GEM+Timepix2 in the framework of CERN@SCHOOL project

Gabriele Croci, Matteo Alfonsi
on behalf of
CERN-GDD Group
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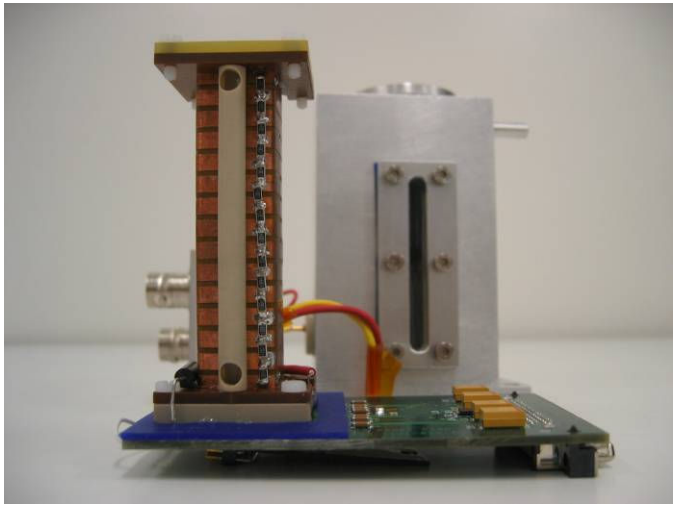
Motivations

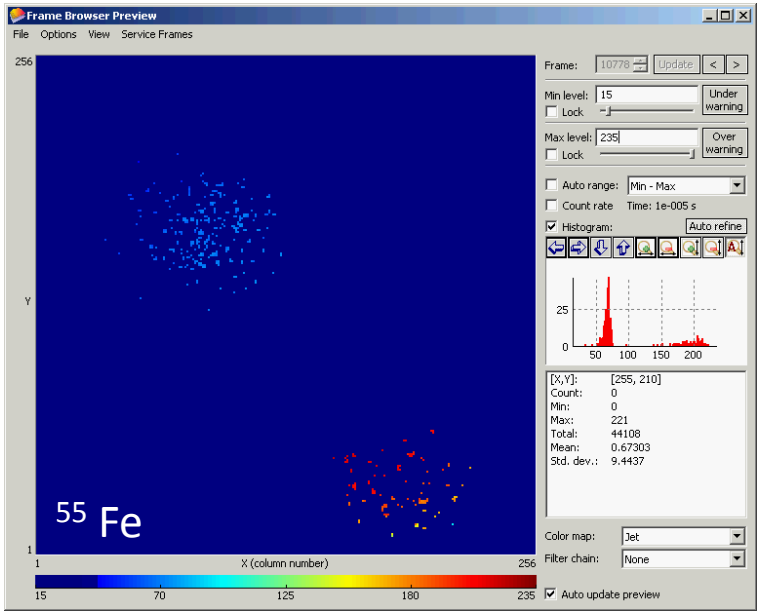
- Build a small TPC equipped with MPGDs+TimePix chip gives the possibility to measure tracks for different particles (MIPs, HIPs,…)
  - Very interesting for a teaching purpose
  - …but also for measurements of basic physics (e.g. measurement of cluster size and distribution,..)
- MPGD+TimePix2 detectors have been already implemented by other groups in RD51 -> a lot of experience is already present in the collaboration

Examples of MPGDs+TimePix2 (1)

