5th RD51 Collaboration Meeting in Freiburg

# WG7 summary

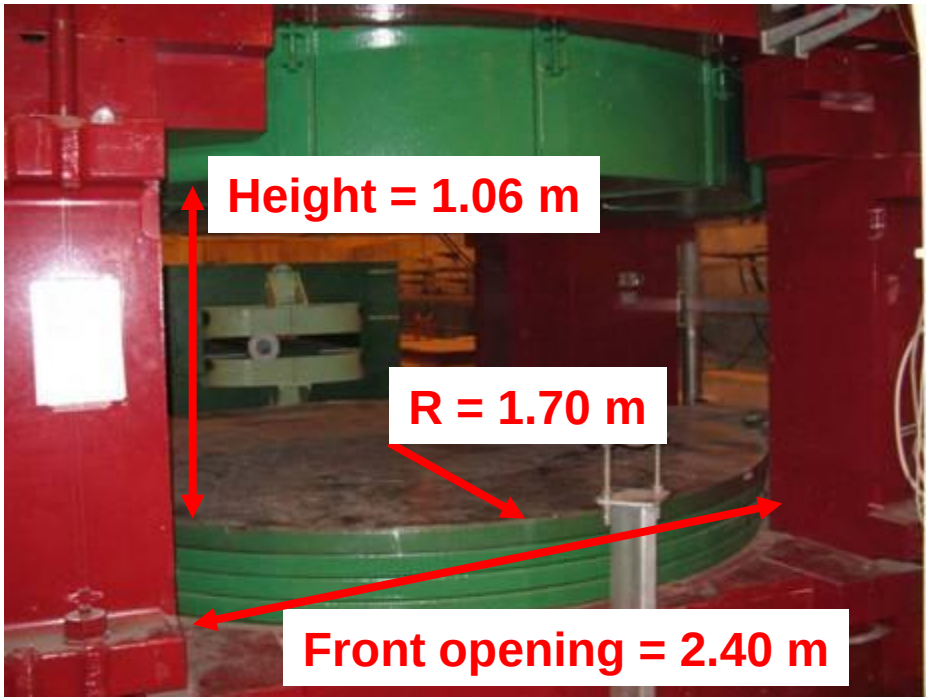
M. Alfonsi (CERN)

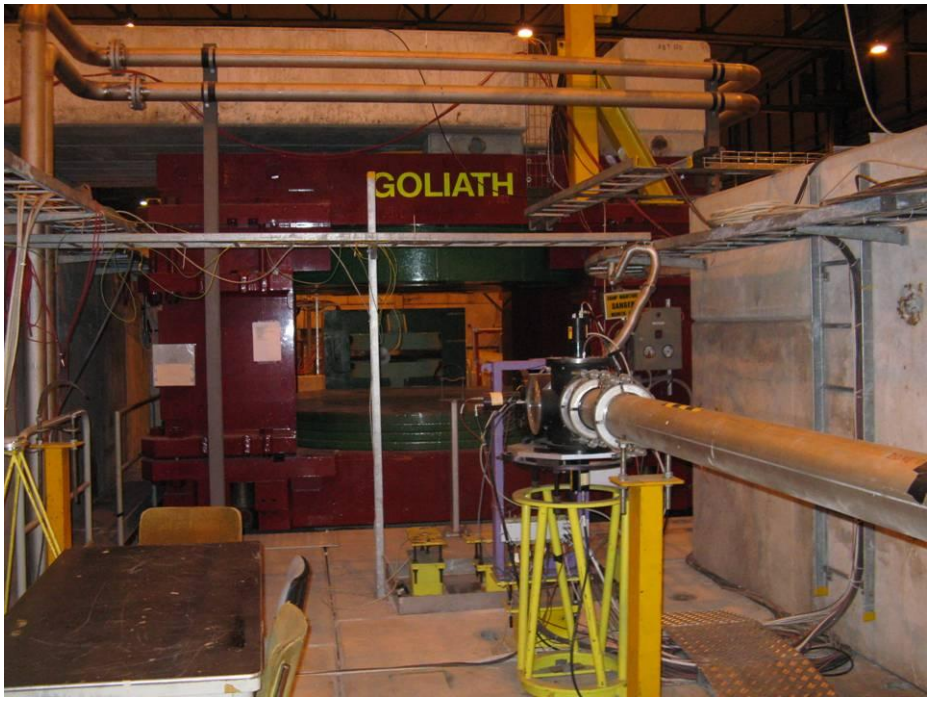
# Outline

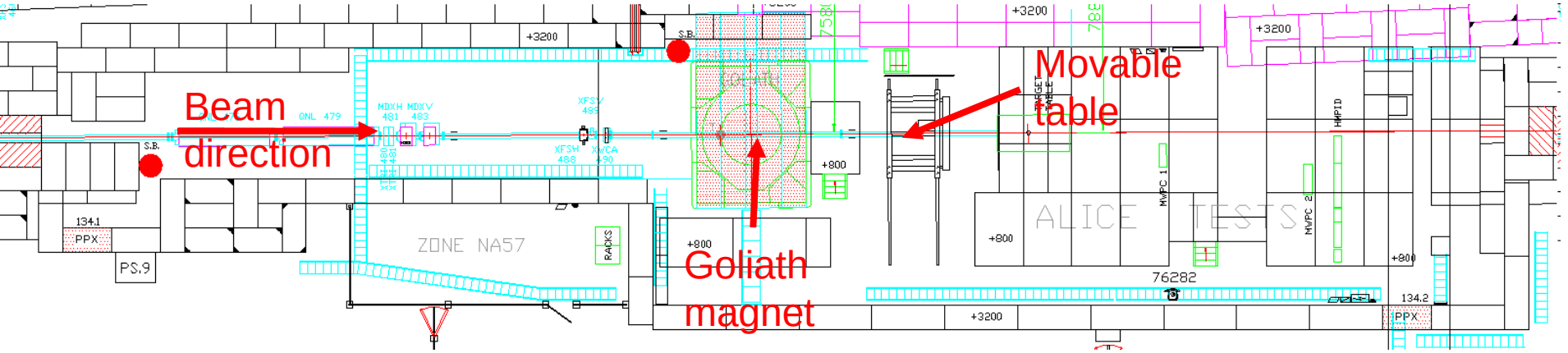
- General area description, available services, safety aspects
- Results from last year test beam
- 2010 beam schedule and Period 1 setup
- 2010 test beam goals and plans
- Conclusion and special announcement

