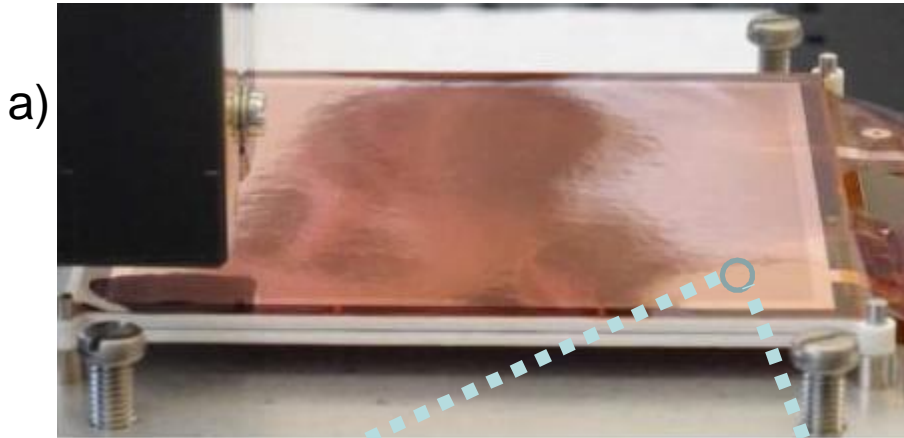Eleonora Gandin

Universitá del Piemonte Orientale,
Alessandria (IT)

Mechanical Properties of a GRID GEM system

FLC_TPC, Supervisor: Klaus Dehmelt
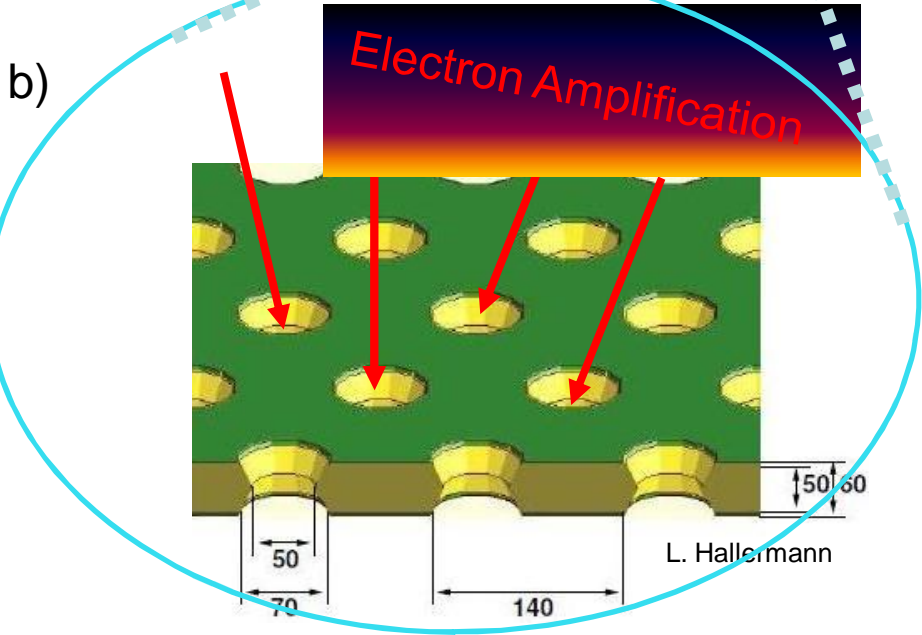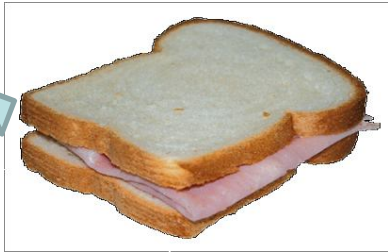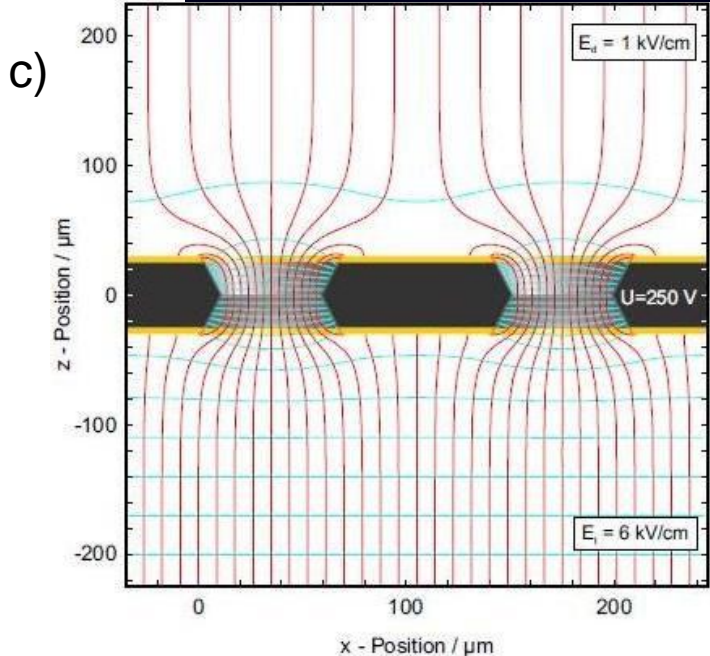
GEM: What is it?

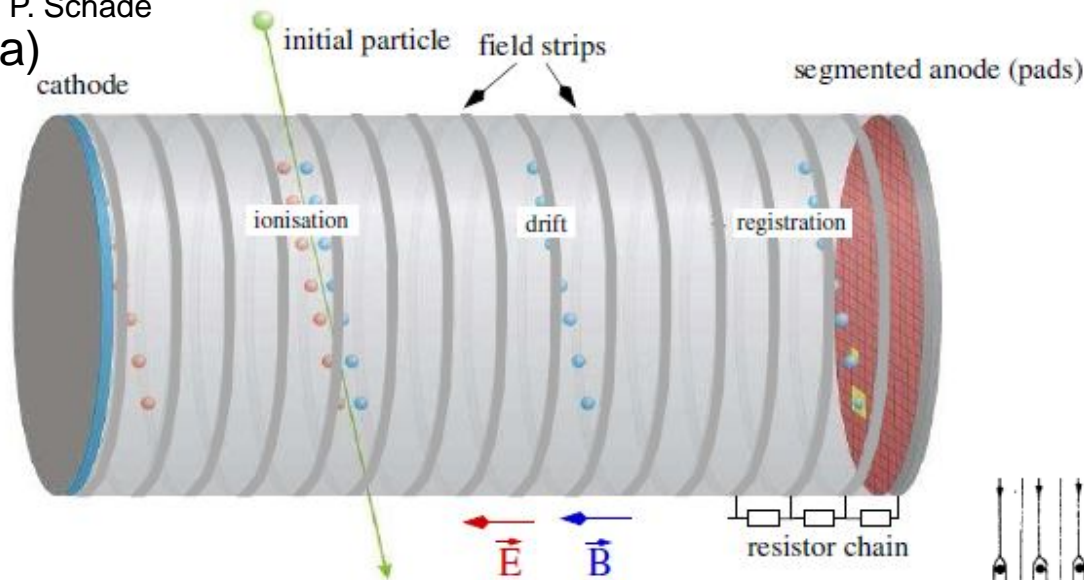GEM : Gas Electron Multiplier

a)

L. Hallermann

Same structure

b)

Electron Amplification

L. Hallermann

50 50

50

70

140

c)

Simulated field lines of a GEM

E_d = 1 kV/cm

200

100

0

-100

-200

z - Position / µm

U=250 V

E_I = 6 kV/cm

0   100   200

x - Position / µm

L. Hallermann

Why a GEM ?

