TOTEM & RD51

(acknowledgement: la maggior parte delle slides dalla presentazione di Francesco alla CSN1, 21/05/2018)

Cross section at 2.76 & 13 TeV

EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

TOTEM 2017-001

CERN-PH-EP-2017-231
December 15, 2017

First measurement of elastic, inelastic and total cross-section at $\sqrt{s} = 13$ TeV by TOTEM and overview of cross-section data at LHC energies

The TOTEM Collaboration

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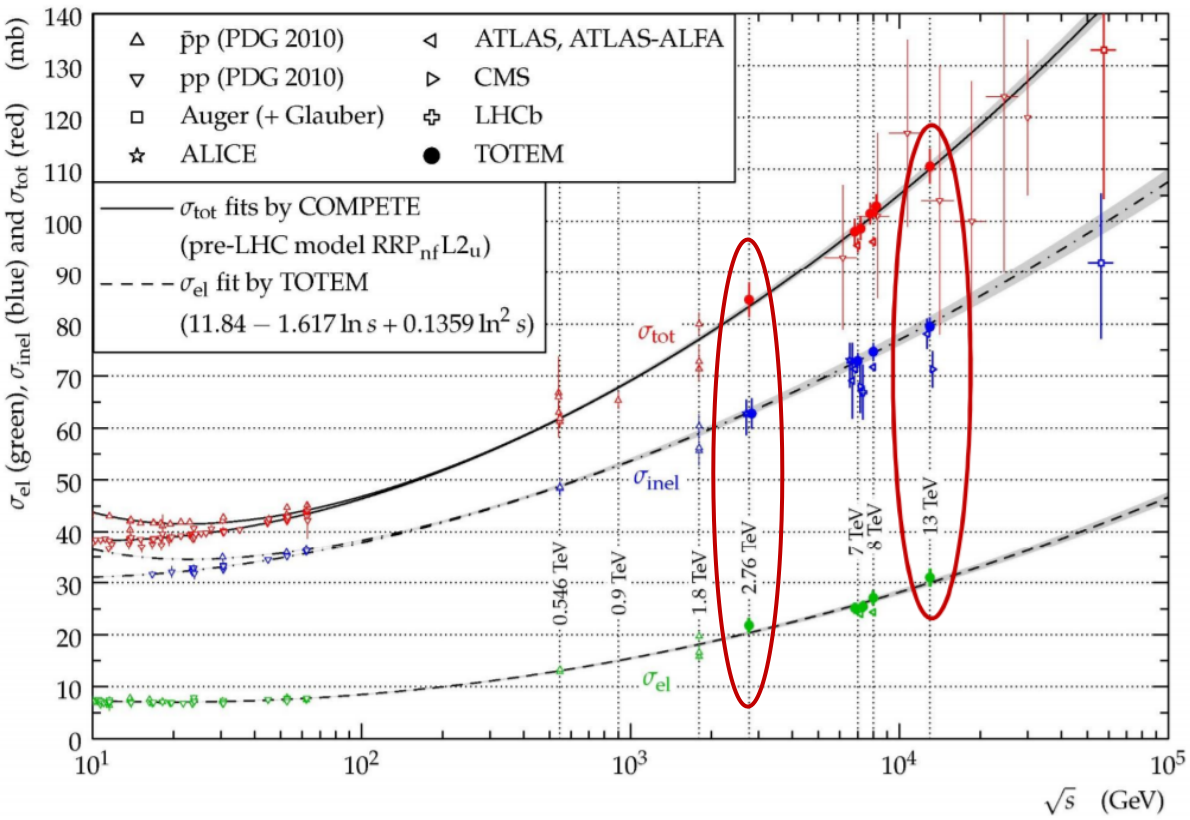

- *First measurement of elastic, inelastic and total cross-section at √s =13 TeV by TOTEM and overview of cross-section data at LHC energies,* [CERN-EP-2017-321]

ρ at 13 TeV (Odderon hints)

EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

TOTEM-2017-002
16 December 2017

CERN-EP-2017-335
19 December 2017

First determination of the ρ parameter at $\sqrt{s} = 13$ TeV – probing the existence of a colourless three-gluon bound state

The TOTEM Collaboration

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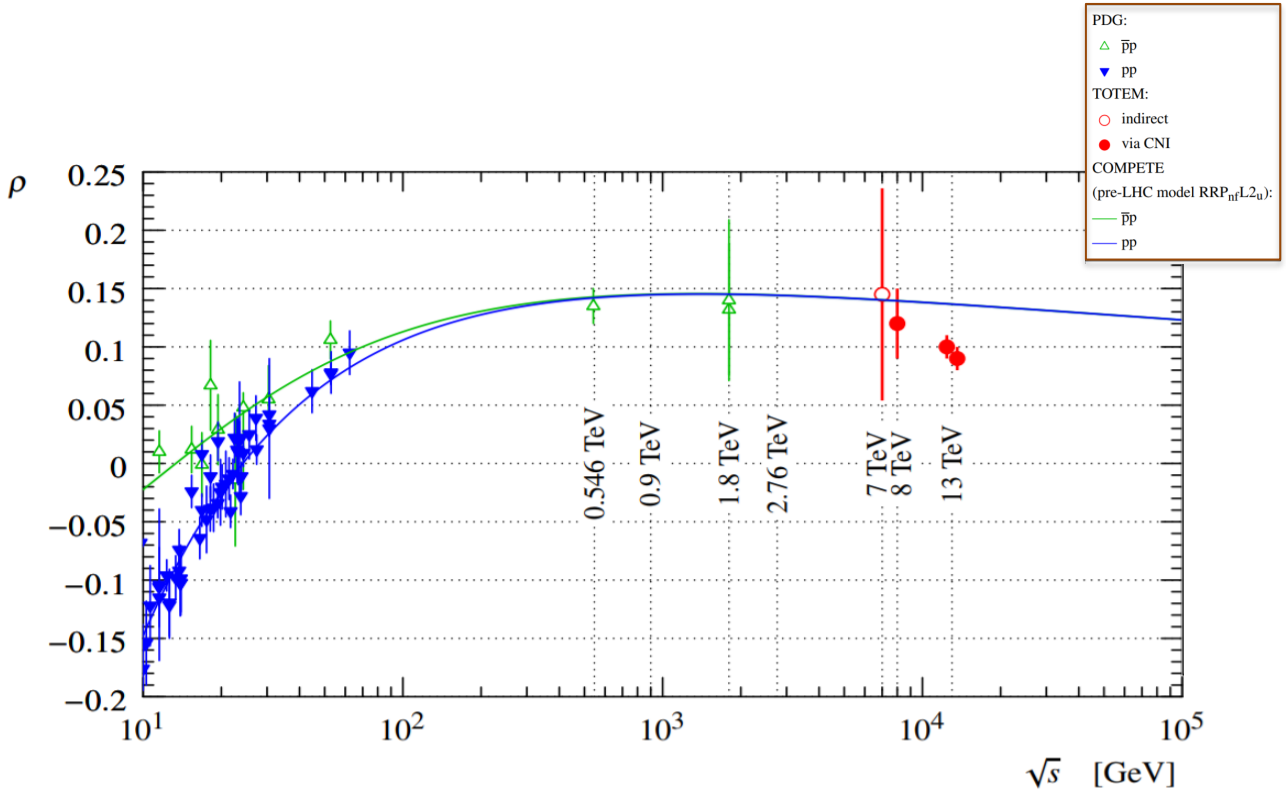
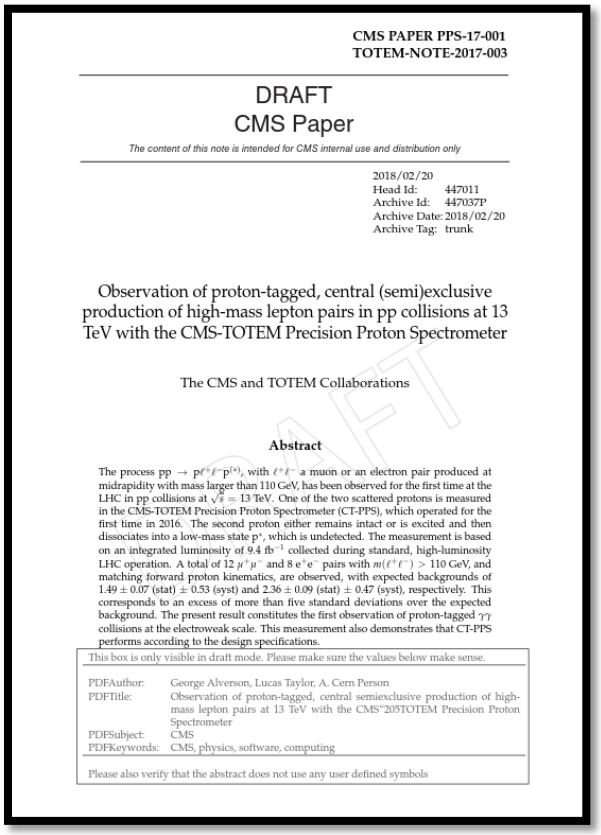


