

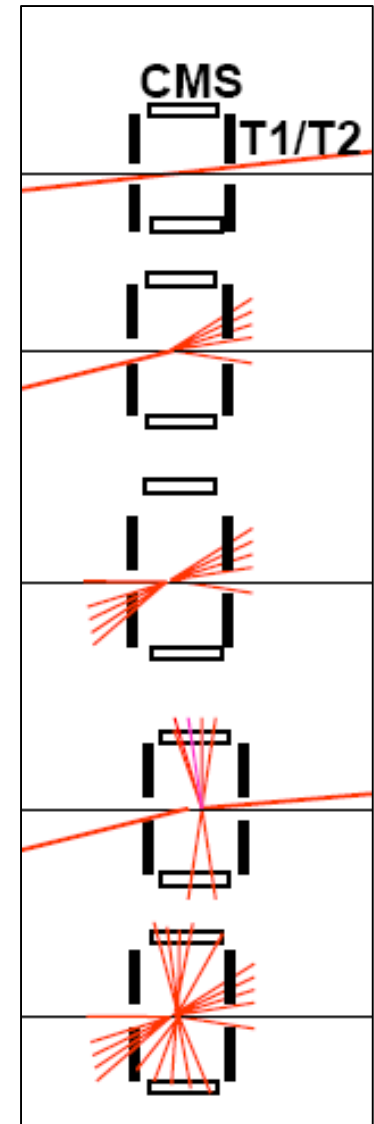
LS2

Other LHC Experiments

Mike Lamont

Thanks to:

Michael Rijssenbeek (AFP)
 Joachim Baechler (TOTEM)
 Karl-Heinz Hiller (ALFA)



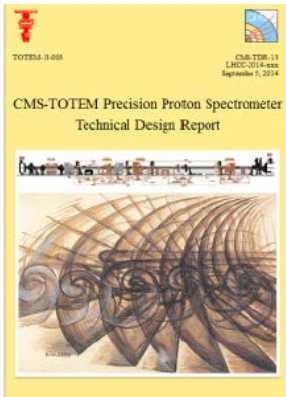
TOTEM and CT-PPS

Operation at low β^* (< 1 m),
high luminosity ($\text{fb}^{-1}/\text{day}$), standard runs
diffractive masses > 250 GeV

CMS-TOTEM Precision Proton Spectrometer (CT-PPS)

separate project, not covered here

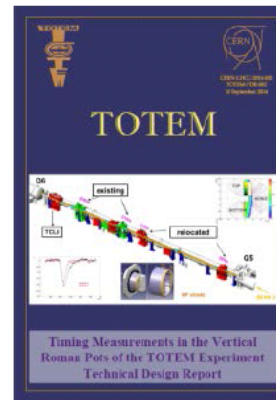
Cherenkov timing detectors
in new horizontal Roman Pots



Operation at high β^* (19 m, 90 m, > 1 km),
Low - medium lumi. ($< 6 \text{ pb}^{-1}/\text{day}$), special runs
all diffractive masses

