

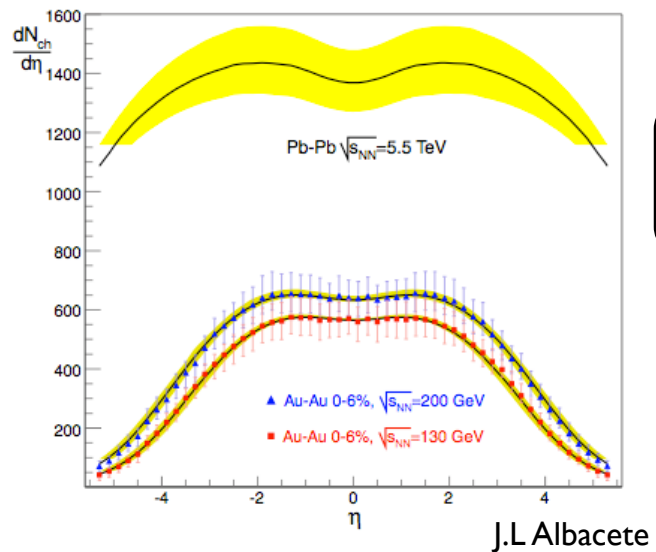
Readout from Heavy Ion collisions in the CSCs

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UC Davis

Purpose

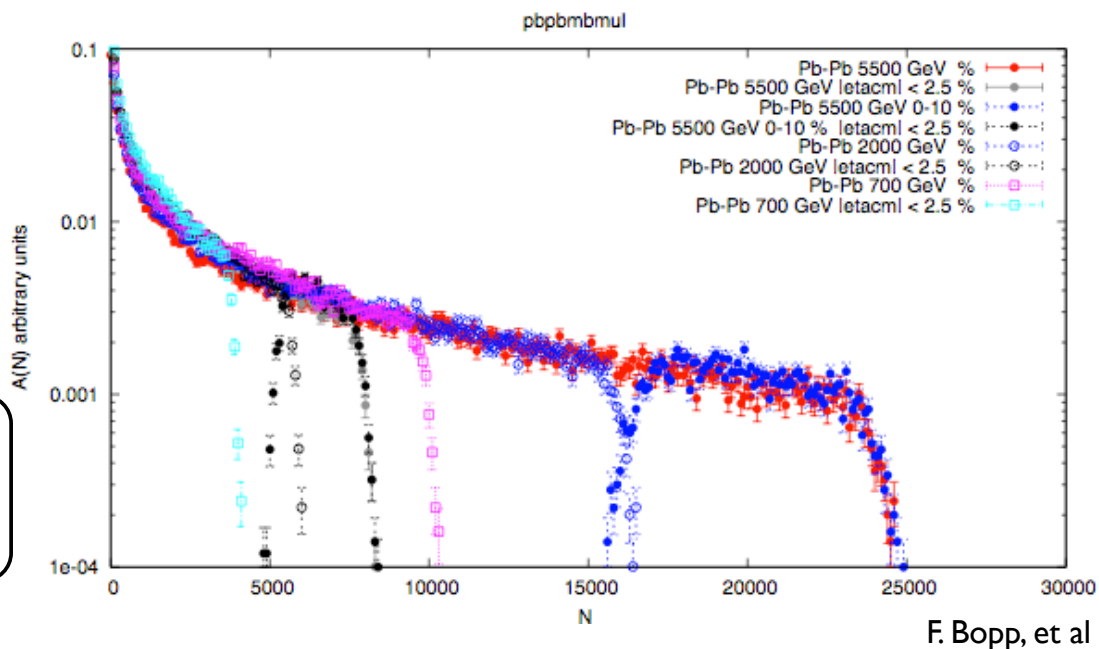
- Establish communication with the various sub-detectors experts and prepare for HI run
- Study occupancies in higher multiplicity environment.
- Spot data bottlenecks.
- All the information will be collected in:
 - <https://twiki.cern.ch/twiki/bin/view/CMS/CSCdetValidationHI>
- Workshop with all the sub-detector experts will be held sometime in October

Some HI background



Multiplicities from RHIC, and predictions for PbPb central collisions.

Multiplicity distribution in MinBias and central collisions in $|\eta| < 2.5$



Most central collisions →

Heavy Ion Run

- Expected to go for about two weeks at the end of the pp run (October 2010)
- Pb+Pb[Z=82, A=208] @ $\sqrt{s} = 5\text{TeV}$ (Initial 4TeV)
- Luminosity: Initial $10^{25} \text{ cm}^{-2}\text{s}^{-1}$, Nominal $10^{27} \text{ cm}^{-2}\text{s}^{-1}$
- Average Collision rates: 100 Hz @ $\sqrt{s} = 4\text{TeV}$, and 3kHz @ $\sqrt{s} = 5.5\text{TeV}$

