ZDC Calibration for 2016

STATUS AND PLANS

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2016 running

Issues

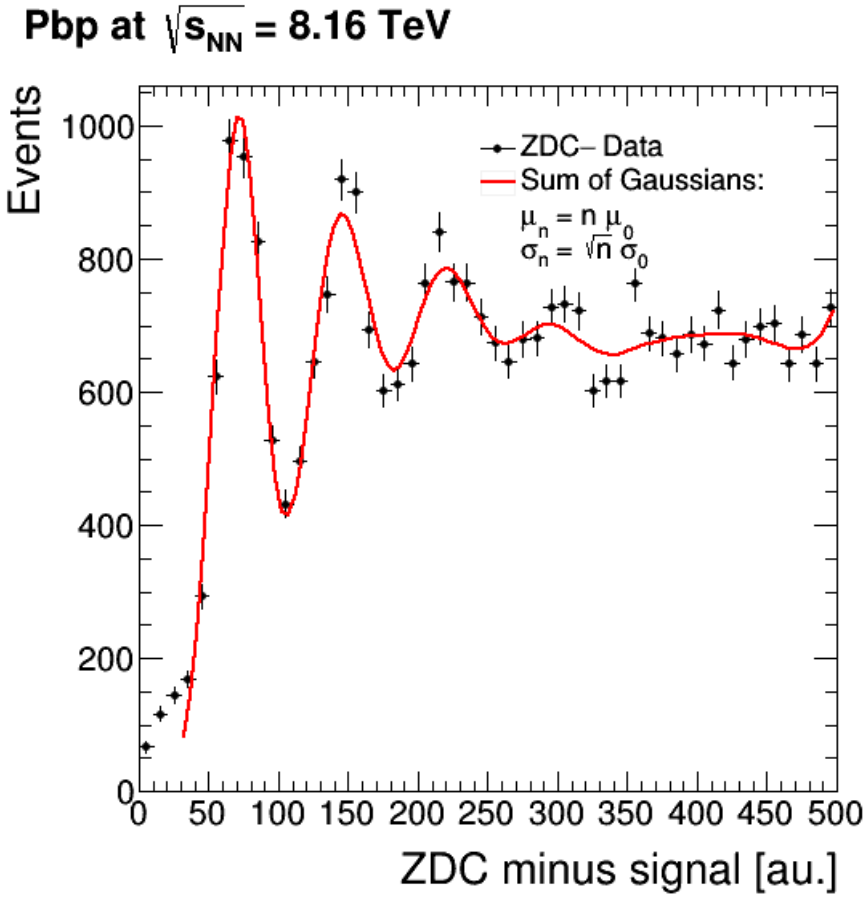
1. We tried very hard to install our new electronics. Unfortunately our readout fibers were radiation damaged and so we had to to use this old system. This has only a 7 bit readout for each channel and this gives us dynamic range problems. (ALICE has the same issue)
2. For the first part of the run the ZDC timing was off and so for the early period it will be hard to use the ZDC.

Responses

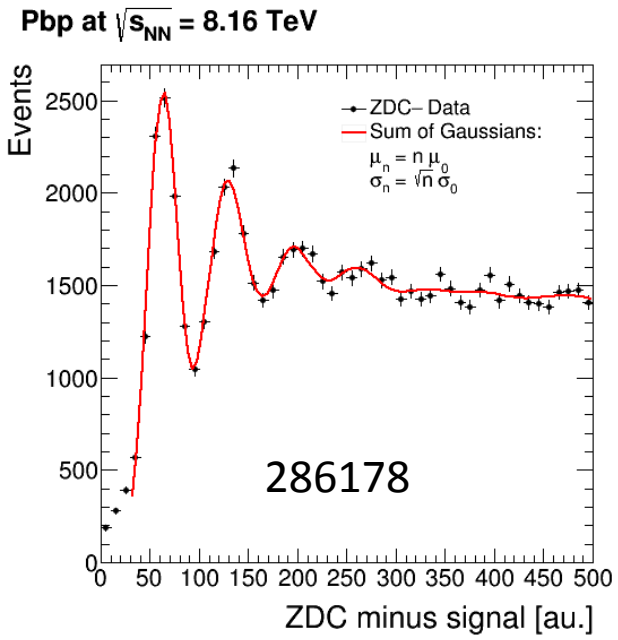
1. For each event we readout out 10 time slices. When studying the single neutron peak we use Time Slice 3 and 4 but when studying central events we use time slice 4 only. Since TS4 has only a small fraction of the signal this extends our dynamic range.
2. If we can study the correlations of the ZDC with HF, Ntracks etc in the latter half of the run it may help us understand any biases that arise from using these detectors to classify events.