P. Schade

a)

initial particle   field strips

cathode   segmented anode (pads)

ionisation   drift   registration

$\vec{E}$ $\vec{B}$

resistor chain
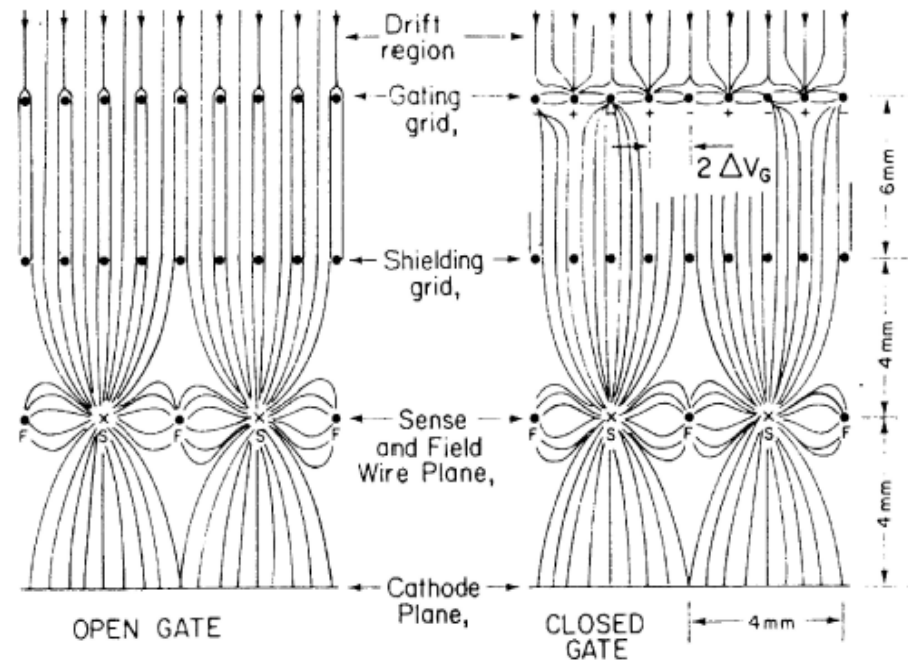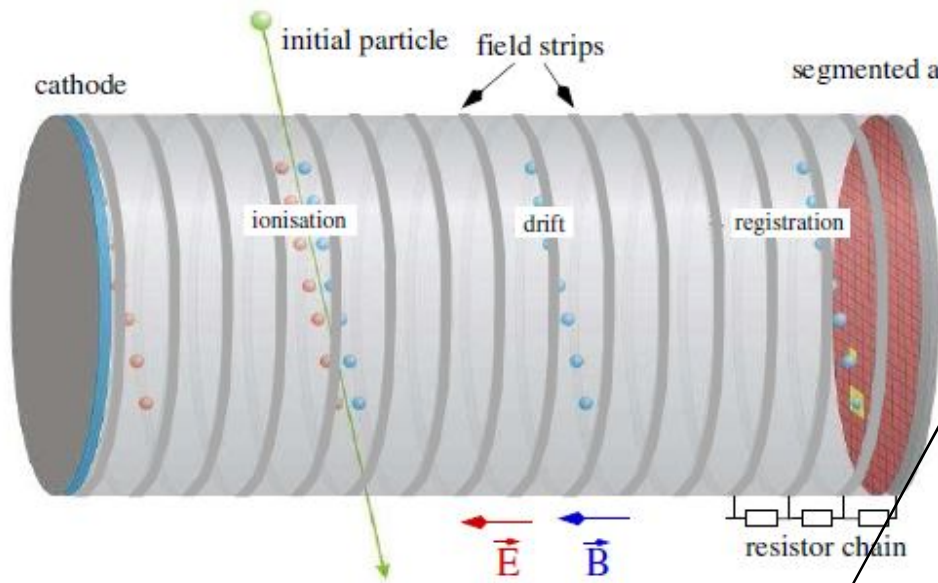
Capacitor in a gas container:
 Gas ionization
 e⁻ drift towards anode
 Registration due to charge
          amplification
 Sampling on segmented anode
 Determination of z-coordinate
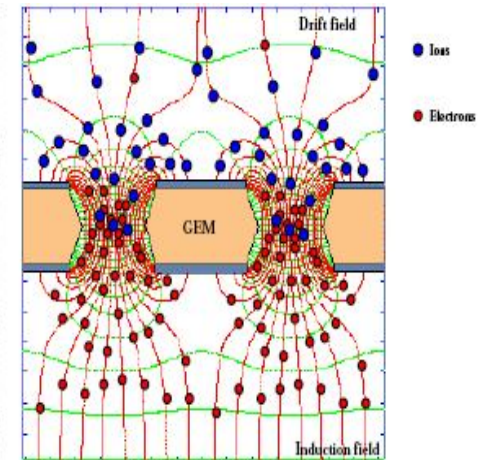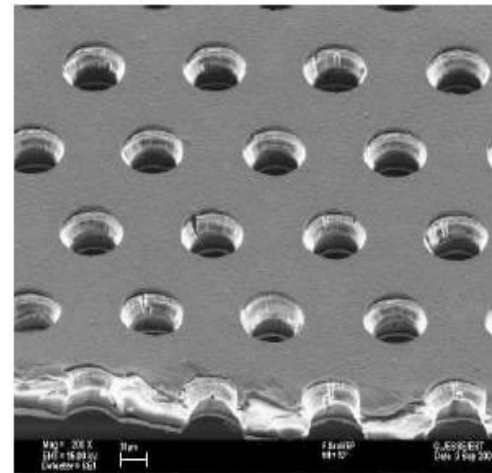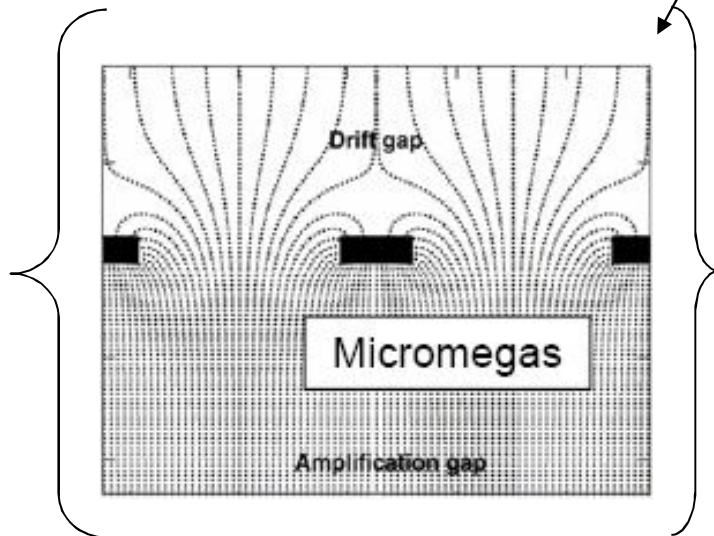due to time measurement