- *First determination of the ρ parameter at √s = 13 TeV – probing the existence of a colourless three-gluon bound state.* CERN-EP-2017-335

CT-PPS paper



CMS PAPER PPS-17-001
TOTEM-NOTE-2017-003

DRAFT
CMS Paper

The content of this note is intended for CMS internal use and distribution only

2018/02/20
Head Id: 447011
Archive Id: 447037P
Archive Date: 2018/02/20
Archive Tag: trunk

Observation of proton-tagged, central (semi)exclusive production of high-mass lepton pairs in pp collisions at 13 TeV with the CMS-TOTEM Precision Proton Spectrometer

The CMS and TOTEM Collaborations

Abstract

The process $pp \to p\ell^+\ell^-p^{(*)}$, with $\ell^+\ell^-$ a muon or an electron pair produced at midrapidity with mass larger than 110 GeV, has been observed for the first time at the LHC in pp collisions at $\sqrt{s} = 13$ TeV. One of the two scattered protons is measured in the CMS-TOTEM Precision Proton Spectrometer (CT-PPS), which operated for the first time in 2016. The second proton either remains intact or is excited and then dissociates into a low-mass state p^*, which is undetected. The measurement is based on an integrated luminosity of 9.4 fb^{-1} collected during standard, high-luminosity LHC operation. A total of 12 $\mu^+\mu^-$ and 8 e^+e^- pairs with $m(\ell^+\ell^-) > 110$ GeV, and matching forward proton kinematics, are observed, with expected backgrounds of 1.49 ± 0.07 (stat) $\pm$ 0.53 (syst) and 2.36 ± 0.09 (stat) $\pm$ 0.47 (syst), respectively. This corresponds to an excess of more than five standard deviations over the expected background. The present result constitutes the first observation of proton-tagged $\gamma\gamma$ collisions at the electroweak scale. This measurement also demonstrates that CT-PPS performs according to the design specifications.

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PDFAuthor: George Alverson, Lucas Taylor, A. Cern Person
PDFTitle: Observation of proton-tagged, central semiexclusive production of high-mass lepton pairs at 13 TeV with the CMS"205TOTEM Precision Proton Spectrometer
PDFSubject: CMS
PDFKeywords: CMS, physics, software, computing

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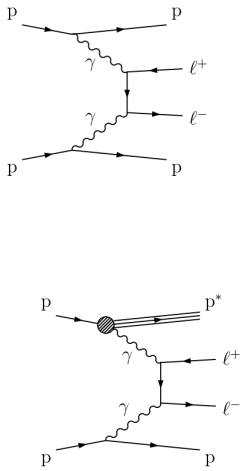
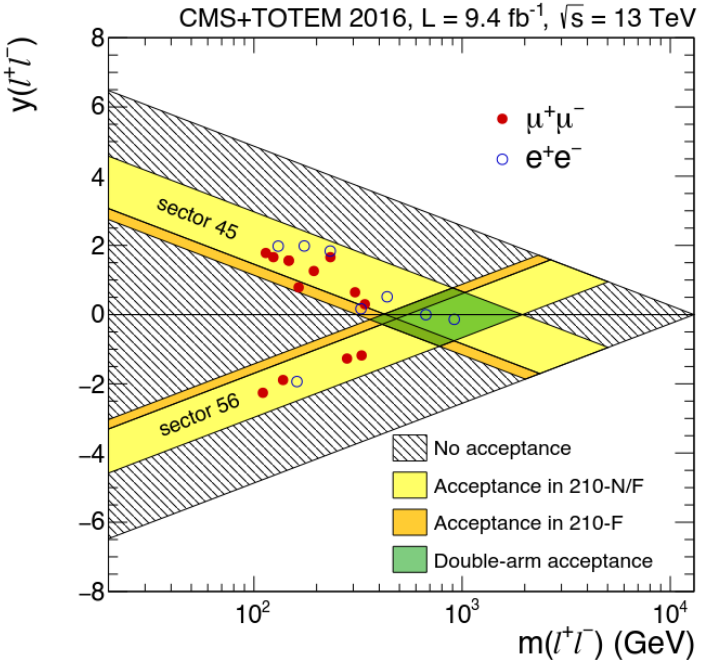
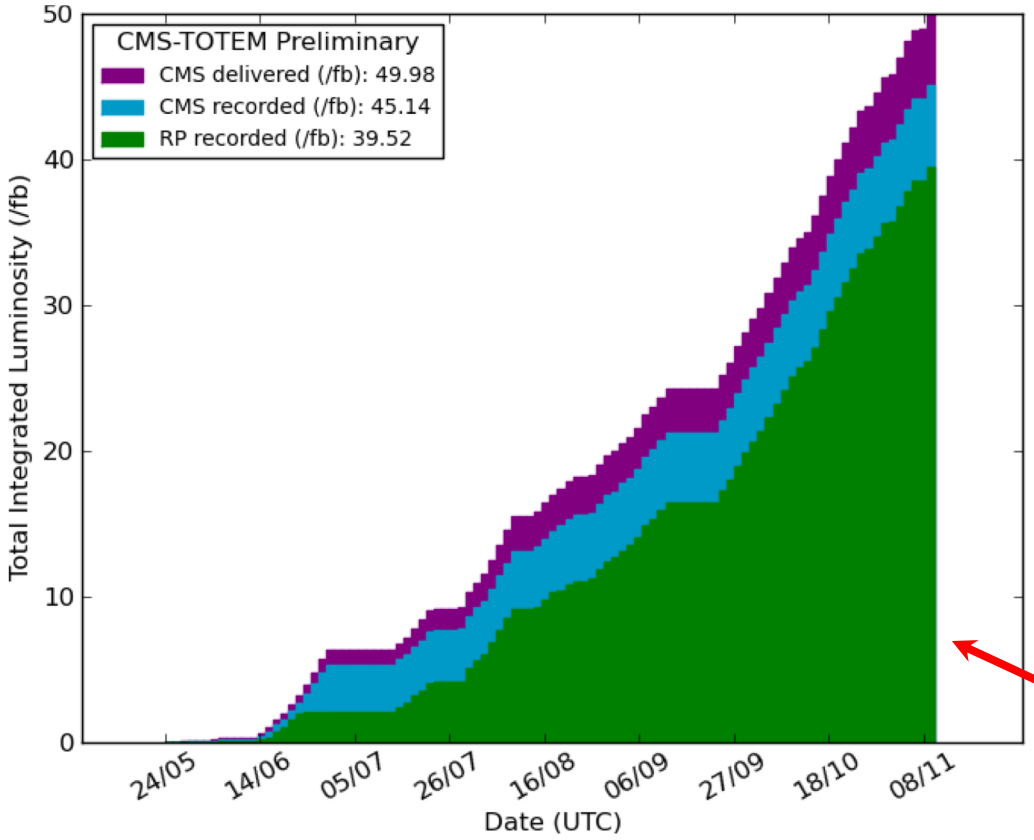




