

RPC assembling facility in J-PARC



2023 in France

Natsuki TOMIDA
SACRA, Kyoto University



2025 in Japan

Maxime Gouzevitch
IP2I, Lyon

2026/5/19

Hamamatsu

Joint Workshop of TYL/FJPPN and FKPPN 2026

Structure



France: IP2I, LPCA

FKPPN

CMS-RPC

CMS iRPC (2017-2022)



RPCGAP

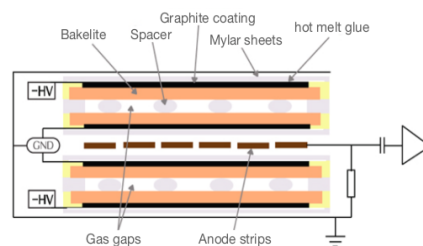
COMET iRPC (2025-)

May/19 11:35-
Tae Jeong Kim
(parallel b)

Korea: Hanyang Univ.,
Sungkyunkwan Univ.

Technology
transfer
Production

RPC



J-PARC



FJPPN
D_RD_30

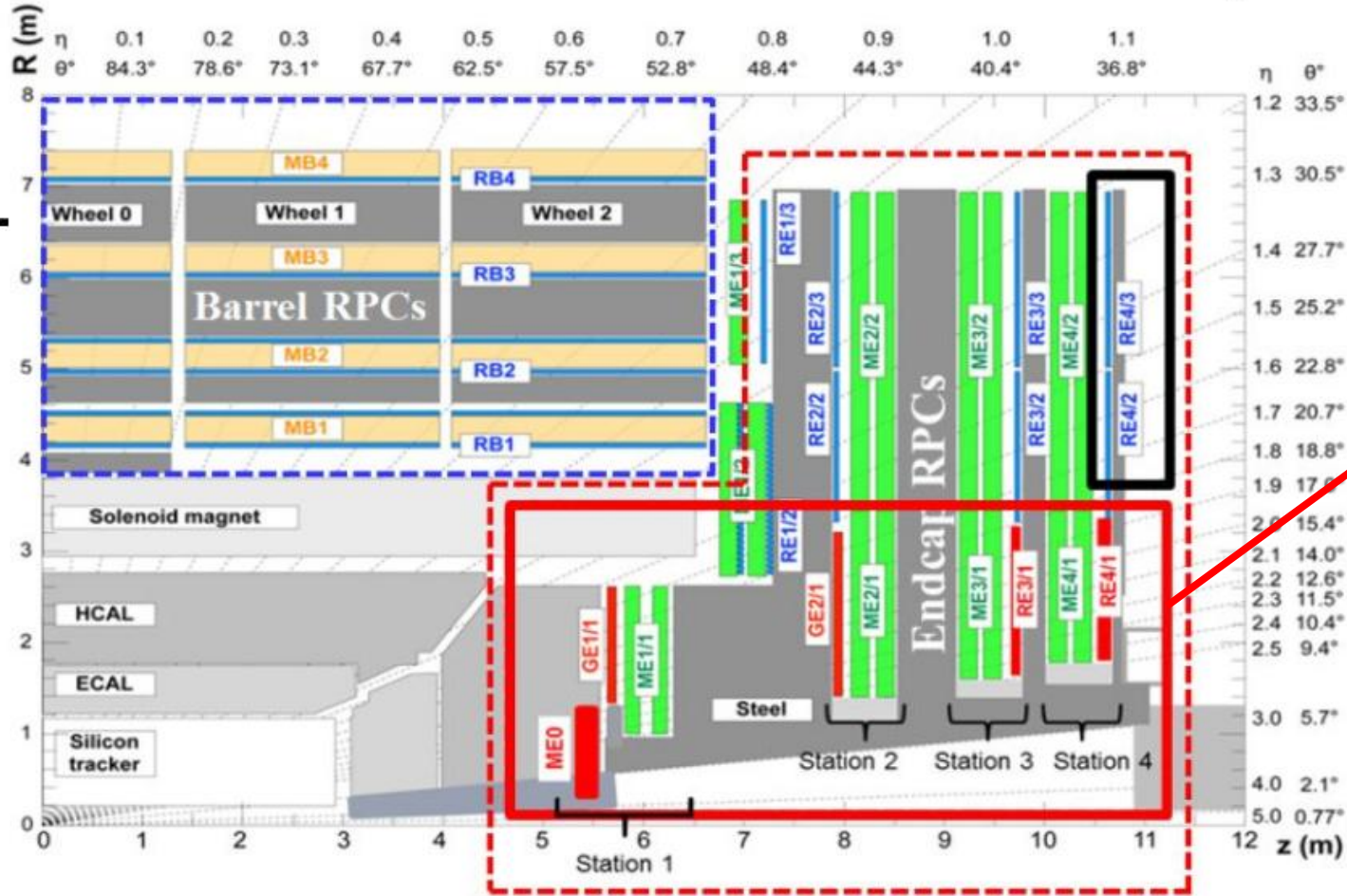
MARQ MRPC (2023-)

+ E88&E95 MRPC,
COMET iRPC (2025-)

Japan: Kyoto Univ.,
KEK, Sokendai, JAEA

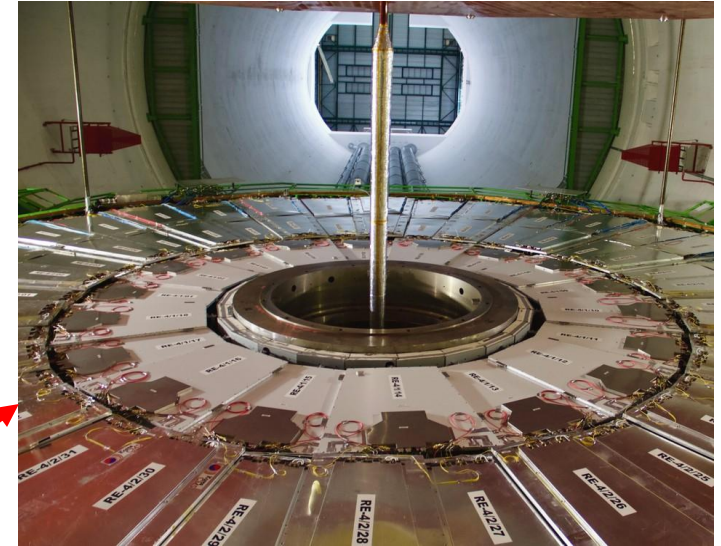
CMS iRPC

- improved RPC detector in Endcap for HL-LHC



[More details](#)

