

A'+beam MC sample production

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ENERGY

Stanford
University

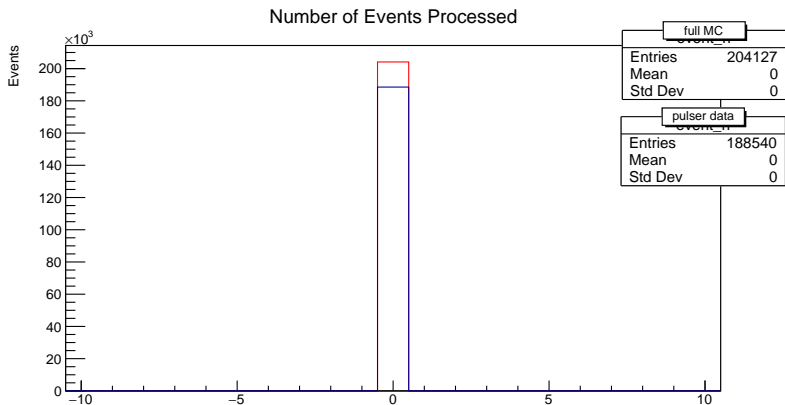


NATIONAL
ACCELERATOR
LABORATORY

- 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`
- Detector used: `HPS_Run2021Pass1_v4`; run number: 14229

- Generating full beam + signal MC sample takes a lot of time
 - gen: 9900s
 - slic: 4500s
 - comb: 3100s
 - total: about 5h
 - need 10x more beam files than signal
 - a lot of files fail
- Using random beam background much faster
 - conversion evio → lcio: 90s
 - this step isn't need for 2021, data already in lcio format
 - overlay: 70s

Number of processed events

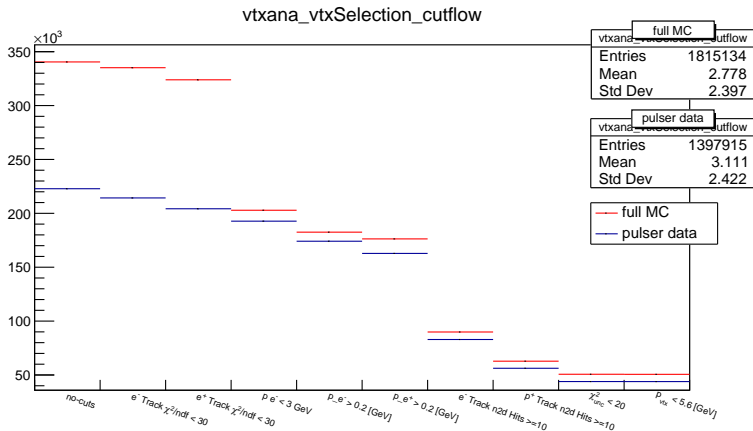


- Full simulation has more triggers \rightarrow investigate this in more detail

Number of processed events

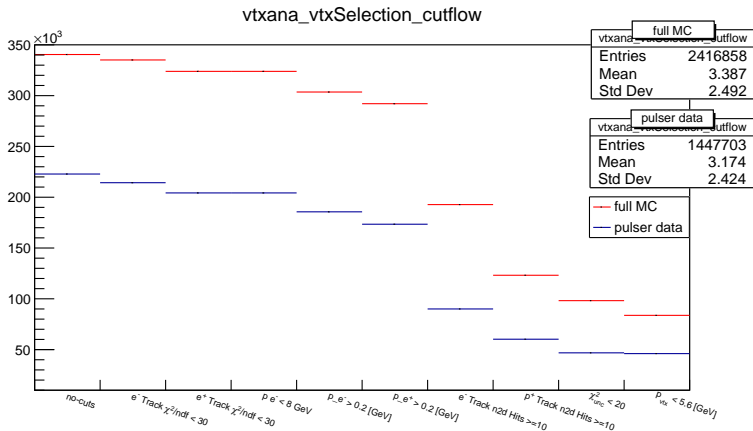
- We need to understand the difference in the number of processed events
- Where are the extra triggers in full MC coming from?
- Do we miss anything using new way of generating MC samples?

