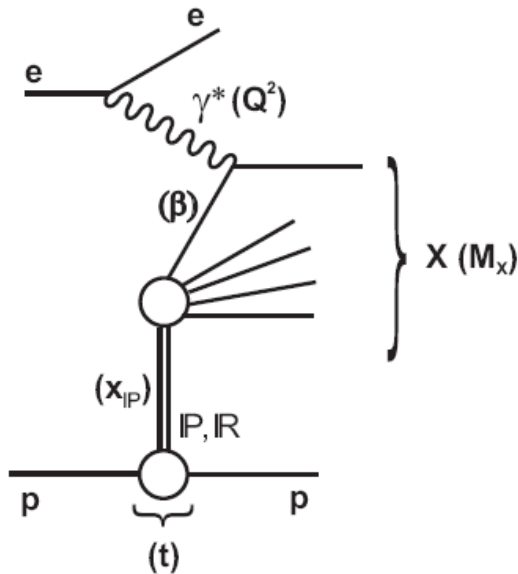


F2D4 with VFPS

Tomas Hreus, Laurent Favart, Robert Roosen
(IIHE ULB/VUB)

H1 Collaboration Meeting, Liverpool

Recap: Motivation



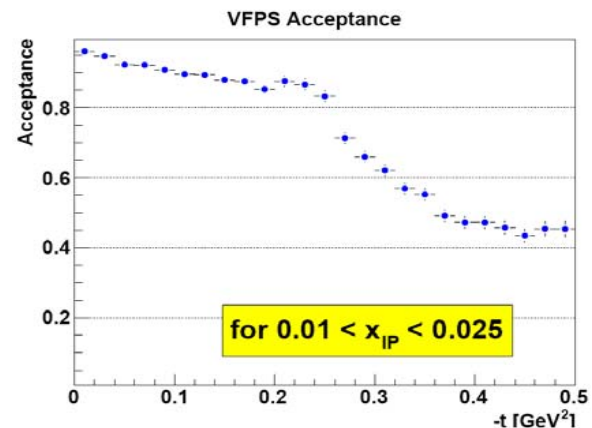
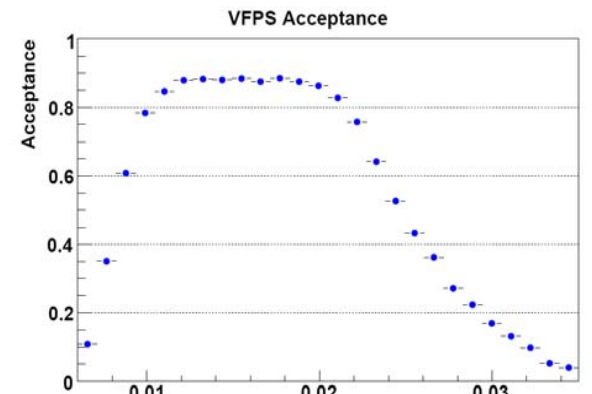
$$\frac{d^4 \sigma_{ep \rightarrow eXp}}{dQ^2 d\beta dx_{IP} dt} = \frac{4\pi\alpha^2}{\beta Q^4} \cdot \left(1 - y + \frac{y^2}{2}\right) \cdot \sigma_r^{D(4)}(Q^2, \beta, x_{IP}, t)$$

Advantages wrt LRG method

- Free of proton dissociation (VFPS at -220m)
- High acceptance in $0.008 < x_{IP} < 0.025$ and $|t| < 0.25 \text{ GeV}^2$
- Improved resolution in x_{IP} and β (both reconstructed from VFPS)
- Measurement of t

But

- Limited x_{IP} range
- Highly non-trivial calibration



Recap: Selection

Kinematics

$$y = y_{el}^2 + y_{da}(1 - y_{da})$$

$$Q^2 = 4E^2(1 - y) / \tan^2(\theta_{e'}/2)$$

$$x_{IP} = \text{from VFPS local/global track}$$

$$\beta = x/x_{IP}$$

$$y > 0.01$$

Event Selection

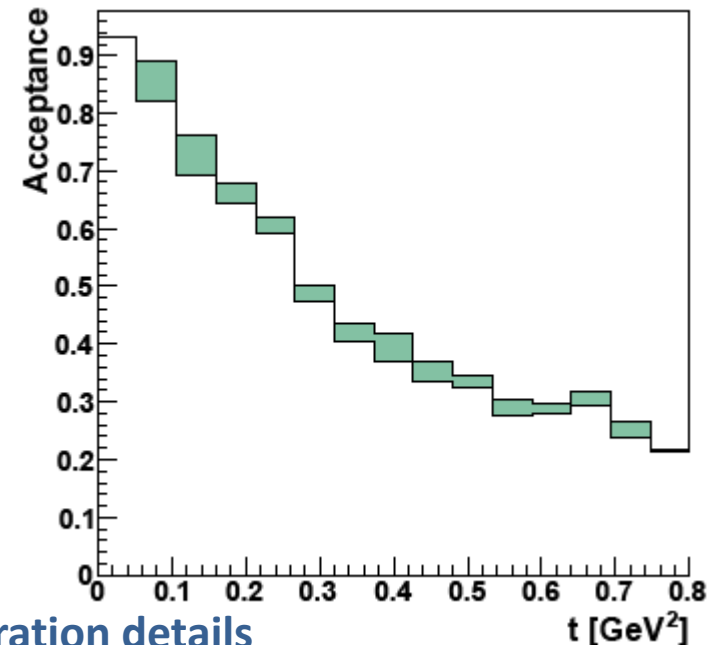
period	2006/07e+ (82pb-1)
scattered electron energy	> 10 GeV
reconstructed vertex	+/- 30 cm
VFPS trigger	s115: either of VFPS stations
Q^2	4.5 – 100 GeV ²
β	0.003 – 1.0
x_{IP}	0.009 – 0.026

