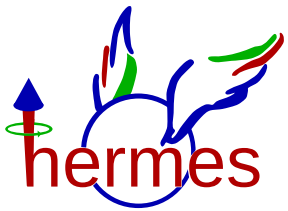
Report from HERMES

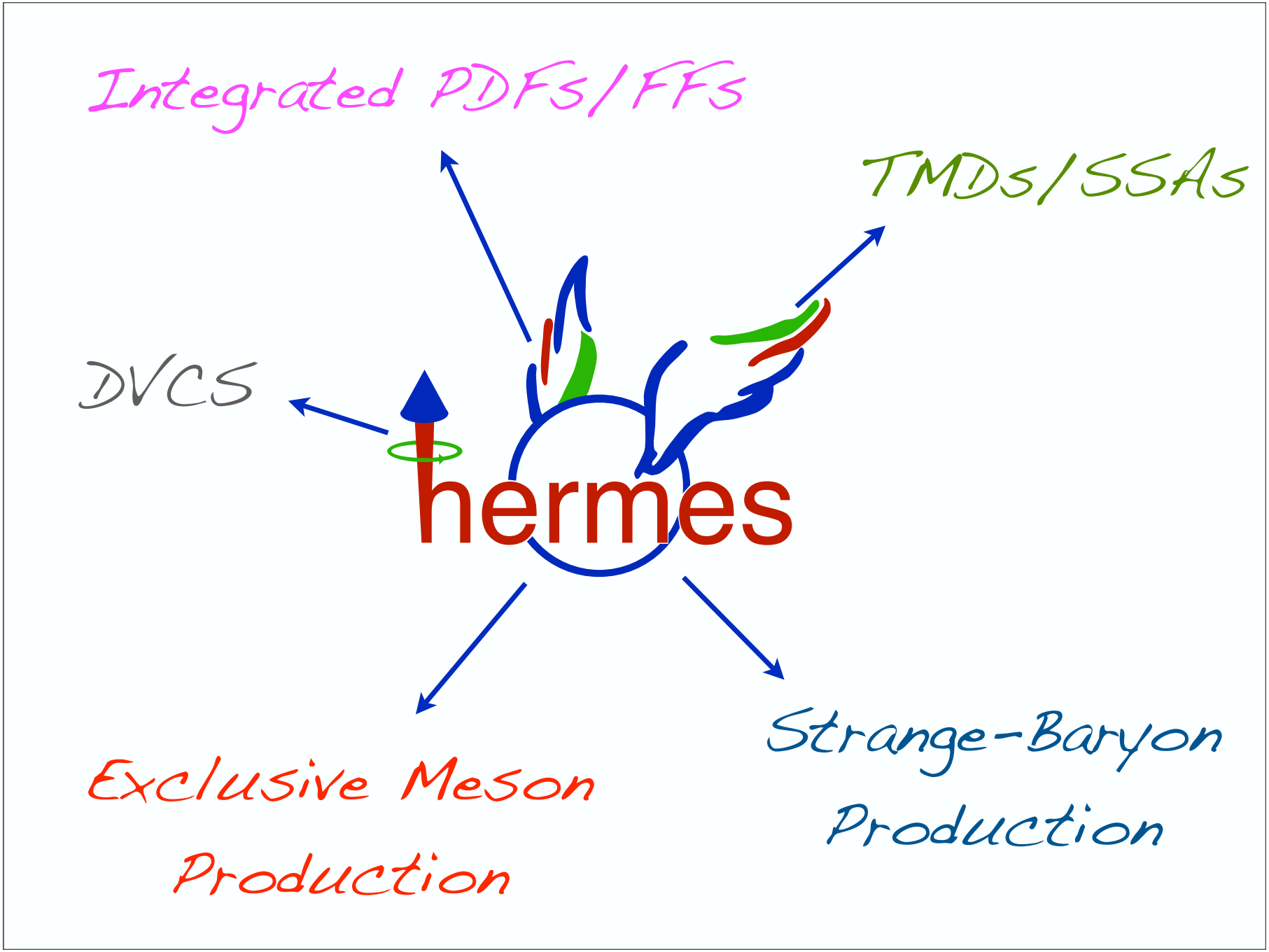
Caroline Riedl
for the HERMES Collaboration

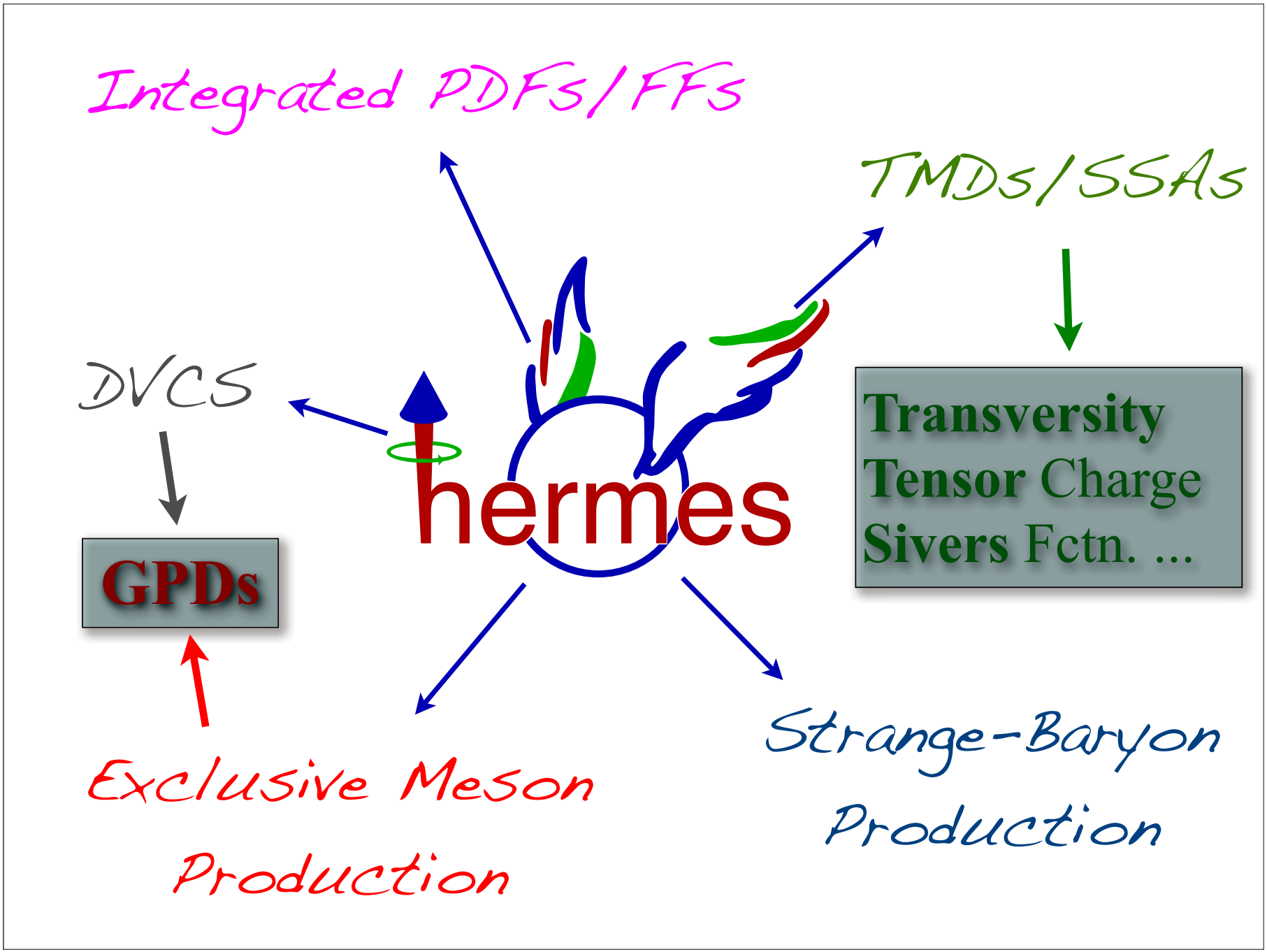


66. Physics Research Council
– Open Session –
Zeuthen
October 1, 2008

Outline

- Recent Physics Highlights at HERMES
- New Results with the HERMES Recoil Detector
- Milestones


Integrated PDFs/FFs
TMDs/SSAs
DVCS
hermes
Exclusive Meson Production
Strange-Baryon Production


Integrated PDFs/FFs
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hermes
Transversity
Tensor Charge
Sivers Fctn. ...
GPDs
Strange-Baryon
Production
Exclusive Meson
Production

HERMES Physics Highlights since last PRC Mtg.

Publications:

- Strange-quark distribution and polarization PLB 666, 446 (2008)
- First measurement of spin-dependent two-hadron fragmentation functions JHEP 06, 017 (2008)
- Transverse-target and beam-charge asymmetries in DVCS JHEP 06, 066 (2008)

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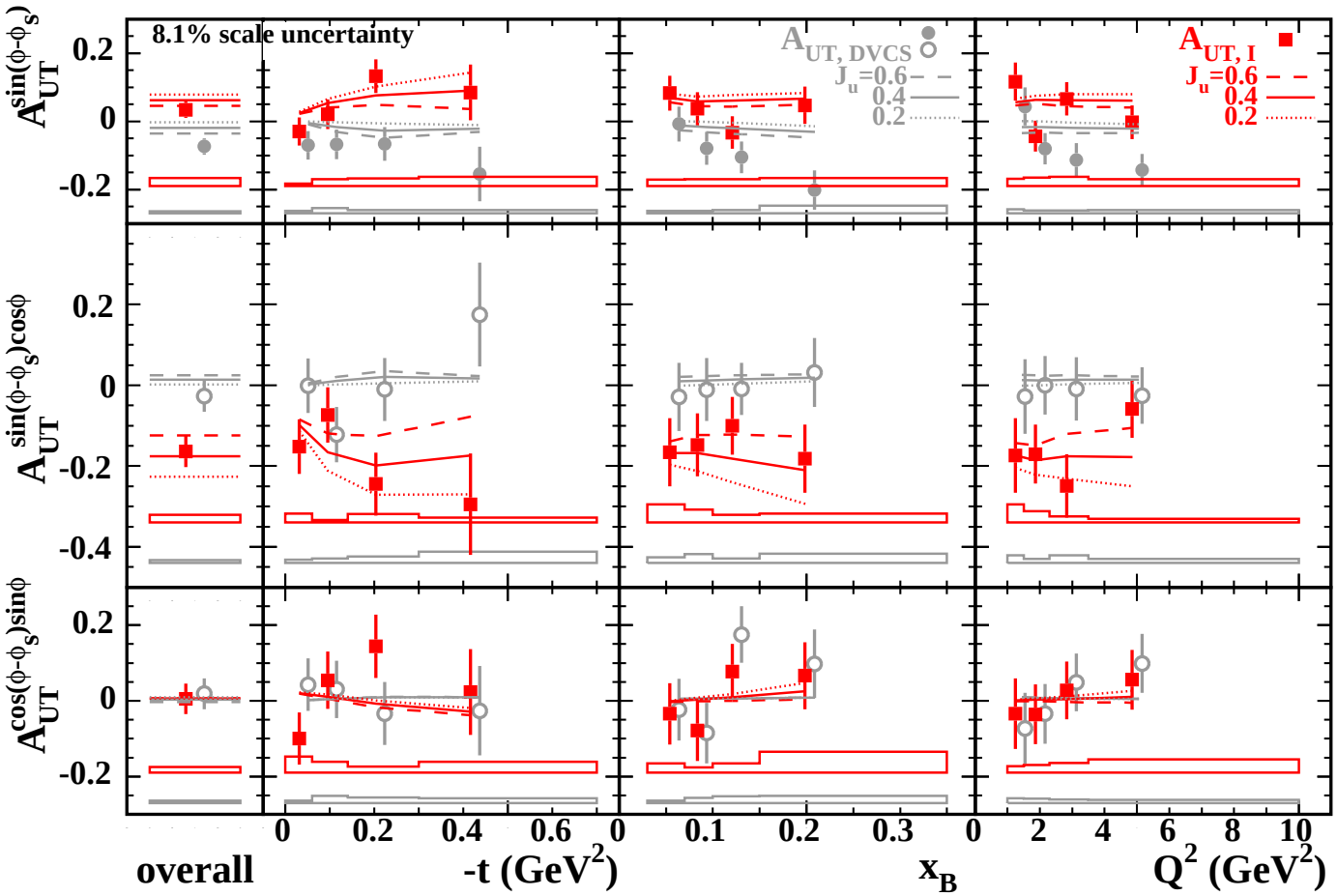
HERMES Physics Highlights since last PRC Mtg.