- *Observation of proton-tagged, central (semi)exclusive production of high-mass lepton pairs in pp collisions at 13 TeV with the CMS-TOTEM Precision Proton Spectrometer.* https://arxiv.org/abs/1803.04496
- First observation of proton tagged $\gamma\gamma$ collision at the electroweak scale.

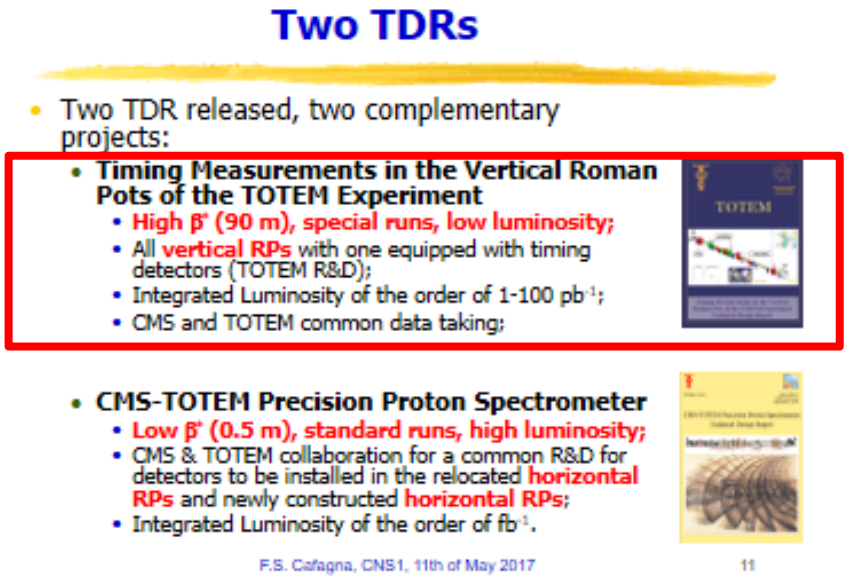
Luminosity with RP inserted (CT-PPS) in 2017



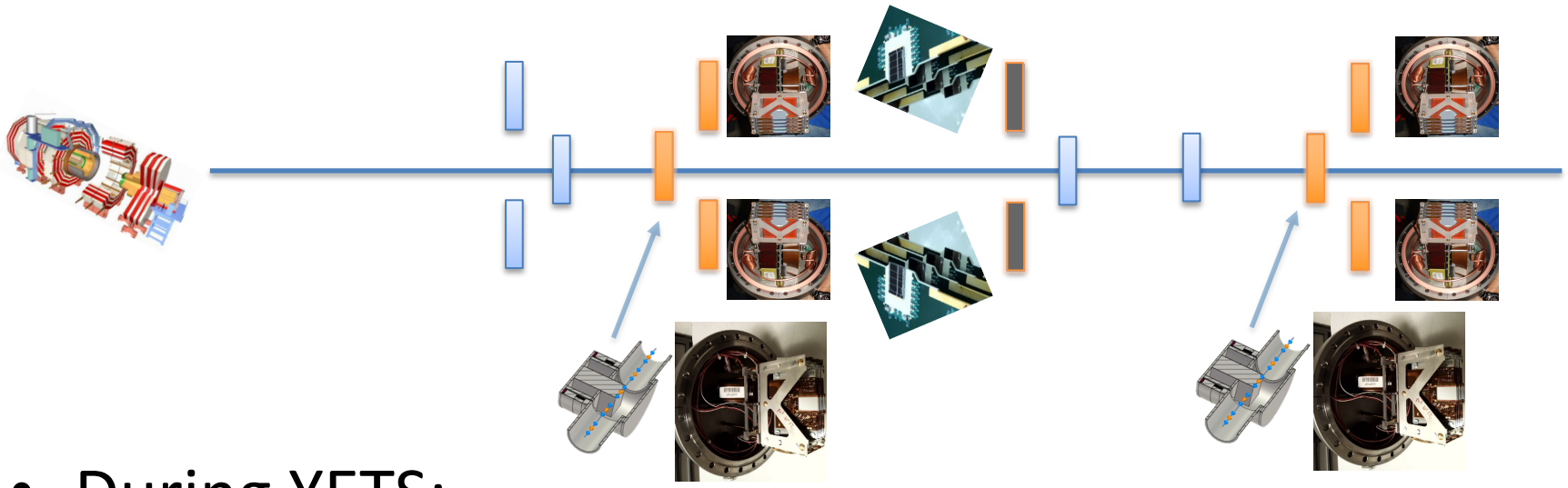
- In green, the luminosity collected by CMS with RPs inserted in the beam

hi-β^* 2018

- Preparation for high β^* (90m) run:
  - TOTEM + CMS dedicated to low mass central diffraction with higher statistics.
  - Run is scheduled for end of June, after TS1.
  - For each arm will be used:
    - 6 Vertical RPs:
      4 Tracking (Si-strip)
      2 Timing (UFSD)
    - 2 Horizontal RPs
      (only for alignment):
      Tracking (pixel)