IRPC station

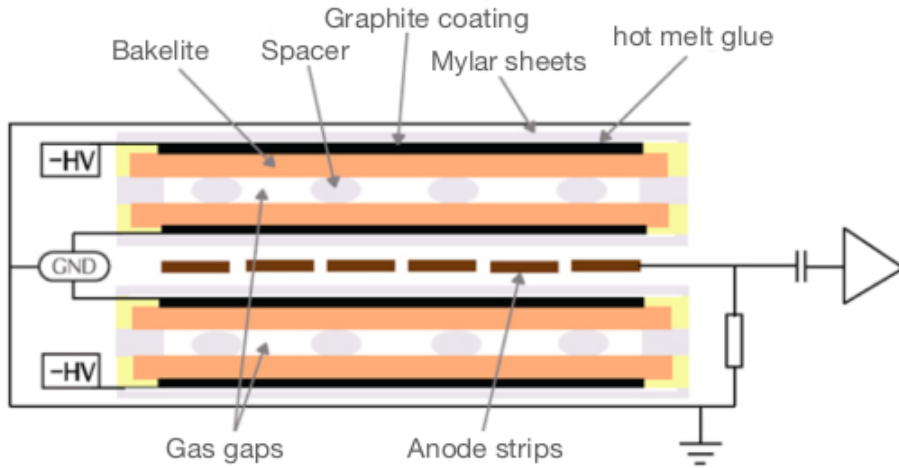


Installation



CMS iRPC

- Double gap RPC (Resistive Plate Chamber)

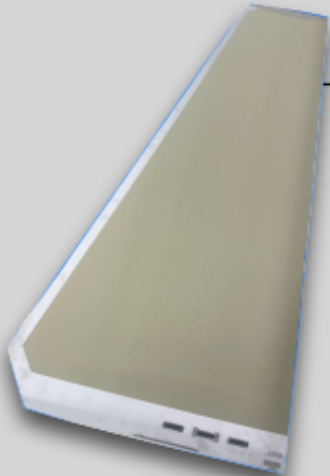
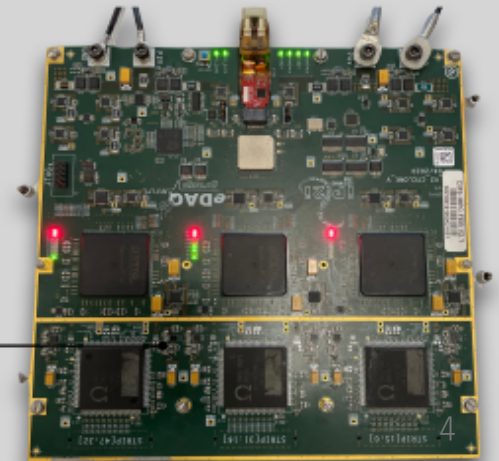


Figures from Ece Asilar in RPC2024

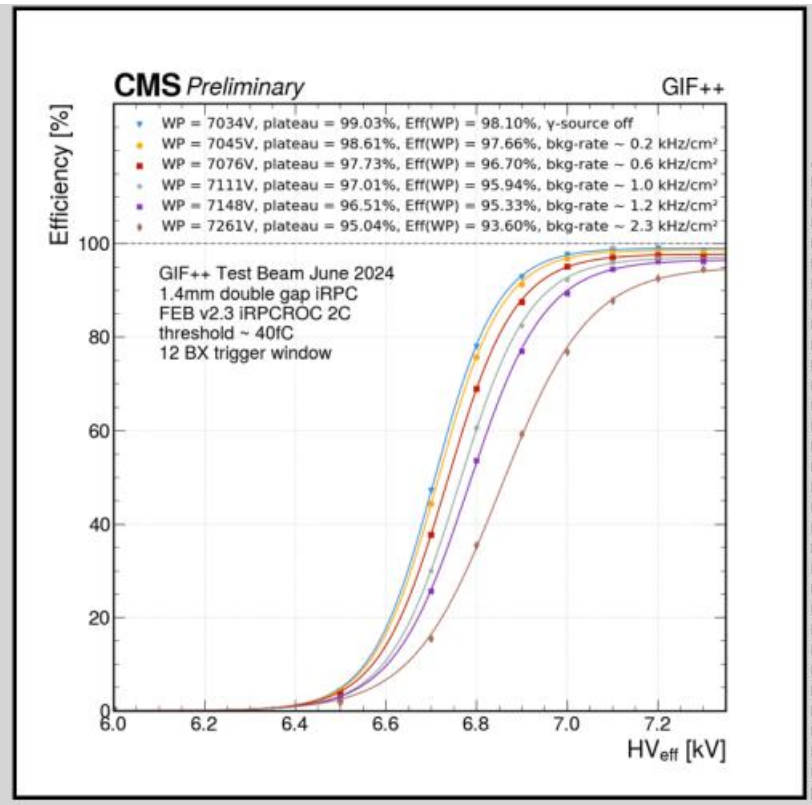
☀ **Bakelite :**
Long lasting, not fragile, can be very large in size, easy to handle.
Allow use of flex piping, without a necessity of very well control of humidity.

☀ **PCB :**
A quite large solution (60 x 170 cm²) and resistant.
2D readout without multi layer strip. No XY ambiguities.
Perfect impedance matching (better than 5%).

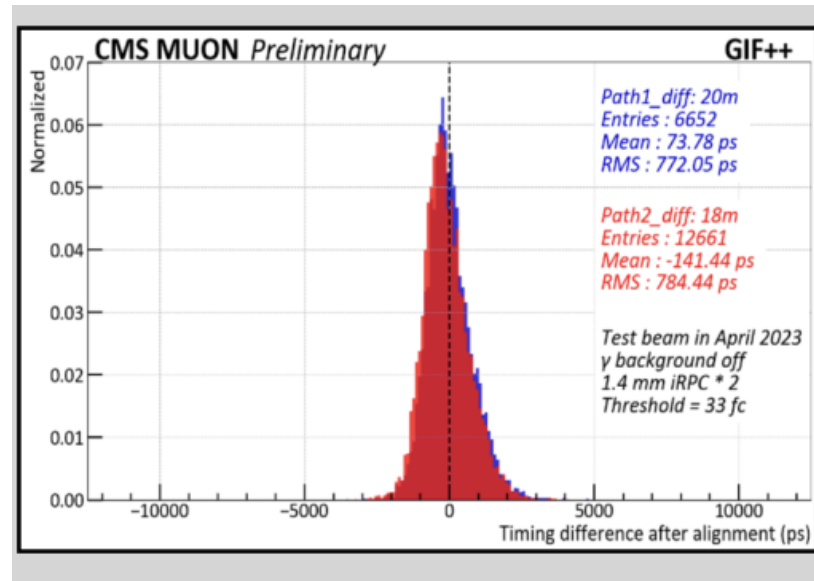
☀ **FEB :**
FEB and PCB shape can be flexible. Easy to plug.
Design is open to changes at component level



