

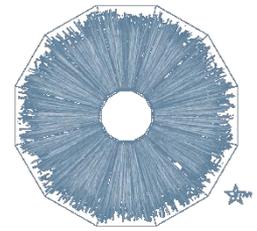
ALTRO THRESHOLD OPTIMIZATION

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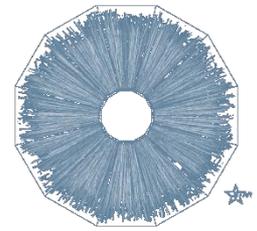
Overview



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- The goal of this study is to use the TPC data recording bandwidths more efficiently;
 - ▣ Tanko's measurements during datataking in Run2015 showed the deadtime reduction (caused by TPC) by about 10%.
- TPC data readout goes through the ALTRO chip that has readout threshold value which could be customized;
- This study was performed to understand the effects of the threshold change and optimize its value as a function of primary track reconstruction efficiency.

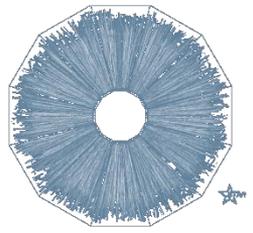
Overview



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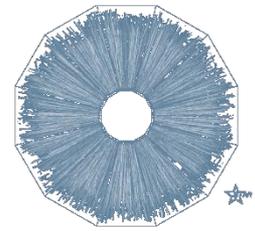
- The measurements, done by Tonko, during datataking of Run2015 showed the deadtime reduction (caused by TPC) by about 10%, when increasing the ADC threshold to four.
- The study to support such a change is done using simulation, real data, and the simulation embedded to the data.

Simulation



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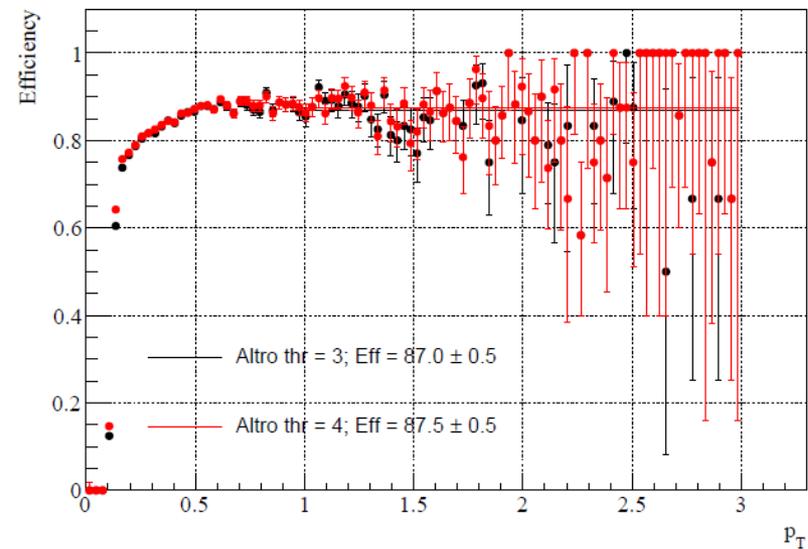
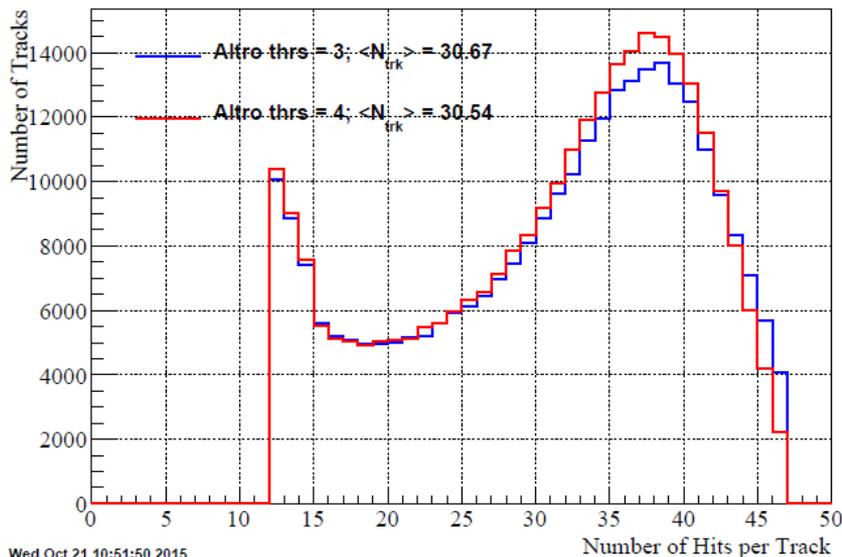
- HIJING simulation of Au-Au collisions at 200 GeV energy was used for the study (with 2014 STAR geometry);
- The efficiency on the plots is for the primary tracks with at least 15 hits on track used for $\frac{dE}{dx}$ fit;
- For studies in data and in embedding 2014 Au-Au zerobias daq files were used.



