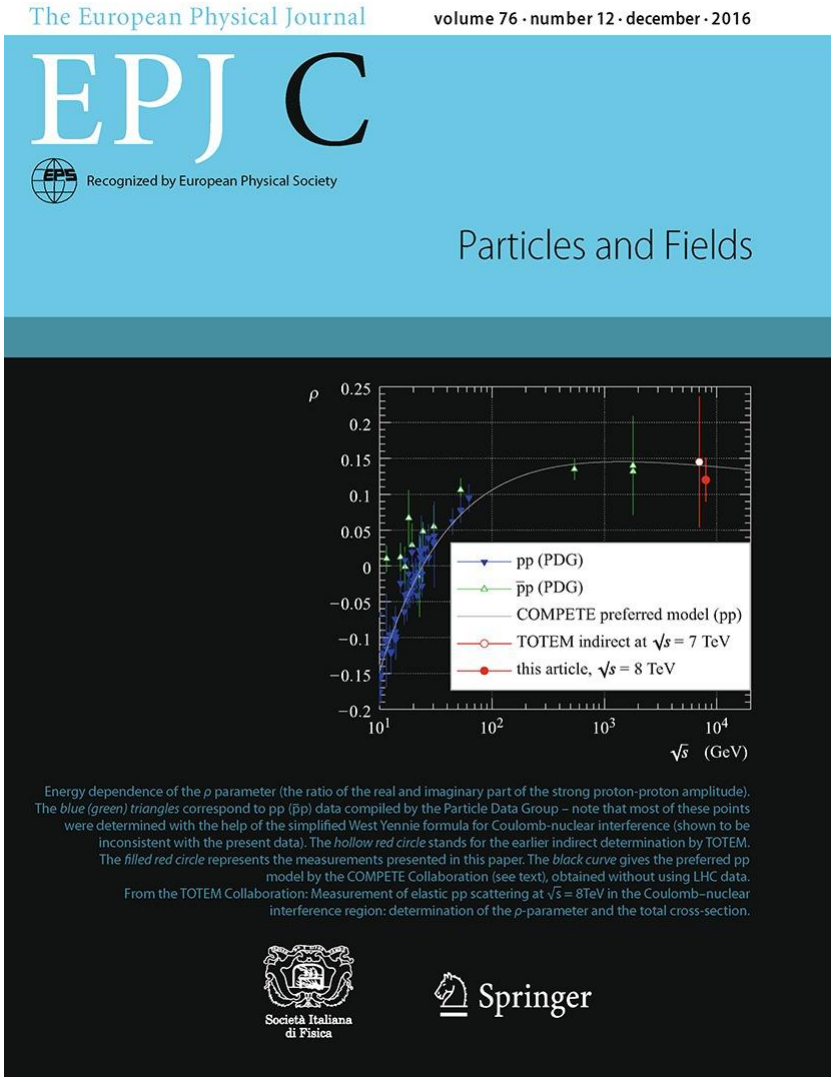
stato di TOTEM & richieste 2018

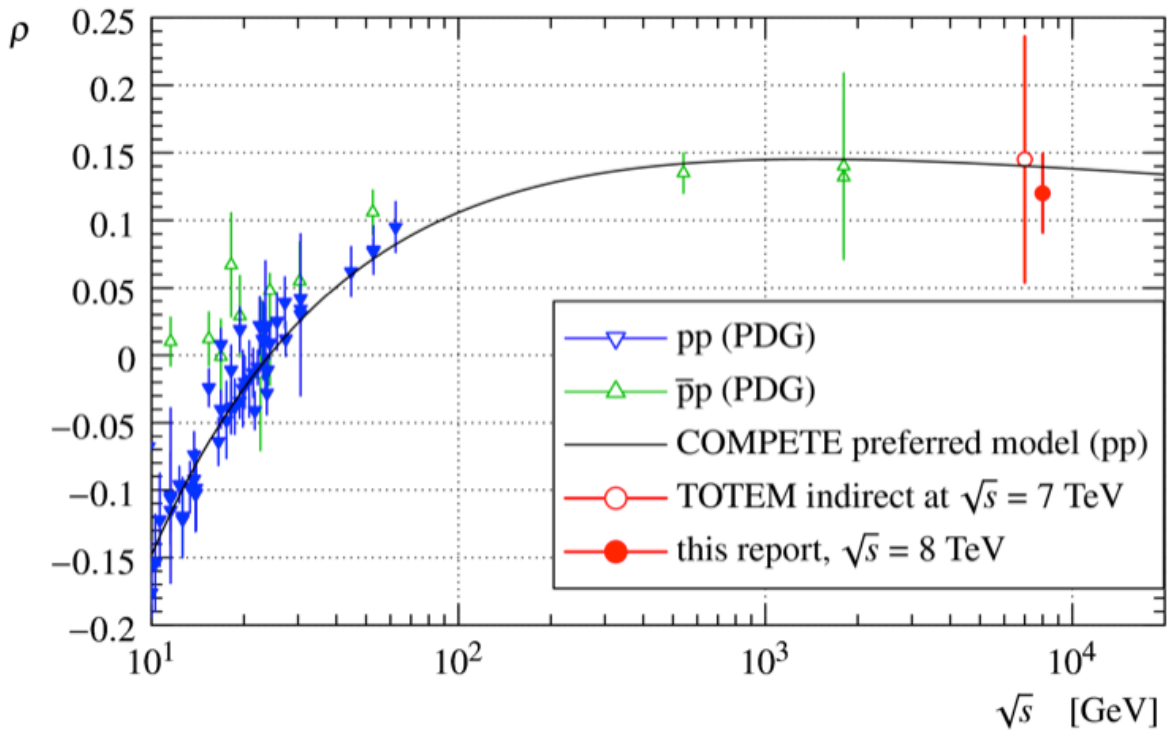
F. Cafagna, E. Radicioni

Coulomb Nuclear interference: ρ

- **EPJC cover**:
  - Measurement of Elastic pp Scattering at √s = 8 TeV in the Coulomb-Nuclear Interference Region - Determination of the ρ Parameter and the Total Cross-Section
- CERN-PH-EP-2015-325
- Eur. Phys. J. C76 (2016) 661



Coulomb Nuclear interference 8 TeV: ρ



	KL, constant	KL, peripheral
step 1: χ^2/ndf	$25.7/25 = 1.03$	$25.0/25 = 1.00$
step 2: χ^2/ndf	$57.5/56 = 1.03$	$57.6/56 = 1.03$
a [mb/GeV^2]	549 ± 24	549 ± 24
b_1 [GeV^{-2}]	20.47 ± 0.14	19.56 ± 0.13
b_2 [GeV^{-4}]	8.8 ± 1.6	-3.3 ± 1.5
b_3 [GeV^{-6}]	20 ± 6	-13 ± 5
ρ	0.12 ± 0.03	0.12 ± 0.03
ζ_1		800
κ		2.311
ν [GeV^{-2}]		8.161
σ_{tot} [mb]	102.9 ± 2.3	103.0 ± 2.3

- First LHC determination from Coulomb-hadronic interference at √s=8TeV: $\rho = 0.12 \pm 0.03$.
- Cross-section measurements compatible with lumi-independent one.

