π^0 Cross section Update for kin 484 and 361

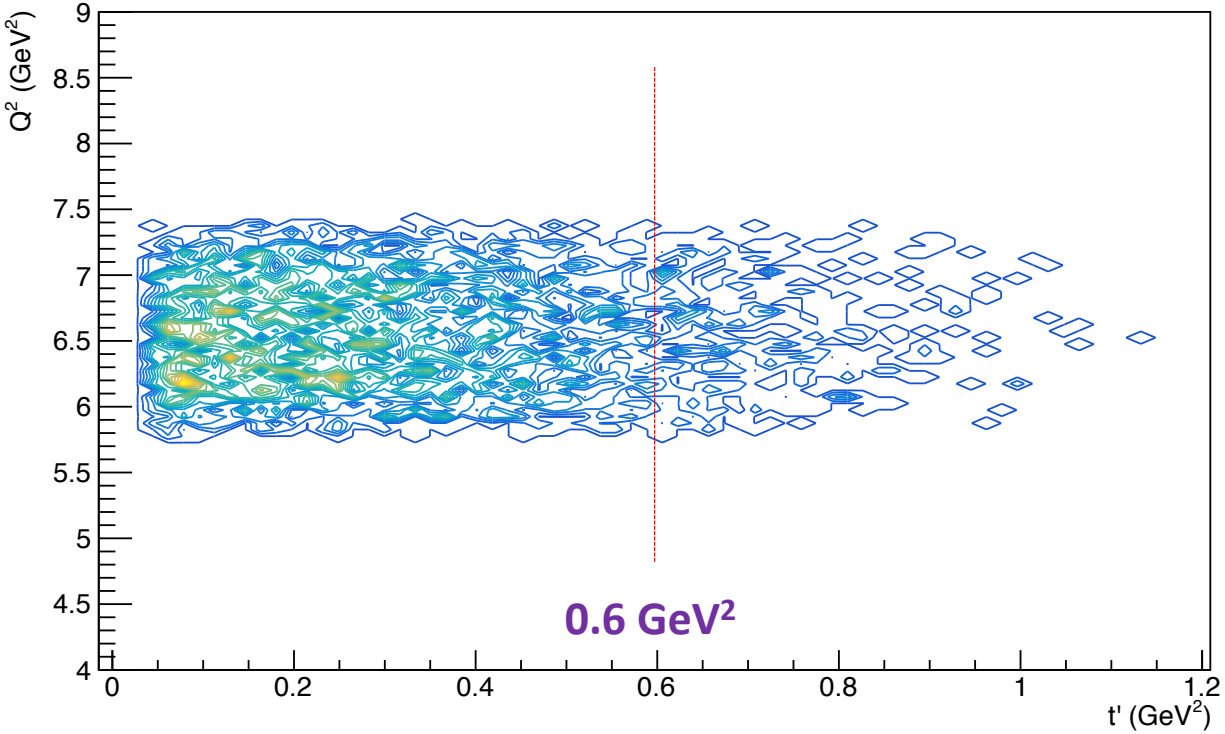
02-01-2020

Salina Ali

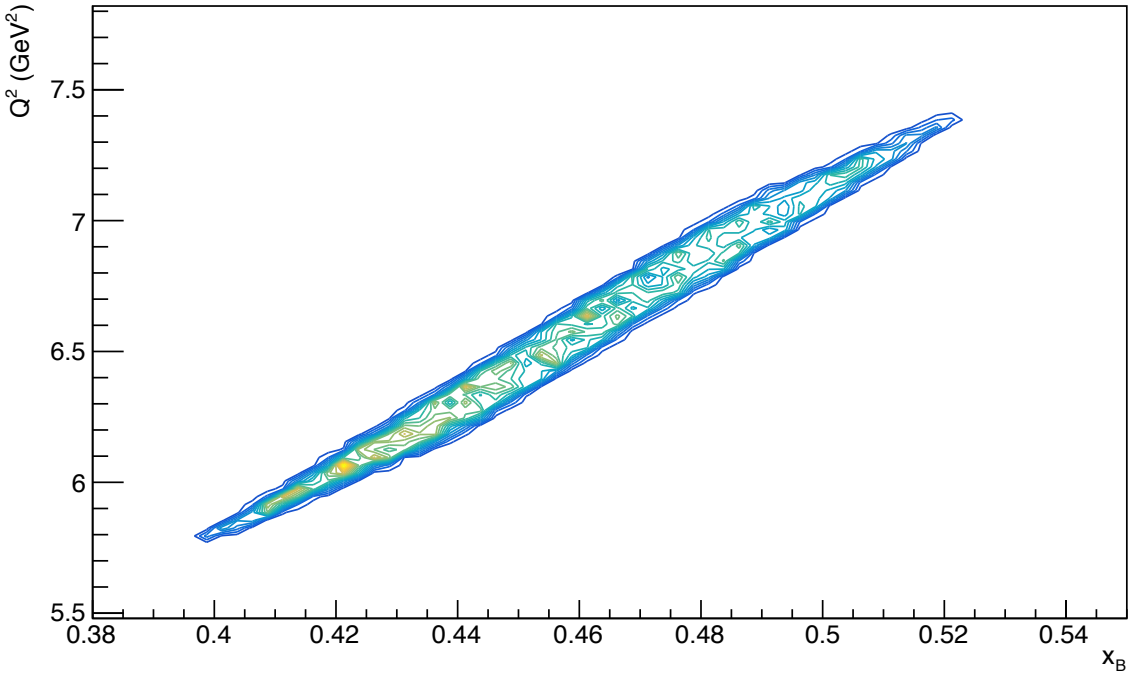
Kin 484: t’ binning and coverage

- Binning choice: t’ < 0.6 GeV^2
- Binning in t’: {0.0,0.096,0.165,0.238,0.37,0.6} (GeV^2)
  - 1st bin avg → t’ = 0.048 (GeV^2)
  - 2nd bin avg → t’ = 0.131 (GeV^2)
  - 3rd bin avg → t’ = 0.202 (GeV^2)
  - 4th bin avg → t’ = 0.304 (GeV^2)
  - 5th bin avg → t’ = 0.485 (GeV^2)

Q^2 vs. t’