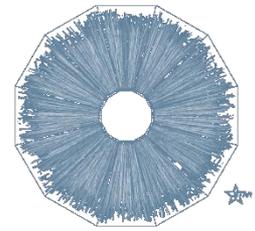
Threshold change 3→4 (Simulation)

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- In current setup the threshold value is 3;
- Tanko's suggestion was to set it to 4;
- This change reduces total number of hits, as expected, but average number of hits per track stays the same due effective increase of length of the reconstructed tracks;
- This translates into a slight increase in the efficiency of the track reconstruction (about 0.5%).

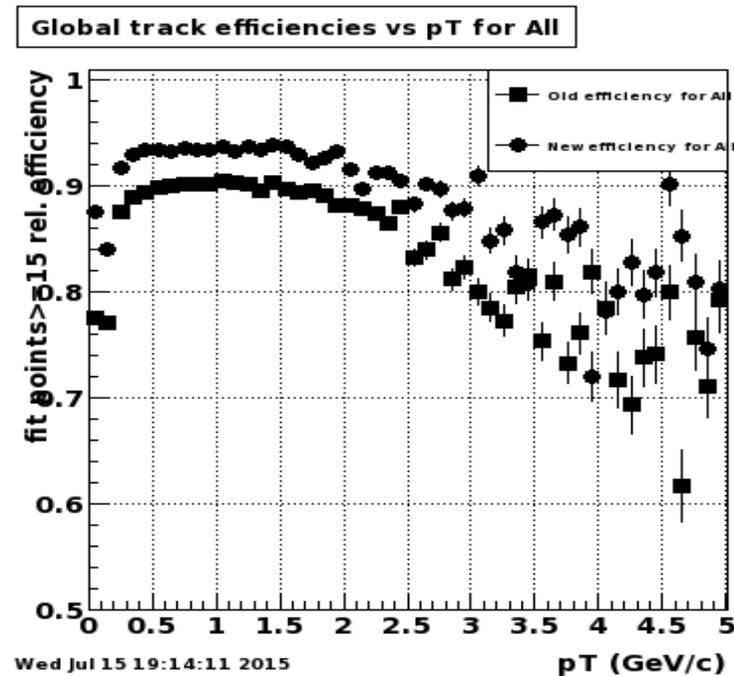


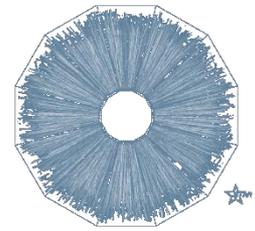
Threshold change 3→4 (Data)



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- Efficiency study performed on data also yielded the increase in reconstruction efficiency (even larger increase);