Systematics

source	shift	error
Electron energy	0.5%	2%
Electron theta	1mrad	2%
HFS energy scale	1.5%	1%
Xpom shift	2%	3%
VFPS track eff	4% (norm.)	4%
VFPS trig eff	1% (norm.)	1%
Luminosity	2.5%	2.5%
VFPS X position calibration	400 microns	5%
VFPS Y position calibration	150 microns	3%
VFPS X' angular calibration	0.008mrad	2%
VFPS Y' angular calibration	0.008mrad	2%
beam-pipe acceptance (VTXX)	30 microrad	2%
Model: x_{1p}	$1/x_{1p}^{+0.1}$	1%
Model: β	$1/\beta^{+0.05}$	1%
Model: t	e^{+t}	1%
Model: Q^2	$(\log Q^2)^{+0.2}$	2%

Beam-pipe acceptance (NEW)

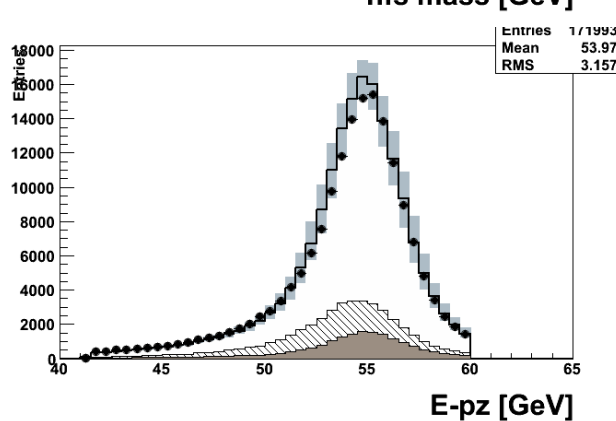
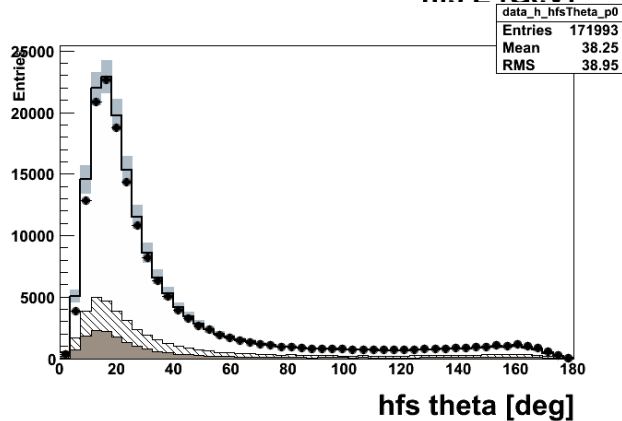
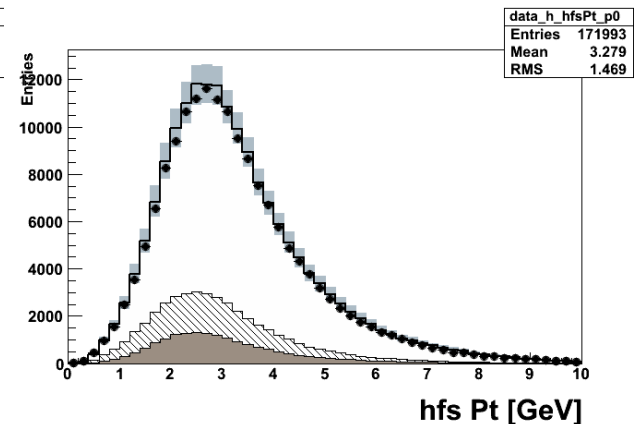
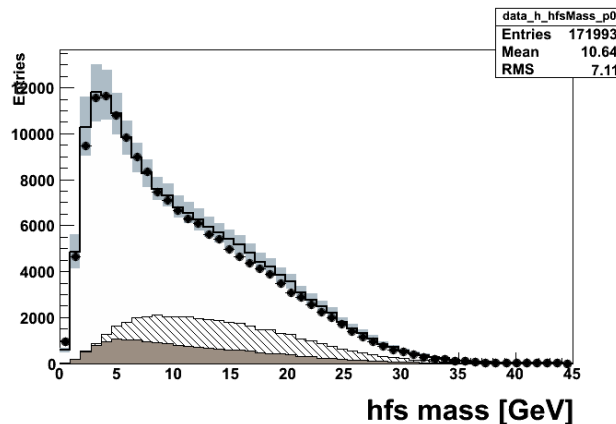
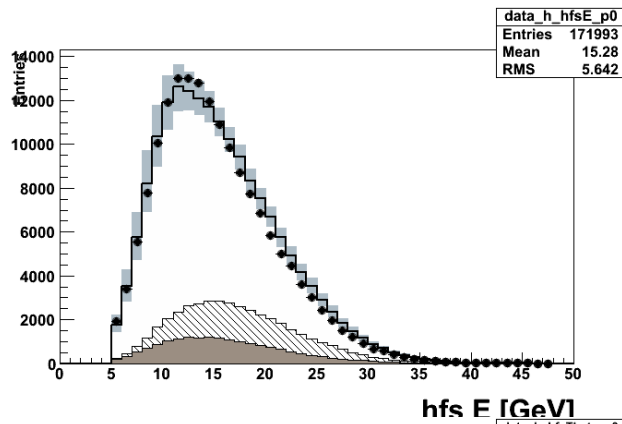
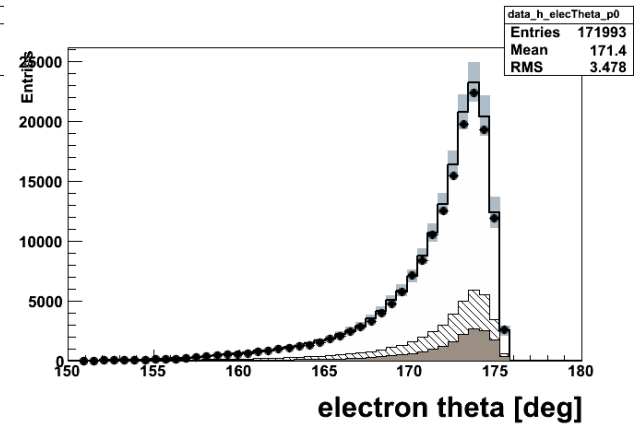
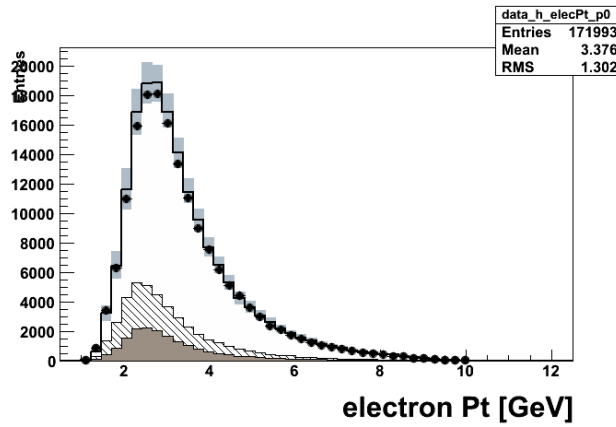
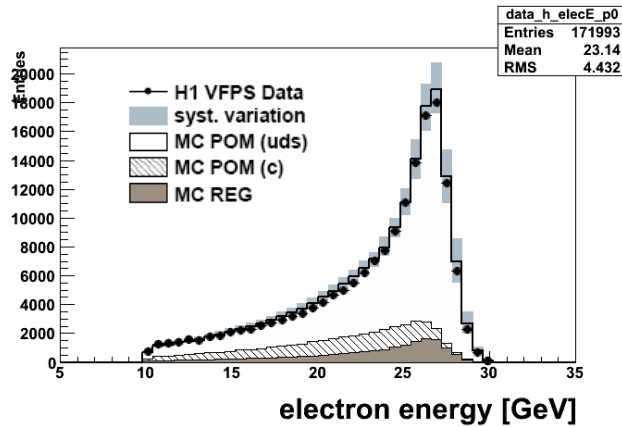
- Events with large VTXX and theta_x hit the beam pipe before reaching VFPS
 - Limits t acceptance
- Acceptance in t with error induced by the primary vertex x-position limitation:



All calibration details
given in H1 note
(submitted to NIM):

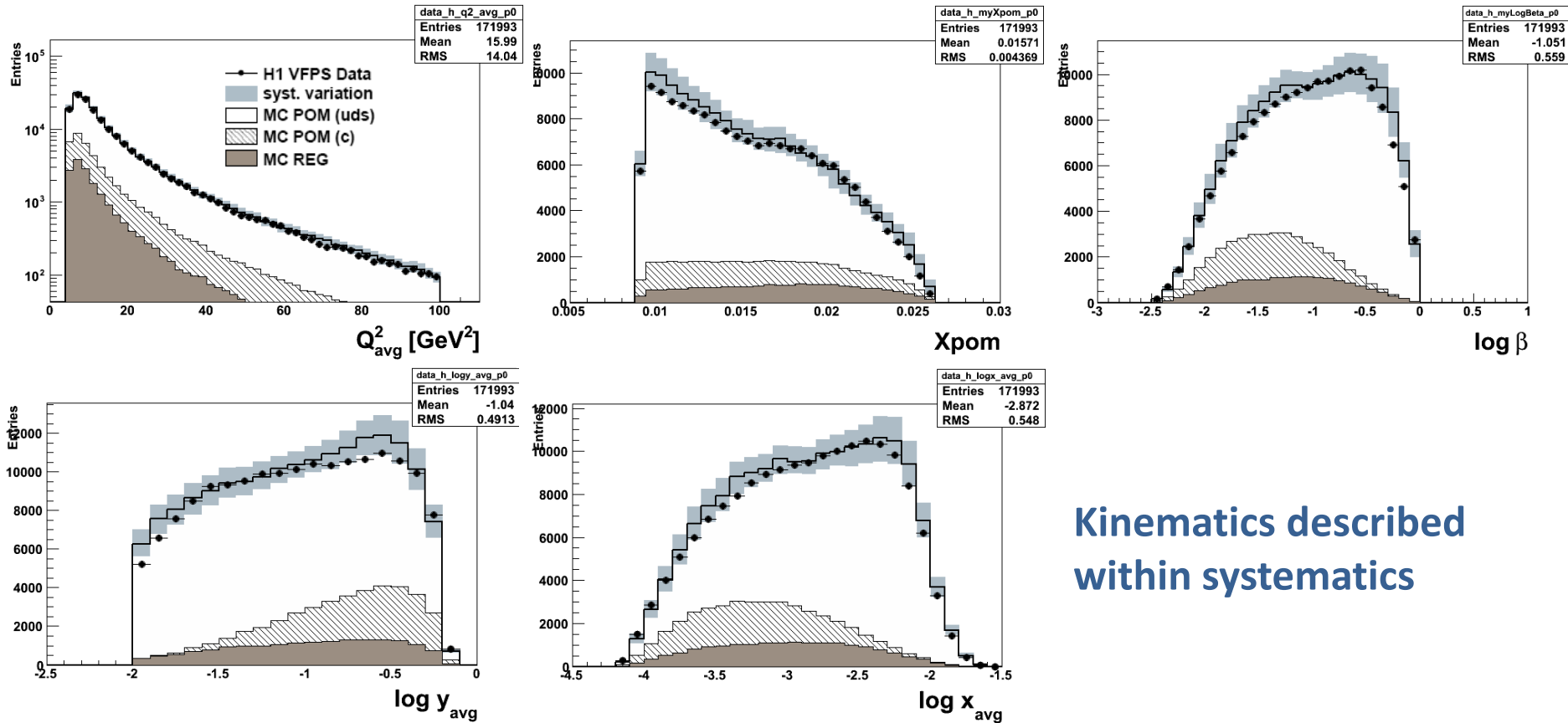
H1-note: 0113-637

Distributions: electron + HFS



Nice description of the
'main H1' activity

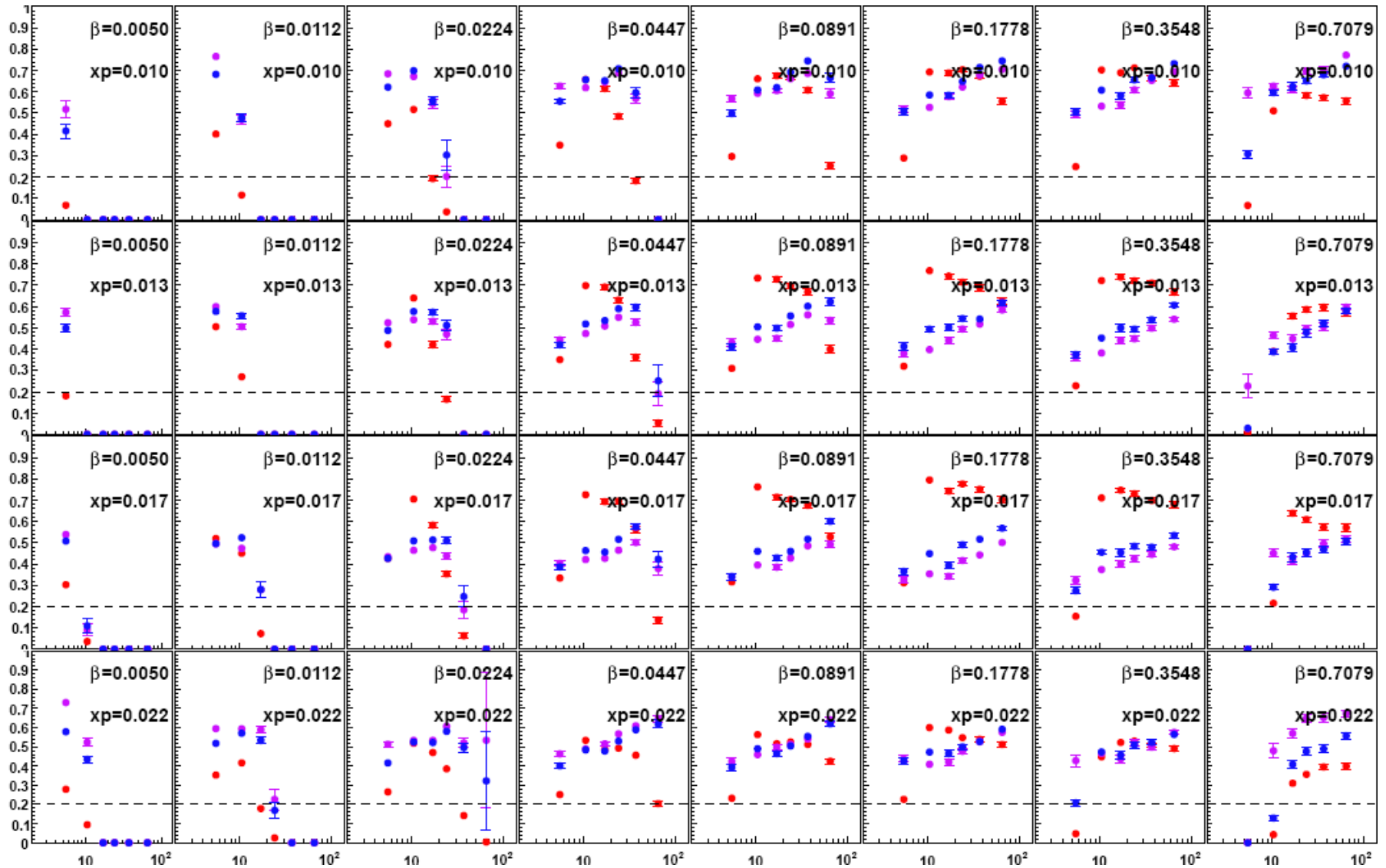
Distributions: Kinematics



Kinematics described within systematics

Using OR between the two VFPS stations for F2D3 measurement (local tracks)

Acceptances, Purities, Stabilities: F2D3



- Acceptance
 - Purity
 - Stability
- Cut on 3-dim purities: > 20%**
- Typically around 50%

