Diffractive Dijets in DIS with Large Rapidity Gap

Physics Analysis Forum
Status Report

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Monte Carlo & Data

Data:
2005/2006e- & 2006/2007e+ total luminosity of 289.902 pb-1

MC Signal:
1. Elastic: rapgap31 (pom→uds) + (pom→cha) + reggeo
2. Proton Dissociation: rapgap31 (pom→uds) + (pom→cha)
3. Resolved Pomeron: rapgap31

MC Background:
DIS jet production: rapgap31

Reweighting:

Gen. Level → 2006 DPDF fit B (Misha's weight)

→ $w(z_{vtx}) \times w(x_{\gamma}) \times w(z_{P})$

Data Selection

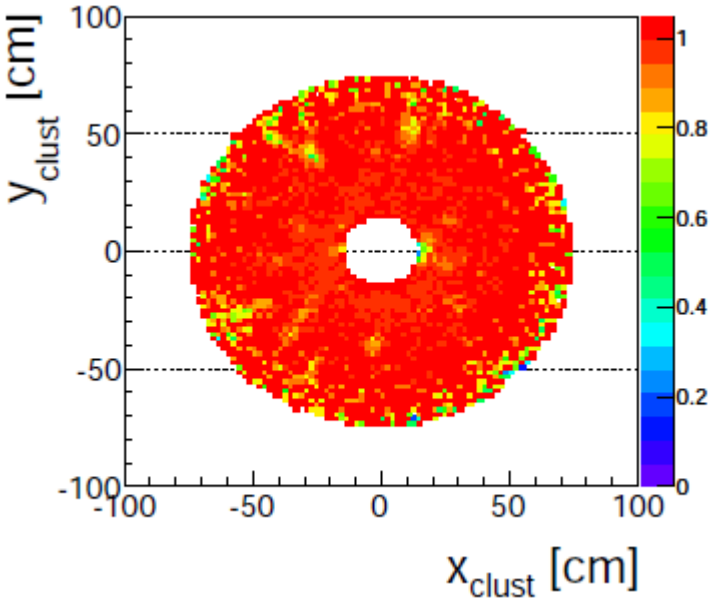
Event Selection	Electron Selection	Diffraction	Dijet
$\|z_{vtx}\| < 35$ cm	$E_e > 9.5$ GeV	$\eta_{max} < 3.2$ (Clust. 800 MeV)	$N_{jet} > 1$
$35 < E\text{-}p_z < 75$ GeV	$r_{log} < 4$ cm	$x_P < 0.03$	$p_{T1} > 5.5$ GeV
$4 < Q^2 < 80$ GeV^2	$16 < r_{clus} < 74$ cm	$E_{plug} < 3$ GeV	$p_{T2} > 4.0$ GeV
$0.1 < y < 0.7$	SPACAL Box Cut $\varepsilon_{trig}(x_{clus}, y_{clus}) > 0.96$	$N_{FTS}=0$	$-1 < \eta^{lab}_{1,2} < 2$
Subtrigger 61	$E_{had}/E_{tot} < 0.15$ $E_{cone}/E_{tot} < 0.05$	FMD $N_{12} < 2$ $N_{123} < 2$	

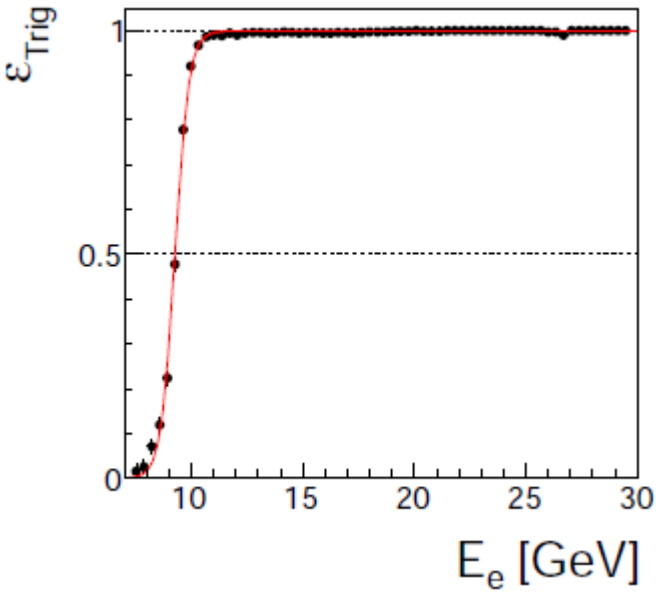
Requirement of no energy in had. SPACAL removed

Reconstruction method – eΣ
SAPCAL Cluster position corrected for zvtx and beam position

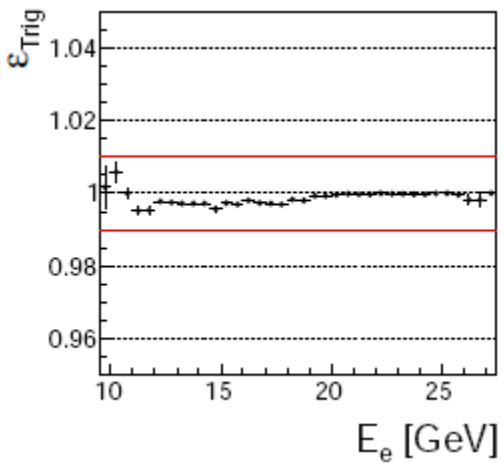
S61 Trigger Efficiency - SPACAL

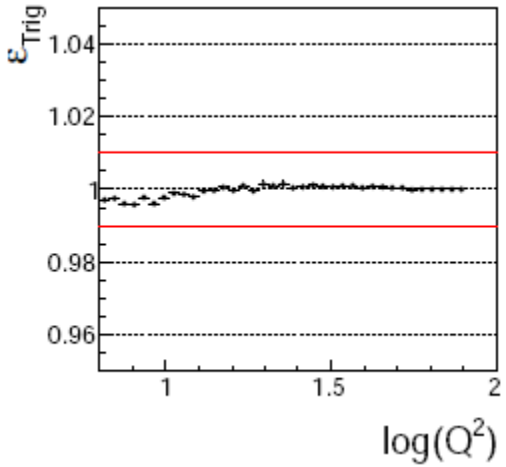
- S61 ~ (SPACAL && FTT)
- SPACAL condition – Data, Inclusive DIS, all SPAC. Independent triggers as monitor
- Box Cut – Trigg.eff. in x,y plane > 96 %
- Low energy (high y) correction – sample with E_e > 7 GeV
- Run Perion 2005e-, similar for other run periods

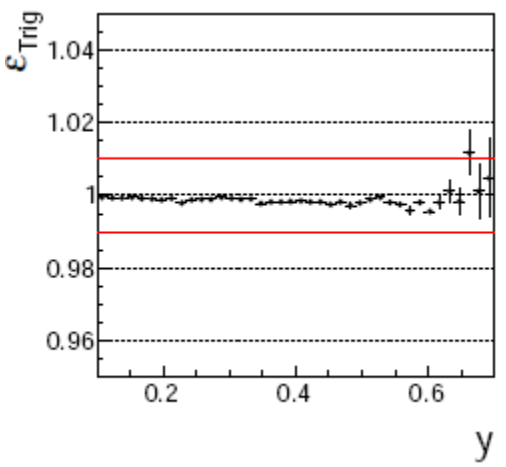




S61 Trigger Efficiency - SPACAL



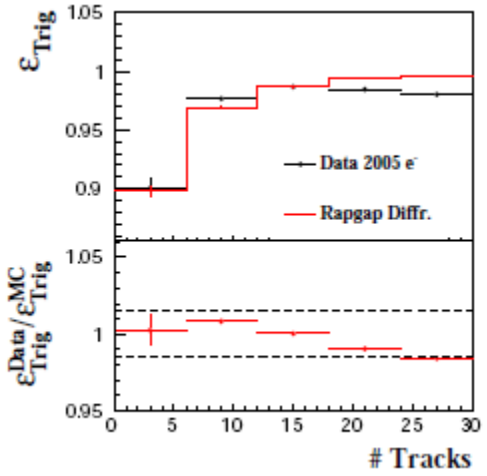


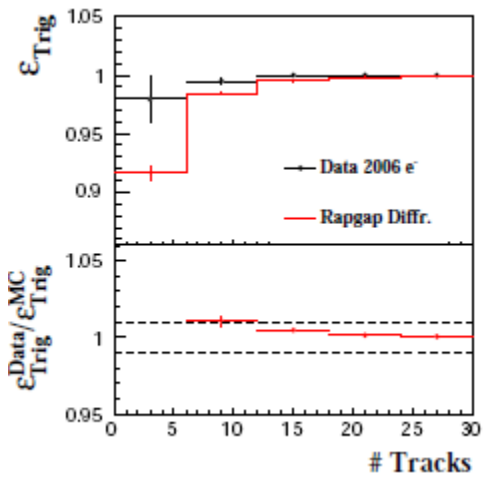


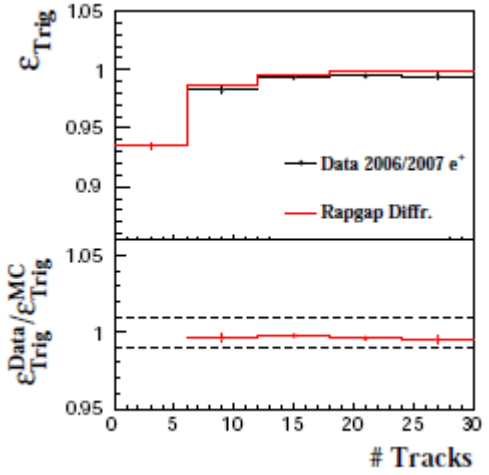
- Analysis sample reweighted with the Fermi func.
- Error on Trigg. Efficiency ~1%
- Run period 2005e- other run periods similar

