Detector for LHC, some ideas

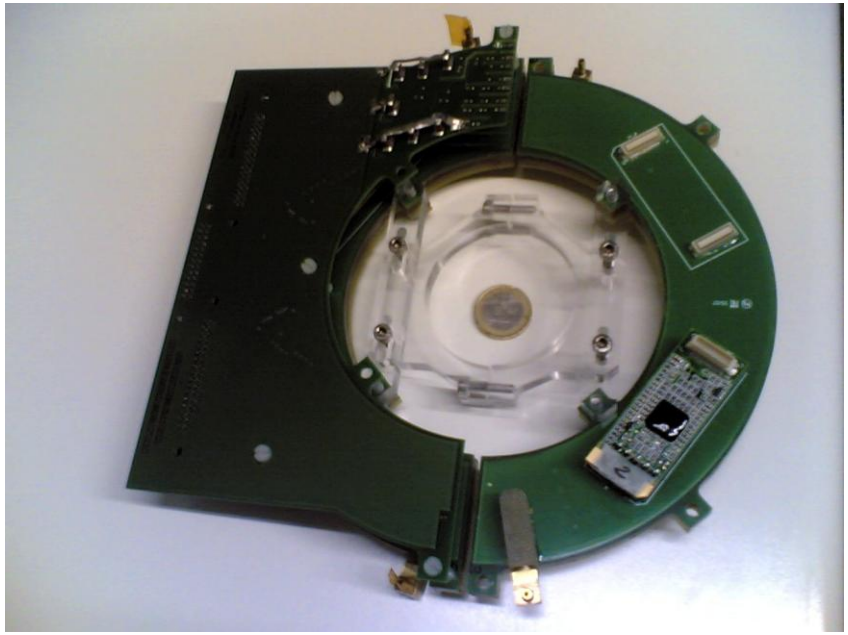
G.Cavoto, P.Valente
INFN Roma
F.Murtas
INFN LNF

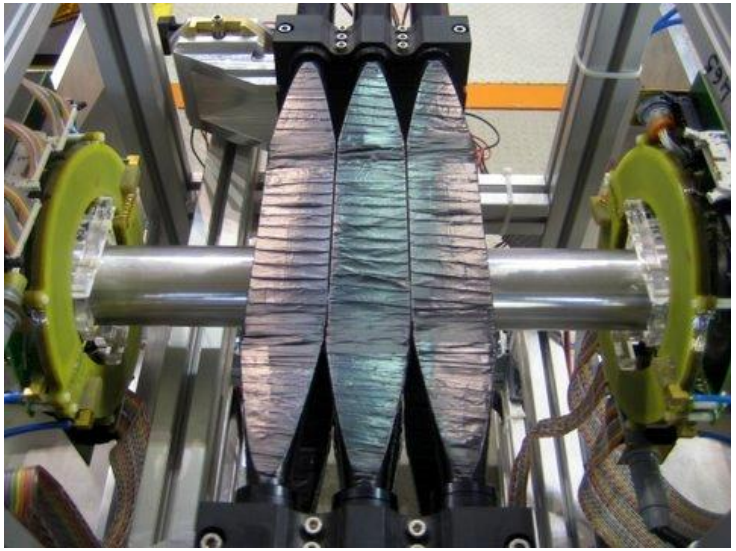
What we should measure

- Detect inelastic interaction
  - Instrument region ***close to crystal*** or to the ***absorbers/secondaries*** collimator where no LHC BLM available.
  - ***External*** to vacuum chamber
- Detect channeled beam
  - Measure ch. ***beam profile***
    - ***Channeled beam (check torsion effect, axial channeling…)***
    - ***Count protons passing thru***
    - In secondary vacuum ?
- ***Count channeled particles***
  - Possibly without absorbing the beam
  - In vacuum

I assume that in LHC all BLM are working very well,
no need to have many other BLM as in SPS