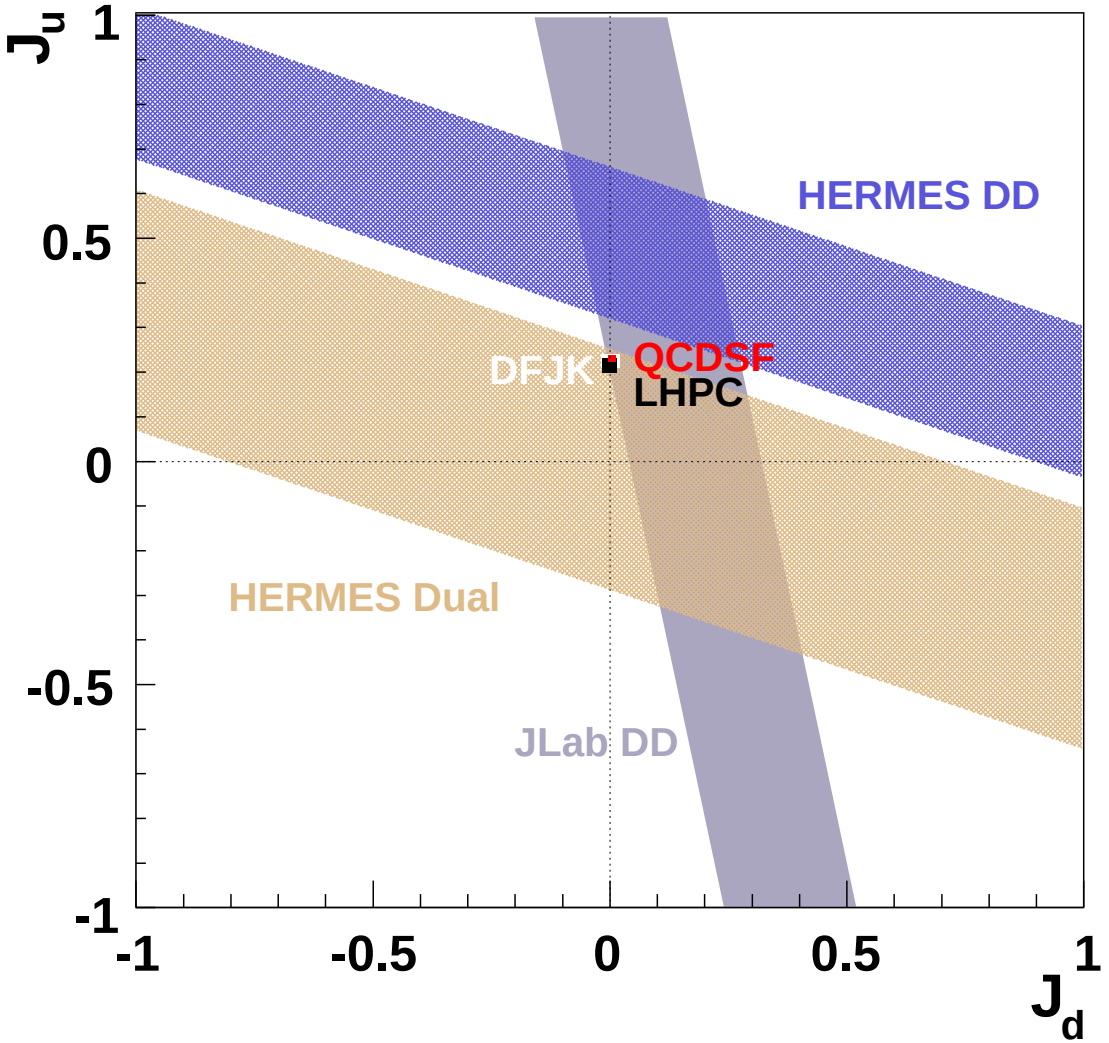
Transverse-target spin asymmetries in DVCS



Model curves:
Variation of total angular momentum J_u

HERMES Physics Highlights since last PRC Mtg.

Model-dependent constraint of $J_u + k \cdot J_d$



- Bands $\equiv$ 1–sigma constraint on J_u vs. J_d
- J_u and J_d free params in GPD models

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- Azimuthal asymmetries in the spin-independent semi-inclusive cross-section

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- Kinematic dependences of longitudinal spin transfer in Lambda production

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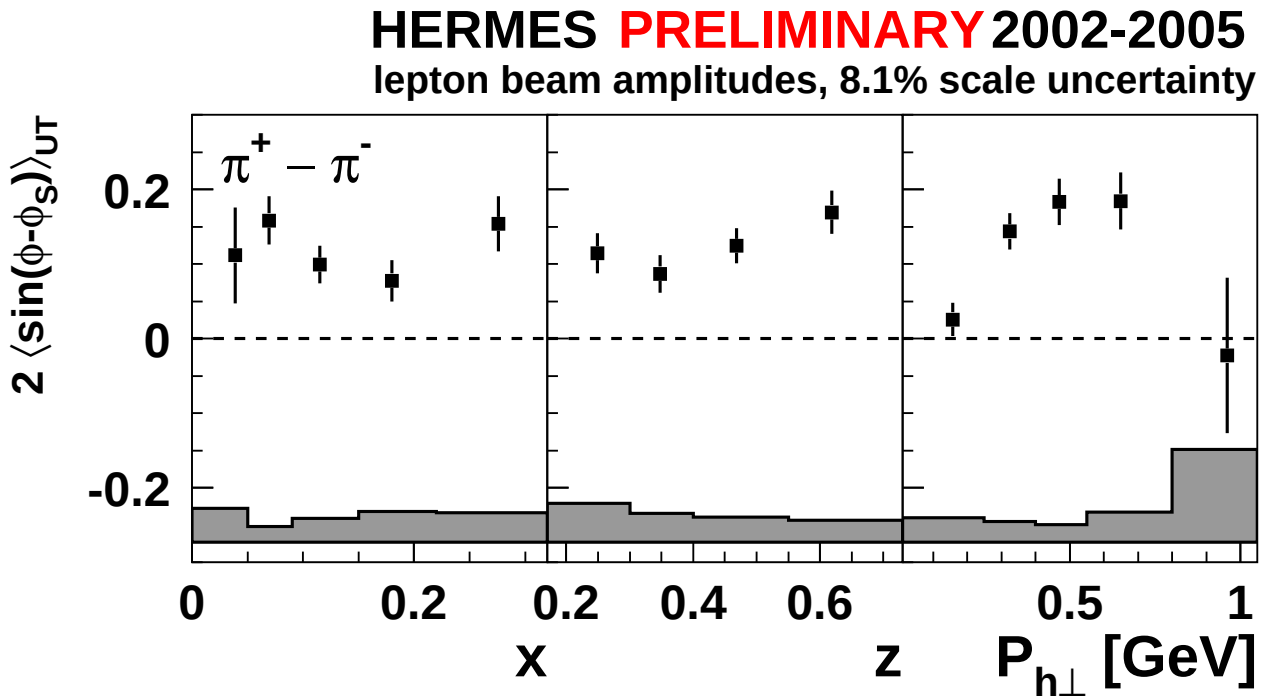
- Transverse single-spin asymmetry in inclusive DIS
- Kinematic dependences of longitudinal spin transfer in Lambda production
- Additional results on longitudinal double-spin asymmetries and transverse single-spin asymmetries

HERMES Physics Highlights since last PRC Mtg.

Transverse single-spin asymmetry in semi-inclusive DIS



$\Rightarrow$ Access to Sivers valence distribution

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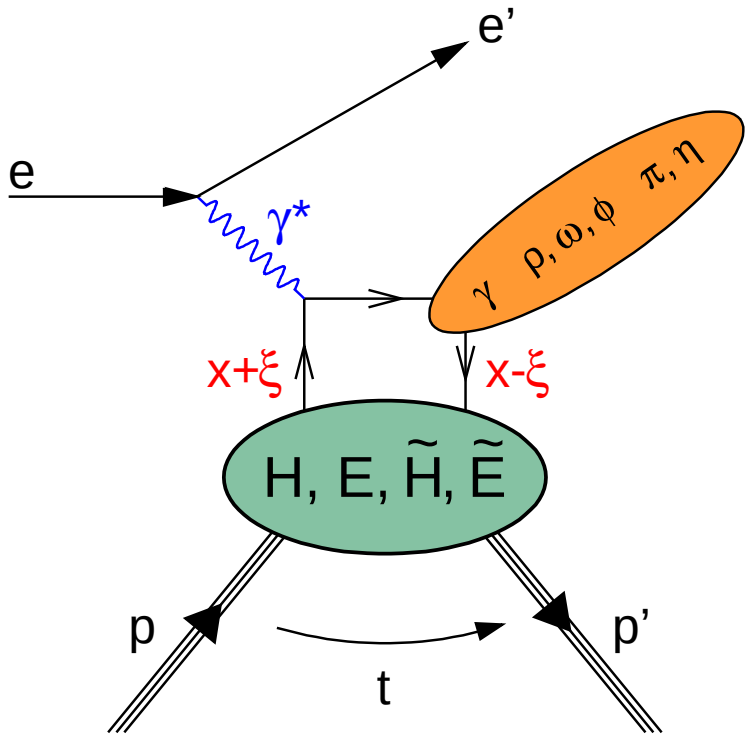
Exclusive Processes, GPDs, Angular Momentum



GPD access at HERMES:

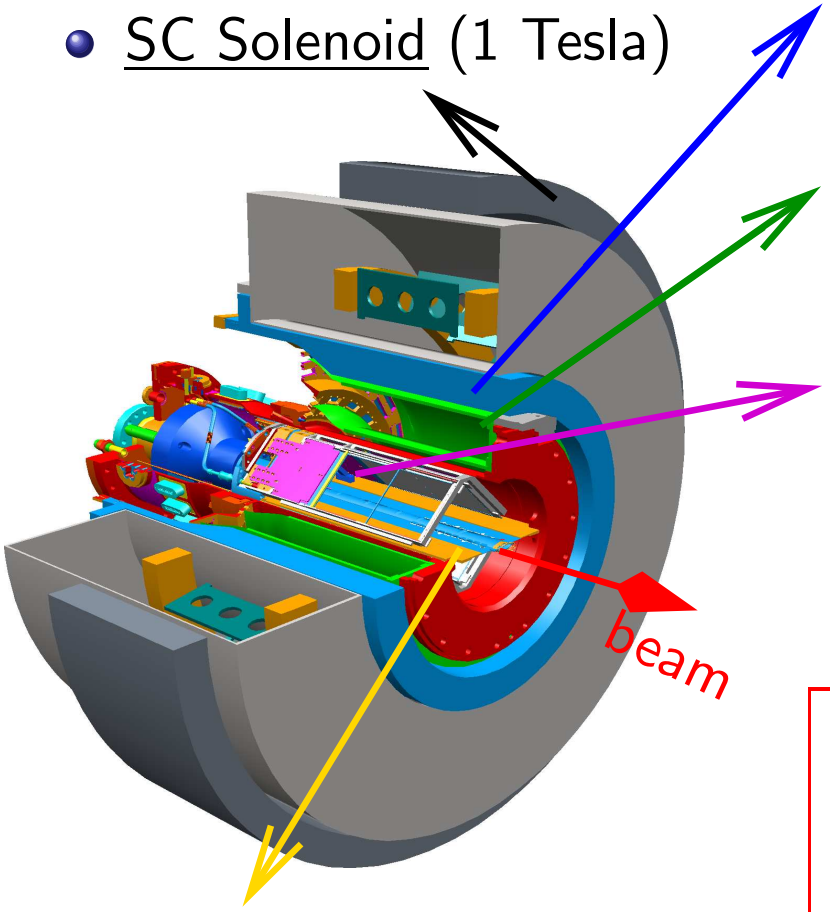
unpolarized	polarized
photon: $J^{\mathcal{P}} = 1^-$ (DVCS)	
H: A_{C}, A_{LU}, A_{UT} **E:** A_{UT}	$\widetilde{\mathbf{H}}$: A_{UL}, A_{UT} $\widetilde{\mathbf{E}}$: A_{UT}
$J^{\mathcal{P}} = 1^-$ mesons	$J^{\mathcal{P}} = 0^-$ mesons

Ji Relation:

$$J_{\mathrm{q}} = \frac{1}{2} \lim_{t \to 0} \int_{-1}^{1} \mathrm{d}x \; x \left[H_{\mathrm{q}}(x, \xi, t) + E_{\mathrm{q}}(x, \xi, t) \right]$$

