Task 13.4.6
Preparation for large series production: production protocols of optimised RPC components for easy technology dissemination

G. Pugliese

Past experience

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Scientific applications:
RPCs used in most of LHC experiments as well as in Cosmic Rays (Argo), underground (Opera) experiments and for time of flight measurements (Alice, Hades, Fopi).

The joint effort from research and industry was crucial in order to build up these large area detectors.

Two examples:

1. **Resistive electrodes:** there was no industrial material qualified with the needed resistivity. A lot of work done to adapt the standard production to our needs.
2. **Gas mixer**: the good gas candidate for the standard RPC gas mixture was found in the refrigeration industry (first the CF3Br then the C2H2F4). Now we have to replace C2H2F4 and the Tetra-fluoropropene seams the new gas industrially candidate.

What next

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Scientific Applications
HL – LHC
ILC
CBM

OtherApplications:
Muon tomography for inspection systems (trucks, containers, trains) for heavy materials (guns, fissile materials)
PET
Volcano radiography with cosmic-ray muons

Each application implies specific requirements

However they have in common:

1. **Development of production protocols of optimised RPC components for an easy construction**
2. **Quality controls and assurance needed to guarantee high quality and stability of the production.**

Technological activity (1)

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1. **Production protocols of optimized RPC components for easy technology dissemination:**
   - Standardized production of each components
     - **Electrode:** the Bakelite and glass (or others) production should be standardized keeping high level of quality and with technical specification satisfying the specifiations (see value resistivity).
   - Detector construction simplification:
     - New coating → Bari – Roma
     - Spacers gluing → Bari – Roma
     - Improved Gas distribution → LYON
     - Microstrip → LIP
   - Develop of engineering design and protocols suitable for standards large-scale production → LYON - Mun

GRPC example (Lyon)

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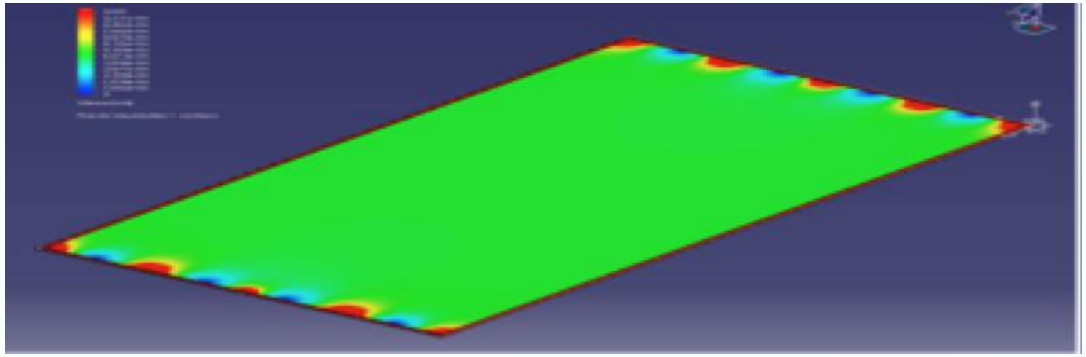
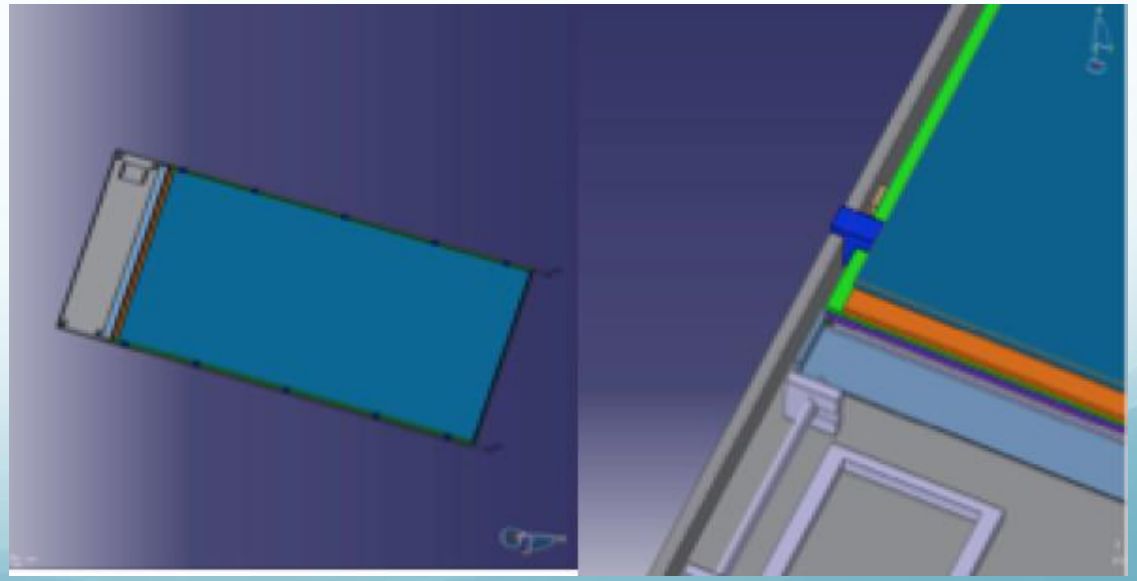
Preparation for the construction of large GRPC (>2 m2) for ILC



