CLAS12 Deep Virtual ϕ

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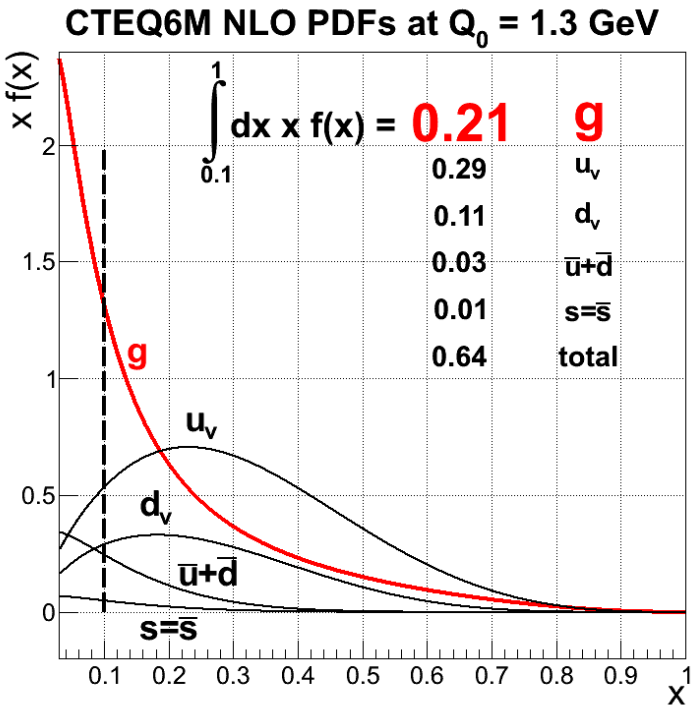
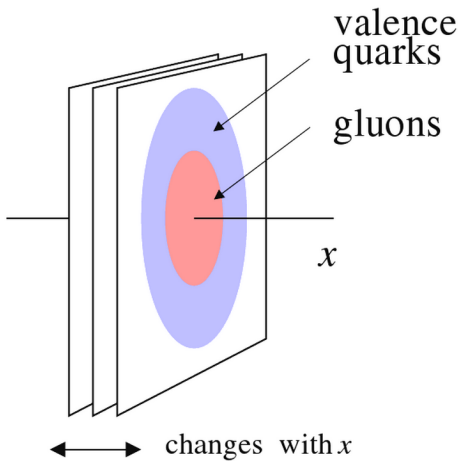
Gluons at large x





- Large glue density at $x > 0.1$

  PDF from global fits
  (F_2 evolution, $\nu_{\mathbf{DIS}}$, jets)

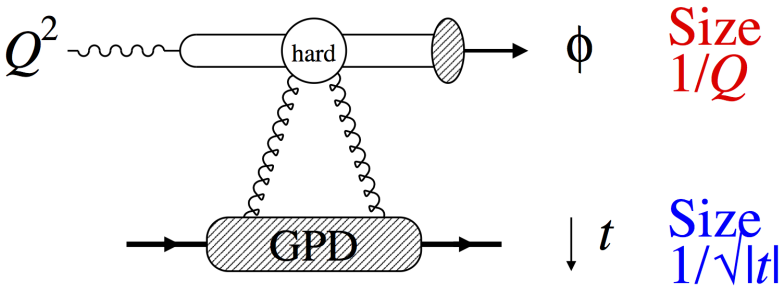
  Gluons carry more than 30%
  of the momentum for $0.1 < x$

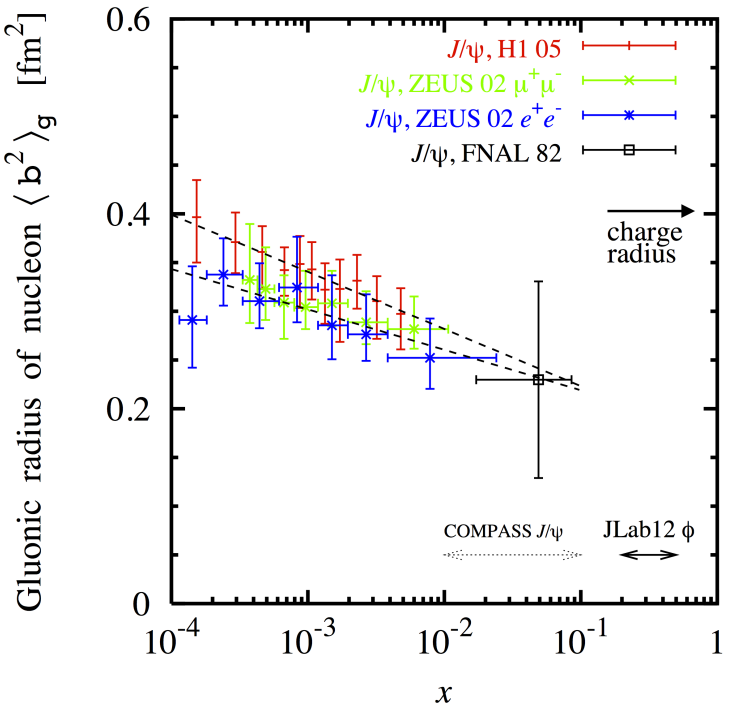
- 3D imaging of the nucleon

  spatial distribution of valence quarks :
  elastic scattering, DVCS, ...

  Nucleon gluonic radius ?
  exclusive ϕ

Nucleon gluonic radius at 11 GeV





- Exclusive ϕ electroproduction as the best probe of gluon GPD at 11 GeV

  Dominance of small-size configurations at $Q^2 \sim$ few GeV^2

  GPD = Universal gluon form factor

- Gluonic radius as a function of x

  Small x : radius grows through parton diffusion

  $x < 0.01$ measured: J/ψ and ϕ at HERA H1/ZEUS and Fermilab

  $x > 0.1$ unknown range : ϕ with CLAS12

CLAS12 Exclusive ϕ electroproduction

Analysis of the cross-section in two steps :

- Test the approach to small-size regime, through model-independent features

  When do t-slopes become independent of Q^2 ?
  How does W-dependence change with Q^2 ?
  L/T ratio and s-channel helicity conservation

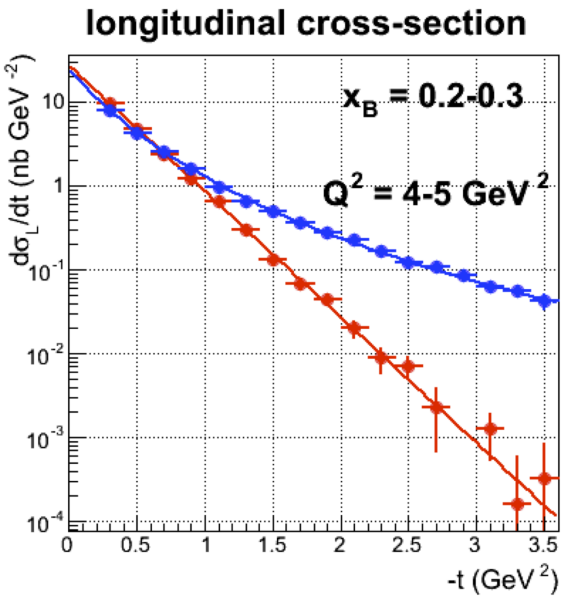
- Extract the gluonic radius accross the valence region from the *relative* t-dependence of the differential cross-section

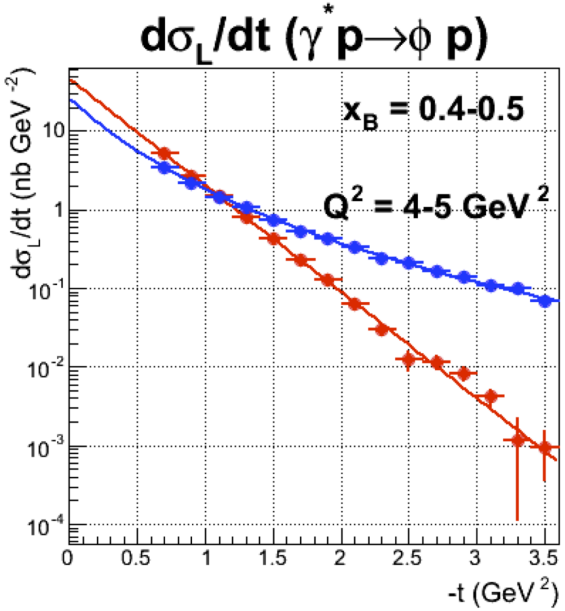
  Average gluonic radius : model independent
  Change with x : use GPD models (e.g. Double-Distribution)