The HERMES Recoil Detector

- SC Solenoid (1 Tesla)



- Target Cell with unpol. H_2 or D_2

- Photon Detector **PD**
  - 3 layers of Tungsten/Scintillator
- Scintillating Fiber Tracker **SFT**
  - 2 Barrels
  - Each 2 parallel- & 2 stereo-layers
- Silicon Strip Detector **SSD**
  - 2 Layers of 16 double-sided sensors
  - (10cm×10cm) active area
  - Inside accelerator vacuum

Silicon & Fiber Tracker:

$p_p \in [135, 1200]$ MeV/c

p/π **PID** for $p < 650$ MeV/c

Photon Detector:

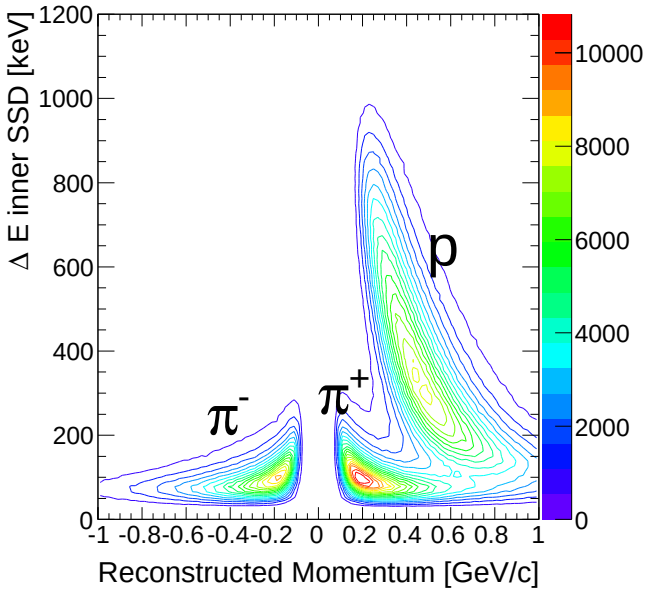
p/π **PID** for $p > 600$ MeV/c

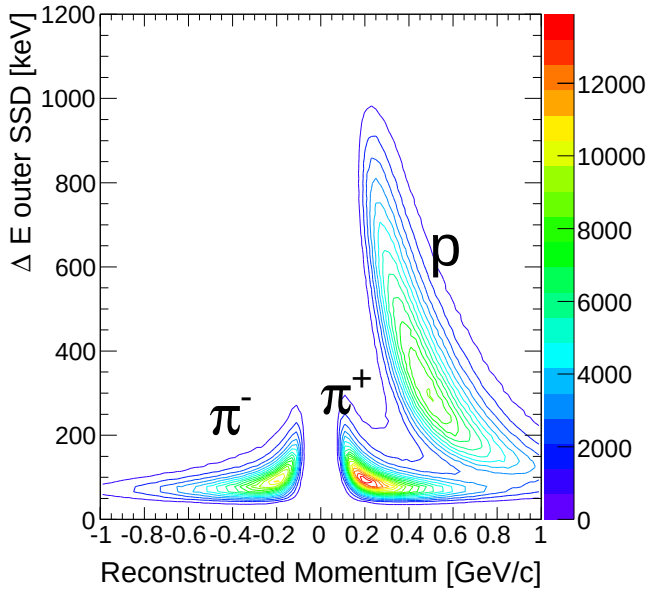
π^0 background supression

Progress with the Recoil Detector

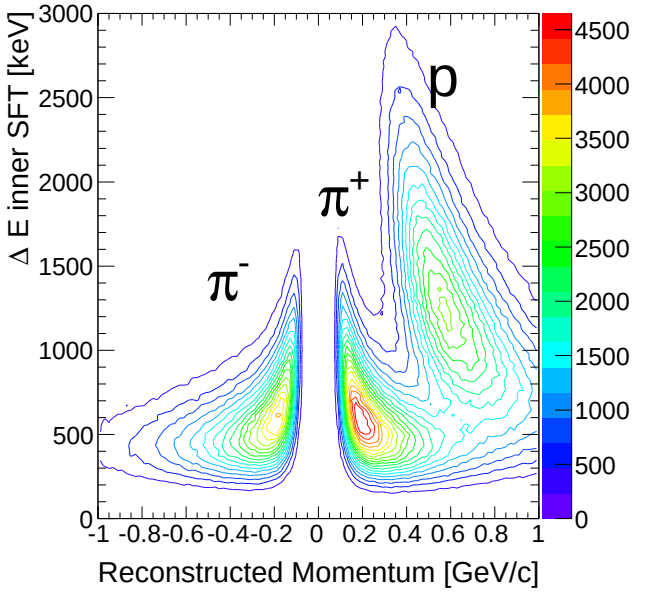
- First full calibration of SSD, SFT, PD
- Improvement of detector alignment
- Precise determination of detector efficiencies
- Development of PID method