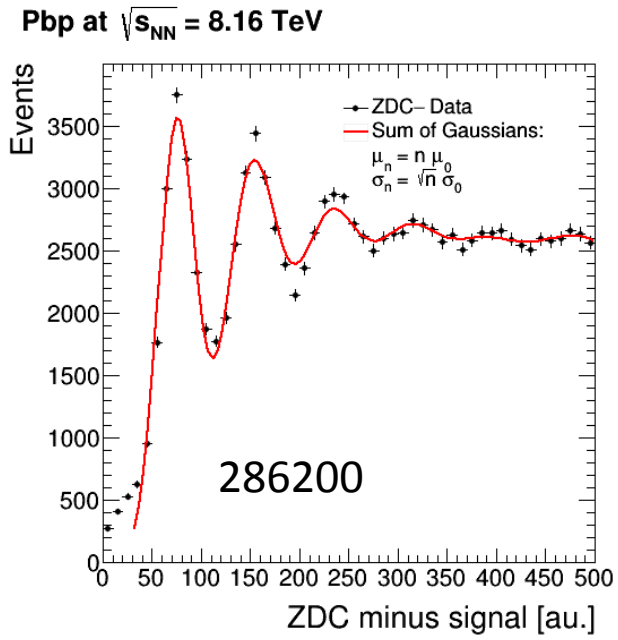
Calibration using neutron peaks

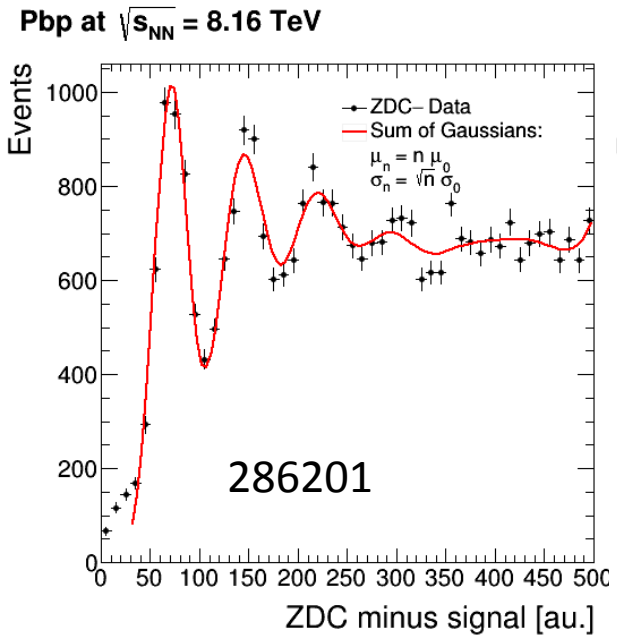
1. For peripheral events we have only 1 or 2 neutrons within the ZDC. To ensure that we have a good signal we require that we have ZDC show a maximum in Time Slice 3 for hadronic sections 1 and 2 and also for the EM sections 2,3 and 4. This rejects events where there is nothing in the ZDC and so makes it easier to find the neutron peaks.
2. However it may reject some diffractive events and probably should not be used in analysis.