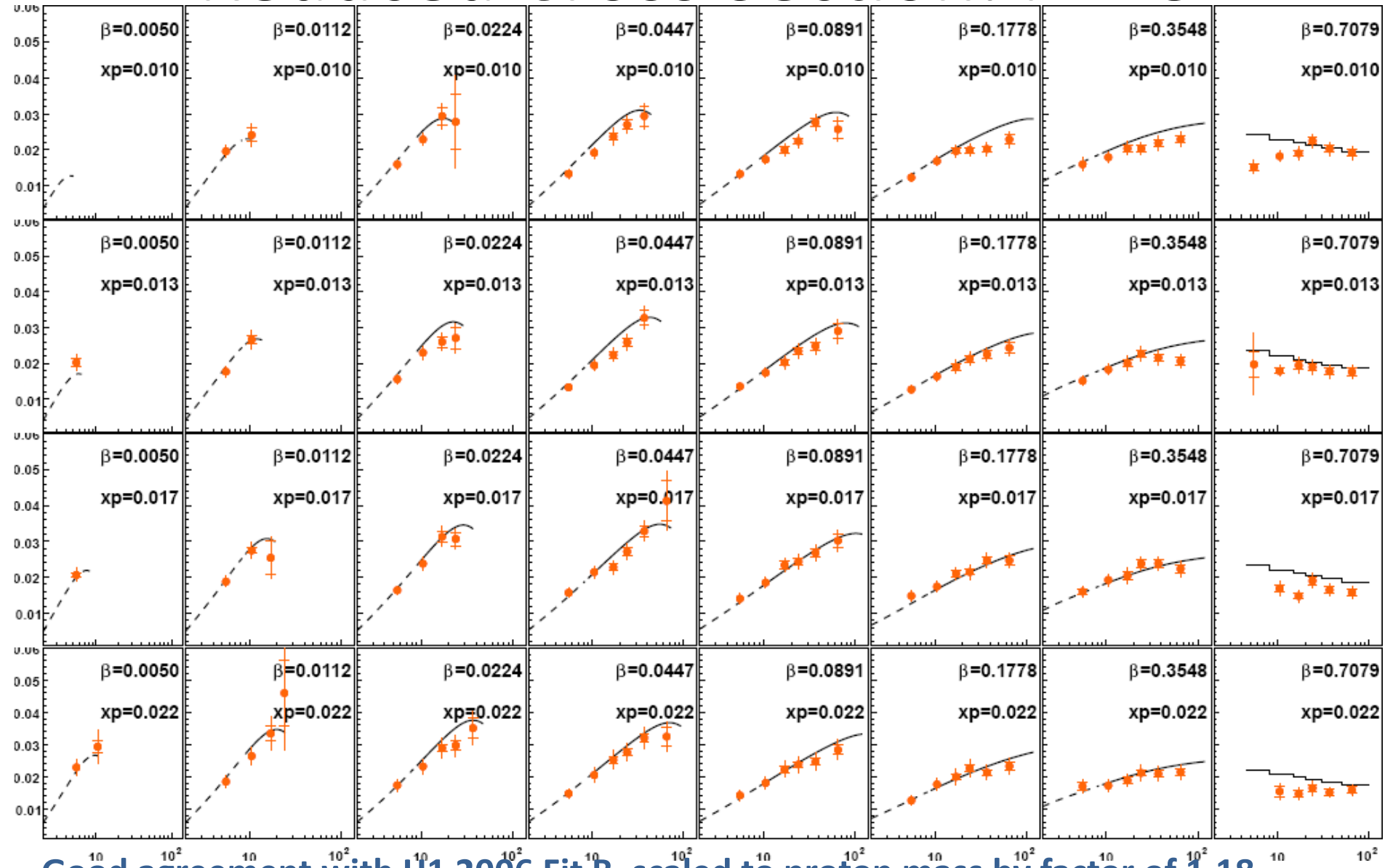
Reduced Cross Section

$$\sigma_{r,i}^{D(3)}(Q^2, \beta, x_{IP}) = \frac{N_i^{data} \cdot (1 - B)}{N_{RAD,i}^{MC}} \cdot \sigma_{r,i}^{D(3),BORN}(Q^2, \beta, x_{IP})$$

- $B = 2.1\%$, a global subtraction of beam-gas events
 - contamination from the beam-gas events in VFPS with an overlap of the DIS event in the main H1
- Theoretical prediction averaged over the bin volume
 - Important effect at large beta, where DPDFs have complicated shape
- Easier definition of bin-center, no need to compute radiative corrections

