



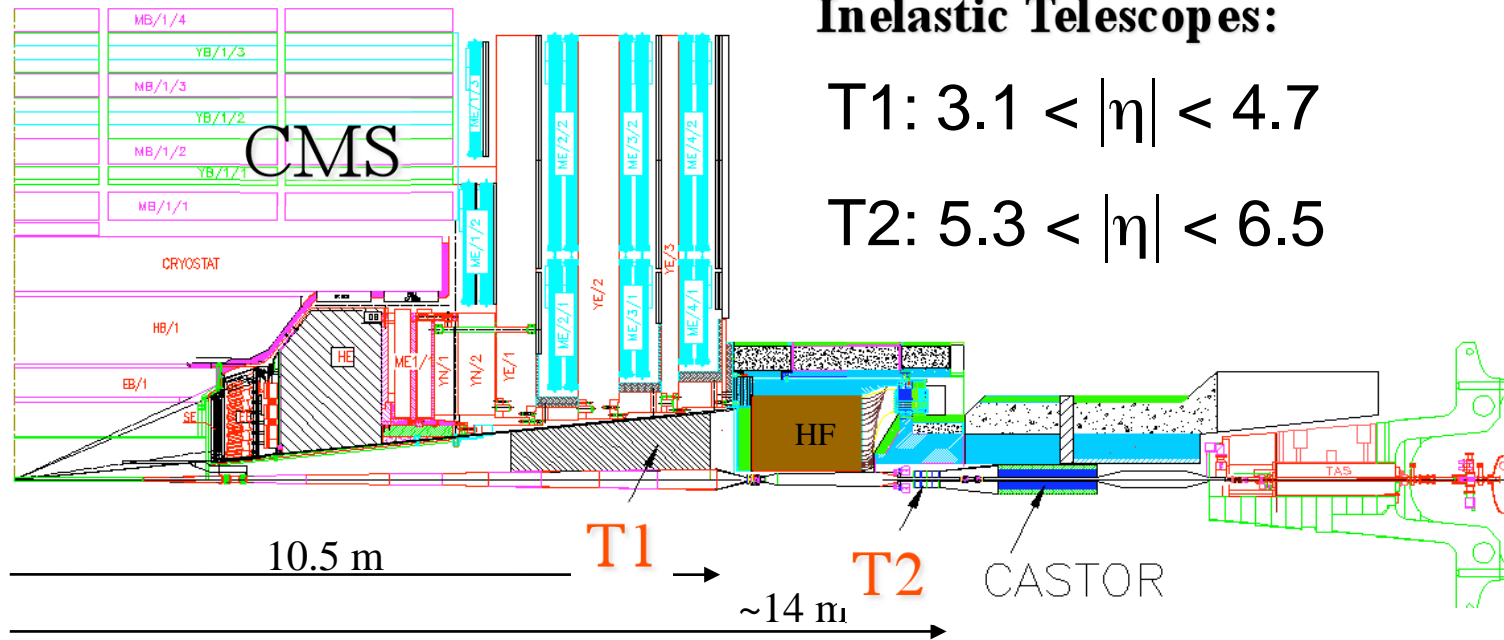
# TOTEM Status Report

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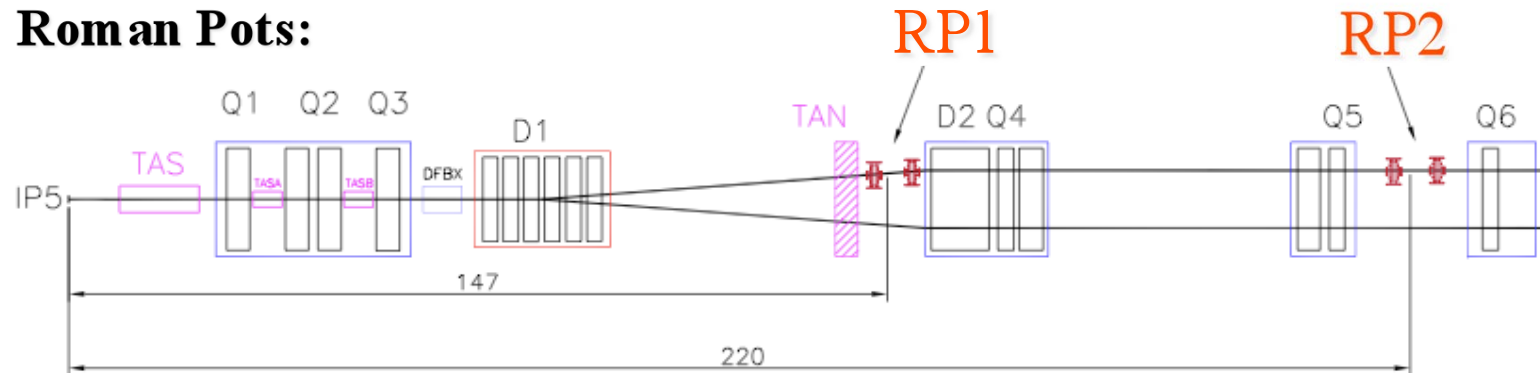
- Introduction
- The T1 detector
- The T2 detector
- The Roman Pots
- Summary and outlook



# The TOTEM experiment



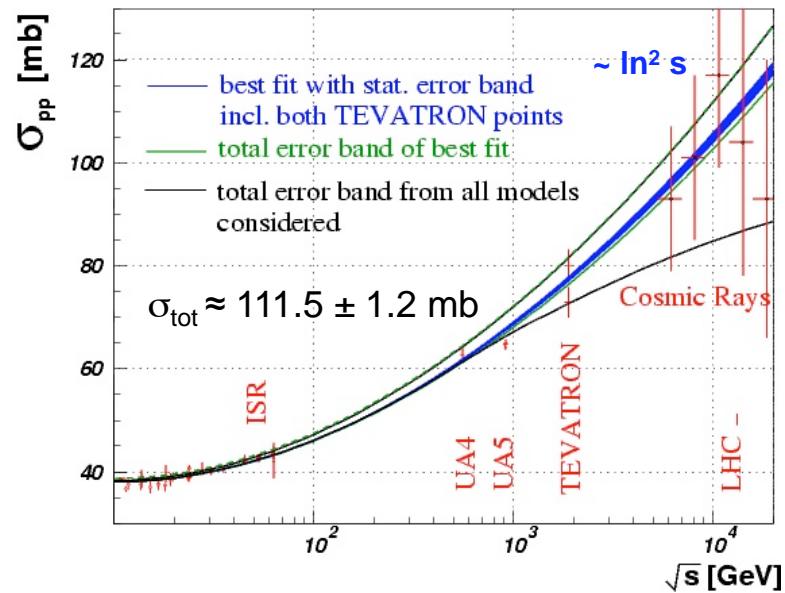
## Roman Pots:



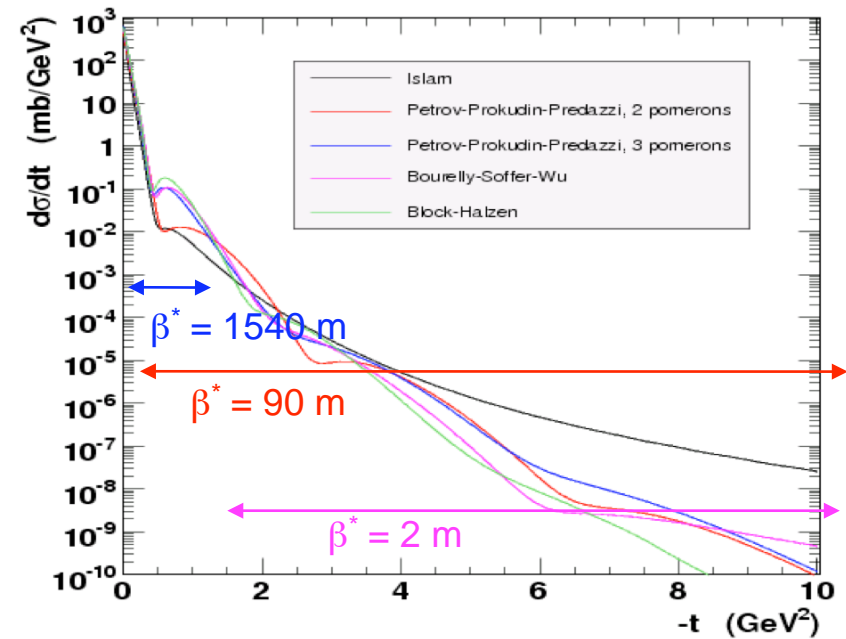


# TOTEM Physics

## Total cross-section

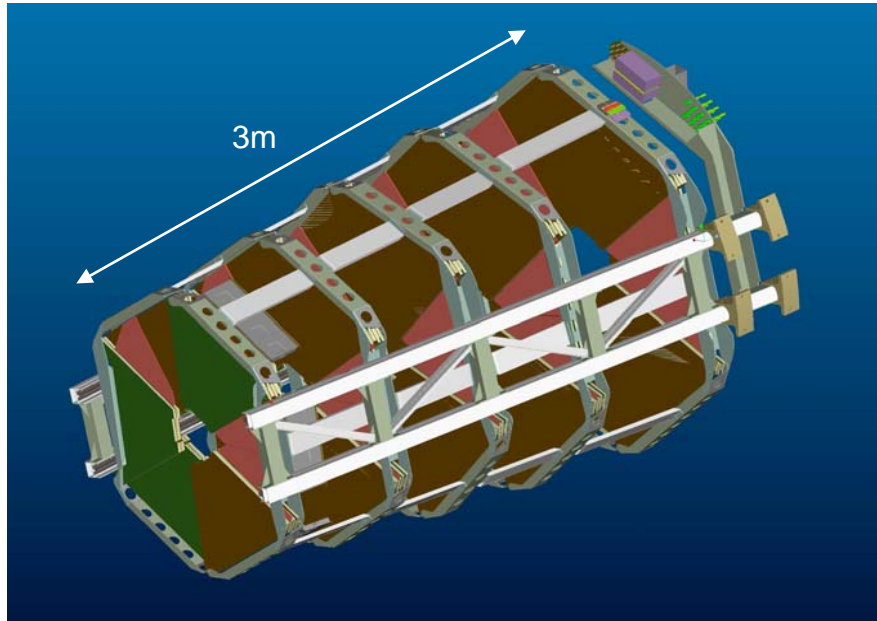


## Elastic Scattering

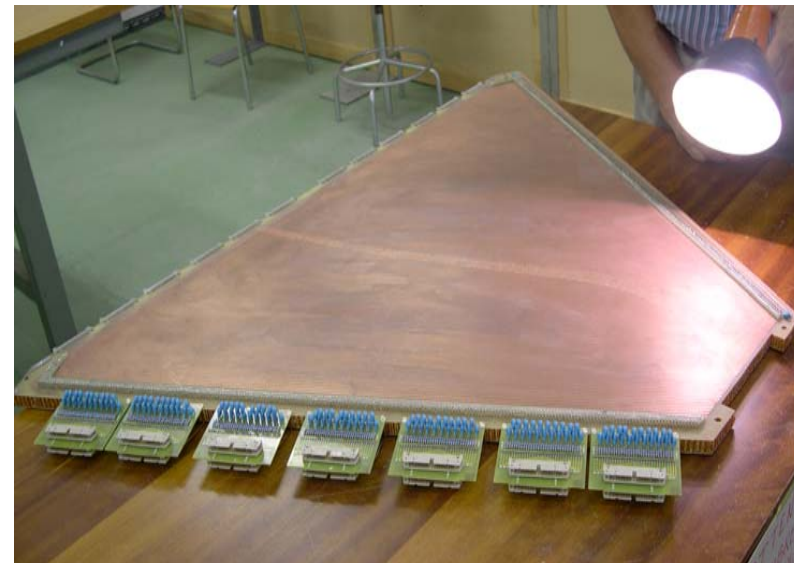
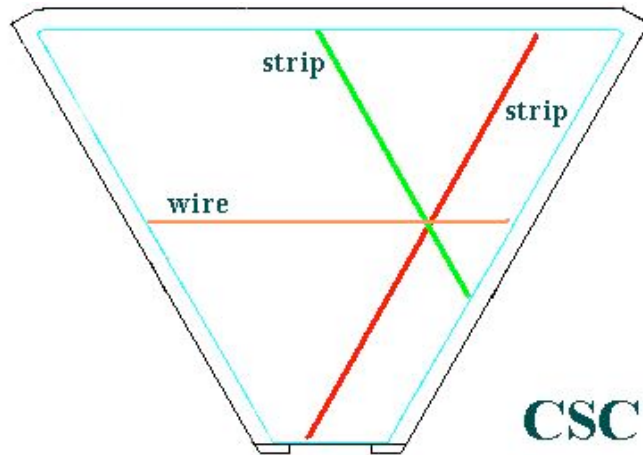




# The T1 Telescope



- Cathode Strip Chambers (CSC)
- $3.1 < |\eta| < 4.7$
- 5 planes with measurement of 3 coordinates per plane
- 3 deg rotation and overlap between adjacent planes
- Primary vertex reconstruction allows background rejection
- Trigger with anode wires





# The T1 CSC chambers

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Production at Gatchina (PNPI): 70 CSCs

Test and assembly done at CERN



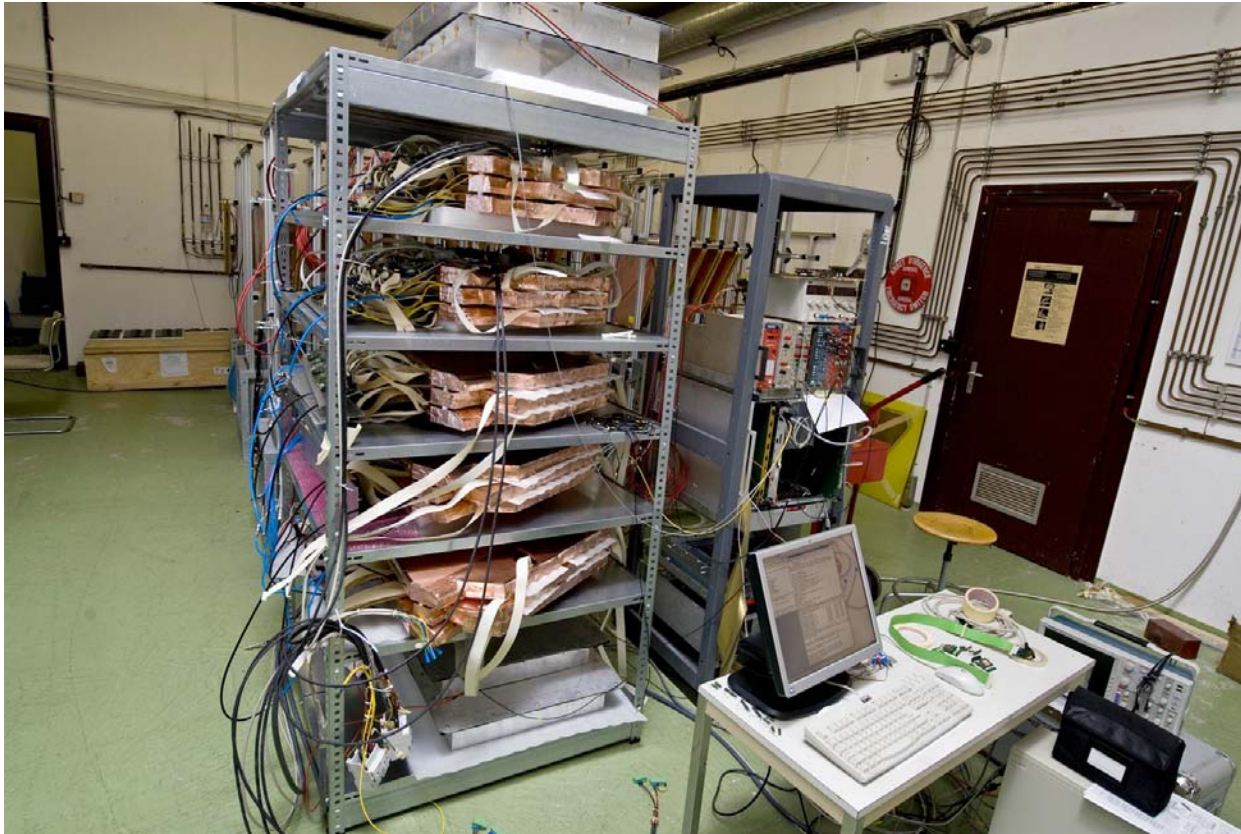


# Cosmic Ray test set-up

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15 CSCs for first  $\frac{1}{4}$  telescope

Even firemen help !!





