A'+beam MC sample production

Update III

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# 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
  - Steering for readout: PhysicsRun2021TrigMultiSingles.lcsim and PhysicsRun2019TrigSinglesWithPulserDataMerging.lcsim
- Detector used: HPS_Run2021Pass1_v4; run number: 14229

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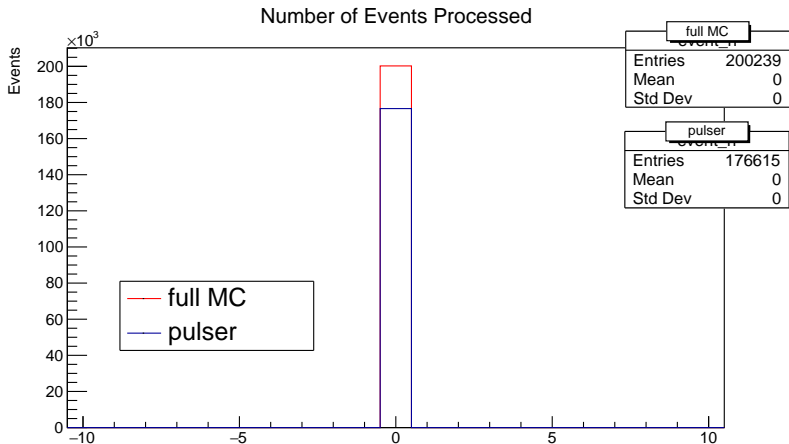
- More events processed for full MC method – Extra or missing events?

Ratio of psum – Full MC/pulser overlay
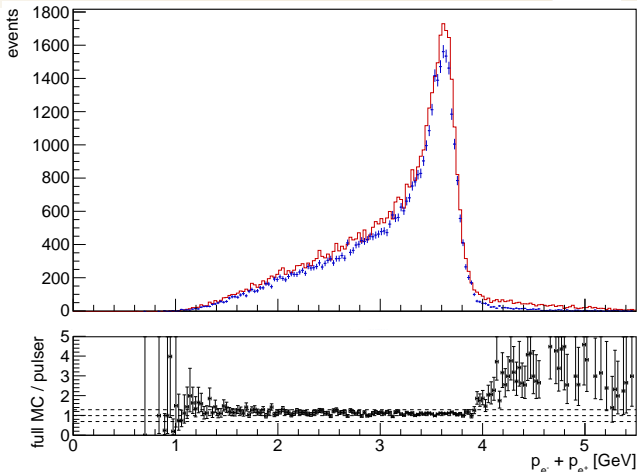
- red: full MC, blue: pulser
- constant ratio $\rightarrow$ pulser is missing same fraction of events
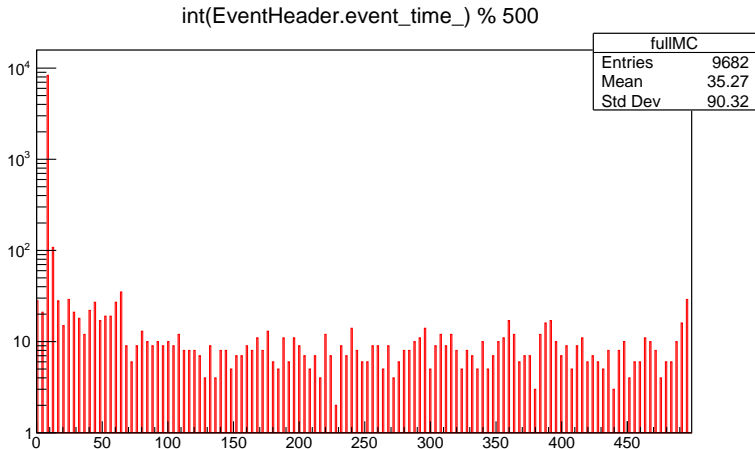
Number of processed events