Impact of preselection



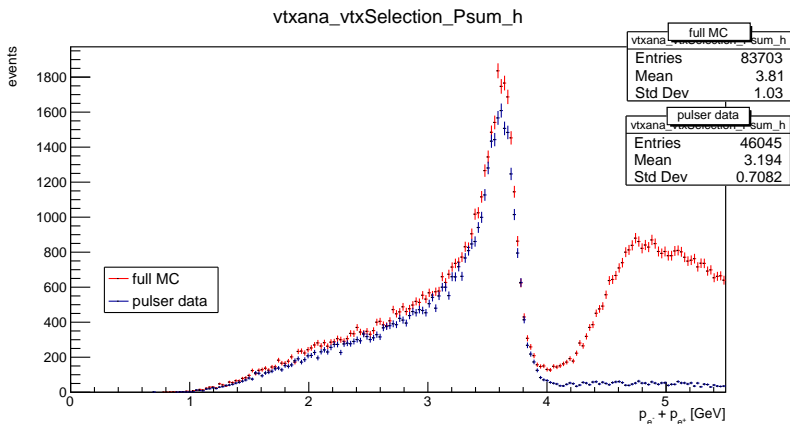
- Cuts have similar impact on both samples – exception: FEE cut
- Similar number of events after preselection

Preselection – no FEE cut



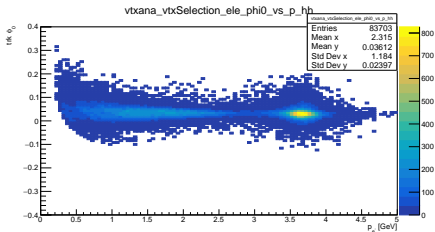
- Bigger difference in number of events after preselection without FEE cut

Psum after preselection – no FEE cut

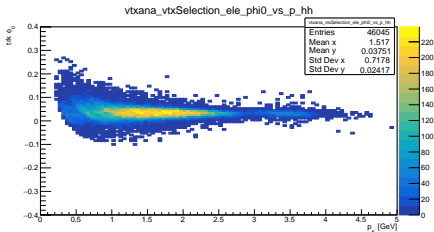


- Bump at high psum due to FEEs for full MC
- Higher rate of events in peak for full MC

