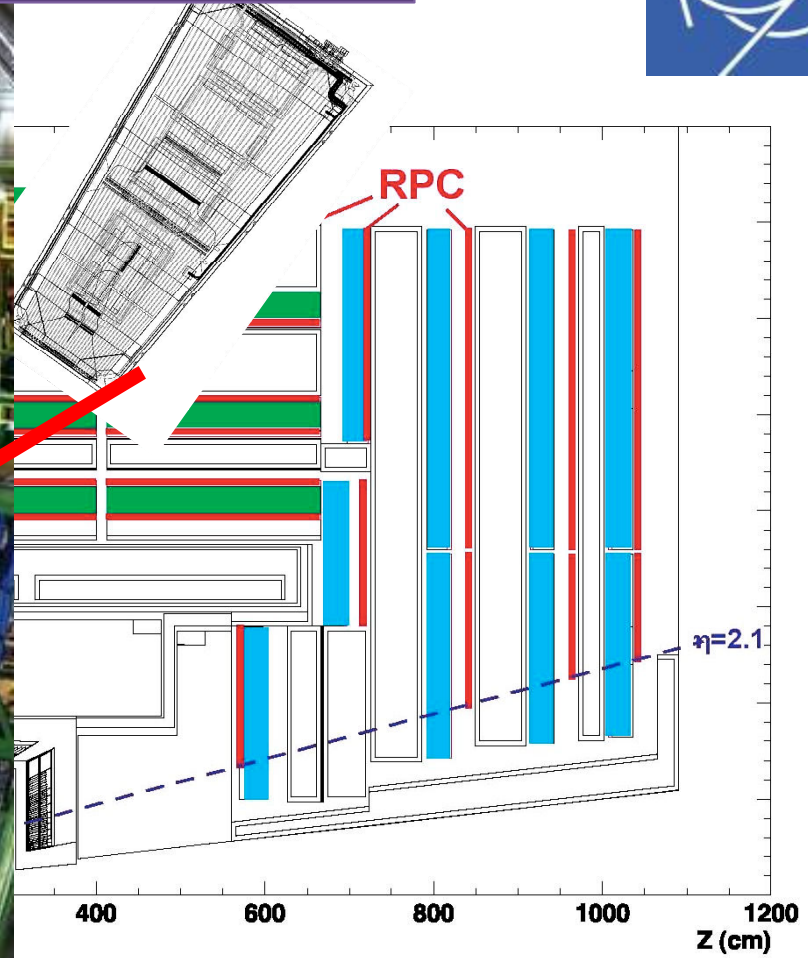
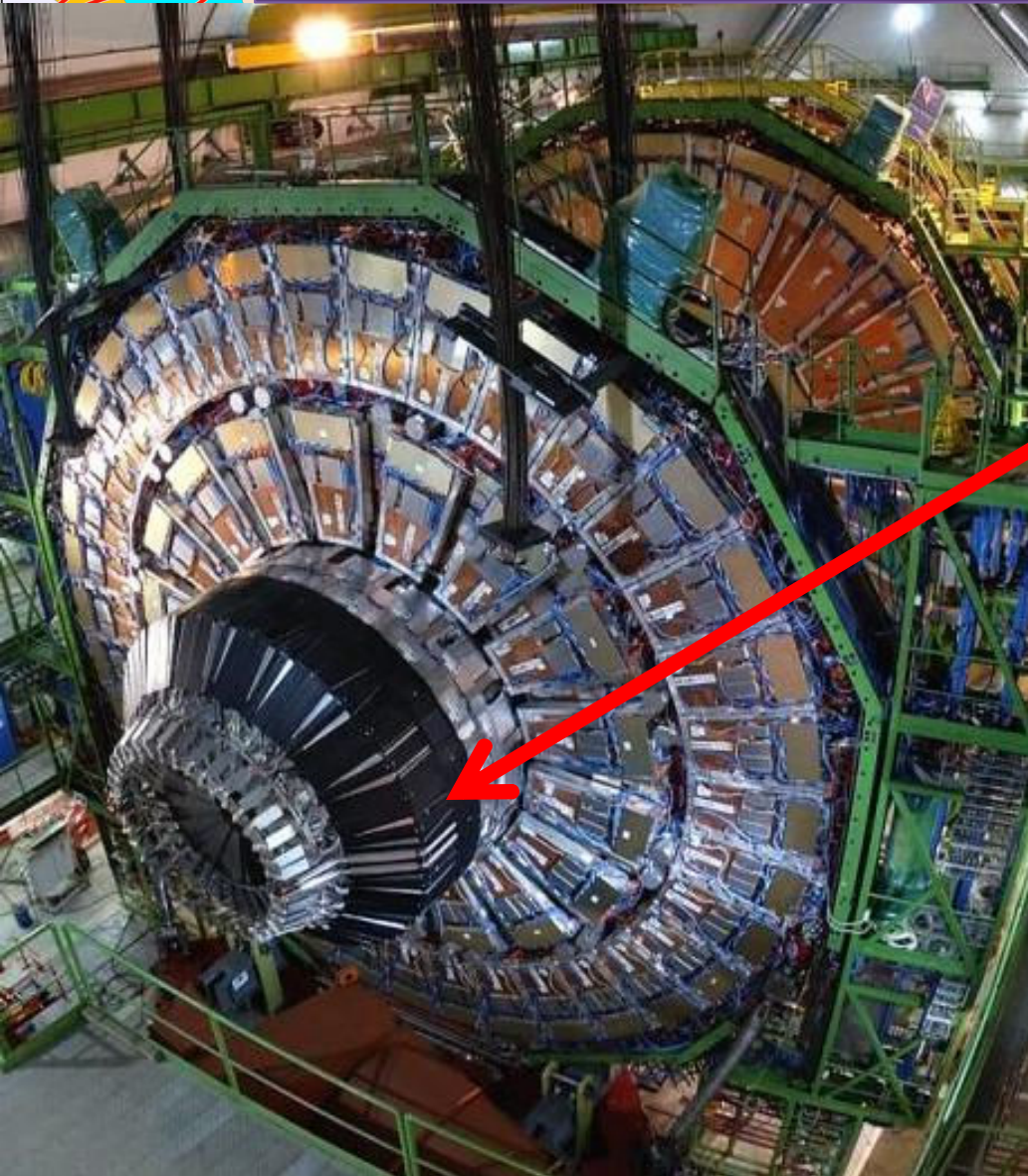


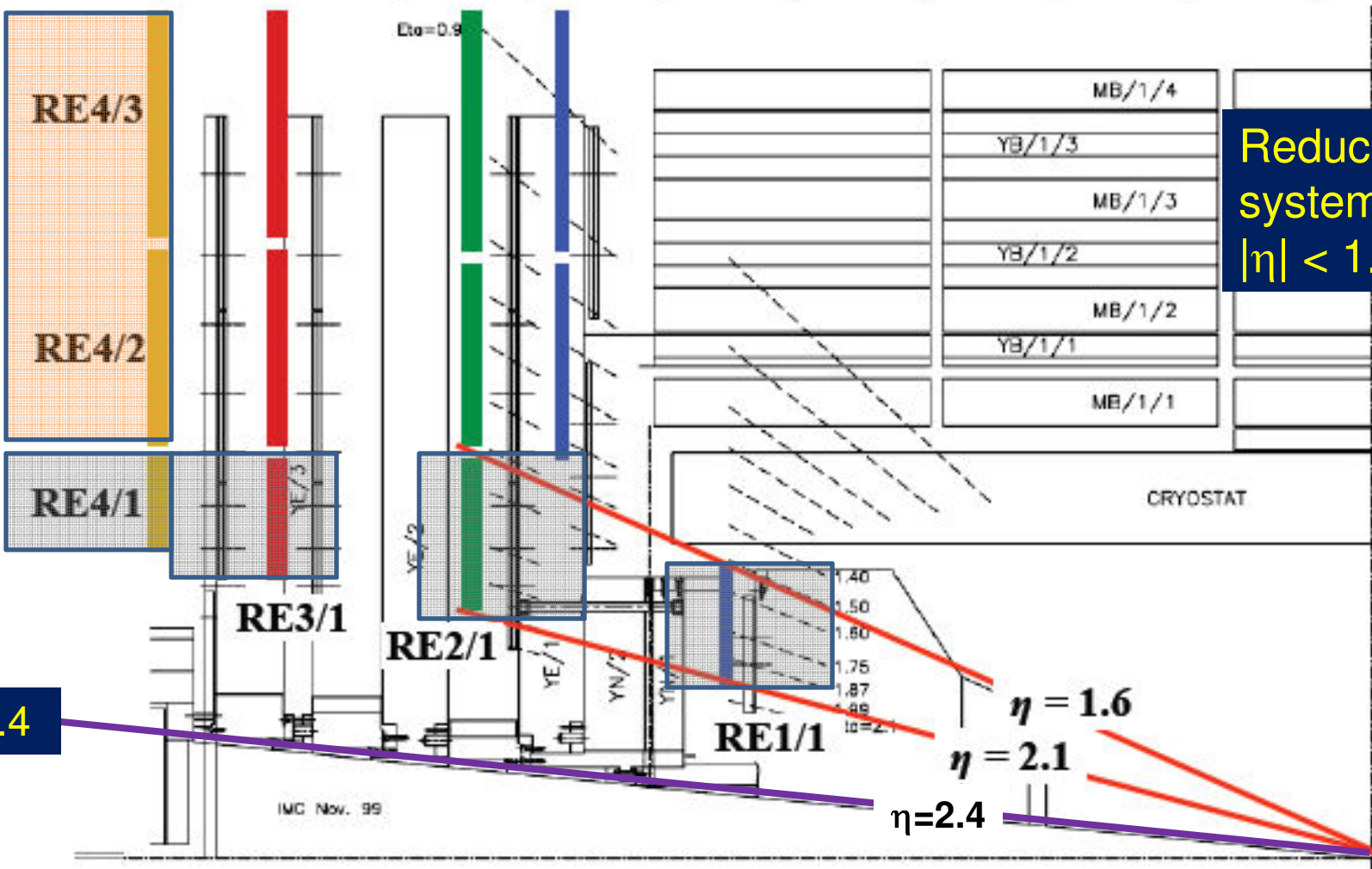
A High Eta Forward Muon Trigger and Tracking detector for CMS