Conventionally charge
amplification via MWPC

Drift region

Gating grid,

$2\,\Delta V_G$

Shielding grid,

Sense and Field Wire Plane,

Cathode Plane,

OPEN GATE   CLOSED GATE   4mm

6 mm   4 mm   4 mm

Why a GEM ?

initial particle field strips

cathode

ionisation drift registration segmented anode (pads)

$\vec{E}$ $\vec{B}$

resistor chain

MicroPatternGasDetector
MPGD
not limited by **E** x **B** effects

Gas Electron Multiplier GEM

Drift gap

Micromegas

Amplification gap
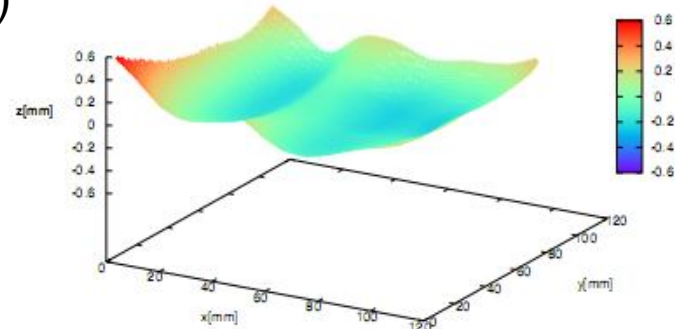
Drift field

Ions

Electrons

GEM

Induction field

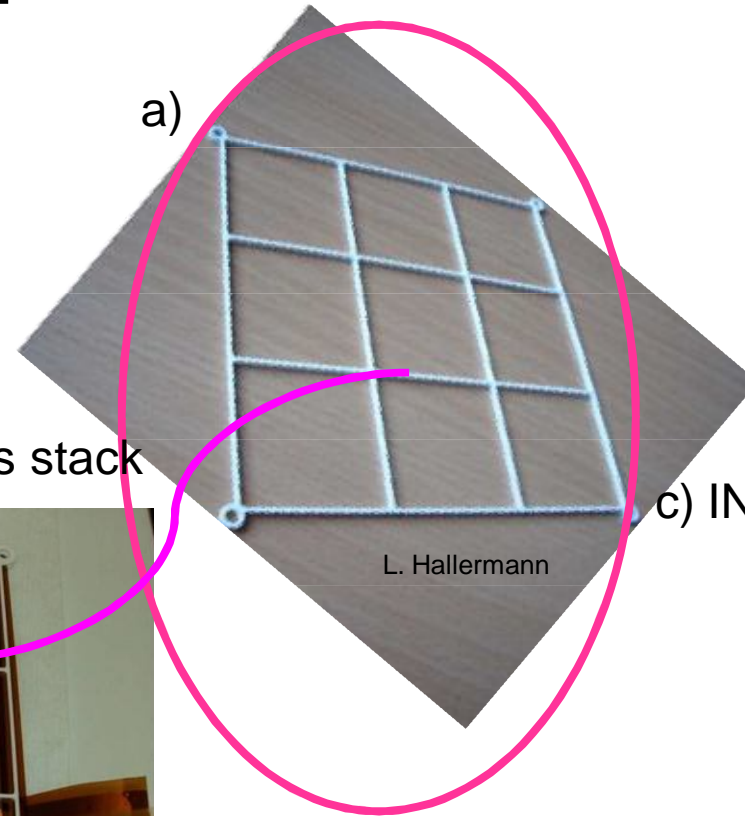# Traditional Support: GRP Frame
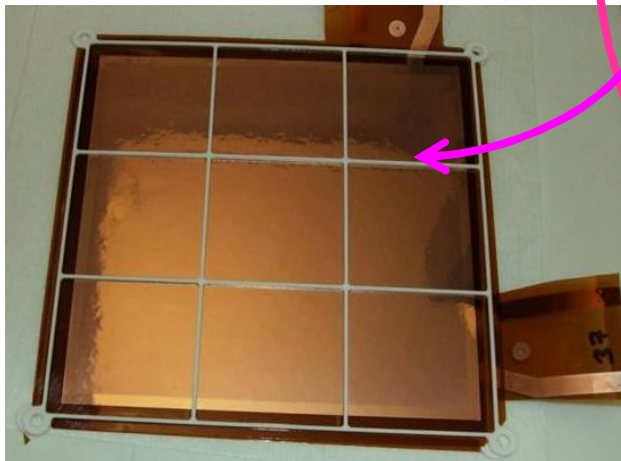
a)

b)

Sag in the middle

L. Hallermann

c)

cathode	———————	
	90 V/cm	drift field
GEM I	———————	
	1.5 kV/cm	transfer field
GEM II	———————	
	1.5 kV/cm	transfer field
GEM III	———————	
	3 kV/cm	induction field
anode	———————	

d)

