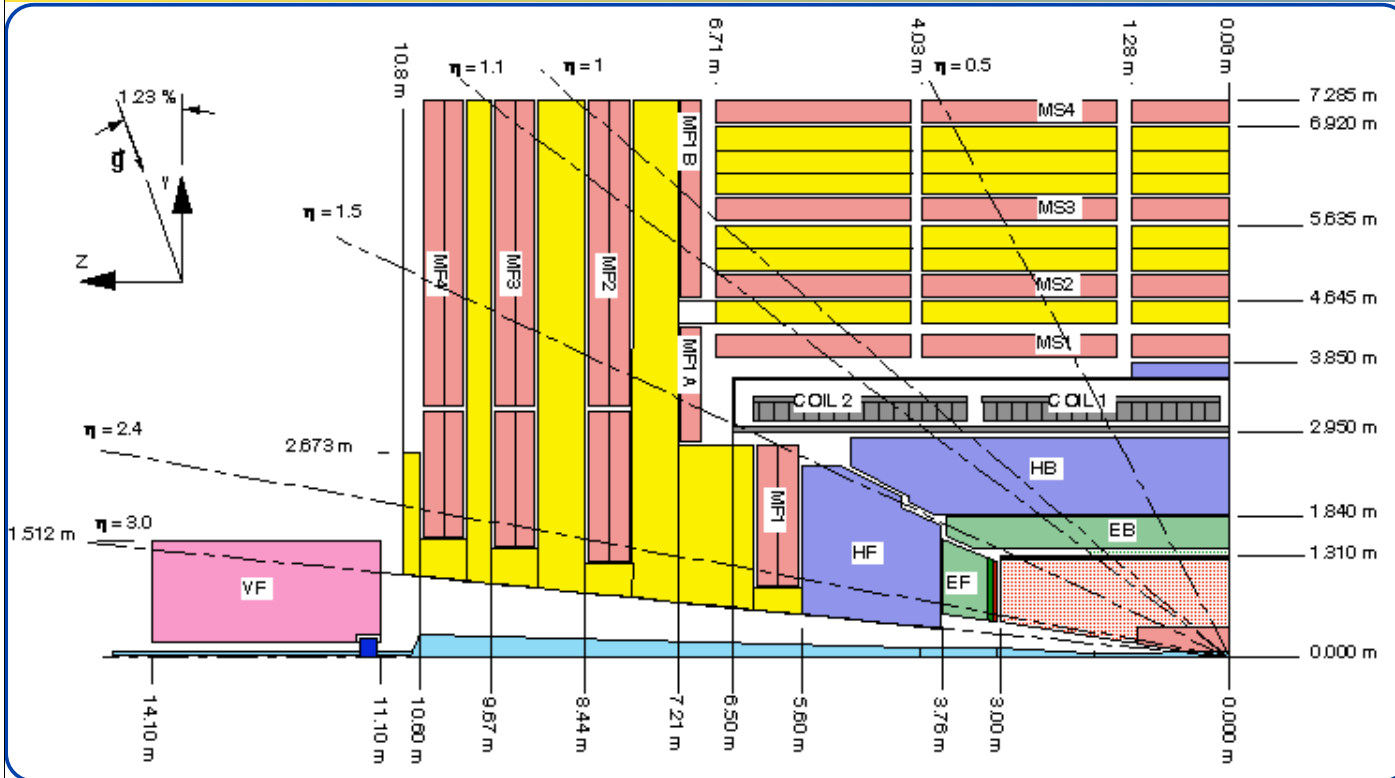# Heavy Ion readout : CSC

Jorge Robles
UC Davis

Geometry / data


Samples

- **Central b=0 (2000 events)** dcap:///pnfs/cmsaf.mit.edu/t2bat/cms/store/mc/Summer09/Hydjet_B0_4TeV/GEN-SIM-RAW/MC_31X_V2-GaussianVtx_311_ver1/

- **Minimum Bias(10 000 events)** dcap:///pnfs/cmsaf.mit.edu/t2bat/cms/store/mc/Summer09/Hydjet_MinBias_4TeV/GEN-SIM-RAW/MC_31X_V2-GaussianVtx_311_ve

- **pp ttbar (9000 events) from(CERN**) /store/relval/CMSSW_3_1_0/RelValProdTTbar/GEN-SIM-RAW/MC_31X_V1-v1/0001

- **pp QCD MInbias (352 000 events) from (MIT)** dcap:///pnfs/cmsaf.mit.edu/t2bat/cms/store/mc/Summer09/MinBias/GEN-SIM-RAW/MC_31X_V3-v1/0001

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2000 Central HI events
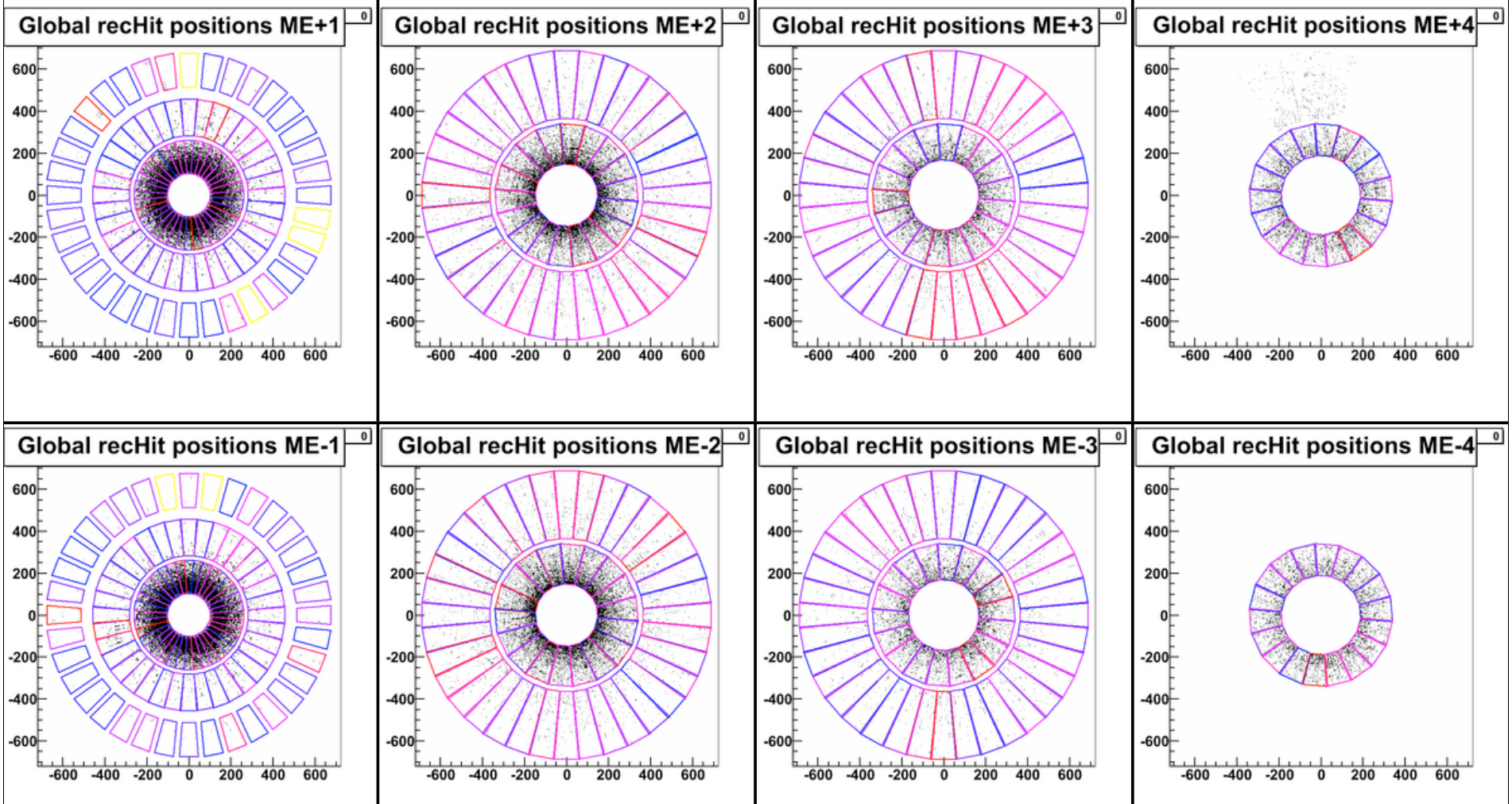
Most of the tracks hit the ME1/1 chambers
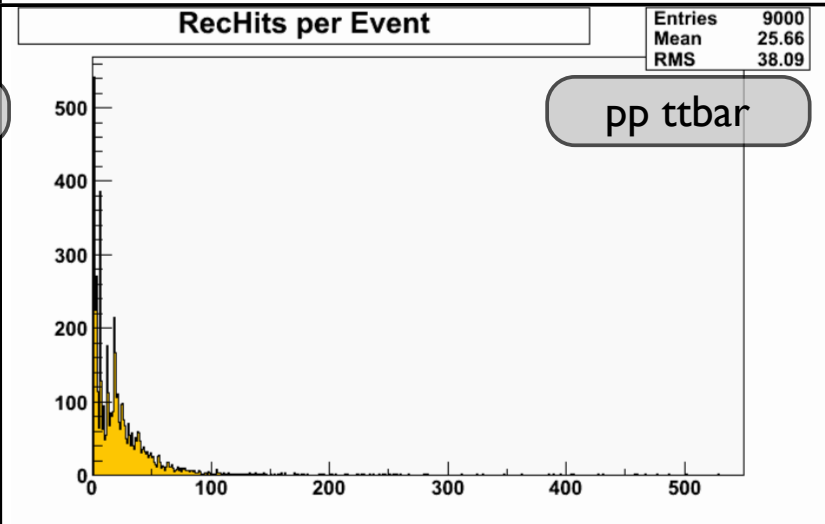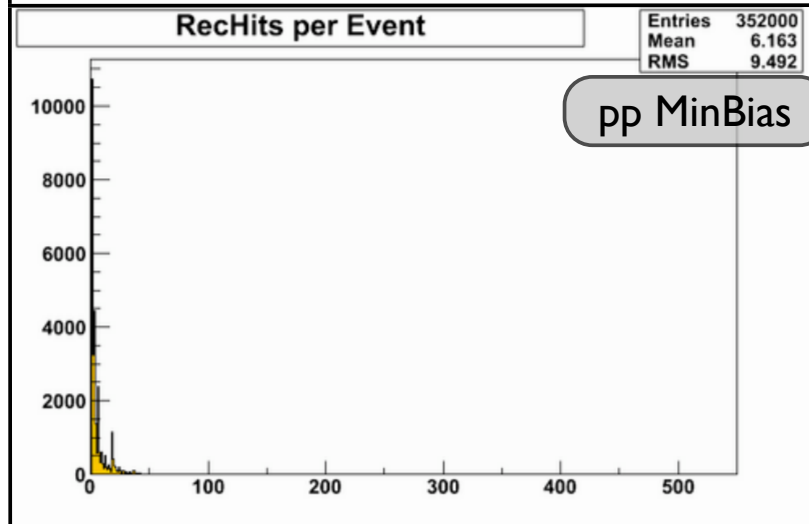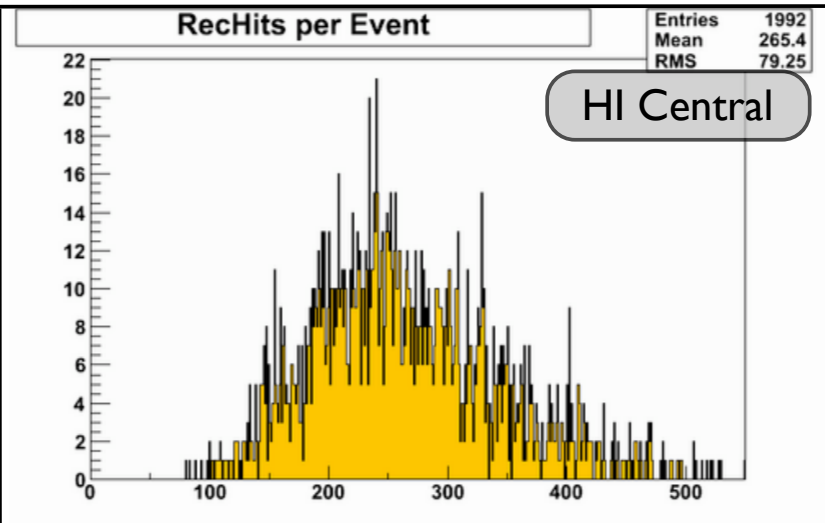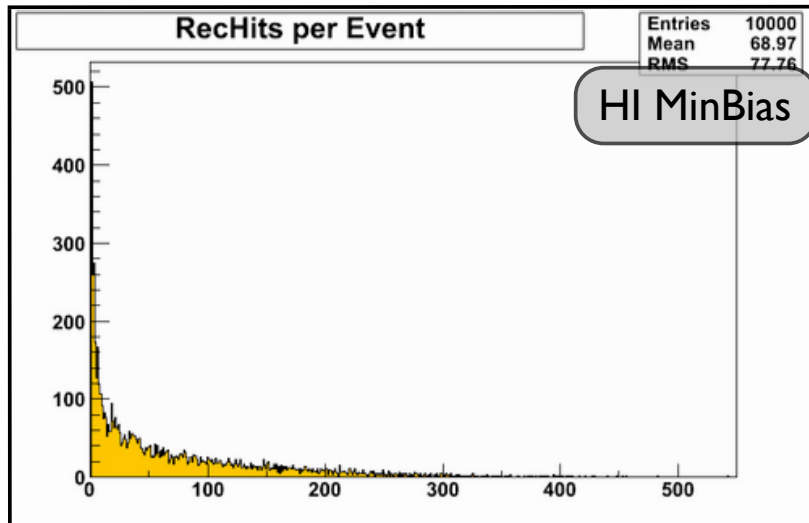
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Multiplicity