Endcap RPC:

- RE 1,2,3,4 = 1 layers
- 540 trapezoidal chambers
- 80 000 radial strips

Initial RE system –tailored to budget



Reduced RE system
 $|\eta| < 1.6$

$\eta = 2.4$

STAGED

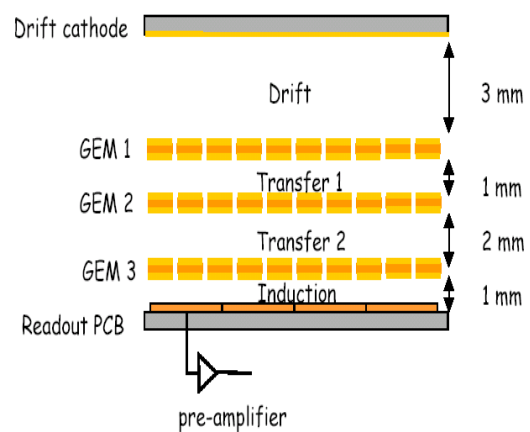
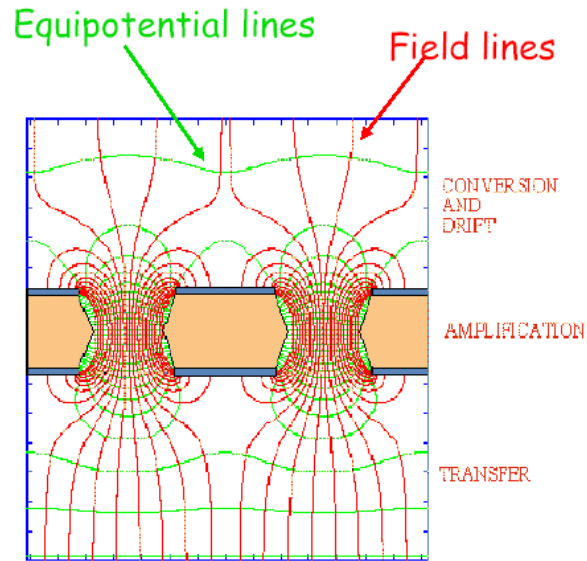
	RE 1/1	RE 1/2	RE 1/3	RE 2/1	RE 2/2	RE 2/3	RE 3/1	RE 3/2	RE 3/3	RE 4/1	RE 4/2	RE 4/3
No. of chambers	36*2	36*2	36*2	18*2	36*2	36*2	18*2	36*2	36*2	18*2	36*2	36*

MPGDs as candidate technology

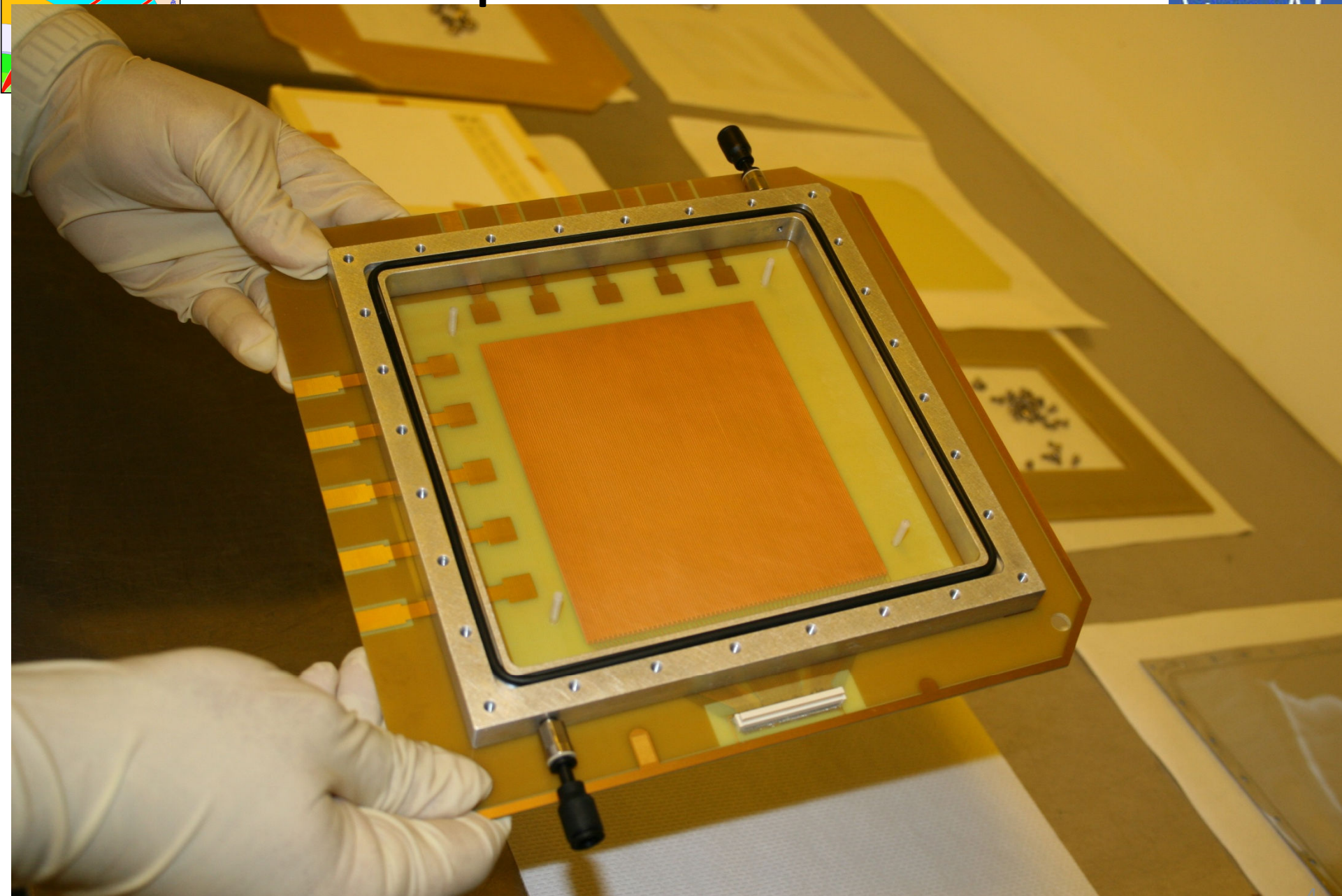
Enhance and optimize the readout ($\eta-\phi$) granularity by improved rate capability

