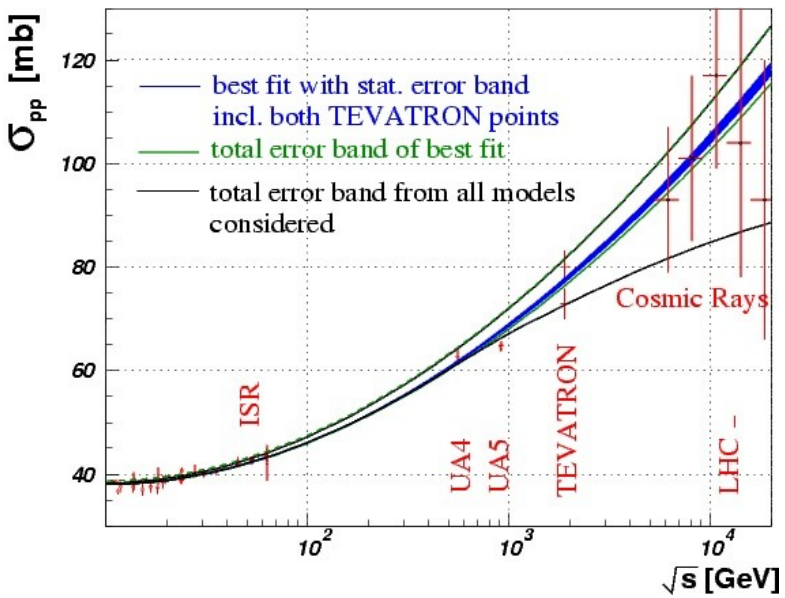
TOTEM Results from 2010

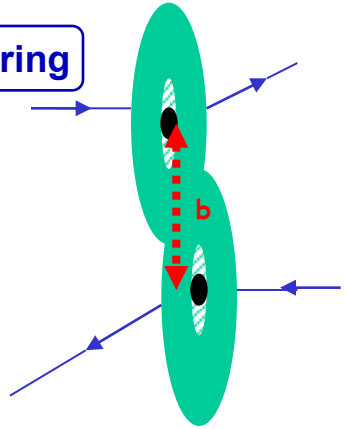
Simone Giani
on behalf of the TOTEM Collaboration