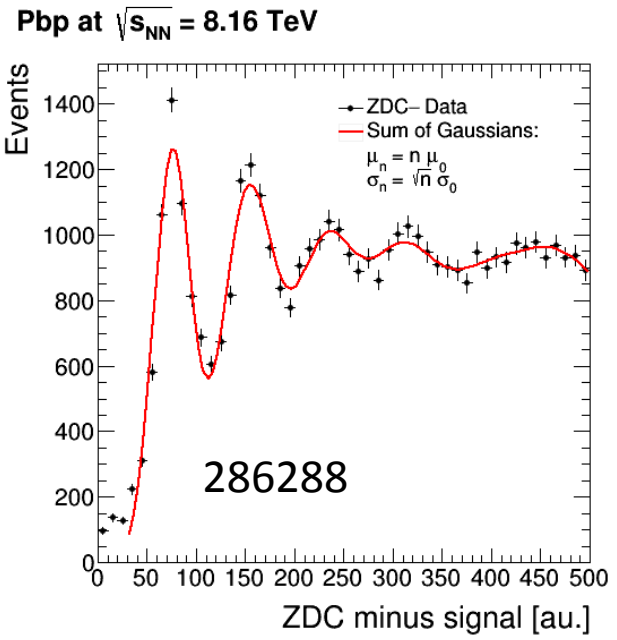


Calibration examples from 8 TeV Pbp









	286178	286200	286201	286288
1 n peak location	61.6±0.4	75.5±0.2	71.4±0.3	76.0±0.3
1 n peak width	17.2±0.3	19.1±0.1	17.5±0.2	18.9±0.2

Full ZDC spectrum

To avoid saturation we use only Time Slice 4 to produce the ZDC spectrum for a min bias spectrum. The peaks corresponds to about 30 neutrons, which is similar to a preliminary 5TeV result from Alice arXiv:1403.5143 .

This spectrum is probably missing some very peripheral events because of our cut that the maximum signal be in TS 3.