- We need to understand the difference in the number of processed events to see if we are throwing away valid signal events.
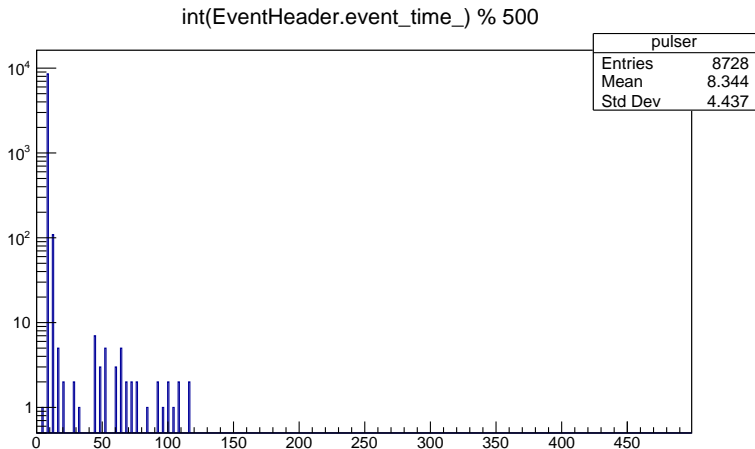- How do signal and beam merging work for both methods?
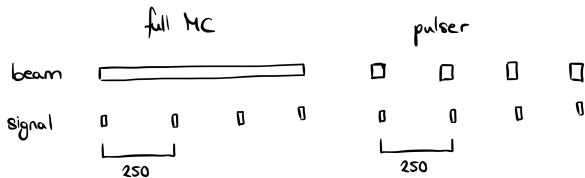
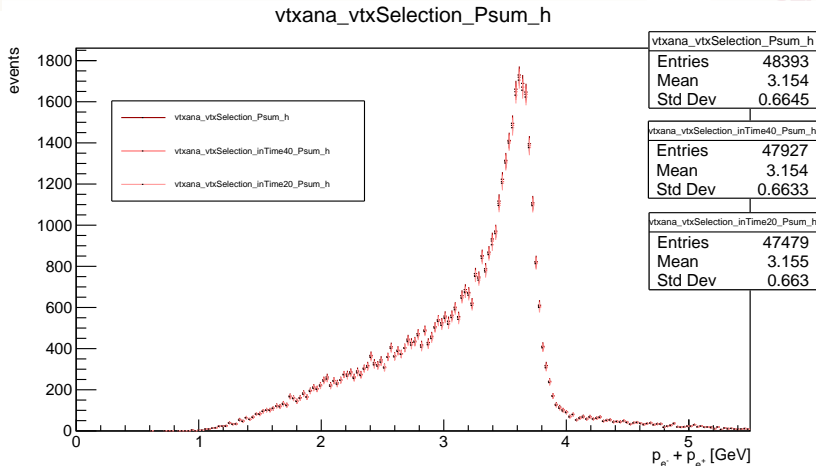- Is there a difference in timing?

int(EventHeader.event_time_) % 500

- Event time mod 500 for full MC

EventHeader event time – pulser

int(EventHeader.event_time_) % 500

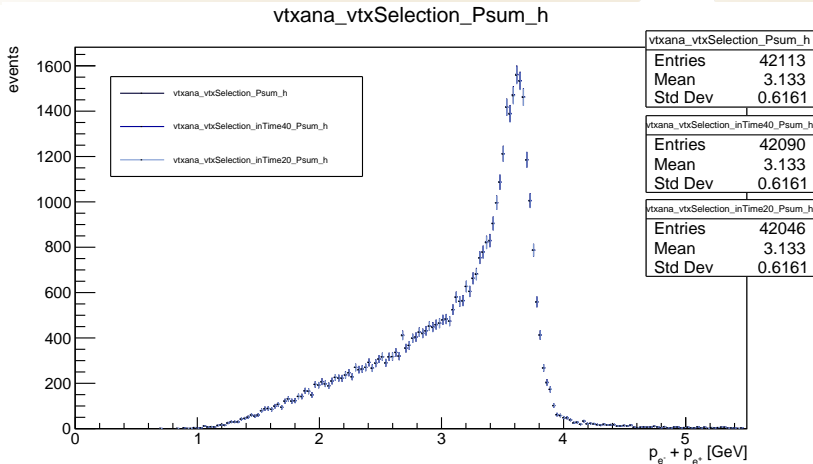| pulser	
Entries	8728
Mean	8.344
Std Dev	4.437