Timing Measurements in the
Vertical Roman Pots of the
TOTEM Experiment

Thin diamond timing det.
in old vertical Roman Pots

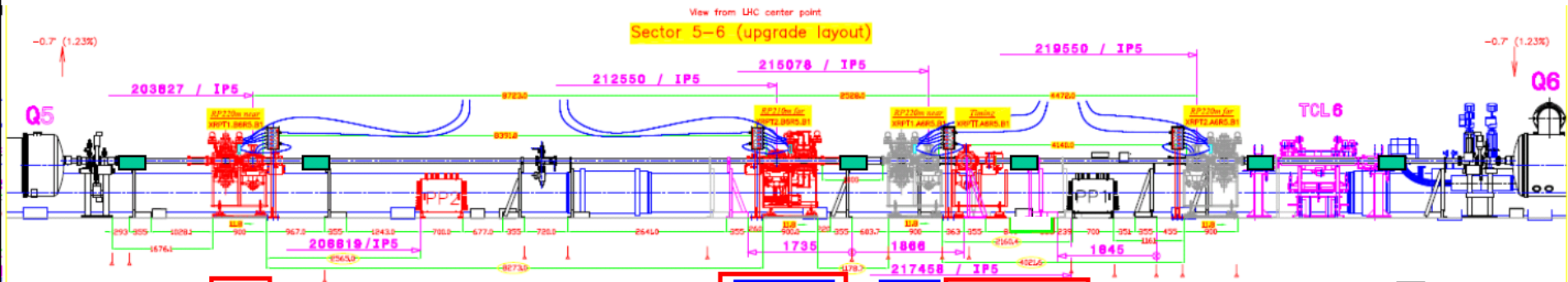


The Roman Pot System after LS1 and its Usage at High and Low β^*

(Example: Sector 5-6)



26 Roman Pots: the largest Roman Pot system ever operated at a collider



XRP.C6R5

XRP.D6R5
8° rotated unit

XRP.A6R5

XRP.E6R5
cylindrical pot
for future timing

XRP.B6R5

Operation at low β^* (0.8 m): CT-PPS
14 individual pots (both sectors together)

Operation at medium/high β^* (19 m, 90 m)
18 individual pots (both sectors together)

“Roman Pots” detectors (CT PPS & TOTEM) installed in LHC tunnel

CERN, 2015

**CT-PPS
timing**

**TOTEM
tracking**

**CT-PPS
tracking 2**

**CT-PPS
tracking 1**

IP5▶

**Collimators TCL 4 & TCL 6
TOTEM upgraded detectors (12 RPs)
New CT-PPS detectors (12 + 2 RPs)
New BP elements: vacuum chambers, ionic
pumps and cartridges, BLMs, ...**

TOTEM

Plan to progressively install the detector components in the Roman Pots

- Diamond Timing Detectors (vertical RPs of 220m near, sector 4-5 and 5-6) & associated components
 - start: **TS3 2015 -> YETS 2015-2016**
 - ECR - under preparation
- Pico-second clock distribution system (fibre based)
 - start: **TS3 2015 -> YETS 2015-2016**
 - ECR - under preparation

CT-PPS

CMS-TOTEM Precision Proton Spectrometer

- Cerenkov Quartz timing detectors (cylindrical Roman Pots, 220m region, sector 4-5 and 5-6) & associated components
 - start: **YETS 2015/2016 -> TS 2016**
 - ECR under preparation
- Pixel detector (horizontal RPs, 210m near/far, sector 4-5 and 5-6) & associated components
 - start: **YETS 2015/2016 -> TS 2016**
 - ECR under preparation
- Clock distribution system - based on rigid RF cable to be laid from 220m region sector 4-5 via the bypass to 220m region of sector 5-6.
 - start: **YETS 2015/2016**
 - ECR draft version already in EDMS (Finn Rebassoo)
 - First meeting with G. Canale (EN-MEF) took place last week 16.9.2015 -> problems with the size of the cable drum -> not yet clear how to proceed.