# $\frac{1}{4}$ T1 Telescope complete with CSC chambers

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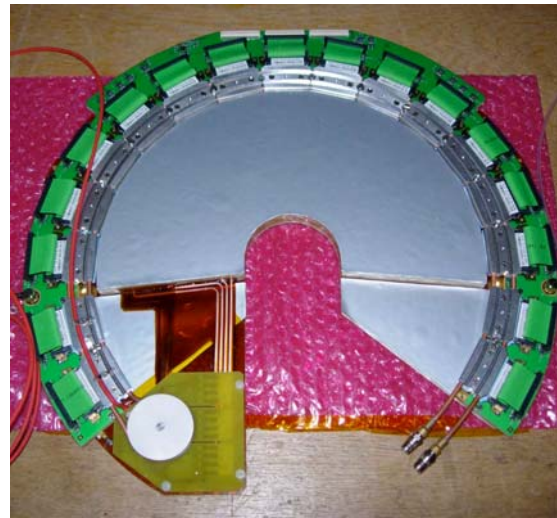
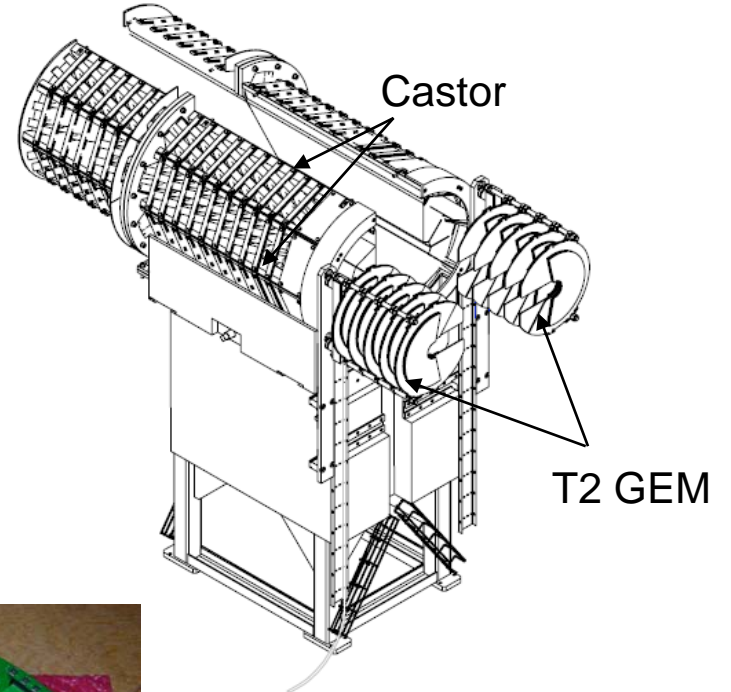
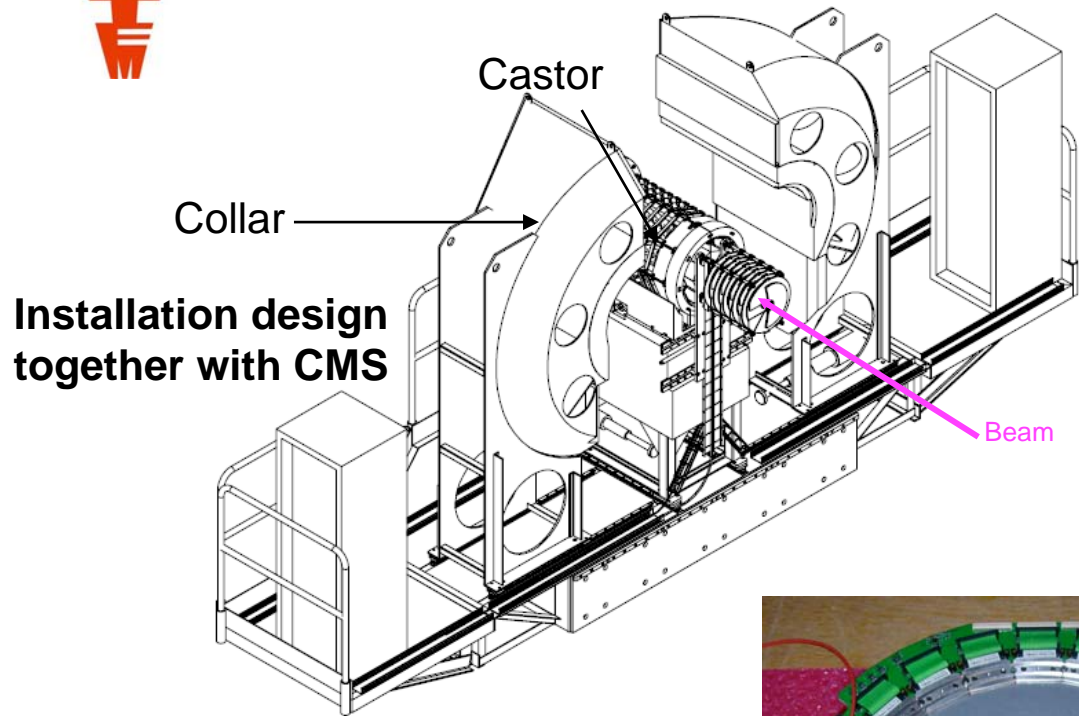
15 CSCs mounted 3 by 3

Tilt between layers





# The T2 Telescope



Final GEM chamber

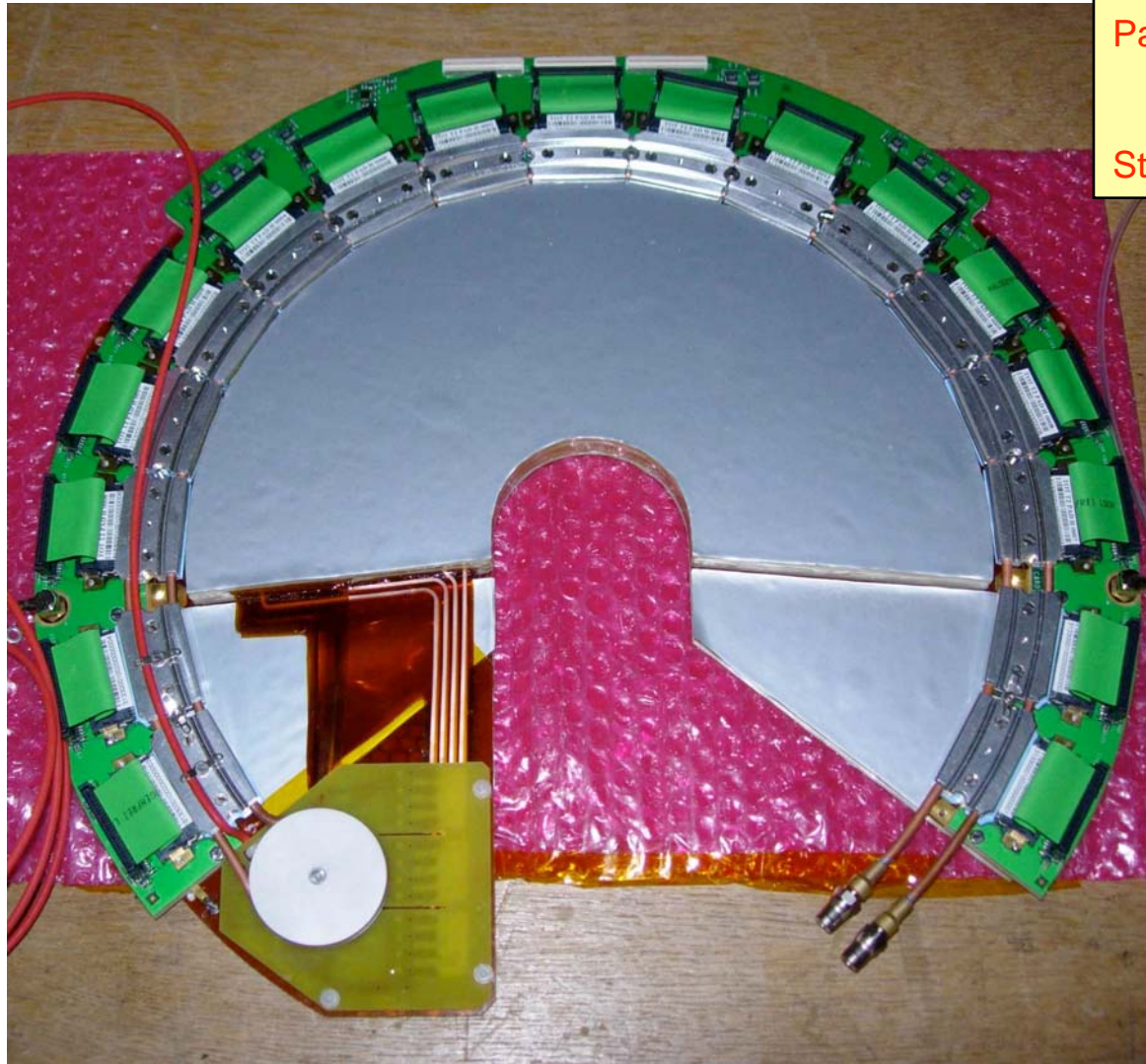
10 triple-GEM planes on each side of the IP to cope with high particle fluxes.

$$5.3 < |\eta| < 6.6$$

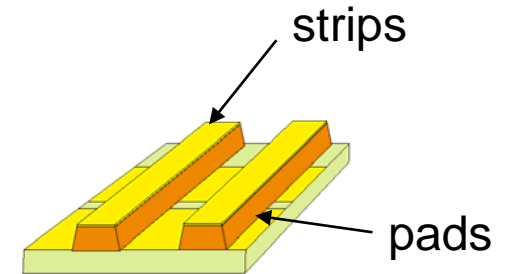




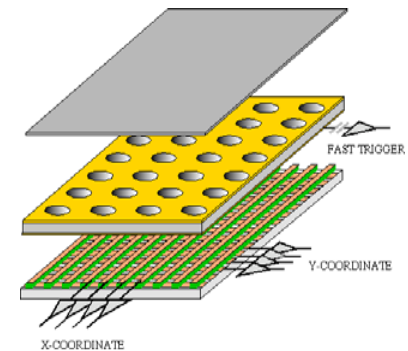
# The T2 GEM chambers



$65(\varphi) \times 24(\eta) = 1560$  pads  
Pads:  $\Delta\eta \times \Delta\varphi = 0.06 \times 0.015\pi$   
 $2 \times 2 \text{ mm}^2 - 7 \times 7 \text{ mm}^2$   
Strips: 256 (width:  $80 \mu\text{m}$ , pitch:  $400 \mu\text{m}$ )

