Forward Detectors after LS2 (TOTEM)

1st WP8 Workshop on Collider-Experiment Interface

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for TOTEM
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Remarks

- This presentation refers to the TOTEM physics program at high β*, special runs and p-A. The detectors necessary to perform this program are outlined.

- Possible additional detectors in the region of +/- 200m from IP5, that are presently discussed in the framework of “detector upgrade studies” by TOTEM in collaboration with CMS (related to diffractive physics at low β* and high luminosities), are not addressed in this presentation.

Main goals of TOTEM experiment

- Measurement of total cross section

$$\sigma_{TOT}^2 = \frac{16\pi(\hbar c)^2}{1+\rho^2} \cdot \left.\frac{d\sigma_{EL}}{dt}\right|_{t=0}$$

Using luminosity from CMS

$$\frac{d\sigma_{EL}}{dt} = \frac{1}{L} \bullet \frac{dN_{EL}}{dt}$$

ρ parameter from compete fit

$$\sigma_{TOT} = \frac{16\pi(\hbar c)^2}{1+\rho^2} \cdot \frac{\left.\frac{dN_{EL}}{dt}\right|_{t=0}}{N_{EL}+N_{INEL}}$$

TOTEM detectors integrated in CMS (T1, T2)

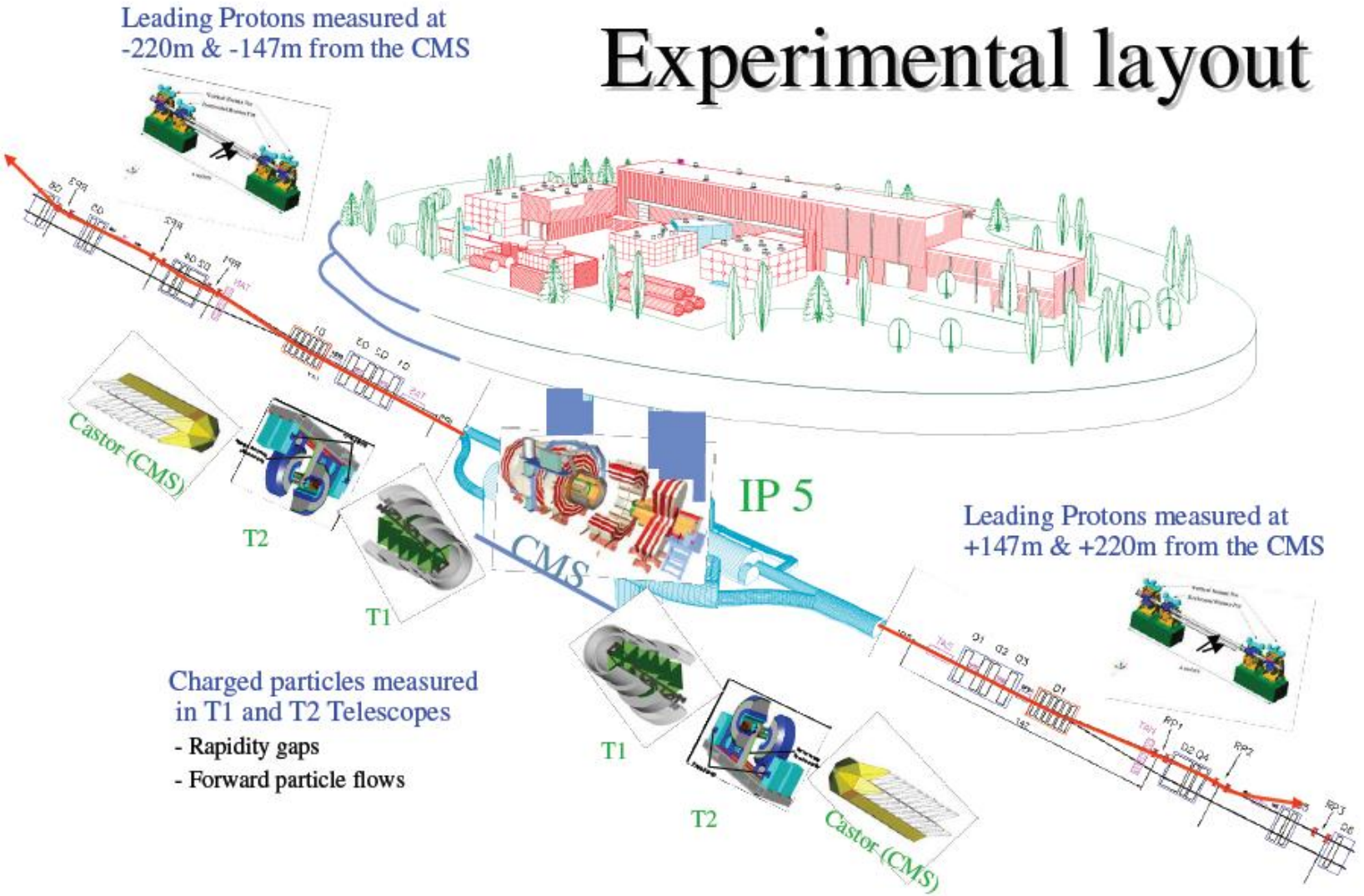
TOTEM detectors integrated in LHC (RP)