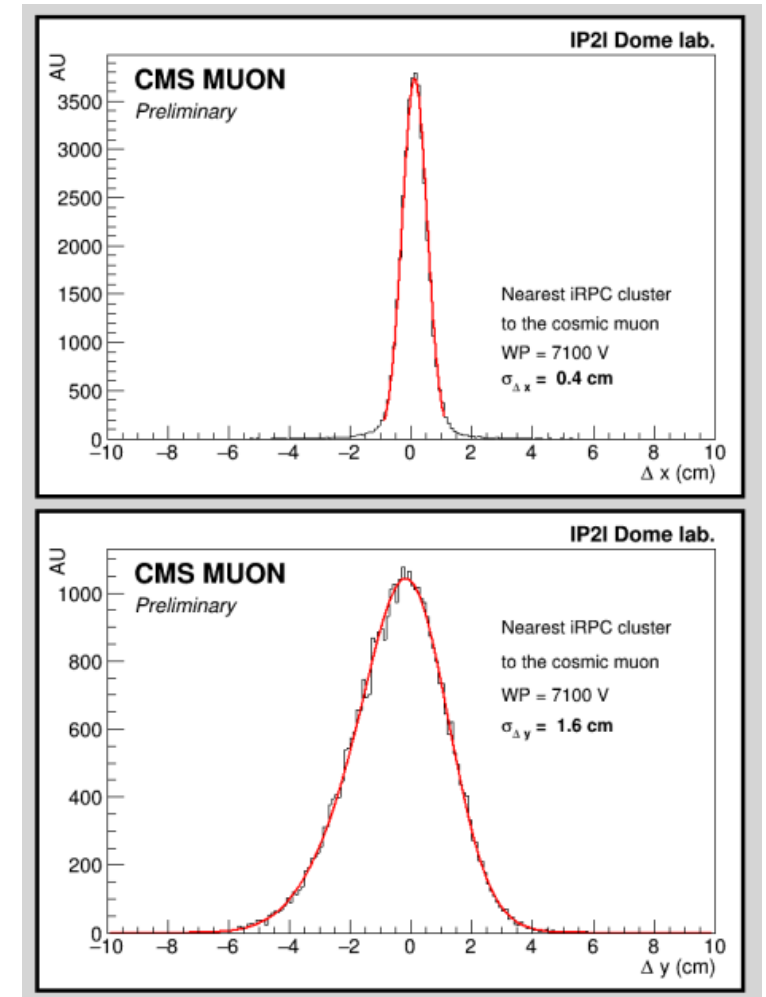
CMS iRPC performance



High efficiency for high background rate



Ece Asilar in RPC2024



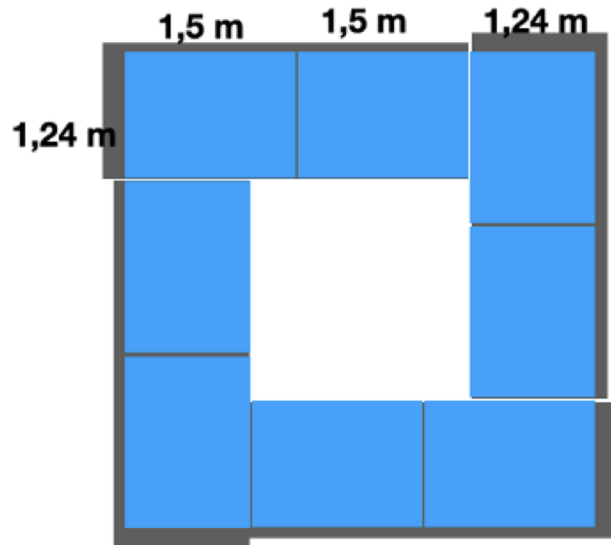
Good time resolution (550 ps),
Good position resolution ($x=0.4$ cm, $y=1.6$ cm)

COMET

- COherent Muon to Electron Transition
- $\mu \rightarrow e$ conversion search in muonic atoms at J-PARC : $\mu^- + N(A,Z) \rightarrow e^- + N(A,Z)$
- Beyond Standard Model

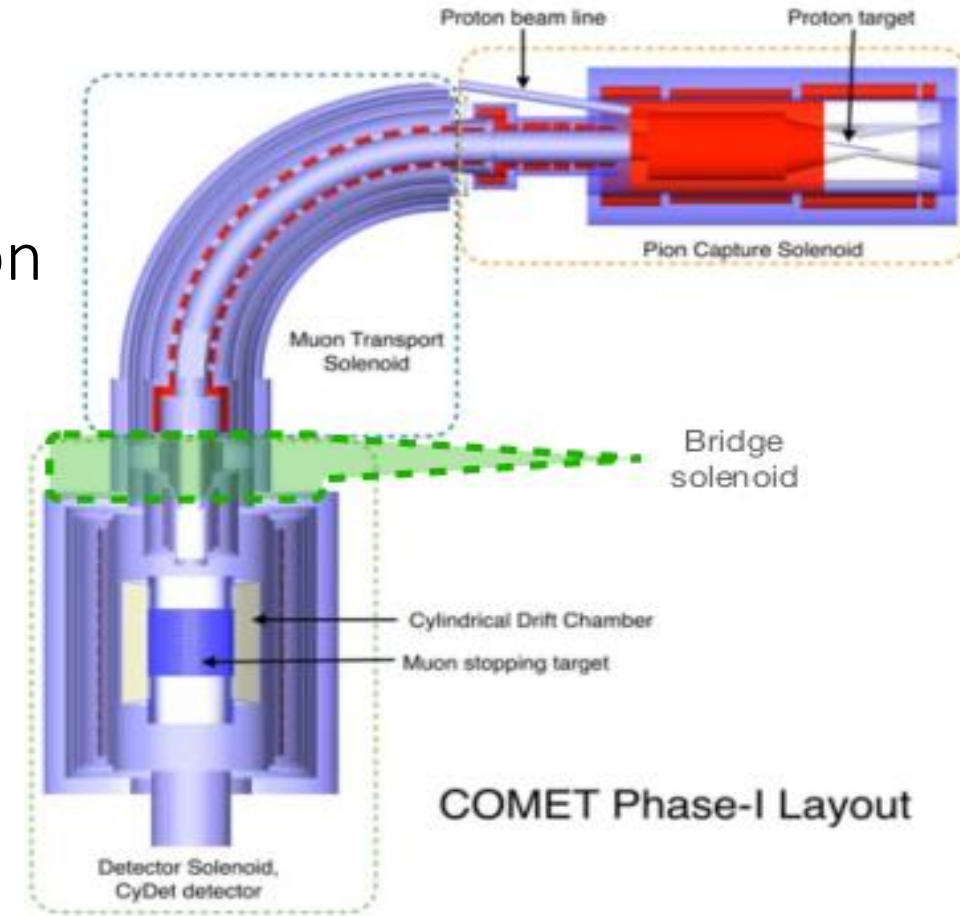
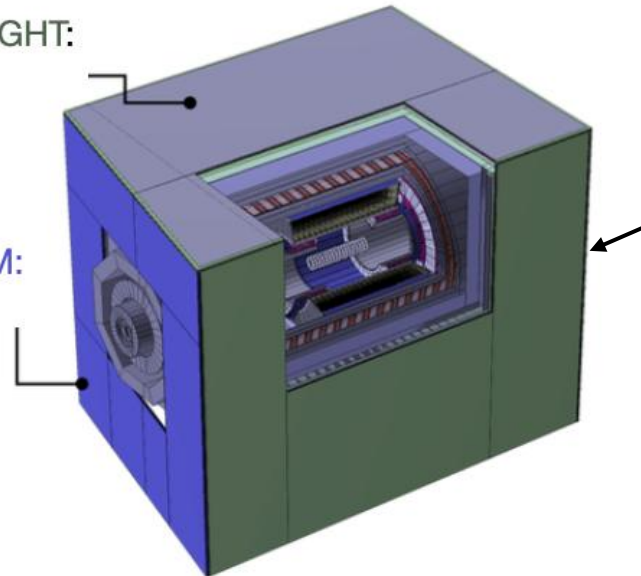
iRPC for cosmic ray veto

