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FXT TO Work

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It was noticed that some of the distributions in the FXT runs have indication similar to wrong TO for the TPC. So far there has been no practice of introducing additional TO for FXT runs, but it looks like it is necessary.

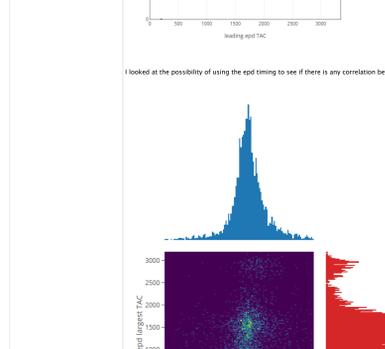
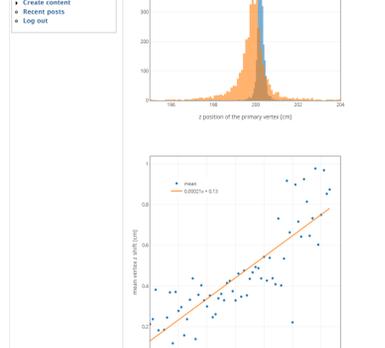
In FXT runs of Run-19 (and probably in all the past ones as well) STAR has been adjusting the global timing to be centered for the collision setup of that energy and keeping it same for the FXT runs. This effectively introduces of about 7 ns shift in trigger time (2 m with speed of light, from target to the center of the TPC).

This is the table with final parameters for the calibration:

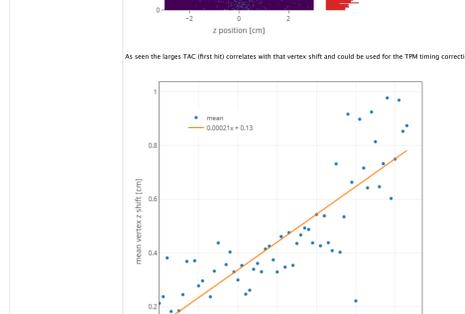
FXT Runs	Mean	Offset	Slope
Run-19: 7.3 GeV	0.38249	-0.25250	0.00021
Run-19: 4.59 GeV	0.71824	-0.29706	0.00021
Run-19: 3.85 GeV	0.87307	-0.17249	0.00016
Run-19: 3.1 GeV	-	-	-

Below is the study to figure out how to deal with this.

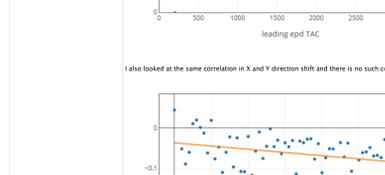
FXT 7.3 GeV Run-19
 On the plot below we use the primary vertex for the tracks reconstructed only from hit in west and east sides. There is about 3 mm shift and substantial broadening from the ones reconstructed only from hit in east.



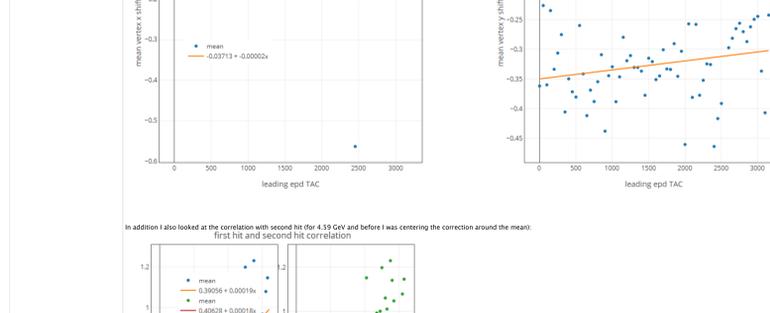
I looked at the possibility of using the epd timing to see if there is any correlation between the distance between the peaks and the first registered epd time:



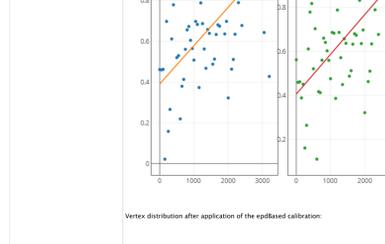
As seen the largest TAC (first hit) correlates with that vertex shift and could be used for the TPM timing correction. Below is the correlation:



I also looked at the same correlation in X and Y direction shift and there is no such correlation observed in those directions:



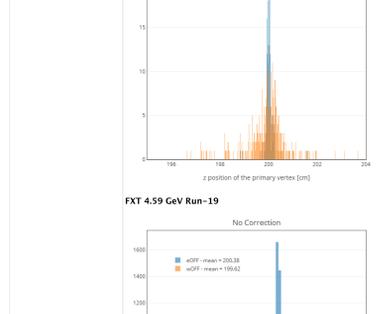
In addition I also looked at the correlation with second hit for 4.59 GeV and before I was centering the correction around the mean:



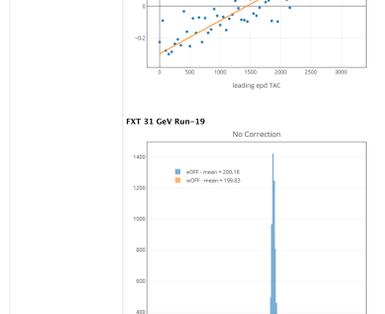
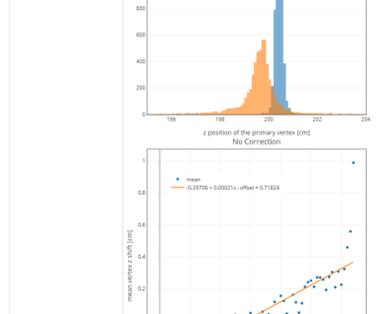
Orange is the second hit, red is the first hit.