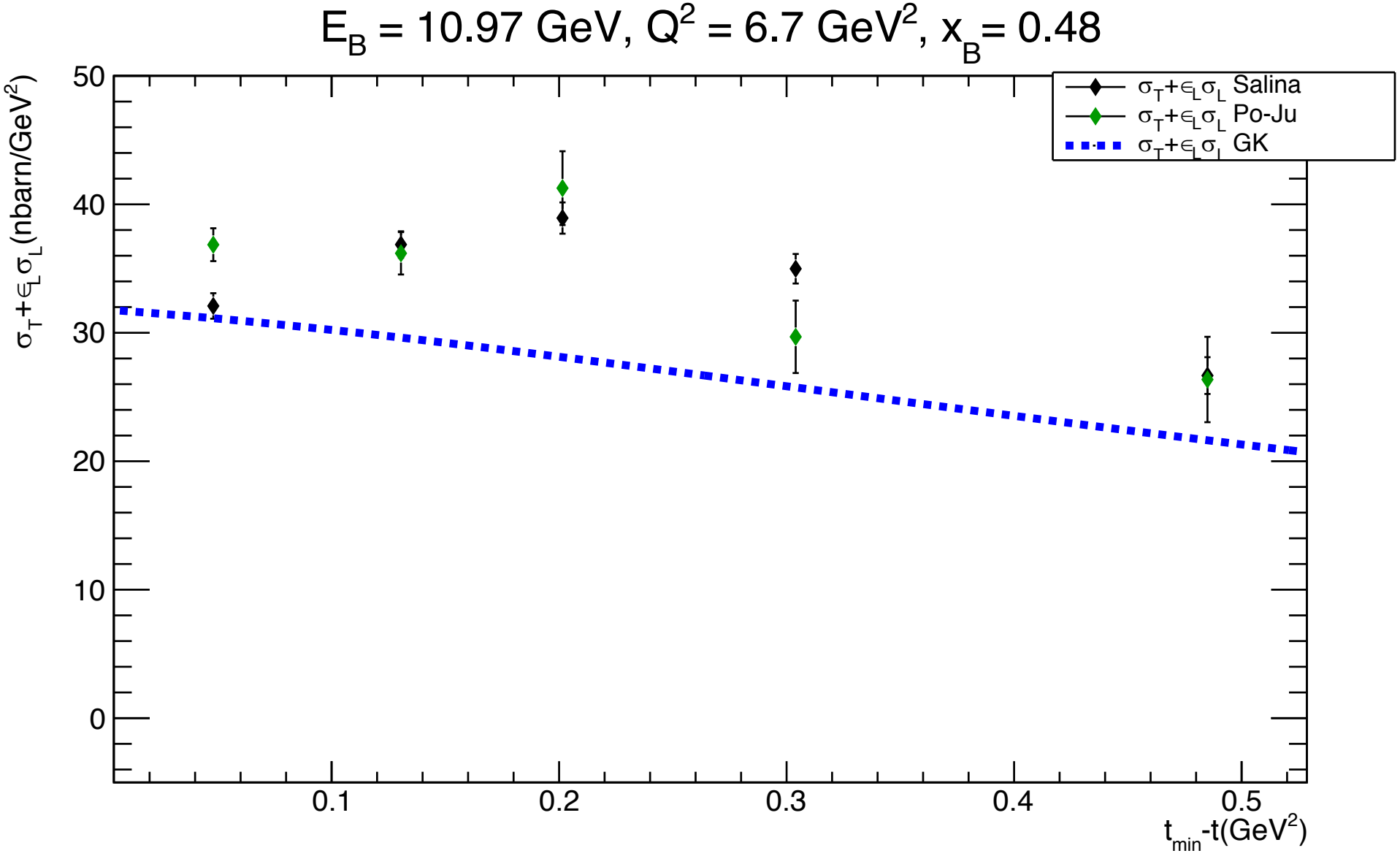
Q^2 vs. x_B



Cuts for kin 484

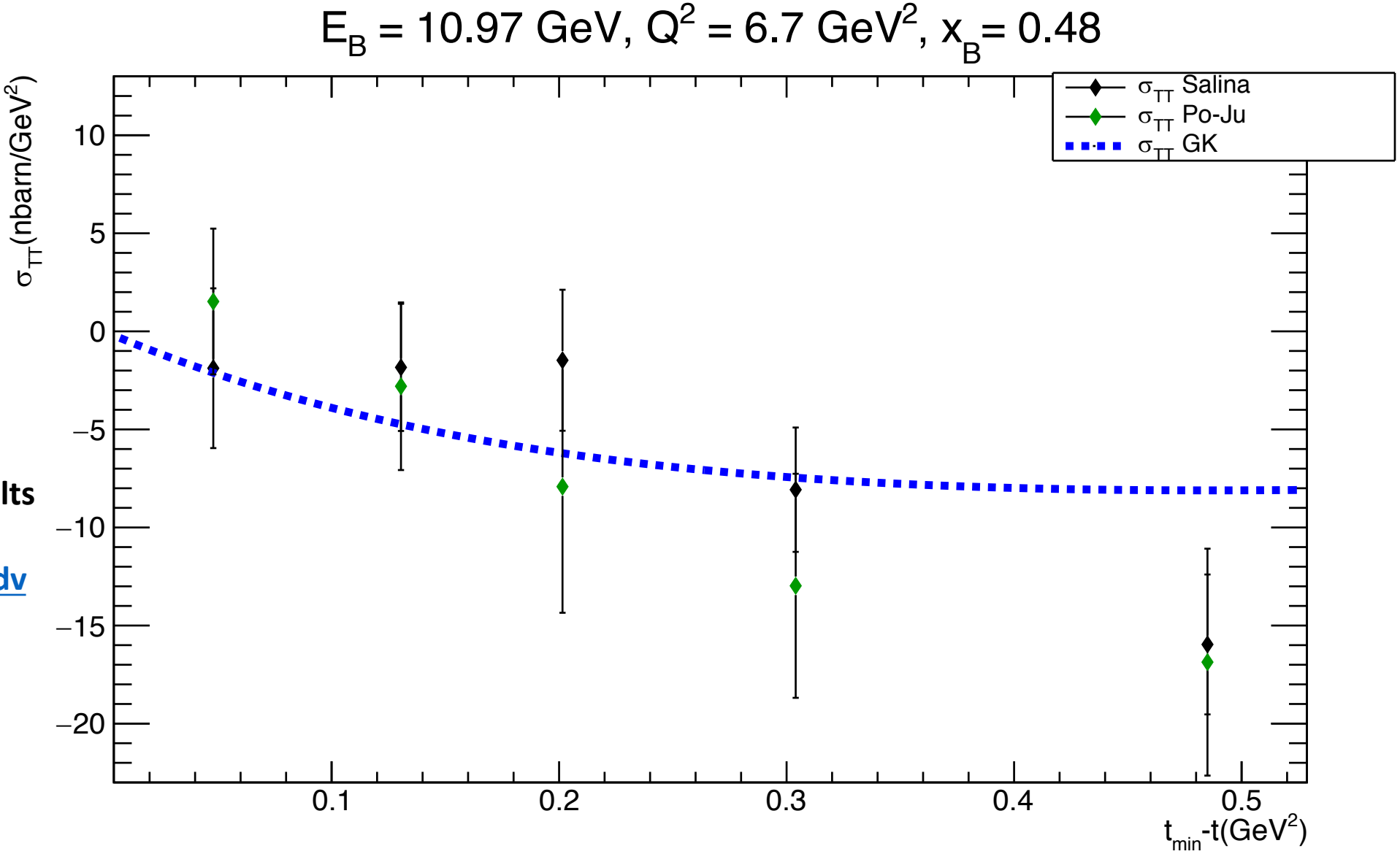
- Invariant mass cuts: $0.105 < M_{\gamma\gamma} < 0.165$ (GeV)
- Missing mass cuts: $0.5 < M_X^2 < 1.1$ (GeV^2)
- R-function cut: rval > -0.002
- (same as Po-Ju)

Kin 48_4 Cross section extraction (new GK): $\sigma_T + \epsilon\sigma_L$



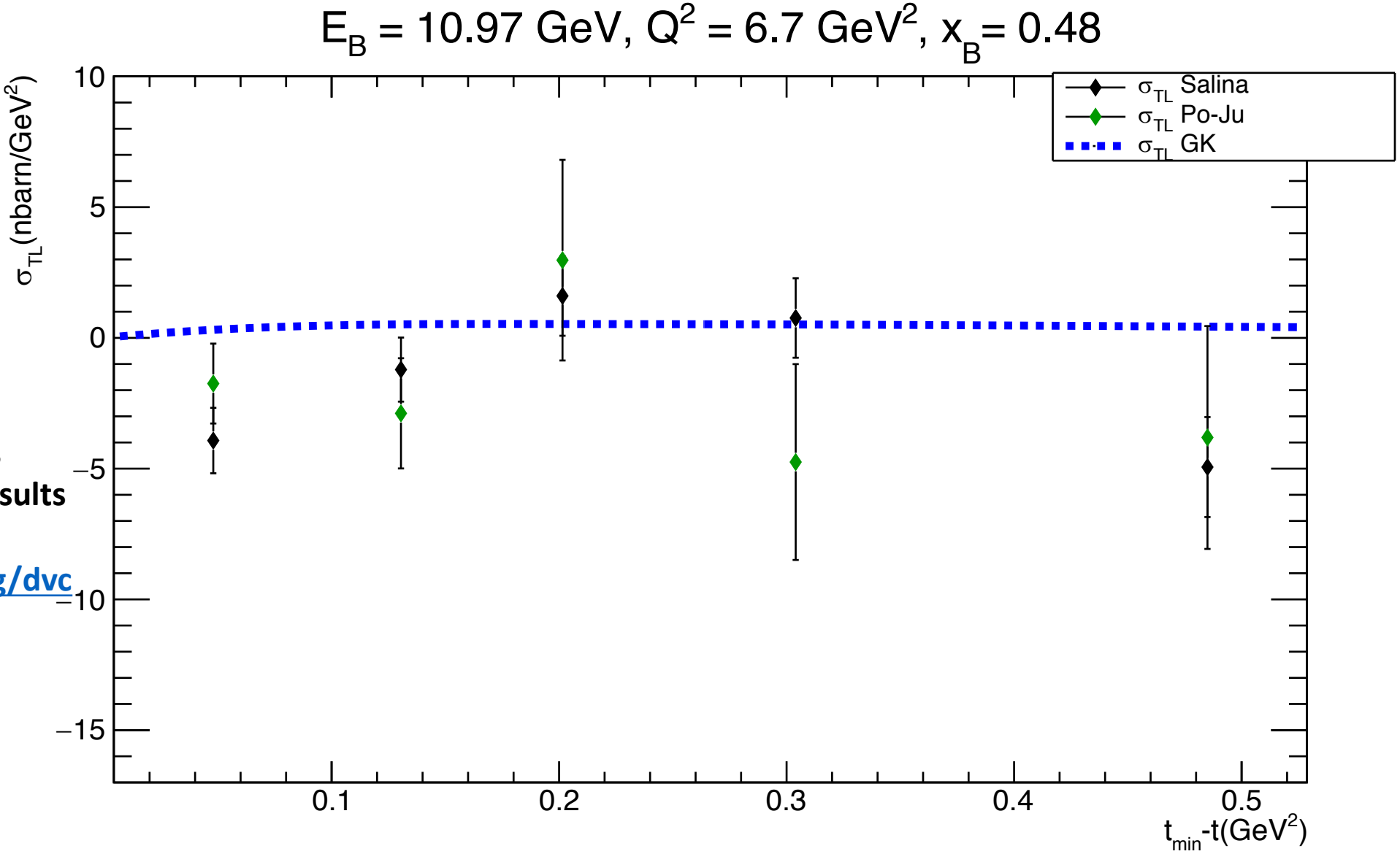
Black points = My results
Green = Po-Ju's recent results
Blue = GK Model(new):
https://hallaweb.jlab.org/dvcslog/12+GeV/625

Kin 48_4 Cross section extraction (new GK): σ_{TT}



Black points = My results
Green = Po-Ju's recent results
Blue = GK Model(new):
https://hallaweb.jlab.org/dvcslog/12+GeV/625

