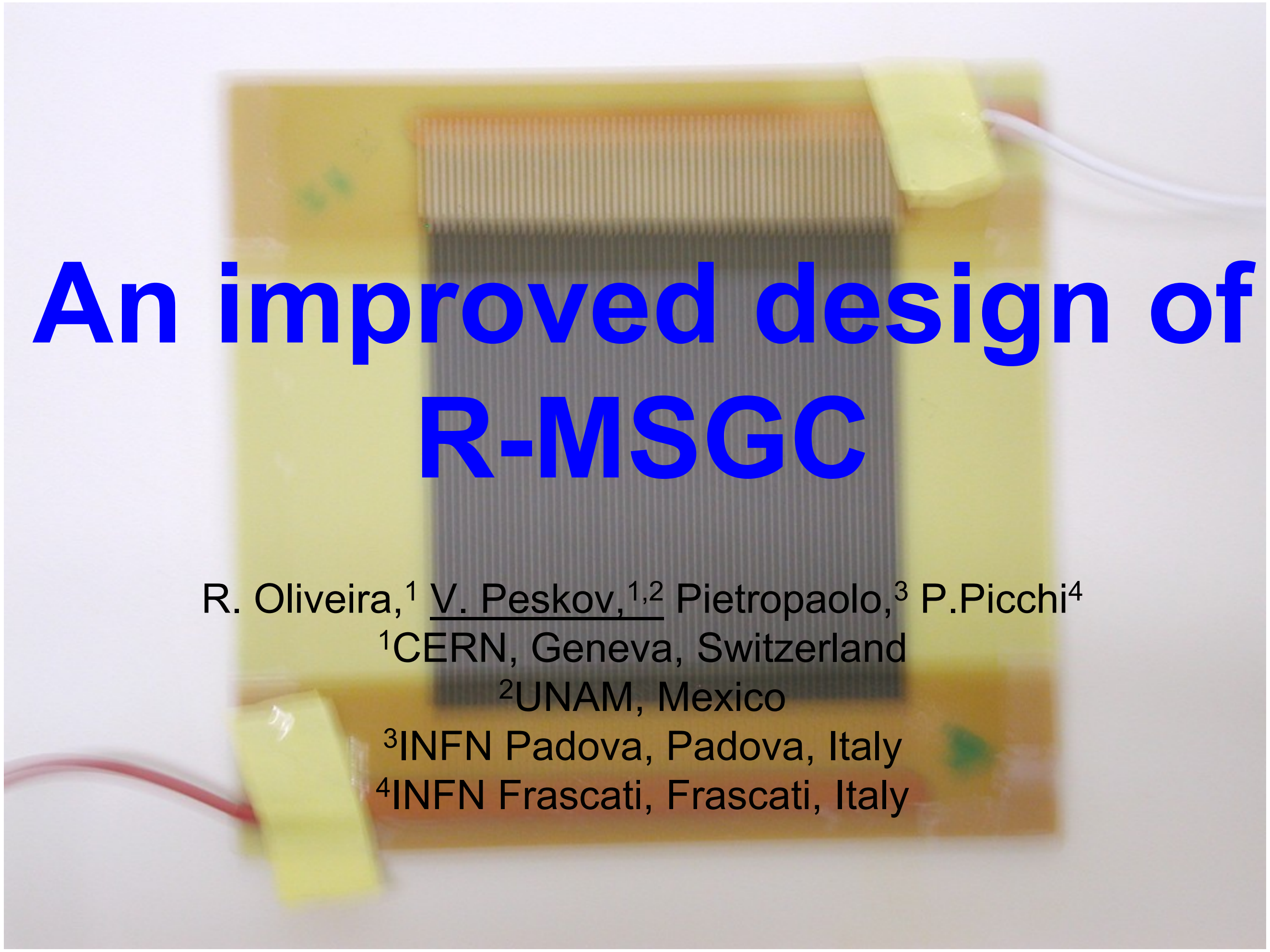

An improved design of R-MSGC

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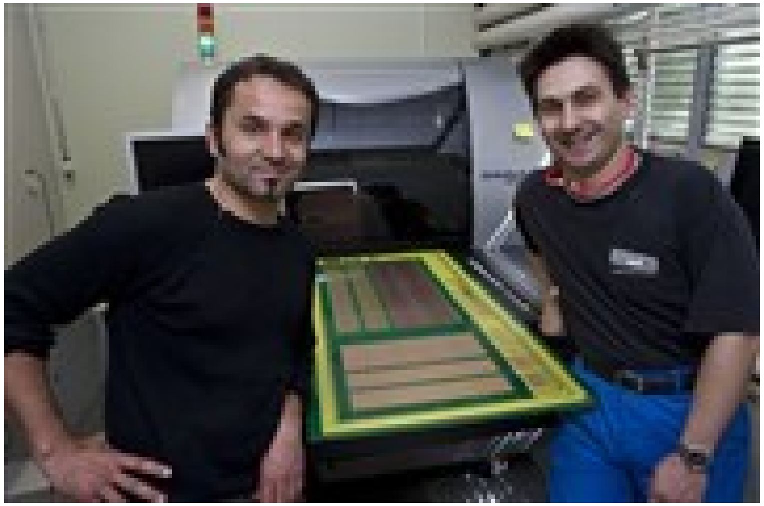
"All futiure MPGDs will have resistive electrodes"

R.. Oliveira, CERN, 2010



The aim of ongoing work in our Lab is to demonstrate that all types of MPGD can be made spark-proved if they have resistive electrodes

We already proofed this in the case of TGEM/GEM and MICROMEGAS and of course other groups (see for example: *F.Hartjes, Report at the MPGD Conf in Crete*, R. *Akimoto et al, presentation at MPGDs conference in Crete , V. Razin et al., arXiv:0911.4807, T. Alexopoulos et al., RD-51 Internal report #2010–006)*

also successfully working in this direction

At this time we focus on microstrip gas counters (MSGCs)

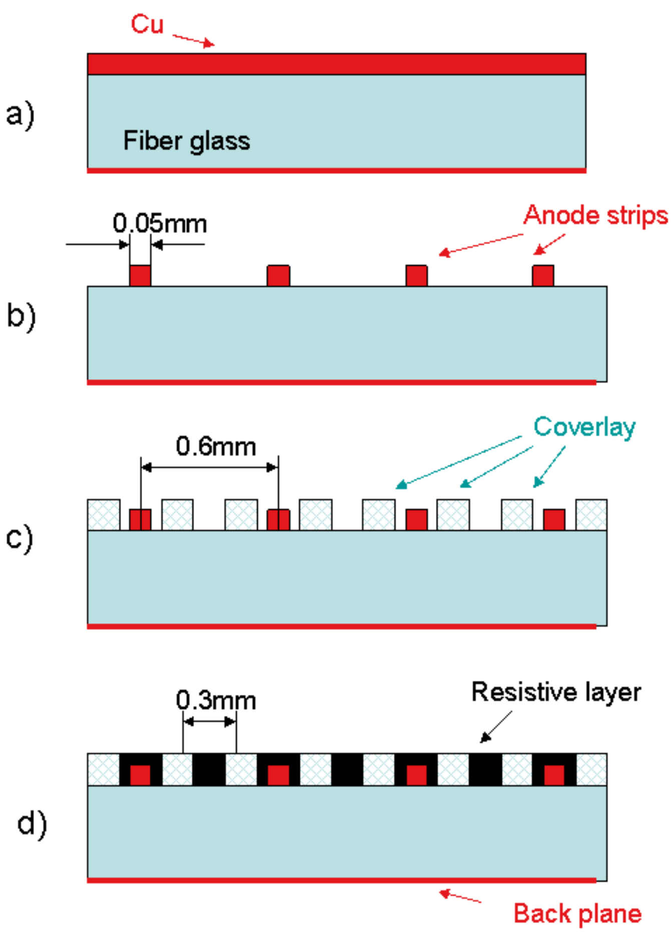
Let me remind you that MSGCs were the first micropattern gaseous detectors invented a long time ago by A. Oed;

however due to the sparking problems and due to the inventions of GEM and MICROMEGAS this type of micropattern detector is nowadays abandoned

However, if one makes the MSGC spark-protected, may be it will be not a so bad detector?