New gas distribution system
(2 inlets and one outlet)
Control of homogeneity distribution using the radioactive Krypton 83m

New Design of a robust way to maintain the electronics on the GRPC in a large cassette



GRPC example (Lyon)

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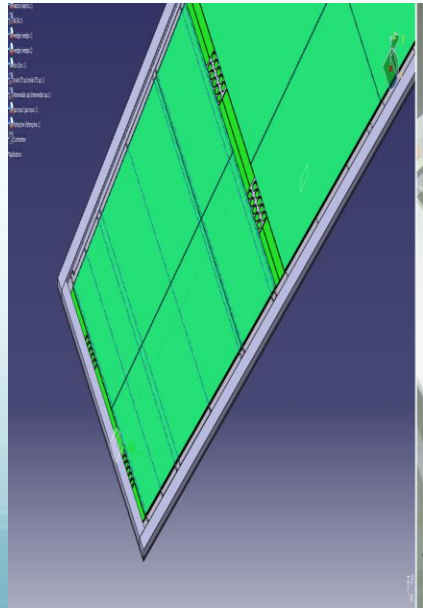
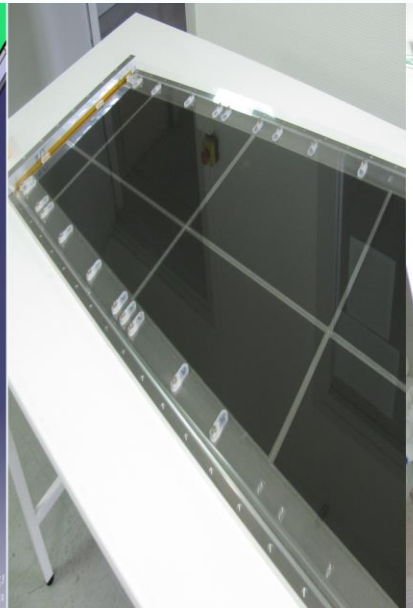
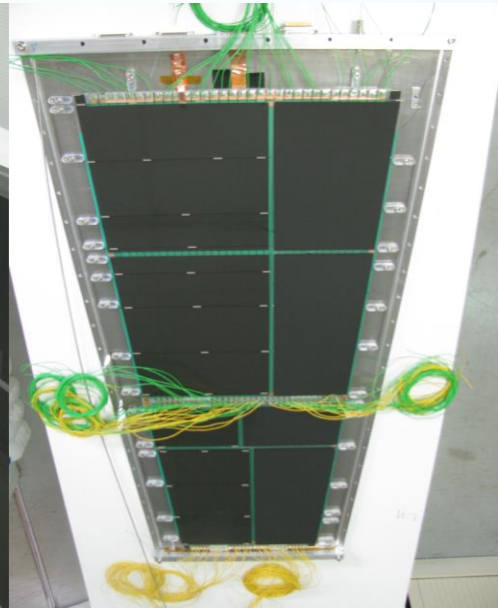
For CMS: Construction of large GRPC using small pieces of Chinese glass



By gluing the glass plates together

Or by mechanical fixation with gas-tight cassette.