Kin 48_4 Cross section extraction (new GK): σ_{TL}



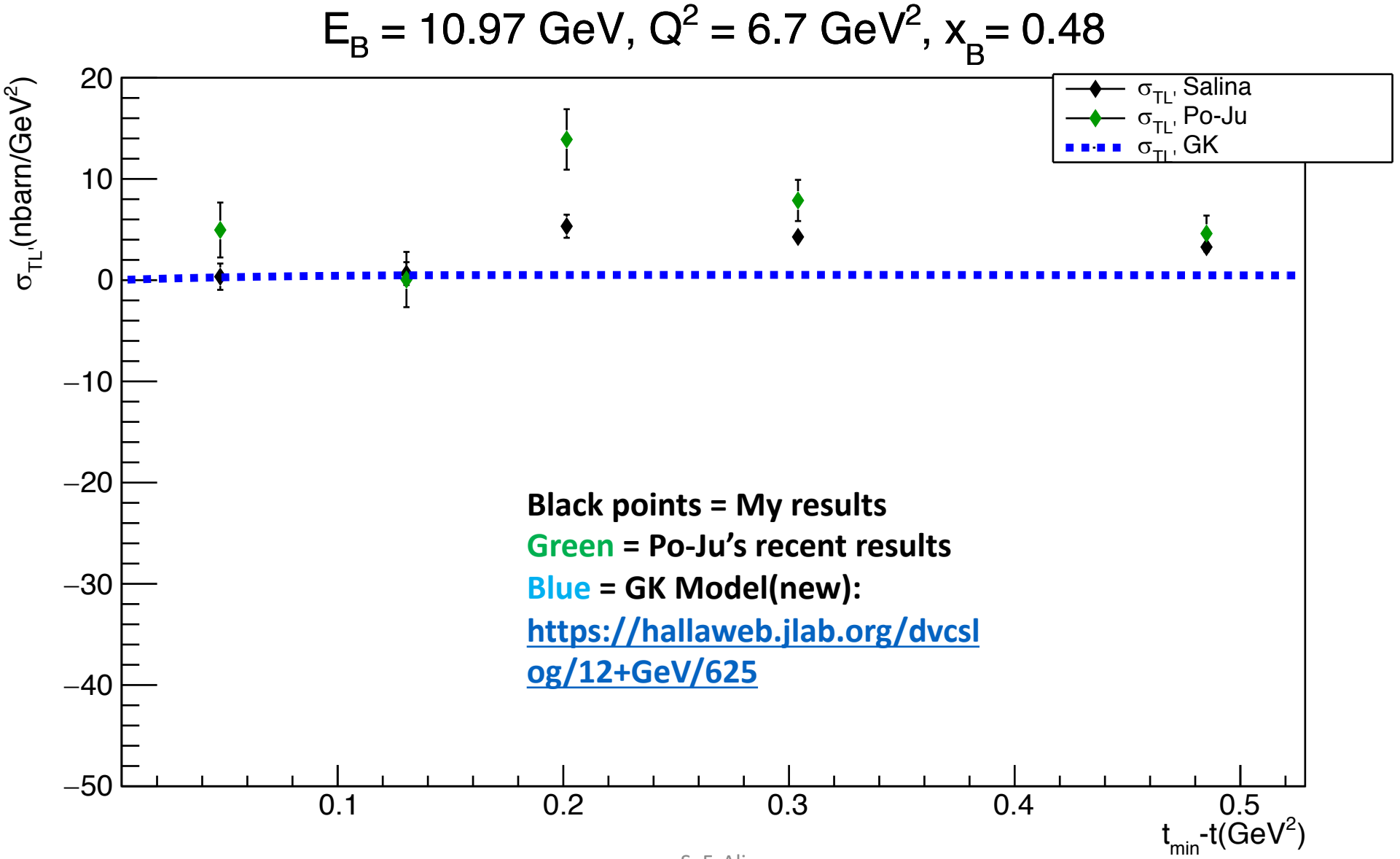
Black points = My results

Green = Po-Ju's recent results

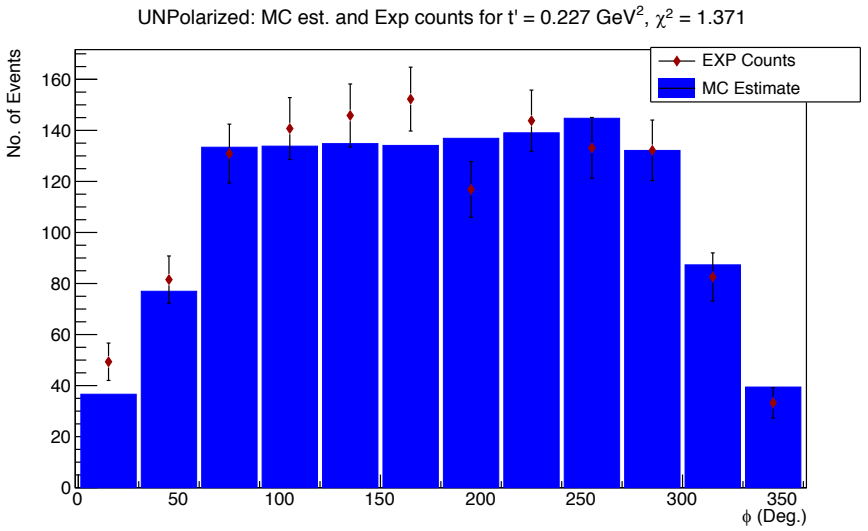
Blue = GK Model(new):

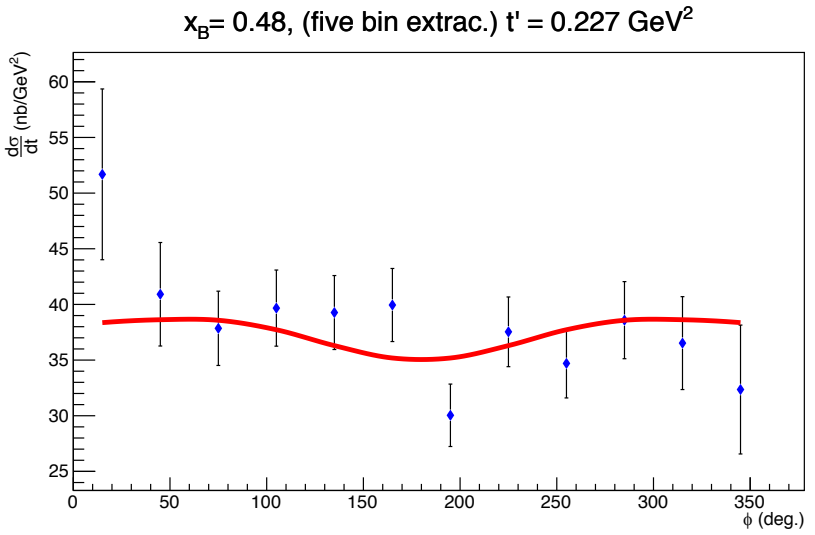
https://hallaweb.jlab.org/dvcslog/12+GeV/625

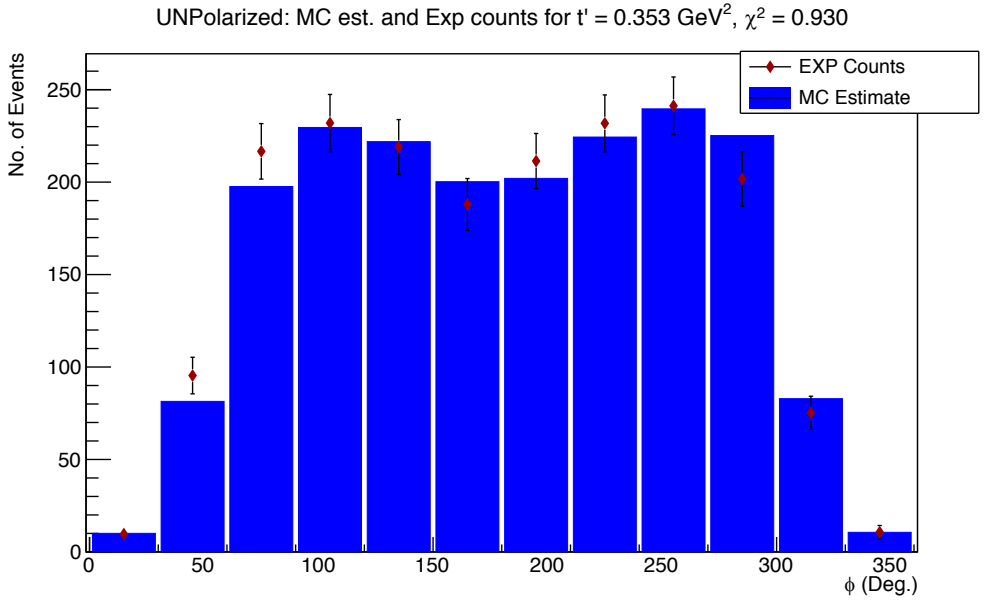
Kin 48_4 Cross section extraction (new GK): $\sigma_{TL'}$

