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CMS IRPC ASSEMBLY AND QUALITY CONTROL

A CERN SUMMER STUDENT JOURNEY

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WHAT CAN A SUMMER STUDENT CONTRIBUTE TO CERN?

HOW ABOUT BUILDING THE REAL DETECTORS AND PERFORM STRICT QUALITY CONTROL!!

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HL-LHC

HIGH LUMINOSITY LARGE HADRON COLLIDER

- 5 TIMES THE LUMINOSITY OF LHC

$$5 \times 10^{34} cm^{-2} s^{-1}$$

→

- MORE PARTICLES
- MORE BACKGROUND

→

- INNOVATIVE DETECTORS

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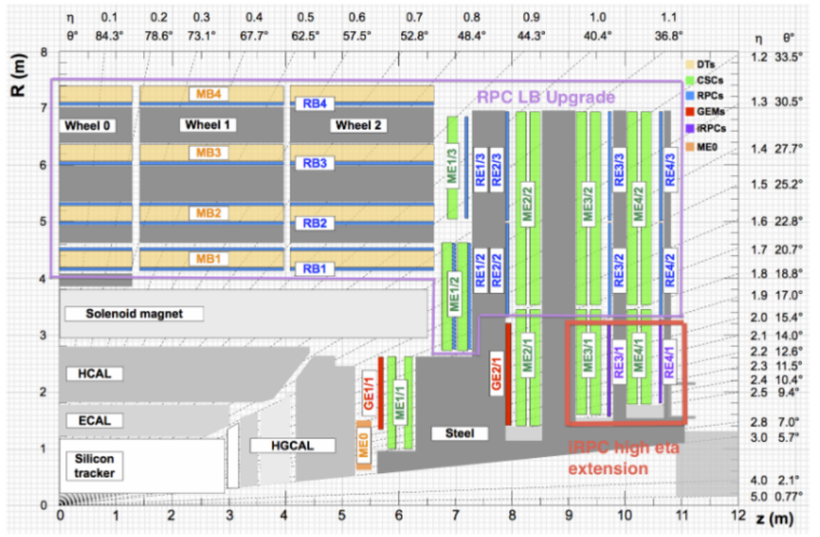
CMS iRPC

- Improved Resistive Plate Chambers
- Will be installed in the forward region of CMS
- Will operate in the HL-LHC

	iRPC	RPC
High Pressure Laminate thickness	1.4 mm	2 mm
Num. of Gas Gap	2	2
Gas Gap thickness	1.4 mm	2 mm
Resistivity (Ωcm)	0.9 - 3 x 10^{10}	1 - 6 x 10^{10}
Charge threshold	< 50 fC	150 fC
space resolution (eta)	1.5 cm	20-28 cm
space resolution (phi) strip pitch driven	0.3-0.6 cm	0.8-1.9 cm
Intrinsic time resolution	0.5 ns	1.5 ns