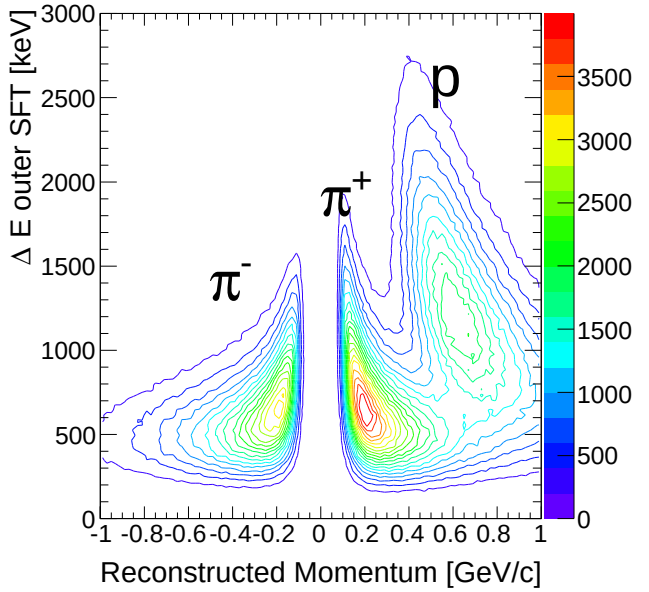
Recoil Detector Proton/Pion Separation





Silicon Strip Detector

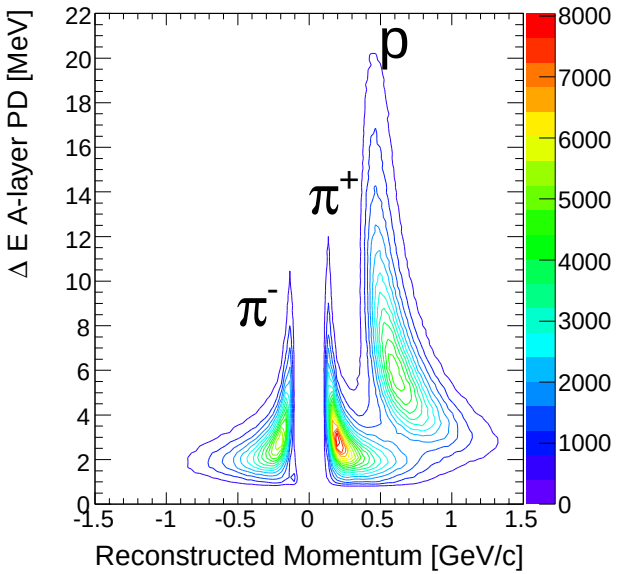


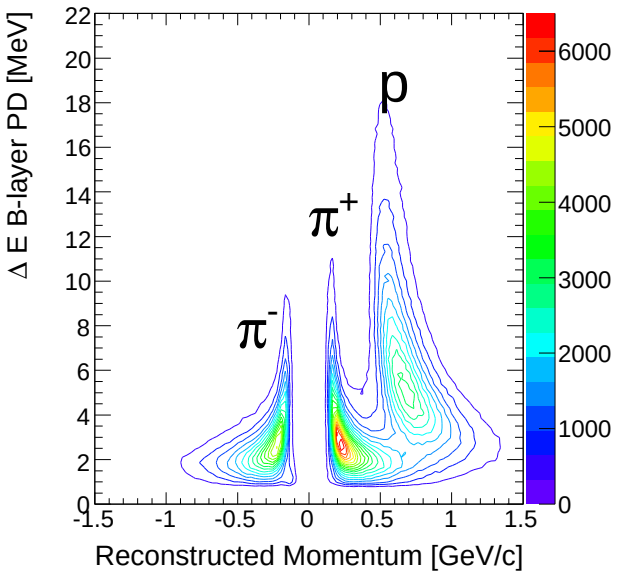


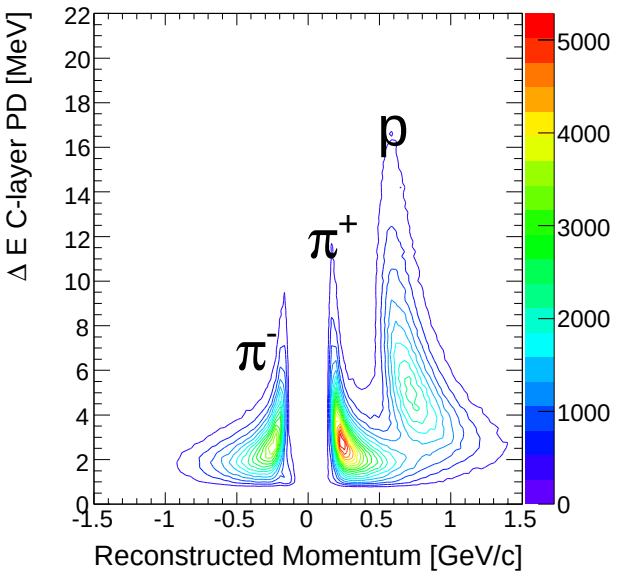
Scintillating Fiber Tracker

Recoil Detector Proton/Pion Separation

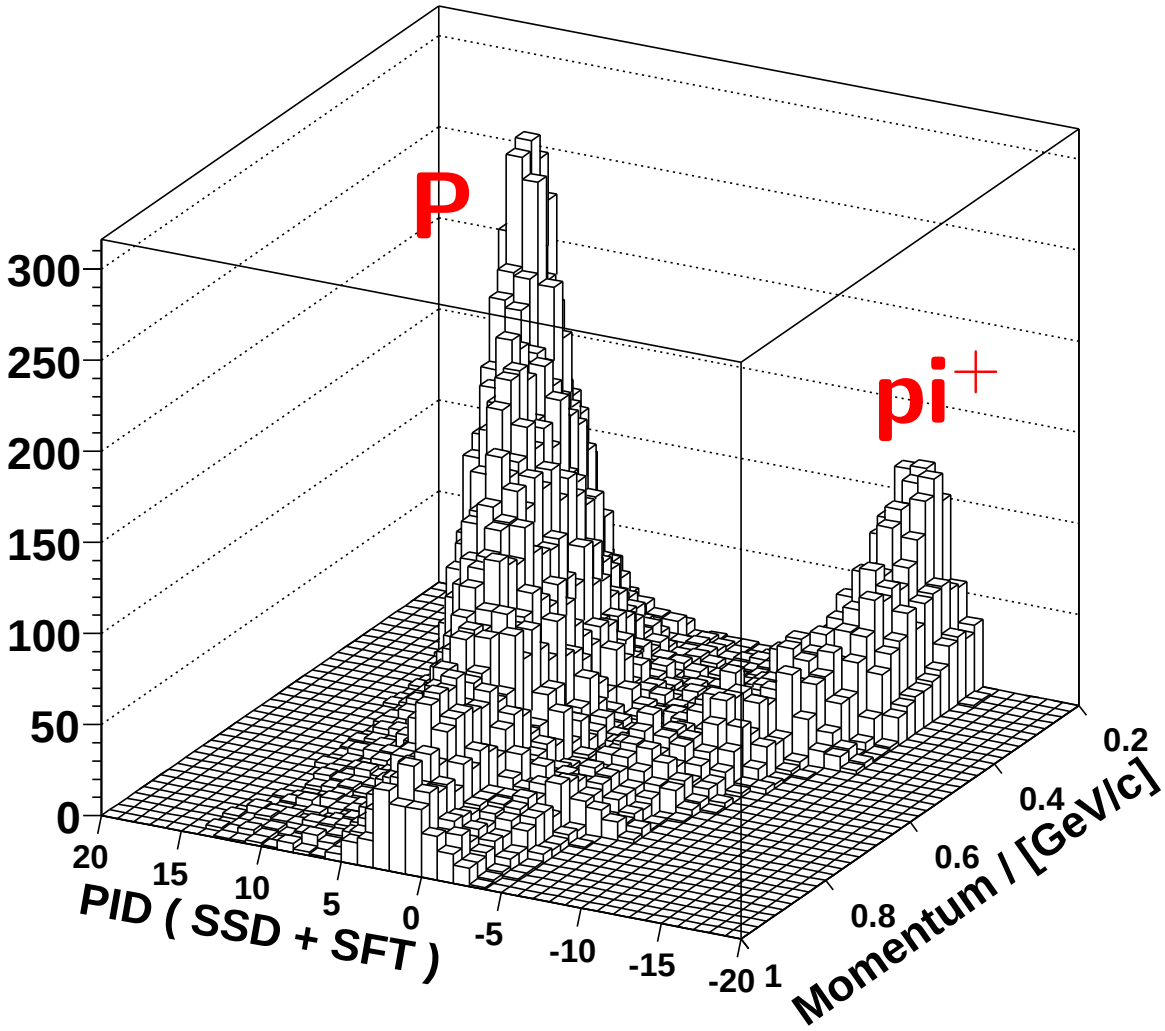
Photon Detector



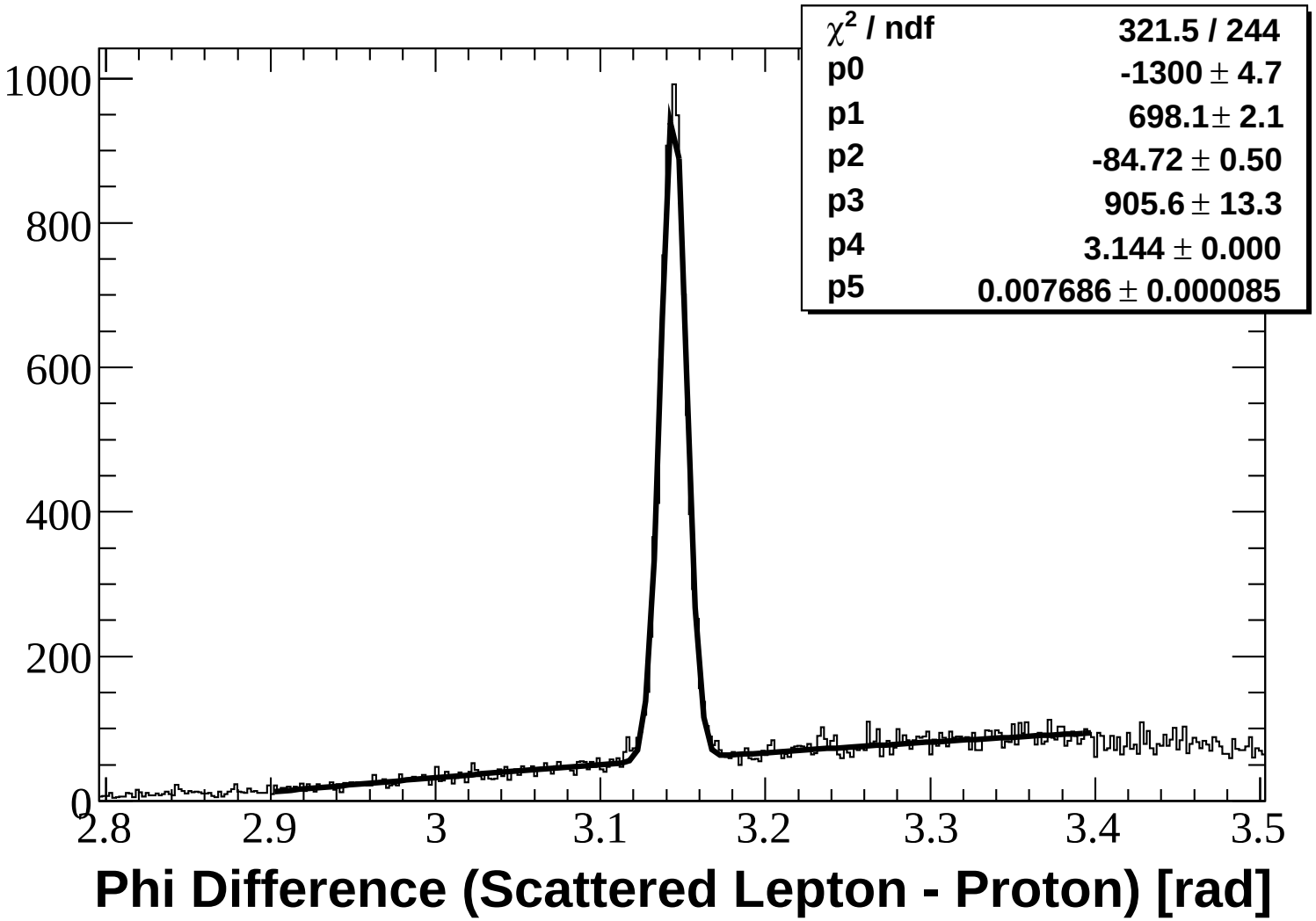




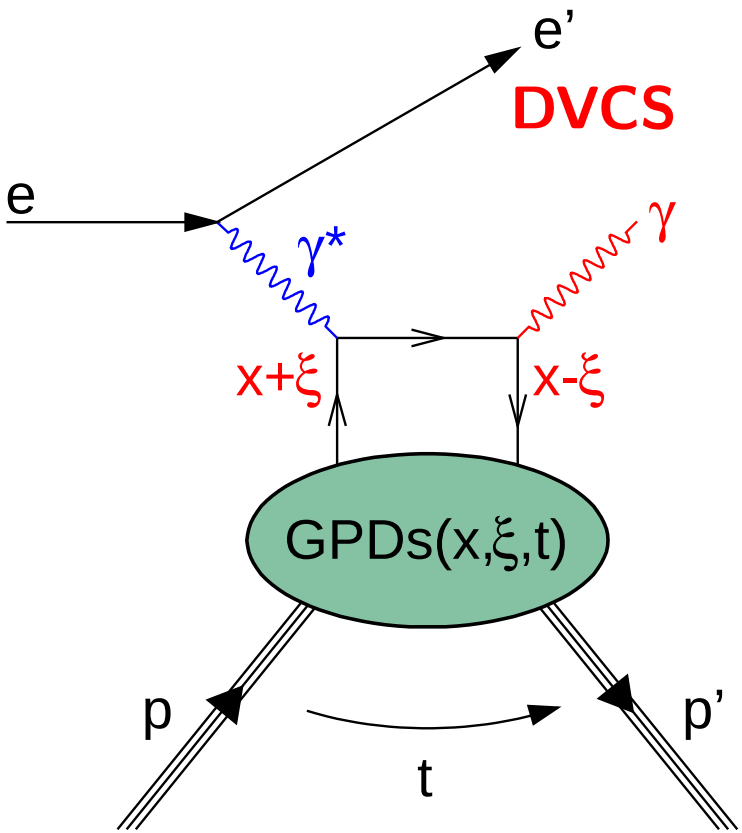
Recoil Detector PID (SSD/SFT combined)

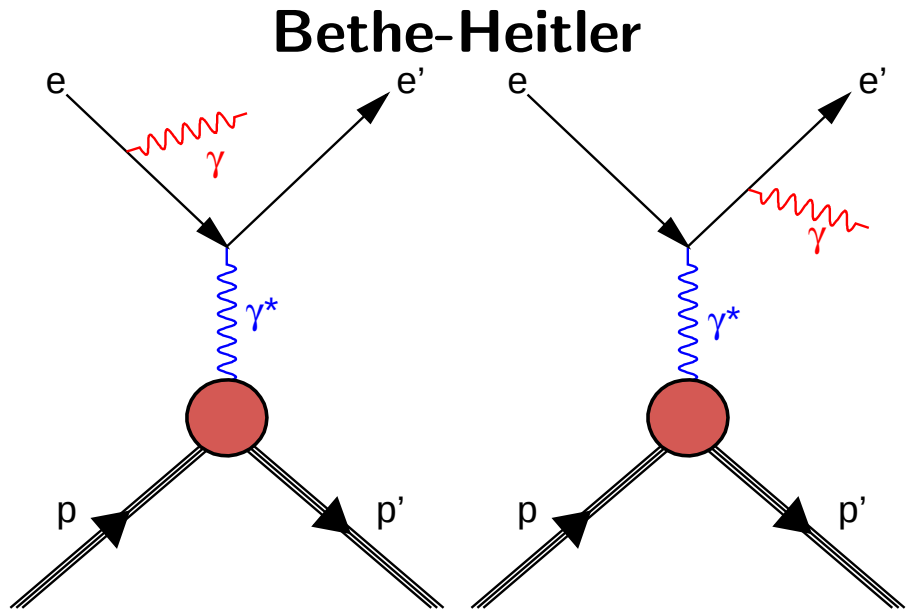


Elastic ep: ϕ-correlation Spectrometer$\leftrightarrow$Recoil



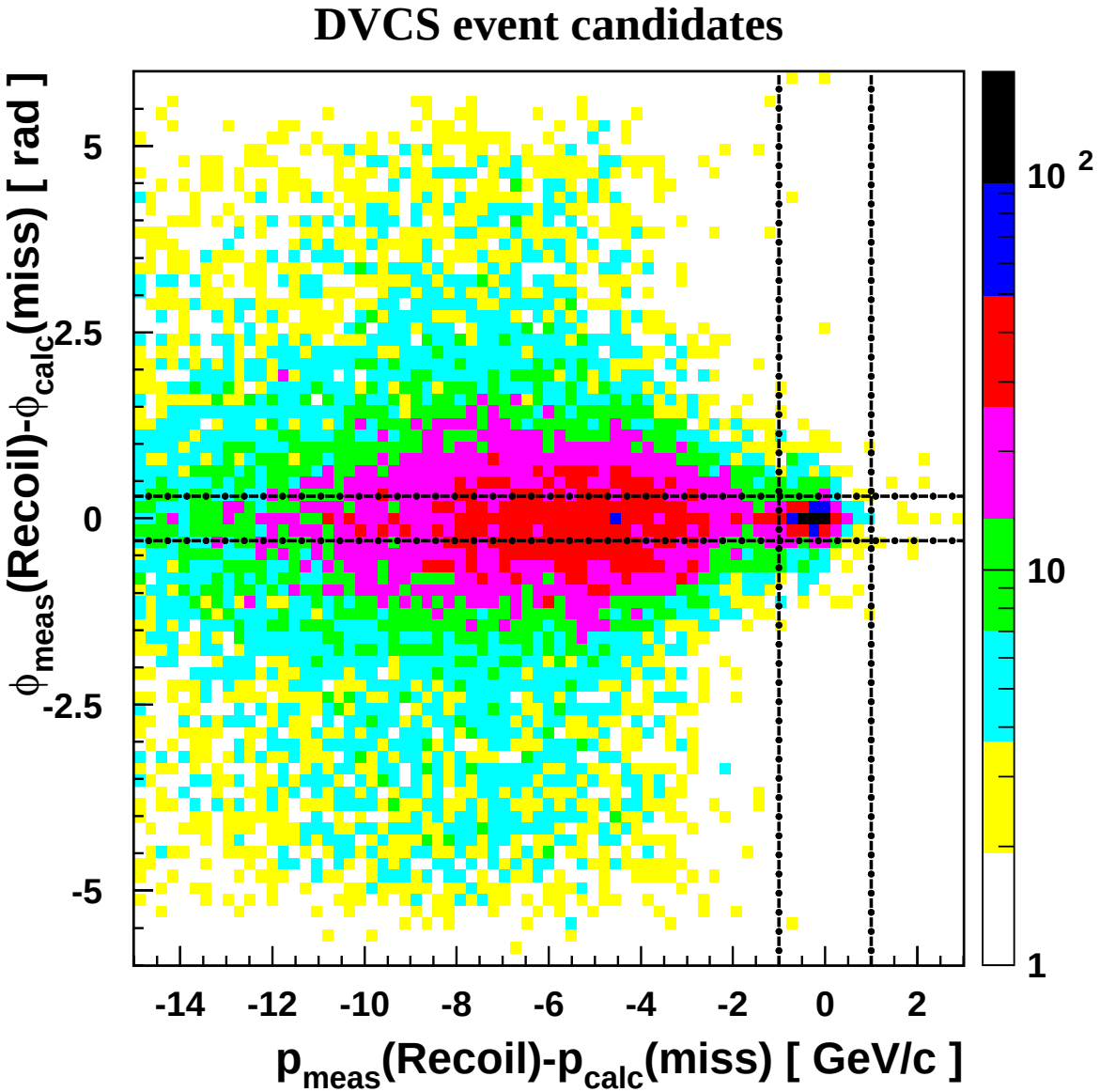
DVCS/Bethe-Heitler interference in $eN \longrightarrow eN\gamma$