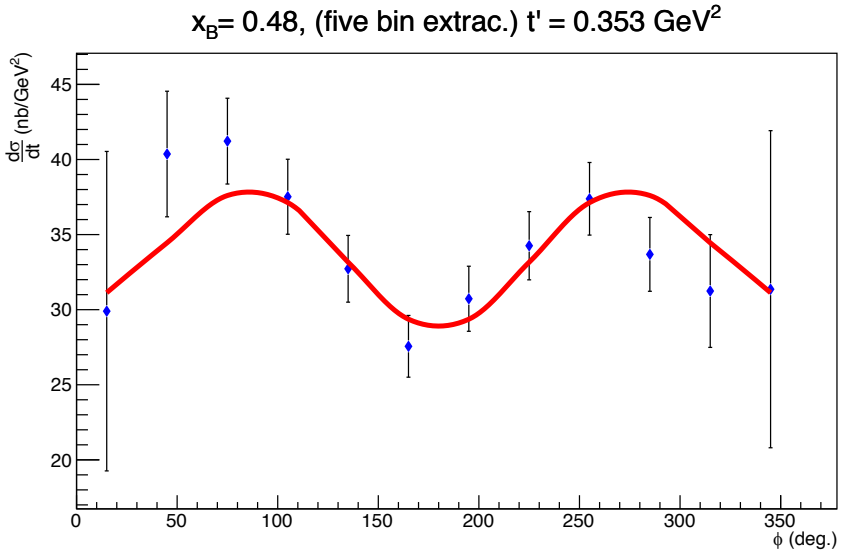


Total cross section (48_4) → Helicity independent

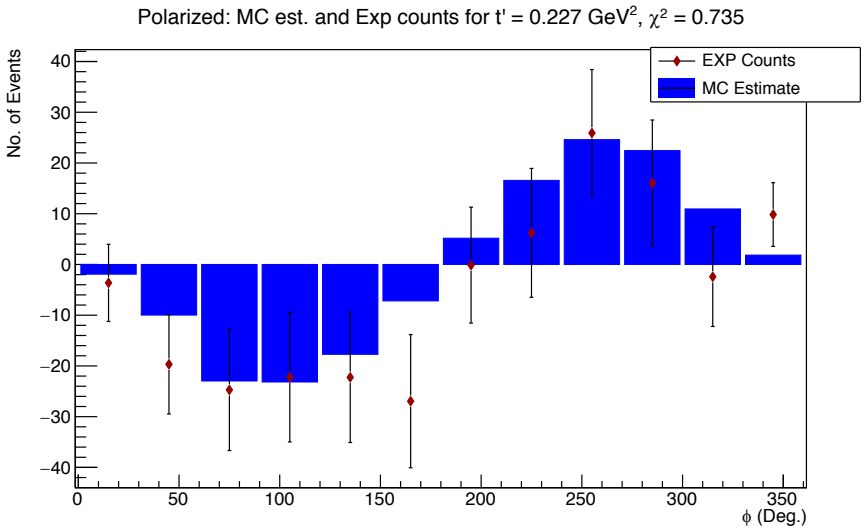


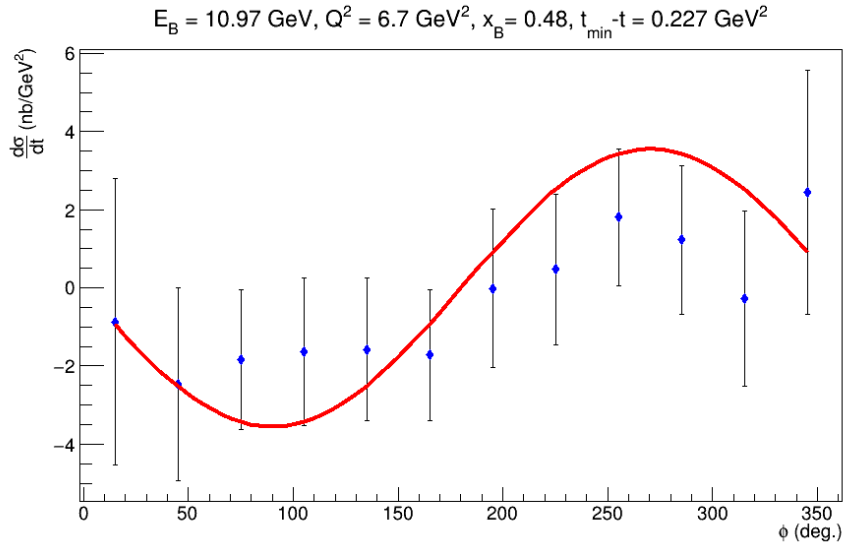


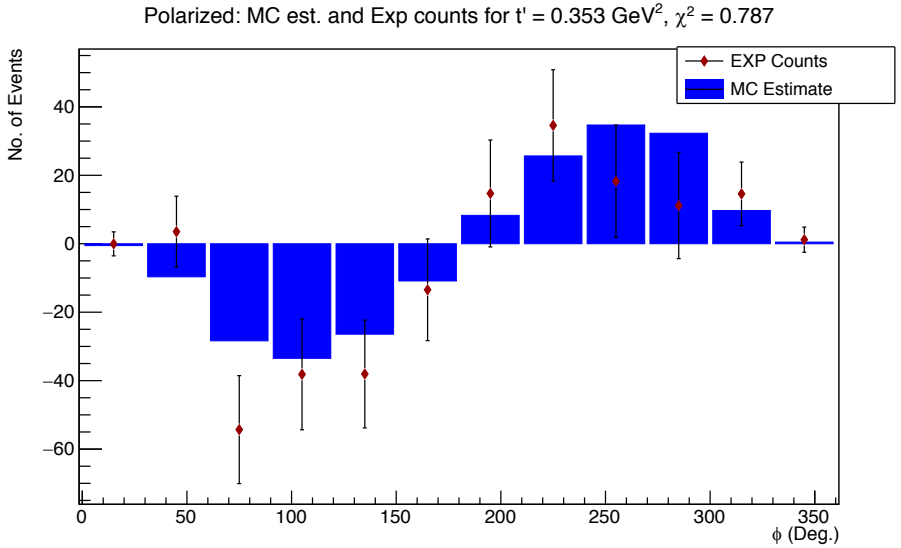


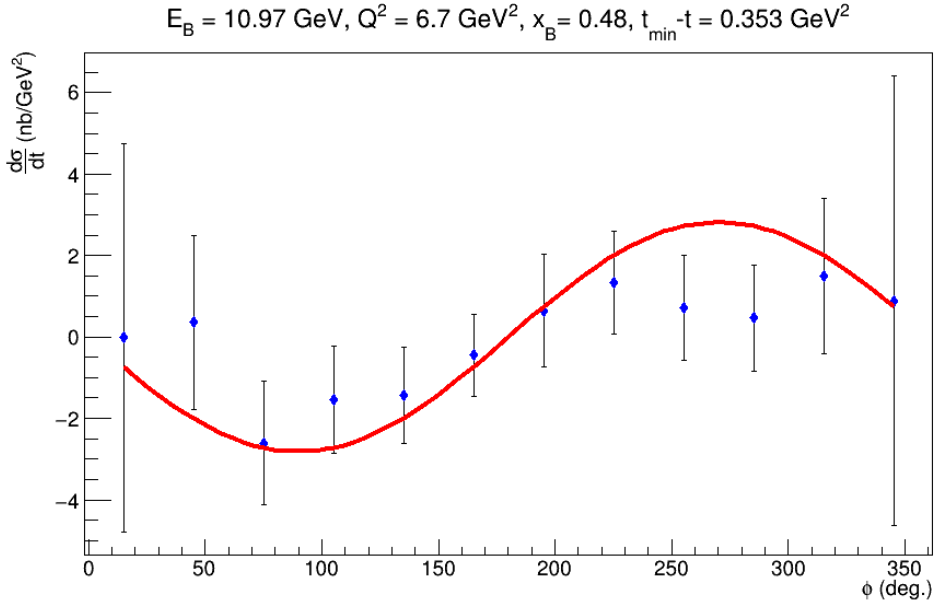


Total polarized cross section (48_4) → Helicity dependent









Kin 361: t' binning and coverage

My binning choice: same as Mongi's

- Binning in t': {0.0,0.067,0.13,0.204,0.3,0.8} (GeV^2)
  - 1st bin avg → t' = 0.0335 (GeV^2)
  - 2nd bin avg → t' = 0.0985 (GeV^2)
  - 3rd bin avg → t' = 0.167 (GeV^2)
  - 4th bin avg → t' = 0.252 (GeV^2)
  - 5th bin avg → t' = 0.55 (GeV^2)

My Cuts for kin 361

- Invariant mass cuts: $0.10 < M_{\gamma\gamma} < 0.17$ (GeV)
- Missing mass cuts: $0.5 < M_X^2 < 1.15$ (GeV^2)
- R-function cut: rval > 0.003

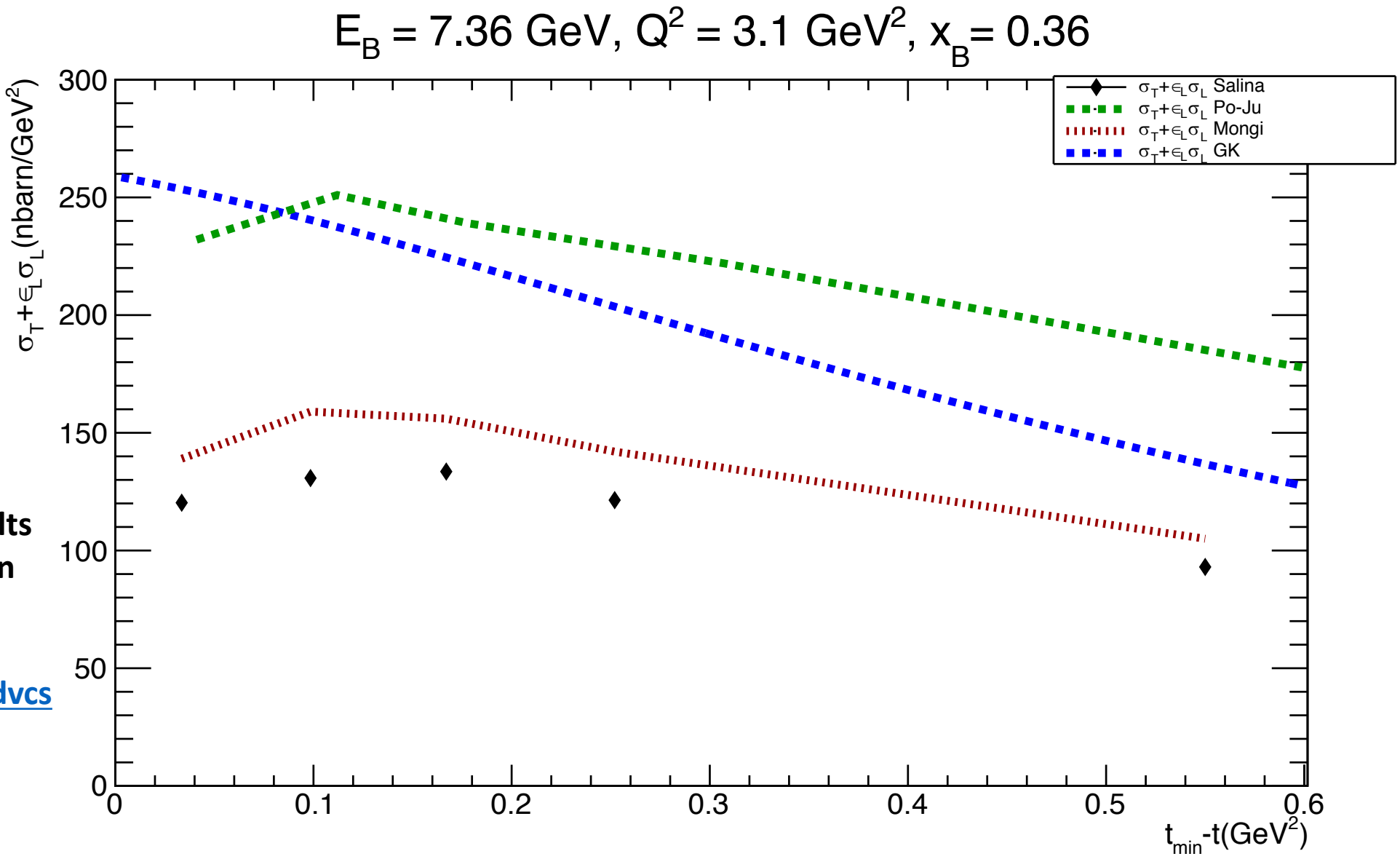
Po-Ju's binning choice for 36_1

- Binning t'={0.0,0.082,0.142,0.214,0.4,0.9};(GeV^2)
  - 1st bin avg → t' = 0.041 (GeV^2)
  - 2nd bin avg → t' = : 0.112 (GeV^2)
  - 3rd bin avg → t' = 0.178 (GeV^2)
  - 4th bin avg → t' = 0.307 (GeV^2)
  - 5th bin avg → t' = 0.65 (GeV^2)