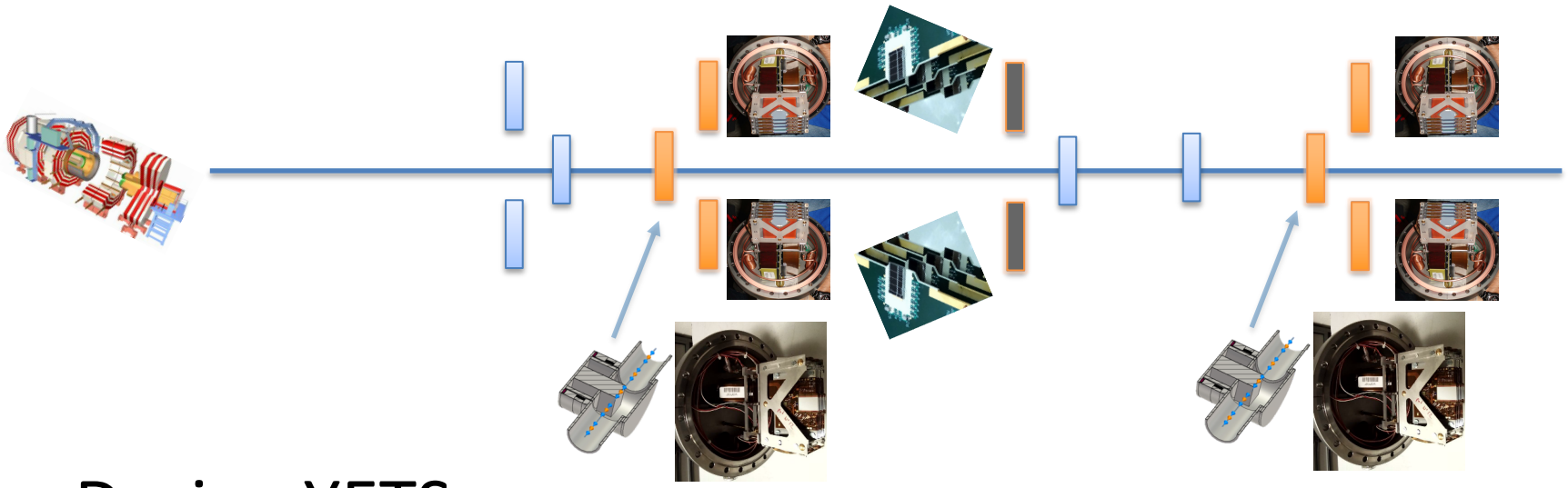


hi-β^* 2018 (v-RP)



- During YETS:
  - Vertical Si-strip detectors have been replaced by UFSD (Ultra Fast Silicon Detector): 4 planes for each RP.
  - Digitizer boards equipped with a Sampic mezzanine have been installed.
  - Firmware & software deployed.

hi-β^* 2018 (v-RP)



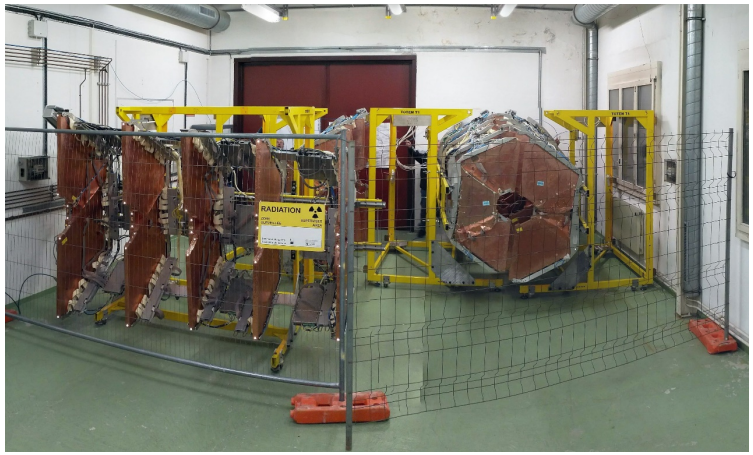
- During YETS:
  - Integration in the CMS central DAQ.
  - Proton trigger has been updated to implement a sophisticated algorithm to reduce the impact of elastic event on L1.

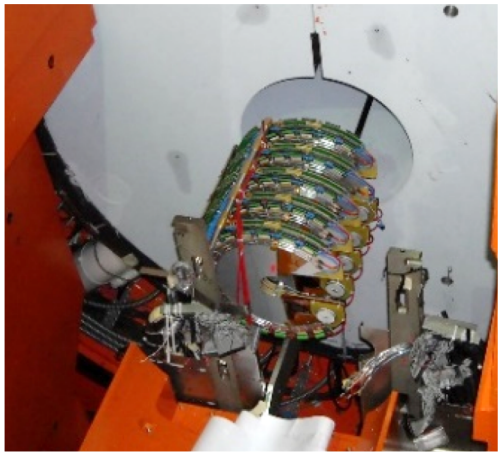
hi-β^* run 2018

- run β^* = 90m concluso con successo durante la scorsa settimana
- lumi ramp-up 100ns fino a ~700 bunch
- seguito da lumi ramp-up 50ns fino ~1400 bunch
- configurazione dedicata di HLT in CMS
- > 5 fb^{-1} recorded
- tutti i sottosistemi hanno funzionato come previsto

T1 & T2

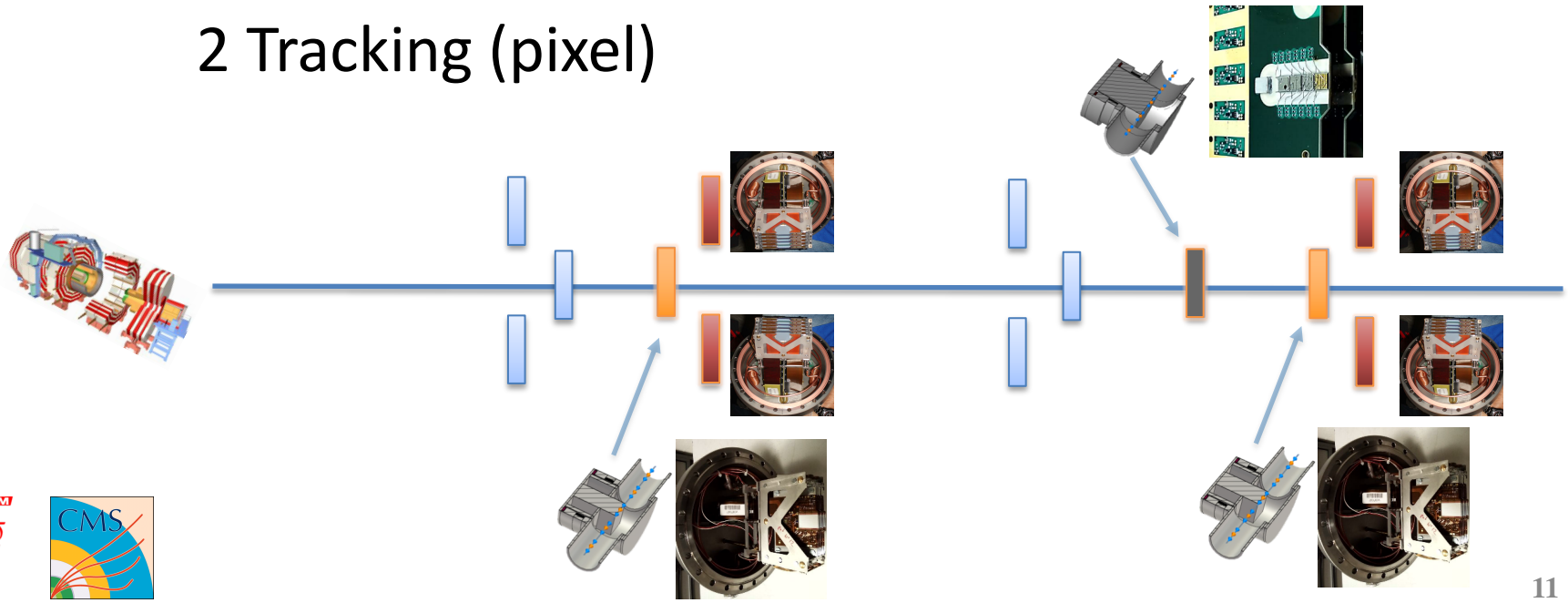
- During YETS:
  - T1 stored in a controlled area and maintained for future installation.
  - T2 moved from IP5 and stored in dedicated boxes in a controlled areas.