TOTEM Physics Overview

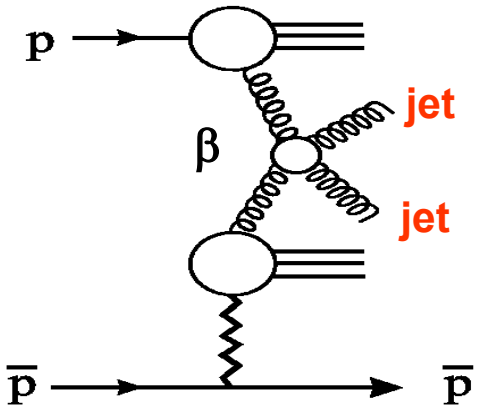
Total cross-section



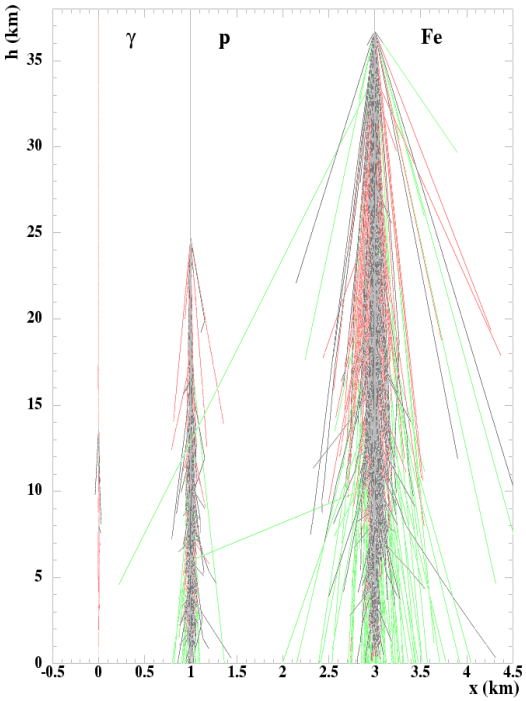
Elastic Scattering



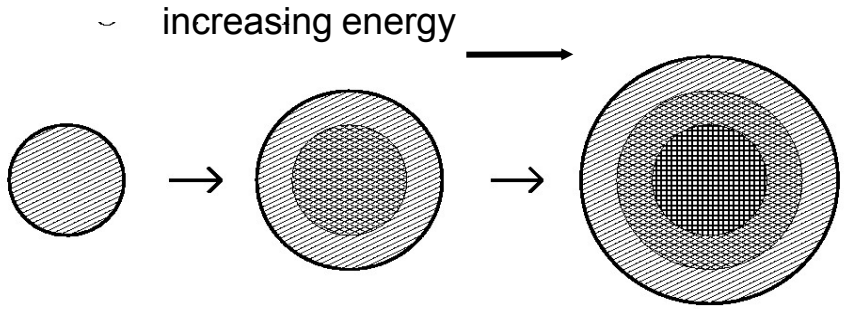
Diffraction: soft and hard



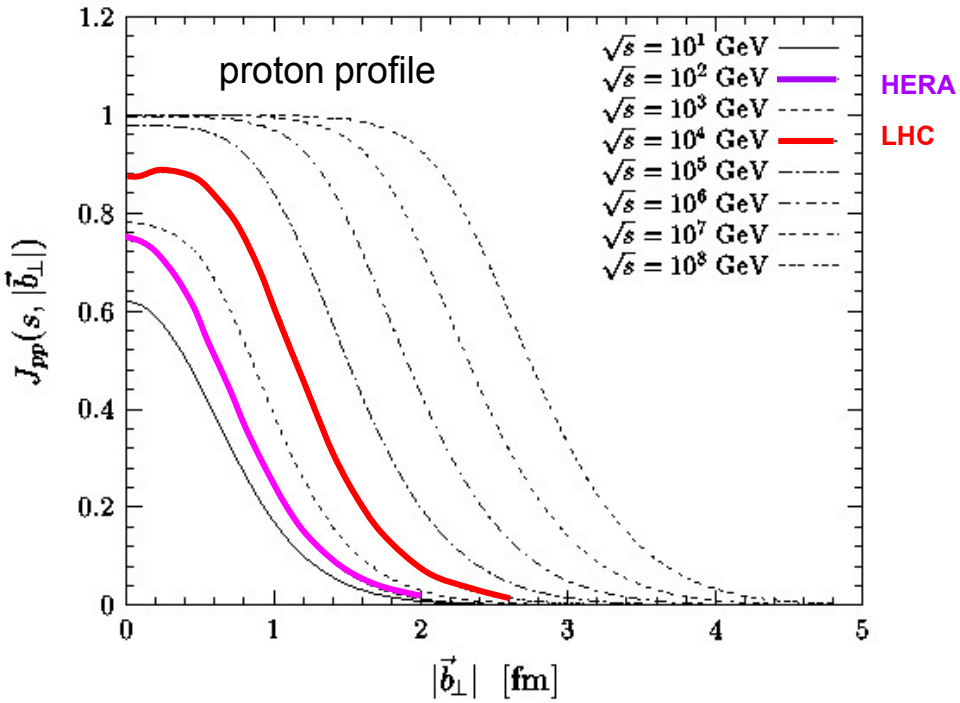
Forward physics



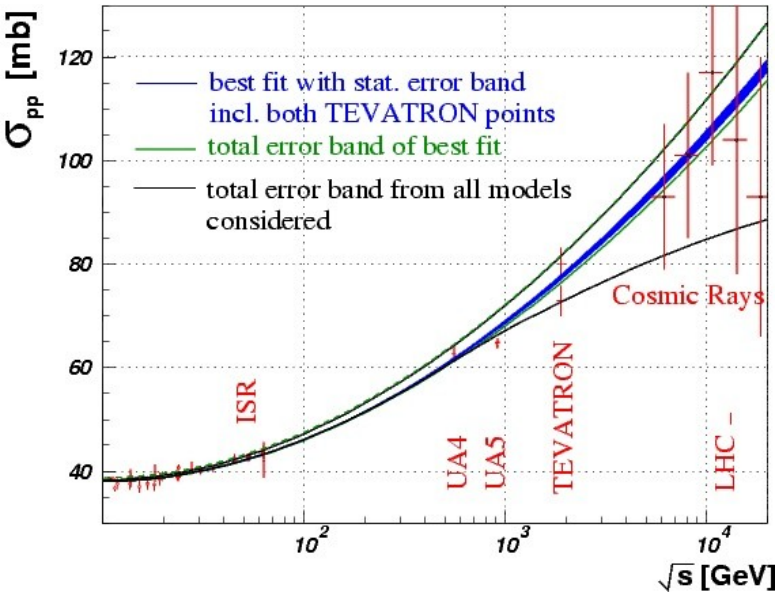
The proton structure



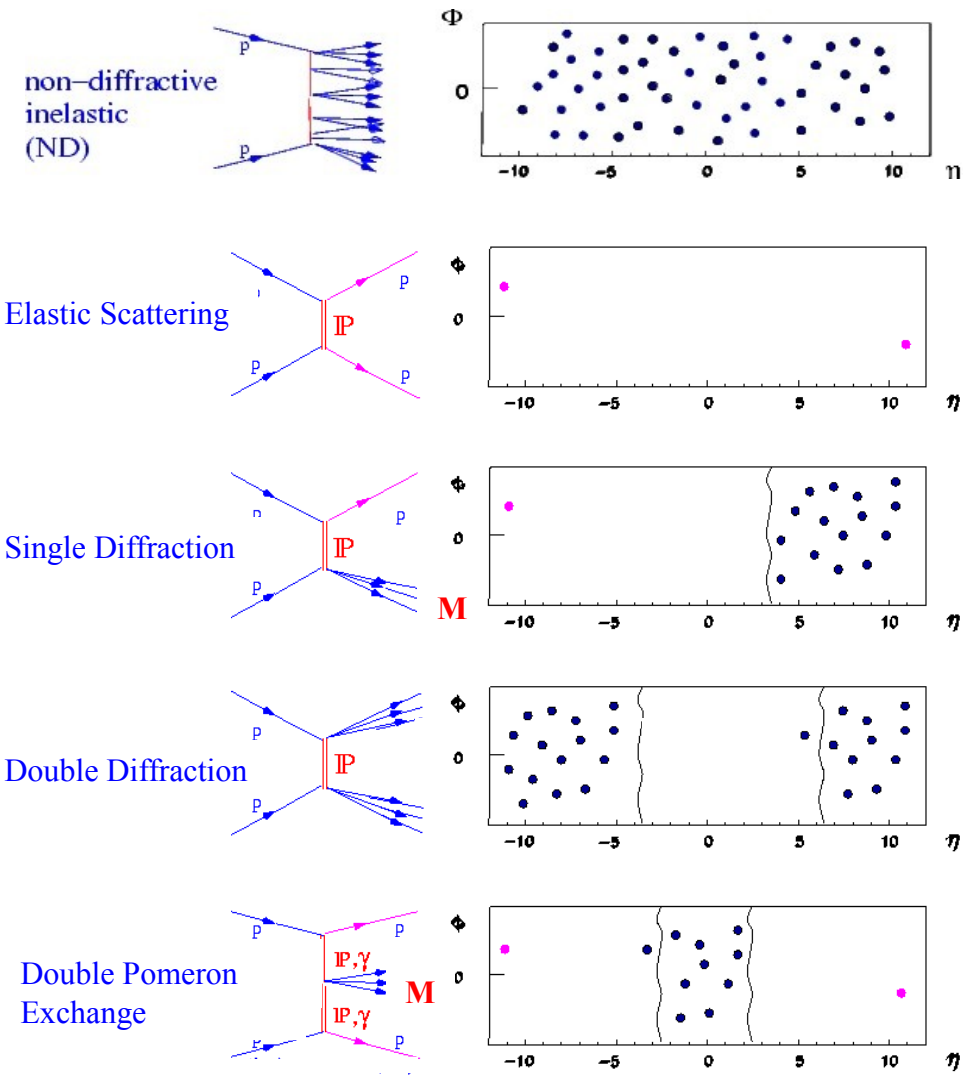
blacker
radius increases
edge area increases



Total cross-section

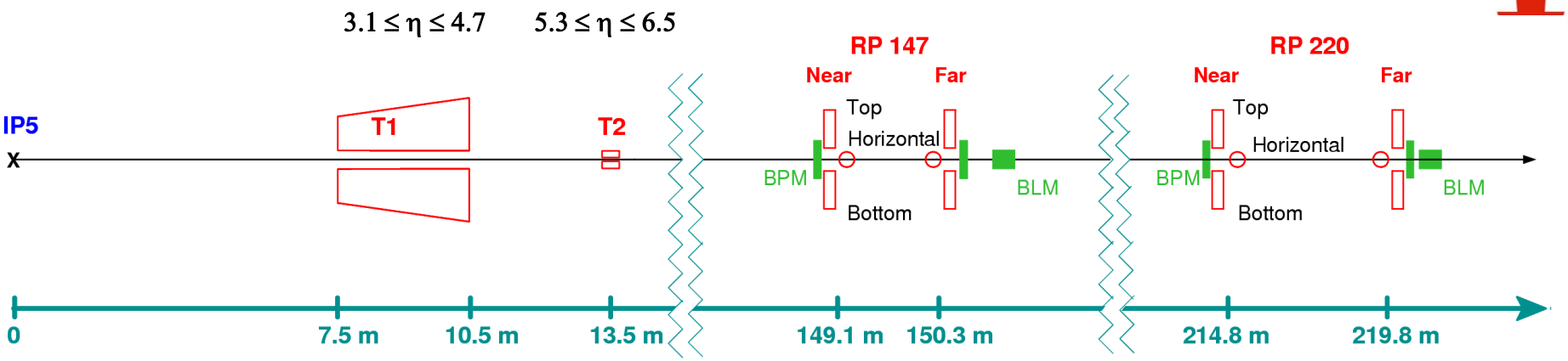


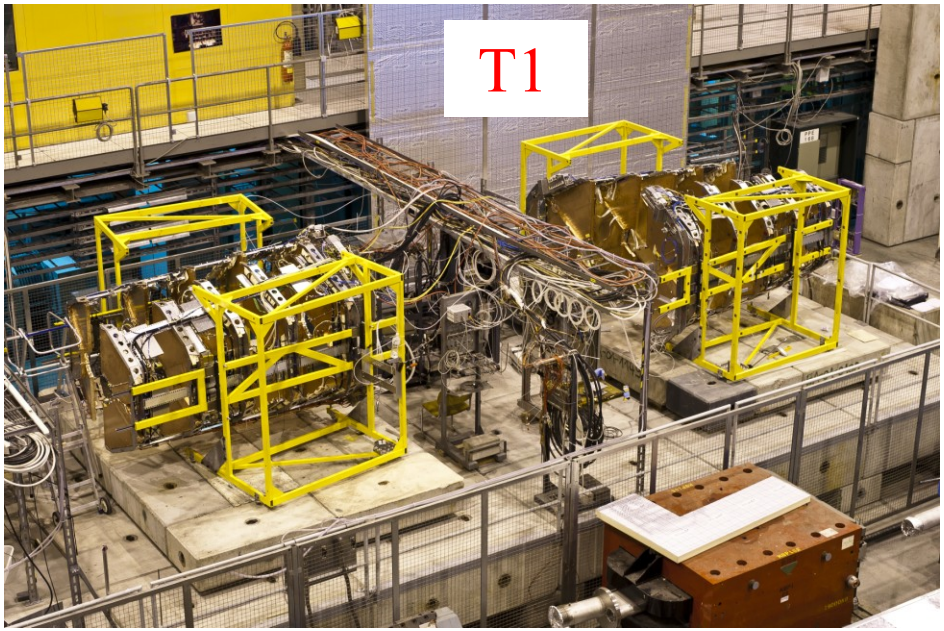
Dominant Event Classes in p-p Collisions