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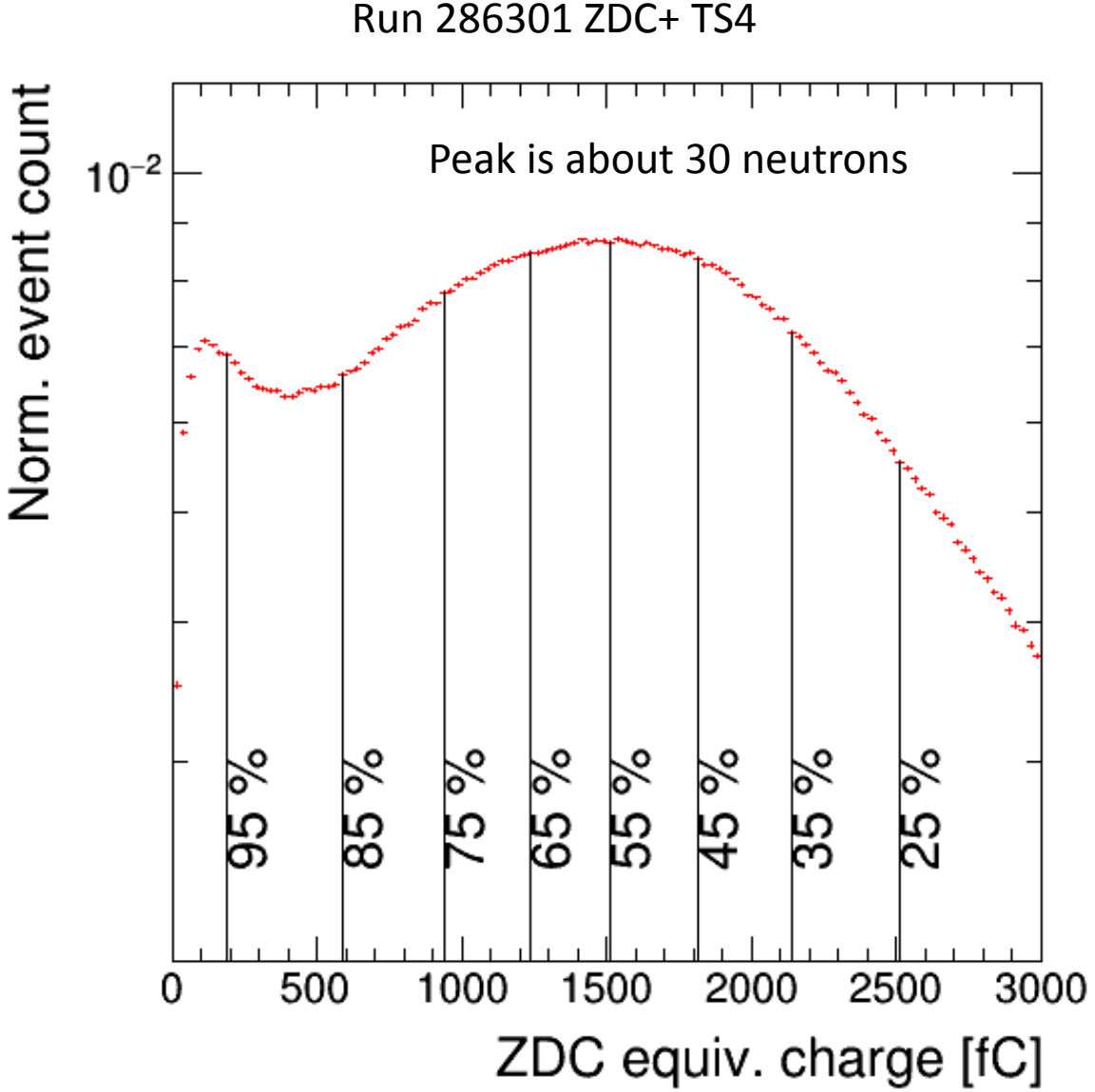