Analysis status

- 2.76 TeV Cross Section has been completed and article is in progress.
- 13 TeV Cross Section analysis well advanced.
- Hadronic-Coulomb interference studies with data at β^*=2.5 km extremely fast progress.
- Low mass resonances studies and Glueballs searches with diffractive events (jointly with CMS).
- CT-PPS data analysis on-going.
  - Central Exclusive Production.
    - $\mu\mu$ exclusive production analysis almost finalized
    - $\gamma\gamma$ exclusive production analysis in progress
  - Missing mass searches

TOTEM results @ √s = 2.76 TeV

- Preliminary results at 2.76 TeV, lumi. independent.

TOTEM @
√s = 2.76 TeV
(ρ = 0.145):

σ_{tot} = 84.7 ± 3.3 mb

σ_{inel} = 62.8 ± 2.9 mb

σ_{el} = 21.8 ± 1.4 mb

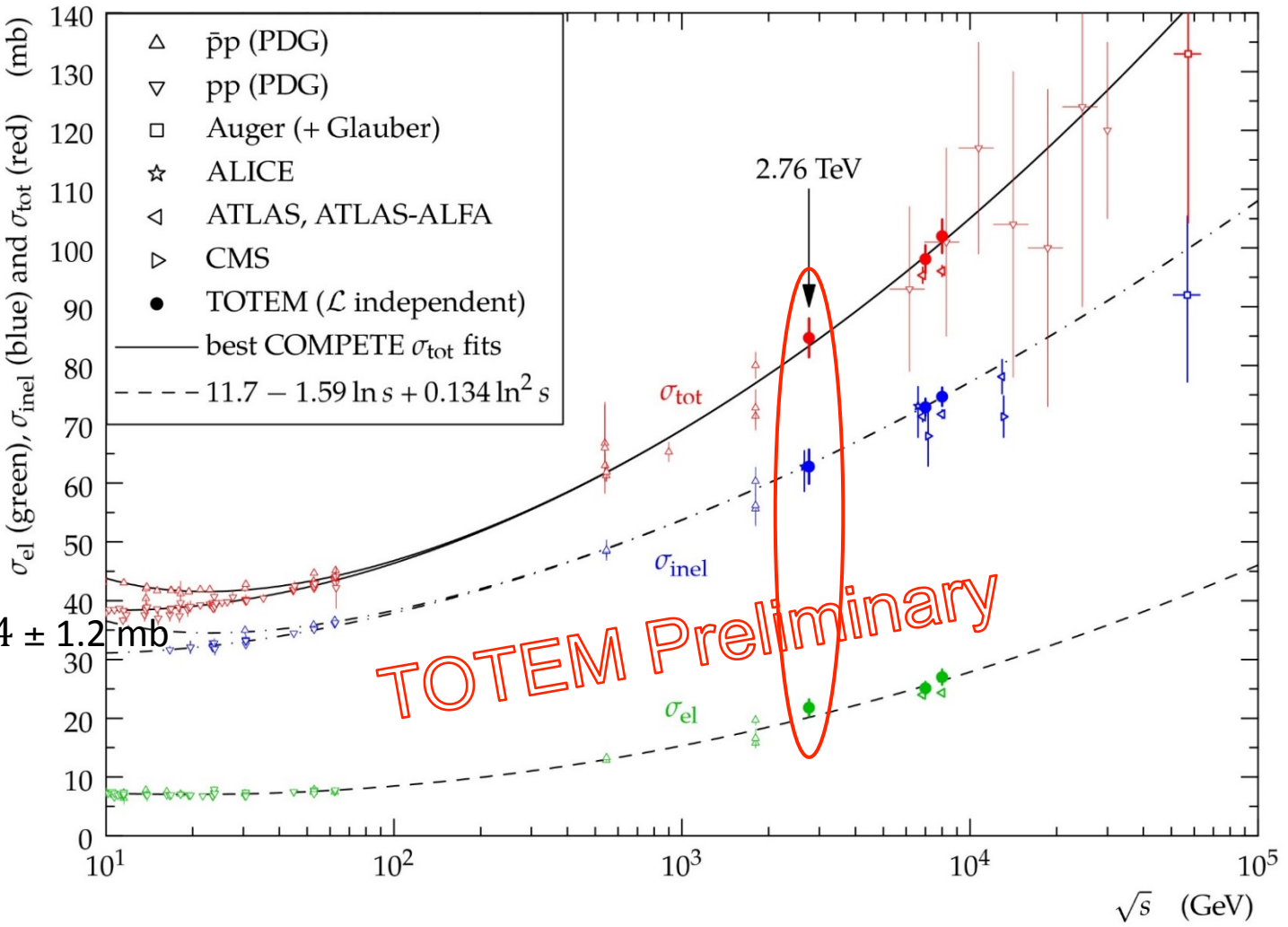
B = 17.10 ± 0.26 GeV^{-2}

($d\sigma_{el}/dt \propto e^{-B|t|}$)

ALICE @
√s = 2.76 TeV:

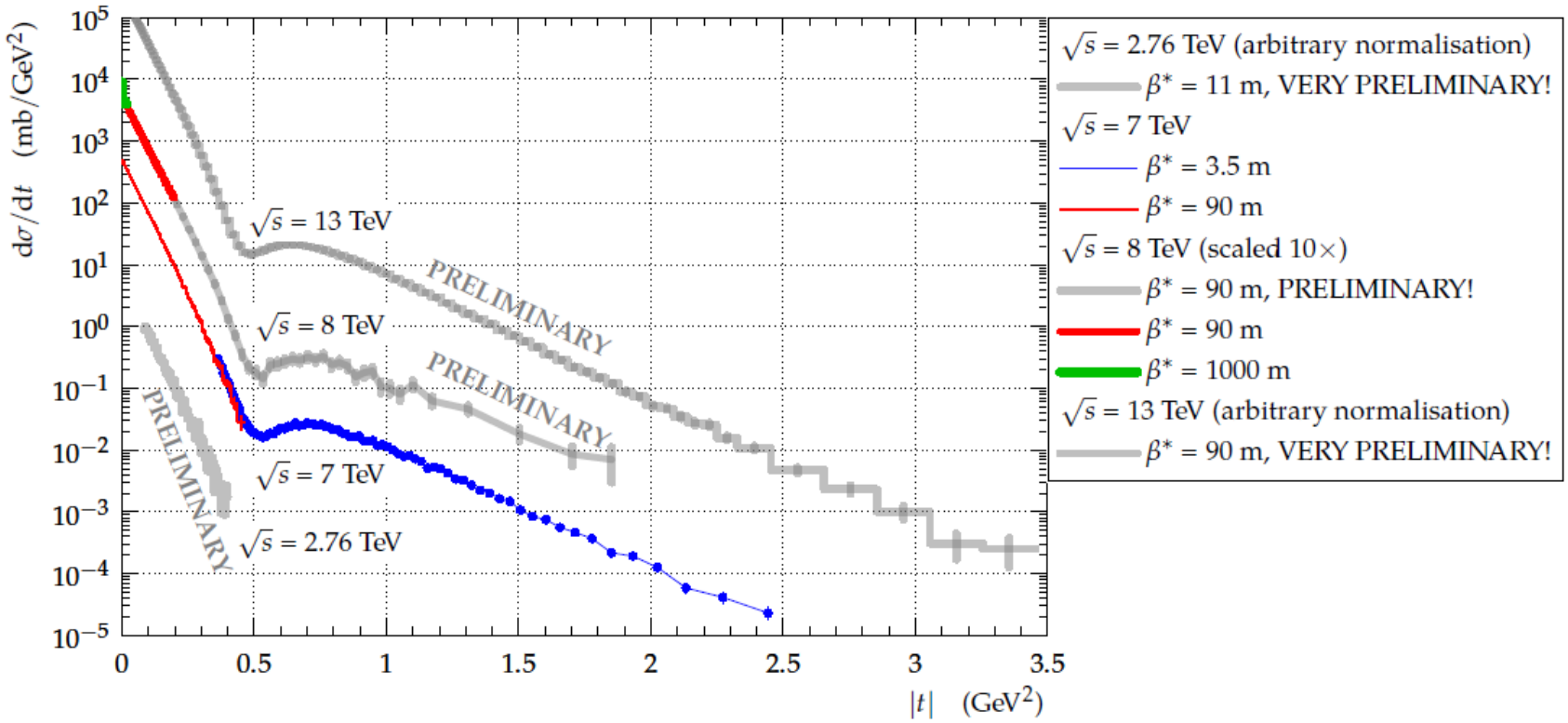
$\sigma_{inel} = 62.8\downarrow -4.0\uparrow +2.4 \pm 1.2$ mb

ALICE coll.,
EPJC 73 (2013) 2456



TOTEM results @ √s = 2.76 TeV

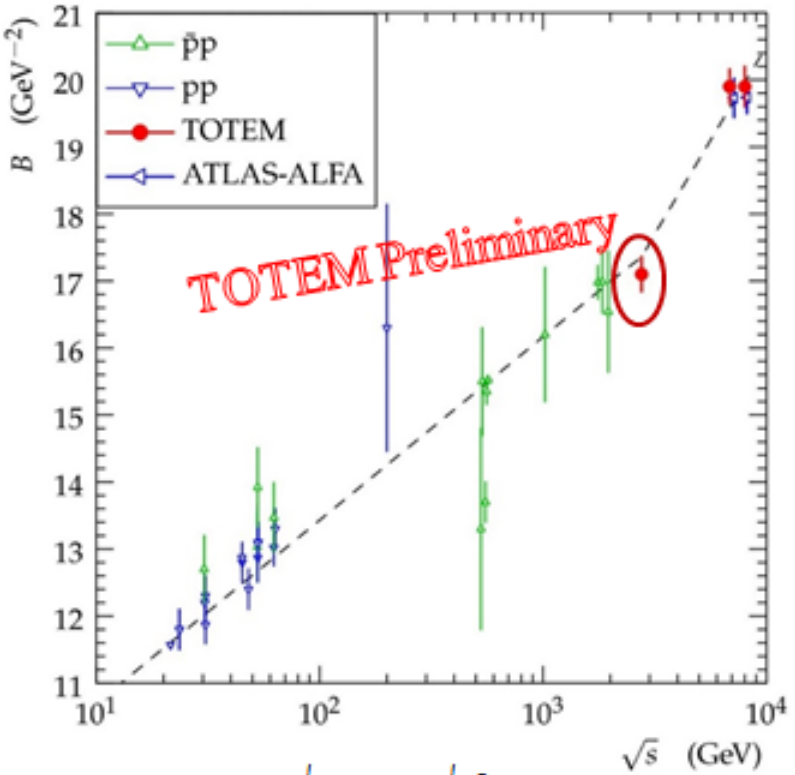
|t|-value of dip position decreases with increasing $\sqrt{s}$



$B = 17.10 \pm 0.26\ \text{GeV}^{-2}$ ($d\sigma_{el}/dt \propto e^{-B|t|}$)

TOTEM results @ √s = 2.76 TeV

Diffractive slope parameter $B = \frac{d}{dt} ln(\frac{d\sigma}{dt}\Big|_{t=0})$ **increase with** $\sqrt{s}$



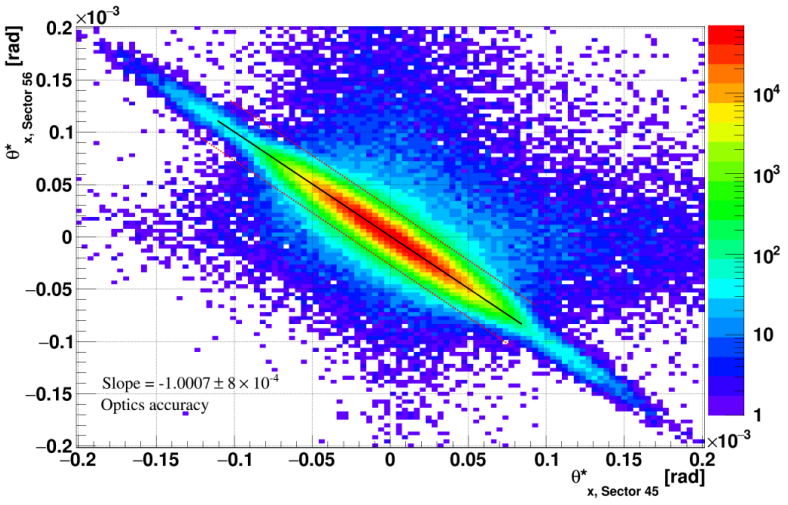
$B \propto \ln\sqrt{s} \rightarrow \ln\sqrt{s^2}$ @ LHC