- Thin
- High-rate capability
- Good time resolution



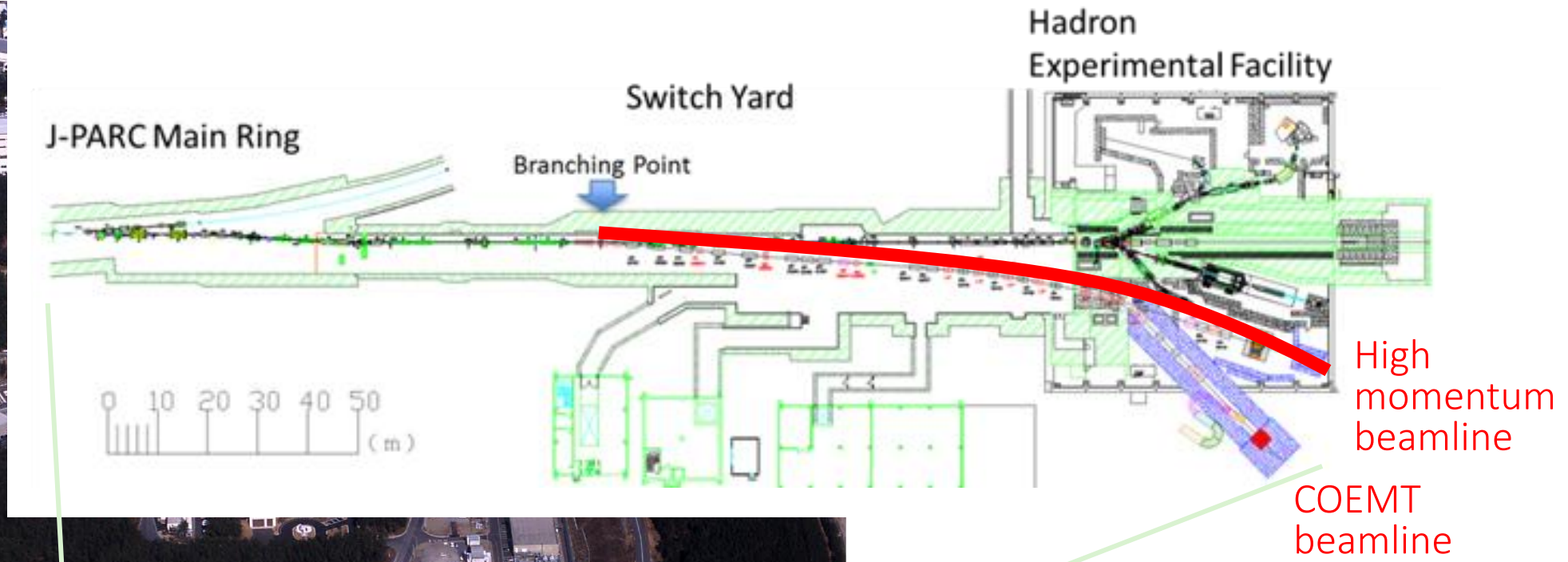
TOP, LEFT, RIGHT:
Scintillators

UPSTREAM:
□ RPCs



COMET Phase-I Layout

Experiments at the new high momentum beamline



- 30 GeV primary beam
 - 2020 first delivery
 - 2025 first physics run
- 2-20 GeV/c secondary beam ($\pi/K/p/\mu$)
 - 2025 first delivery

Physics program @ J-PARC high momentum beamline

Primary beam

- **Meson mass modification in nuclei**

- $\phi \rightarrow KK$ (E88)

- **Pentaquark search**

- $\pi^- p \rightarrow \phi n$ (E95)

Secondary beam

E16 spectrometer (for e^+e^-) +
Multigap RPC (K^+K^- TOF ID)

MARQ spectrometer
(Multigap RPC for PID)

Secondary beam

- **Hadron structure**

- Charmed baryon spectroscopy
- Ξ ($s=-2$) baryon spectroscopy

- **Exotic hadrons**

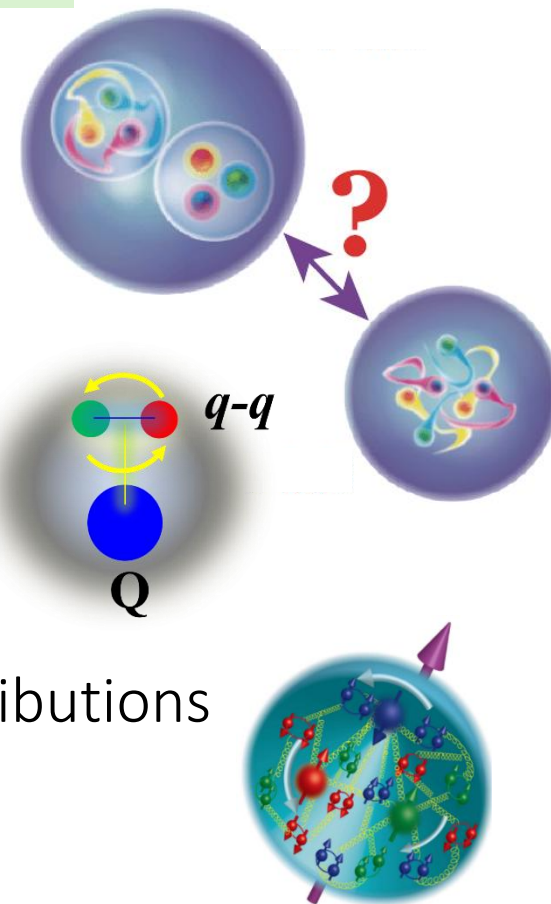
- High isospin dibaryon search
- Pentaquark search

