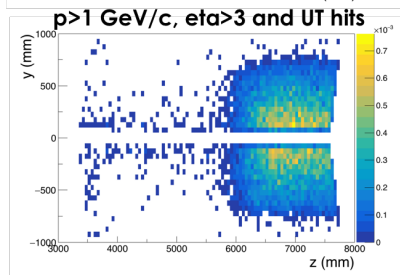
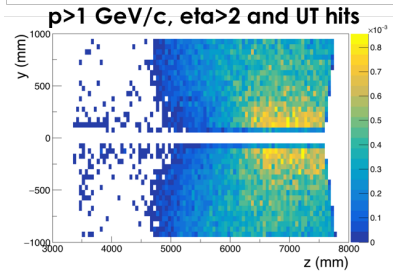
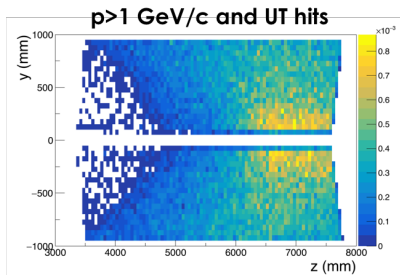
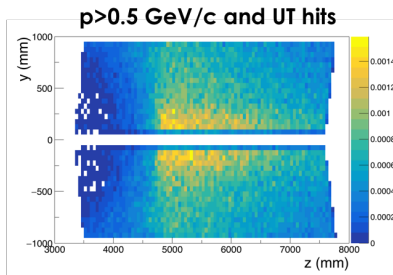




- end vertex of electrons from converted photons

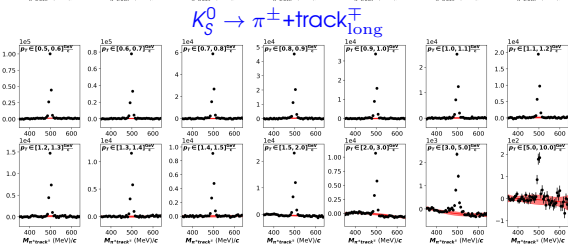
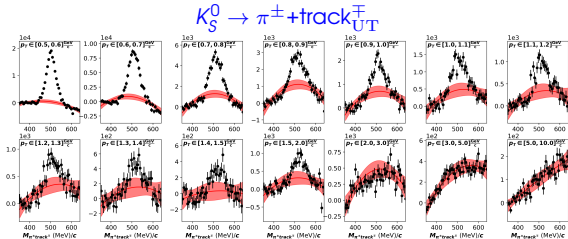


- the red band corresponds to the increased acceptance provided by the Magnet Station
- momentum > 500 MeV



- possible coverage : $4 < Z(m) < 7.5$

Improvement in mass resolution



- mass peaks from 2016 pPb data
- mass resolution obtained by MS will be equivalent to long tracks