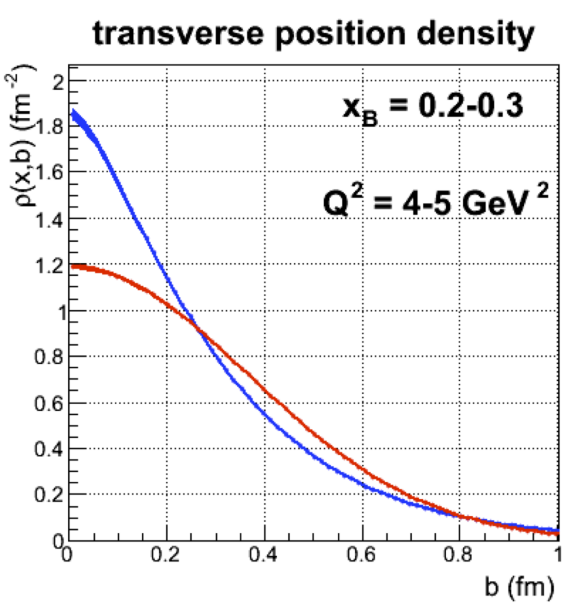
$$\frac{\frac{d\sigma}{dt}(t)}{\frac{d\sigma}{dt}(t=0)} \propto \frac{\langle H^g(t)\rangle^2}{\langle H^g(t=0)\rangle^2} \quad + E^g \text{ contribution}$$

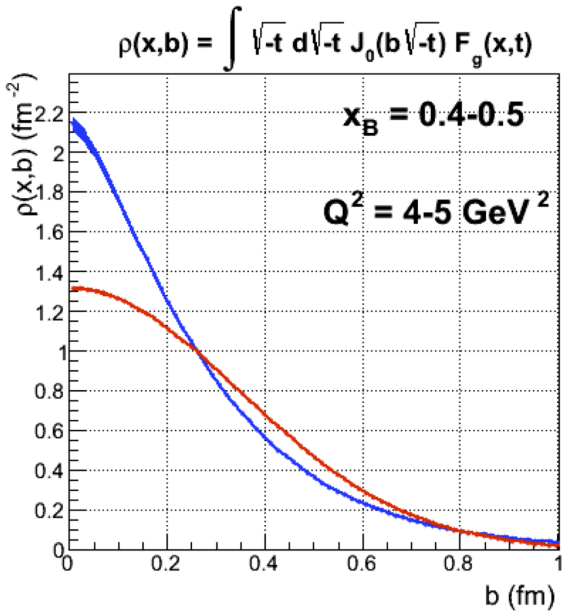
$$\hookrightarrow \langle b^g \rangle^2$$