- **Nucleon structure**

- Measurement of 3D parton distributions
- Color Transparency

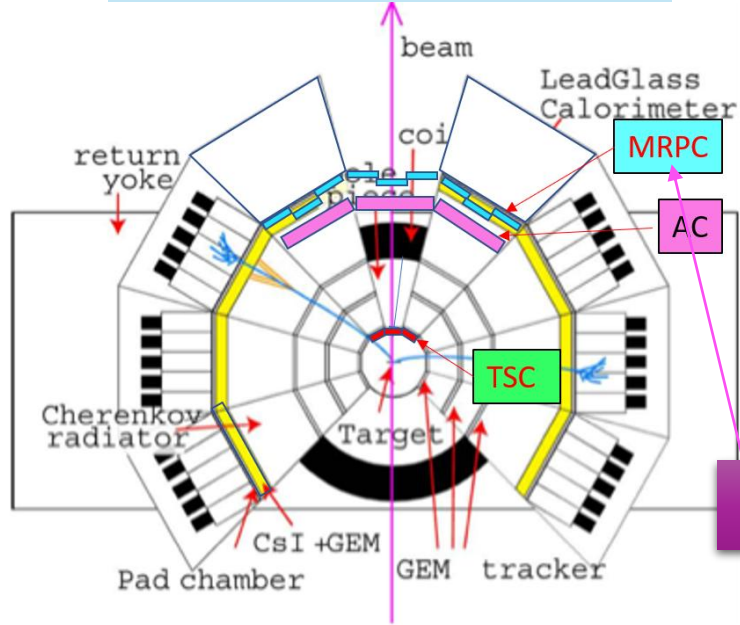
- **Elementary cross sections**

- Λp scattering cross section
- Hadronic cross sections for neutrino experiments



RPCs for J-PARC high momentum beamline

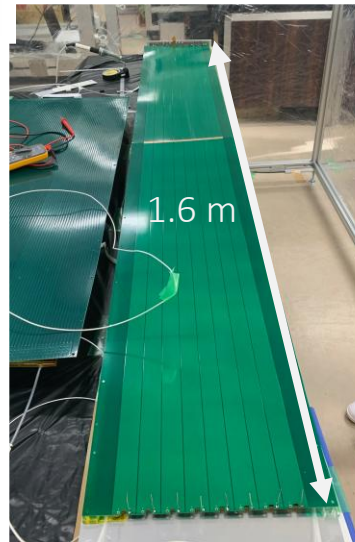
E16 spectrometer



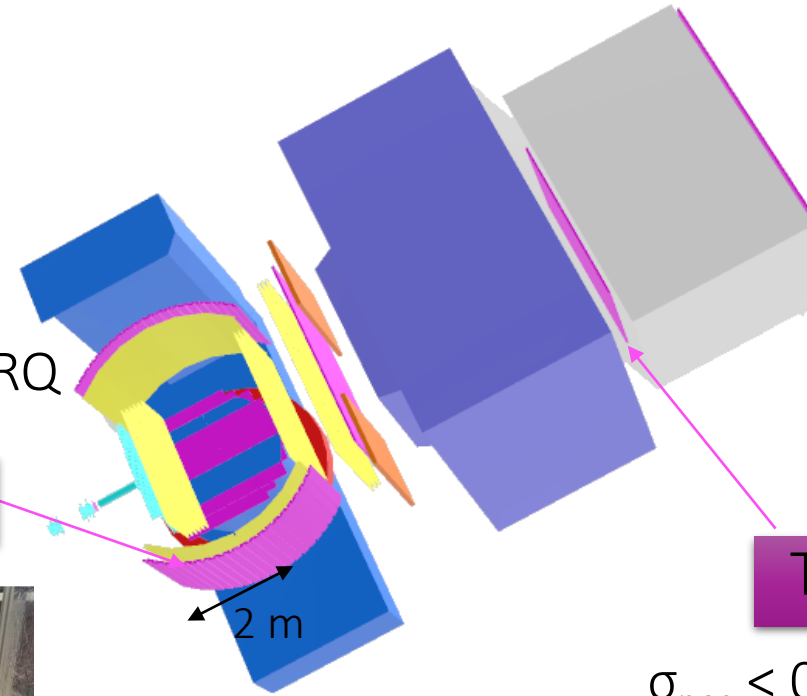
E88/E95/MARQ
Common
TOF MRPC

$$\sigma_{\text{time}} = 60 \text{ ps}$$

N. Tomida et al.,
NIM A 1056 (2023) 168581



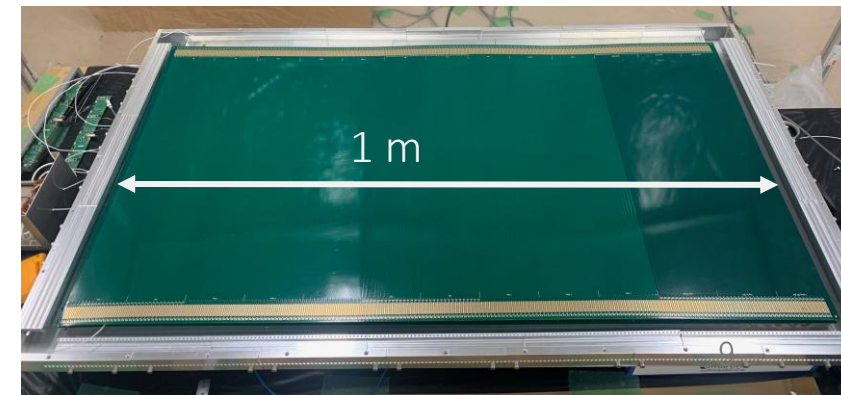
MARQ spectrometer



N. Tomida et al.,
NIM A 1077 (2025) 170517
R. Uda et al.,
NIM A 1056 (2023) 168580

Tracker MRPC

$$\sigma_{\text{pos}} < 0.8 \text{ mm}, \sigma_{\text{time}} = 70 \text{ ps}$$



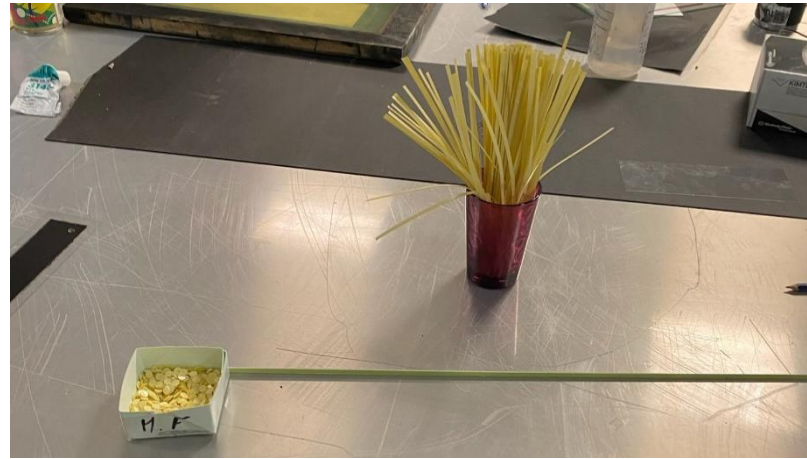
- 5 gap × 2
- glass
- Detector design almost finalized
- FEE tests

Technology transfer : France -> Japan

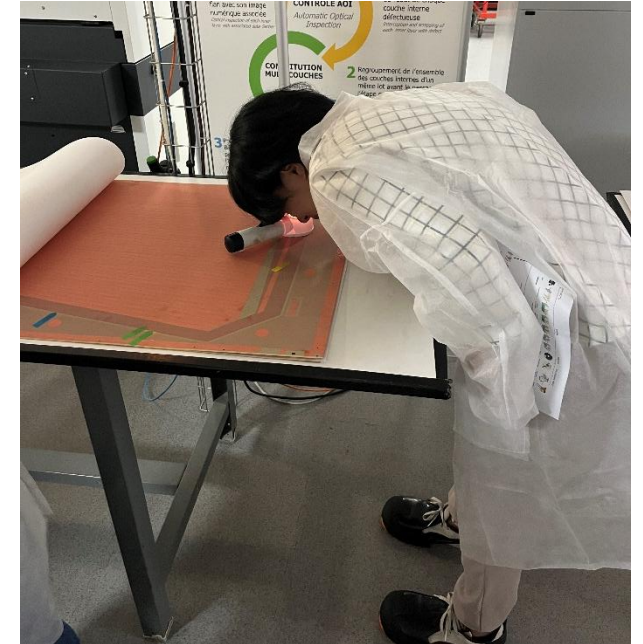
Gas tight



Hand made gas spacer



Readout strip (PCB)

