TOTEM & CT-PPS

Consolidation and upgrade strategy

Review activities during LS1 (CERN activities)

Schedule for 2015

Summary

Roman Pot
consolidation & upgrade strategy

CONSOLIDATION -> LS1

- Remove RP147 m stations & patch panel (allows installation of TCL4)
- Relocation of RP147 m stations (including Si strip detectors) in +/- 210 m region
- Exchange of ferrites of all RPs, Integration of ferrite support spring

Consolidation RP147&RP220 -> during LS1

UPGRADE - Roman Pot station –> LS1

- Installation of additional new RP stations (horizontal) in +/-220 m region
  (1 RP stations in each sector (4/5), (5/6))
- Integration of RF optimized horizontal Roman Pots
  in relocated horizontal stations in +/- 210 m region

Upgrade Roman Pot station -> during LS1 or **In end of year technical stops after LS1** (break of vacuum)

UPGRADE – new movable beam pipe devices –> after LS1

- Development of new movable beam pipe devices

Upgrade movable beam pipe devices -> after LS1 (break of vacuum)

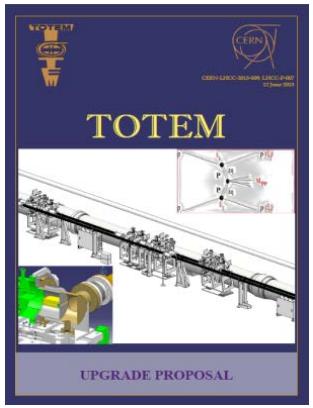
UPGRADE detector -> after LS1

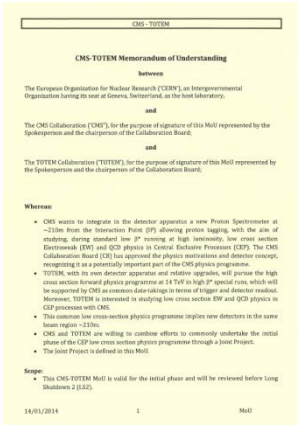
- Integration of new pixel detectors in the (relocated RP147m) RPs in 210 m region
- Integration of new timing detectors in the new horizontal RPs

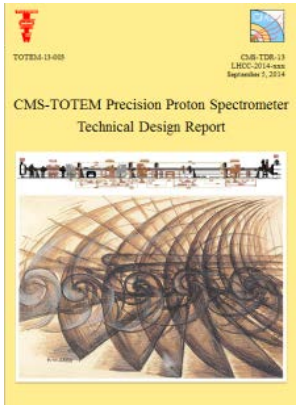
Upgrade Roman Pot detector -> during LS1 or in short technical stops **after LS1**

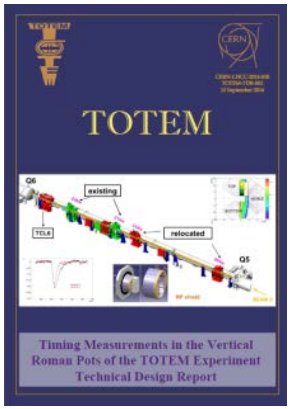
ROMAN POT: Milestones during LS1

LHCC









March 2013

June 2013
consolidation
& upgrade

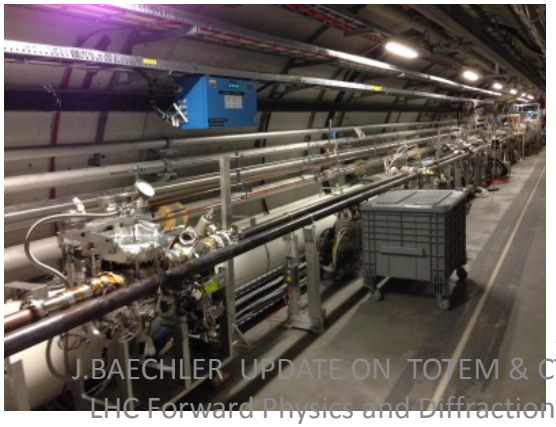
January 2014
CMS-TOTEM
MoU

September 2014
TOTEM timing TDR
CT-PPS TDR

November 2014

March 2015
Restart LHC
Run 2

LHC LS1 access for RP installation



August 2014

DP Si operation
& RP movement &
calibration & interlock LHC

Cooling & vacuum
tests

RP operation with DAQ

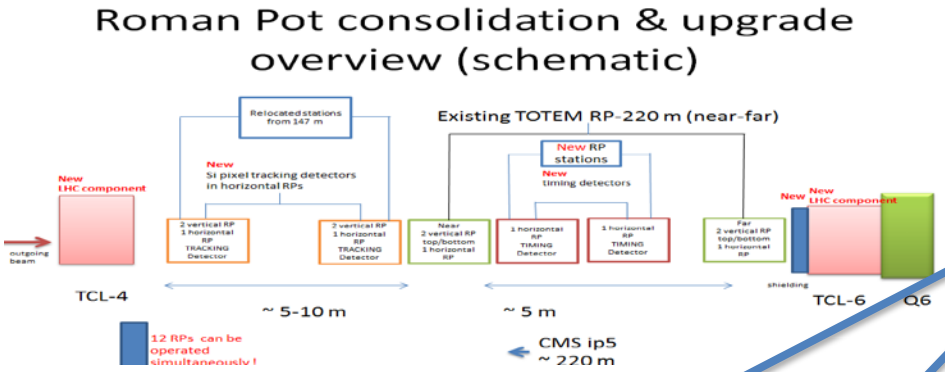
RP operation from CCC

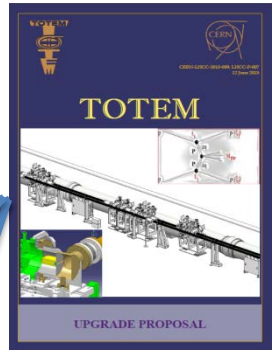
commissioning

Timing detector R&D
Test beams at CERN (PS,SPS) & PSI

All Components integrated in the LHC beam line by August 2014

ECRs related to consolidation & upgrade @LHC ip5





LHC

EDMS NO.	REV.	VALIDITY
1283826	1.0	RELEASED

TOTEM

EDMS NO.	REV.	VALIDITY
1314925	1.0	RELEASED

ENGINEERING CHANGE REQUEST

Installation and Renaming of Absorbers for Physics Debris (TCL type collimators) on both sides of IP1 and IP5 in front of D2/Q4

BRIEF DESCRIPTION OF THE PROPOSED CHANGE(S):

It is proposed to install TCL4 (TCL type) collimators in the forward regions of IR1 and IR5, in front of D2/Q4 cryostats. These collimators were built as part of the present LHC collimation system and their installation was delayed to allow the operation of the "close" TOTEM Roman pot stations in IR5.

