HJET 2017
Asymmetries & Background

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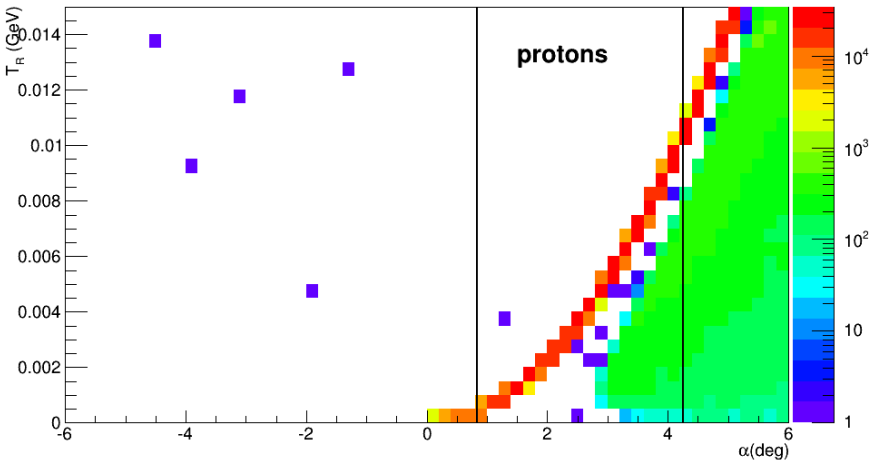
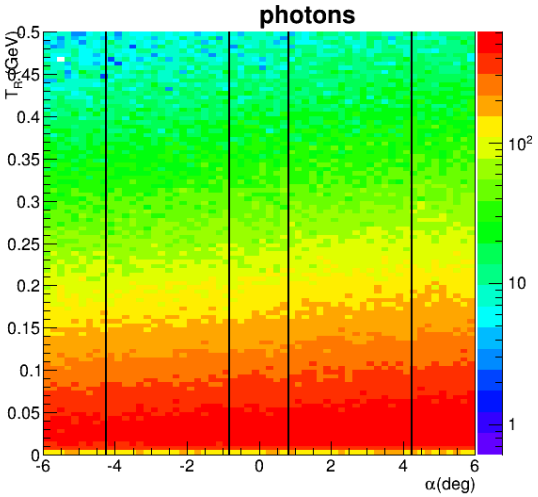
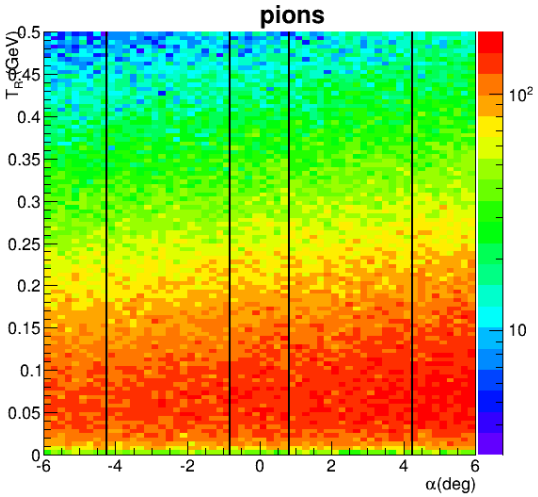
Prompt Background

- p+p at $\sqrt{s} = 21.6$ GeV
- PYTHIA 6.4.28, Perugia 0
  - QCD $2 \rightarrow 2$
  - Elastic
  - diffractive
- Prompt background
  - pions / photons up to a few GeV
  - covering whole detector (down- & upstream)
  - target asymmetries suppressed from both beams

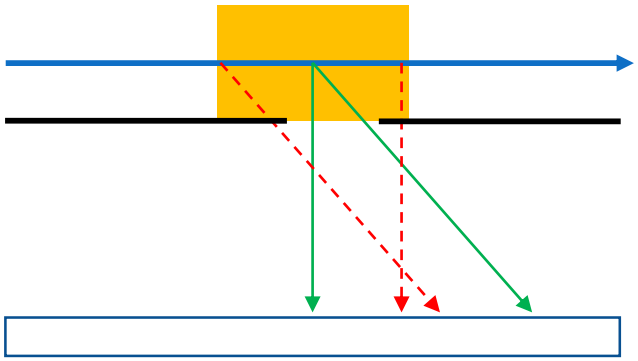






Background Issue

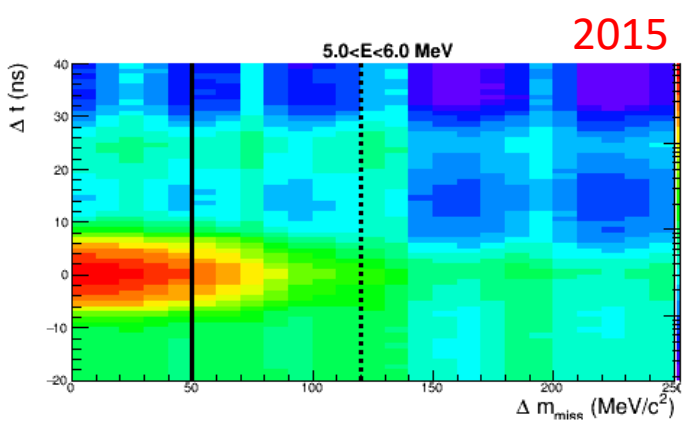
- Collimating windows have been removed
  - Geometry not well constrained for elastic signal (wide target)
  - Previously used to estimate background asymmetries
  - Potential effect from target fringes (effective polarization?)

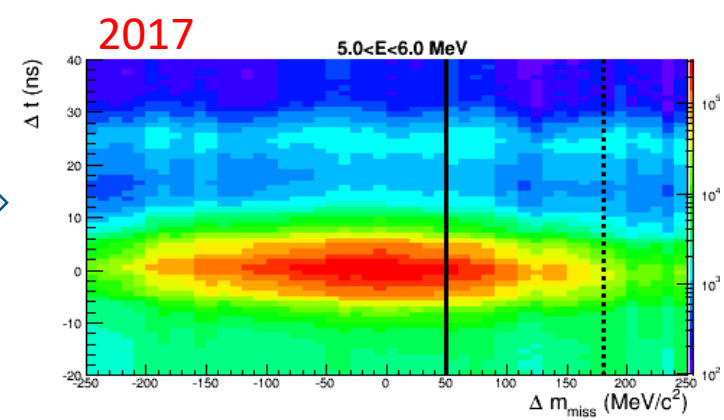


- No effect on kinematics
  - ToF distance dominated by distance
  - But missing mass depends on angle

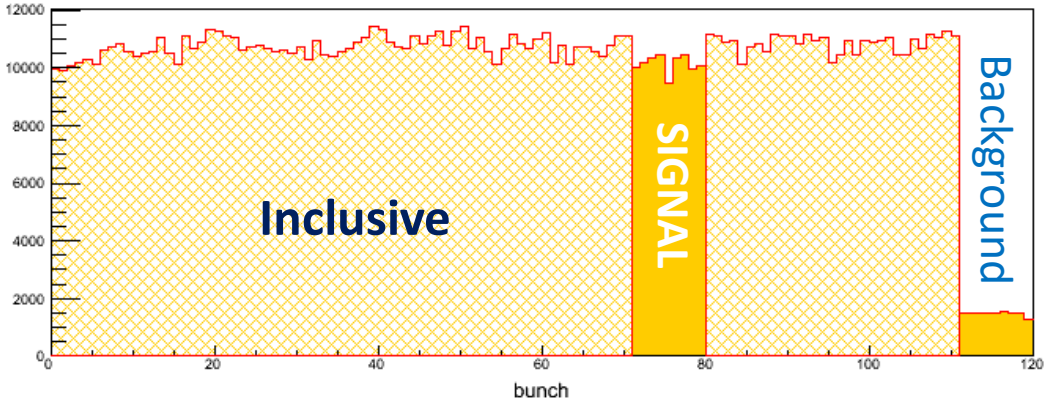
$$m_{miss}^2 = m_p^2 - 2(m_p + p_{beam})T_R + 2p_{beam}\sqrt{2m_pT_R}\sin\alpha$$

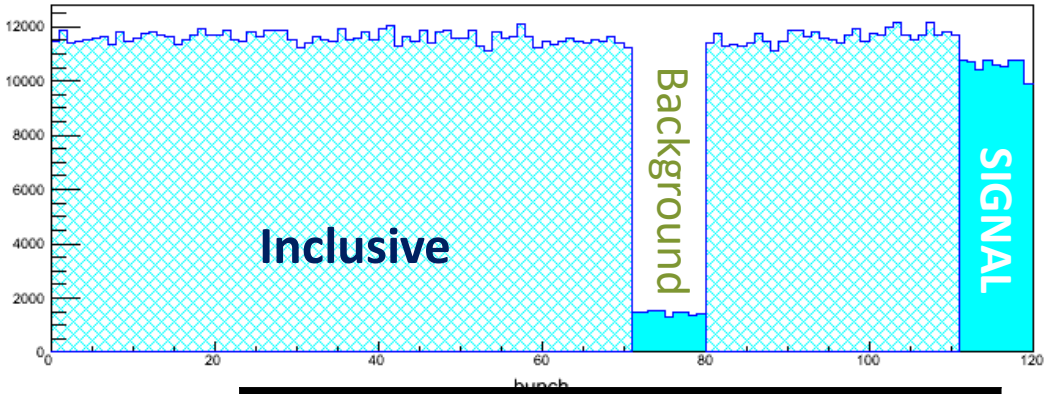
Example:

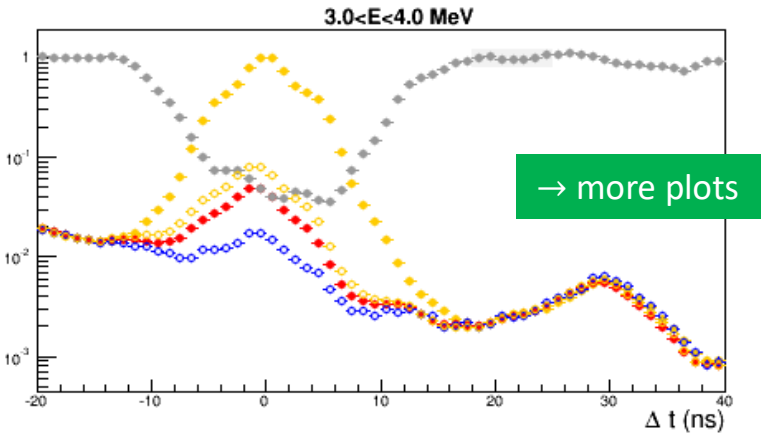




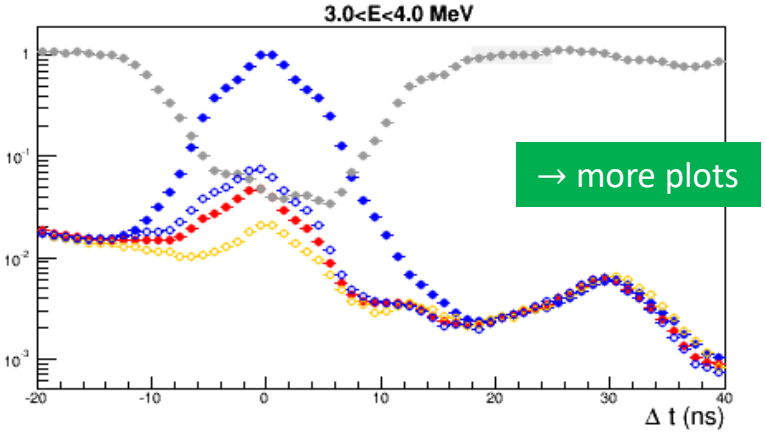
Background Estimation







→ more plots

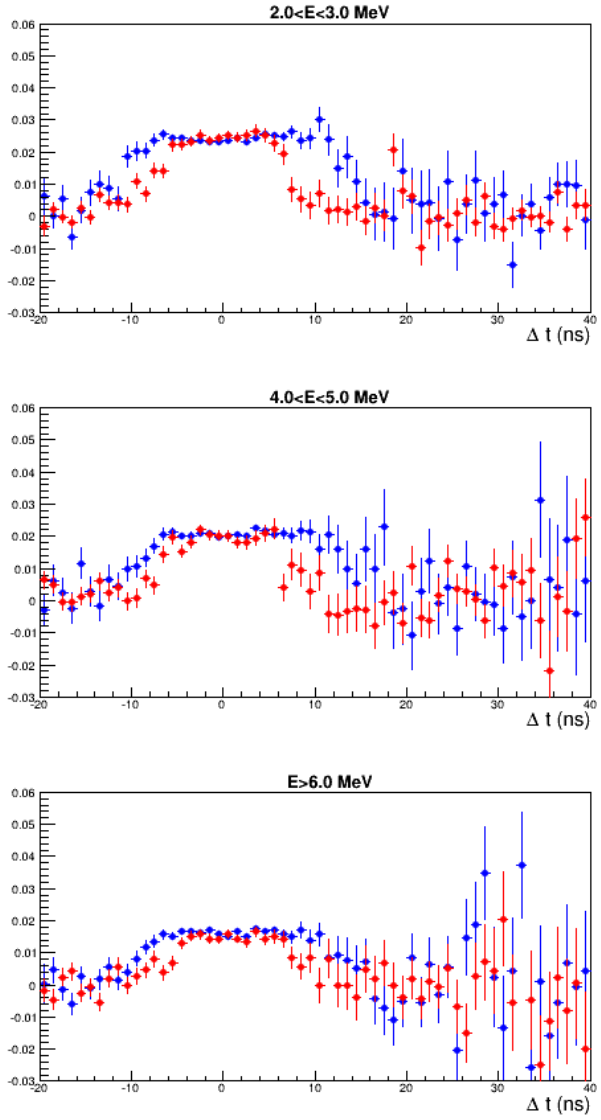


→ more plots

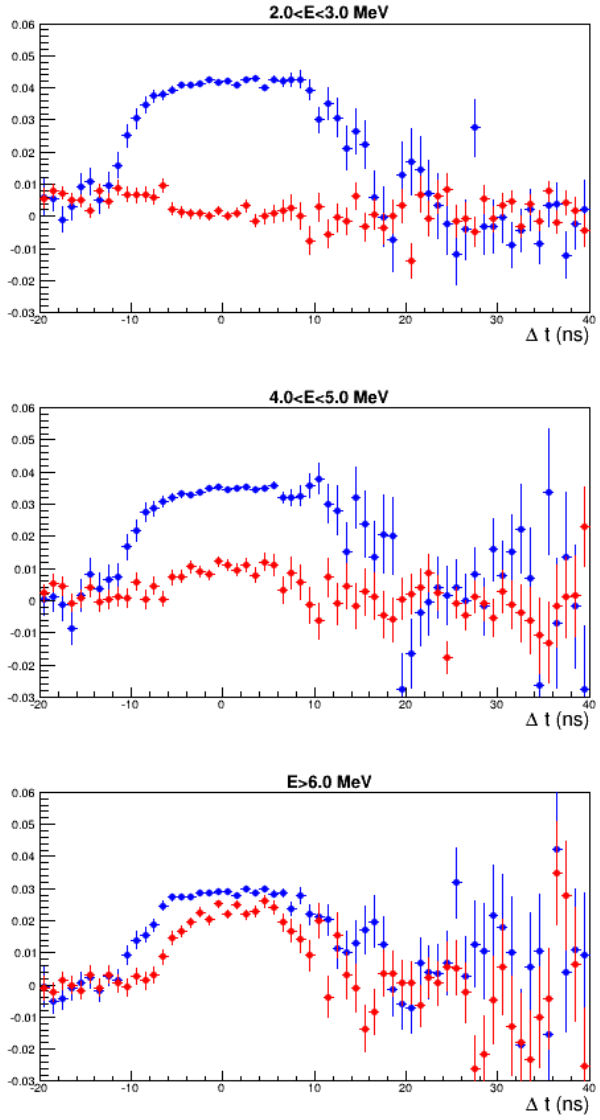
	$m_{miss} \approx m_P$	$m_{miss} \neq m_P$
Inclusive	●	○
Abort gap	●	
Clean		○

Beam & Target Asymmetries I

BEAM



TARGET



- Inclusive bunches
- As function of time of flight
  - Final results use $\Delta t < 5\ ns$
- Background asymmetry
  - Not zero
  - Different for beam and target
  - Energy dependent

→ more blue target

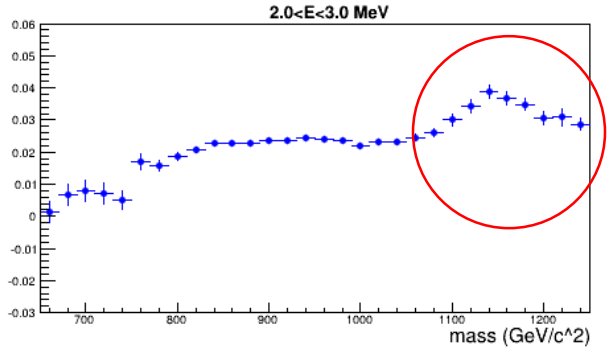
→ more blue beam

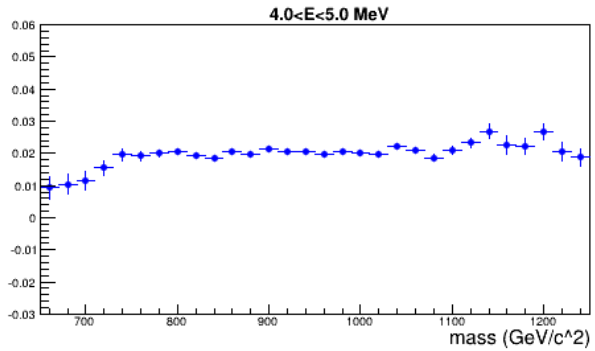
→ more yellow target

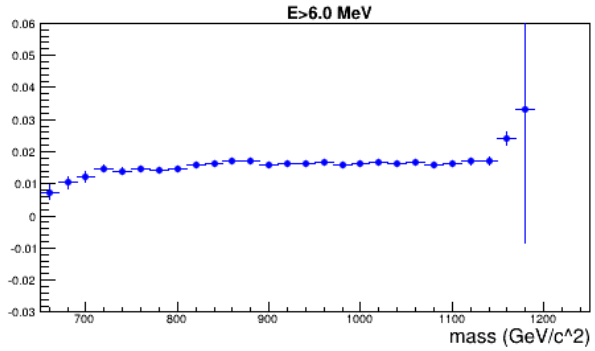
→ more yellow beam

Beam & Target Asymmetries II

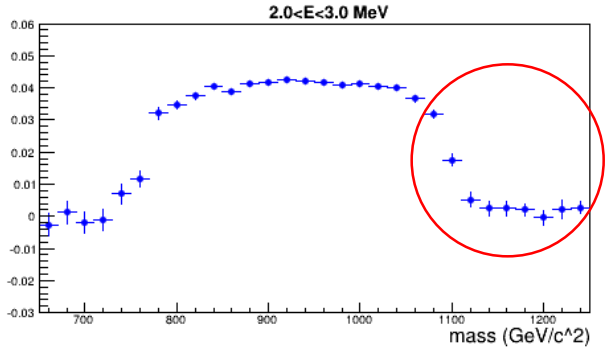
BEAM

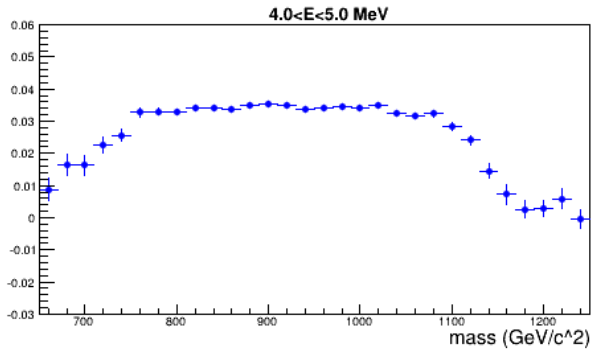


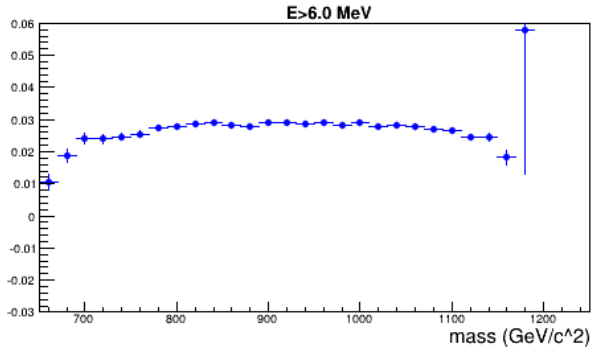




TARGET







- Inclusive bunches
- As function of missing mass
  - with $\Delta t < 5\ ns$
- Flat around m_P
- Different for target and beam

