Centrality status report

Yeonju Go, Javier Martin, Shengquan Tuo, Anna Zsigmond

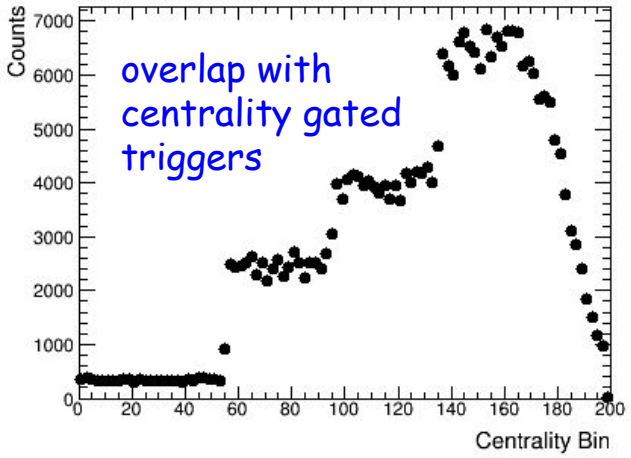
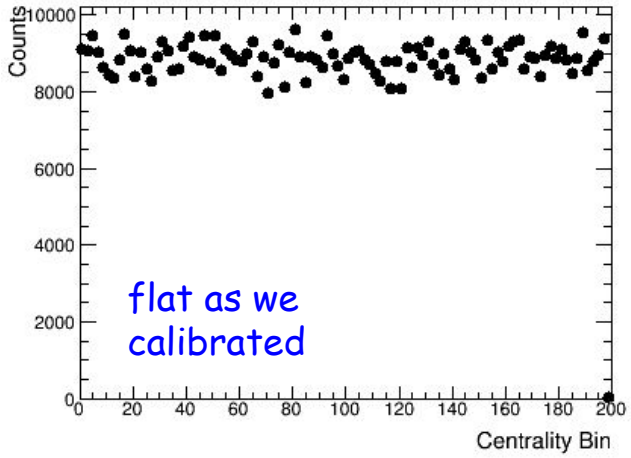
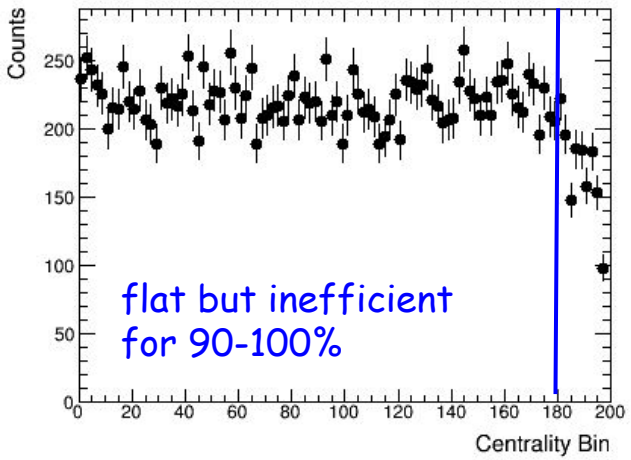
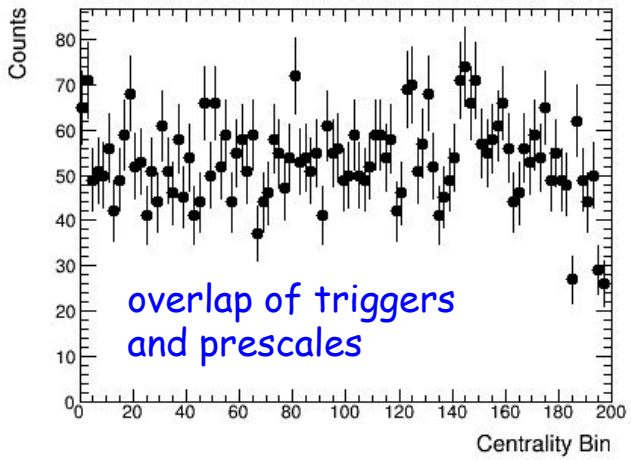
HIN East meeting
18th March 2016

Minimum bias datasets and triggers

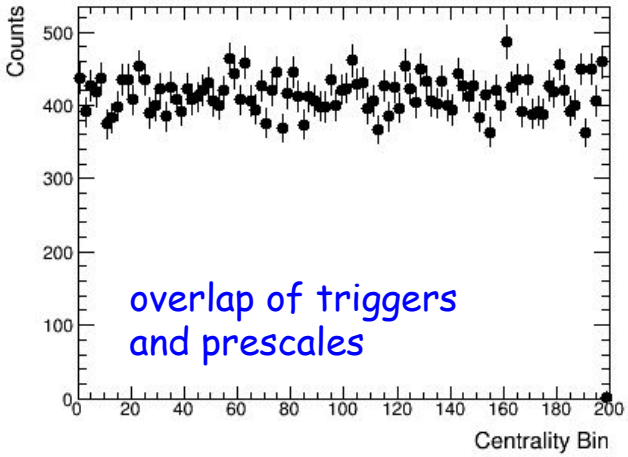
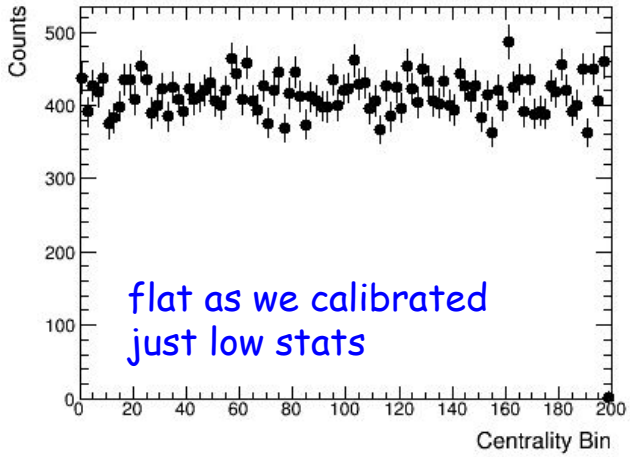
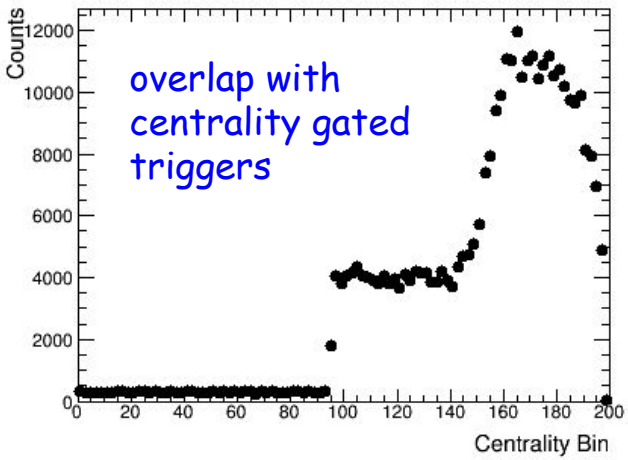
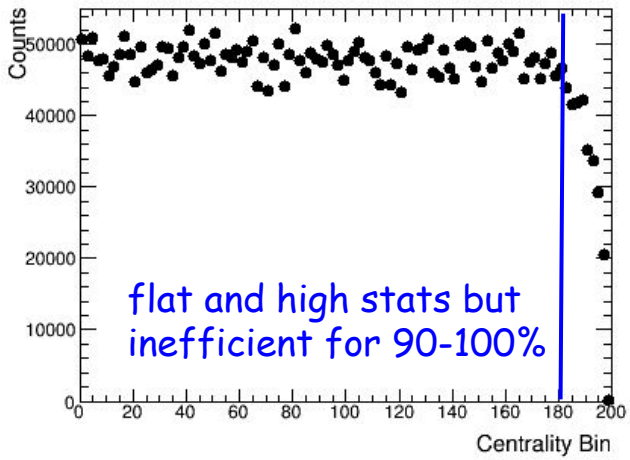
- HIMinimumBias1
  - All other minimum bias, centrality gated and BPTX triggers
  - HLT_HIL1MinimumBiasHF2AND_v1 → until 263153
- HIMinimumBias2
  - HLT_HIL1MinimumBiasHF1AND_v1 → all the run but prescaled from 263155
  - HLT_HIL1MinimumBiasHF2AND_v1 → from 263155 until 263286
  - HLT_HIL1MinimumBiasHF2AND_part1_v1 → from 263192
- Summary google doc from trigger experts

https://docs.google.com/spreadsheets/d/1dn5UUZnoqp1XSXPWf60rOJQeSjUFFDKmGrRyLA90wCM/edit#gid=0