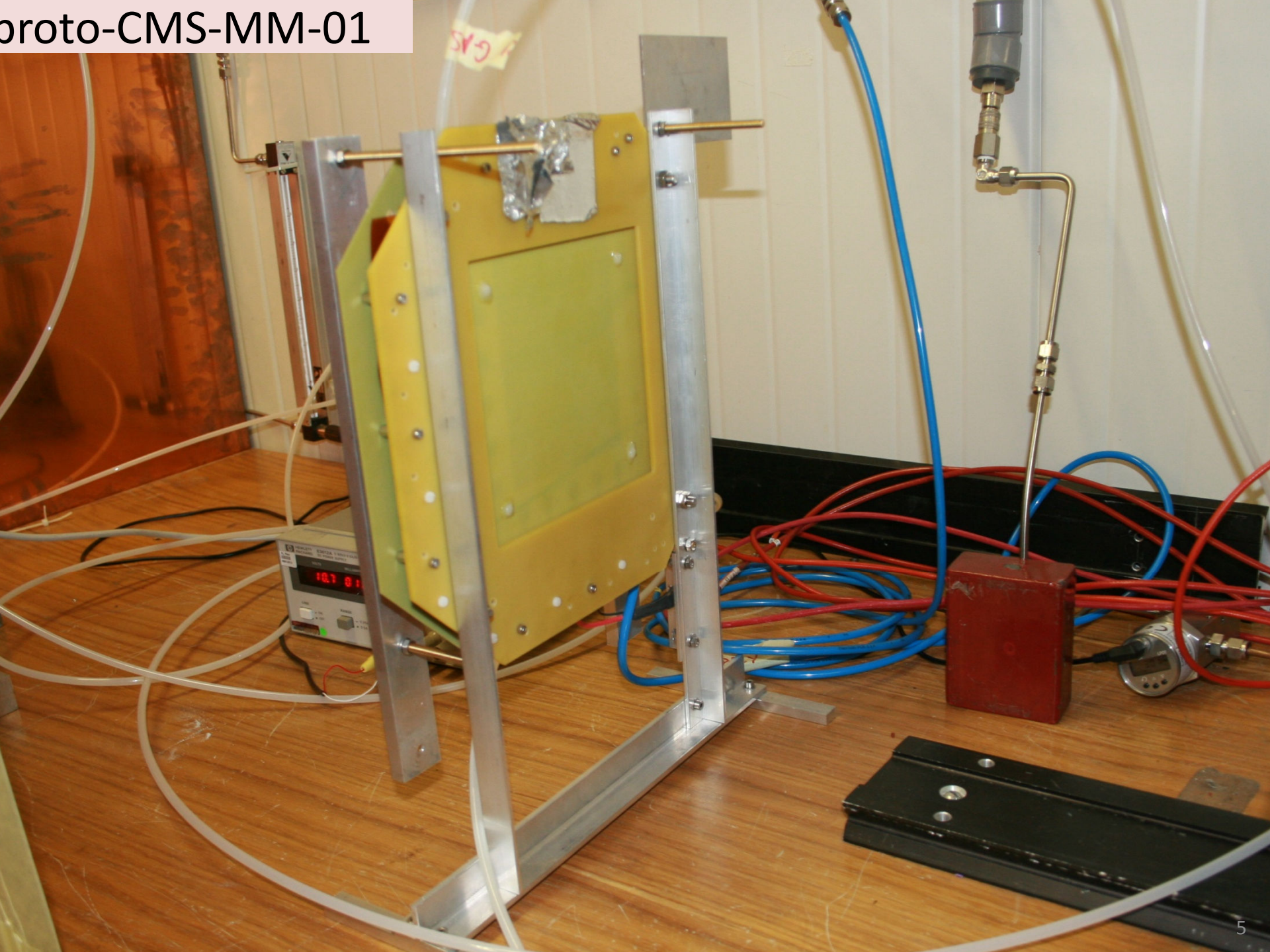
Rate capability – $10^4/\text{mm}^2$

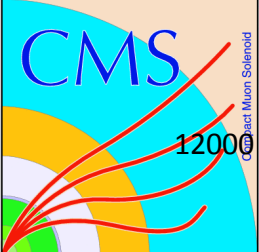
- Spatial resolution $\sim 100 \mu\text{m}$
($\Theta_{\text{track}} < 45^\circ$)
- Time resolution $\sim 1\text{-}3 \text{ ns}$ (Gas!)
- Efficiency $> 98\%$
- Rate capability $> 5 \text{ kHz}/\text{cm}^2$
- Argon CO2 (non flammable mixture - big plus)



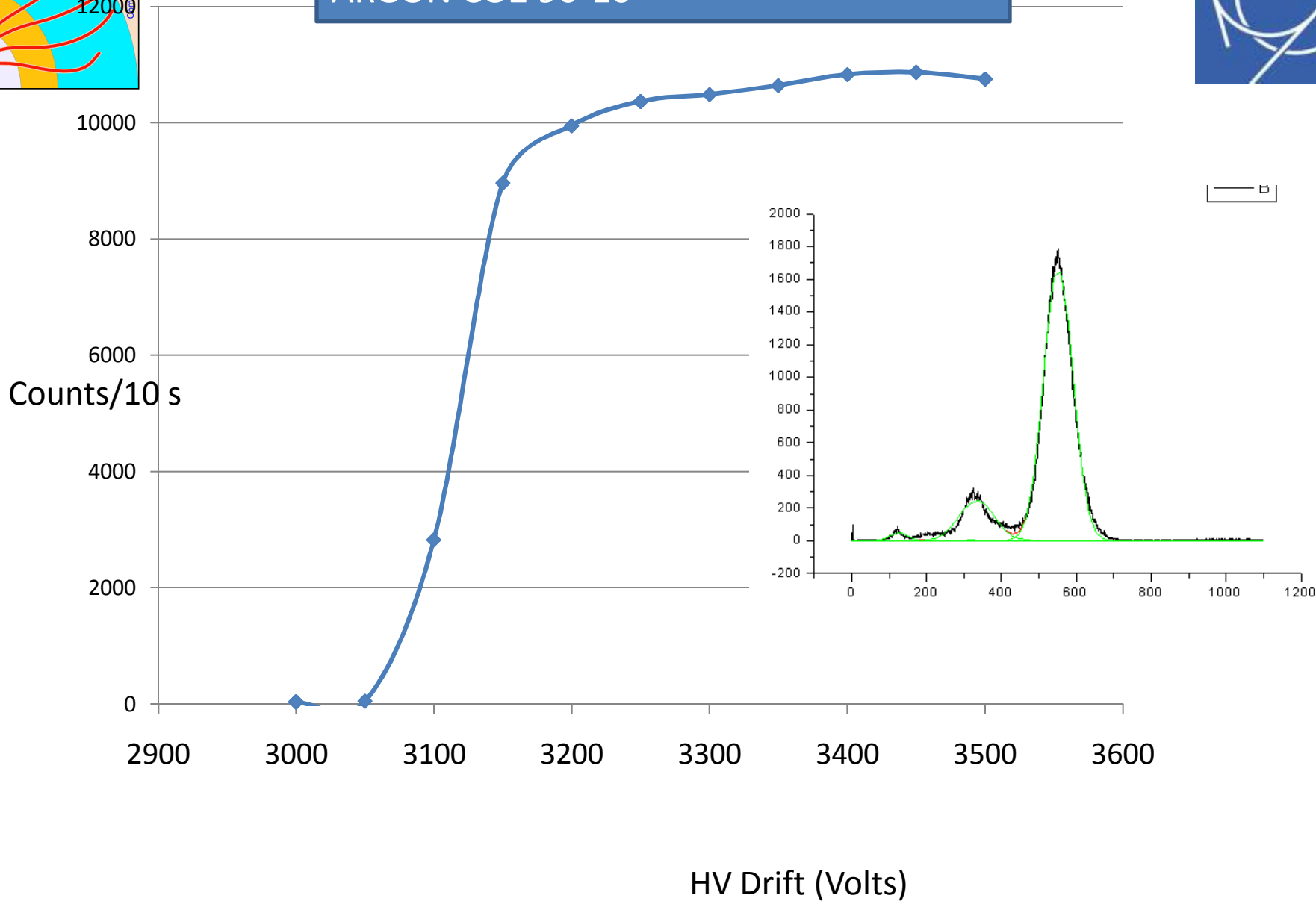
Small proto-CMS-TG-01





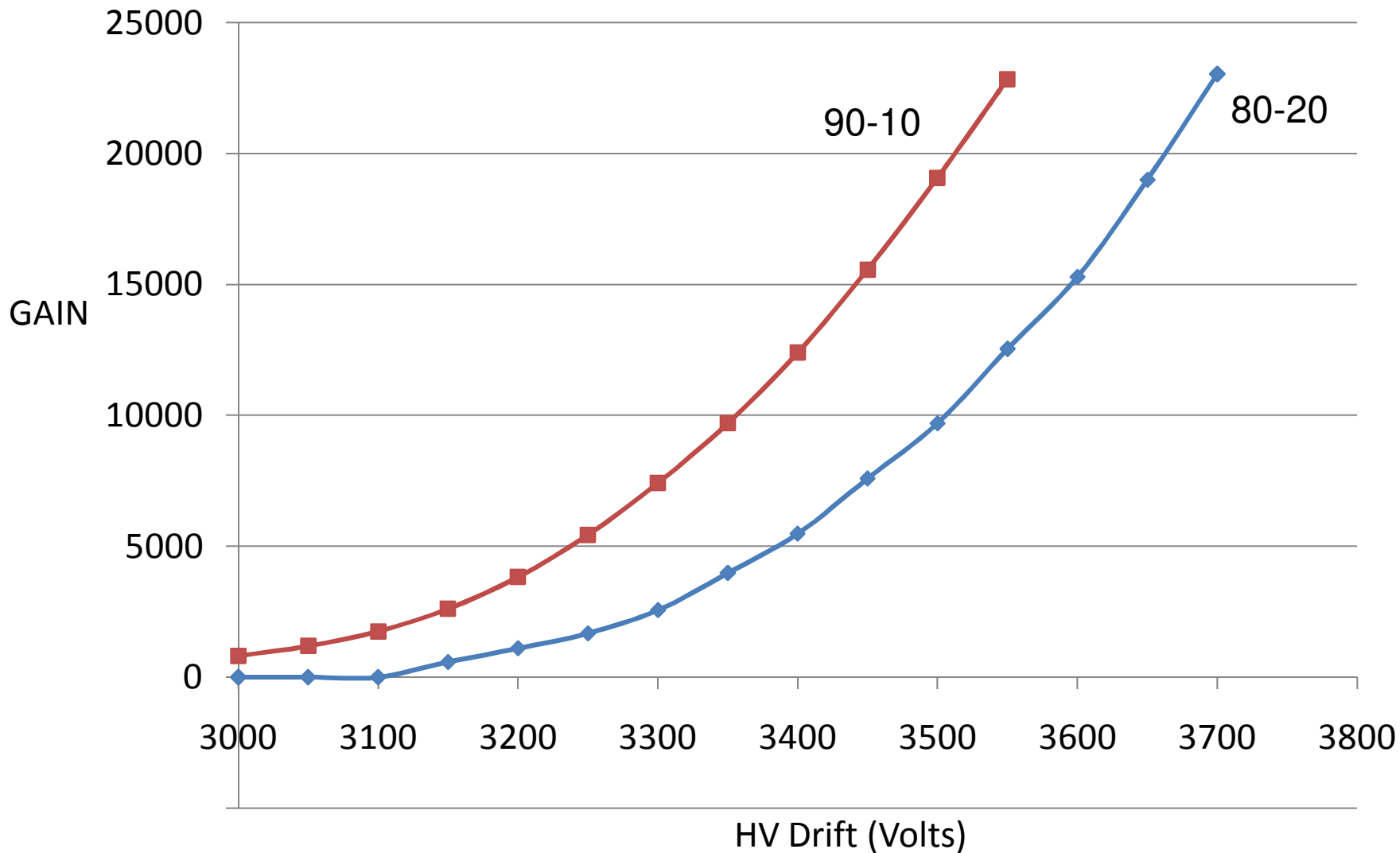


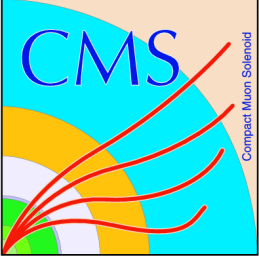
EFFICIENCY STUDIES WITH TRIPLE GEM ARGON CO2 90-10