Po-Ju's cuts for kin 361

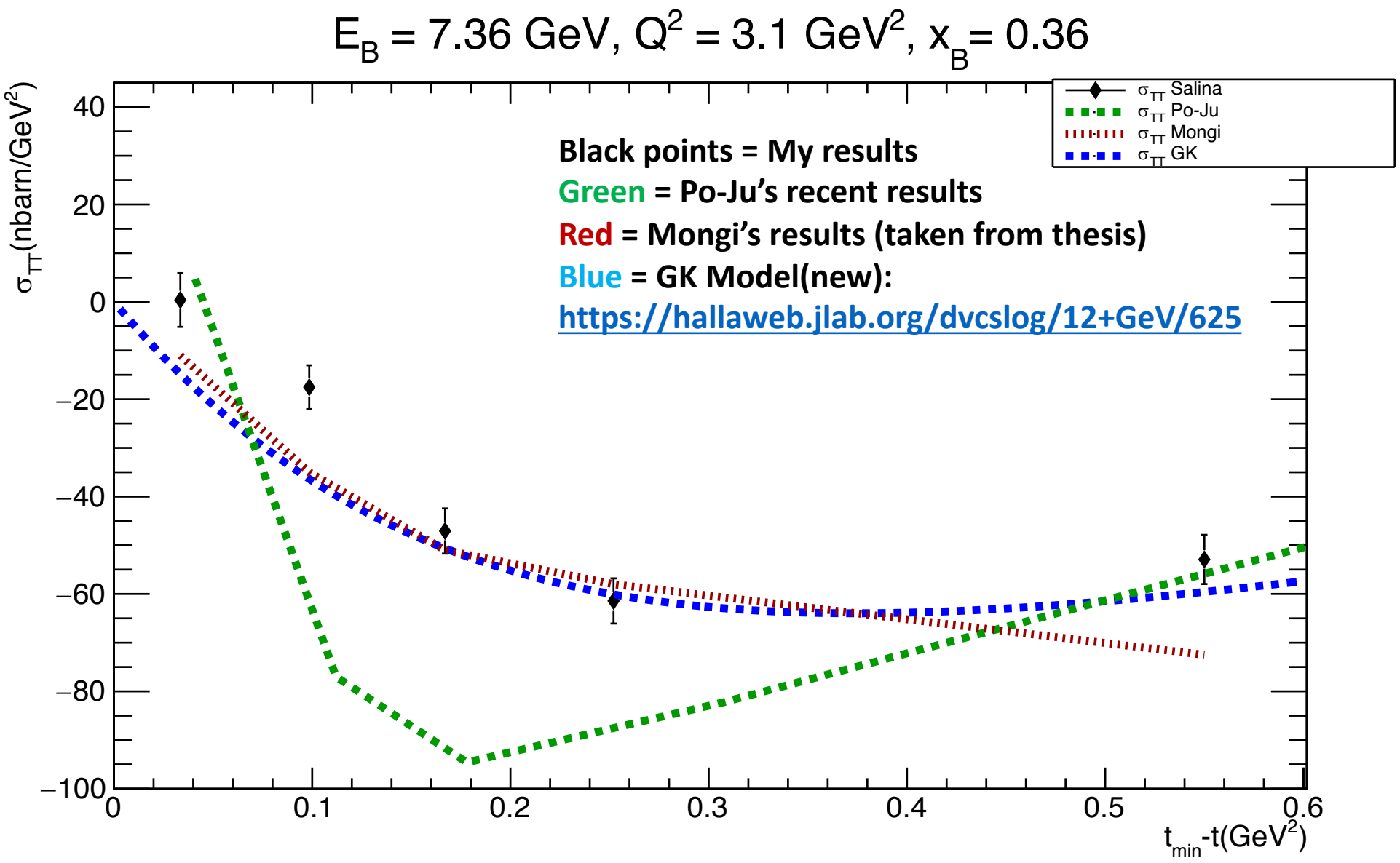
- Invariant mass cuts: $0.105 < M_{\gamma\gamma} < 0.165$ (GeV)
- Missing mass cuts: $0.5 < M_X^2 < 1.1$ (GeV^2)
- R-function cut: rval > 0.003

Kin 36_1 Cross section extraction(new GK): $\sigma_T + \epsilon\sigma_L$

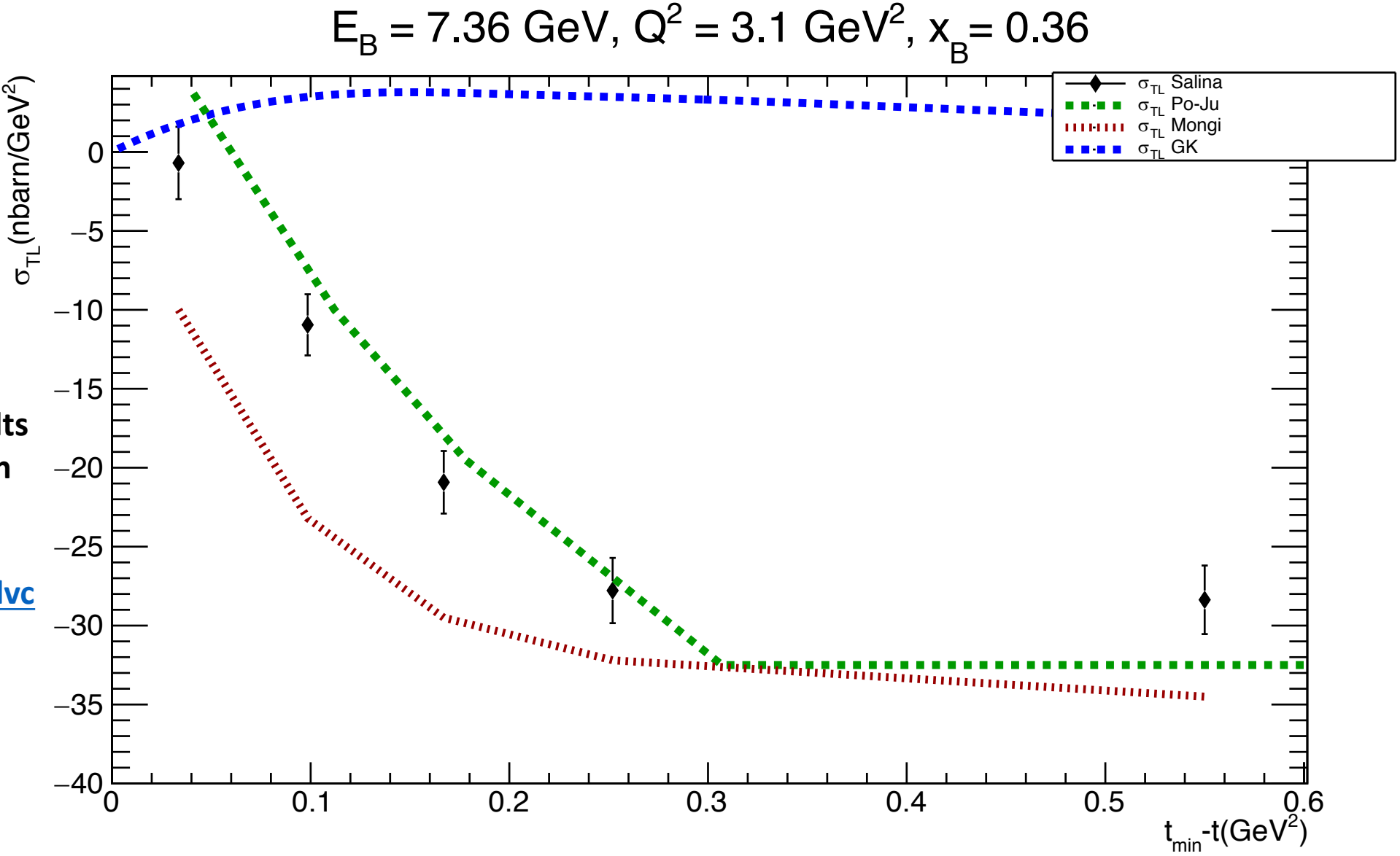


Black points = My results
Green = Po-Ju's recent results
Red = Mongi's results (taken from thesis)
Blue = GK Model(new):
https://hallaweb.jlab.org/dvcslog/12+GeV/625

