

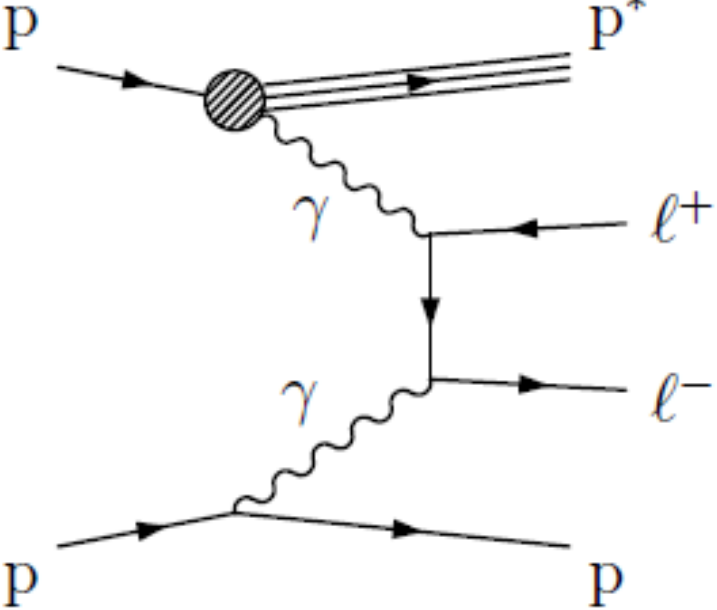
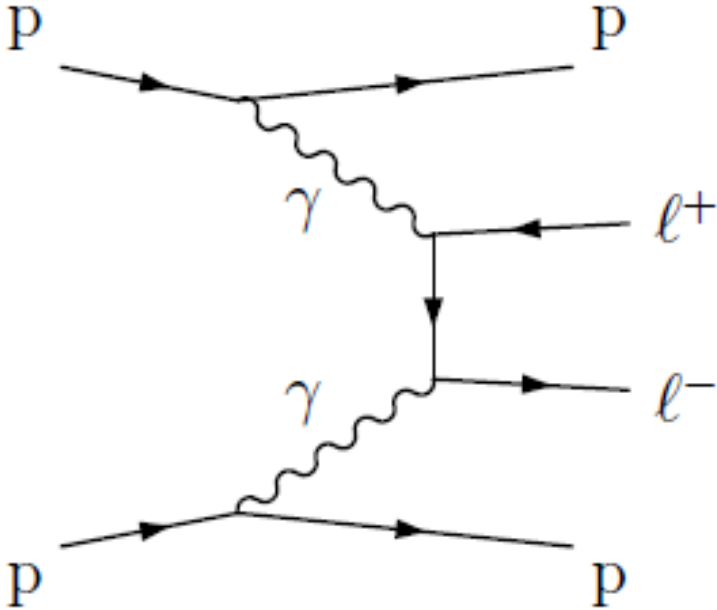
Course on Physics at the LHC- Observation of proton-tagged, central (semi)exclusive production of lepton pairs