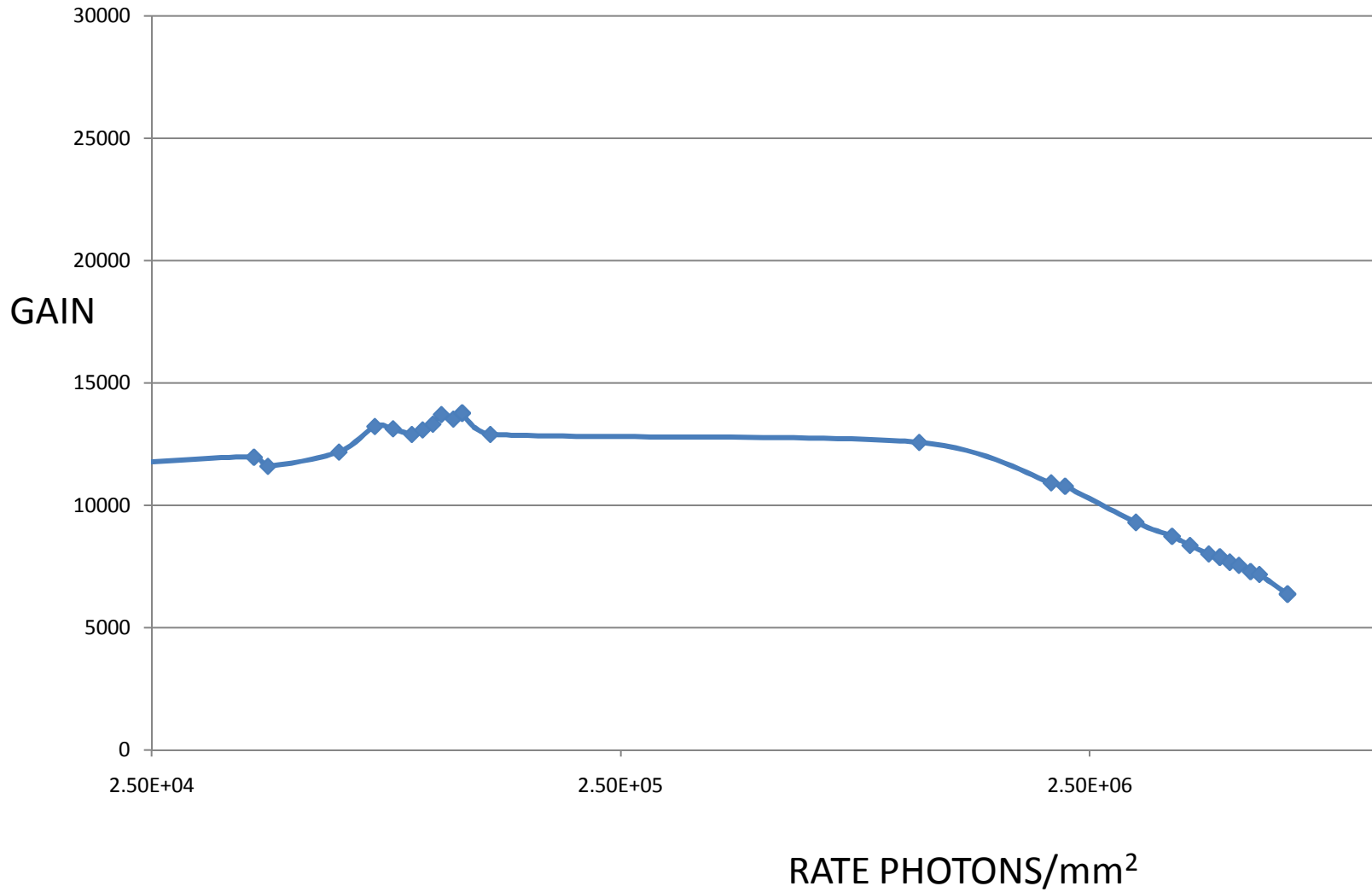


GAIN STUDIES WITH TRIPLE GEM
ARGON CO2
CURRENT WITH Cu X-Rays

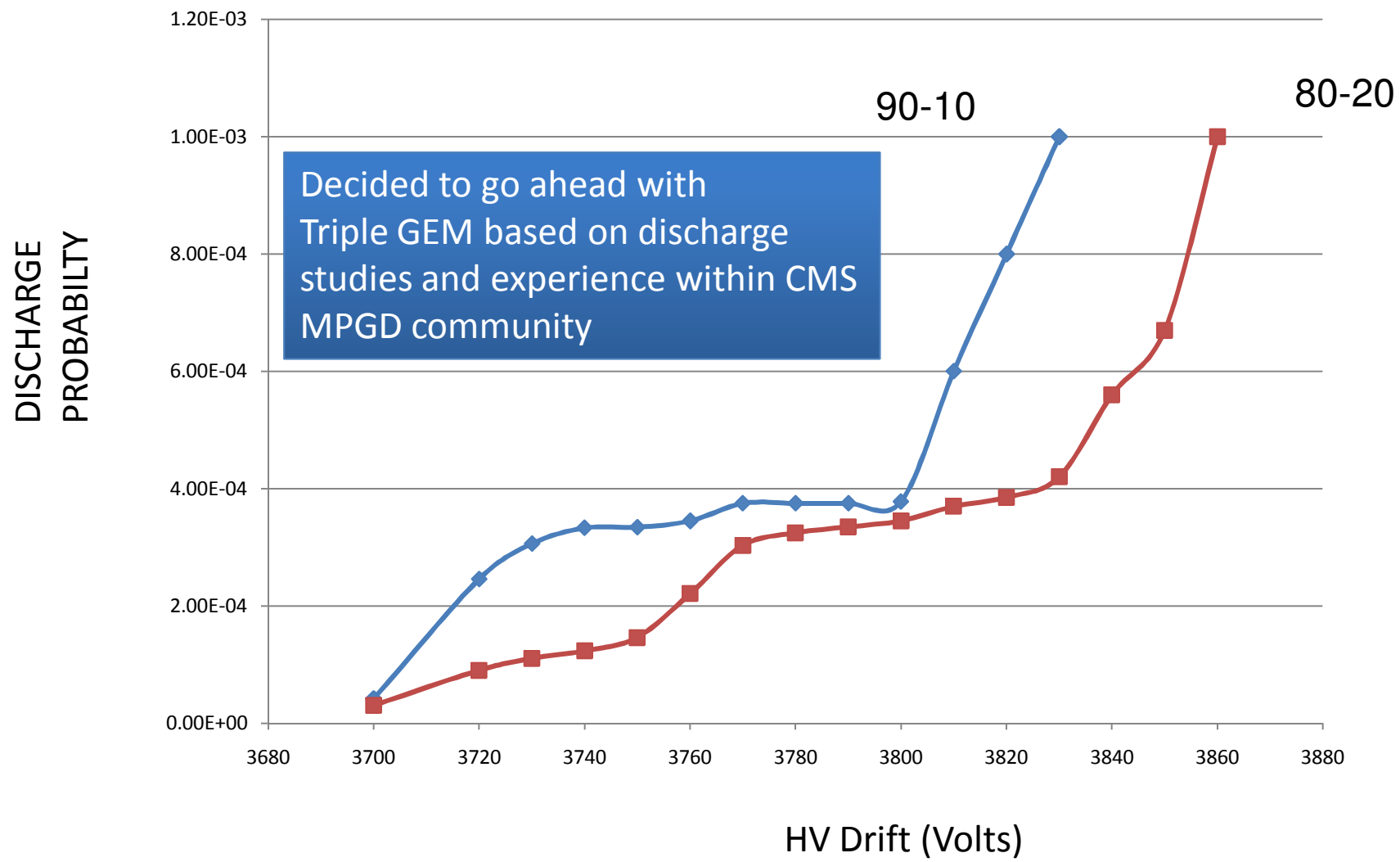




RATE CAPABILITY STUDIES WITH TRIPLE GEM ARGON CO2 90-10



DISCHARGE STUDIES WITH TRIPLE GEM ARGON CO2



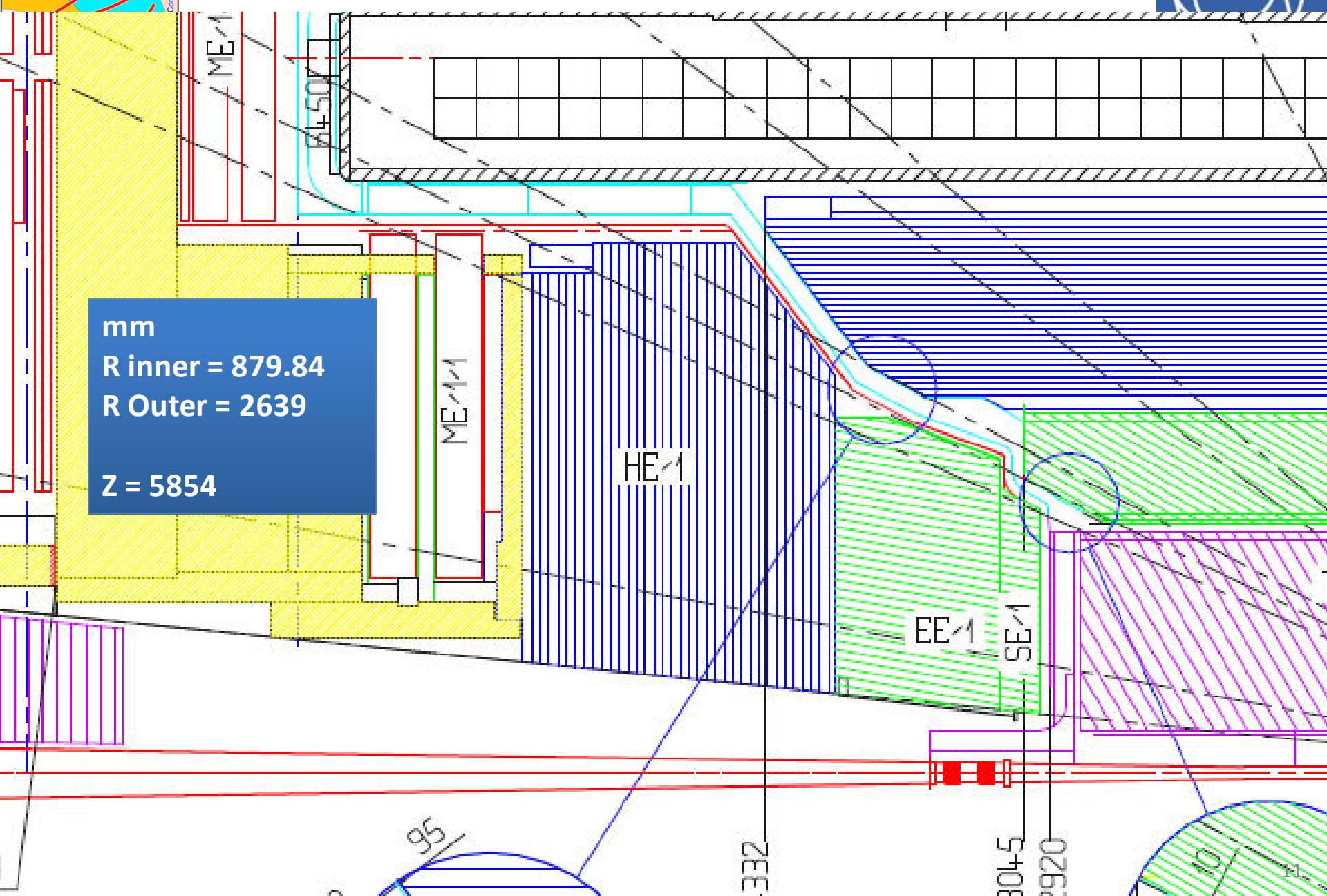


PROTOTYPE Plan:



1. Detail mechanical design
2. Definition of the readout electronics and it's mechanical support
3. Services and routing
4. Mockup realization of the detector