→ more blue target

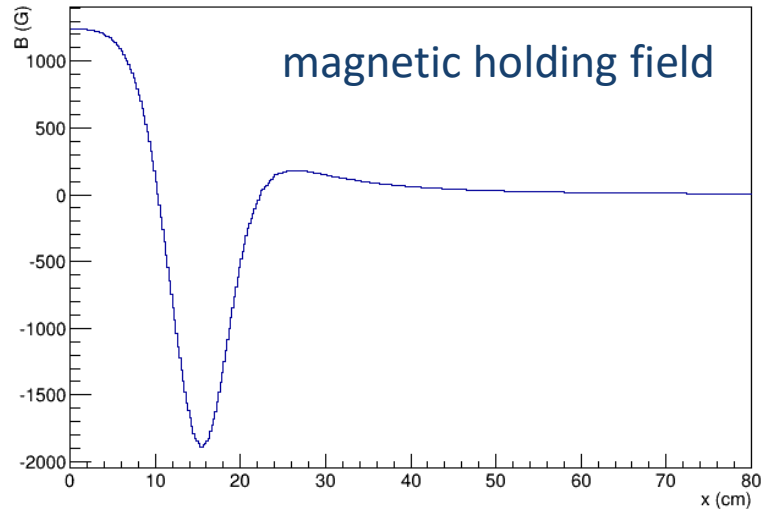
→ more blue beam

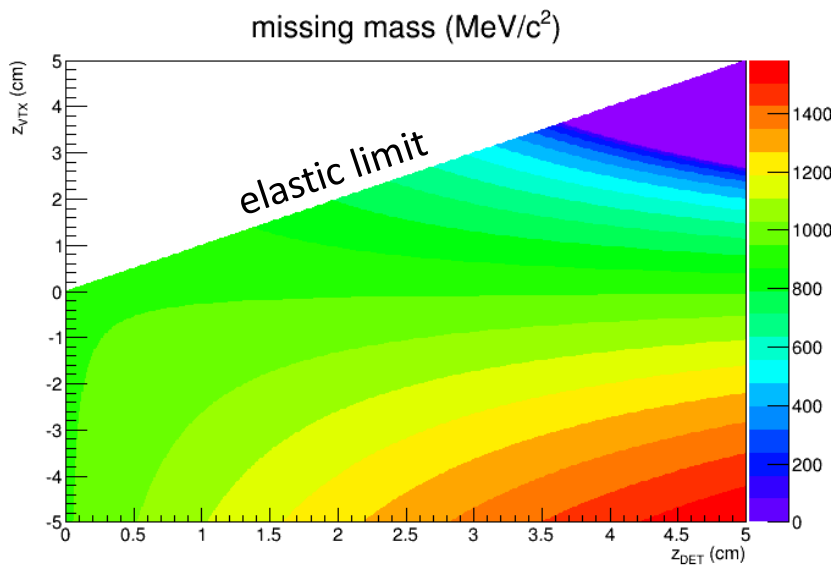
→ more yellow target

→ more yellow beam

Displaced Vertex

- Holding field extends comfortably far longitudinally
- Detector range is ± 5 cm
- Jet target size is less than 1 cm





$$m_{miss}^2 = m_p^2 - 2(m_p + p_{beam})T_R + 2p_{beam}\sqrt{2m_pT_R}\sin\alpha$$

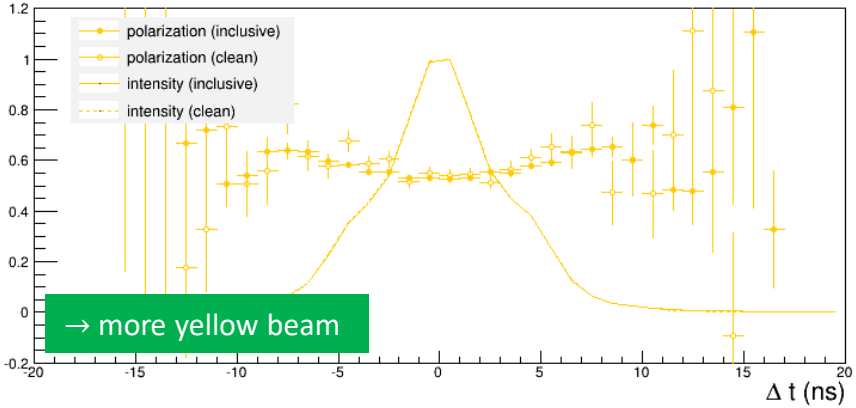
$$m_{miss}^2 = m_p^2 - \frac{4m_p p_B^2}{m_p + p_B}(\sin^2\alpha' - \sin\alpha'\sin\alpha)$$

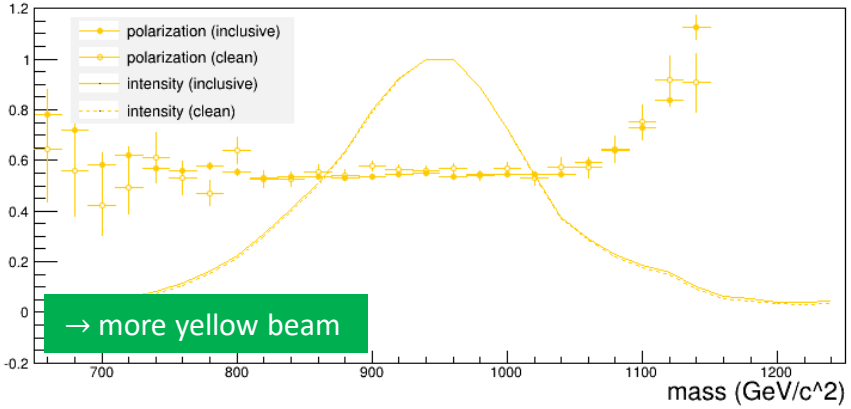
α: detector
α': physics (elastic recoil)

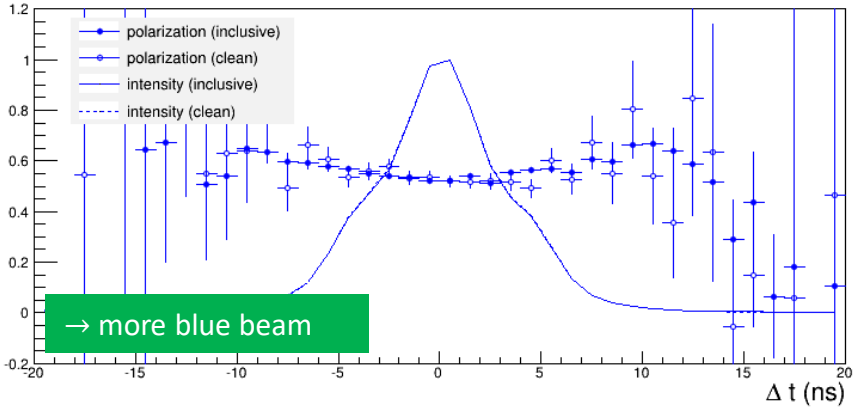
$$\sin\alpha = \frac{z}{\sqrt{z^2 + d^2}}$$

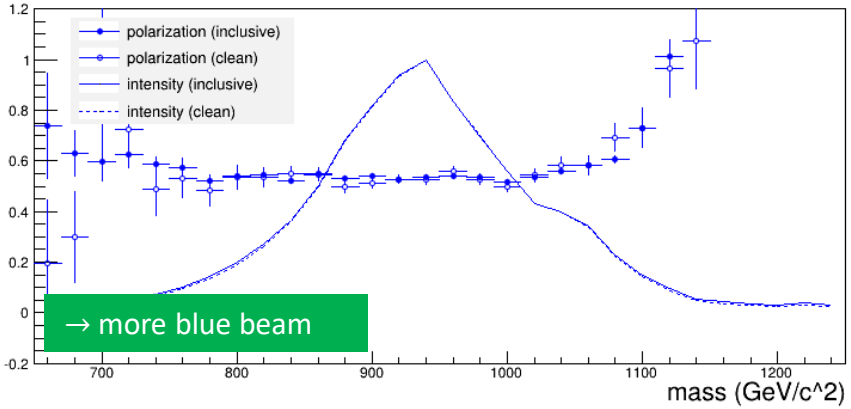
(*) This is for $p_{beam} = 100$ GeV/c.
The mass difference scales with p_{Beam}!

Beam Polarizations









Previous cuts $\Delta t < 5$ ns and $\Delta m_{miss} < 50$ MeV/c^2 are safe

Background correction unclear

Losing statistics at large T_R

Possible cancellation from opposite beam?
Also in clean bunches

APPENDICES

- Background fraction
- Asymmetries (time of flight)
- Asymmetries (missing mass)
- Beam polarization (time of flight)
- Beam polarization (missing mass)

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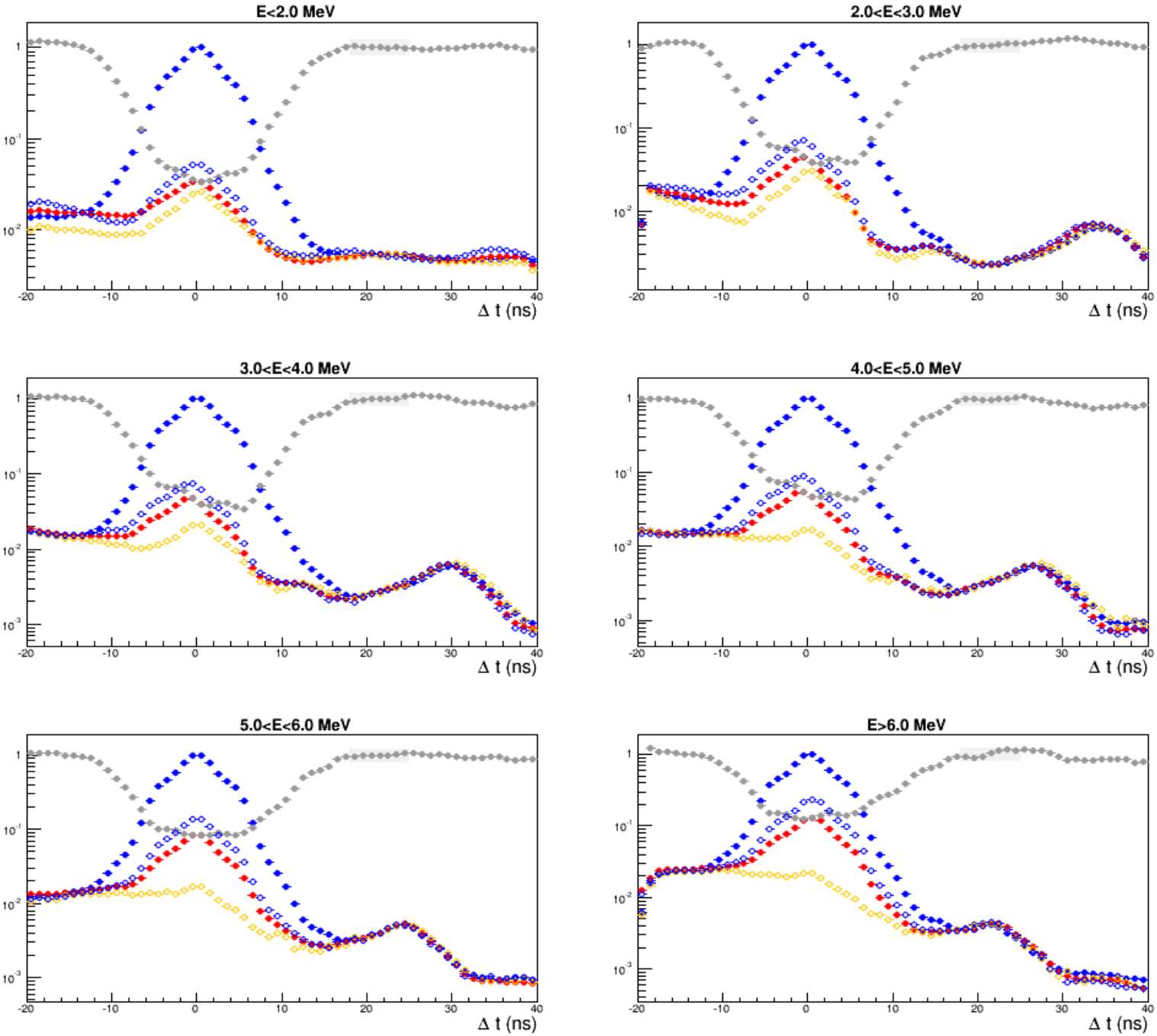