ENGINEERING CHANGE REQUEST

TOTEM Consolidation Project

BRIEF DESCRIPTION OF THE PROPOSED CHANGE(S):

The TOTEM Roman Pot (RP) stations that were installed on the outgoing beam at a distance of 147m on both sides of IP5 have been de-installed. TOTEM proposes to move these stations to 210 m (between Q5 and Q6) on both sides of IP5, so that after LS1 the TOTEM setup will contain a new 210 m station with a near and far unit in addition to the existing 220m station. The new 210 m far unit will be rotated by 8° around the axis of the beam. To foresee the later addition of timing detector units, TOTEM proposes to add one piece of dummy beam pipe between the existing near and far units of the 220m station.

LHC

EDMS NO.	REV.	VALIDITY
1357736	0.1	DRAFT

CMS-TOTEM

EDMS NO.	REV.	VALIDITY
1361537	0.1	DRAFT

ENGINEERING CHANGE REQUEST

Installation of Physics Debris Absorbers (TCL) on both sides of IP1 and IP5 in front of the Q6 Quadrupole

BRIEF DESCRIPTION OF THE PROPOSED CHANGE(S):

It is proposed to install TCL, physics-debris collimators, on both sides of IP1 and IP5 in front of the Q6 Quadrupole (TCL6). This request follows the ECR EDMS Doc. 1283867 where the preparation of the TCL6 infrastructure was proposed and approved. This proposal to install the TCL6 is now brought forward taking into account the latest information on collimator production schedule and results of simulations that were deemed necessary before taking the final decision.

ENGINEERING CHANGE REQUEST

TOTEM Upgrade Project

BRIEF DESCRIPTION OF THE PROPOSED CHANGE(S):

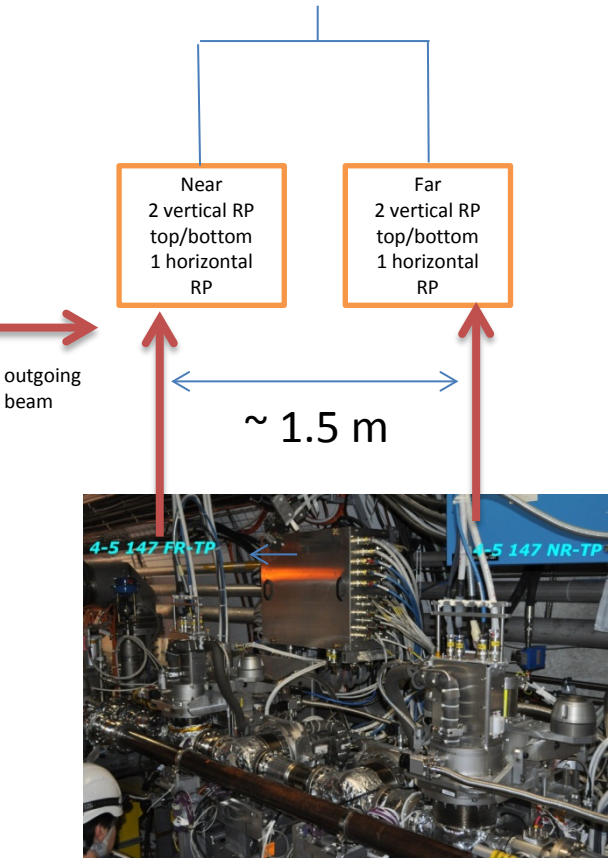
The TOTEM Upgrade Proposal [1] foresees the installation of additional horizontal Roman Pots (RPs) between the existing RP units at 215 and 220 m from IP5. These new RPs, intended to house time-of-flight detectors for elastically or diffractively scattered protons, have been designed in cylindrical geometry minimising the beam impedance and offering enough space for 12 cm long Cerenkov detectors, one of the technologies being explored for the time measurement.

Furthermore, the existing horizontal RPs of the units at 203 and 213 m will be equipped with Faraday shields to reduce their impedance.

This ECR elaborates on the technical details of the new RP elements and their integration in the LHC. It thus complements the already approved consolidation ECR [2].

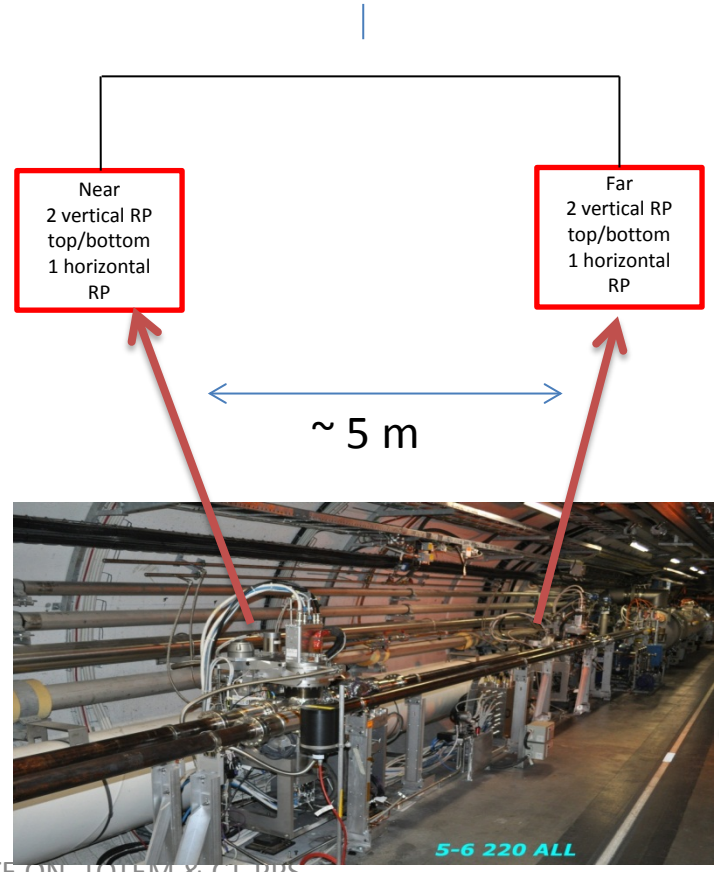
RP installation at IP5 (before LS1)

TOTEM RP-147m (near-far)



CMS ip5
~ 147 m

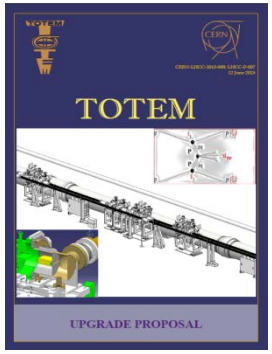
TOTEM RP-220m (near-far)