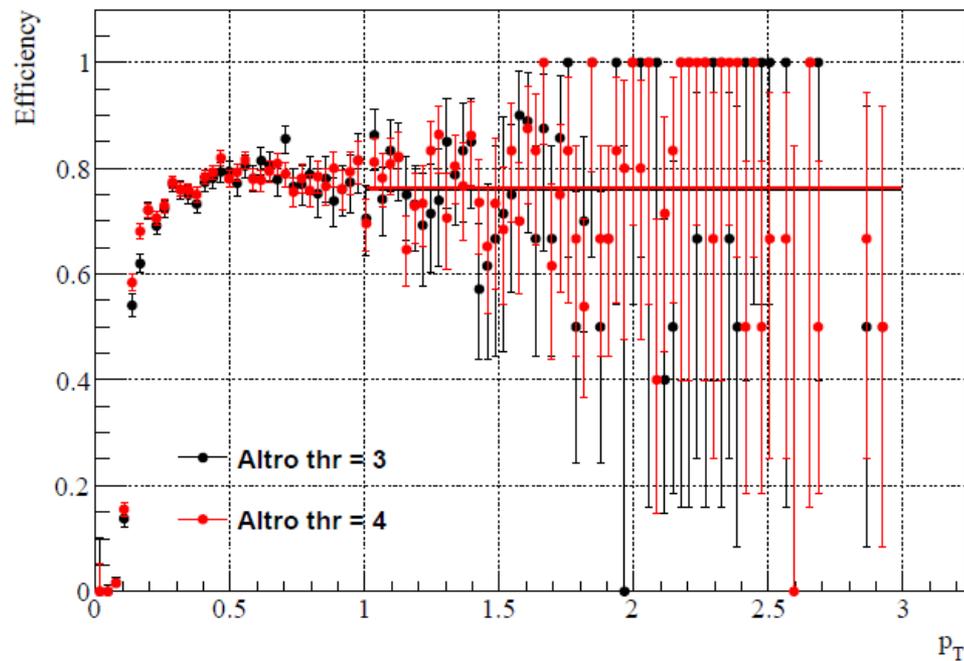


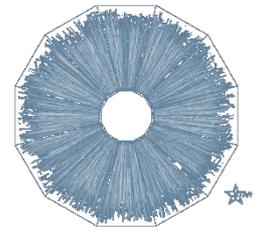


Threshold change 3→4 (Embedding)

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- The same study was also performed on the exactly same MC events embedded into the exact same data;
- The result is still - slight increase in efficiency.

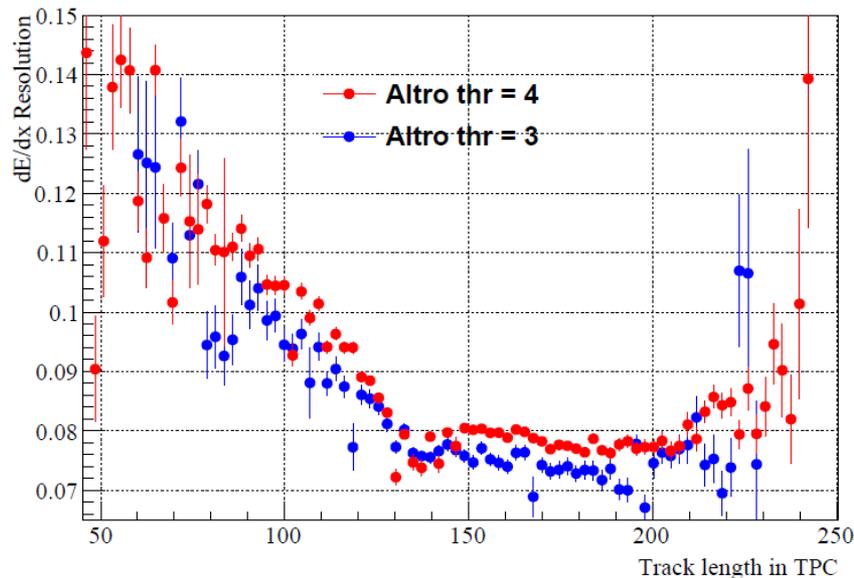




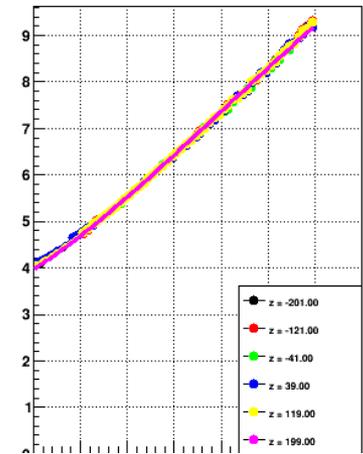
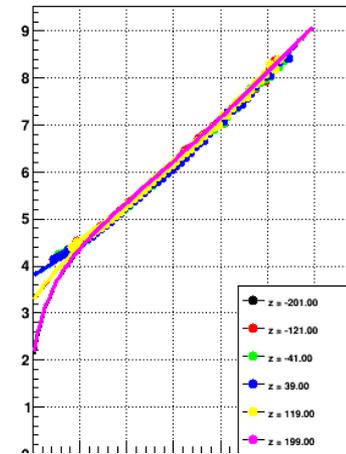
Effects on dE/dx resolution