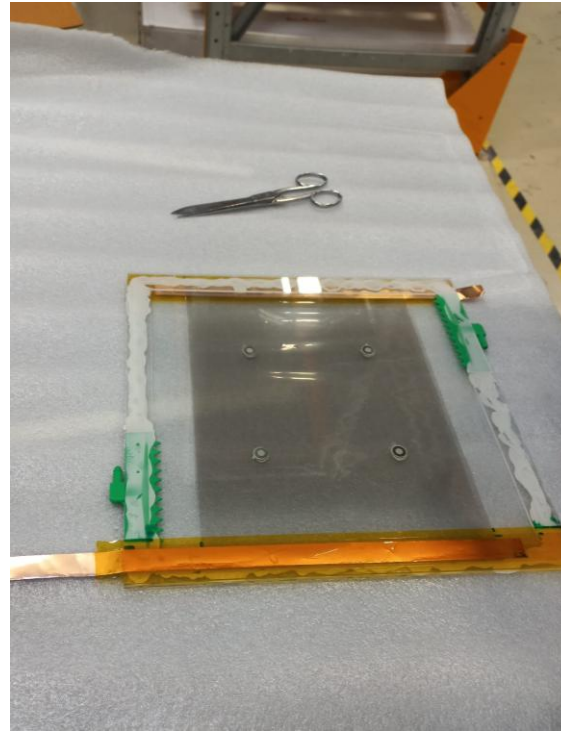


HV electrode paint

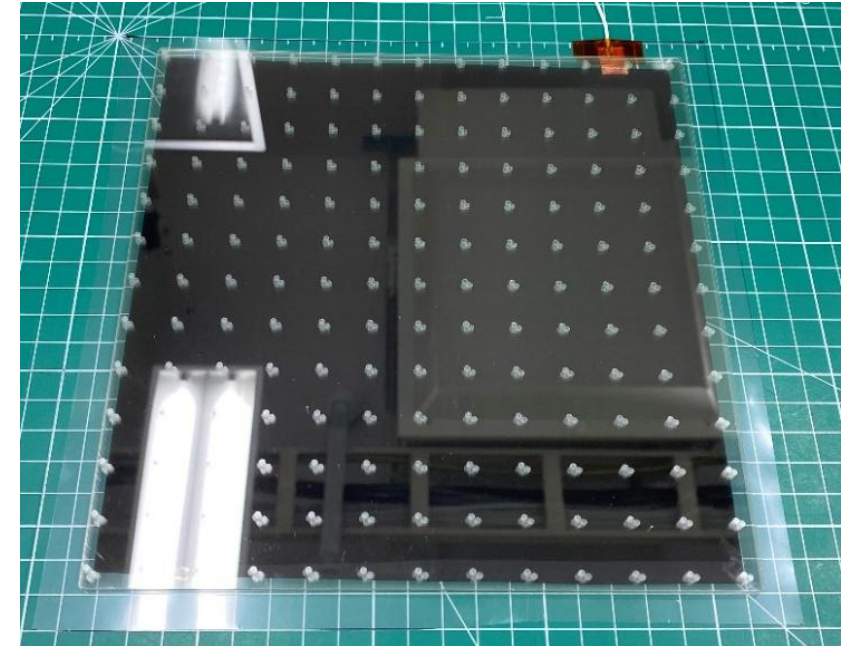


Technology transfer : Japan → France

Transparent HV electrode



Seal gas spacer



Not written in literature

Face-to-face communication with actual system/material

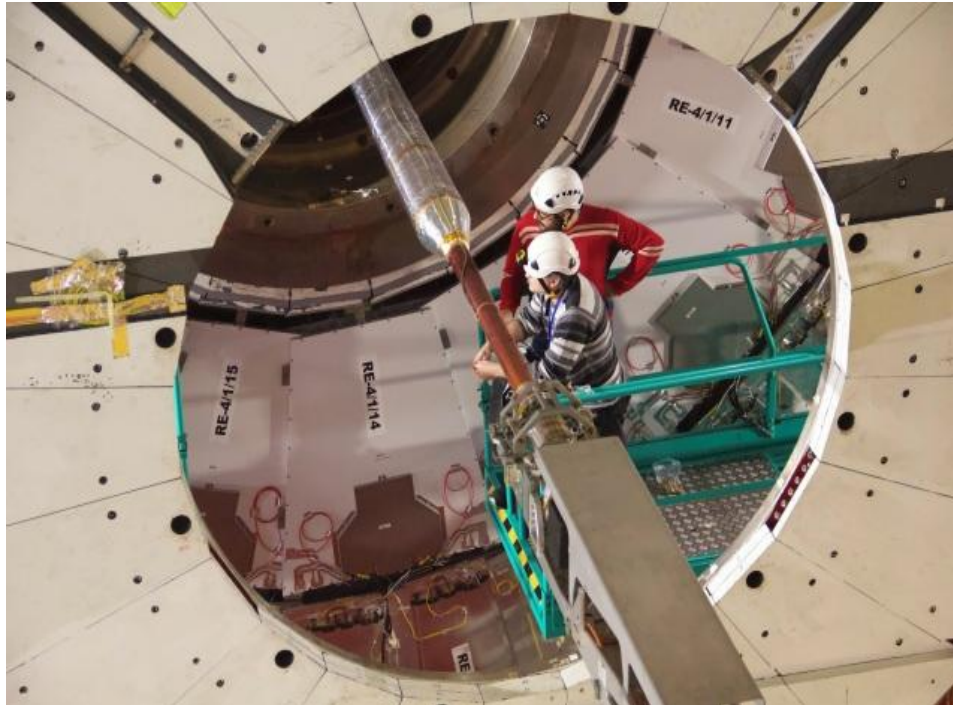
Realized thanks to FJPPN !!

Activities in 2025



iRPC chamber production

- Winter 2024-2025: Installation of 50% of the iRPC chambers in CMS
- Apr. 2025: end of the production of iRPC chambers in CMS including demonstrator chambers for COMET experiment.
- 87 chambers available while 80 required for CMS.
- 2025-2026: massive campaign of test beams of iRPC chambers



