

MicroStrip Gas Counters at ILL

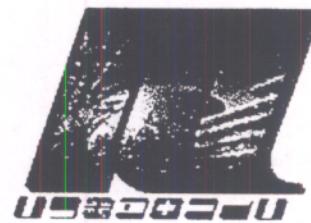
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Neutron Detector Laboratory

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Brookhaven, Sept. 24-26, 1998 MSGC detectors at ILL



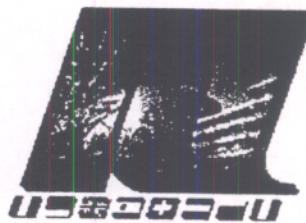
MSGC versus Wire Counters

MSGC are intrinsically superior in terms of

- Energy resolution
 - > Gamma discrimination
 - > Counting stability
- Counting rate
- Position resolution
- Homogeneity of response
- Reproducibility of fabrication
- Maintenance cost and repair delay

... but one advantage of MWPC relies in the fact that they can be manufactured in any size.

Today, the maximum size of a MSGC plate is 30 x 30 cm². It is possible to make large MSGC detectors by juxtaposing several plates.



Fabrication Outline

◆ Gas quality

Only materials qualified for very low outgassing are used.

The gas tightness is given by a metallic joint, and the detector is baked out at high temperature.

Ultra-pure gas is selected, and controlled by measuring the resolution of the full absorption energy peak.

◆ Mechanics

In view of a modular assembly of several detectors, the bidim200 has a square shape, and electric field guard electrodes are used to minimize the dead zone.



Fabrication Outline

◆ MSGC

The substrate is made of S8900 Schott glass, an electroconductive glass that is qualified for its long term stability, and its high counting rate capability.

We now use MSGC with the anode on one side, and the cathode on the other side. This “virtual cathode” configuration gives 2 advantages :

- Higher maximum amplification factor (10^5 measured with 5.9 KeV X-rays) --> more robust
- anode and cathode signals have the same amplitude.



Fabrication Outline

◆ Localisation methods

INDIVIDUAL READOUT $\tau_{\max} = 200 \text{ KHz}$

Each strip is connected to an amplifier/discriminator,
followed by an anti-coincidence logic.

CHARGE DIVISION $\tau_{\max} = 100 \text{ KHz}$

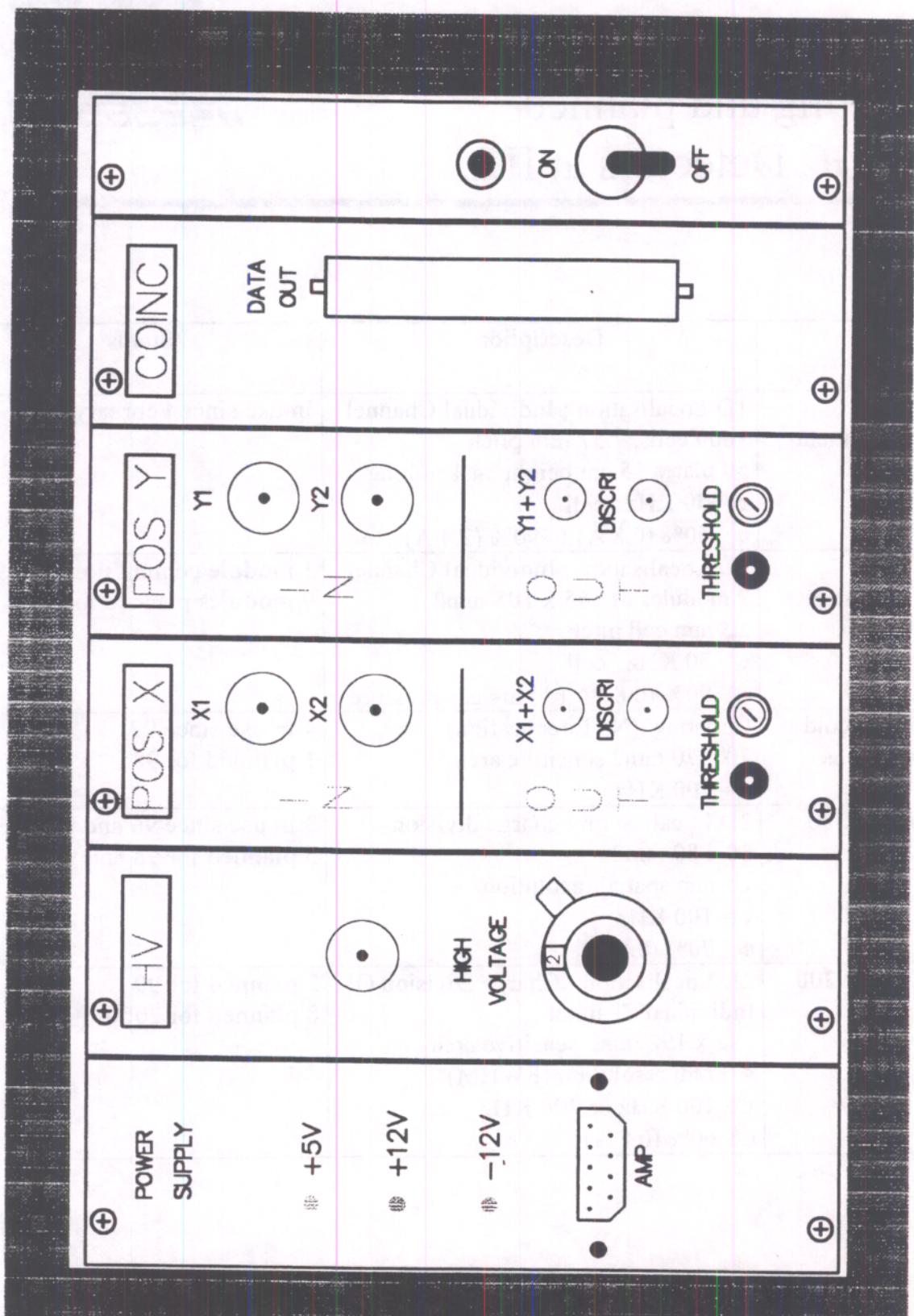
The interconnection resistive line is engraved directly on the substrat. Only 5 readout channels are used : 4 for X and Y coordinate measurement, and 1 for energy selection.
Correction of spatial non-linearity may be necessary for large area detectors.

Cheaper than individual readout :

by 20 K\$ for the bidim200 (64 X / 64 Y)

The APM (Analog Position Measurement) electronic module has been developped at ILL to provide fast localisation by charge division at a reasonable price. It is compatible with PC, CAMAC, and VME systems.

226 (mm)