Centrality bin distribution run 262620

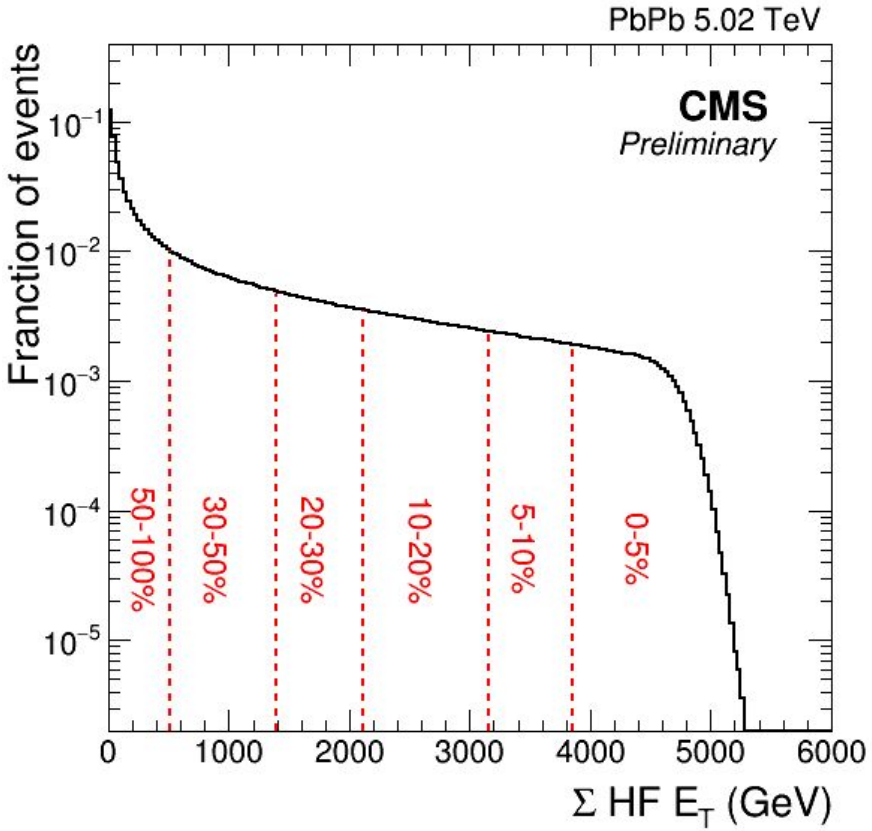
	HIMinimumBias1	HIMinimumBias2
HF1 AND		
HF2 AND		

Centrality bin distribution run 263614

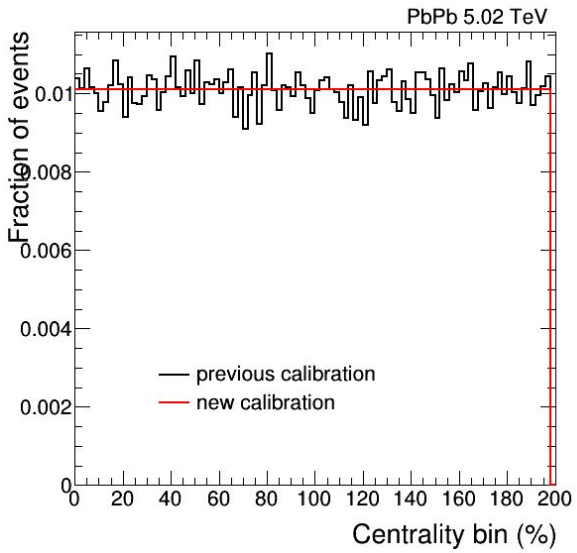
	HIMinimumBias1	HIMinimumBias2
HF1 AND		
HF2 AND		

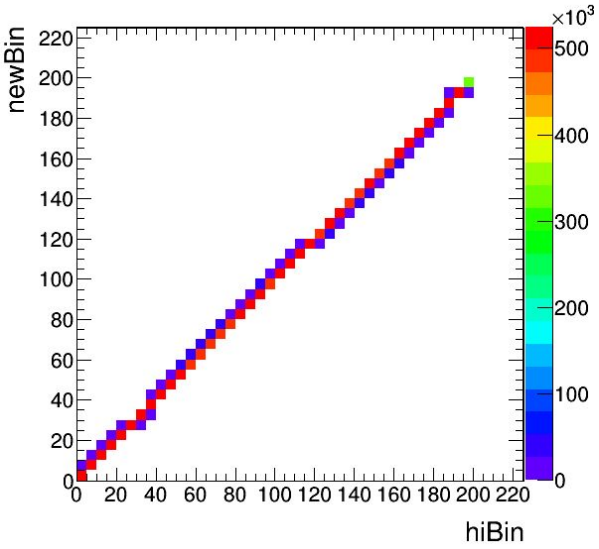
Centrality calibration

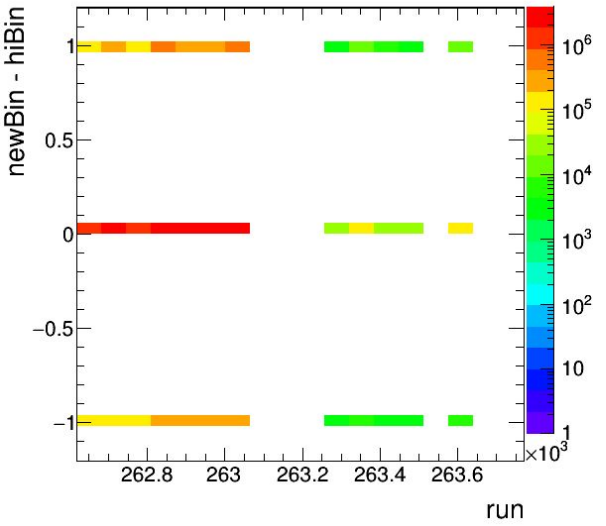
➔ HIMinimumBias2 dataset filtered on HLT_HIL1MinimumBiasHF1AND_v1 trigger and default event selection → more than 20M events



Comparing initial and new calibration



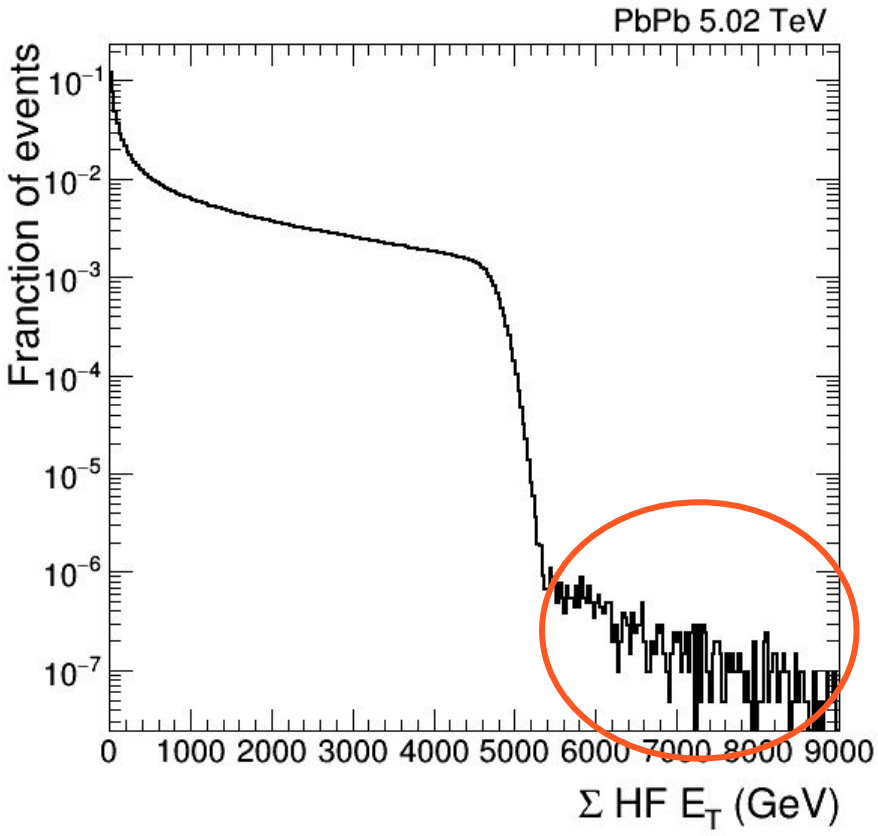




- ➔ Maximum shift is 1 bin (0.5%) because efficiency assumption is the same → no run dependence
- ➔ Uploaded as new IOV → transparent to users → new ntuples will be with the new calibration
- ➔ Macro for adding new centrality bin: https://github.com/azsigmon/UserCode/blob/master/addNewCentralityBin.C

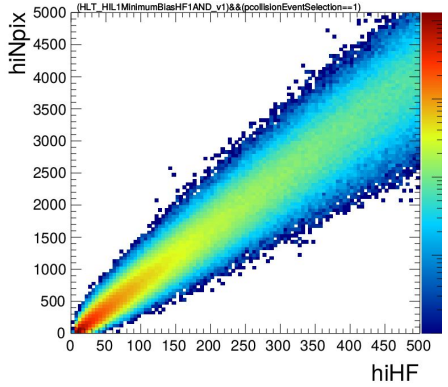
Note about pileup

- ➔ Only important when selecting ultra-central events
- ➔ 600 events above 5400 GeV → 3×10^{-5} fraction of this sample

