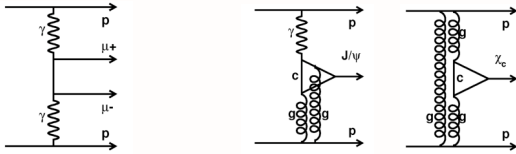


Definition and motivation

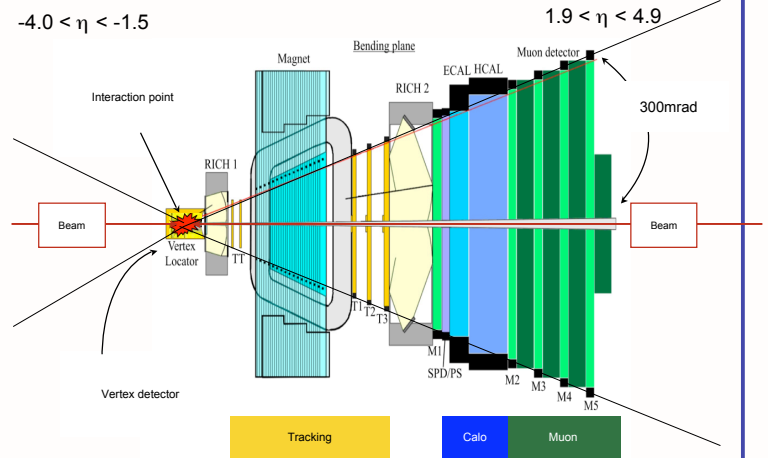
Exclusive: $p + p \rightarrow p + X + p$

Protons remain intact, so propagators are colour neutral (photon, pomeron, odderon)



QED: can be used as precise indirect luminosity measure.

QCD: can test predictions in a low multiplicity environment.

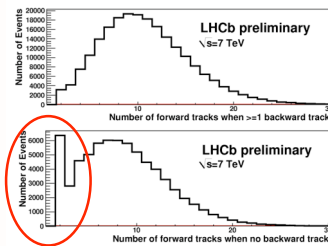


Event selection

Dataset: 37 pb⁻¹ data at $\sqrt{s} = 7$ TeV.

Trigger: <20 hits in scintillating pad detector (SPD)
 $M(\mu\mu) > 1$ GeV and $P_T(\mu\mu) < 0.9$ GeV, or
 $M(\mu\mu) > 2.7$ GeV.

Consider μ, γ within $2 < \eta < 4.5$.

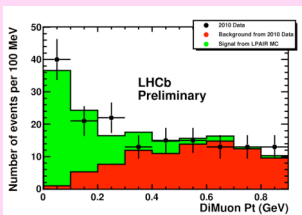


Exclusivity:

reconstruct forward tracks ($1.9 < \eta < 4.9$)
reconstruct backward tracks ($-4.0 < \eta < -1.5$)
Exclusive events have **only 2 forward tracks** in total.

QED: $P_T < 0.1$ GeV, $M(\mu\mu) > 2.5$ GeV.
Resonances removed.

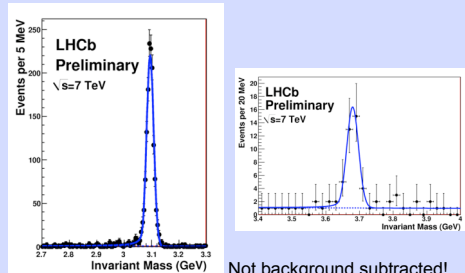
Backgrounds: inelastic production, double pomeron exchange



Background estimate from data (events with > 2 tracks)

J/psi, Psi: $P_T < 0.9$ GeV
2 tracks, no γ .

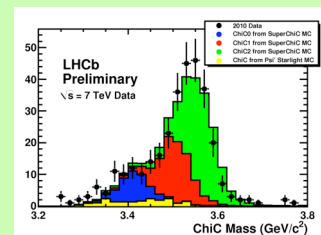
Backgrounds: inelastic production.



Not background subtracted!
Elastic component ~ 80%

chi_c: $M(\mu\mu)$ consistent with J/psi
2 tracks, 1 γ .

Backgrounds: inelastic production.



$\chi_c^0 \cdot \chi_c^1 \cdot \chi_c^2$ scaled to fit data
Elastic component ~ 40%

Results and theory comparison

Efficiencies calculated from MC.
Systematics from MC/Data difference.

Effective luminosity depends on trigger efficiency and av. no. beam crossings \Rightarrow large uncertainty.

$\sigma(\text{QED}): 67 \pm 10 \pm 5 \pm 15$ pb

$\sigma(\text{J/}\Psi): 474 \pm 12 \pm 45 \pm 92$ pb
 $\sigma(\Psi'): 12.2 \pm 1.8 \pm 1.2 \pm 2.4$ pb
 $\sigma(\Psi')/\sigma(\text{J/}\Psi): 0.20 \pm 0.03$

$\sigma(\chi_c^0): 9.3 \pm 2.2 \pm 3.5 \pm 1.8$ pb
 $\sigma(\chi_c^1): 16.4 \pm 5.3 \pm 5.8 \pm 3.2$ pb
 $\sigma(\chi_c^2): 28.0 \pm 5.4 \pm 9.7 \pm 5.4$ pb

42 pb (LPAIR)

292 pb (Starlight) 330 pb (SuperChic) 330 pb (Motyka&Watt) 710 pb (Schafer&Szcurek)
6.1 pb (Starlight) 17 pb (Schafer&Szcurek)
0.16 (Starlight) 0.2 (Schafer&Szcurek)
0.166 \pm 0.012 (HERA) 0.14 \pm 0.05 (CDF)

14 pb (SuperChic)

10 pb (SuperChic)

3 pb (SuperChic)

- Large theoretical uncertainties (apart from QED prediction, uncertainty ~ 1%)
- Predictions contain rescattering corrections (alters cross-section by ~ 20%)
- **Results are consistent with predictions.**