Fired strips

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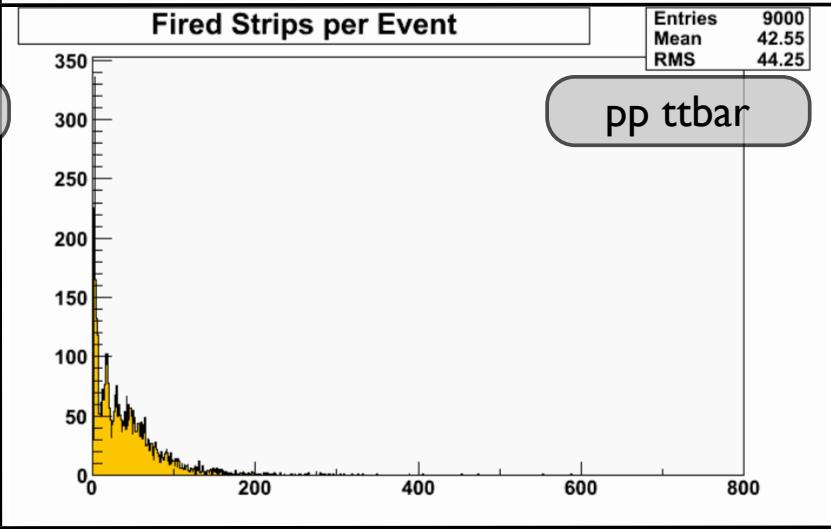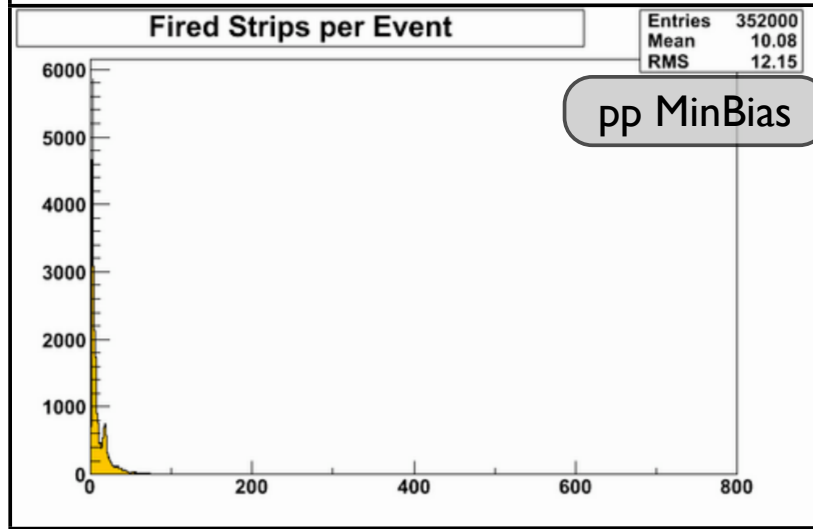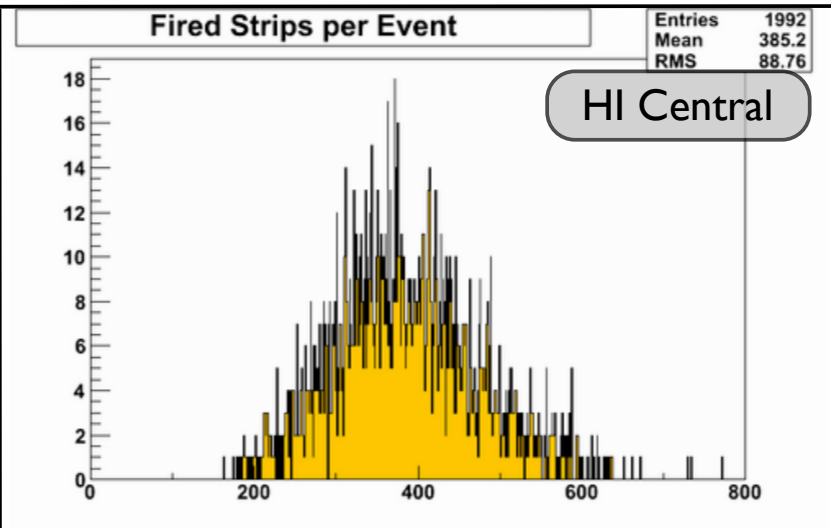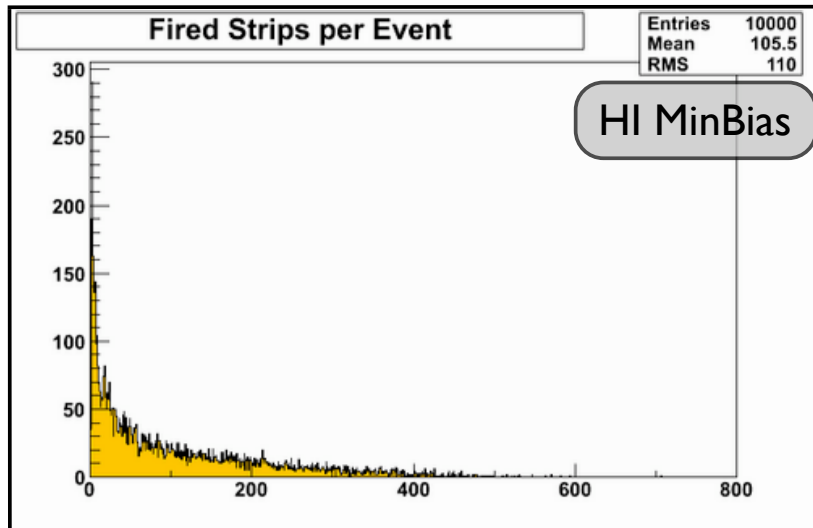
Multiplicity