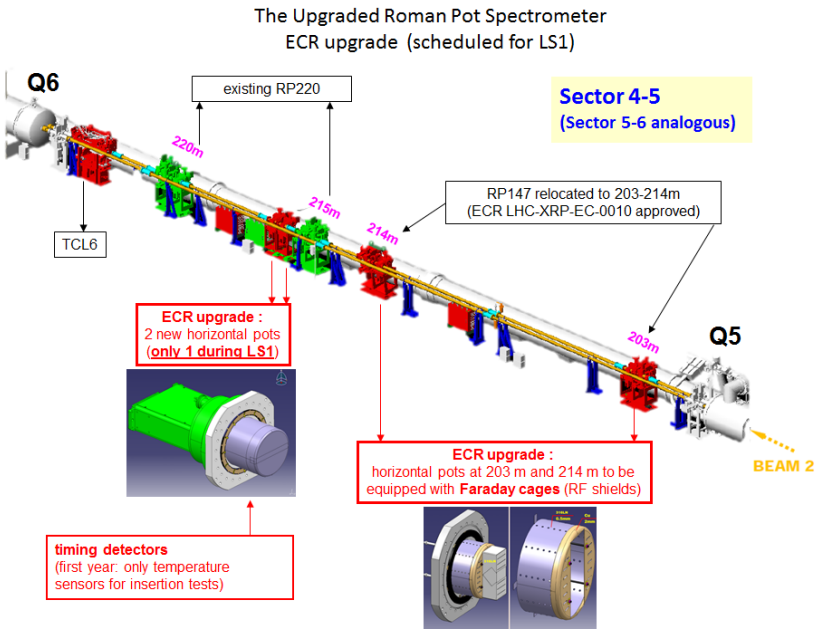


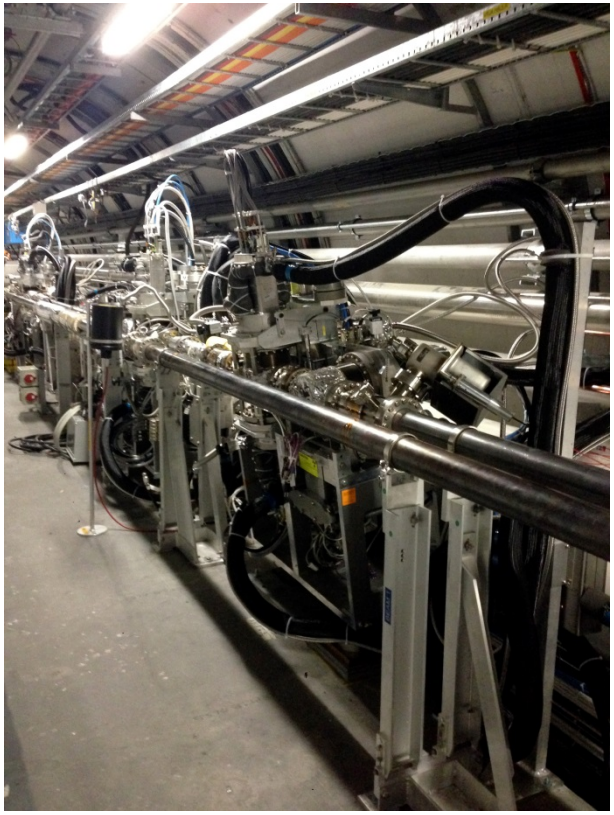
Q6

CMS ip5
~ 220 m

Roman Pot installation in LHC tunnel completed (consolidation) during LS1



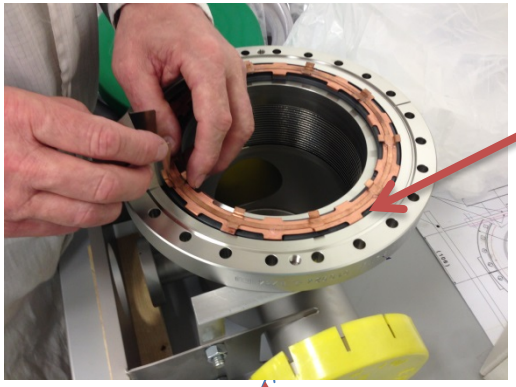




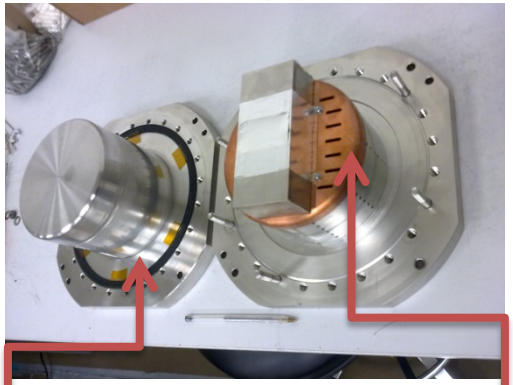
November 2014

R&D of new ROMAN POT (2013-2014)

RF test of new Roman Pot design with thin window of 300 µm
combination of new bellow & beam pipe & circular ferrite with new cylindrical RP or RF shield

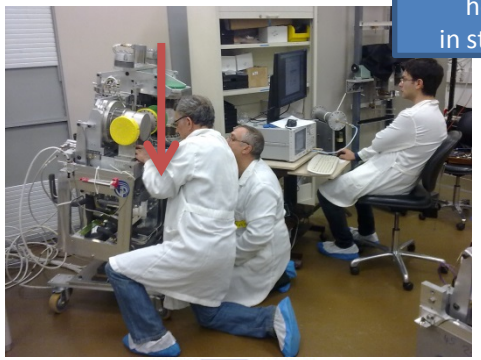


New bellow & beam pipe with circular ferrites &
ferrite support ring –> integrated in horizontal RP test station