Extraction of gluonic profiles









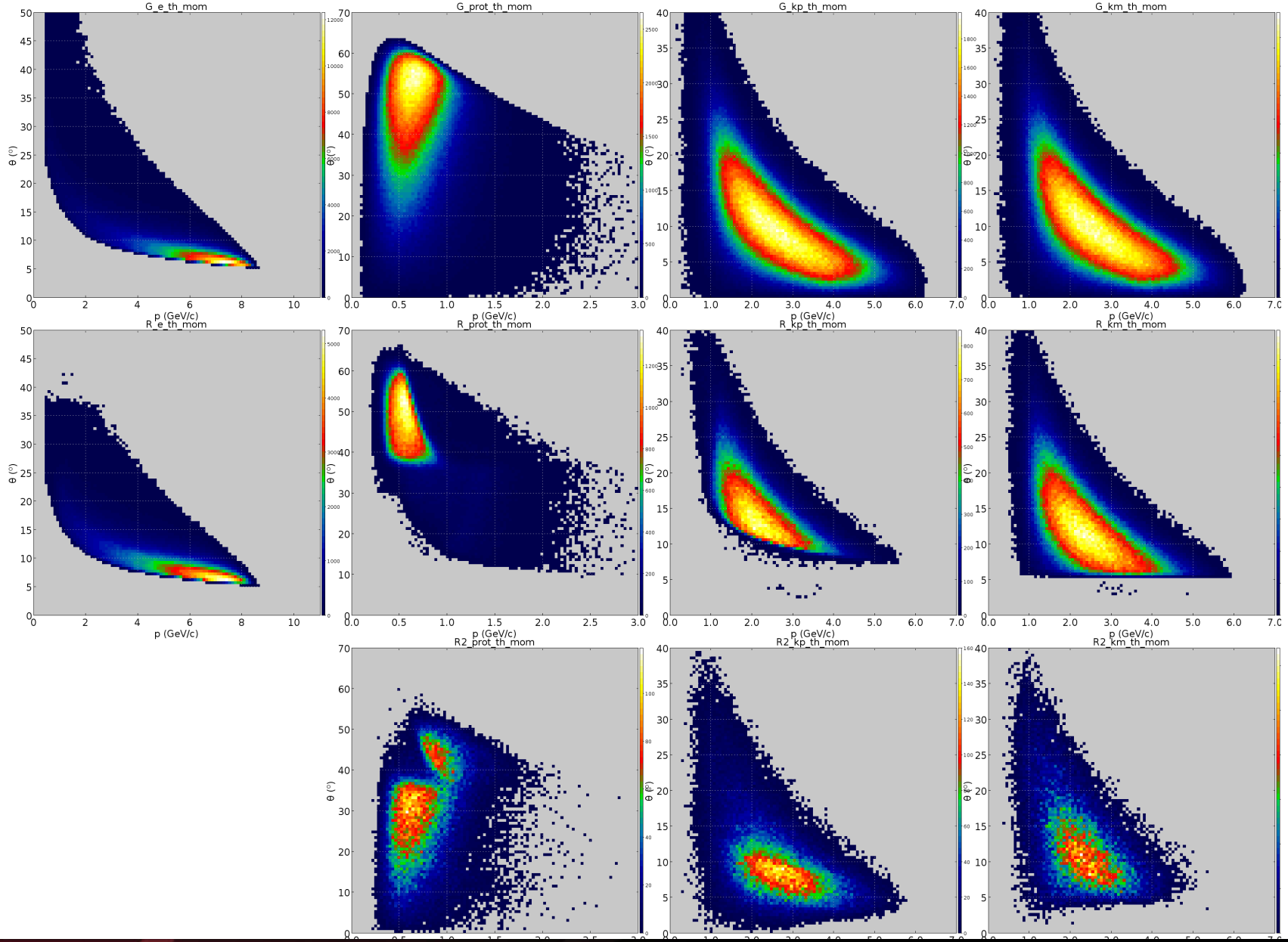
Longitudinal cross-section

Corresponding sensitivity in transverse position space

$$b = 1/\sqrt{-t}$$

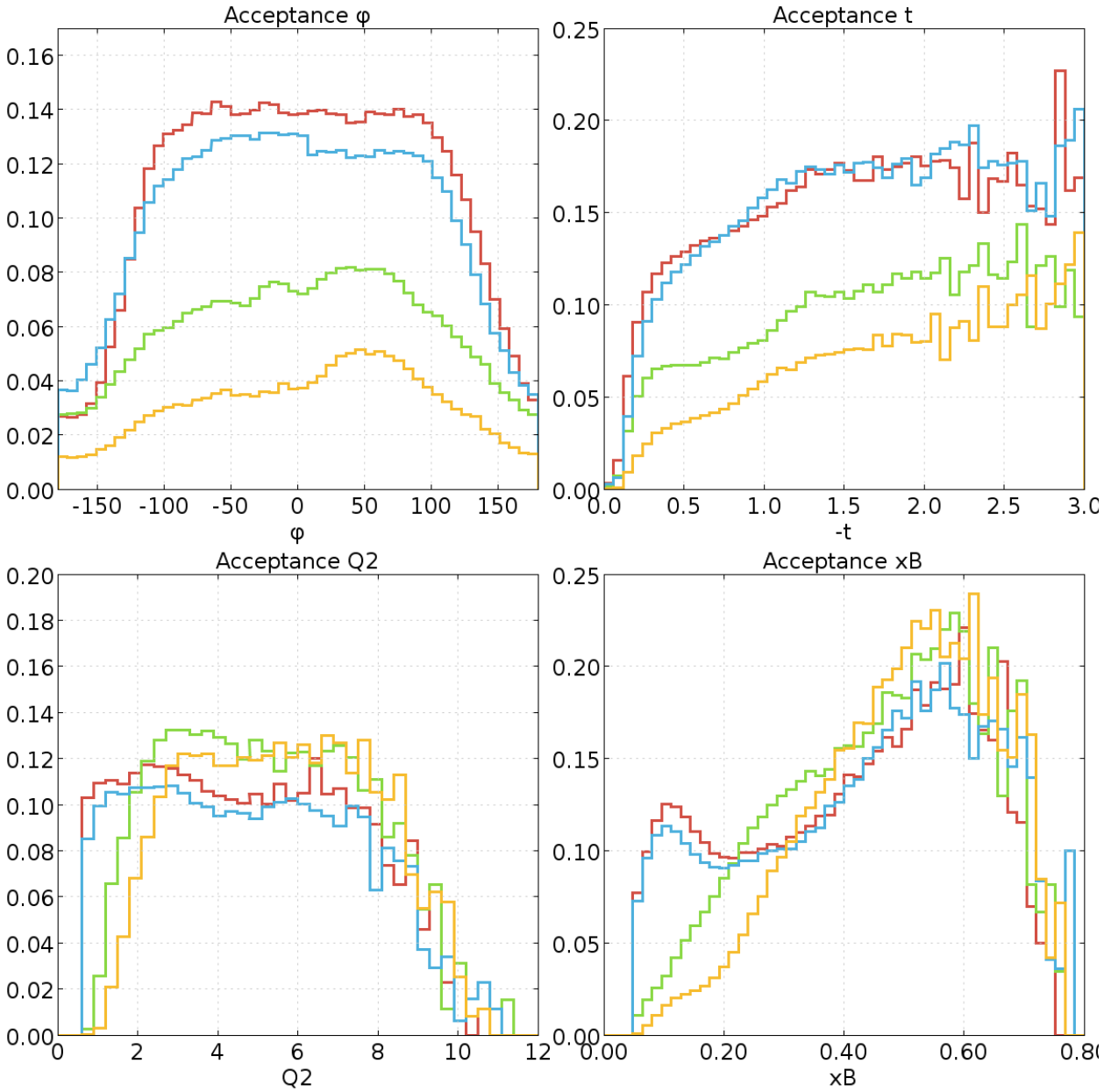
Error propagation study
Skewness $\xi \neq 0$ neglected

$0.05 < x_B < 0.8$, $0.8 < Q^2 < 14$, $0.01 < -t < 5$, $\theta_e > 4^\circ$, $W > 1.5$, $E' > 0.5$
5 cm long target ; Torus Fields : $\pm 1.0, \pm 0.75$; Sol. Field : 1.0, 0.7
Desired config : torus +0.75 and sol 0.7 (negative outbending)



Fully Integrated Acceptances Table, results given in %

	Torus -1 / Sol 1 Torus -1 / Sol 1	Torus -0.75 / Sol 0.7 Torus -0.75 / Sol 0.7	Torus 1 / Sol 1 Torus 1 / Sol 1	Torus 0.75 / Sol 0.7 Torus 0.75 / Sol 0.7
single e	28	40	52	54
proton	11	14	20	20
K+	32	31	14	18
K-	15	19	32	31
Full Excl	0.15	0.37	0.68	0.95
p miss	0.6	1.9	2.4	3.0
K+ miss	0.5	0.8	3.8	3.6
K- miss	1.5	2.1	0.98	1.4
One miss	2.6	4.9	7.1	8.1



1D Integrated Acceptances

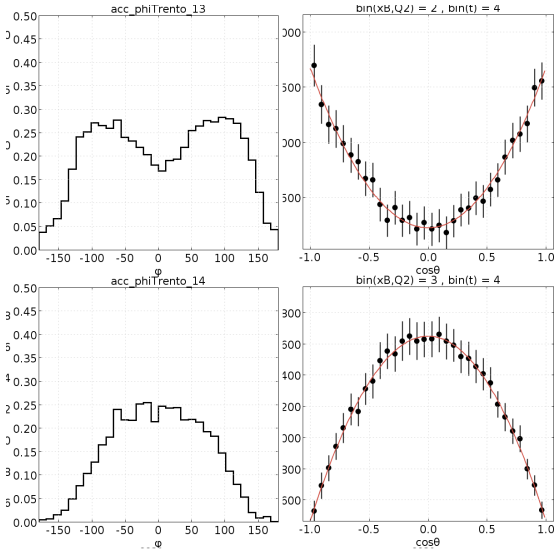
Torus 0.75 / Sol 0.7

Torus 1 / Sol 1

Torus -0.75 / Sol 0.7

Torus -1 / Sol 1

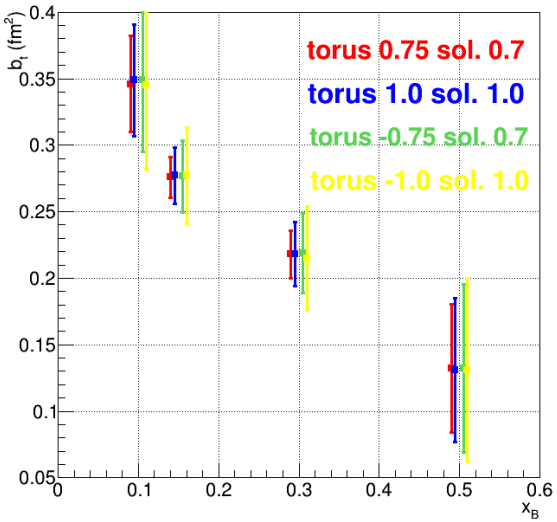
Projected Results for Deep ϕ t-slopes



Left column : ϕ acceptances
used for amplitude extraction in **SCHC test**

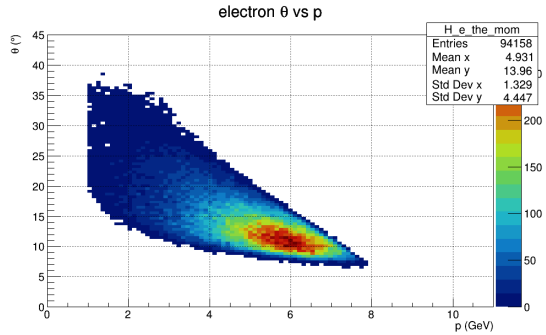
Right column : $\cos\theta_{CM}$ of meson decay
allows **separation of σ_L and σ_T** under SCHC

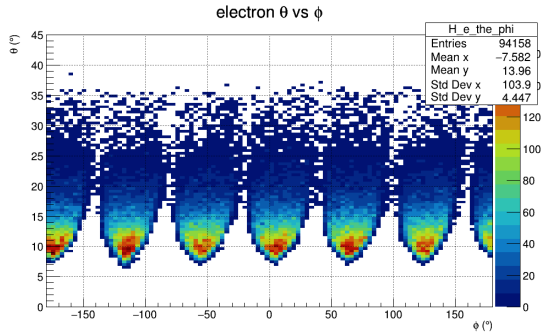
Deep ϕ σ_L t-slopes

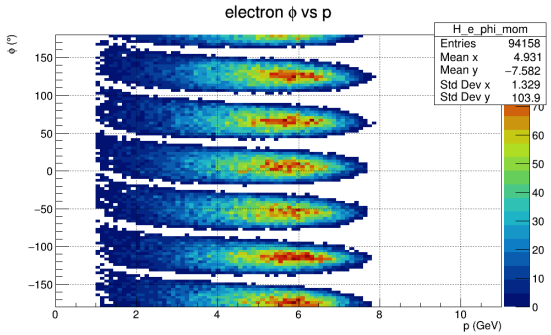


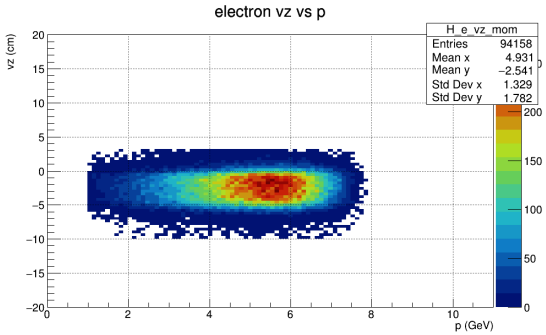
σ_L t-slopes extracted for different magnetic fields
Lower field and negative outbending torus are prefered