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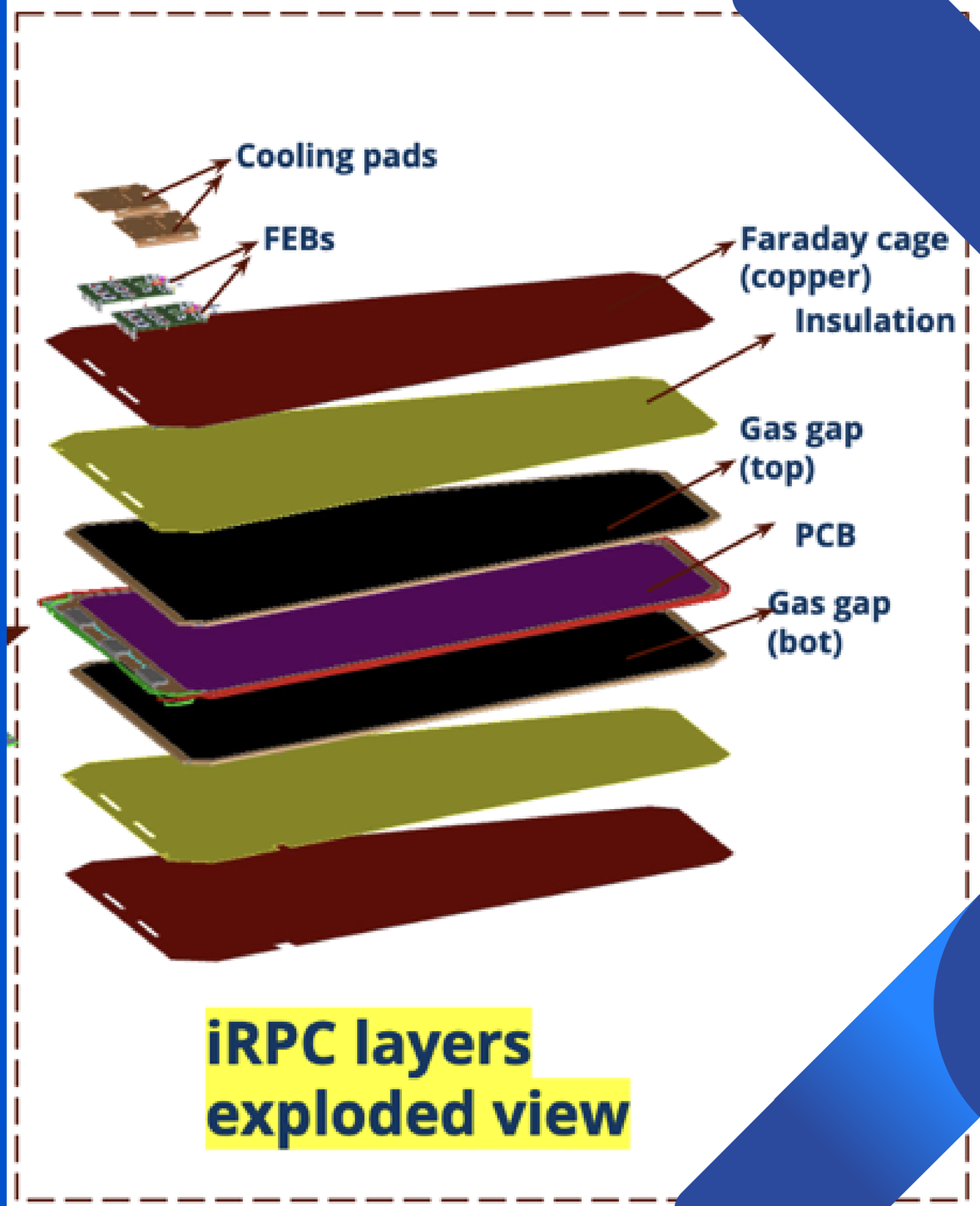
iRPCs Components

- **Mechanics:** Honycomb pannels, side bars, Al shapers
- **Double Gaps:** Very Large Capacitors with gas inside
  RPC --> 2.0 mm iRPC --> 1.4 mm
- **Faraday Cage:** Copper foils surround all iRPC components to isolate detectors. requires fine soldering on top of fragile gaps.
- **PCB Strip: 3 layer s**trip printed circuit board (PCB) collecting electrical signals from both gaps reading signals from 2 ends



iRPC layers exploded view

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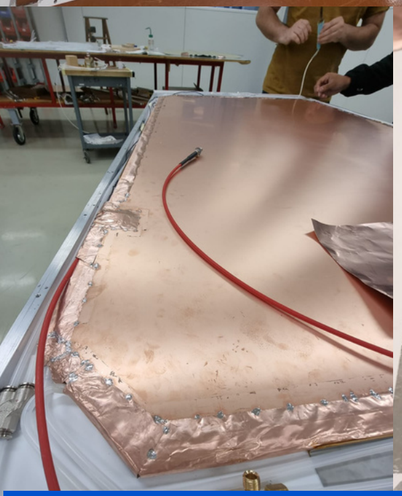
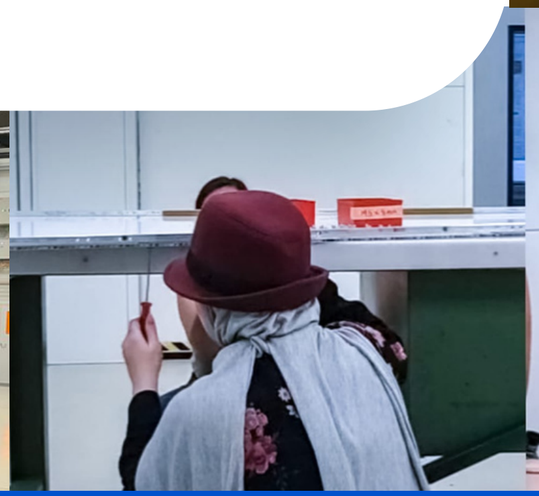
iRPC Chamber Assembly:

- Mechanics preparation
- Faraday Cage
- Gap handeling and preparation
- Gap electric connections
- Gas connections (LD PE and copper)