S61 Trigger Efficiency – FTT

- S61 FTT condition – relay on FTT MC emulation
- DIS dijet selection, s0, s1 monitor trigger
- Data/MC agreement within ~2% → Syst. Error

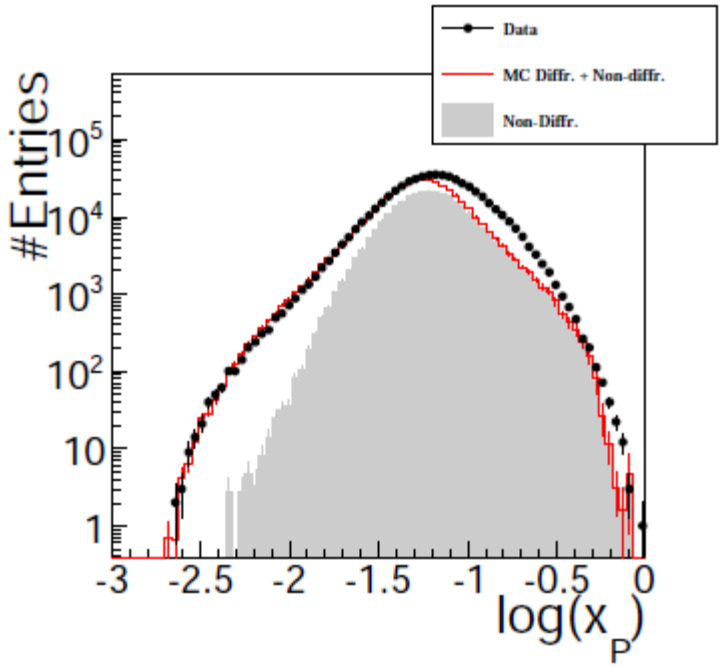


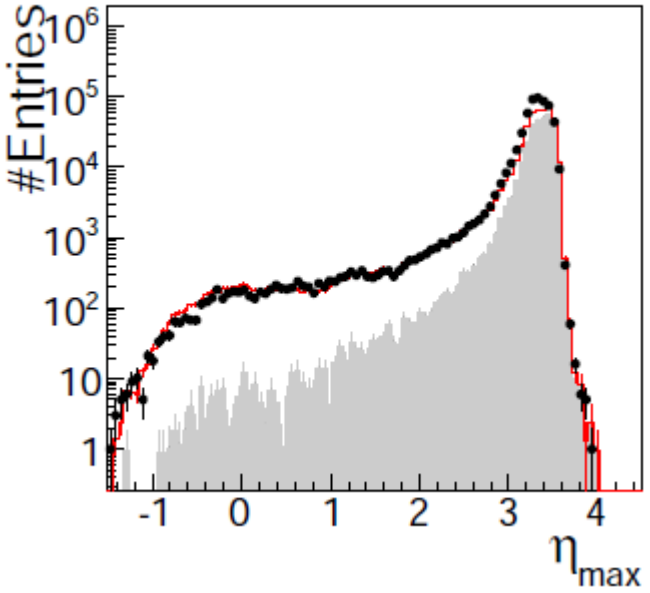




Background Normalization

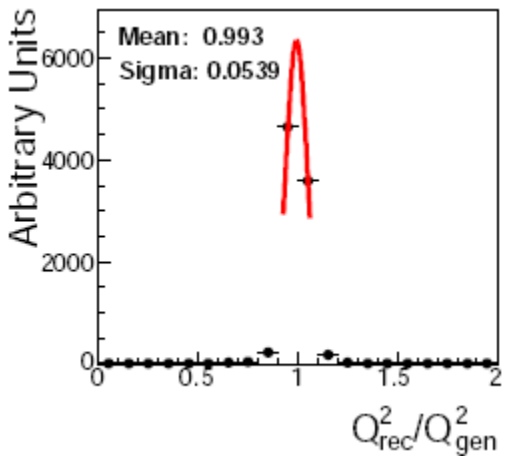
- DIS Dijet sample (no diffr. Cuts)
- Diffractive MC nomalized to data in region log(xpom)<-2.2
- DIS + Diffr. MC normalized to data around log(xpom) = -1.5 (cut value)
- Normalization correction -> ~1
- sys error 0.5 – 1.5 normalization variation

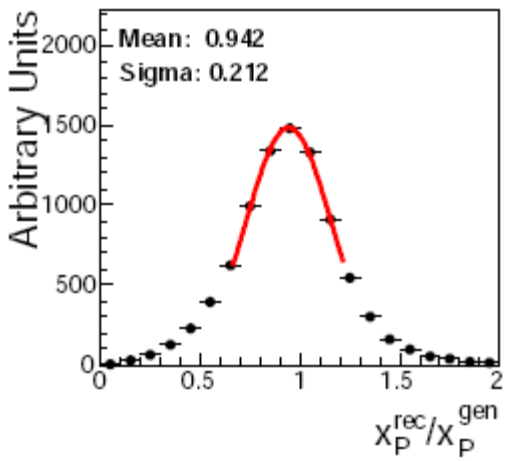


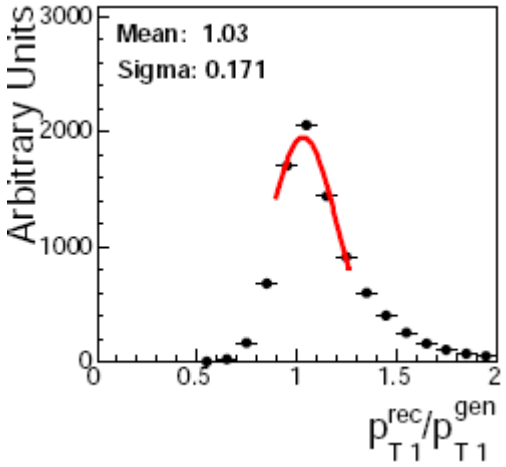


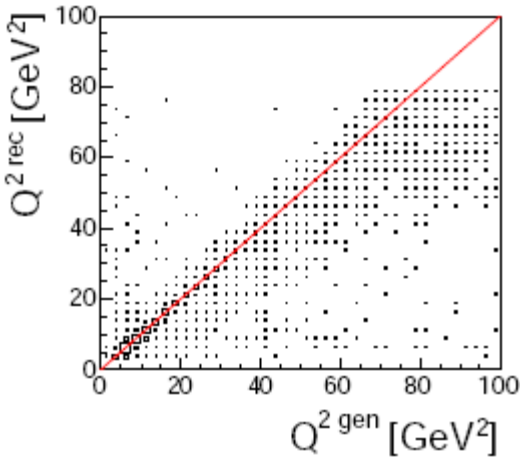
Detector Resolution

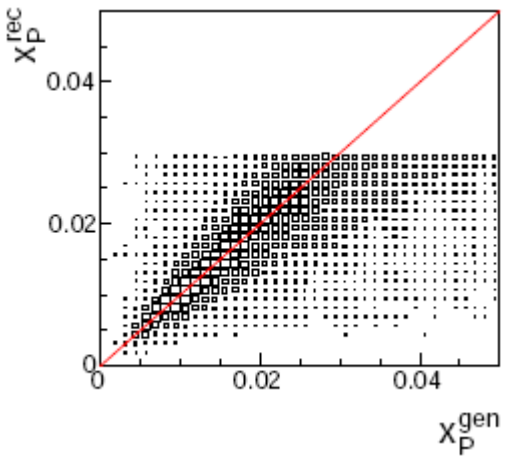
- MX corrected by factor dependent from η_{max}