Wires
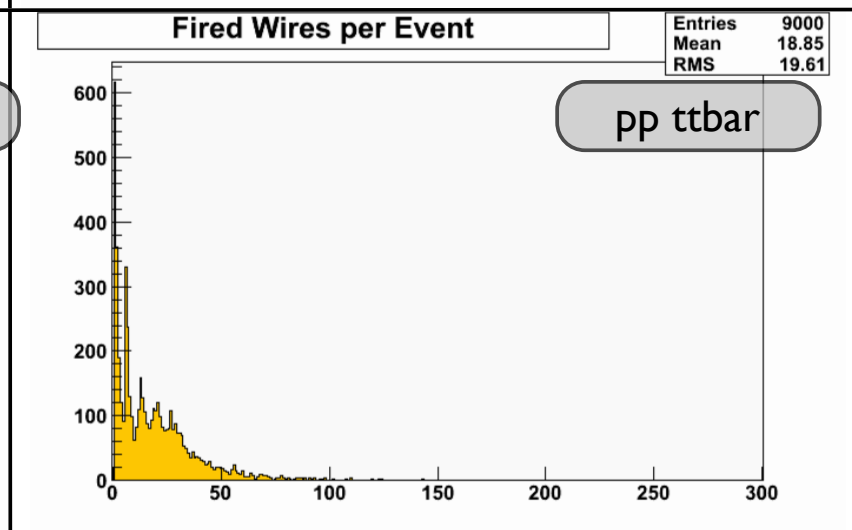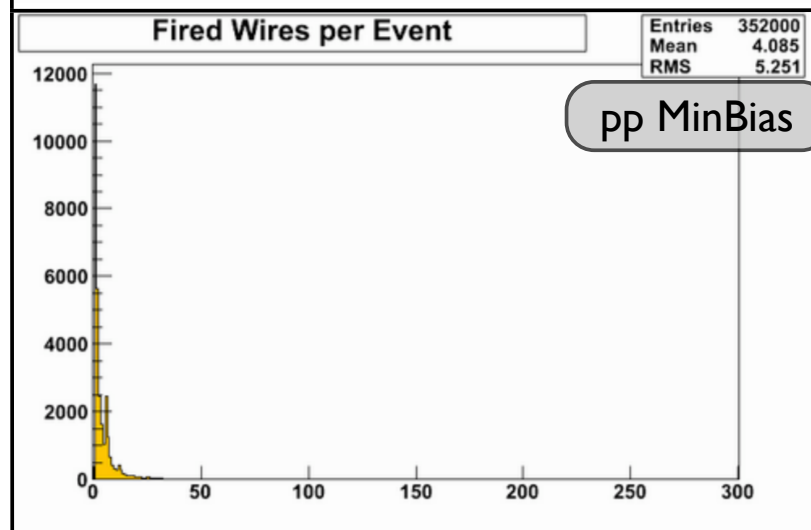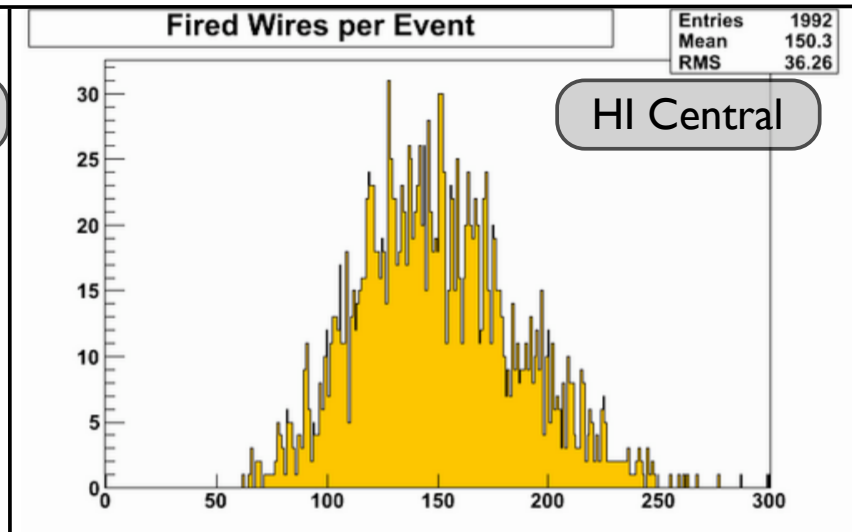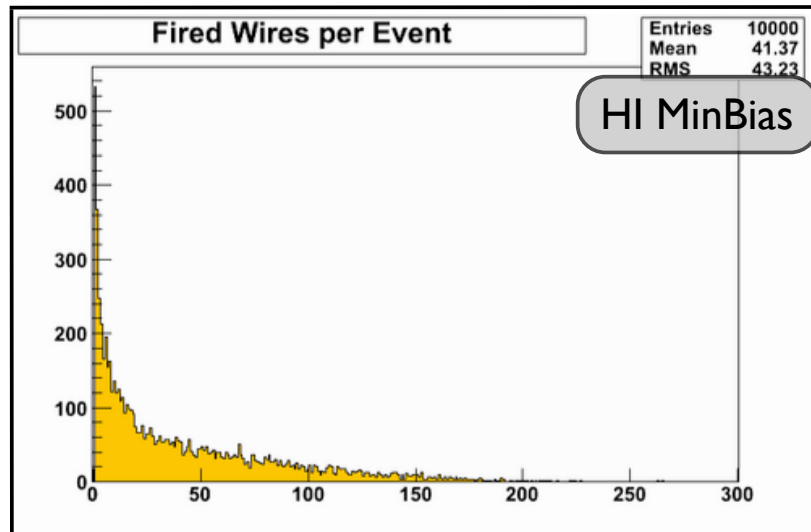
Multiplicity

