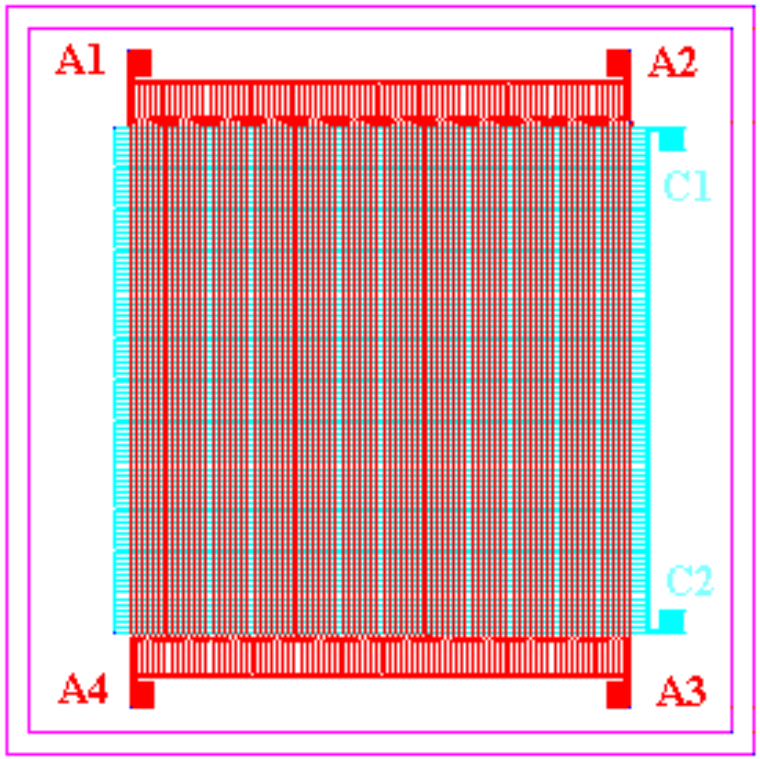
Gas scintillator system for neutrons detection

Giuliana Manzin
ILL

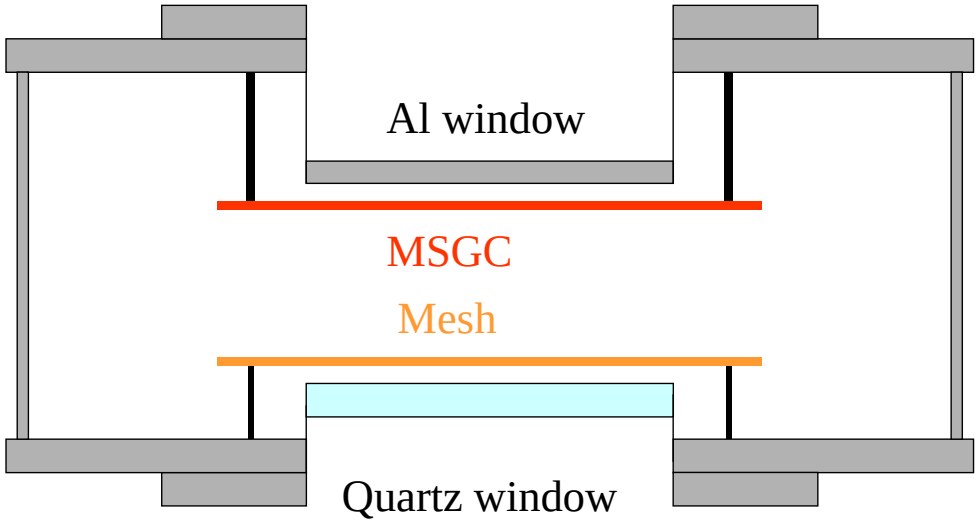
Bidimensional Micro Strip Gas Chambers

Glass substrate with electronic conductivity
Shott S8900
Thickness: 0.5 mm
Dimensions: 5 x 5 inches



Strips:
Metal: Chromium
Anodes width: 10 μm
Cathodes width: 980 μm
Pitch: 1 mm
Active surface: 80 x 80 mm^2