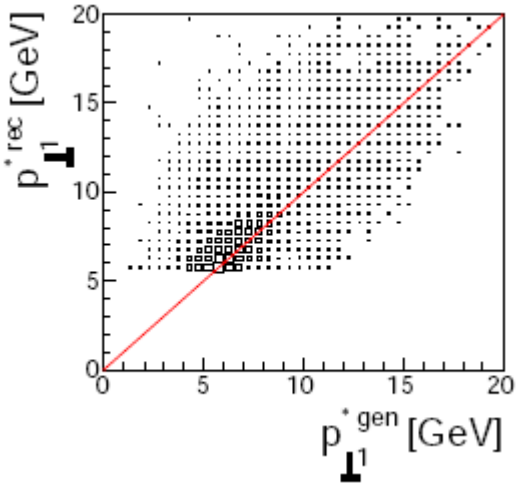












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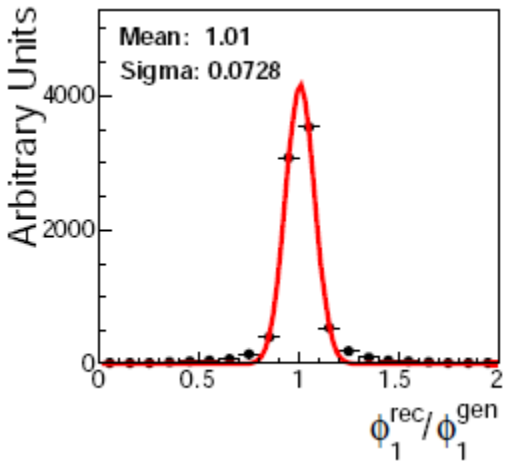
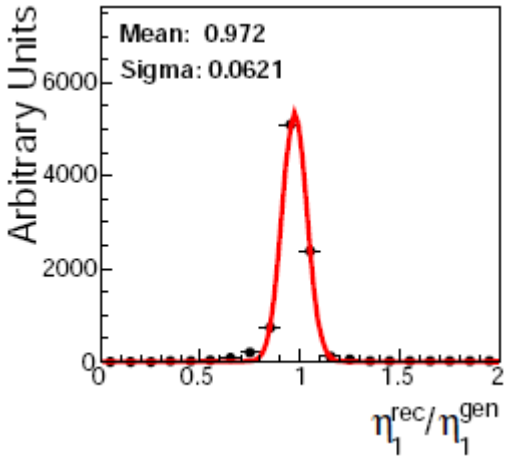
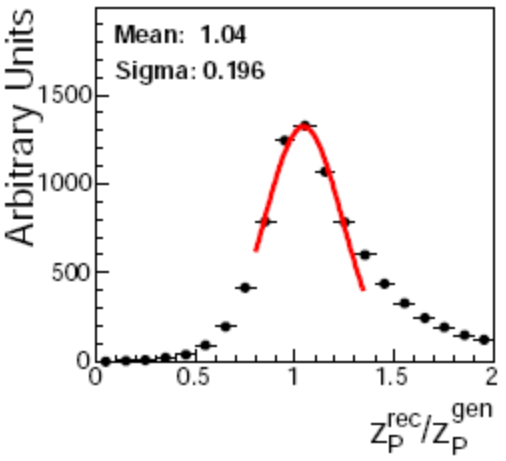
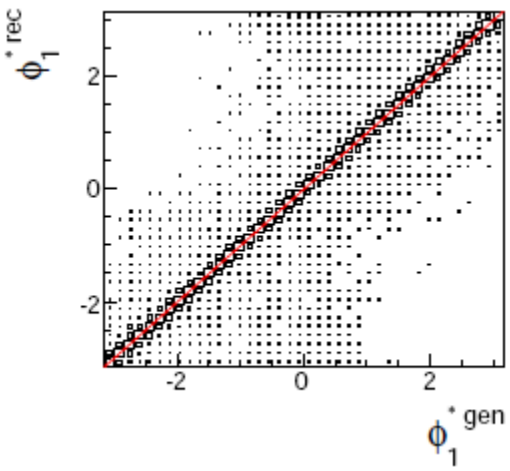
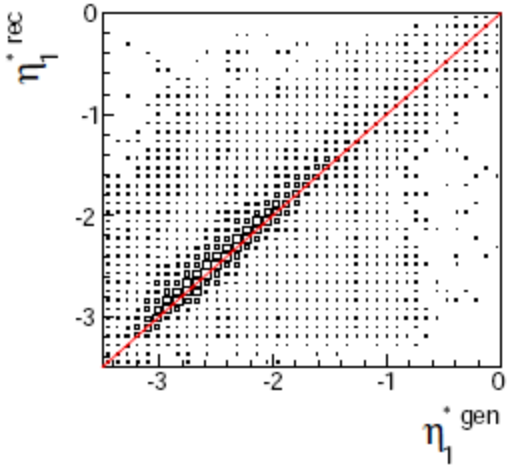
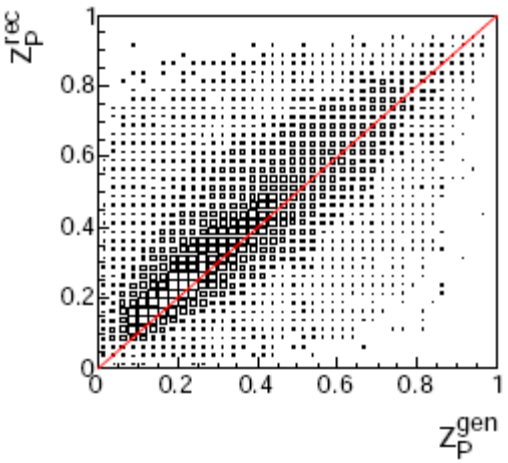