BLM close to crystals

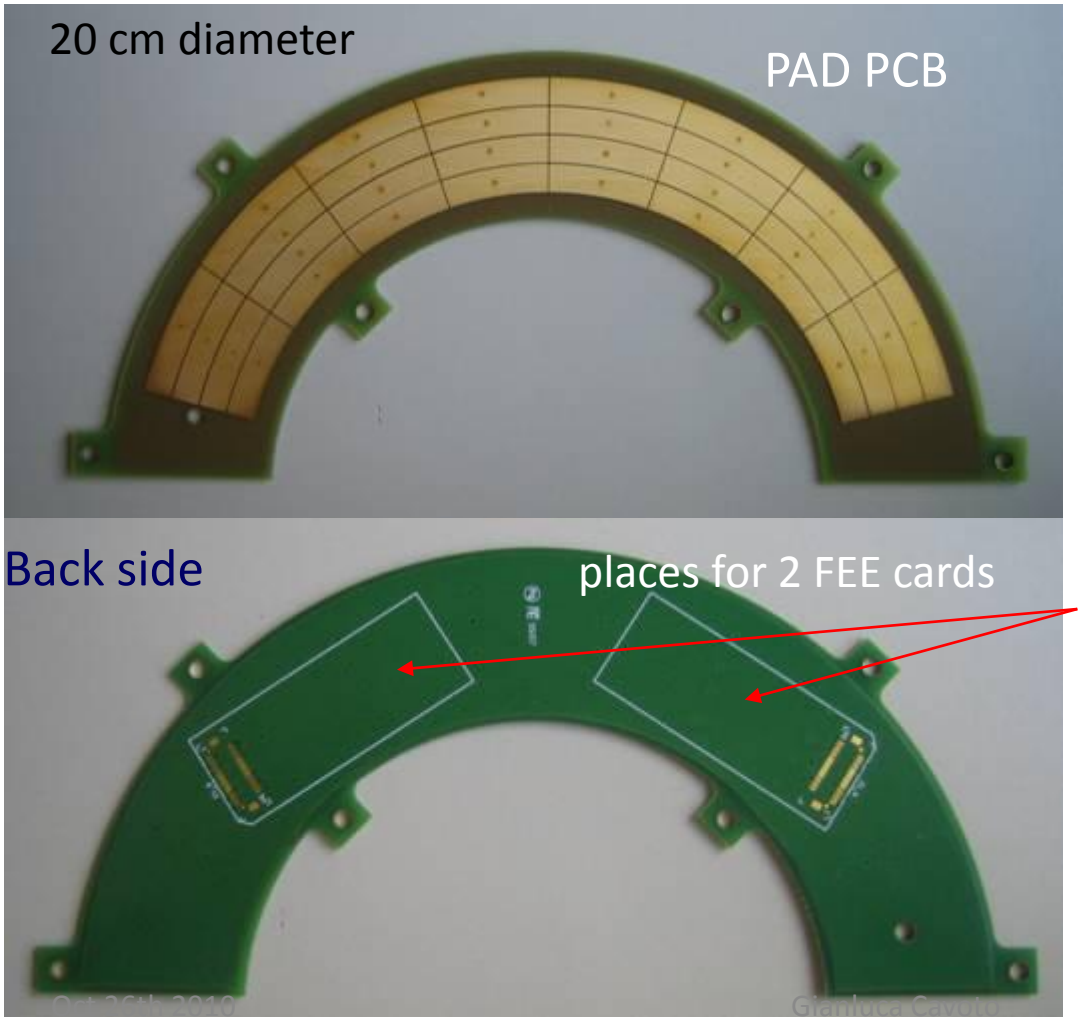




LUMI GEM detector
Dafne (LNF) luminometer

LHC close-to-crystal can be modeled on this

Details on LUMI GEM



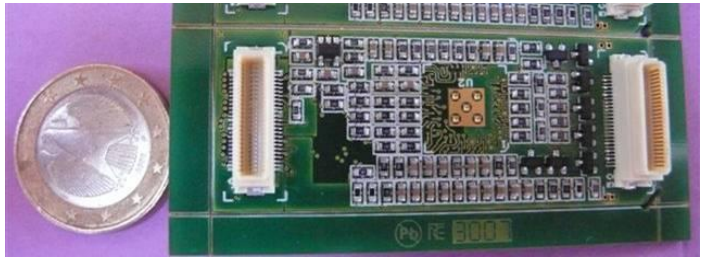
Instrinsically radiation hard detector (No flammable gas)

GEM principle:
Localized electron multiplication can sustain large rate (MHz/cm2)

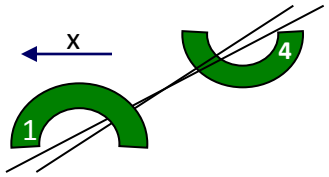
Each pad can count number of m.i.p.'s crossing it.
[threshold well know]

More on GEM BLM

– Electronics Radiation Hard
(Carioca chip, used for LHCb)