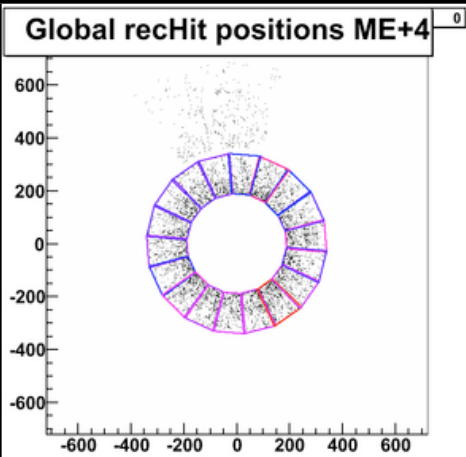
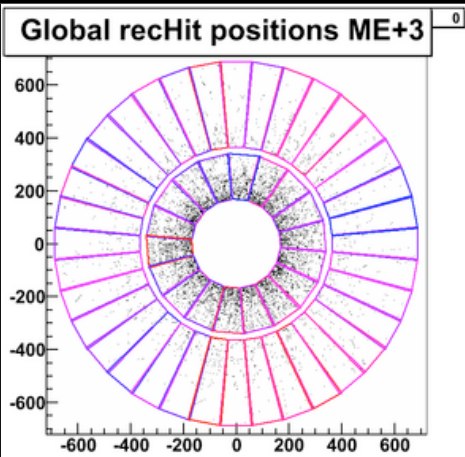
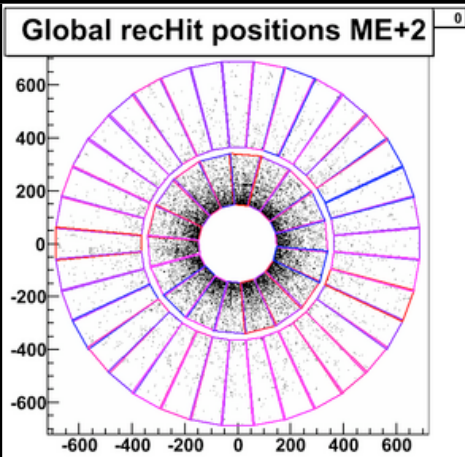
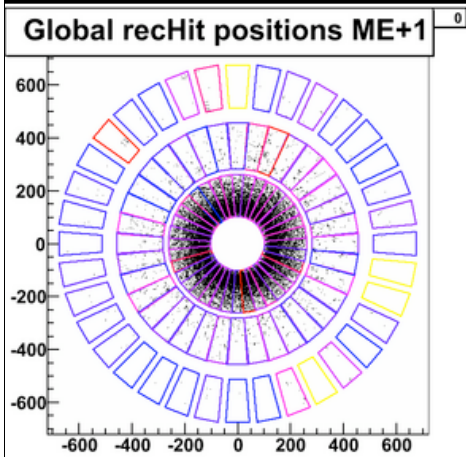
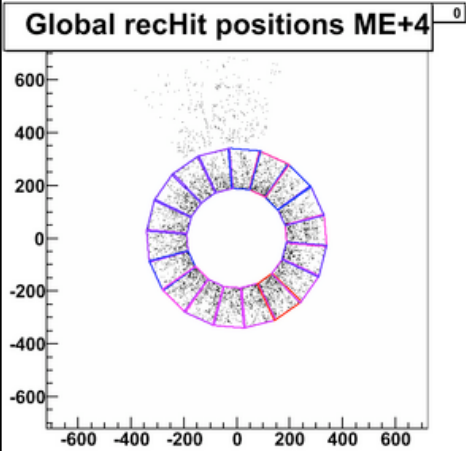
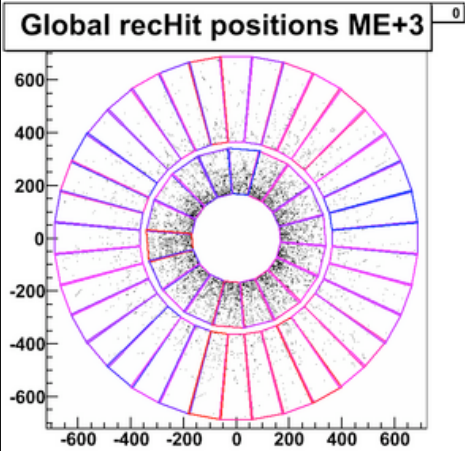
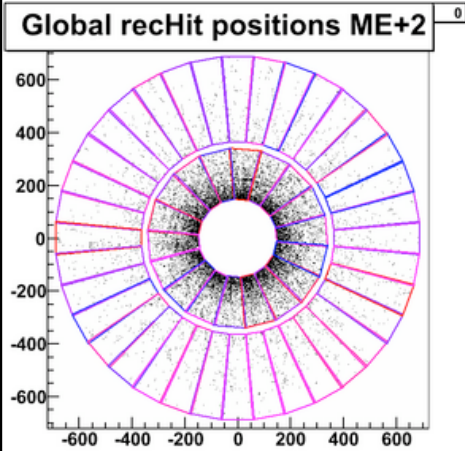
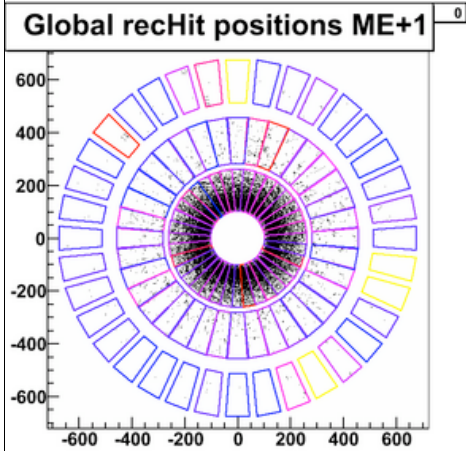
Key Parameters of "Early" Pb Ion Beam (from LHC Design Report)

