



# RPCs for the SHiP upstream muon spectrometer

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with the contribution of LNF and LNGS

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# OUTLINE

- Pilot production of RPC gaps as possible module#0 for the SHiP muon spectrometer
- New production of front end electronics for avalanche RPCs (synergy with ALICE project)
- Adapting/new production of the present streamer readout electronics (NESSiE project)

# RPCs for the SHiP upstream muon spectrometer

OPERA RPCs were tested to work in streamer mode ( $\sim 3 \times 1 \text{ m}^2$ , XY strips 2,5 cm wide) with an efficiency  $\sim 95\%$  (*see my presentation in Berlin*)

But high resistivity RPCs in streamer mode are not ideal for high rates

**G. Iaselli (CMS Bari)** suggested a synergy with CMS activities:

**A new pilot production of low resistivity RPCs is possible .**

**We foresee a production of 6 RPCs for the Muon Flux test beam .**

**They could be the module#0 for the SHiP RPCs production .**



# RPC production

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## High Pressure Laminate (Bakelite) production

- Production takes place at PURICELLI (Milano, Italy)  
( Resistivity range 1-6  $10^{10}$  Ohm.cm )
- Cutting takes place at RIVA (Milano, Italy)
- Cleaning takes place at GENERAL TECNICA (Colli, FR)
- Currently small productions for ATLAS and CMS are on the way. The standard CMS-like production is well reproducible.
- Some bakelite plates are already available for a pilot production.

# RPC production

## Gaps

- We are asking to the Korea University ( KODEL) a pilot production of gaps
- We are sending them Bakelite plates
- We will certify gaps production in Bari/Naples sites
- STRIPS production (1 cm wide ) is under discussion ( Kodel or General Technica )

*G. Iaselli , Bari*

# Electronics

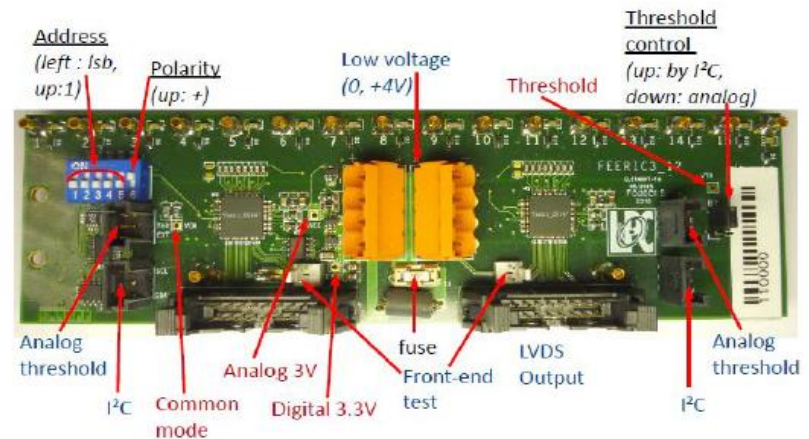
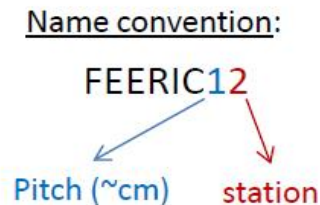
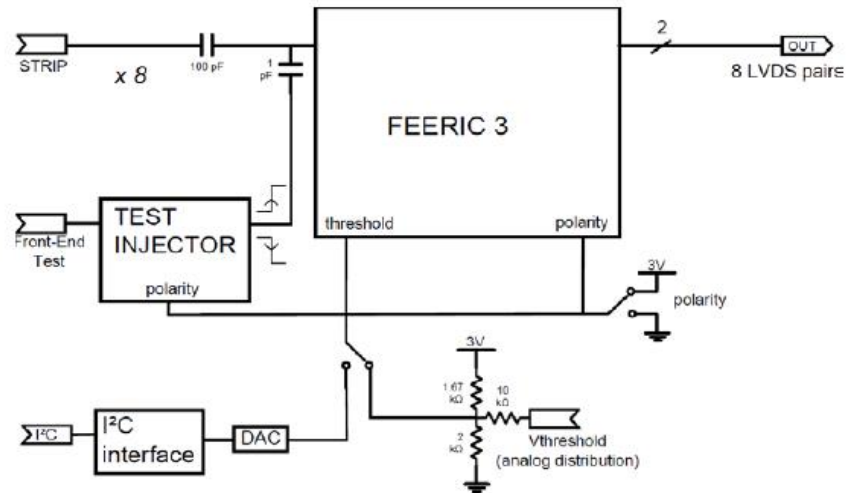
- We plan to use ALICE front end boards developed for RPCs operated in avalanche mode ( with LVDS output )
- The ALICE boards will be coupled to the present Readout electronics ( with LVDS input) developed for RPCs working in streamer mode

# Front end Electronics

- We got some sample of FEERIC Front-End electronics (from ALICE Collaboration), at moment:
  - N. 2 samples of readout cards
  - N. 9 FEERIC ASIC chips
- Next steps are:
  - Test the received boards
  - Design a suitable board for our purposes, hosting #1 OR #2 FEERIC ASICS
    - Setting up via computer
    - Small Slow Monitor included
  - Use them on the RPC test.