# Experimental area & services

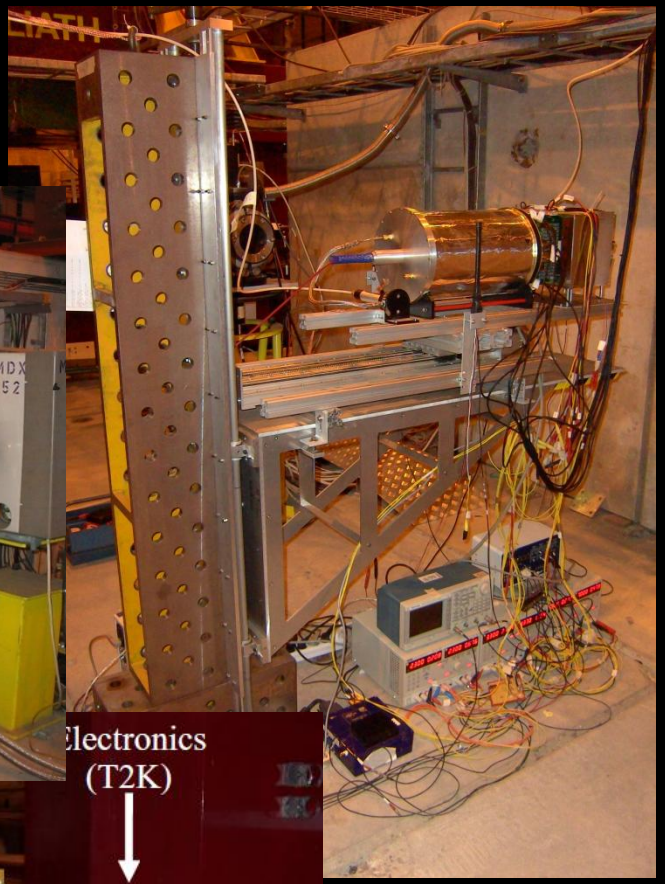
# SPS/H4 line at Prevessin North Area

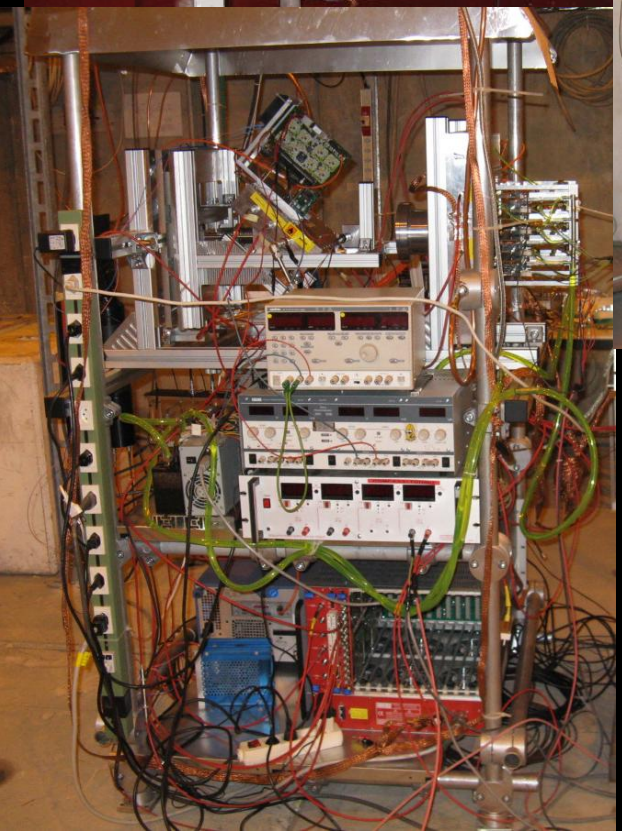


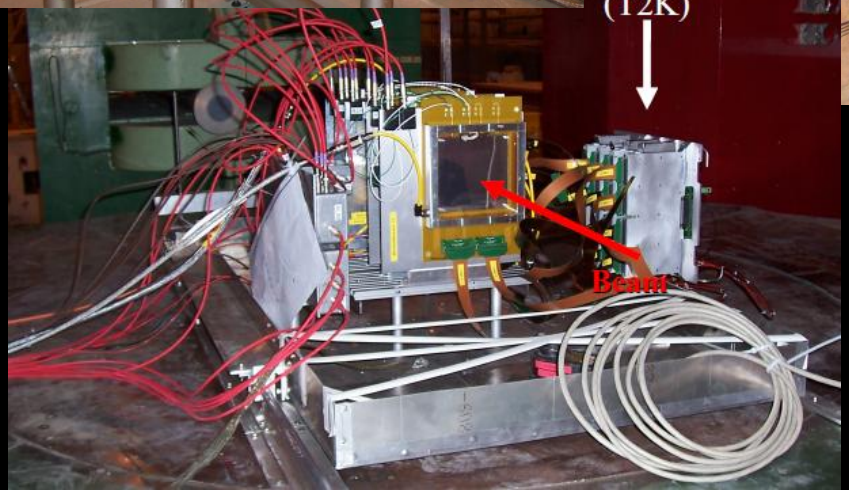



# Pictures of previous RD51 setups

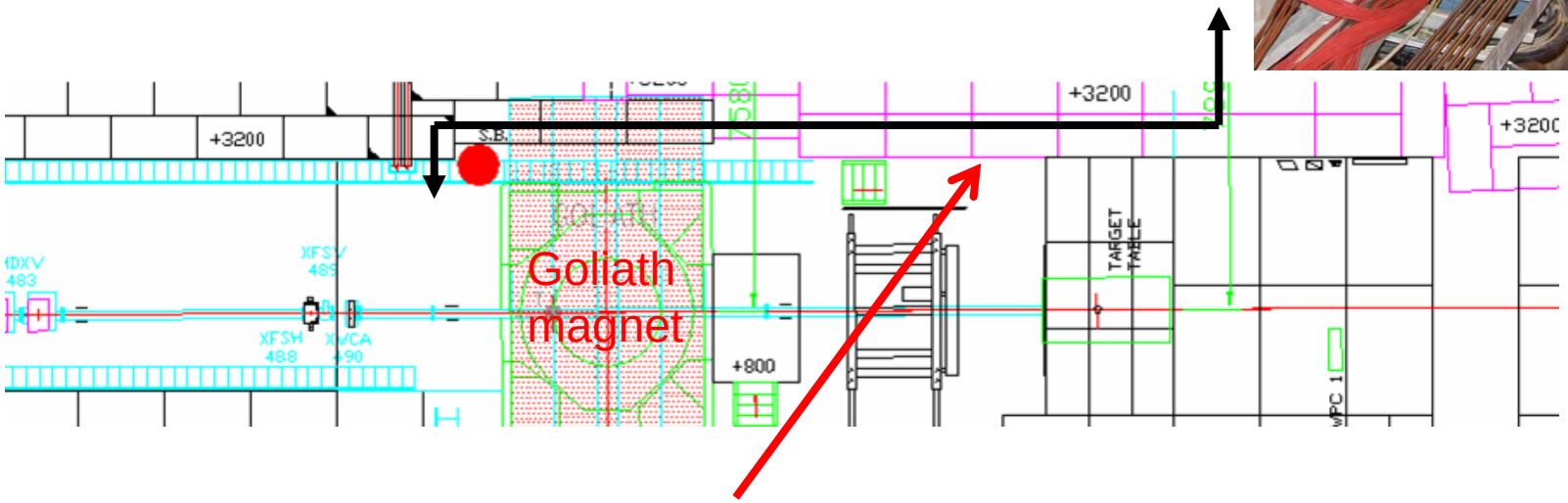







# Gas services

- Stainless steel from gas zone to a patch panel in the experimental area
- 5 RD51 lines, each with 6mm diam. pipes for inlet and 10mm diam. pipes as return lines




- 1 additional 8mm diam. copper line (inlet + return) from SPS group
- exhaust lines (= going out of the building):
  - 16mm diam. copper tube with flange type fitting
  - 2 in the experimental hall, 1 in the gas zone

# RD51 cables and fibers

From the control room to the experimental area:

- Fiber line x2
- Ethernet lines x3 + 2 small switches at both sides
- SHV lines x4
- 2 x 16 LEMO coaxial cables
- Many other BNC, fibers, SHV cables installed by single RD51 members.. Please ask them before using

VERY IMPORTANT REMARK:

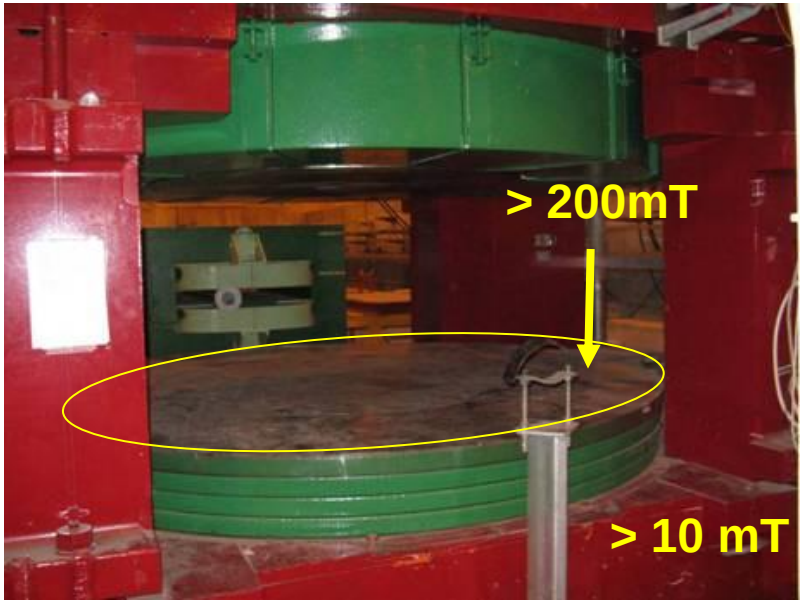
Services from the control room to the experimental hall can be installed only during Machine Development slots, where all beams are off!

# Crates, HV PS, ..

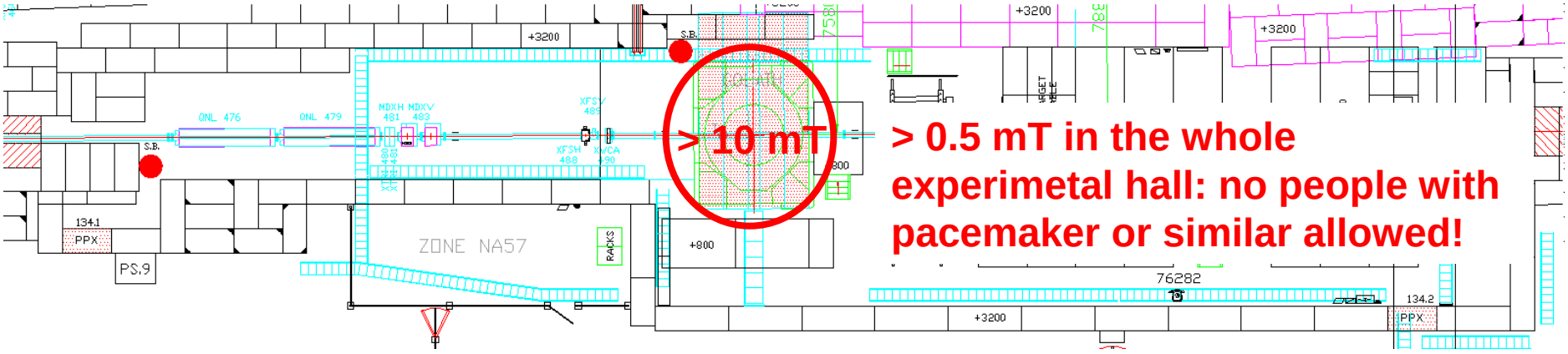
- Test beam users can share racks
- NIM, VME crates and modules can be rented from the CERN electronic pool
- Common crates and (in some cases) common electronics module can be charged on RD51 WG7 common funds
- The CAEN 1527 mainframe can be rented to supply HV and LV to all test beam users (please let us know the number and type of required channels!)

# Hazards and safety aspects

# Magnetic field hazards




- The magnet reaches 1.4T in the central part of the yoke
- All the yoke and coil surfaces has a magnetic field larger than 200mT, the limit for the worker
- Around the magnet a line on the floor delimits the area of 10mT, the limit for the public
- The whole experimental hall is affected by a magnetic field larger than 0.5mT, the limit for people wearing pacemaker or similar device



# Access limitations and rules

- No people wearing pacemakers or metal implants or similar sensitive devices are allowed in the experimental area. Check with your medical service if this is your case.
- You are allowed to work in the experimental area after reading carefully this presentation and the general presentation by CERN Safety Commission about static magnetic field hazards, and after learning the position of emergency equipment (red button, emergency button..)
- Check with the medical service of your home institute for special autorizations or procedures to work with magnetic field. CERN people must communicate their names to the medical service, if they will work inside the magnetic field.
- Remember that: workers can operate at fields larger than 10mT, but recordings must be produced with exposure start, duration and value; the exposure of workers must be avoided if it is not strictly necessary; nobody can stand for a 8h working day inside a magnetic field larger than 200mT.

**These restrictions will apply in every RD51 test beam, even if your team is not involved in the setup inside the magnet, even when the magnet is off.**

# Limitations for detectors and other devices in the magnetic field

- Any device that will equip the setup inside the magnet must be checked for ferromagnetic material
- These devices must be strongly fixed in the setup
- Take into account that metallic devices are subject to eddy currents when the magnetic field change too fast (e.g. for a magnet quench). Eddy currents can induce movements on such devices

# Radioactive sources

**The use of calibration radioactive source inside the magnetic field must be avoided.**

E.g. the casing of the actual $^{90}$Sr source contains ferromagnetic components and it would be attracted by the field.

Any exception, if really necessary, must be discussed with the GLIMOS

**Calibration source cannot be exposed to beam: before leaving the area they should be locked in the safe.**

# Flammable gas

- All the setups and using flammable gas must be equipped with a retention bucket/roof and an alarm sensor
- Limit connections: they must be equipped as well with alarm sensor
- Metallic pipes (few cm plastic pipe for detector connection are derogated)
- Lines must be purged at the beginning/end of the period (the main distribution lines are 20mm diam. 150m long lines!!!)

# ISIEC form

We need the filled ISIEC form before the end of the week.