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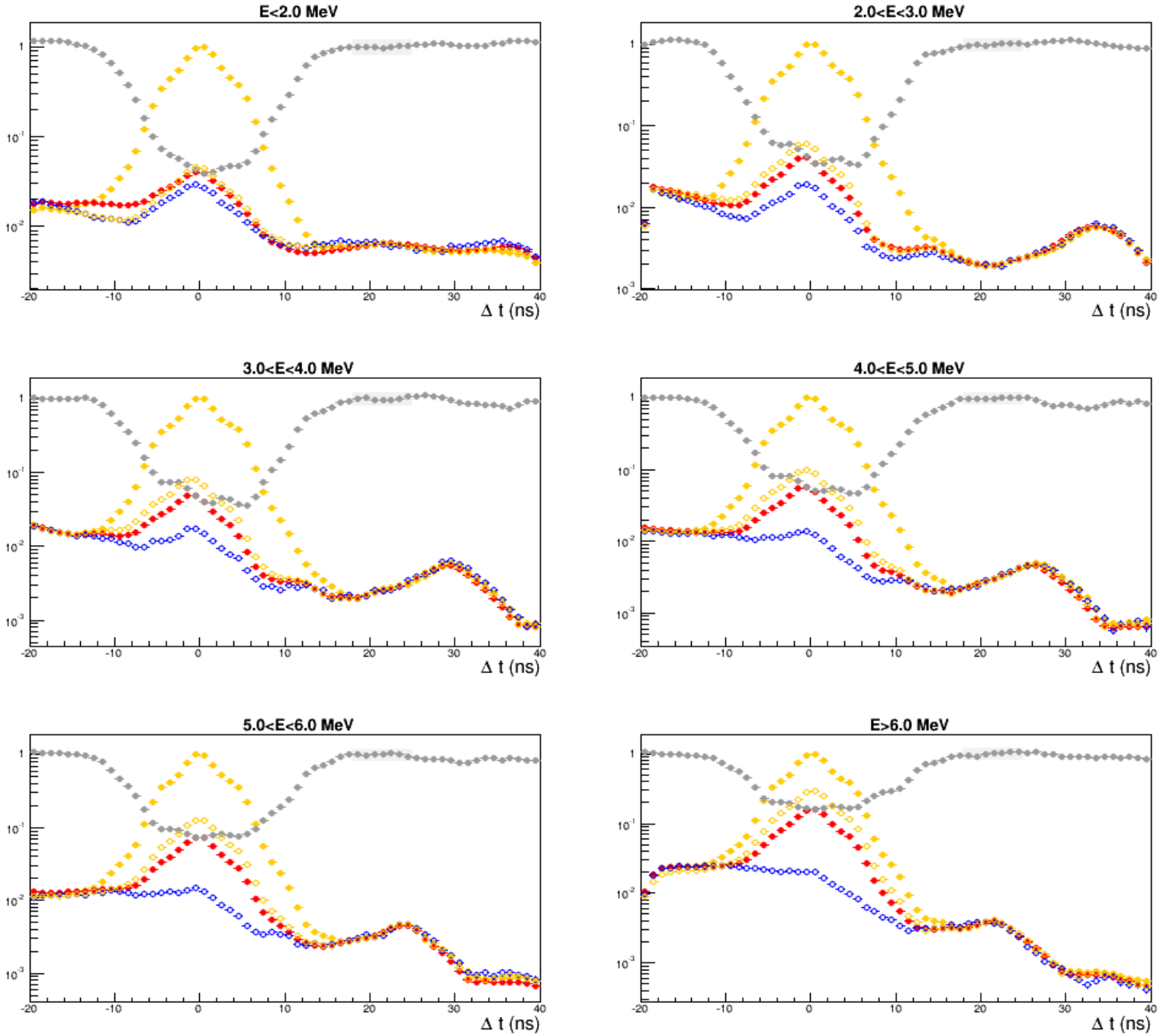

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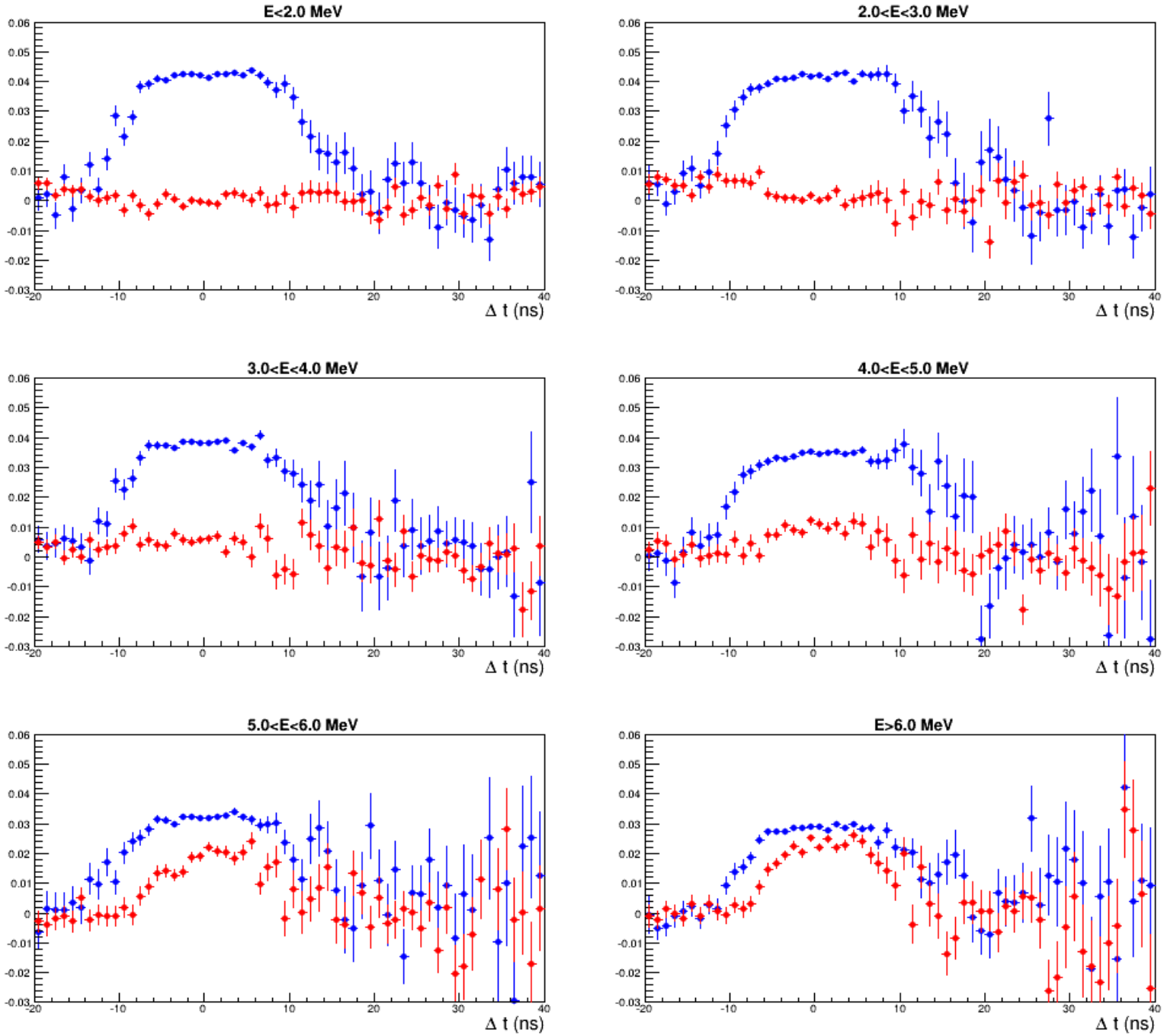
Target Asymmetries (time of flight)