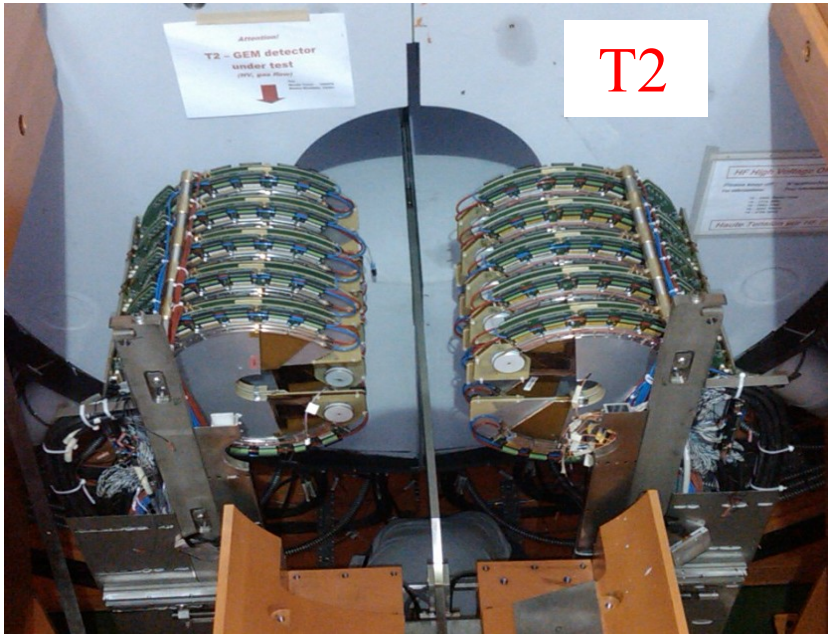


$\eta = - \ln \tan \theta/2$

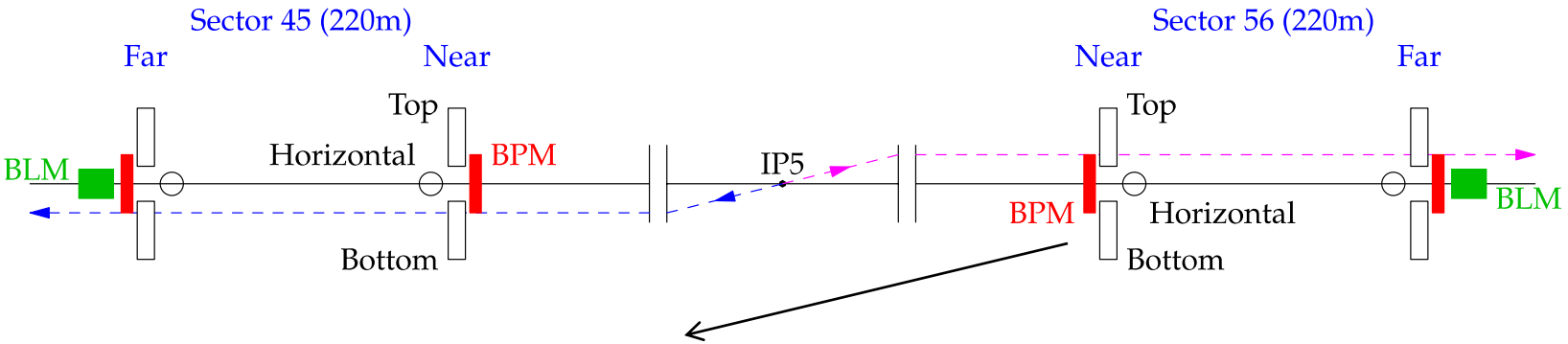
The TOTEM detector set-up

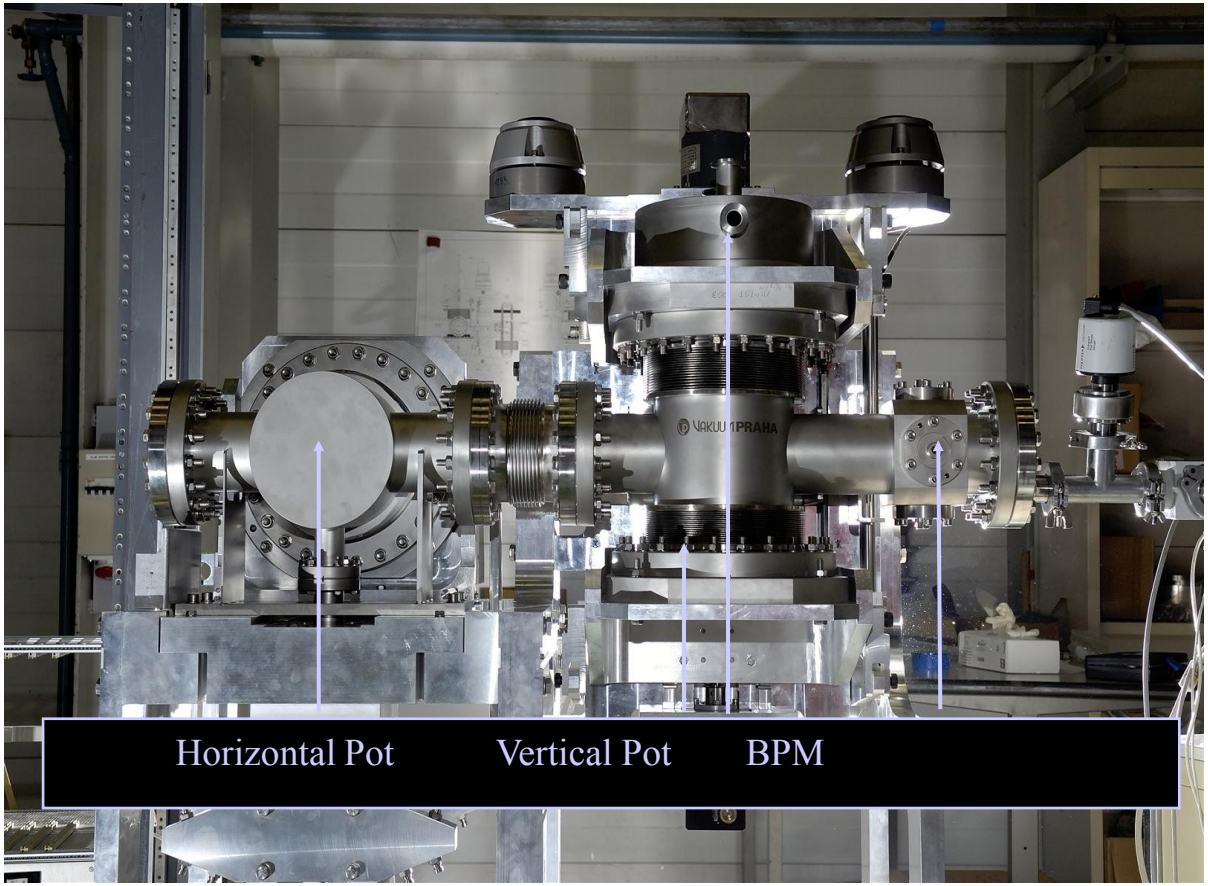


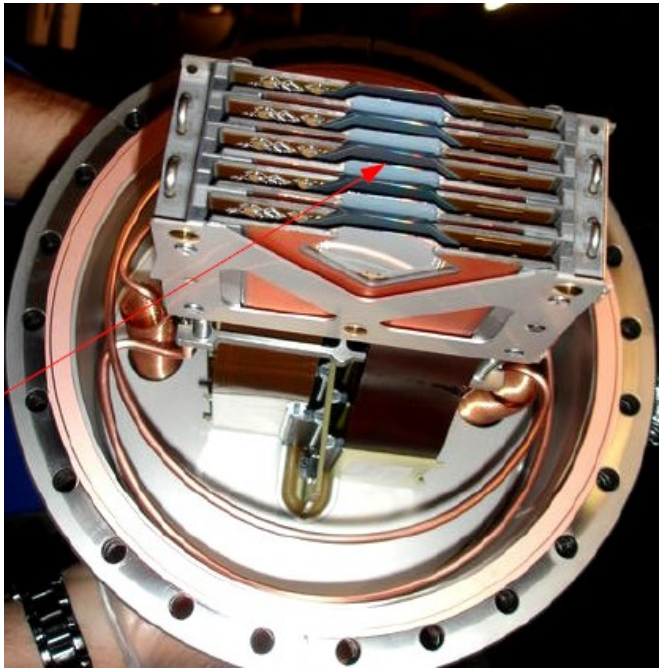




Roman Pot Unit



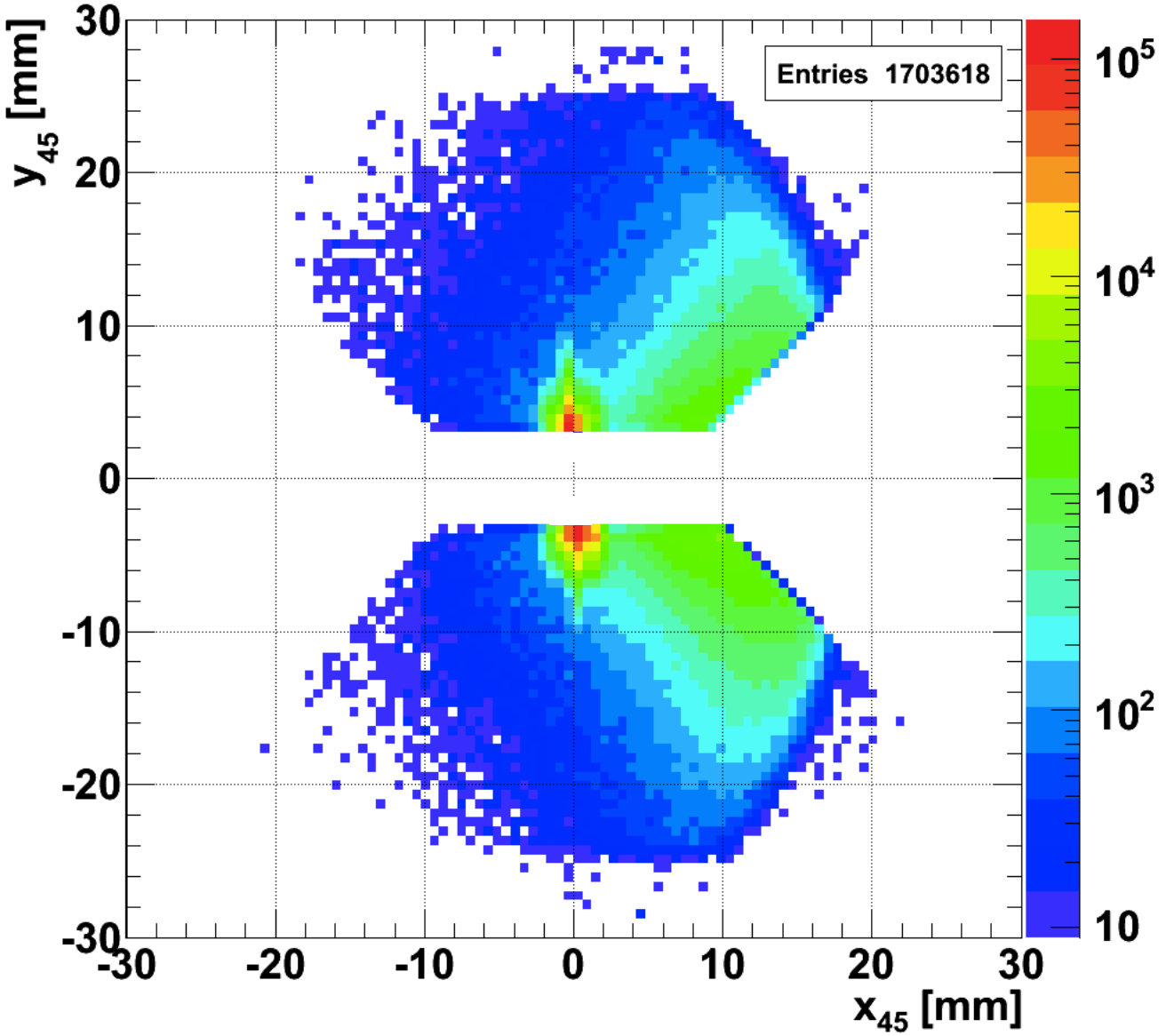




Run Overview

RP position		int. Lumi	Physics
vertical	horizontal		
25 σ	30 σ	1.5 nb^{-1}	first 2 elastic candidates