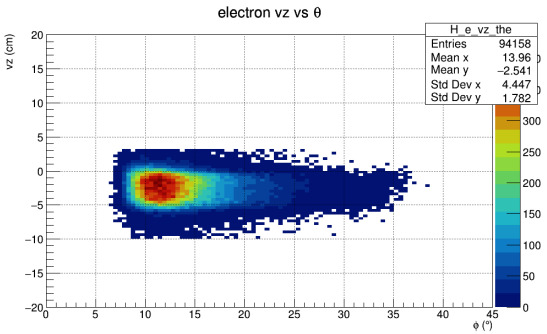
Spring19 Data fully exclusive sample

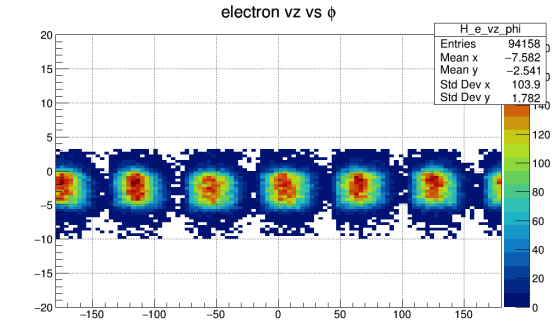


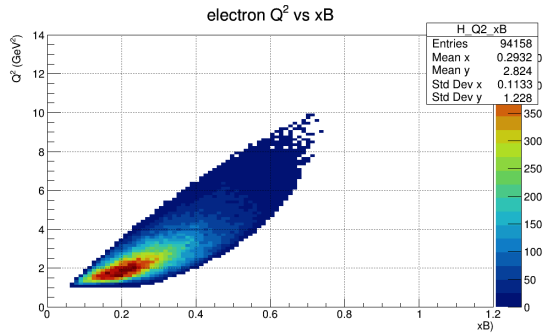


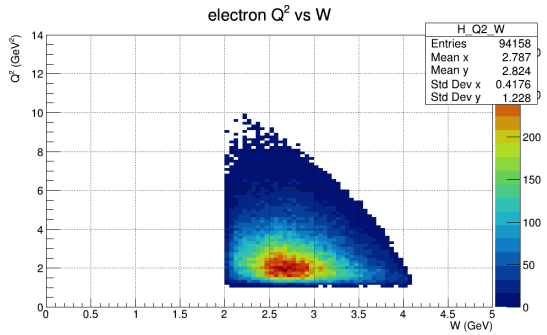


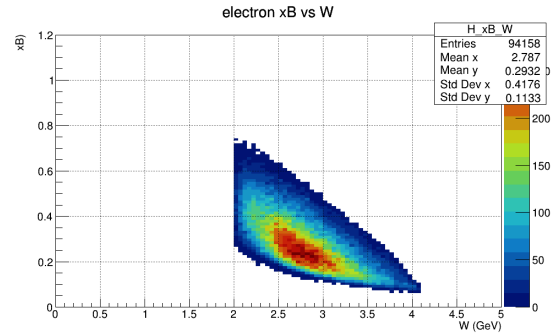












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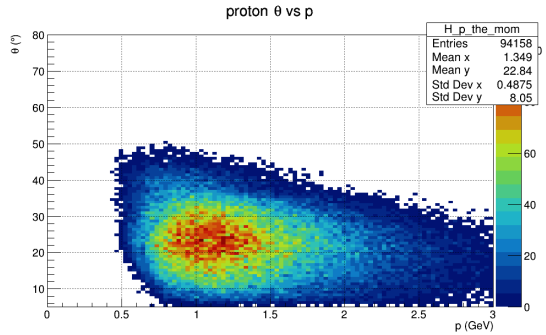

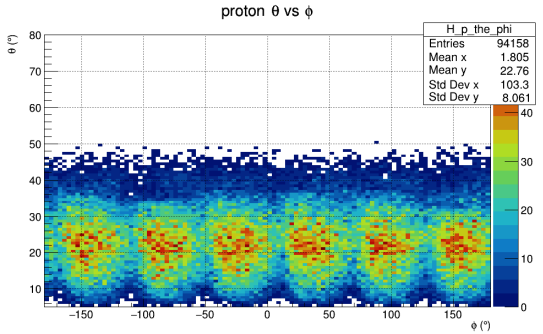

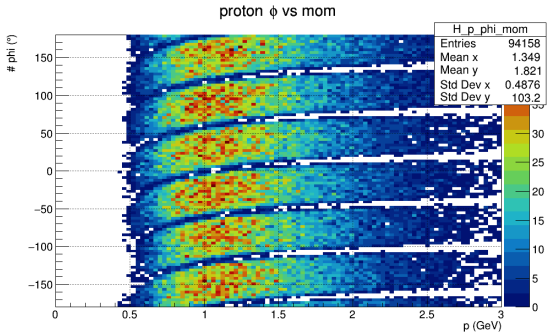

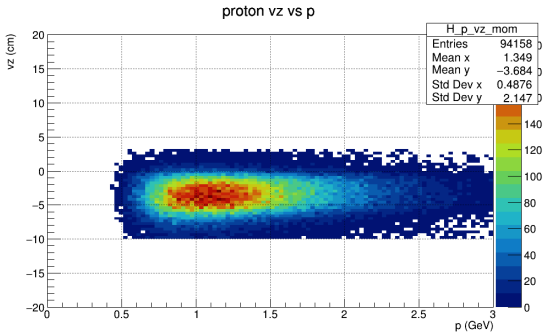

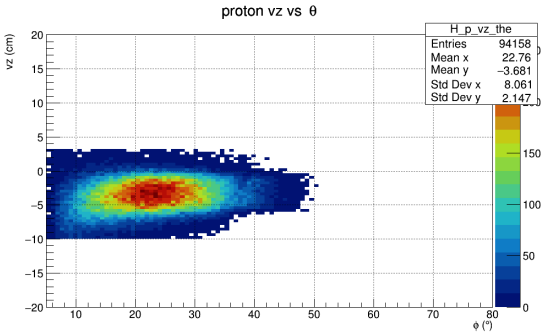

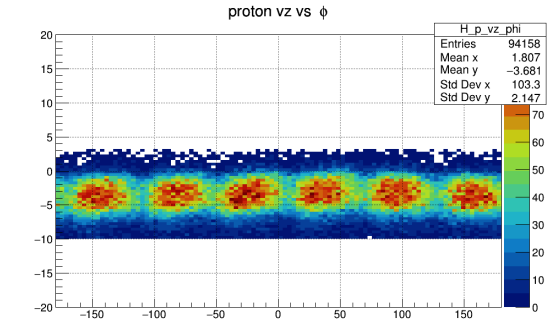

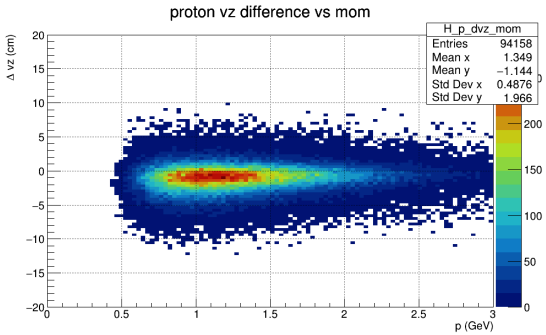

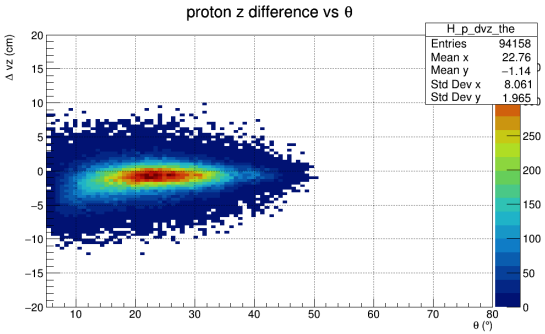

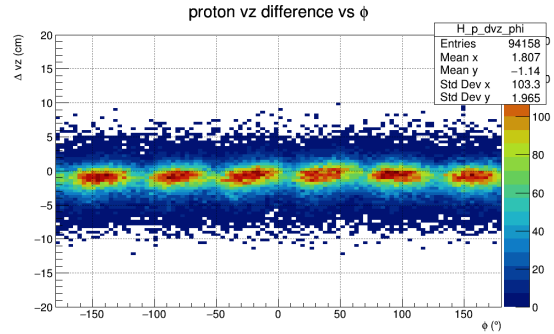

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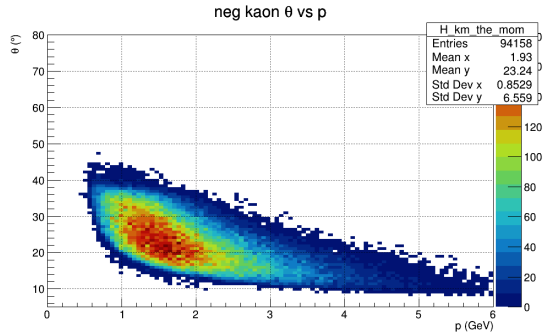