			cathode
drift field	100 V/cm	85 V/cm	
transfer field	1.3 kV/cm	1.8 kV/cm	GEM I
transfer field	1.5 kV/cm	1.4 kV/cm	GEM II
			GEM III
induction field	3.1 kV/cm	3.2 kV/cm	
			anode
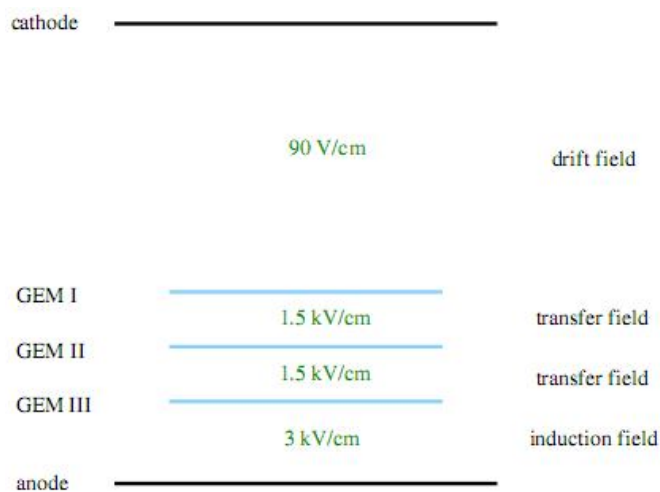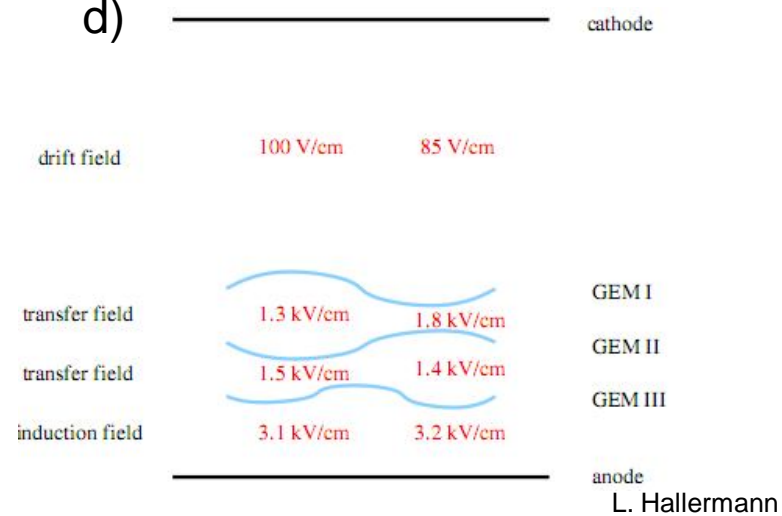
L. Hallermann

New Support: Ceramics Structure

a)