20 σ	25 σ	185 nb^{-1}	100 elastic events at ~ 2.3 GeV^2 < |t| < 3.5 GeV^2
18 σ	20 σ	3867 nb^{-1}	~ 10 k elastic events at ~ 2.1 GeV^2 < |t| < 3.5 GeV^2
7 σ	16 σ	9.5 nb^{-1}	TOTEM dedicated run: 1 pilot bunch (1e10 p/b) + 4 bunches (7e10 p/b) – 80 k elastic events at ~ 0.4 GeV^2 < |t| < 2.8 GeV^2 – pileup-free T2 data – diffractive physics with RP and T2

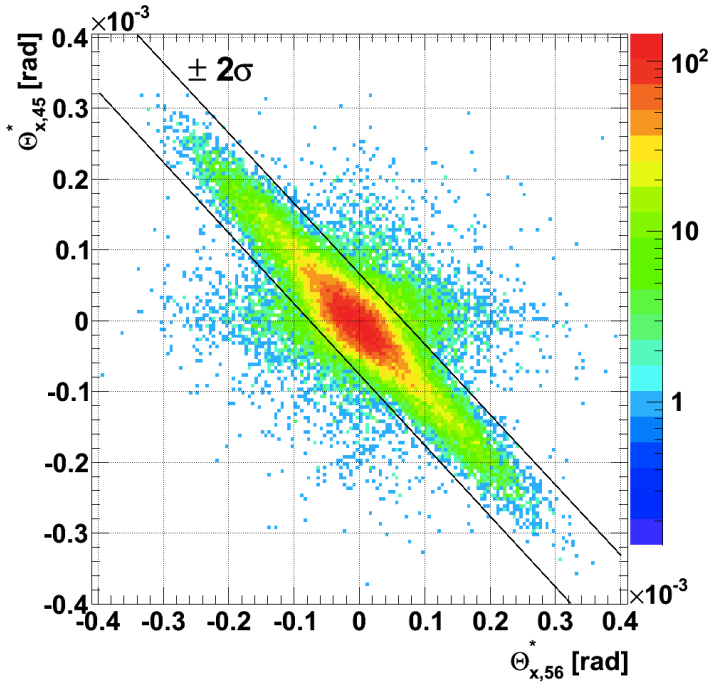
Track map (side 4,5) for left right coincidences



