Role of MinBias physics for LHC HI commissioning

S.White, 10/26/10

- New Results on Large Cross section Processes- Tony
- Fragmentation/acceptance issues- Mark, Sebastian, Igor
- Short summary of ZDC performance and possible impact on LHC commissioning- Michael,Federico(?), Sebastian
- kickoff for future discussion of minbias triggers-Mark

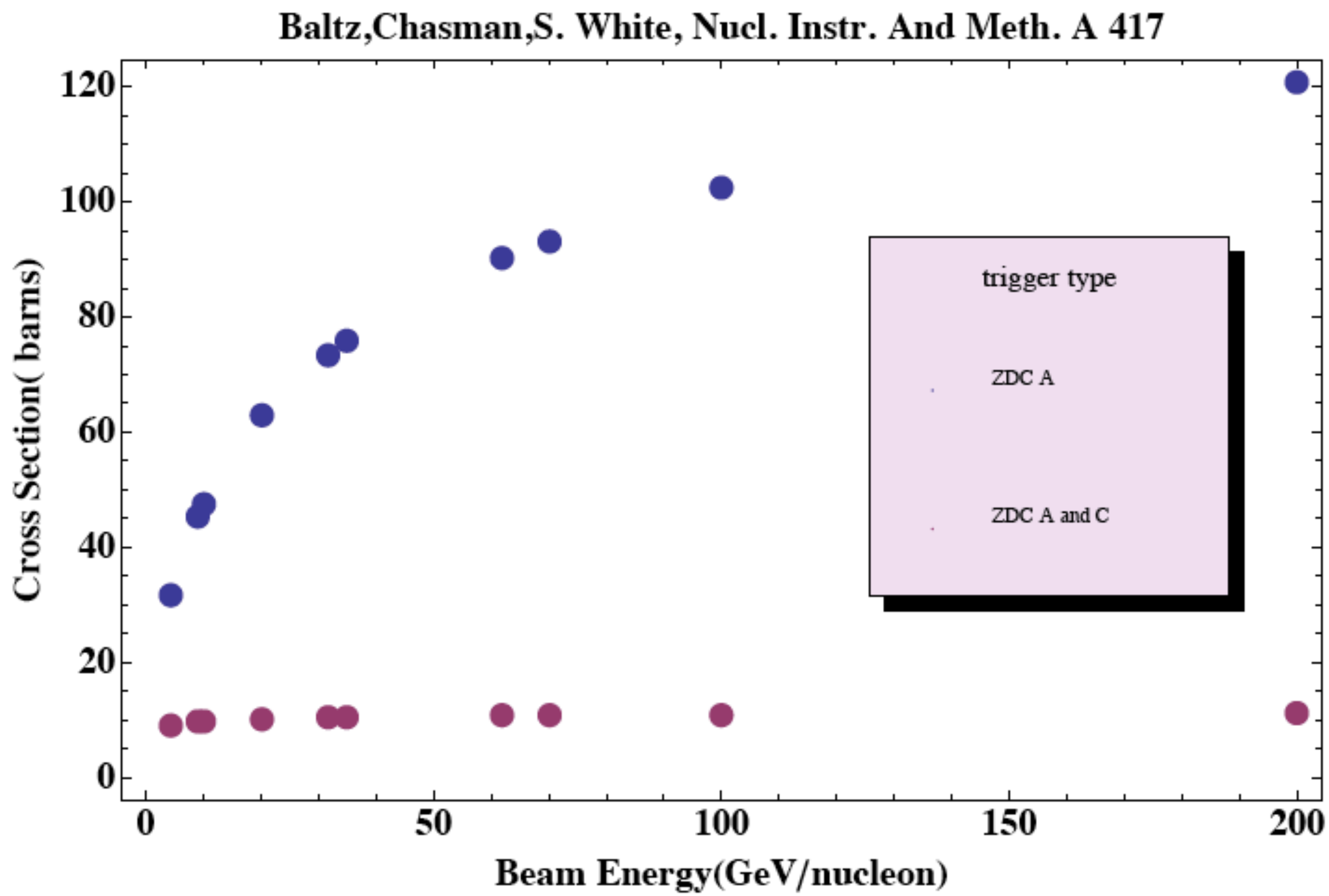


Figure 5: ZDC effective cross section with Au beams vs. cms energy.