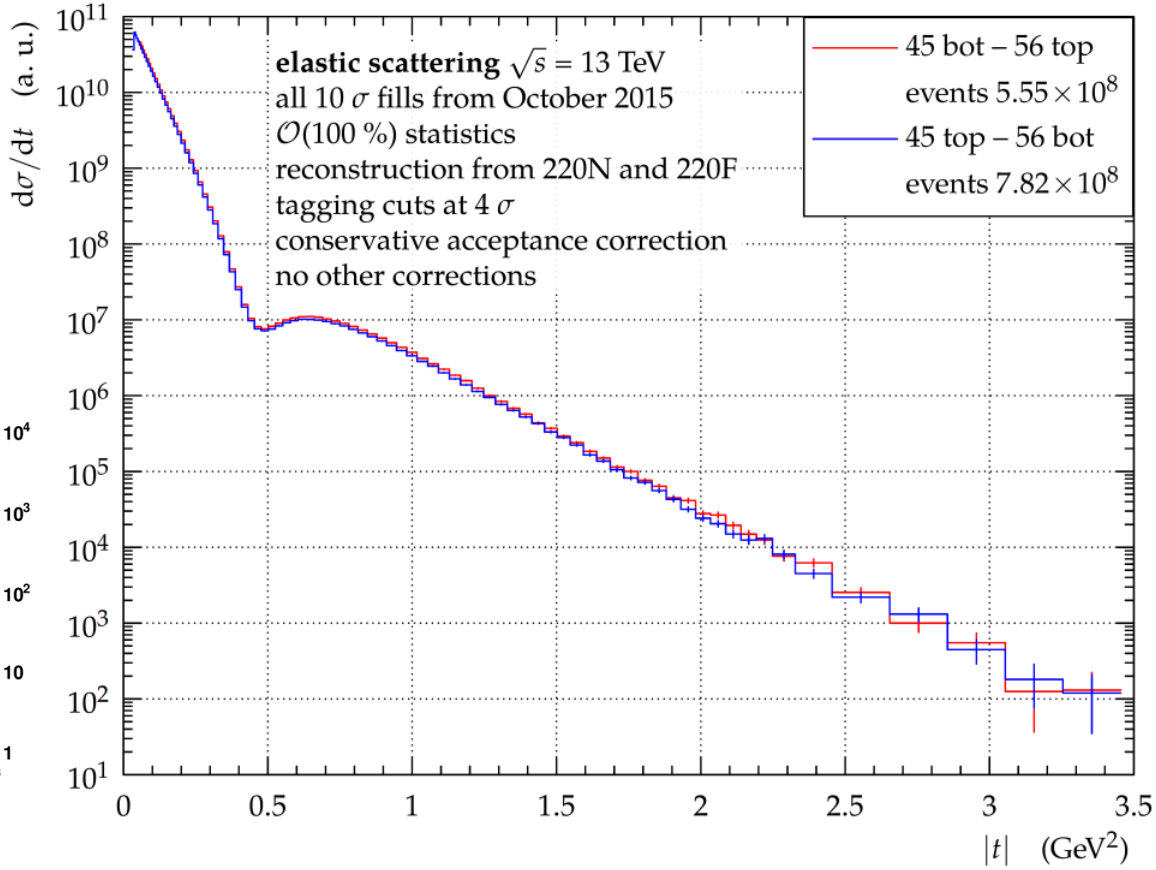
Larger impact from contribution of multi-Pomeron exchanges:
arXiv1112.2485 and PRD 85 (2012) 094024

Deviation from pure exponential under measurement at 13 TeV:
A.D. Martin, V.A. Khoze, M.G. Ryskin, JPG 42 (2015) 025003; D.A. Fagundes et al., IJMPA 31 (2016) 1645022

Special run @ 13TeV β^* 90m

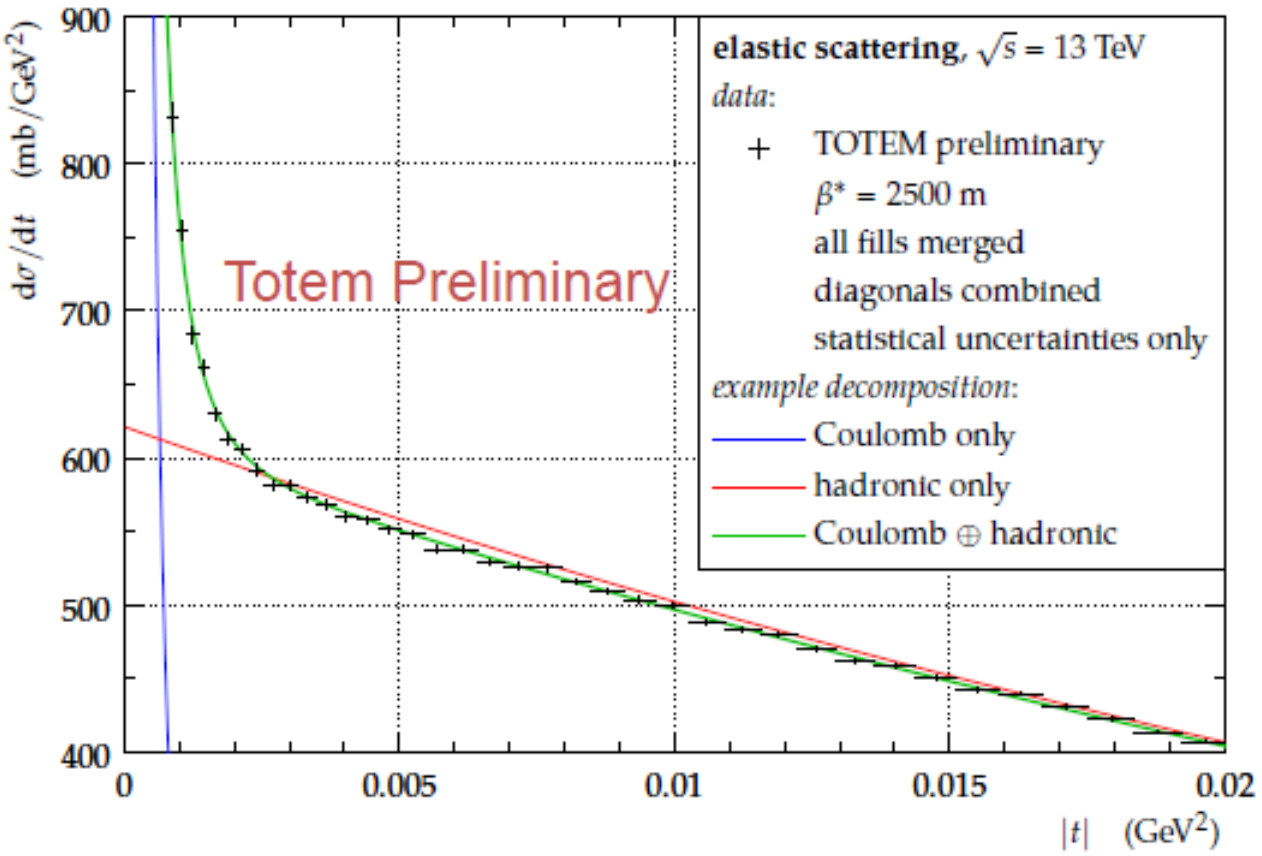
- 2 Analyses:
  - 5σ data: luminosity independent cross-section
  - 10σ data: large-t elastic differential cross-section
- Acceptance and analysis cuts carefully defined for all fills
- Geometrical and beam divergence corrections
- Advanced status:
  - DAQ inefficiency,
  - unfolding,
  - pile-up from background,
  - alignment uncertainty
  - propagation