Luminosity independent

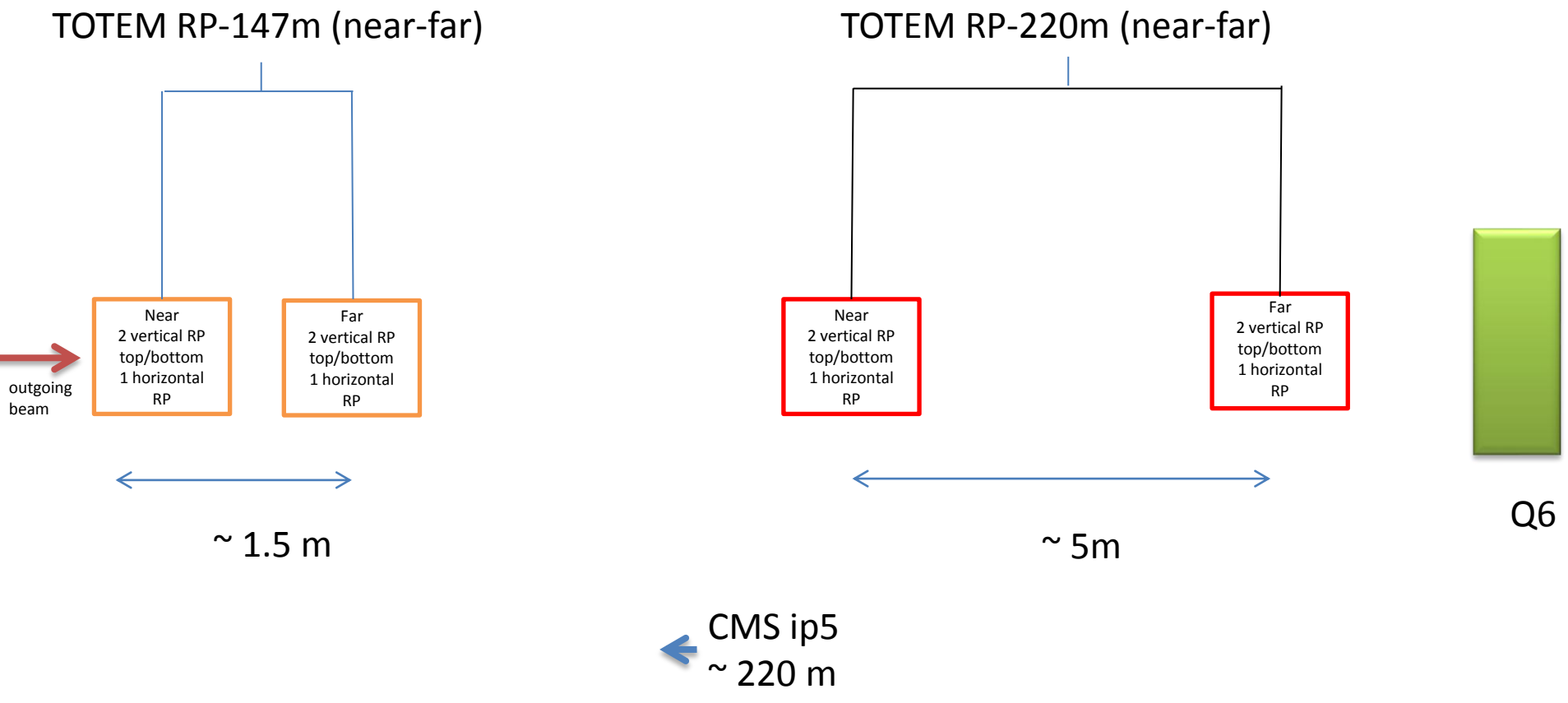
- Forward multiplicity
- Diffractive physics (soft& hard diffraction, jets)