1.96 TeV, from
Chamonix meeting

Parameter	Units	Early Beam	Nominal
Energy per nucleon	TeV	2.76	2.76
Initial ion-ion Luminosity L_0	$\text{cm}^{-2} \text{s}^{-1}$	$\sim 5 \times 10^{25}$	1×10^{27}
No. bunches, k_b		62	592
Minimum bunch spacing	ns	1350	99.8
β^*	m	1.0	0.5 / 0.55
Number of Pb ions/bunch		7×10^7	7×10^7
Transv. norm. RMS emittance	μm	1.5	1.5
Longitudinal emittance	eV s/charge	2.5	2.5
Luminosity half-life (1,2,3 expts.)	h	14, 7.5, 5.5	8, 4.5, 3
		Only possibility for 2009 or early 2010	Goal for 2-3 years (?) beyond

At full energy, luminosity lifetime is determined mainly by collisions ("burn-off" from ultraperipheral electromagnetic interactions) $\sigma \approx 520 \text{ barn}$

Central HI events(2000)



Most of the tracks are forward

Multiplicity, digis

Heavy Ion events from Hydjet

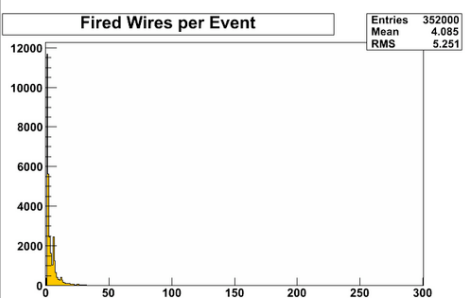
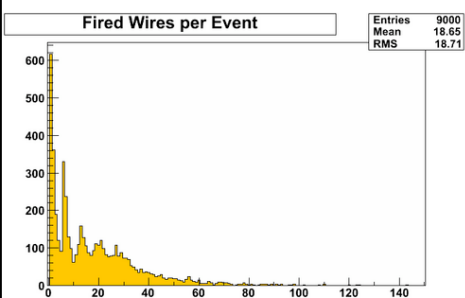
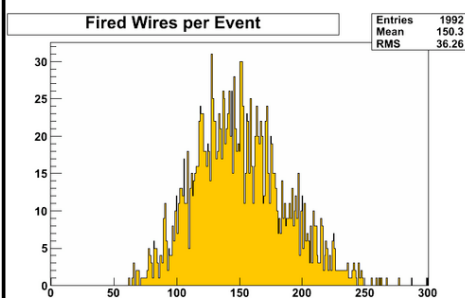
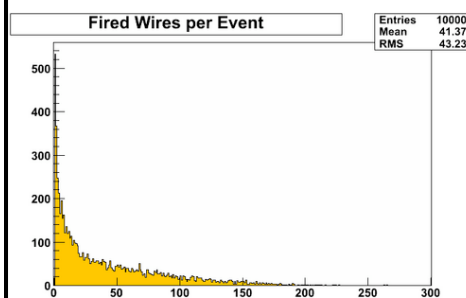
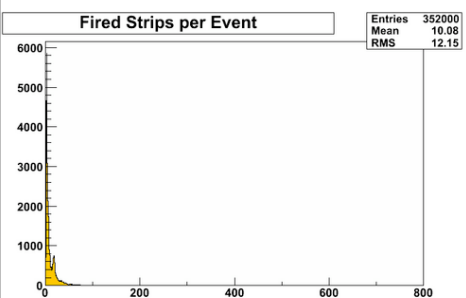
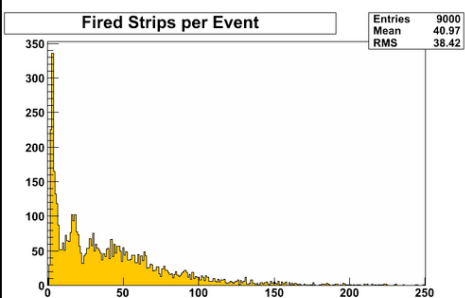
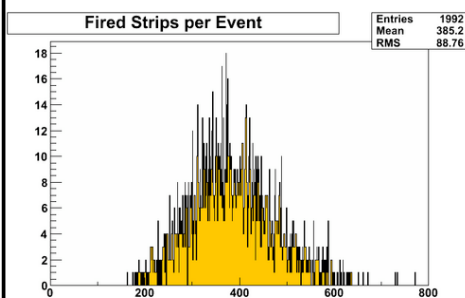
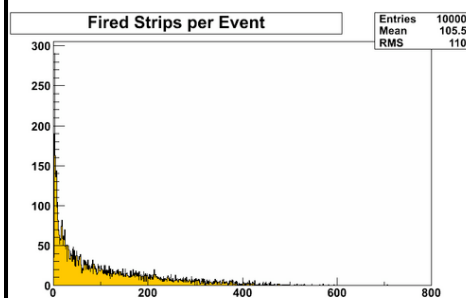
HI MinBias