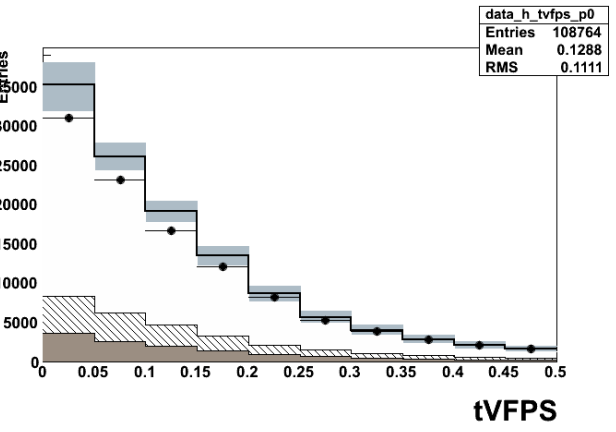
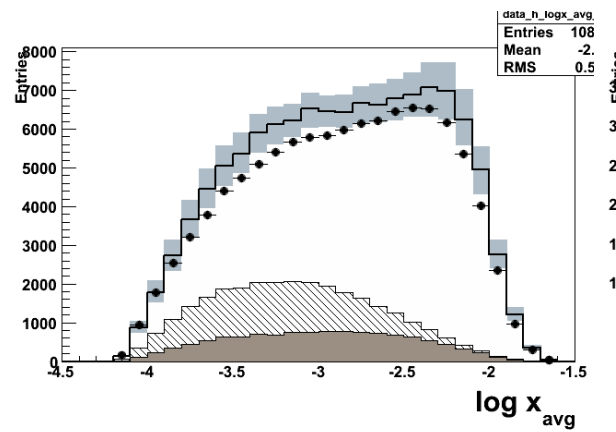
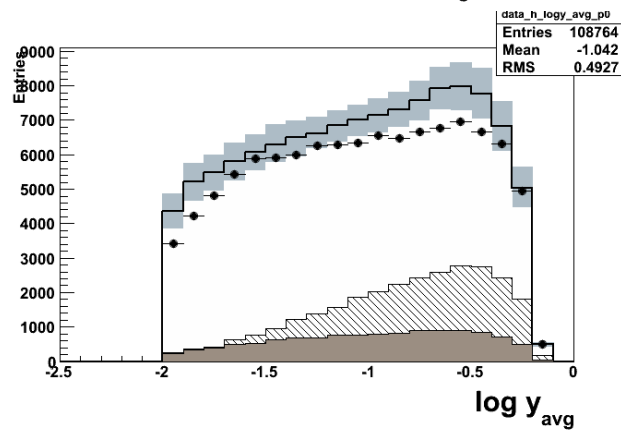
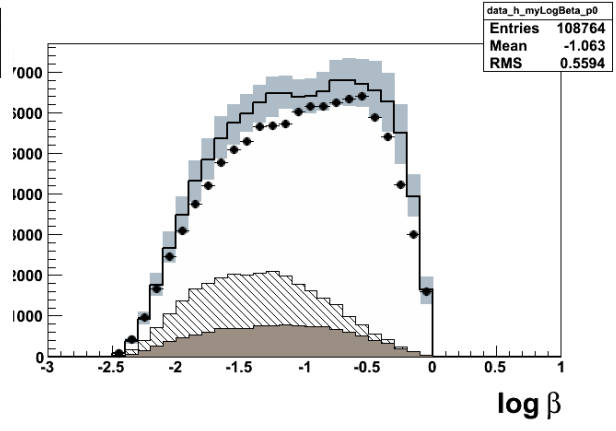
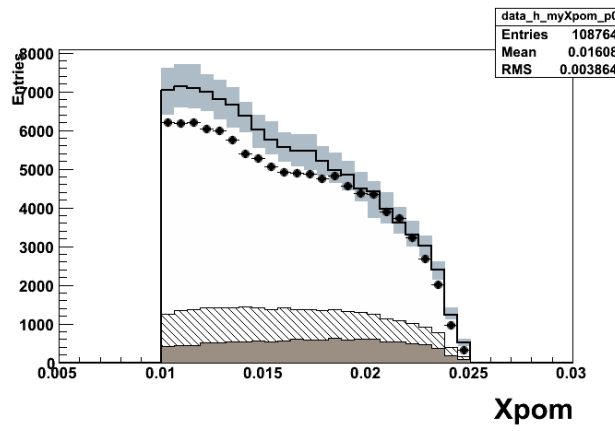
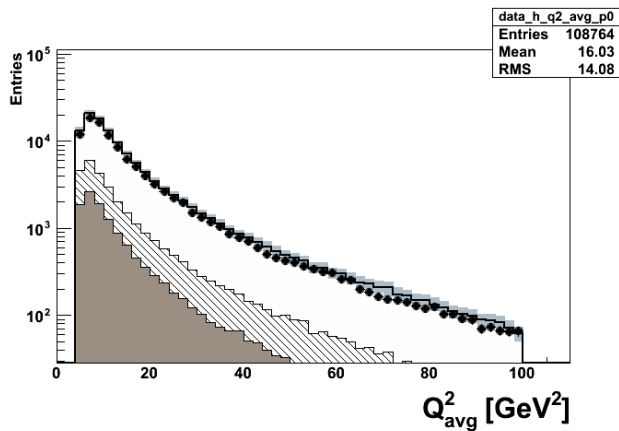
$$\begin{cases} ep \rightarrow eX \\ pA \rightarrow p(A') \end{cases}$$

Reduced Cross Section: F2D3



Good agreement with H1 2006 Fit B, scaled to proton mass by factor of 1.18
(from $M_\gamma < 1.6$ GeV)