PEDRO DUARTE – 87347

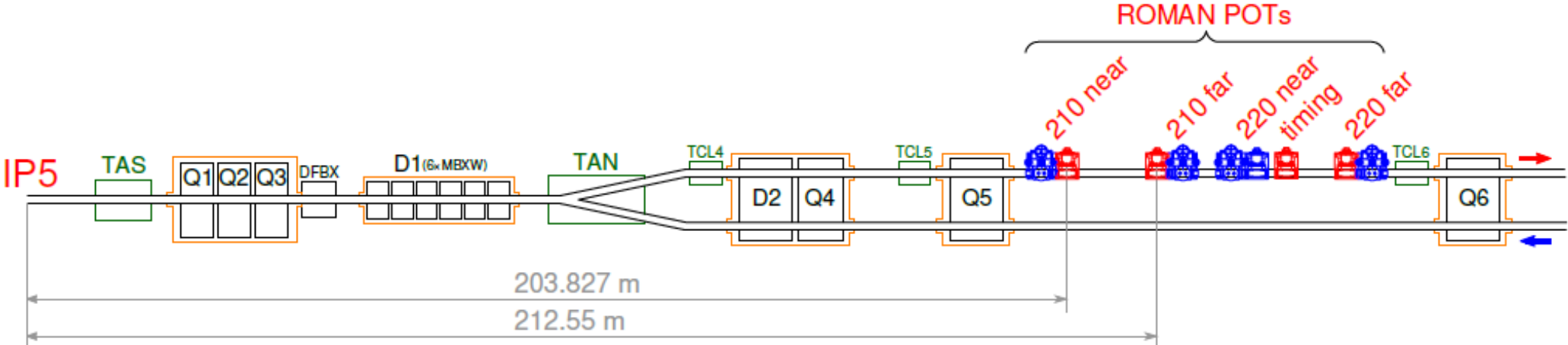
INSTITUTO SUPERIOR TÉCNICO



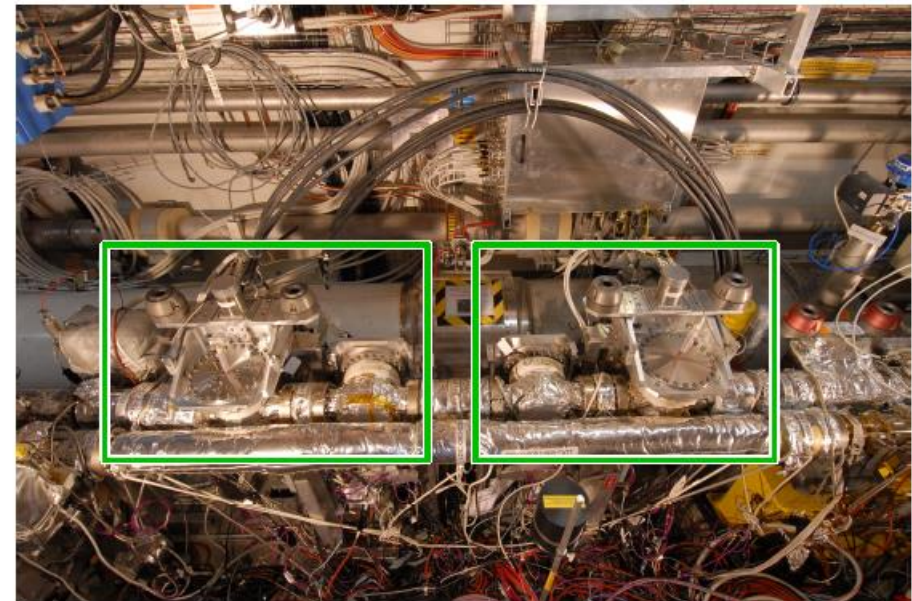
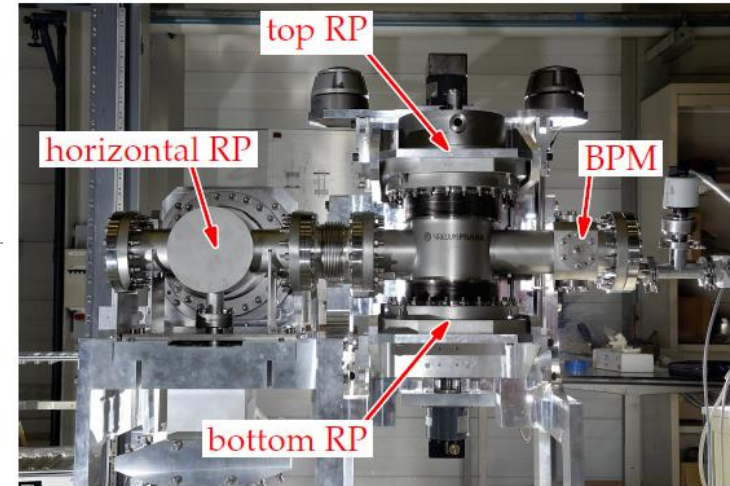
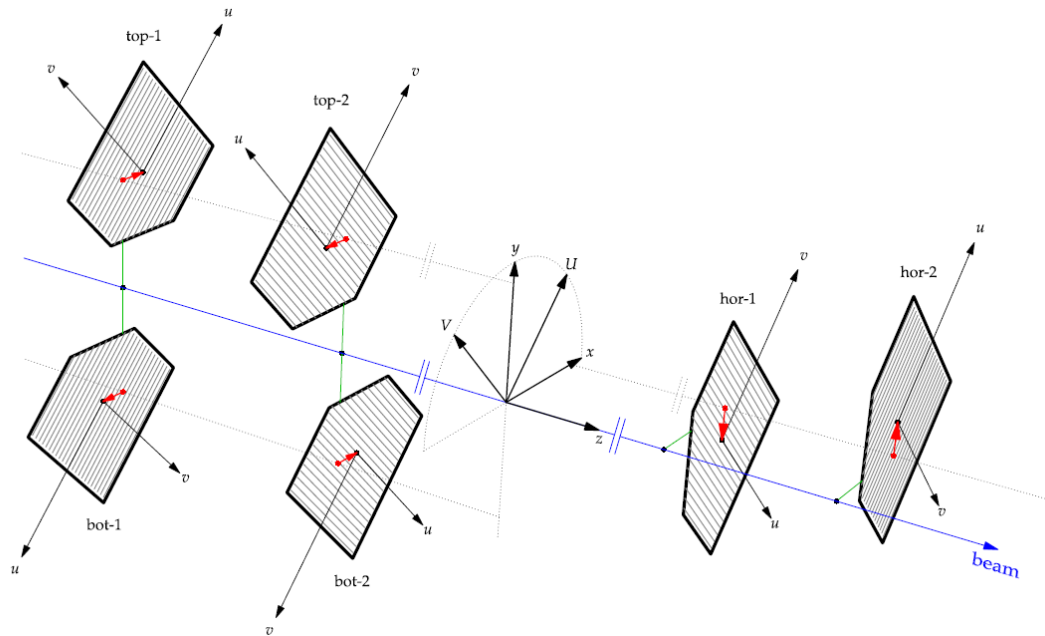
Introduction



