# Workshop on Pileup effects

(almost) all stolen from presentations in :

https://indico.cern.ch/conferenceDisplay.py?confId=156570

•Status of PU simulation

•DPG/POG : Calorimeters, Jets, MET (something on leptons shown by TOP, SUSY)

•Reports from PAGS

### Future Pileup Scenarios



 Depending on what the machine chooses to do, we could have either 25ns bunch spacing (=large out-of-time pileup effects) or higher currents at 50ns (=lots of pileup occupancy)



Mike Hildreth - MET/Pileup Workshop

Viola

# Samples

Special high pileup runs (average ~30 interactions) :

runs 178203,178207 and 178208 with 1bunch others with ~10 bunches i couldnt find the run number yet Again today (average PU ~45 possible ?)

Special MC samples :

/DYToEE\_M-20\_TuneZ2\_7TeV-pythia6/Fall11-Peak32PU\_START42\_V14B-v1/AODSIM /DYToEE\_M-20\_TuneZ2\_7TeV-pythia6/Fall11-Peak32PU\_START42\_V14B-v1/GEN-SIM-RECO /DYToMuMu\_M-20\_TuneZ2\_7TeV-pythia6/Fall11-Peak32PU\_START42\_V14B-v1/GEN-SIM-RECO

/G\_Pt-15to3000\_TuneZ2\_Flat\_7TeV\_pythia6/Fall11-Peak32PU\_START42\_V14B-v1/AODSIM /G\_Pt-15to3000\_TuneZ2\_Flat\_7TeV\_pythia6/Fall11-Peak32PU\_START42\_V14B-v1/GEN-SIM-RECO

/QCD\_Pt-15to3000\_TuneZ2\_Flat\_7TeV\_pythia6/Fall11-Peak32PU\_START42\_V14B-v1/GEN-SIM-RECO

/TT\_TuneZ2\_7TeV-pythia6-tauola/Fall11-Peak32PU\_START42\_V14B-v1/GEN-SIM-RECO

# **Pileup simulation**

#### What is simulated :

Pythia6 Tune Z2 for Summer 11 production of minbias events (used sigmatot = 71.3mb, 68mb is a better fit to data, Higgs people observed Z->mumu events agree better ) The number of in- and out-of-time interactions to be overlaid are selected individually from a poisson distribution based on the chosen luminosity and the total inelastic cross section. Out-of-time interactions are simulated for each beam crossing that is "in scope" for a given production run.

No detailed studies yet on the underlying physics/differences within different generators...

#### Stored info and reweighting :

Summer11 : full BX info saved, but not the true mean of number of interactions per event. Calculate the average mean from the BX info and use that one. Or reweighting with 3D (Nint-1, Nint0,Nint+1) matrix of in- and out-of time pileup

Fall11 : the true value of number of interactions per event is stored, so truth to truth reweighting will be standard procedure. Mike (https://indico.cern.ch/getFile.py/access? contribId=0&resId=1&materialId=slides&confId=156570)

## Calos and Jets

Sal (https://indico.cern.ch/getFile.py/access? contribId=7&resId=0&materialId=slides&confId=156570) calorimeters DAQ changes :

Viola

ECAL : clustering and timing info under study HCAL : timing changes studied and will be included in CMSSW 5x

#### Pileup subtraction in Jets :

• L1Offset remove run-averaged pileup contribution (see also talk by Ia https://indico.cern.ch/getFile.py/access? contribId=14&resId=0&materialId=slides&confId= 156570 )

• event-by-event :

- L1FastJet : mean-pt-per-unit-areasubtraction (~20% better resolution than offset method JME-10-011).
- **PfNoPU** : customizeable, starts from PF top projection (exclusive categorization of particles), can remove objects at will. Standard procedure : remove all the charged hadrons from subleading vertices

O(n) = <pt, offset> MS. L = 36 pb{p<sub>T,offset</sub> }, GeV 8.0 Markers: Data, Histograms: MC photons Minimum Bias - Noise em deposits (PU)=1 e+mu neutral hadrons hadronic depositscharged hadrons 0.6 0.4 0.22 3

### Jets

Standard procedure : PfNoPU (only CHS), with subsequent L1FastJet (or L1Offset)



Current software performances studied in 2012 like PU scenarios (15-25 interactions), expect <3.5% bias at low pt jets .

Plot |eta|<2, CHS+L1FastJet ( sure?)



## PU removal at HLT

L. Apasanevich (https://indico.cern.ch/getFile.py/access?

contribId=5&resId=0&materialId=slides&confId=156570) use of L1FastJet correction in HLT.

Some trigger paths in use since run 178411.

CPU affordable and they seem to do the right job (behaviour not yet checked in high PU runs)

### MET

#### MET (https://indico.cern.ch/getFile.py/access? contribId=6&resId=0&materialId=slides&confId=156570) Comparing data and (reweighted) MC for Photon or Z→mumu events



Scale (ET/qT) : not dependent on # vertices Resolution (RMS of u) : worse with higher # vertices Some data-MC disagreement under study Effects of pileup subtraction not yet tested.

Studies on PU removal for MET (https://indico.cern.ch/getFile.py/access? contribId=8&resId=0&materialId=slides&confId=156570) for the moment no official standard recipy, different possibilities under study (L1FastL2L3-L1Fast correction instead of L2L3 for the type I corrections, CHS+neutral removal, pseudo Met variables), no universal working point found

### PAGs views

Report from different PAGs (QCD, TOP, HIGGS, SUSY)

QCD, TOP, SUSY in general PU subtraction methods (and eventually increased thresholds in selections) are able to contain the effects from PU. Not a big issue for the analyses now Concern whether the effects will scale linearly with the increase of number of interactions in 2012

HIGGS : mostly concerned by PU effects on MET, using pseudo MET variables, thinking of MET cut dependent on # vertices, data driven studies..