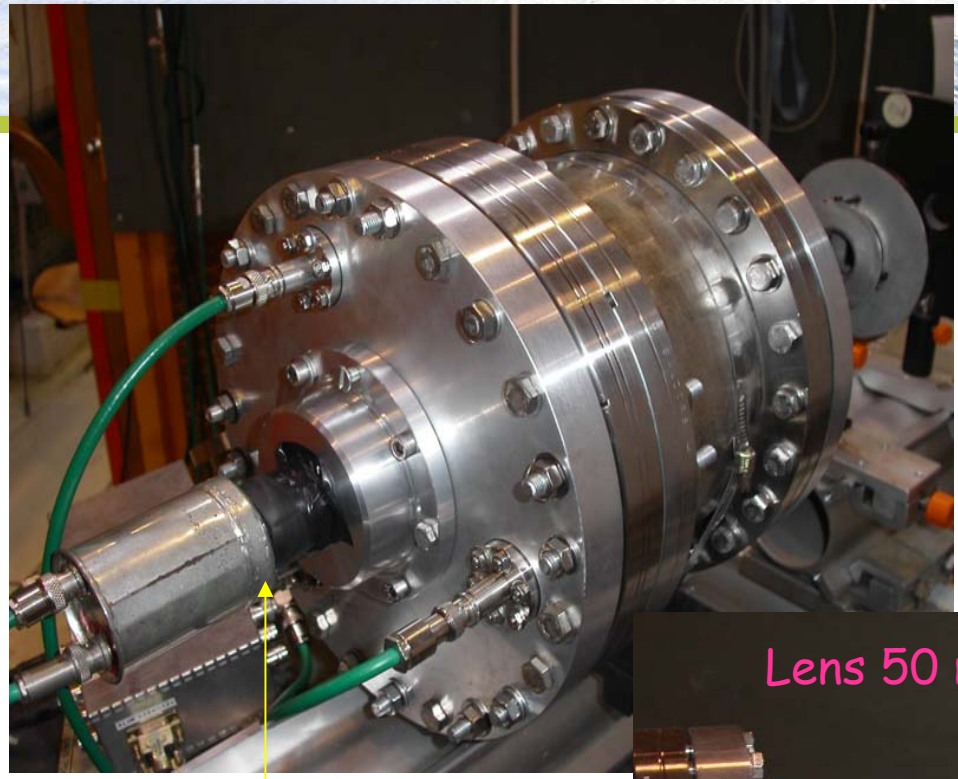
System description



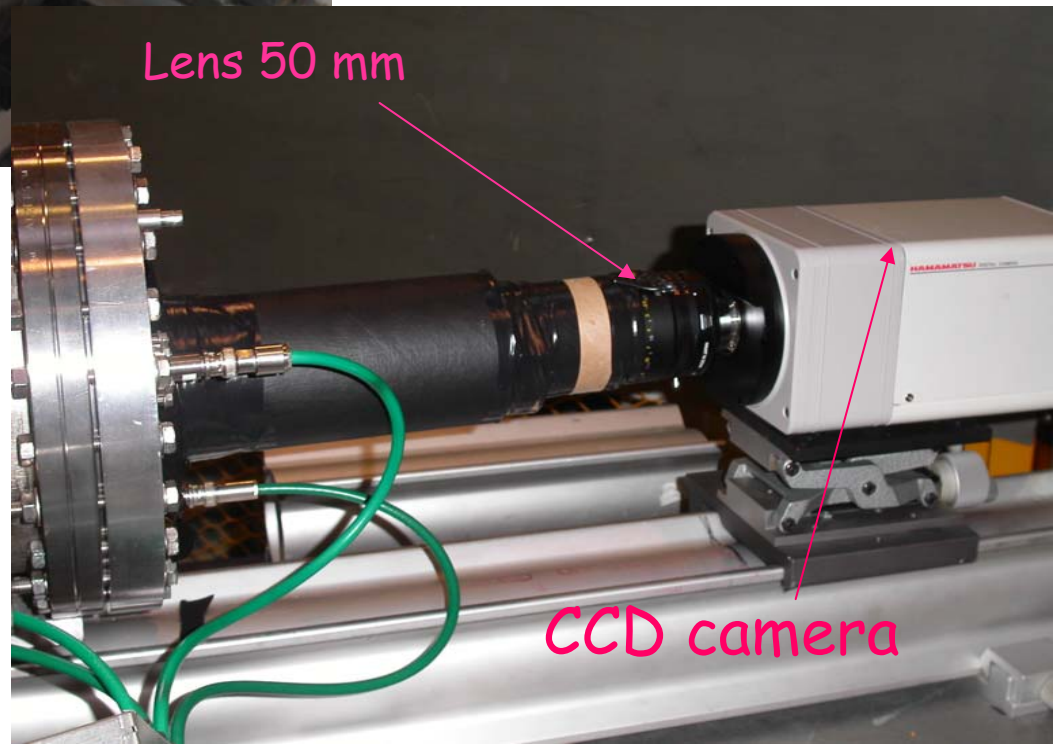
Feedthrough allow charge readout simultaneously to the ligh readout

MSGC or GEM detectors

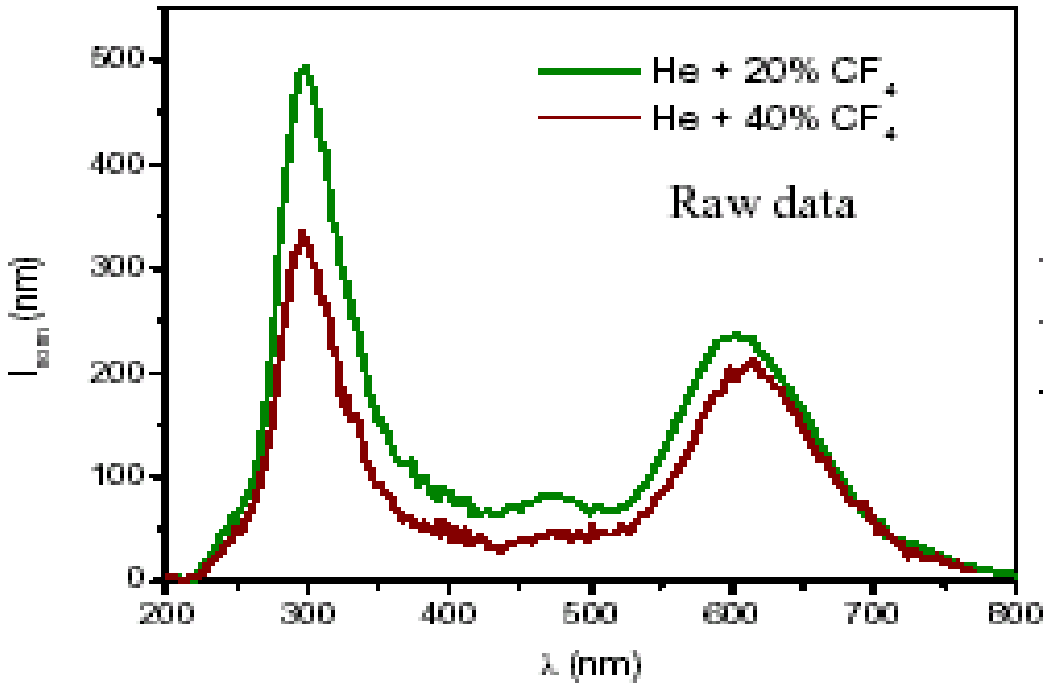
MSGC installed very close (< 1mm) to the entrance Al window with the anodes facing the glass window.