HI Central

pp MinBias

pp ttbar

Note:x-axis



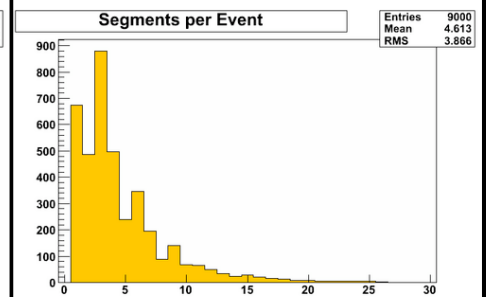
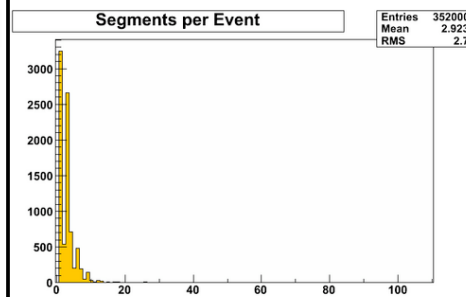
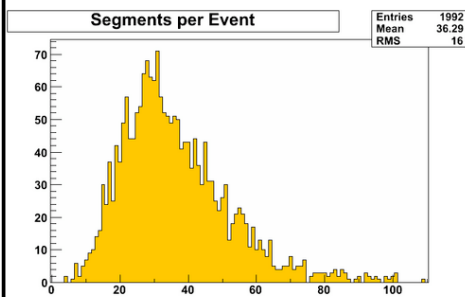
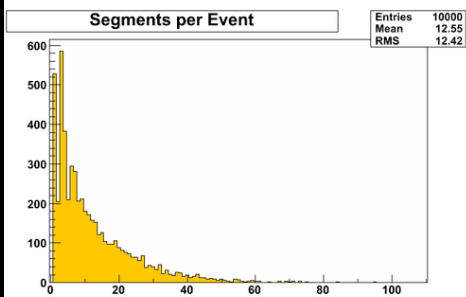
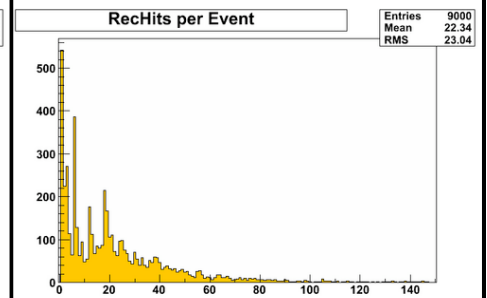
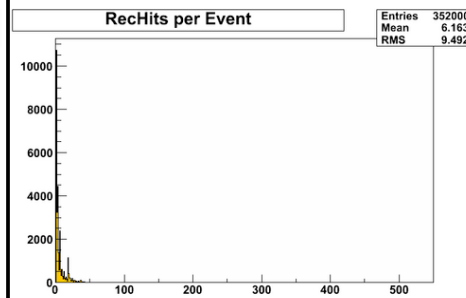
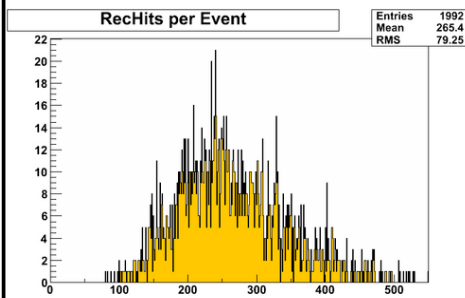
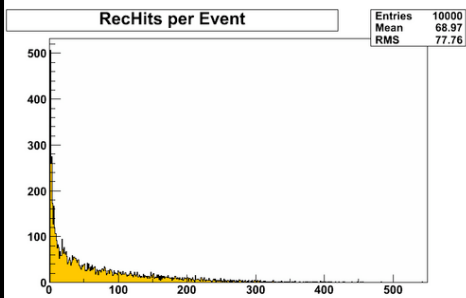
Multiplicity