RecHits

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Multiplicity

Segments
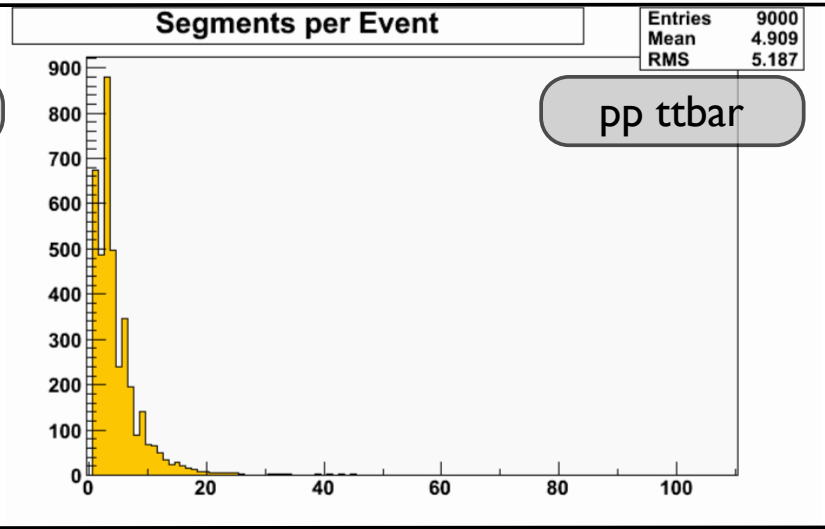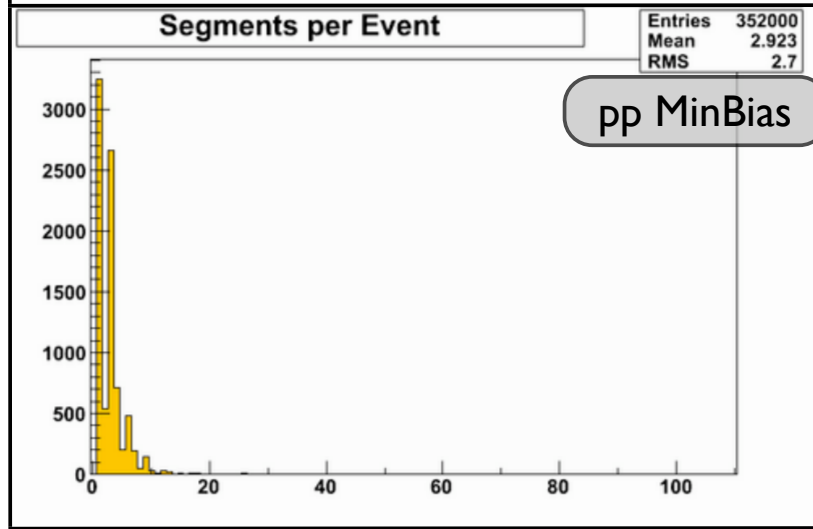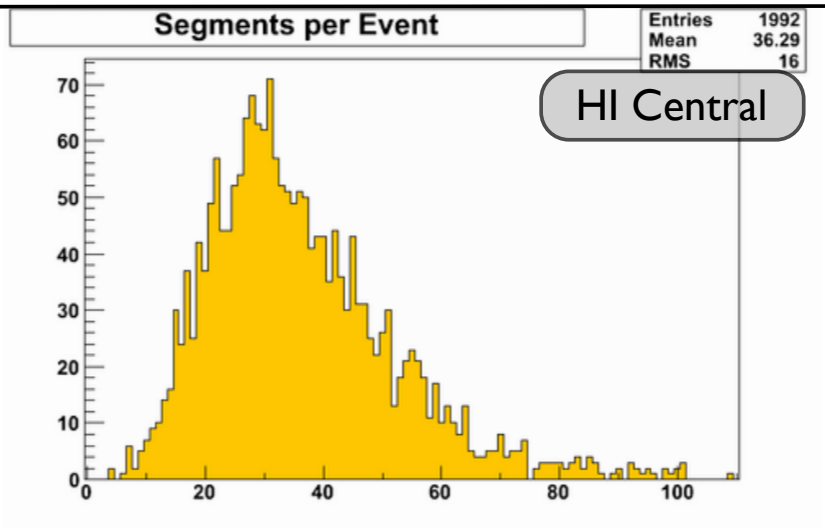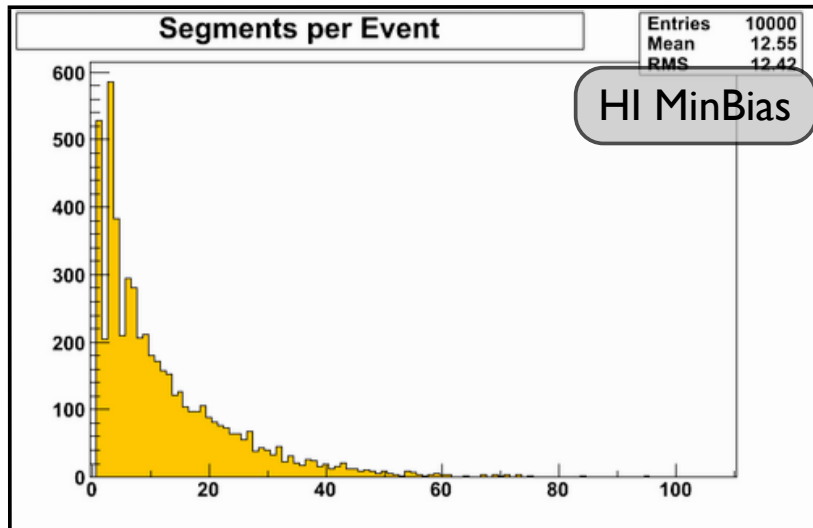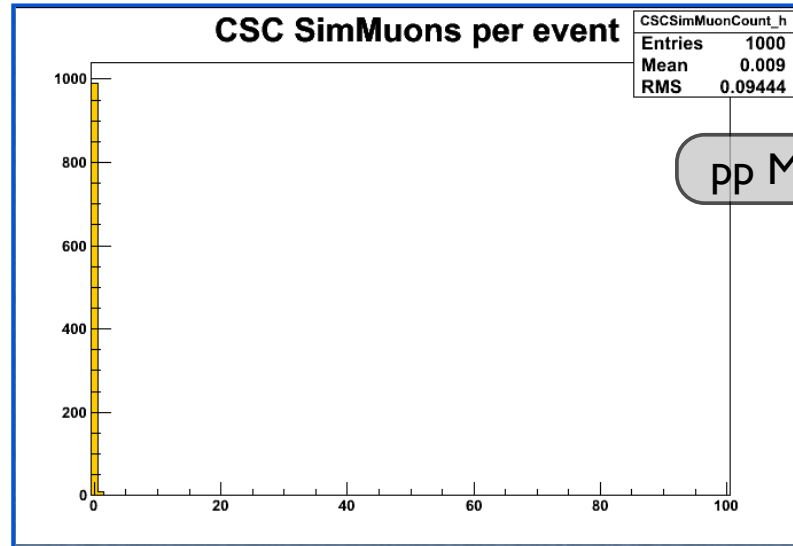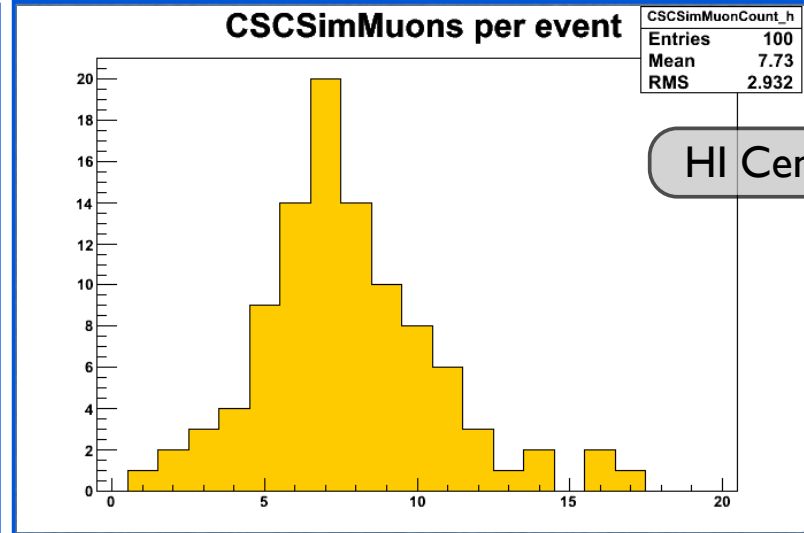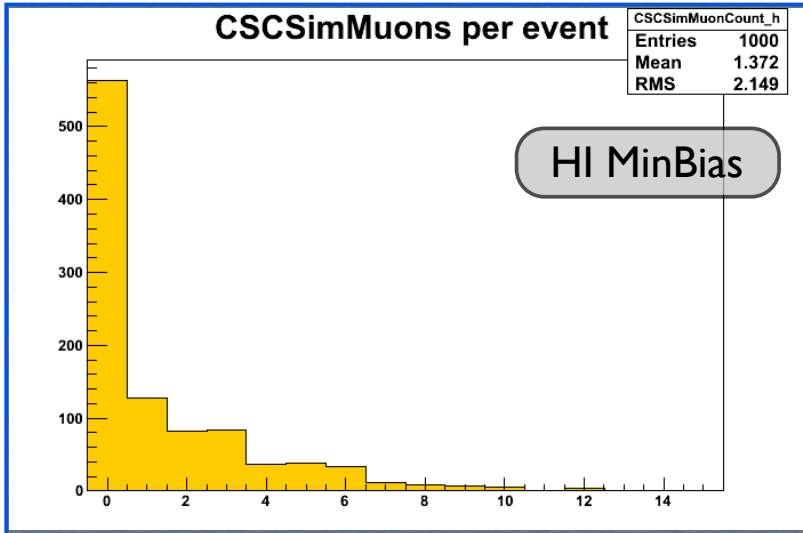
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Sim Muons in CSC

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RecHit Occupancy
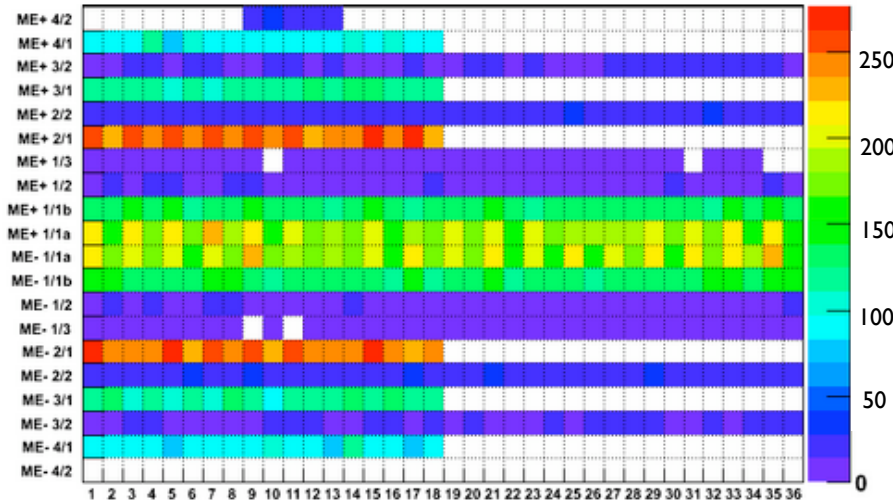
Segments Occupancy
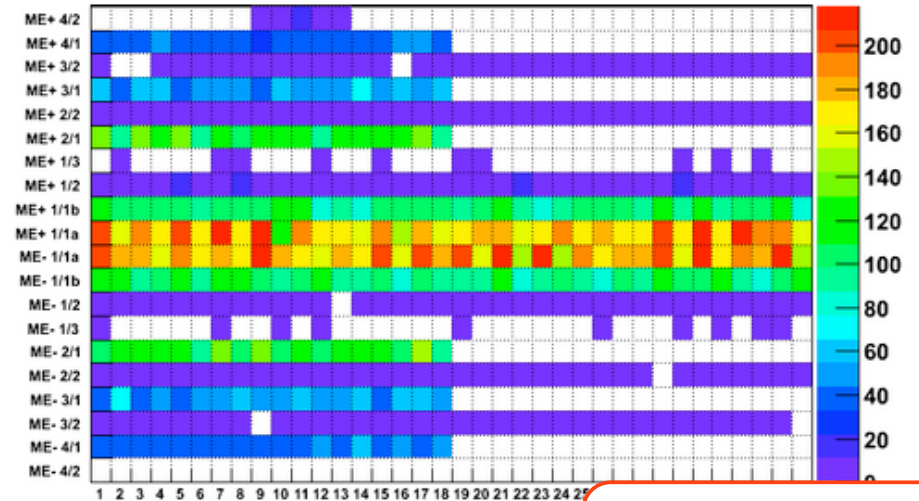
Strip Digi Occupancy
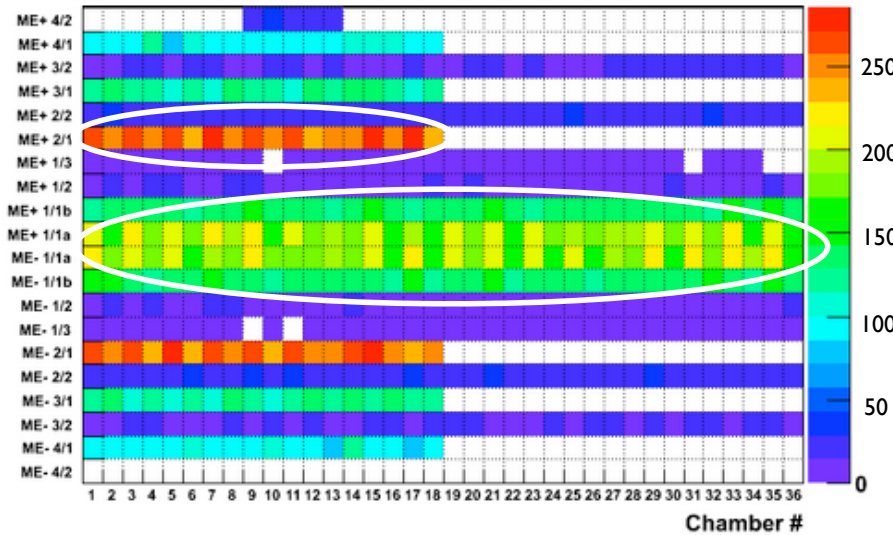
Wire Digi Occupancy
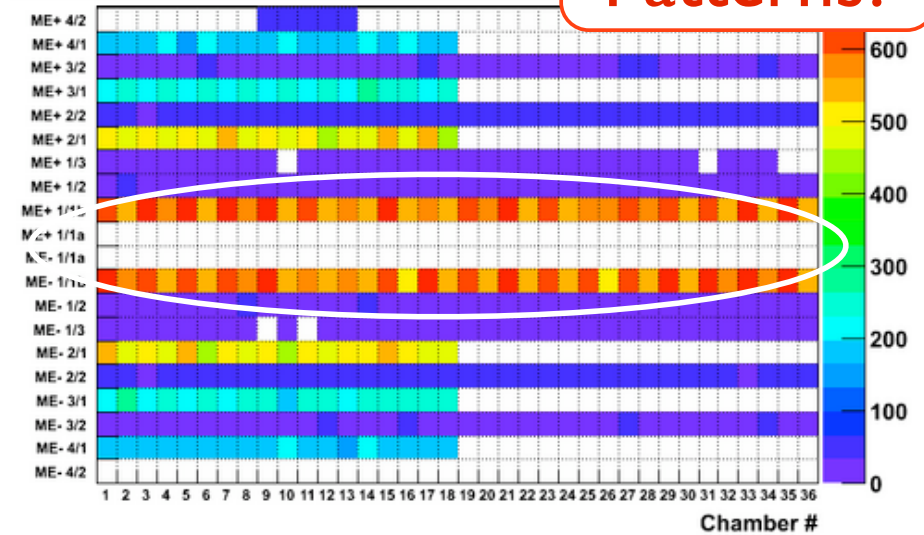
Patterns?