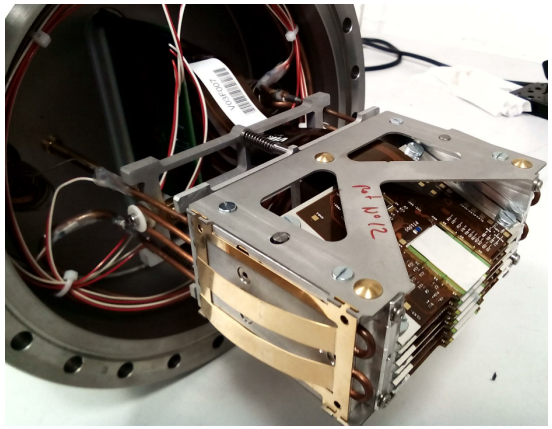



hi-lumi 2018: tracking (h-RP)

- PPS run. Standard runs at high luminosity.
- For each arm:
  - 4 vertical RPs (only for alignment):
    4 Tracking (Si-strip)
  - 2 horizontal RPs:
    2 Tracking (pixel)



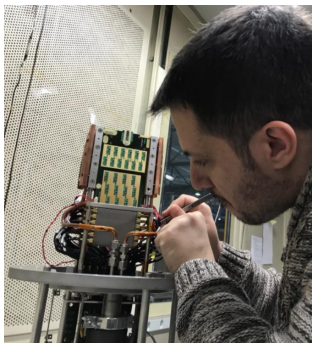
hi-lumi 2018: tracking (h-RP)

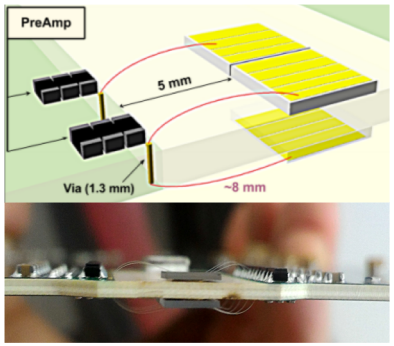


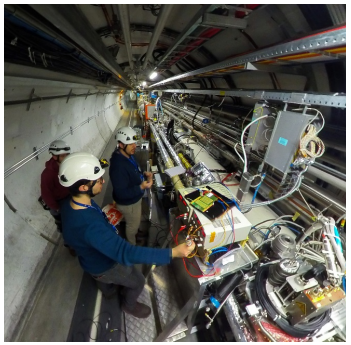
- During YETS:
  - 2 new pixel detectors installed; they replace Si-strip detectors.
  - Swap of the old pixel detectors between 45 and 56.
  - Update of the CMSSW, DQM and DAQ.
  - 4 pixel detectors (two for each arm), have been commisioned.
  - R&D to introduce a remotely controlled vertical micro-movement for larger radiation tolerance

hi-lumi 2018: timing (h-RP)

- During YETS:
  - Diamond detectors dismounted
  - UFSD planes substituted by a «double-diamond» planes.
  - 4 «double diamond» planes installed.
  - 2 single + 2 double diamond planes in use.
  - New version of the Digitizer Board installed.

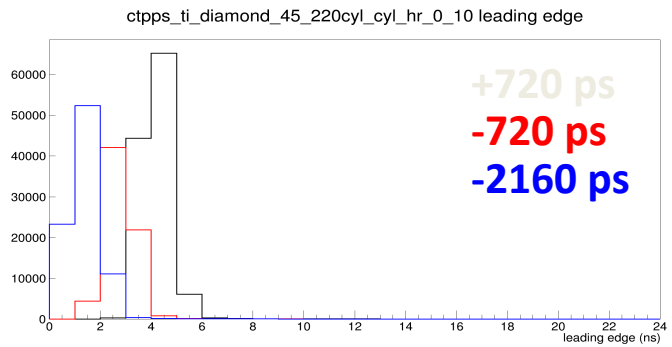




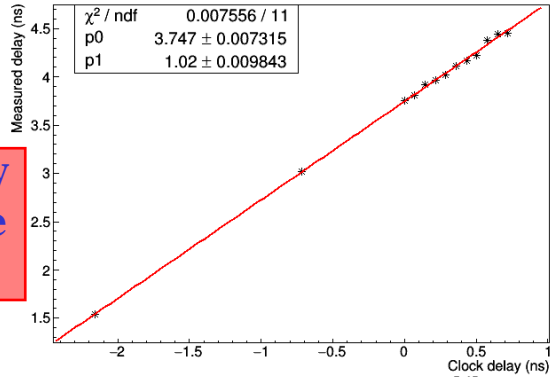


Riferimento temporale (comune)

- Optical clock:
  - Since June 2017 a new clock source based on Silicon Lab 5344 chip, has been installed:
    - Zero delay mode, guarantees constant phase delay between input and output regardless of the clock scalers configuration;
    - Jitter level is ~600fs rms in jitter cleaner mode;
    - Controlled and configured via Ethernet to SPI bridge:
      - Clock generator OR jitter cleaner mode
      - Change frequency using dividers, change output format
  - A remote controlled tunable phase has been implemented, using ~18ps step, between TTC clock and the jitter cleaner input.
  - Power supply updated and consolidated.
  - Since September 2017 also used for PPS timing detector.