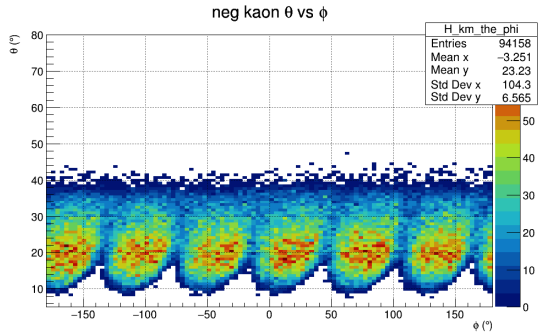

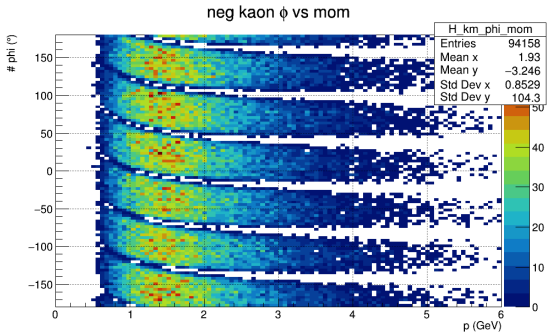

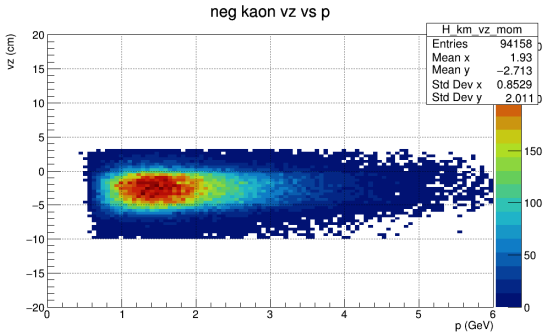

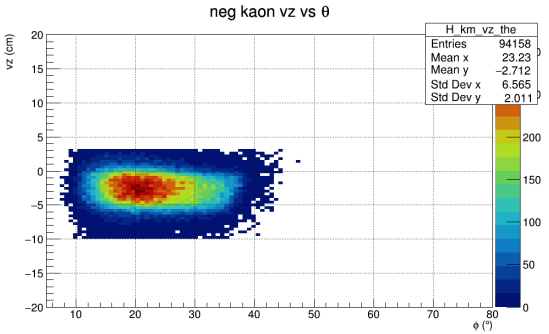

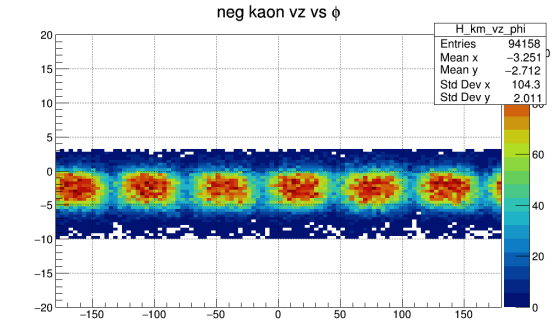

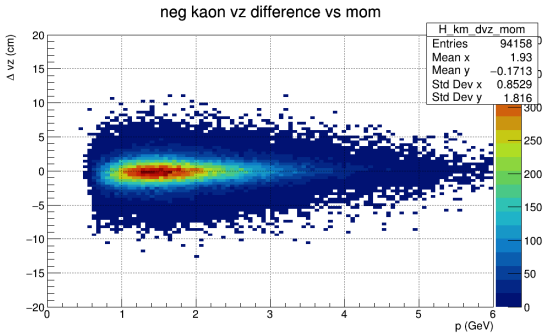

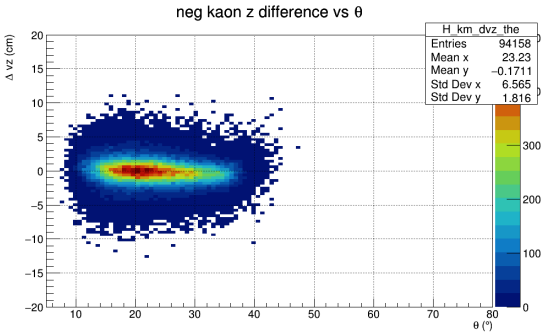

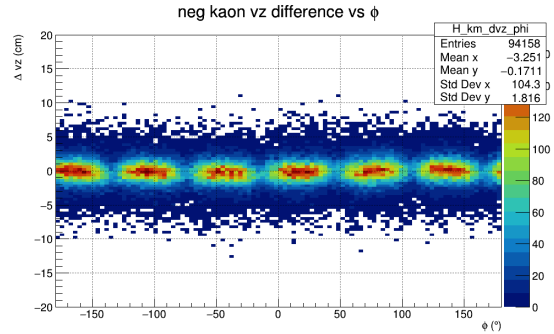

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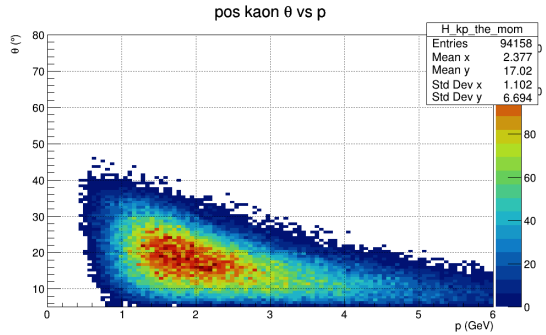
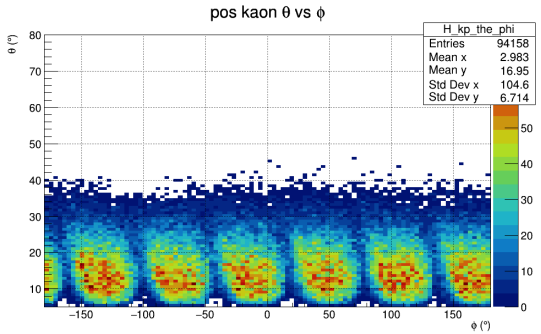
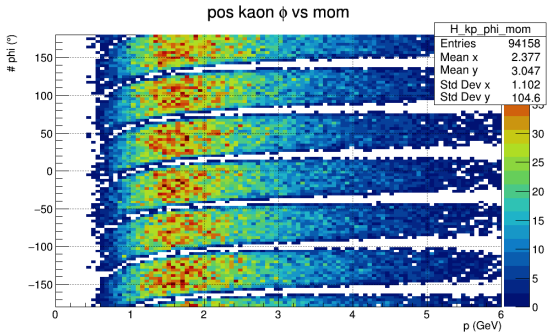
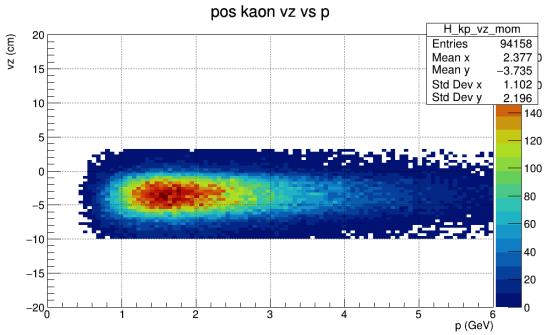
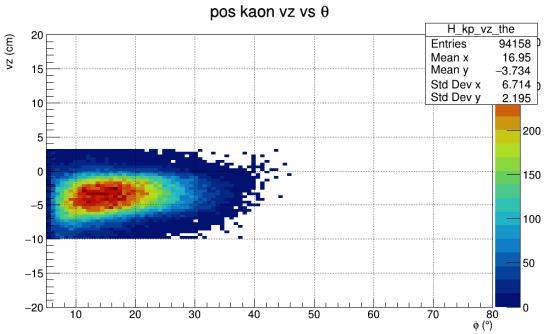
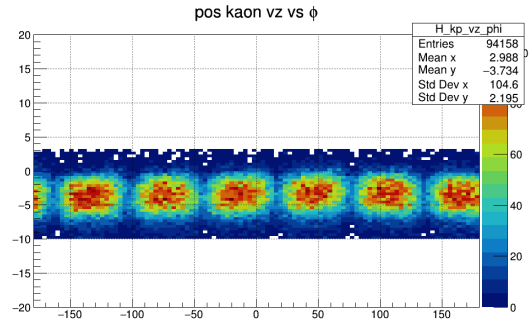


