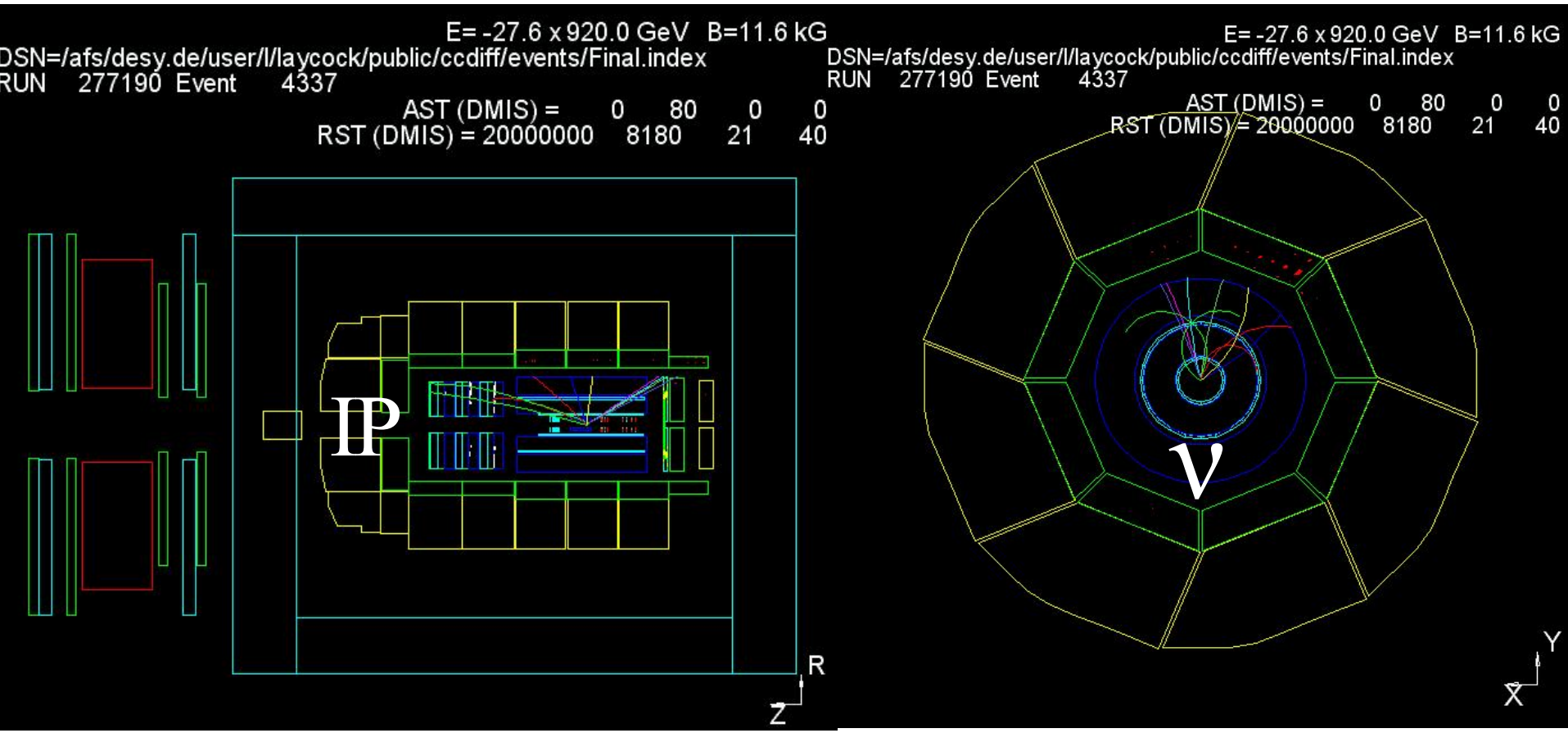
Diffraction in CC events in H1

Paul Laycock

HERA-LHC Workshop – 17th November

CC Events with a Rapidity Gap

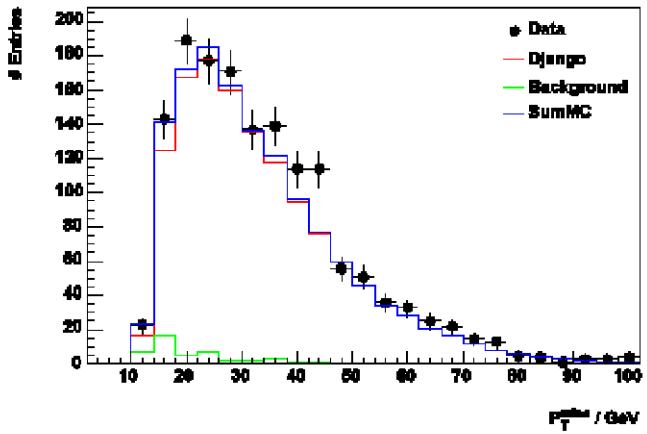


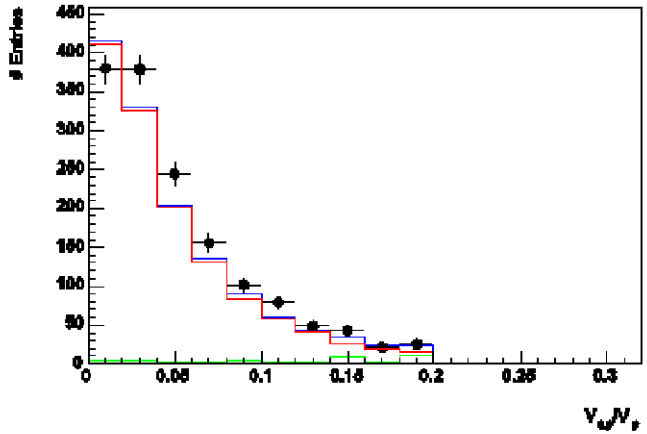
$ep \rightarrow \nu X Y$

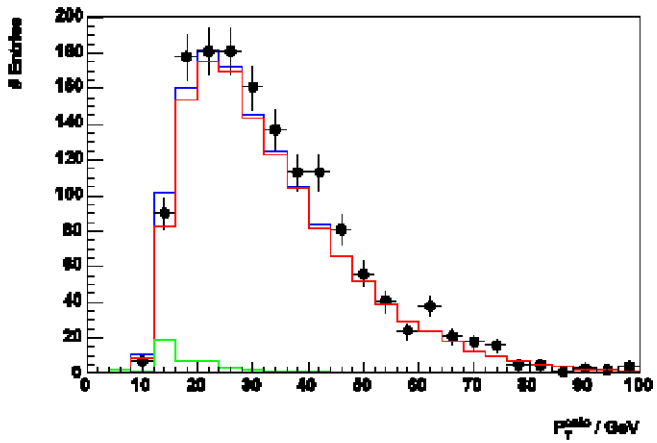
Analysis Strategy

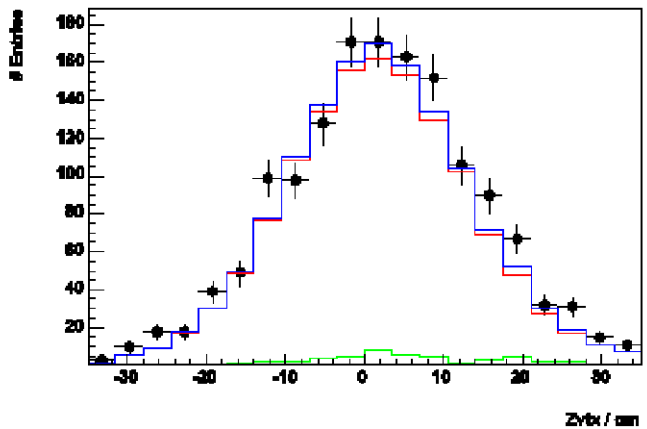
- Same 1999/2000 data set used for high Q^2 NC analysis – aim to have simultaneous inclusive and diffractive NC and CC analyses – $\mathcal{L} = 65\ pb^{-1}$
- Compare inclusive analyses to the published NC and CC analyses of this data set
- Use the same forward detector treatment for both analyses, i.e. use the understanding of the forward detectors from the higher statistics NC analysis