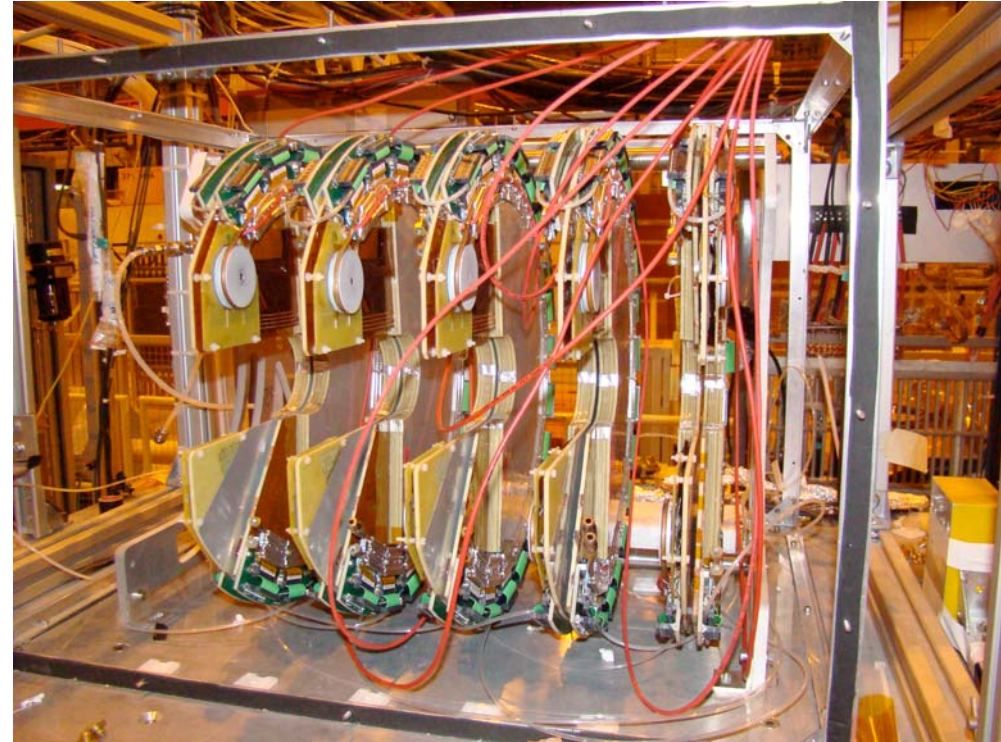
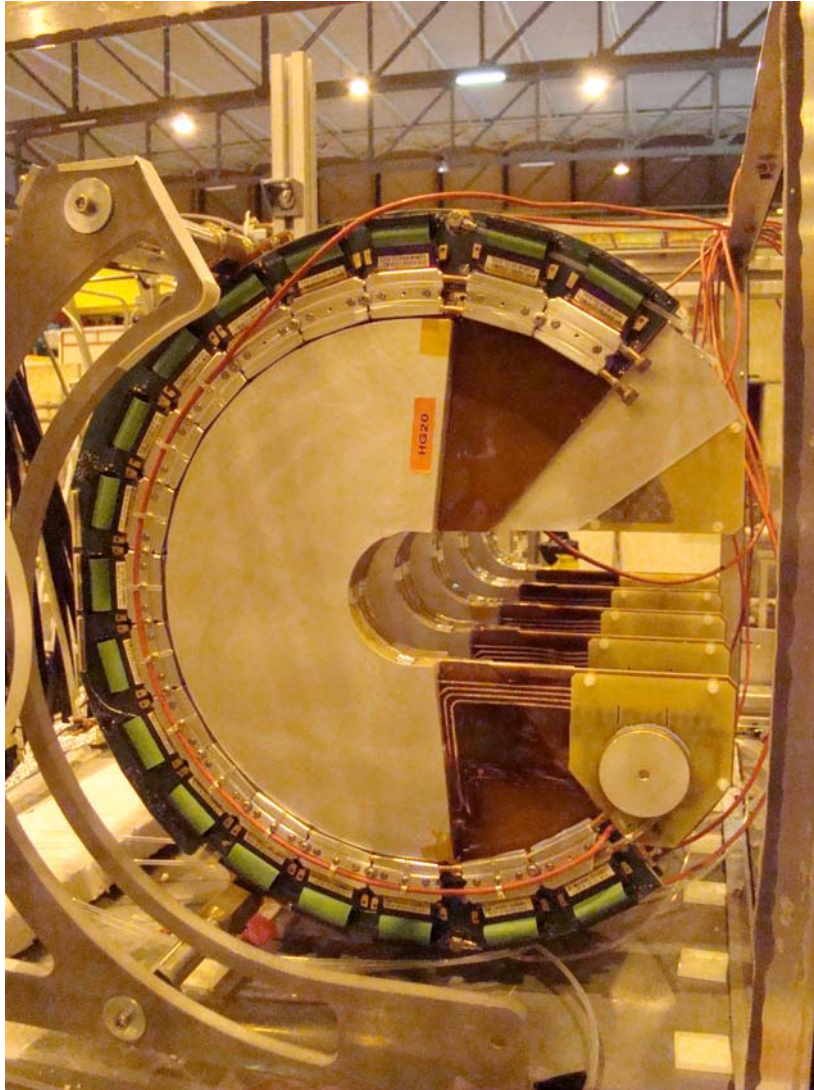