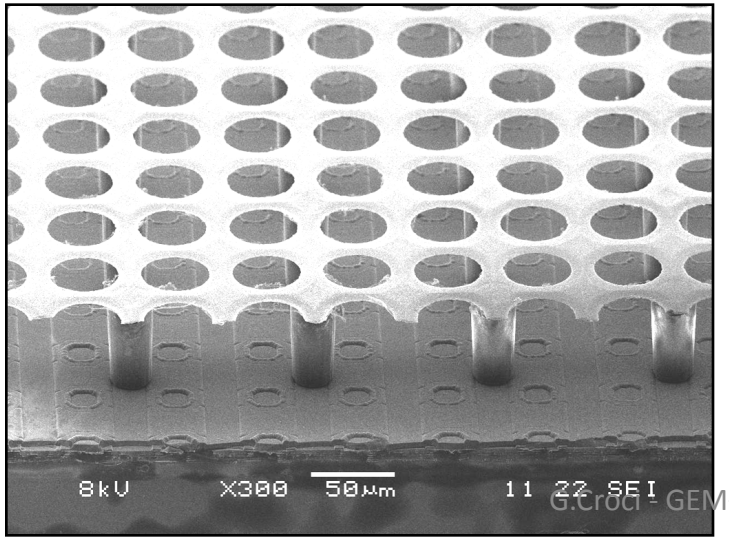
Ingrid + TimePix small TPC

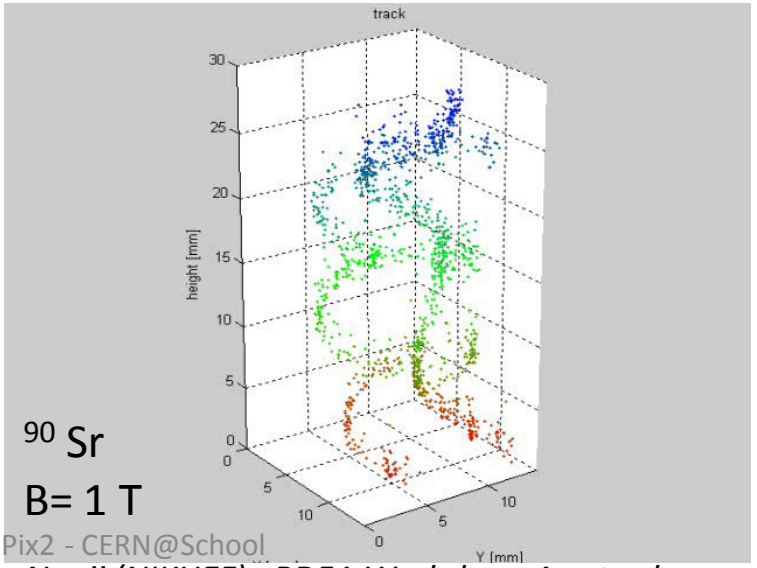


Paul Colas (CEA), 3rd RD51 Collaboration Meeting Crete



Timepix chip + SiProt + Ingrid:

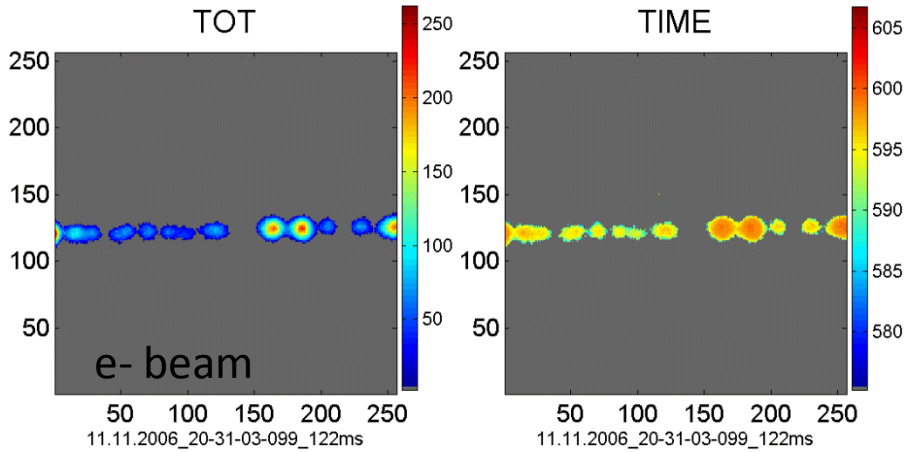




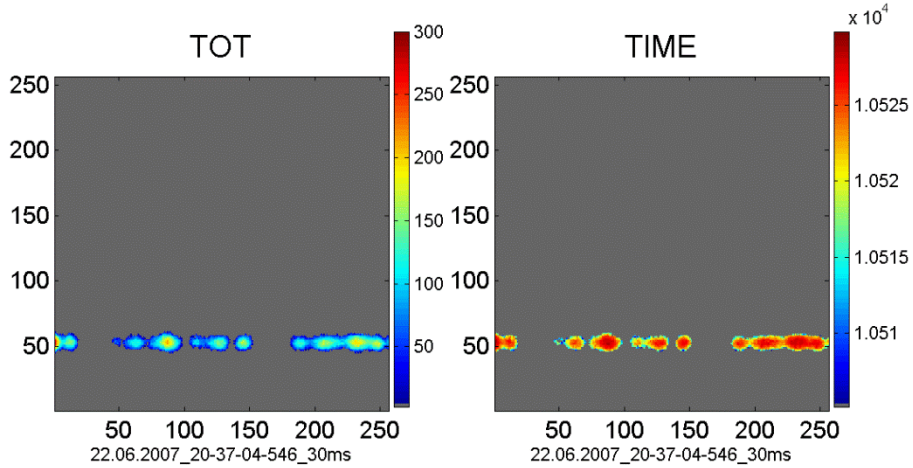
L. De Nooij (NIKHEF), RD51 Workshop, Amsterdam

Examples of MPGDs+TimePix2 (2)