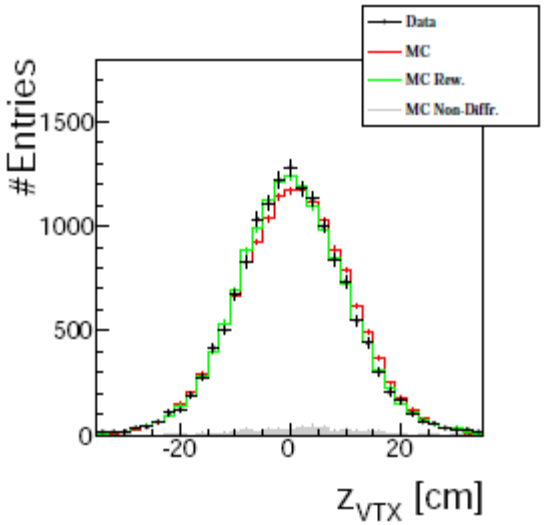


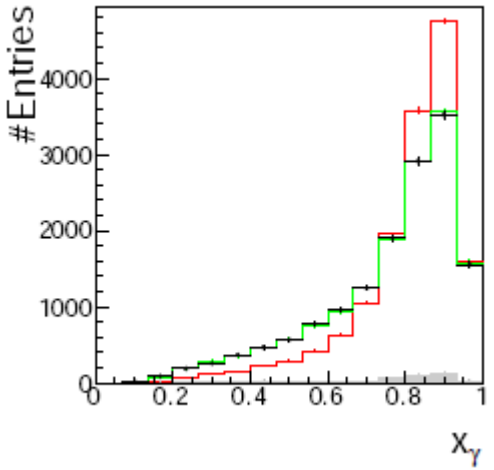


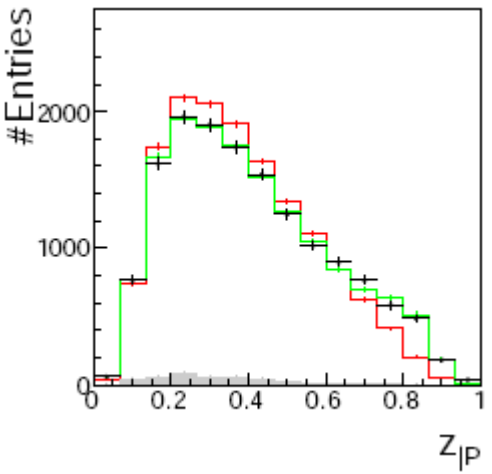


MC/Data Reweighting

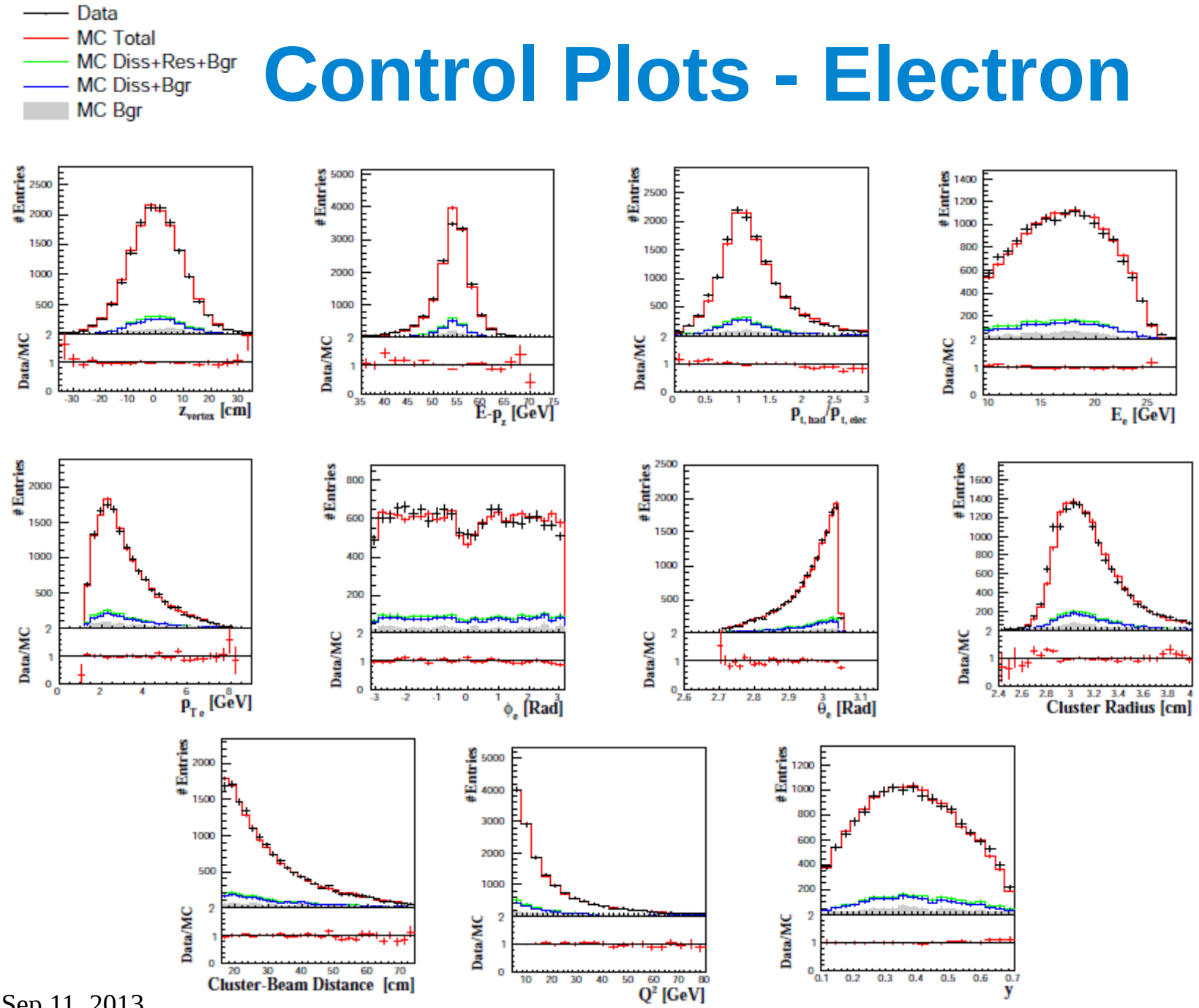
- Reweighting on generator level – inversion of hadr./reconstr. Matrix in variables z_{vtx} ,x_γ, z_{pom}
- Weight in x_γ and z_{pom} determined iteratively stable after three iterations, $w(x_\gamma) \times w(z_{pom}) = \prod (w^i(x_\gamma) \times w^i(z_{pom}))$