Kin 36_1 Cross section extraction(new GK): σ_{TT}

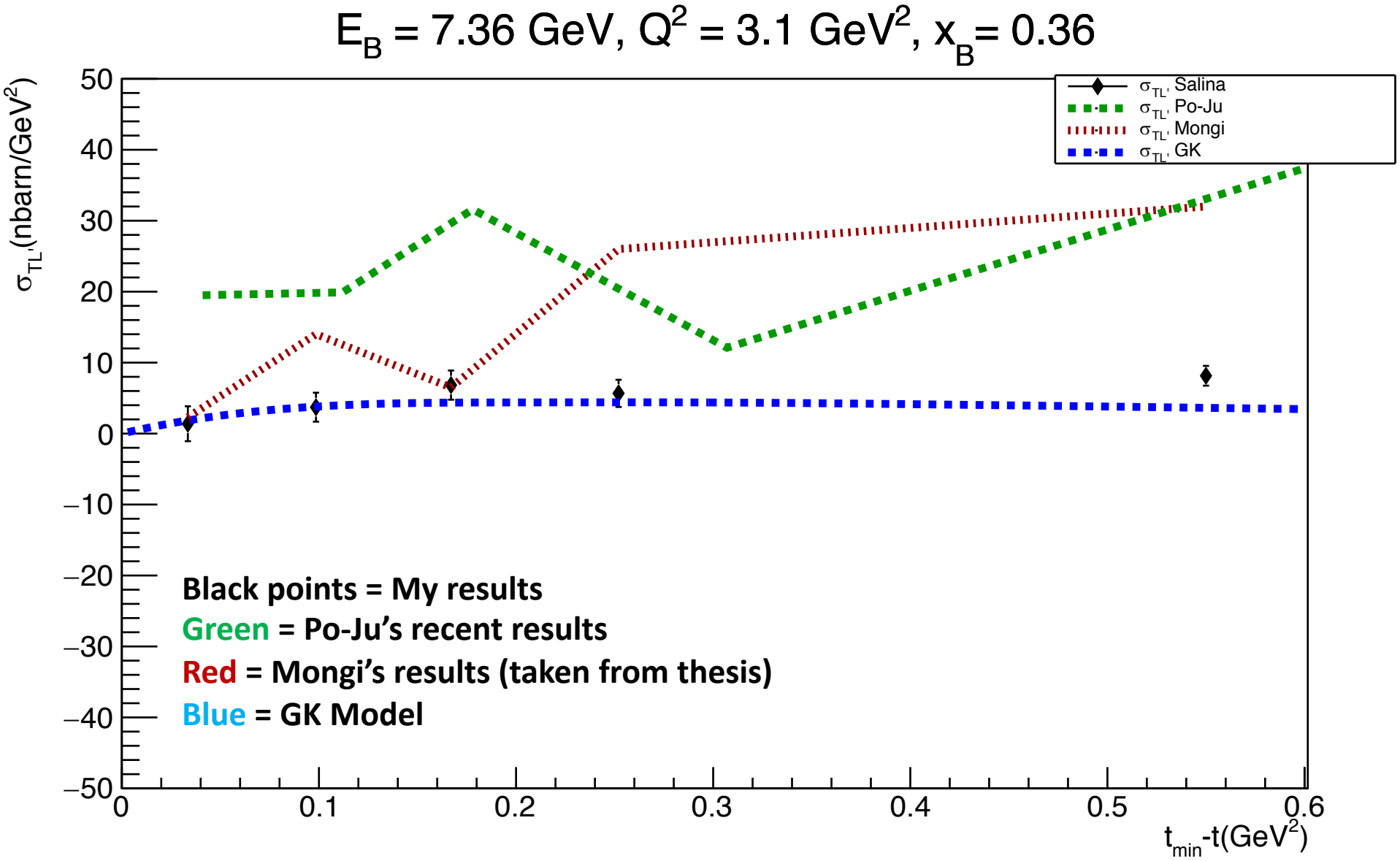


Kin 36_1 Cross section extraction(new GK): σ_{TL}

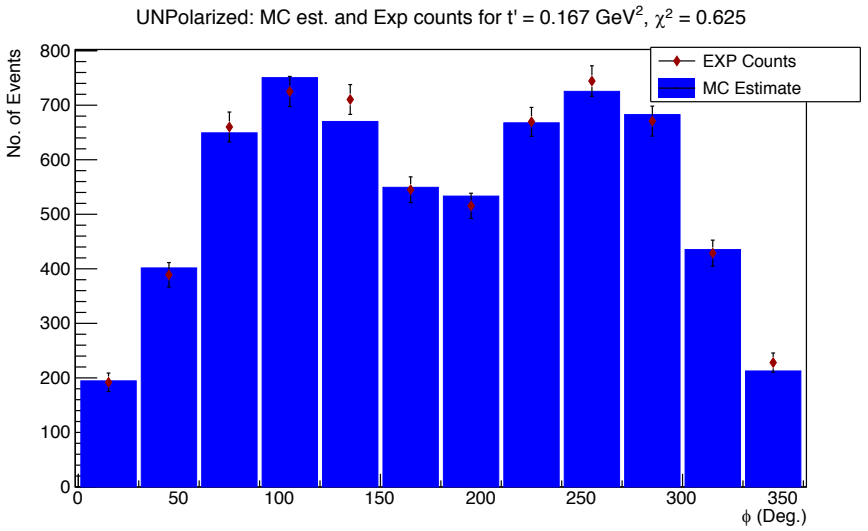


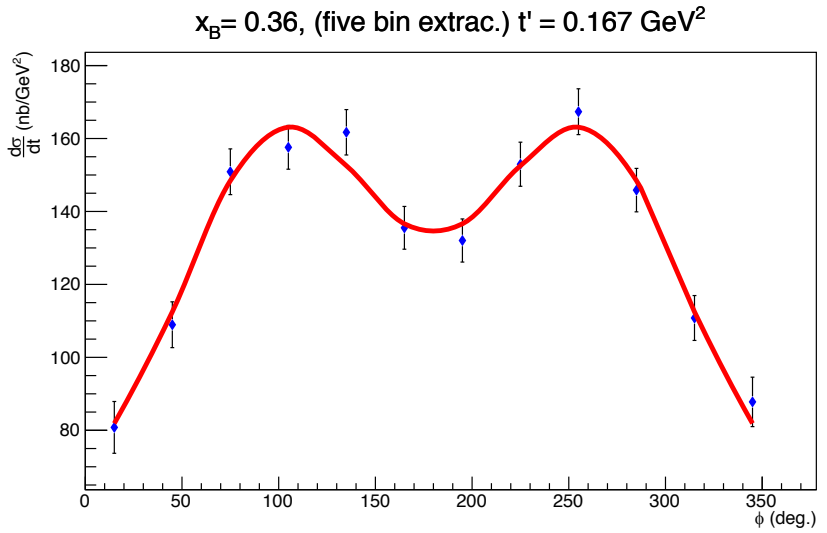
Black points = My results
Green = Po-Ju's recent results
Red = Mongi's results (taken from thesis)
Blue = GK Model(new):
https://hallaweb.jlab.org/dvcslog/12+GeV/625

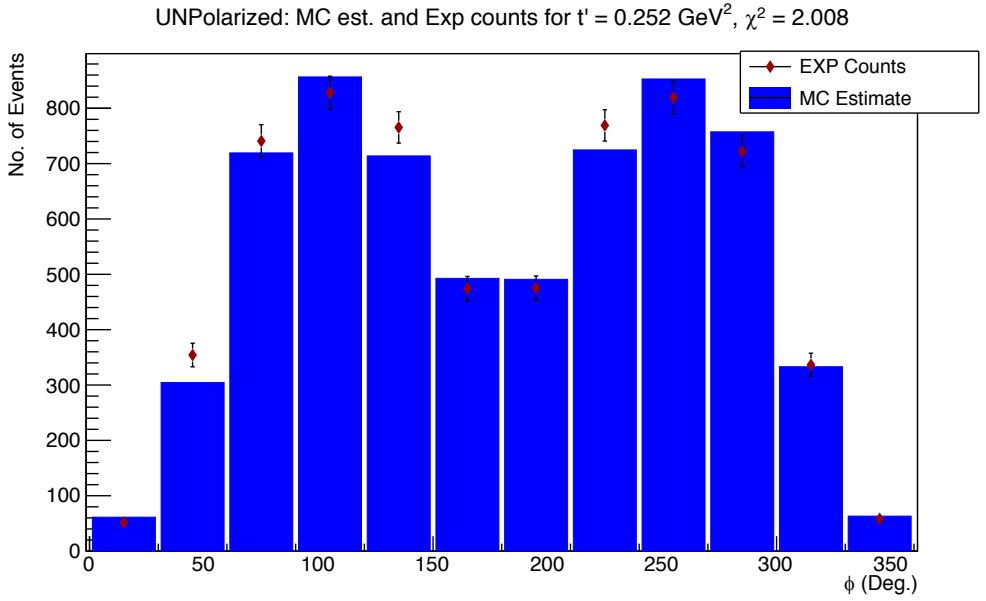
Kin 36_1 Cross section extraction (new GK): $\sigma_{TL'}$