Experimental Setup

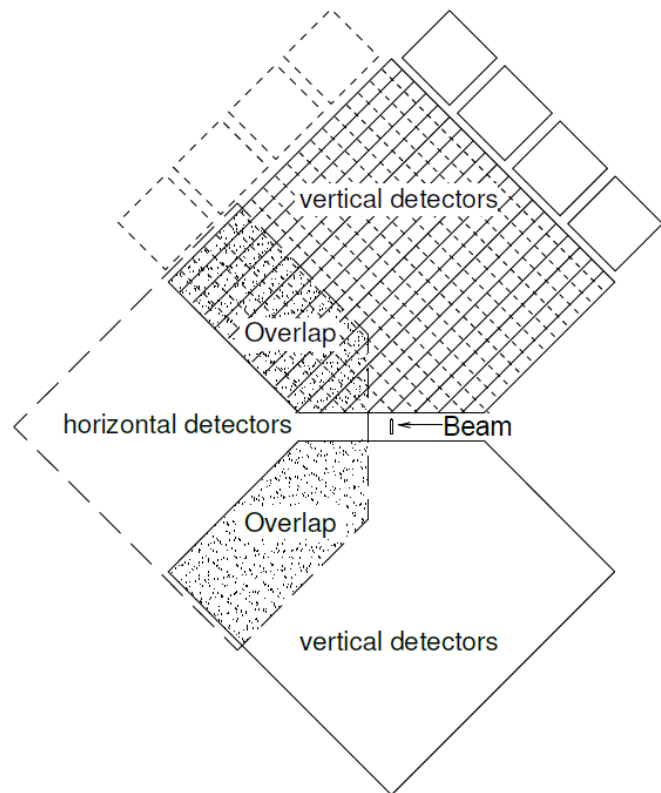


Experimental Setup

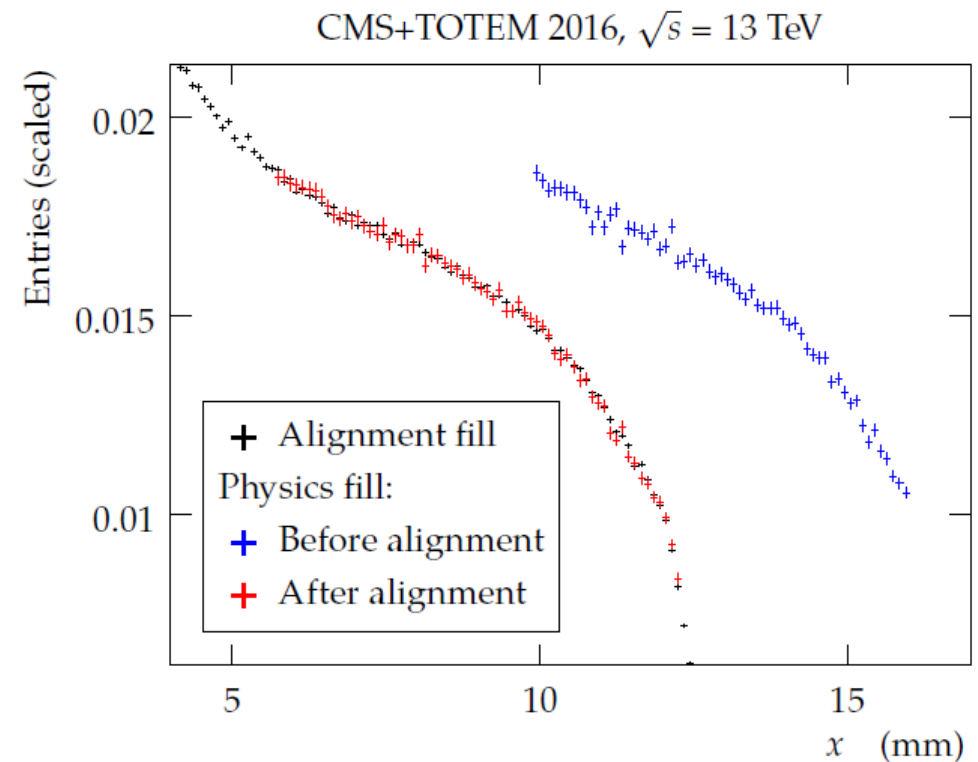


Alignment of the CT-PPS tracking detectors

1) Alignment Fill



2) Physics Fill



Proton reconstruction

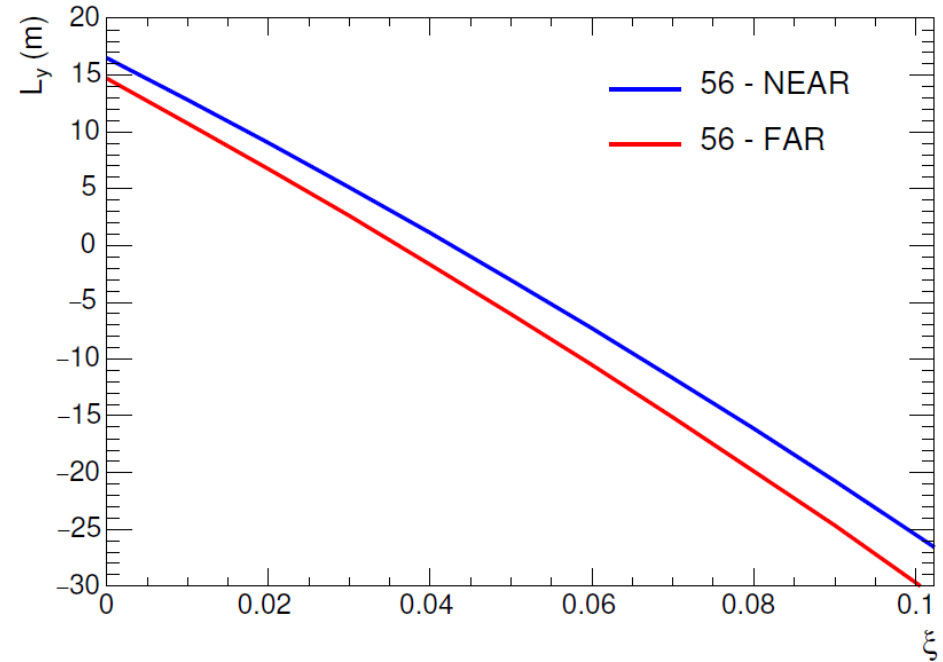