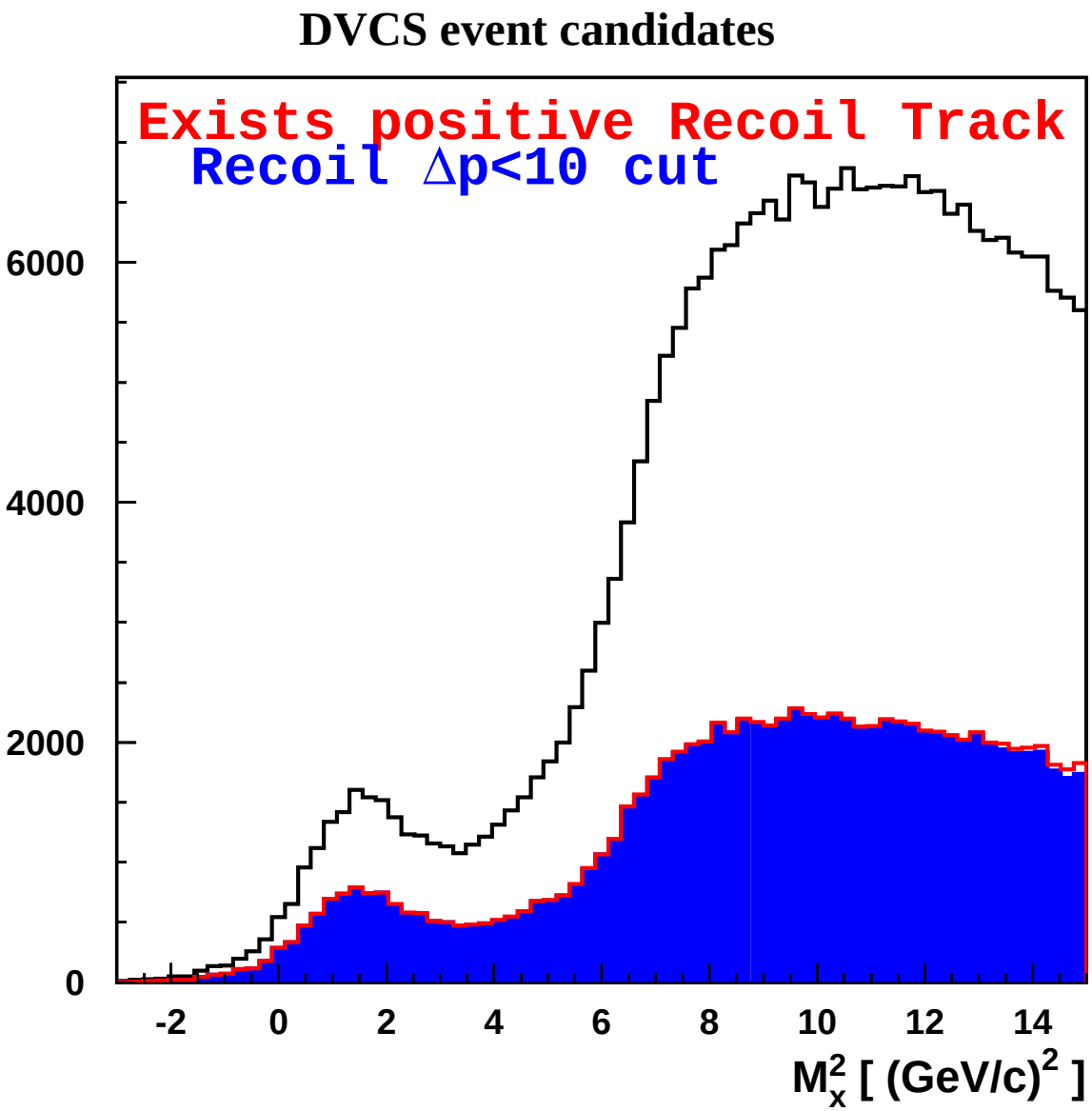


DVCS azimuthal asymmetries give access to GPDs

DVCS: ϕ/p–correlations Spectrometer$\leftrightarrow$Recoil



Δp-cut on DVCS Candidates



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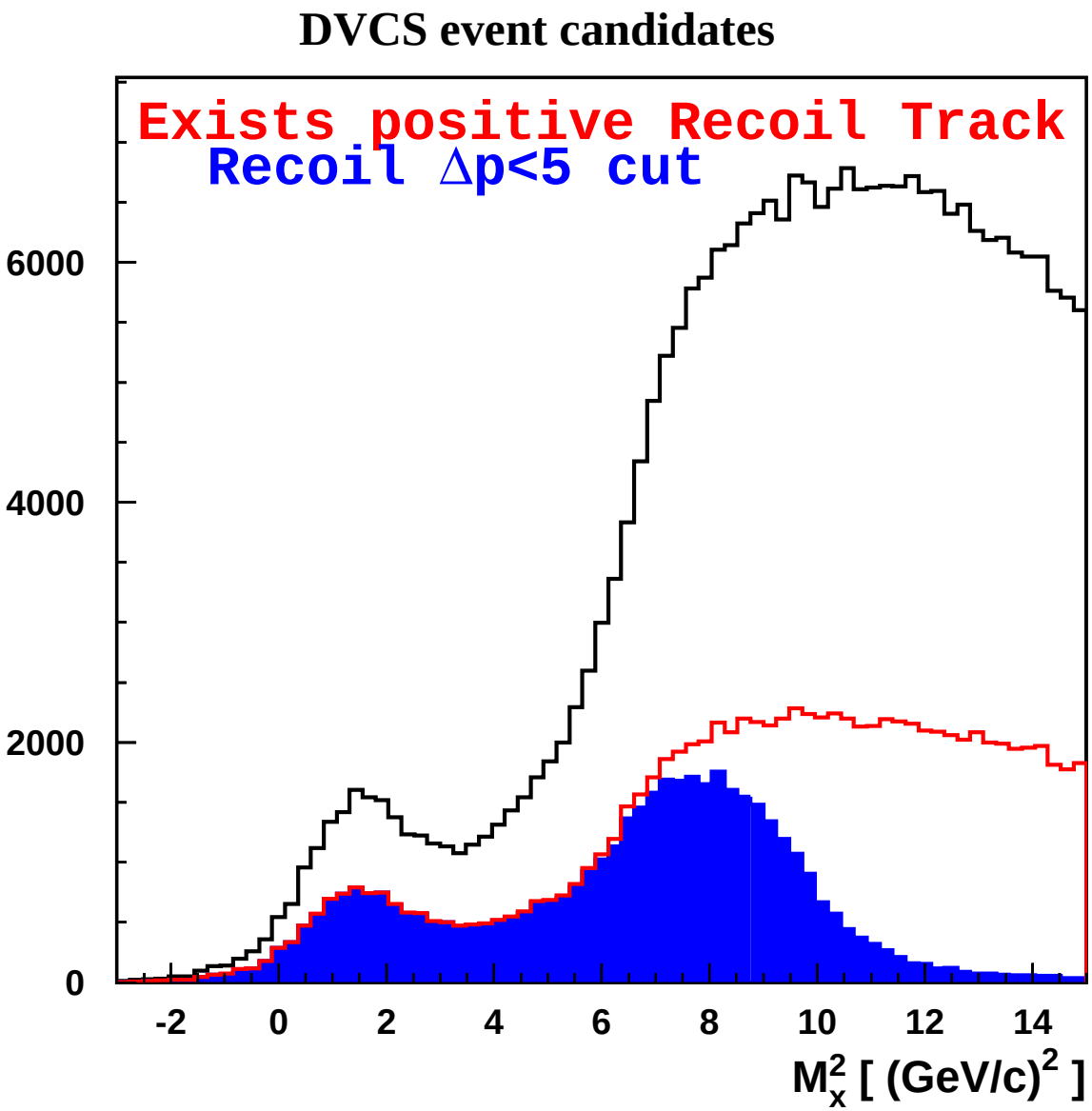

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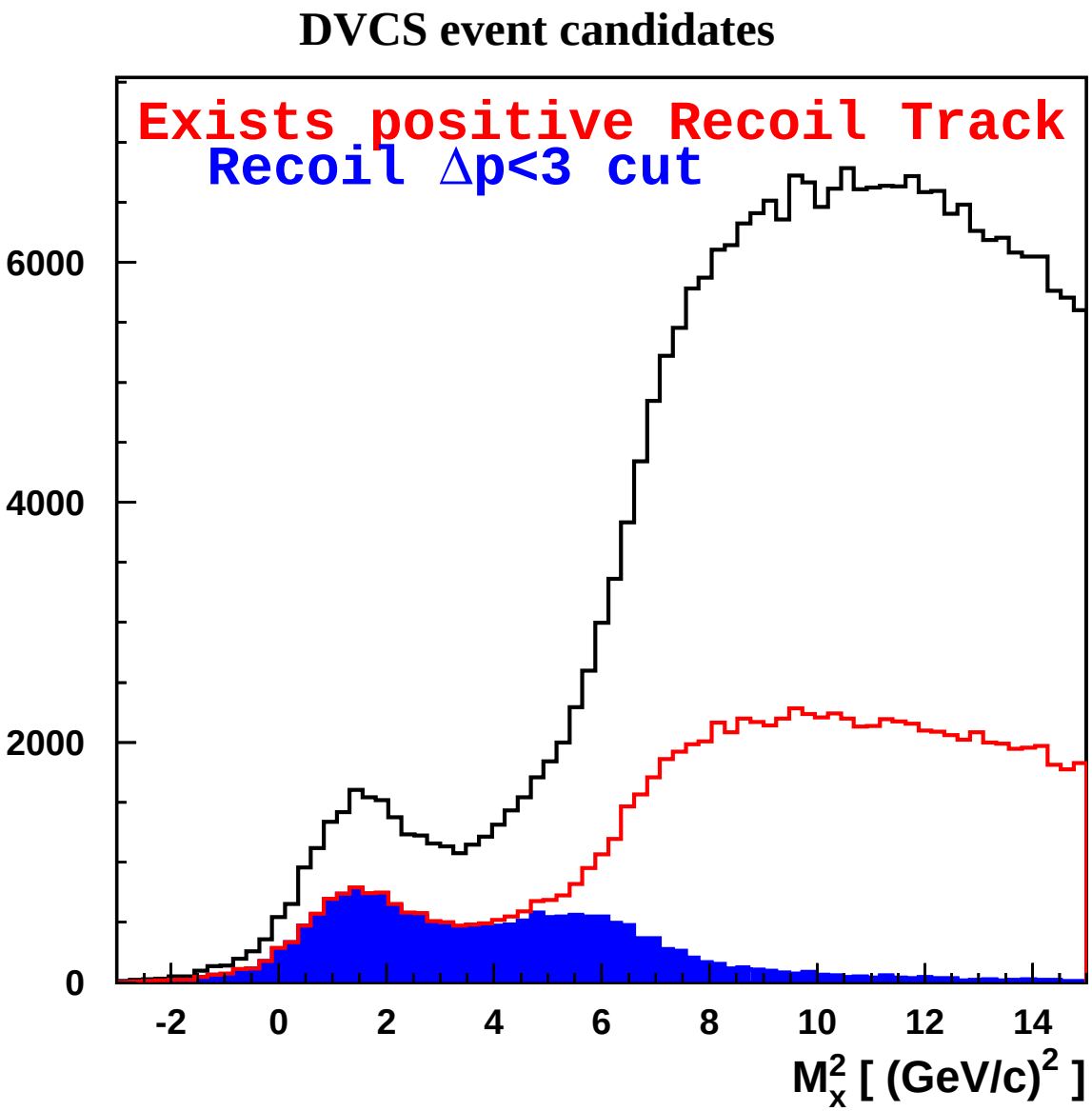