ϕ_0 vs p_{e^-} – no FEE cut



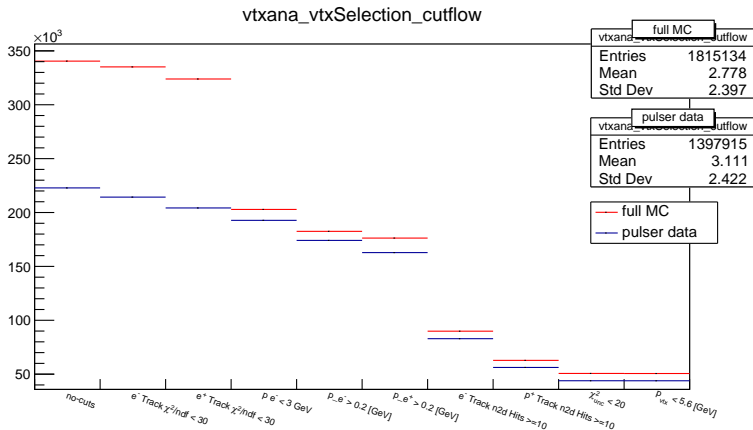
full MC



pulser data

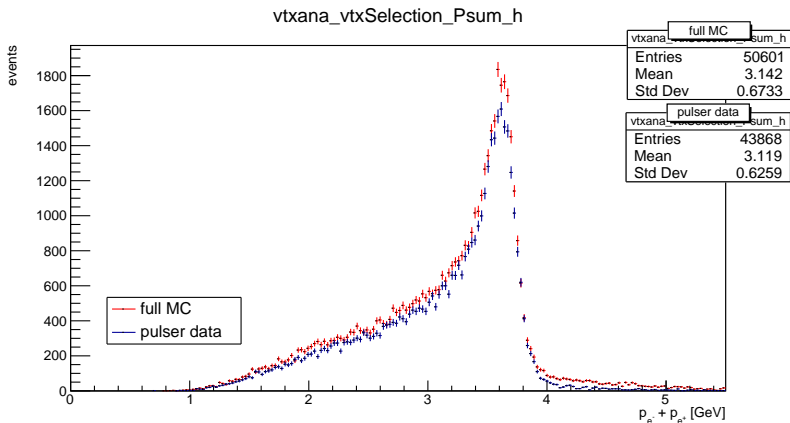
- Again: significantly more FEEs in full MC data
- Ignoring FEE peak: similar distribution in ϕ and p_{e^-} for both samples

Preselection cutflow – with FEE cut



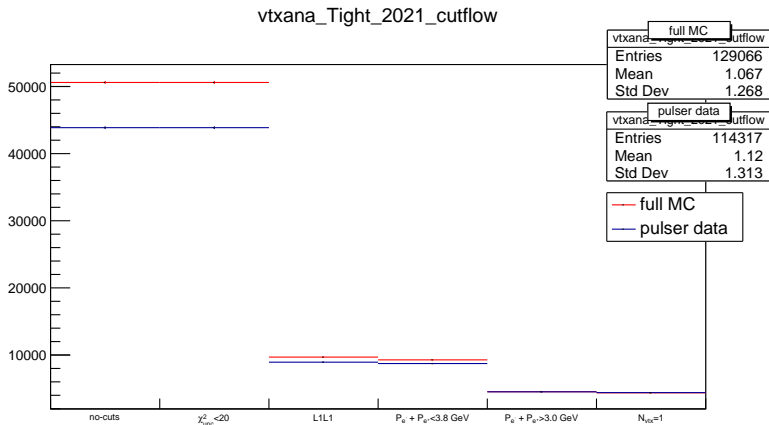
- Same plot as earlier – number of events closer after FEE cut

Psum after preselection – with FEE cut



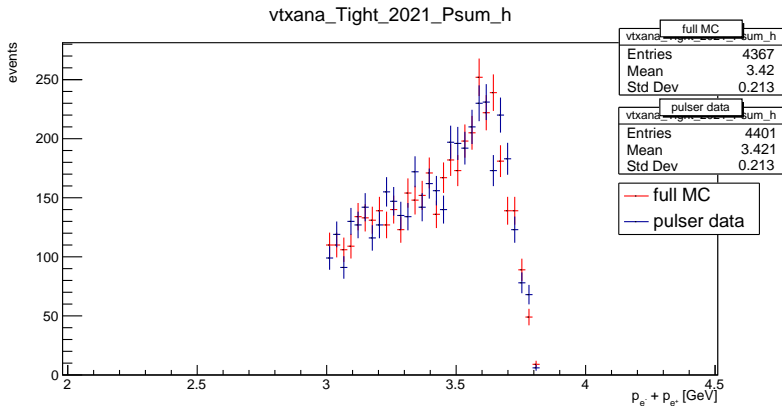
- Rate for full MC higher in peak even after FEE cut

Cutflow for tight selection – with FEE cut



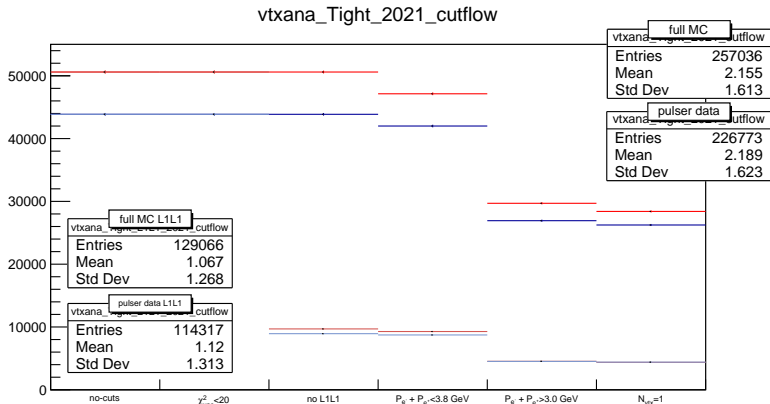
- L1L1 cut leaves similar number of events for both methods
- Same number of events by end of cutflow