Inclusive Control Plots (1)









Rapidity Gap Selection

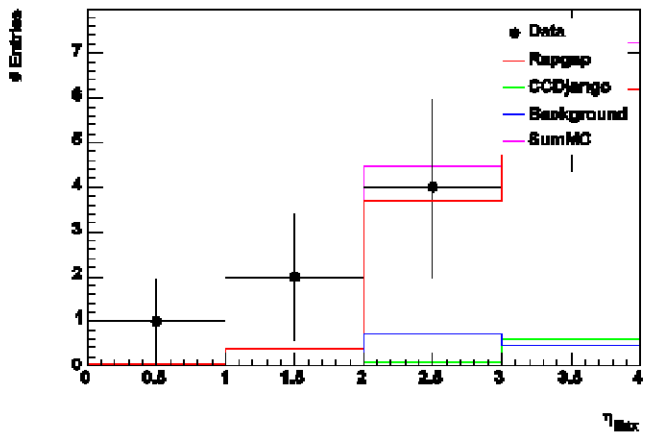
- $\eta_{MAX} < 3.3$
- $N_{PRT} < 1$
- $N_{FMD}1,2 < 2$
- $N_{FMD}1,2,3 < 3$
- $E_{PLUG} < 3.5$ GeV

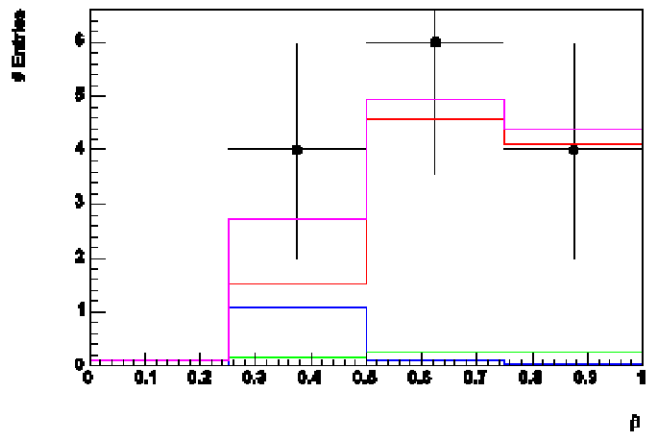
Monte Carlo	Allowed Phase space
Django	$x_{IP} > 0.15 \,\|\|\, M_Y > 5.0$
Rapgap	$x_{IP} < 0.15 \,\&\&\, M_Y < 5.0$

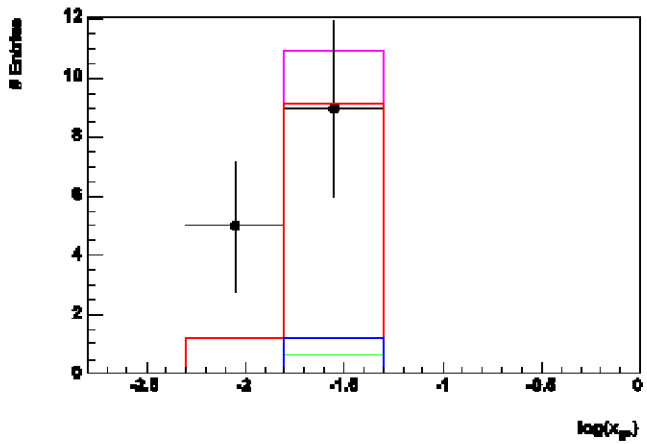
Demand the forward detectors of H1 to be empty

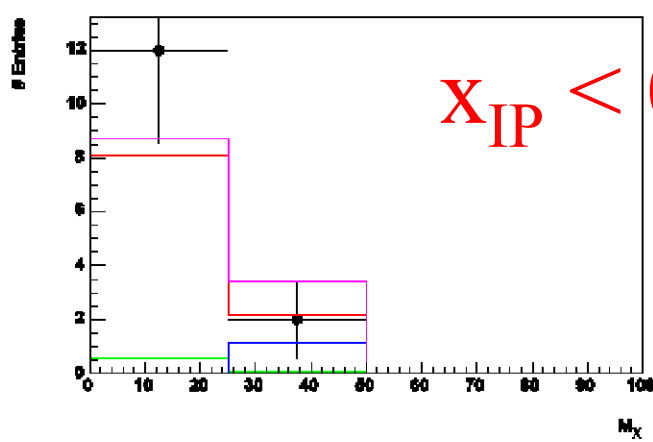
Use the understanding of the forward detectors from the higher statistics NC analysis

Diffractive CC Control Plots (5)









$x_{IP} < 0.05$

CC with Rapidity Gap Sample

- Rapgap able to describe the data
- Photo-production BG is very small

Define cross-sections for $ep \rightarrow \nu XY$:

$Q^2 > 200.0\ \mathrm{GeV}^2$ and $y < 0.9$

$x_{IP} < 0.05$

$M_Y < 1.6\ \mathrm{GeV}$ and $|t| < 1.0\ \mathrm{GeV}^2$

Total cross-section and ratio to inclusive cross-section

Measure the total CC diffractive cross-section to be :

$\sigma_{CC}^{diff} = 0.42 \pm 0.13\ (stat.) \pm 0.09\ (sys.)$ pb

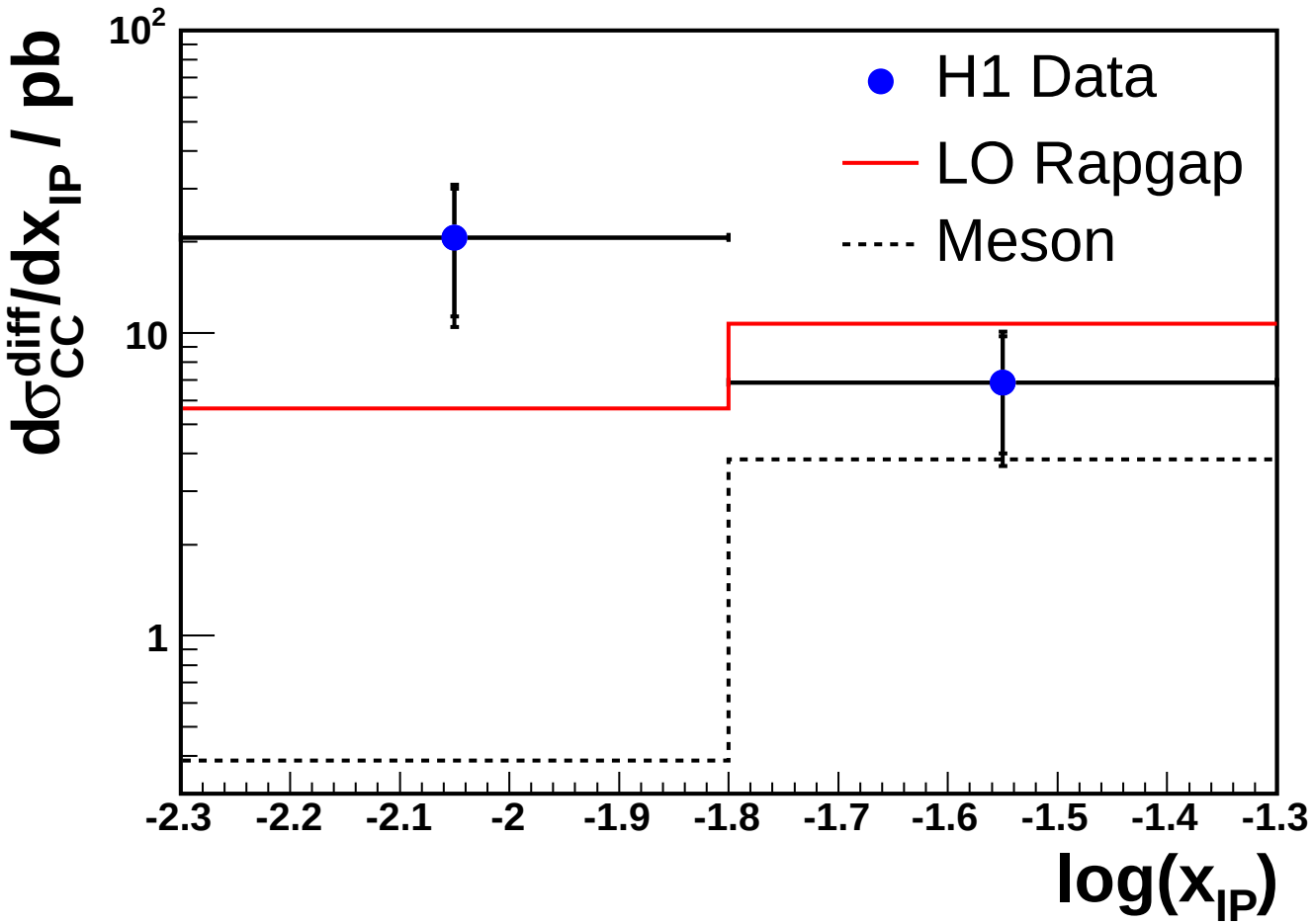
ZEUS = $0.49 \pm 0.20\ (stat.) \pm 0.13\ (sys.)$ pb