Triple GEM (Standard) + TimePix

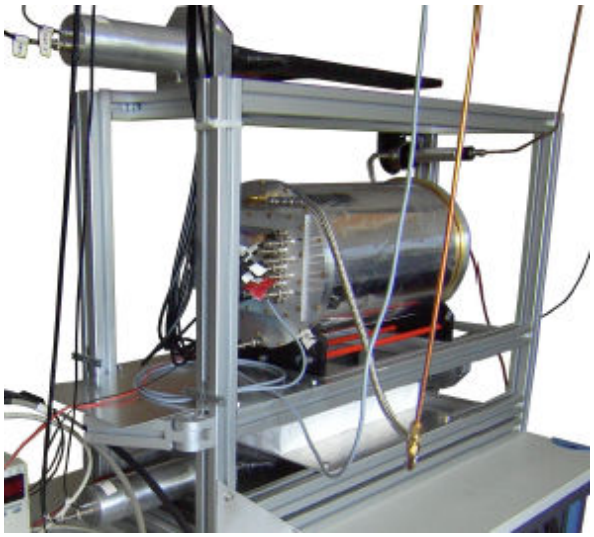


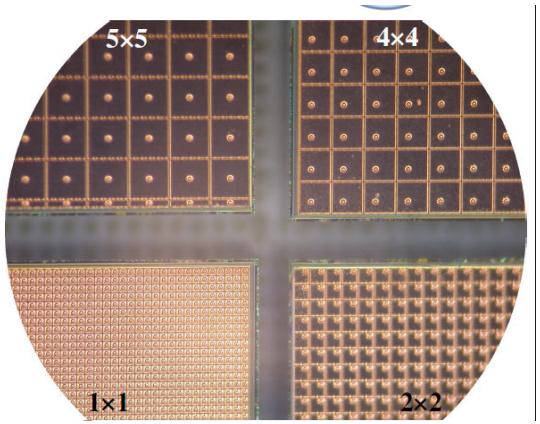
Triple GEM (Fine Pitch) + TimePix

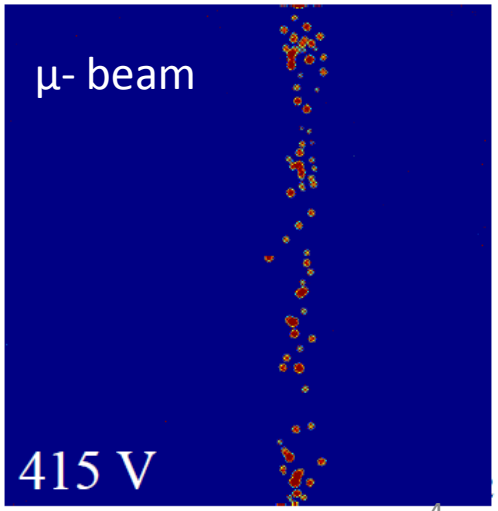


U. Renz et Al, Activities on Si-TPC , Micro Pattern Gas Detectors. Towards an R&D Collaboration, CERN, Sept 2007

Triple GEM TPC equipped with TimePix2 Chip



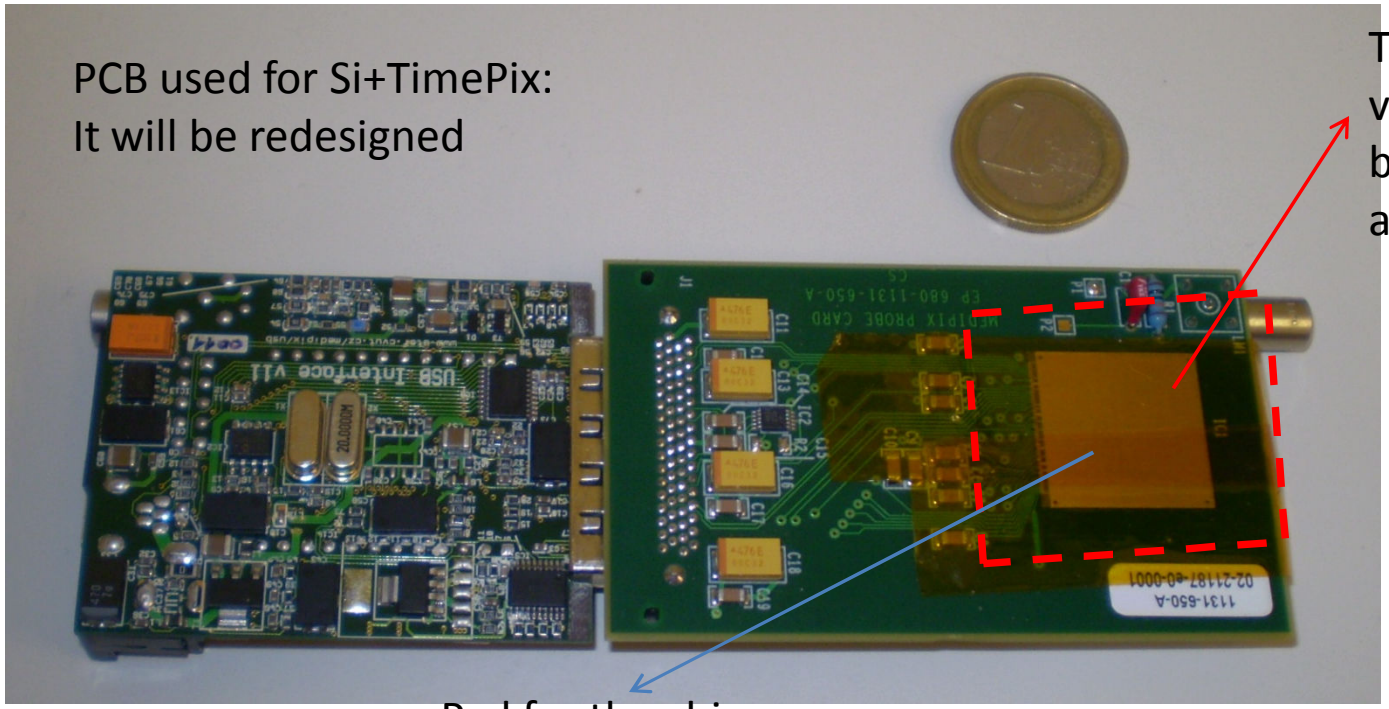




J. Kaminski et Al, Measurements during the October test beam with the GEMTPC and Timepix, 4th RD51 Collab Meeting

GEM+TimePix Project for CERN@SCHOOL

- Small TPC (1 cm drift gap)
- Amplification given by a Triple GEM or a Double GEM stage
- Readout by TimePix Chip
- Build the TPC on top of TimePix PCB that will serve as backplane; the TPC must be only on top of the chip