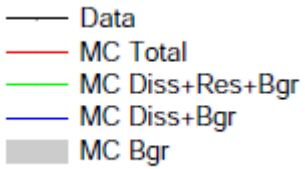


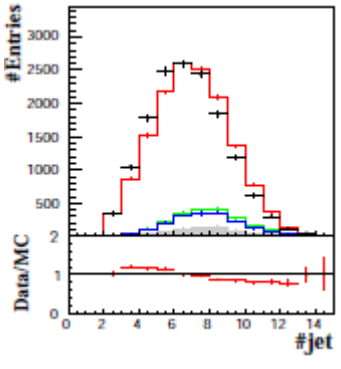


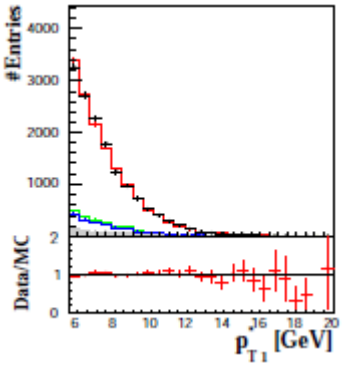
Control Plots - Electron

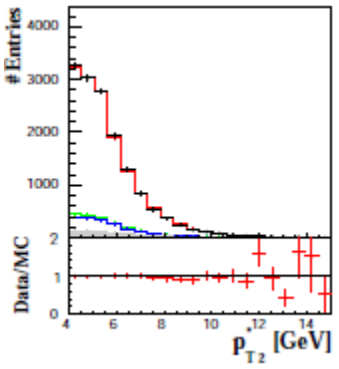


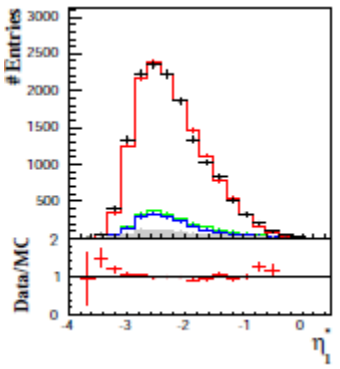
Control Plots - Jets

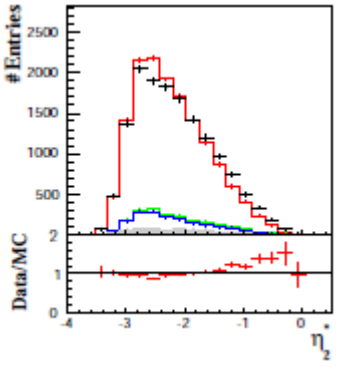


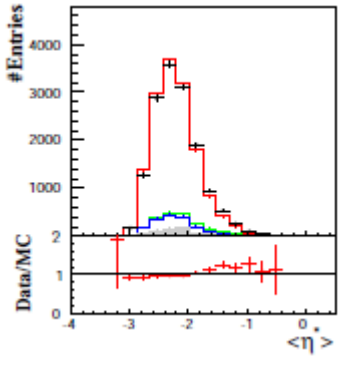


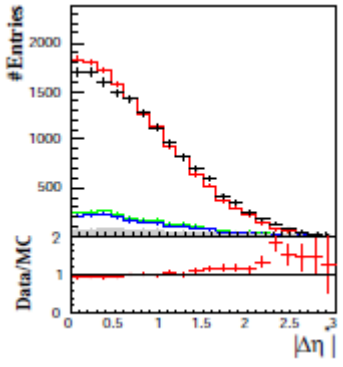


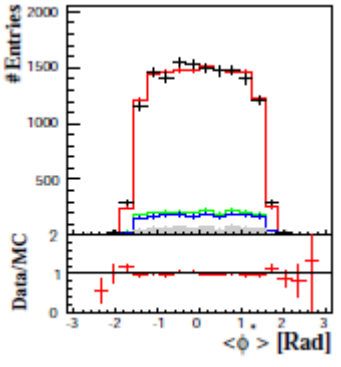


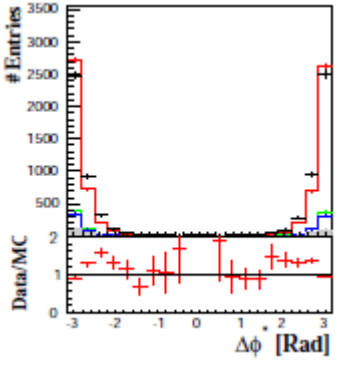


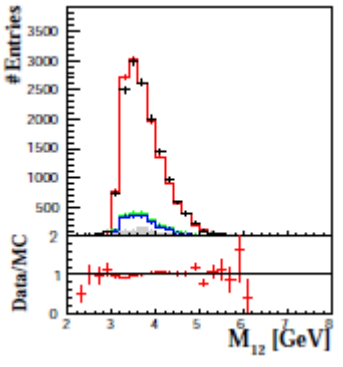


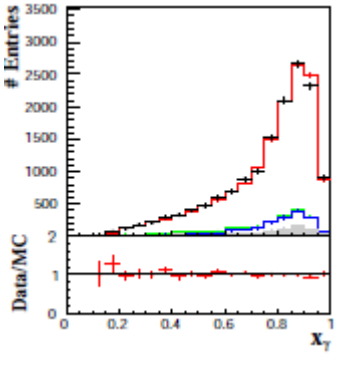


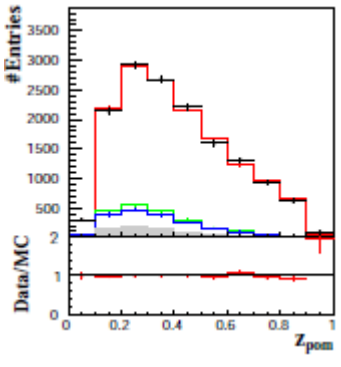




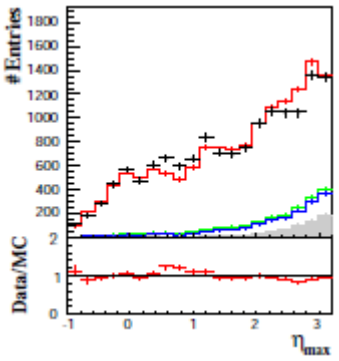


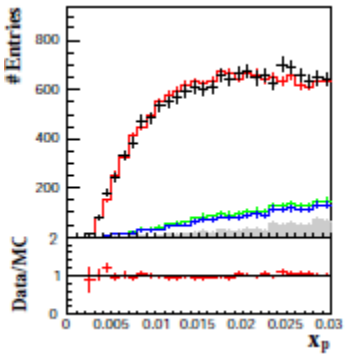


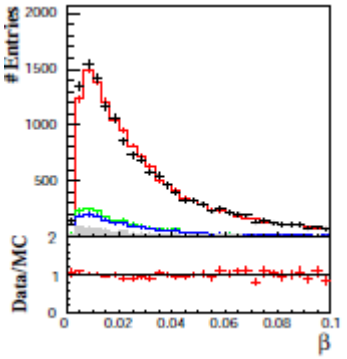


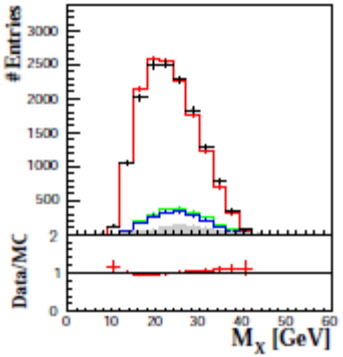


Control Plots - Diffraction









Data are well described after reweighting,
Remaining disagreement included in systematic

Systematic Errors

Model uncertainties:

Weight	Contribution
$x_P^{\pm 0.05}$	0.6 %
$\log^{\pm 0.2}(Q^2)$	1.1 %
$\beta^{\pm 0.01}(1-\beta)^{\pm 0.01}$	0.5 %
$p_T^{\pm 0.15}$	3.1 %
$\exp^{\pm .t}$	2.6%
$x_{gamma}^{\pm 0.15}$	0.6%
$(1+deta)^{\pm 0.05}$	2 %
$z_{pom}^{\pm 0.15}$	2 %
LRG selection	7 %
Bgr. normalization	2 %
Total Model	9 %

Uncorrelated syst.:

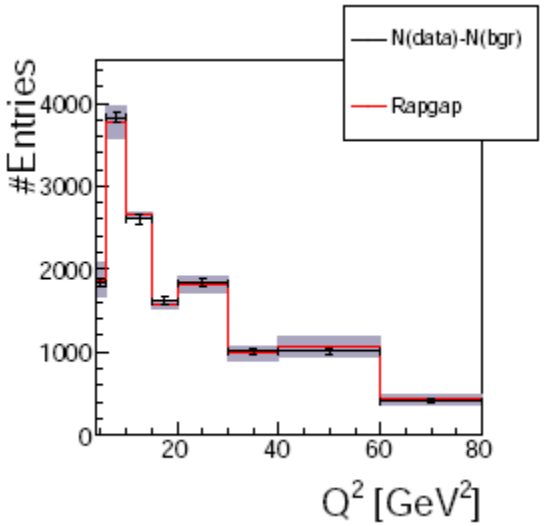
Source	Shift	Error
E_e	1%	1%
E_θ	0.1%	1%
HFS	2%	4%

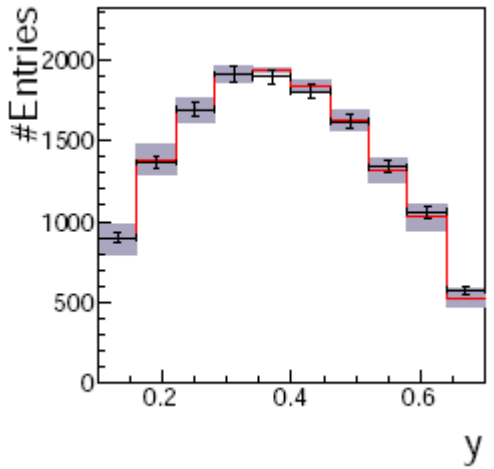
Correlated syst.:

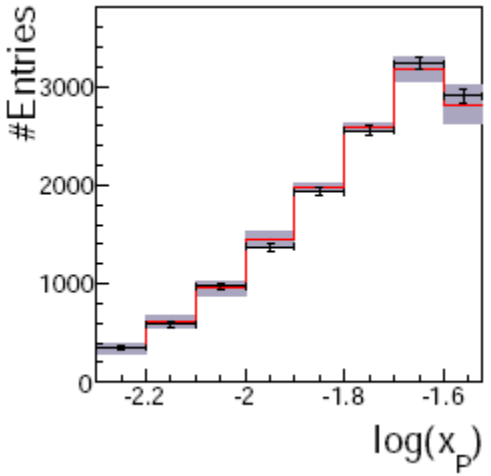
S61 - SPAC	1%
S61 - FTT	2 %
lumi	2.5 %

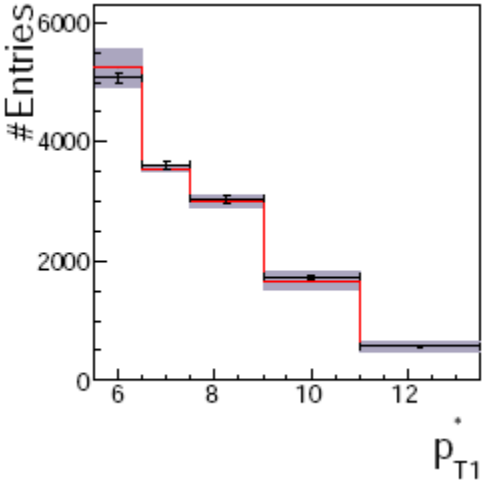
Total uncertainty 11 %

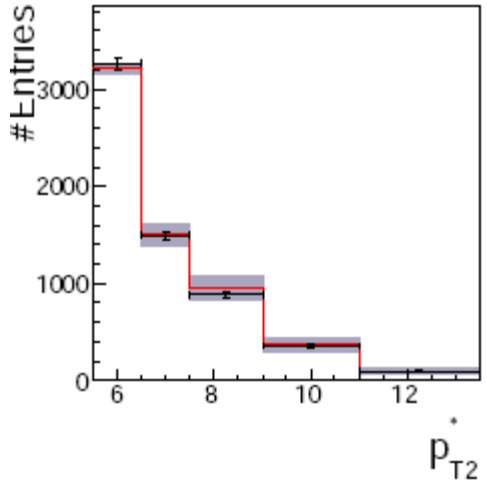
Model Systematic – All Shifts

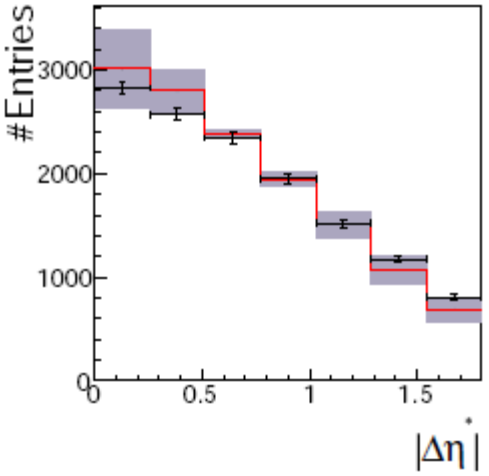






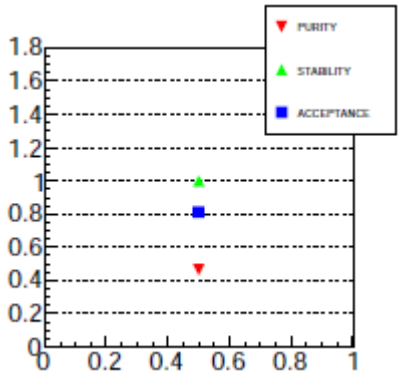


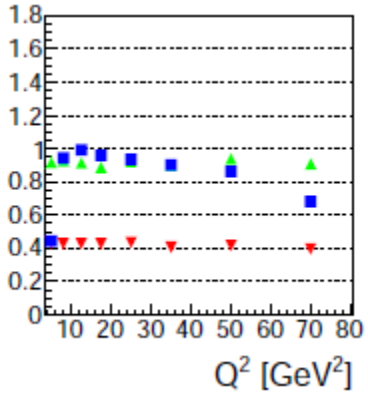


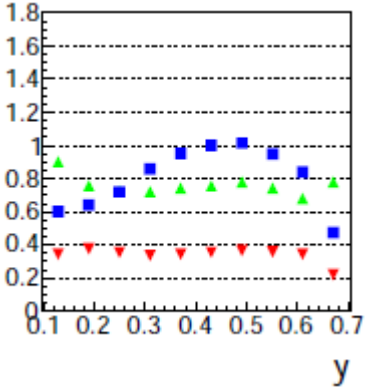


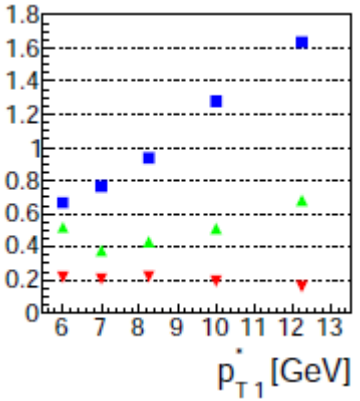
Purity, Stability, Acceptance

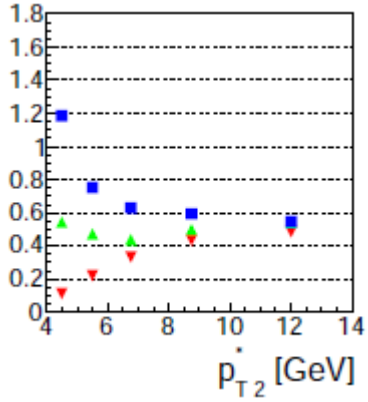
Total purity ~46%, acceptance 80 %

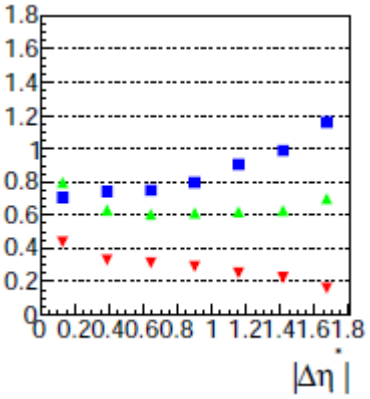


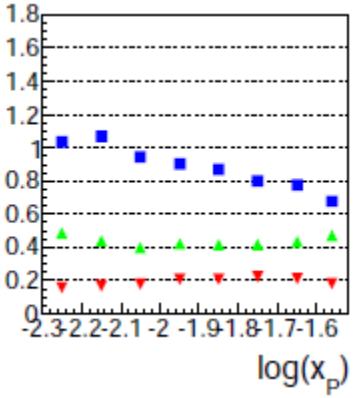


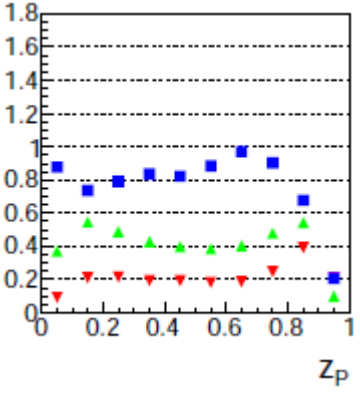






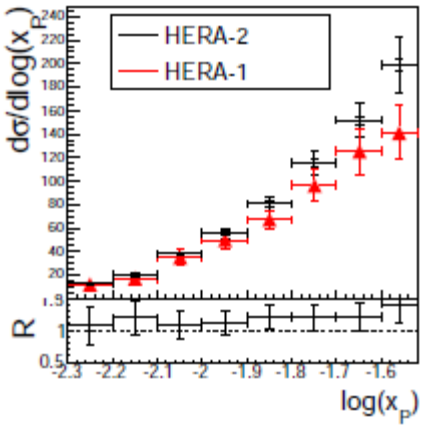


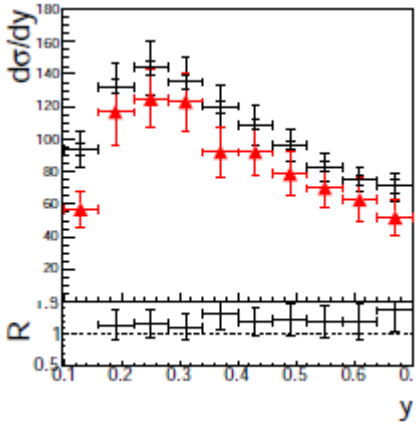


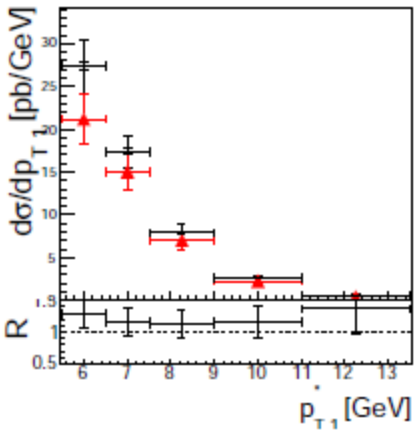


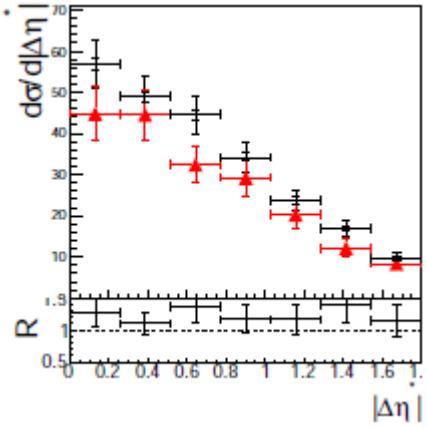
Cross Section BB & HERA-1

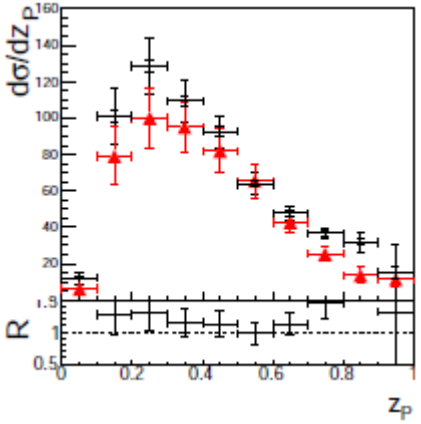
- Comparison of bin by bin corrected cross section to HERA-1 measurement
- QED radiation corrections applied, trigg.eff. Correction in data
- Stat. and total syst. Error added in square