Ratio of diffractive to inclusive ($x_{Bj} < 0.05$):

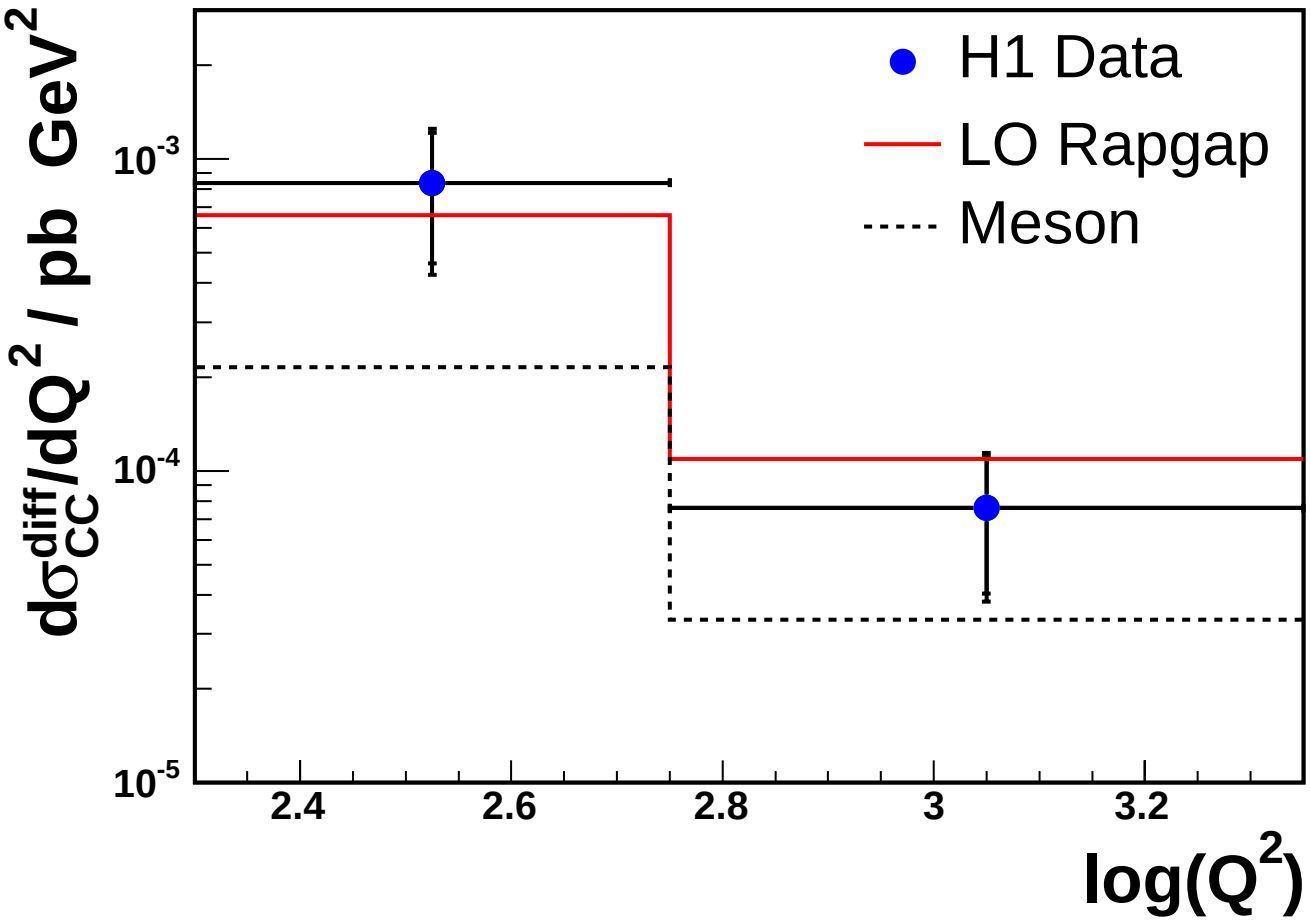
$\sigma_{CC}^{diff} / \sigma_{CC}^{inc} = 2.5 \pm 0.8 \pm 0.6$ %