Please send us the document as soon as possible

# Results from last year

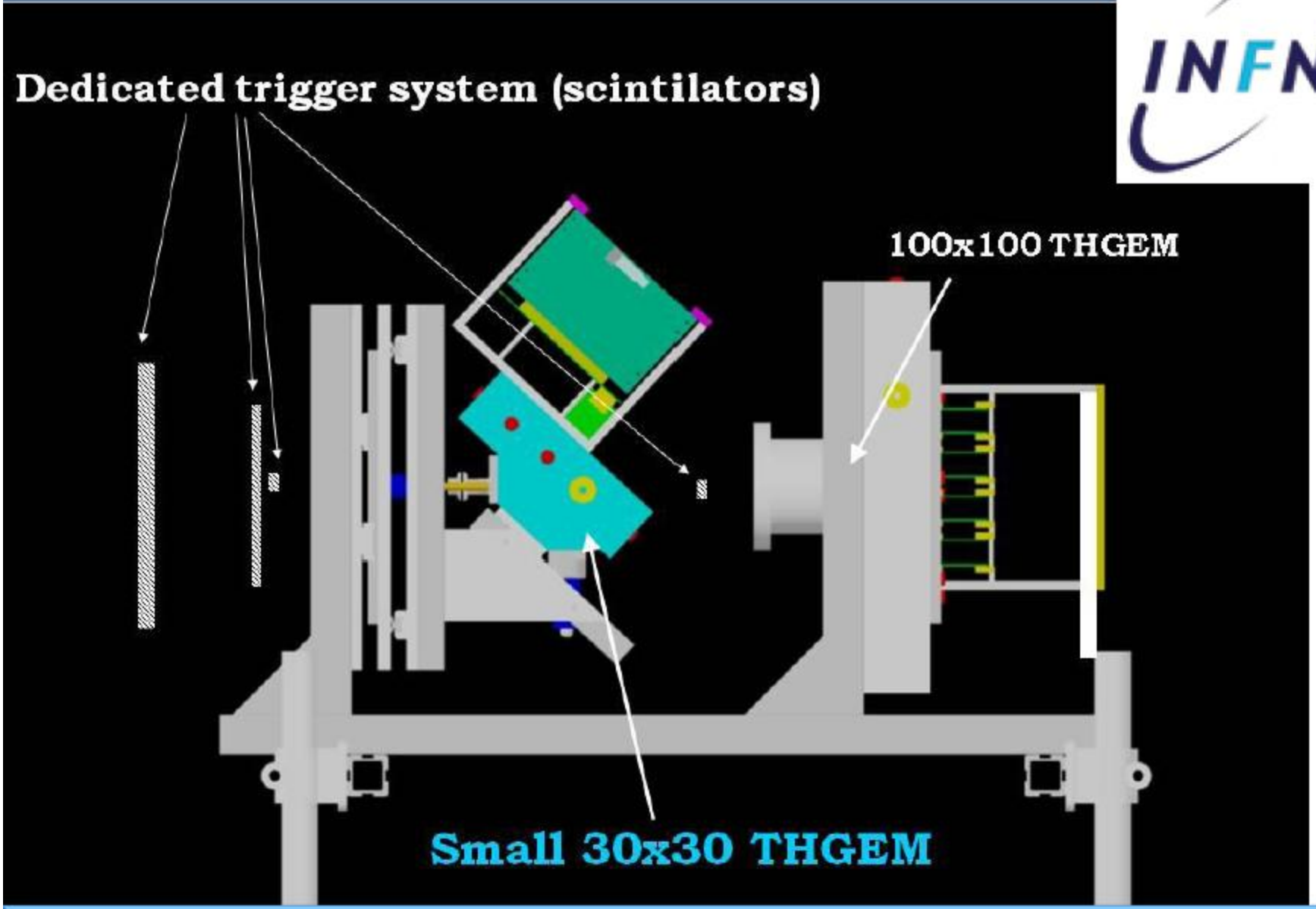
# RD 51 Collaboration meeting
# THGEM photon detector for RICH application, 2010 test beam goals and program

Outline:

- 2009 test beam result
  - -setup description
  - -results
  - What we learnt
- 2010 setup
  - -Program for the first test beam
  - - Goals and objectives

S. Levorato INFN Trieste
Alessandria, CERN, Freiburg, Liberec, Prague, Torino, Trieste Collaboration

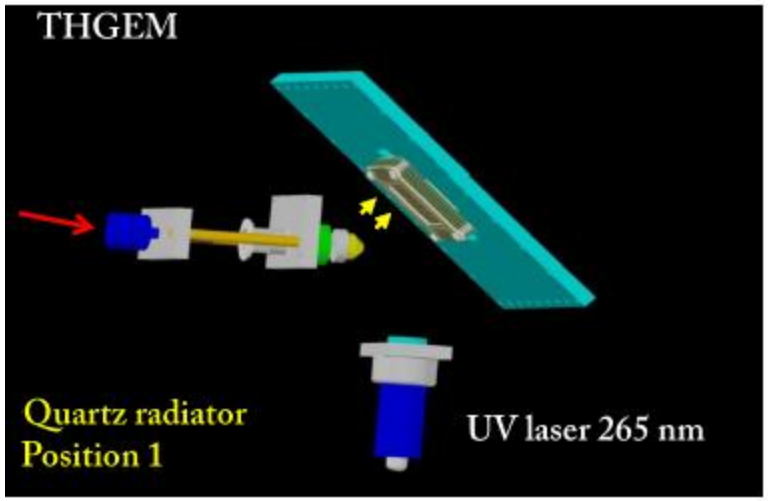
## Reminder :2009 setup

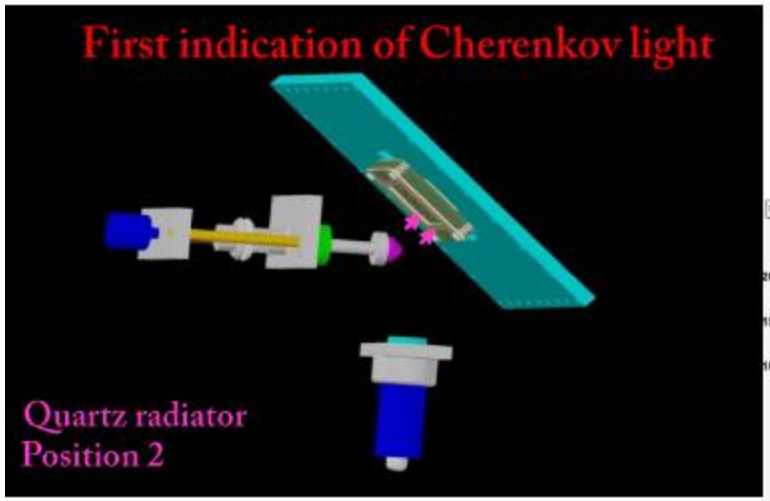


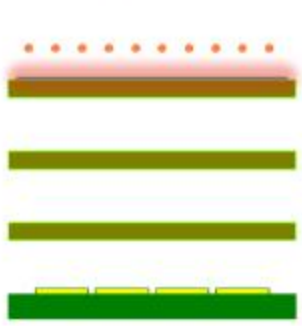
## Reminder :2009 setup

Triple THGEM (CsI) $Ar/CH_4$ 50/50 Diam=0.4 mm, pitch =0.8, Thick=0.4, rim ≤10 μm (GE)

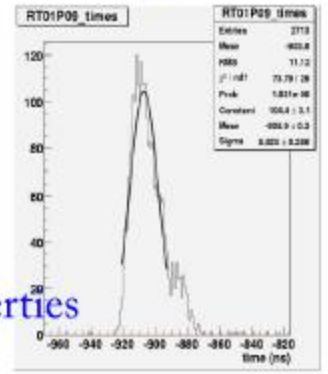
**2 different positions of radiator (change of 20mm)**

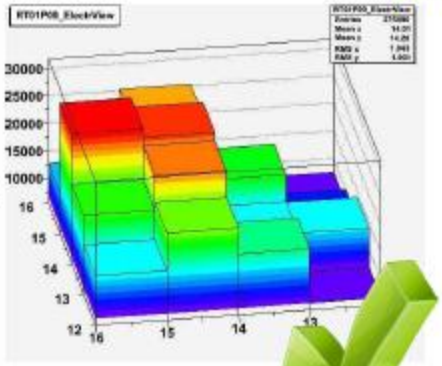


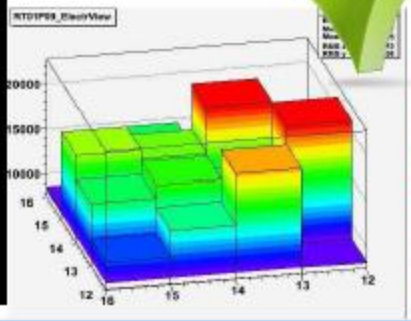



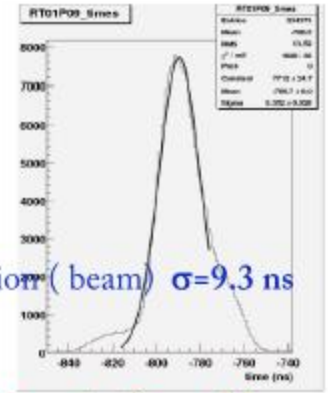




Timing properties









Time resolution ( beam) σ=9.3 ns

Max. sustainable gain for stable operation: ~ $10^5$
More studies are needed in beam conditions
(mip ionization, Ion Back Flow….)