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Sim Muons per chamber

HI Central (100)	HI Minbias (1000)	pp MinBias(1000)
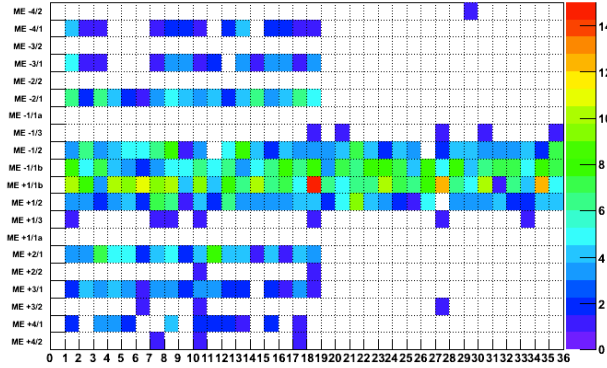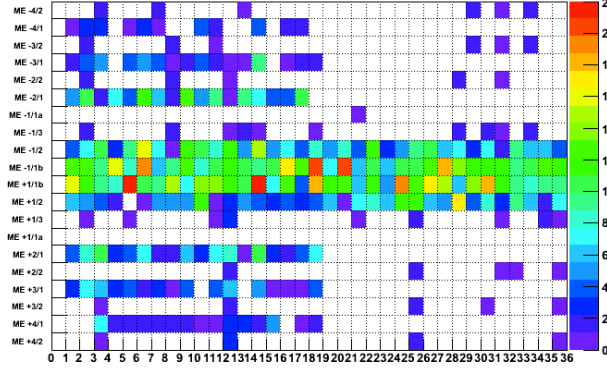
CSC Readout path

(1)Trigger Mother Board(TMB)

(1)Anode Local Charged Track (ALCT)

5:1

Data Acquisition Mother Board (DMB)

4:1

(DDU)

9:1

(8)S-Links

Data Concentrator Card(DDC)

(5)Cathode Front End Board (CFEB)

Global DAQ

Deals with preTriggers, and time lapses for L1Accept

Bandwidth issues? 8*200Mb/sec

Possible bottlenecks, any others?

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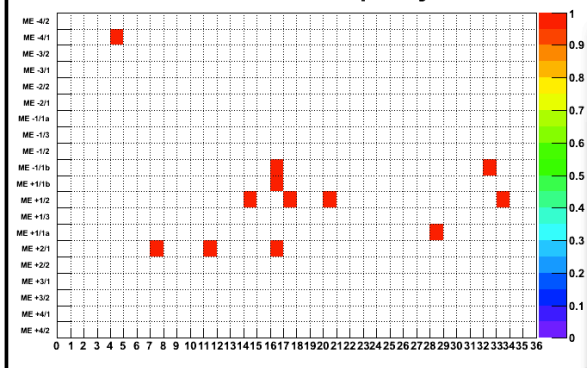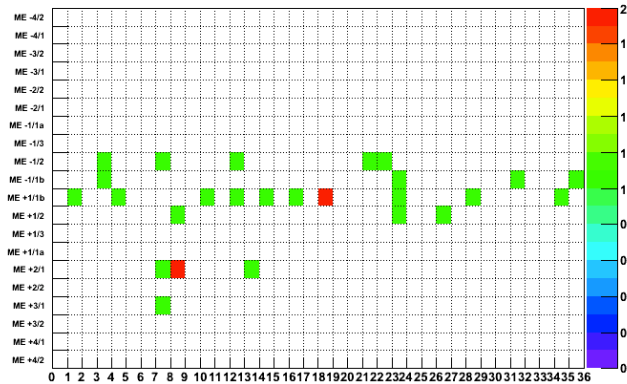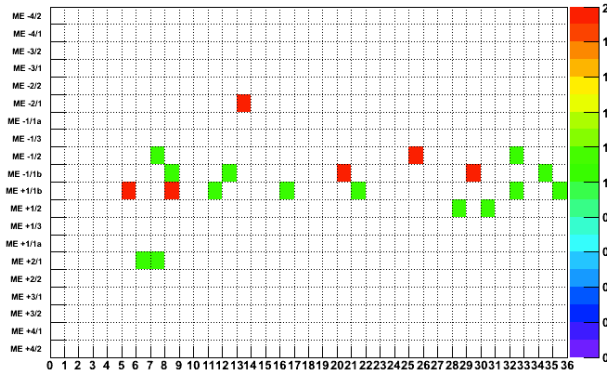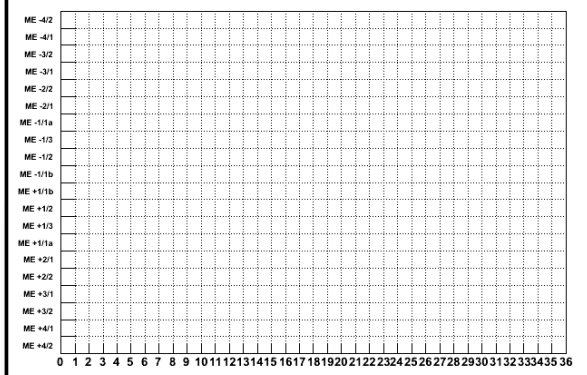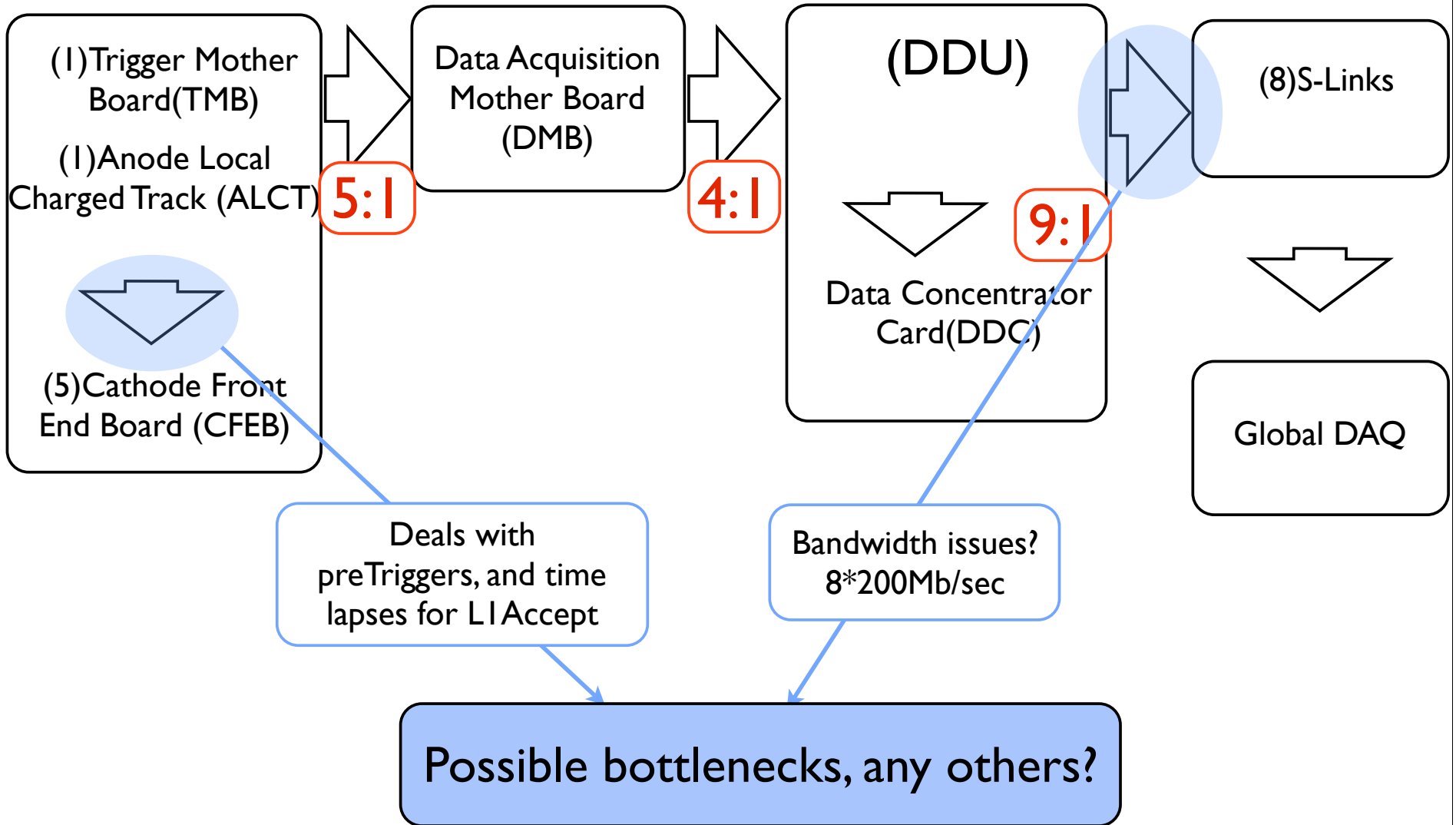
Trigger Path

CSCs need to trigger to read out

- pre-Trigger

  - CFEB stores buffer, to wait for L1A accept/reject

  - For pp 2(3)/6 layers consistent with track stub

- CFEB reads out on coincidence of (CLCT pre-trigger * L1A)

- ALCT reads out on coincidence of (ALCT * L1A)

- TMB reads out on coincidence of (LCT * L1A)

All the readouts are based on L1A

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- PreTrigger window 128ppBX ~ 3.2μs

    - CFEBs take this long to get a L1Accept.