HI MinBias

HI Central

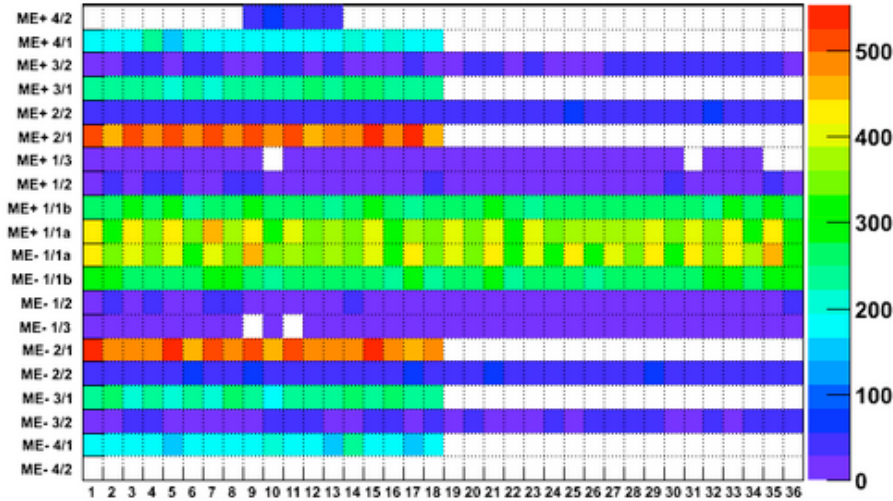
pp MinBias

pp ttbar
Note: x-axis

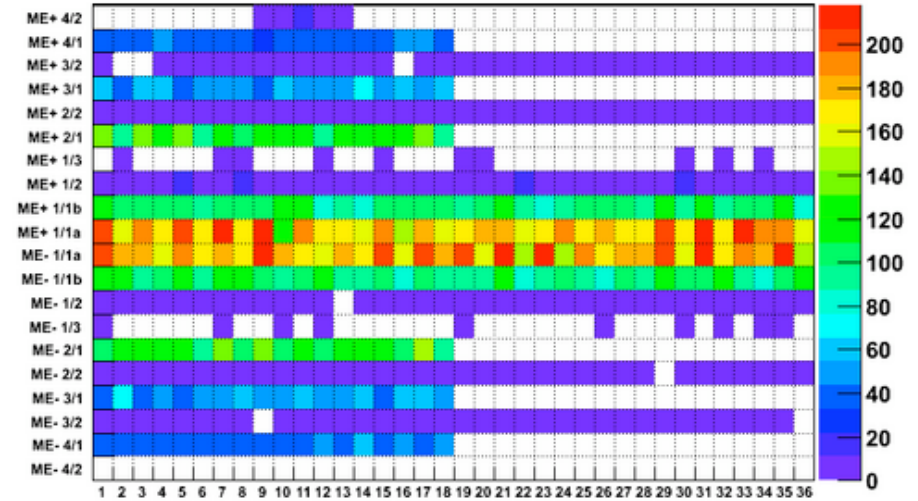


Occupancies in central HI (2000) events

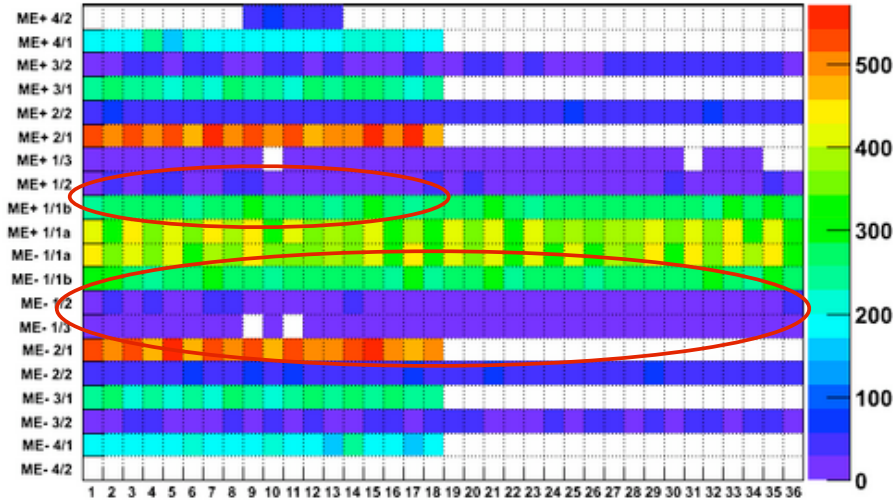
RecHit Occupancy



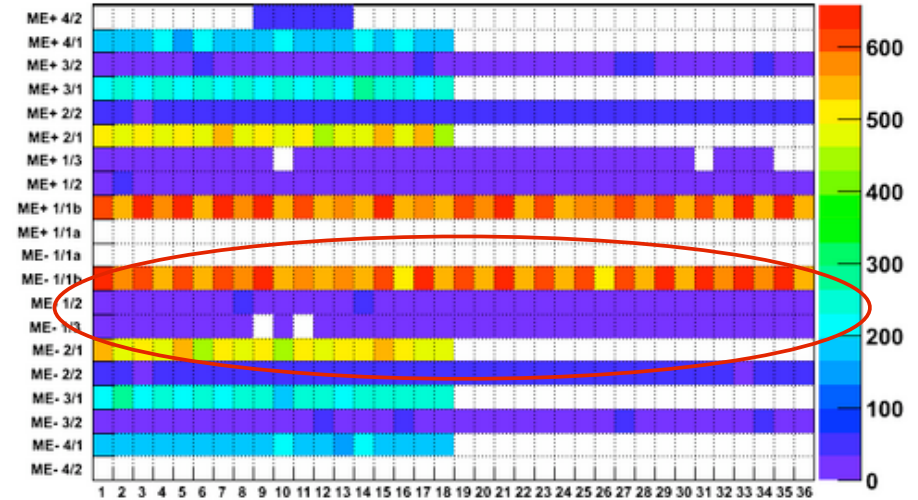
Segments Occupancy



Strip Digi Occupancy



Wire Digi Occupancy



Patterns?