$$\mathbf{d}(s) \parallel = T(s, \tilde{\zeta}) \mathbf{d}^*,$$

$$\mathbf{d} = (x, \Theta_x, y, \Theta_y, \tilde{\zeta}),$$

$$\tilde{\zeta} = \Delta p / p,$$

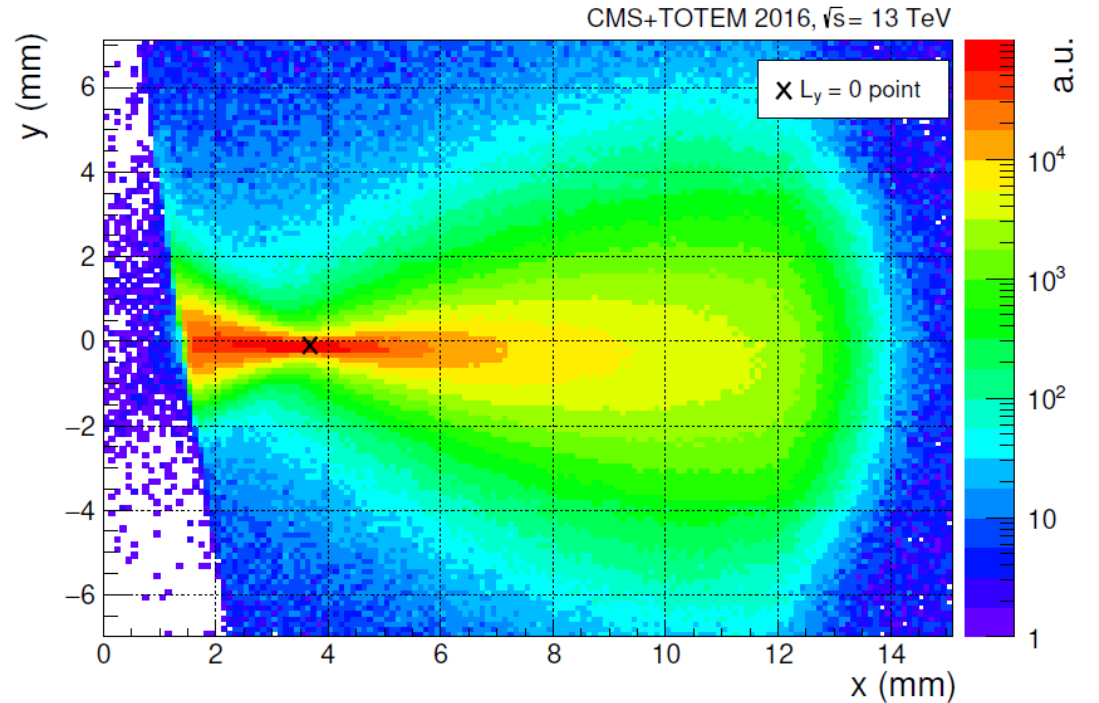
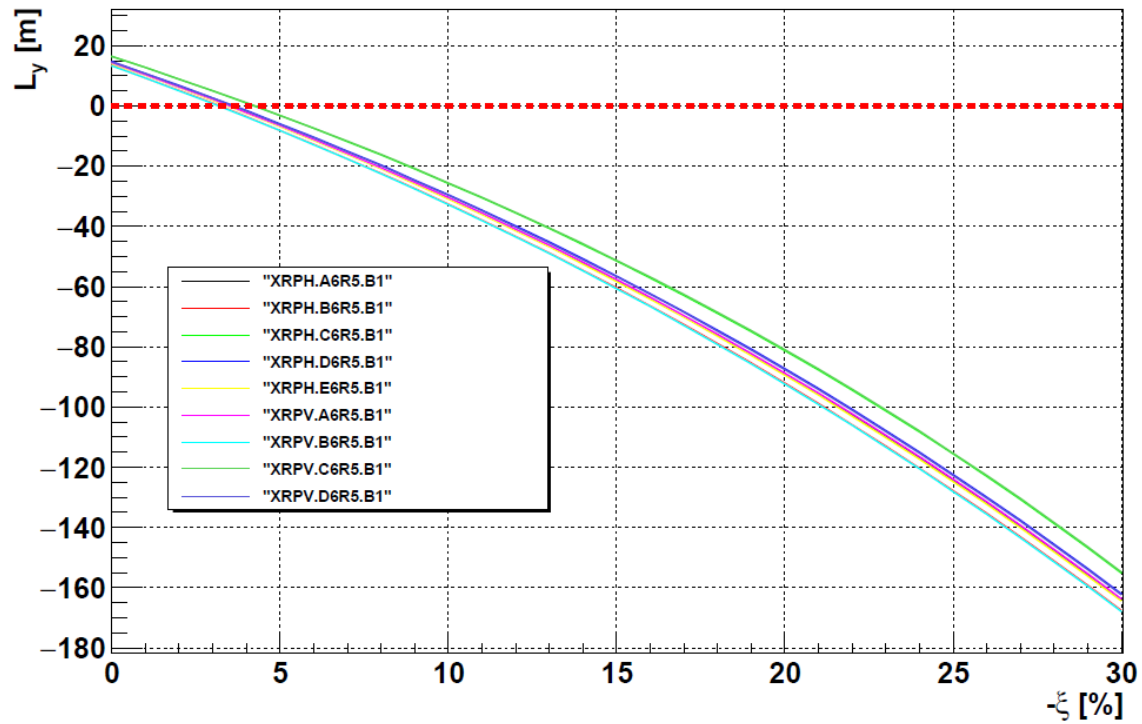
$$y = L_y(\tilde{\zeta}) \Theta_y^*,$$