In the previous RD-51 meeting (a mini-week at CERN) we show some first preliminary results obtained with R-MSGCs (prototypes #1 and 2)

R-MSGC #1



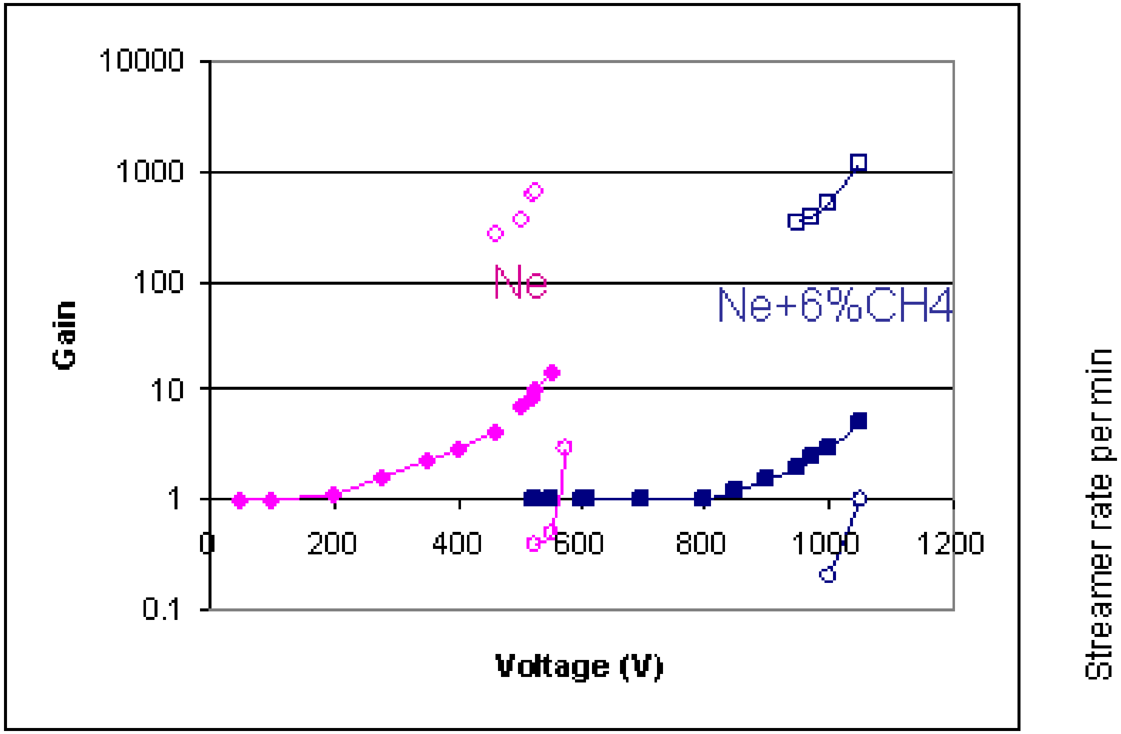
Fiber glass plates (FR-4)

Cu strips 50 μm wide were created on the top of the fiber glass plate by the photolithographic method

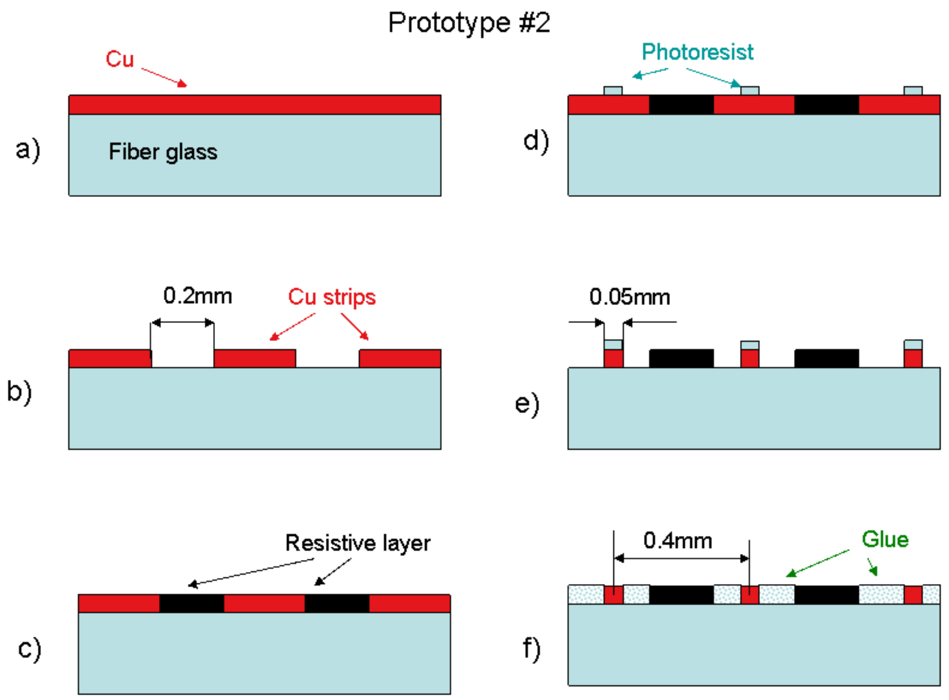
Then in contact with the side surfaces of each Cu strip dielectric layers (Pyralux *PC1025* Photoimageable *coverlay* by *DuPont*) were manufactured;

Finally the detector surface was coated with resistive paste and polished so that the anode and the cathode resistive strips become separated by the Coverlay dielectric layer.

Results obtained with R-MSGC **#1**



R-MSGC #2



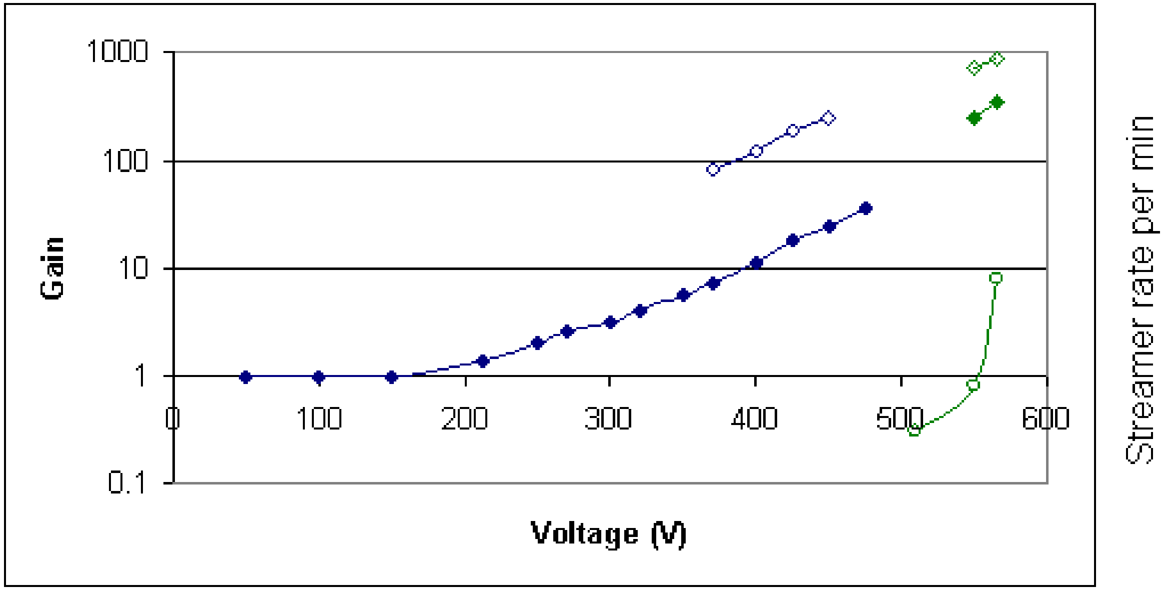
As a next step the middle part of the Cu strips were coated with 50 µm width layer of photoresist (Fig. d) and the rest of the area of the Cu strip were etched (Fig e); in such a way metallic anode strips 50 µm in width were created.