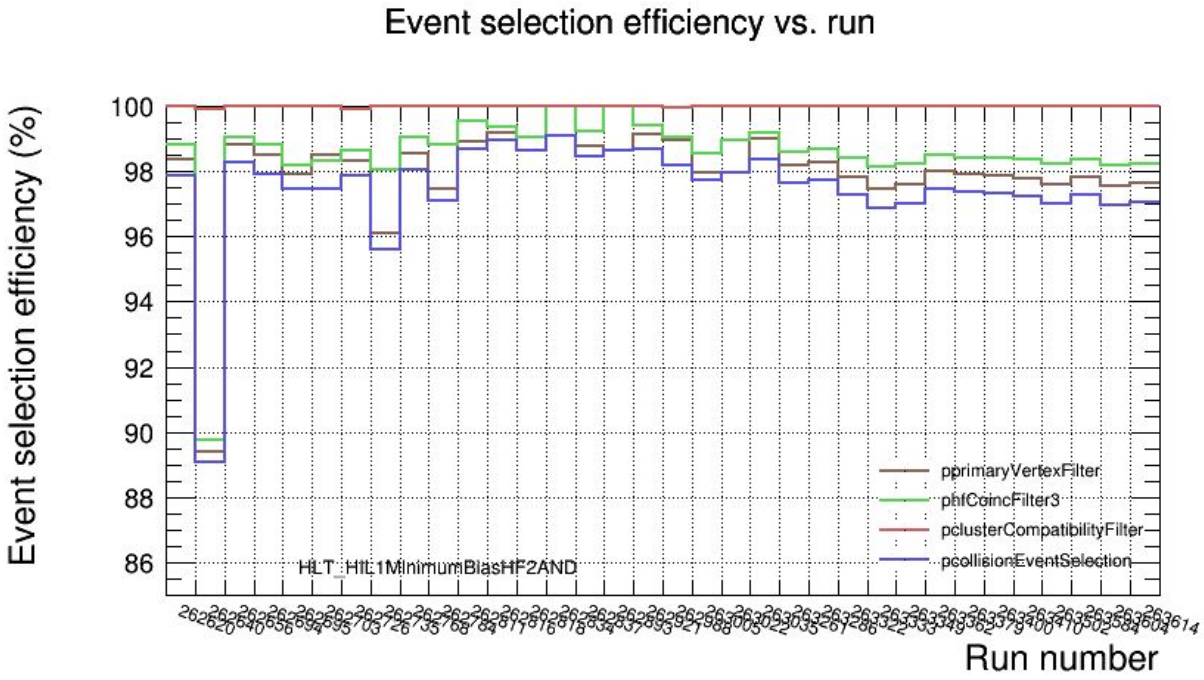


Event selection

- No change in the selection filters
  - primary vertex filter
  - pixel cluster compatibility filter
  - HF coincidence filter with 3 towers



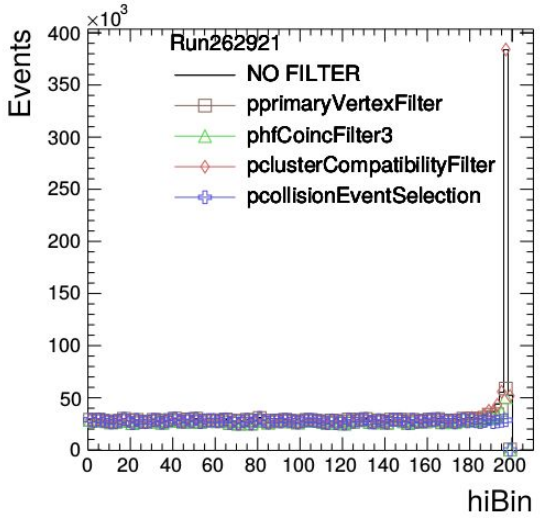
- Fraction of failing events is very stable during the run

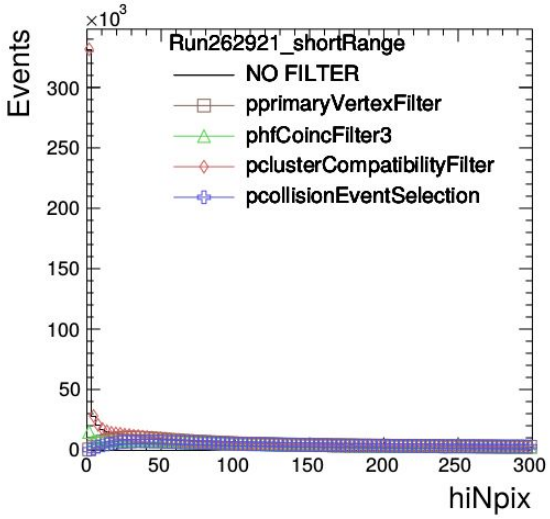


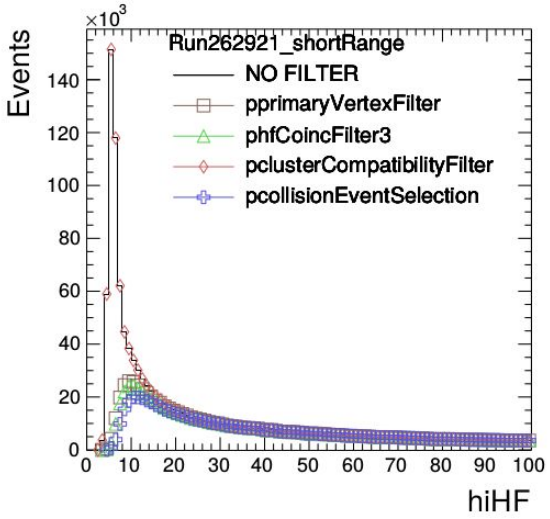
Yeonju

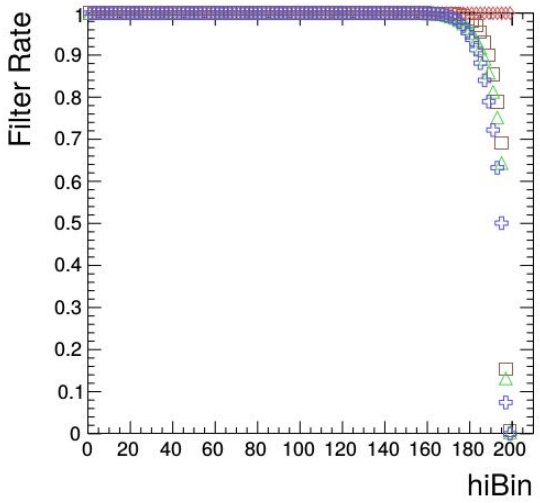
Event selection

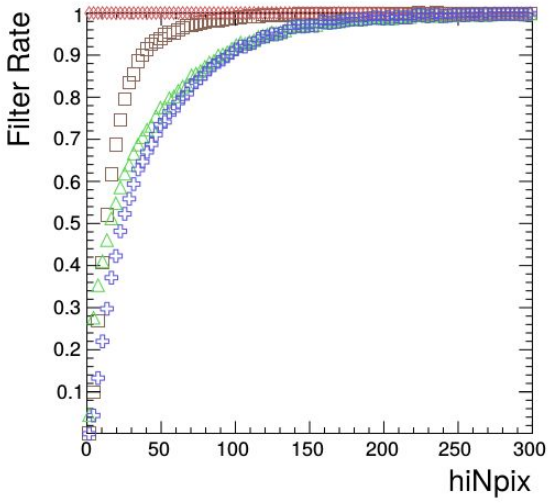
➔ Only events in the low multiplicity (peripheral) region fail

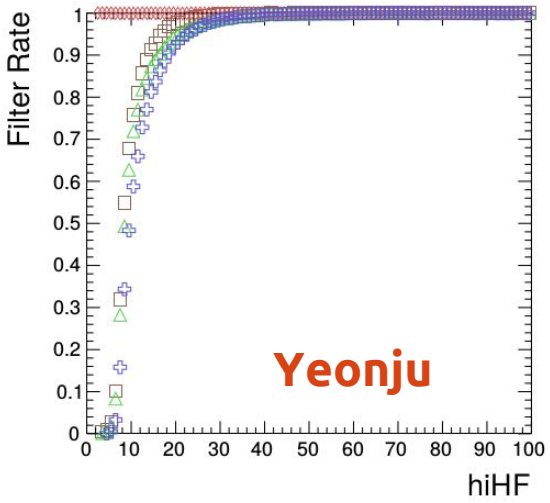






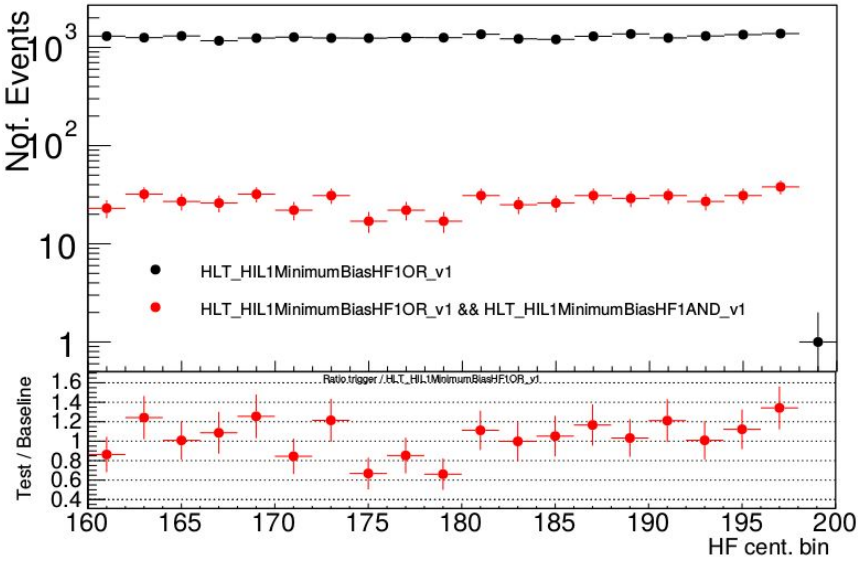


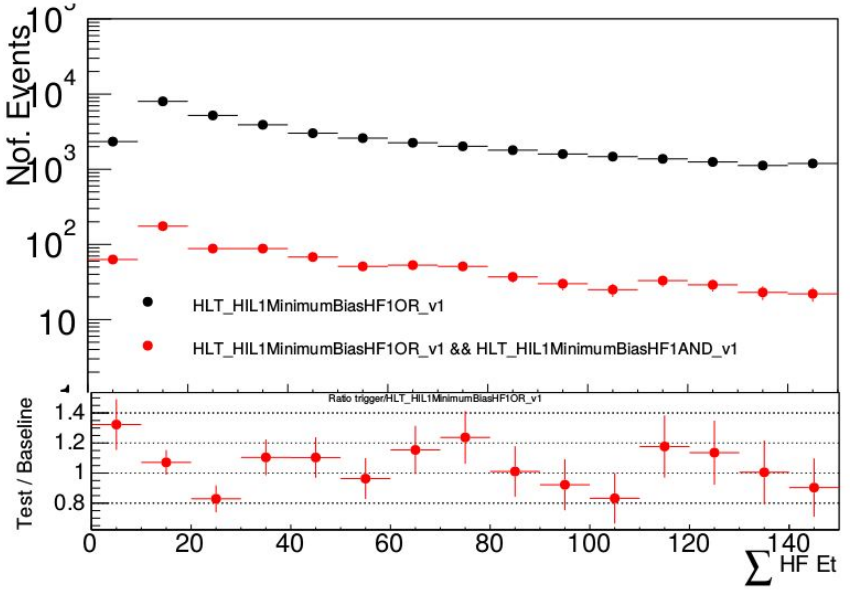




Minimum bias trigger efficiency

- ➔ Check with HF1OR triggered data (proxy for ZeroBias)
- ➔ Events that go through default event selection don't fail the HF1AND trigger
- ➔ Small overlap of prescaled triggers makes efficiency calculation uncertain