L. Hallermann

b) BEHIND a two GEMs stack

c) IN FRONT of a two GEMs stack

L. Hallermann

Laser: Triangulation Principle

a)

Laser Beam

Sensor

b)

Target
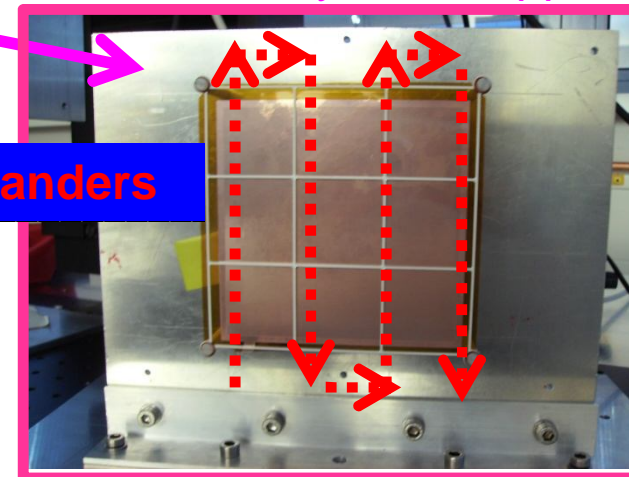
L. Hallermann

c)

θ
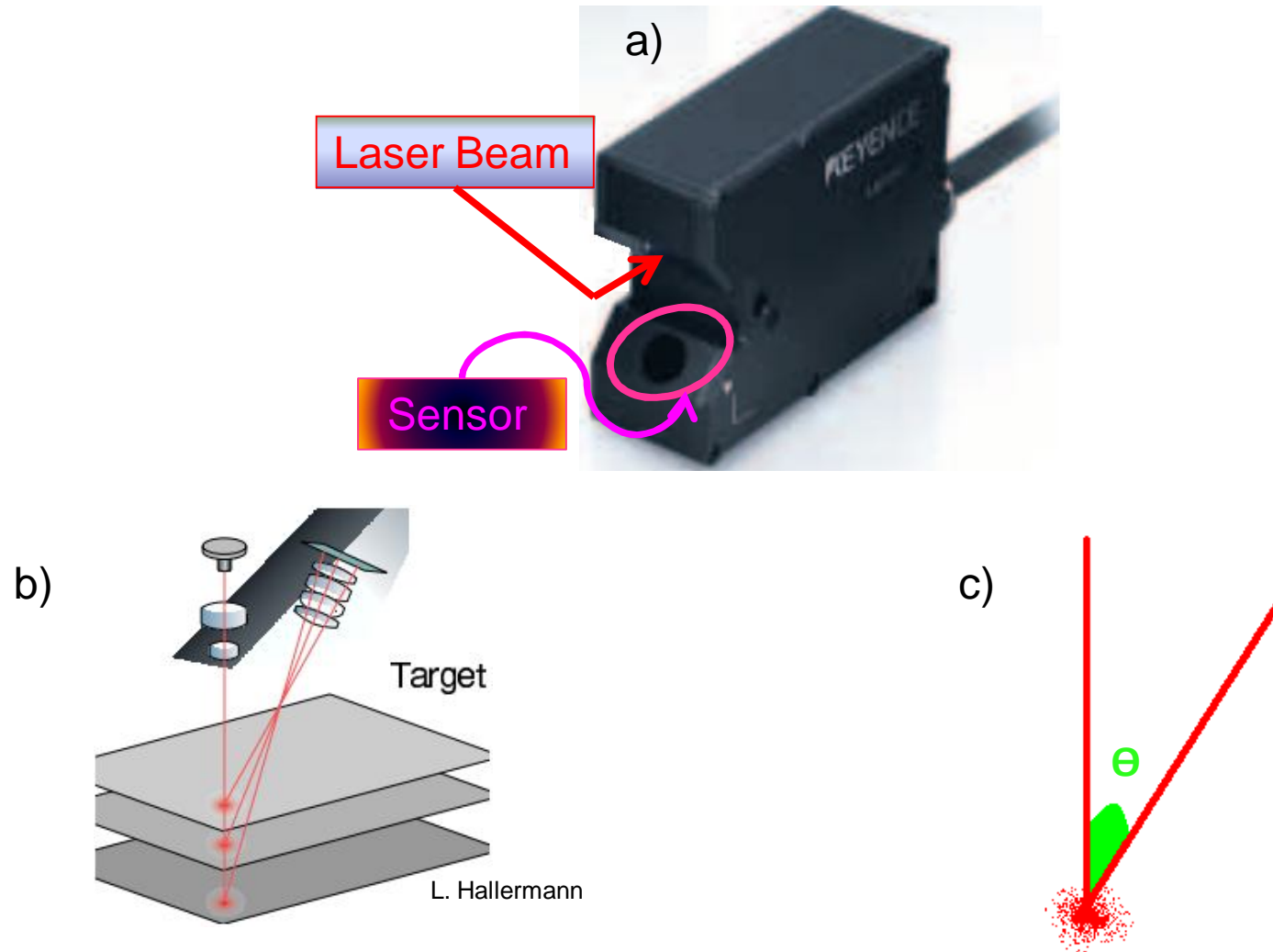
MY WORKBENCH
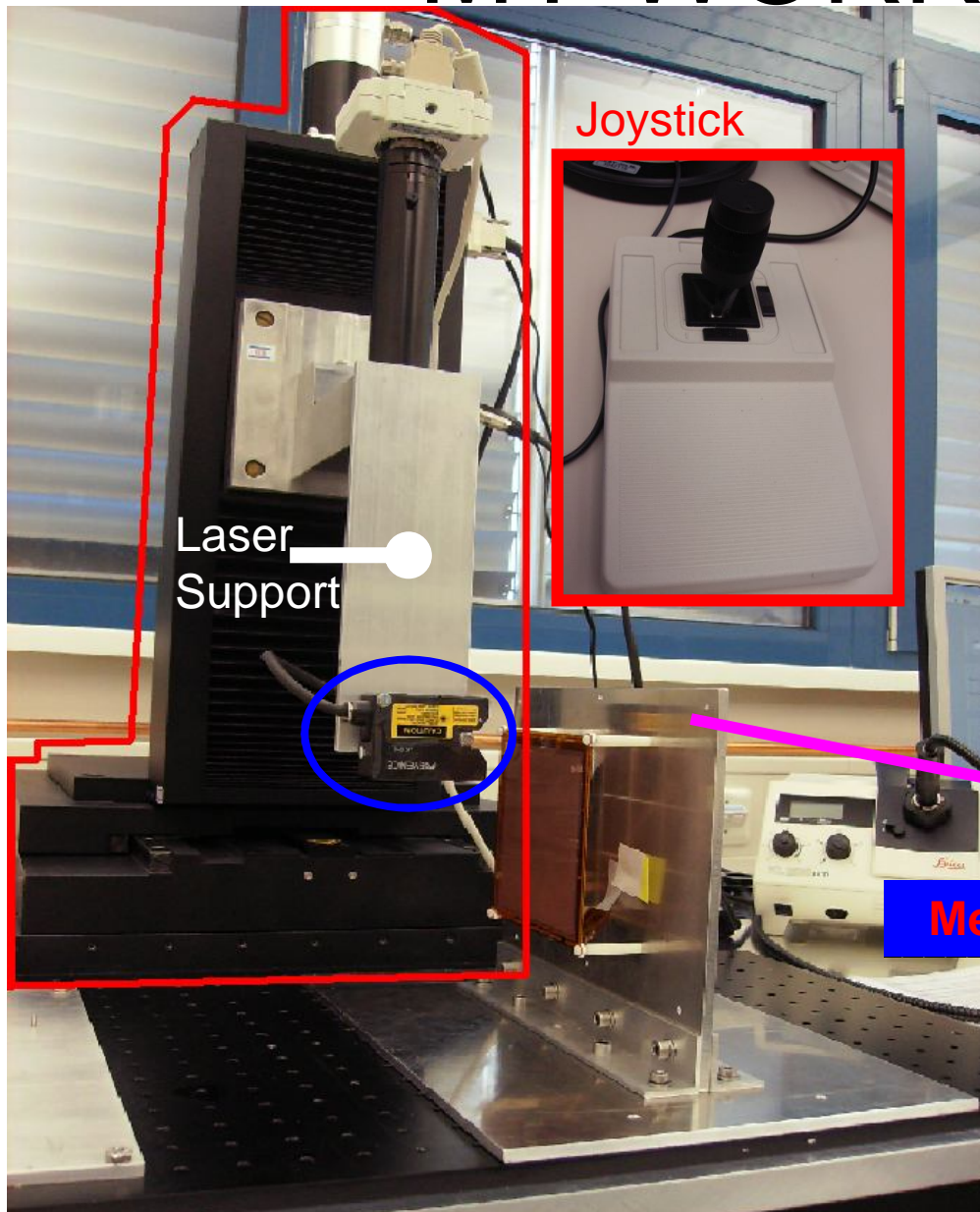
Joystick