# First Results of October CERN Testbeam with Postprocessed Timepix Chips in a TPC

RD51 Collaboration Meeting
May 25th, 2010

Martin Schultens [1]

Christoph Brezina [1], Klaus Desch [1], Jochen Kaminski [1], Martin Killenberg [3], Frederik Klöckner [1], Markus Köhli [2], Thorsten Krautscheid [1], Uwe Renz [2]

[1] Universität Bonn
[2] Universität Freiburg
[3] CERN

gefördert vom Bundesministerium für Bildung und Forschung

PHYSICS AT THE TERA SCALE Helmholtz Alliance

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# Pad Enlargement Chips

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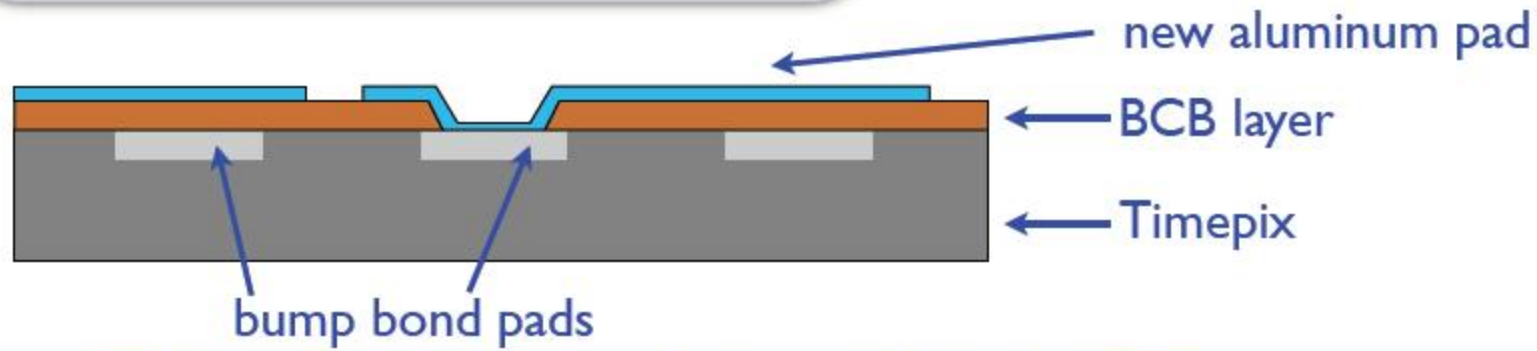
- Larger pads might be better
- Design of new chips is expensive

- Postprocessed Timepix-Chips with larger aluminum pads on insulating BCB layer
- Through connection to bump bond pad of Timepix chip in the middle of aluminum pad
- Chips with 9 different geometries were build at IZM (Berlin)

surface of new pads seen through microscope



# Experimental Setup at CERN

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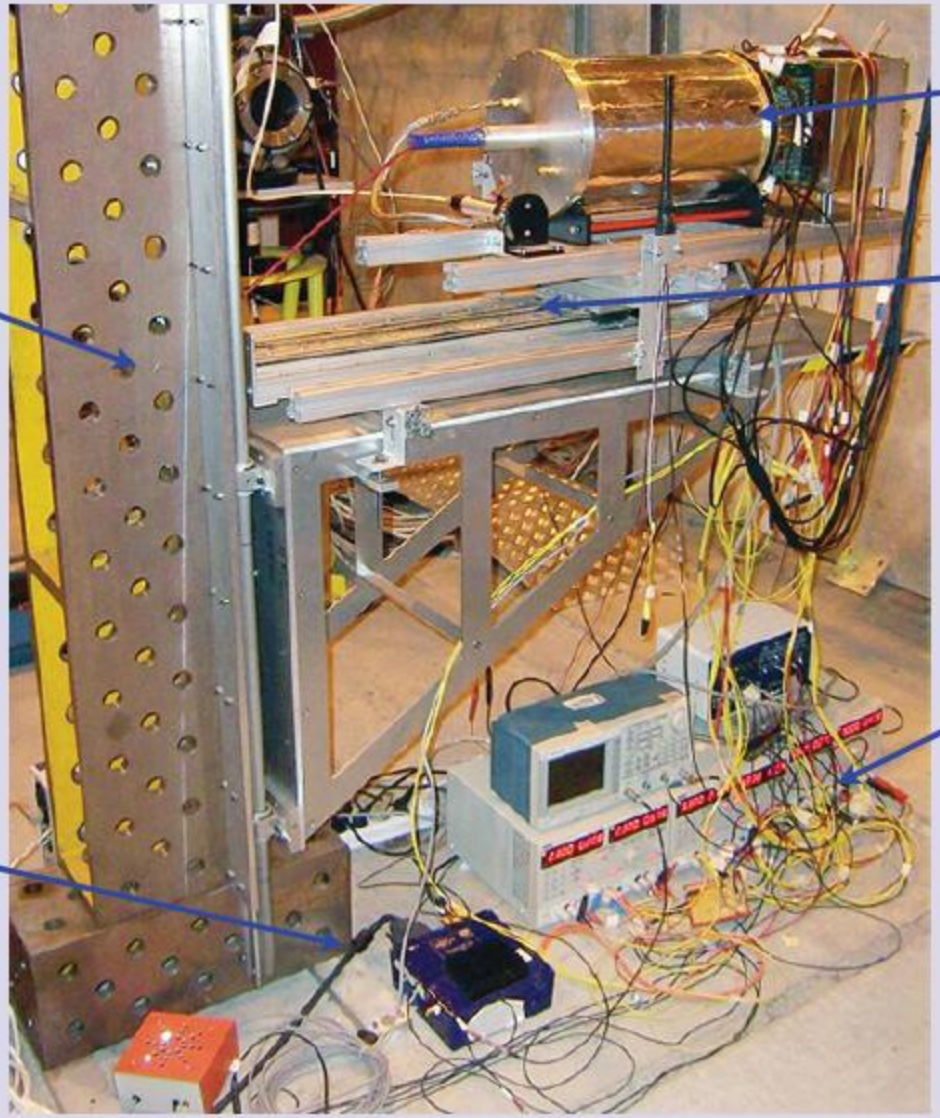

# 4 Postprocessed Timepix

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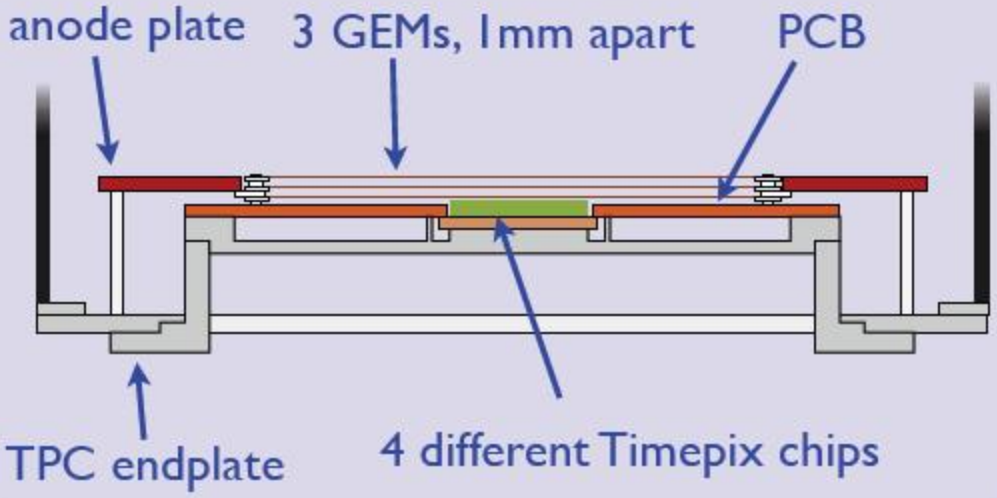
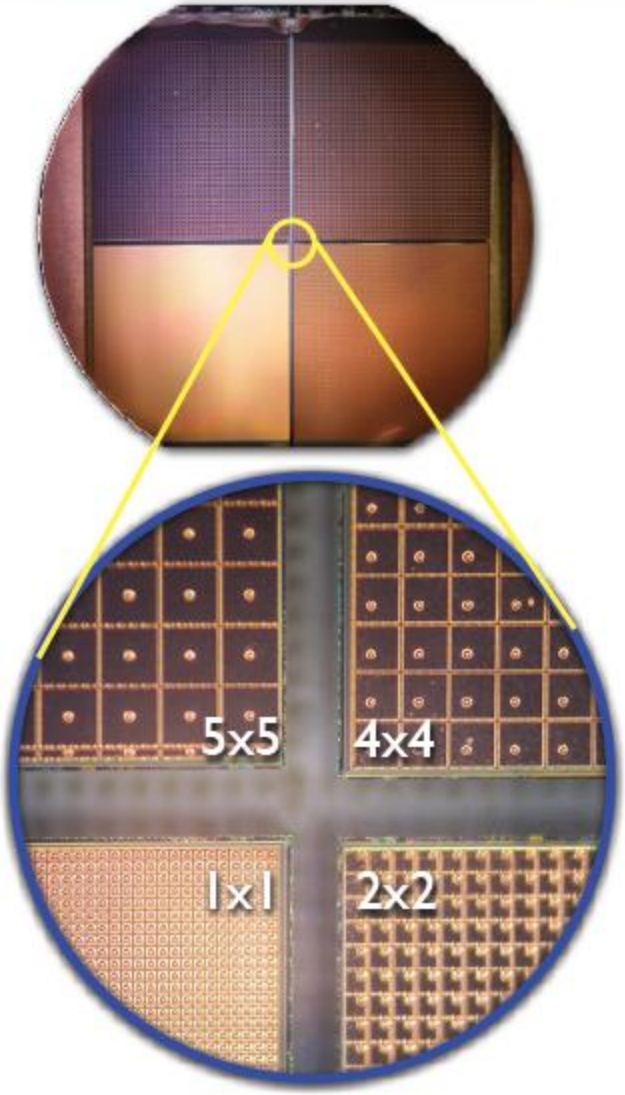
- 4 chips with different pad sizes were tested:
  1x1 pixels for comparison, 2x2 pixels, 4x4 pixels and 5x5 pixels
- all chips connected to one readout board