- Event time mod 500 for pulser overlay

Cut on event time mod 500 – full MC

- Cut on event time – how does it affect the psum distribution?
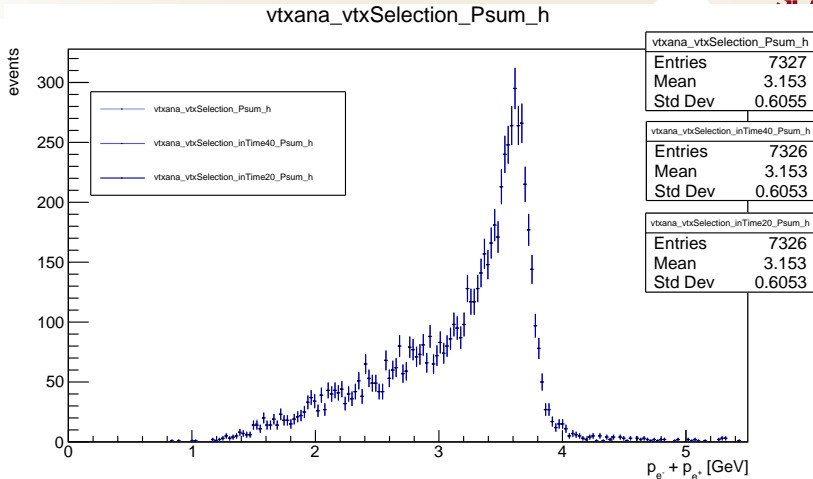- Slight decrease in event numbers
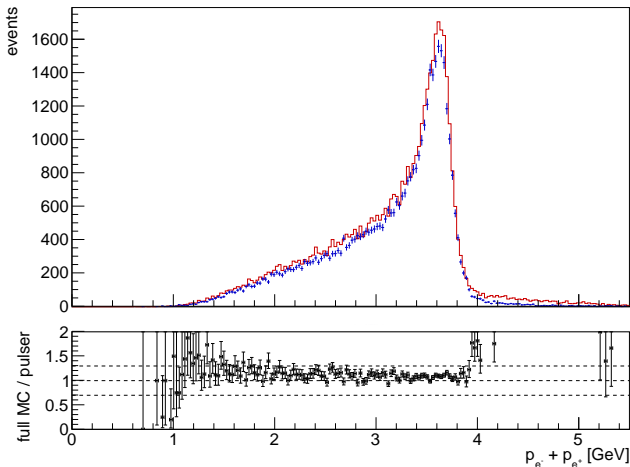
Cut on event time mod 500 – pulser

- Cut on event time – how does it affect the psum distribution?
- Almost no events are cut

Cut on event time mod 500 – events in both

vtxana_vtxSelection_Psum_h

- Looking at events that are in both files
- Cut has basically no effect
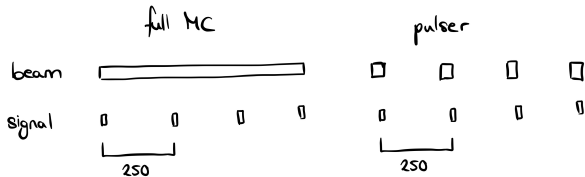
- Ratio almost the same as before, needs more analysis to see difference

Number of processed events

- We need to understand the difference in the number of processed events to see if we are throwing away valid signal events.

- How do signal and beam merging work for both methods?
    - Is there a difference in timing? $\rightarrow$ yes
- Determine simulated signal events that are present in full MC and pulser readout
   - Use this to understand which events are 'lost'
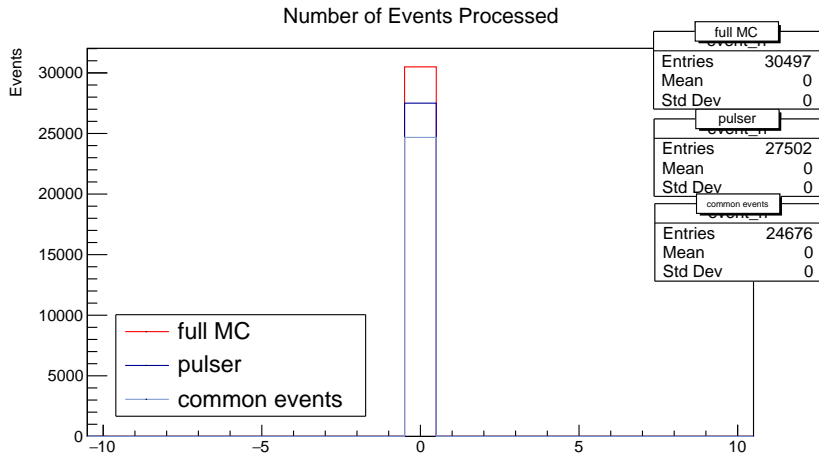
- Both sets contain some events that are not in the other