Laser Support

Meanders

- **Moving Table**
- 3 independent axes
- Sub-micrometrical Resolution

- **Laser**
- Resolution 1micron
- Reference distance 10mm
- Measurement range +-1mm

- GRID GEM System Support Structure

LABview: Meander.vi

PLANE SETTINGS

Axis 1 Axis 2
Y   Z

Choose Axes

1st AXIS SETTINGS

N steps 1st axis   1

1st axis steps length (mm)   -125

2nd AXIS SETTINGS

N steps 2nd axis   106

2nd axis steps length (mm)   1

Set the number of data rows and the distance in between them

VELOCITY SETTING (mm/s)
Same speed every axes

Set Speed

15,0000   Velocity set   Status Meander

START

Return to initial position

Return

STOP THE PROGRAM

NOTES: Y axis -> move FORWARD +
                  move BACK -

        Z axis -> move UP -
                  move DOWN +

DELAY SETTING
Delay between steps (ms)   0
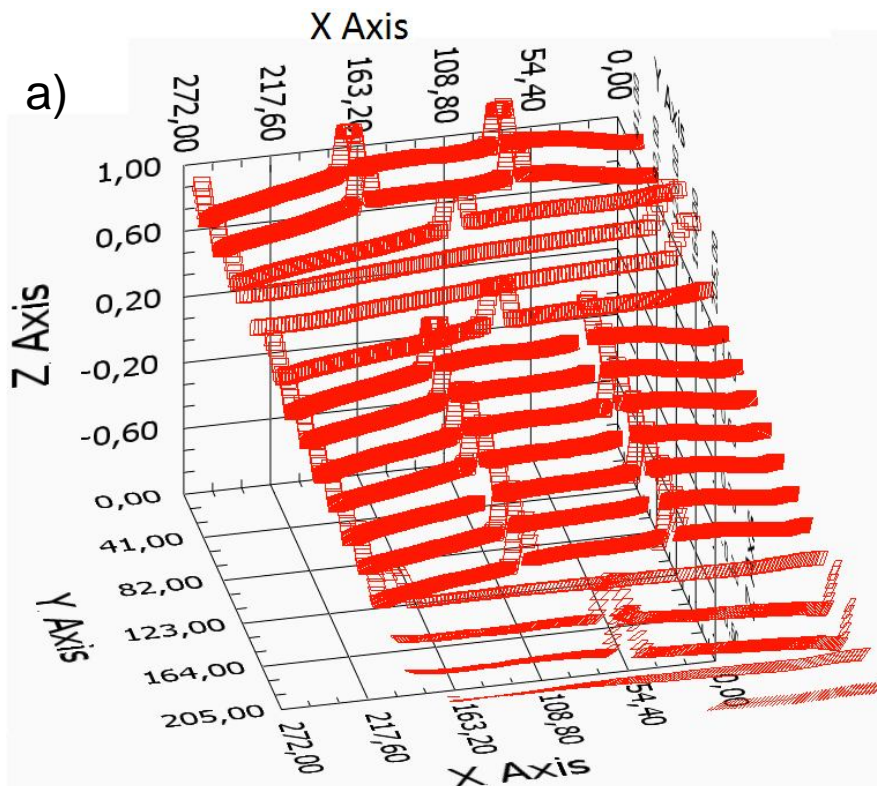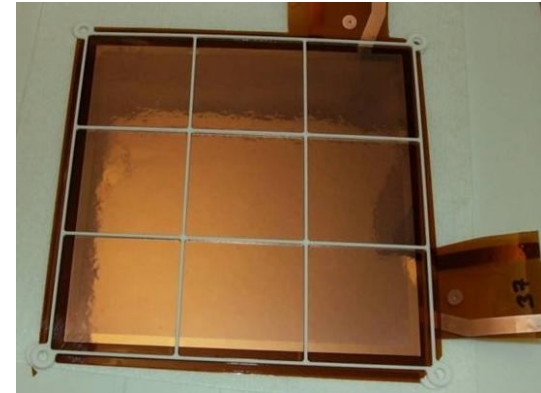
System set up completed: The Main Panel
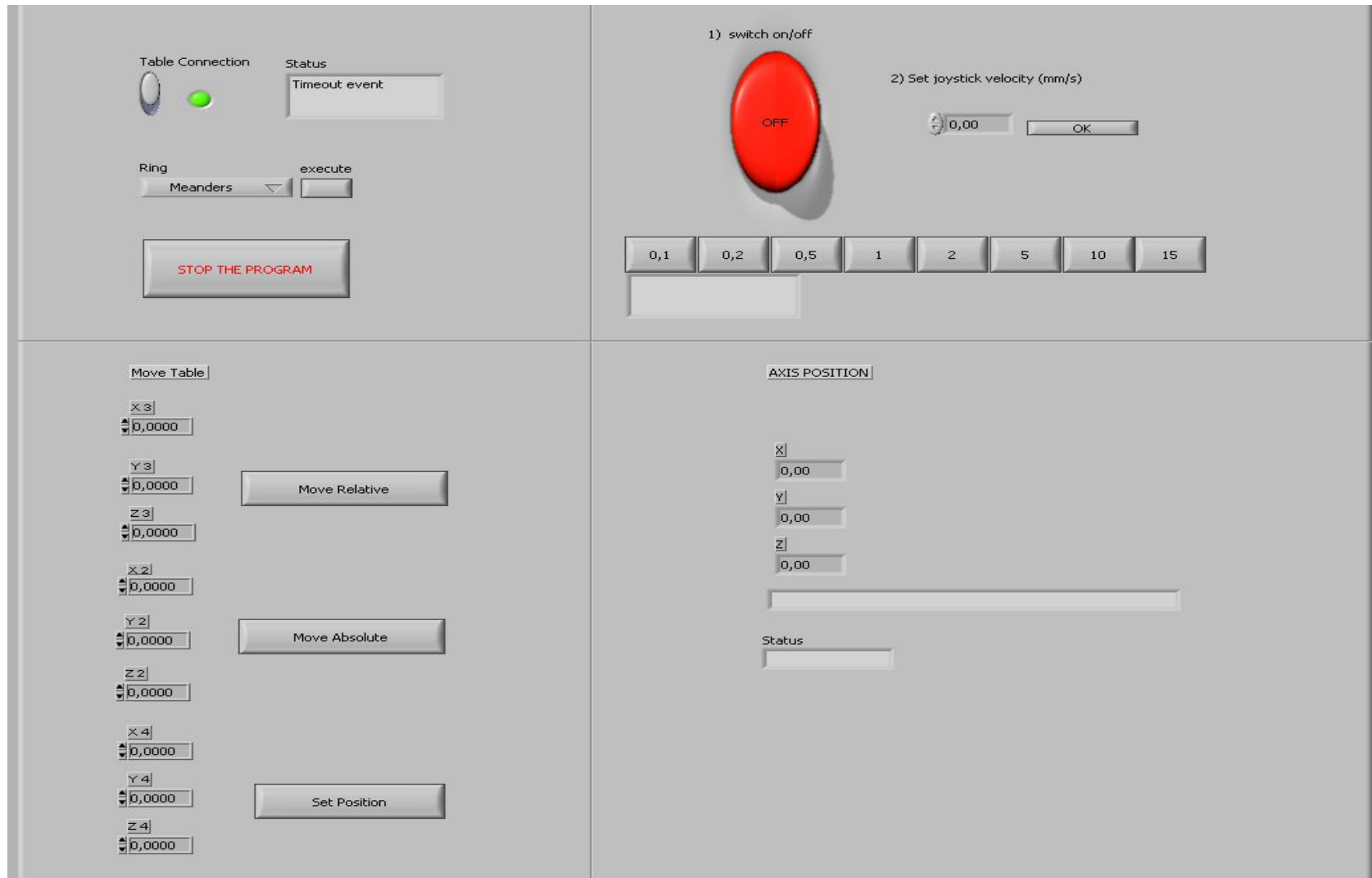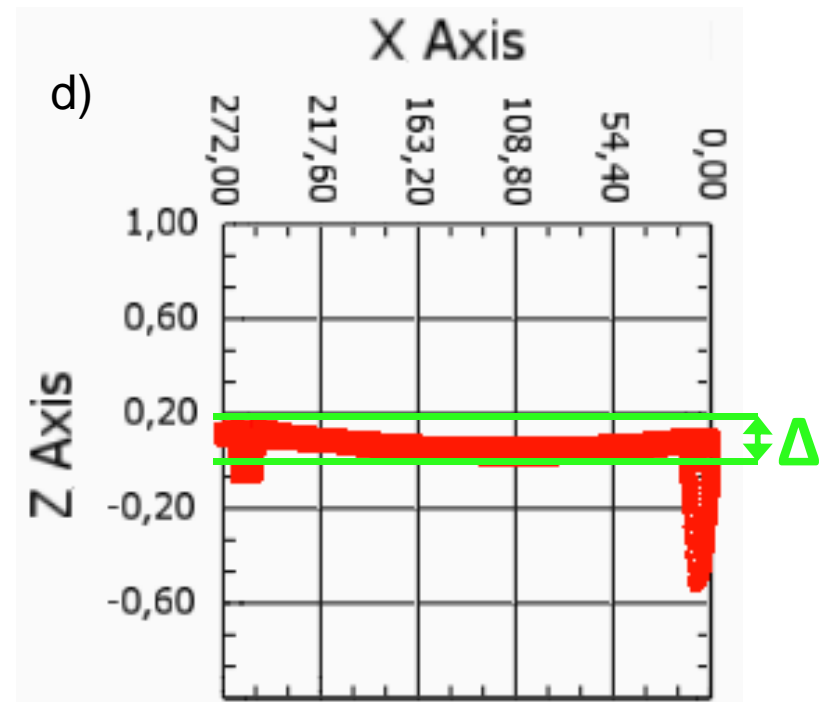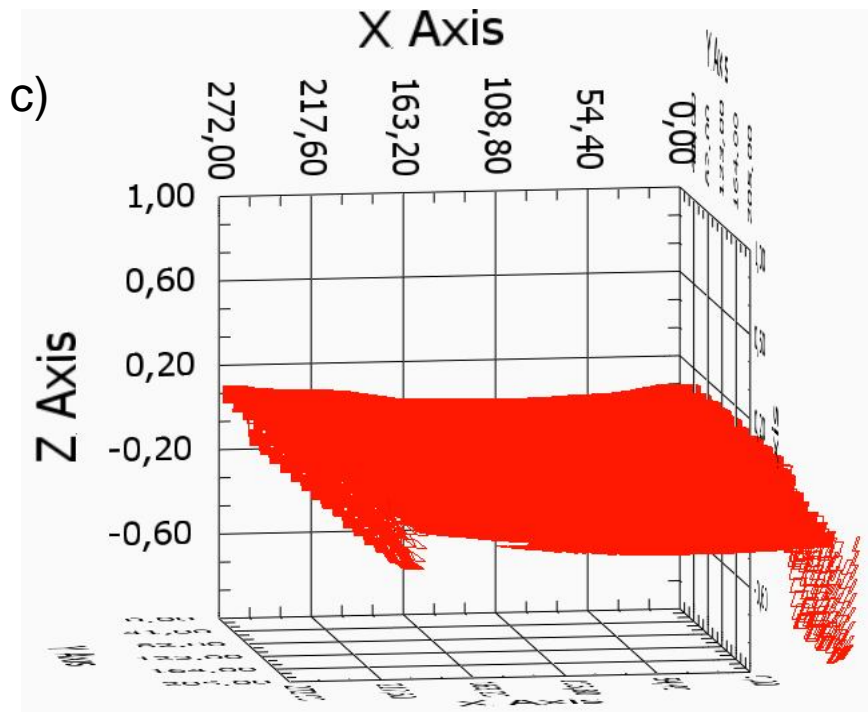
GRID GEM System Analysis
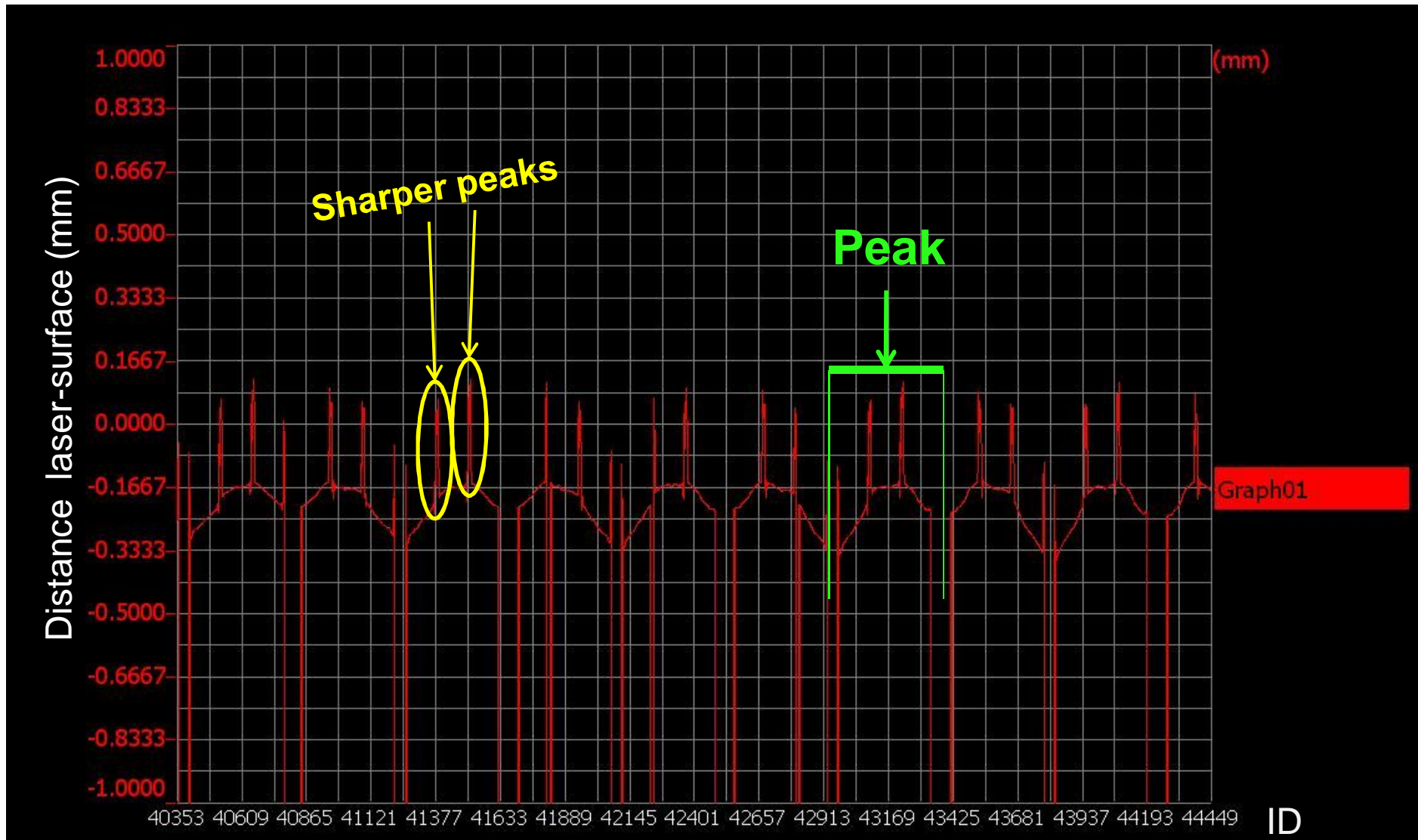
Results: First surface elaboration