$t = -p^2 \theta^2$

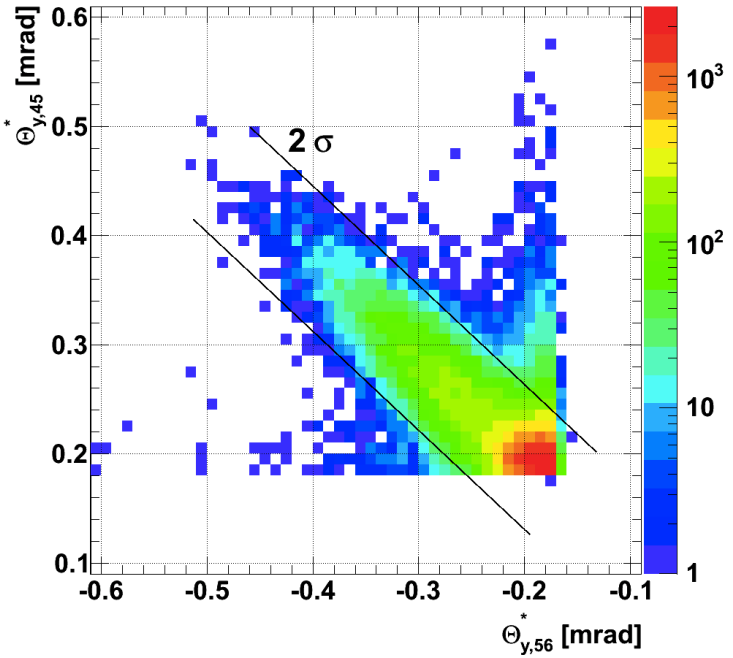
$\xi = \Delta p/p$

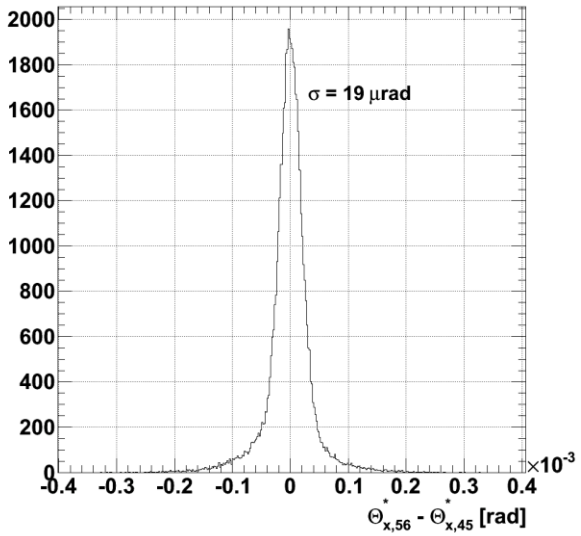
Collinearity in θ^*_x and θ^*_y



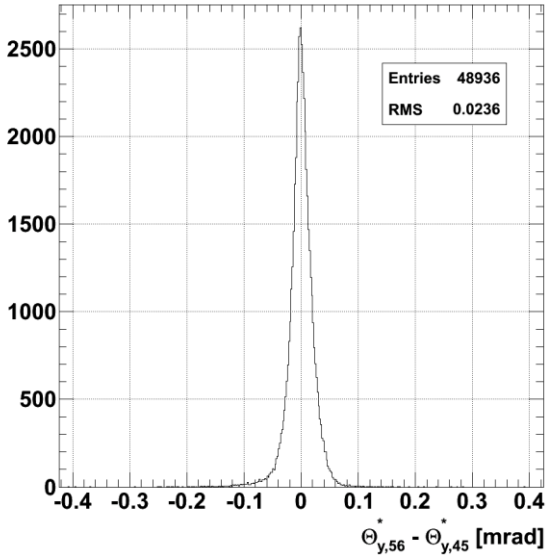
Low ξ :

$|x| < 0.4$ mm

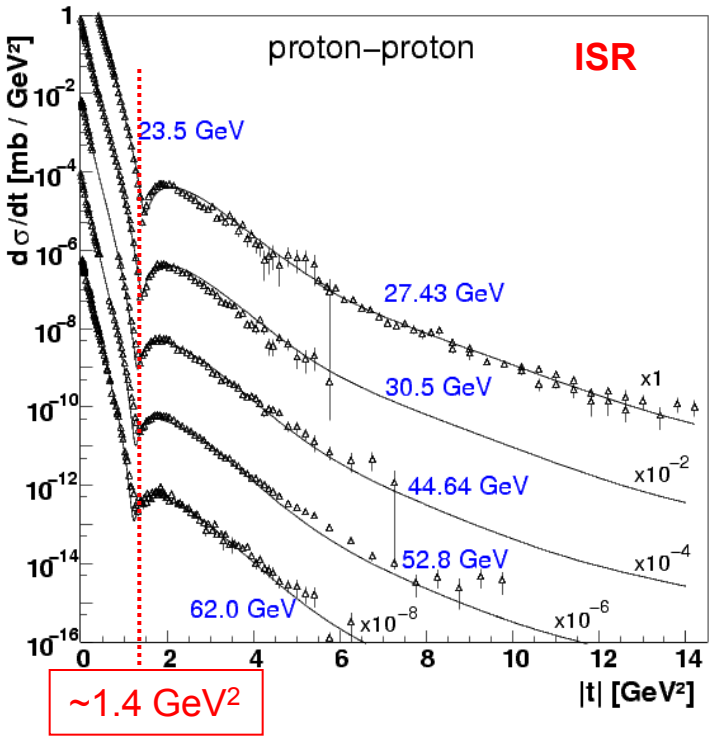


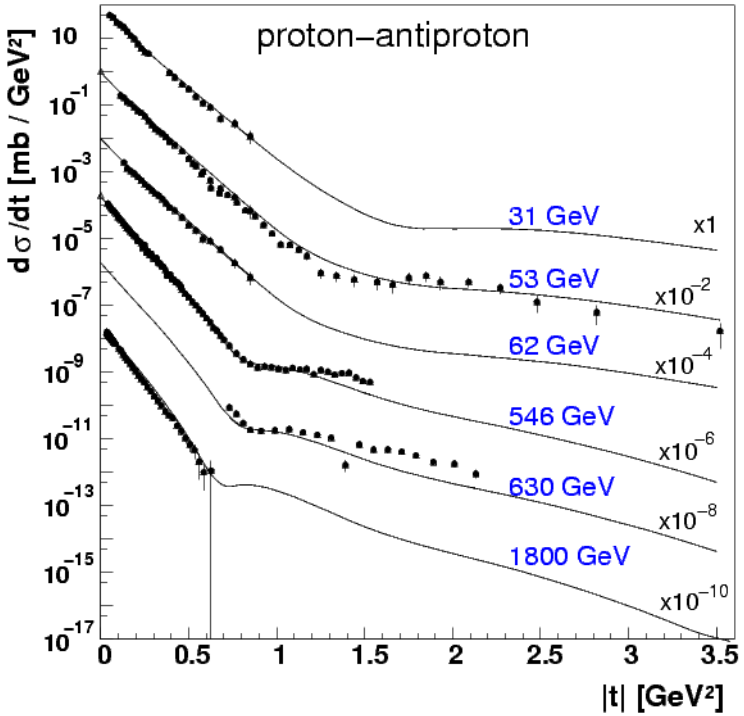


Compatible with the beam divergence

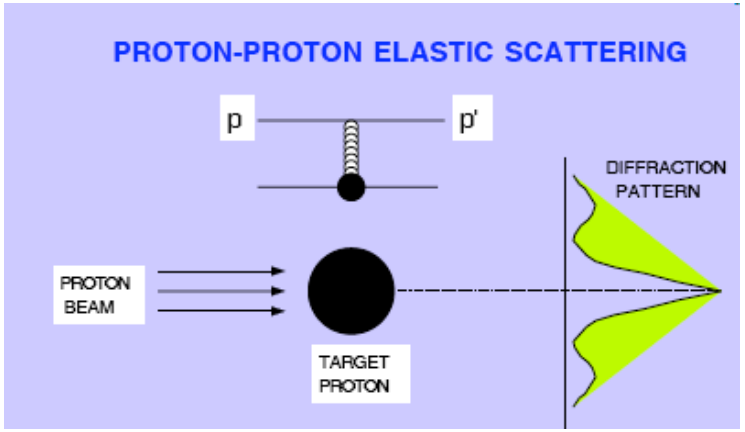


Elastic scattering – from ISR to Tevatron





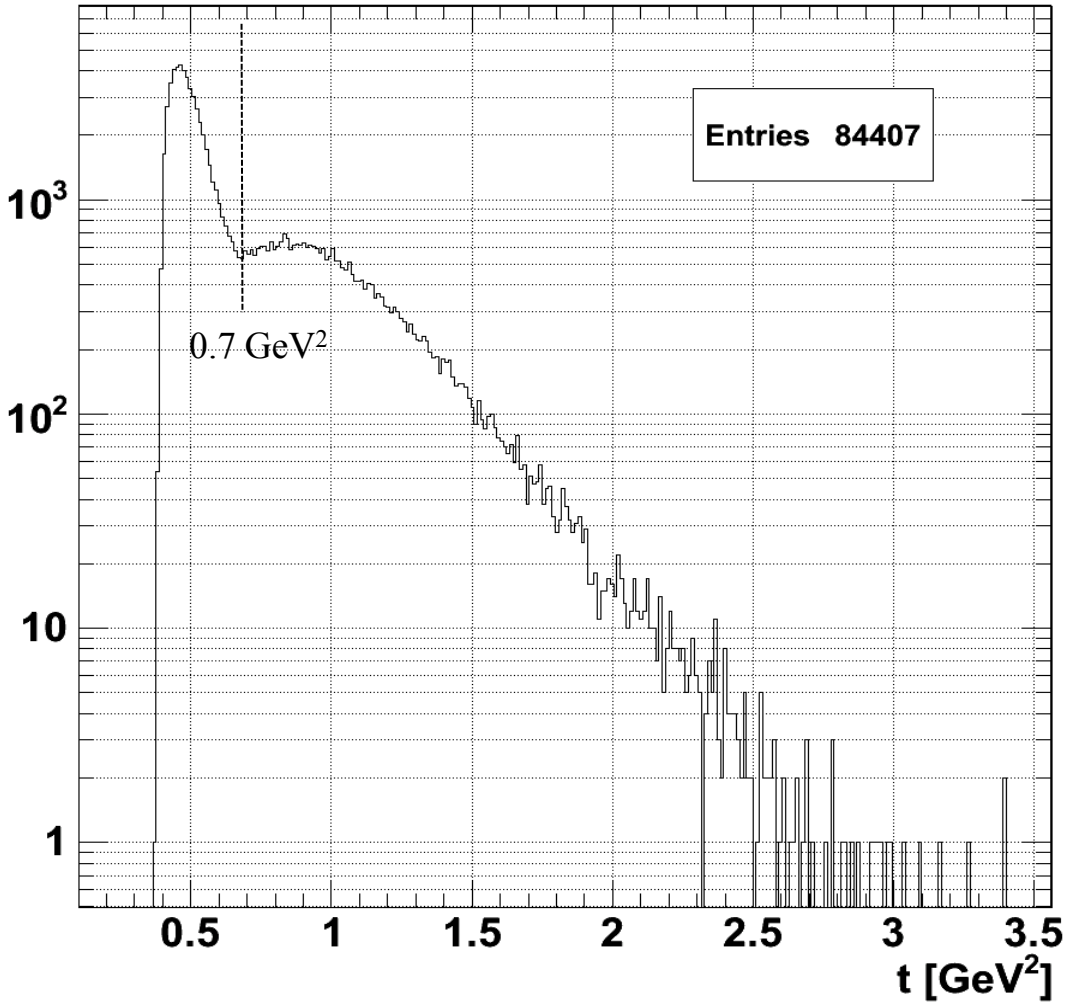
Diffractive minimum: analogous to Fraunhofer diffraction: $|t| \sim p^2 \theta^2$