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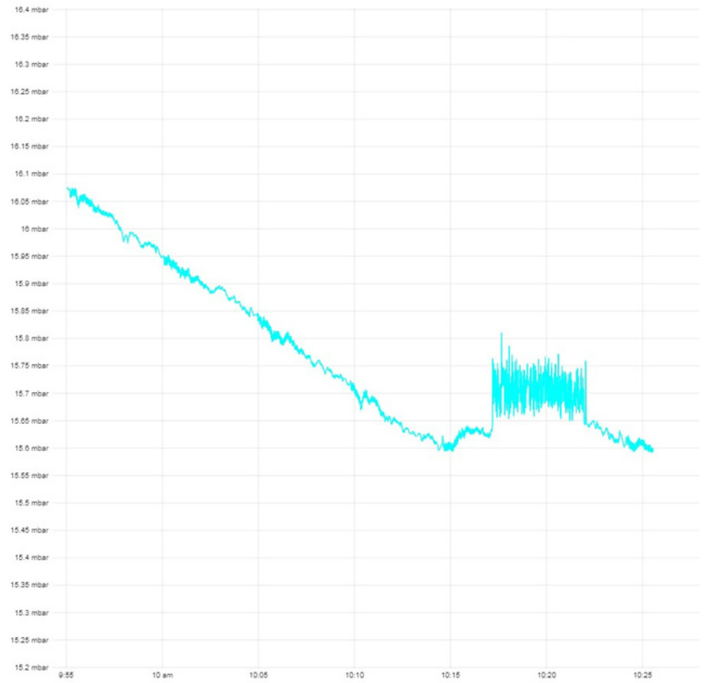
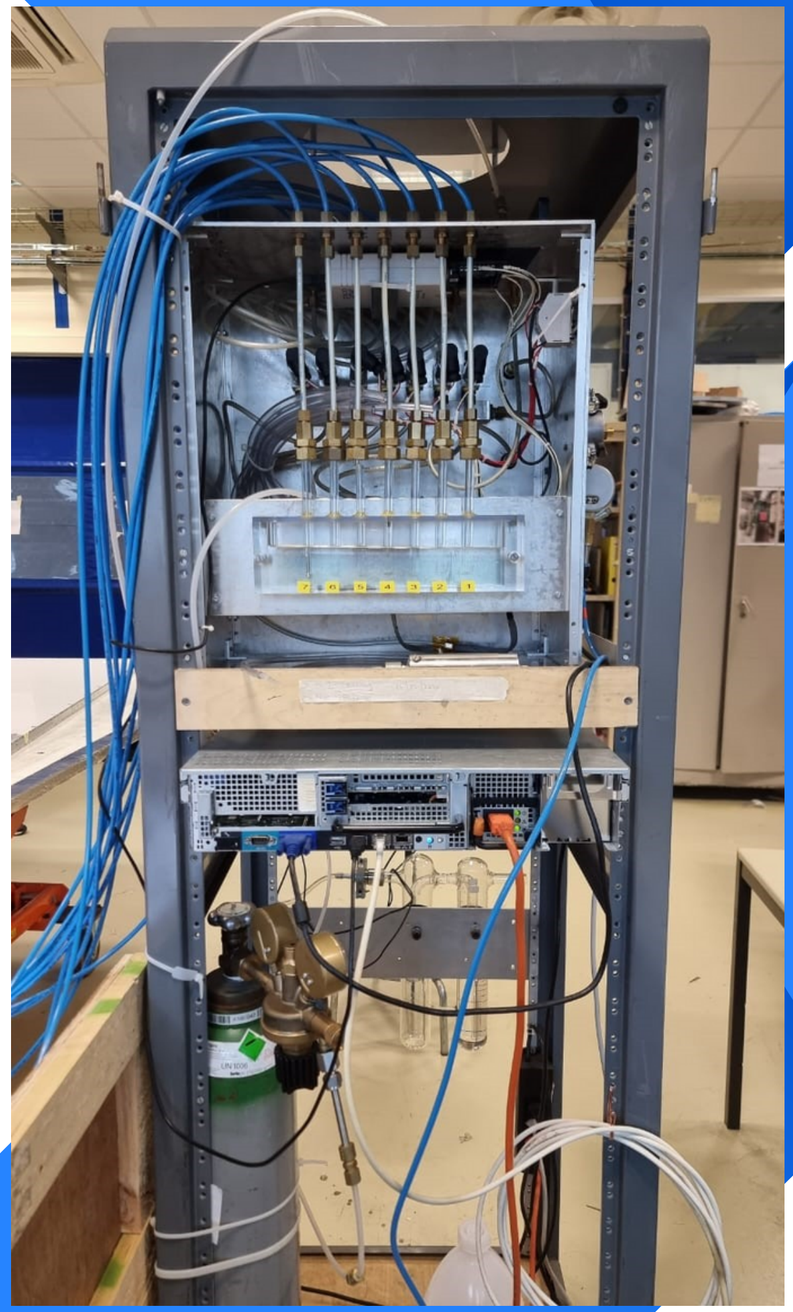
Gap/Chamber Quality Control