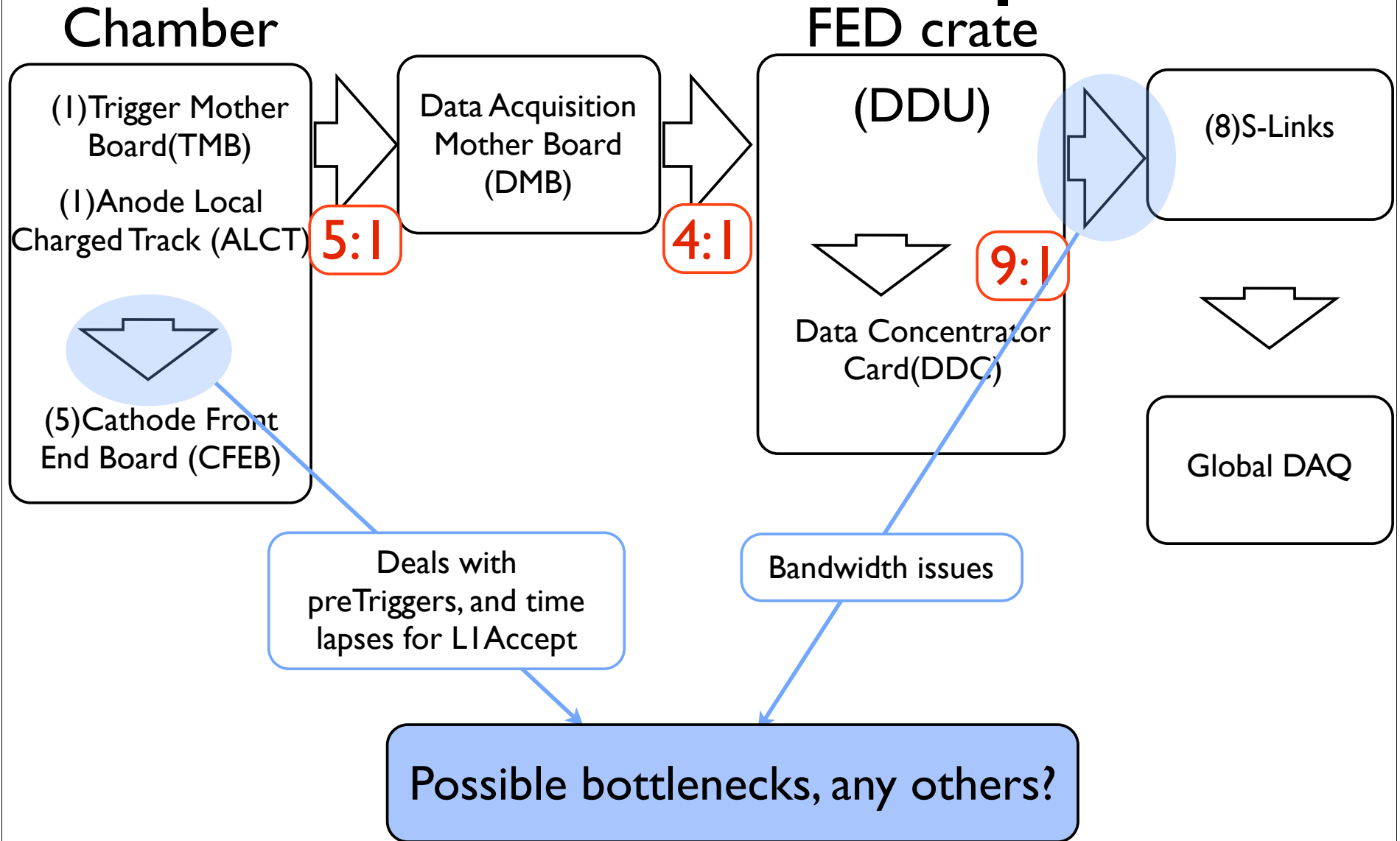
Trigger Path

CSCs need to trigger to read out

- preTrigger
 - CFEB stores data, to wait for LIA accept/reject
 - For pp 2(3)/6 layers consistent with track stub
- CFEB reads out on coincidence of (CLCT pretrigger * LIA)
- ALCT reads out on coincidence of (ALCT * LIA)
- TMB reads out on coincidence of (LCT * LIA)