HPTDC linearity study using the clock tunable phase shift



Attività DEE per TOTEM/PPS clock

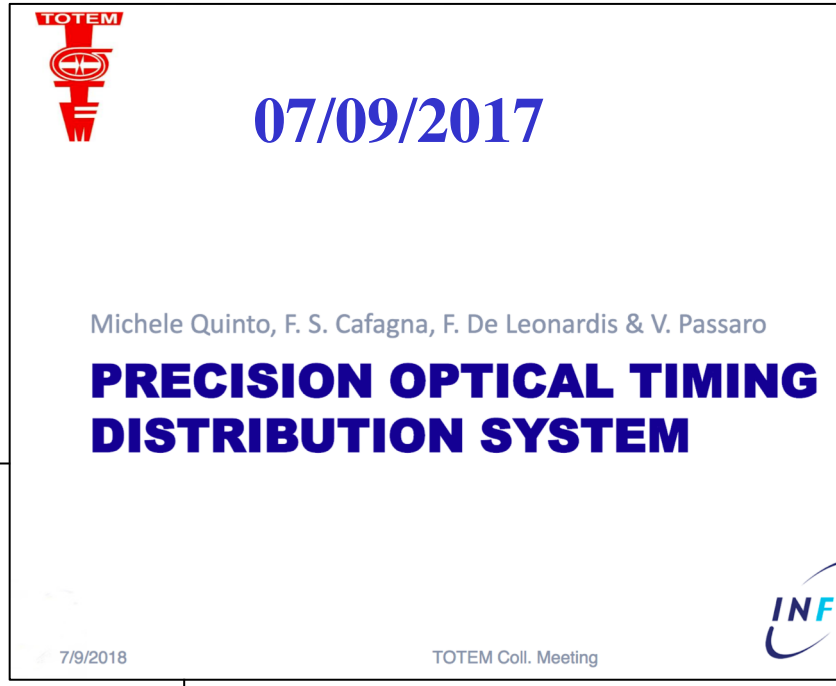
- Simulazione e caratterizzazione dei componenti ottici ed elettro ottici con il programma Optisystem, che ha permesso di evidenziare le sorgenti di rumore ed i componenti che maggiormente avrebbero potuto influenzarne le performance guidando la scelta della componentistica e della loro modalità di controllo (MACH-Zehnder modulators) [1,2].
- Caratterizzazione, in laboratorio, di alcuni componenti ottici passivi inseriti nel sistema di trasmissione del clock, cioè l'accoppiatore direzionale, l'isolatore, il multiplexer add-drop ottico, il circolatore, il reticolo di Bragg in fibra (FBG) [2].
- Per il prossimo anno collaboreranno nella valutazione delle caratteristiche del sistema nel lungo periodo e delle dipendenze delle performance al variare dei danni da radiazione dei componenti installati nei pressi della linea di fascio e delle fibre usate per il trasporto [3].