$$x = D_x(\tilde{\zeta}) \tilde{\zeta},$$



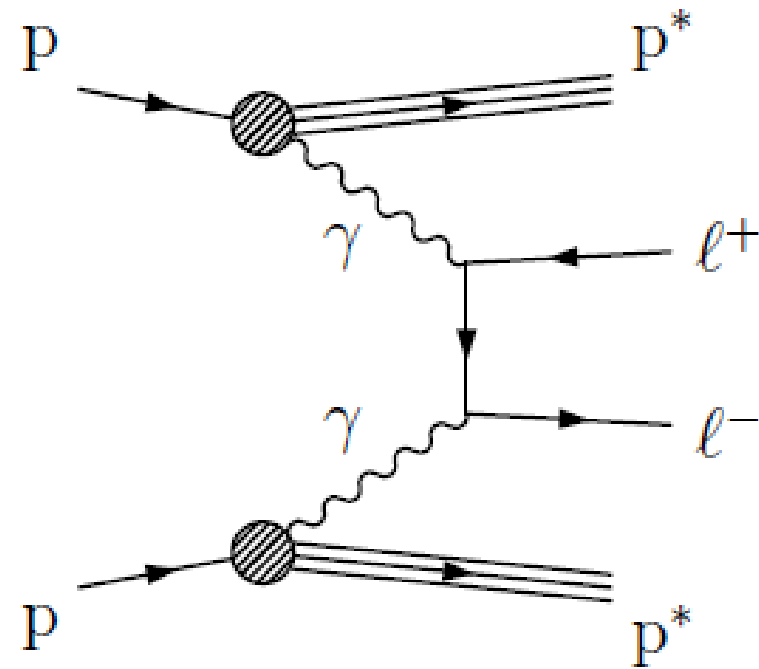
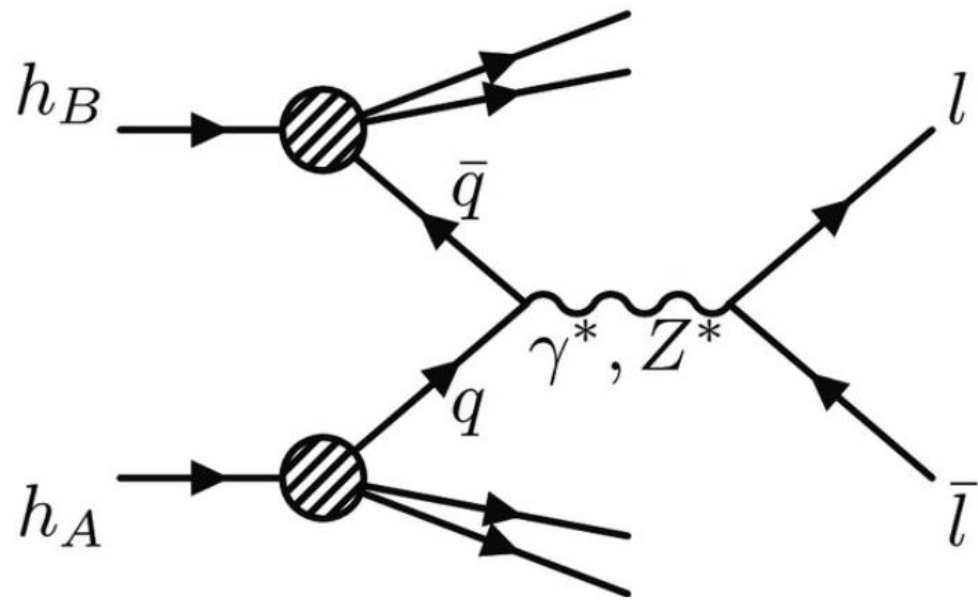
$$D_x \approx \frac{x_0}{\tilde{\zeta}_0}.$$