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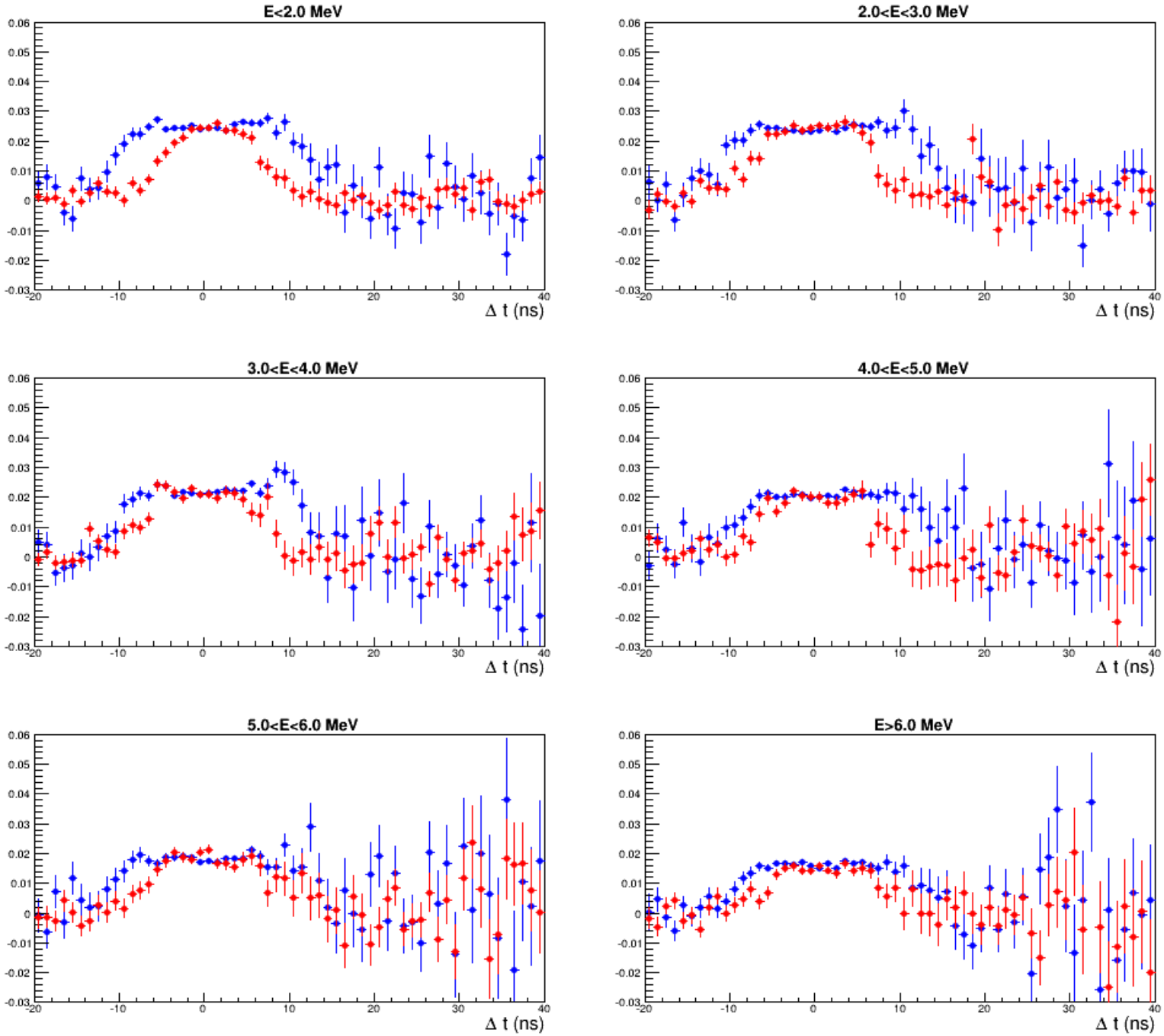

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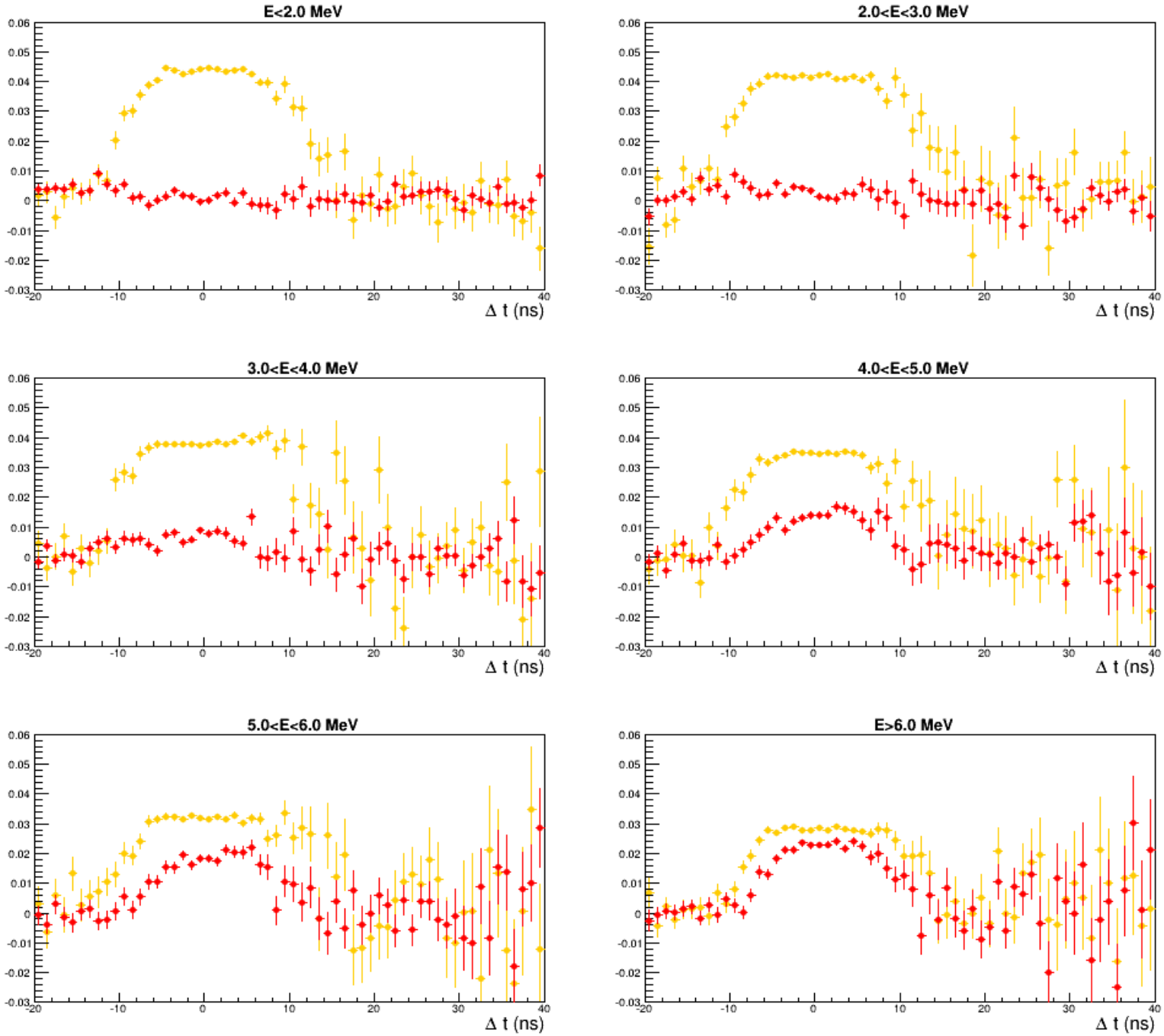

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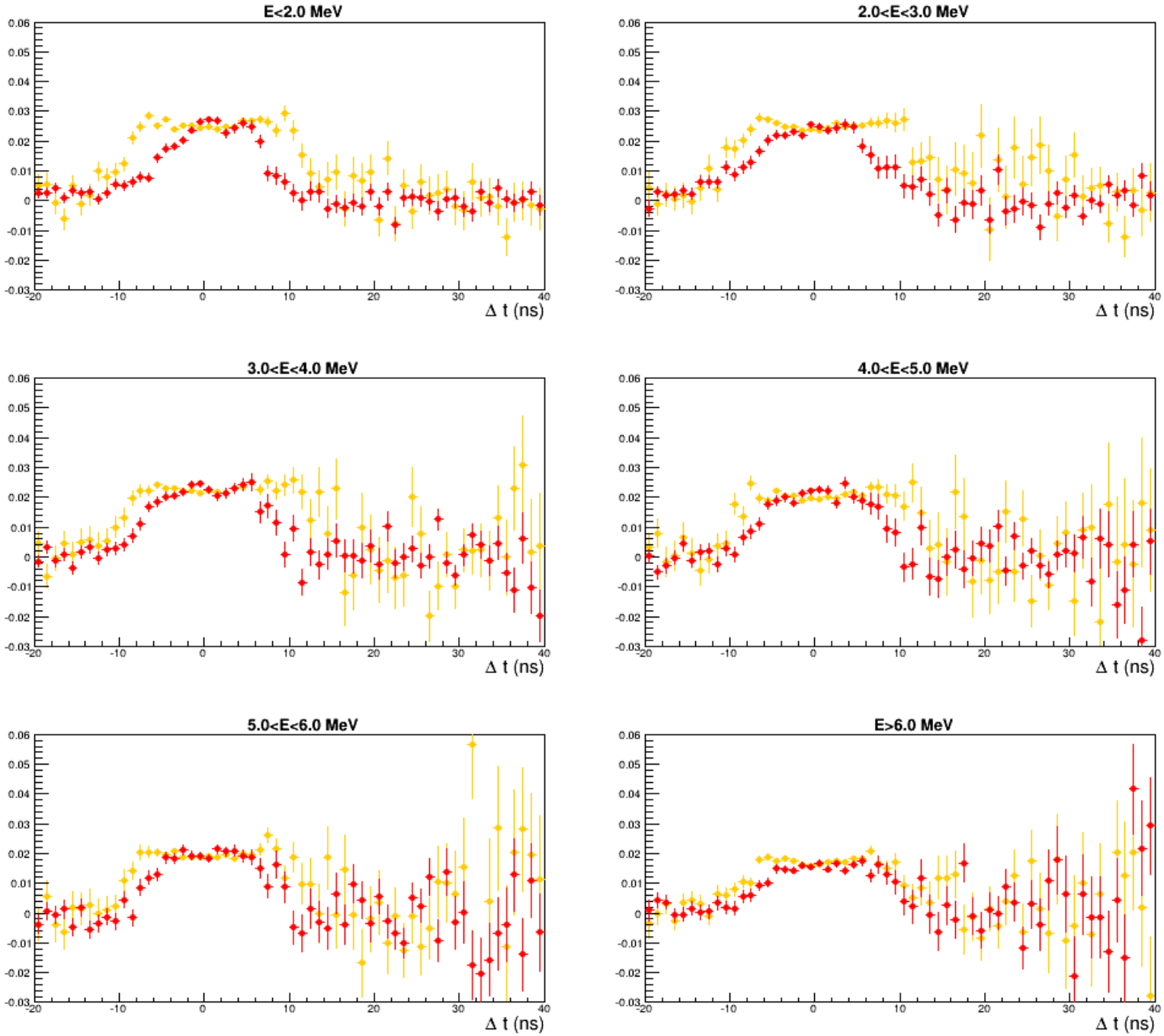