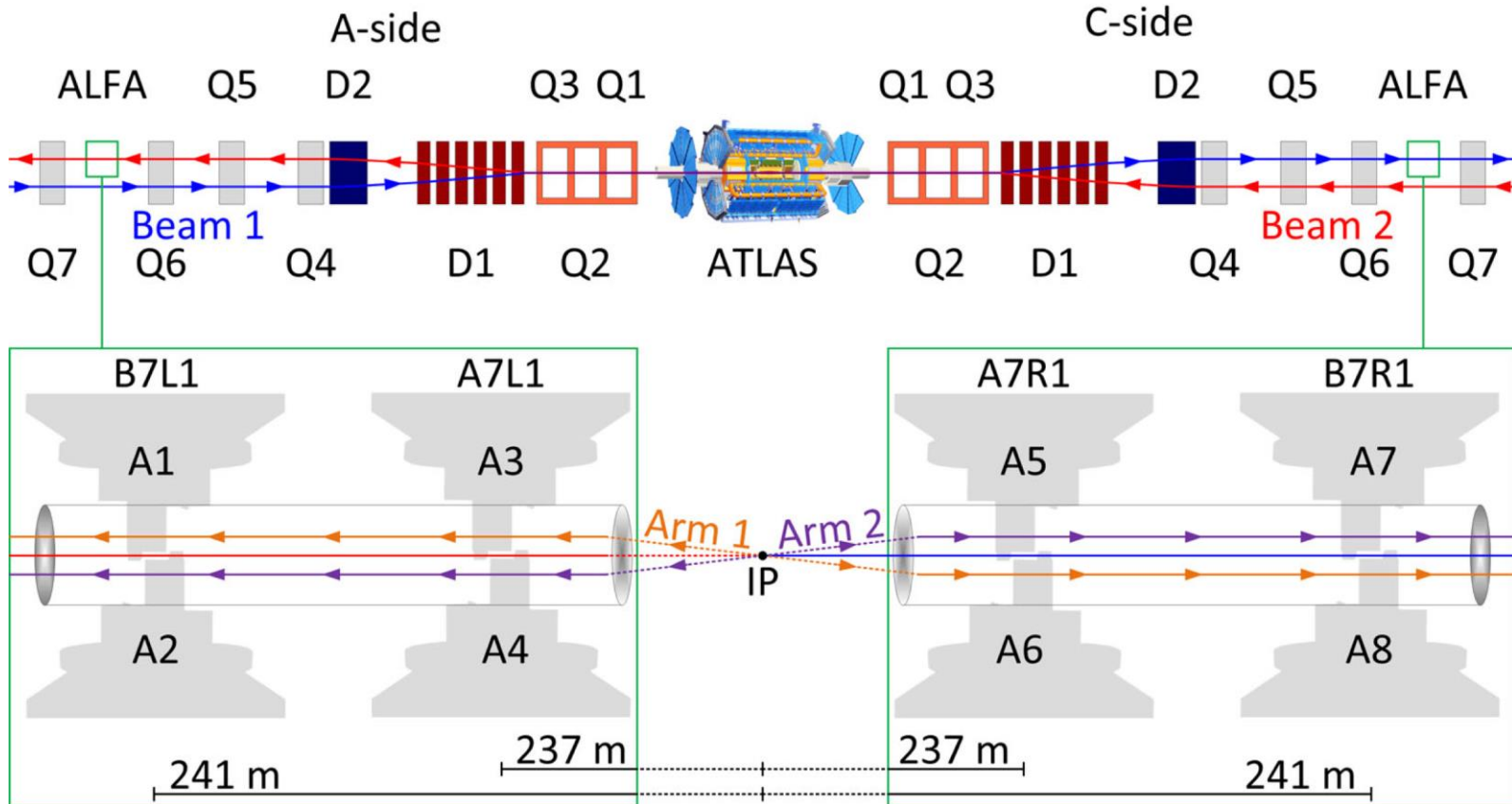
TOTEM: LS2

- no major upgrades planned for LS2
 - data taking in Run 3 with existing detectors
 - no planned operation during HL-LHC
-
- Originally planned to have two cylindrical RPs per side and it could be possible, that we use LS2 to integrate such additional RP per side in the already existing mechanical frame.
 - Furthermore, during LS1 we have not succeeded to create the **two small excavations (radiation limiter) in the tunnel floor** to locate radiation sensitive electronic timing components close to the detector.
 - This might still be required, if the radiation level would limit the operation of the FPGA or other electronics
 - **This activity (if finally approved) during LS2 might require for safety reason the local removal of the beam pipe.**

TOTEM: Run 3

- The operation of the present TOTEM Roman Pots at high beta optics/special runs is officially foreseen until the **max. possible energy of LHC** has been reached, allowing to complete the approved scientific mission of TOTEM.
- Any future operation of the Roman Pots within the CT-PPS project at standard LHC optics will depend on the insertion limitations we find during the intensity ramps.
- The performance of the detector inserts in the Roman Pots under the specific radiation conditions (tracking and timing) will then determine the physics reach.