Proton reconstruction



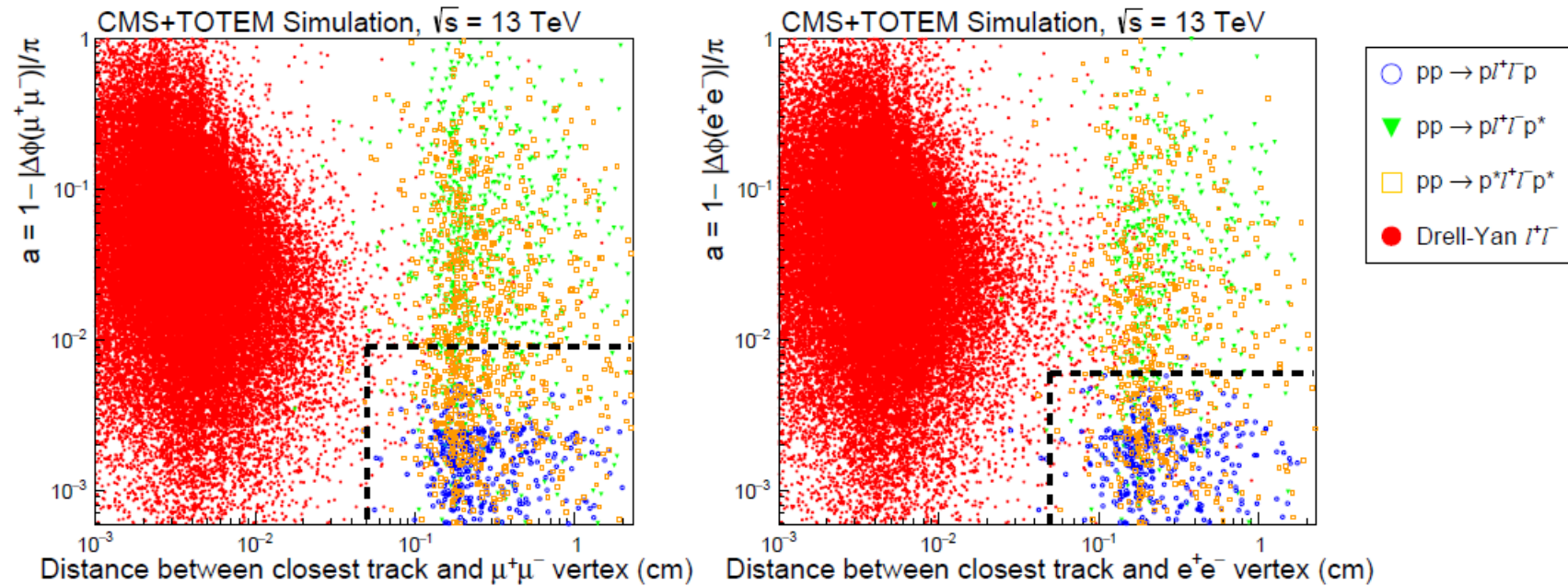
TOTEM Collaboration, "LHC optics measurement with proton tracks detected by the Roman pots of the TOTEM experiment", *New J. Phys.* **16** (2014) 103041,