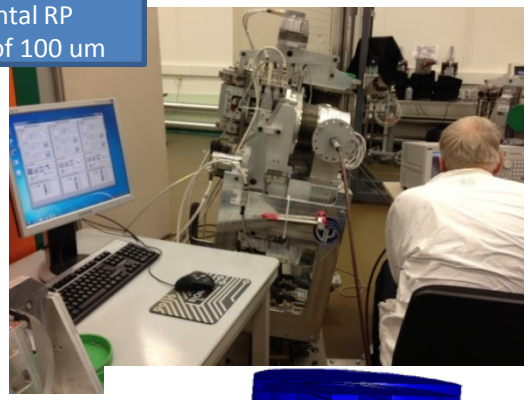


New cylindrical Roman Pot &
RF shield for box Roman Pot

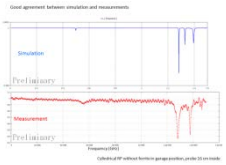
Horizontal RP test station

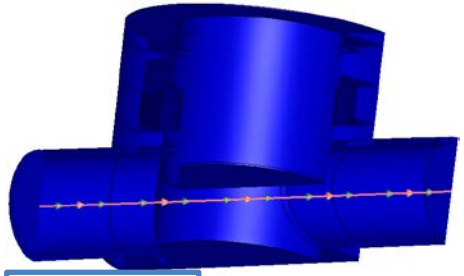


Movement of horizontal RP in steps of 100 um

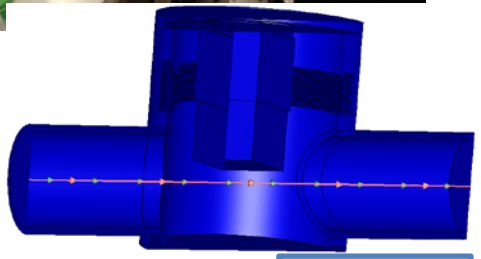


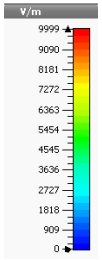
Measurements with and without ferrites
Results show good agreement with simulation



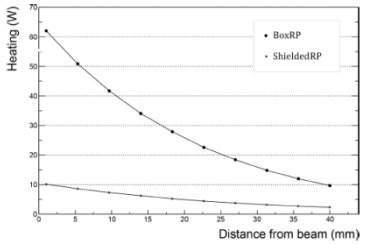


New design
Cylindrical or RF shield

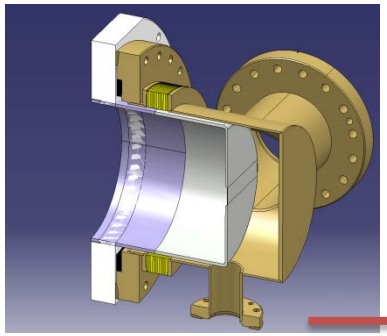


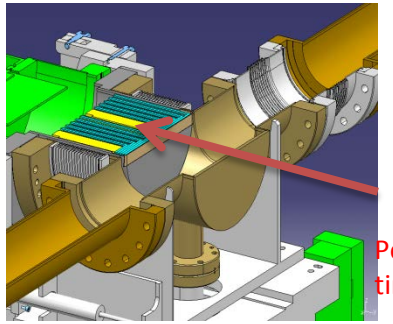


Old box design
without RF shield

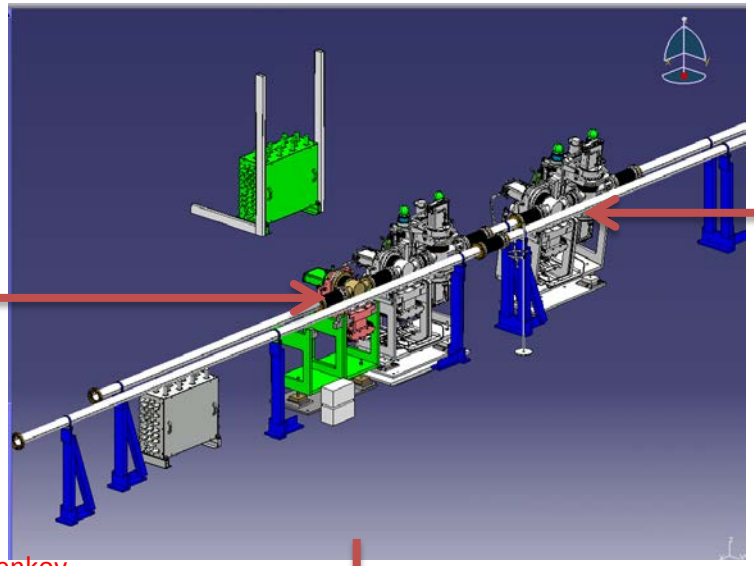


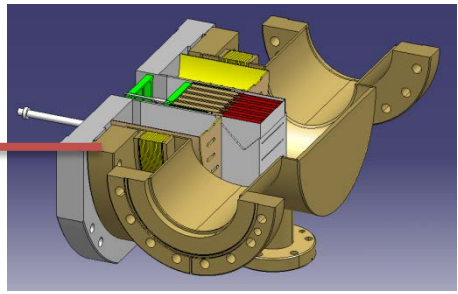
New timing and tracking detectors to be installed in Roman Pots 2015 & 2016 (CTP-PPS)