5. Production of the prototype

High Eta MPGD Prototype for 1/1 Space



mm
R inner = 879.84
R Outer = 2639
Z = 5854

ME-1

ME-1

HE-1

EE-1

SE-1

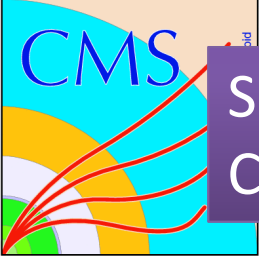
95

332

3045

920

100



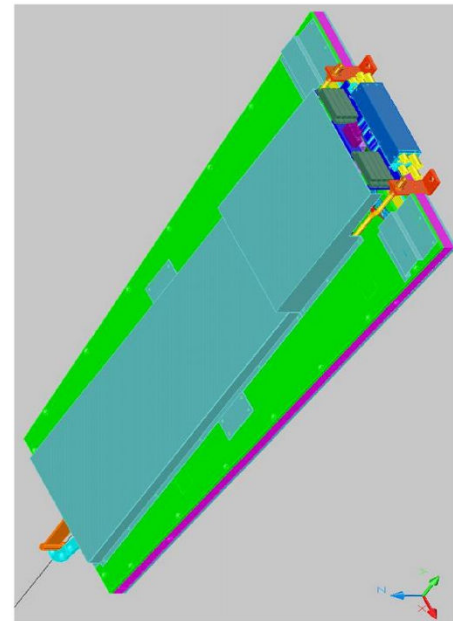
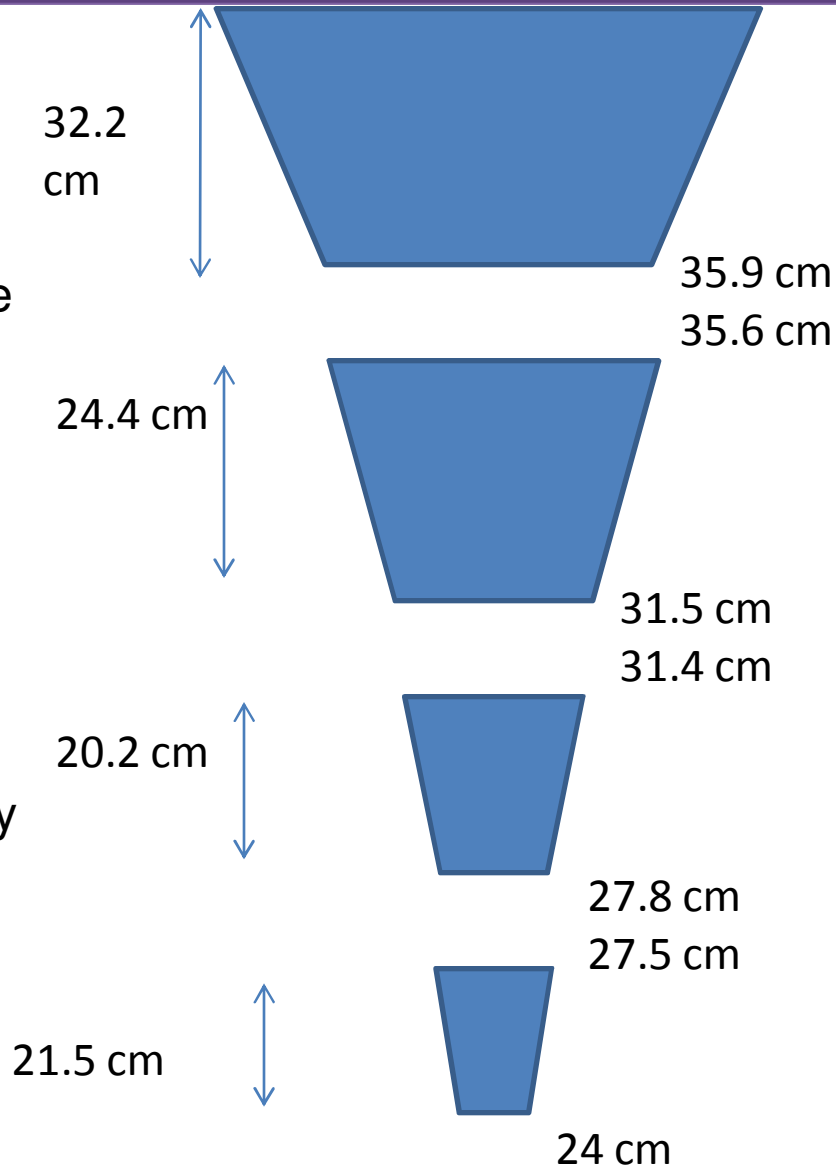
Sensitive Area & Readout Plane Sizes for CMS high η 1/1

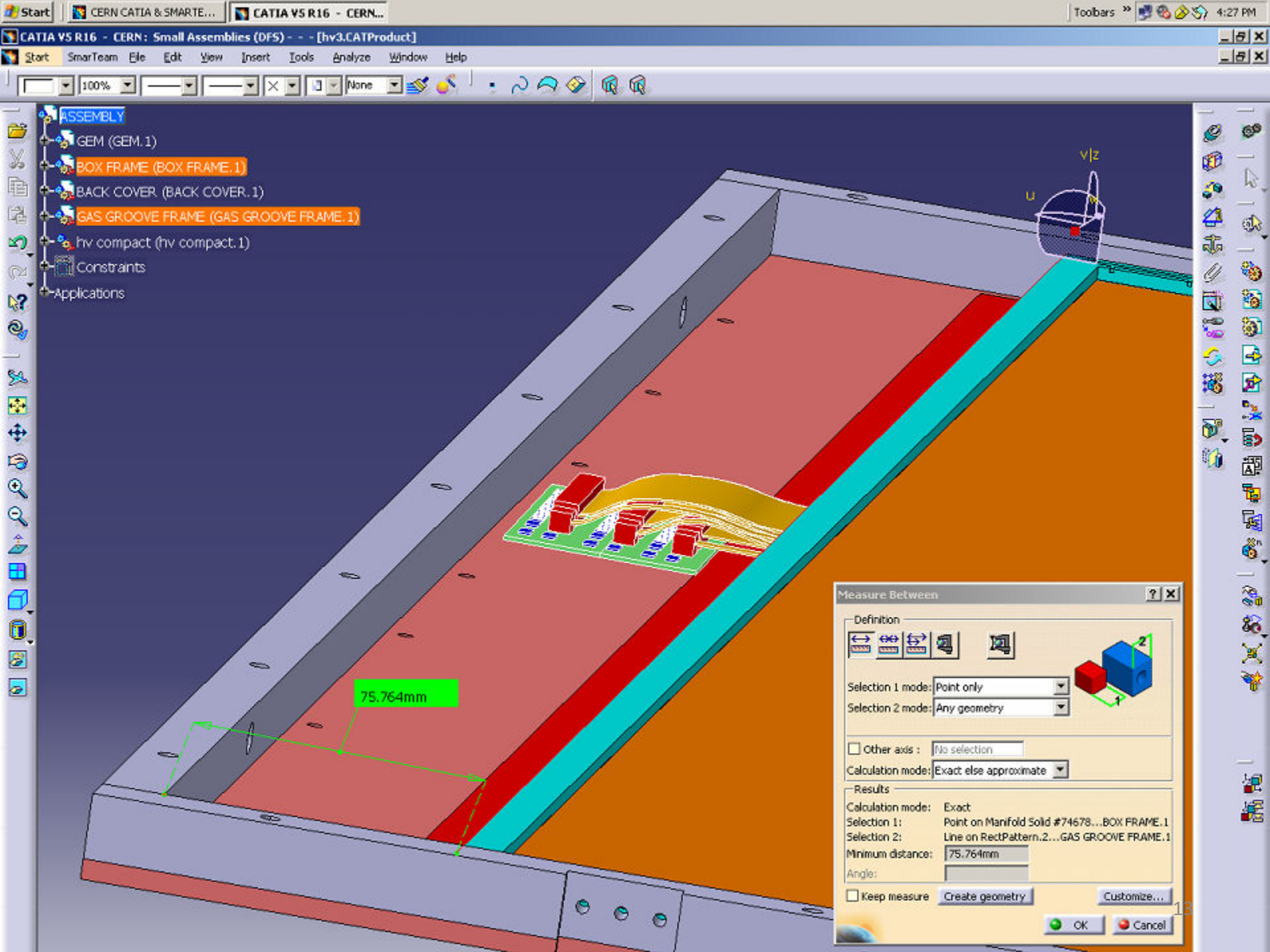
According to present Sensitive area coverage