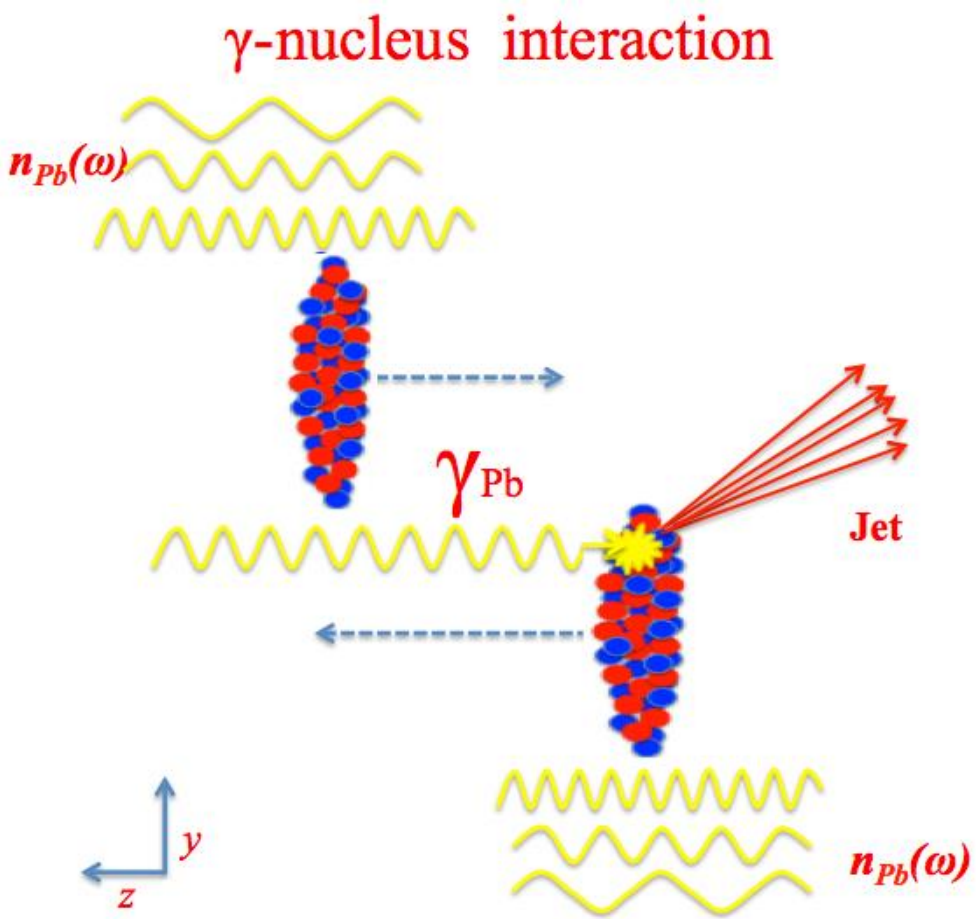
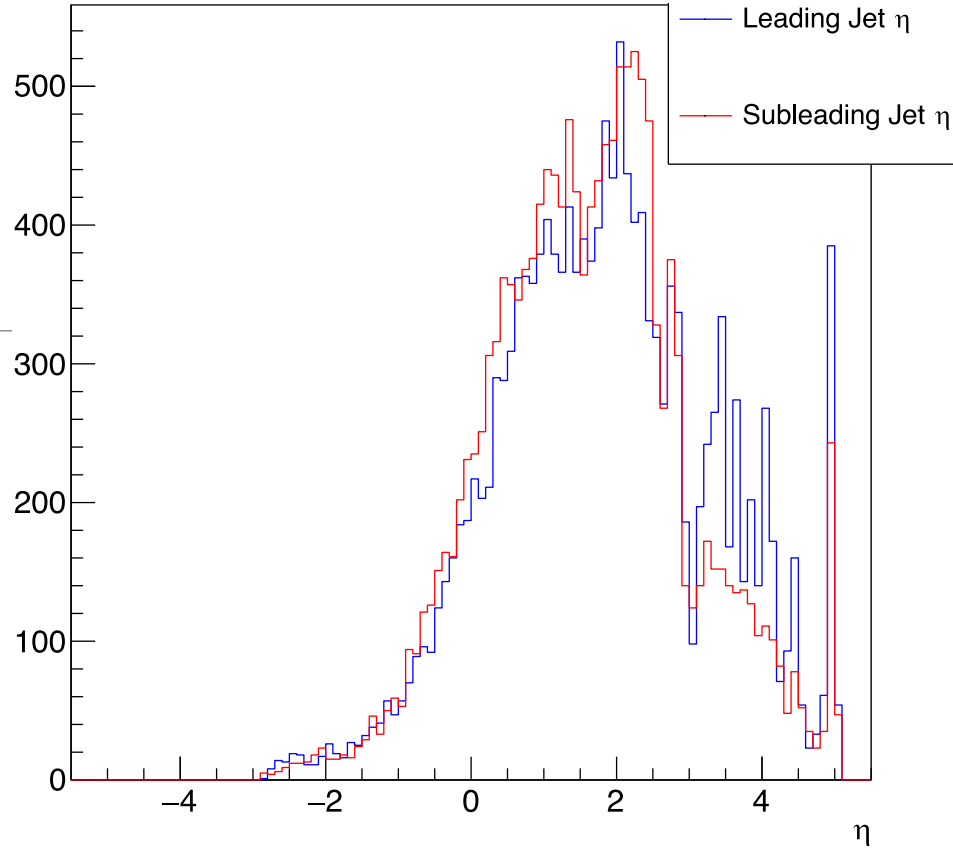
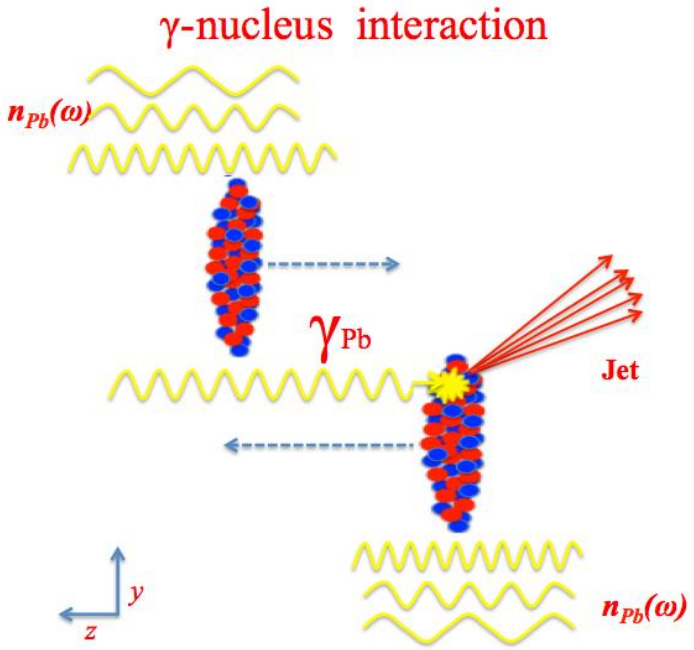