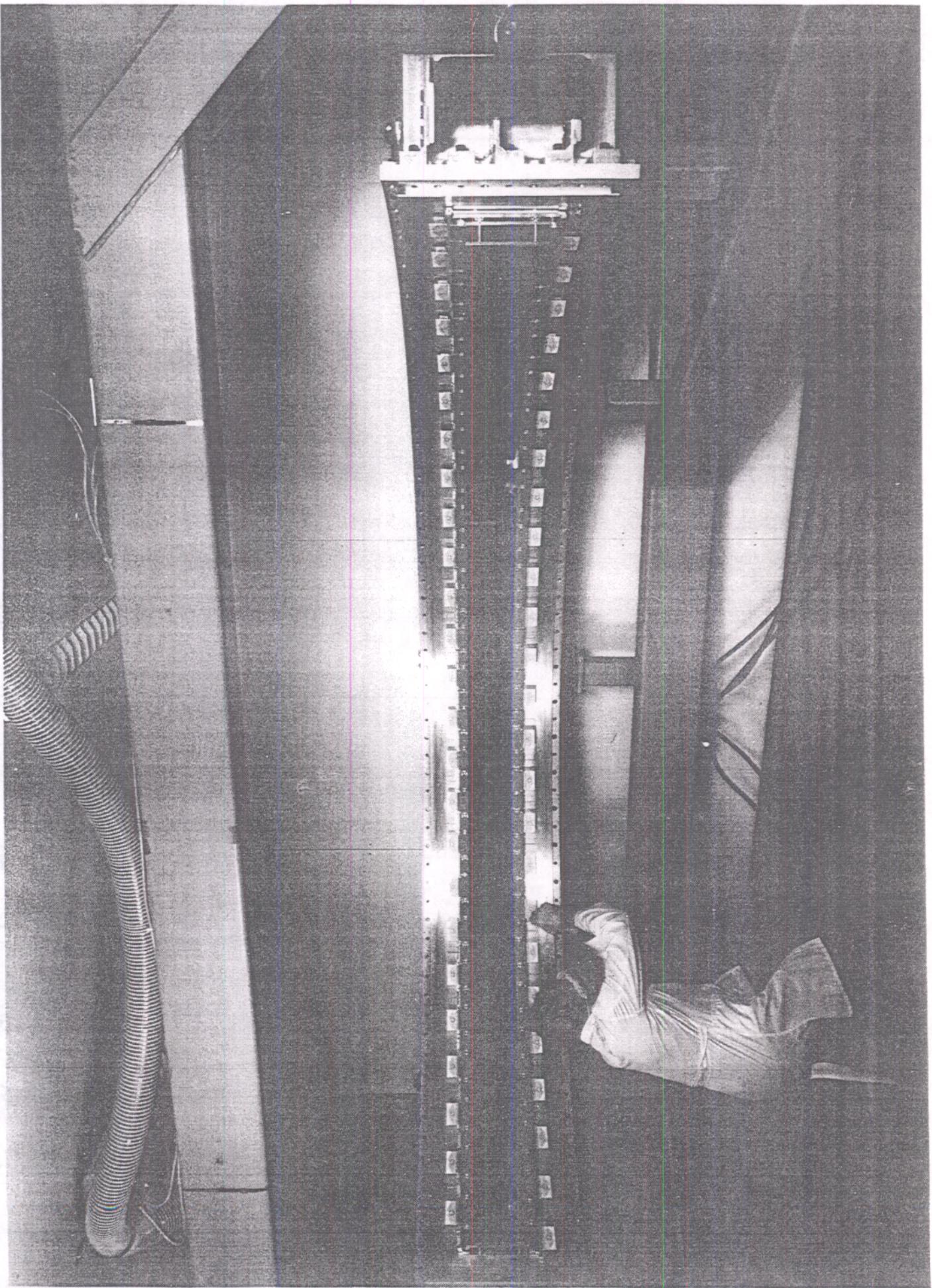


153 (mm)