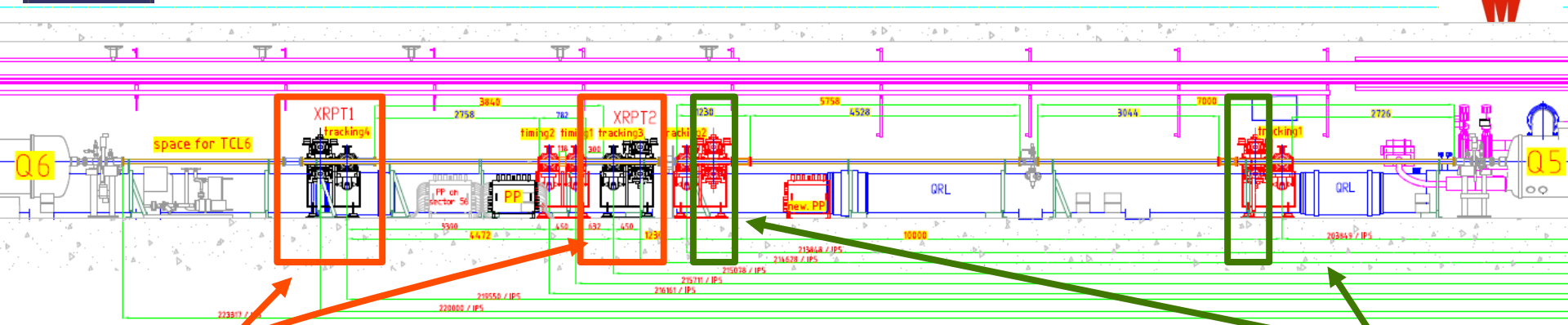


Special run @ 13TeV. β^* 2.5km

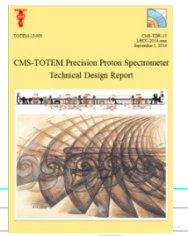
- Hadronic Coulomb interference
  - First full analysis cycle completed with all corrections applied



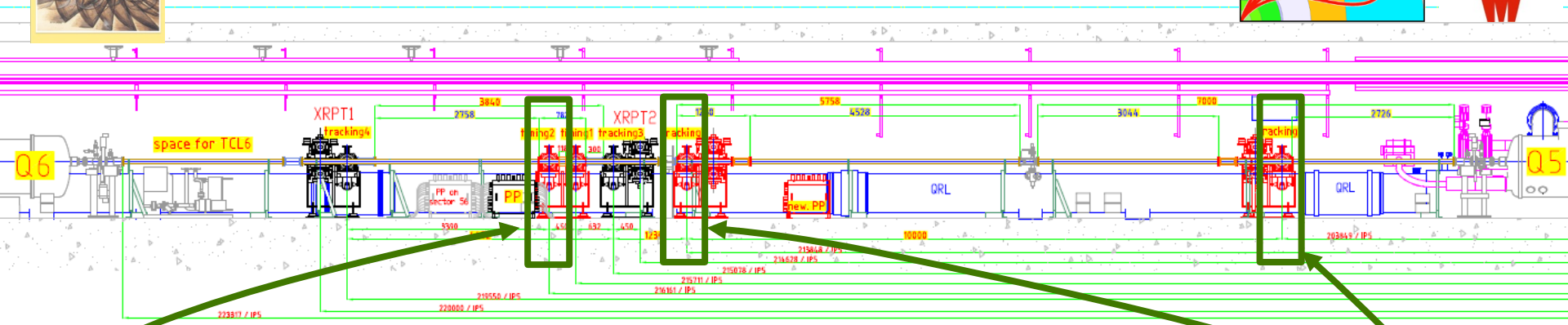
The TOTEM timing TDR



- In this measurements all TOTEM tracking detectors in **all vertical RPs** will be used, i.e. existing RP at 220 m and relocated RP at 203-213 m.
- New timing detector will be installed in a **vertical RP**.



The CT-PPS layout



- Tracking detectors will be installed in the two relocated **horizontal RPs**.
- Timing detectors in one new **horizontal RP.**

The Si-Strip integration

Feb
- CTPPS "accelerated" approved by the two collaborations

Mar
- Existing Reconstruction SW refactorized in CMSSW81X
- SW Integration started

Apr 1st half
- 1st MiniDAQ readout test at low rate
- Files available for SW validation

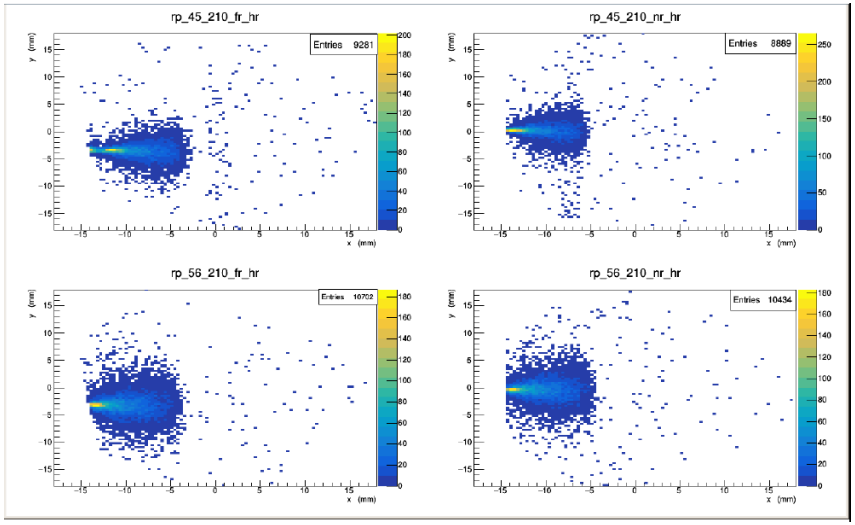
Apr 2nd half
- 1st MiniDAQ high rate test
- Beam based alignment of RP
- RP Insertion commissioning at high luminosity

