

A'+beam MC sample production

Update II

Sarah Gaiser
Stanford/SLAC
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U.S. DEPARTMENT OF
ENERGY

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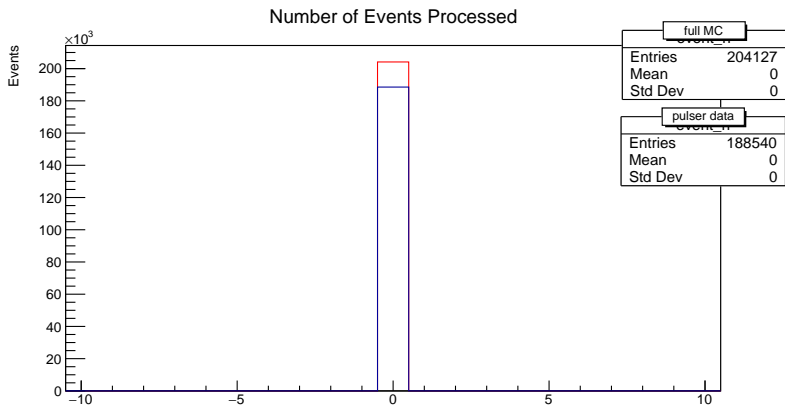


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LABORATORY

A'+beam MC sample production

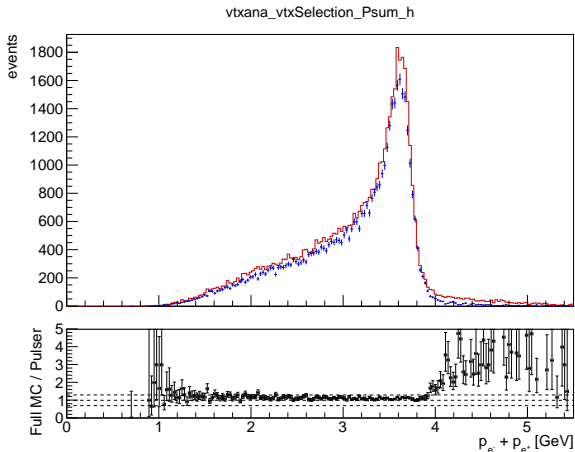
- Full MC
 - Beam and signal simulated
 - Signal spaced by event interval = 250
 - Using LCIOMerge to merge both samples
- Pulser data
 - Overlay random beam data and simulated signal
 - Space events with event interval = 250
- For both samples: run same readout and reconstruction
 - UPDATE THIS Steering for readout:
PhysicsRun2021TrigMultiSingles.lcsim and
PhysicsRun2019TrigSinglesWithPulserDataMerging.lcsim
- Detector used: HPS_Run2021Pass1_v4; run number: 14229

Number of processed events



- More events processed for full MC method – Extra or missing events?