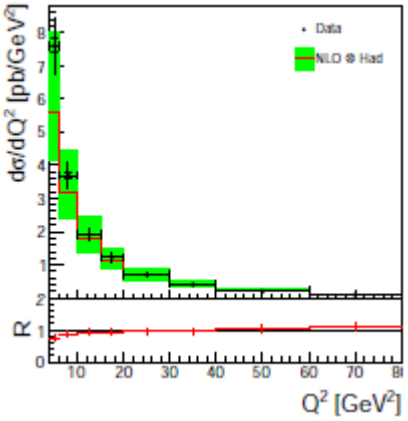


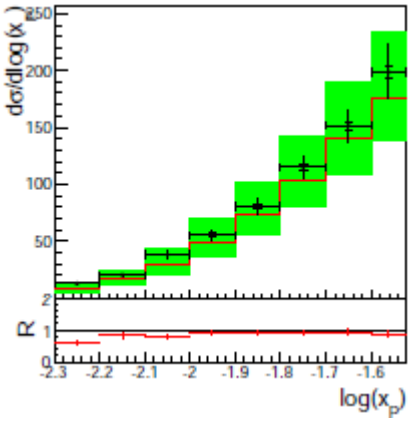
Significant difference in high xpom

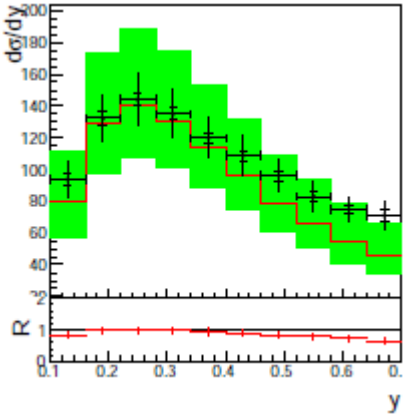
Total cross section 18 % above HERA 1

Cross Section BB & QCD-NLO

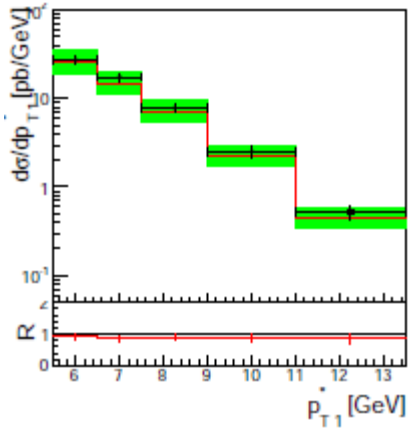
- noljet++, diffractive interface with x_{pom} scaling
- $n_f=5$, $\Lambda_{QCD}=0.22$
- Hard Scale $\mu^2=p_T^{\,2}+q^2$
- Hadronization uncertainty ~8%, LLPS and CDM