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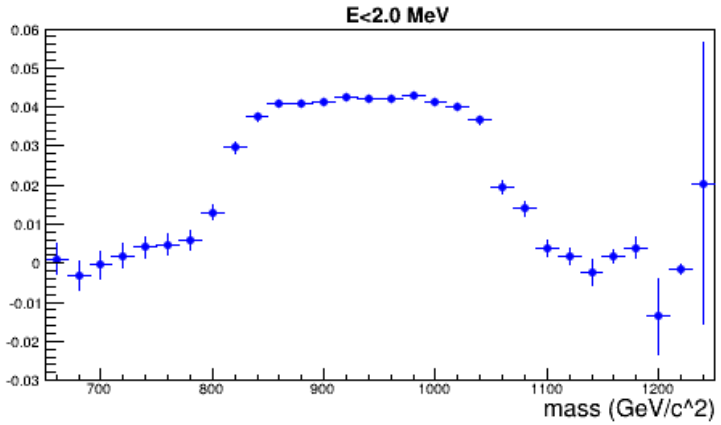
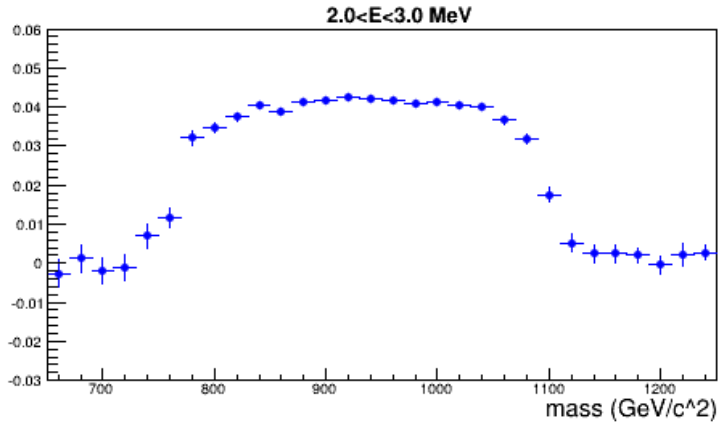
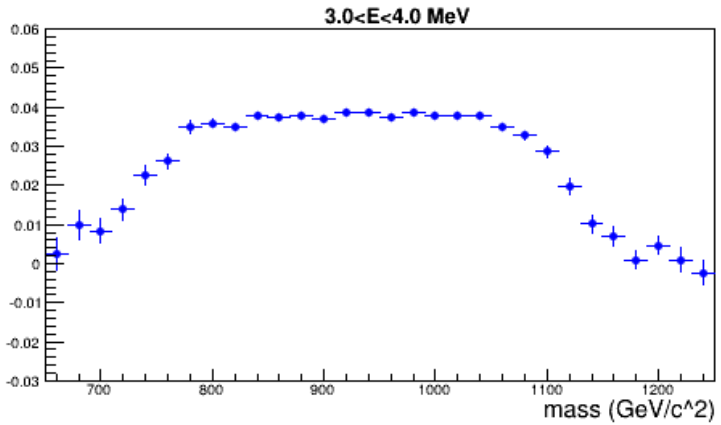
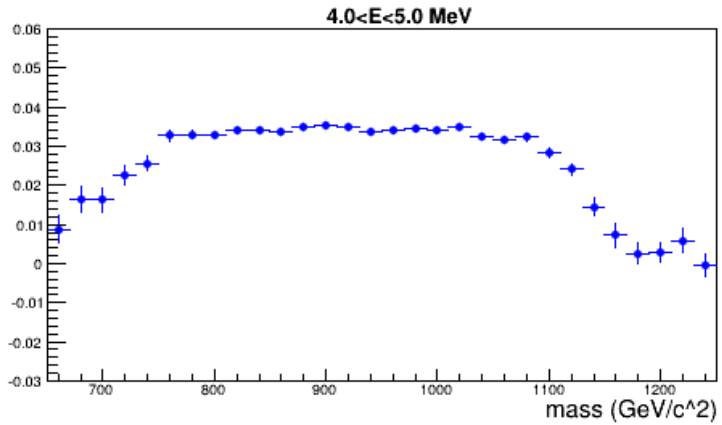
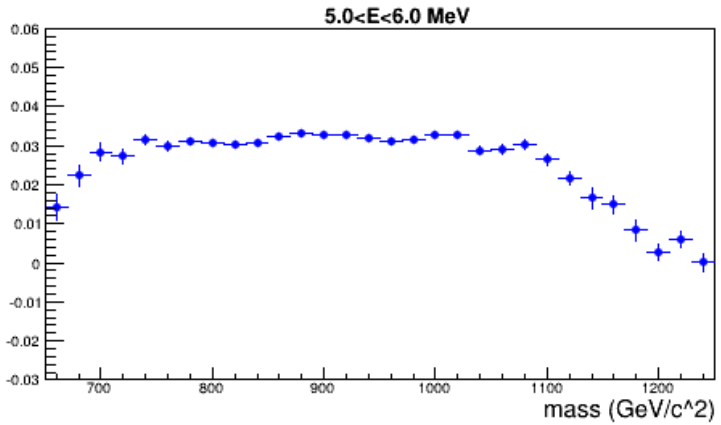
Target Asymmetries (missing mass)

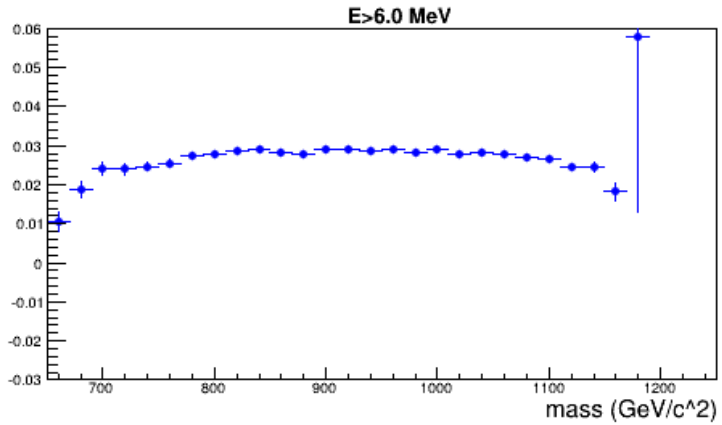












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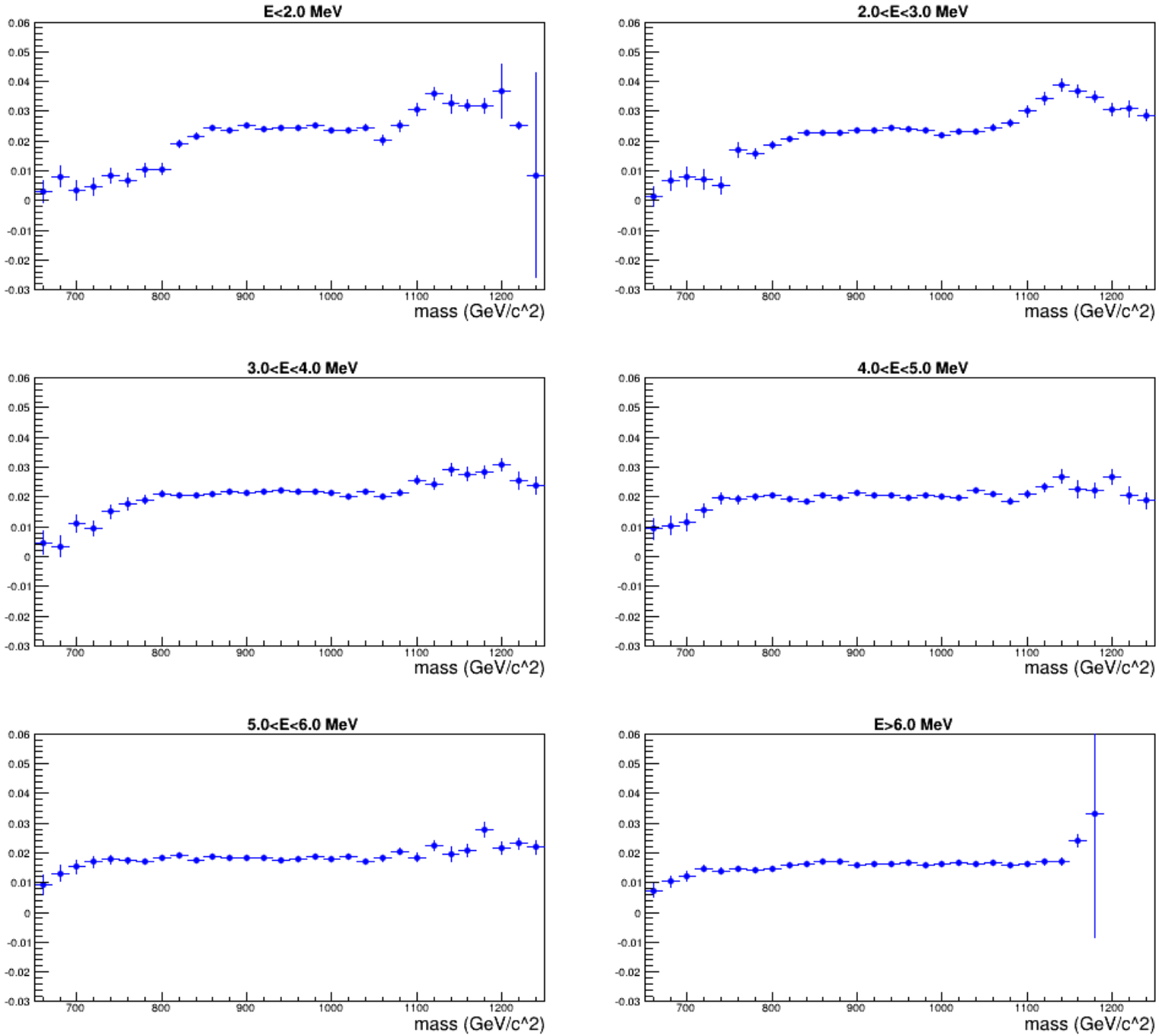
Beam Asymmetries (missing mass)