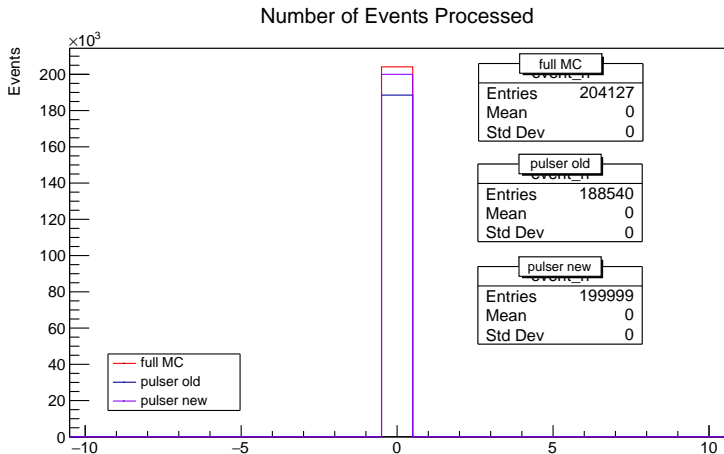
Ratio of psum – Full MC/pulser overlay



- Ratio between both methods is constant around ~ 1.1

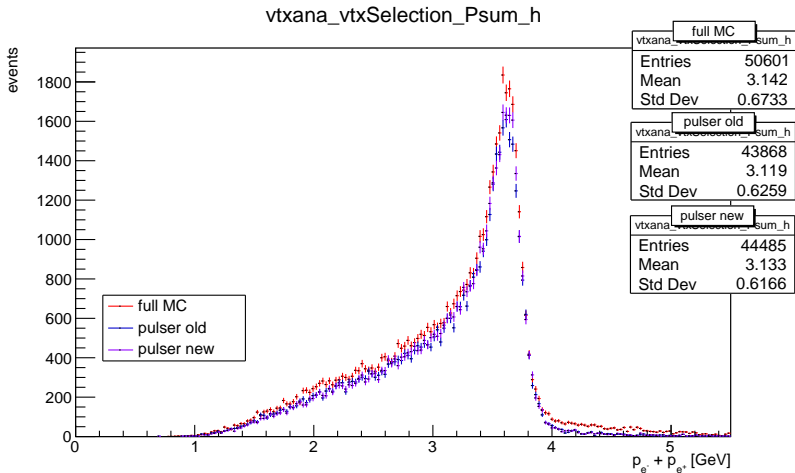
- We need to understand the difference in the number of processed events
- Where are the extra triggers in full MC coming from? Do we miss anything using new way of generating MC samples?
 - Full MC uses singles2 and singles3 trigger in readout simulation
 - The pulser overlay readout simulation is using only the singles3 trigger
- Add singles2 trigger to pulser readout and investigate results
- Disclaimer: full MC and old pulser sample generated with "old" hps software setup
 - I have to rerun reconstruction and analysis for these samples to make sure that I am doing the same thing to all three samples.

Number of processed events



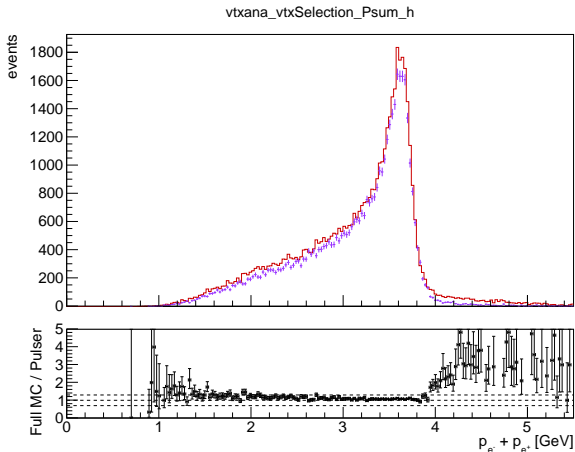
- Number of events increases but still doesn't match full MC

Impact of preselection



- Slight increase in number of events in Psum peak

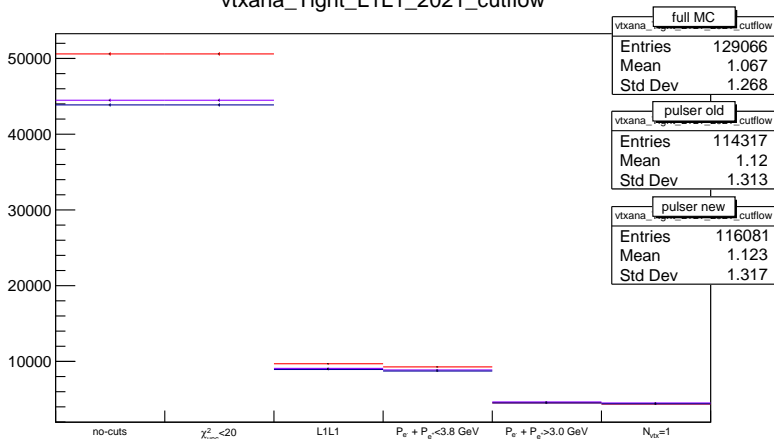
Ratio of psum – Full MC/new pulser overlay