Finally the gaps between Cu anode strip and the cathode resistive strips were filled with glue FR-4 and after it hardening the entire surface was mechanically polished.

First by photolithographic technology Cu strip 200 µm in width were created on the top of the FR-4 plate (Figs a and b).

Then the gaps between the strips were filled with the resistive paste (Fig. c).

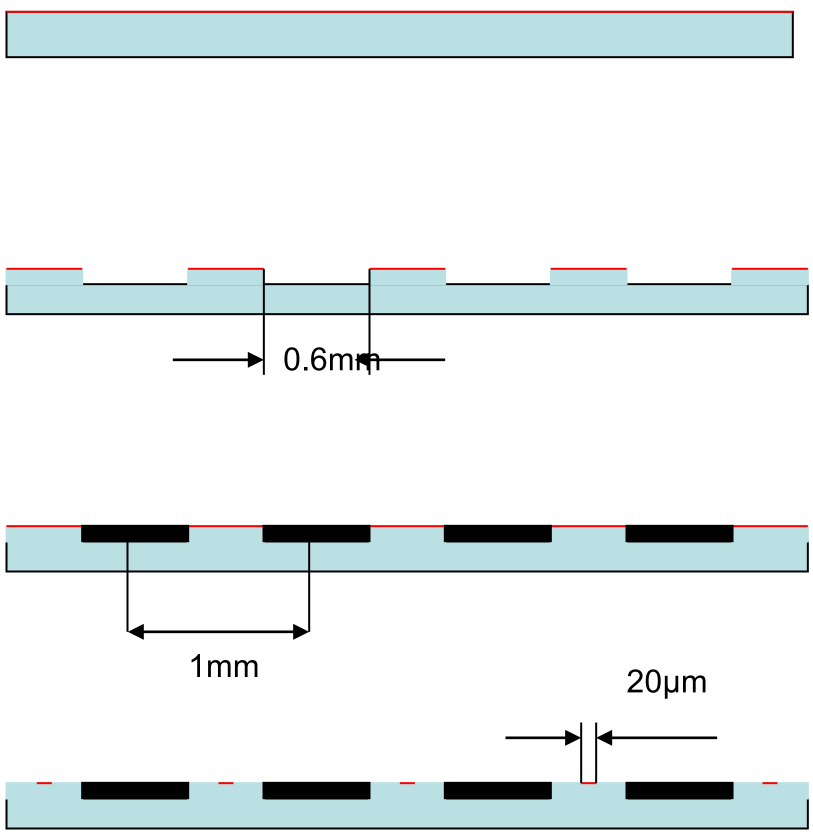
Results obtained with R-MSGC#2 in $Ne+5\%CH_4$



After learning the problems we produced now much better R-MSGC allowing gas gains as high as with the best MSGCs manufactured on a glass substrate to be achieve

R-MSGC prototype #3

An improved and simplified technology of R-MSGC production:

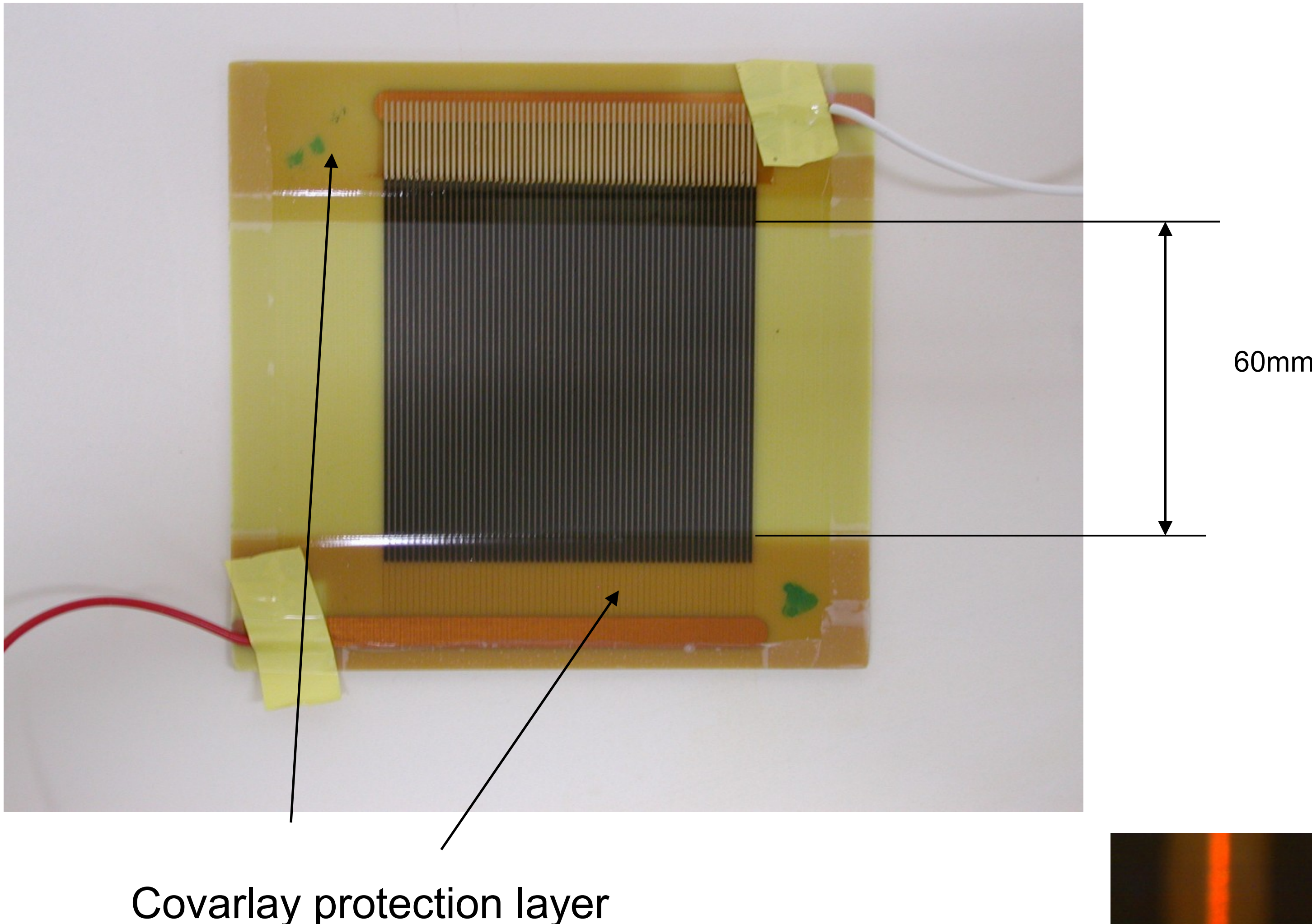


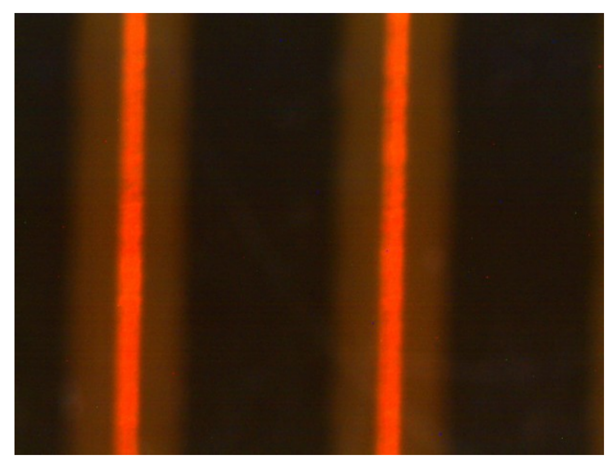
PCB with 5µm thick Cu layer

Milled grooved 100 µm deep and 0.6 µm wide, pitch 1mm.

The grooves were then filled with resistive paste

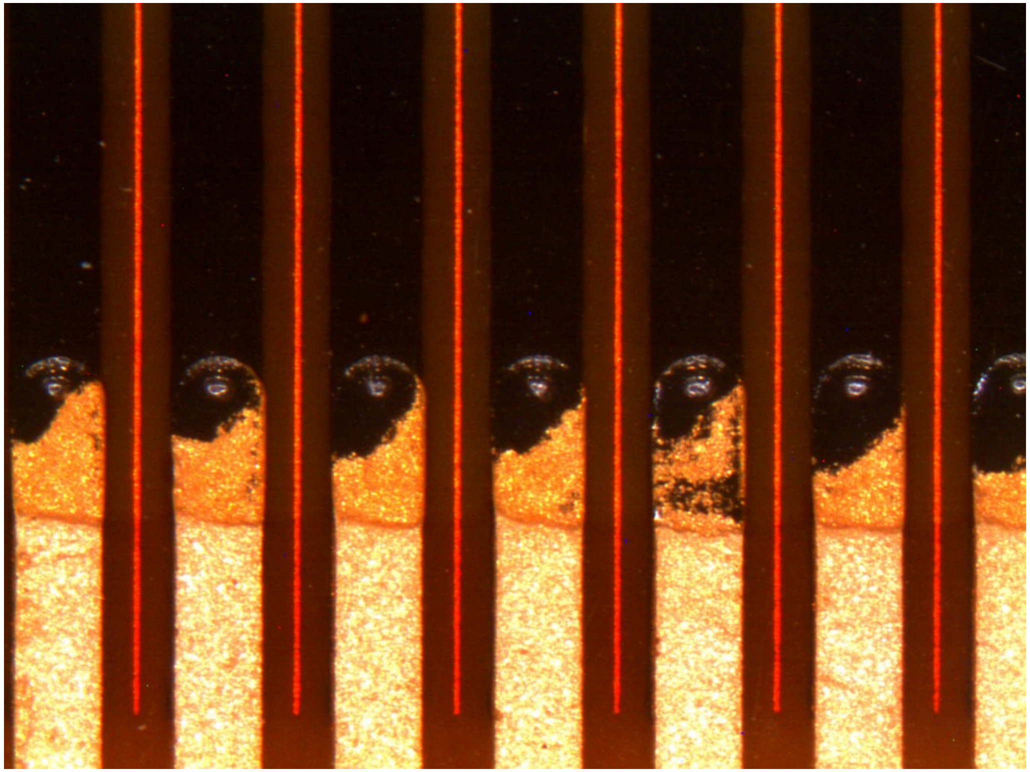
By a photolithographic technology Cu 20 µm wide strips were created between the grooves


60mm
Covarlay protection layer

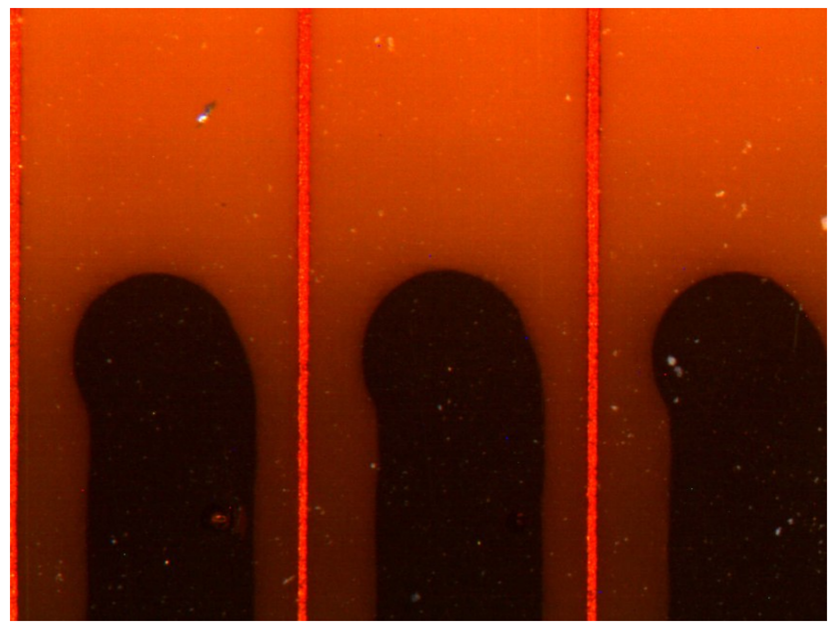


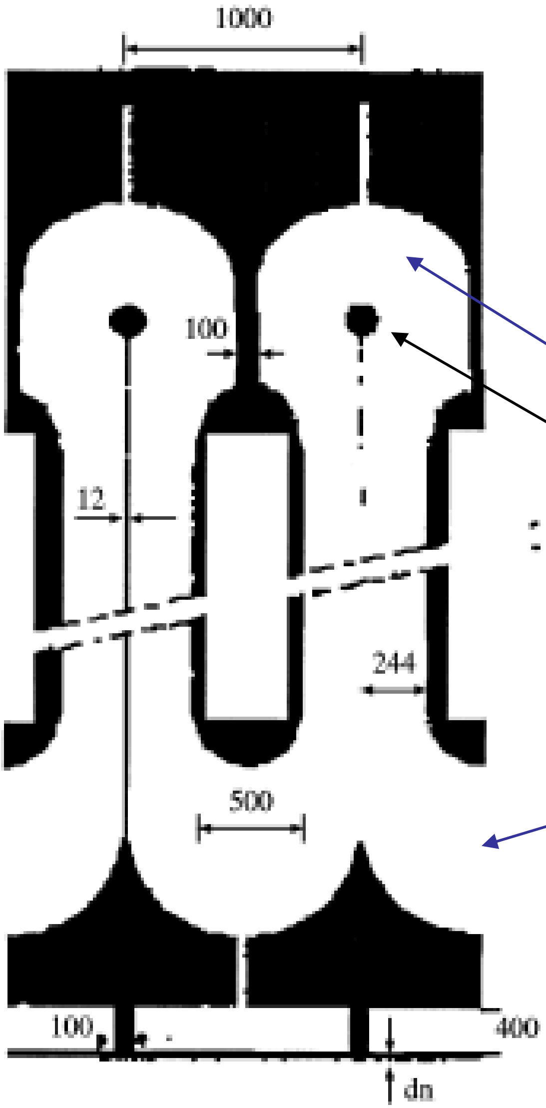
Features:

1) Printed circuit bard (not the glass!)
2) Thin metallic anodes
3) Resistive cathodes
4) Coverlay (65 μm, laminated) protection of edges



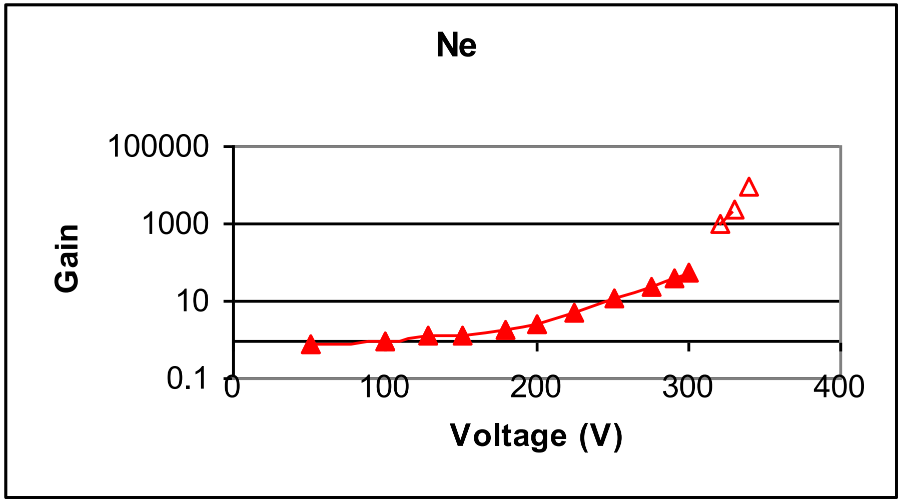
Coverlay layer reliably protects
the edges region against the sparks