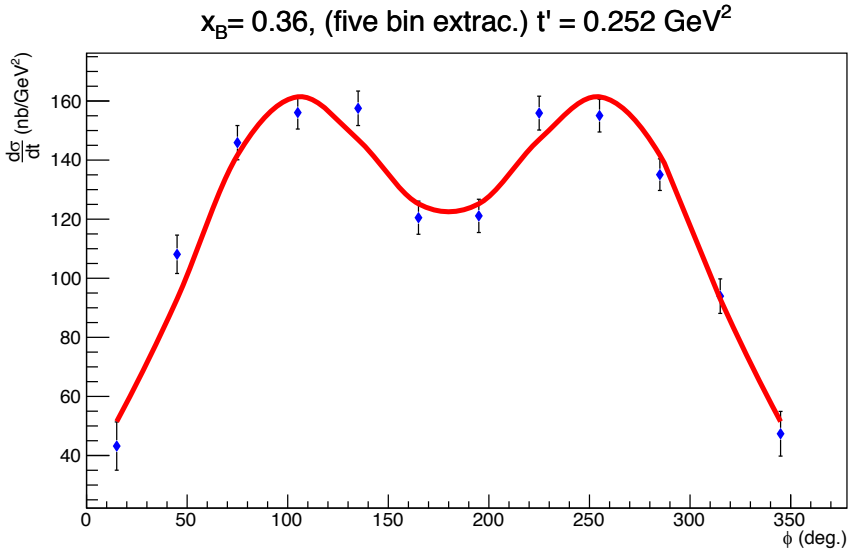


Total cross section (36_1) → Helicity independent

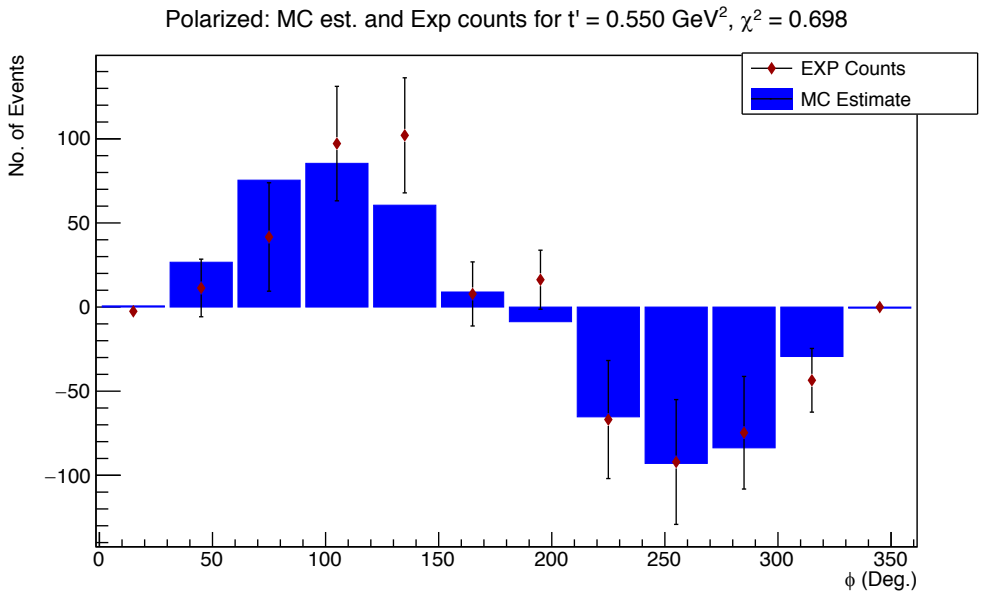


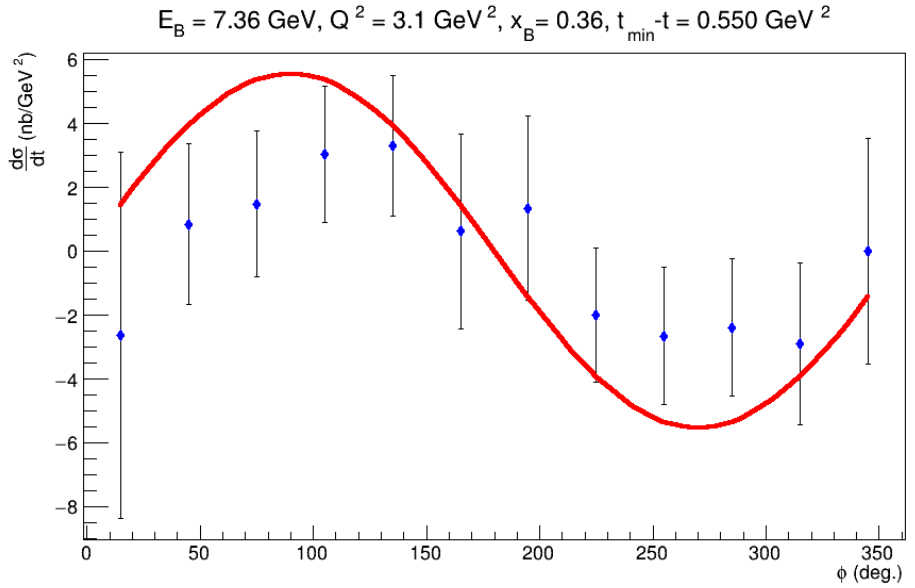






Total polarized cross section (36_1) → Helicity dependent





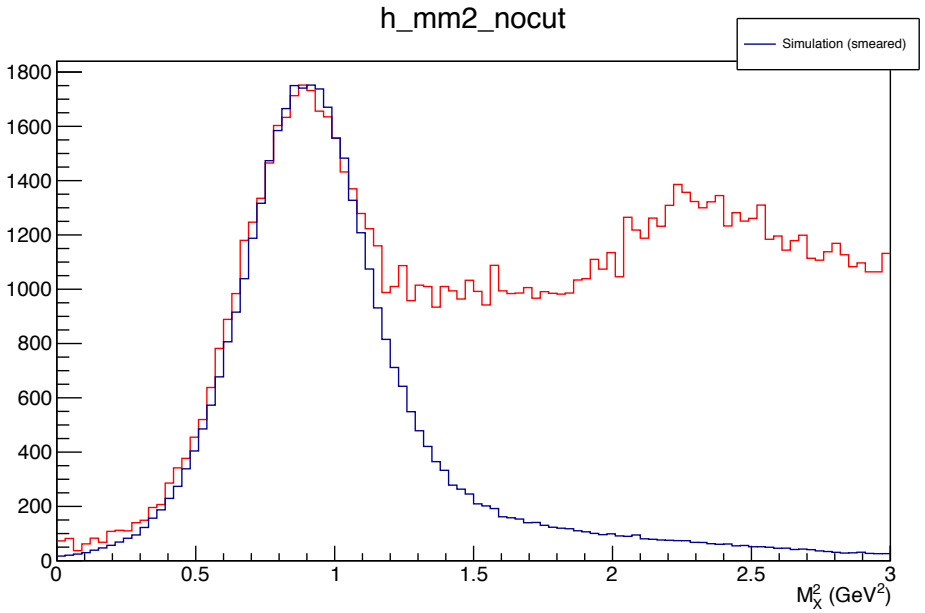
Kin 361: Systematic Uncertainty Studies → Exclusive cut M_x^2

Cuts for kin 361

- Invariant mass cuts: $0.10 < M_{\gamma\gamma} < 0.17\ (\mathrm{GeV})$
- Missing mass cuts: $0.5 < M_X^2 < 1.15\ (\mathrm{GeV}^2)$
- R-function cut: rval > 0.003

- Lower bound fixed: hold lower bound fixed (0.5), vary upper bound with step size 0.05.
- Upper bound fixed: hold upper bound fixed(1.15), vary lower bound with step size 0.05

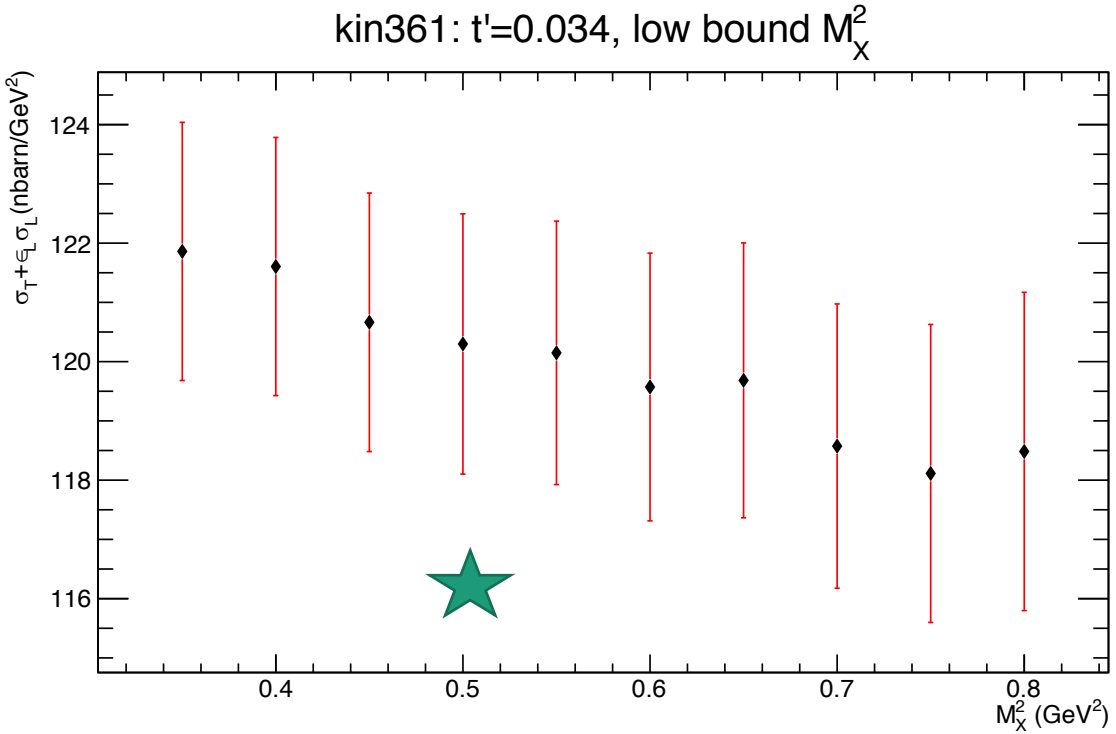
  → See how cross section changes in each t' bin.

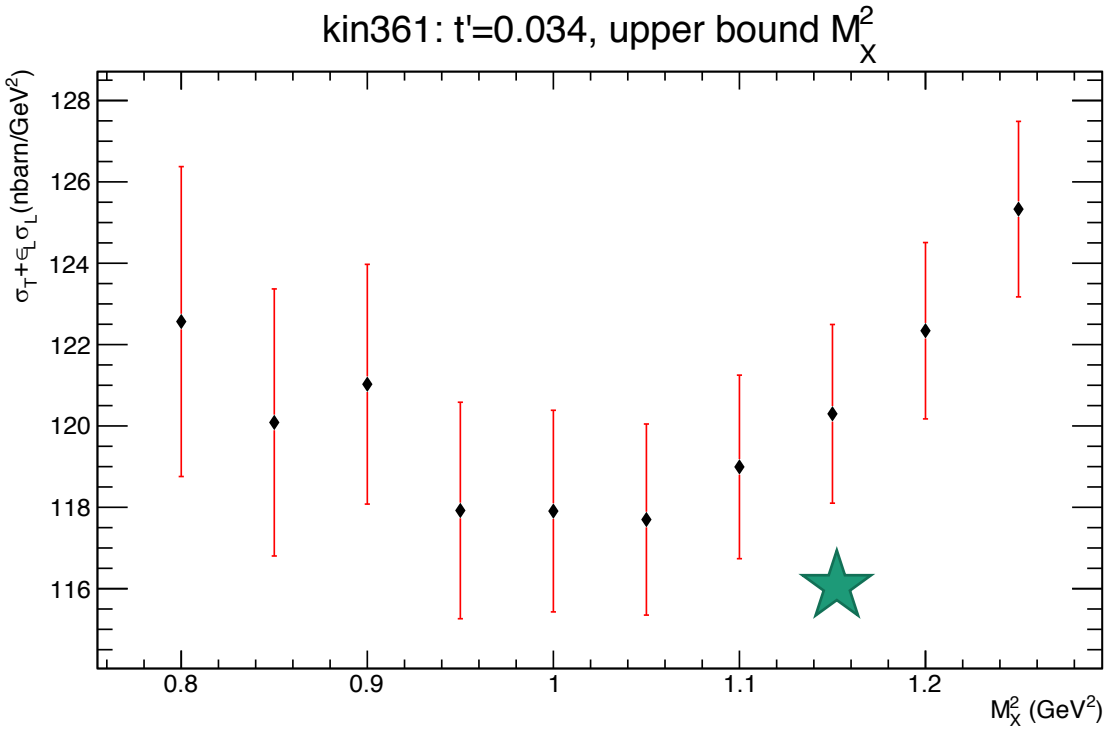


M_X^2 (Missing mass squared, or "mm2")