Psum after tight selection – with FEE cut



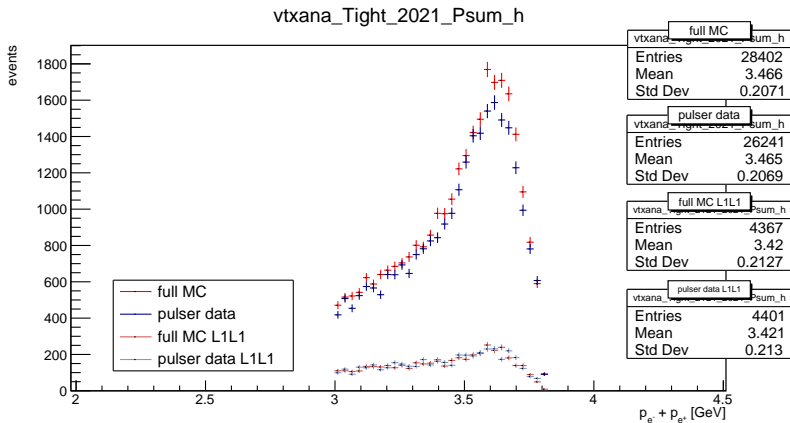
- Psum distributions match now – what caused this?

Effects of L1L1 cut



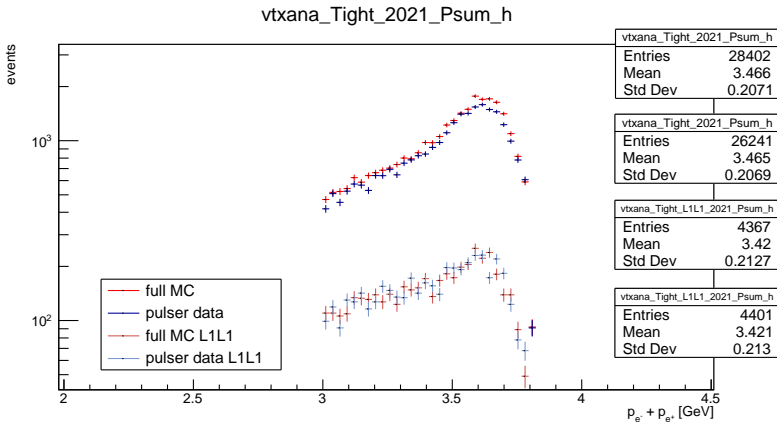
- Dark colors: no L1L1 cut; light colors: including L1L1 cut
- Number of events differs stronger if L1L1 cut is not applied

Effects of L1L1 cut – Psum



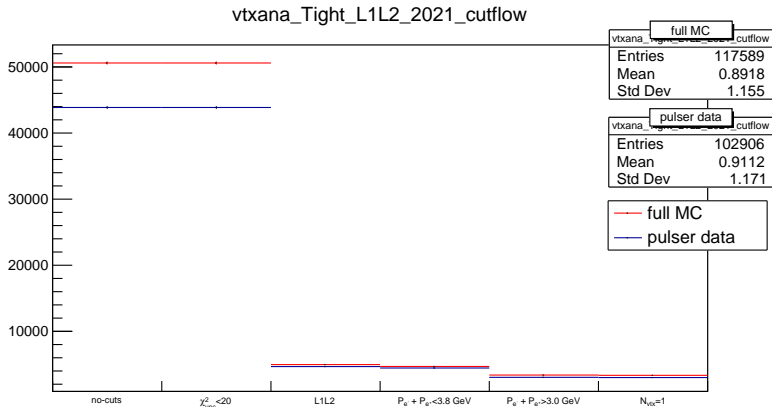
- Higher rate in peak for full MC if L1L1 not applied
- Rates very similar if L1L1 cut is applied

