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!!
INNOVATIVE DETECTORS

5 TIMES THE LUMINOSITY OF LHC

5 × 10^{34} \text{ cm}^{-2} \text{s}^{-1}

MORE PARTICLES

MORE BACKGROUND

INNOVATIVE DETECTORS

HL-LHC
HIGH LUMINOSITY LARGE HADRON COLLIDER

CMS RPC TEAM
CERN
CMS iRPC

Improved Resistive Plate Chambers

Will be installed in the forward region of CMS

Will operate in the HL-LHC

<table>
<thead>
<tr>
<th></th>
<th>iRPC</th>
<th>RPC</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Pressure Laminate thickness</td>
<td>1.4 mm</td>
<td>2 mm</td>
</tr>
<tr>
<td>Num. of Gas Gap</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Gas Gap thickness</td>
<td>1.4 mm</td>
<td>2 mm</td>
</tr>
<tr>
<td>Resistivity (Ωcm)</td>
<td>0.9 - 3 x 10^{10}</td>
<td>1 - 6 x 10^{10}</td>
</tr>
<tr>
<td>Charge threshold</td>
<td>&lt; 50 fC</td>
<td>150 fC</td>
</tr>
<tr>
<td>space resolution (eta)</td>
<td>1.5 cm</td>
<td>20-28 cm</td>
</tr>
<tr>
<td>space resolution (phi) strip pitch driven</td>
<td>0.3-0.6 cm</td>
<td>0.8-1.9 cm</td>
</tr>
<tr>
<td>Intrinsic time resolution</td>
<td>0.5 ns</td>
<td>1.5 ns</td>
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</tbody>
</table>
**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 strip printed circuit board (PCB) collecting electrical signals from both gaps reading signals from 2 ends
iRPC Chamber Assembly:

- Mechanics preparation
- Faraday Cage
- Gap handling and preparation
- Gap electric connections
- Gas connections (LD PE and copper)
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
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.
Thank You