Technology used in COMPASS





## T2 Telescope Assembly in Test Beam



**Production at Helsinki (50 GEMs)**

**Final assembly at CERN**



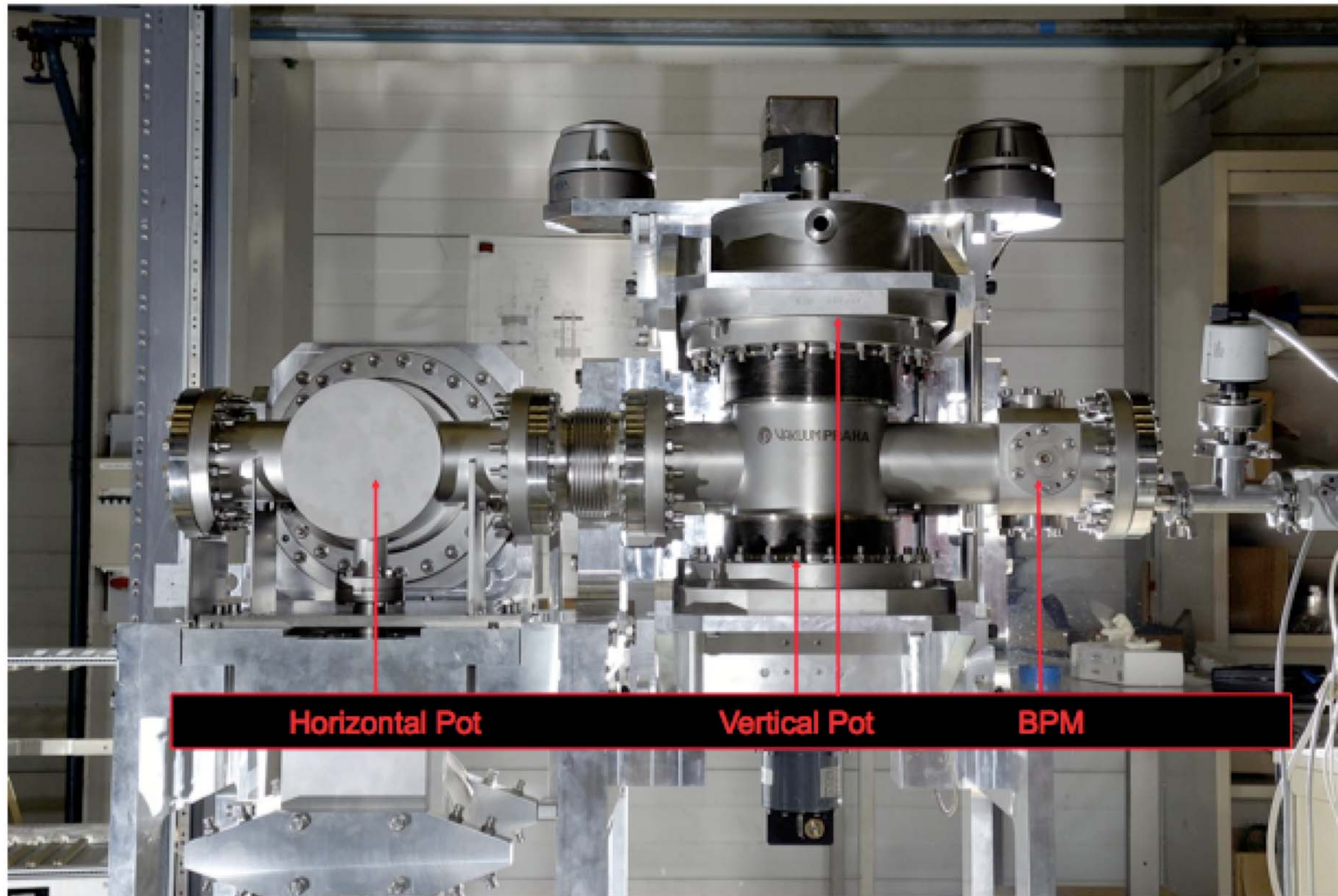
# Installation of T2 Telescope in CMS

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# The Roman Pot Module





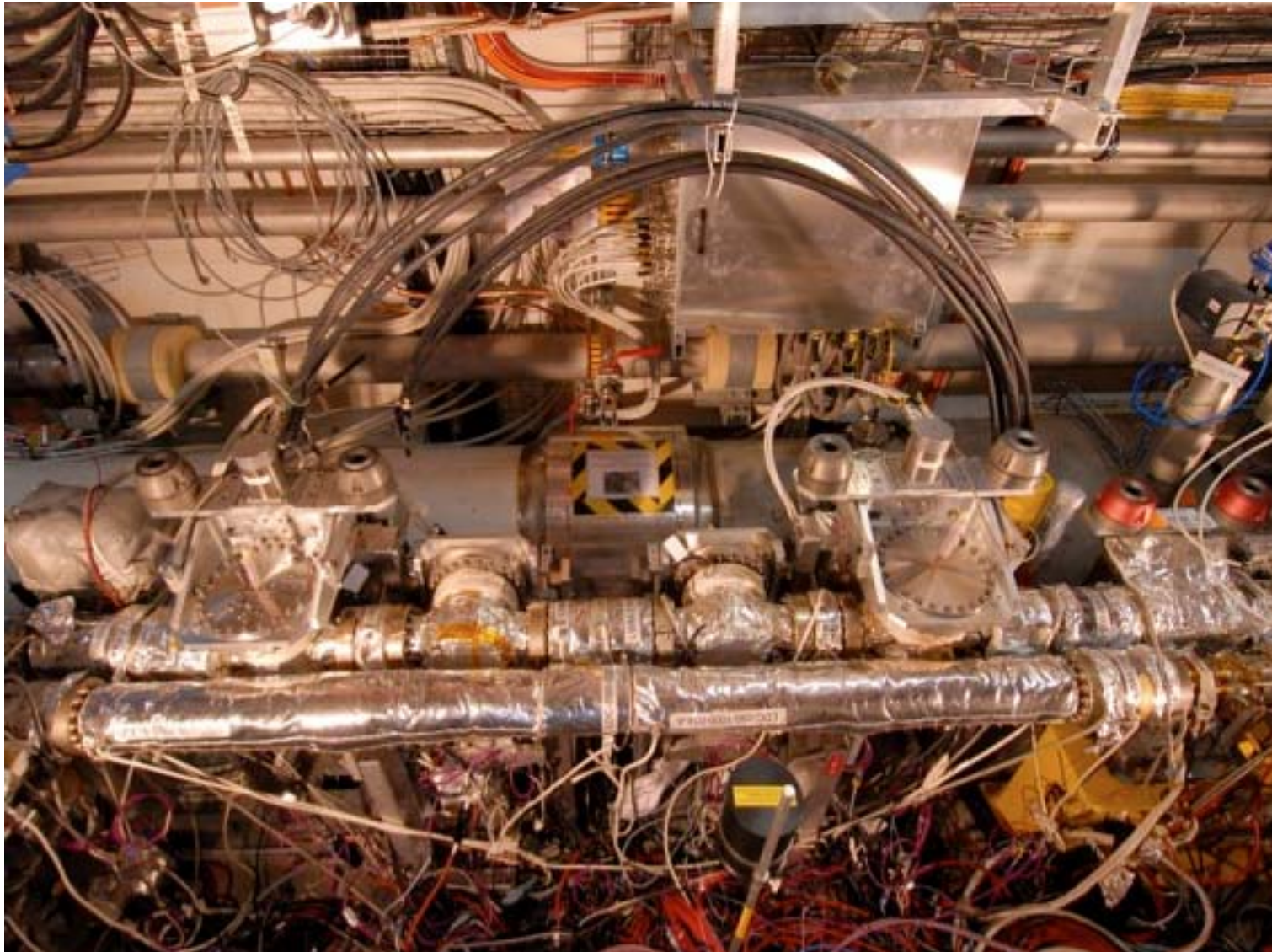
## The Roman Pots at 220 m





## The Roman Pots at 147 m

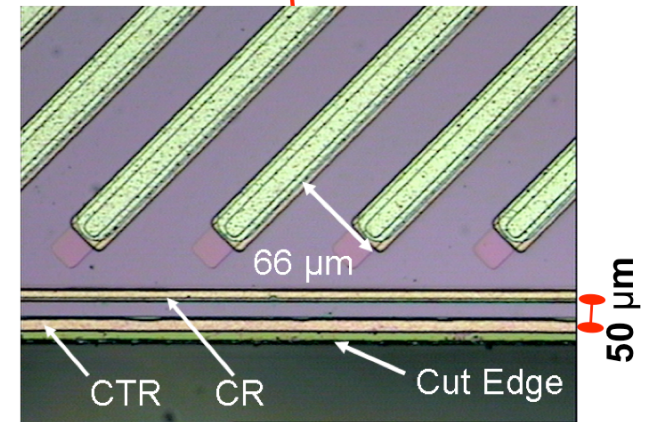
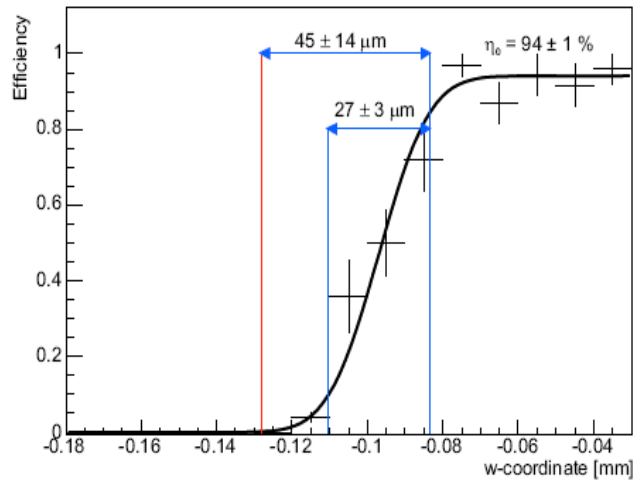
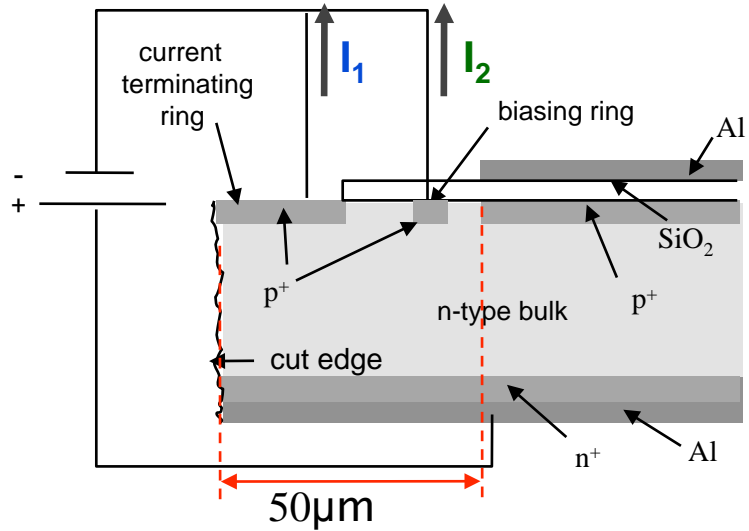
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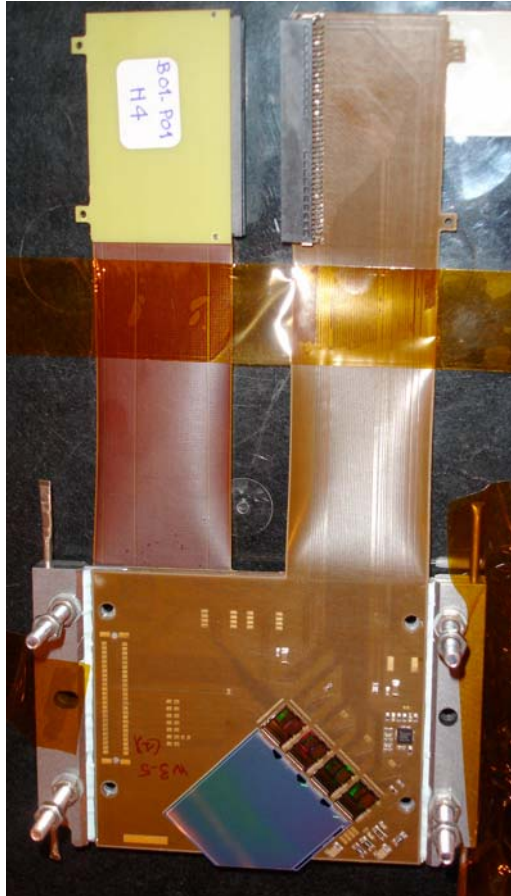
# Si Edgeless Detectors for Roman Pots

Planar technology with CTS  
(Current Terminating Structure)