- exponential slope B at low |t| increases
- minimum moves to lower |t| with increasing s
  → interaction region grows (as also seen from σ_{tot})
- depth of minimum changes
  → shape of proton profile changes
- depth of minimum differs between pp, p^-p
  → different mix of processes

Preliminary t-distribution

~ 84K elastic scattering candidate events TOTEM special run (~ 9 nb $^{-1}$)



$\sqrt{s} = 7$ TeV

$\beta^* = 3.5$ m

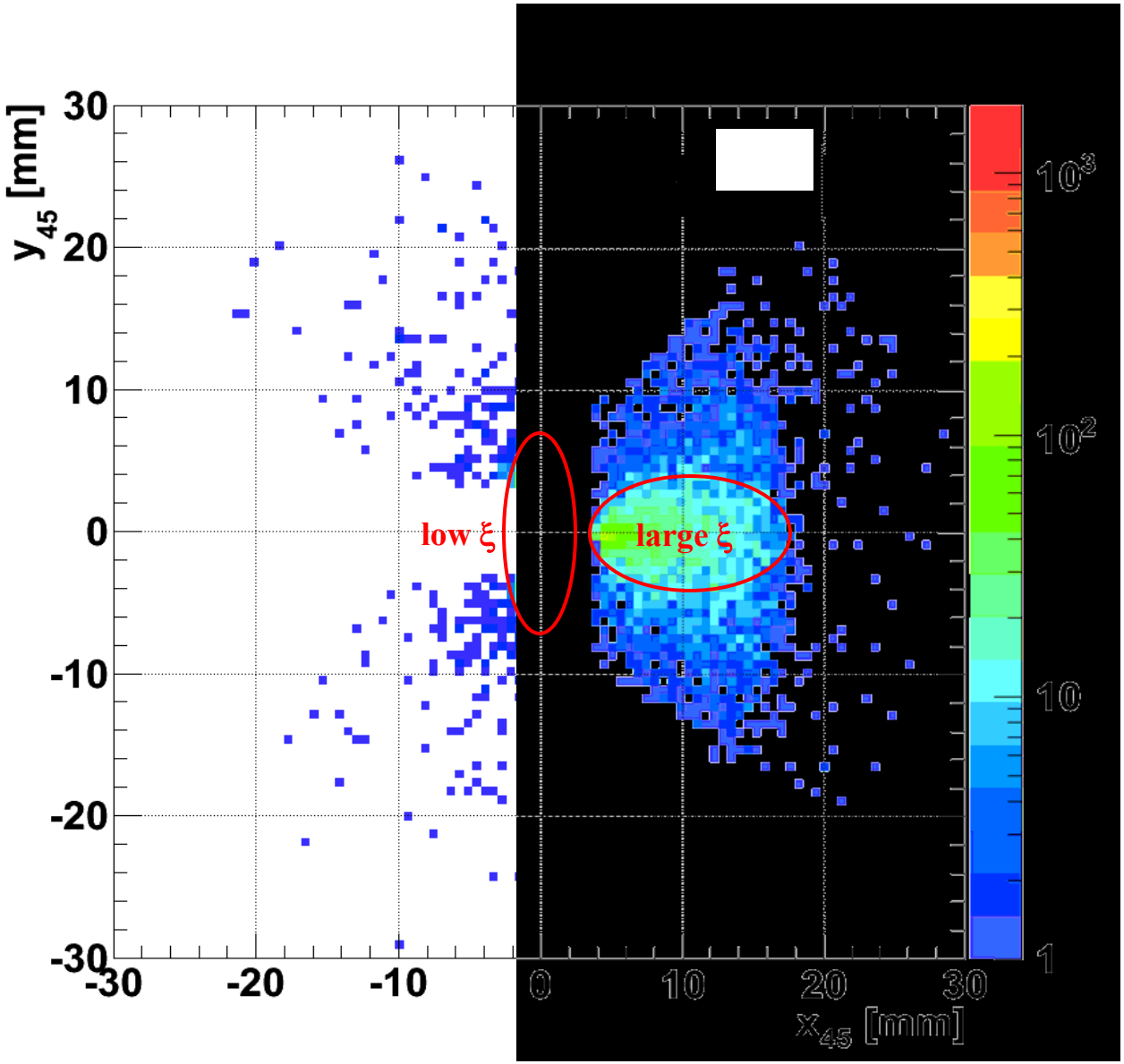
RPs @ 7 σ (V) and 16 σ (H)

"Raw" distribution:

- No smearing corrections
- No acceptance corrections
- No background subtraction

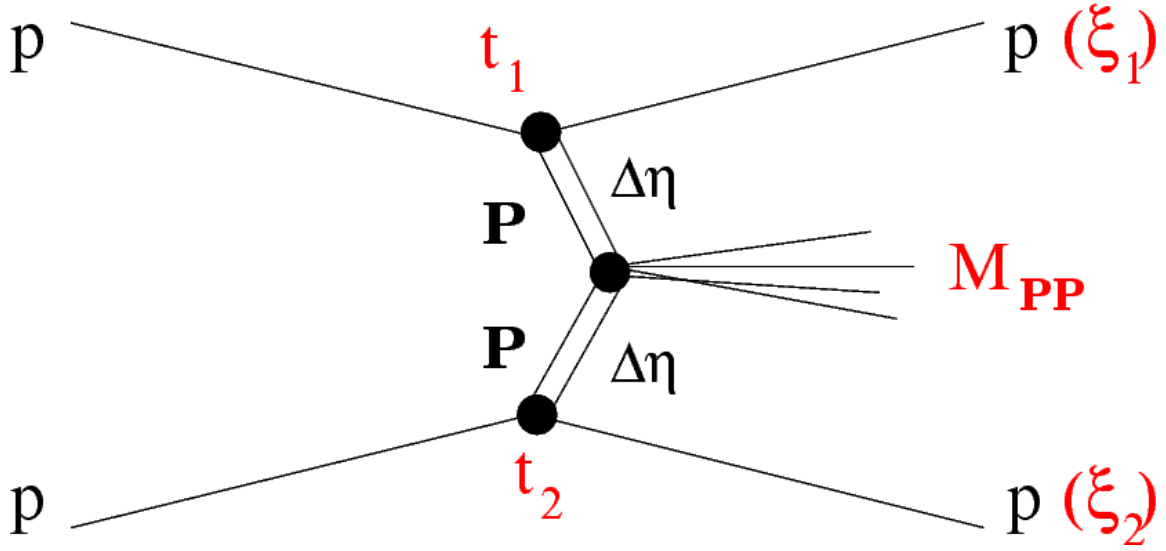
Syst. error sources under study: alignment, beam position and divergence, background, optical functions, efficiency, …