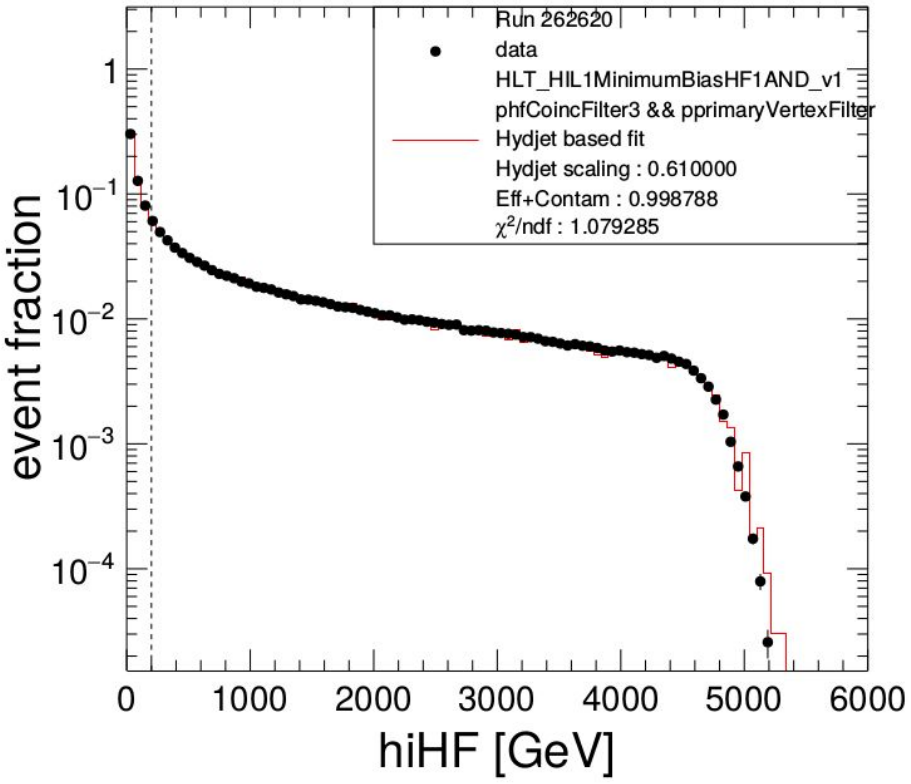
Javier

Event selection efficiency

- ➔ Two methods to estimate the event selection efficiency + contamination (one value)
- ➔ Both methods scale the MC to the data in the fully efficient region and estimate the ‘missing’ part in the peripheral
- ➔ Caveat: HYDJET (or EPOS) does not describe the data very well

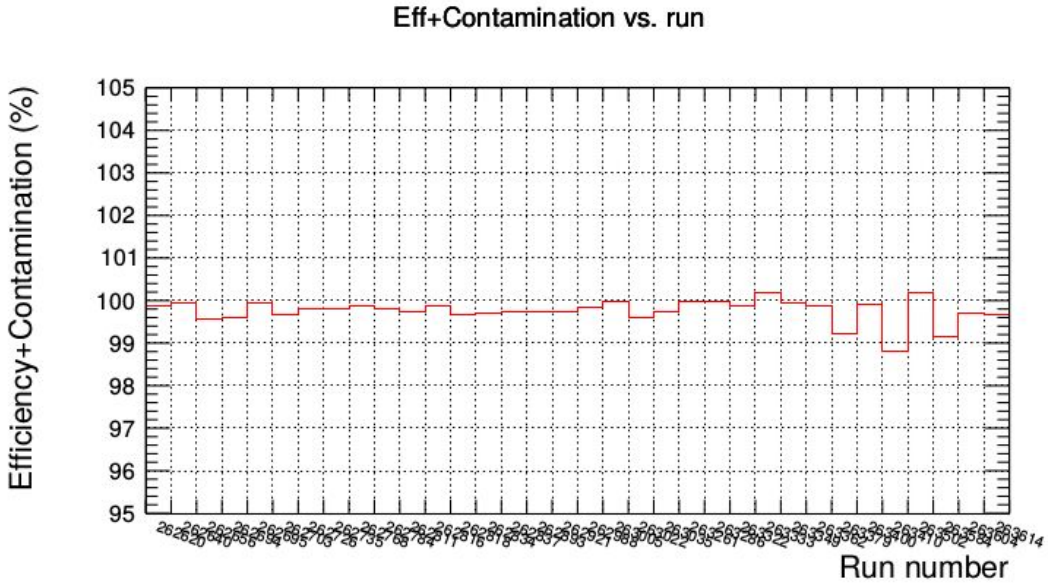
Event selection efficiency

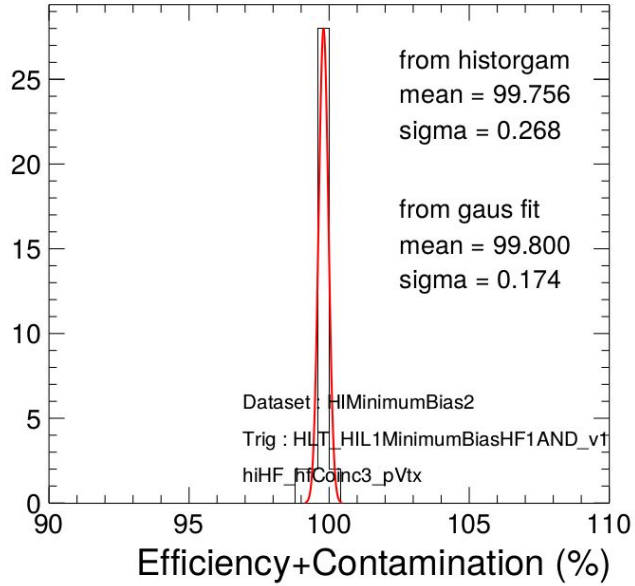
- ➔ Fitting the MC to the data
- ➔ Different variables: hiHF, hiEB, hiET, hiNpix, hiNtracks
- ➔ Efficiency + contamination between 98% - 102%



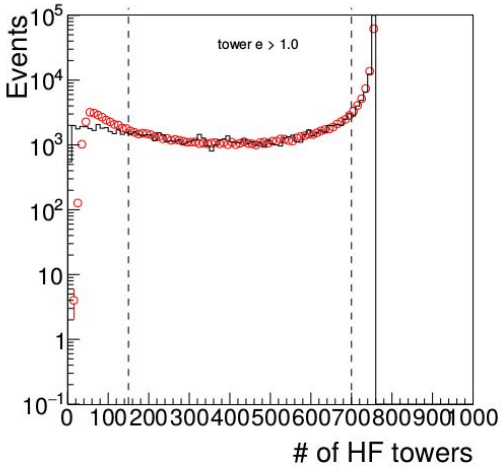
Event selection efficiency

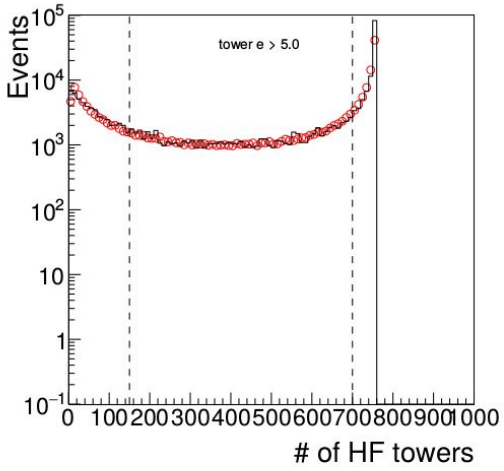
- ➔ Run dependence of fitted value is stable (small variance)
- ➔ One calibration for the whole run is sufficient