R&D for COMET

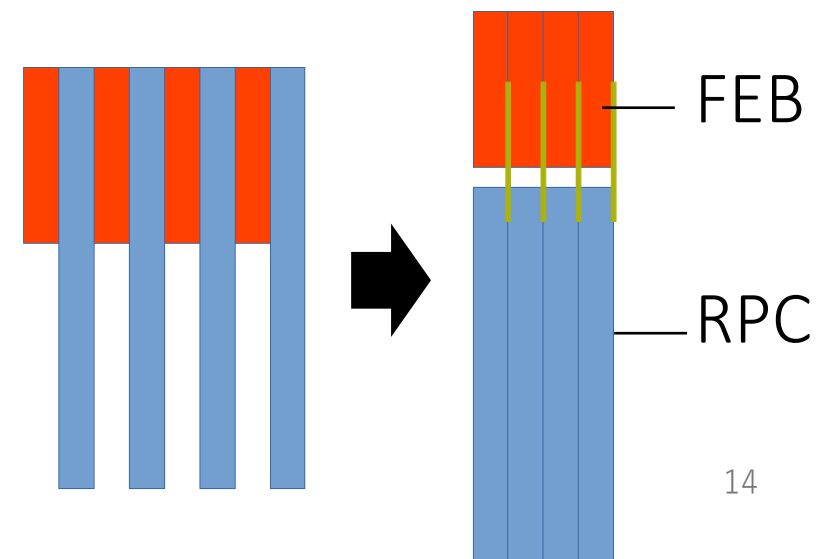
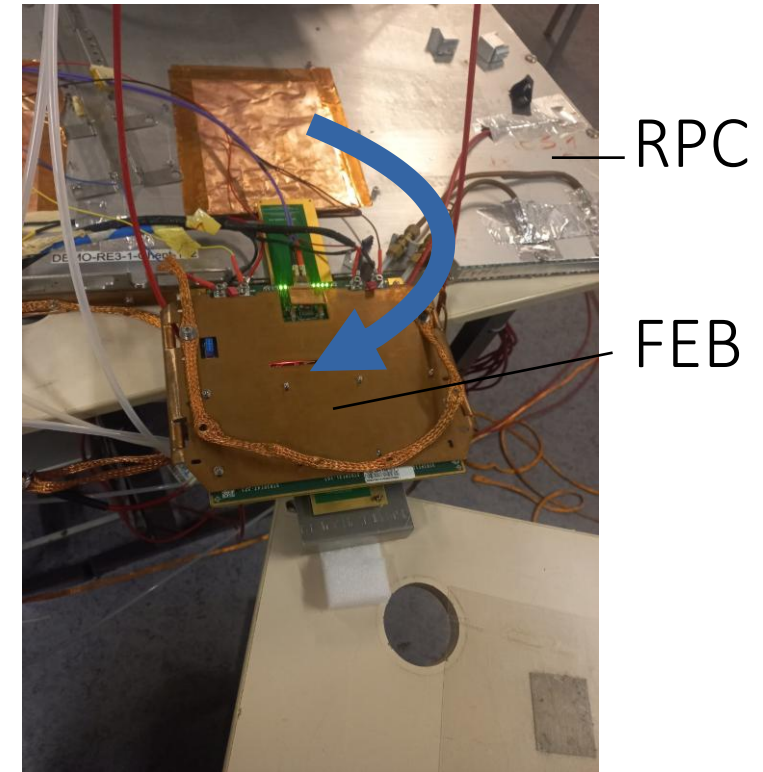
- Readout extensions for the iRPC chambers.

Question1: the region between the wall and COMET experiment is very narrow (~30 cm) and we need to position 4-5 chambers to maximize detection efficiency.

To reduce chambers thickness we need to move the FEB outside of the chamber footprint.

Idea: use shielded PCB extensions.

Test: we verified that extensions doesn't add any extra noise.



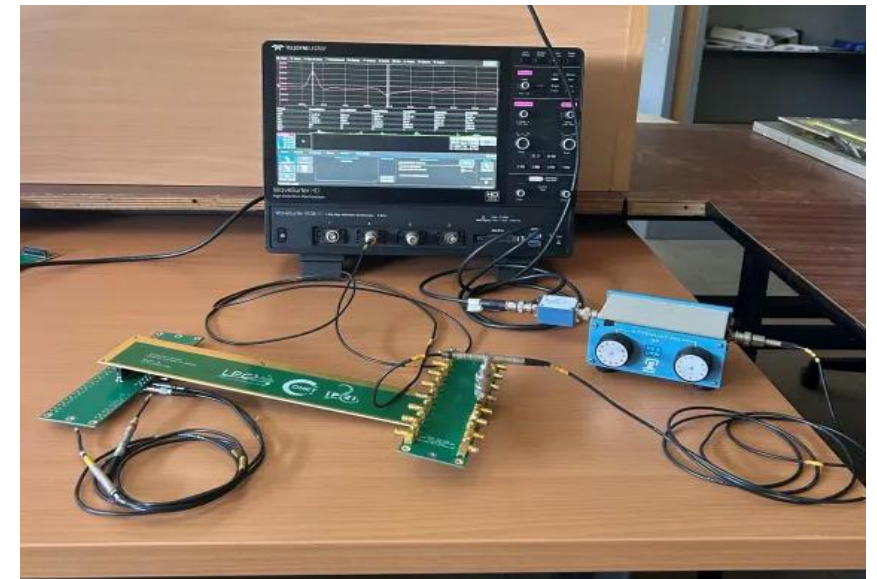
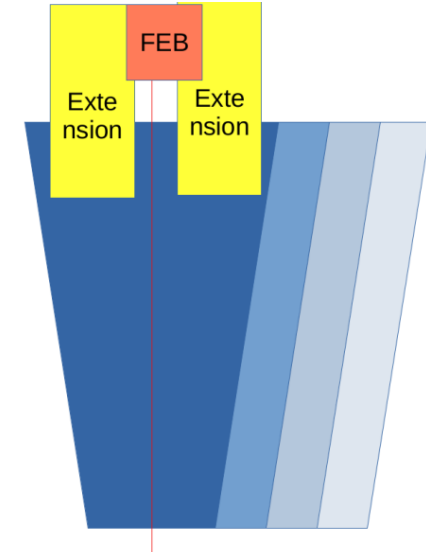
R&D for COMET

- Readout extensions for the iRPC chambers.

Question2: the iRPC electronics is expensive. Can we merge strips by pairs to save channels. And if in future we have a cheaper electronics we connect it without merging.

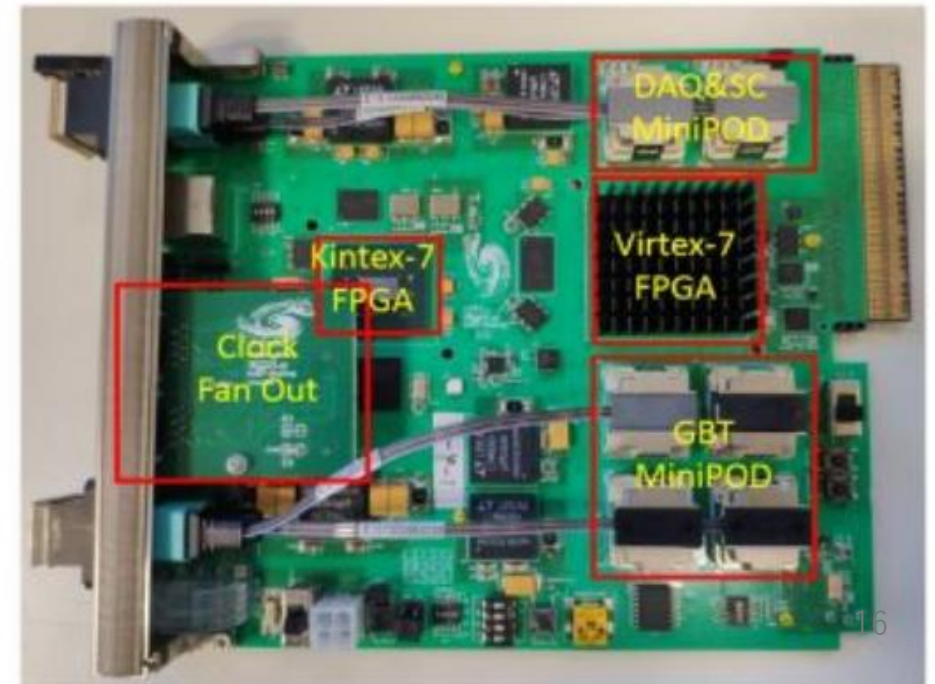
Idea: use shielded PCB merging 2 strips to 1. Work with impedance matching. Not a simple problem. Splitting signal is easy, merging much more complicated.