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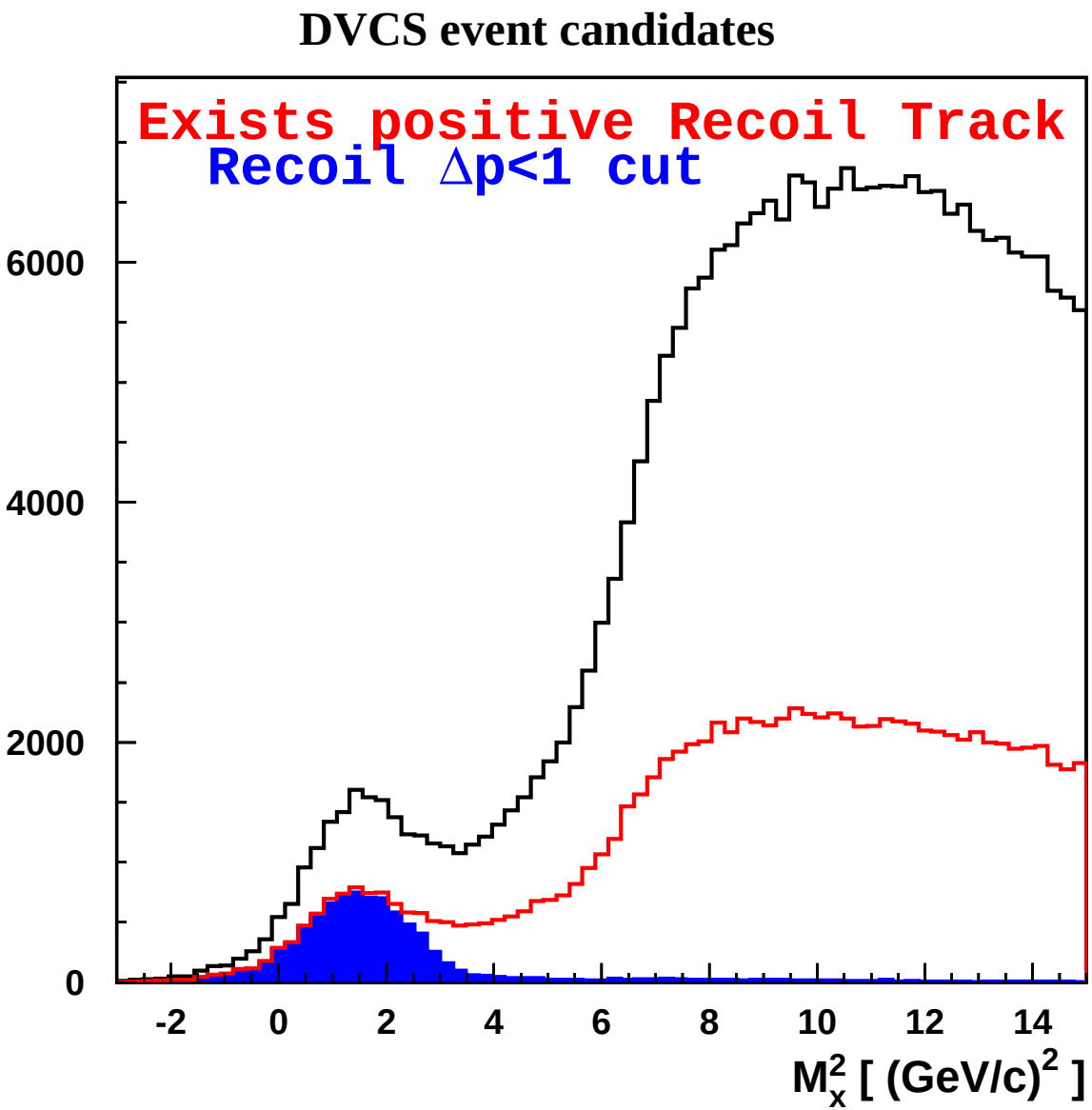
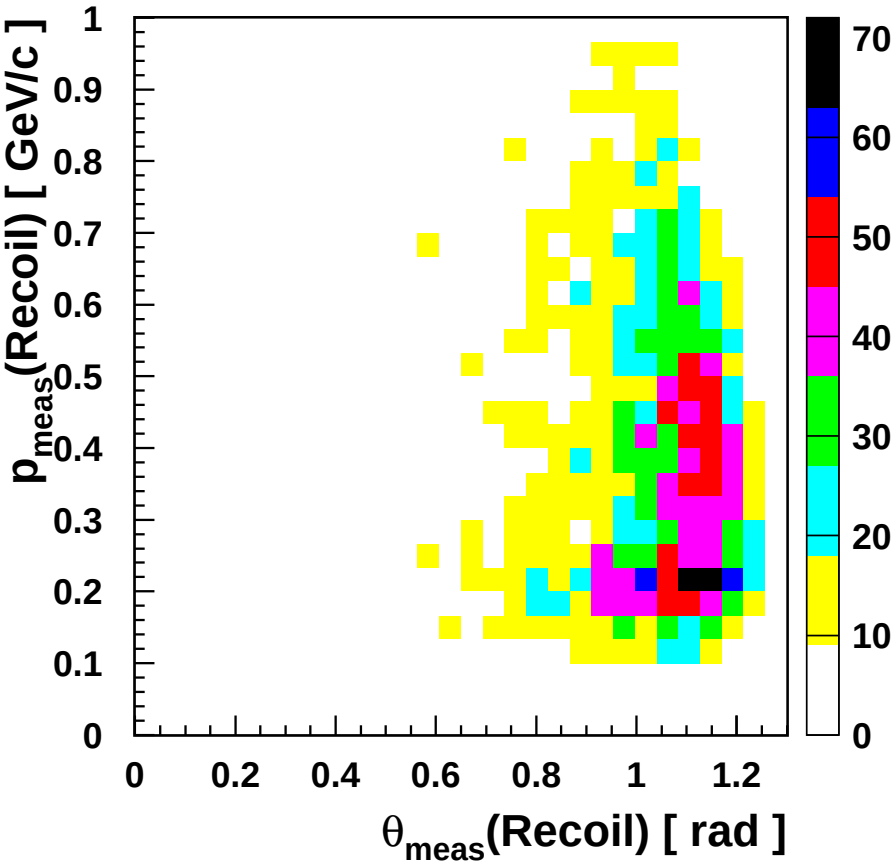
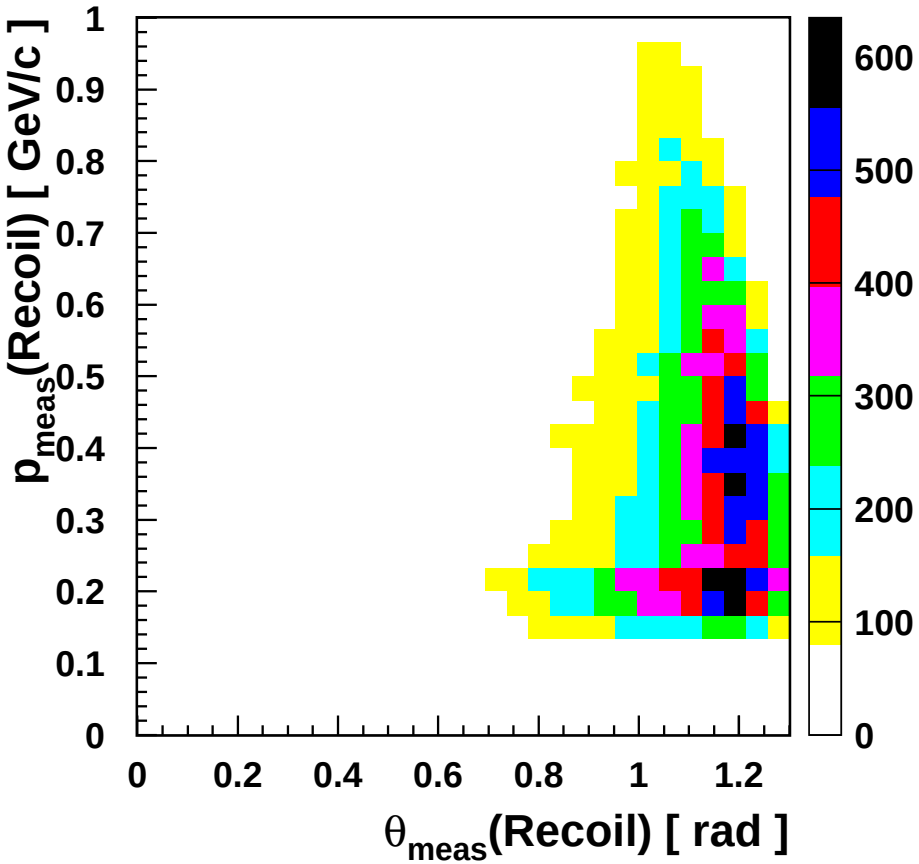