These are routine for Workshop : cm

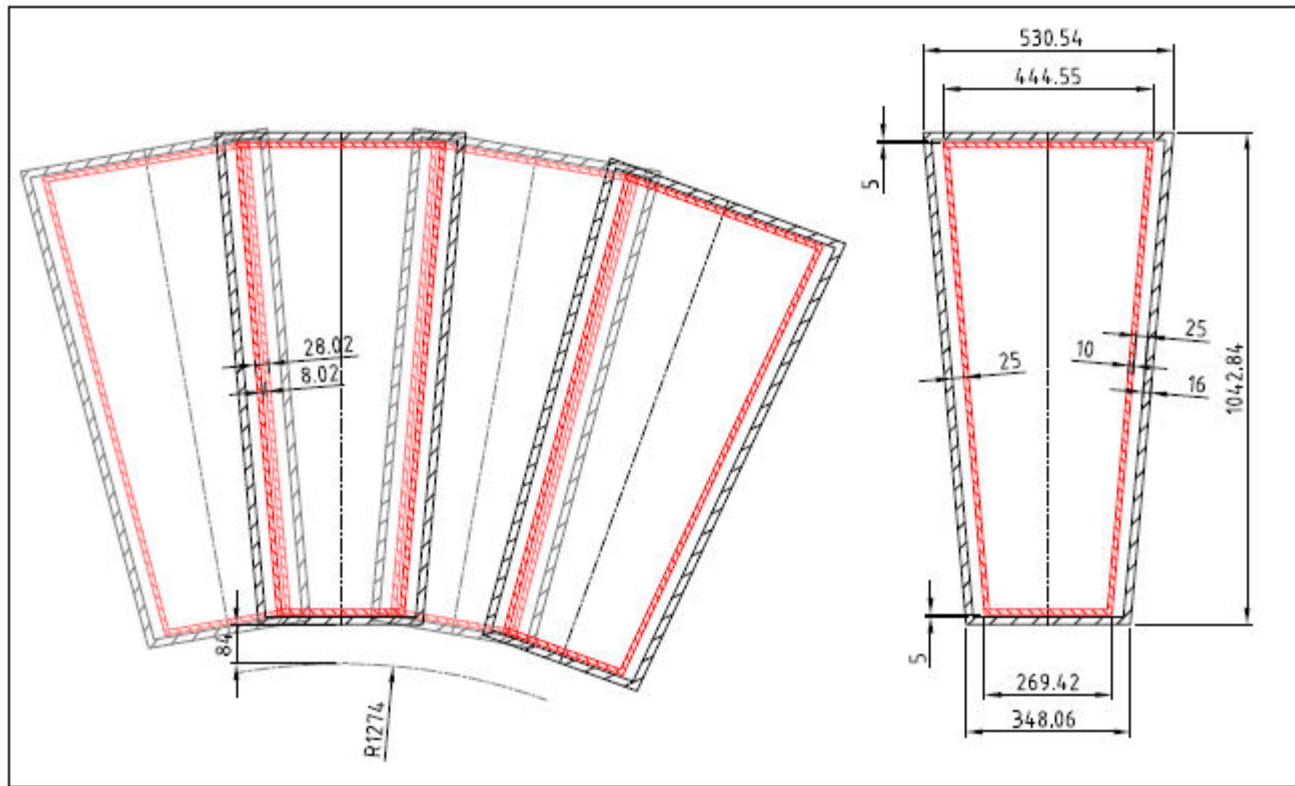
- 43x33=1419
- 36x25=900
- 32x20=640
- 28x22=616

Can extend coverage by 5-7 %
PLUS Extend further to Eta 2.2 ?

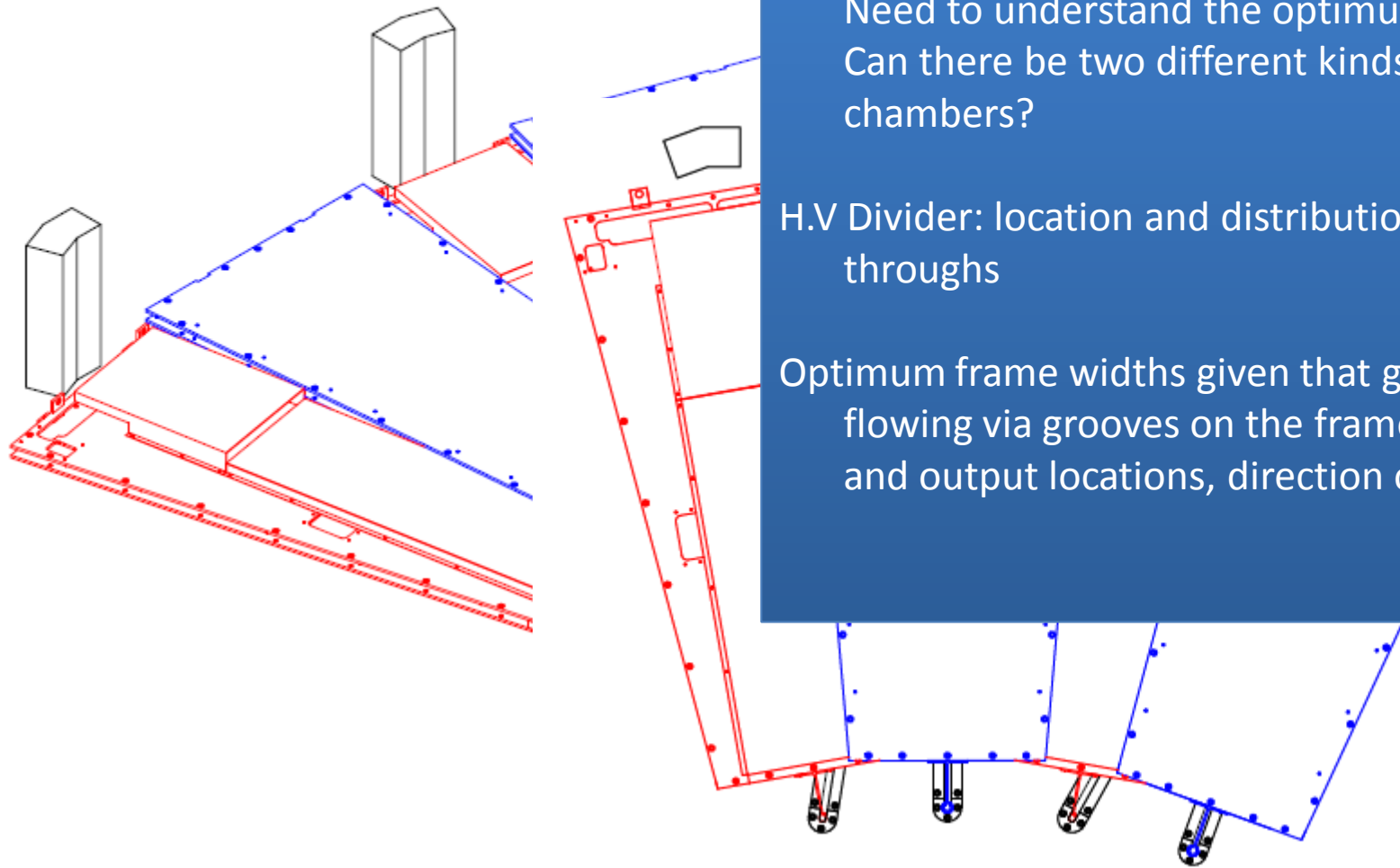




Is it possible to increase the eta coverage from 2.1 to > 2.2 ? There are mechanical (and installation) constraints to be understood.