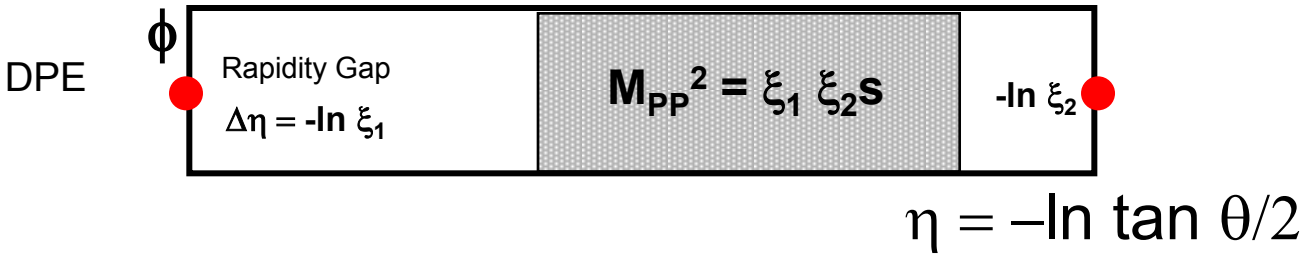
Track distribution for an inclusive trigger (global “OR”)



$\xi = \Delta p / p$

Double Pomeron Exchange (DPE)

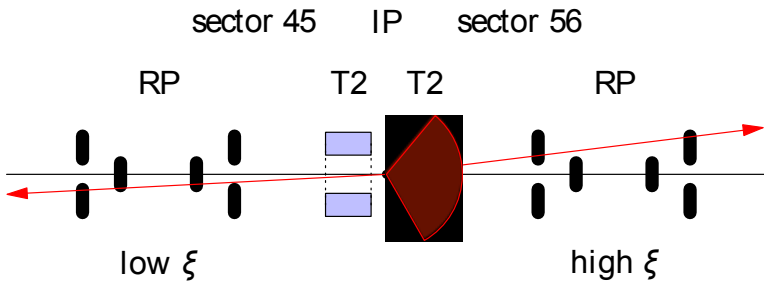




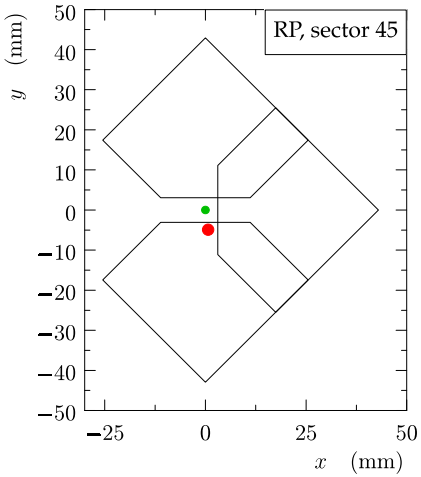
$\eta = -\ln \tan \theta/2$

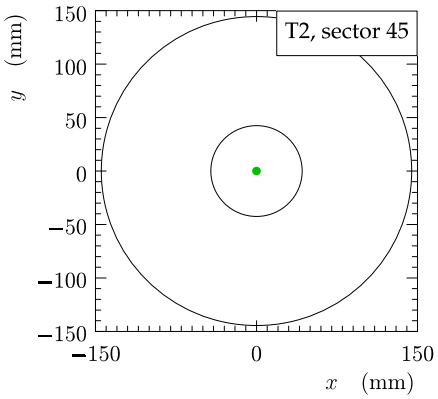
USE the LHC as a Pomeron-Pomeron (Gluon - Gluon) Collider

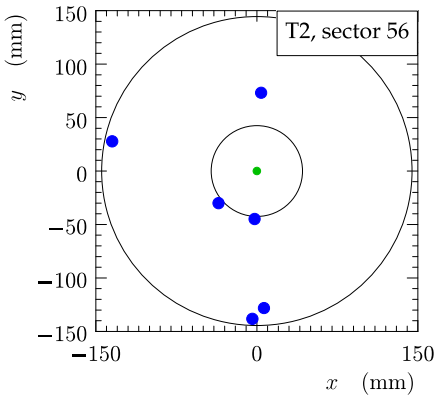
Double Pomeron Exchange
correlation between leading proton and forward detector T2