ALFA



ALFA: YETS

- Our major activity in LS1 was the protection against RF heating.
 - Full success.
 - If there are no future dramatic effects this ensures data taking until end of Run2.
- Enhanced **UFO activity of one particular station**
 - After some movement exercises the UFO level is unchanged.
 - Raise dump threshold by a factor 25, as done for TOTEM - should be sufficient for a safe LHC running

ALFA YETS 2015 activities

The team is small and load for people high!

- On surface:
 - movement firmware update
 - prepare executables for PXI
 - commissioning of new movement & interlock
 - new firmware for ALFA_CTPIN trigger board
 - timing and commissioning of new triggers
 - adding a second DCS computer and splitting of the project
- In USA15 and tunnel:
 - install new crate for movement system to reduce noise
 - replace a noisy LVDT and electronics for A7L1L
 - upload new firmware for motherboards + PMFs
 - install new vacuum pumps & replace filters
 - exchange or modify a few radmons for higher intensity

ALFA – LS2

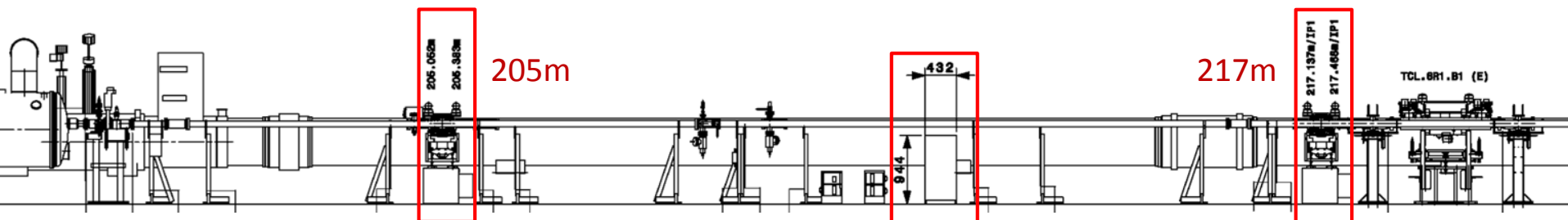
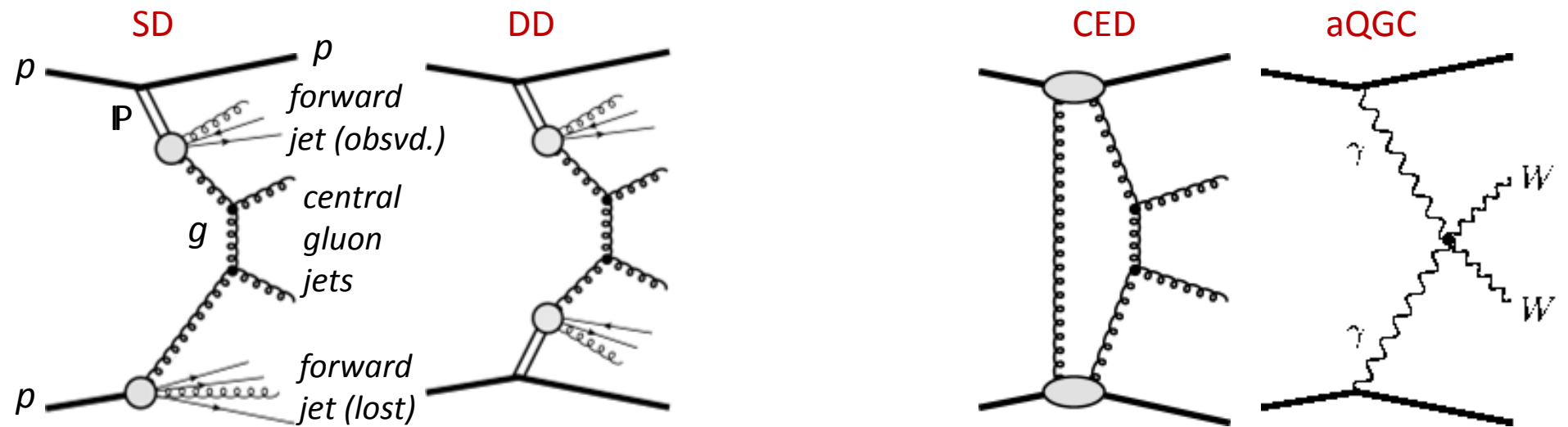
The long term plan for ALFA is to finish the physics program, total cross section and luminosity measurement, in Run2.