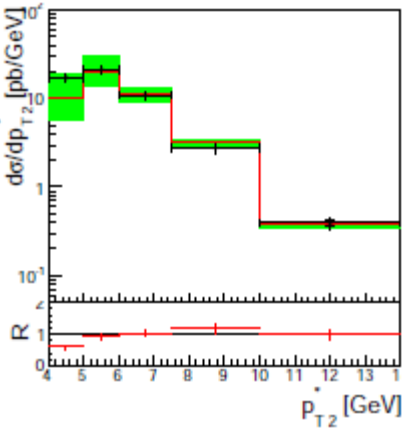


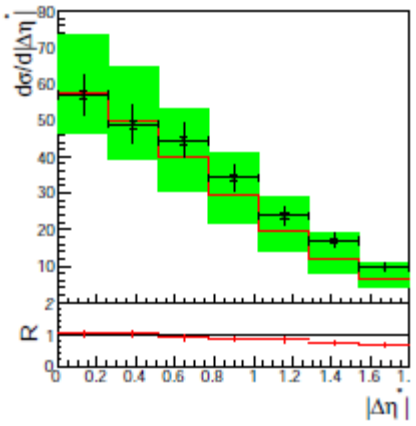


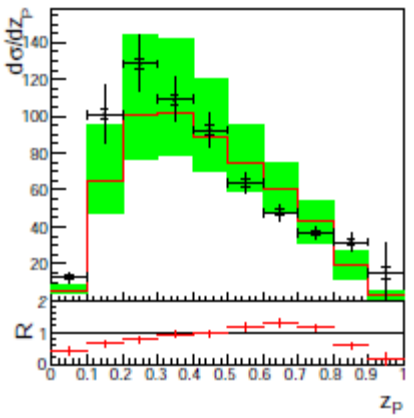


Cross Section BB & QCD-NLO





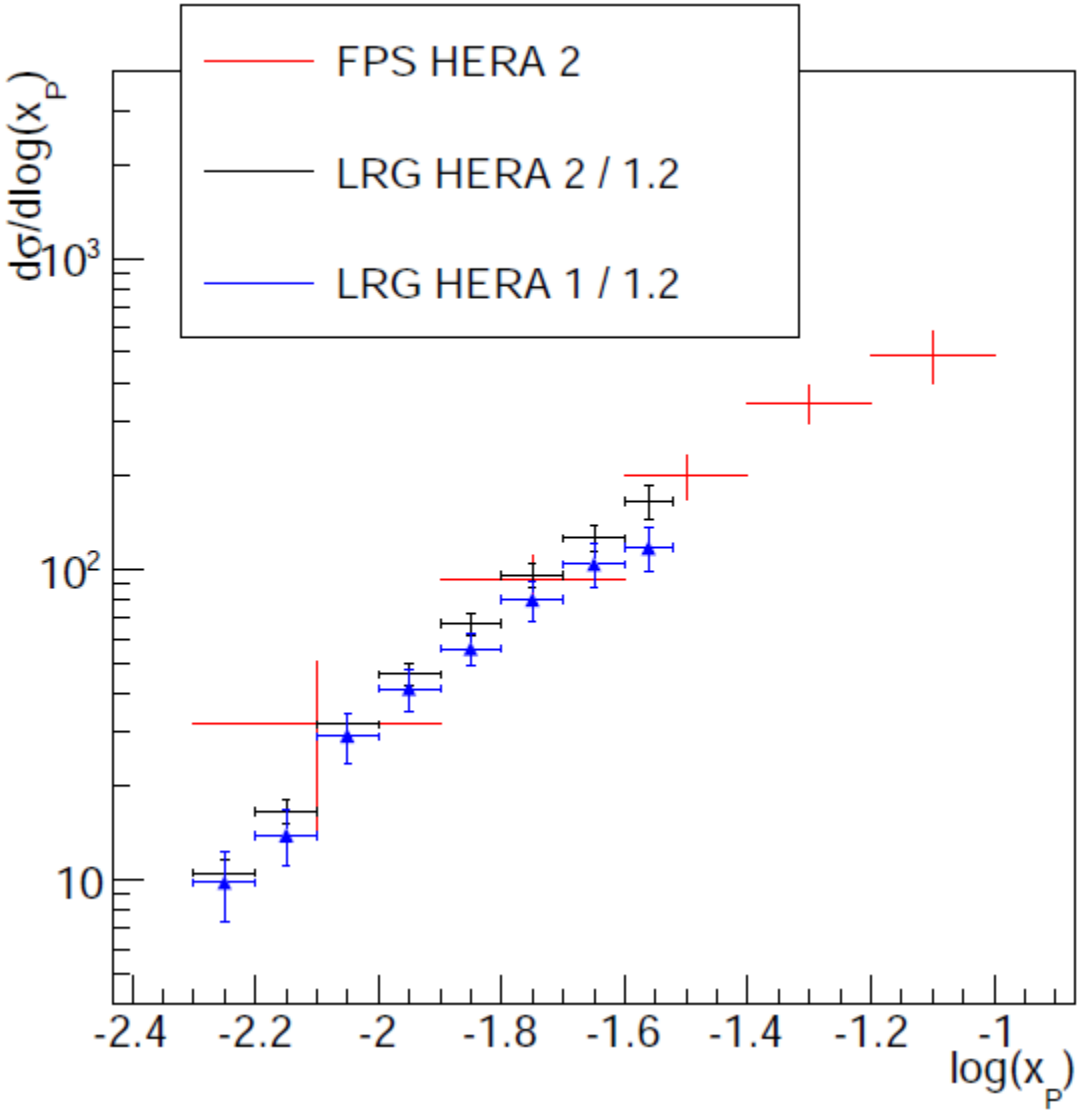




Measured total cross section 12 % higher than QCD prediction

Disagreement in zpom exceeds theory and exp. uncertainty

Cross Section BB & FPS

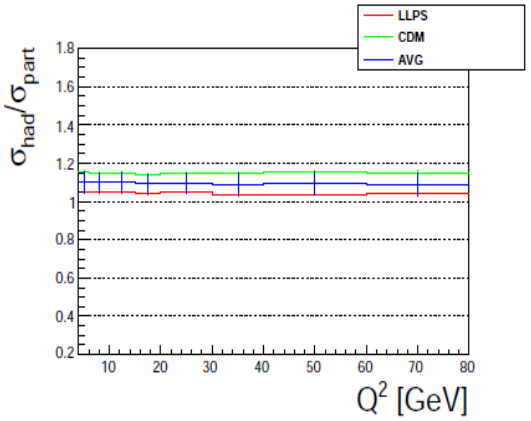


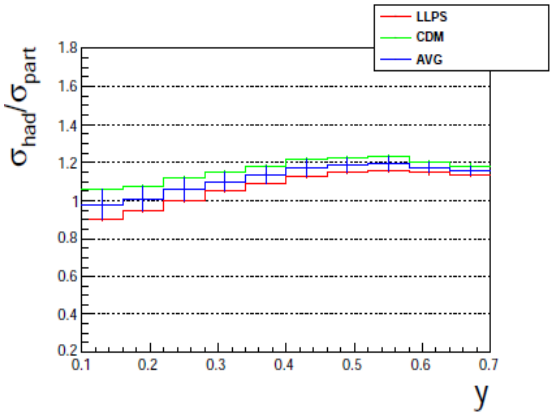
Summary & Outlook

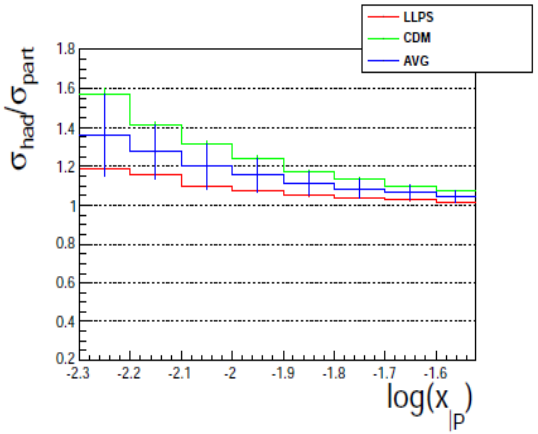
Bin by cross section compared to

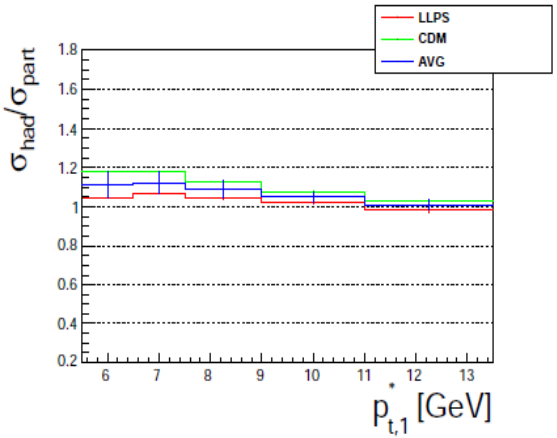
- NLO QCD prediction
- HERA 1 LRG analysis
- HERA 2 Leading proton

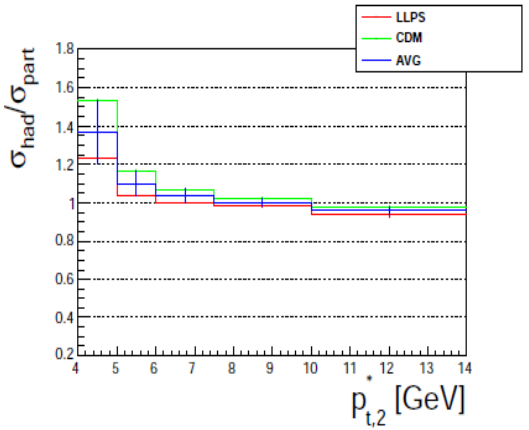
Hadronization Corrections

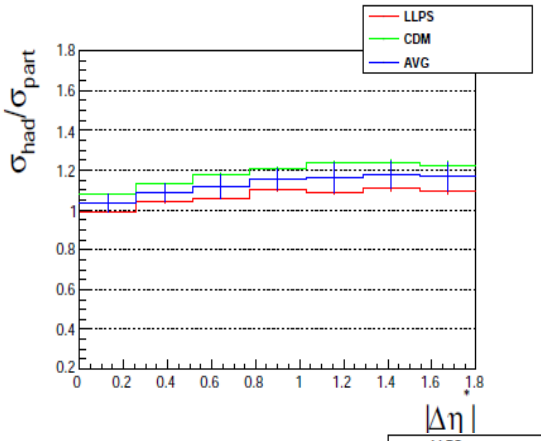






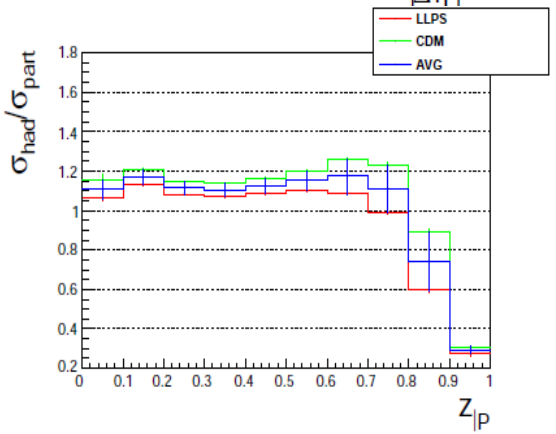




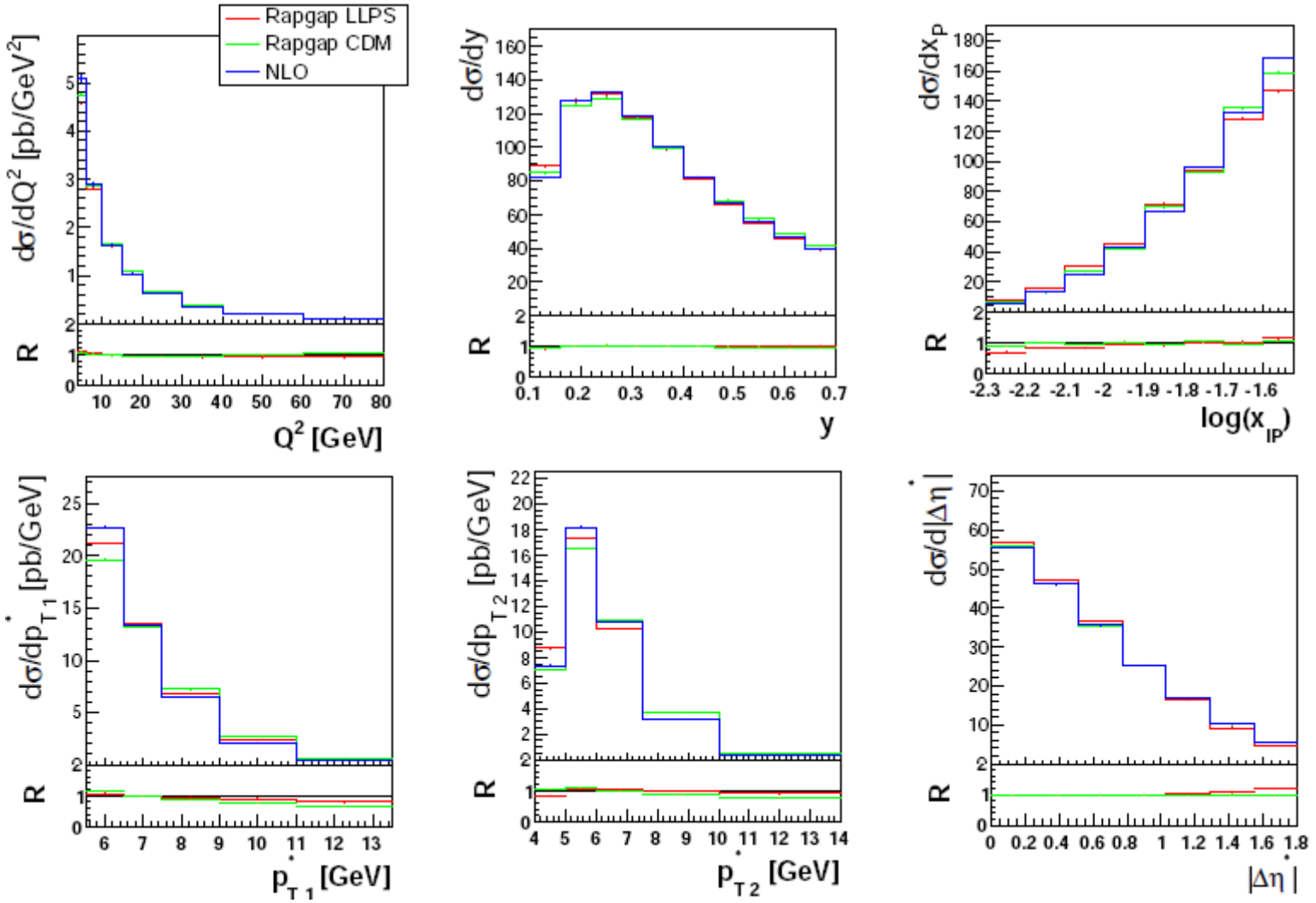


Average of CDM,LLPS

Uncertainty – max. difference between avrg.
And orig. value in every bin – max 8%



RAPGAP vs NLO



QED Radiation Corrections