Gas Leak Test & Spacer bonding test for gas gaps



- Pressure 15 mBar (for gap)
- Pressure 5 mBar (for chamber)

- Max Accepted values: 0.4 mBar/10 min



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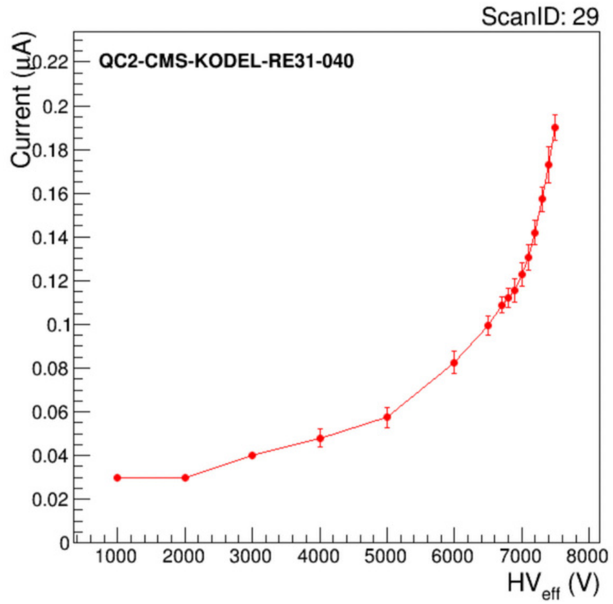
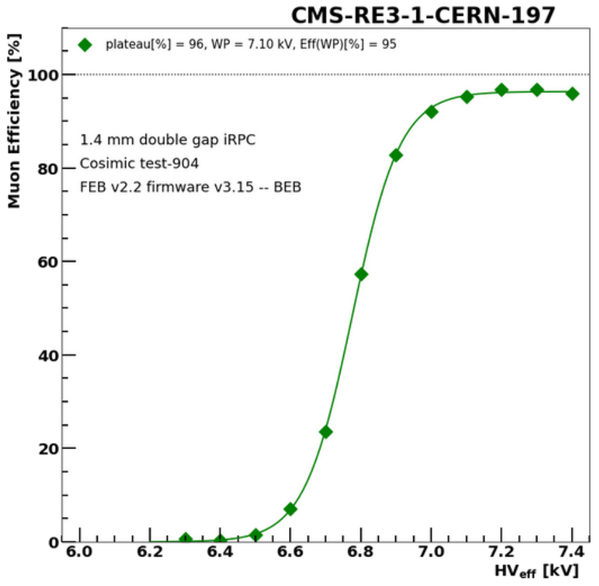
Gap/Chamber Quality Control

Dark Current Test

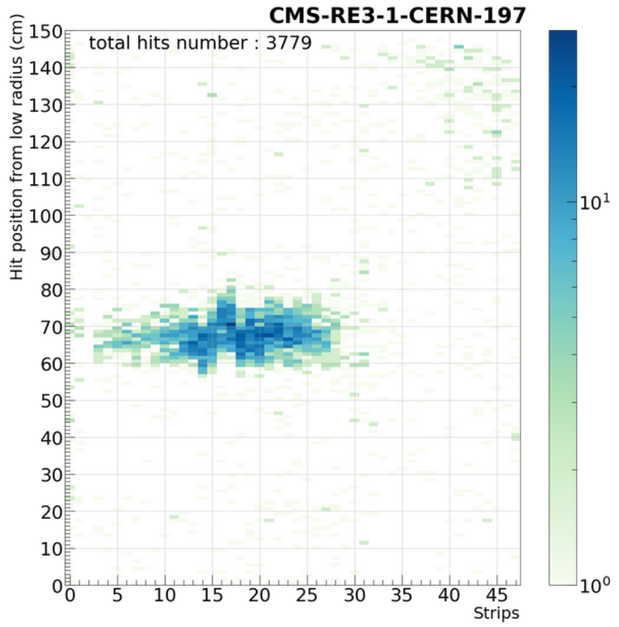


- Using a dedicated webDCS
- Tests done after keeping chamber one day under gas (standard gas mixture)
- Tests done for all gaps before and after the assembly.

Cosmic Data Taking



Efficiency Curve



The hit profile at 7.2 KV

Concluding Remarks

- Improved Resistive Plate Chambers provide improved spatial and temporal resolution suitable for the HL-LHC.
- iRPC Assembly is a delicate and precise process, coordinating multiple complex components simultaneously.
- iRPC Quality control tests are the key procedures at all stages of iRPC assembly.



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Thank You