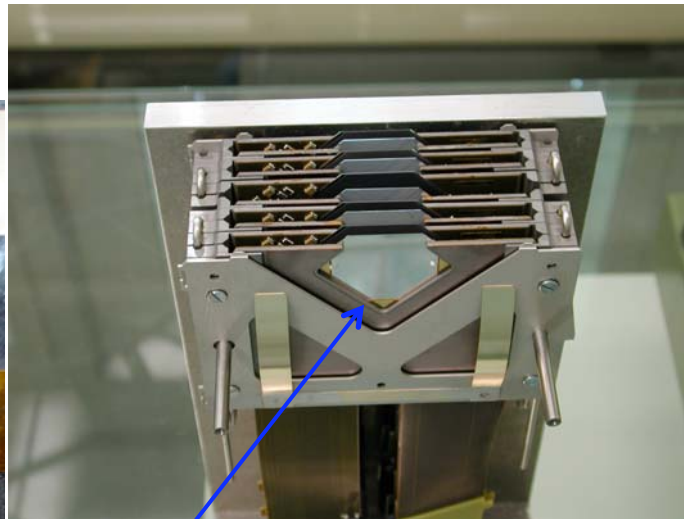




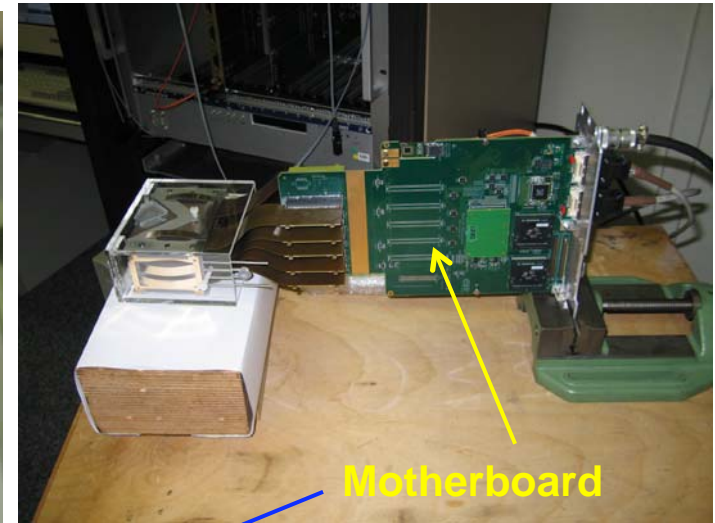
# The Hybrid and the Assembly



**Kapton hybrids  
laminated on CE7**

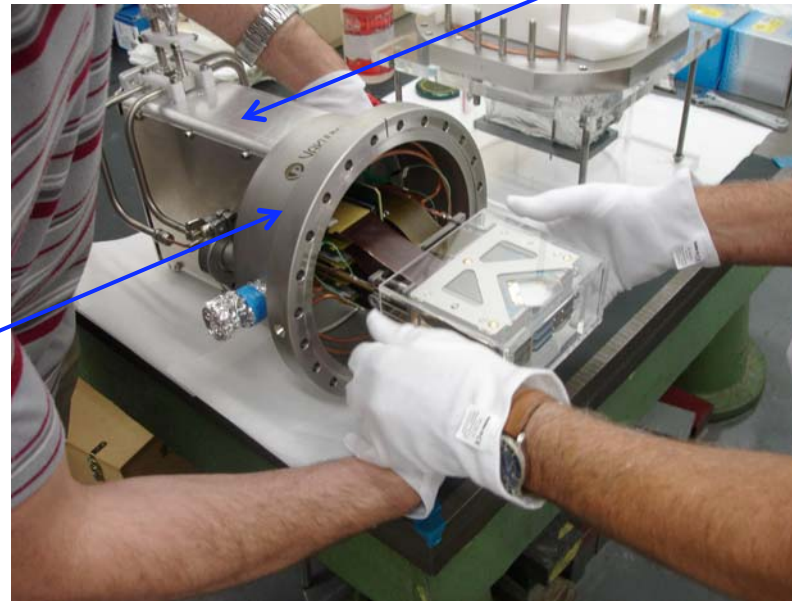


**Assembly of  
10 detectors**



**Motherboard**

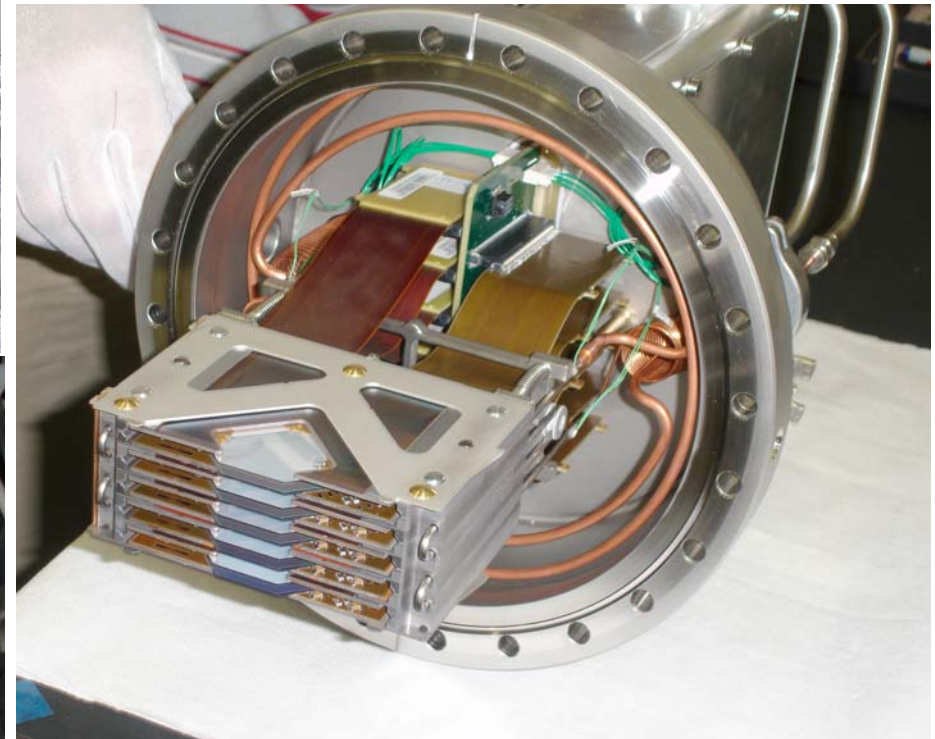
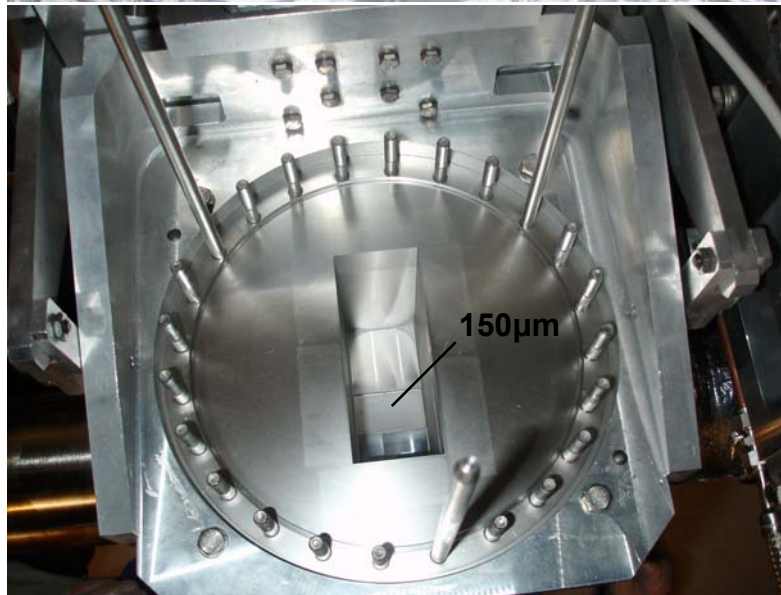
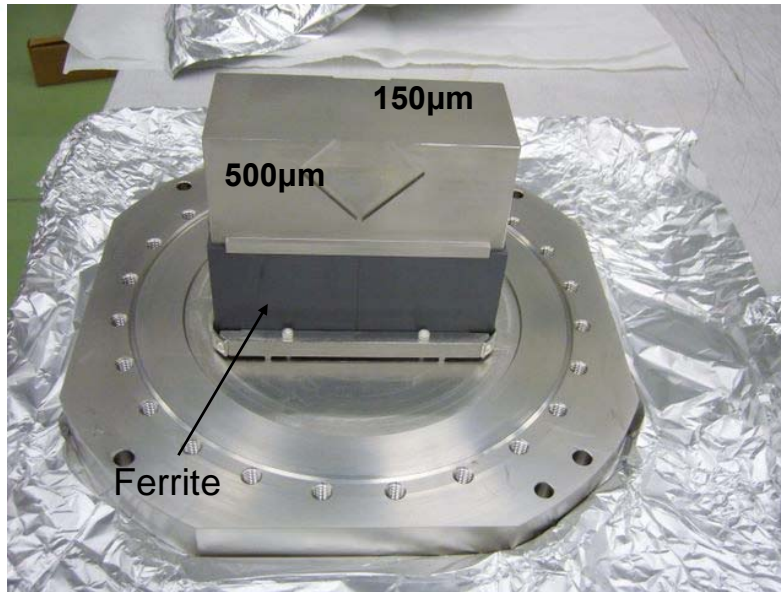
**“Champignon”**







# The window and the detector assembly

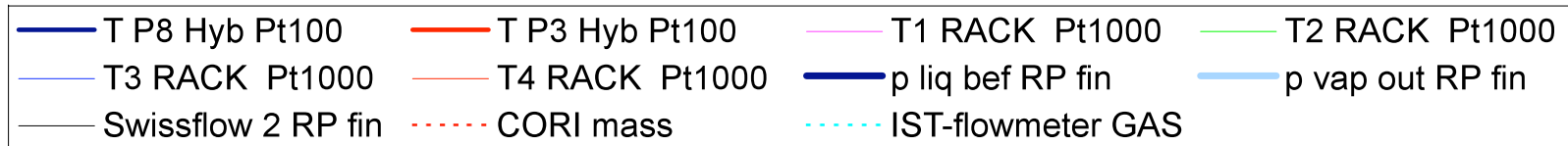
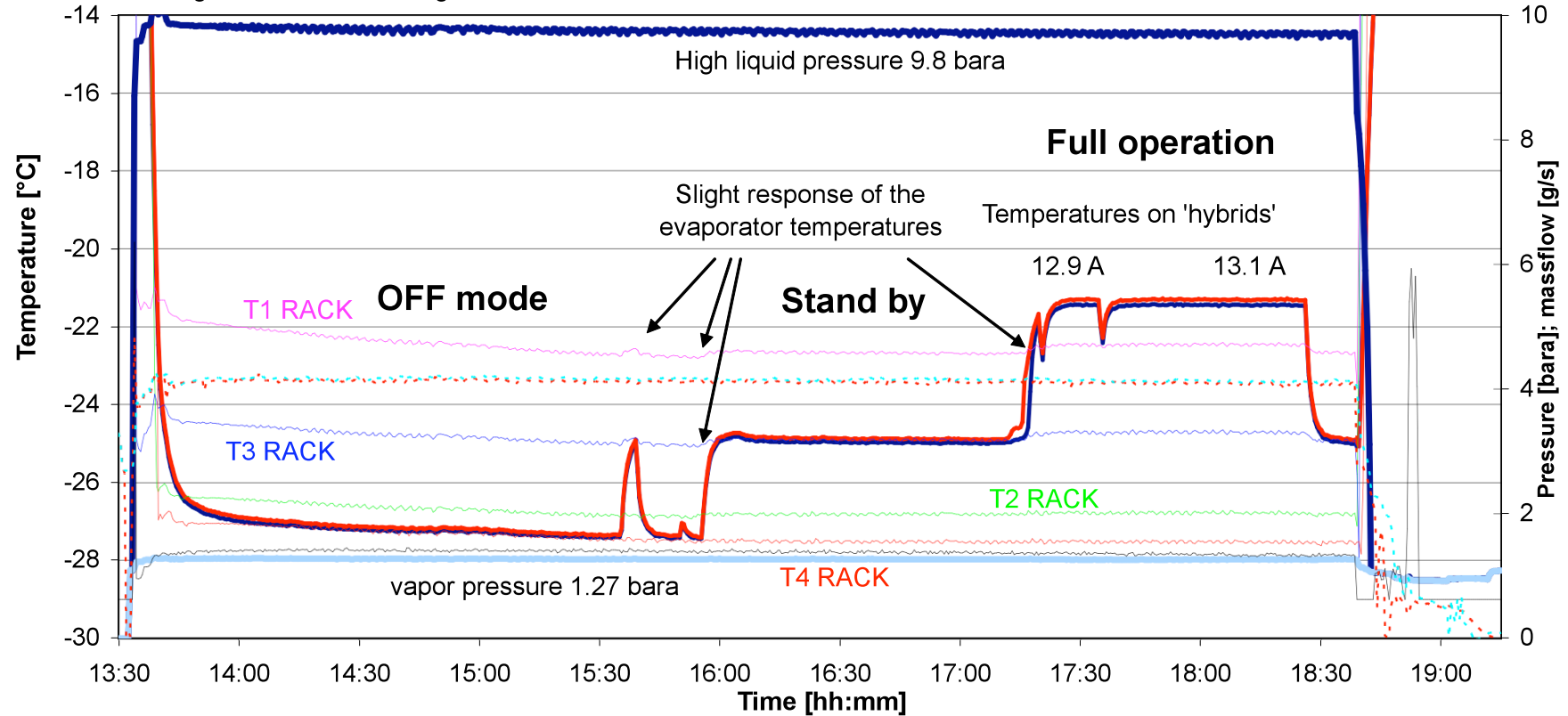