# Data Splitting

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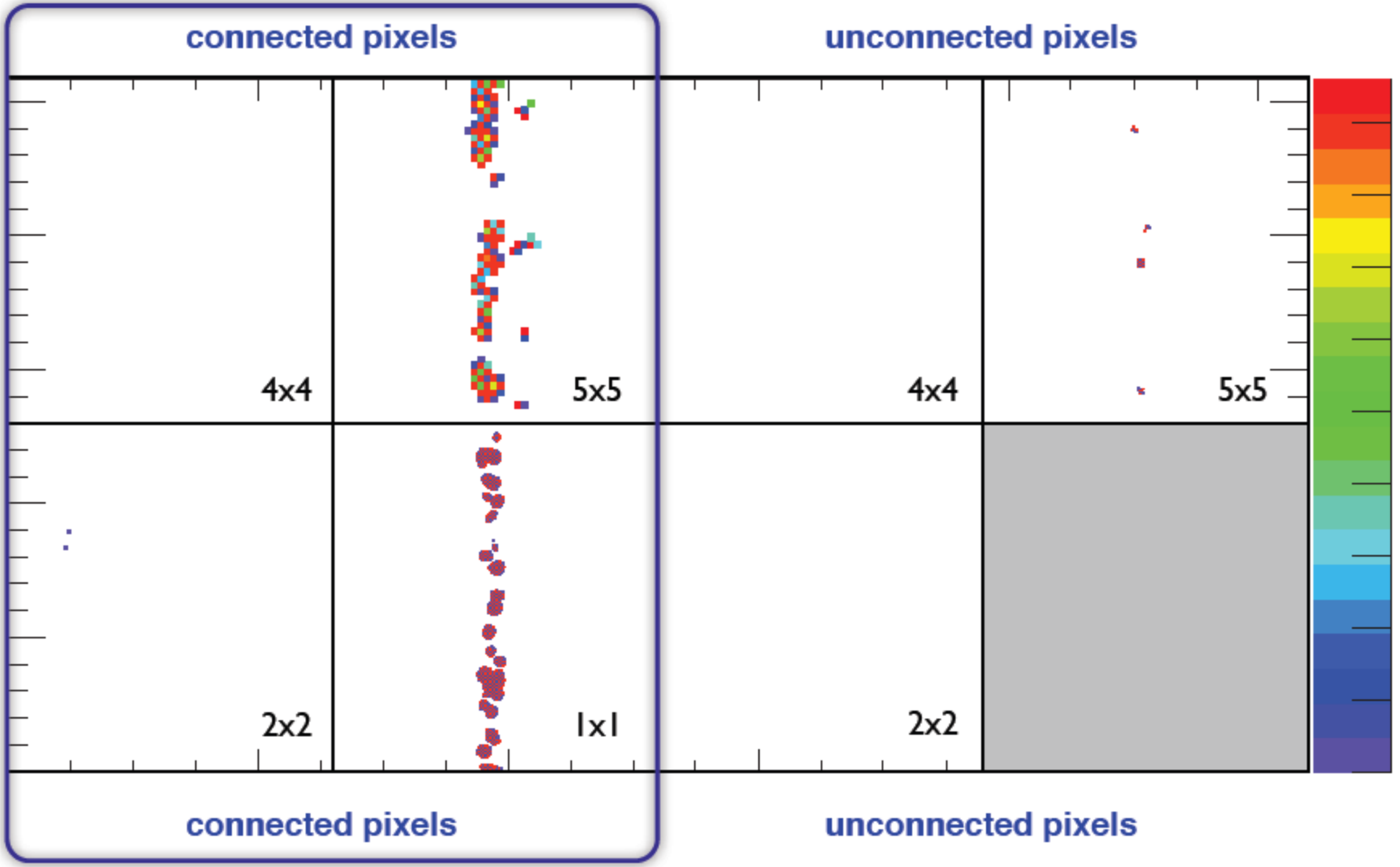

# Cluster and Track Analysis

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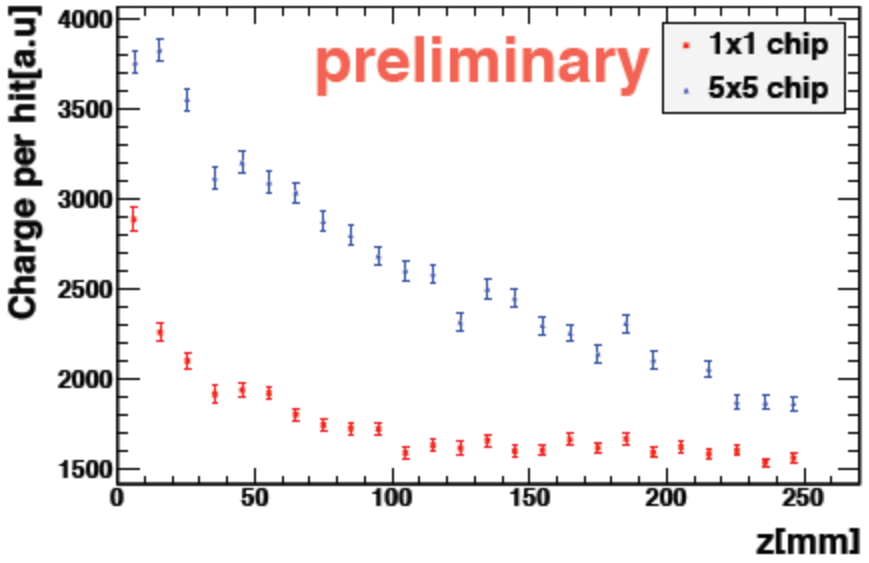


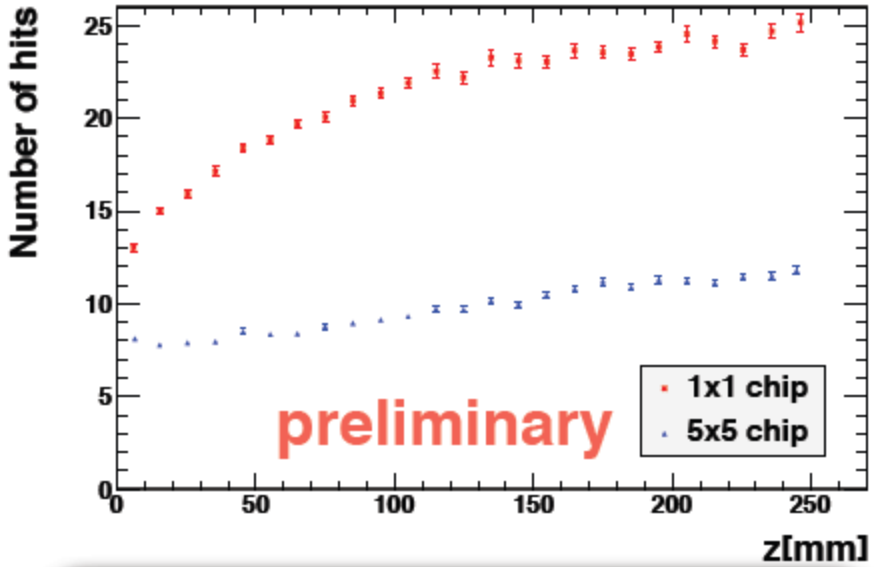


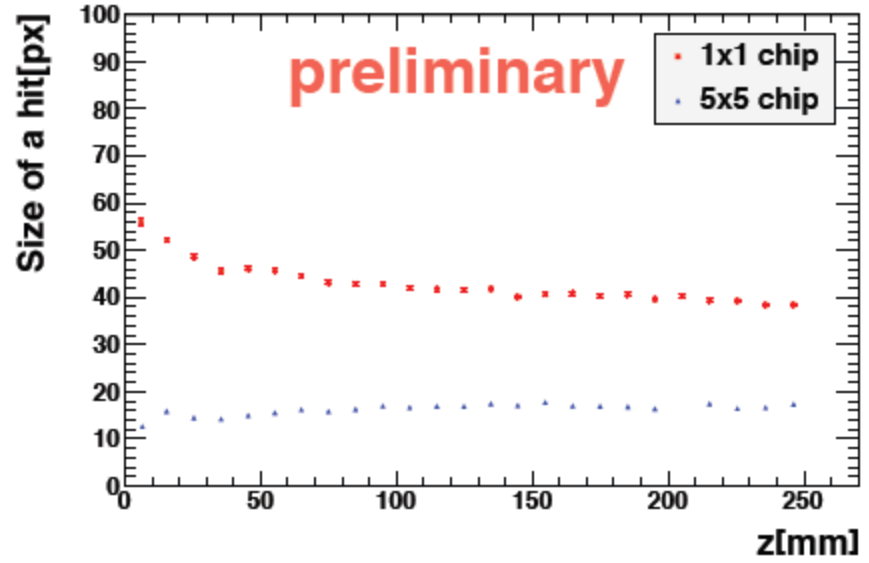


Comparison of 5x5 and 1x1:

- More charge per hit
- Fewer hits per track reconstructed
- Clustersize constant over drift distance

➡ Clusters are more difficult to separate

# Transversal Spatial Resolution

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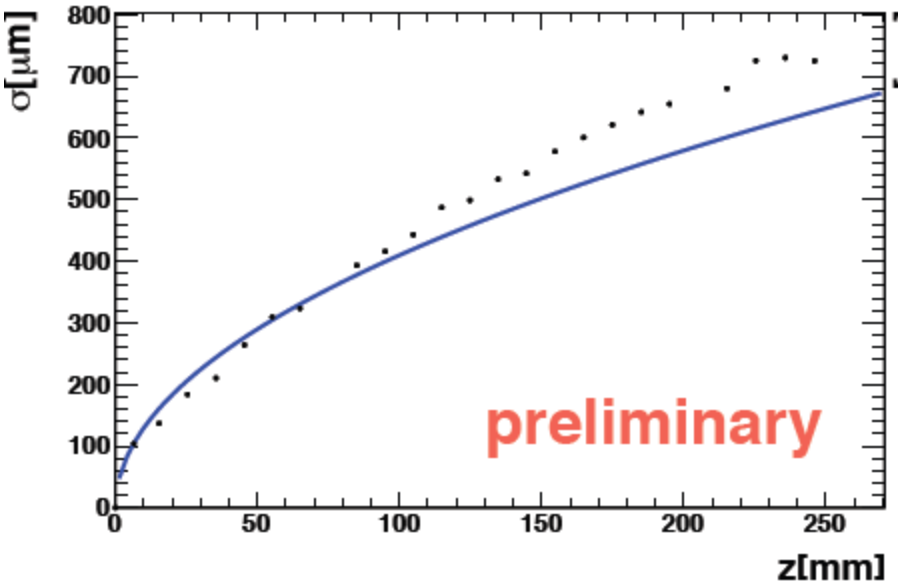
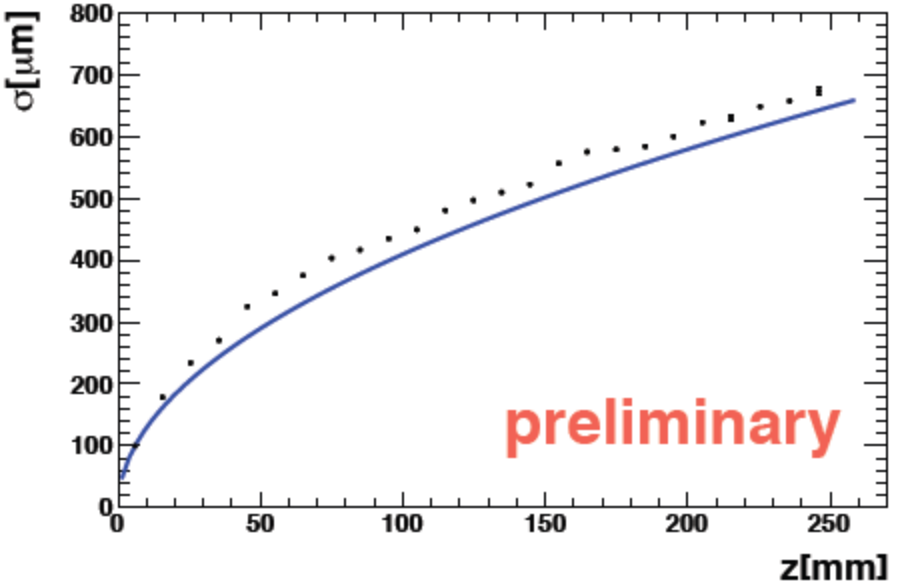
5x5 chip: transversal spatial resolution