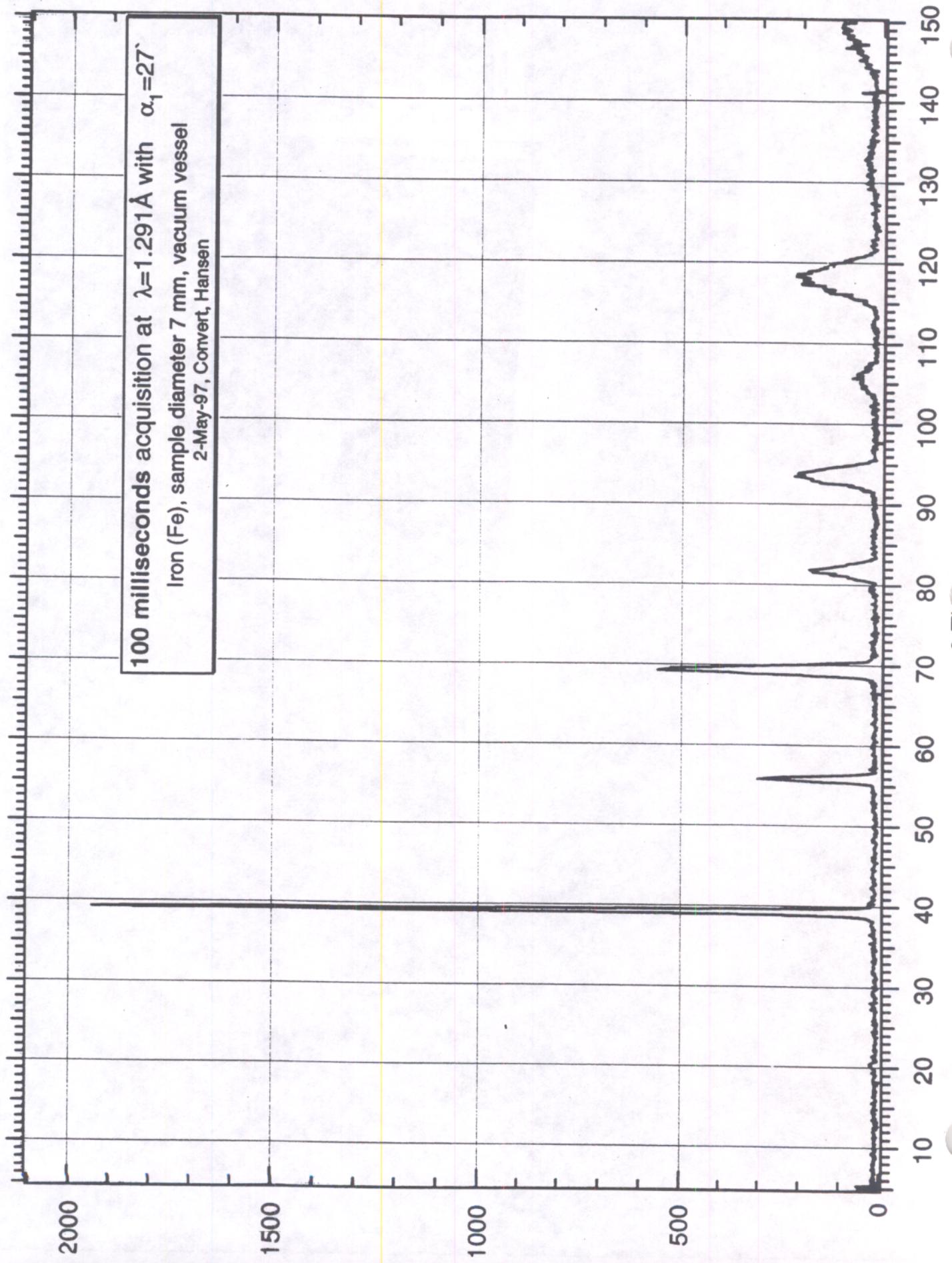


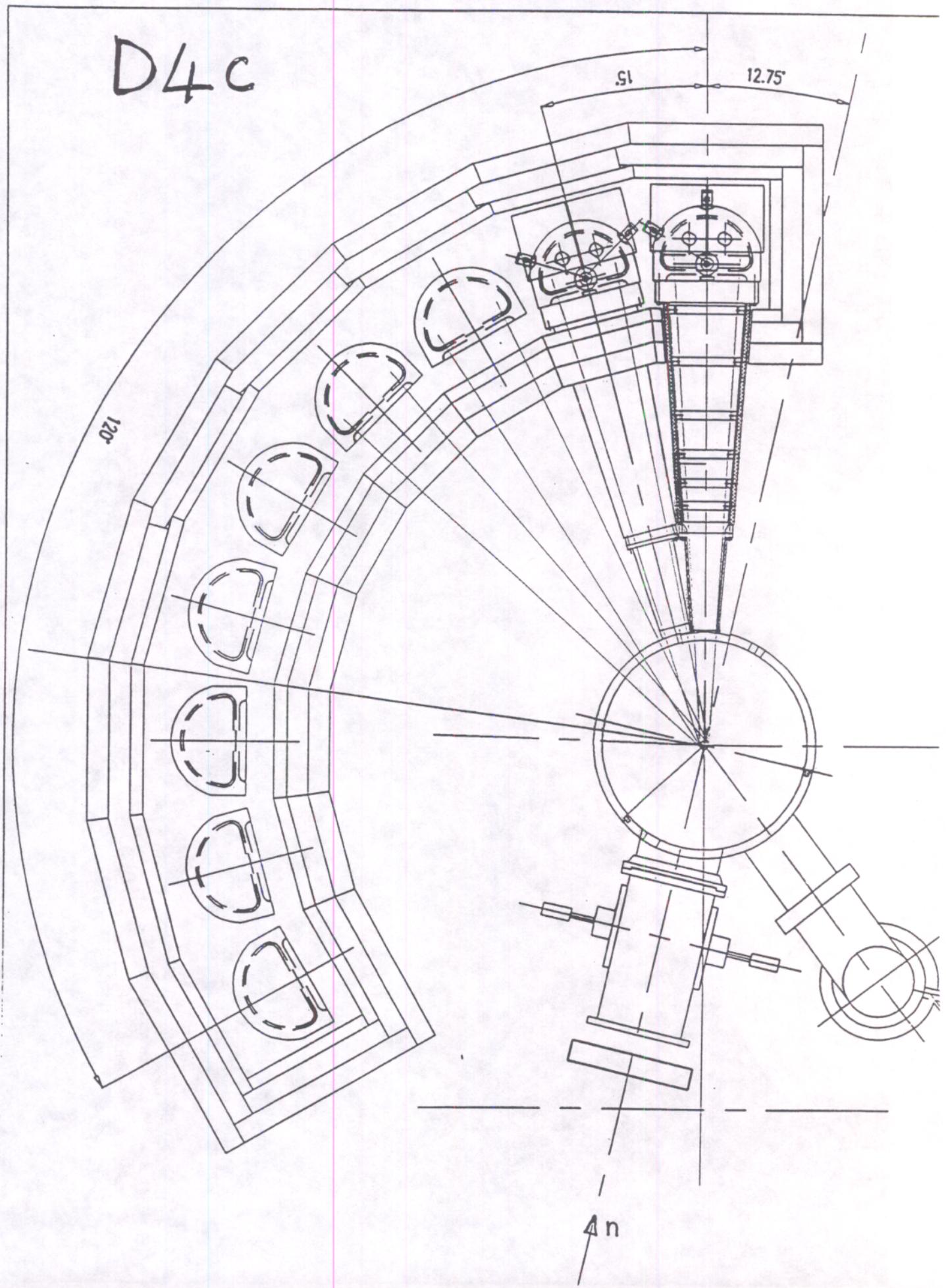
Existing and planned MSGC Detectors at ILL

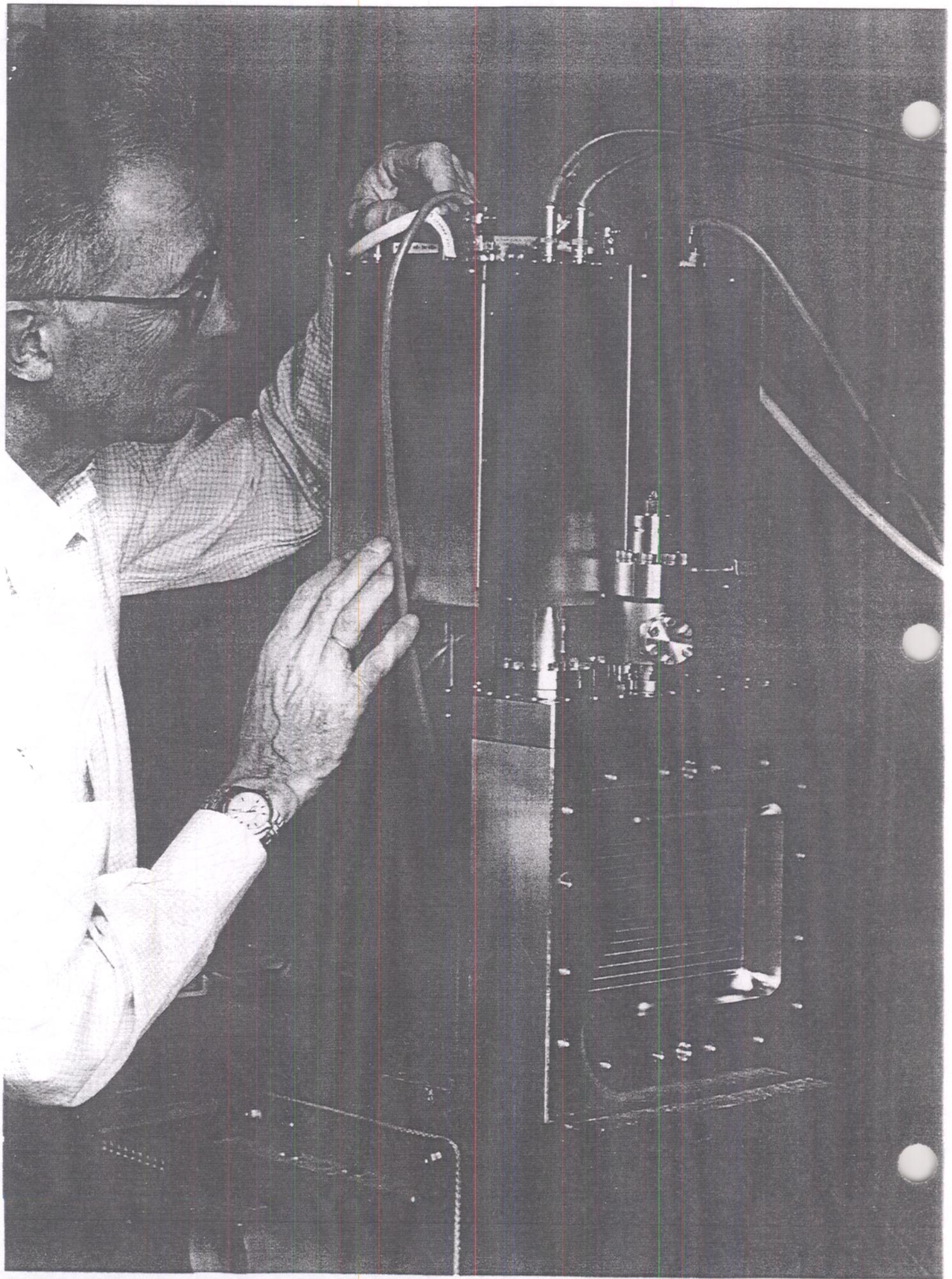
	Description	Status
D20 Instrument	1D Localisation ; Individual Channel 1600 cells, 2.57 mm pitch 50 plates 15 cm height 4.1 m long $\tau = 50$ KHz / cell $\epsilon : 60\% (0.8 \text{ A}) ; 90\% (2.4 \text{ A})$	In use since February 97
D4C Instrument	1D Localisation ; Individual Channel 9 modules of 165 x 108 mm ² 2.5 mm cell pitch $\tau = 50$ KHz / cell $\epsilon : 90\% (0.8 \text{ A})$ 15 bars gas pressure	1 module commissioned in 97 9 modules planned for 99
Ultra-cold neutrons	Counting (No Localisation) 70 x 70 mm ² sensitive area $\tau = 100$ KHz	4 in use since 97 1 planned for 98
Bidim_80	2D Localisation ; charge division 80 x 80 mm ² 1.5 mm spatial resolution $\tau = 100$ KHz $\epsilon : 70\% (0.8 \text{ A})$	3 in use since 96 and 97 5 planned for 98 and 99
Bidim_200	2D Localisation ; Charge Division OR Individual Channel 192 x 192 mm ² sensitive area < 3 mm resolution (FWHM) $\tau = 100$ KHz or 200 KHz $\epsilon : 60\% (0.8 \text{ A})$	2 planned for 99 8 planned for 2000



100 milliseconds acquisition at $\lambda=1.291\text{\AA}$ with $\alpha_1=27^\circ$
Iron (Fe), sample diameter 7 mm, vacuum vessel
2-May-97, Convert, Hansen