Summary

- Not all the same signal events get triggered for full MC and pulser
- Cutting on the event time affects full MC but not so much the pulser distribution
  - No effect on the common events
  - These are probably in the peak of the time distribution
- Slight change of topic: looking at spaced A' events vs A'+pulser overlay
  - Observed decrease in number of triggers for A'+pulser compared to spaced A'

Losing events during overlay

Number of Events Processed
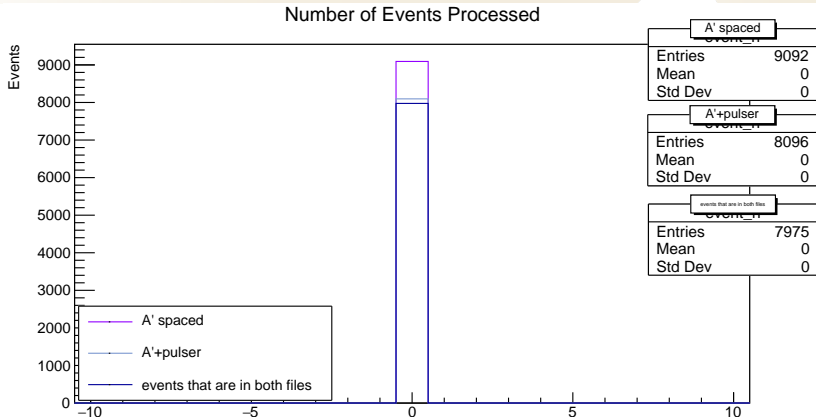
- Looking at number of events after readout
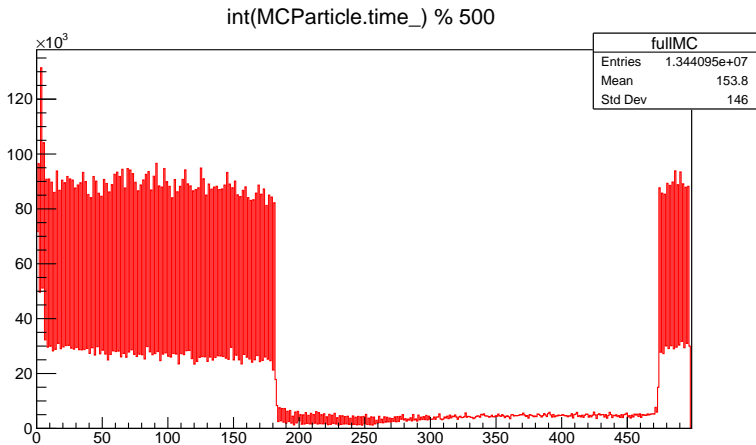- More events triggered for A' spaced (which means no beam/pulser) than for A'+pulser