- With 400ns snapshots taken after a global L1 trigger.

- At a rate of 386Hz in HI we get one interaction ~2600 μs.

- Safe here?

Volume estimates

- Assumptions

  - Max at 1.6 GBytes/sec for entire CSCs

  - HI interaction rate 385 Hz

  - Header and tail 1.8 kBytes/event *

  - 2kB/segment *

Segments per Event

Entries	1992
Mean	36.29
RMS	16

HI Central

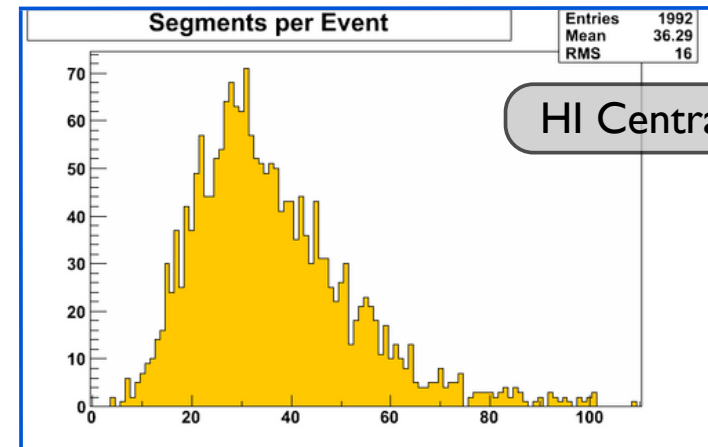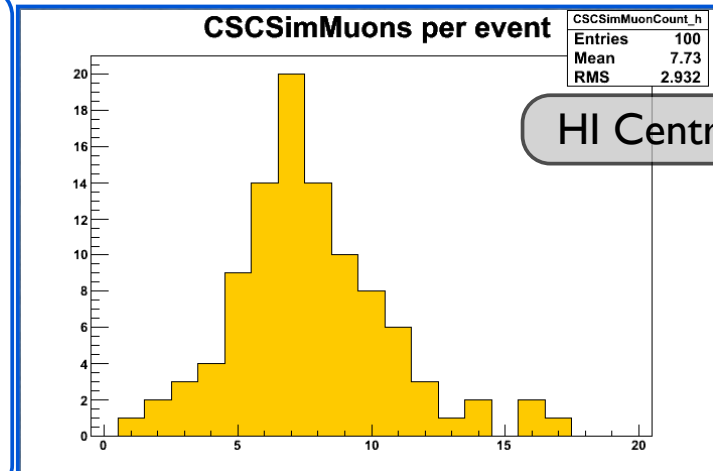|	Average [Segments] Readout	Tail [Segments] Readout
MinBias pp	[3] 3.08 Mb/s	[15] 12.35 Mb/s
MinBias HI	[13] 10.80 Mb/s	[60] 47.09 Mb/s
Central HI	[37] 29.33 Mb/s	[100] 77.97 Mb/s

*From email exchange

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Volume estimates II

- Assumptions

  - Max at 1.6 GBytes/sec for entire CSCs

  - HI interaction rate 385 Hz

  - Header and tail 1.8 kBytes/event *

  - 4 X 3 kB / endcap muon *

CSCSimMuons per event

CSCSimMuonCount_h	
Entries	100
Mean	7.73
RMS	2.932

HI Central

	Average [Segments] Readout	Tail [Segments] Readout
MinBias pp	[] Mb/s	[] Mb/s
MinBias HI	[2] 10Mb/s	[10] 46.97Mb/s
Central HI	[8] 37.65Mb/s	[17] 75.46Mb/s

*From email exchange

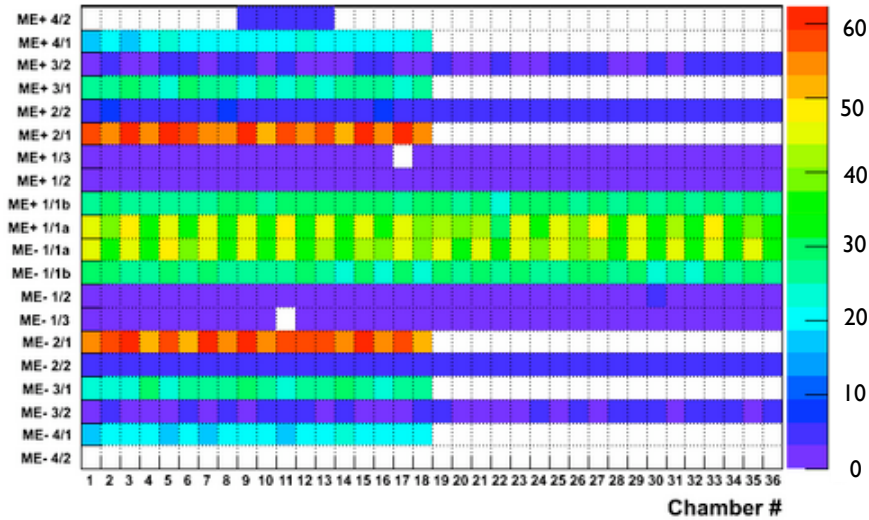Jorge Robles

- Calibrations.
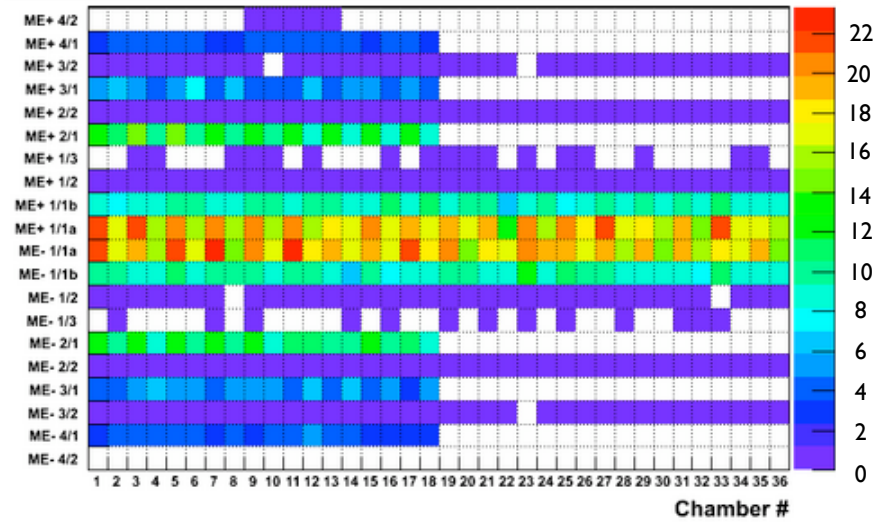
- Other possible readout problems.
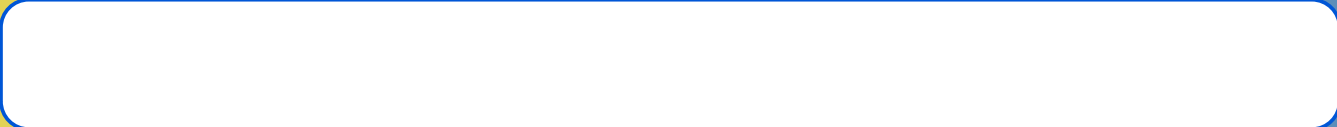
Extra Slides