# Production-like prototype boards

- 6 different formats (stations 1 and 2, pitch ~1, ~2, ~4 cm)
  - FEERIC11 and 12: 16 channels (2 FEERIC ICs)
  - FEERIC21, 22, 41, 42: 8 channels (1 FEERIC IC)
- Functionalities
  - Threshold set either by analog distribution or by digital bus (I<sup>2</sup>C)
  - Configurable polarity by switch
  - Test injector (FET system)
- Power consumption @ 4V
  - Board 80 mW/ch (20 mA/ch) in normal operation
  - ASIC 63 mW/ch
  - 90 mW/ch (22 mA/ch) in noise (thresh too low)
  - Spec < 100 mW/ch



Baptiste Joly - LPC Clermont - April 5 2016

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A pilot production of 150 ALICE boards for the Muon flux test is under investigation



# Current RPC Readout electronics (streamer mode)

- Input: 64 channels, Discrimination of the signals by means of **LVDS receivers**, Zero suppression of the data. Time stamp of the data with a resolution of 10 ns. Operating in **Trigger less** mode with **long spills** ( 1 – 2 sec ) .
- **Continuous transmission** of the zero-suppressed data via the **Ethernet 100 Mbit/s** Interface with the UDP/IP protocol .
- Tests are in progress to connect **ALICE / CMS front-end boards** with our readout boards
- A new backplane is under design to improve the synchronization ( an internal or external clock will be accepted ) .

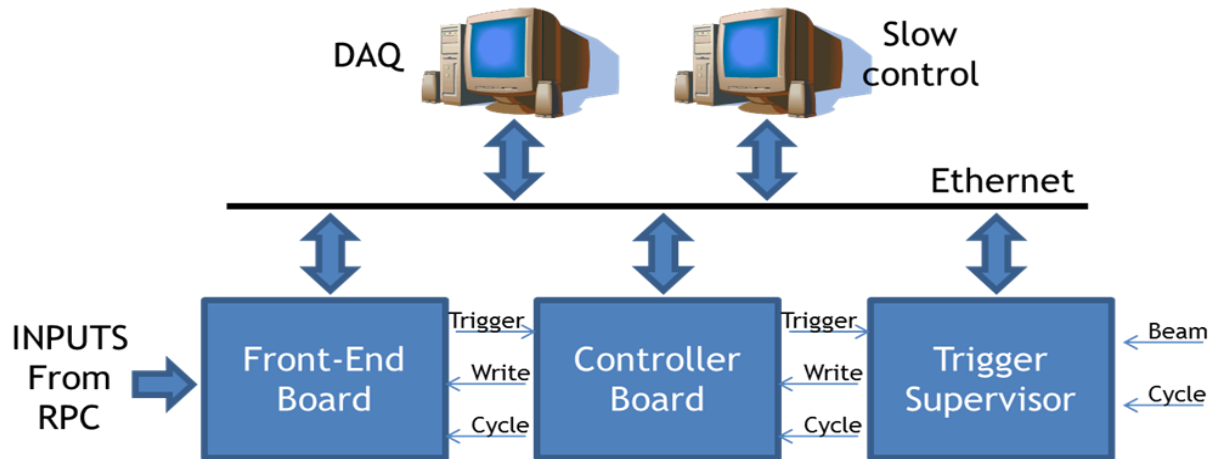


# CONCLUSIONS

- A new RPCs production is feasible and it could be a pilot production for SHIP ( KODEL , synergy with CMS )
- A production of front end electronics for avalanche RPCs is under study ( Napoli , synergy with ALICE )
- Adapting of present read out electronics is in progress ( Bari )

- SPARE

# Current RPC Readout electronics (streamer mode)



- The readout system is structured in three levels: Front-End Board (FEB), Controller Board (CB) and Trigger Supervisor (TS).
- A new TS version will be developed to take in account .....

# Read out electronics Block scheme

LVDS input ( about 1500 channels available )