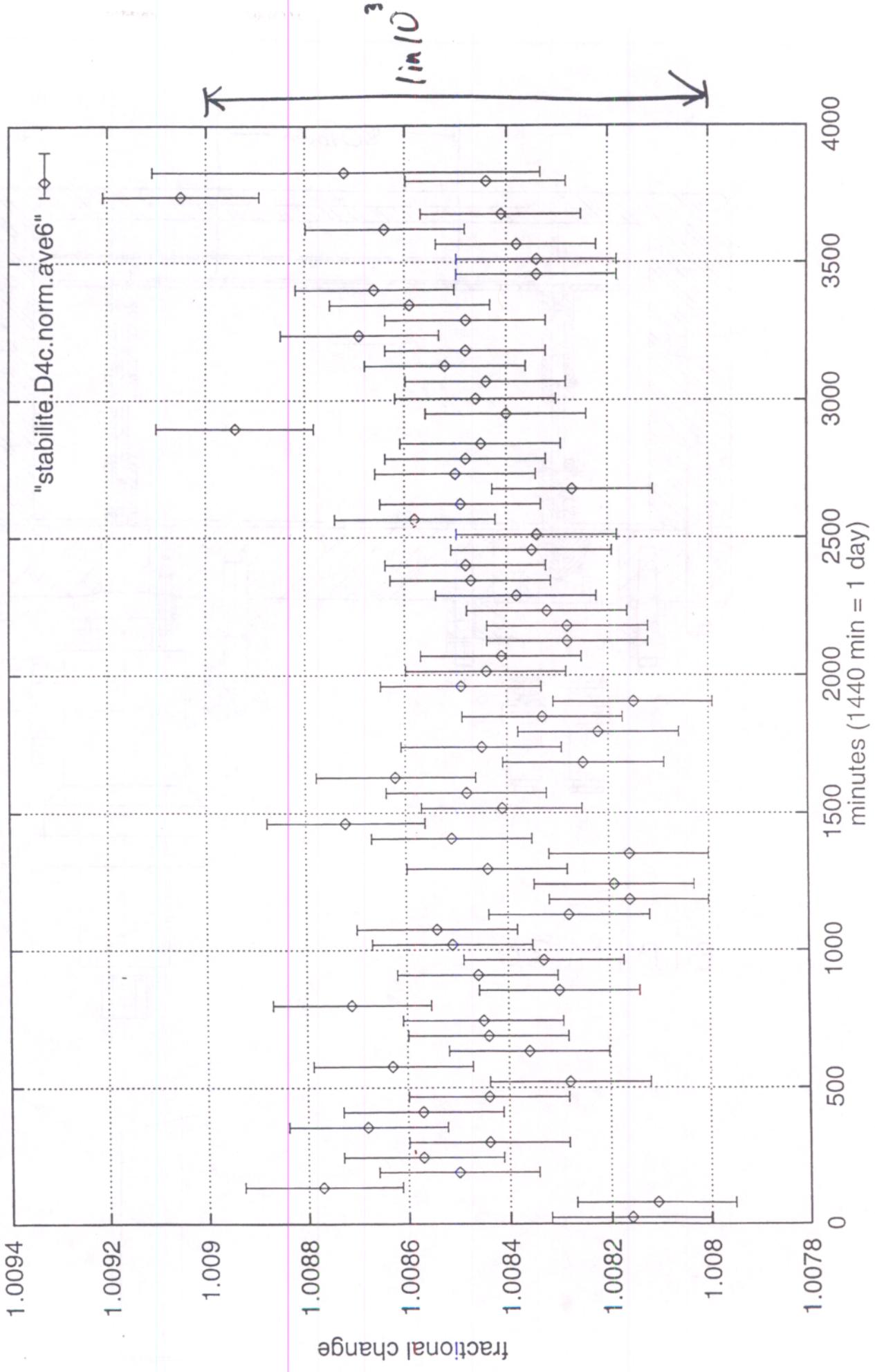


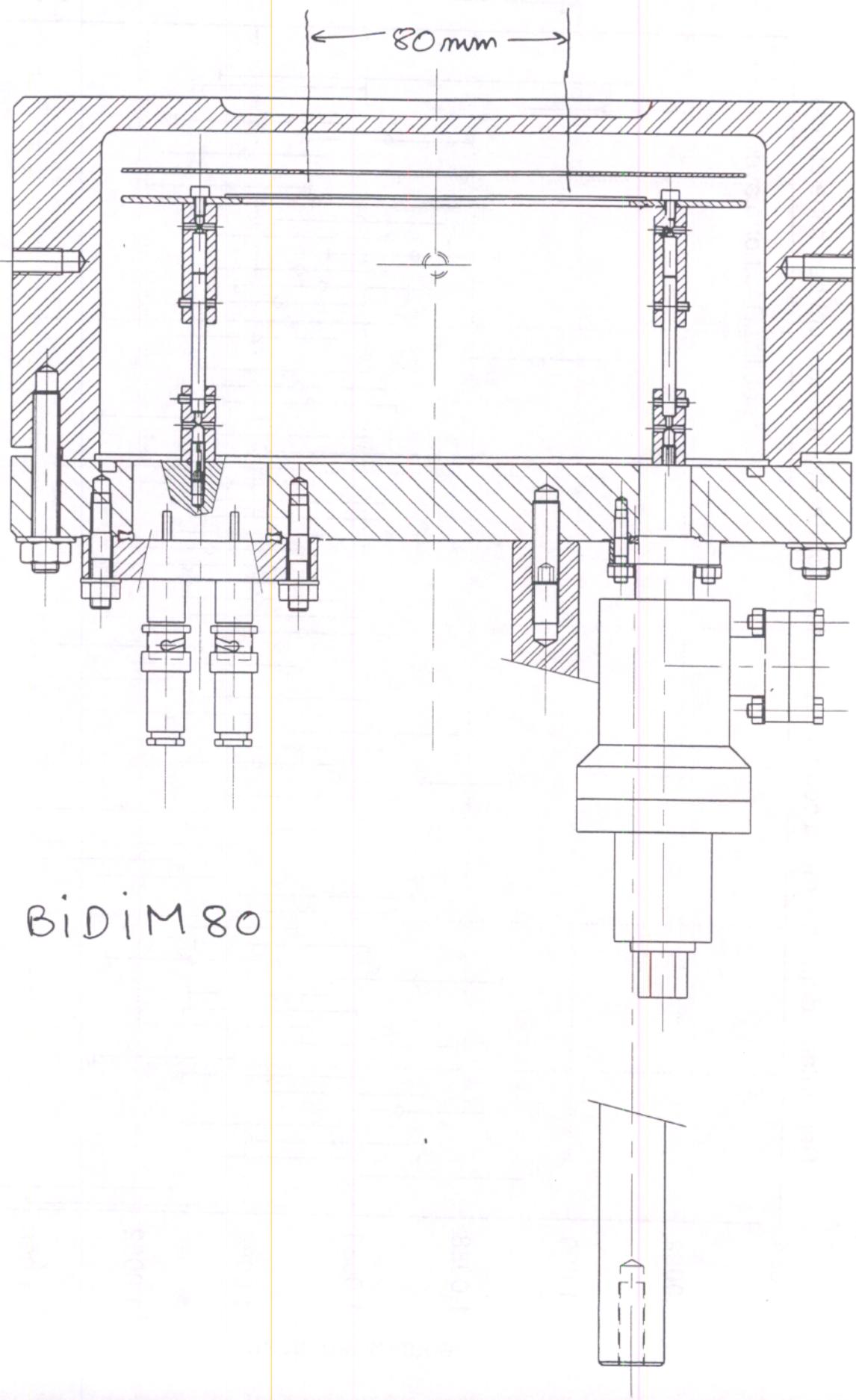


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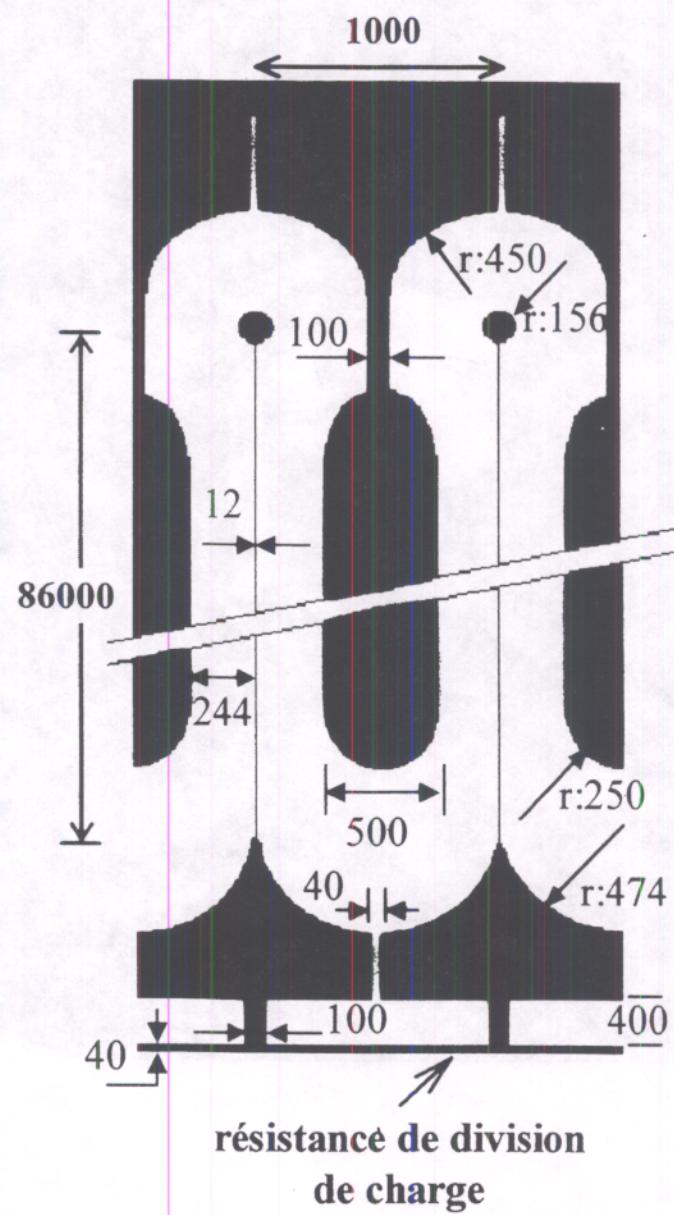
Renormalized and averaged counts of D4c detector (taking into account beamline optics)