Kin 36_1: Systematic studies → cut on M_x^2

$$\sigma_T + \epsilon\sigma_L$$



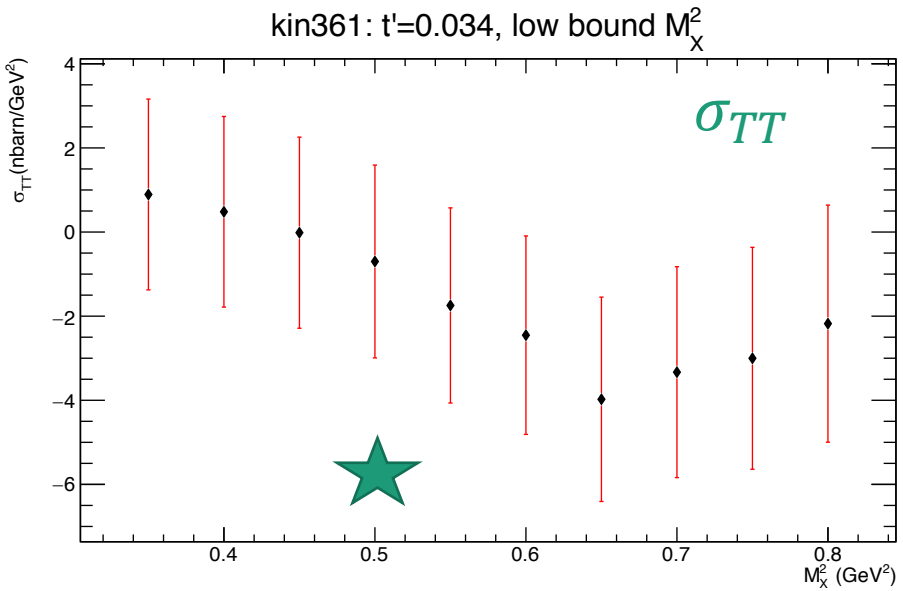


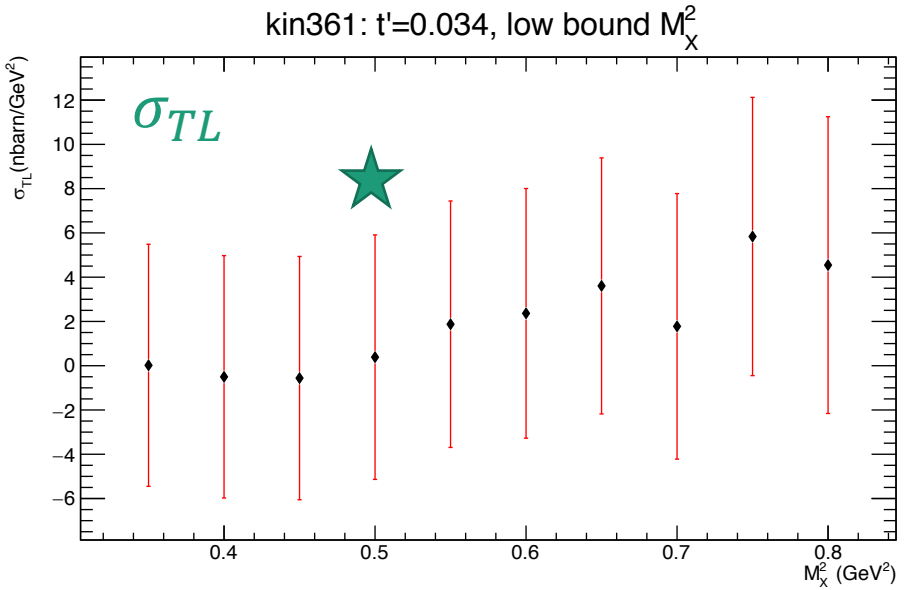
M_x^2 Upper bound fixed:
varying lower bound from 0.35 to 0.8
Variation → 1.1%

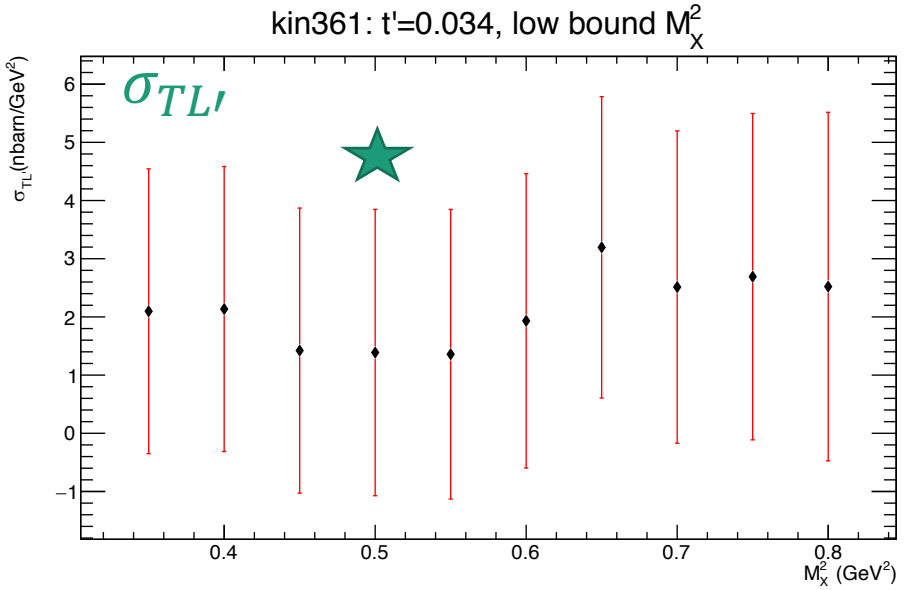
$$0.5 < M_X^2 < 1.15\ (\mathrm{GeV}^2)$$

Lower bound fixed: varying from 0.8 to 1.25
Variation → 2.1%

Kin 36_1: Systematic studies → cut on M_x^2 (lower bound)







$0.5 < M_X^2 < 1.15\ (\mathrm{GeV}^2)$

M_x^2 Upper bound fixed: varying lower bound from 0.35 to 0.8

To-do

- Other sources of systematic uncertainties: Photon clustering threshold, cuts on photon energies.

Kinematic setting	DAQ threshold (GeV)
kin36_1	1.0975
oldkin36_2	1.0975
kin48_1	0.4243
kin48_1 (run 12508)	0.8907
kin48_2	0.8907
kin48_2 (run 13000, 13183-4)	1.0073
kin48_2 (run 13001 to 13015, 13191 to 13193)	0.3076
kin48_3	1.0073
kin48_3 (run 12838)	0.4243
kin48_4 (run 13100 to 13162)	1.0073
kin48_4 (run 13279 to 13418)	1.4571
kin36_2	1.5200
kin36_3	1.5200
kin60_1	0
kin60_3	0

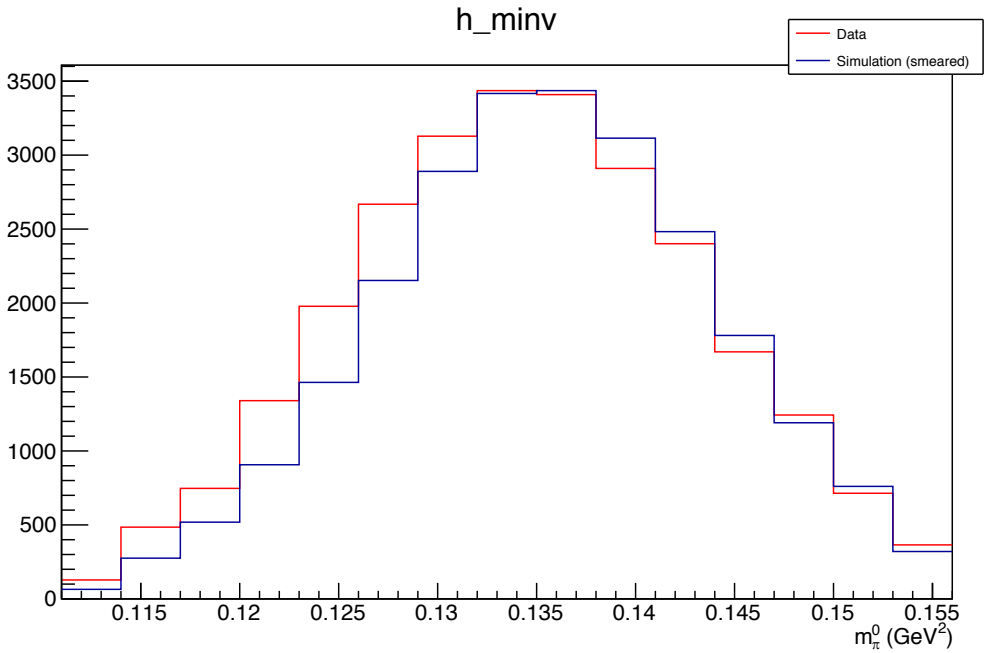
Hardware threshold (from Mongi's thesis)

run period	TriggerSim clustering threshold (GeV)
kin36_1	1.1
oldkin36_2	1.1
kin48_1	0.5
kin48_2	0.9
kin48_3	1.1
kin48_4 (run 13100 to 13162)	1.1
kin48_4 (run 13279 to 13418)	1.5
kin36_2	1.6
kin36_3	1.6
kin60_1	0.8
kin60_3	1.0

Software threshold
(from Mongi's thesis)

Extra/backup

Data vs. simulation (smeared) plots for 36_1



$M_{\gamma\gamma}$ (Invariant mass, or ”minv”)

Data vs. simulation (smeared) plots for 48_4