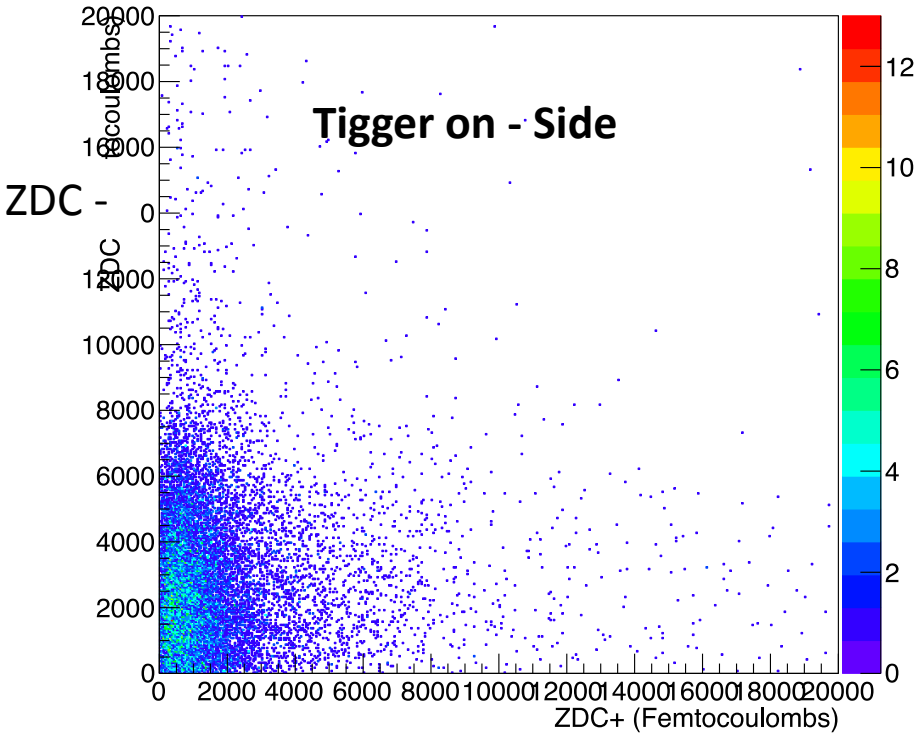
Search for UPC Jets





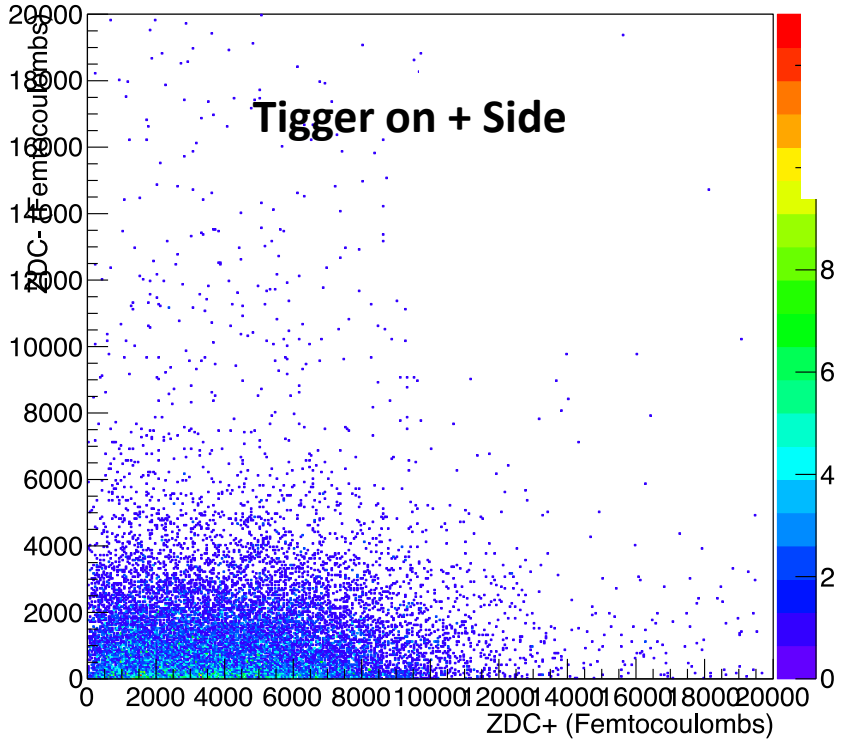
Use the breakup of the nucleus to tag the direction of the photon