ZEUS = $2.9 \pm 1.2\ (stat.) \pm 0.8\ (sys.)$ %

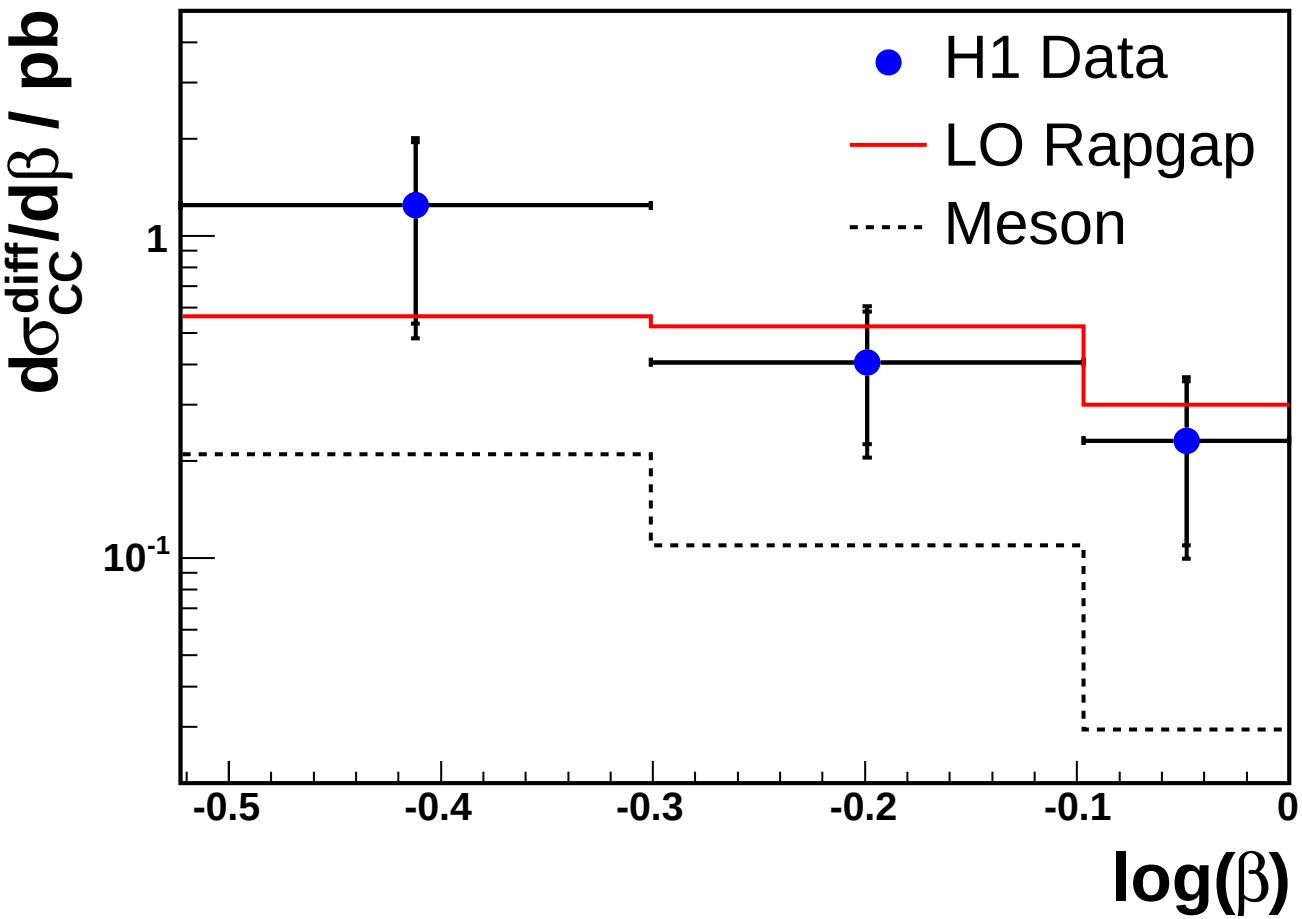
Differential cross-section in x_{IP}



Differential cross-section in Q^2



Differential cross-section in β



Summary

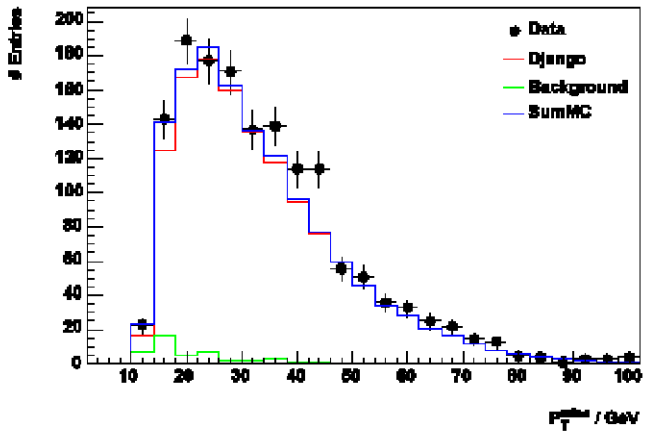
- Inclusive CC is in very good agreement with published
- H1 measurements are in very good agreement with ZEUS
- First differential measurements of the diffractive charged current cross-section
- Find good agreement with Rapgap

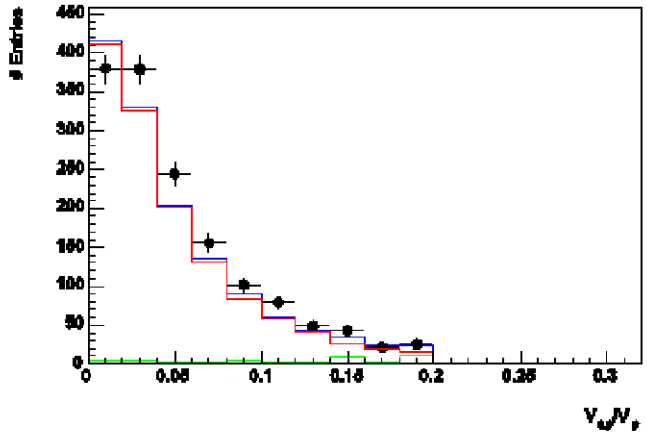
Inclusive CC selection

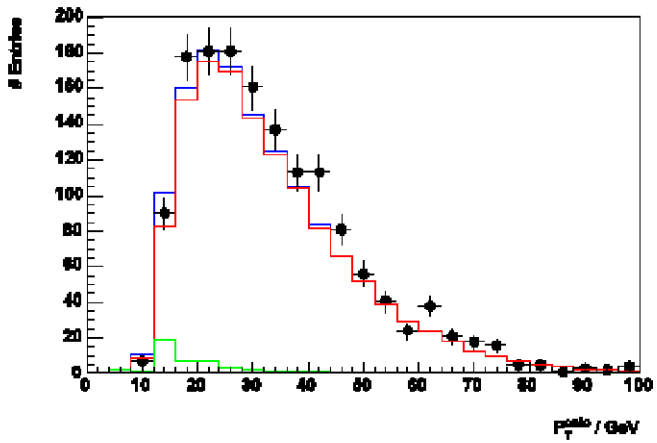
- HV:CJC1,2 LAr,TOF,Lumi,CIP,COP
- Triggers 66, 67, 77 OR 71 with L2TT(15)
- CJC Timing
- $|zvtx| < 35.0$ cm
- Background finders
- $0.03 < y_h < 0.85$
- $Q^2_h > 223.0\ GeV^2$
- $P_T^{miss} > 12.0$ GeV
- $V_{ap}/V_p < 0.2$
- Anti NC and photo-production cuts

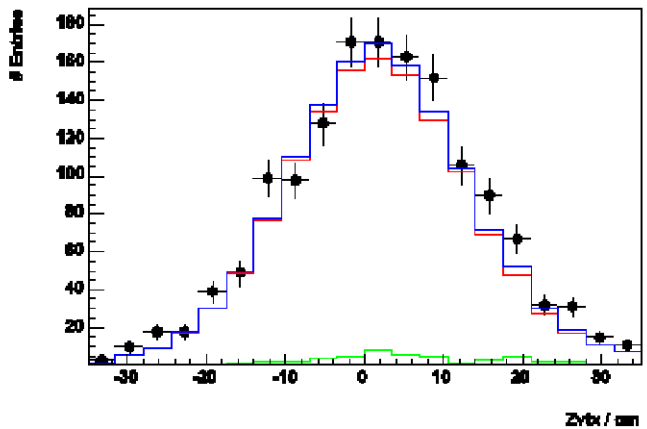
An ep interaction with large missing P_T

Inclusive Control Plots (1)