No plans for LS2

But note AFP...

ATLAS Forward Proton (AFP)

- ATLAS Forward Proton detectors ~upgrade of ALFA
- Approved Physics: Single Diffraction, Double diffraction in special runs 2016 – 2018
- To be approved: Exclusive Dijet, Exclusive WW (ZZ, $\gamma\gamma$, ...)



AFP: Installation in YETS2015

- **Install ONE arm of AFP in C6R1 (Jura side of IP 1):**
 - **Cabling:**
 - 2×2 7/8" Ø Fast trigger cables, 2×1 optical data cable through SURVEY galleries on BOTH (!) sides of IP1
 - ~20 Service cables (LV, HV, monitoring, controls, ...)
 - **Modify Exterior vacuum chamber between Q5 and Q6**
 - 2 VPI
 - 2 BLM, 1-2 BPM
 - **2 Roman pot stations:** 205 m, 217 m from Point 1
 - secondary vacuum
 - air cooling
 - **Tracking and (possibly) Time-of-Flight detectors**
 - PLUS: patch panels/crates/racks at 205 m, 217 m, and 212 m
 - commissioning of motorization, interlocks, and detectors

} ~4
weeks

} ~3
weeks

AFP: Installation in EYETS2016

- Install **SECOND** arm of AFP in C6L1 (GVA side of IP 1):

- Cabling:

- ~20 Service cables (LV, HV, monitoring, controls, ...)

- Modify Exterior vacuum chamber between Q5 and Q6

- 2 VPI
- 2 BLM, 1-2 BPM

- **2 Roman pot stations:** 205 m, 217 m from Point 1

- secondary vacuum
- air cooling

- Tracking and Time-of-Flight (ToF) detectors

- PLUS: patch panels/crates/racks at 205 m, 217 m, and 212 m
- commissioning of motorization, interlocks, and detectors
- Commissioning of new Trigger Electronics based on ToF