Photomultiplier



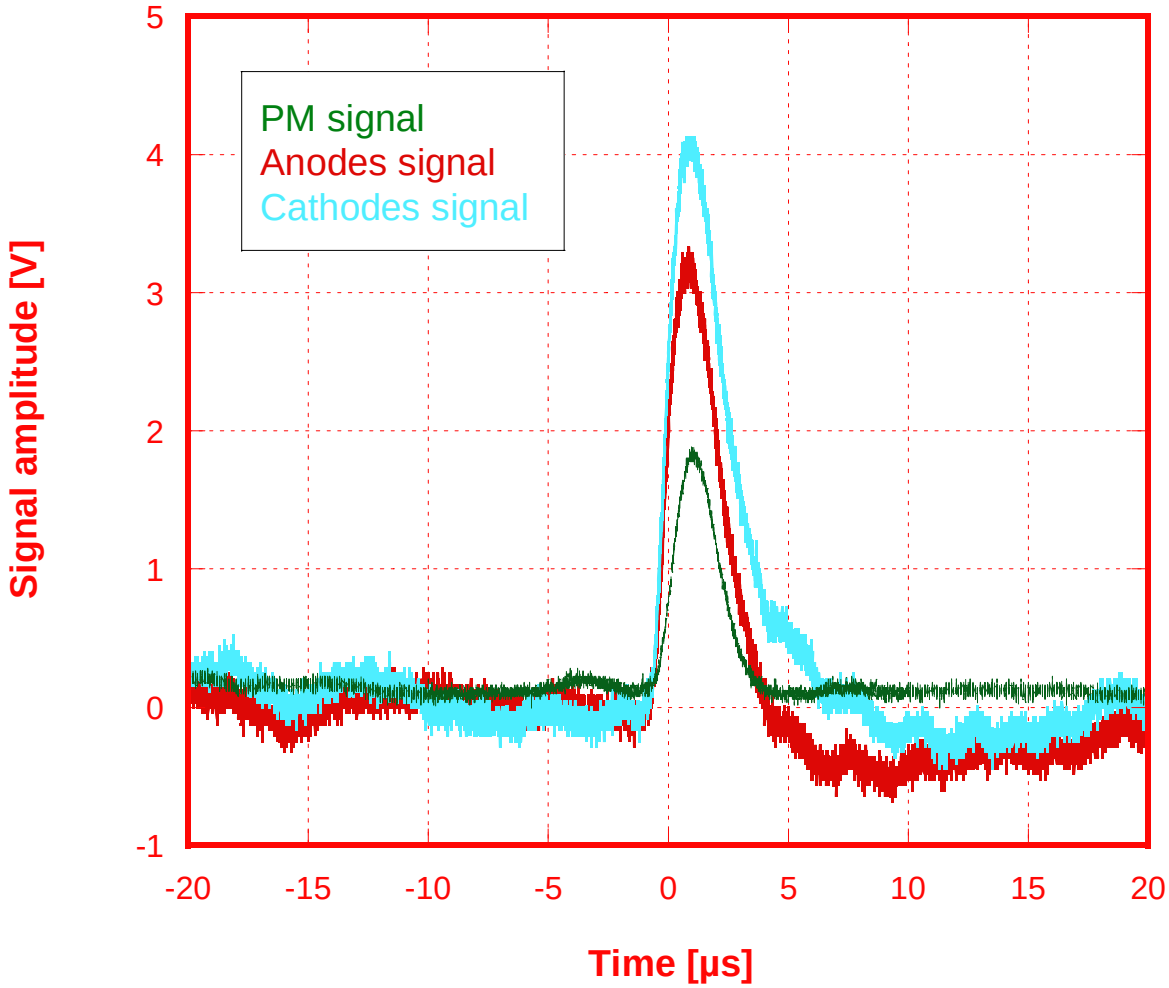
Gas mixture choice



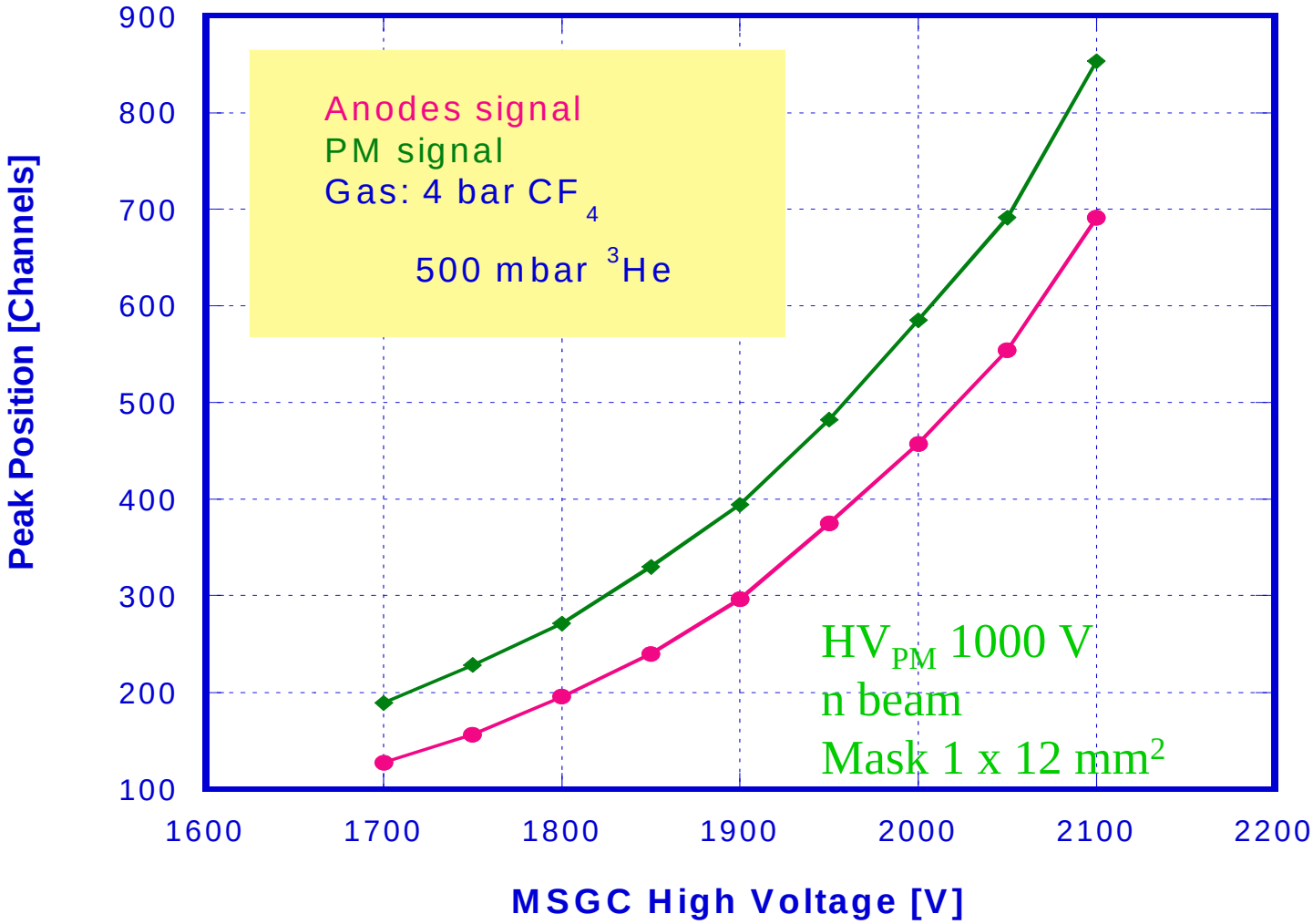
CF_4 emission spectrum

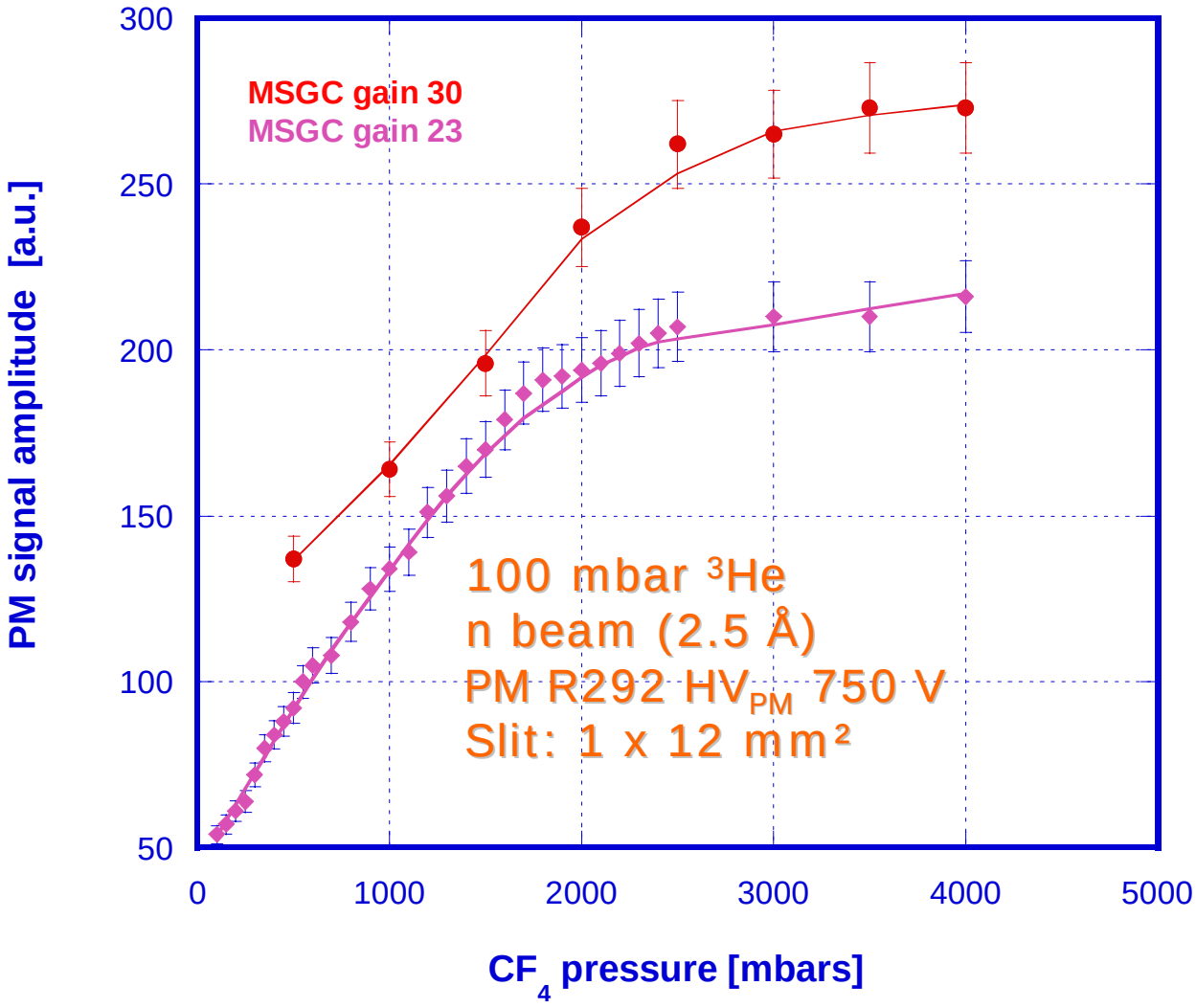
The GEM scintillation In HE-CF4, Ar-CF4, AR-TEA and XE-TEA Mixtures, M. M. F. R. Fraga, F. A. F. Fraga, S. T. G. Fetal, L. M. S. Margato, R. Ferreira Marques, A. J. P. L. Policarpo, NIM A 504 (2003) 88-92