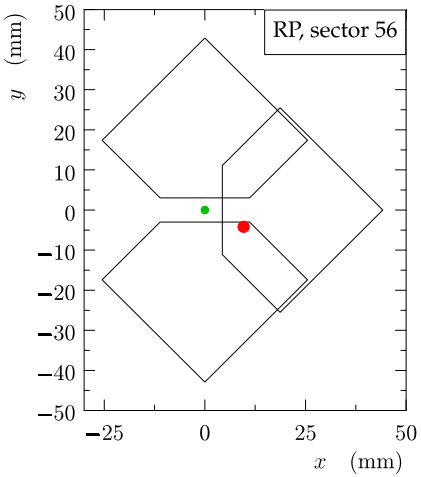


run: 37220007, event: 9904

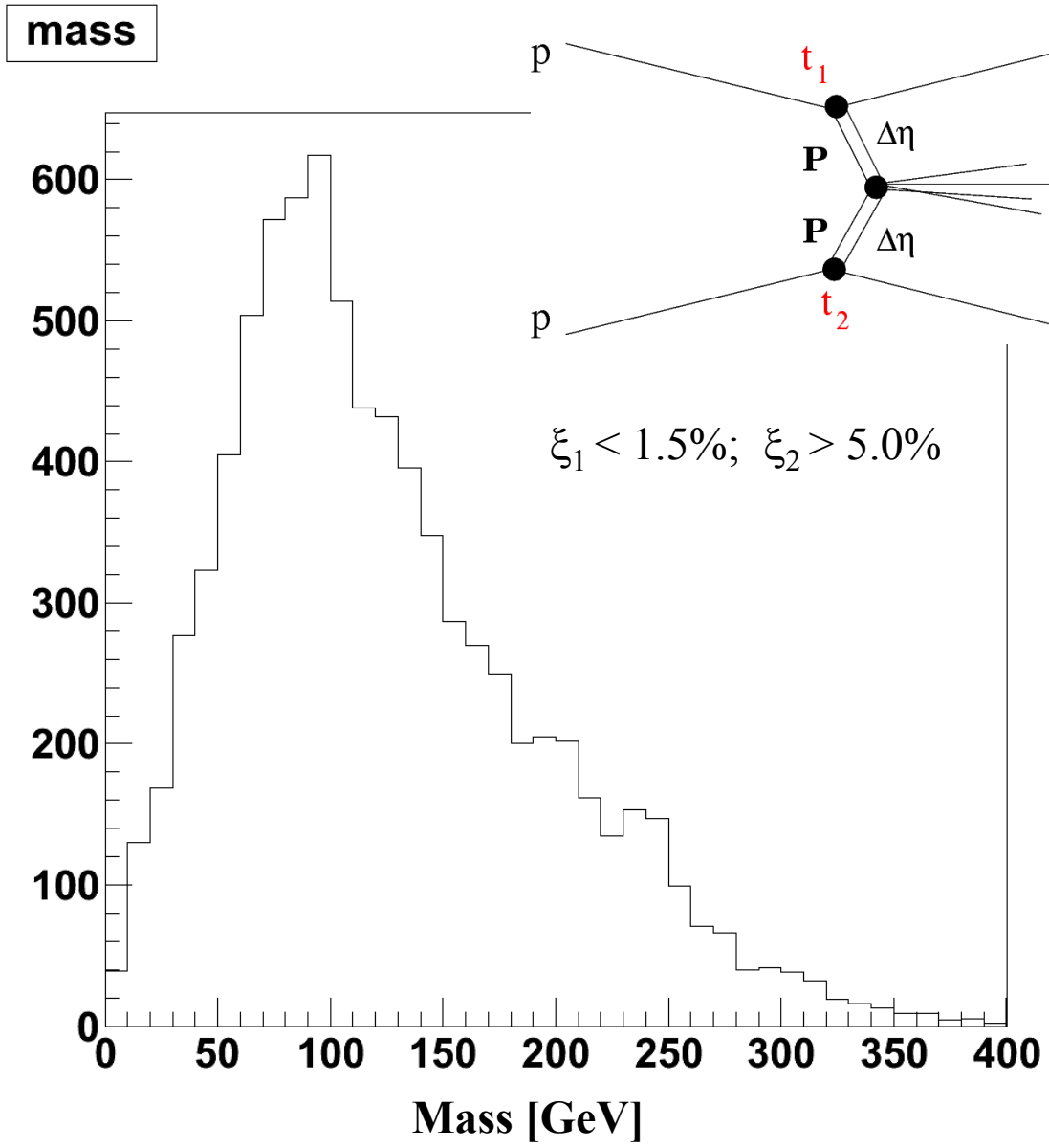






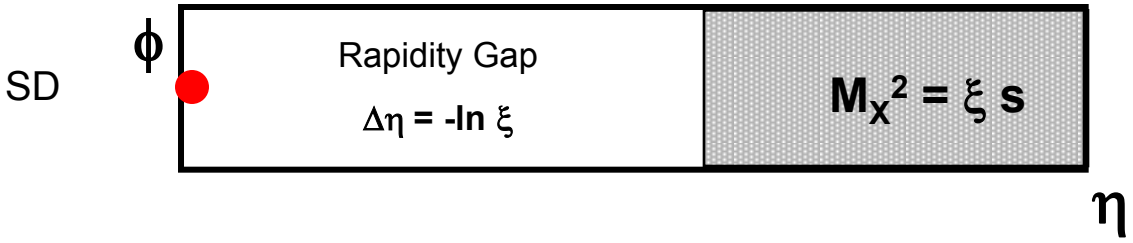


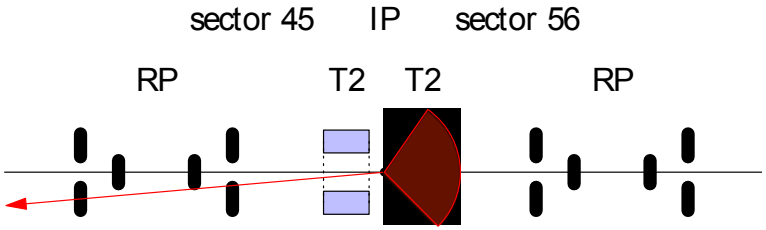
Under Work: DPE Mass Reconstruction



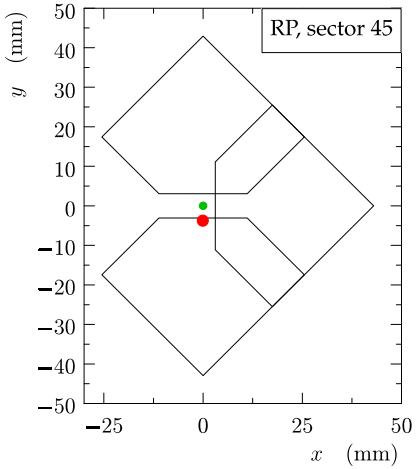
Single diffraction low ξ

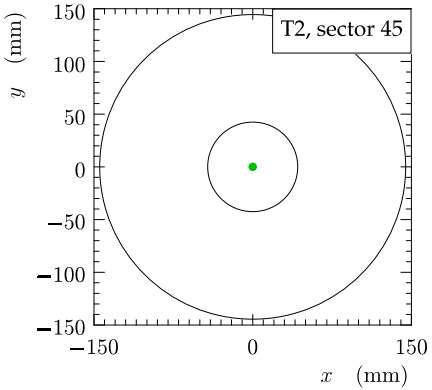
Correlation between leading proton and forward detector T2

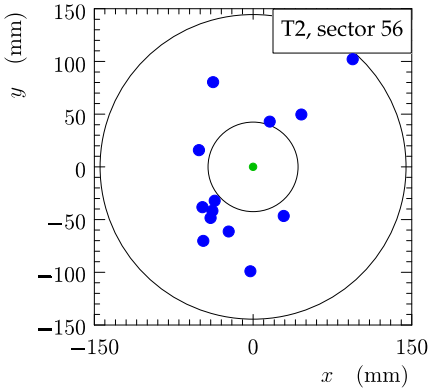


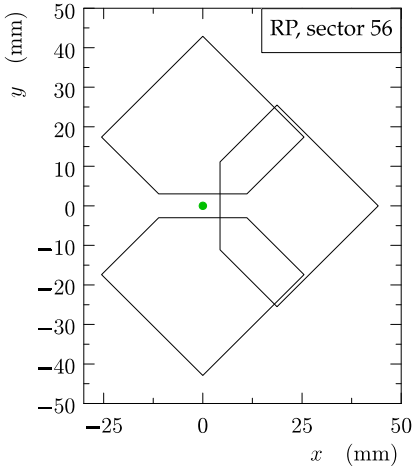


run: 37280003, event: 3000



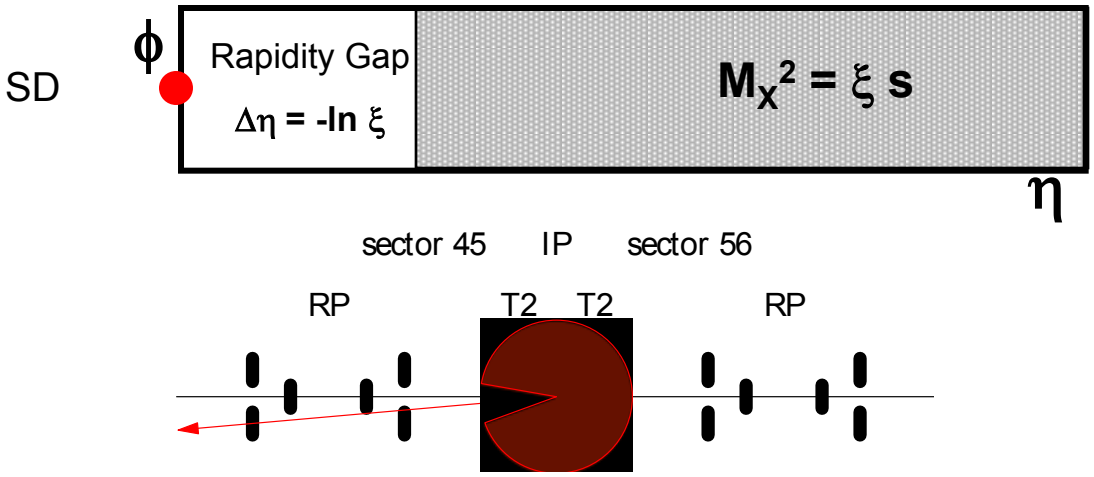




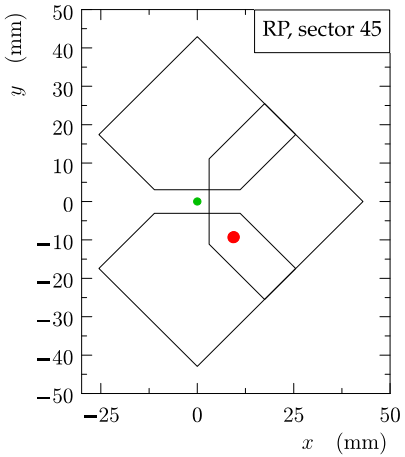


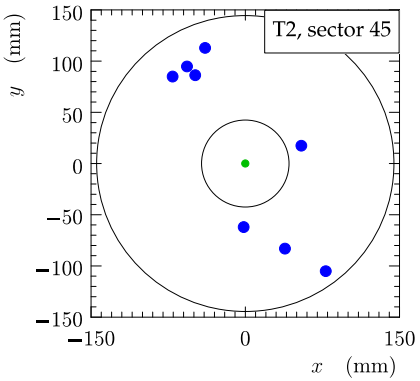
Single diffraction large ξ

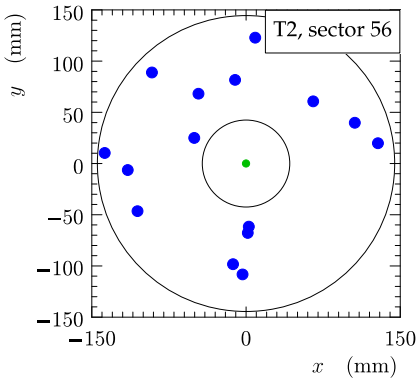
correlation between leading proton and forward detector T2

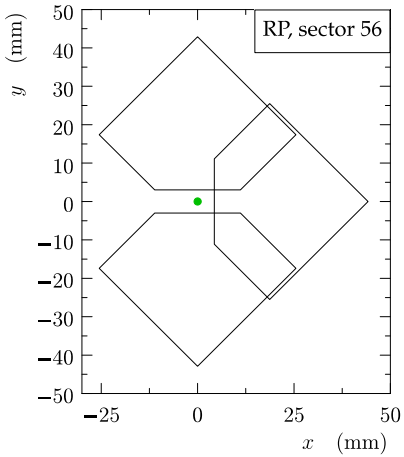


run: 37280006, event: 9522









Runs in 2011

Next Year:

Measurement of the Total Cross-Section