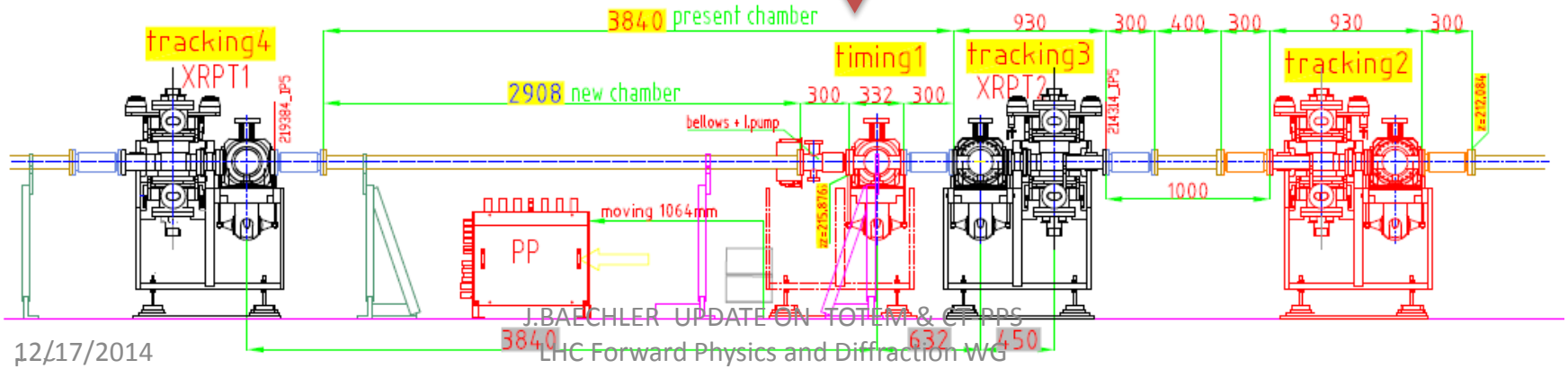
Cylindrical RP and timing detector





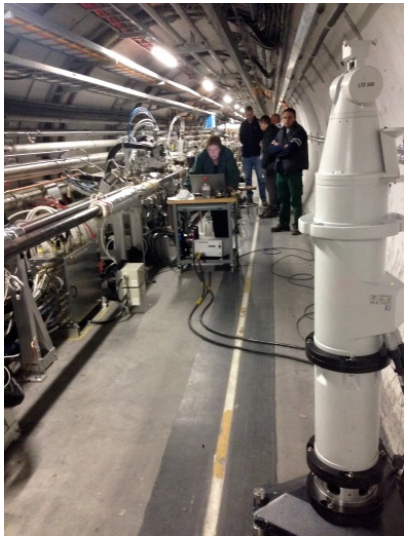
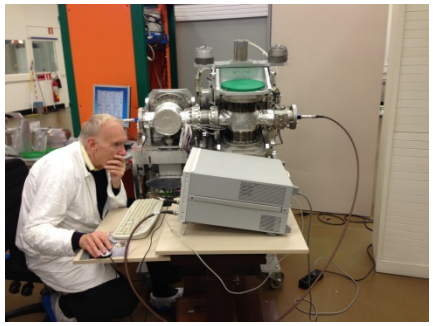
RP with RF shield and tracking detector

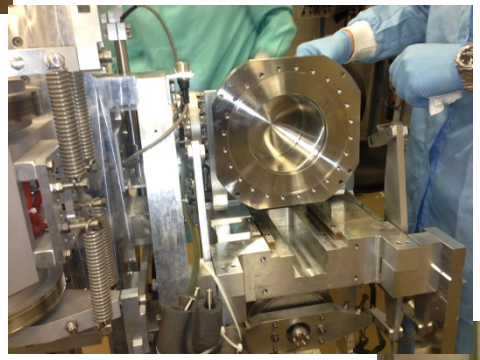
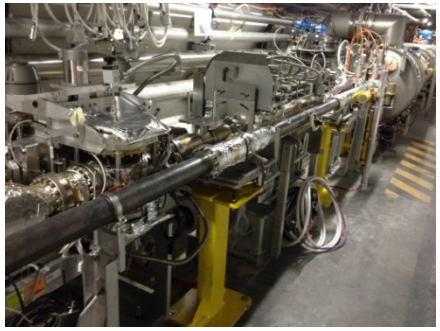
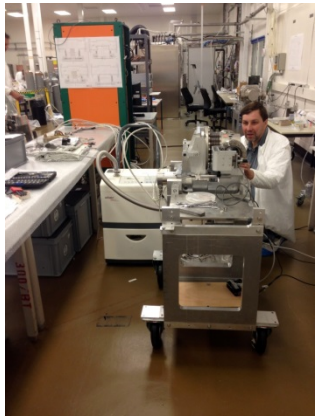
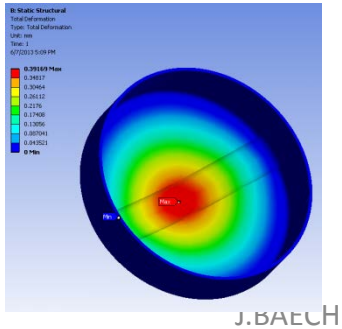
Possible to integrate Cerenkov timing detector or other type of timing detector

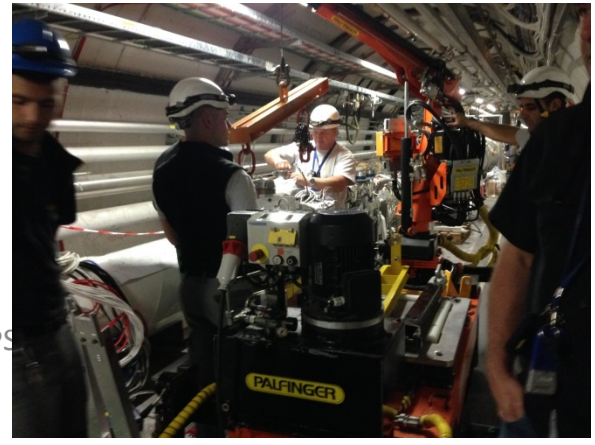


Building & testing & installation& calibration of new Roman Pot



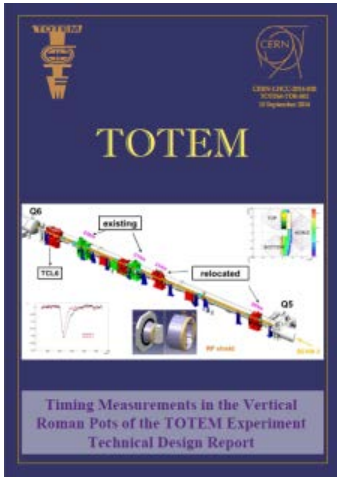



TOTEM
Physics program - R&D and detectors

LHC
β* = 90m

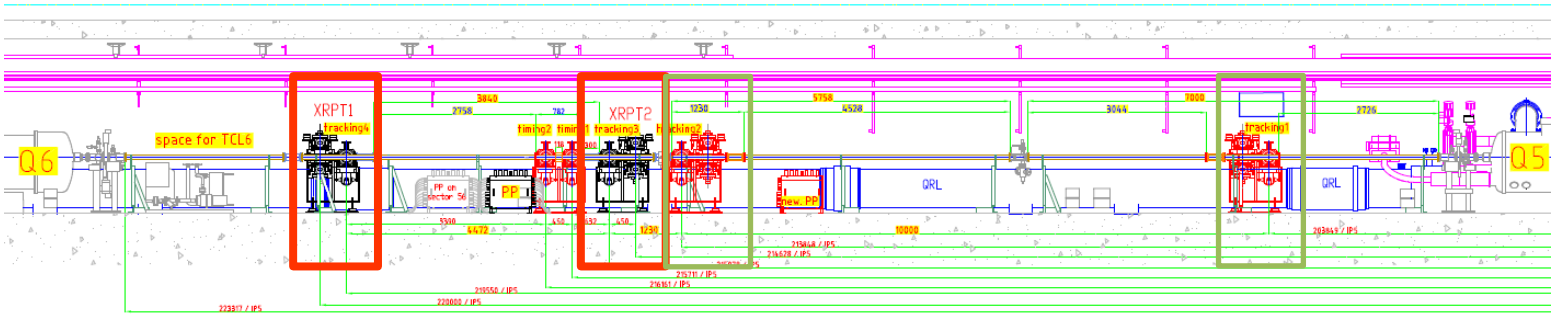


Physics program

R&D timing detectors
50 ps

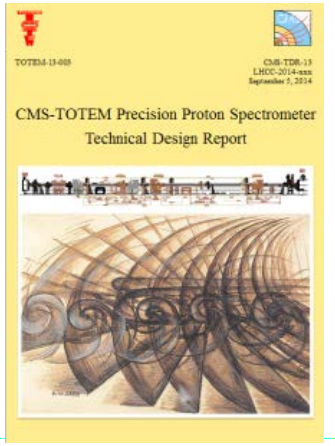
Precision clock
distribution

Timing detector
to be integrated
in vertical Roman Pots
+/- 220 m region of ip5
(2015-2018)