Effects of L1L1 cut – Psum



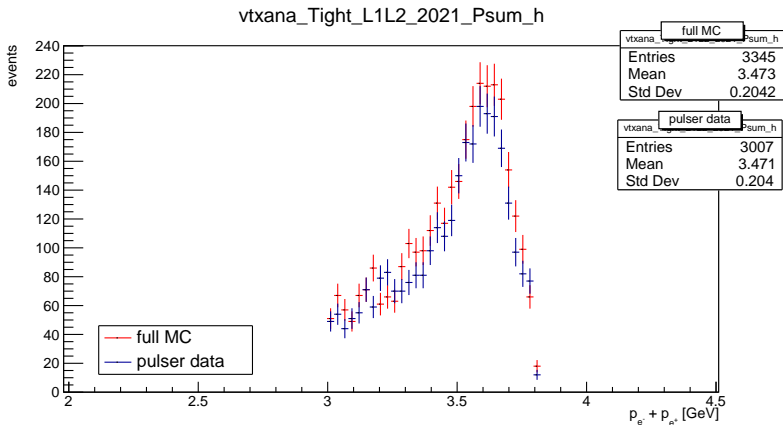
- Higher rate in peak for full MC if L1L1 not applied
- Rates very similar if L1L1 cut is applied

Effects of L1L2 cut – cutflow



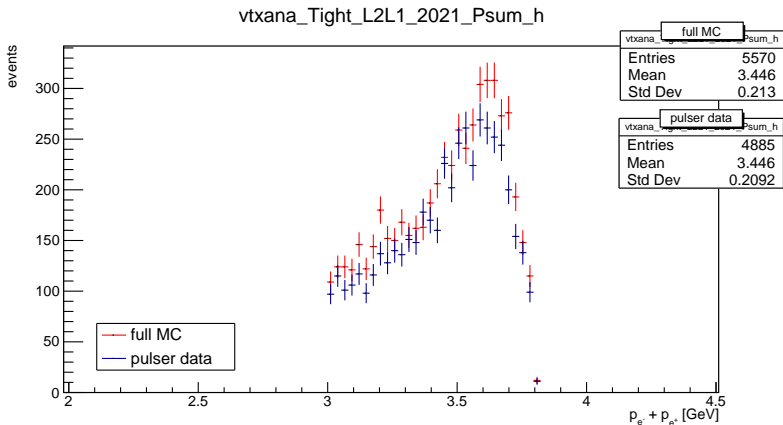
- L1L2 cut has similar effect on number of events as L1L1 cut

Effects of L1L2 cut – Psum



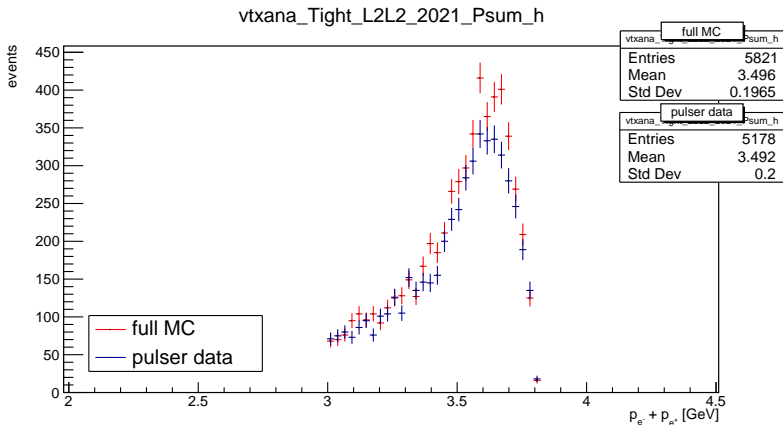
- Slightly higher rate in peak for full MC persists