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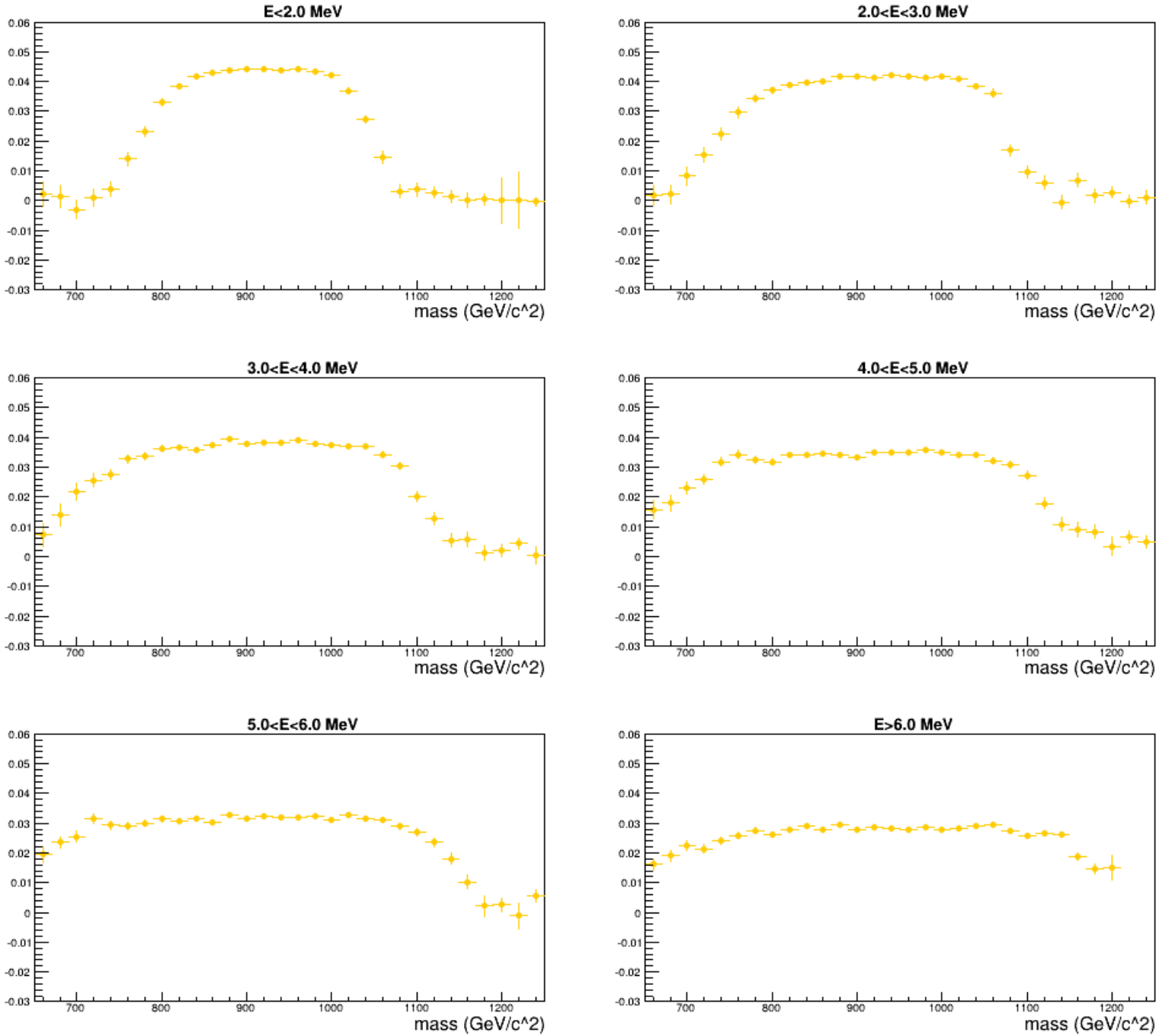
Target Asymmetries (missing mass)



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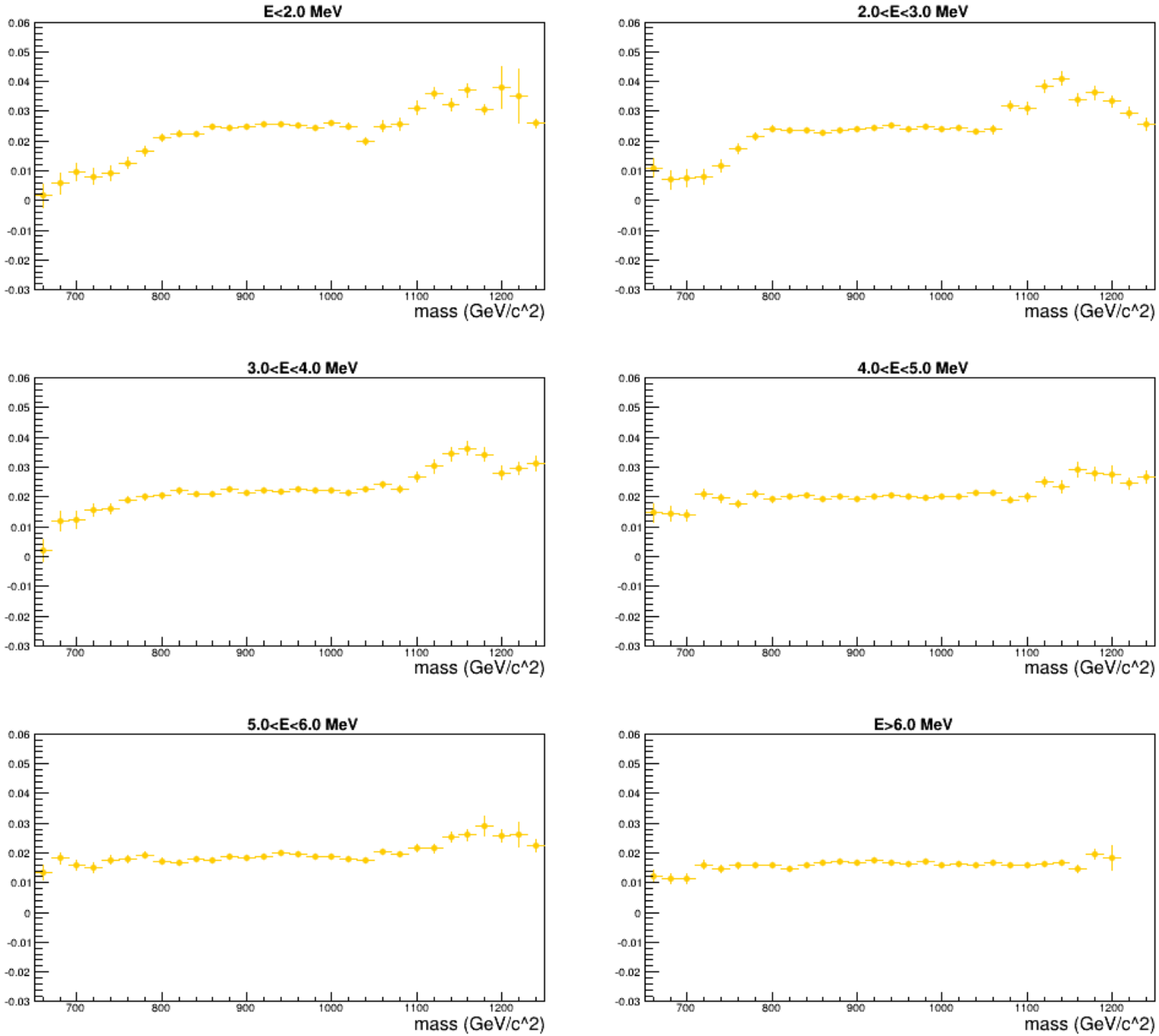

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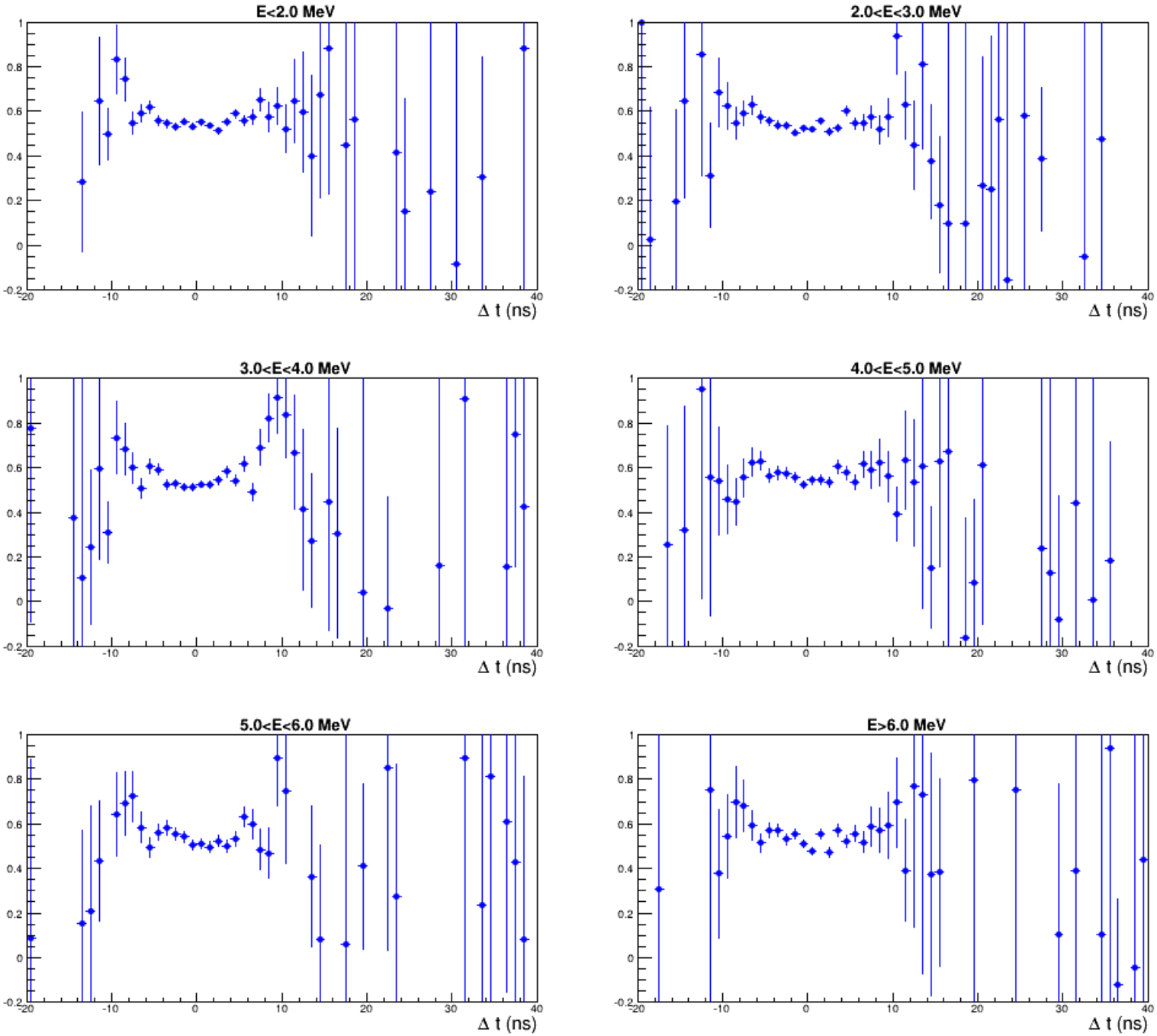
Beam Polarization (time of flight)