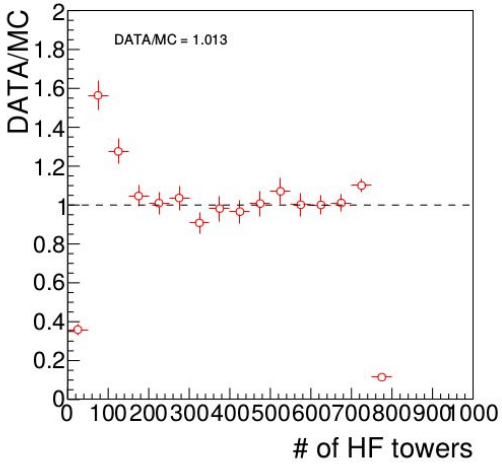


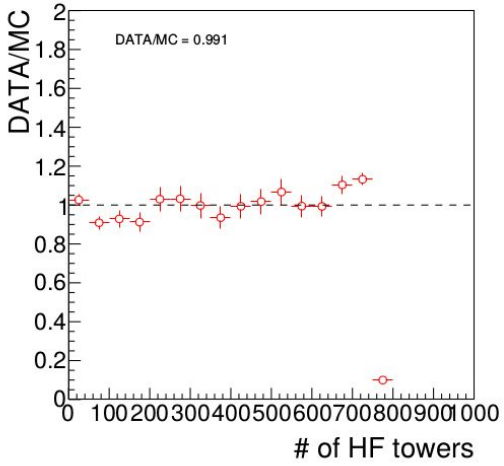


Event selection efficiency





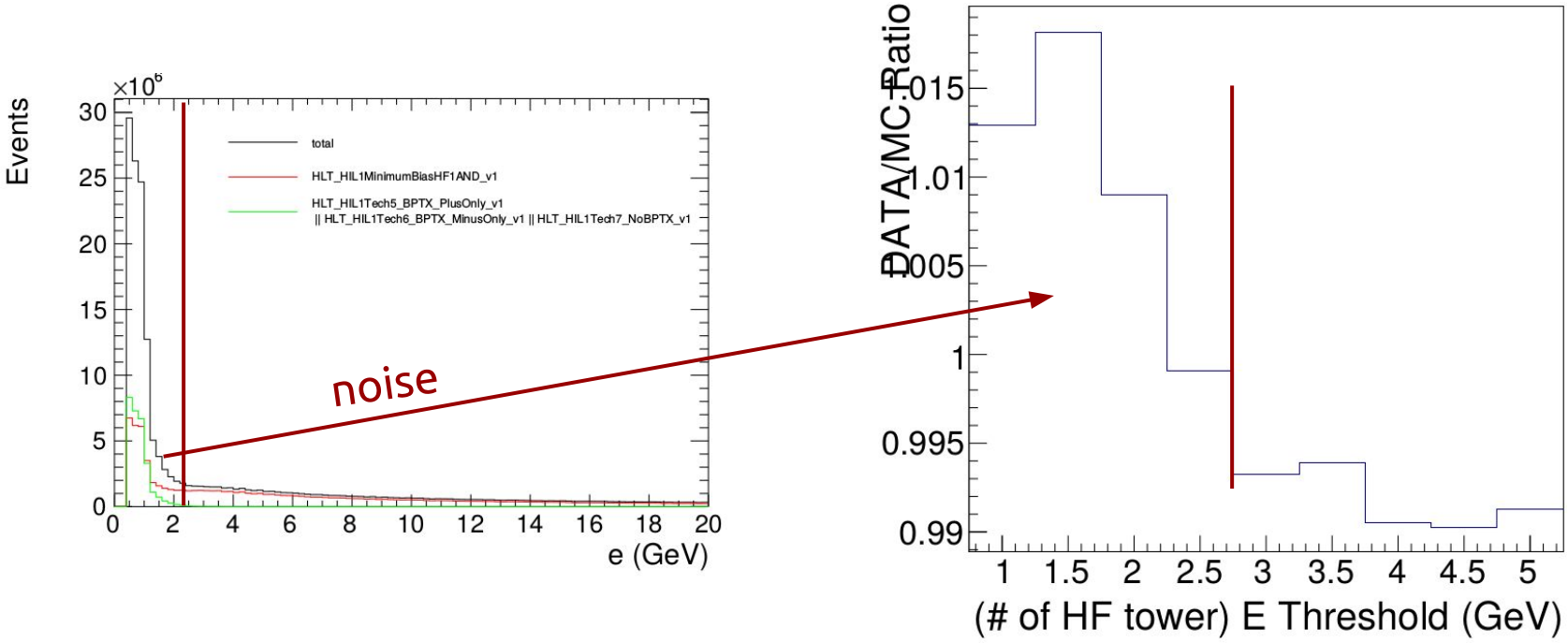




- ➔ Counting HF towers above some E threshold
- ➔ Scaling MC to the data in the middle region
- ➔ Ratio of integrals gives another efficiency estimate
- ➔ Done with different E thresholds

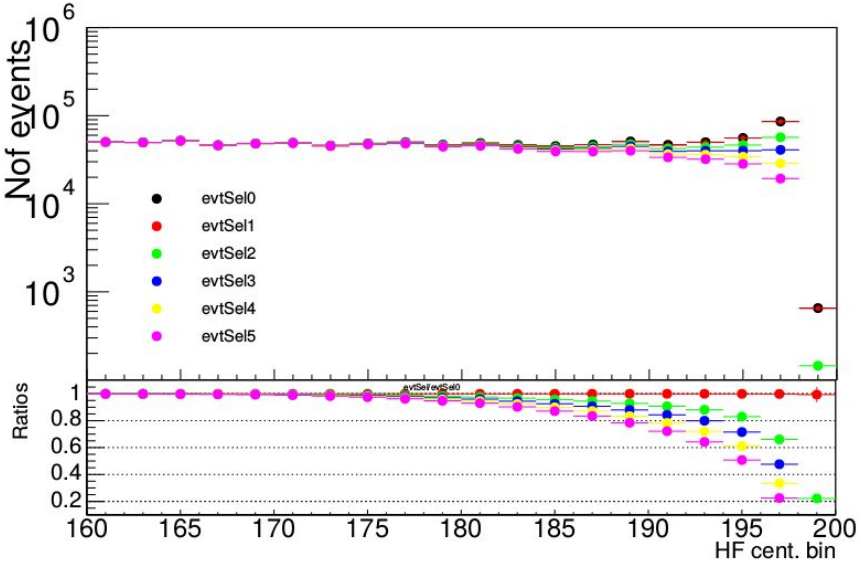
Event selection efficiency

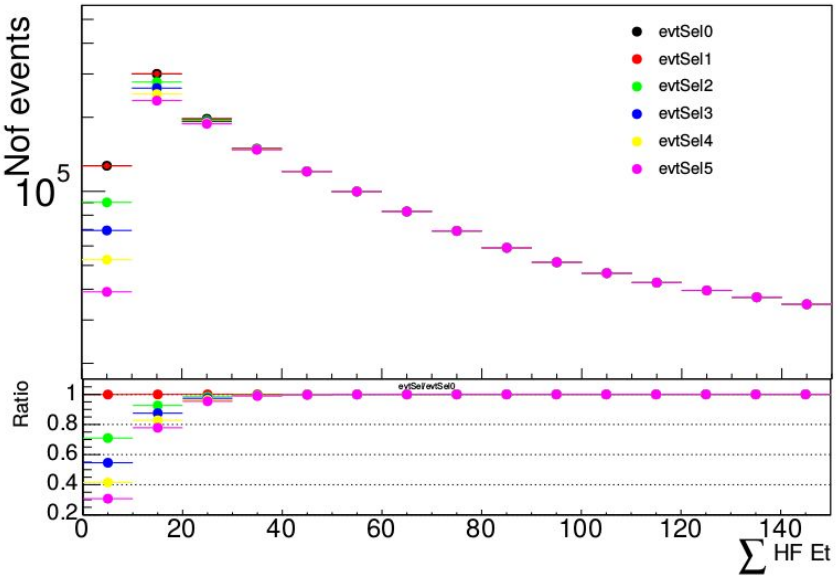
- ➔ Counting towers with different energy thresholds gives about 99% for efficiency + contamination
- ➔ Below 2.5 GeV tower energy there is a lot of noise in HF



EM contamination

- ➔ Studies only started
- ➔ Selecting events with HF1AND trigger and primary vertex filter and checking the rate of different number of HF towers required in coincidence
- ➔ No conclusions yet, need MC with trigger, ideas welcome





Javier

Glauber model calculations

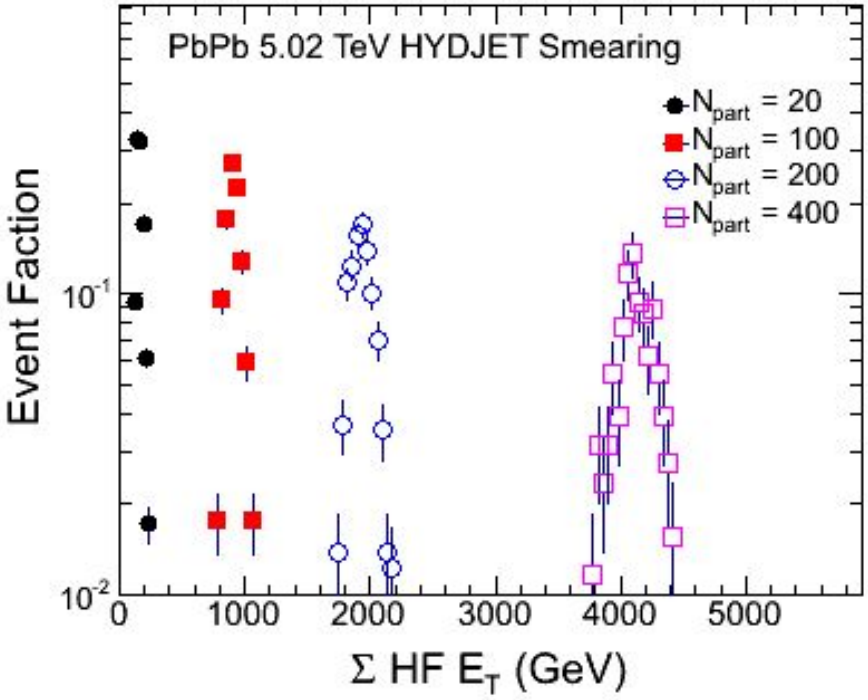
➔ Default values and systematic uncertainties of Glauber parameters at 5 TeV (agreed with ALICE and ATLAS)