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RecHit Occupancy

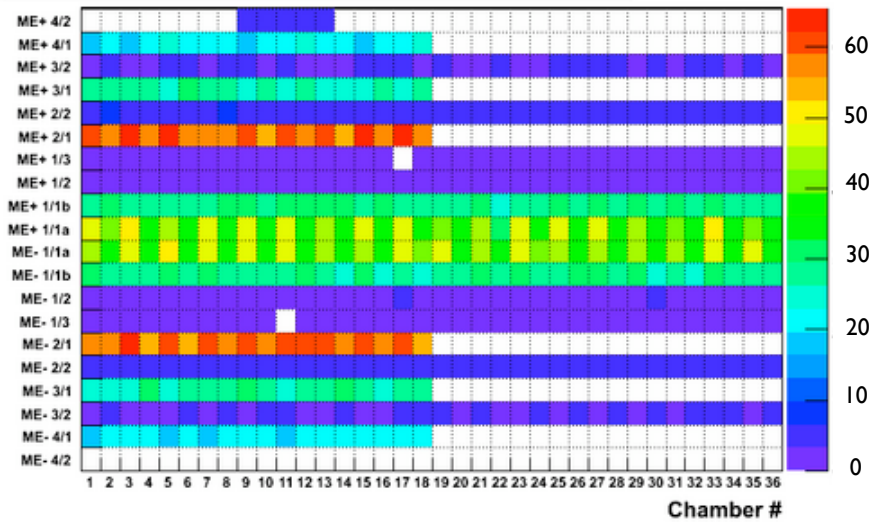Segments Occupancy

Strip Digi Occupancy

Wire Digi Occupancy

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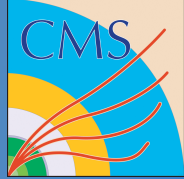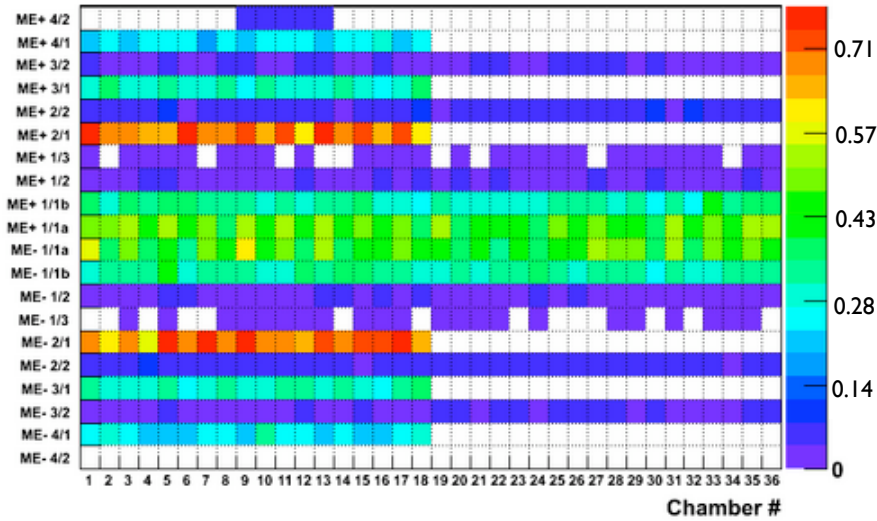
RecHit Occupancy
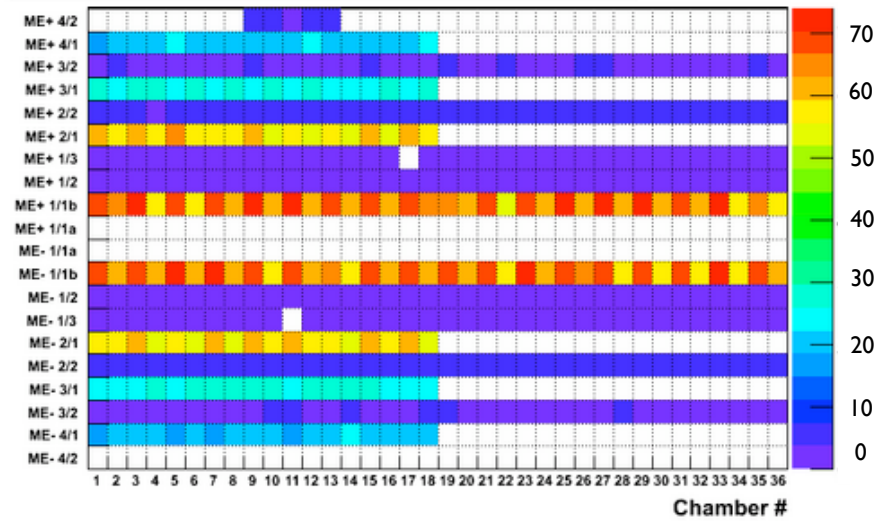
Segments Occupancy

Strip Digi Occupancy

Wire Digi Occupancy
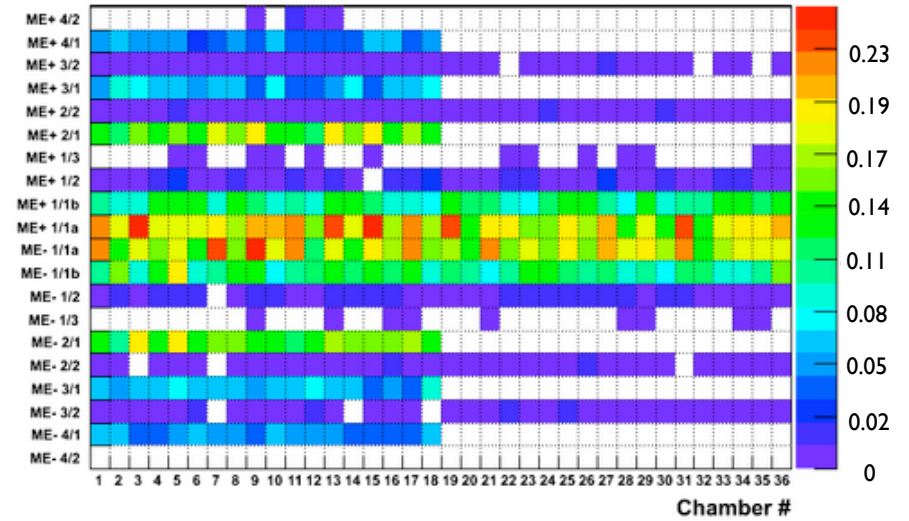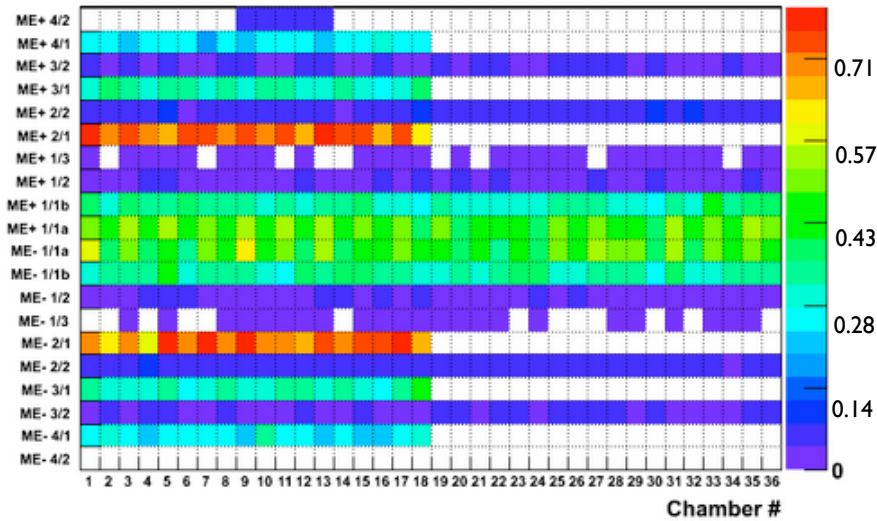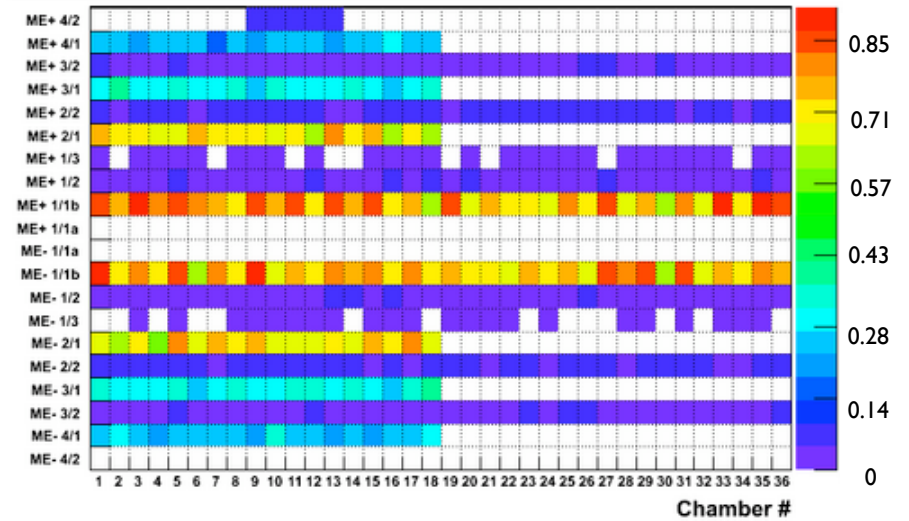
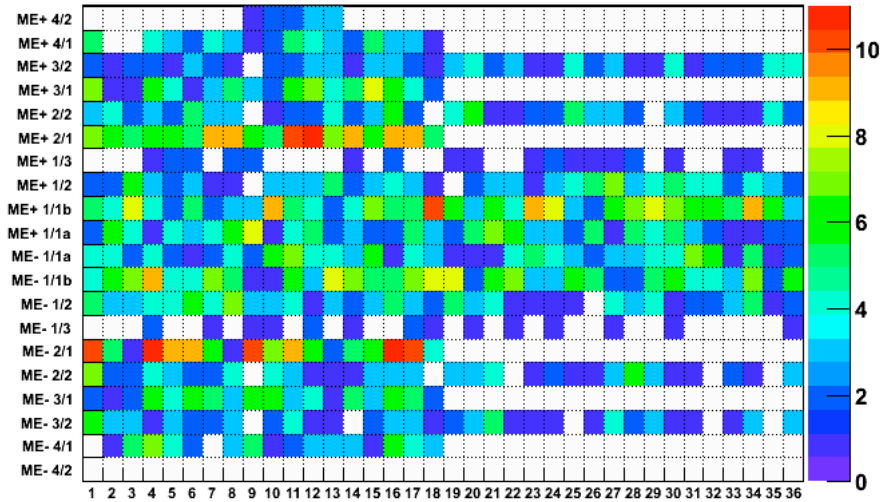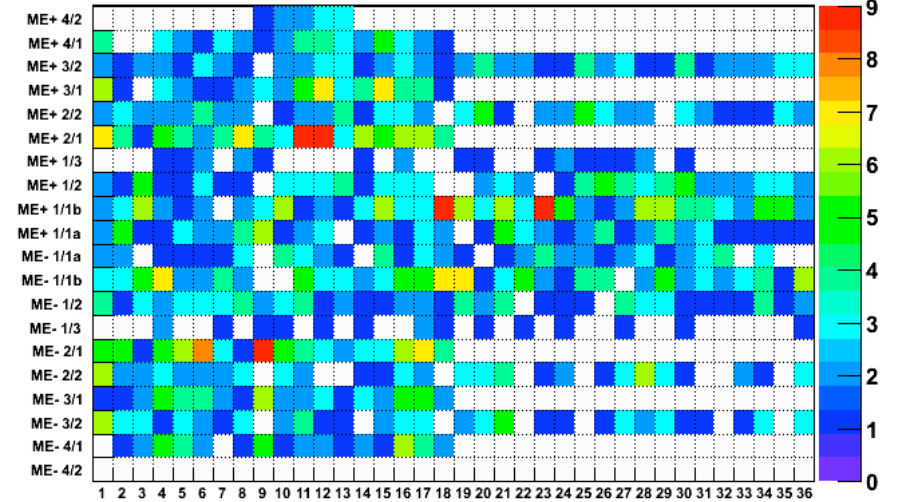# pp ttbar (1000)
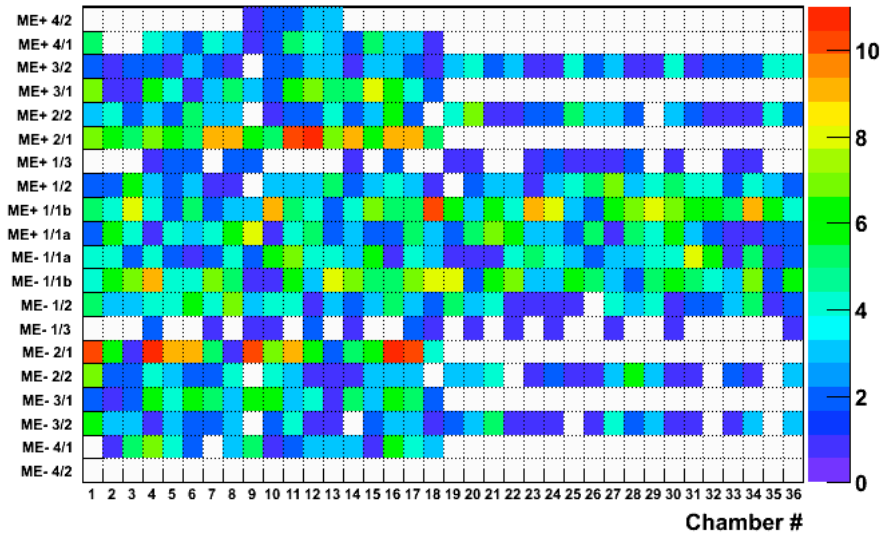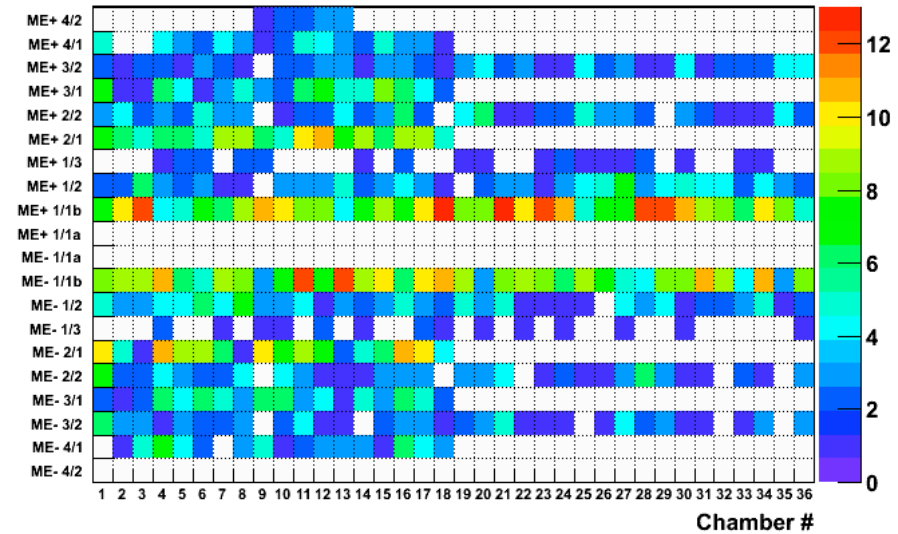