DVCS: Recoiling Proton Candidates

DATA

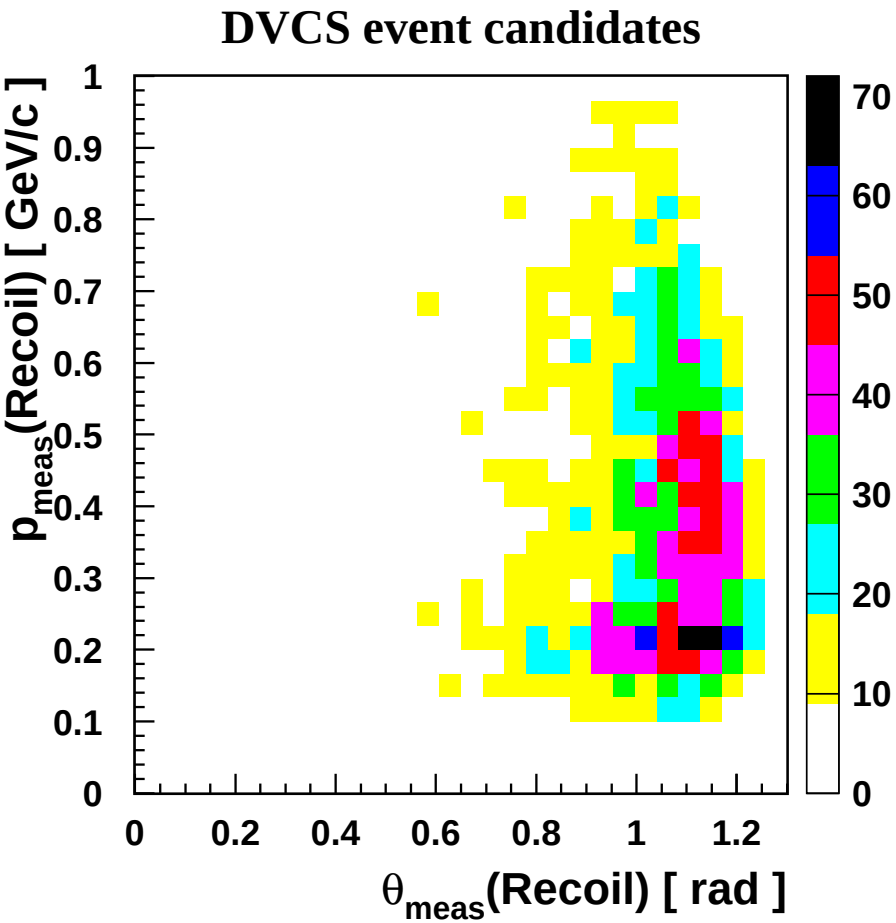


Monte Carlo

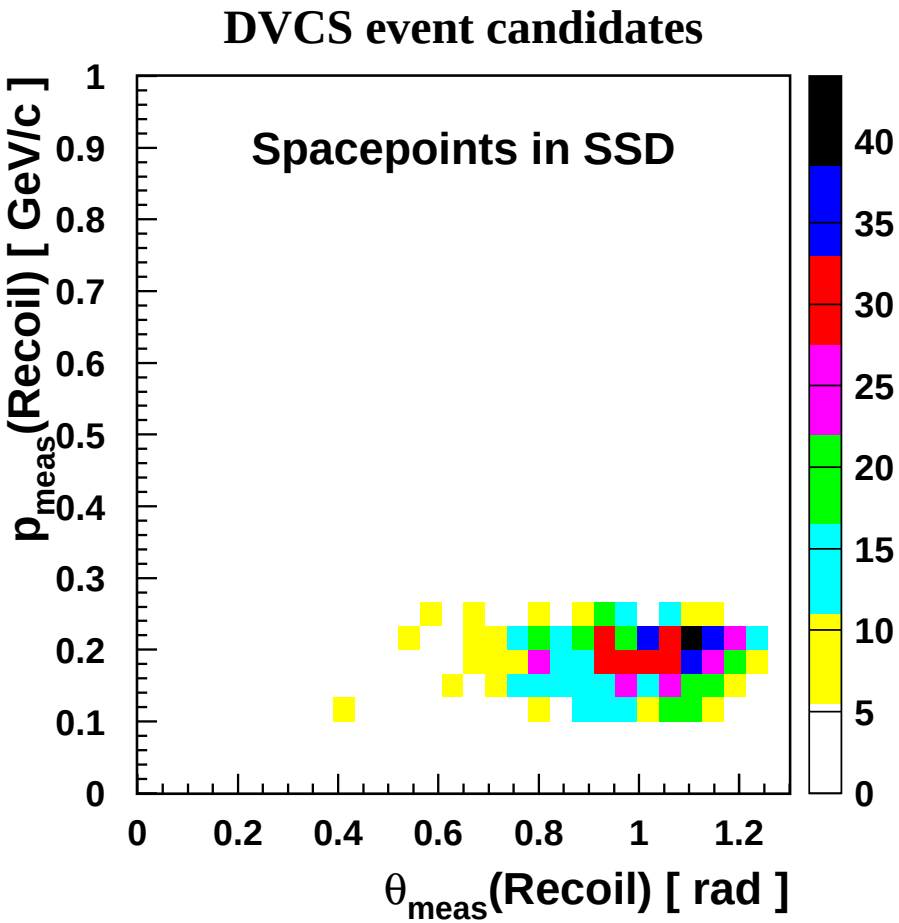


DVCS: Recoiling Proton Candidates

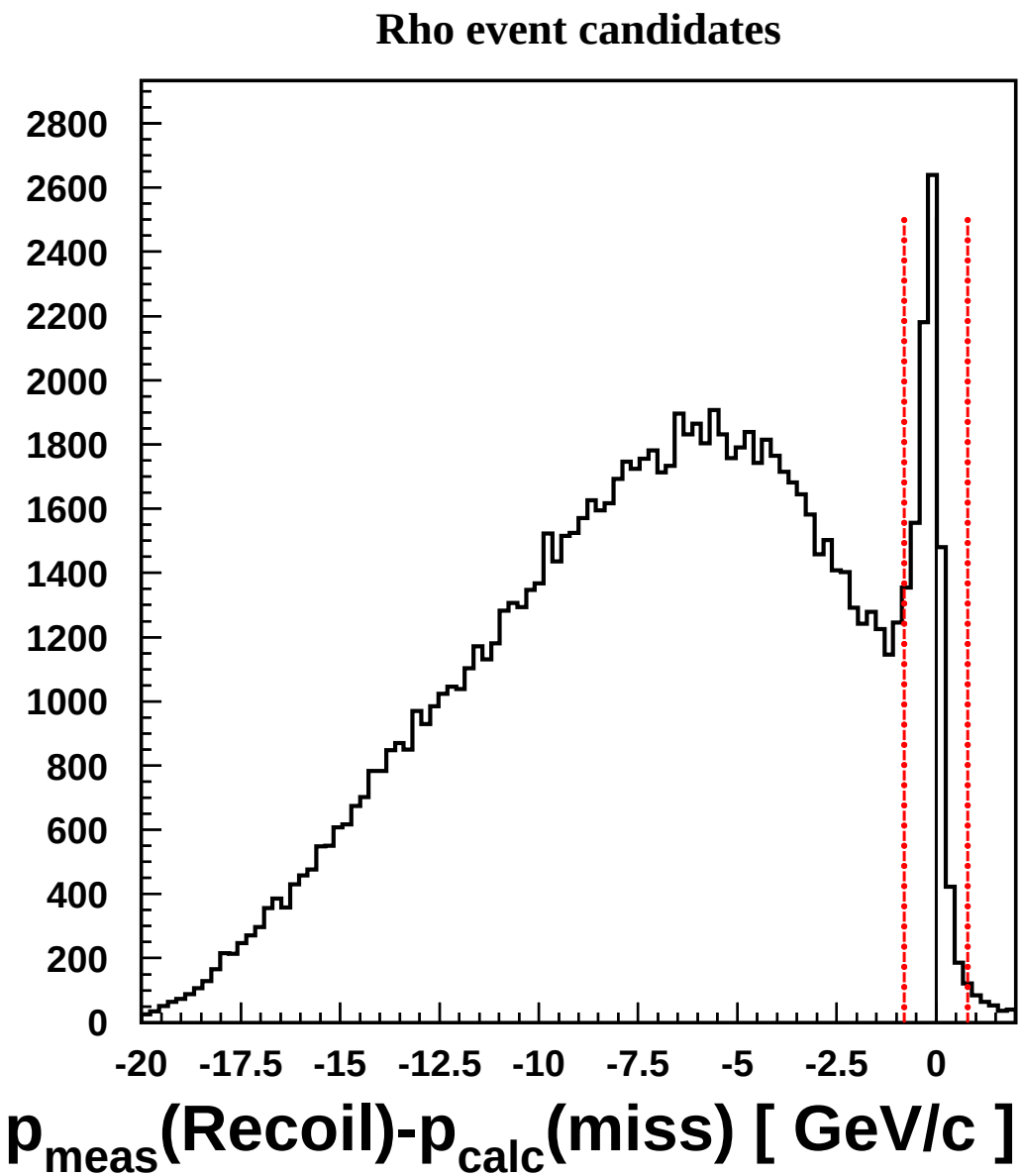
DATA (all tracks)



DATA (Silicon-Detector-only tracks)



Exclusive Rho Candidates: Missing Momentum



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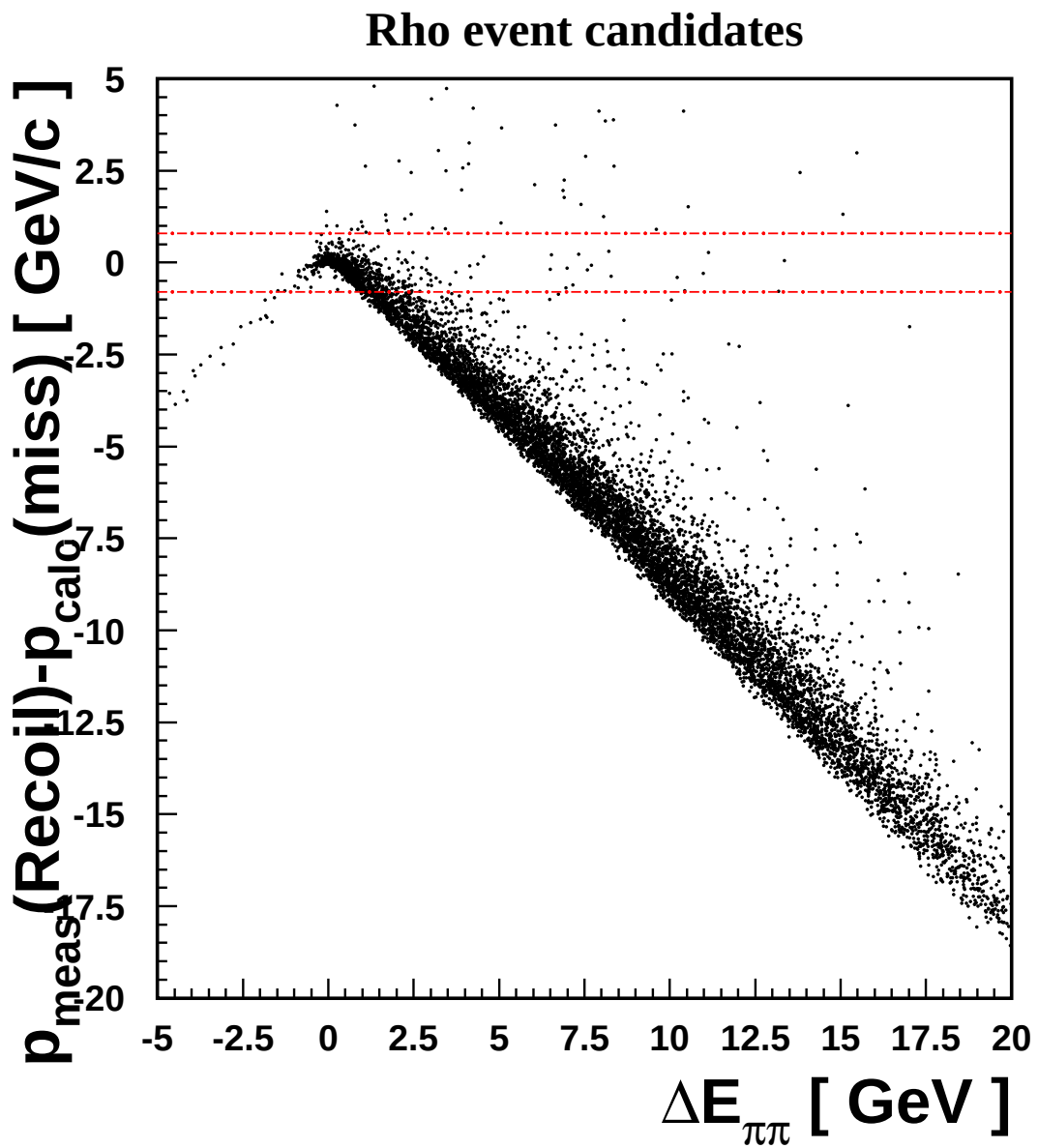

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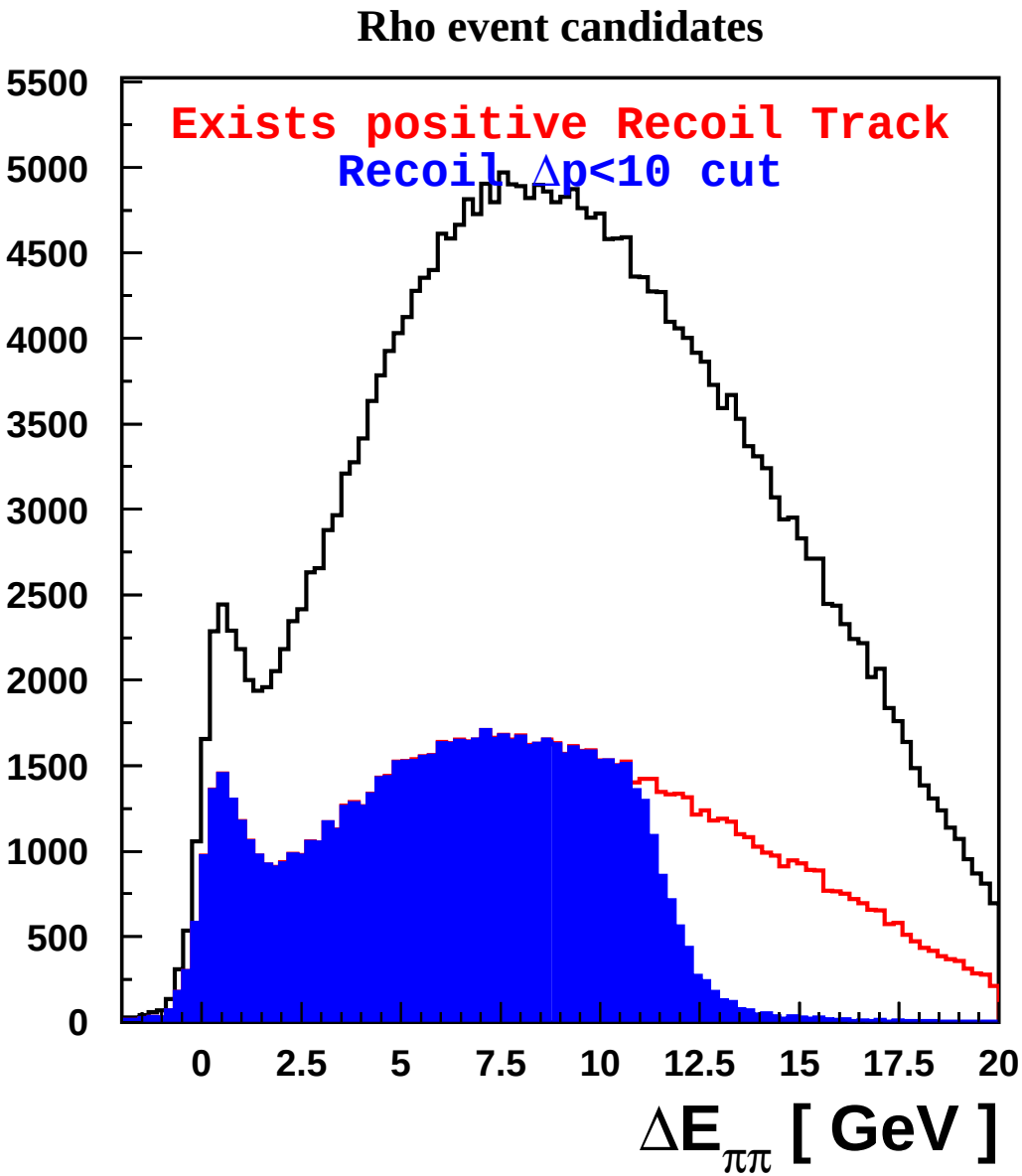