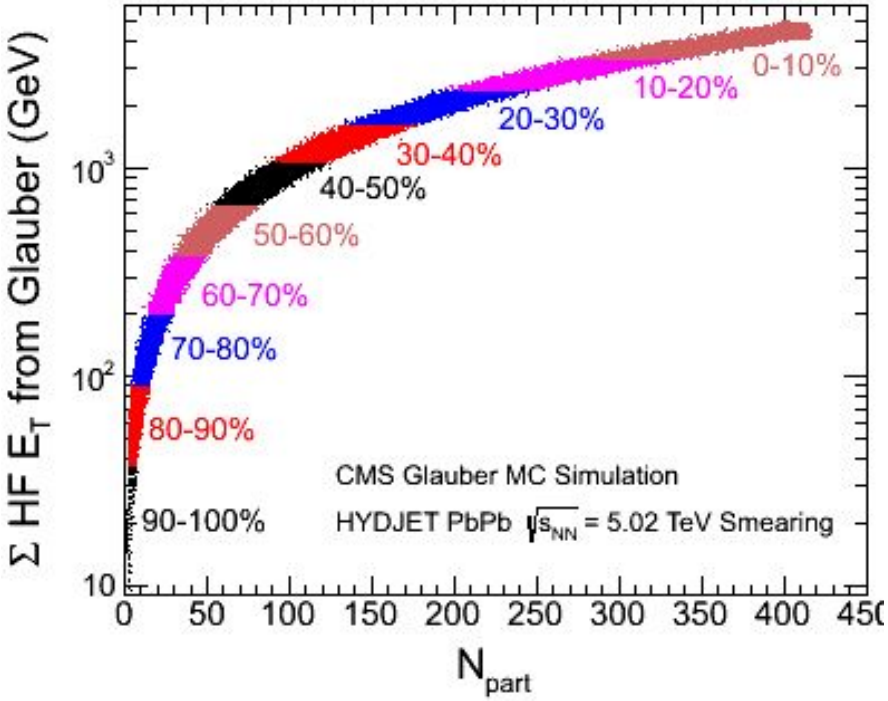
	default	minimum	maximum
Nuclear radius	**6.62 fm**	6.56 fm	6.68 fm
Skin depth	**0.546 fm**	0.536 fm	0.556 fm
d_{min}	**0.4 fm**	0.0 fm	0.8 fm
σ^{NN}_{inel}	**70 mb**	65 mb	75 mb

https://twiki.cern.ch/twiki/bin/view/CMS/Glauber5TeVPbPb

Glauber smearing with HYDJET

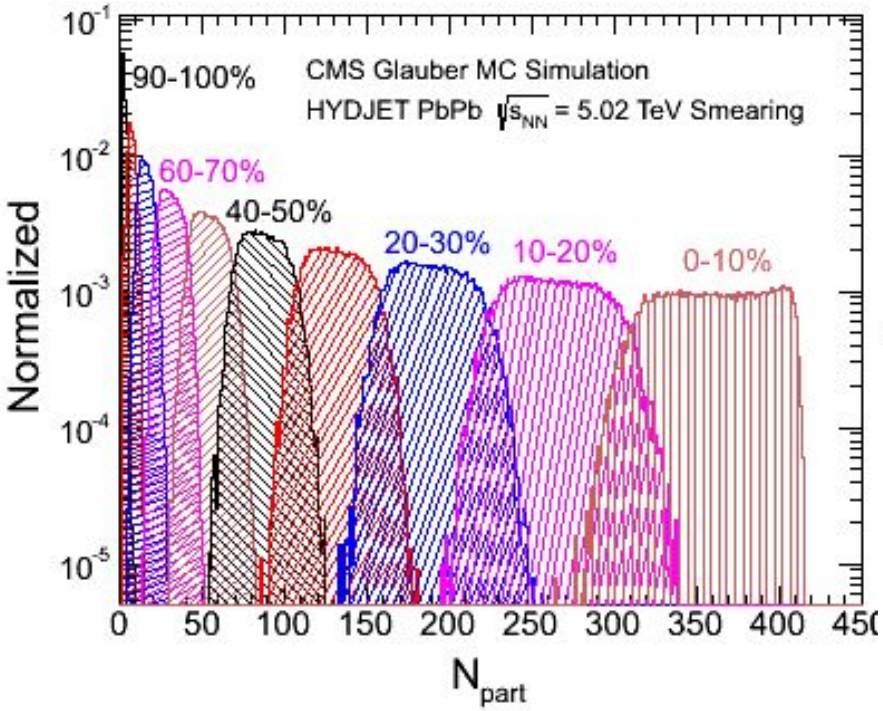
- ➔ HF distribution for each N_{part} is taken from HYDJET
- ➔ Taking the N_{part} distribution, HF distribution for Glauber MC is built and sliced into equal area centrality bins

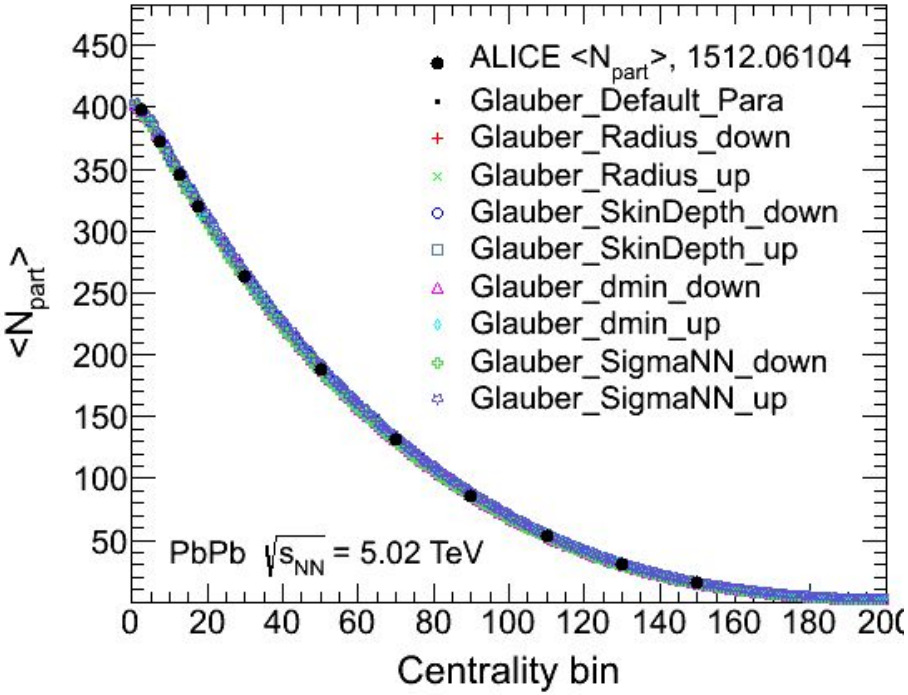




Glauber smearing with HYDJET

- For each Glauber HF centrality bin, the average of N_{part}, N_{coll} and T_{AA} is calculated
- N_{part} results agree with what ALICE published in dN/dη paper