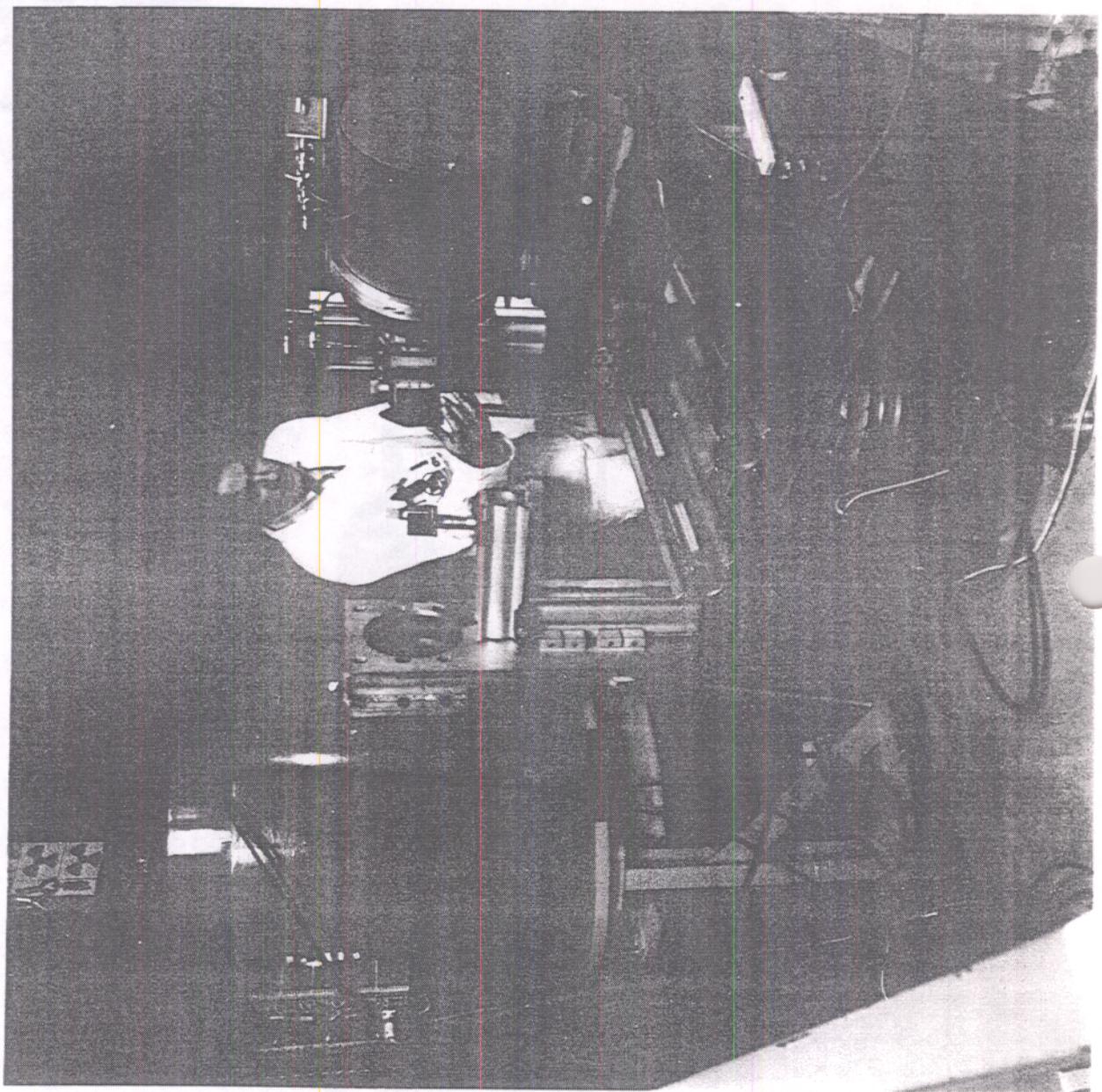


Bidim_80 structure



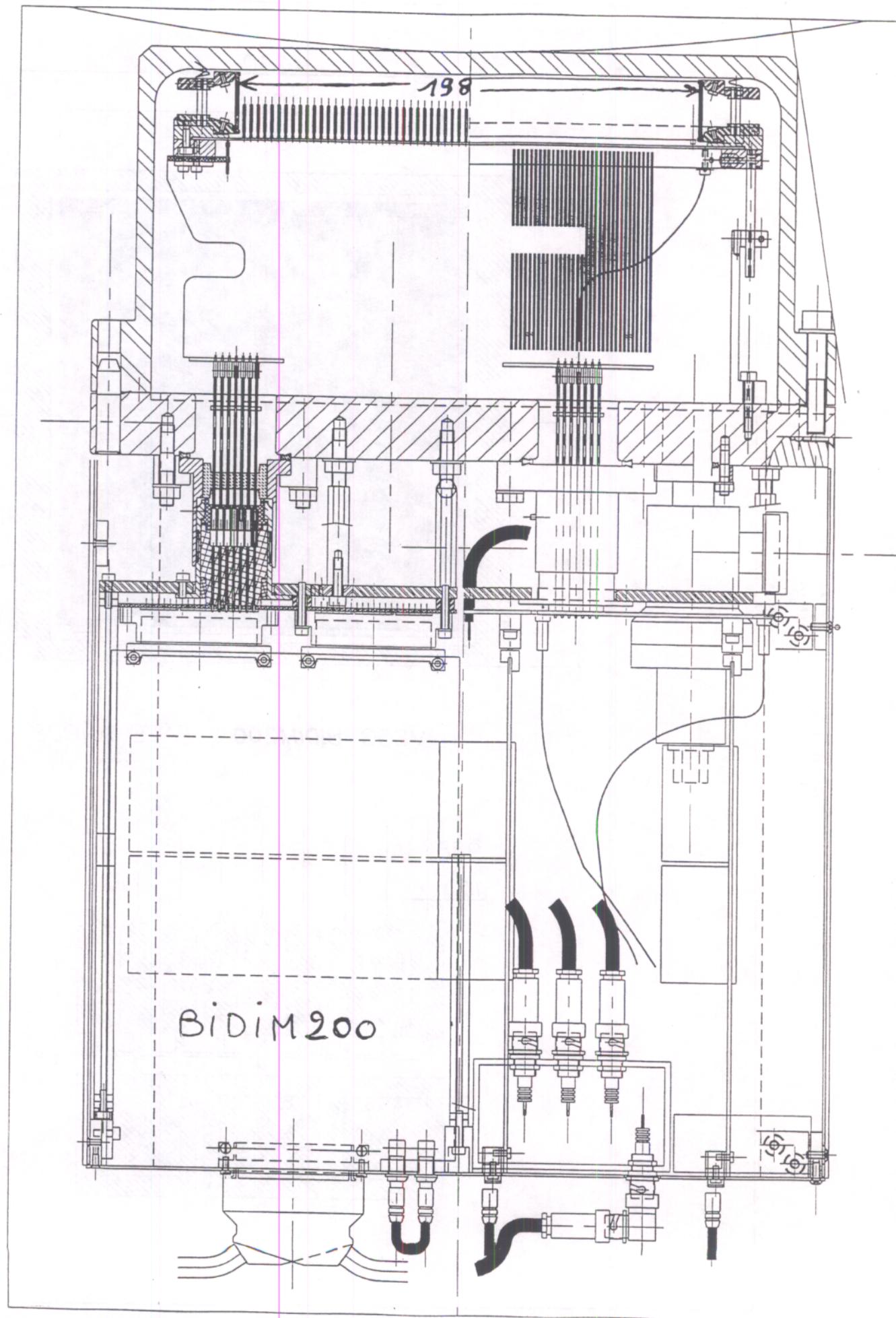
Brookhaven, Sept. 24-26, 1998

MSGC detectors at ILL



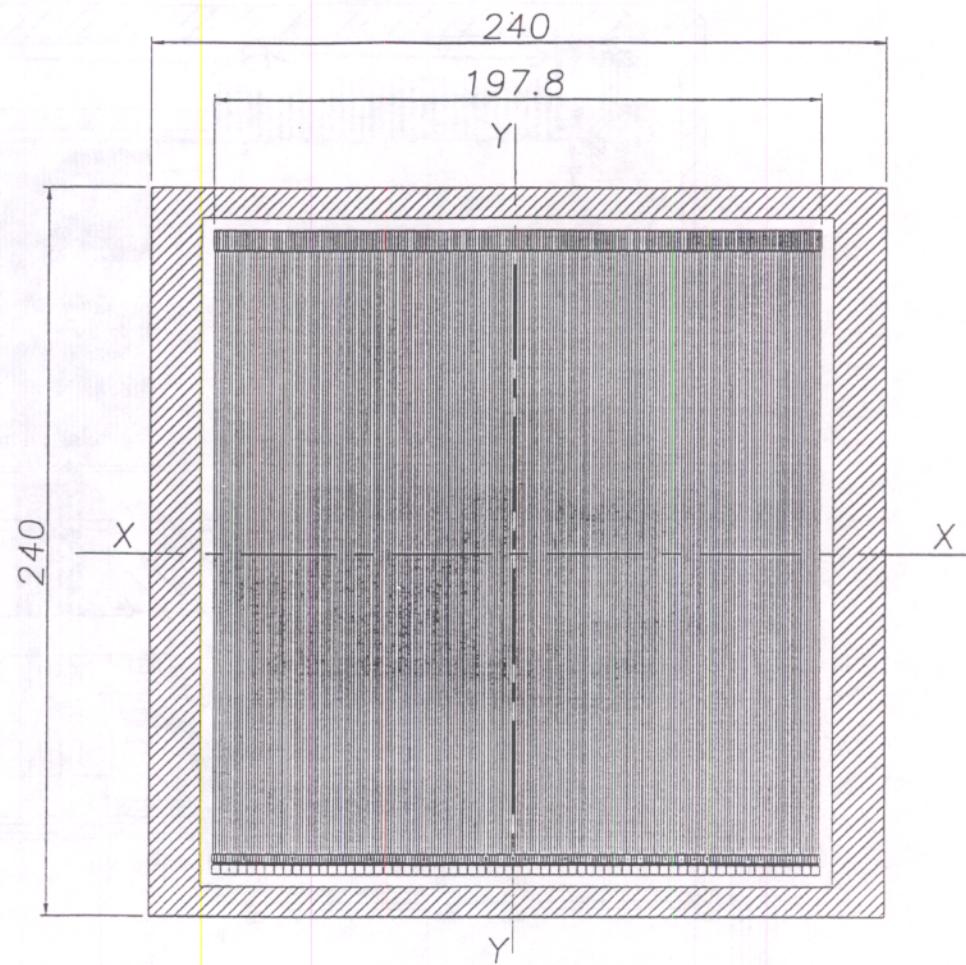