Background

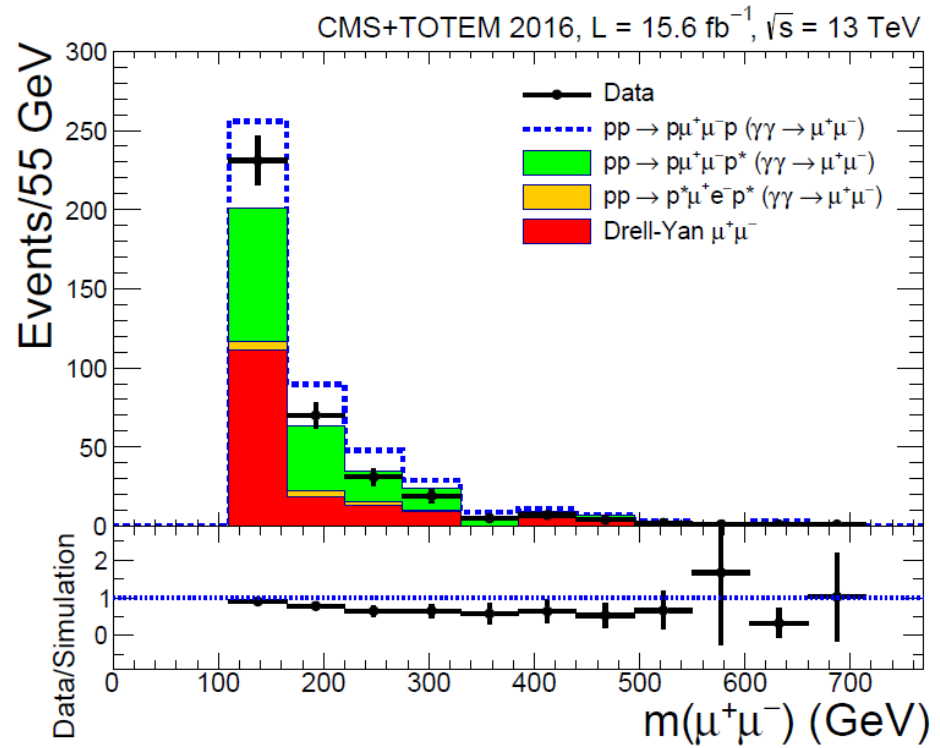
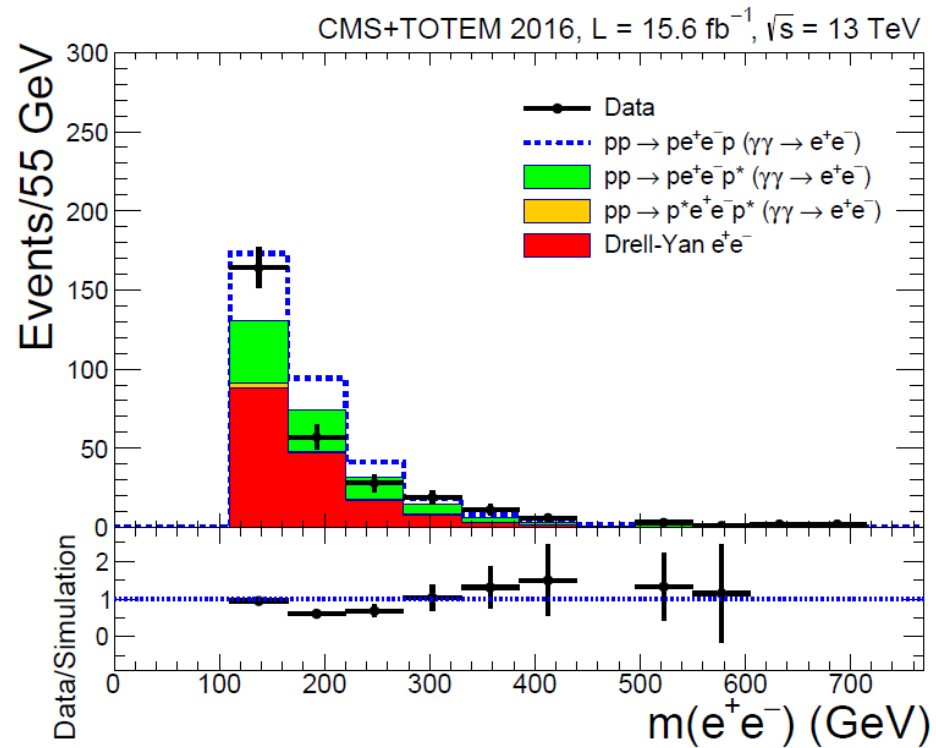