RHIC ZDC Rates and Corrections

Sebastian White, PHENIX note

March 15 '10

New results from Tony Baltz

Sebastian,

Results of a calculation for 1.38 TeV/N Pb on Pb:

R = 6.624, a = .549, sigNN = 80 mb

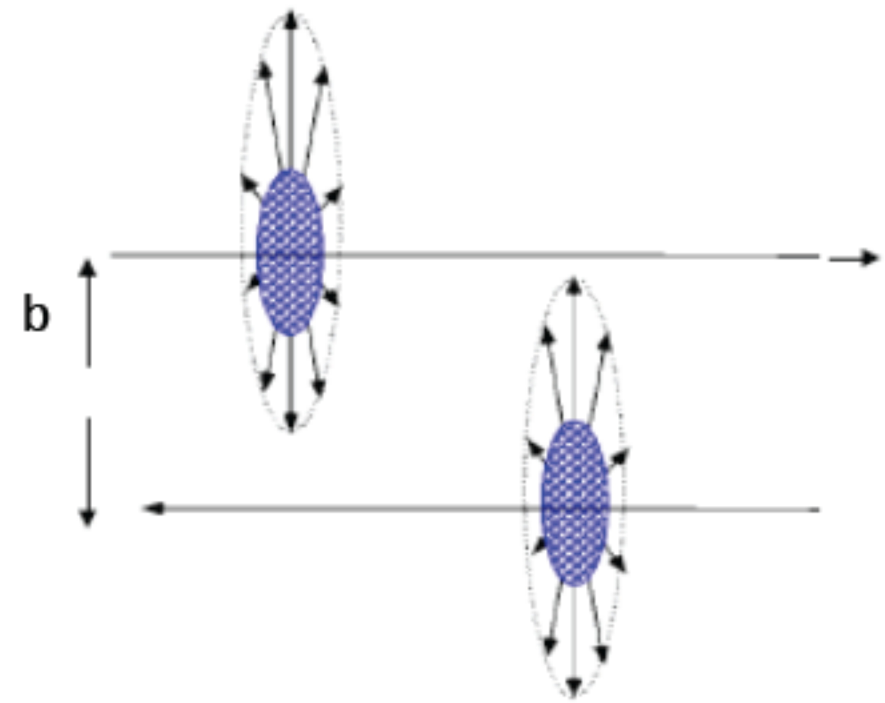
sig(1n,1n)	sig(1n,xn)	sig(xn,xn)	sig(1n)	sig(xn)
0.5586714	1.867285	13.99582	96.95243	202.5460

For 2.76 TeV/N we previously got (in our paper):

sig(1n,1n)	sig(1n,xn)	sig(xn,xn)	sig(1n)	sig(xn)
0.537	1.897	14.75	105.93	227.28

The fact that sig(1n,1n) is lower at the higher energy is due to increasing multiple Coulomb excitation (excluded in 1n) with increased energy.

Tony



Acceptance Issues:

see e.g.

"Neutron Production and Zero Degree Calorimeter Acceptance at LHC", Sebastian White, http://adsabs.harvard.edu/abs/2009arXiv0912.4320W

"Beam Fragmentation in Heavy Ion Collisions and its implication for RHIC triggers at low s", Sebastian White, Mark Strikman, http://arxiv.org/abs/0910.3205

"The role of Spectator Fragments at an electron Ion collider", Sebastian White and Mark Strikman, http://arxiv.org/pdf/1003.2196