Vertex distribution after application of the epd based calibration:

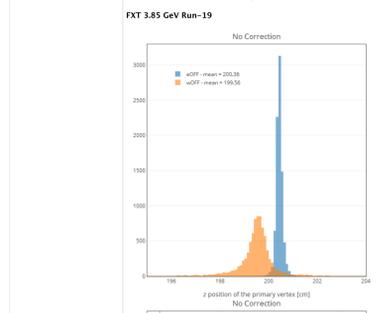
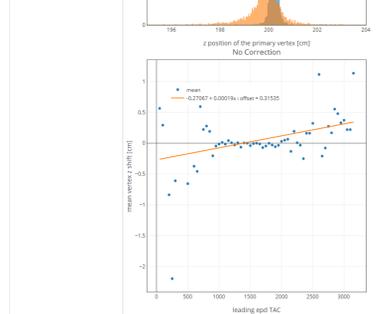
After applying the EPD correction using the track-node adjusting method and hit moving methos



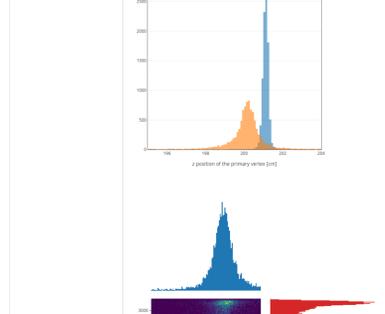
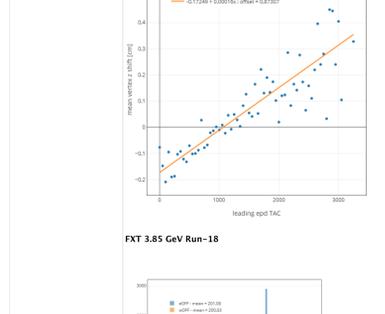
FXT 4.59 GeV Run-19



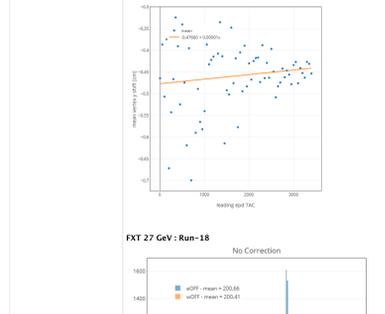
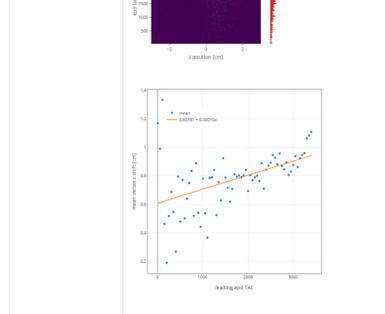
FXT 3.1 GeV Run-19



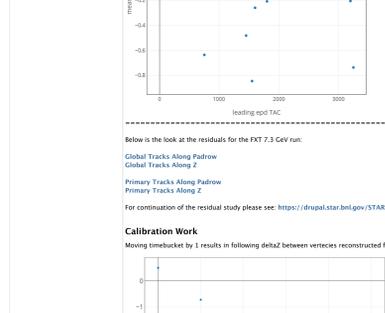
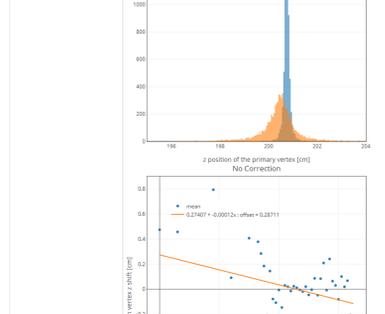
FXT 3.85 GeV Run-19



FXT 3.85 GeV Run-18



FXT 27 GeV Run-18



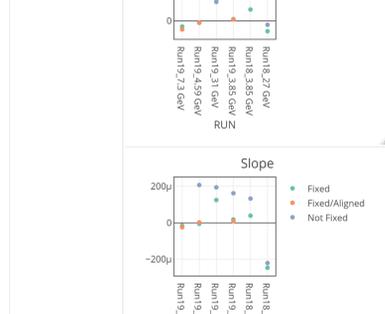
Below is the look at the residuals for the FXT 7.3 GeV run:

Global Tracks Along Padrow
 Global Tracks Along Z
 Primary Tracks Along Padrow
 Primary Tracks Along Z

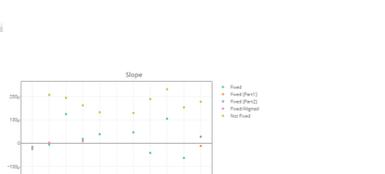
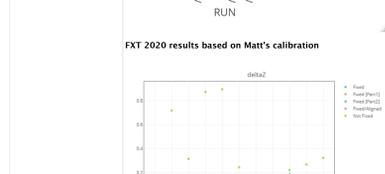
For continuation of the residual study please see: <https://dnpal.star.bnl.gov/STAR/blog/iraklik/residuals-tpc-era>

Calibration Work

Moving timebucket by 1 results in following deltaZ between vertices reconstructed from hits in east and west sides separately:



After re-running the Run-19 alignment (see the appropriate blog post) I checked the FXT-19 event-by-event samples. Results are below showing that alignment did not affect the FXT vertex correction, which to me makes sense - the timing shift between trigger time and event time is should not depend on alignment.



FXT 2020 results based on Matt's calibration

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