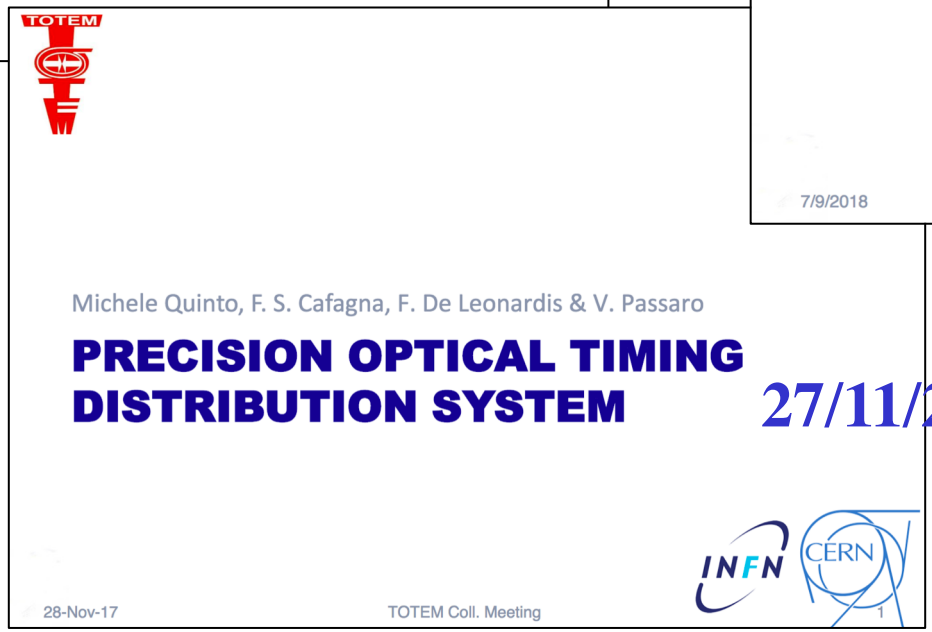
presentazioni a collaboration meetings

DAQ, Online and Optical Clock system status

27/02/2018

F.Cafagna, M. Quinto, E. Radicioni, F. De Leonardis & V. Passaro





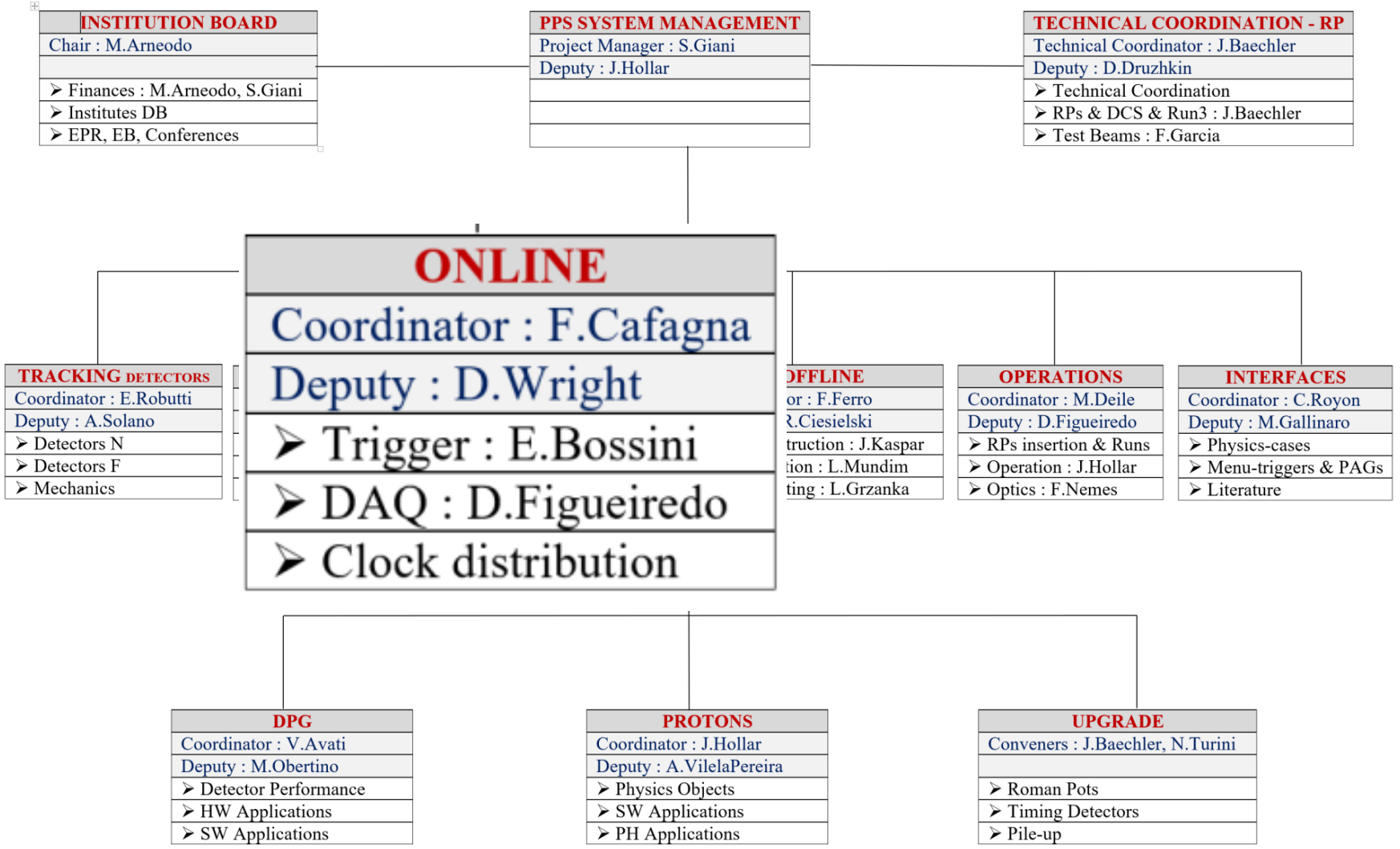
TOTEM-CMS-CERN MoU

- CMS e TOTEM avevano intrapreso un processo di discussione interna per definire i dettagli di una transizione che permettesse al progetto comune CT-PPS, di proseguire in una prospettiva di più lungo periodo, ed alla collaborazione TOTEM, di terminare il suo programma di misure.
- Il processo ha portato all'approvazione di un MoU che regola il periodo da ora al 2021 (data in cui si presume si possano completare le misure di sezione d'urto a 14TeV)
- **Il documento definisce i passaggi che permetteranno a CMS di dotarsi a pieno titolo degli apparati di TOTEM ed alla istituzioni di TOTEM di accedere a CMS**.
- **Questo MoU copre il periodo di transizione dal 2018 al 2021.**

TOTEM-CMS-CERN MoU

- Goal: transizione che permettesse al progetto comune CT-PPS di proseguire in una prospettiva di più lungo periodo, ed alla collaborazione TOTEM di terminare il suo programma di misure.
- Il nuovo MoU tra CMS e TOTEM, scritto con la supervisione dell'ufficio legale del CERN, regola il periodo da ora al 2021 (data in cui si presume si possano completare le misure TOTEM di sezione d'urto a 14TeV)
- All'atto pratico **l'MoU stabilisce che CT-PPS è rinominato PPS, che diventierà un "detector system" di CMS, e che fornirà l'oggetto "tagged proton".**
- L'accordo prevede che gli Istituti ed i Collaboratori di TOTEM che sono in CT-PPS, passando in PPS, manterranno una doppia "membership" durante la fase transitoria 2018-2021.
- Dopo il 2021, all'atto della scadenza dell'MoU, questo canale transitorio verrà chiuso e gli Istituti e Collaboratori di TOTEM che vorranno entrare in CMS dovranno farlo attravero i canali ordinari.
- Come riconoscimento dell'attività comune svolta in CT-PPS, l'accordo tra gli Spokepersons e il CERN prevede che i membri di TOTEM che decideranno di entrare in CMS entro il 01/09/2018 verrà riconosciuta la firma come autore dal 01/01/2019, a patto di aver svolto la quota standard annuale di EPR 2018.

CT-PPS → PPS (Management Plan)



PPS MANAGEMENT PLAN

Conclusioni

- La presa dati ad alta luminosità è stata regolare nel 2017 e prosegue nel 2018.
- Installati i rivelatori di timing nelle verticali per il run speciale.
- Inseriti 4 piani con doppio diamante nei rivelatori di timing orizzontali.
- Attrezzate due RP di tracking con i pixel.
- Consolidamento generale del readout, DAQ e clock.
- Approvato l'MoU per coprire il periodo di transizione, 2018-2021, e definire l'ordinata transizione di persone, fondi ed apparecchiature, da TOTEM a CMS.

responsabilità del gruppo

- Responsabilità DAQ/online (Francesco)
  - → **a cui si aggiunge quest'anno ONLINE di PPS**
- chairman Editorial Board (Gabriella)
- Timing di precisione (Francesco)
- Resource coordinator & Management Board (Emilio)
- Coordinatore Nazionale (Francesco)

Il dominio "ONLINE" di PPS si adatta perfettamente all'attività abituale e alle competenze del gruppo: DAQ/Trigger/Clock

composizione del gruppo

Ricercatori	%
V. Berardi	30
F. Cafagna	70
M.G. Catanesi	30
E. Radicioni	60

Tecnologi	%
F. De Leonardi	30
V. Passaro	50

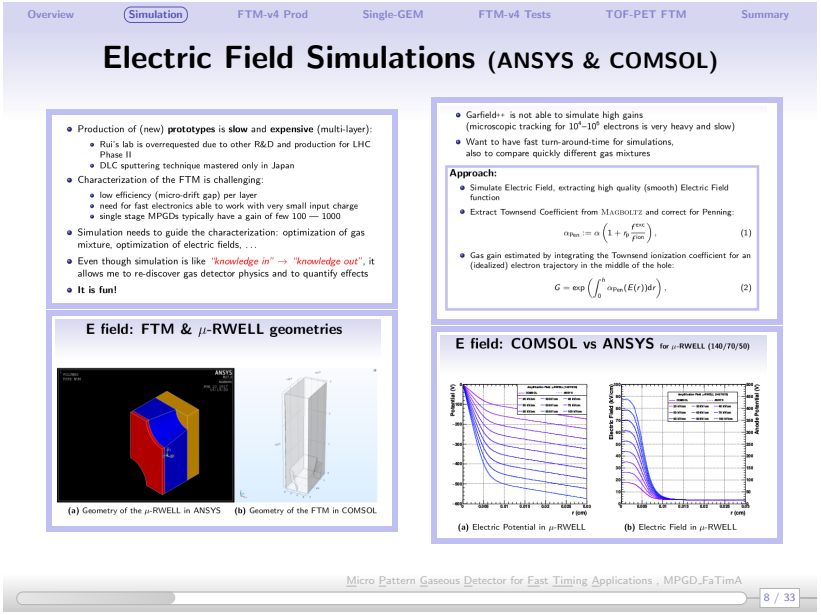
Totale FTE: 2.7 (2018: 2.6)