Hans Postema, Stephane Bally, Antonio Conde, Gerard Faber
Nov 19, 2009



Discussion on what is the optimum overlap for GEMs inside the mechanical envelope, given that the two planes of staggered chambers will make them asymmetric. Need to understand the optimum overlap. Can there be two different kinds of chambers?

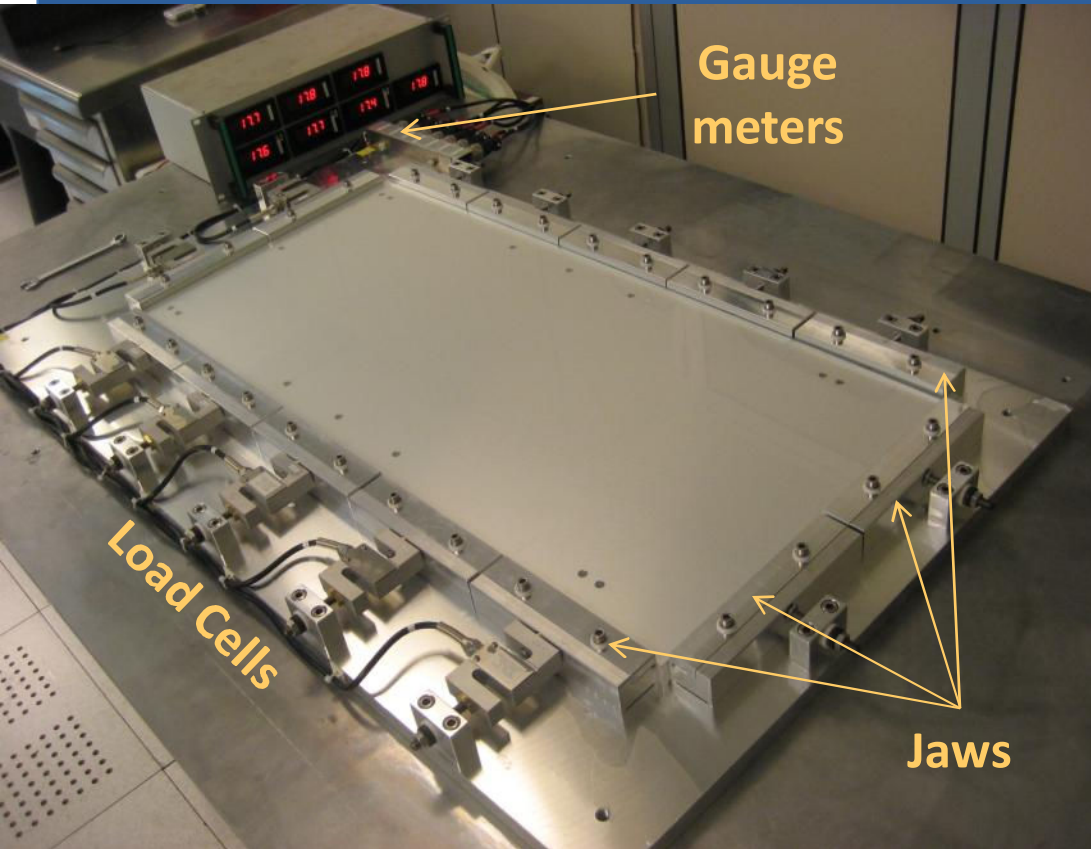
H.V Divider: location and distribution of feed-throughs

Optimum frame widths given that gas will be flowing via grooves on the frames. Input and output locations, direction of flow...

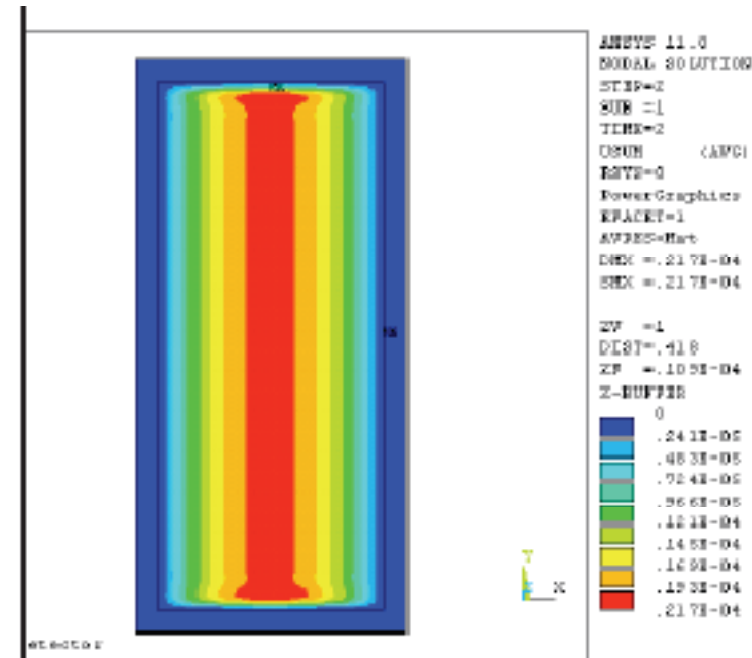
Hans Postema, Stephane Bally, Antonio Conde Garcia, Gerard Faber
Nov 19, 2009

R&D on large GEM: the construction tools

G. Bencivenni



With the usual 1 kg/cm , finite element simulation indicates a maximum gravitational/electrostatic sag of the order of $20 \mu\text{m}$

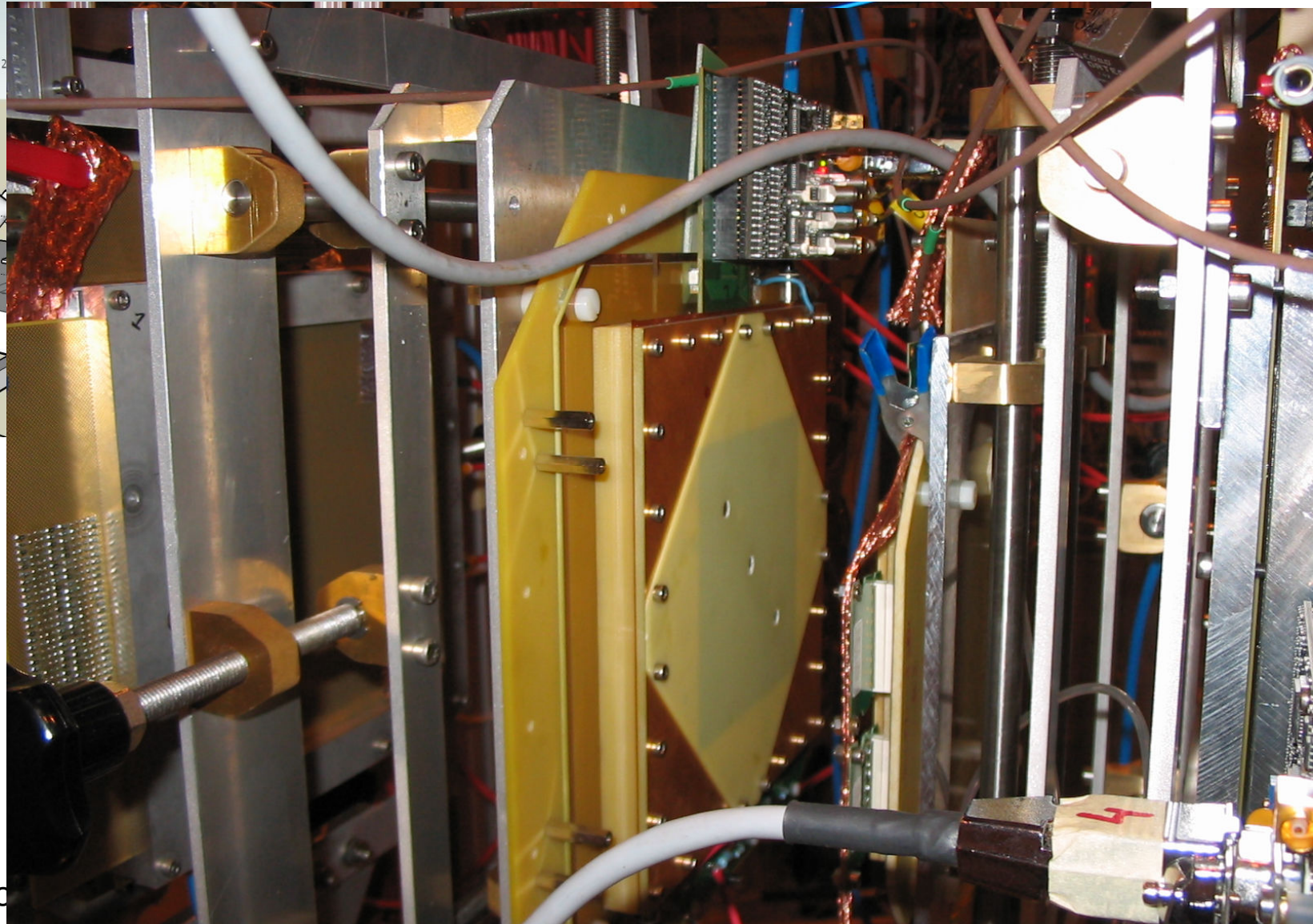
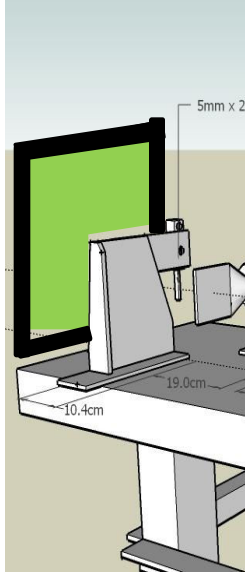


A large **stretching tool** has been designed and built.