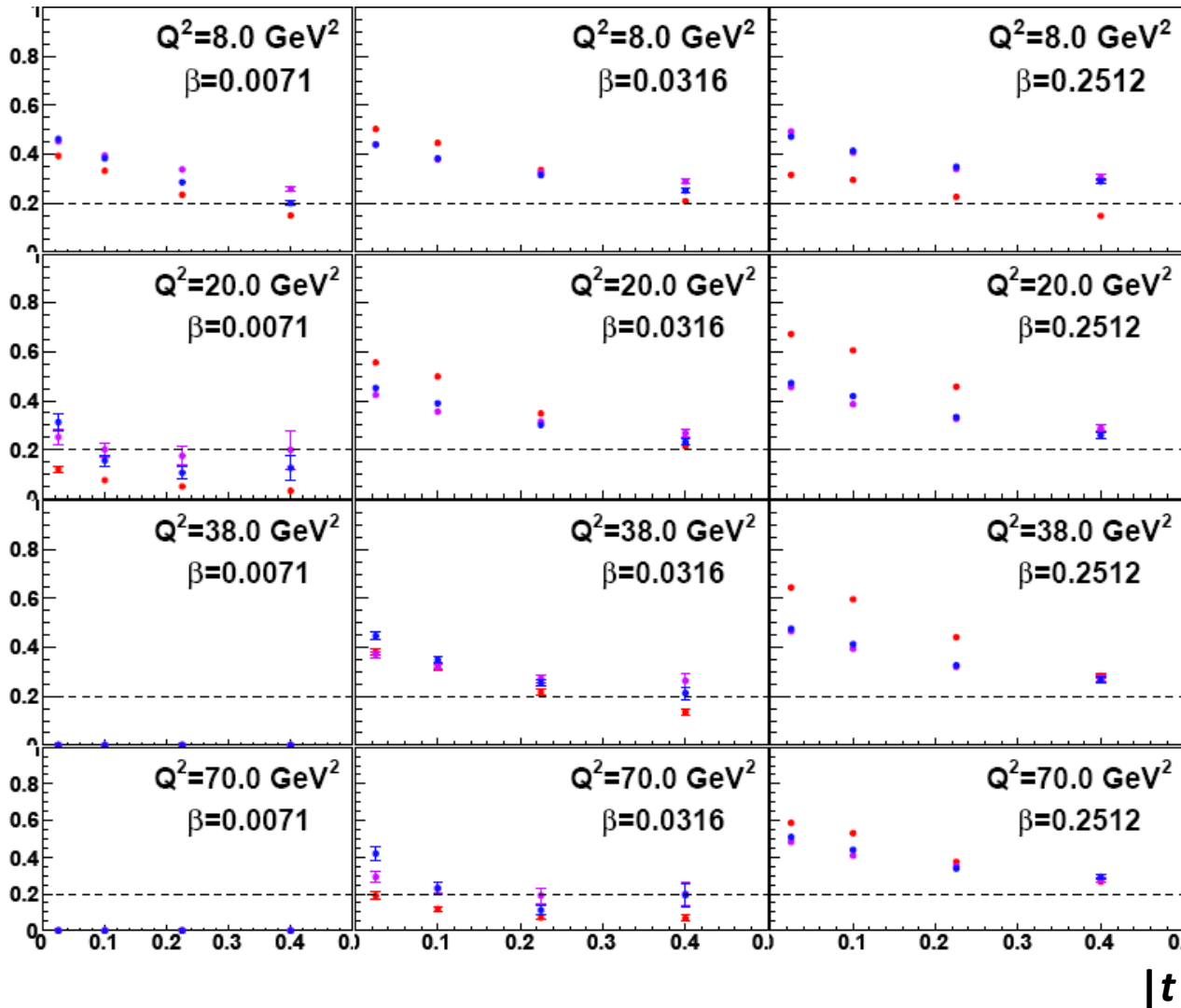
Distributions: VFPS Global Tracks



Data below MC (reason to be checked, likely a trivial problem)

Using AND between the two VFPS stations for F2D4 measurement (global track)

Acceptances, Purities, Stabilities: F2D4



Reduced binning:

X_{pom} : 1 bin
(0.010 – 0.025)