- Can be made in several modules
(put at different distances in coincidence)
- Can be made movable
  - (to scan different angles) ?
- Addition of degrader can make them sensitive to neutron (TBC)

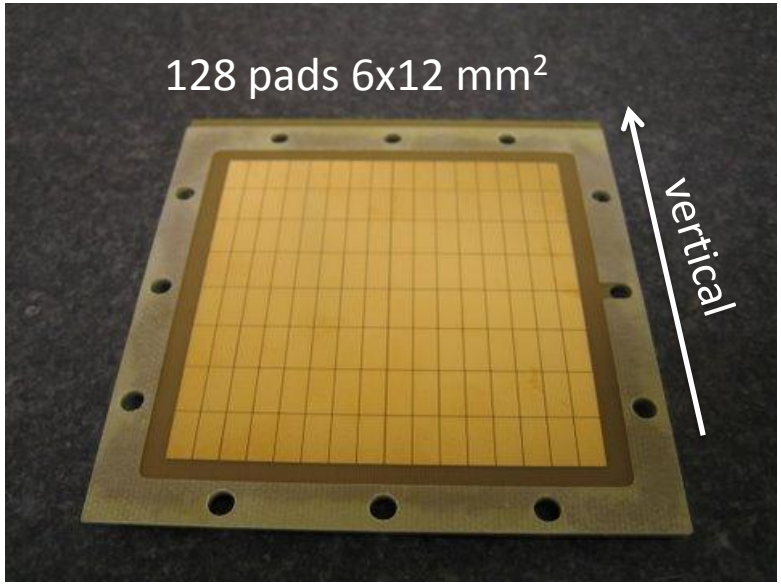


Need some simple simulation of crystal+pipe + obstacles (GEANT) to see the shape of the shower.

GEM on SPS

- Two GEM mounted on Ex-RD22 tank since 2009
- Operate during UA9 MD, data synchronized with other UA9 BLM

Carioca chip on board
DAQ crate remote



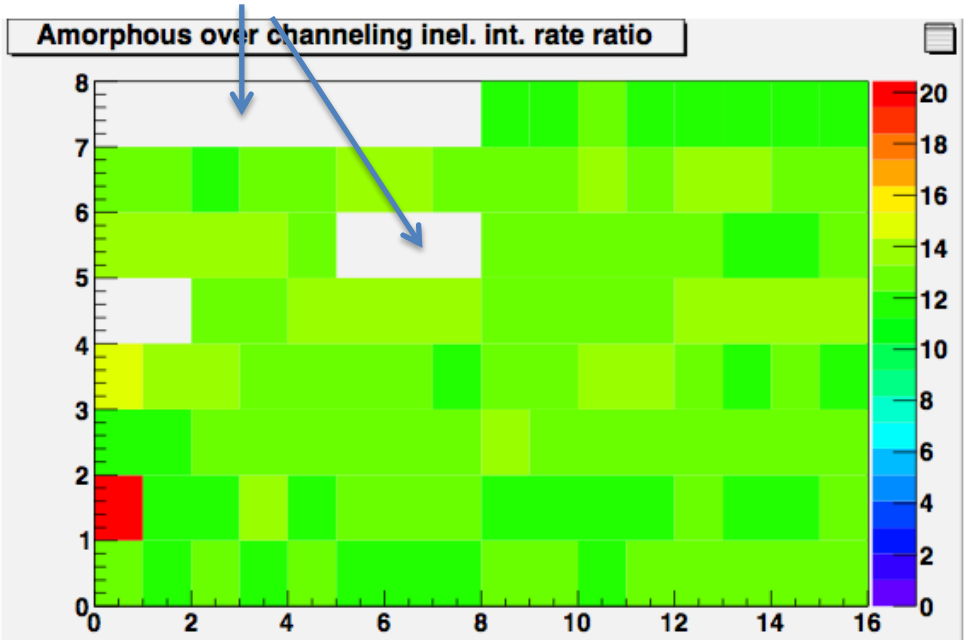
10x10 cm2 active area

Electronics to control thresholds and LV PS

GEM1 results

- Sep 2nd MD. Mounted downstream IHEP tank
- Measured rate on each pad with crystal 3 in amorphous and in channeling condition (high stat).

Dead electronics chan.