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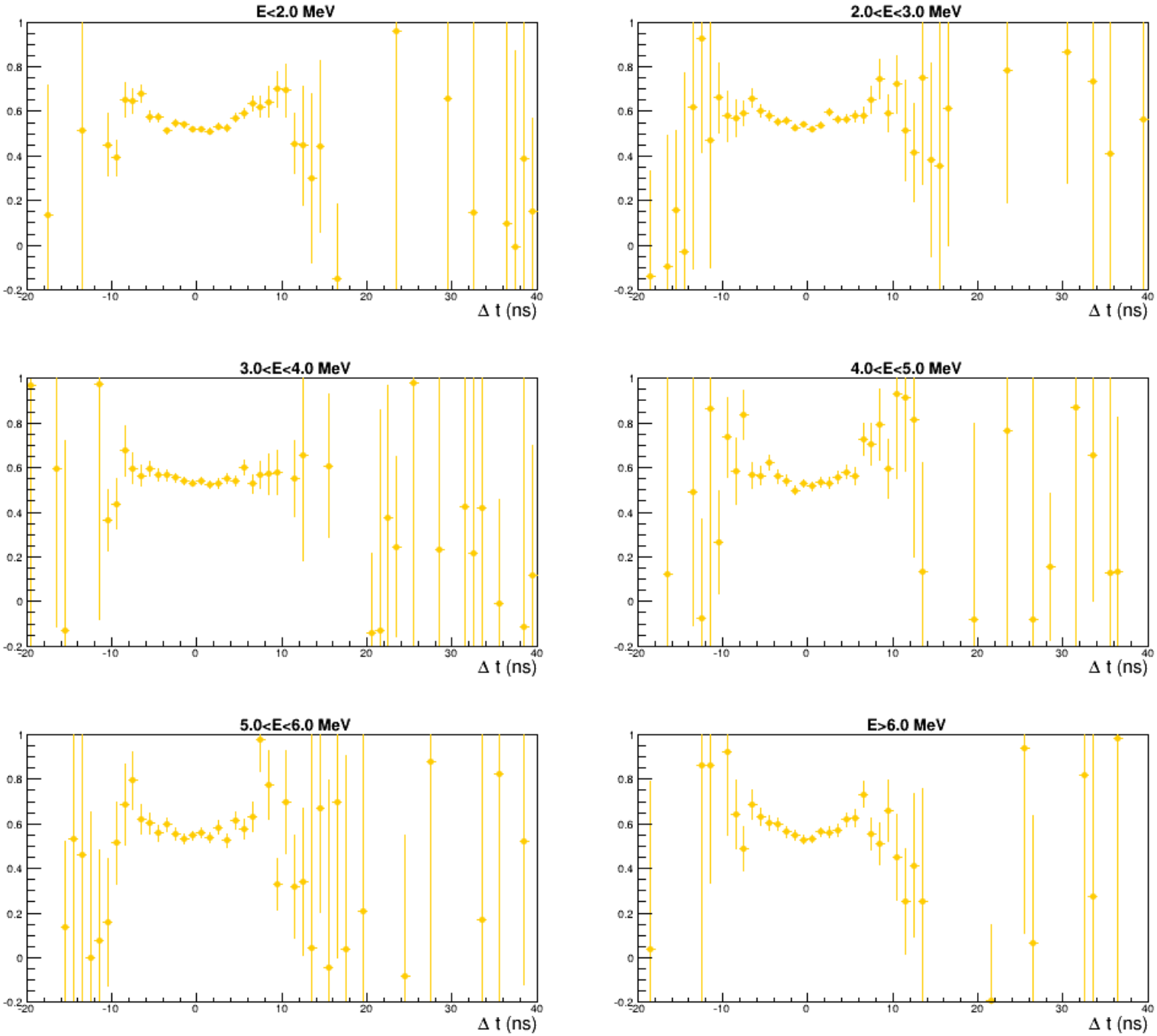

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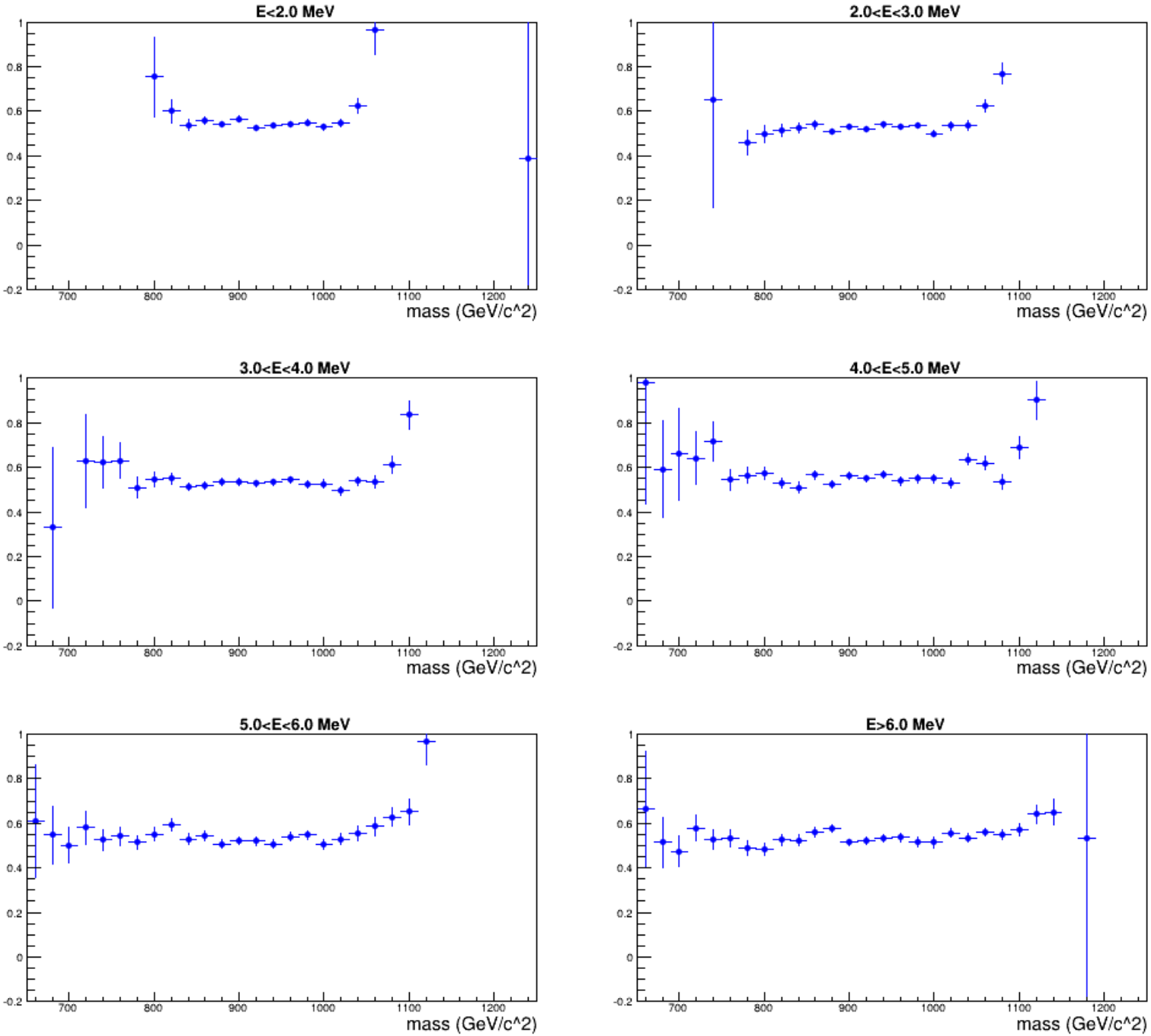

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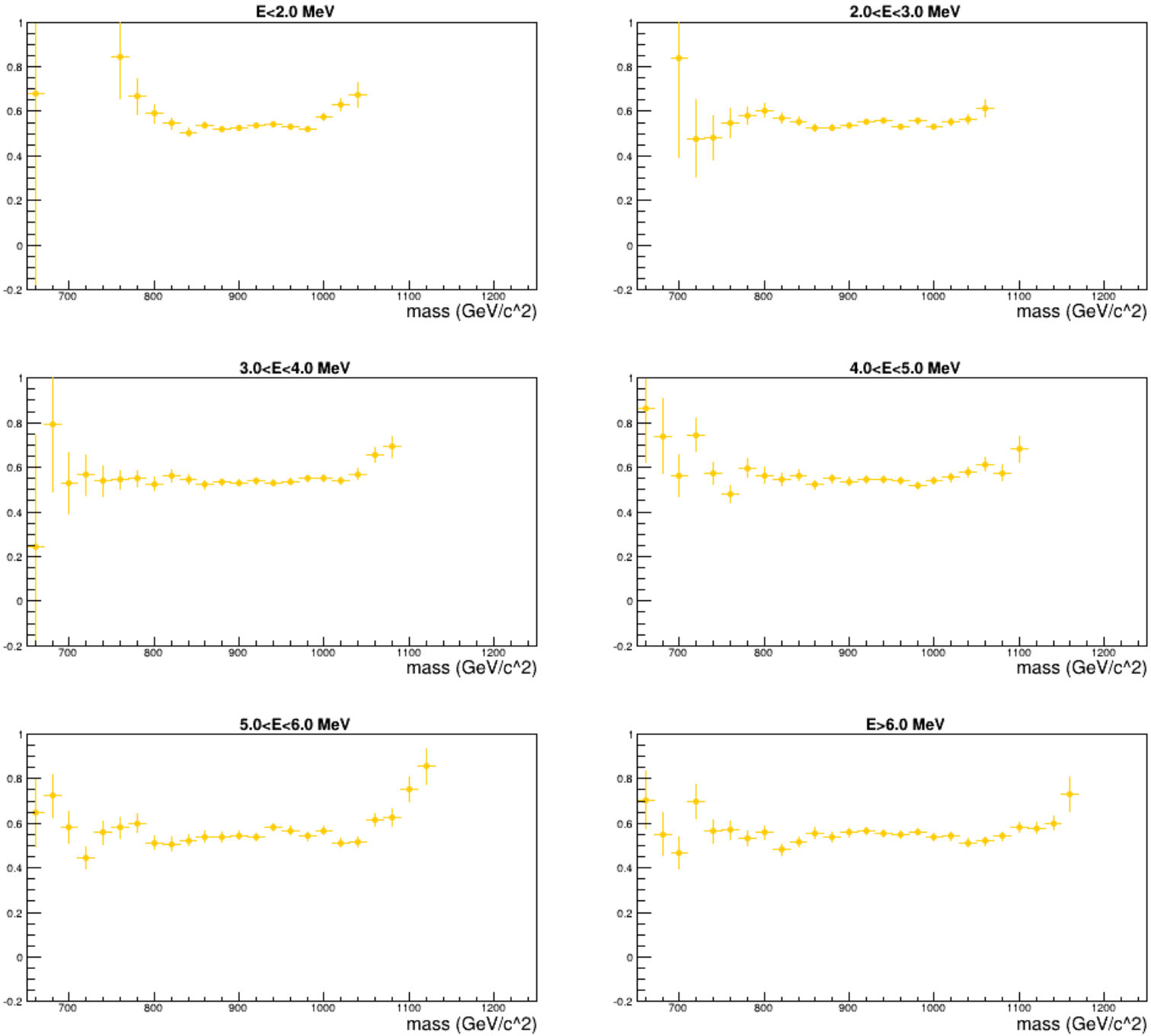
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