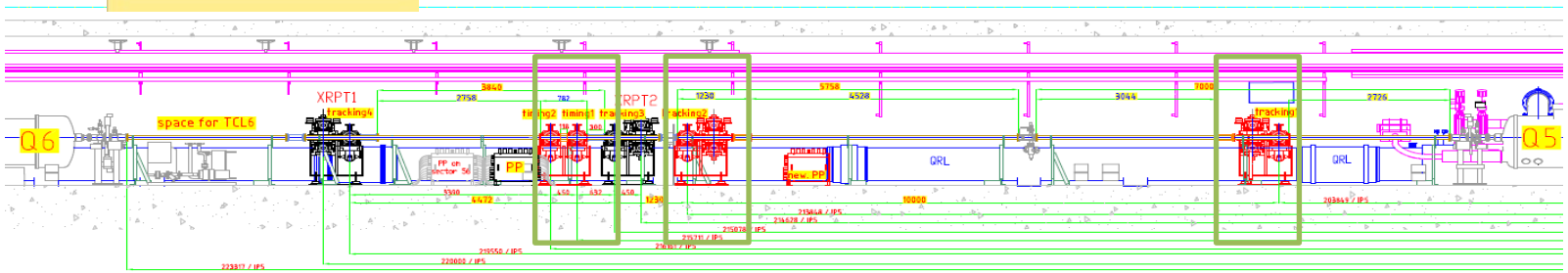
CT-PPS project

LHC standard optics



- Physics program
- Timing detector baseline (Cerenkov) and R&D 10 ps
- Rad. Hard pixel
- New Roman Pot & movable beampipe

Tracking detector integrated in standard Roman Pots with RF shield
Timing detector
to be integrated
in new cylindrical horizontal Roman Pots
+/- 220m ip5
(2015-2018 + x)



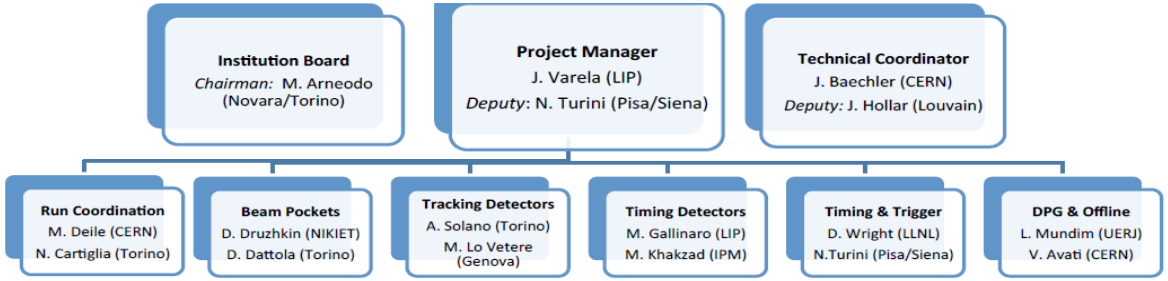
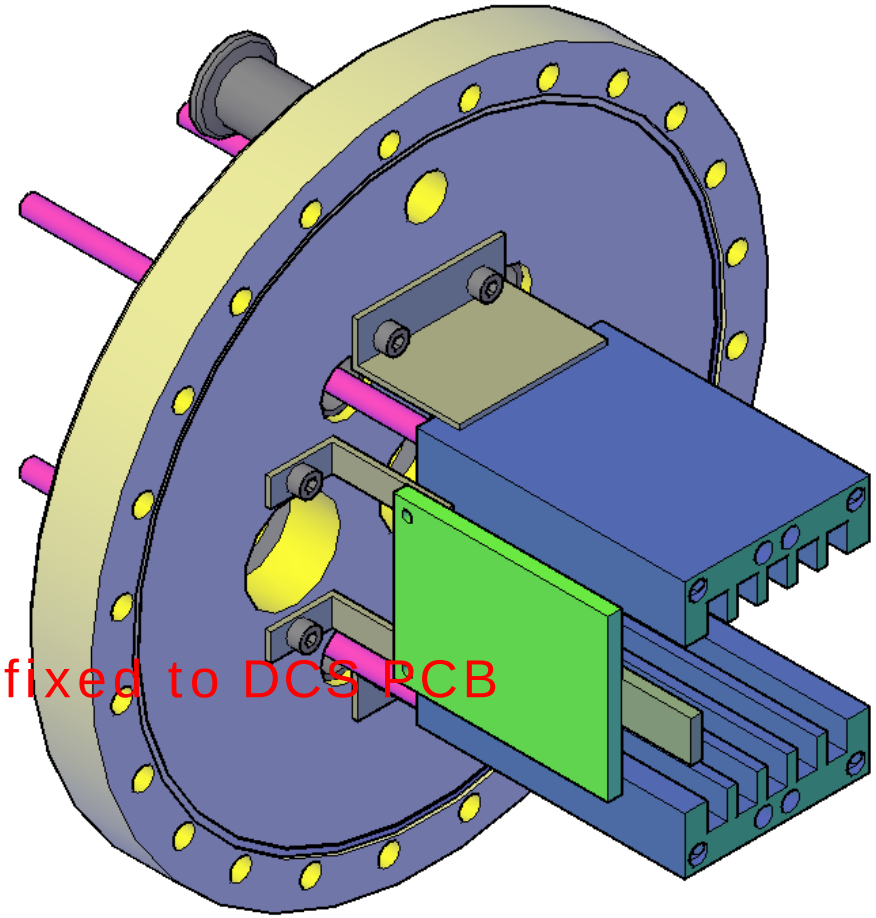