All the readouts are based on LIA

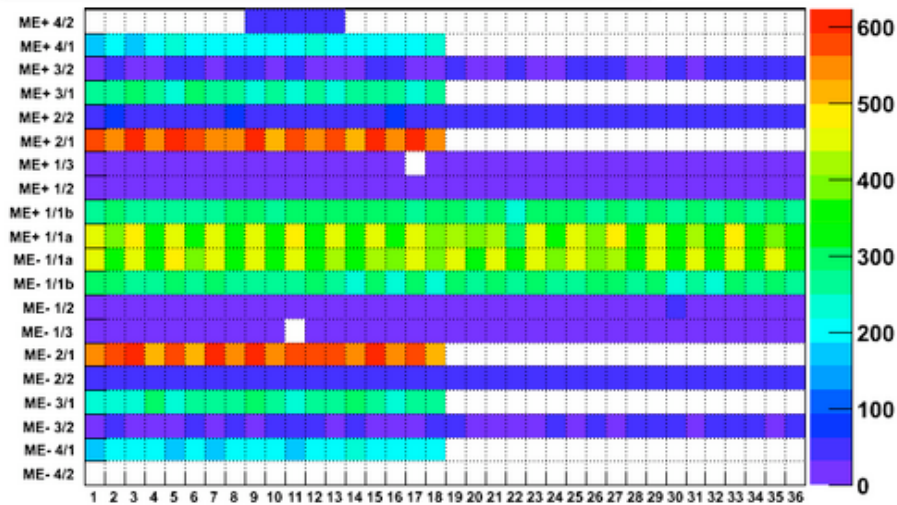
CSC Readout path



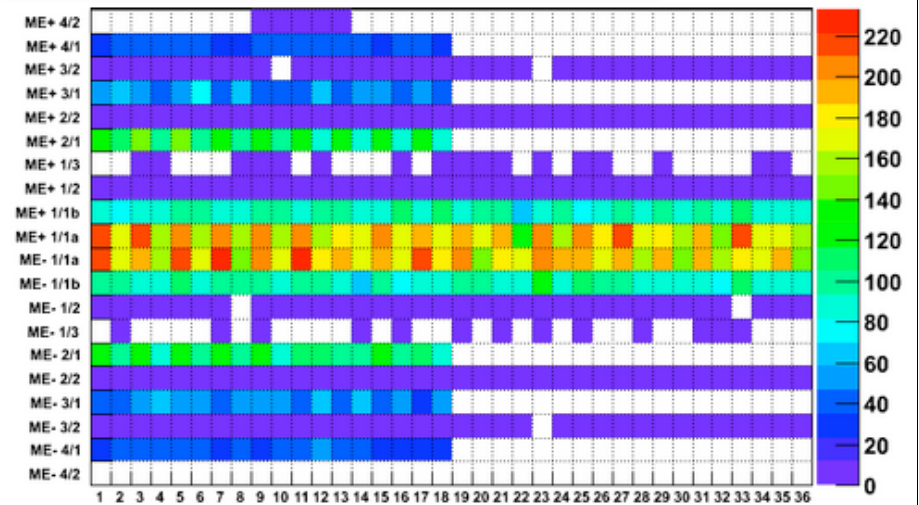
Extra Slides

HI MinBias(10000)