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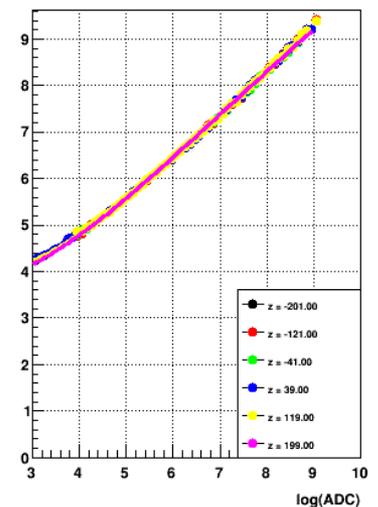
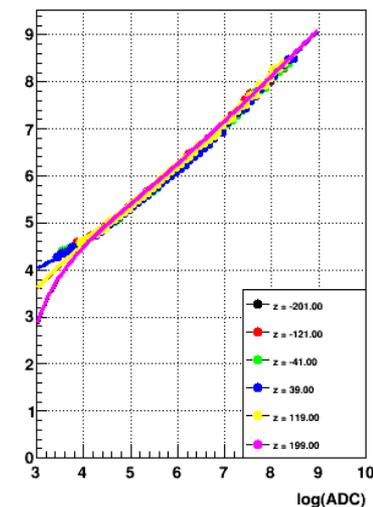
- The correction factors for $\frac{dE}{dx}$ calculation were recalculated for the threshold 4 value;
- The resolution of $\frac{dE}{dx}$ measurement is not affected by the change;