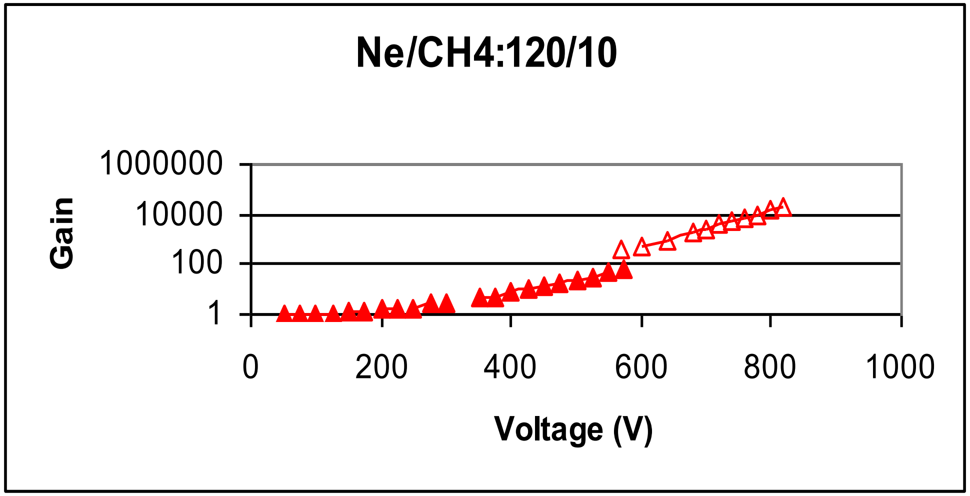


Electrodes edges arrangement in “classical” MSGC

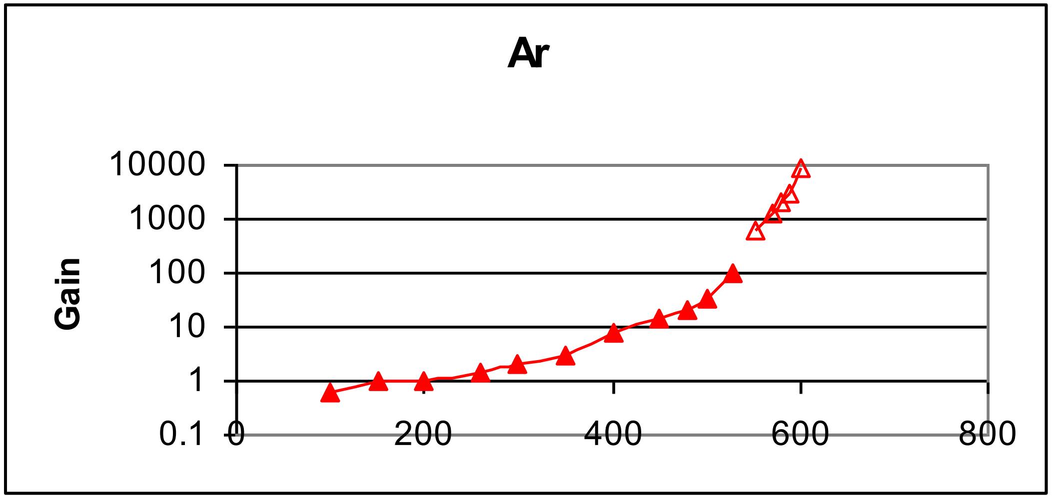
Some results

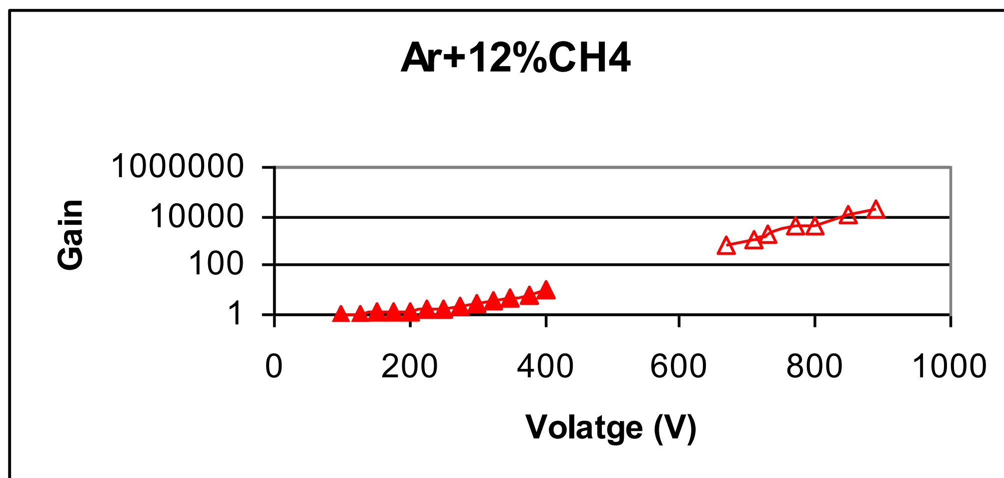


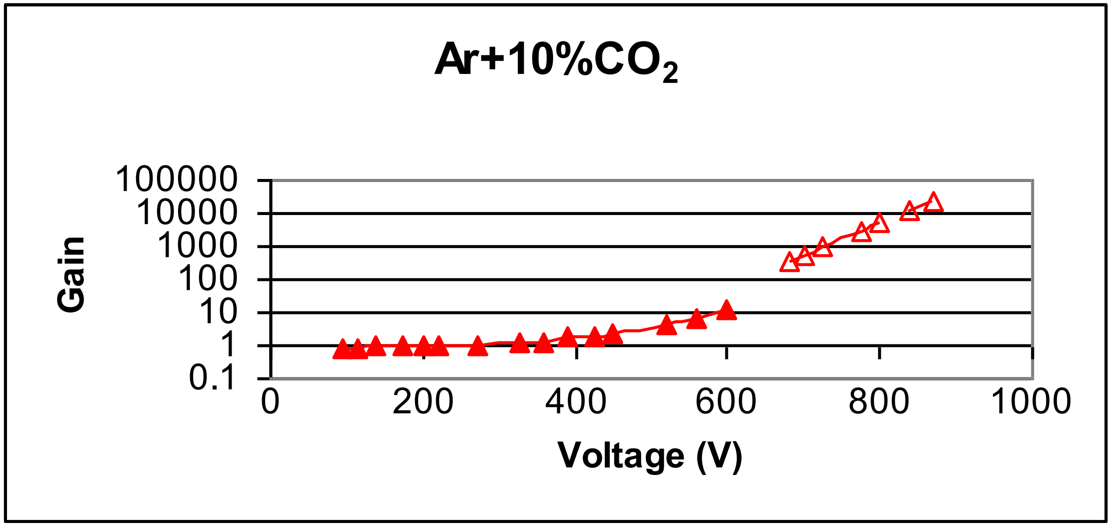
Ne
100000
1000
10
0.1
Gain
0
100
200
300
400
Voltage (V)

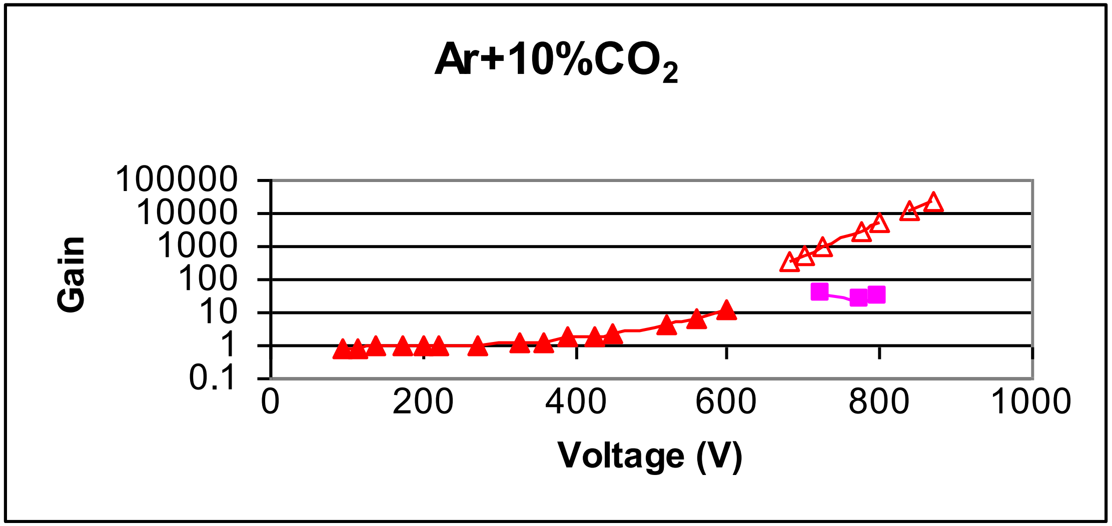


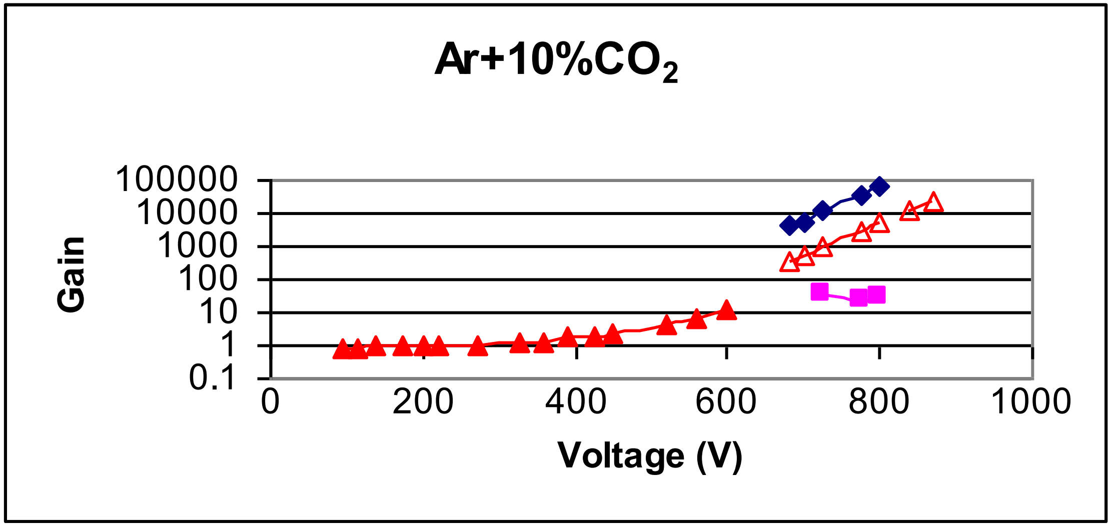
Ne/CH4:120/10
1000000
10000
100
1
Gain
0
200
400
600
800
1000
Voltage (V)


Ar
Gain
10000
1000
100
10
1
0.1
0
200
400
600
800


Ar+12%CH4
Gain
1000000
10000
100
1
0
200
400
600
800
1000
Volatge (V)