A' spaced vs A'+pulser − psum

vtxana_vtxSelection_Psum_h
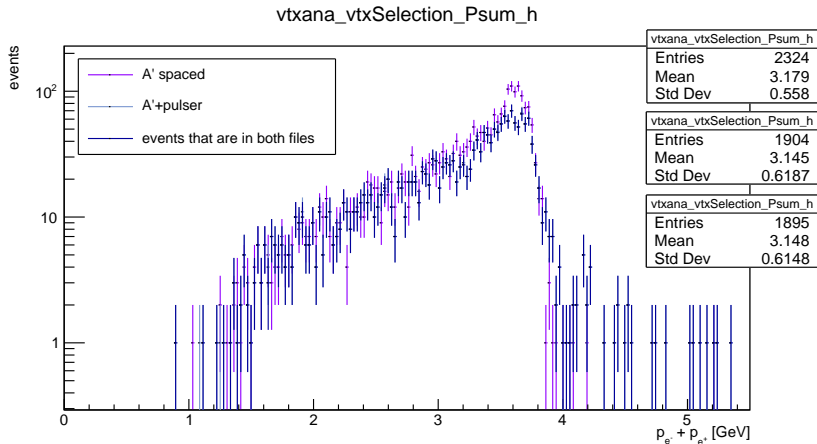
- All the extra events seem to be in the peak of the psum distribution
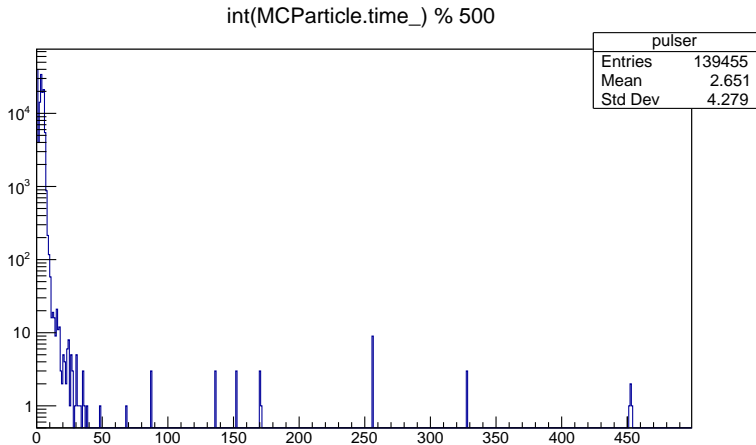- Unfortunately, I don't have a higher stats sample at the moment
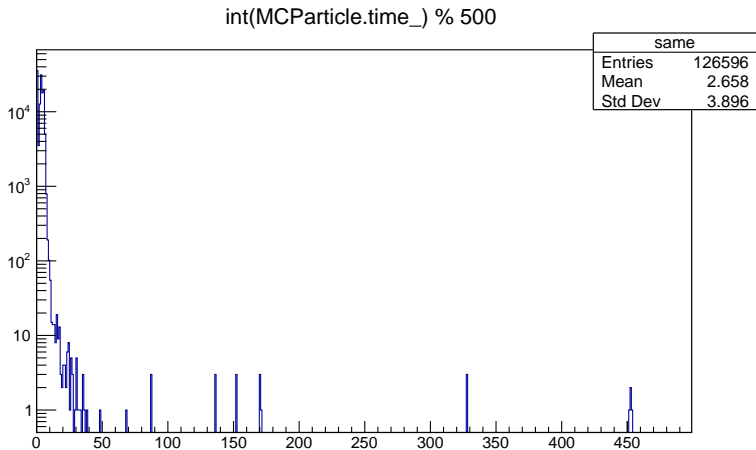
MCParticle time – full MC

- Simulated particle time mod 500
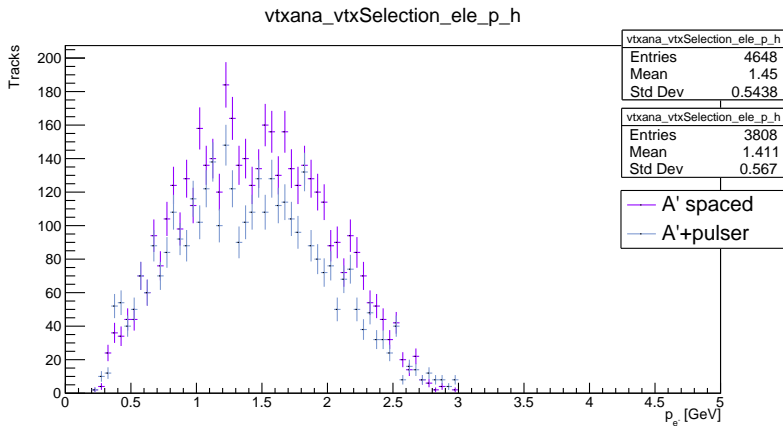
MCParticle time – pulser

int(MCParticle.time_) % 500

pulser	
Entries	139455
Mean	2.651
Std Dev	4.279

- Simulated particle time mod 500

MCParticle time – events in both

int(MCParticle.time_) % 500

- Simulated particle time mod 500

A' spaced vs A'+pulser − ele momentum

vtxana_vtxSelection_ele_p_h

A' spaced vs A'+pulser − pos momentum