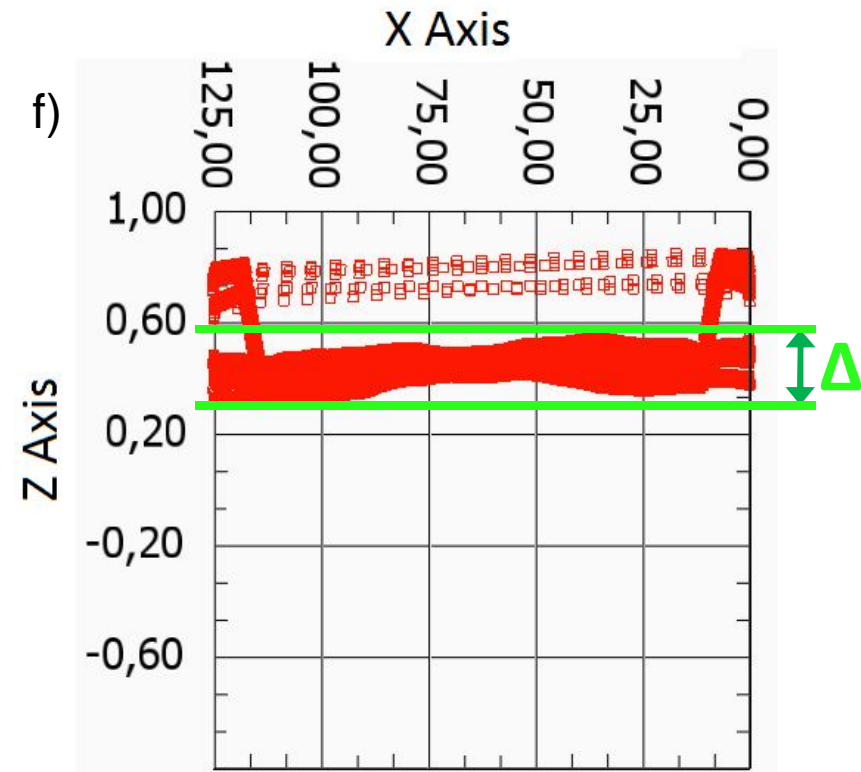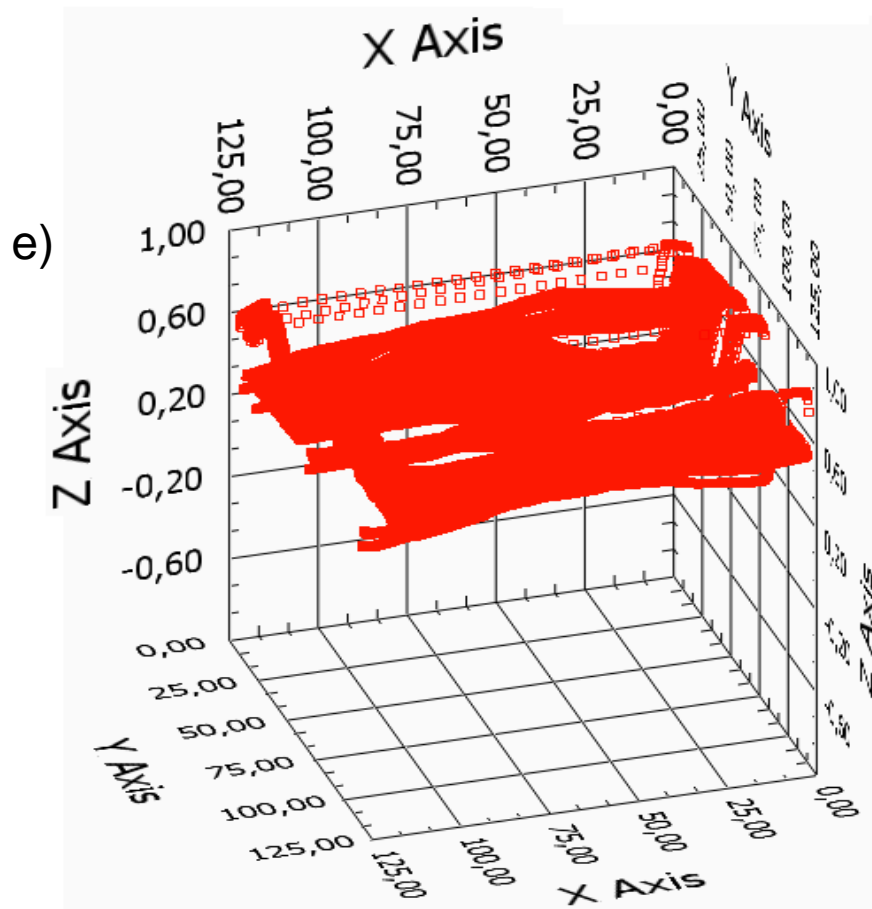Elaboration 1: BEHIND the GRID GEM system
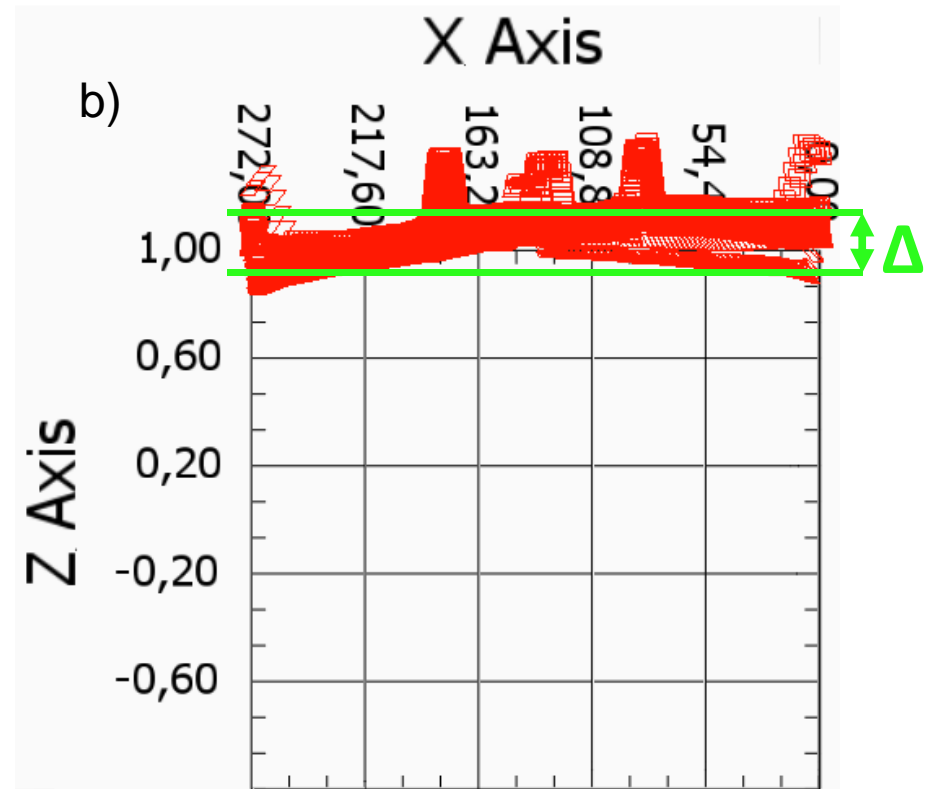
Results: First surface elaboration

Elaboration 2: IN FRONT of the GRID GEM system
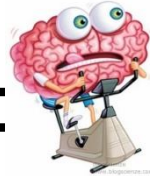
GRP framed GEM first surface elaboration

Elaboration 3: GRP framed GEM

Summary

- What I have done:

    1) System set up to measure mechanical properties of a GRID GEM system

    2) GRID GEM system and GRP framed GEM profile acquisition

- Preliminary Result :

    1)Ceramics grid profile has a more uniform distribution than GRP profile

Outlook

- Measure the influence of an applied high voltage
- Perform more detailed analysis of the surface structure and its influence on gain

Acknowledgments

- Thanks to

  Klaus Dehmelt

  Stefano Caiazza

  Lea Hallermann

  Christoph Rosemann

  Oliver Schäfer

  Robert Volkenborn

  Franziska Hegner