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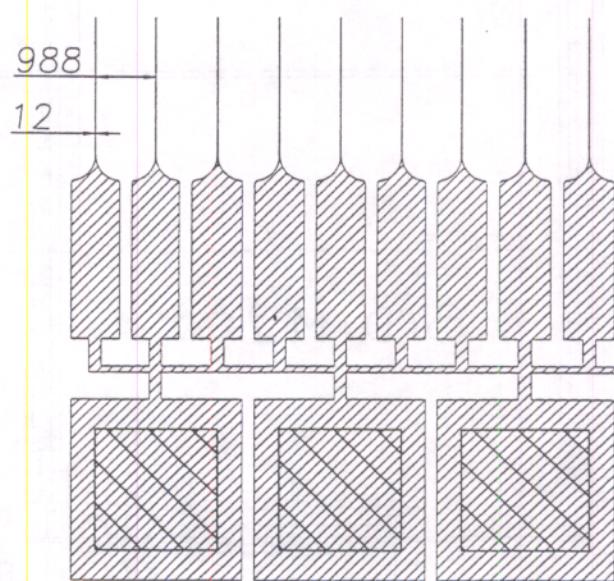


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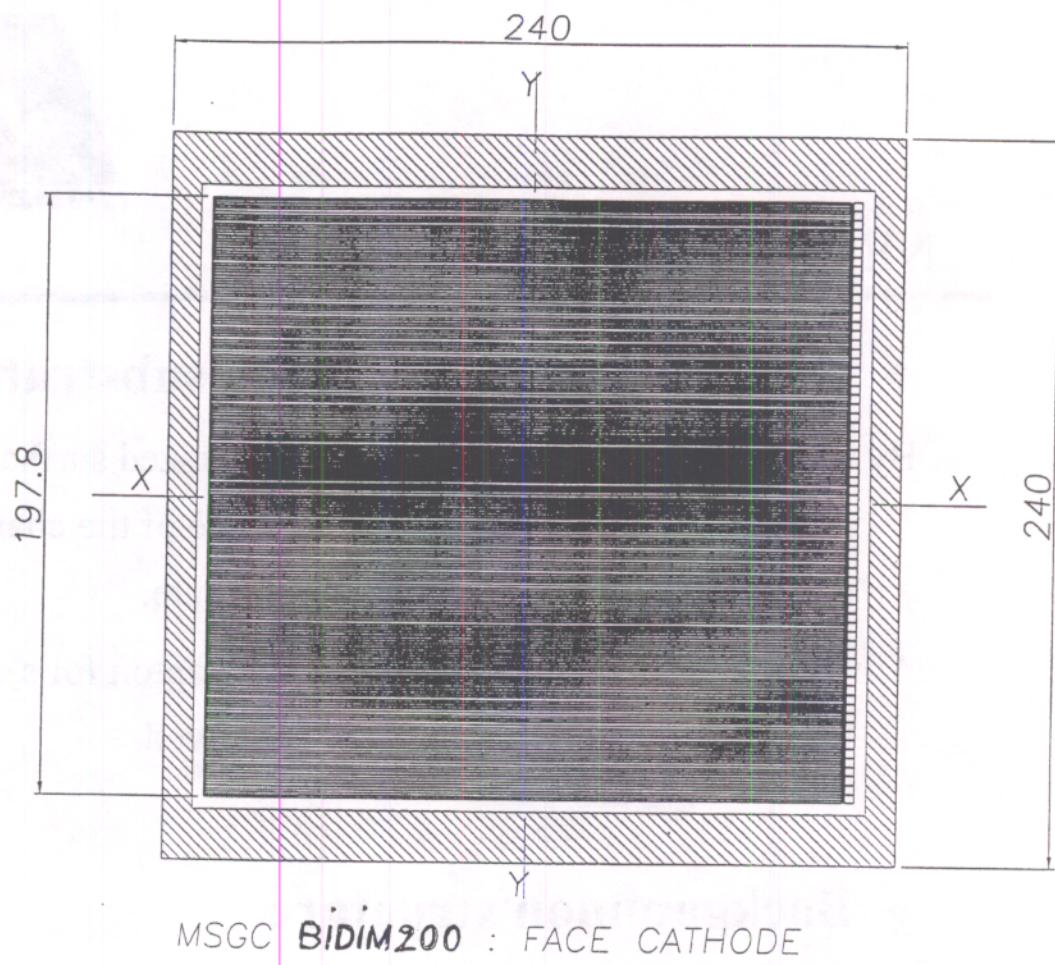