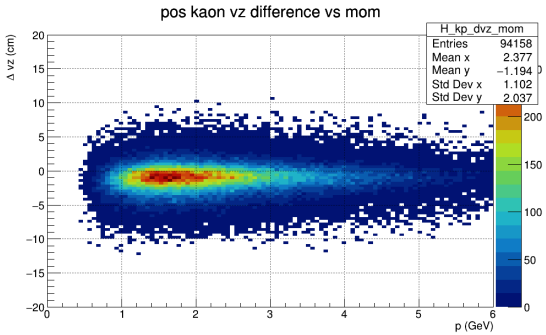


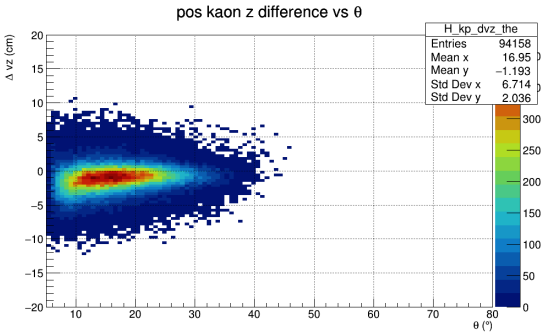


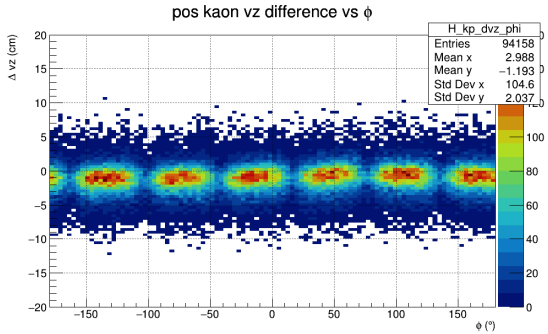




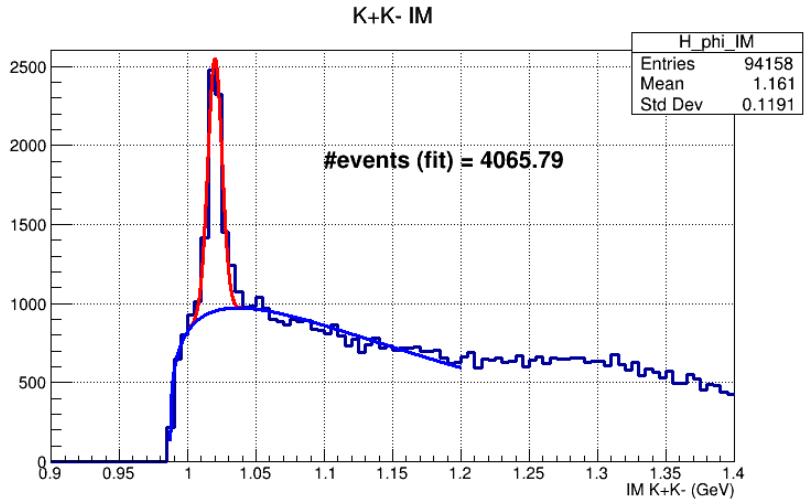


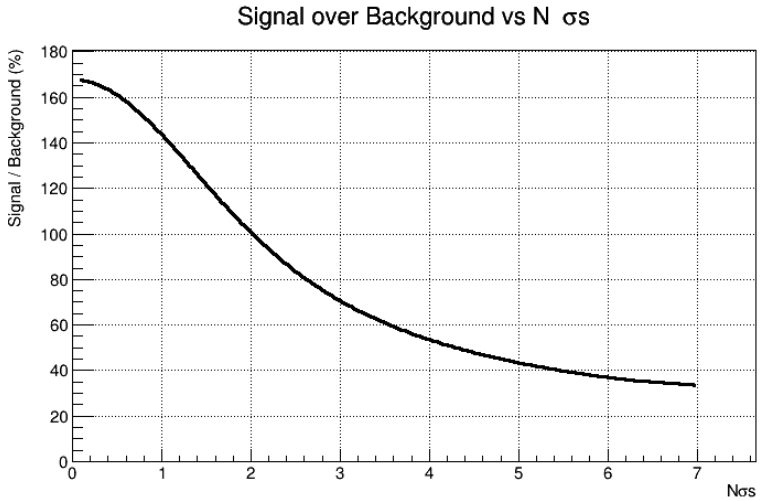


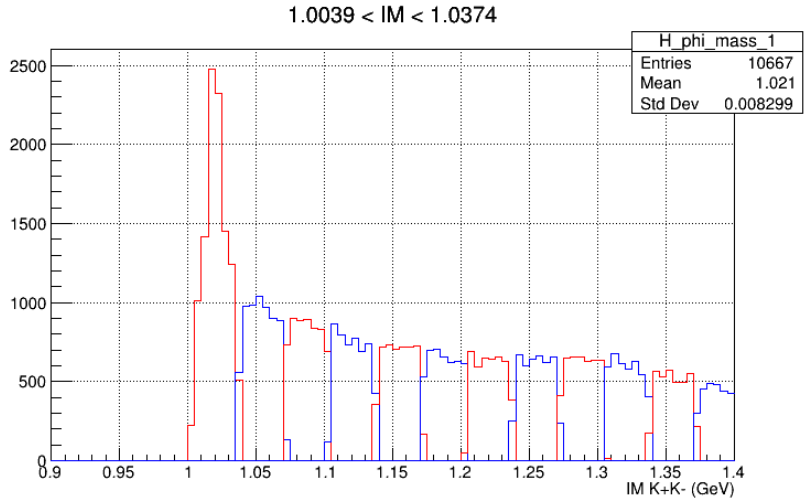


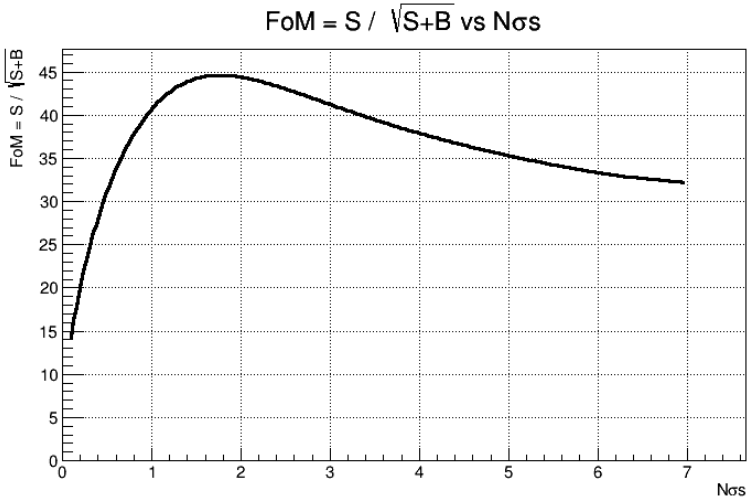


Spring19 Data fully exclusive sample









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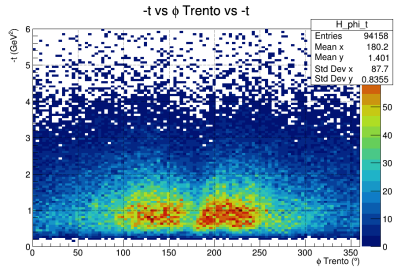
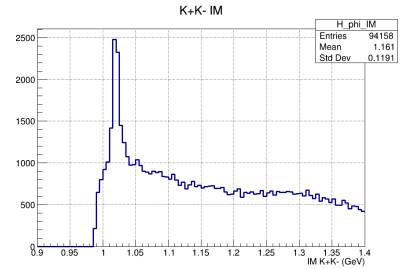
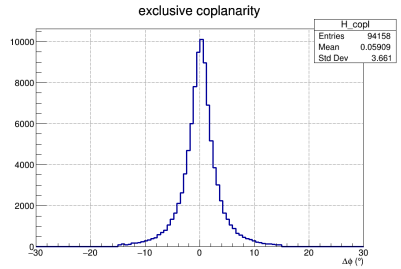
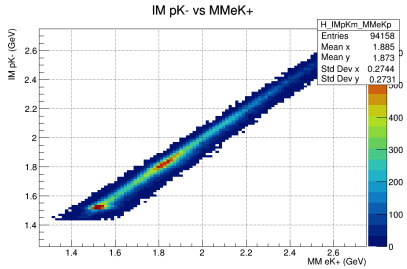
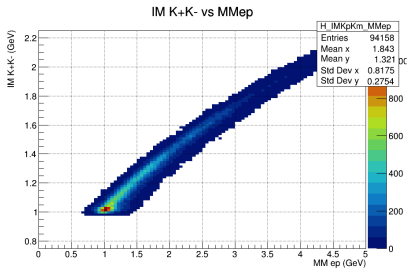
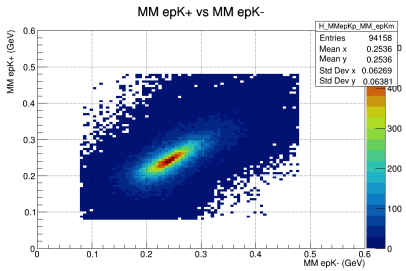