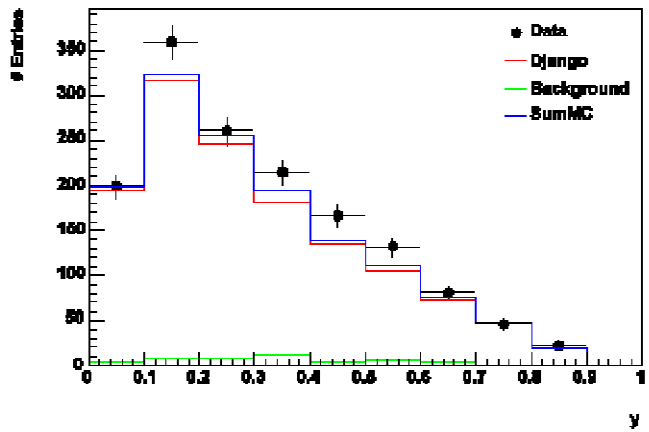


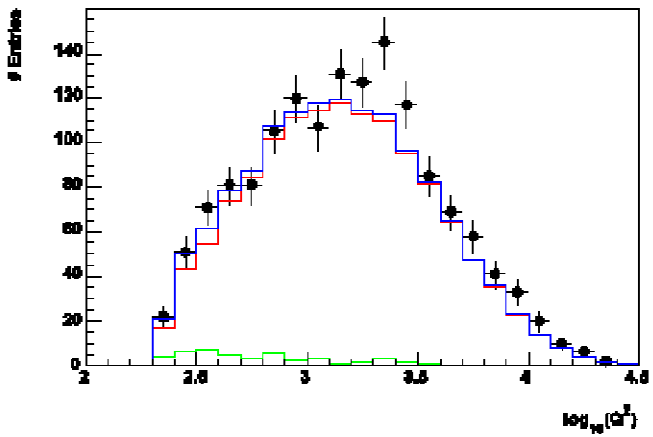


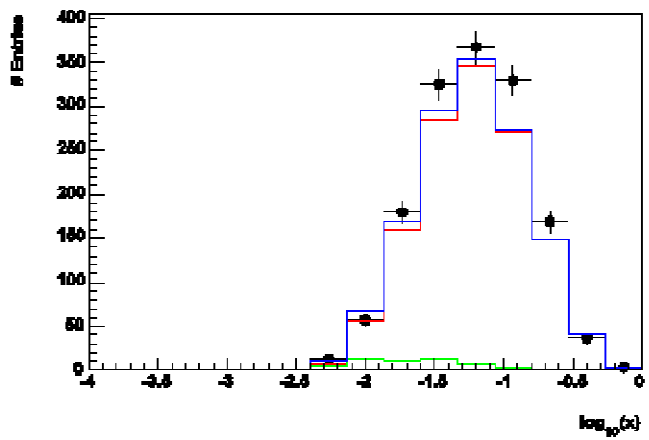


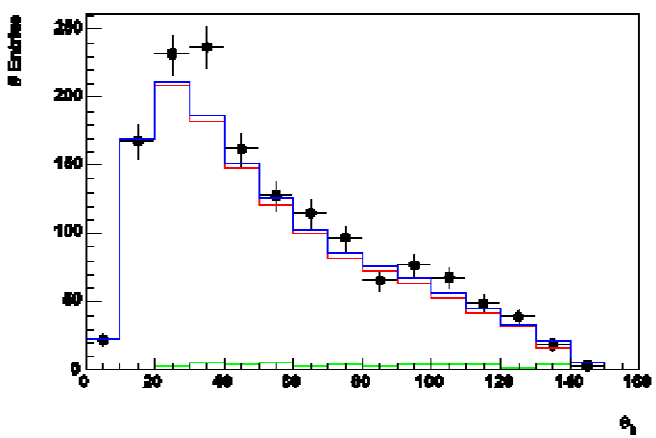


Inclusive Control Plots (2)

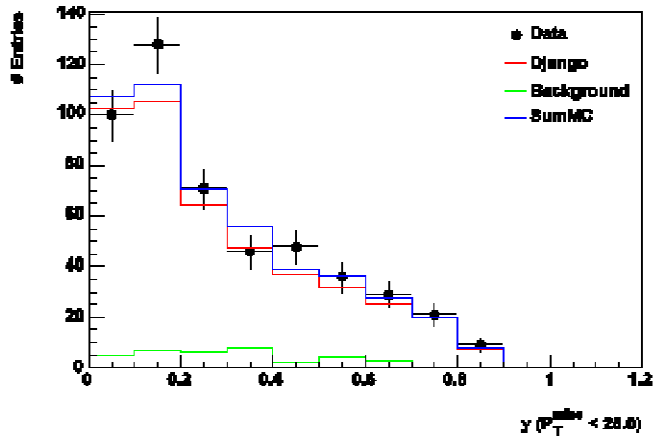


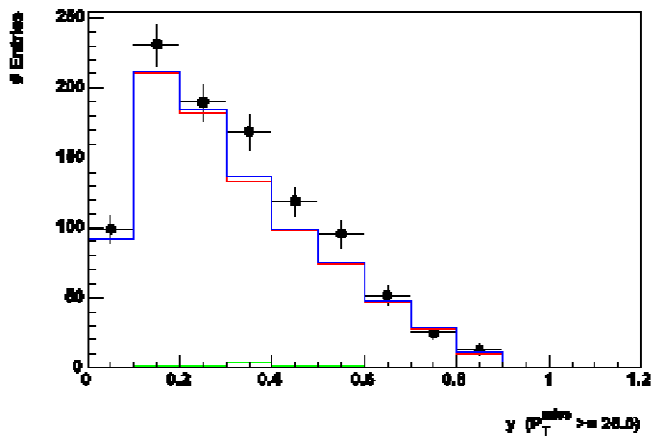


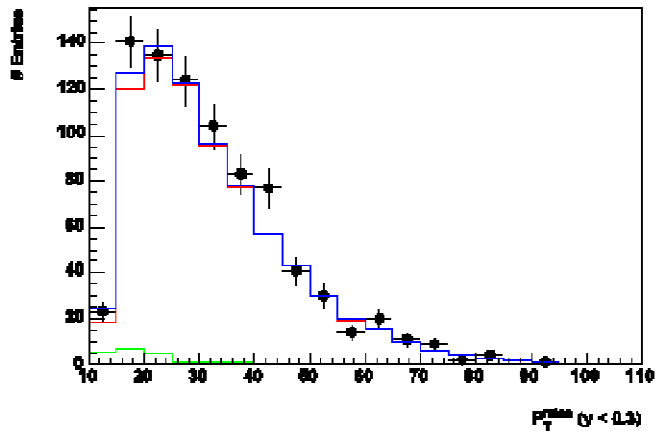


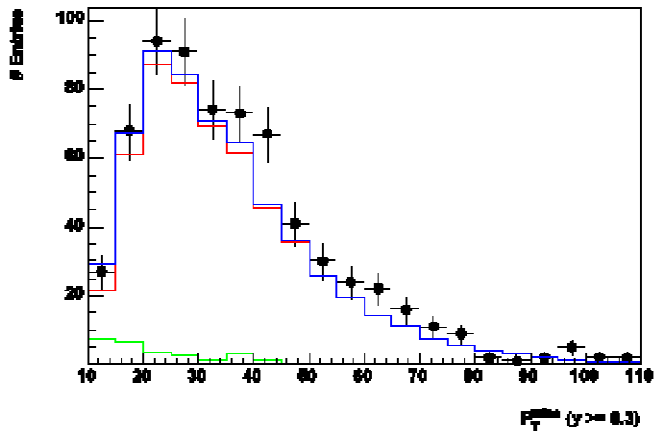


Inclusive Control Plots (3)

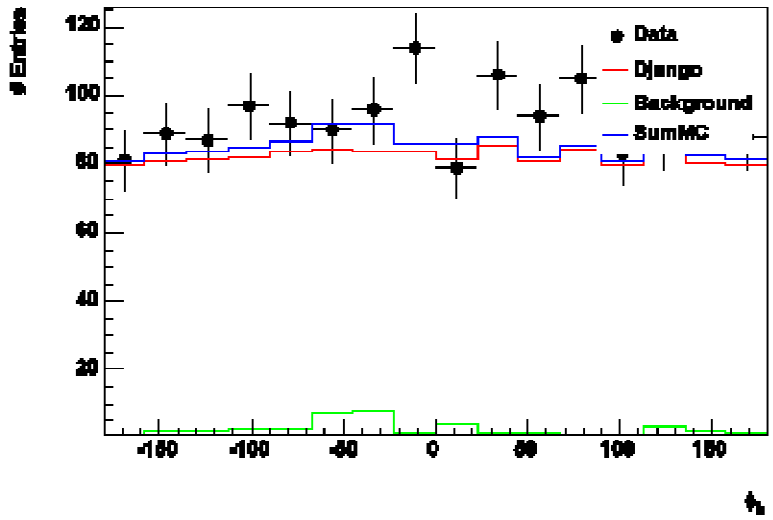


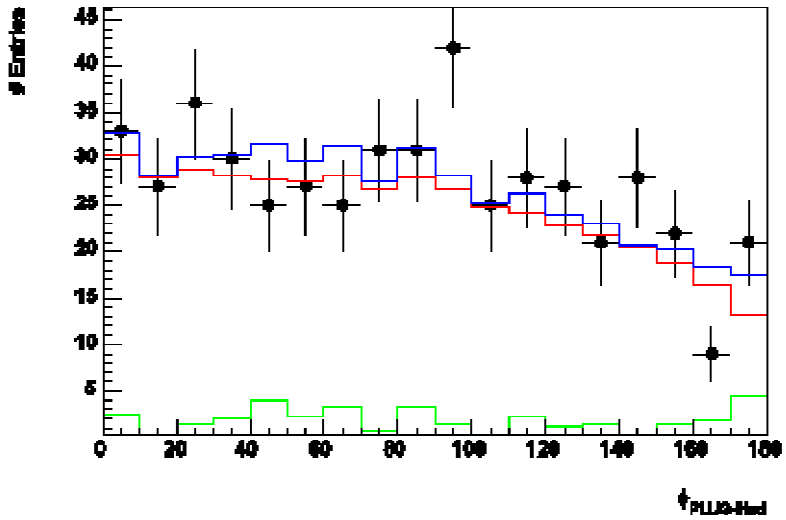






Inclusive Control Plots (4)