MSGC **BiDIM200** : FACE ANODE

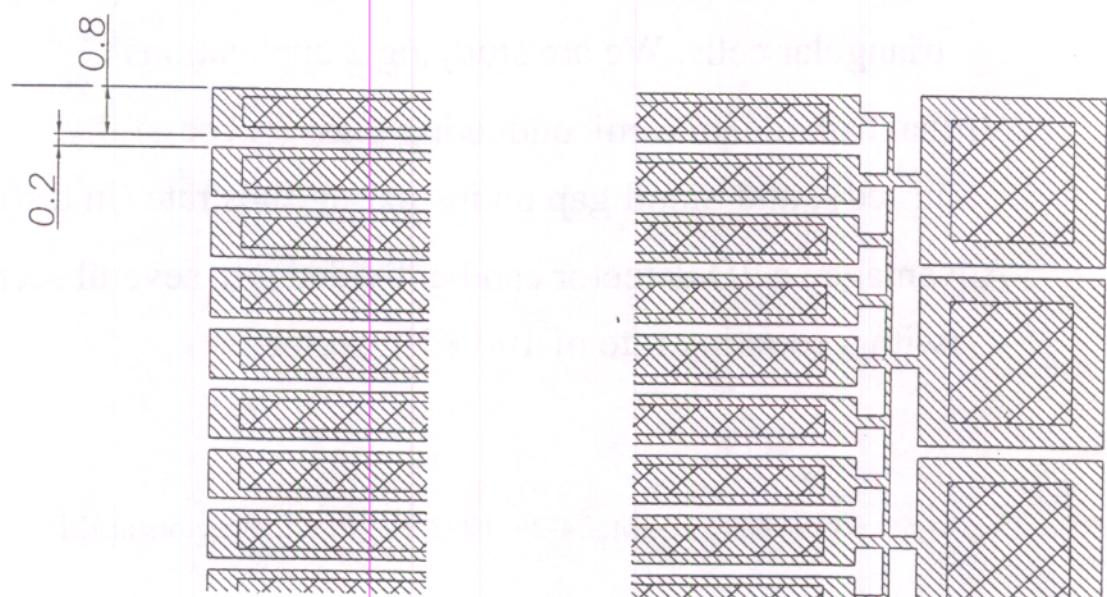


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MSGC **BIDIM200** : FACE CATHODE





NEW DEVELOPMENTS

◆ Small gap with insulating substrate

By reducing the inter-electrode non metalized surface of the MSGC, we can decrease the influence of the charge accumulation on the insulating substrate.

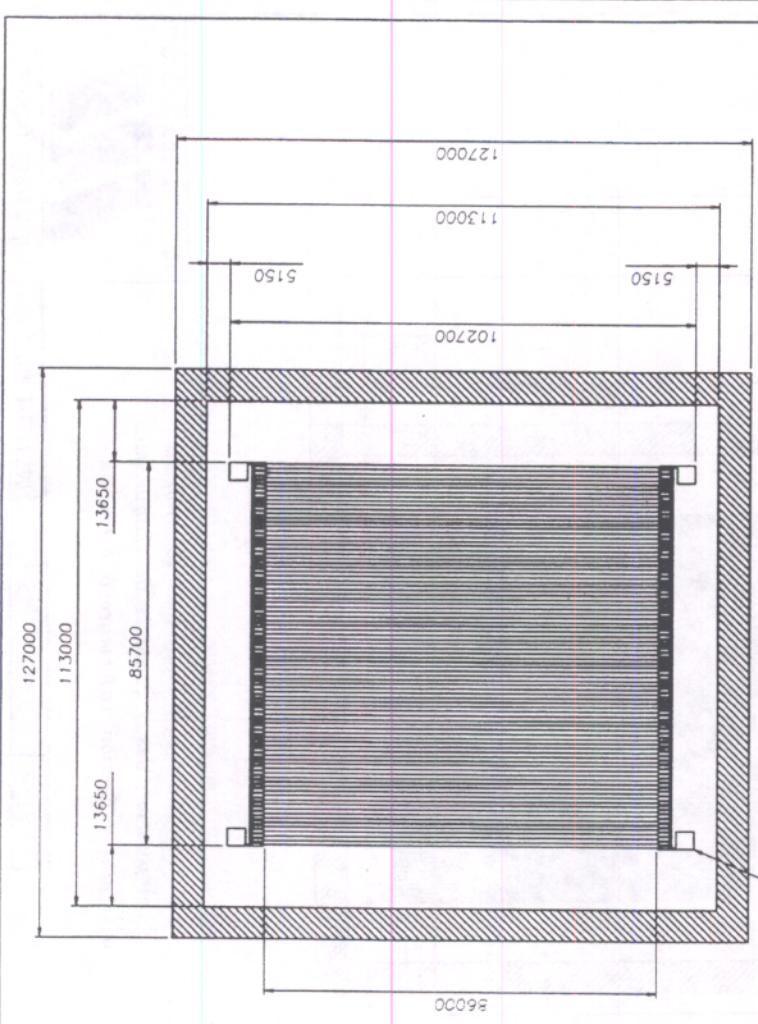
Advantage : It becomes possible to use kapton foils, or very thin glass of 100 µm, that can be curved.

◆ Backgammon structure

A geometrical charge division measurement is performed with a cathode divided into two electrodes comprising triangular cells. We are studying 2 applications :

Virtual cathode on semiconducting glass (successfully tested), and Small gap on insulating substrate (in test)

Advantage : a 2D detector can be divided into several sectors with a counting rate of 100 KHz/sector.