Test: verify that we don't lose or multiply signal by reflections. Measure the efficiency with a real chamber.



Preparation of COMET iRPC demonstrator

- Dec. - April 2026: preparation and test beams of 4 iRPC chambers to be shipped to Japan in July 2026 for the commissioning and low intensity run.
- Dec. 2025: trip of Maxime Gouzevitch to IHEP, Beijing to agree on the loan of a Back-End-Board similar to the one used in CMS to read the 4 iRPC chambers.



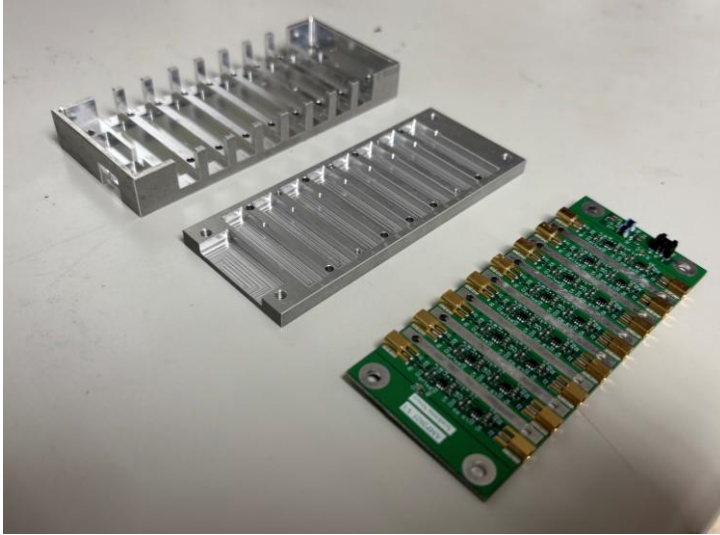
E88/E95/MARQ Multigap RPC

- Evaluation of preamp, discriminator with MRPC using beams @ LEPS2

Pre-amp

Satisfied requirements

→ Start mass production



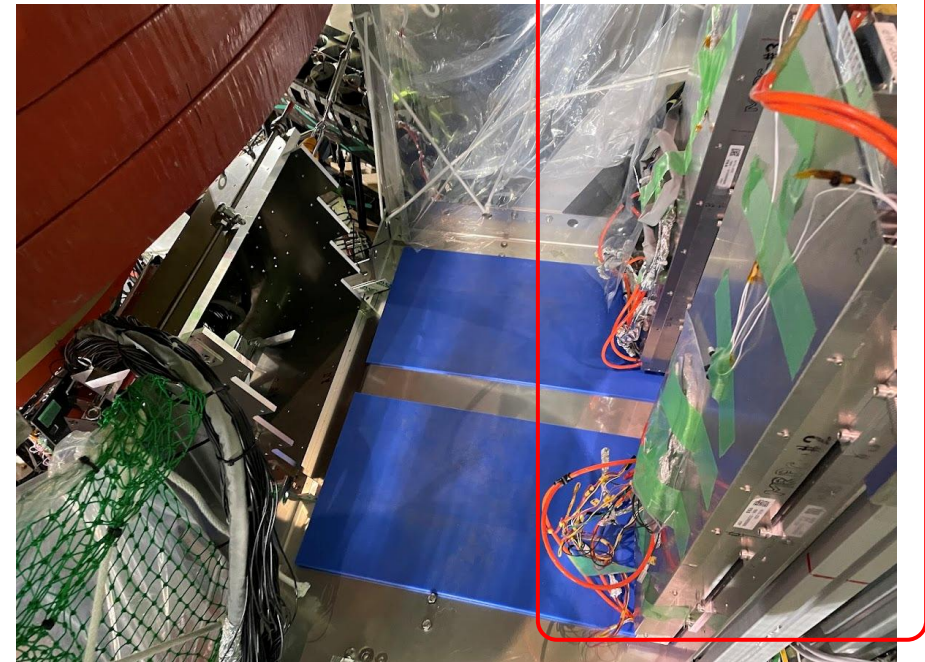
Discriminator

→ Small modification needed to deal with narrow signals of tracker MRPC



- Installation of 2 prototype modules to the E16 spectrometer

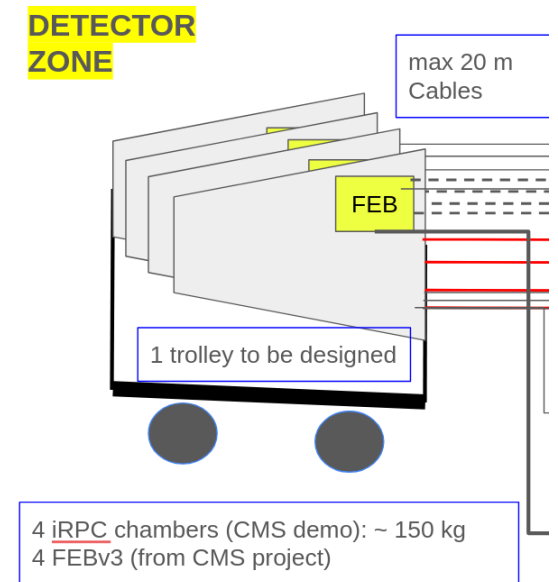
2026/4 commissioning postponed (fire accident)



Plan for 2026

2026

- Start assembling of RPCs for both COMET and E88/E95/MARQ @ J-PARC
 - July 2026: Shipment of 4 iRPC chambers to J-PARC.
 - August 2026: Visit of Maxime Gouzevitch to Japan to prepare the COMET integration run and supervise the organization of the RPC assembly lab for COMET and MARQ. **Common gas/HV/CR test bench**
 - Oct.-Nov. 2026: New visit of Maxime Gouzevitch to Japan to work on the RPC assembly lab and low intensity run preparation – foreseen in
- Join iRPC aging tests (and installation) @ CERN
 - Natsuki TOMIDA visits Lyon & CERN
- RPC2026 conference @ Rio de Janeiro
 - the results of development of the extension and merging board of iRPC for COMET
 - Publish the legacy iRPC results based on test beam
 - E88/E95/MARQ MRPC FEE & performance



RPC 2026
RIO DE JANEIRO

About For Author Registration Program Sponsorship Destination Outreach

Contact

XVIII Conference on Resistive Plate Chambers and Related Detectors

RPC 2026
September 14 - 18
Rio de Janeiro, Brazil

Summary

- Development of RPCs for COMET and the high momentum beamline experiments (E88/E95/MARQ) in J-PARC
- A triangle project between France-Japan-Korea
- Technology transfer thanks to FJPPN → Detector design fixed
- 2025 : R&D of iRPC for COMET
FEE tests of MRPC for E88/E95/MARQ
- 2026 : Start assembling of RPCs for COMET/E88/E95/MARQ at J-PARC

Members

France

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(KEK)
(COMET)