Total cross-section checks

Total cross-section:

- Cross-check my measured value of the total inclusive cross-section with the published value for $Q^2>1000.0$ and $y < 0.9$:

Published = 19.19 ± 0.61 (stat.) ± 0.82 (sys.) pb

This = 18.51 ± 0.61 (stat.) ± 0.82 (sys.) pb

Systematic uncertainties:

- Cross-checked my values for systematics against published and find good agreement

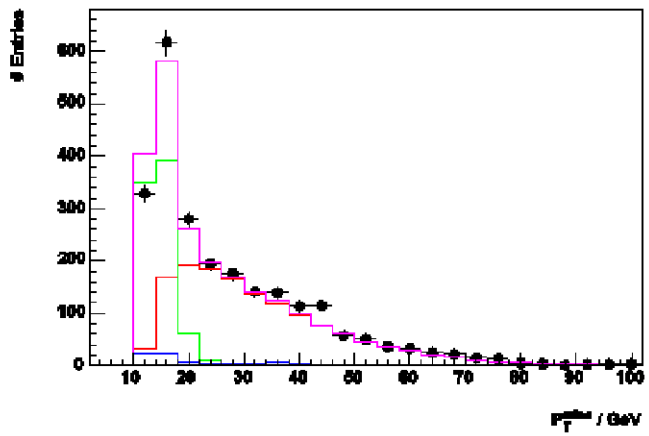
$\rightarrow$ Inclusive CC analysis reproduced

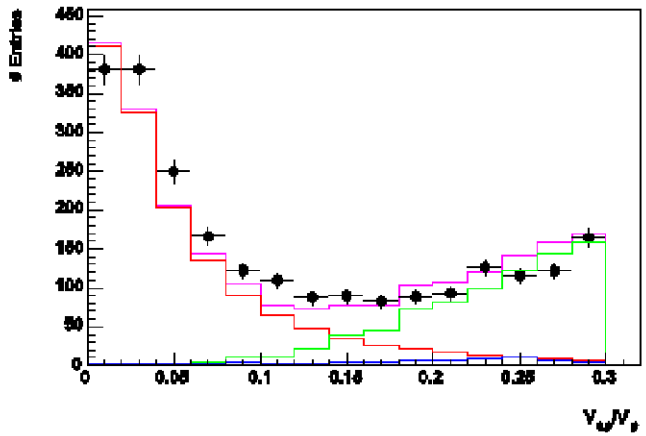
Inclusive cross-checks example – Photo-production

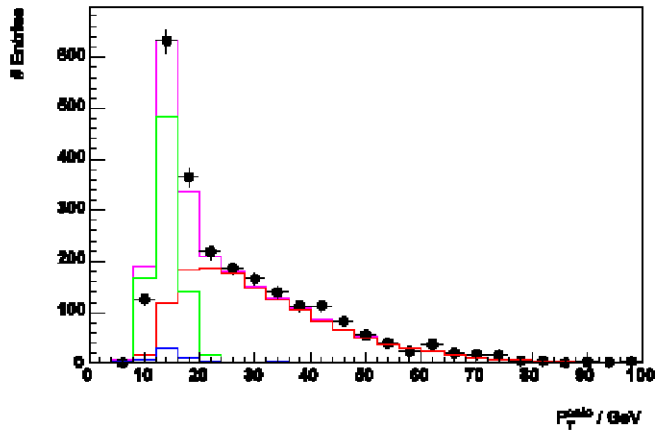
Photo-production:

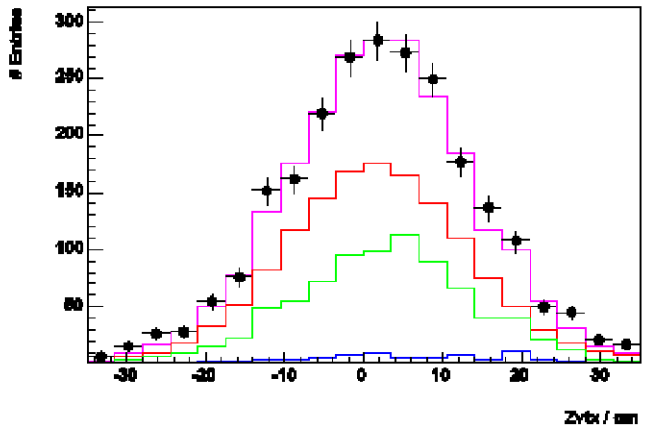
- Asked to open up the anti photo-production cuts to check normalisation (removed Vap/Vp and 3D cuts)
- Find 30% uncertainty on the Pythia normalisation, as in paper

Pythia normalisation



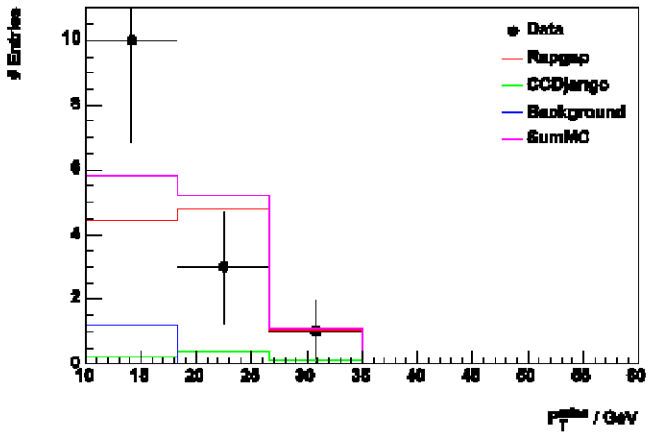


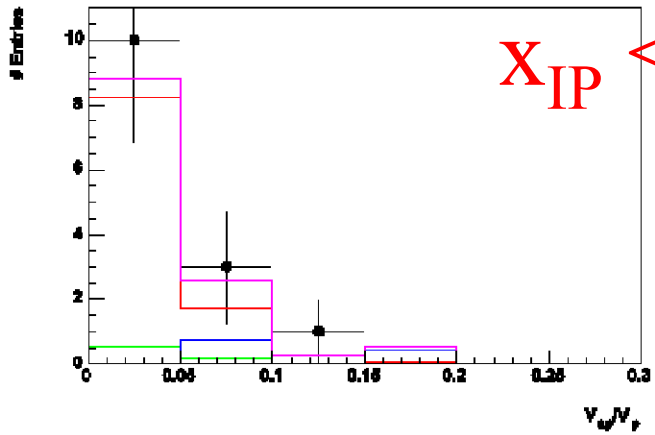




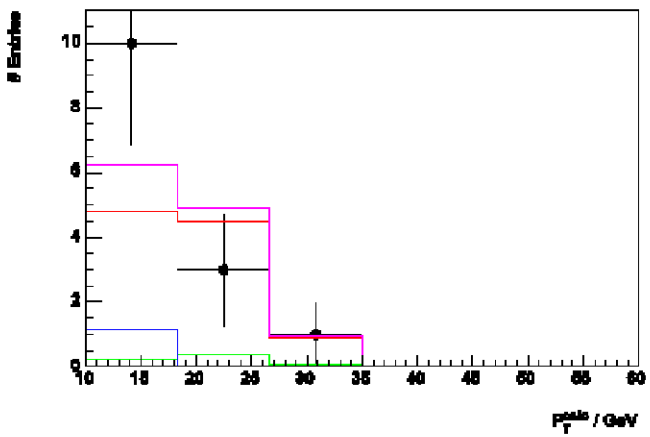
Pythia scaled by 0.7, consistent with published CC analysis