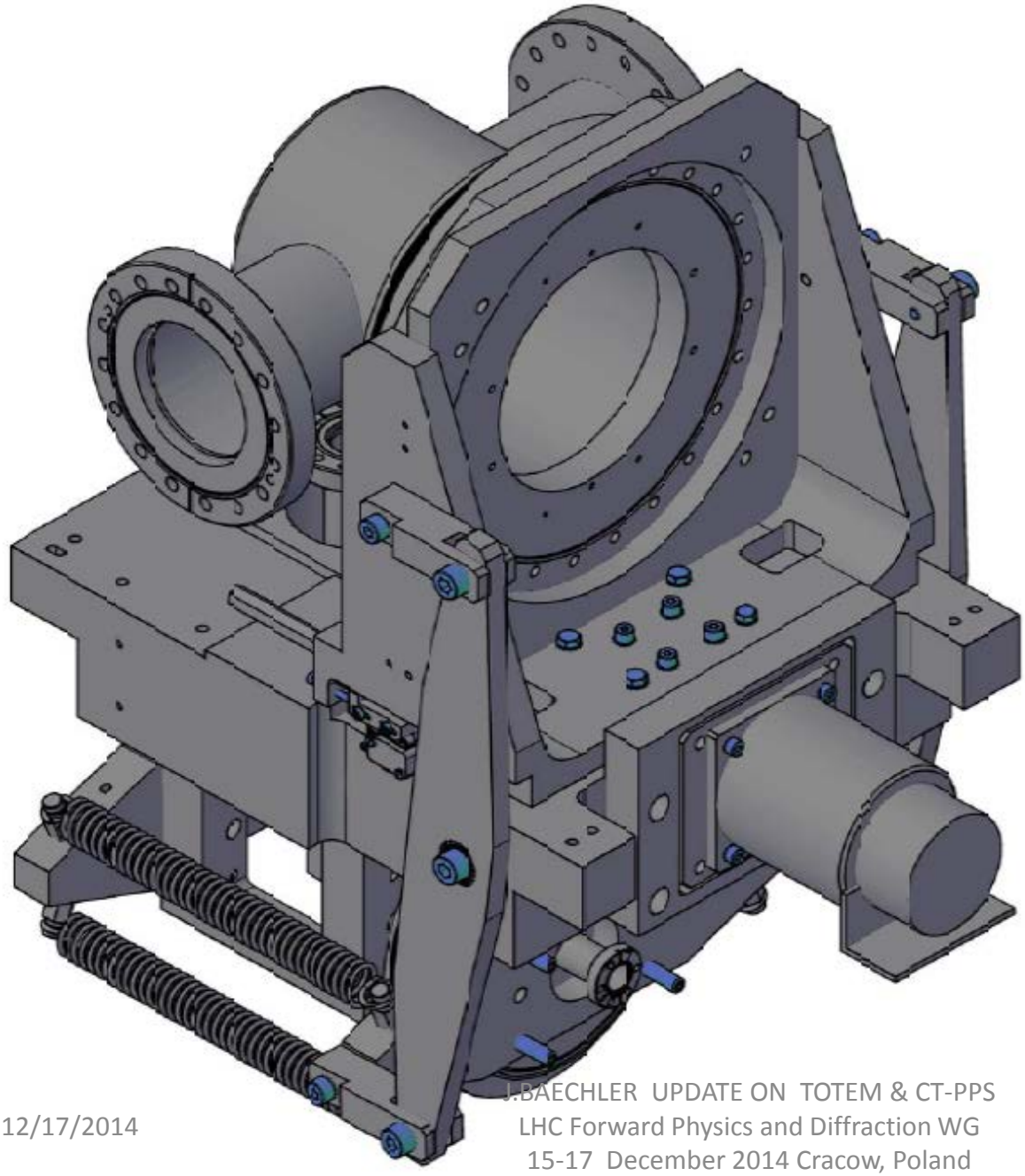
Figure 110: CT-PPS organizational chart.

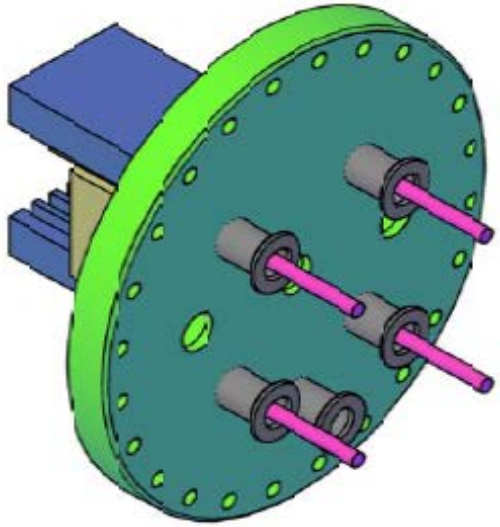
Commissioning of cylindrical RP (timing) at LHC

Integration of flange equipped with temperature sensors RadMon and heat exchanger



2. Setup for first Runs





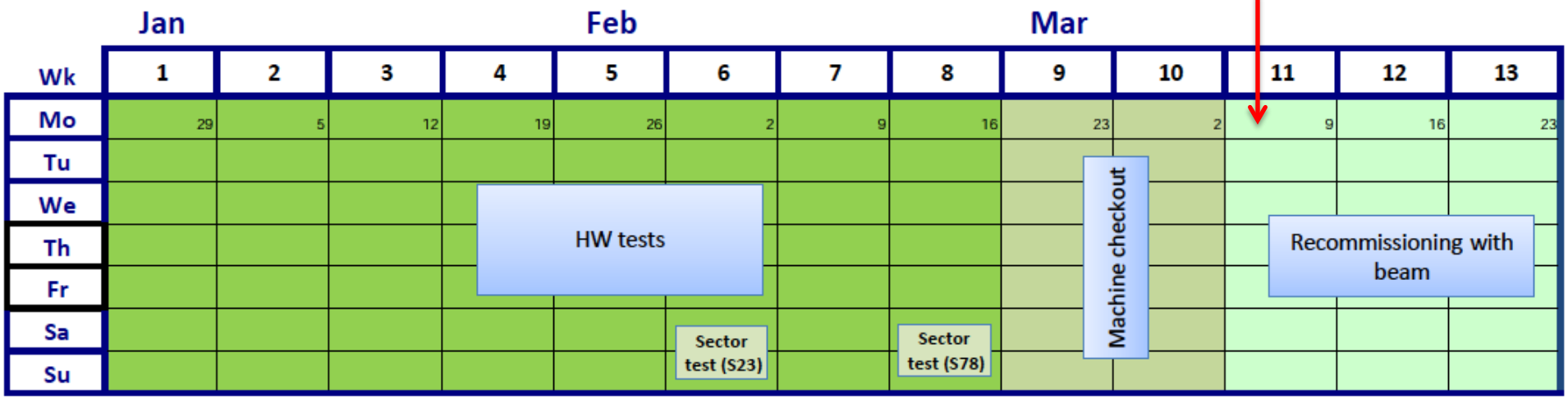
R&D Timing detector

- In 2014 several test beams at CERN and PSI were used to:
  - test & develop solid state detectors in combination with amplifier
  - perform measurements with Scope and SAMPIC
- Timing detector infrastructure