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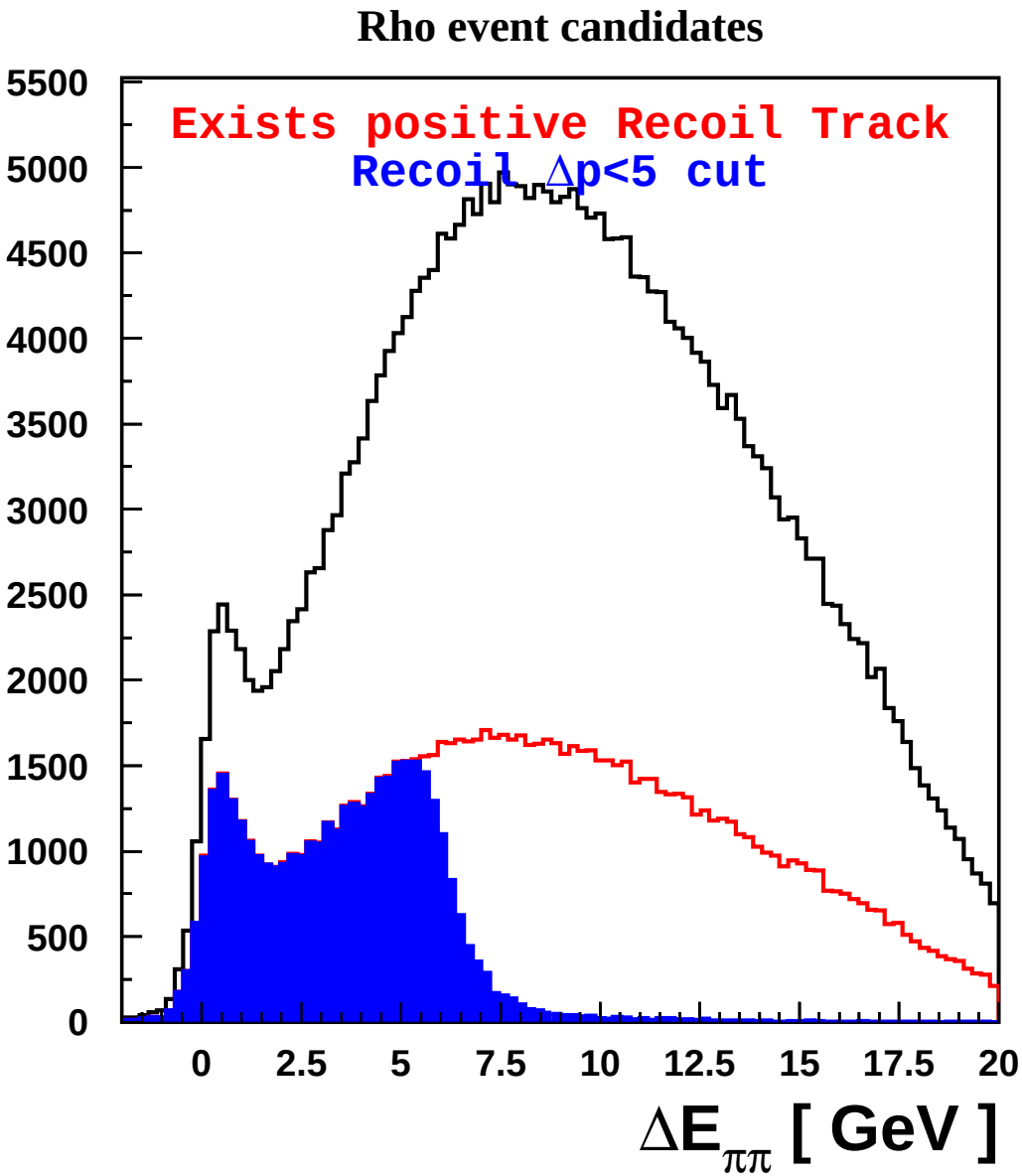

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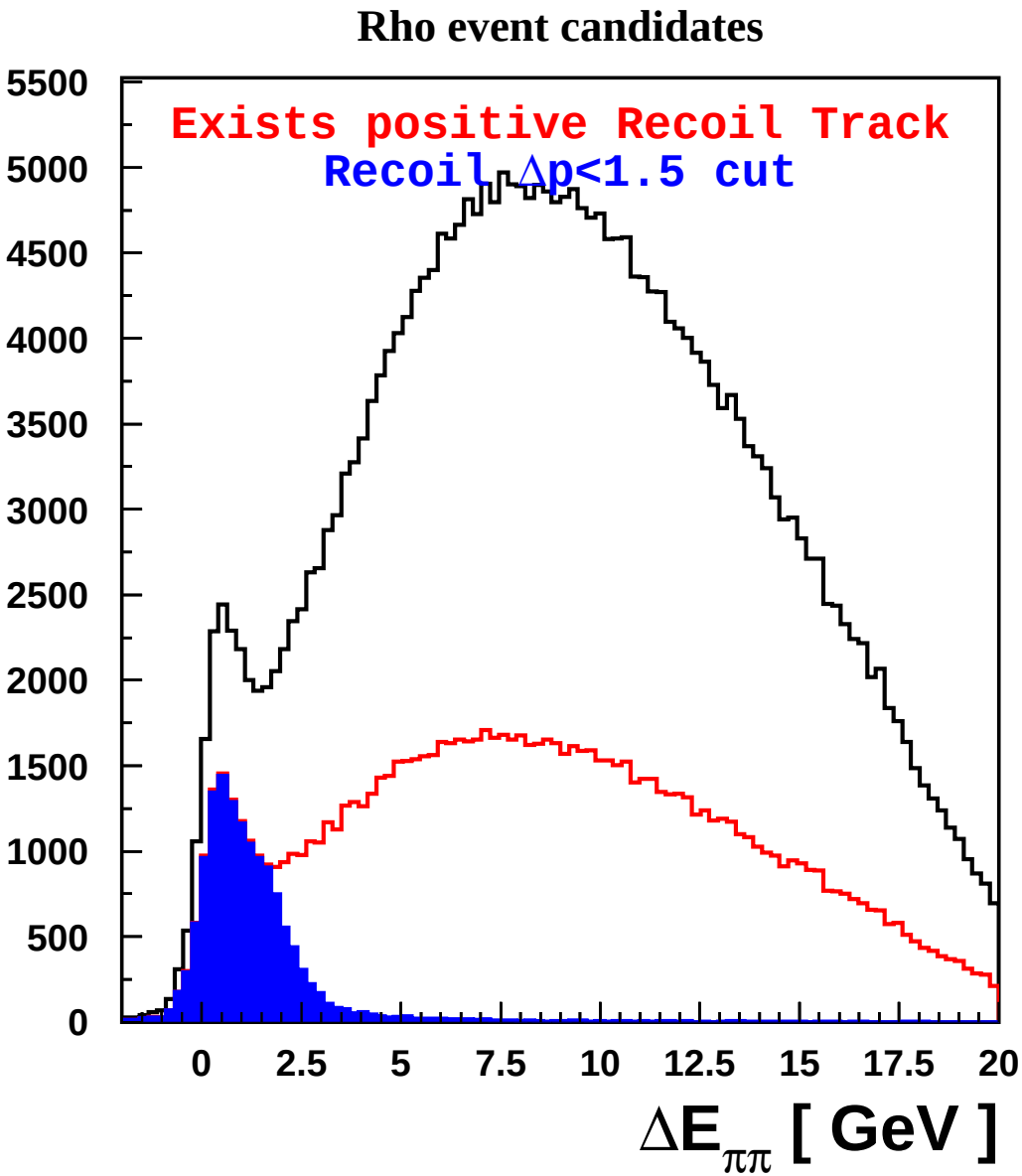

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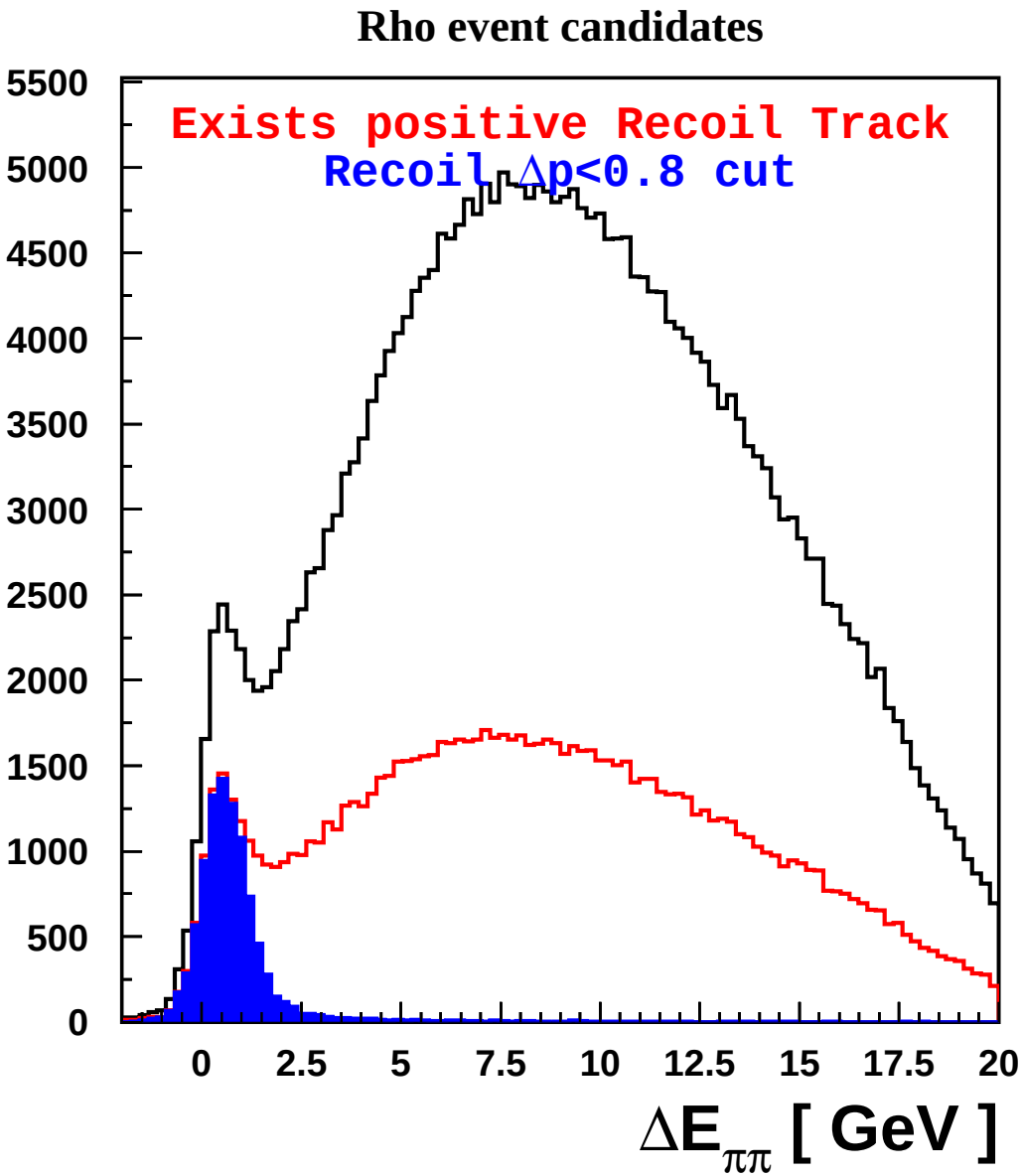

Future (Recoil Detector)

- SSD: refinement of calibration
- Extensive Monte Carlo studies

- Exploit Recoil PID (proton/pion separation)
- Separation of associated background $\Delta^+ \longrightarrow p\pi^0$
  - Photon Detector as π^0 veto
  - Coplanarity cuts
- Event reconstruction (kinematic fitting)

Milestones at HERMES

- TMDs
  - Transversity
  - Sivers distribution
  - Tensor charge
- Detailed investigation of exclusive processes
  - Basis to constrain GPDs
  - Cooperation of experiment $\leftrightarrow$ theory towards global GPD fit (including world data from ZEUS, H1, ...)