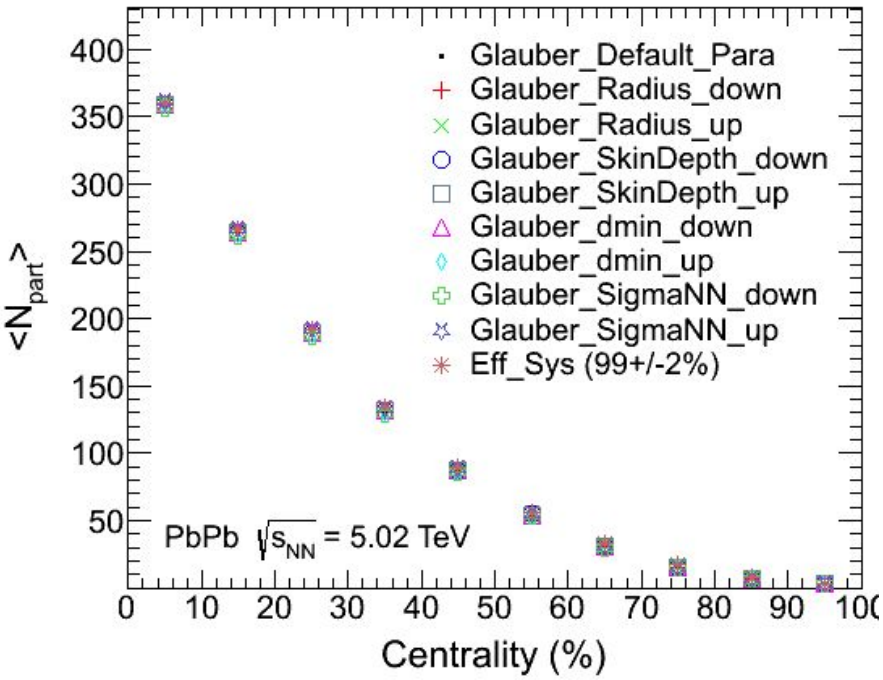


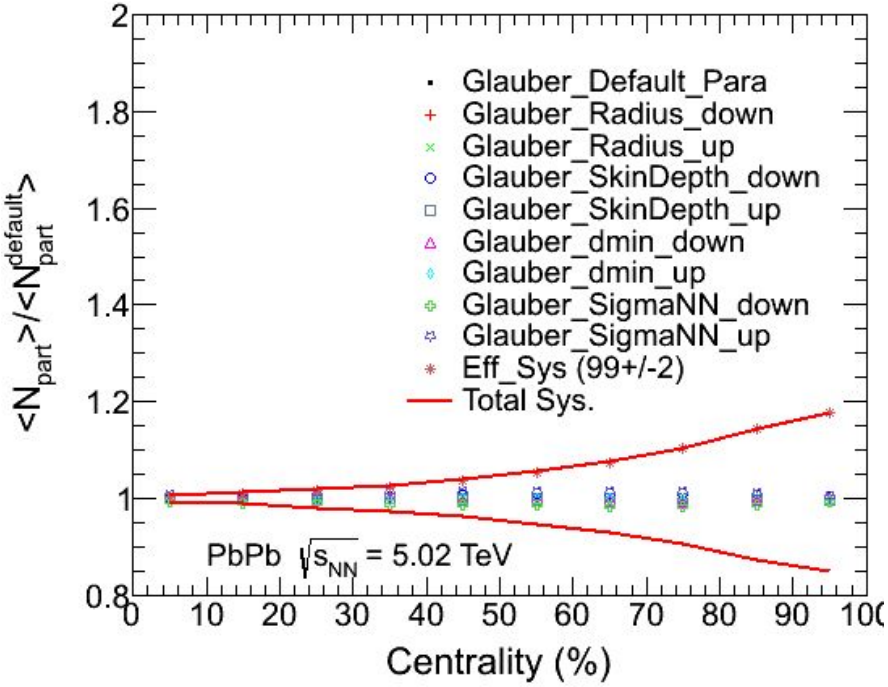


Shengquan

$\langle N_{part} \rangle$ and systematic

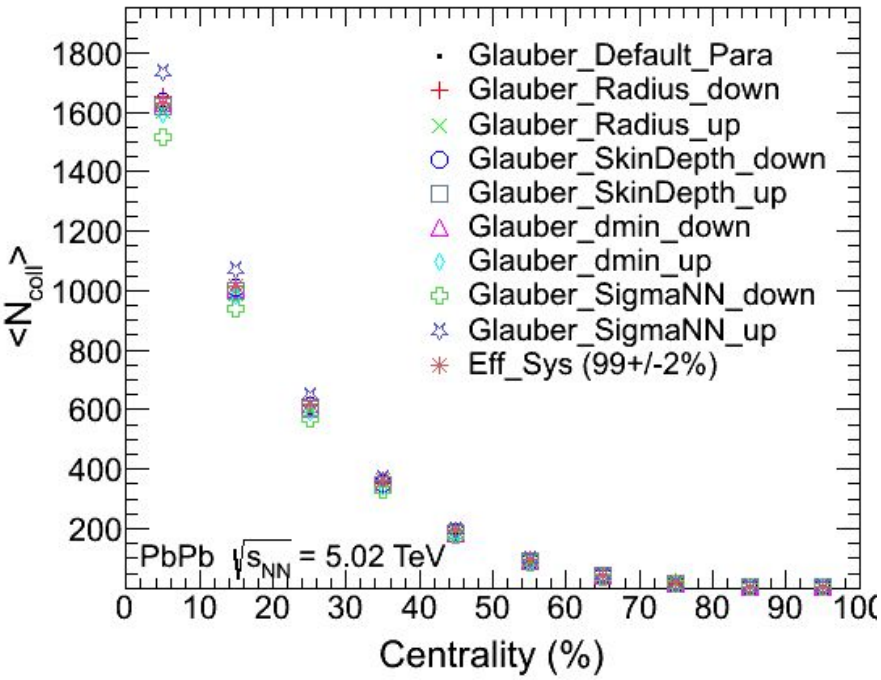
- ➔ Systematic uncertainty from changing the model parameters
- ➔ Also included 99±2% event selection efficiency systematic uncertainty → dominant in peripheral

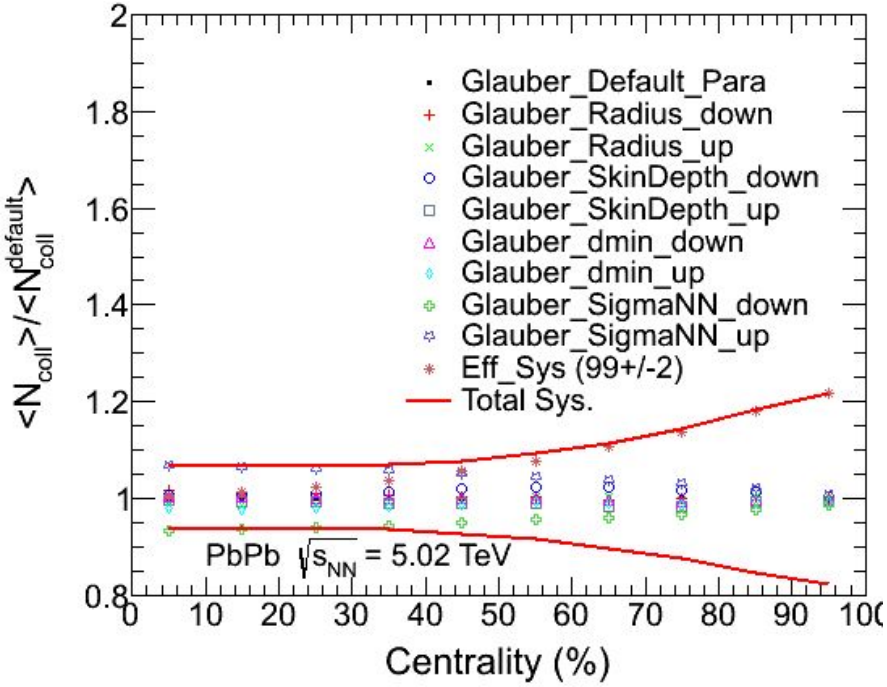




$\langle N_{coll} \rangle$ and systematic

- ➔ Systematic uncertainty from changing the model parameters
- ➔ Also included 99±2% event selection efficiency systematic uncertainty → dominant in peripheral

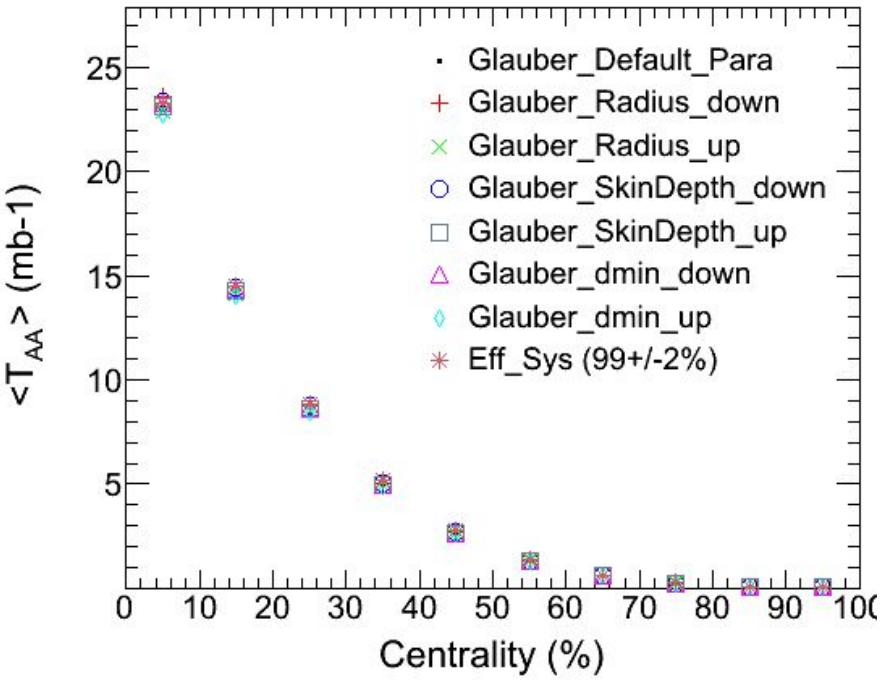


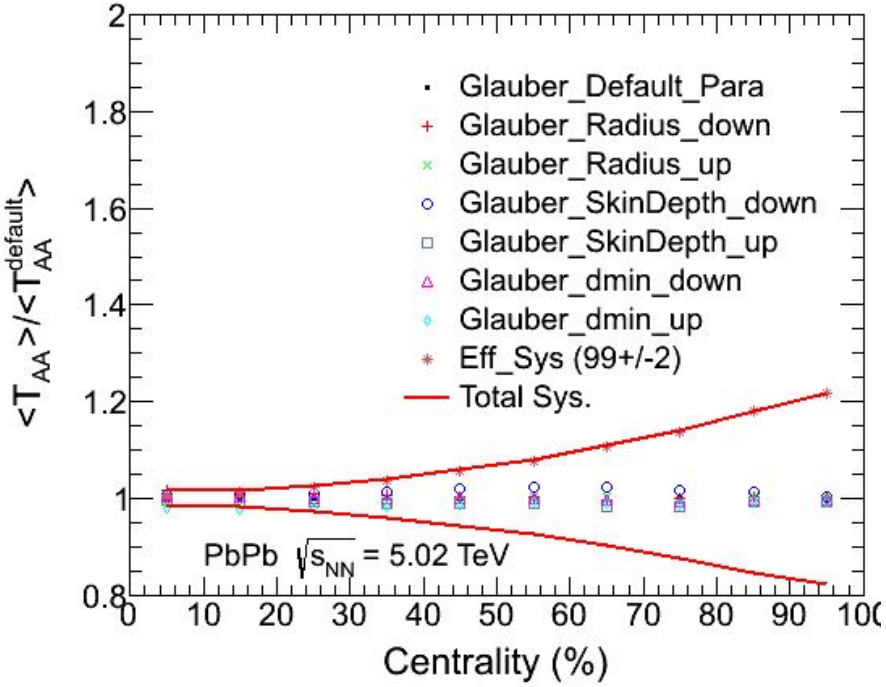


$\langle T_{AA} \rangle$ and systematic

➔ Systematic uncertainty from changing the model parameters

➔ Also included 99±2% event selection efficiency systematic uncertainty → dominant in peripheral