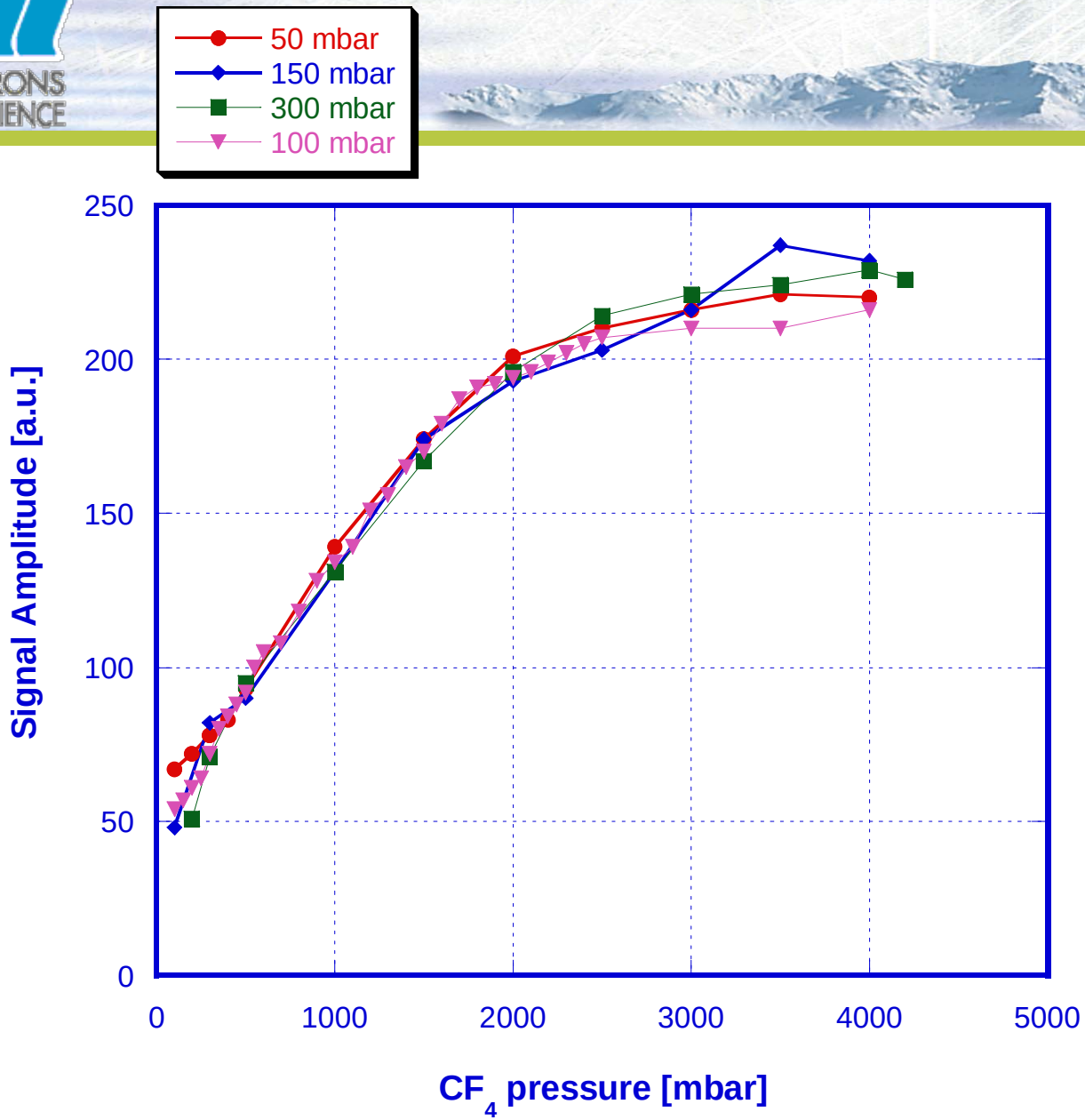
Preliminary measurements



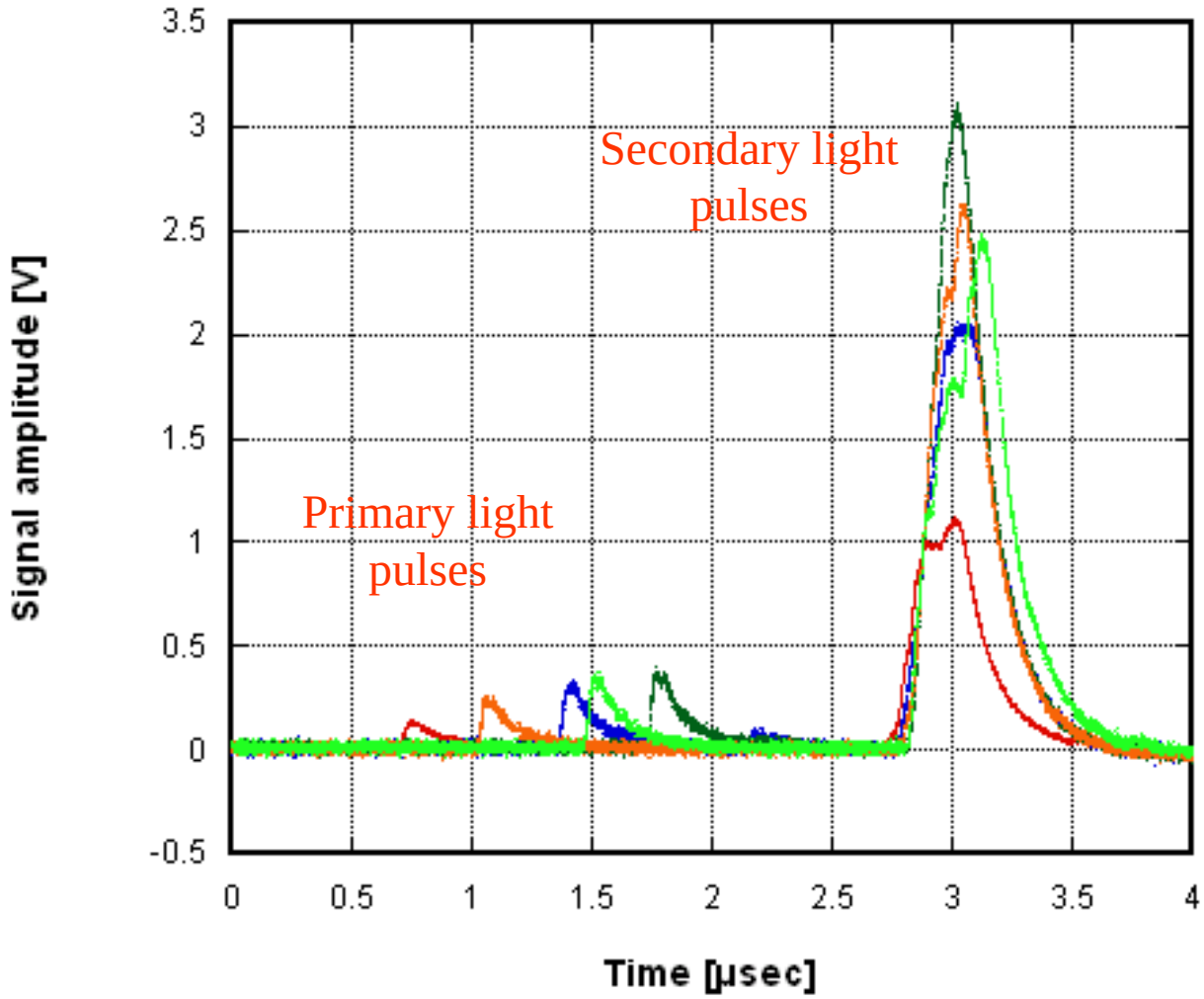
Signals in coincidence
Charge signal:
Gain 30 V/pC 5µs
Light signal:
Gain 0.09 V/pC 5µs