Beam pipe

Ratio of the average rates in the two crystal positions (inelastic interaction suppression factor)

No real angular dependence (~few m from crystals)

Detector calibration

- Devices counting particles
  - Cerenkov, Medipix

BTF at LNF-INFN is a useful tool

Electron/positron ~25-750 MeV

From single particle to $1e^{10}$ particle per burst (1-10 ns burst).

Number of incident particle known!

Few mm^2 beam spot

50Hz operation rate

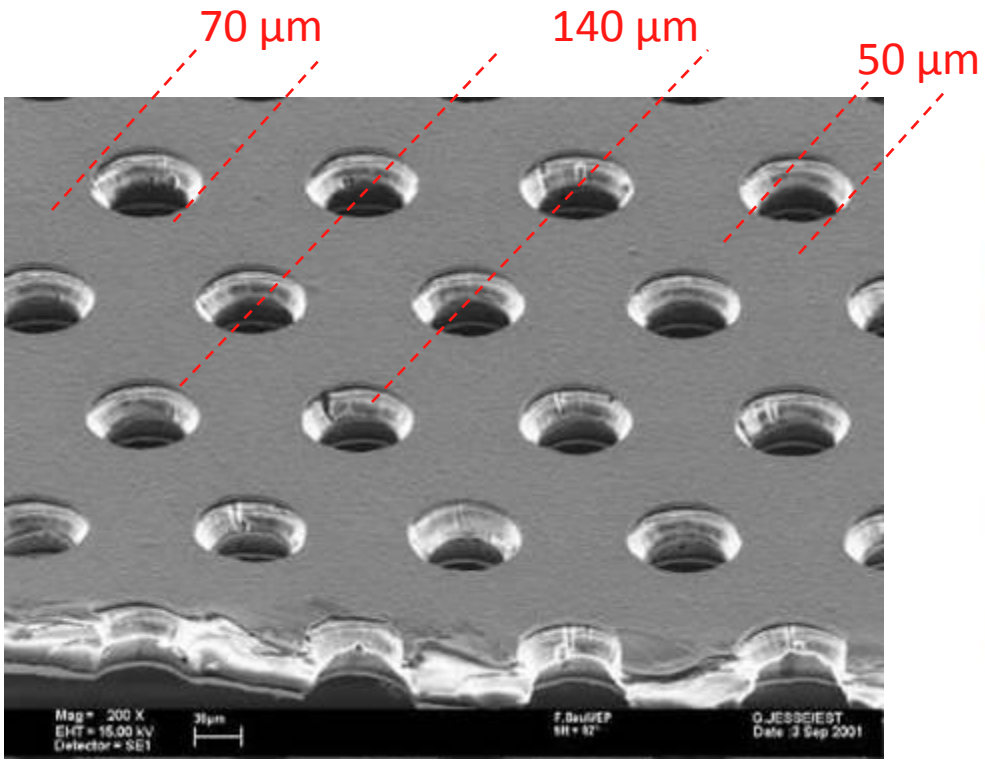
More details on Wed talk on BTF

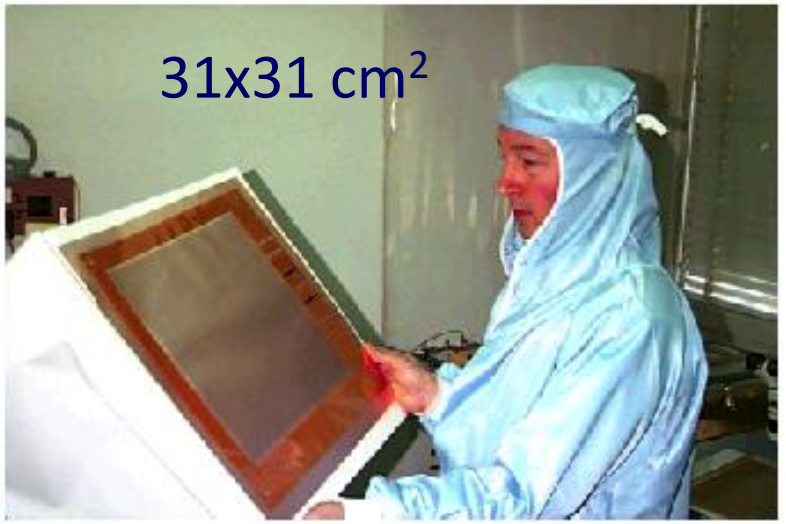
Discussion

- Do we need other observables to be monitored ? And therefore other detectors ?
- Some info about possible location of crystals in LHC
  - Pictures, drawings, expected dose,available space, etc.
- Need input on infrastructure
  - Where power supply can be installed, where DAQ electronics,…