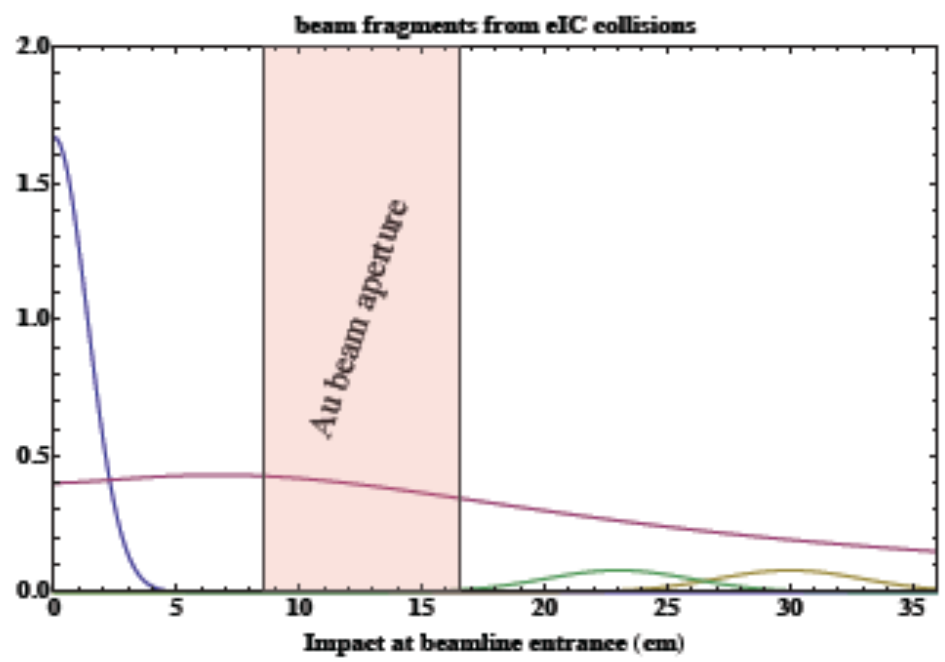
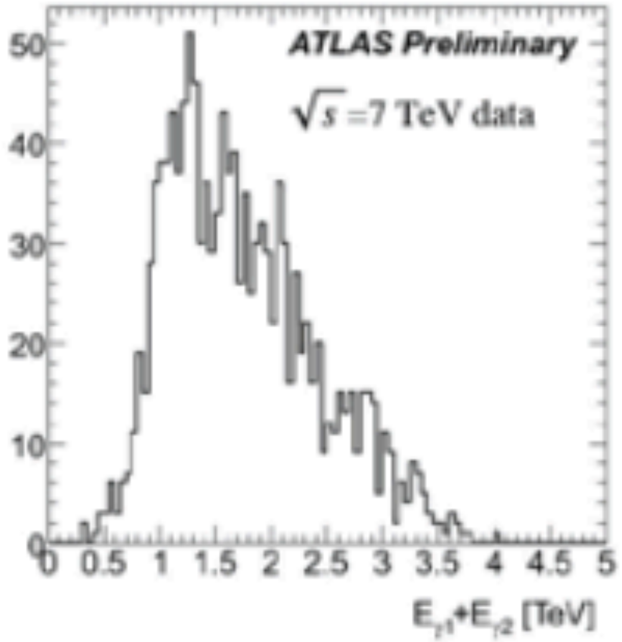
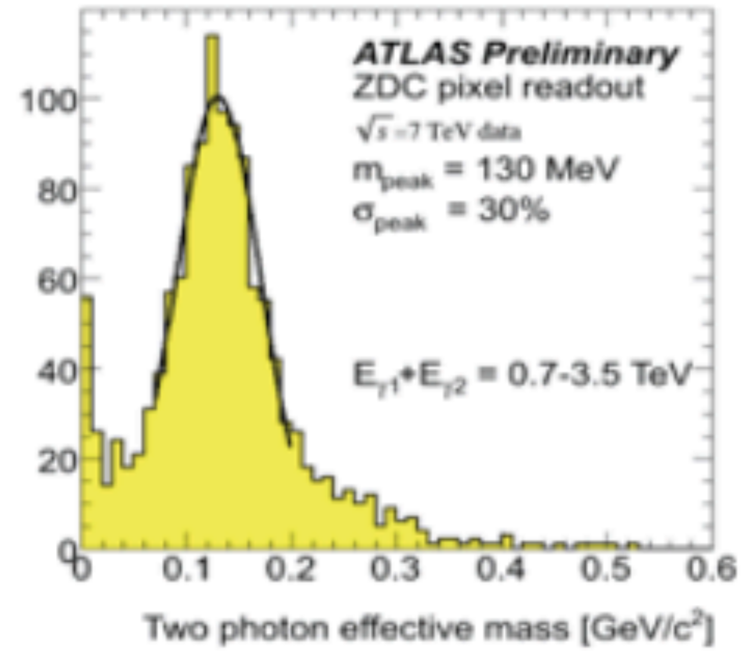