# The cooling of the detector in the test beam

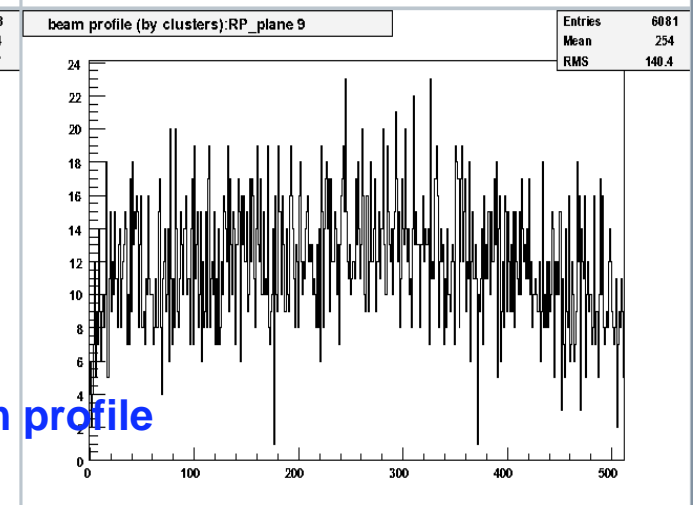
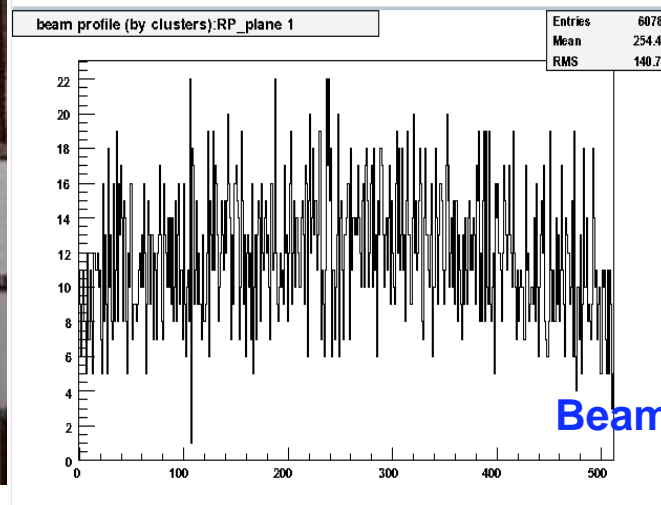
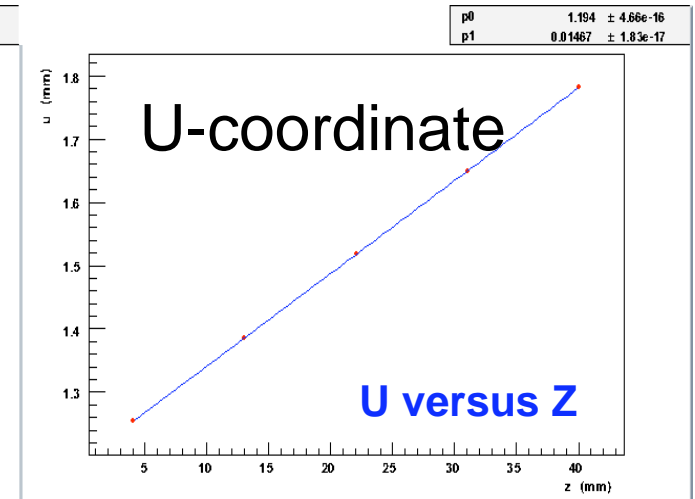
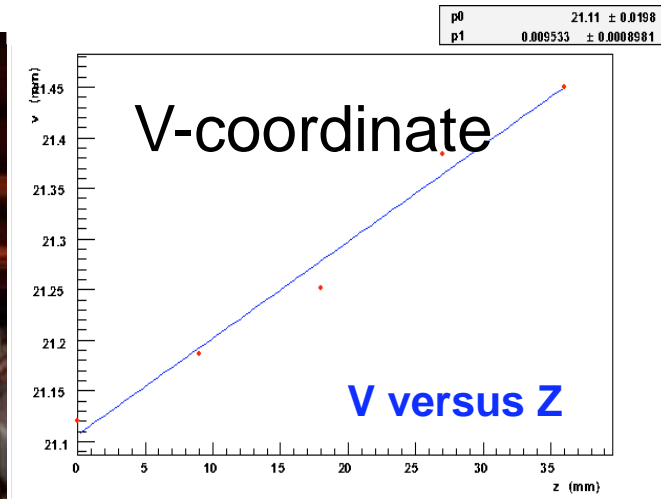
Conditions inside Roman Pot 'final' #2 placed at Beam test area, 30.07.2008, Preveessin H8