Anodes signal
PM signal
Gas: 4 bar CF4
500 mbar 3He
HVPM 1000 V
n beam
Mask 1 x 12 mm2
Peak Position [Channels]
MSGC High Voltage [V]
900
800
700
600
500
400
300
200
100
1600
1700
1800
1900
2000
2100
2200

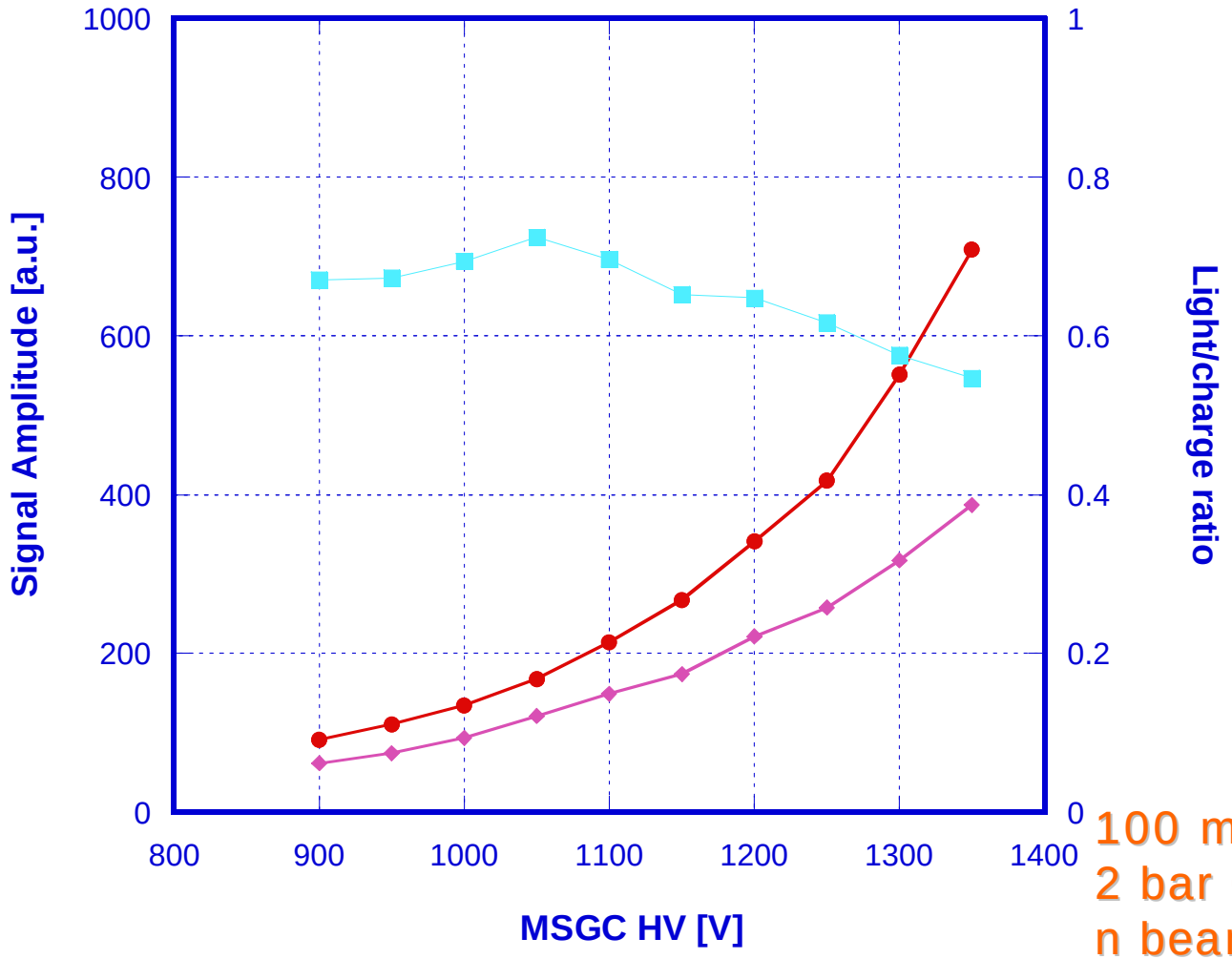

MSGC gain 30
MSGC gain 23
100 mbar ³He
n beam (2.5 Å)
PM R292 HV_PM 750 V
Slit: 1 x 12 mm²
PM signal amplitude [a.u.]
CF4 pressure [mbars]
300
250
200
150
100
50
0
1000
2000
3000
4000
5000



Photons emission does not depend on ^{3}He pressure


Secondary light pulses
Primary light pulses
Signal amplitude [V]
Time [µsec]
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
0
0.5
1
1.5
2
2.5
3
3.5
4

Light charge ratio

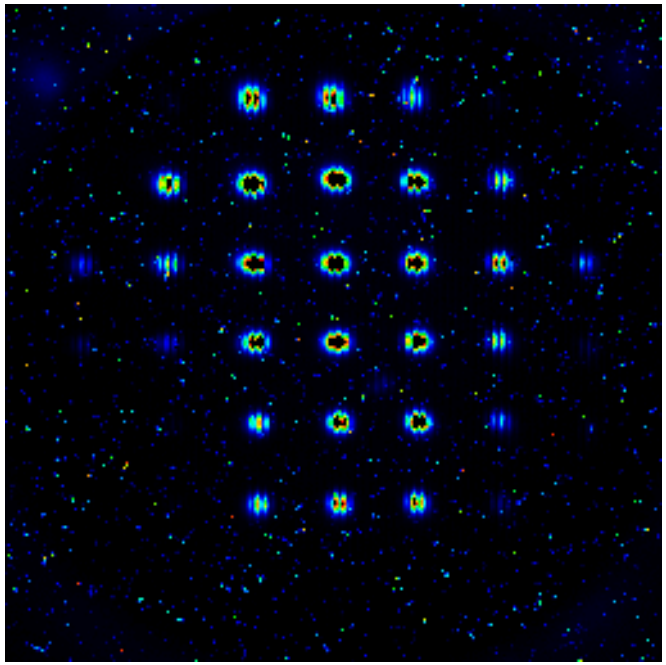


For high gain values the electrons ' multiplication is dominant on the photons ' creation.