Specifications

- We want to have a miniaturized detector in order to get a good portability: the GEM active area will be less than 2 cm* 2 cm
- We want to have an "almost" sealed detector: change the gas once per year
  - > Material selection is very important: no outgassing material

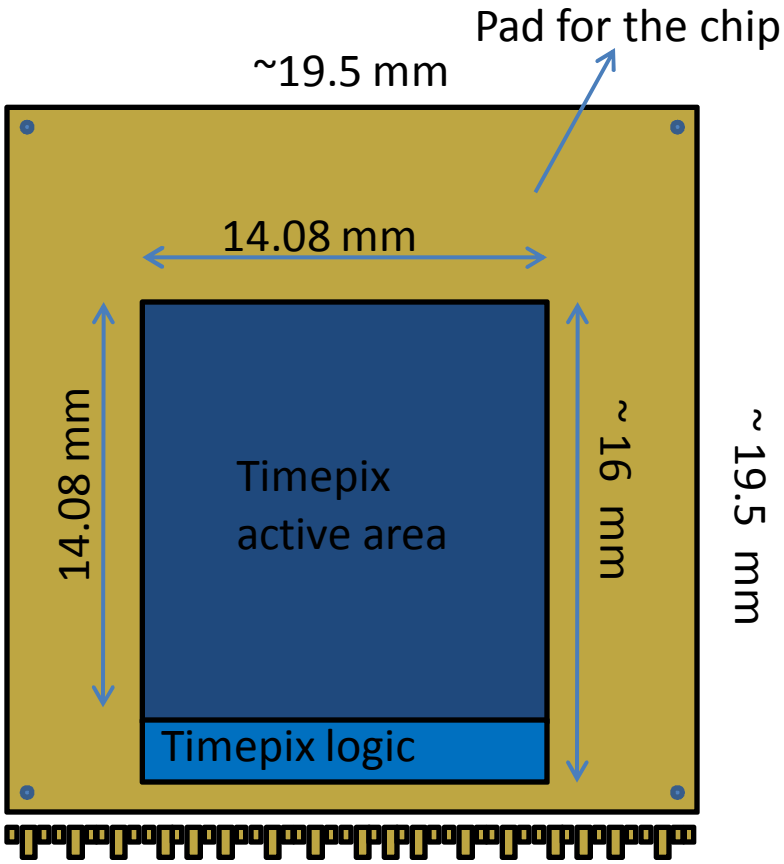
    -> use ceramic PCB instead of FR4

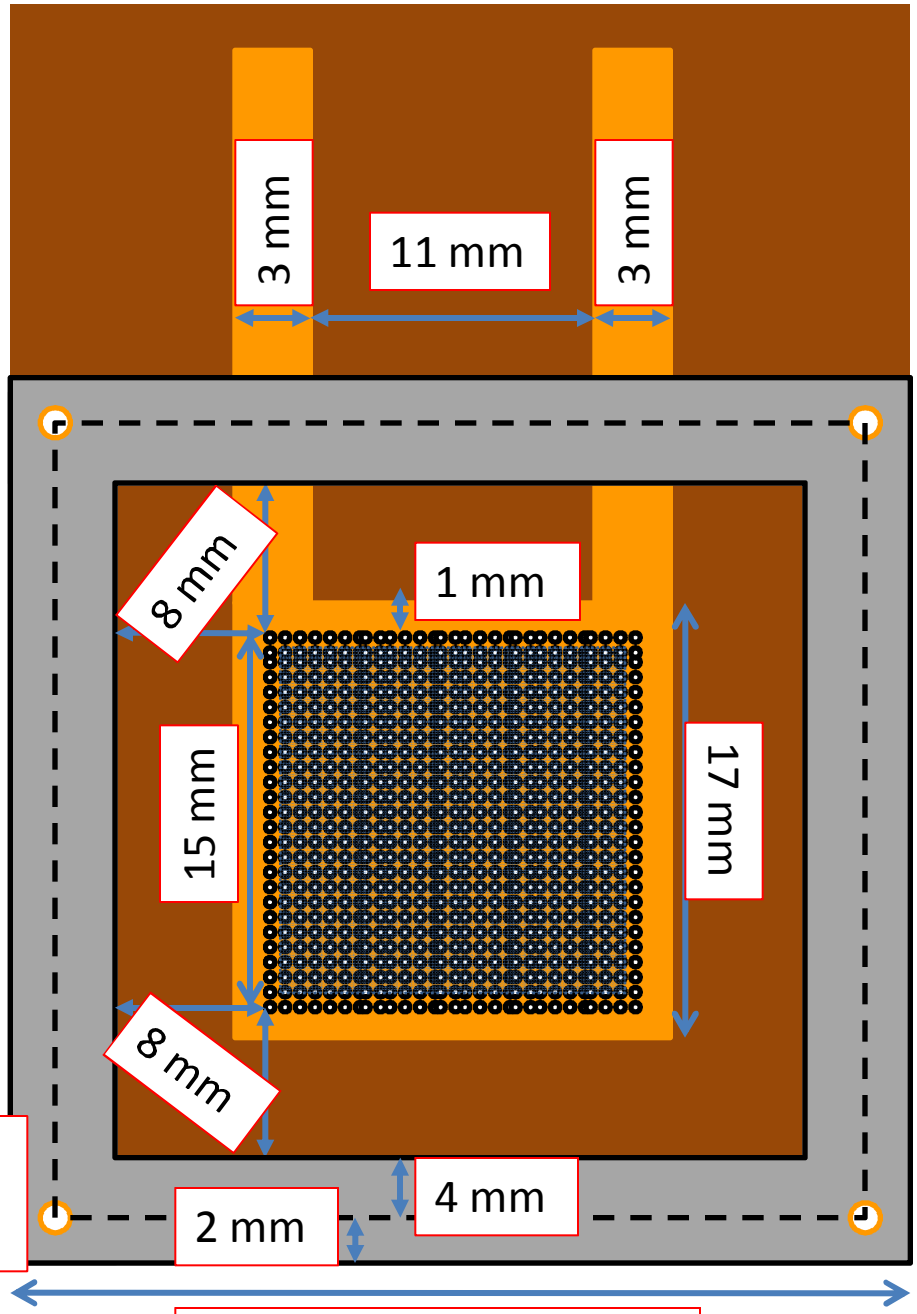
    -> use a non-outgassing material for GEM frames (like Peek)
- We want to test both double GEM and Triple GEM
  - > Double GEM with respect to Triple GEM (at the same effective gain) gives the possibility to have more charge per pixel since it introduces less diffusion
- Test Standard GEM and Fine Pitch (see later) GEM
- Both Triple and Double GEM will be powered using resistor divider: we have to design a small high-power HV divider chain
  - In RD51 we know that there are groups that are developing portable HV : joining efforts can be useful

State of the art

- We have already designed the GEMs and they are in production
- The first test of this GEM will be made in standard detector boxes without chips
- We are going to design the small HV resistor chain
- We are looking for non-outgassing materials

GEM Design





GEM has been designed in order to cover only the active area of the chip

2 mm hole diameter (smaller marker)

GEM Dimensions

	Pitch	Hole Diameter	Thickness
Standard GEM	140 µm	50 µm	50 µm
Fine Pitch GEM 1	60 µm	30 µm	50 µm
Fine Pitch GEM 2	50 µm	25 µm	25 µm

All the three geometries will be tested

Conclusion and future plan

- We are just at the beginning of the project
- First test of GEMs in 2 weeks
- This is a “small” (in dimensions) but big project: a lot of R&D is required!!!

Any advise is welcome!!!!!