- Ratio between both methods starts around ~ 1.1 and decreases to 1

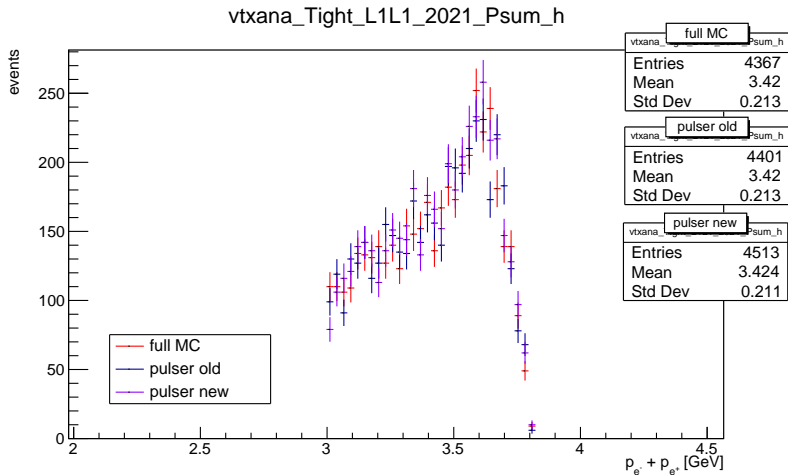
Cutflow for tight selection

vtxana_Tight_L1L1_2021_cutflow



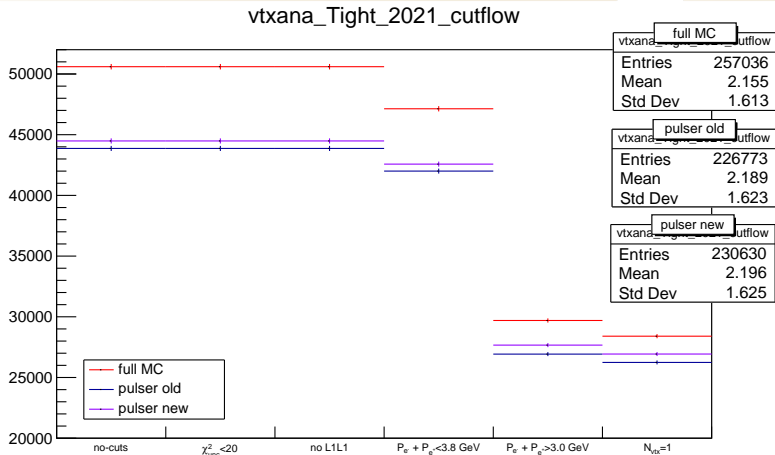
- L1L1 cut leaves similar number of events for both methods
- Same number of events by end of cutflow

Psum after tight selection



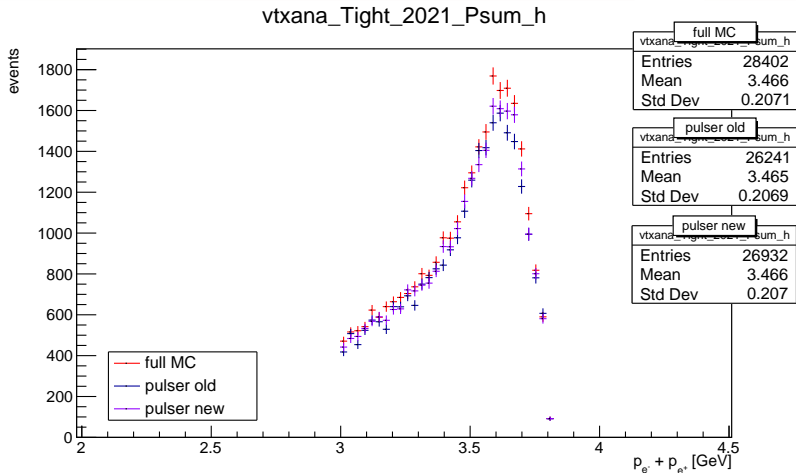
- Psum distributions after tight selection match for all three samples

Cutflow for tight selection – no L1L1



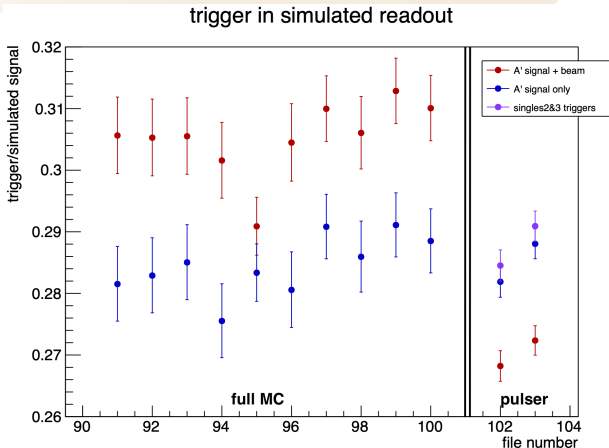
- Without L1L1 requirement: number of events differ by the end of tight selection

Psum after tight selection – no L1L1



- Psum peak contains more events for full MC compared to both pulser methods

Simulated trigger 'efficiency' – A' signal



- A' signal only: trigger rate same for both methods
- A' signal + beam: fewer events for pulser overlay
→ Improves slightly if both triggers are used

- Adding the singles2 trigger to the pulser readout simulation increases the number of events.
 - The additional surplus of events in full MC compared to pulser overlay might come from surplus of FEEs in beam simulation.
- Open questions:
 - Why does the number of triggers decrease for the pulser overlay A' sample if only singles3 is used?
 - Number of triggers changes every time readout simulation is run for same A' signal file
 - Probably due to random process in pipeline
- Next steps:
 - Rerun reconstruction for full MC and old pulser sample
 - Document steps for sample generation using pulser data as beam background