Figure 6: Distribution of fragments at the entrance to the beamline in the RHIC geometry. The size of the beamline aperture is indicated. Neutrons (blue) and photons (red) are centered on the forward direction and completely dominate the fragmentation. Charged fragments, deuterons (green) and protons (yellow) are rarely produced due to Coulomb barrier supression. In a low energy eIC design the bending power of the DS magnet is lower by a factor of 4. Then all fragments enter the beamline. Charged fragments, if produced, would immediately be lost to collisions with the beampipe since the momentum dispersion, $\eta(s)$ is larger than 0.5 meters.

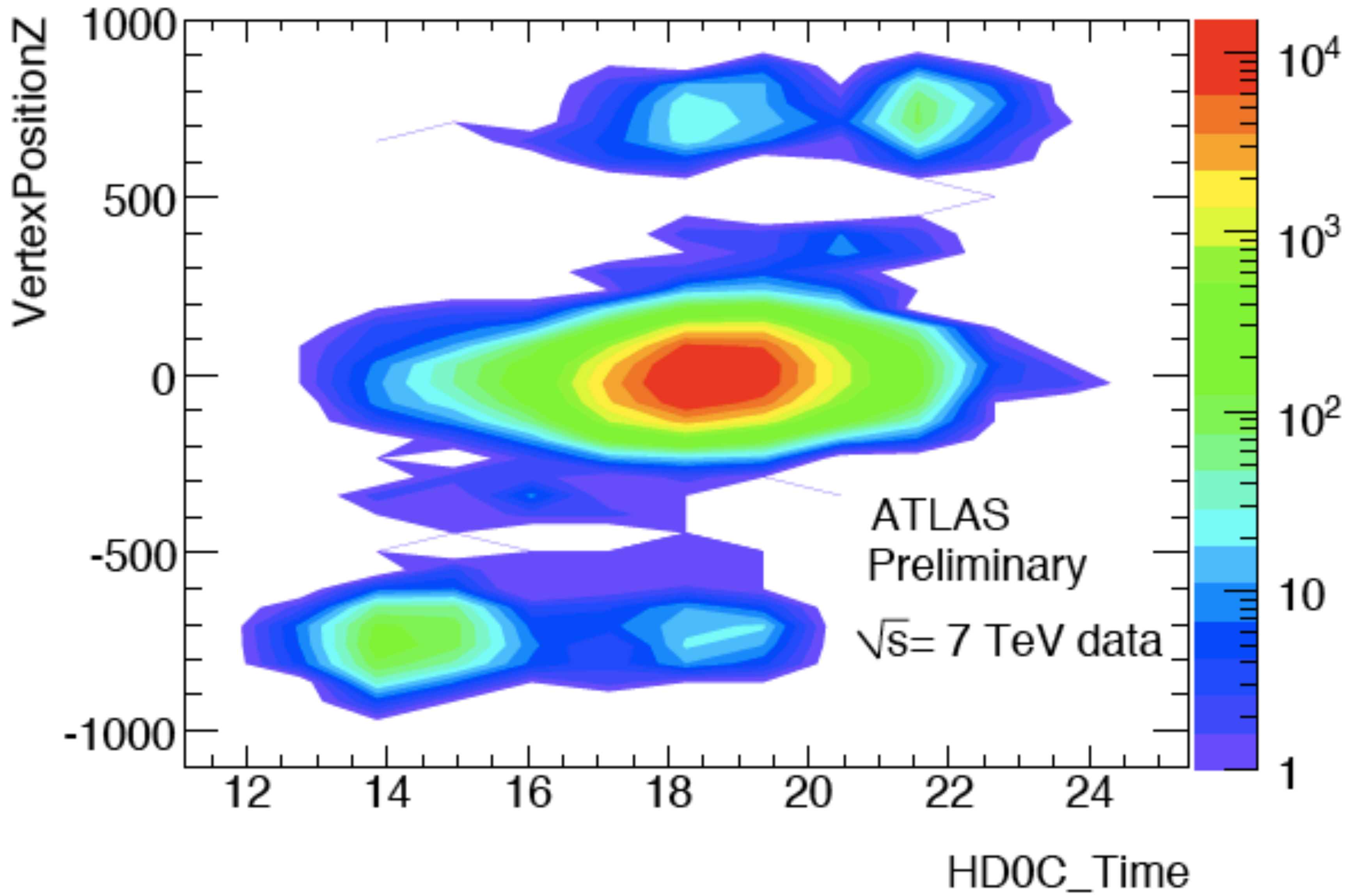
2 photon



Energy distribution of 2 photon candidates in the ZDC, selected using the longitudinal shower profile. The ZDC energy scale was established using the endpoint measured in 7 TeV collision data. Since the shower energy is concurrently measured in the "pixel" coordinate readout channels this allows energy calibration to be established for these channels also.



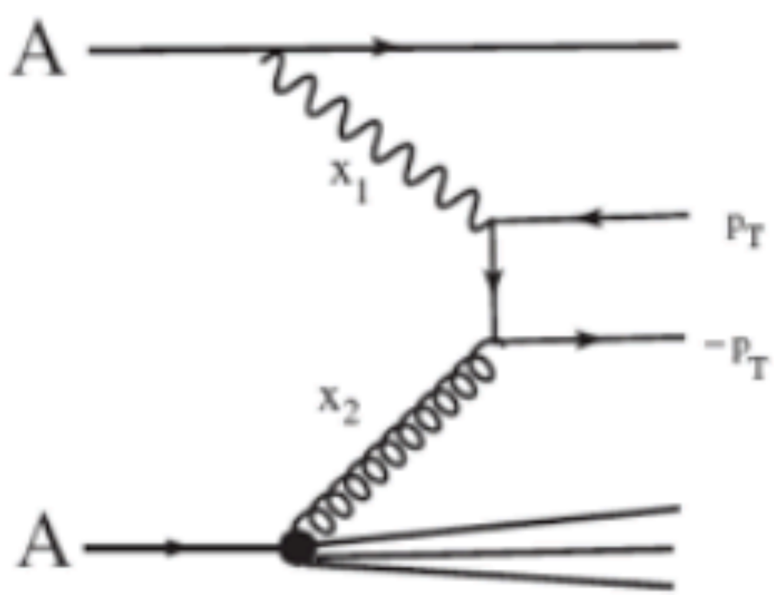
For 7 TeV collision data taken prior to LHCf removal the first ZDC module is the so-called "Hadronic x,y" which has identical energy resolution to all of the other ZDC modules. The coordinate resolution, however, is inferior to that of the high resolution EM, installed 7/20/10. Nevertheless, the reconstructed mass resolution is found to be 30% at m=130 MeV. As is found in ongoing simulation of pi0 reconstruction within the full ATLAS framework (see ZDC simulation TWIKI), the pi0 width is completely dominated by the energy resolution. Therefore, the current state of ATLAS ZDC photon energy resolution can be inferred from this plot.



The Z vertex distribution from inner tracker vs. the time of arrival of showers in ZDC-C relative to the ATLAS clock calculated from waveform reconstruction using Shannon interpolation of 40 MegaSample/sec ATLAS data (readout via the ATLAS L1calo Pre-processor modules). Typical time resolution is ~200 psec per photomultiplier (see ATL-COM-LUM-2010-022). The two areas outside the main high intensity area are due to satellite bunches. Note that this plot also provides a more precise calibration of the ZDC timing (here shown using the ZDC timing algorithm not corrected for the digitizer non-linearity discussed in ATL-COM-LUM-2010-027). With the non-linearity correction the upper and lower satellite separations are equalized.

Inclusive triggers (Mark)

- **"Probing Small x parton densities in Ultraperipheral AA and pA collisions"(Strikman, Vogt, SNW)**



q,anti-q
"jets"