100 mbar ^{3}He
2 bar CF_4
n beam (2.5 Å)
PM R292 HV_{PM} 750 V
Slit: 1 x 12 mm²

CCD camera measurements

Camera data
Hamamatsu Orca II C4742-98
Pixels number: 1280 (H) x 1024 (V)
Cell dimensions: 6.7 μm x 6.7 μm
Surface: 8.58 mm x 6.6 mm
Cooling system: Peltier a
Water circulation
MSGC-camera distance: 33 cm
Lens: 50 mm f = 1.8



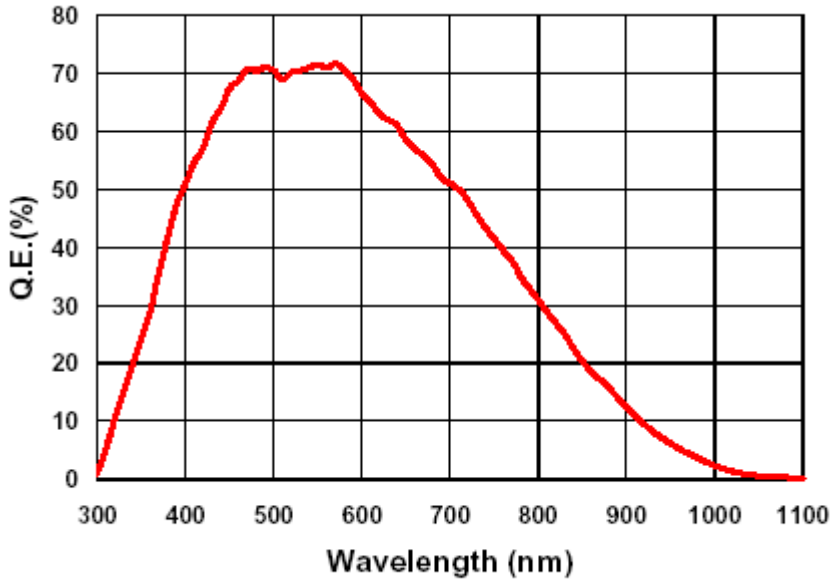
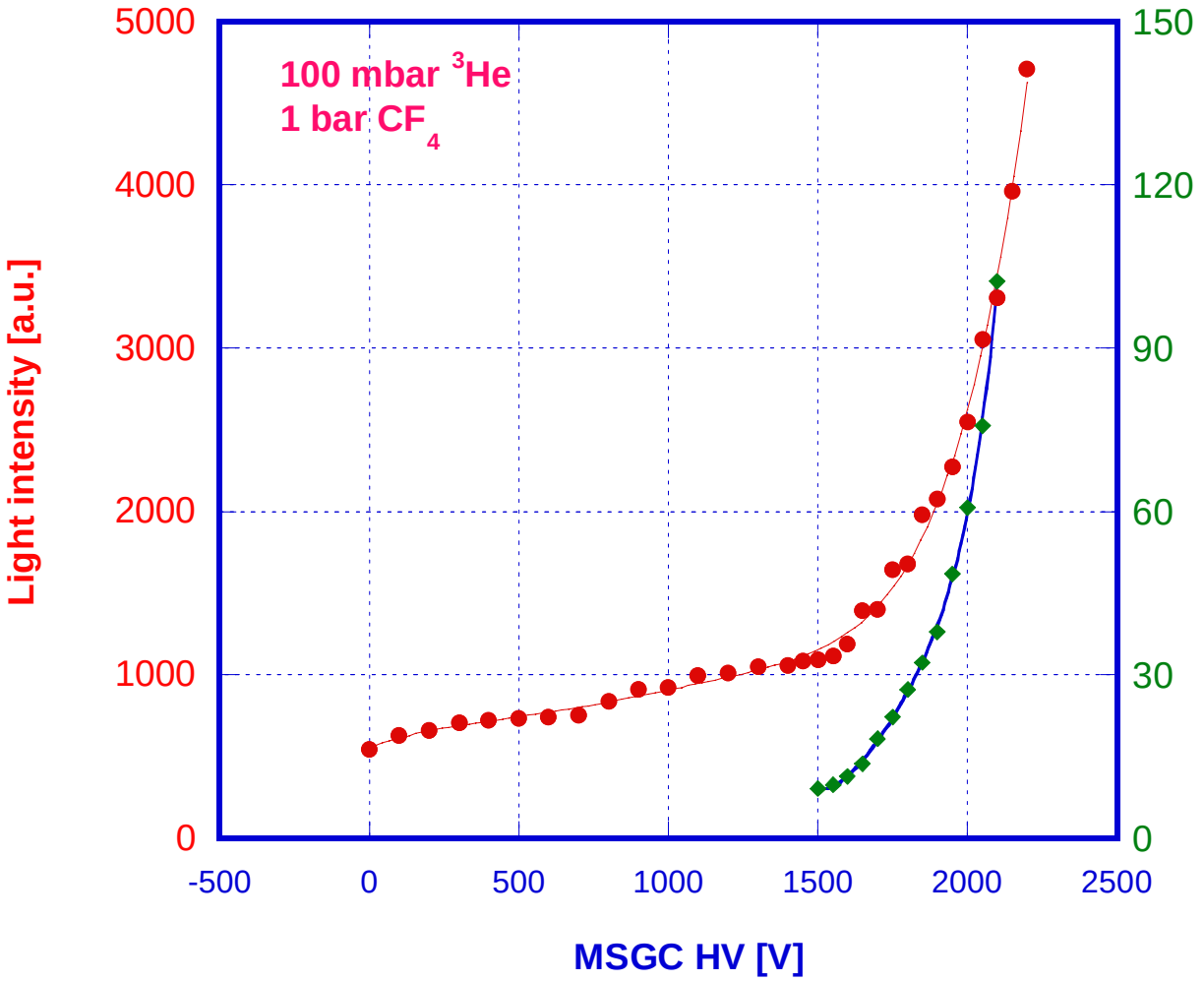
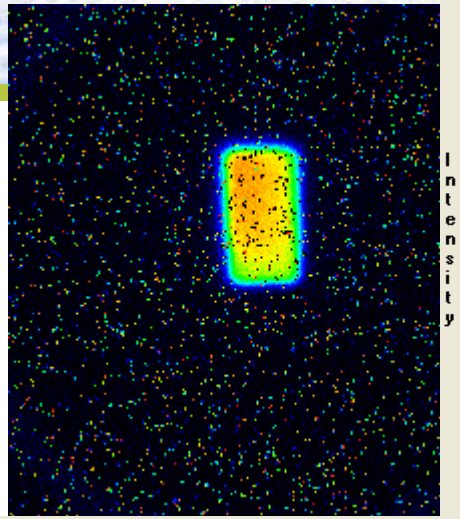