1x1 chip: transversal spatial resolution

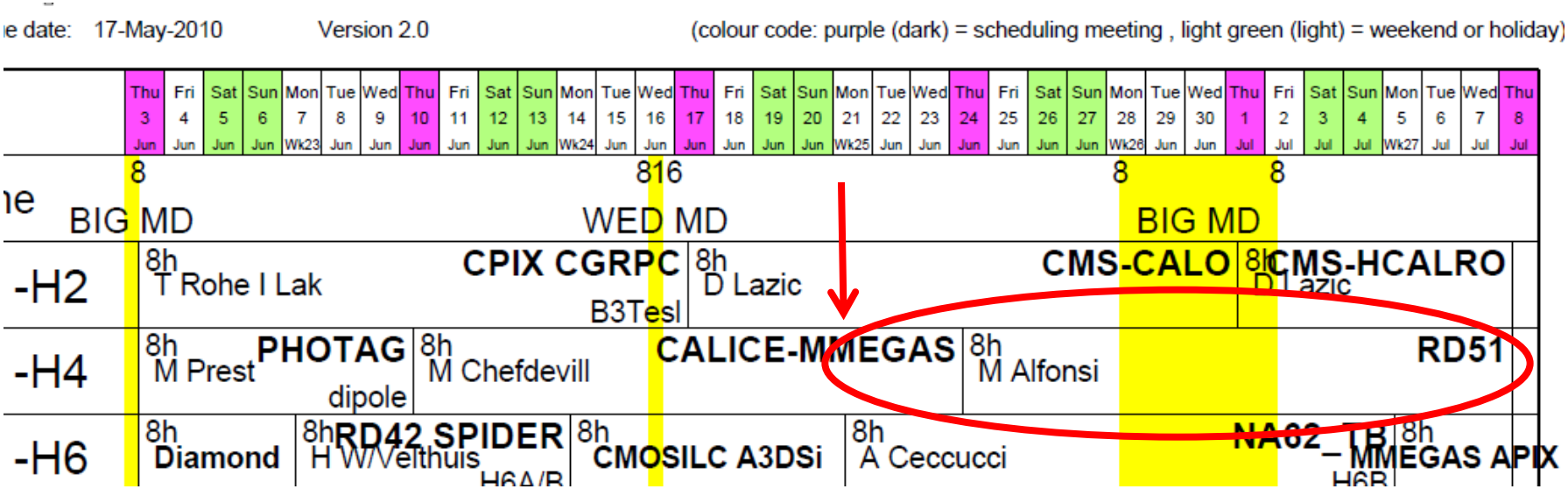



- Blue line: for single electron diffusion $\sigma = D_T\sqrt{z}$

  $D_T = 129.541\frac{\mu m}{\sqrt{cm}}$
- Transversal spatial resulution is of the same magnitude

# 2010 Schedule and Period 1 setup

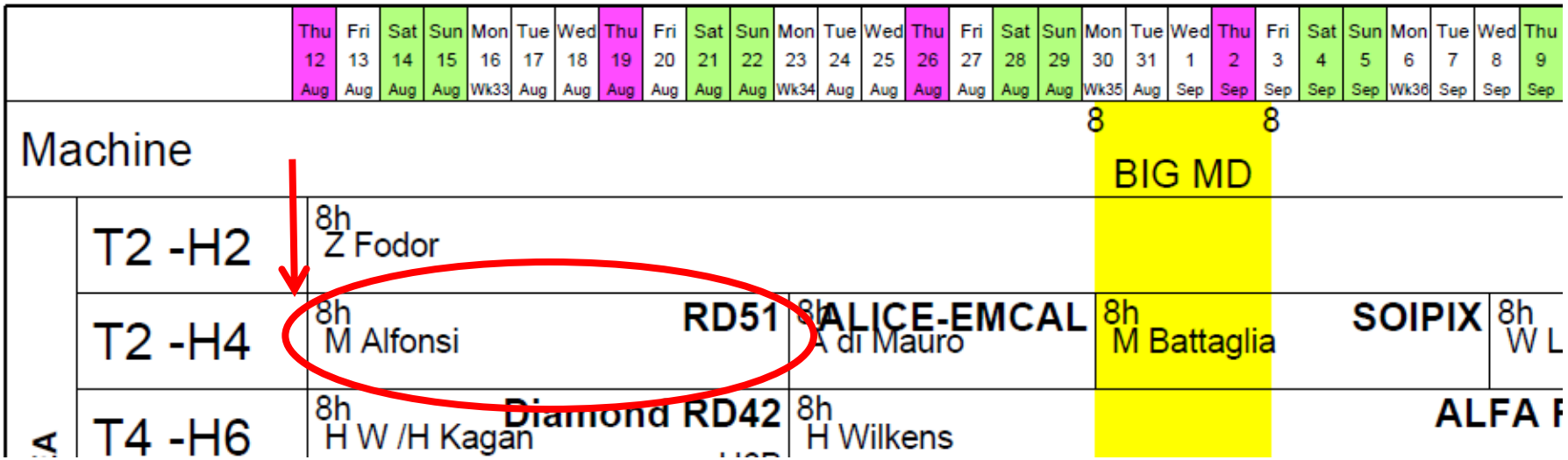
# Period 1 schedule




- Agreement with CALICE-MMEGAS:
  - All people start earlier on June 21st at 8h00
  - Installation must be completed by the end of the day
  - We run parasitically up to 25th at 8h00
- Flammable gas installation must be completed before 15h00 !

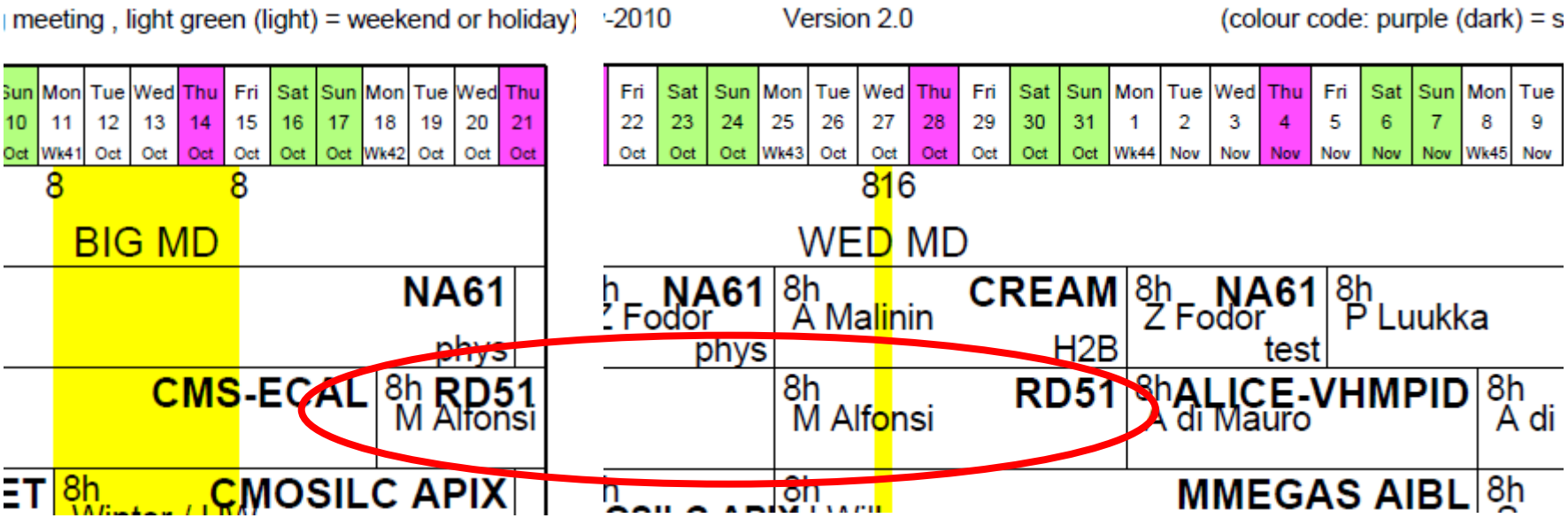
# Period 2 schedule

Schedule issue date: 17-May-2010 Version 2.0 (colour code: purple (dark) = scheduling meeting , light gree