May 1st half
- 1st MiniDAQ test with Si-Strip ON
- Si-Strip in global run with CMS

20th May
- Si-Strip timed w. LHC beam and CMS global trigger

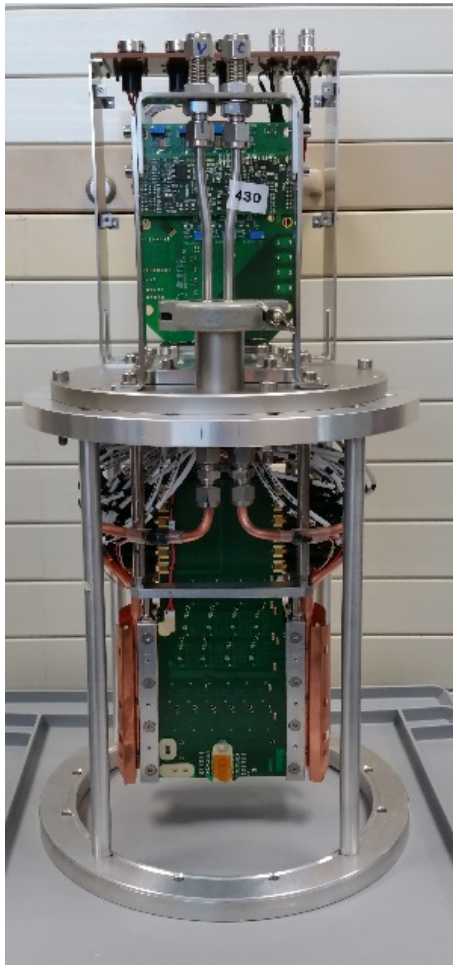
3rd June
- RPs reached their nominal position (15σ)

June 2nd half
- Reconstruction SW fully merged in CMSSW80X
- >3/fb collected!



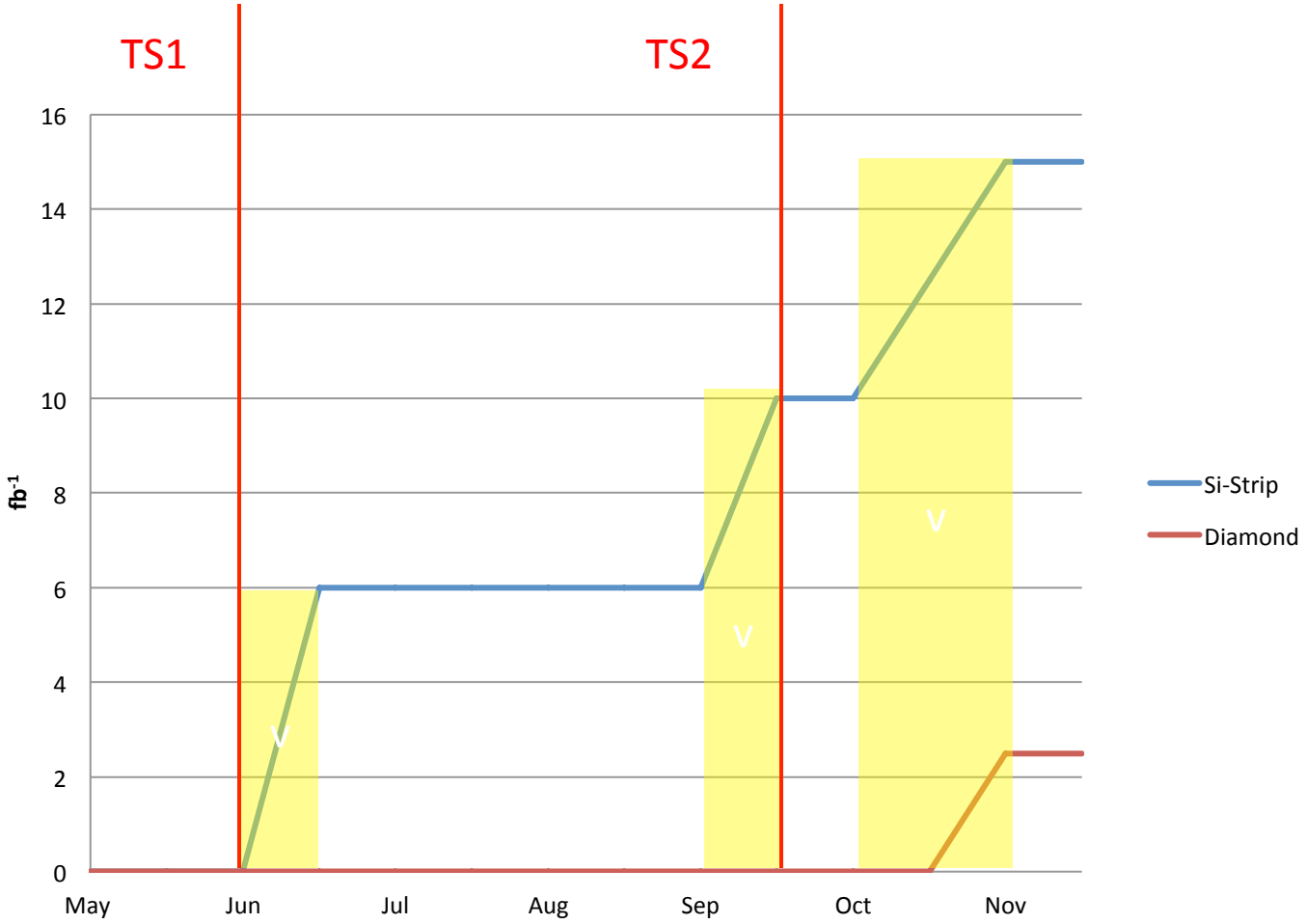
Diamond detectors integration

- Diamond detector, designed for the vertical pot, has been modified to fit in the horizontal cylindrical pot.
- Diamond detectors have been installed during TS1 and TS2.
- Integrated with the TOTEM DAQ, since TS2. They can be readout standalone (special run), or in the CMS central DAQ.