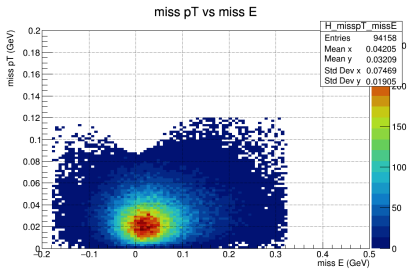


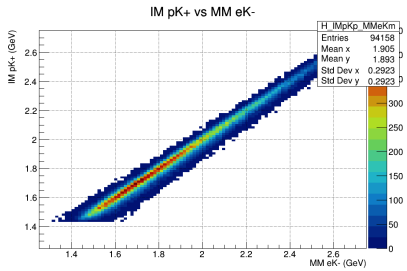


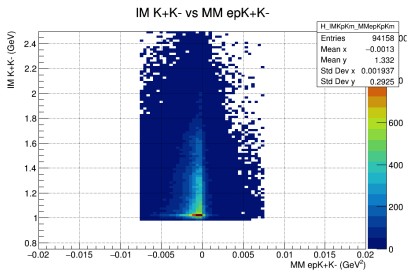


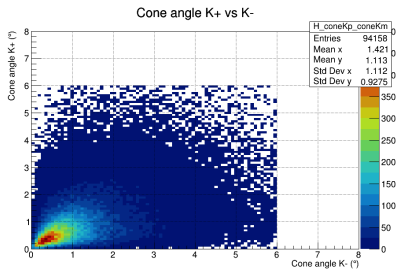


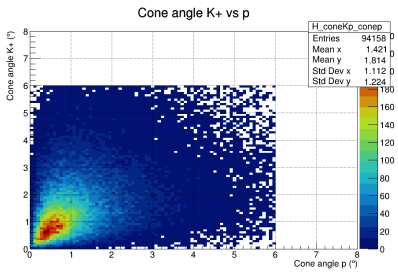


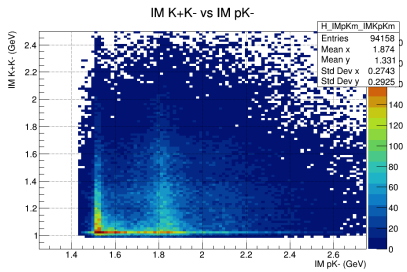




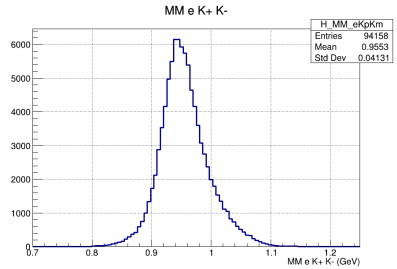


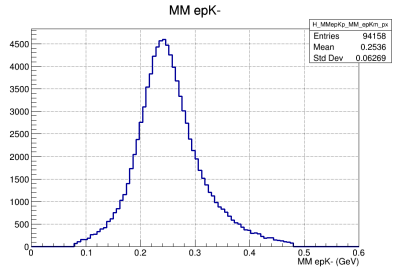


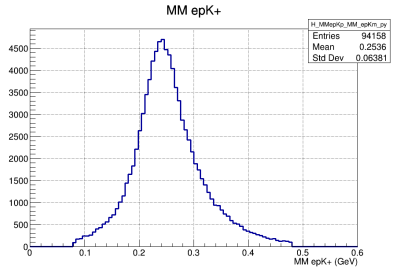


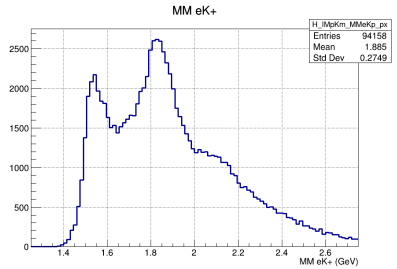


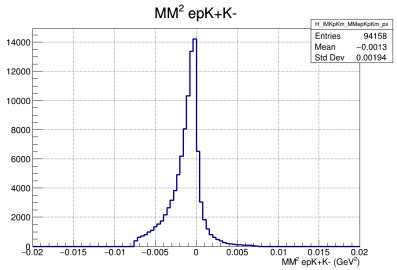
Spring19 Data fully exclusive sample

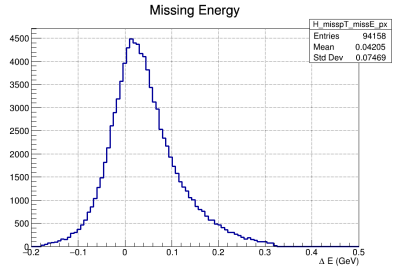


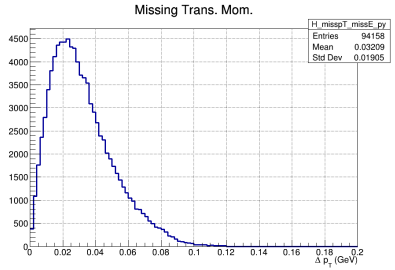


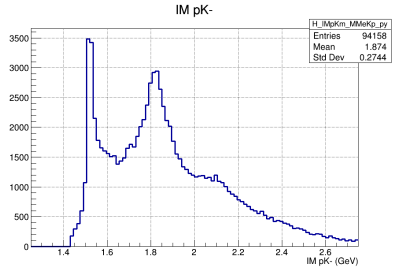


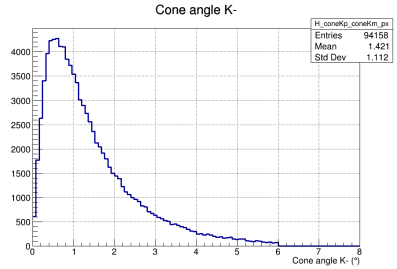


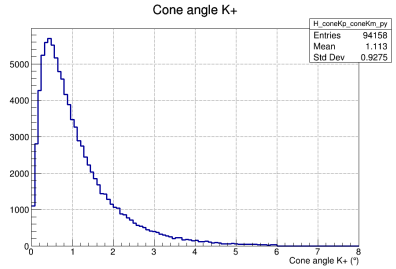


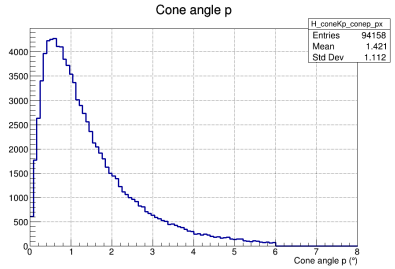


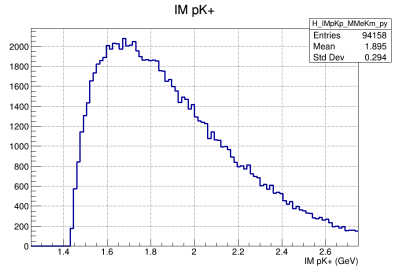




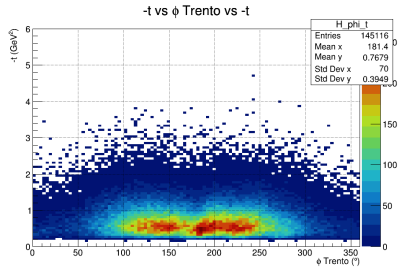


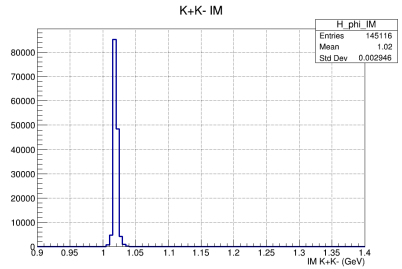


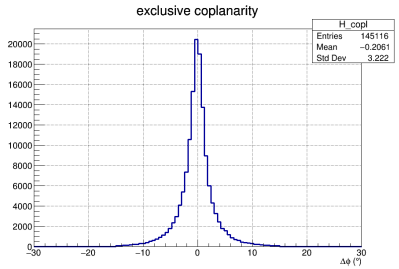


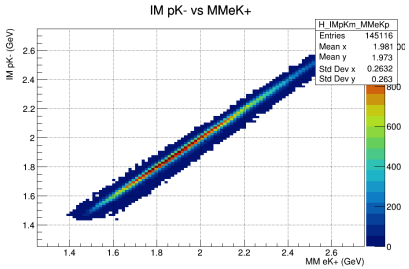


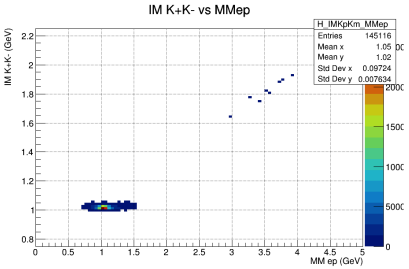
Simulations fully exclusive sample

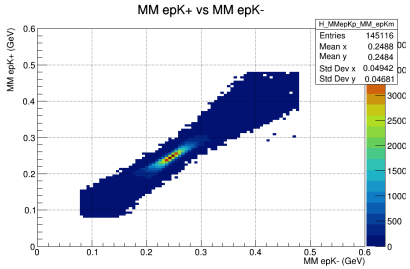


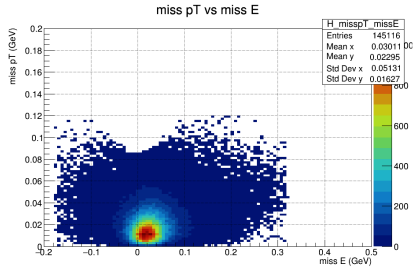


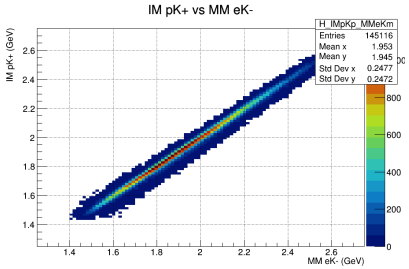