log(simulated ADC) versus log(recon. ADC) and Z

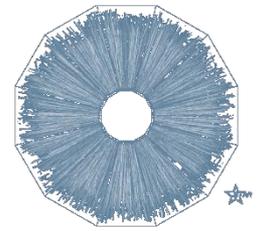


log(simulated ADC) versus log(recon. ADC) and Z



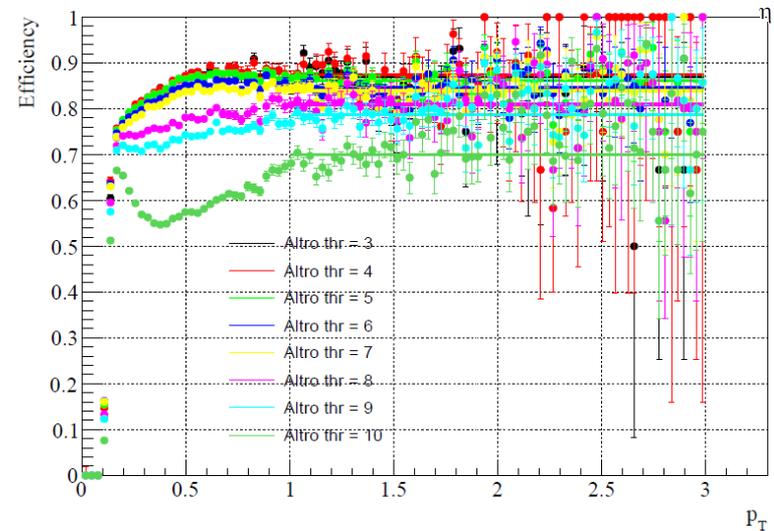
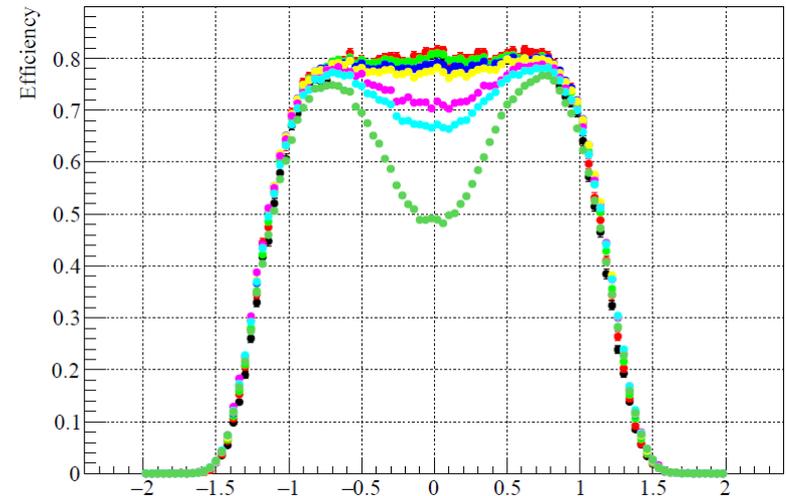
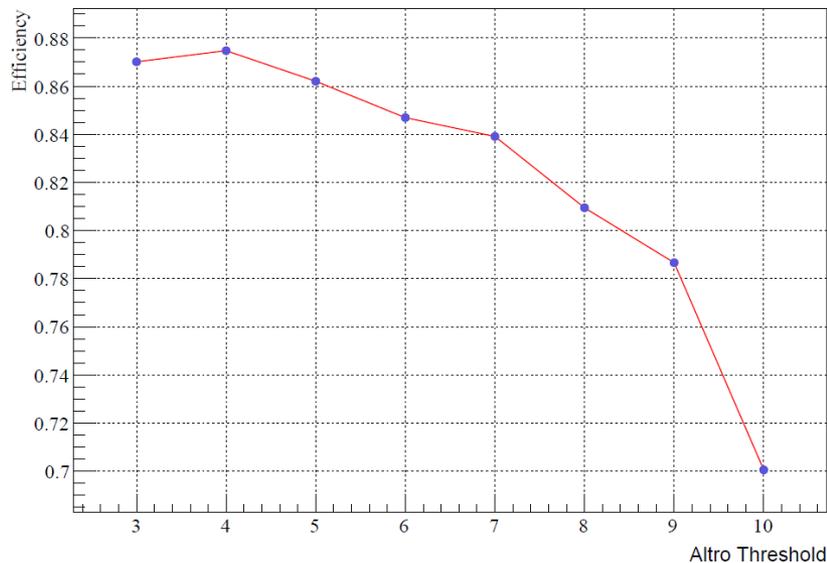
The ...

Threshold Optimization

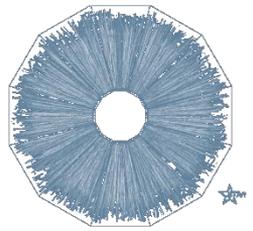


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- Other values of the ALTRO threshold were also considered for its optimization;
- Expected behavior of the reconstruction efficiency as a function of threshold was observed;
- Optimization shows that threshold 4 is the optimal case.



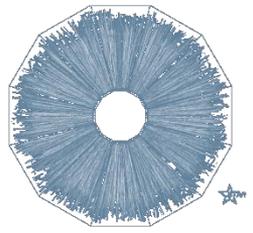
Summary



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- Threshold increase reduces the number of hits in TPC, as expected, but average number of hits per track remains the same;
- It was shown that ALRO threshold change from 3 to 4 does not worsen the track reconstruction but even benefits it by removing “bad” hits;
- Above mentioned was demonstrated in pure MC as well as in data and in embedded sample;
- The optimization study showed that threshold value of 4 maximizes the primary track reconstruction efficiency;

Proposal



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- Proposal to change the ADC threshold was submitted on December 3rd.

Abstract

This document presents the proposal to increase the digital readout threshold in the time projection chamber (TPC) Altro chip from current three to the proposed four. The proposal is based on the study presented in this document.



Proposal

As a result of the presented study, the STAR tracking focus group proposes to increase the digital readout threshold value in the TPC Altro chip from the current value of three to four.