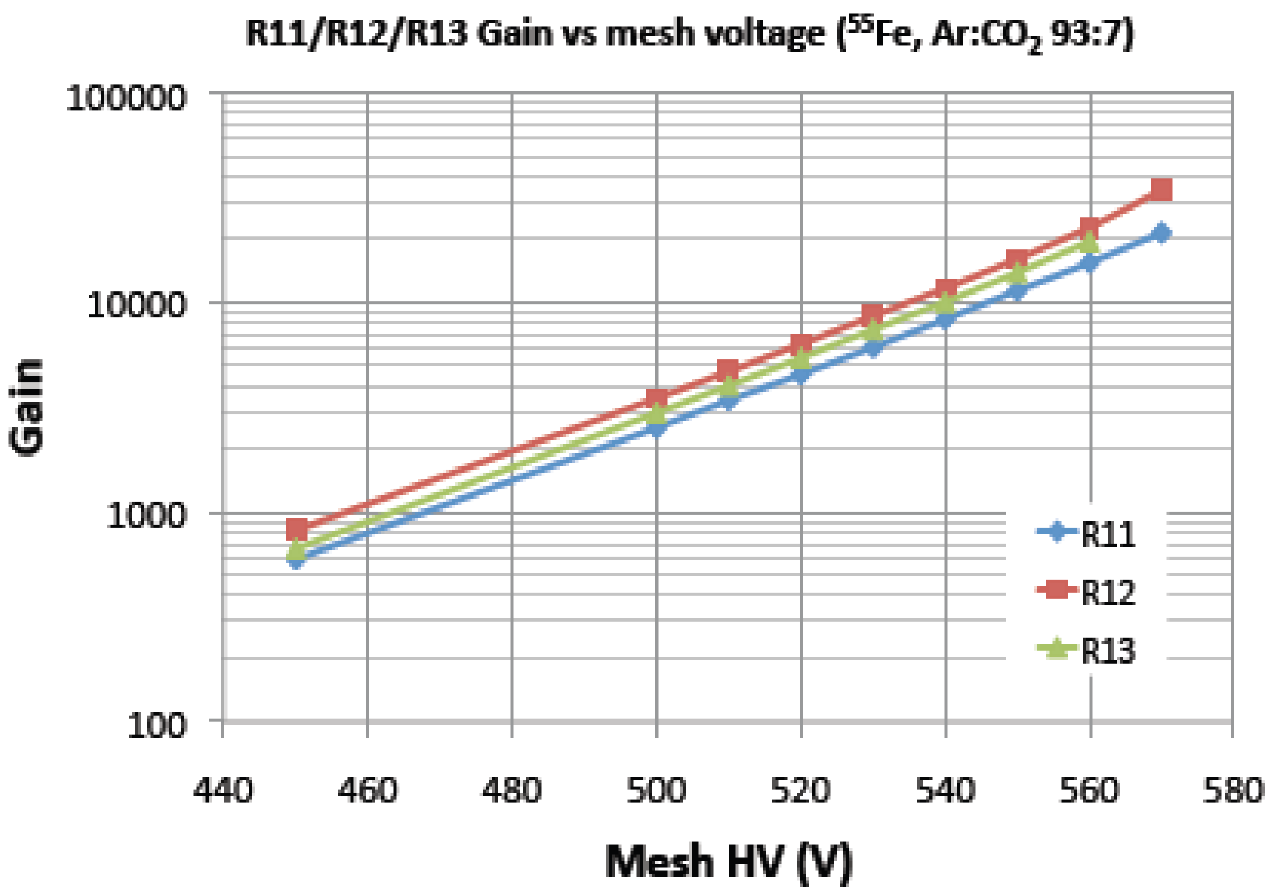

Ar+10%CO2
Gain
100000
10000
1000
100
10
1
0.1
0
200
400
600
800
1000
Voltage (V)


Ar+10%CO2
Gain
100000
10000
1000
100
10
1
0.1
0
200
400
600
800
1000
Voltage (V)



Measurements in Ar/CO_2 were done in order to compare with resistive MICROMEGAS

Resistive MICROMEGAS

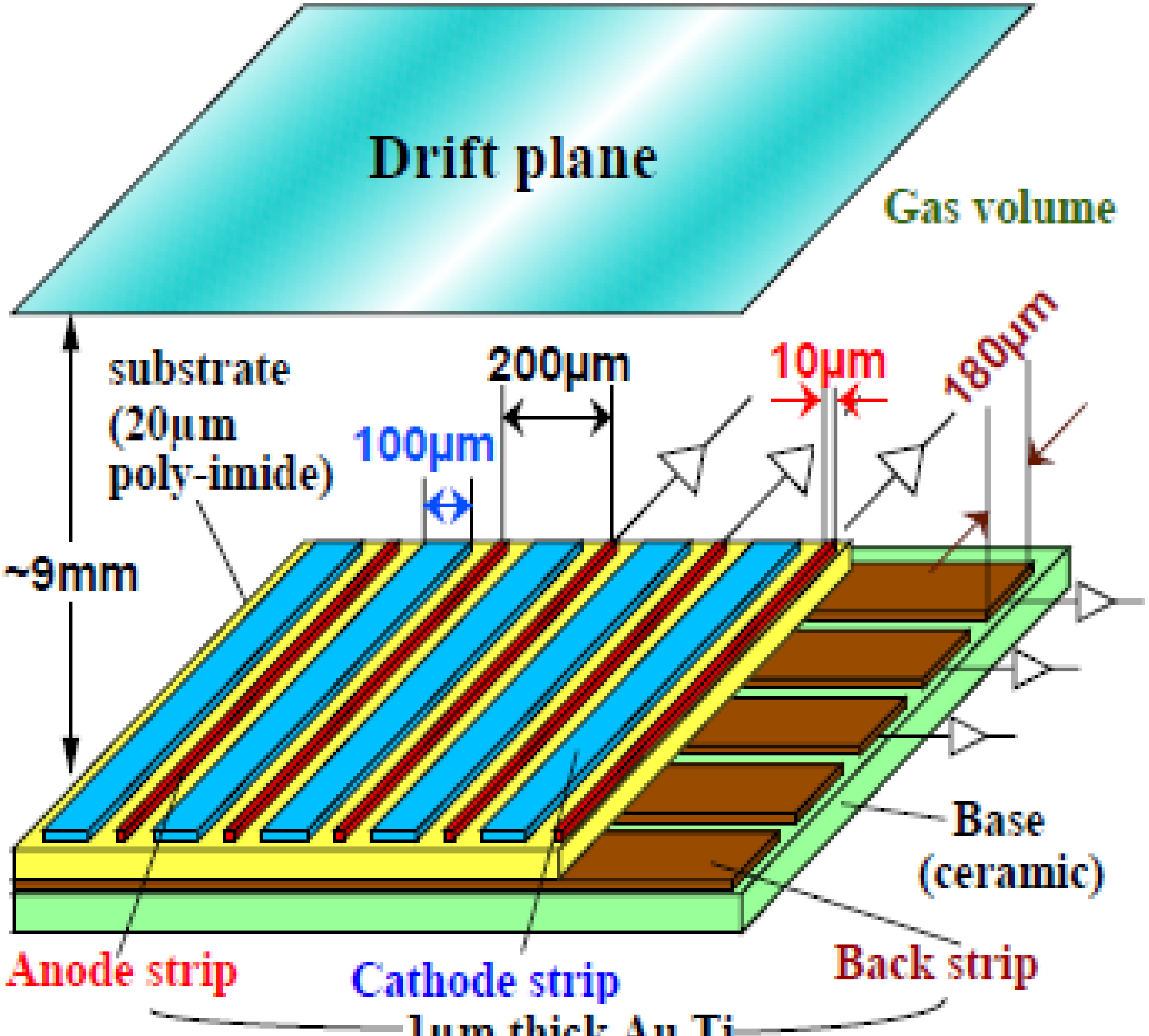


T. Alexopoulos et al., RD-51 Internal report #2010–006

Advantages of R-MSGC:

- Max. achievable gain is comparable to res. MICROMEGAS
- However, R-MSGC is easier to manufacture than MICROMEGAS
- Easier to clean form dust particles
- Less parts in the detector assembly (no cathode mesh)
- Can be assembled from patches practically without dead spaces/zones

MSGCs offer quite good position resolution



Drift plane
Gas volume
substrate
(20μm
poly-imide)
200μm
10μm
180μm
100μm
~9mm
Base
(ceramic)
Anode strip
Cathode strip
Back strip
1μm thick Au,Ti