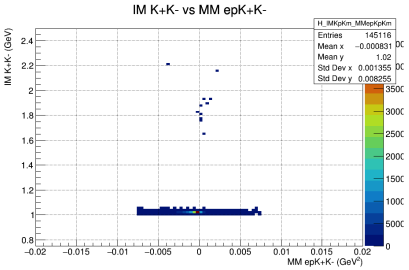


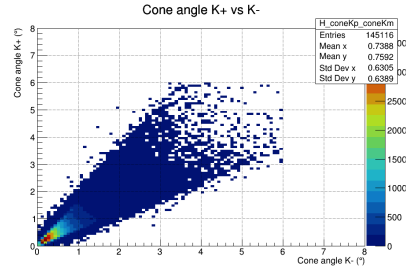


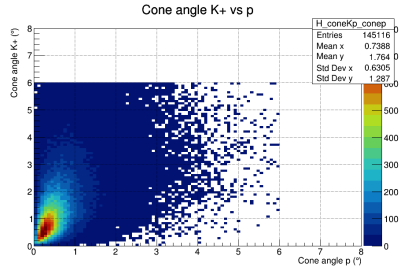


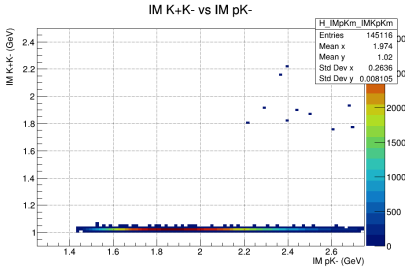




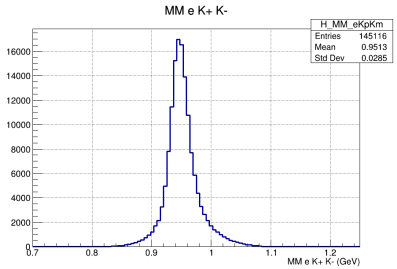


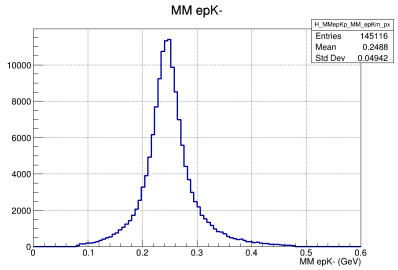


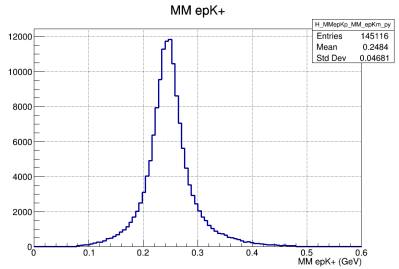


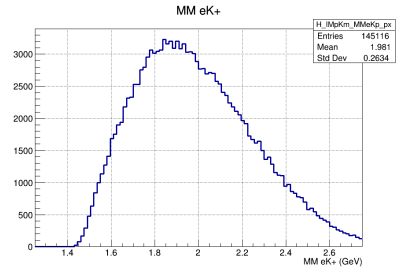


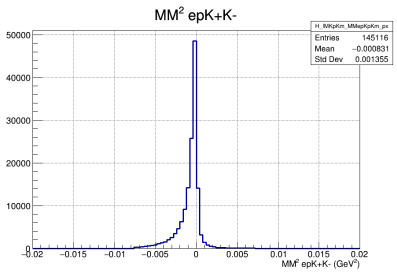
Simulations fully exclusive sample

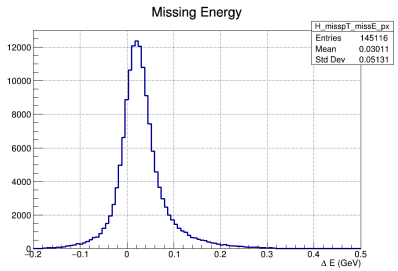


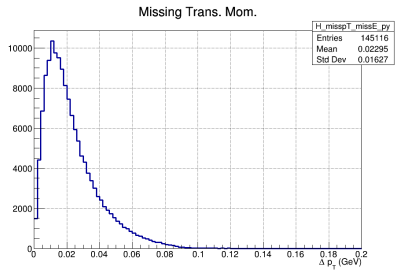


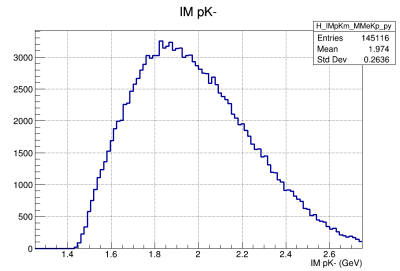


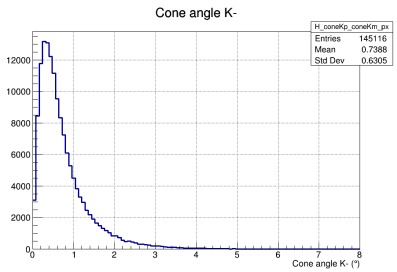


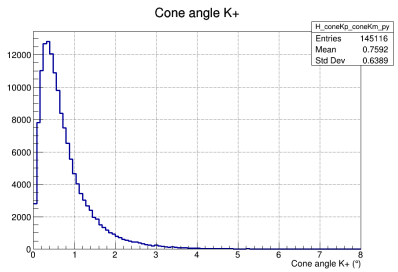


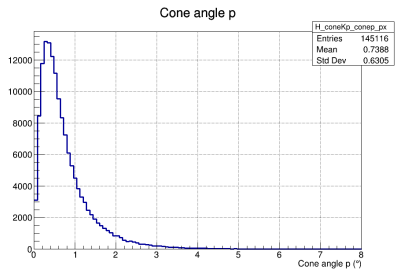


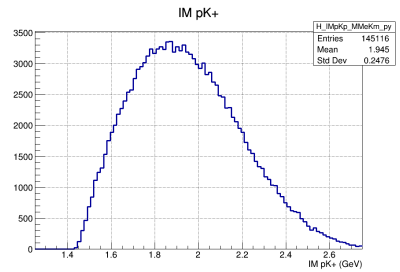












Ongoing and future work

- Tune MC resolutions to match data
- Investigate feasability of analysis with one missing particle
- $\rightarrow$ develop trains with one missing particle topology
- Feasability of L/T separation with available statistics
- Systematics related to t-slopes:
  - acceptance
  - proton efficiency
  - radiative corrections; extrapolation to $t = 0$
  - merging datasets with different energies (?)
  - ...