Attention :

- Positionnement de la structure par rapport au bord du verre précis à moins de 10 microns
- Superposition des 4 contacts de chaque face avec une précision inférieure à 1 micron

Le dessin est la propriété de l'Institut et ne peut être

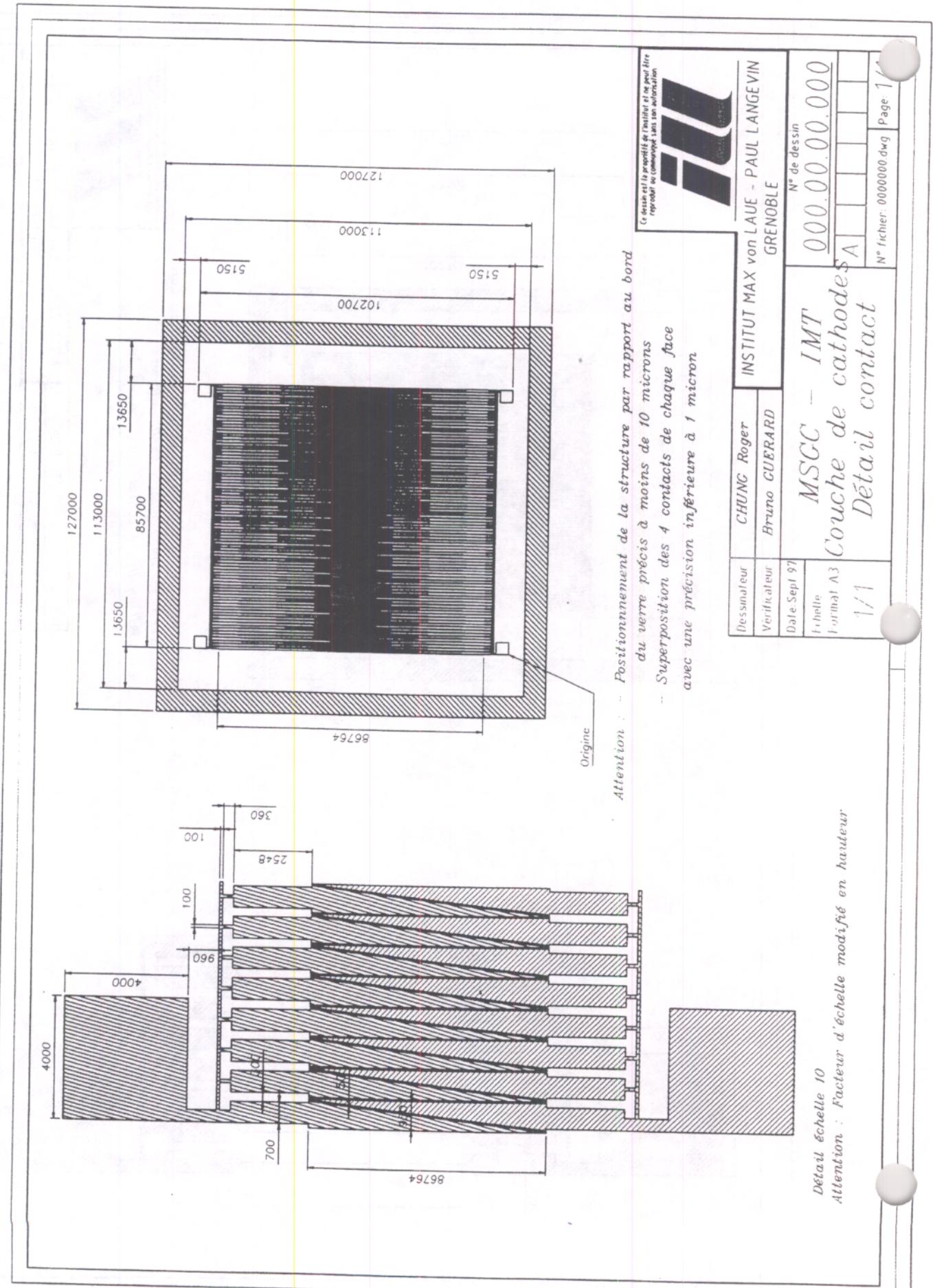
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Personnalier	CHUNG Roger	INSTITUT MAX von LAUE - PAUL LANGE VIN
Vérificateur	Bruno GUERRARD	GRENOBLE
Date Sept 97		N° de dessin
Façade	MSGC - IMT	000.00.00.000
Format A3	Couche d'anodes	
1/1	Détail contacts	

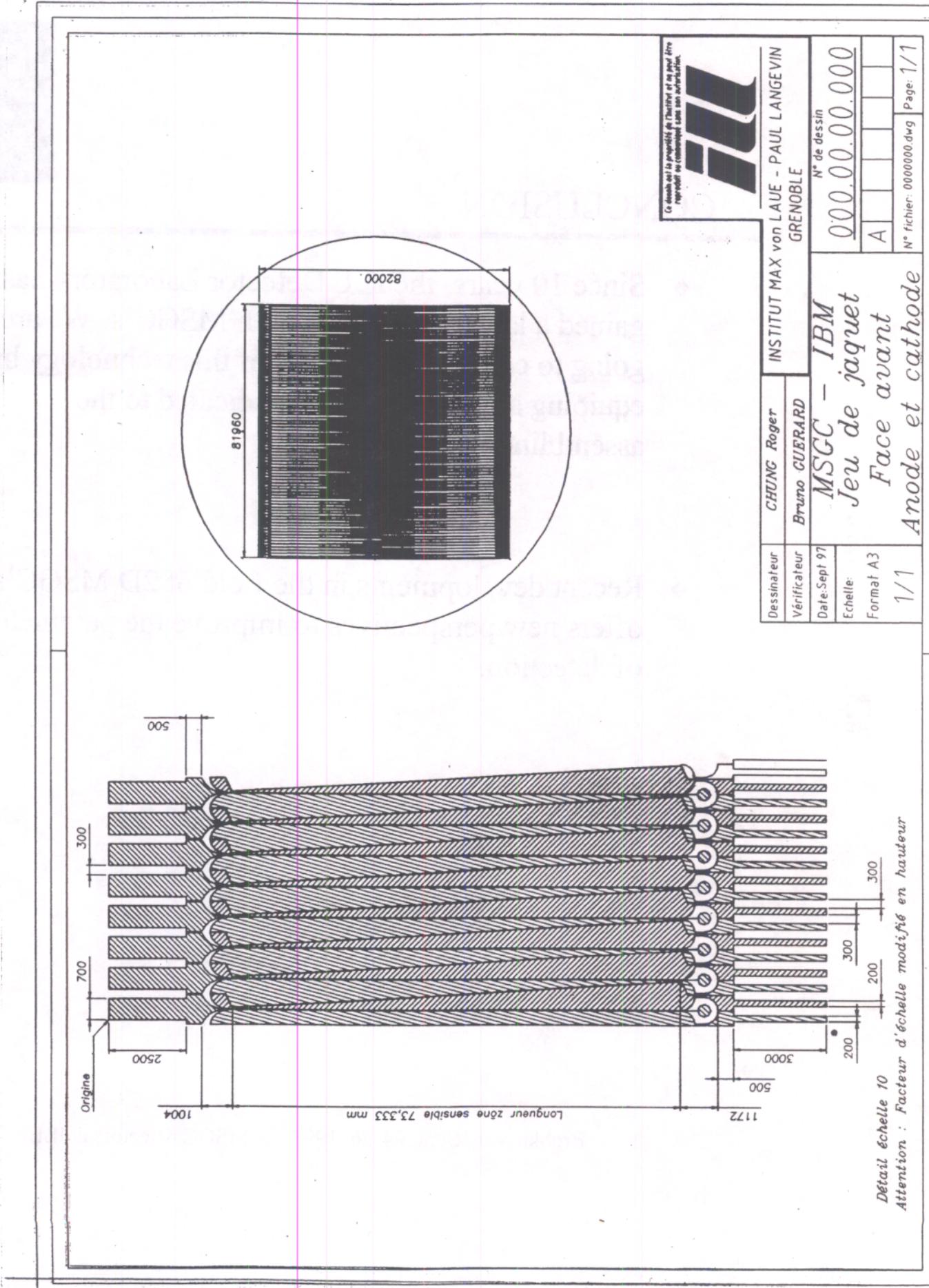
A				

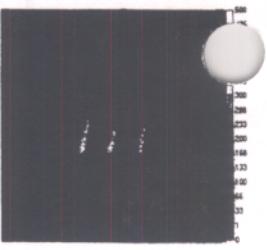
Détail échelle 10
Attention : facteur d'échelle modifié en hardware



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CONCLUSION

- ◆ Since 10 years, the ILL Detector Laboratory has gained a large experience with MSGC's. We are going to confirm the choice of this technology by equipping a new laboratory dedicated to the assembling of MSGC's.
- ◆ Recent developments in the field of 2D MSGC's offers new perspectives to improve the parameters of detection.