TOTEM physics program:
TOTEM (stand alone) & TOTEM+CMS

Experimental layout

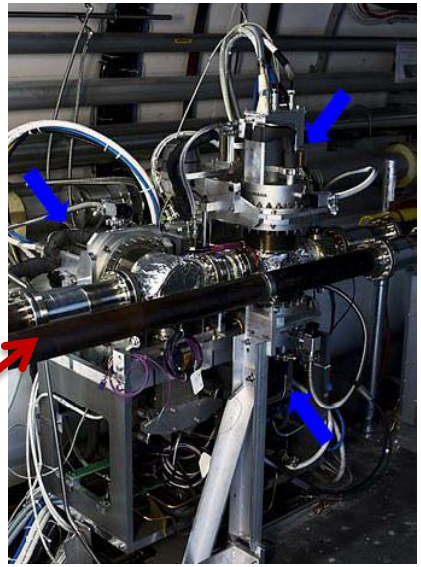


Present RP installation at IP5

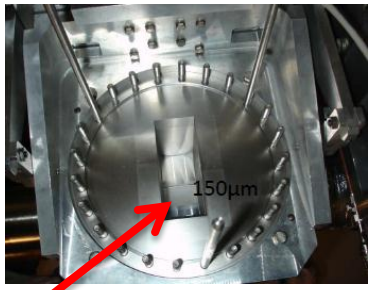


TOTEM Roman Pots installed at LHC

Roman Pot unit with motor system (step size: 5 µm)



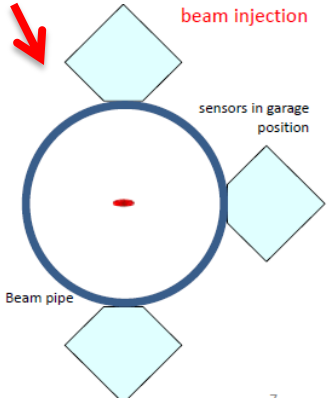
LHC beam-pipe



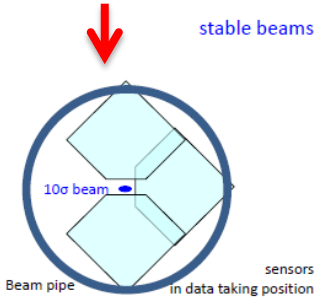
Separation of high LHC vacuum from detector vacuum