The frame gluing will be performed by using the “**vacuum bag**” technique, tested in the construction of the CGEM

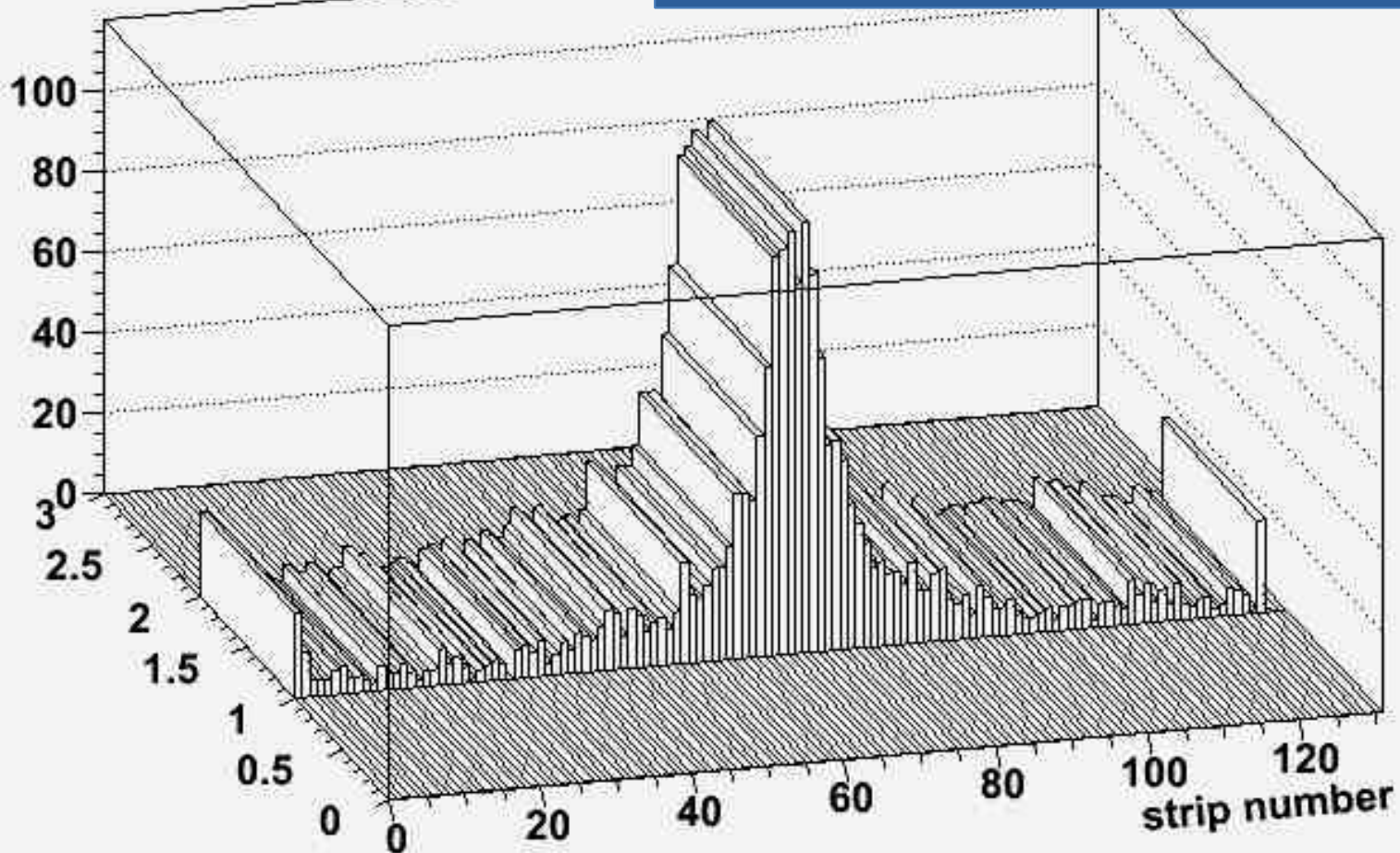
Stato di deformazione [m]

Test beam at SPS H4 Oct 21-Nov 2

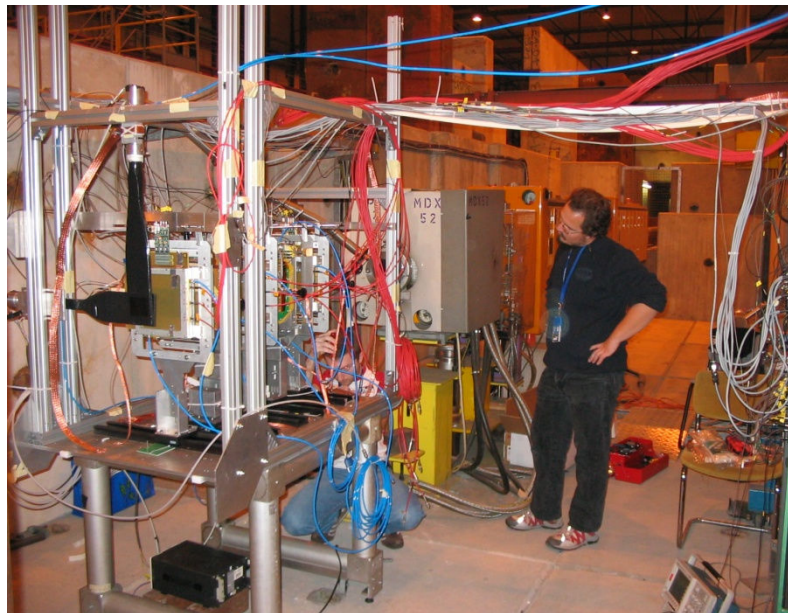


First Results – to be studied in detail

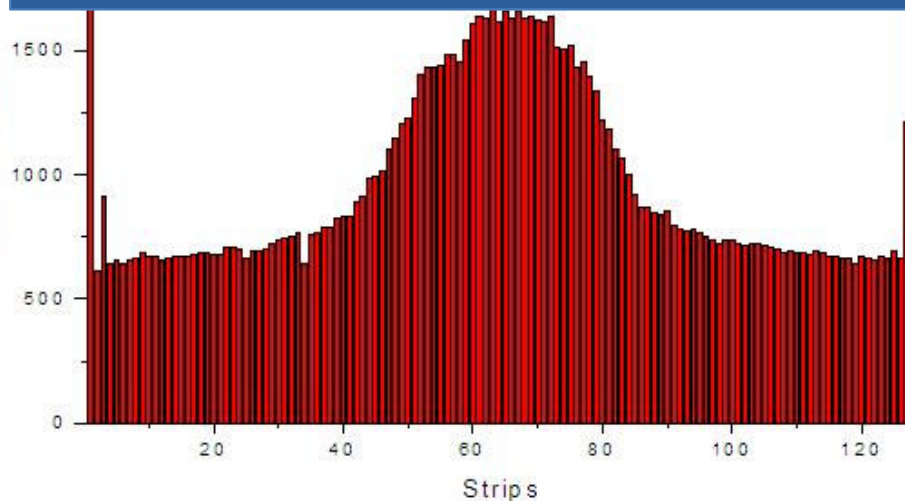
- See talk by G. Croci - 09:00-
>13:00 WG7: Common Test Facilities



Beam Test and thereafter



- See talk by G. Croci - 09:00-
>13:00 WG7: Common Test Facilities



-During the Beam Test and later back in the lab the CMS GEM has been working fine, data has been taken.

-Unfortunately, lots of discharges have been observed during beam in the CMS microMegasp prototype
BACK IN THE LAB

- Read the CMS GEM with VFAT electronics and play with Ar-CO₂-CF₄ Gas mixture.
- Understand the timing performance of the detector.



CMS MPGD Activities since August 2009



1. Assembly and test of two small MPGD prototypes
 - Micromegas
 - Triple Gem
2. Planning for mock up of large prototype
 - Size and envelope limitations
 - Drawings
3. Participated in Beam test Oct-09
 - Overall good performance for Triple GEM
 - Readout electronics
4. Preparation on for building real size GE1/1 prototype






Next Steps..




1. Analyze beam test data
2. Build large size mock up to understand services
3. Build large size prototype to understand performance
4. Calculate rates as a function of eta-phi
5. Background simulations, measurements and calculations
6. Road for muon say 10 GeV, as a function of trigger sectors
7. Stagger / Layer the detector for avoiding fake hits
8. Engineering Design up to eta 2.4
- 9. Evaluate the improvement in trigger and tracking efficiency**
- 10. Build Two 1/1 size chambers 2010**
- 11. Six 1/1 size chambers 2011**
- 12. Install six chamber in 2011/2012 shutdown (tba)**







This talk is on behalf
of collaborators from:
CERN + RD51
Gent Belgium
LNF Frascati
Sienna
Florida Tech
BHU India








Friday 04 September 2009



14:30    Introduction and discussion (20')







14:50    New Physics Potential and Detector Requirements - Albert (de Roeck) (40')







15:30    MPGD Experience and Expression of Interest from Frascati - Stefano Bianco / Benussi / Fabbri (20')

15:50    Current MPGD studies, CSC alignment work within CMS and interest in the high-eta MPGD upgrade from Florida (20') ( Slides  )

16:10    Current Experience, Expression of interest and (preliminary preparation for Simulations of Trigger Efficiency) - Arun K ( Slides   document )

16:30    Update on small prototype tests at CERN - Archana (20')

16:50    Preparation towards large prototype(s) - Andrey / Serguei / Serge (20') ( Slides  )

17:10    Update on Front End Readout - Nicola Turini (20') ( VFAT - Details  )