ZDC -

ZDC +

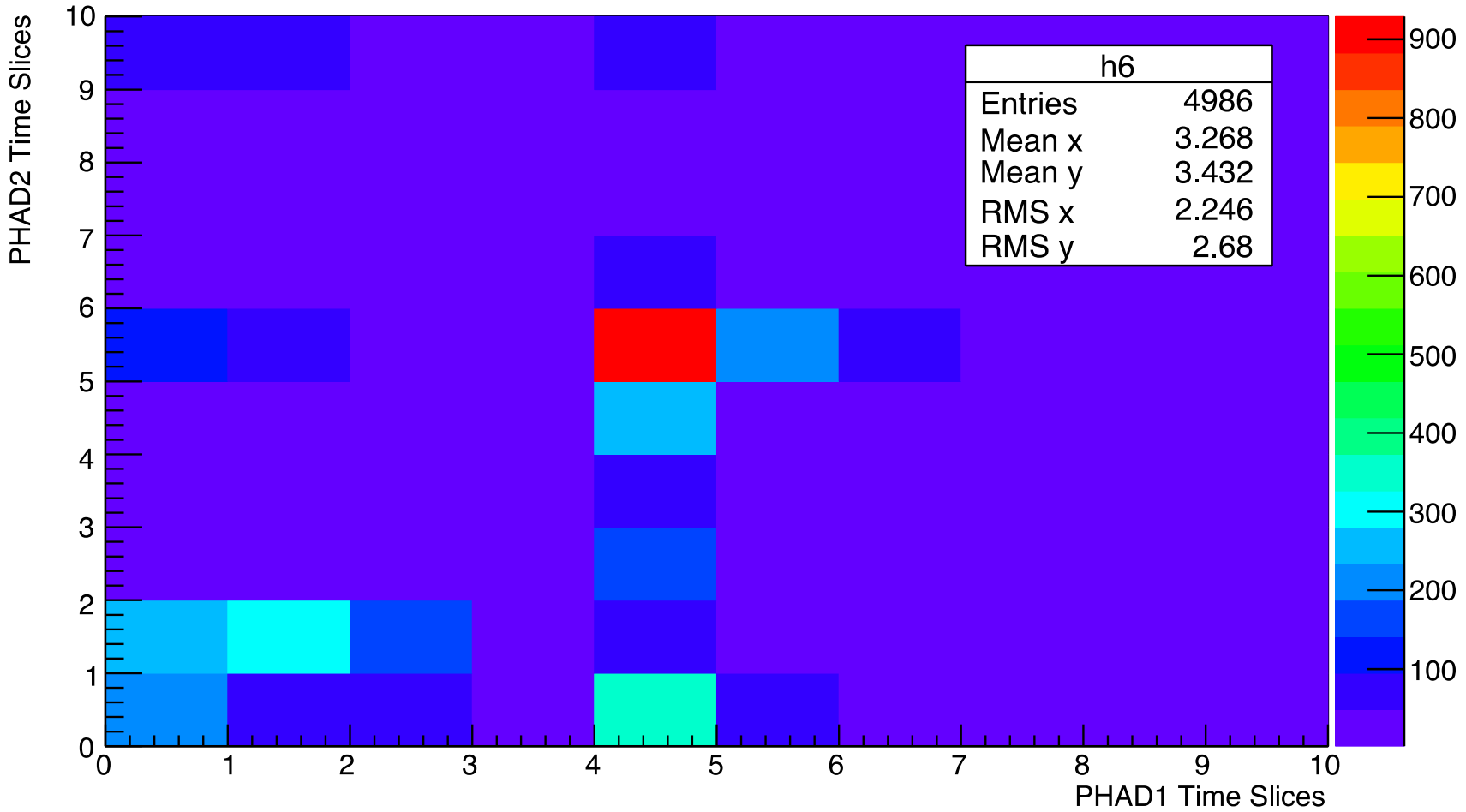


ZDC+

Improvements and upgrades

Use of Timing in addition to energy

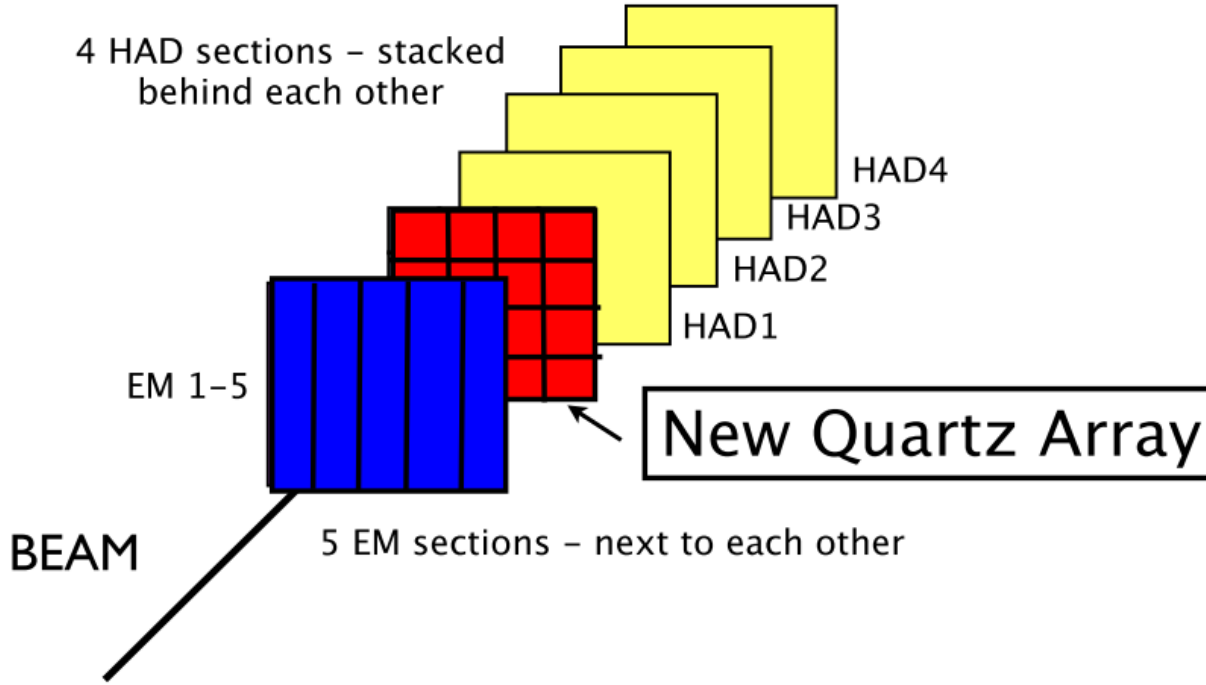
Time in Hadronic Section 2



Time in Hadronic Section 1

Fast timing will be a great help in separating signal from noise in the ZDC. Hope to have about 50ps resolution in the upgraded ZDC.

Upgrades for 2017/18



1. New electronics will increase our dynamic range and dramatically improve our timing.
2. This should give us 10 bit readout and a TDC on each channel.
3. We will also install a new array to measure the orientation of the neutrons.
    1. A few channels were tested in 2016
4. For diffraction studies in pp we could remove the ZDC itself and only use the RPD array
    1. We could probably afford to install new RPDs every year to compensate for radation damage.
5. RPD would have poor energy resolution but could have very good timing reolution.