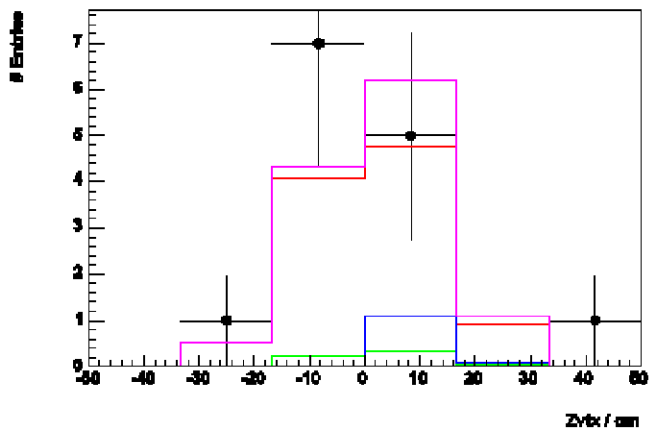
Diffractive CC Control Plots (1)



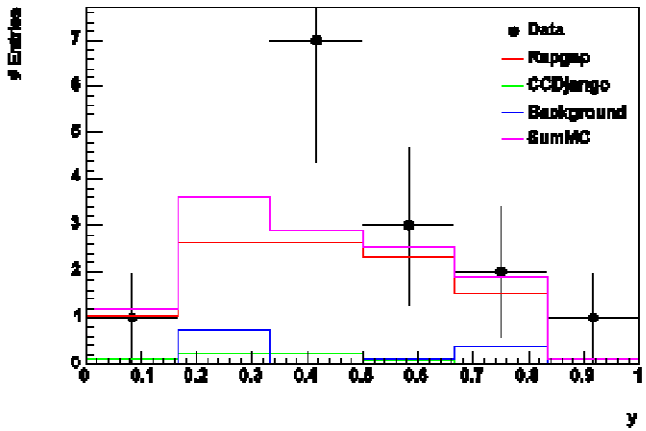


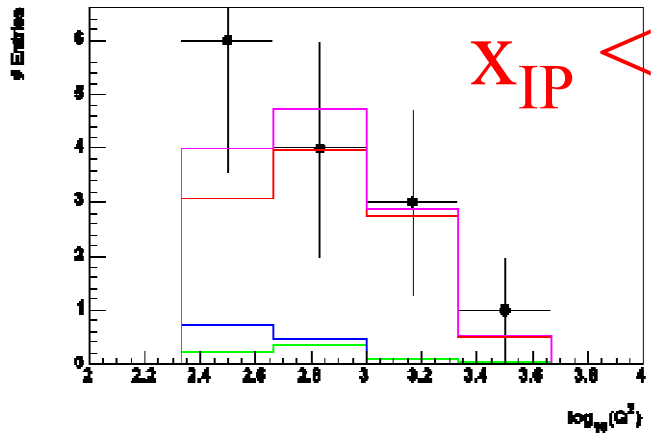
$x_{IP} < 0.05$

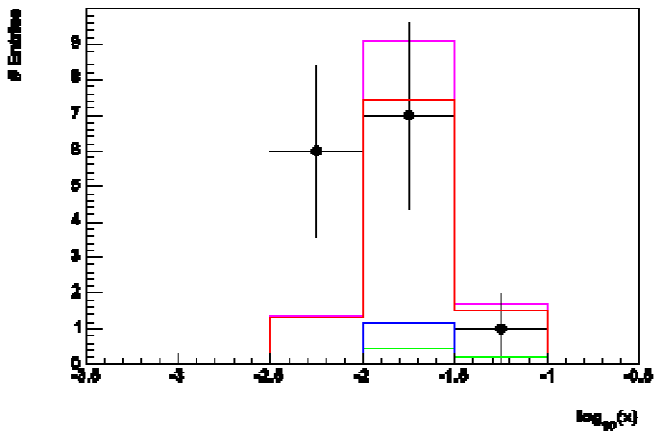


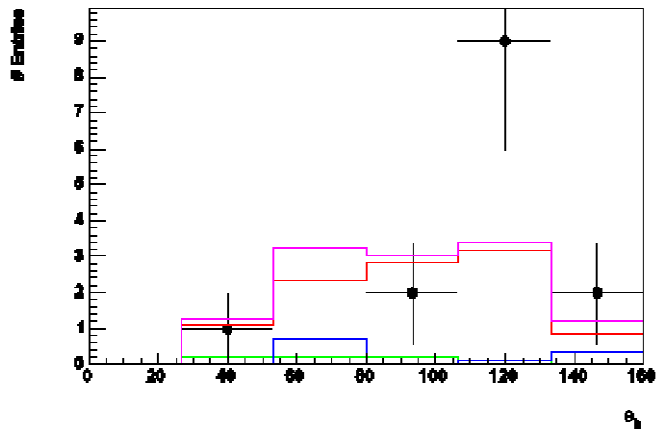


Diffractive CC Control Plots (2)

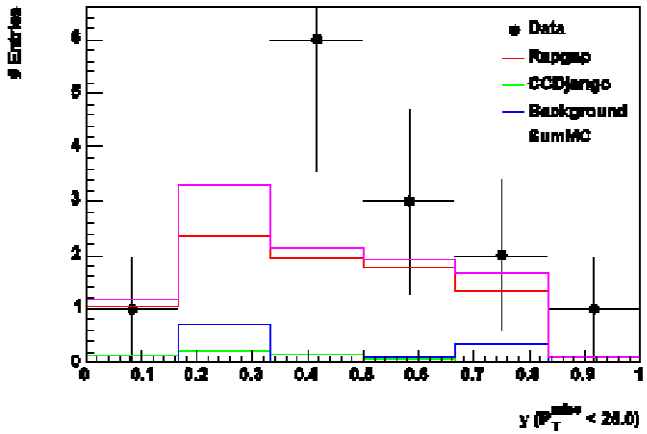


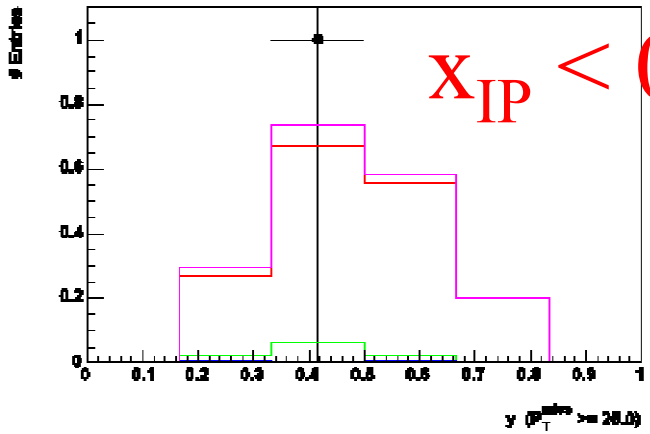


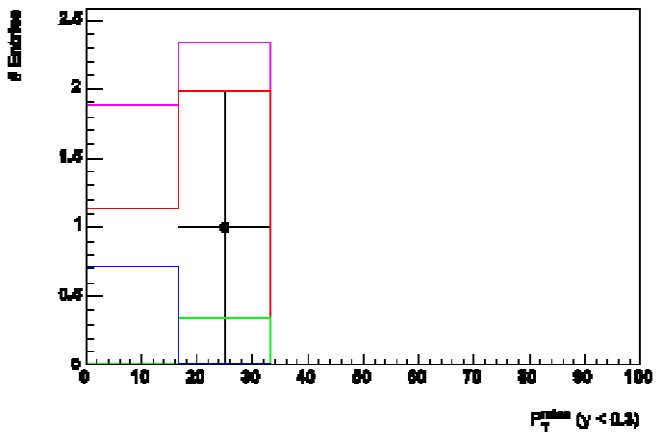


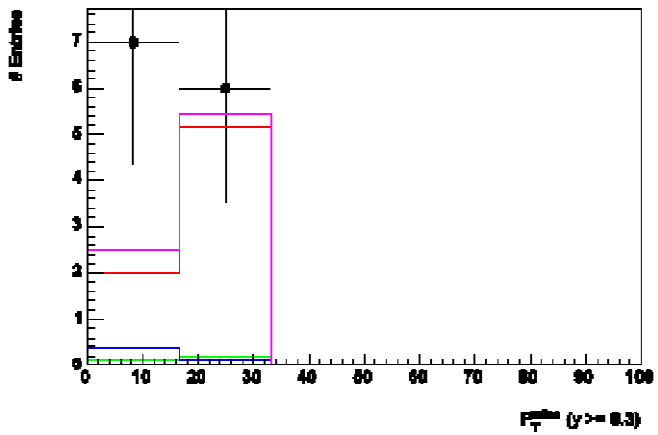


Diffractive CC Control Plots (3)