~3
weeks

~3
weeks

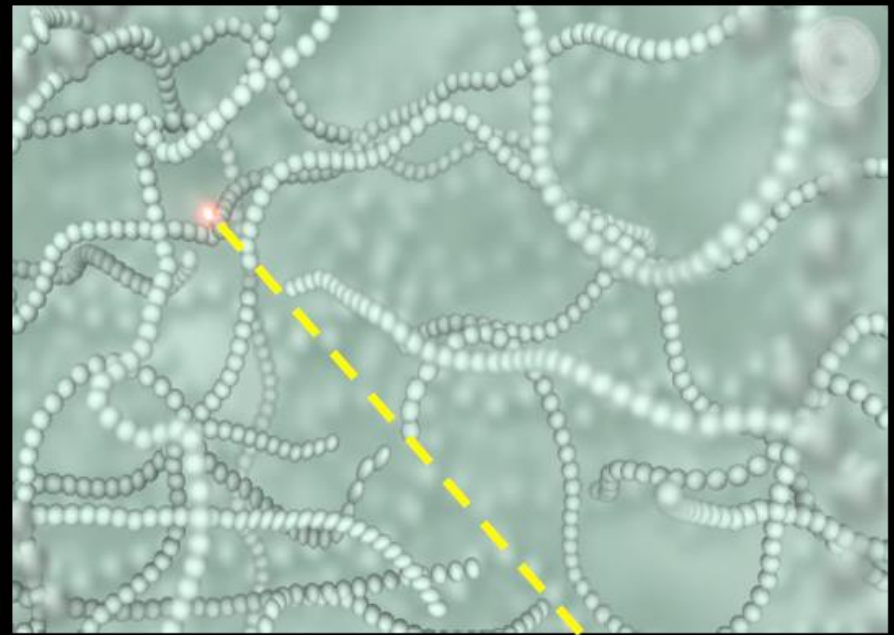
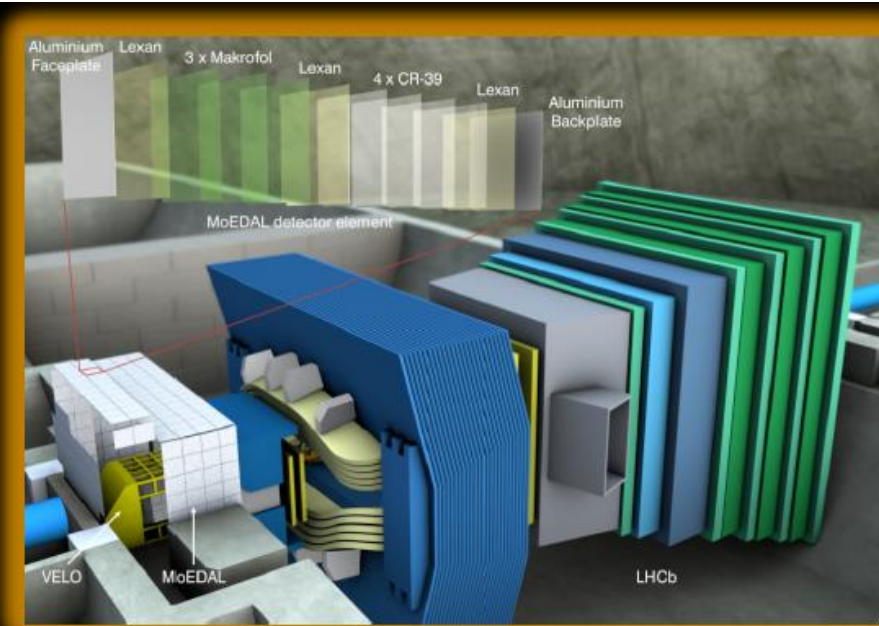
AFP: Plans for LS2

- Possible AFP UPGRADES for Run 3:
 - Strongly dependent on pre-LS2 experience!
 - Modify Exterior vacuum chamber between Q5 and Q6
 - possibly add second BPM (after 205 m station)
 - **Remove & refurbish ALFA vertical stations?**
 - Tracking and Time-of-Flight (ToF) detectors:
 - Update trackers if needed
 - Update ToF if needed
- ~5 weeks
- ~3 weeks

MoEDAL

The 7th LHC Experiment

DESIGNED TO SEARCH FOR HIGHLY-IONIZING PARTICLES PRODUCED IN P-P COLLISIONS AT THE LHC. SUCH PARTICLES ARE HARBINGERS OF REVOLUTIONARY NEW PHYSICS



- The highly ionizing particle leaves a cylindrical trail of damage in the plastic track etch detectors*

MOU start date: 01/09/2014

End date > 01/09/2019

Conclusions

- TOTEM and CT-PPS
 - Detector upgrades ongoing for an ambitious data taking program in Run 2 and Run 3
- ALFA
 - Aim to finish data taking in Run 2
- AFP
 - New pots in YETS15, EYETS
 - Not so much in LS2 (but might refurbish ALFA)