Effects of L2L1 cut – Psum



- Cutflow similar to L1L2
- Slightly higher rate in peak for full MC persists

effects of L2L2 cut – Psum



- Cutflow similar to L1L2
- Slightly higher rate in peak for full MC persists

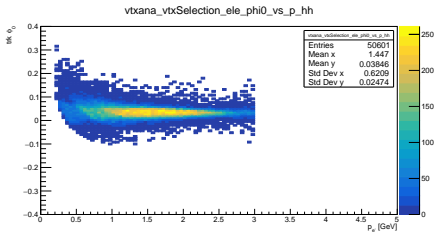
table of triggers

	total 'signal'	total triggers
pulser data	67425	18230
full MC	67425	24016
just pulser MC beam	8063500	20

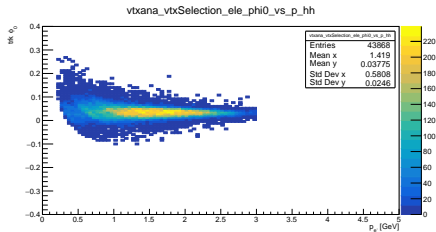
Number of events and triggers for the same signal files (91-100)

-

with FEE cut – tight



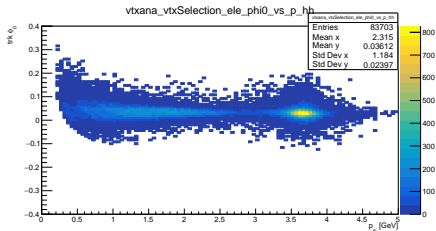
full MC



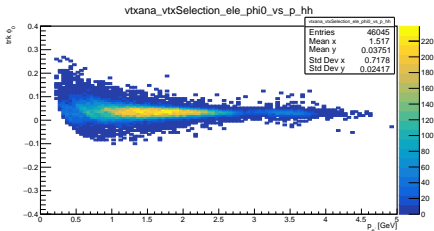
pulser data

- matches better now

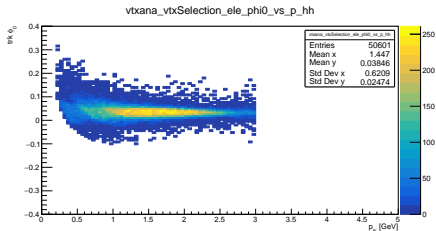
effect of FEE cut on ϕ_0 vs p



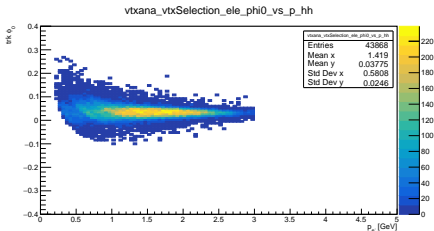
full MC no FEE cut



pulser data no FEE cut



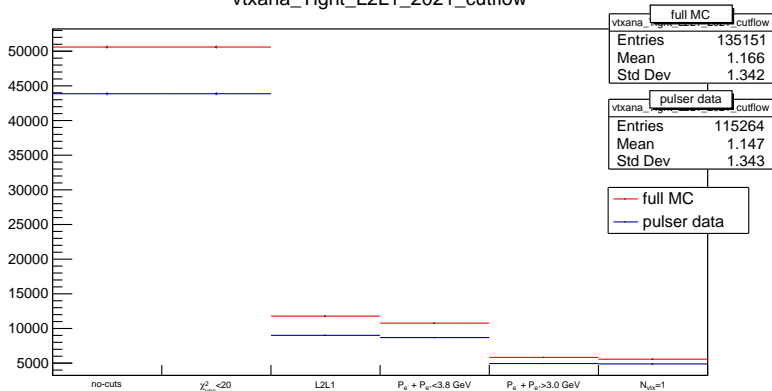
full MC



pulser data

effects of L2L1 cut

vtxana_Tight_L2L1_2021_cutflow



effects of L2L2 cut