Status report
LHCC LHC nov 14

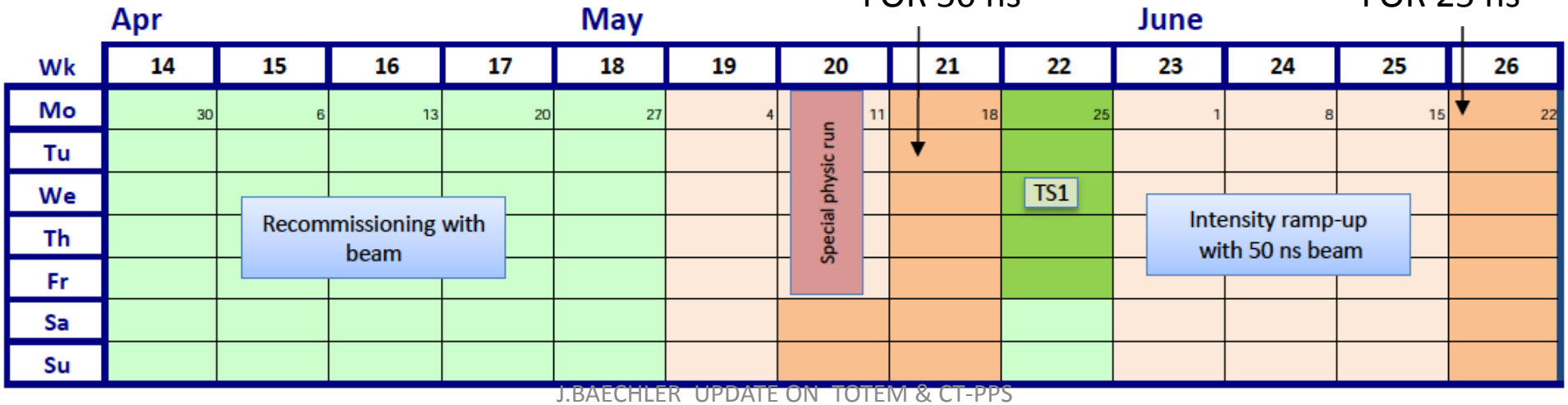
2015 Q1/Q2

FIRST BEAM
9th MARCH



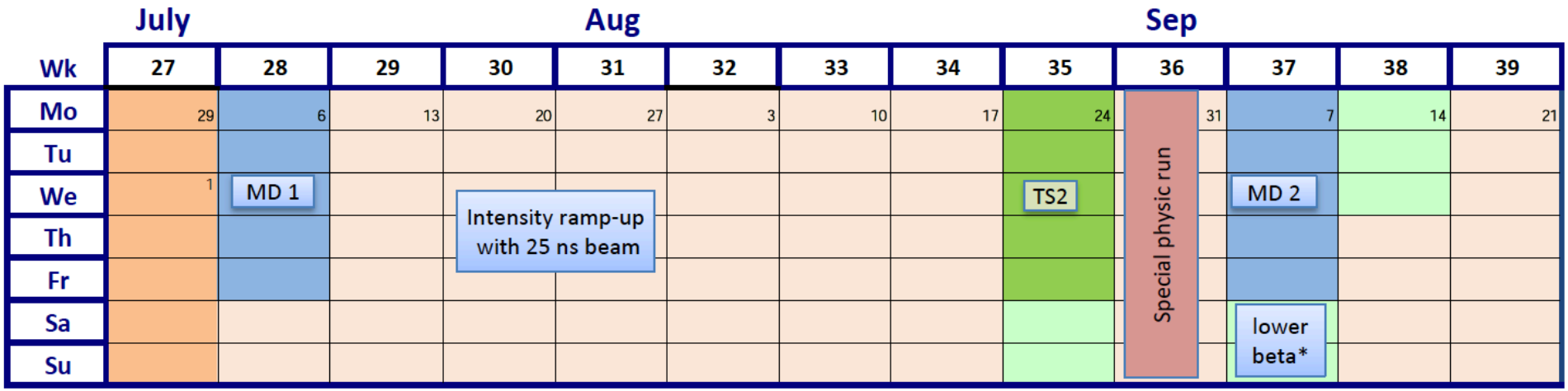
SCRUBBING FOR 50 ns

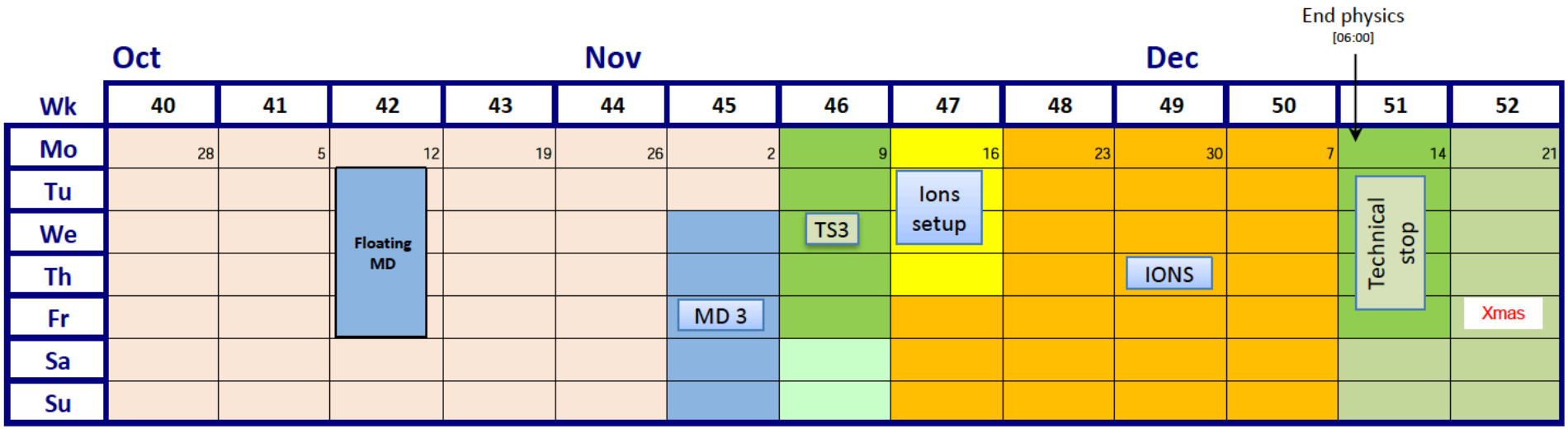
SCRUBBING FOR 25 ns



Status report
LHCC LHC nov 14

2015 Q3/Q4





Summary

- The consolidation program was completed during LS1
- All goals as outlined in the upgrade proposal were achieved during LS1
- MoU of the CT-PPS project was signed by CERN – CMS – TOTEM management
- 2 TDRs were presented in LHCC – September 2014 (TOTEM, CT-PPS)
- R&D on timing detectors has started