Microstrip Boards example (LIP)

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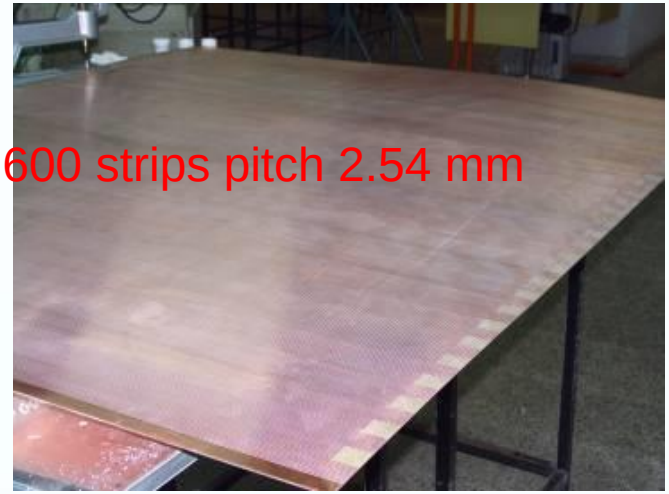

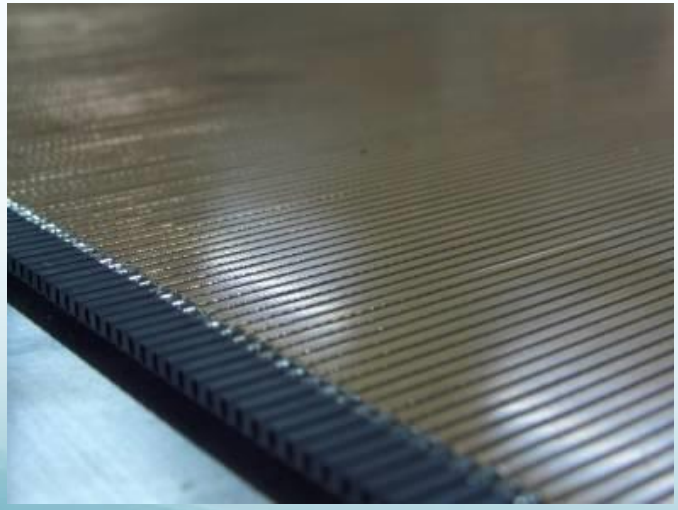

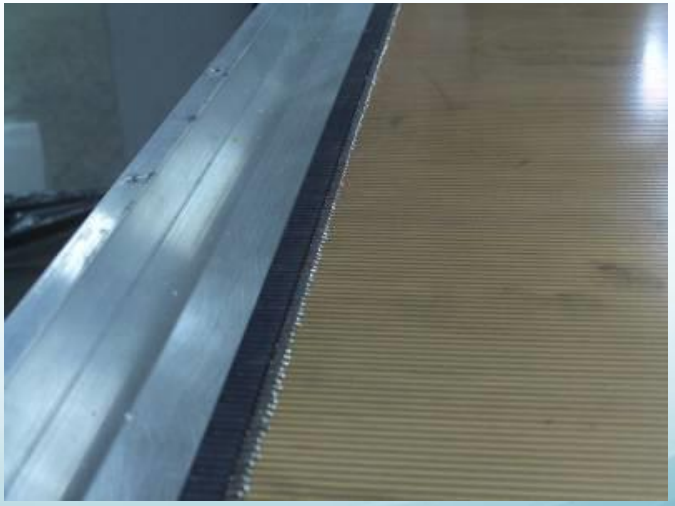

Made in the past by machining (up to 1.2mx1.5m). Another solution build a machine for mechanically cutting strips.

Technological activity (2)

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1. **Quality controls and assurance to guarantee high quality of the production:**

   - In the mass production for industrial applications QC & QA are crucial to guarantee uniformity on each detectors components.