Thanks to: M. Berretti, E. Bossini, N. Minafra, M. Quinto

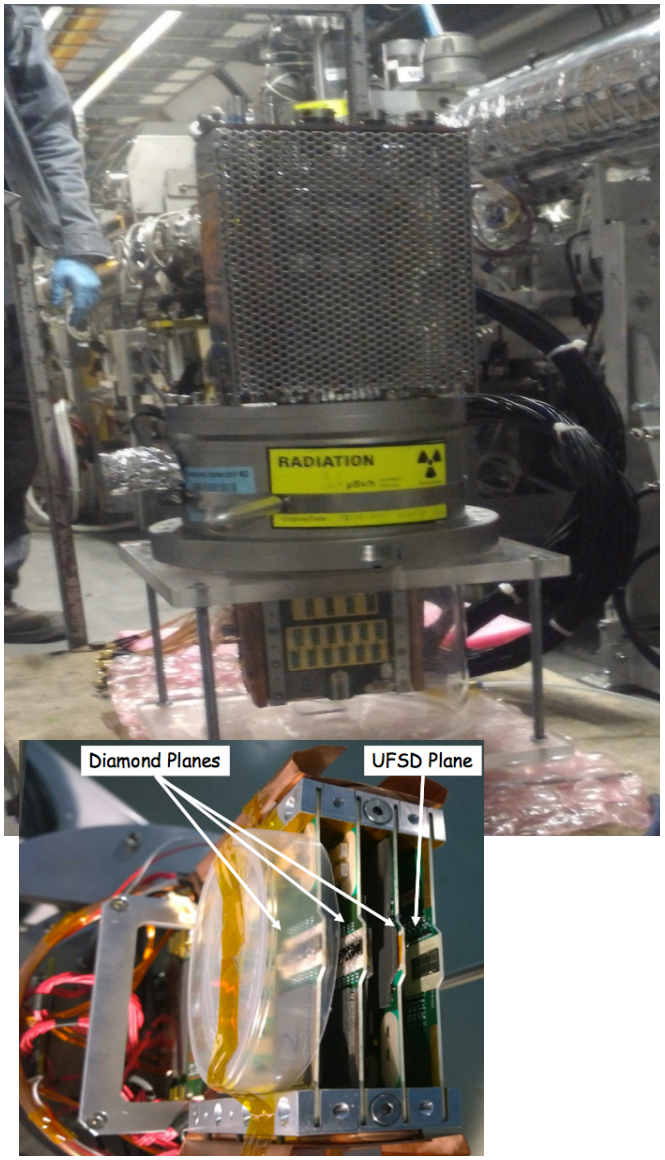
Collected data during 2016



15.7fb^{-1} collected with Si-Strips (2.5fb^{-1}). 70% high quality data thanks to: improved settings, Si-Strip replacement or combination with diamonds

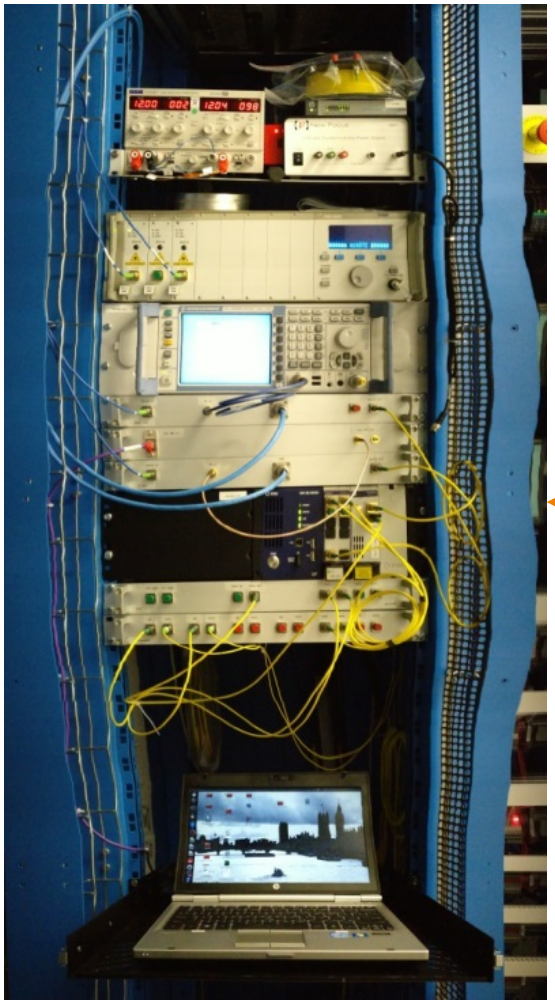
EYETS: Timing

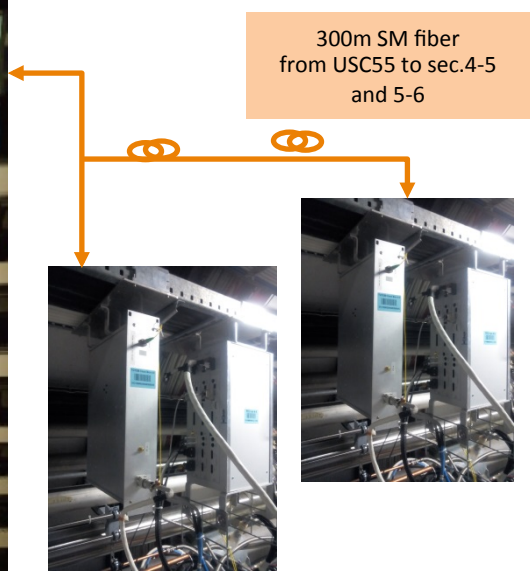
- Consolidation of timing det. hybrid
  - Discharge effect observed in 2016
  - Rework to mitigate HV discharge
- Replace 4th diamond plane with UFSD (Ultra Fast Silicon Detector)
  - Test of technology
  - Radiation effects evaluation
  - Transparent to the readout chain (NINO + HPTDC)
- Mechanical shift introduced on the hybrid
  - Improve position w.r.t. expected beam position
  - Additional vertical tuning possible by moving the full pot. If needed, during tech. stops.