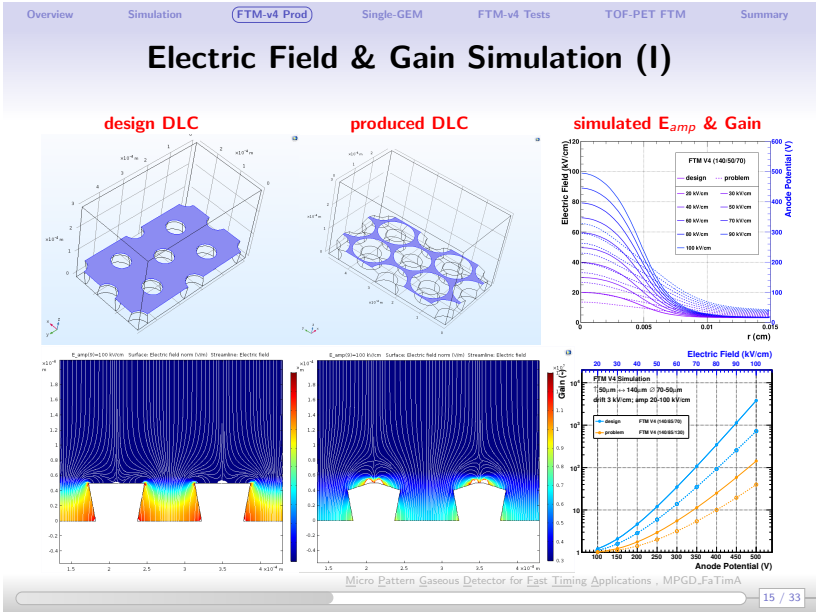
richieste 2019

- richieste di servizi (includono RD51):
  - 1 mese accesso camera pulita (senza supporto tecnico)
  - 0.5 mu progettazione elettronica
  - 0.5 mu officina meccanica
  - 0.5 mu tecnico elettronico
- Nei prossimi anni le richieste saranno funzionali alla manutenzione del sistema di DAQ TOTEM-standalone (fino al 2021) e al consolidamento del sistema di DAQ, diamanti e clock di PPS.
- Per il 2019 prevediamo:
  - ~ 6k per photoreceiver 12GHz (clock)
  - ~4k per manutenzione cluster TOTEM (copertura → 2021)
- M&O funds 2019 secondo RRB 2018; come al solito saranno meglio definiti a ottobre e comunicati alla CSN1.

Fast Timing MPGD (FTM) in RD-51

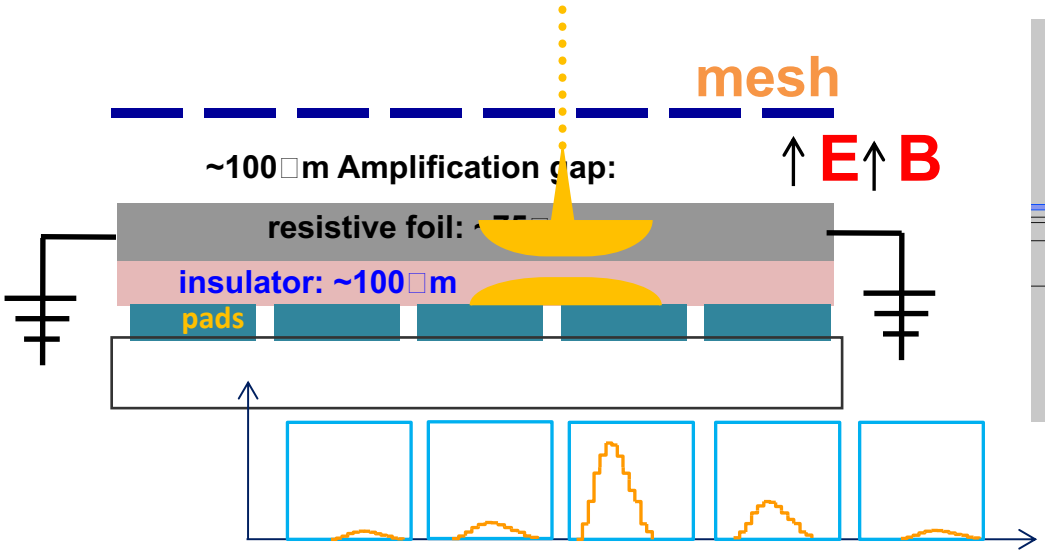
- Grant Giovane CSN-V on FTM development
- RD51 as peer community for detector tests, common test-beam and simulation efforts
- Design & Simulation of FTM:

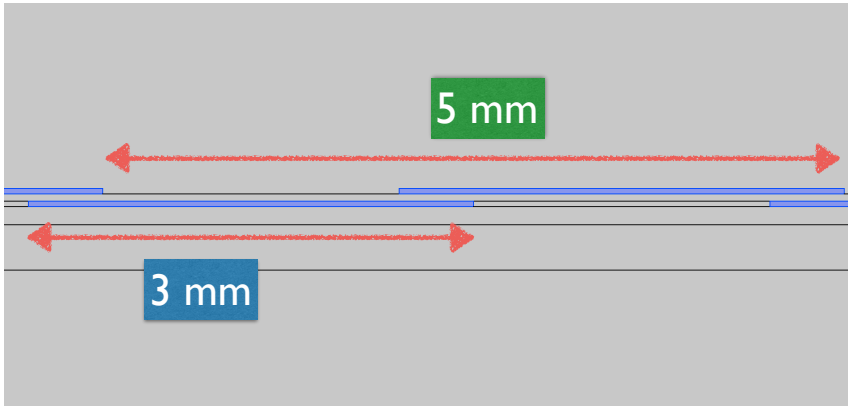




R&D per nuove TPC T2K

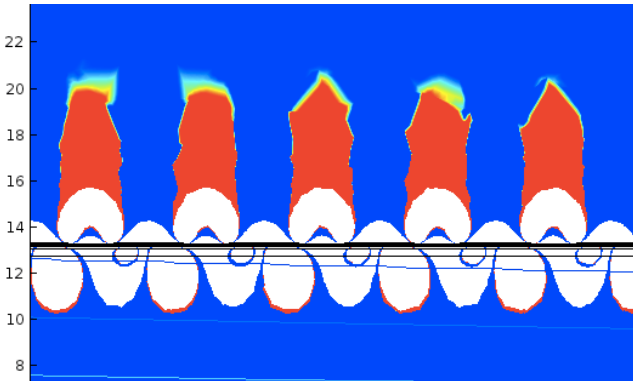
- R&D e simulazioni per costruire field-cages a minimo ingombro (geometrico & radiation length)
- Resistive MicroMegas





$$\rho(r,t) = \frac{RC}{2t}\exp[-\frac{-r^2RC}{4t}]$$

R- surface resistivity
C- capacitance/unit area



summary RD51

- Attività con MPGD
  - fast-timing MPGDs (Piet)
  - CMS GEMs
  - nuove TPC per T2K (field-cages + resistive micromegas)
- Responsabile locale: Gabriella
- Responsabilità di rilievo nella collaborazione:
  - da notare la nomina di Piet come co-convener per la simulazione
  - Emilio (MB)
- Richieste
  - come tutti gli anni: 6k su missioni