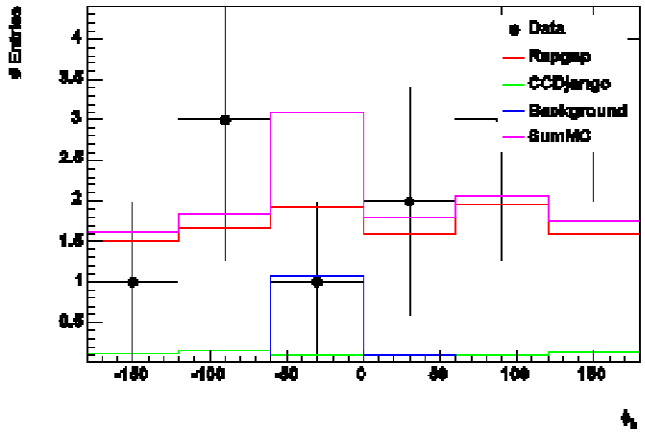


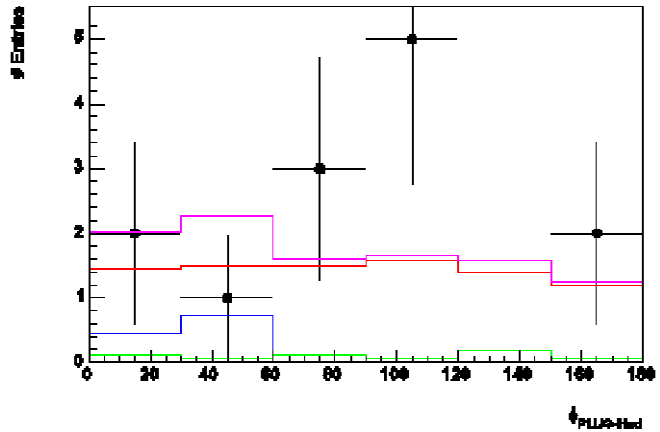




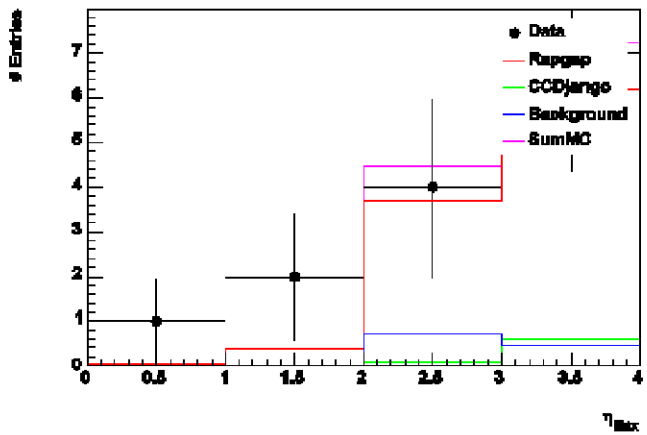
Diffractive CC Control Plots (4)

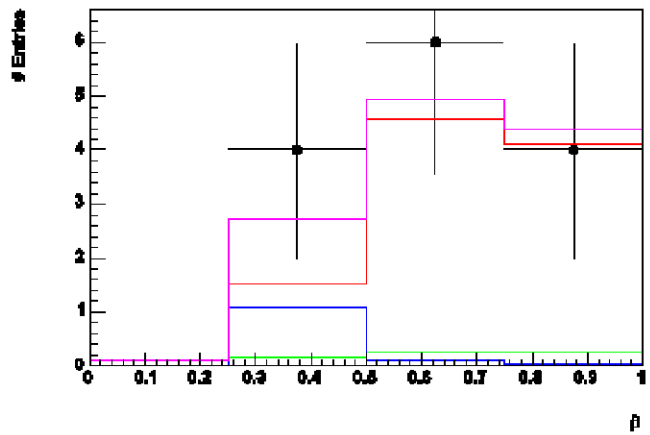
$x_{IP} < 0.05$

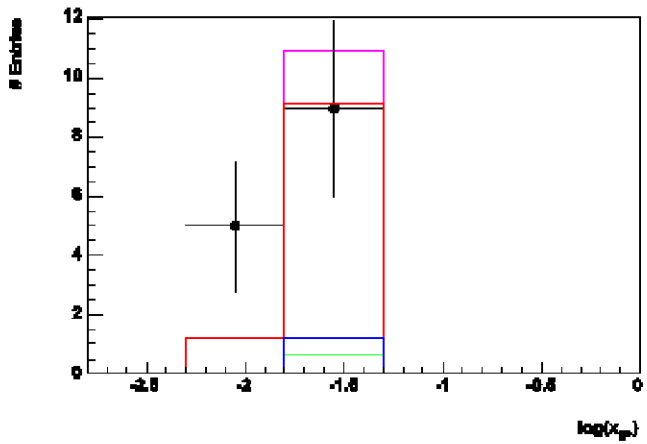


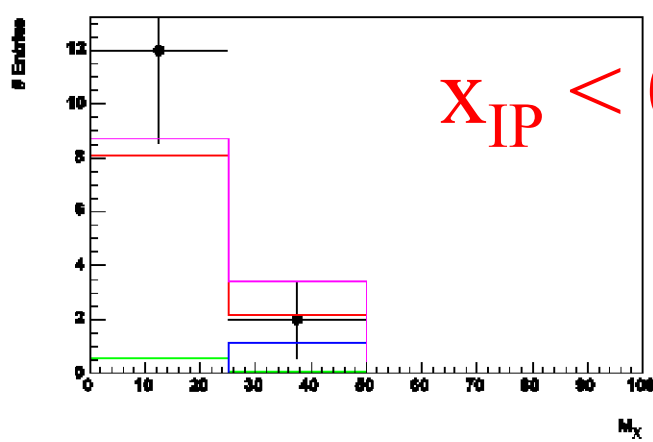


Diffractive CC Control Plots (5)









$x_{IP} < 0.05$

Differential cross-section in x_{IP}

x_{IP}	$d\sigma/dx_{IP}$ / pb	δStat	δSys	Acc	Pur	Sta
0.01	20.69	0.45	0.20	0.33	0.43	0.66
0.03	6.87	0.42	0.31	0.46	0.59	0.91

Differential cross-section in Q^2

Q2	$d\sigma/dQ2$ ($*10^{-4}$) / pb GeV^2	δStat	δSys	Acc	Pur	Sta
400.0	8.38	0.45	0.21	0.29	0.53	0.69
800.0	0.76	0.47	0.17	0.61	0.45	0.76

Differential cross-section in β

β	dσ/dβ / pb	δStat	δSys	Acc	Pur	Sta
0.4	1.25	0.57	0.22	0.21	0.34	0.31
0.65	0.40	0.44	0.22	0.68	0.43	0.71
0.9	0.23	0.53	0.22	1.23	0.36	0.94