Mass flow through RP final #2 ~ 1.4 g/s



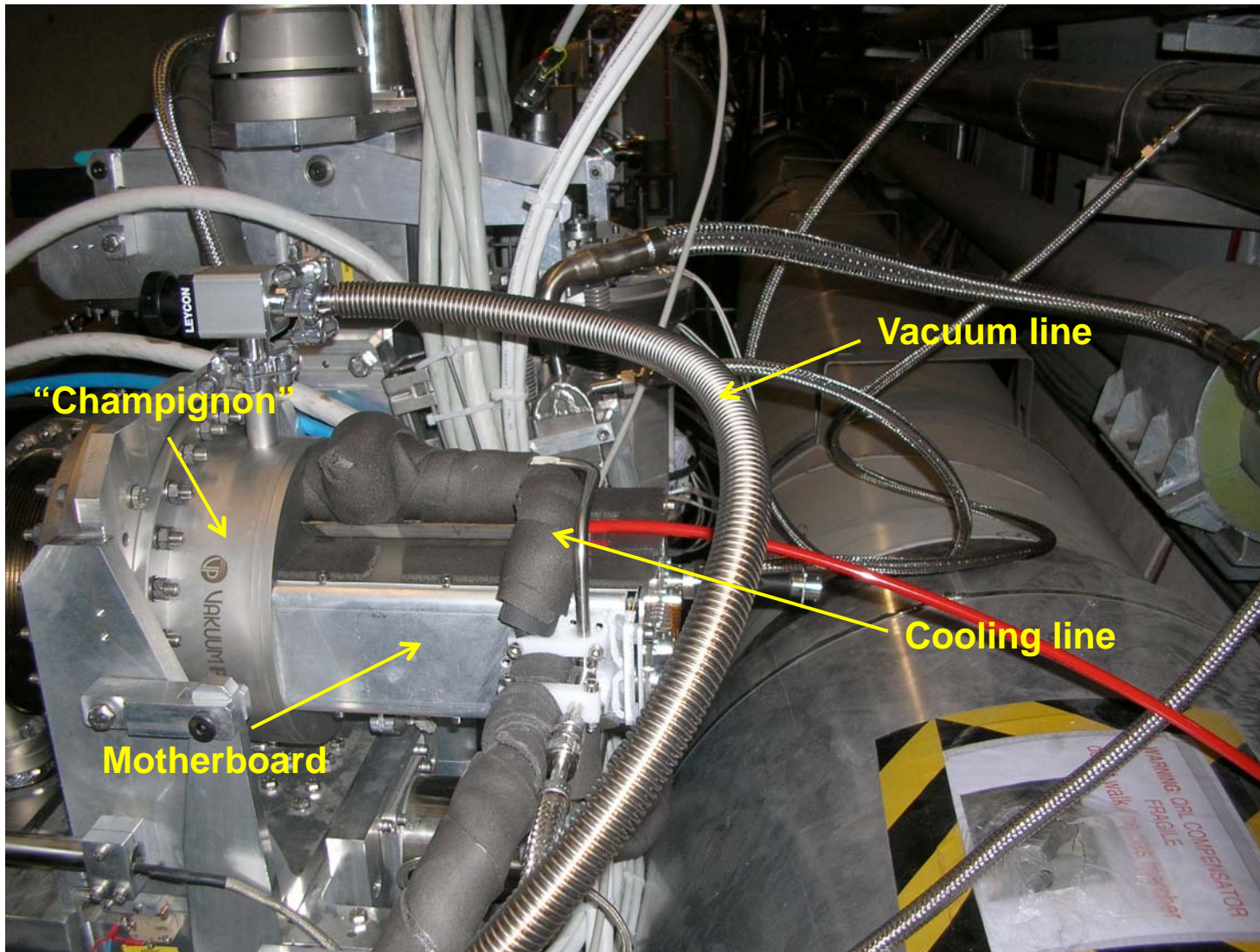


# Commissioning of the Roman Pots with Muons





# Detector Assembly mounted in Roman Pot

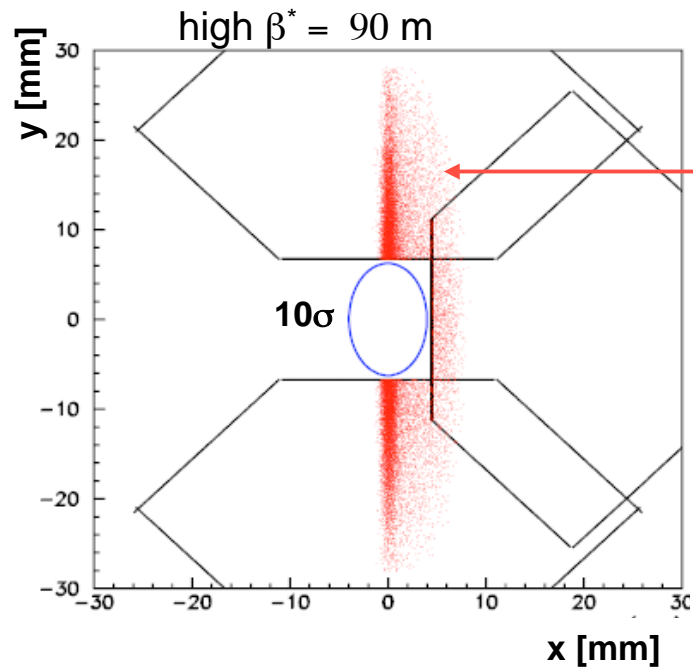




# Early Physics (1)

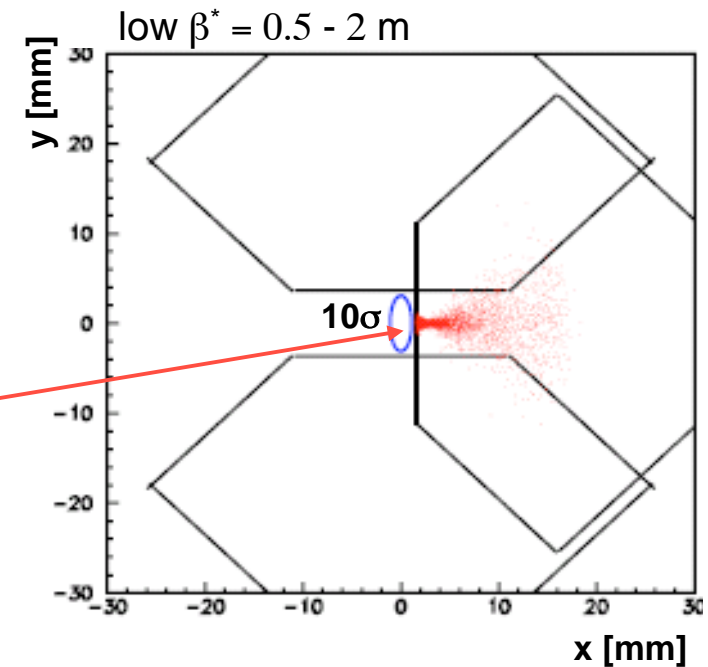
## Measurement of elastic and diffractive protons

Hit distributions @ RP220



$$y \sim \Theta_y^{\text{scatt}} \sim |t_y|^{1/2}$$

$$x \sim \xi = \Delta p / p$$



Detect the proton via:

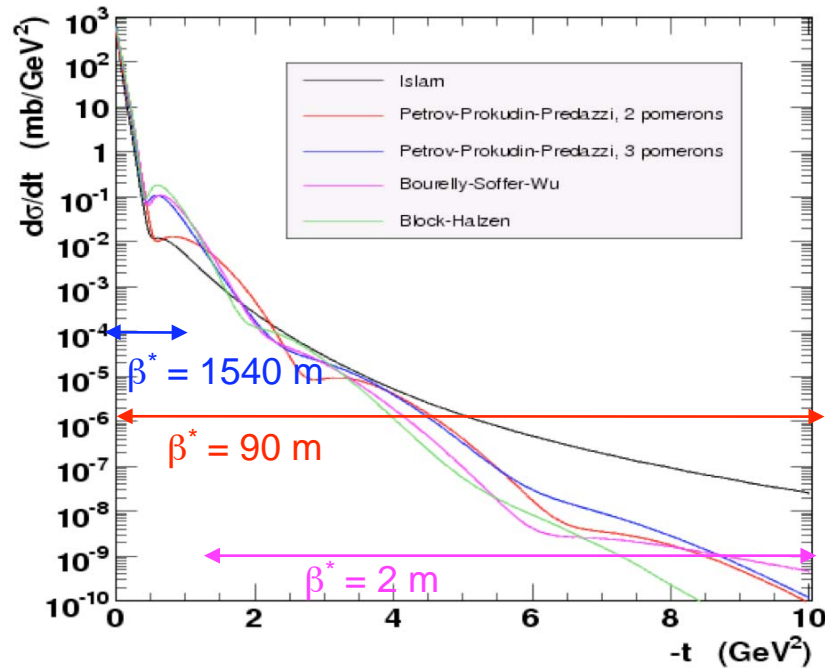
its transverse momentum  $t_y$  (high  $\beta^*$ )

its momentum loss  $\xi$  (low  $\beta^*$ )



# Early Physics (2)

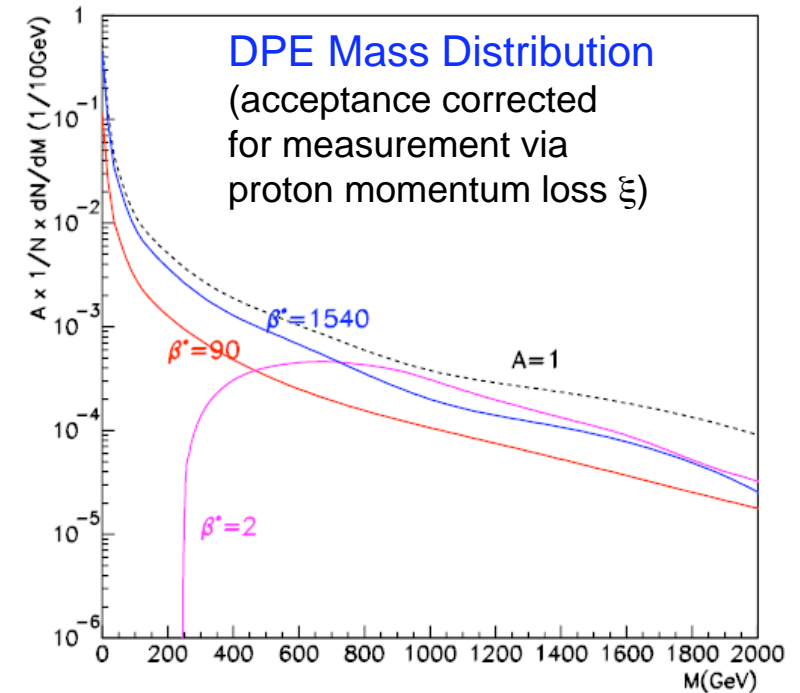
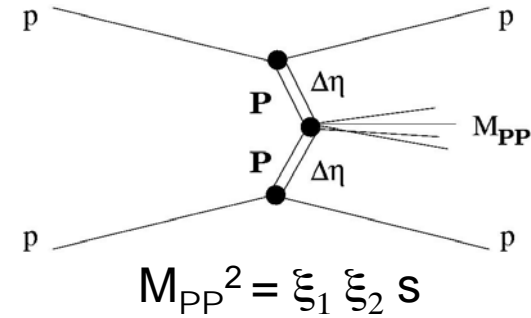
## Elastic Scattering



Statistics for 3 hours of running with  $\beta^* = 2$  m at  $L = 10^{32} \text{ cm}^{-2} \text{ s}^{-1}$  ( $\int L dt = 10 \text{ pb}^{-1}$ ):

- $10^6$  Events
- $60 \times 10^6$  DPE events within acceptance

## Central Diffraction (DPE)





## Summary

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- TOTEM has installed all Roman Pot (RP) stations in the LHC tunnel, at 147 m and 220 m.
  - 2 RPs have been equipped with Si detectors. These detectors need to be commissioned: cooling, motor control and interlocks together with CCC, DSC and DSS and readout.
  - 2 or 4 more RP detectors can be installed soon.
  - In the 2008/2009 shutdown all RP stations at 220 m will be equipped with detectors, at 147 m only some to learn more about background and radiation.
- TOTEM has installed 1/2 of a T2 telescope at one side of CMS, the second one could be installed soon.
  - In the 2008/2009 shutdown the complete T1 and T2 telescopes will be installed.