EYETS: Precision clock

- Low jitter optical clock
  - Installation of central distribution unit in USC55 completed
  - Receiving units already installed in the tunnel during TS1

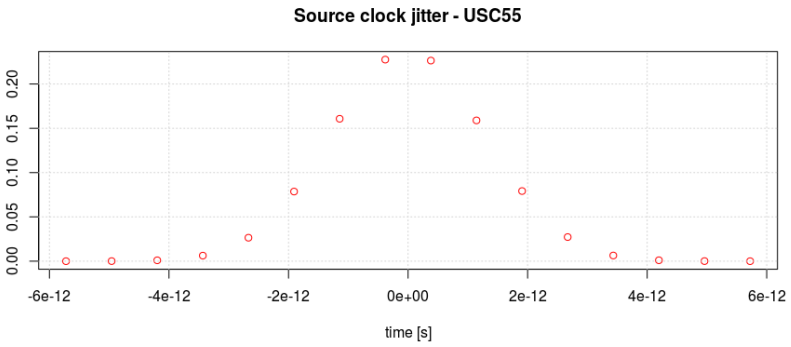




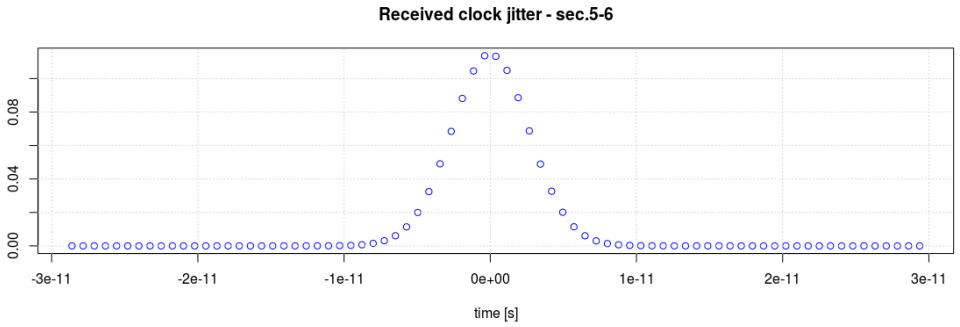
EYETS: Precision clock

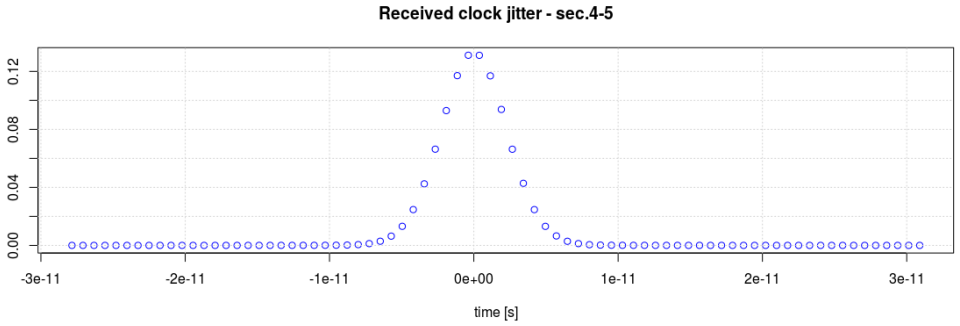
- Optical clock commissioning
  - Check of fibers attenuation **3-4dB**
  - RMS jitter at source **~1ps**
  - RMS jitter at receivers **~2ps**

CMS USC55



LHC's tunnel





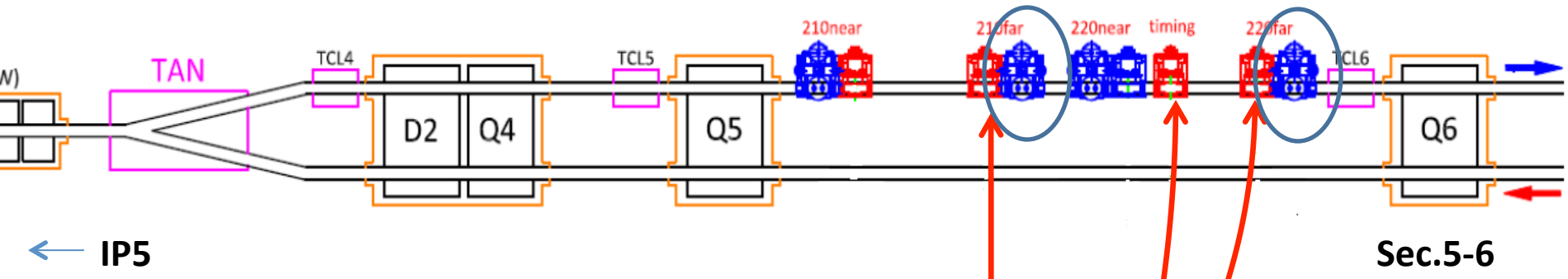
EYETS: T2 status

We examined a piece of a broken pipe and noticed that it was completely fragile, easily broken at the slightest deformation, and crumbled into powder! **Elastic pipe completely lost its properties under the influence of radiation!**

Pieces of broken pipe

plastic cooling pipe D4/d2.5mm

TOTEM run strategy in 2017



Extend the successful experience of 2016 with CT-PPS

- Insertion of 3 Horizizontal RP for each side with 4 detector technologies:
  - 2 tracking: Si-Strip (210-FAR), Pixel (220-FAR)
  - 2 timing: hybrid Diamond + UFSD (cylindrical pot)
- Preparatory dedicated run for alignment and validation
  - 4 additional vertical pots inserted (in blue) to align the sensors w.r.t. the beam (elastic scattering events)
  - RP-210 NEAR insertion validation

run strategy 2018

- We expect a similar running mode as 2017 with CT-PPS
- + the 90m run at intermediate luminosity initially foreseen in 2017
- We are evaluating the impact of missing T2 and replacing its information with HF calorimeter.
- In 2018 the special run will be performed using the integrated CMS DAQ, exploiting at maximum the CMS triggering capabilities.
- Timing detectors information from the vertical RPs will be available at HLT together with CMS primary vertex reconstruction.

- A possible simplified T2 replacement for low-luminosity running beyond LS2 is under study

responsabilità del gruppo

- Responsabilità DAQ/online (Francesco)
- chairman Editorial Board (Gabriella)
- Timing di precisione (Francesco)
- Resource coordinator & Management Board (Emilio)
- Coordinatore Nazionale

composizione del gruppo

Ricercatori	
V. Berardi	40
F. Cafagna	60
M.G. Catanesi	30
E. Radicioni	50
Tecnologi	
F. De Leonardi	30
V. Passaro	50

Totale FTE: 2.6

commenti

- partecipazione del gruppo di ingegneria si riduce ulteriormente, mano a mano che si va verso una situazione di operations & maintenance
- il gruppo ha perso perde due postdoc lo scorso anno (Michele e Nicola) e non abbiamo nuove leve

richieste 2018

- richieste di servizi invariate rispetto allo scorso anno (includono RD51):
  - 1 mu camera pulita
  - 2 mu elettronica
  - 1.5 mu officina meccanica
  - 0.5 mu progettazione meccanica
- Le richieste saranno minori di quelle del 2018
  - ~5-10k, circa la metà dell'anno scorso
  - l'attività su DAQ e sistema di clock è ovviamente nella fase di maintenance ed ottimizzazione
  - Stiamo cercando di rifinire le performance e procurarci alcuni spare mancanti.
- M&O funds 2018 secondo RRB 2017; come al solito saranno meglio definiti a ottobre e comunicati alla CSN1.