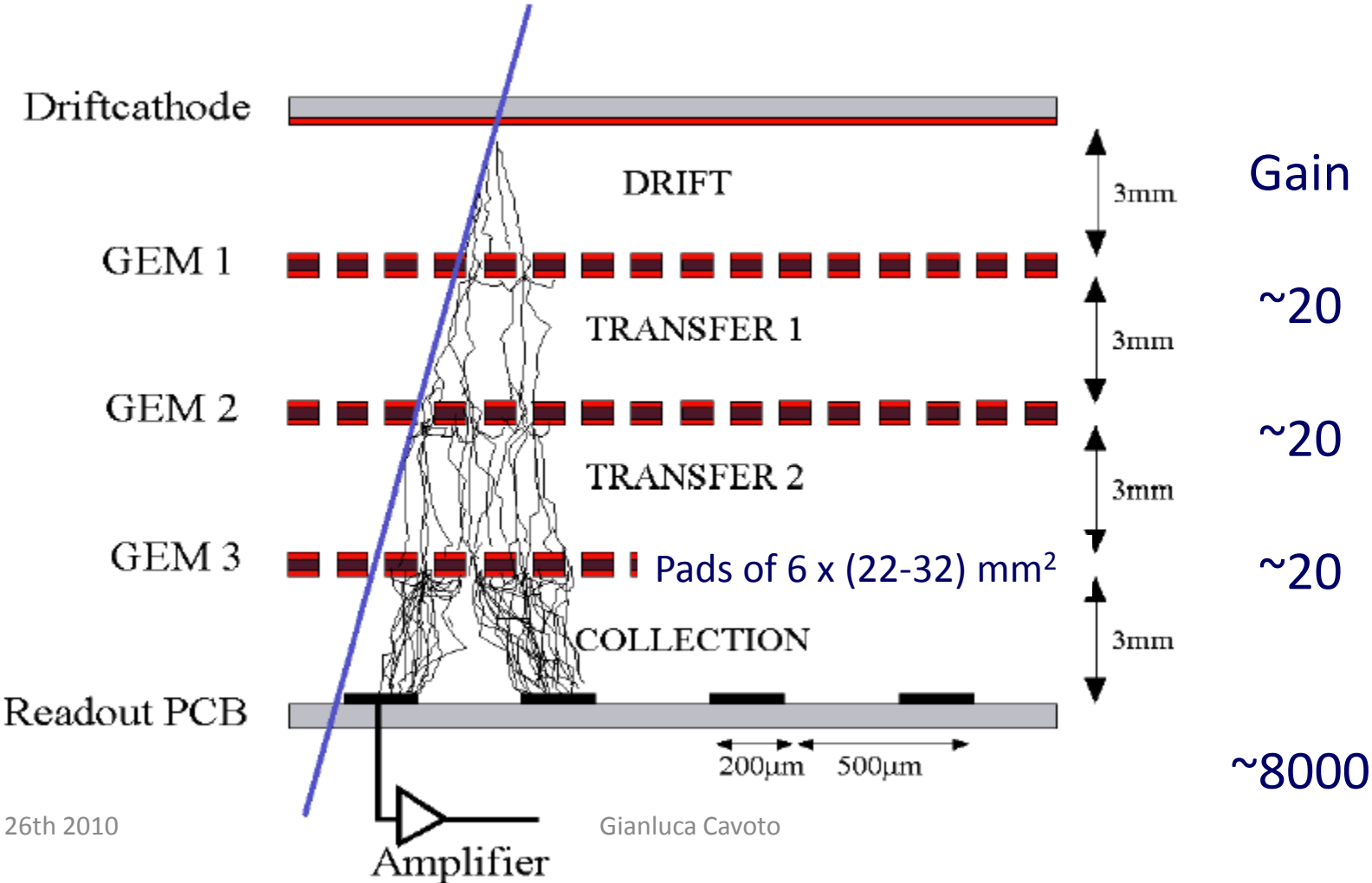
Gas Electron Multiplier

A Gas Electron Multiplier (F.Sauli, NIM A386 531 **1997**) is made by 50 μm thick kapton foil, copper clad on each side and perforated by an high surface-density of bi-conical channels;





Triple GEM



Gain

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~8000