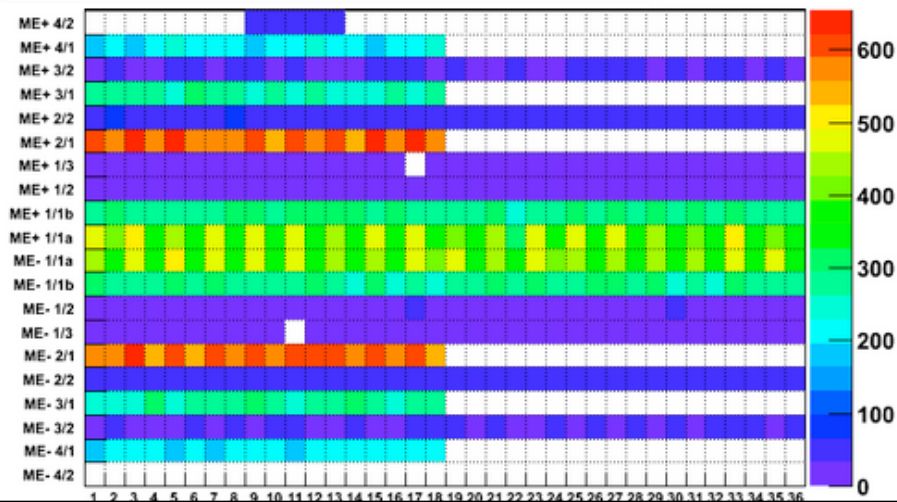
RechHit Occupancy



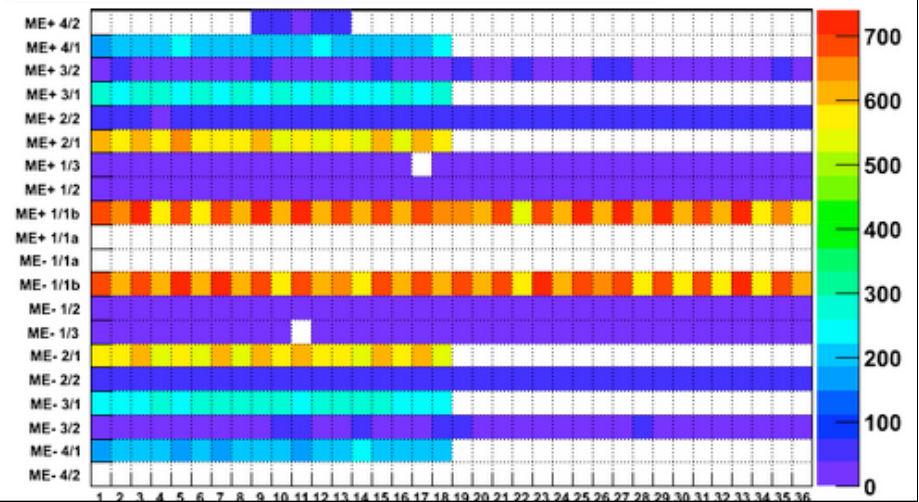
Segments Occupancy



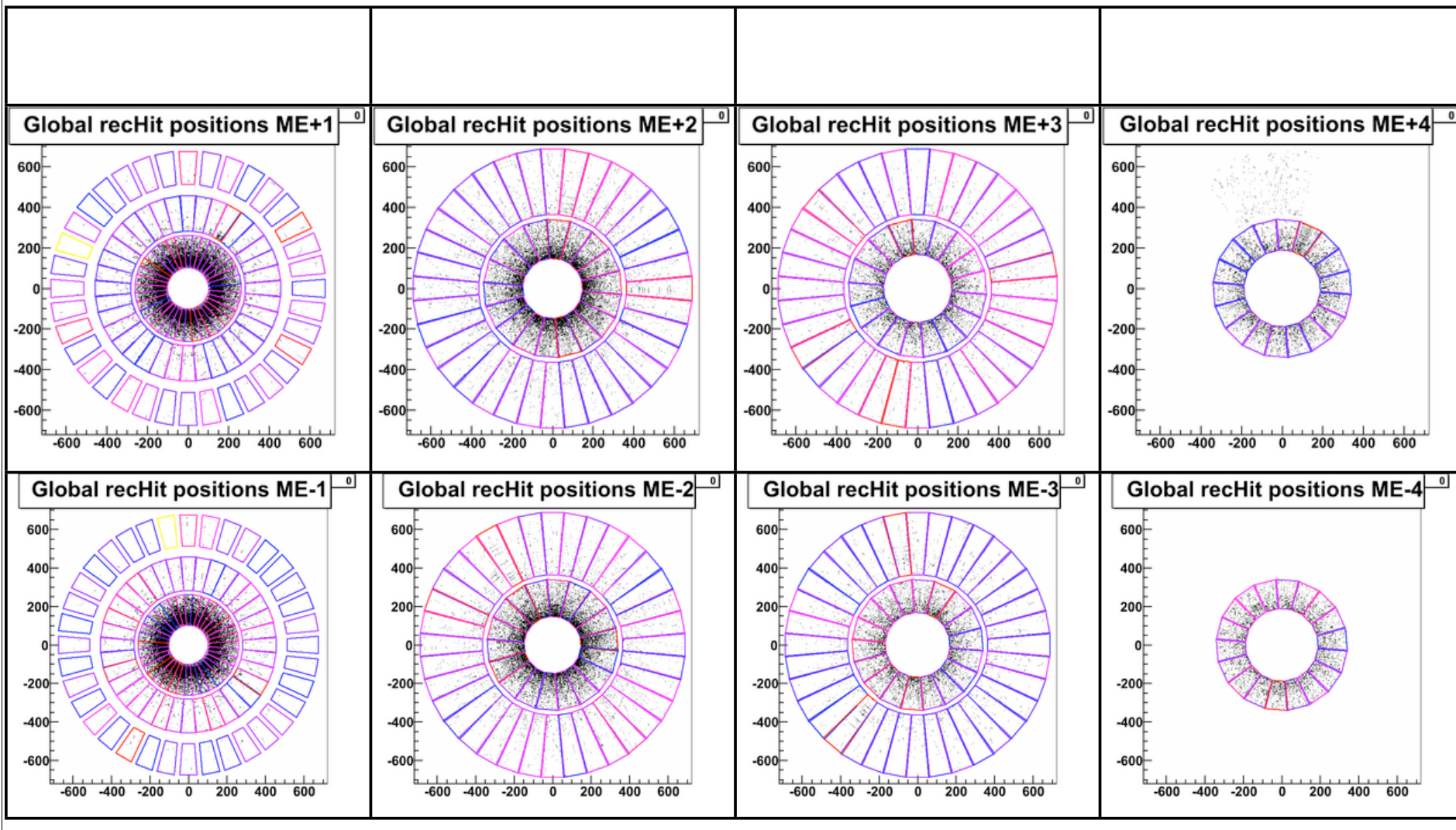
Strip Digi Occupancy



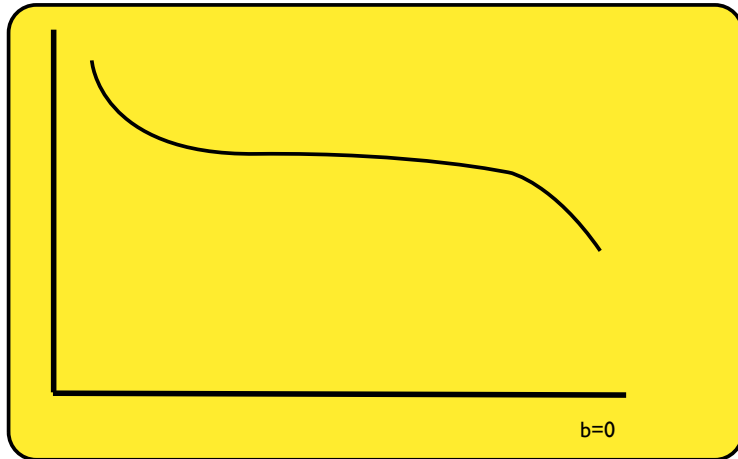
Wire Digi Occupancy



HI MinBias(10000)



Some HI background



Looking for N events vs
impact parameter plot

- preTrigger
 - CFEB stores data, to wait for LIA accept/reject
 - For pp 2(3)/6 layers consistent with track stub
- LCT
- ALCT
- LIA