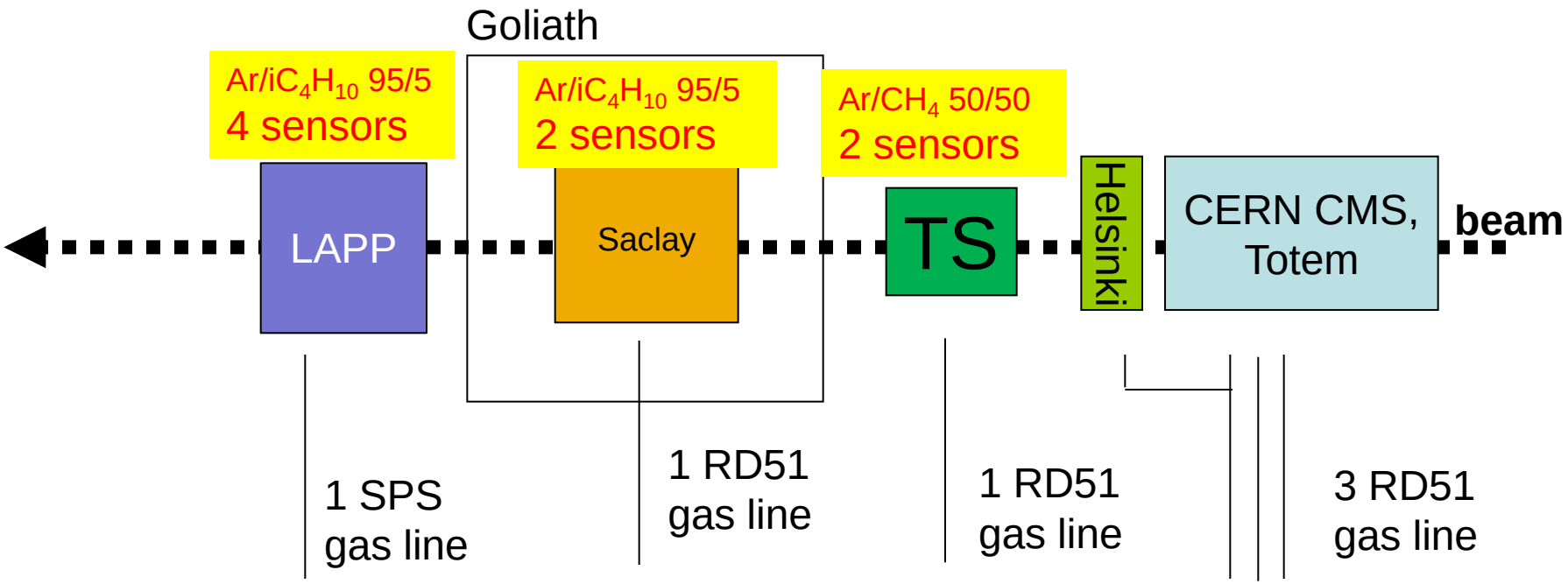

- Installation start on August 12th at 8h00
- Flammable gas installation must be completed before 15h00 !

# Period 3 schedule




- Installation on October 18th at 8h00
- Flammable gas installation must be completed before 15h00 !

# Period 1 (June 21st – July 8th)




Total sensors in the experimental area: 8
Total sensors in the gas zone: 2
Flammable gas: isobutane, methane

# Reminders and recommendations

- Send your gas cylinders orders a.s.a.p. They must be delivered to gas point:
  - 887-G0-921 if not flammable
  - 909-G0-921 if flammable
- Let us know a.s.a.p. if you need HV/LV channels, NIM/VME crates, etc..
- Prepare your installation in advance, in order to complete it the first day
- Cables, fibers, etc. from control room to experimental area can be installed only during MD: the next one is from May 31st to June 2nd
- Send filled ISIEC form a.s.a.p.

# 2010 test beam programmes

# CMS High Eta Upgrade Studies
# Test Beam Plan 2010

Chambers for June:
CMS Triple GEM prototype 10 x 10 cm
Honeycomb Triple GEM
Single Mask GEM

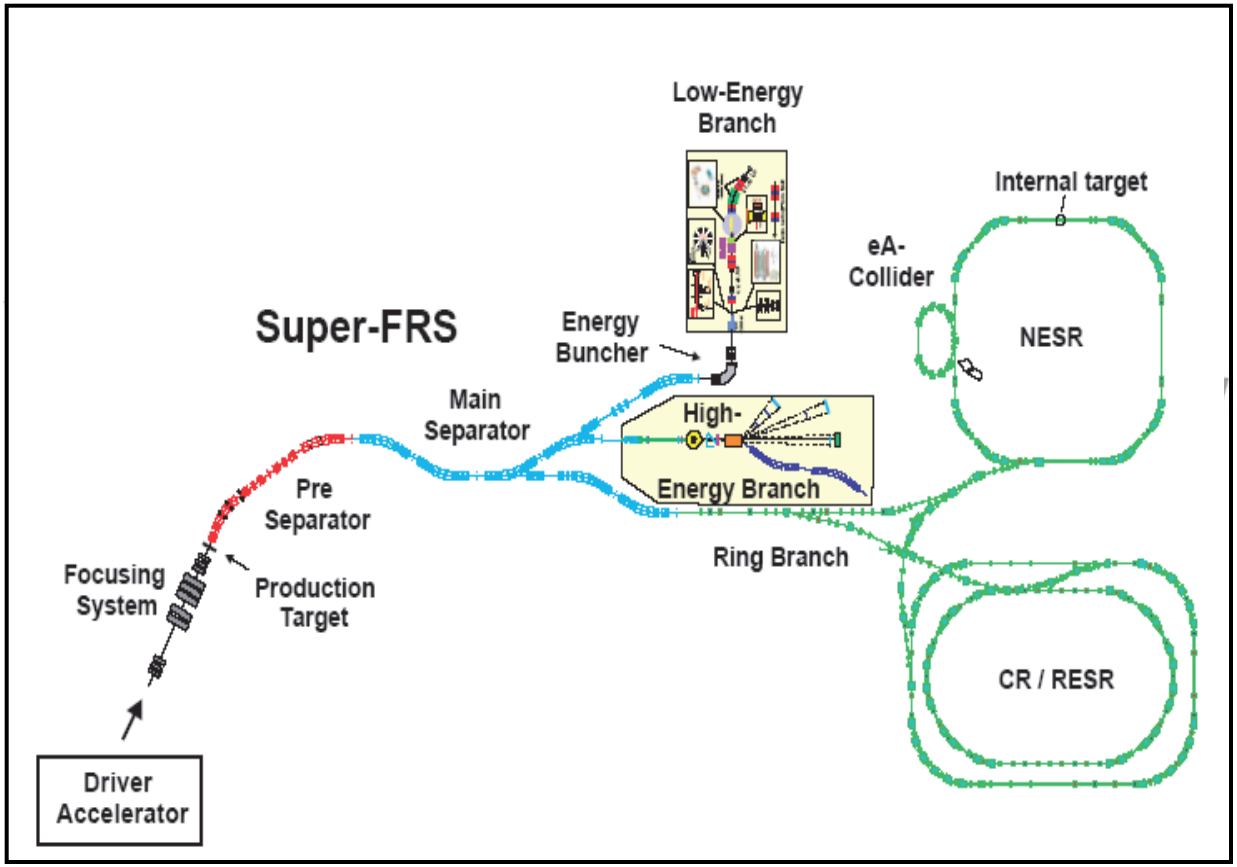
1. Measure Efficiency for perpendicular tracks
2. Measure Efficiency for inclined tracks with tracking
3. Optimization of time resolution
4. Tests with Front End electronics for mips
5. Space and time resolution

1. Gas Studies
2. Magnetic Field Operation
3. Large Prototype test

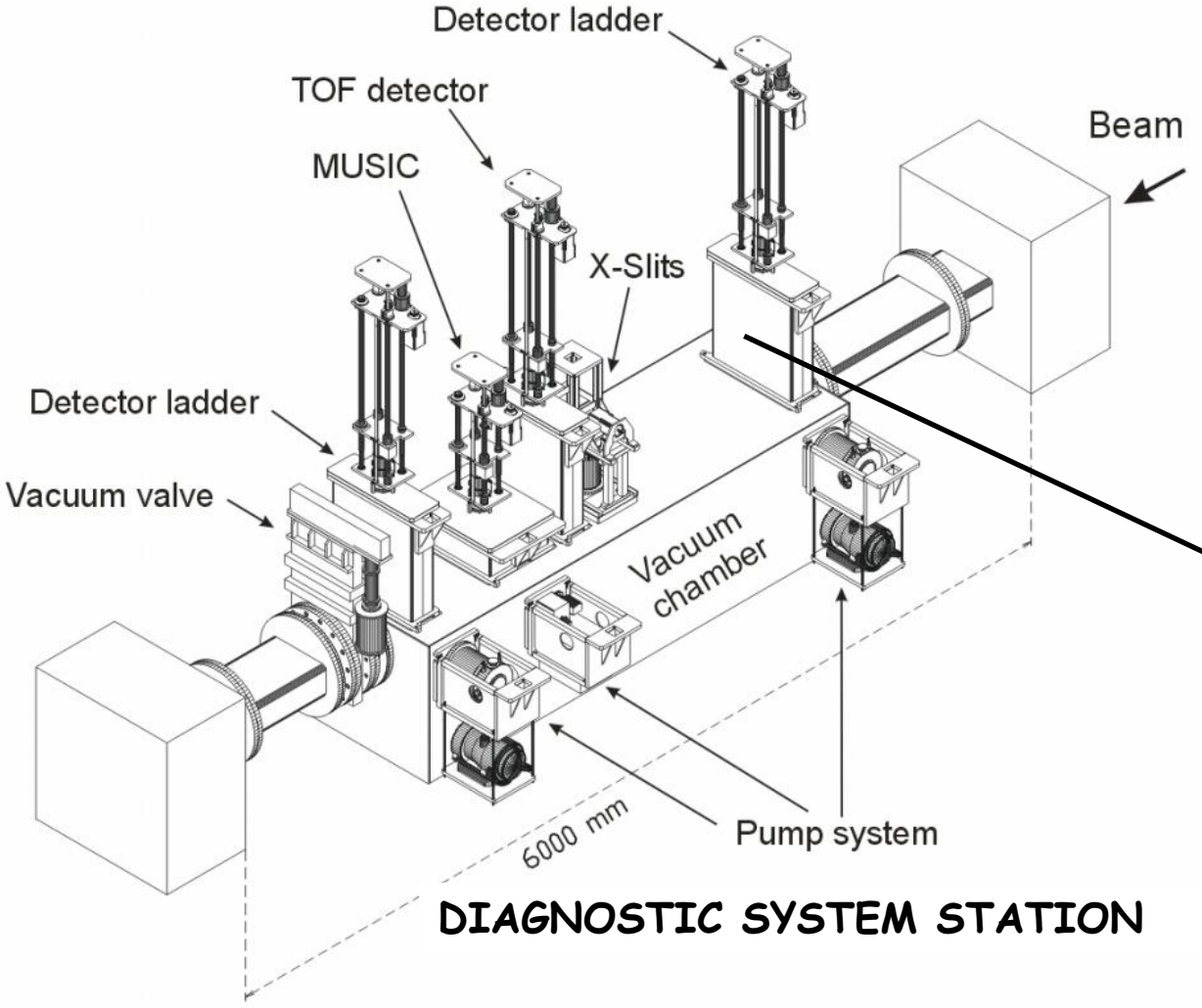
# Development of a GEM-TPC for Beam Diagnostics at SuperFRS - FAIR