ELSEVIER

Nuclear Physics B (Proc. Suppl.) 44 (1995) 268–273

NUCLEAR PHYSICS B
PROCEEDINGS
SUPPLEMENTS

Results from the MSGC tracker at SMC

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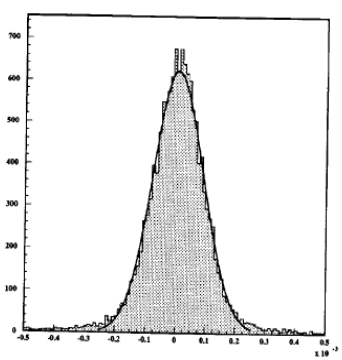
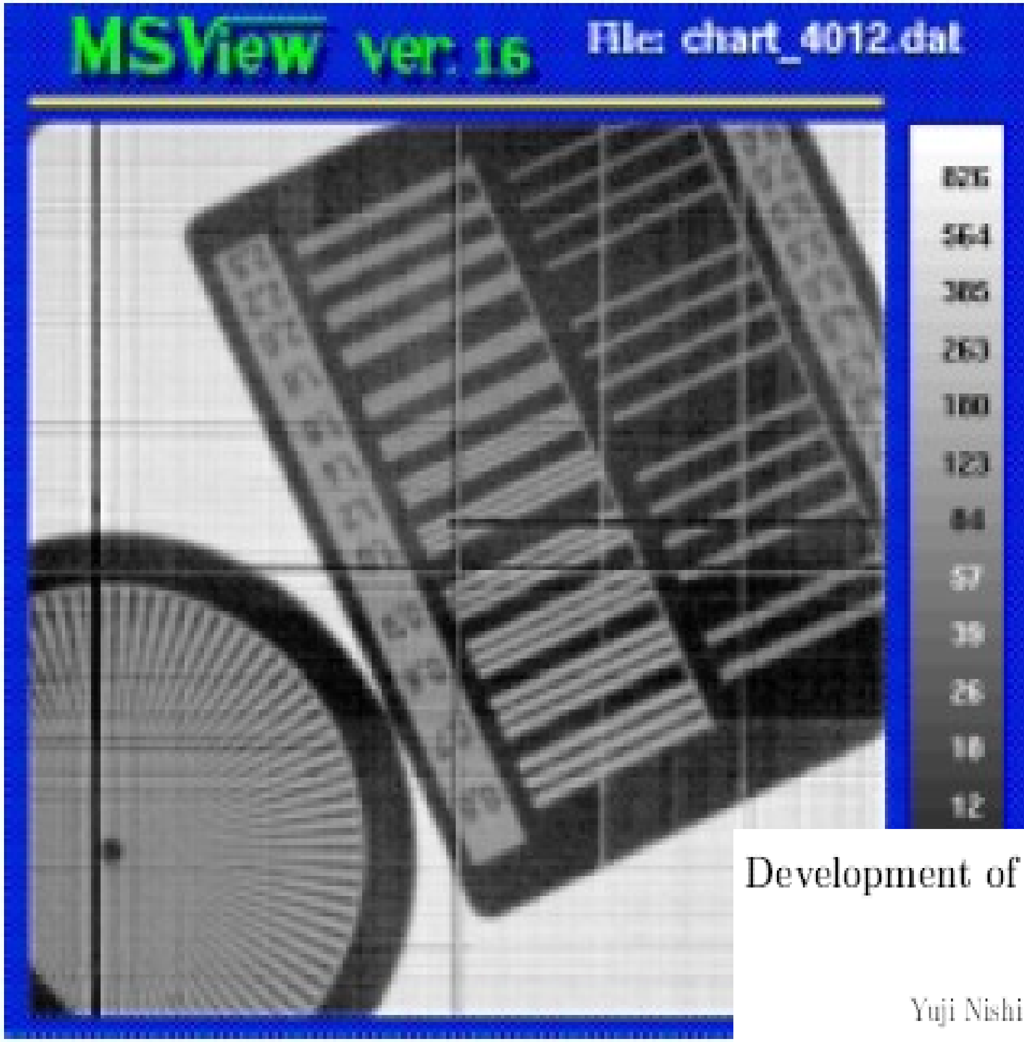


Figure 3. Residuals of tracks fitted through all four MSGC planes of a station.

From fig. 3 we derived a position resolution for a single layer of 54 μm.



X-ray polarimetry with the microstrip gas chamber

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(Received 4 August 1997; accepted 9 January 1998)

Development of a hybrid MSGC with a conductive capillary plate

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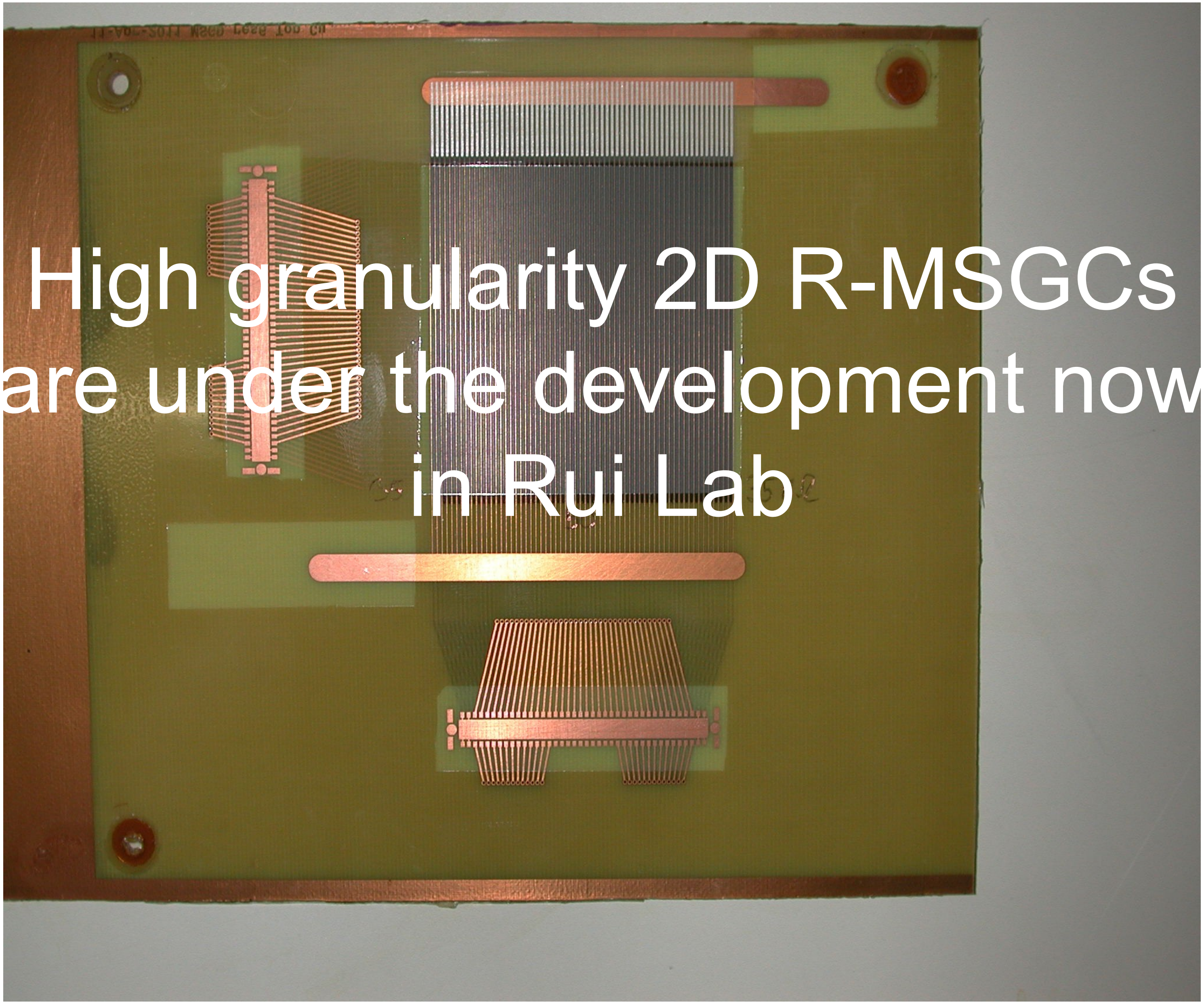
High granularity 2D R-MSGCs are under the development now in Rui Lab



Conclusions:

- Our progress in development R-MSGCs is summarized in the table

R-MSGC -type	Max. achievable gain with 6keV photons
1	~10
2	~500
3	10000

- Features of the new design (#3):

Printed circuit substrate
Thinner anode
Resistive cathodes
Coverlay protection of the edges regions

- The max. achievable gas gains are equal to the best glass MSGC and approaching R-MICROMEGAS

- The advantages: simple technology (less price), less elemenets, easier to clean

We hope our works will renew the interest to MSCG detectors which can be competitive in some applications