Event Selection

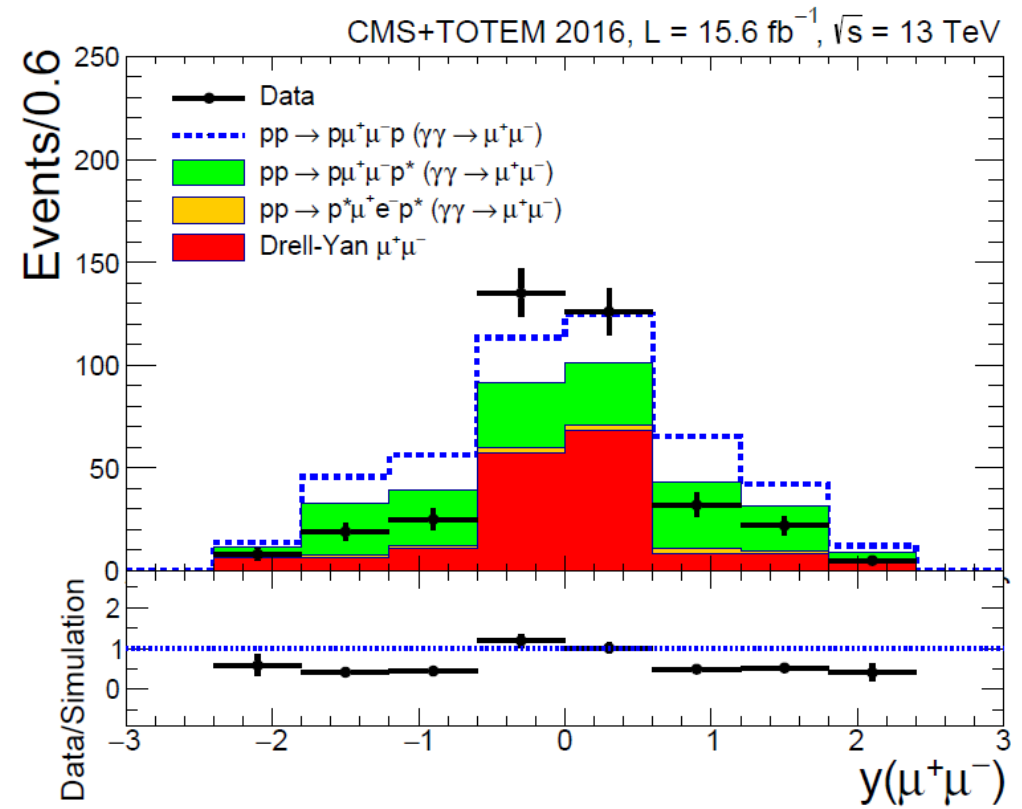
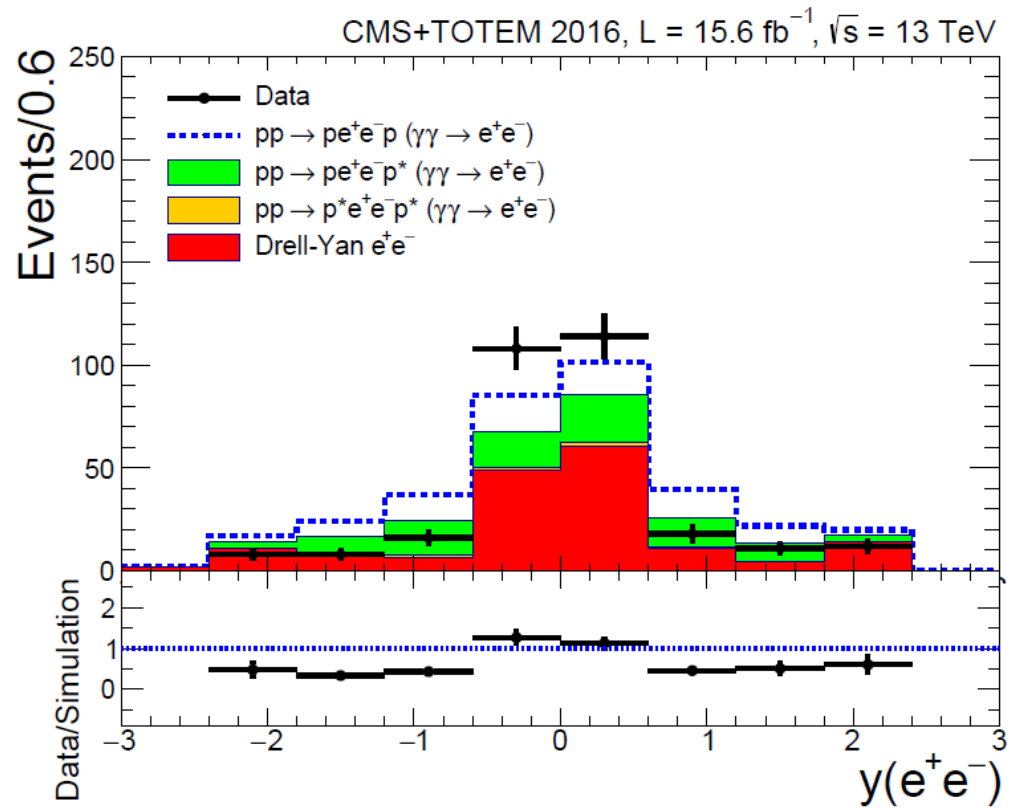
$$a = 1 - |\Delta\phi(\ell^+\ell^-)|/\pi$$



Event Selection



Event Selection



Matching central and proton variables

$$\xi(\ell^+ \ell^-) = \frac{1}{\sqrt{s}} \left[p_T(\ell^+) e^{\pm\eta(\ell^+)} + p_T(\ell^-) e^{\pm\eta(\ell^-)} \right]$$

Background Results

Table1: $\mu^+\mu^-$ production

Background Source	Full	Within 2σ
Drell-Yan	11.36 ± 0.18	1.38 ± 0.06
Double dissociation	1.17 ± 0.02	0.108 ± 0.005
Total background	12.52 ± 0.18	1.49 ± 0.07

Table2: e^+e^- production

Background Source	Full	Within 2σ
Drell-Yan	12.33 ± 0.19	2.30 ± 0.09
Double dissociation	0.56 ± 0.01	0.067 ± 0.003
Total background	12.89 ± 0.19	2.36 ± 0.09

Signal Results

Channel	Full	Within the matching kinematic window	Excess over background(in the matching kinematic window)
e^+e^-	17	12	2.3σ
$\mu^+\mu^-$	23	8	4.3σ
Joint distribution	40	20	5.1σ

Signal Results