*NUSTAR collaboration (Nuclear Structure, Astrophysics, and Reactions) has more than 700 members in total.*

*Part of the Finnish Contribution will be in the superconducting in-flight separator (Super-FRS) Diagnostic systems*



# Diagnostic system station




GEM-TPC in the Test Box

The spatial resolution of the GEM-TPC will be studied

# RD 51 Collaboration meeting
# THGEM photon detector for RICH application, 2010 test beam goals and program

Concerning the photon detectors

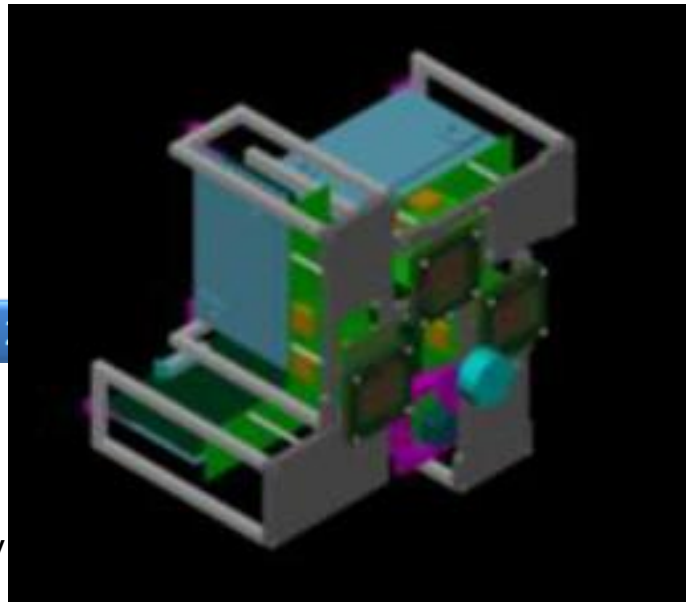
GOALS:
Operate a "*large*" THGEM based photon detector in beam condition and *see* Cherenkov rings
Perform a E field scan ( Drift, Induction, Transfers ) thanks to the new HV system (not possible last year) and check the detector response.
Test the behavior of the FE electronic coupled to a larger capacitance device with a new electronic protection circuit to save CMAD chips from damages when sparks occur

S. Levorato INFN Trieste
Alessandria, CERN, Freiburg, Liberec, Prague, Torino, Trieste Collaboration

A completely new photon detector system has been designed and it's in preparation.

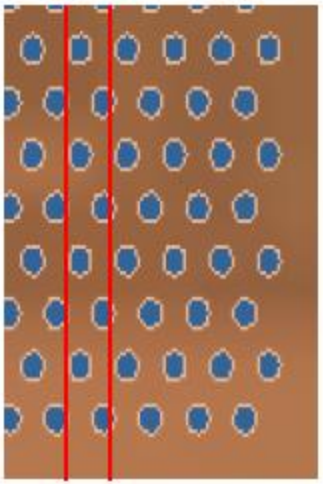
It consists of a newly designed and machined radiator lens ( 160 mm Cherenkov diameter ) . It can be equipped at the same time with 3 independent 30mmx30mm THGEM PDs
A MAPMT R7600 will be permanently installed too.

GOALS
-Perform photon counting and extract THGEM photon detection efficiency by comparison with pmt.
- Test a possible solution for IBF reduction with one of the 3 THGEM detectors adding a dedicated electrode.

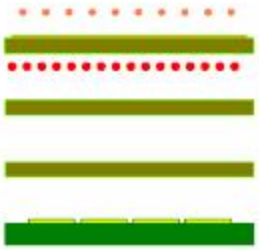


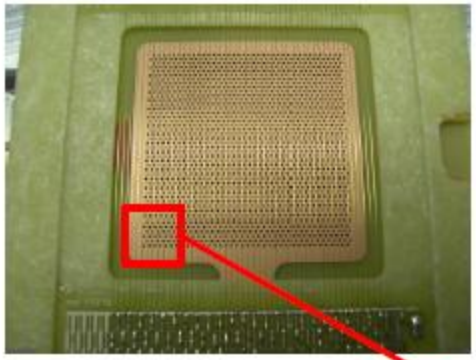
## Ion Back Flow reduction

To get rid of geometrical constrains -> plane of wires facing the 1th bottom electrode



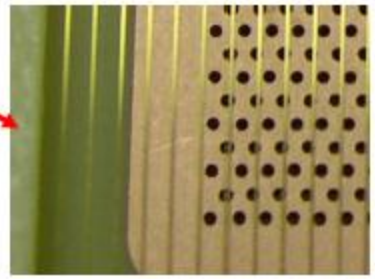
Distance from the bottom plane 500 μm
Wires spacing according to pitch of the THGEM





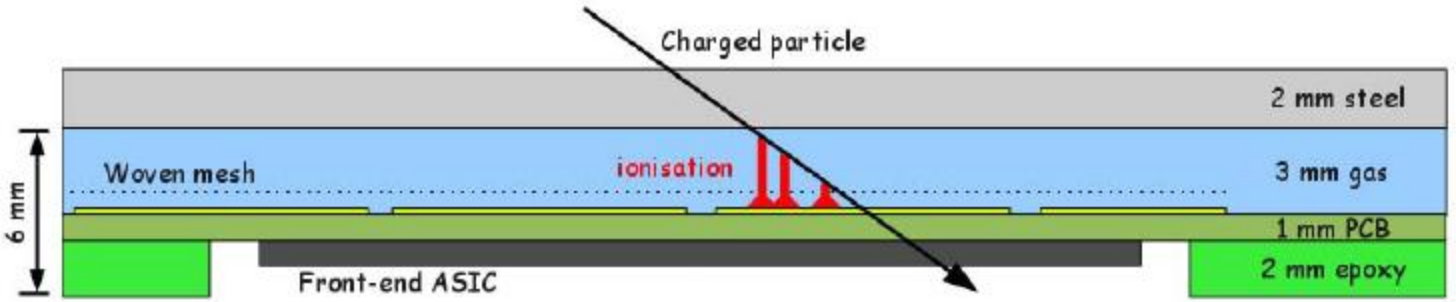
Its realization
100 μm wires

**Very firs trial!**



# Micromegas for a DHCAL

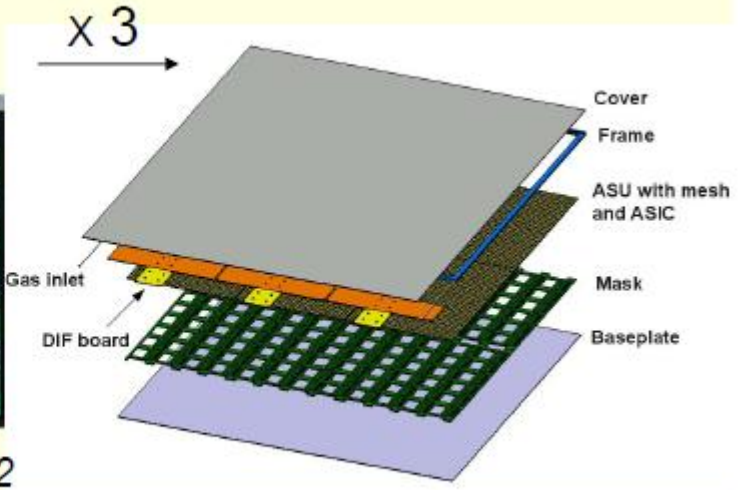
- Bulk-Micromegas
- 1 $cm^2$ semi-digital readout pads (1 or 2 bits)
- Embedded front-end ASICs
- Active medium thickness : 6 mm
  3 mm gas, 3 mm PCB/epoxy
- Part of the Micromegas chamber is the absorber



# Micromegas prototypes (IV)

- 1st prototypes: 6x16 cm² & 12x32 cm² with analog readout (GASSIPLEX)
- 2nd prototypes: 8x8 cm² & 8x32 cm² with embbeded digital chips (DIRAC/HARDROC)
- 3rd prototypes: 32x48 cm²
- **4th prototype: 1 m²**

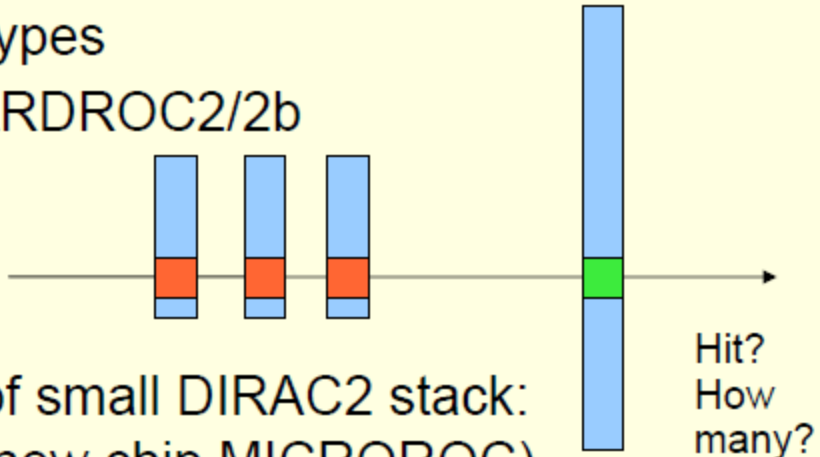
*2 chained ASU of 32x48 cm² bulk with 24 HARDROC2*




see M. Chefdeville talk this afternoon

# Measurements in beam (June 2010)

- Validate large area design, rate effects, sparks effects…
- Efficiency and multiplicity disparity over the 1 $m^2$ area
- Ideally with MIPs → SPS muon beam
- Detectors
  - scintillators
  - telescope : 3 analog prototypes
  - The 1$m^2$ prototype with HARDROC2/2b
- $10^4$ events per pad, $10^3$ pads
  100 Hz DAQ, 10 % duty cycle
  → need 10-20 days
- Measurement inside magnet of small DIRAC2 stack: postponed (priority: design of new chip MICROROC)



# Conclusion

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- RD51 common test beam has been heavily used in 2009, allowing RD51 members to test the results of their R&D programmes

- An even larger use is foreseen in 2010, with 5, 7 and 7 users taking data in the three beam periods.

# Let's conclude a TB with a BBQ!


- I booked the Prevessin BBQ area (just outside the building) for the last TB day (8th July)
- Please let me know the number of people that can stay until the end of the day!