   - The definition and developing of common tools hardware and software for QC & QA procedures needed.

Partners

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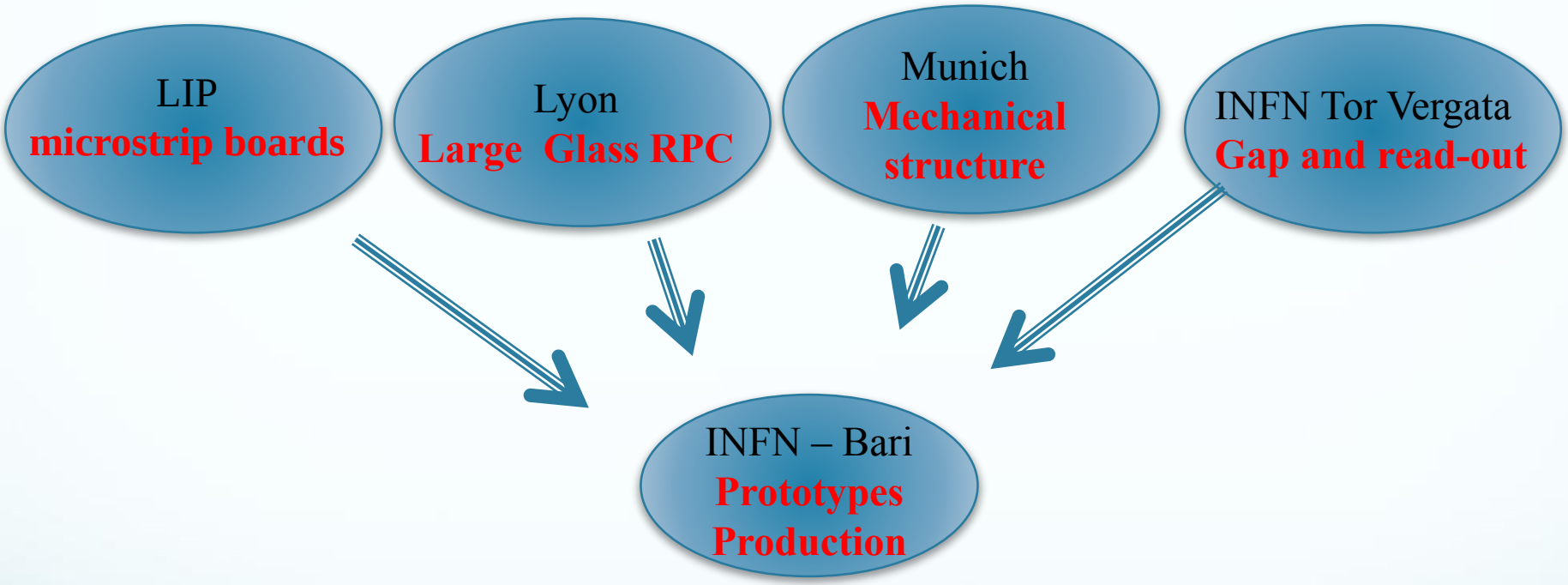

The prototypes production for scientific application will be the test bench for both production protocols optimization and QC & QA definition.

Planning of the first year

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Each partner will propose technical solutions to facilitate the detector construction first in view of the large production as required by future high precision HEP Experiments and for future applications.

1. In contacts with industry:
   - common tools to facilitate the detector construction will be studied.
   - Protocol for a QC/QA production will be developments

2. Technical solutions will be tested on small scale.

4-years planning

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Official milestones and deliverables: Production protocols of optimised RPC components *(specification of the protocols for production procedures, quality assessment and quality control in view of large-scale production)* -- **M36**

- Year 1: identification of technologies
- Year 2: tests of candidate technologies
- Year 3: consolidation and final test of the elected technology
- Year 4: production of report

Complementary financial resources

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→RPC R&D CMS - ATLAS

→Link from other Wp13..

Spare

1 m2 GRPC with embedded readout electronics and its cassette for the SDHCAL prototype(ILC)

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