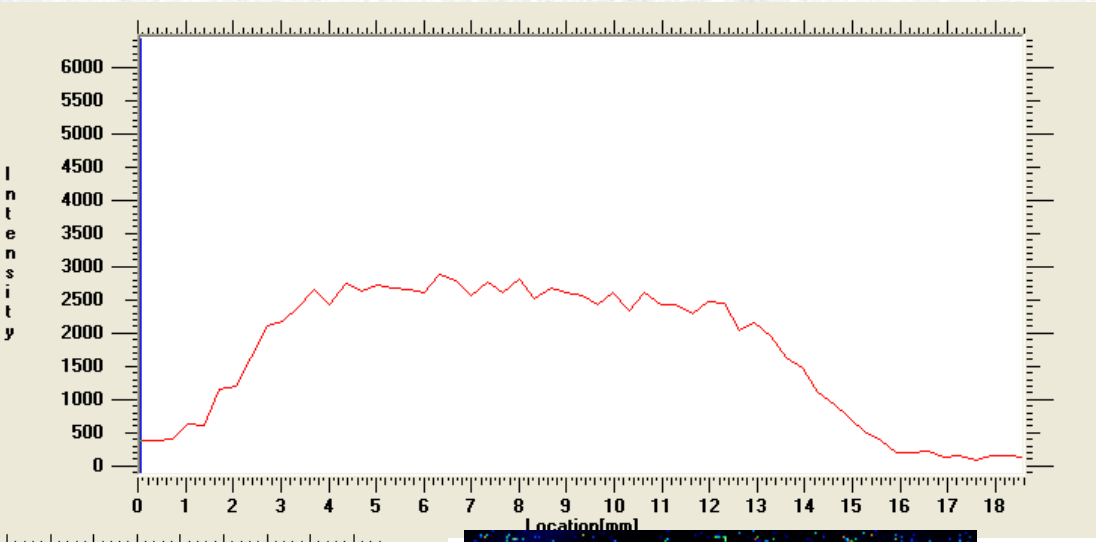
Image dimensions: 8 x 8 cm^2
Mask B_4C:
Holes 2 mm, pitch 1 cm
Binning 4x4
100 mbar ^3He 4 bar CF_4

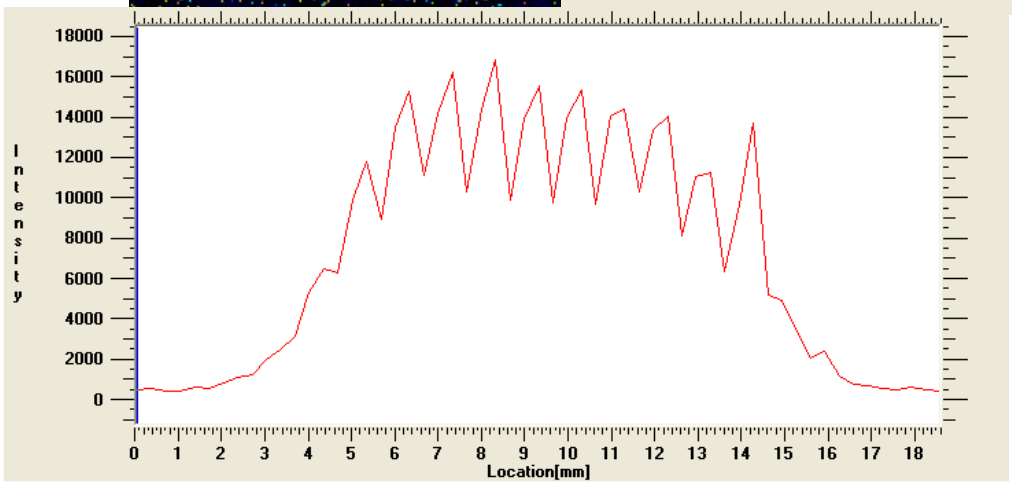
Scintillation properties

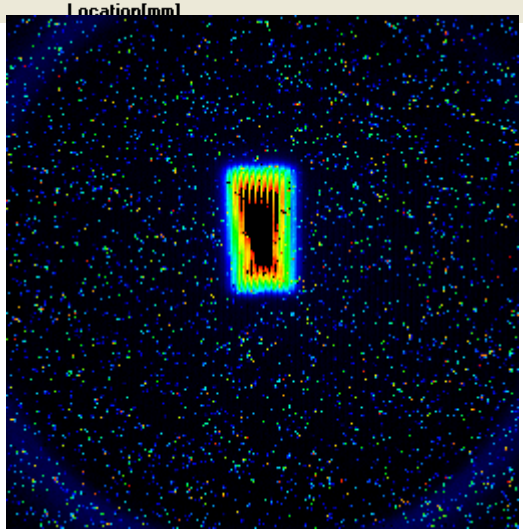


CCD camera
Slit 1.1 x 2.2 cm^2









Gas:
4 bar CF_4
100 mbar ^3He

HV_{MSGC}
2500V
Slit:
1.1 x 2.2
cm^2

It is possible to observe the primary light emission even with the CCD camera (wothout gain, or voltage, on the MSGC) even if the number of emitted photons is small. Applying the high voltage to the electrodes the MSGC granularity becomes visible.