Summary

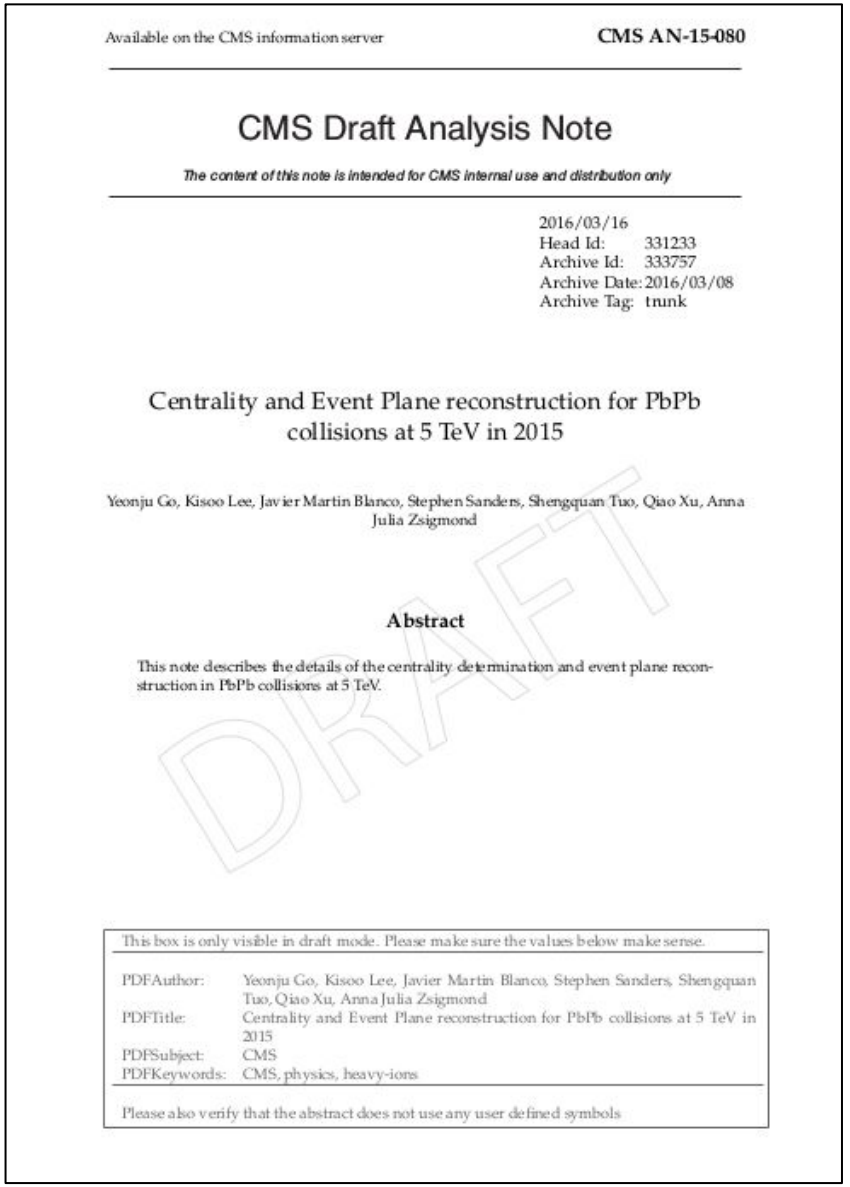
- ➔ **Conditions** and HF response were **stable** during the run
- ➔ Minimum bias analyses using **HF2AND can use 0-90% centrality** region because of trigger inefficiency
- ➔ Event selection efficiency + contamination is about 99-100% and stable over the run
- ➔ **Calibration** with 99% efficiency assumption uploaded to database (new ntuples will have it or use macro)
- ➔ N_{coll}, N_{part} values available from **Glauber smearing** on the twiki
- ➔ **Need feedback** on needs of different analyses
- ➔ Studies continue but new ideas are welcome

Manpower and service work

- ➔ Shengquan Tuo: coordinator, Glauber studies
- ➔ Anna Zsigmond (until end of May): coordinator, software, calibrations
- ➔ Javier Martin: event selection, learning and taking over software and calibrations
- ➔ Yeonju Go: event selection
- ➔ Lingshan Xu: run preparation
- ➔ Steve Sanders: event plane
- ➔ Sunil Dogra (PPD): DQM, validation
- ➔ Kisoo Lee (Generators): StarLight integration
- ➔ Jian Sun (PPD): DQM development of new features

Analysis note AN-15-080

- ➔ Centrality and event plane reconstruction described in this technical note
- ➔ Also including some information on minimum bias and centrality triggers
- ➔ Glauber results in bins of your analysis will be there if you request



Available on the CMS information server CMS AN-15-080

CMS Draft Analysis Note

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2016/03/16
Head Id: 331233
Archive Id: 333757
Archive Date: 2016/03/08
Archive Tag: trunk

Centrality and Event Plane reconstruction for PbPb collisions at 5 TeV in 2015

Yeonju Go, Kisoo Lee, Javier Martin Blanco, Stephen Sanders, Shengquan Tuo, Qiao Xu, Anna Julia Zsigmond

Abstract

This note describes the details of the centrality determination and event plane reconstruction in PbPb collisions at 5 TeV.

DRAFT

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PDFAuthor: Yeonju Go, Kisoo Lee, Javier Martin Blanco, Stephen Sanders, Shengquan Tuo, Qiao Xu, Anna Julia Zsigmond
PDFTitle: Centrality and Event Plane reconstruction for PbPb collisions at 5 TeV in 2015
PDFSubject: CMS
PDFKeywords: CMS, physics, heavy-ions

Please also verify that the abstract does not use any user defined symbols

Links

- ➔ Centrality meetings on Tuesday at 2 pm
  HiCentrality2016

- ➔ Instructions for software and N_{coll} values
  SWGuideHeavyIonCentrality

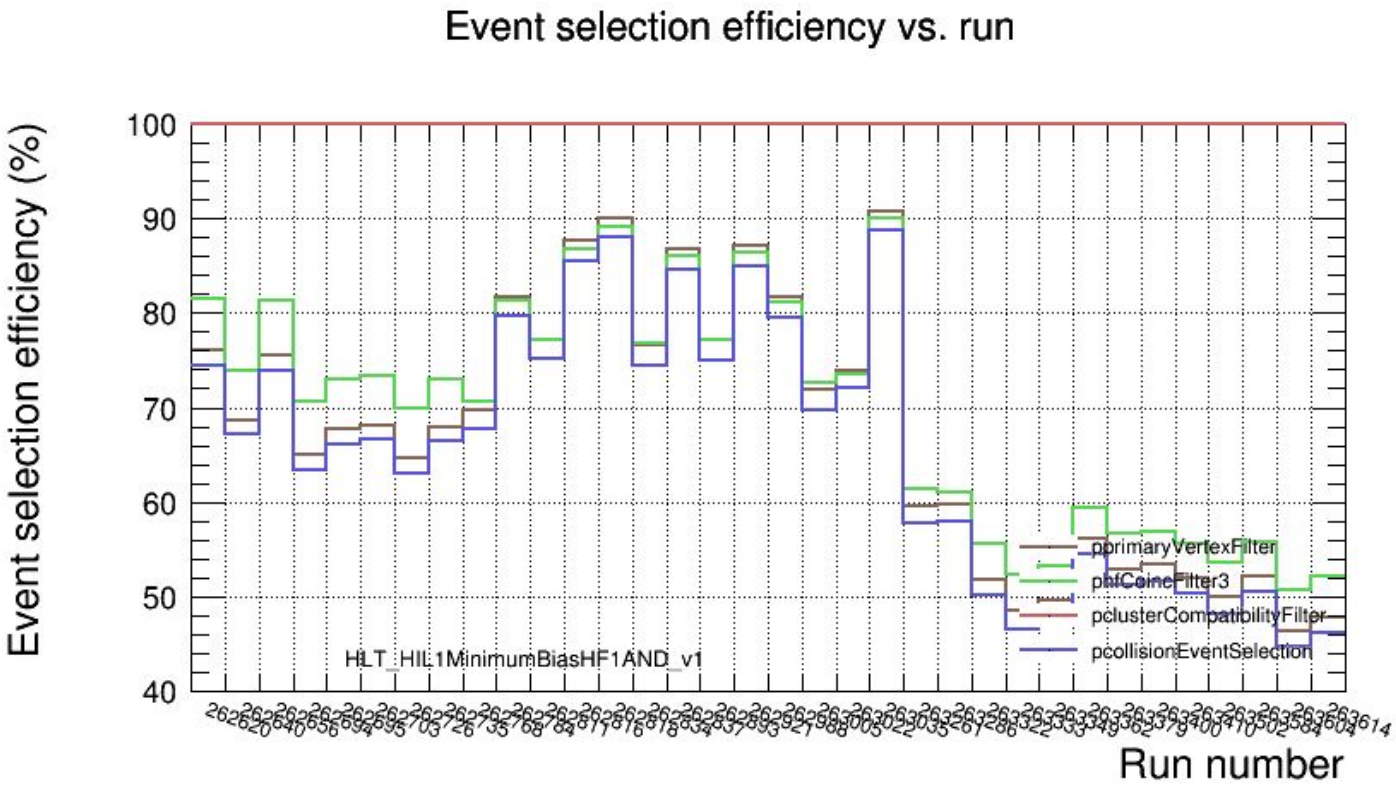
- ➔ Documentation on software, calibration and database
  SWGuideHeavyIonCentralityExpert

- ➔ Event plane discussion in [flow] meeting on Mondays

Backup

Filter rejection with HF1AND trigger

- ➔ HF1AND trigger has more contamination from non-collision and EM events
- ➔ Changes as a function of run number



Yeonju