RecHit Occupancy

Segments Occupancy

Strip Digi Occupancy

Wire Digi Occupancy

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HI MinBias(10000)

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pp ttbar (9000)

PbPb @ 5.5TeV

J.L. Albacete

Multiplicities from RHIC, and predictions for PbPb central collisions.

F. Bopp et, al.

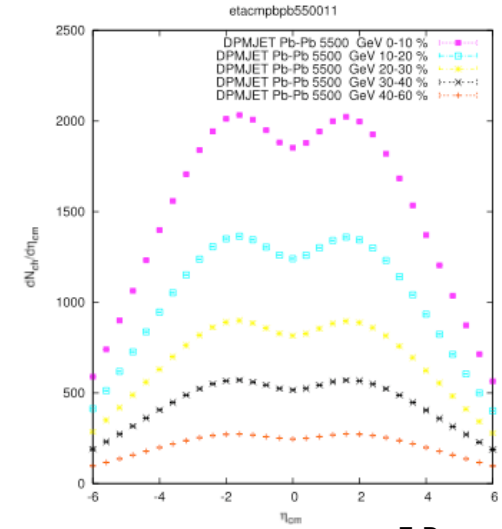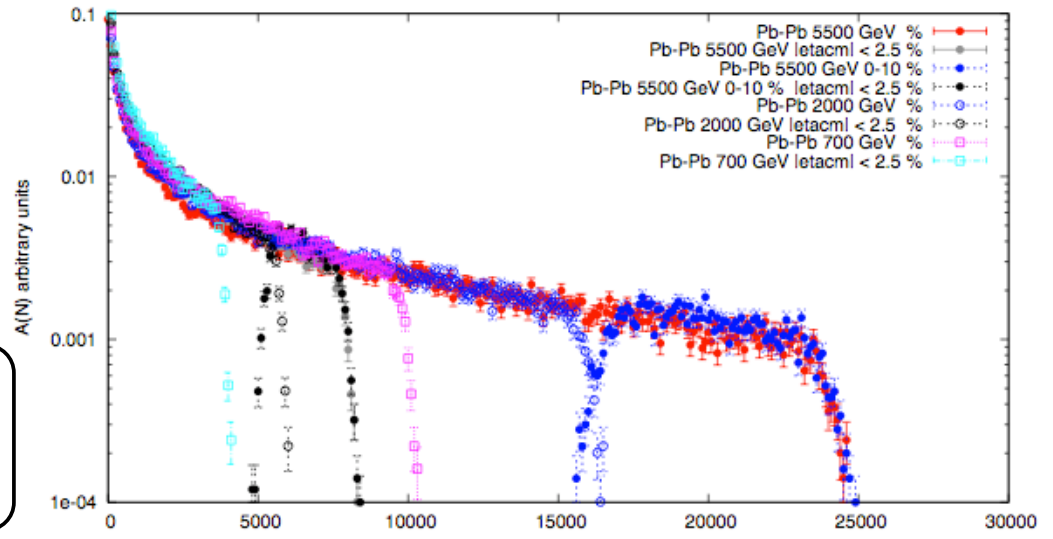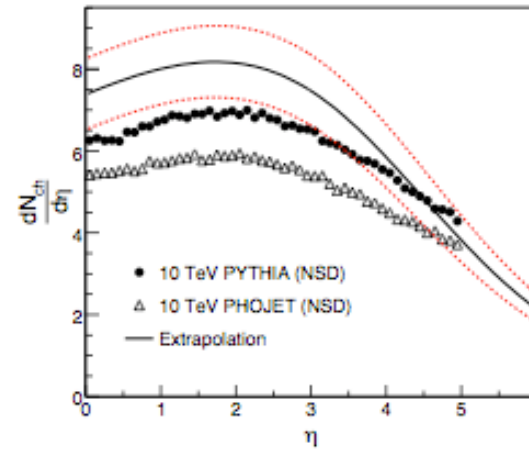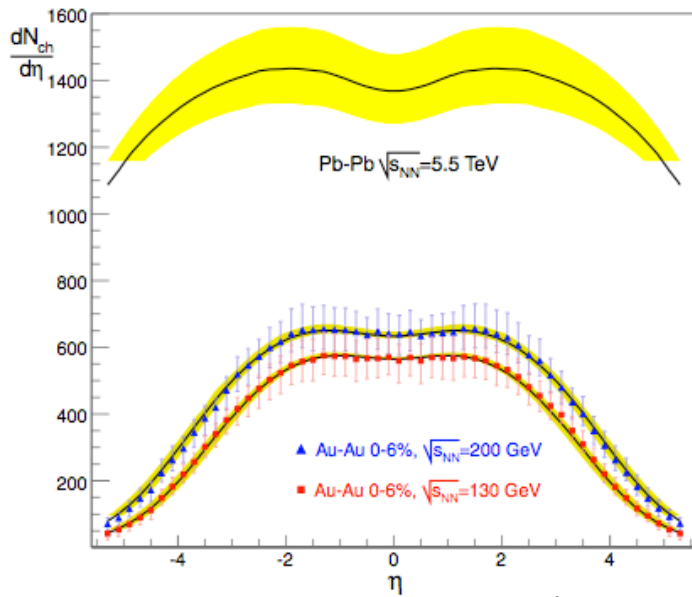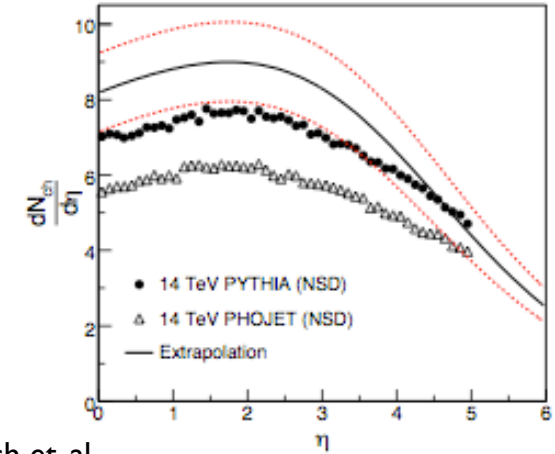Multiplicity distribution in MinBias and central collisions in $|\eta|<2.5$

Most central collisions

F. Bopp et, al

Jorge Robles

Pb-Pb $\sqrt{s_{NN}}$=5.5 TeV

▲ Au-Au 0-6%, $\sqrt{s_{NN}}$=200 GeV
■ Au-Au 0-6%, $\sqrt{s_{NN}}$=130 GeV

J. L. Abacete

Dash et, al

pp @ 10TeV

pp @ 14TeV

10 TeV PYTHIA (NSD)
△ 10 TeV PHOJET (NSD)
— Extrapolation

14 TeV PYTHIA (NSD)
△ 14 TeV PHOJET (NSD)
— Extrapolation

Multiplicities from RHIC, and predictions for PbPb central collisions.

Multiplicity increase ~150x from pp to central PbPb

Jorge Robles