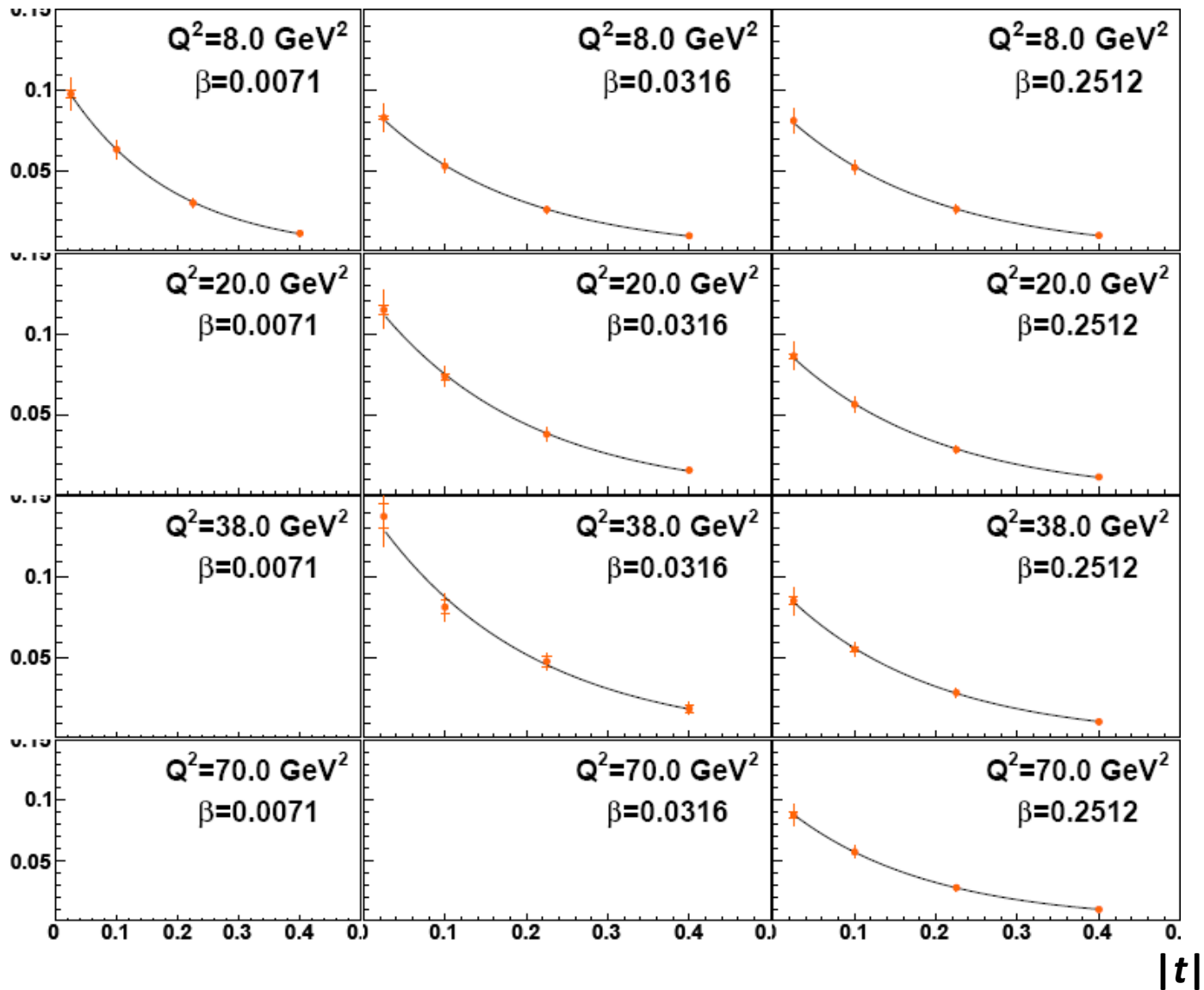
β : 3 bins

Q^2 : 4 bins

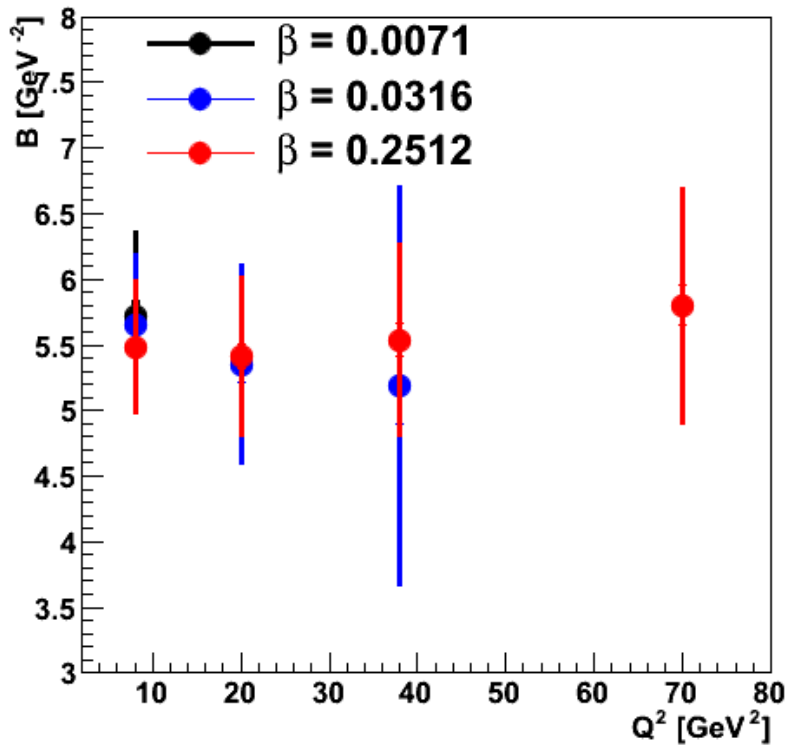
$|t|$: 4 bins

4-dim purities between 20-40%

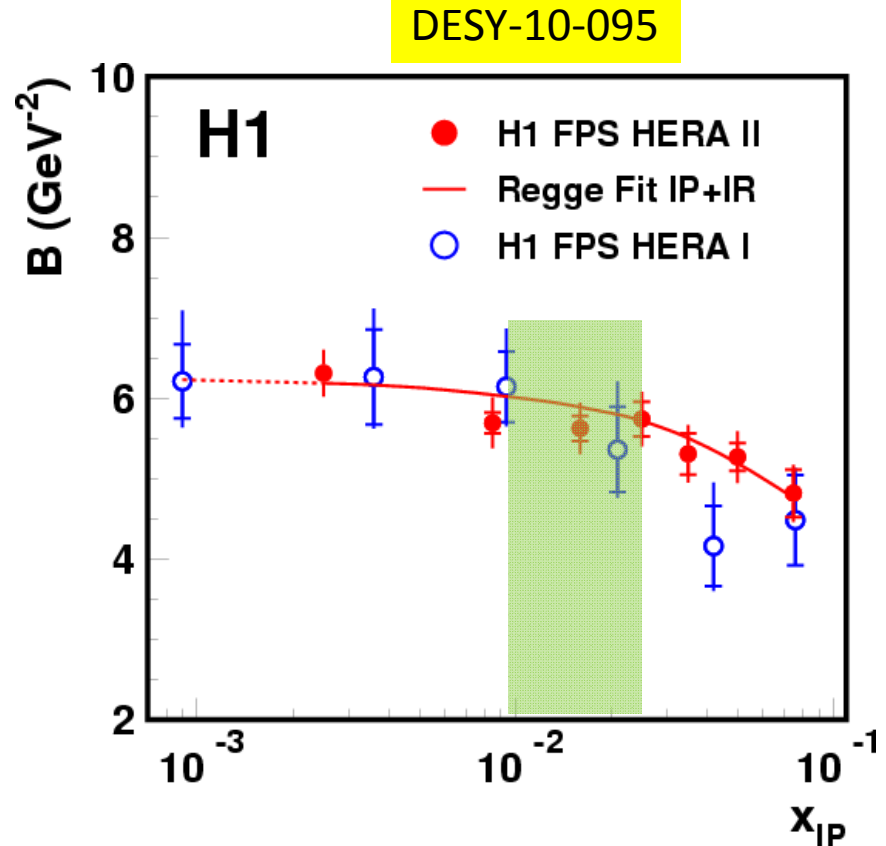
Reduced Cross Section: F2D4



F2D4: B-slopes



- Stat + syst errors
- No visible dependence on Q^2
- $\langle B \rangle \sim 5.5$ GeV⁻², in accordance with FPS measurement in the same x_p region



Summary

- F2D3 stable since preliminary results
- F2D4 stable as well
- B-slope systematics finalized, values in agreement with FPS measurement

- **TODO:**
- Include VFPS measurement into combined fit?
 - In contact with Richard