Secondary vacuum ~ 20mbar
Temp : -25 ^{0}C

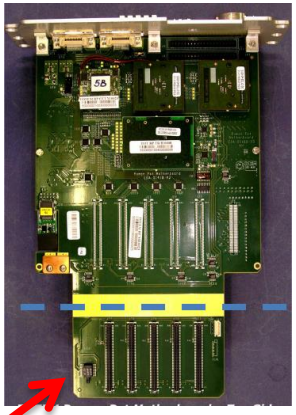
Roman Pot parking position



Roman Pot data taking position



RP detector package

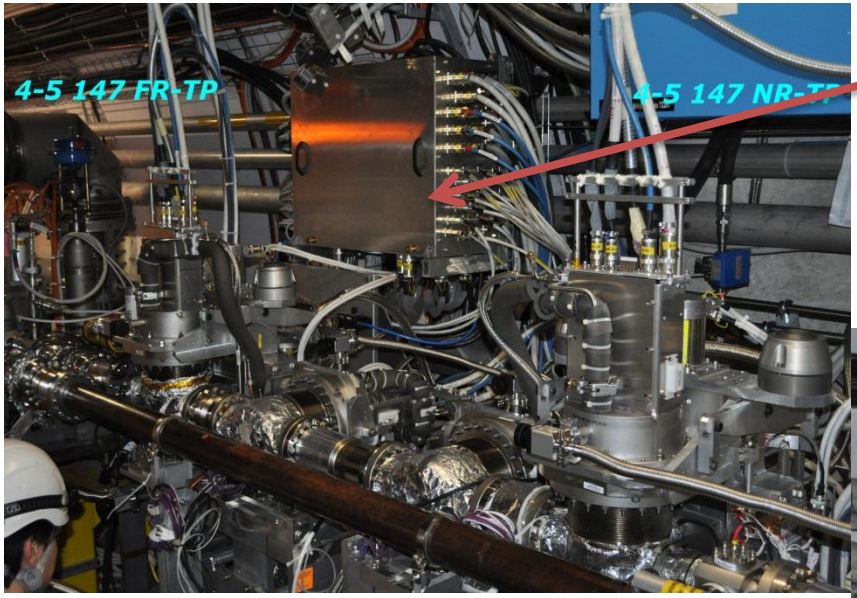


RP mother board

RP mother board: interface Si-detectors to outside world: Signal, Trigger,HV,LV

Hosts Radmon sensor and PT 100

Roman Pot at 147m & 220m



patch panel

RP 220m

RP 147m

TOTEM

- Research Board approved stand alone program of TOTEM at full LHC energy
- During LS1 the detectors are prepared for the new phase of LHC after LS1

  -> Roman Pots

  Removal of RP +/- 147m during LS1

  & adaptation of detector packages to serve as spare detectors for RP +/-220m stations

Water cooled cables

Update of the European Strategy for Particle Physics

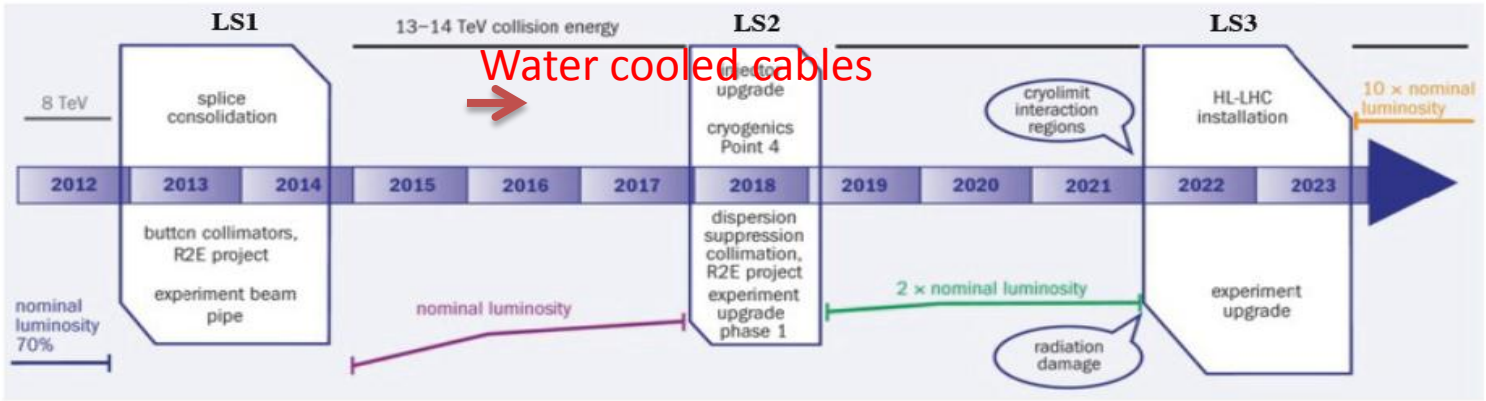
With contributions from accelerators side and experiments, submitted to the Open Symposium in Krakow 10-12/9/2012

The list of all contributions is on the web here ,

with HL-LHC, LIU, HE-LHC (20 T, 2×16.5 TeV, 2 × 10^{34} cm^{-2} s^{-1})

and separated contributions from the experiments.

Based on a common timeline and parameters



LHC baseline plan for the next ten years. In terms of energy of the collisions (upper line) and of luminosity (lower lines). The first long shutdown 2013-14 is to allow design parameters of beam energy and luminosity. The second one, 2018, is for secure luminosity and reliability as well as to upgrade the LHC Injectors.

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Summary

- The RP detector systems at +/-220m will be used for the TOTEM stand alone physics program after LS1&LS2. (removal of RP147m during LS1)
- The expected integrated radiation dose will allow RP operation after LS2 in possible special runs at high β*. (reserve by spare detector packages from RP147m)

Radiation load on TOTEM detectors

Active and passive RadMon sensors mounted on RP – T1 – T2 detector for TID and NIEL measurement