GRAN SASSO SCIENCE INSTITUTE
CENTER FOR ADVANCED STUDIES INFN

CYGNO Experiment

MANGO Data Analyses

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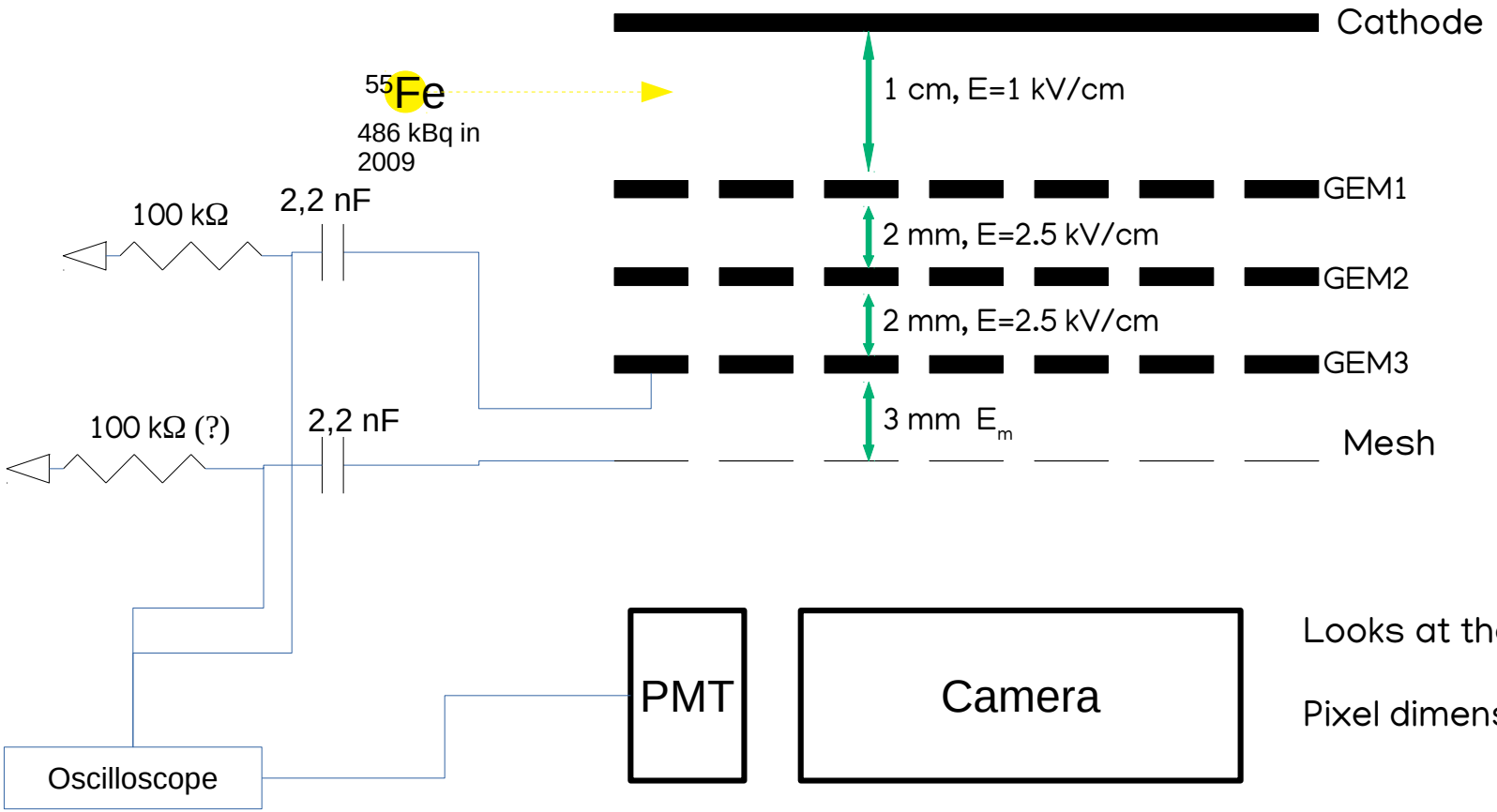
MANGO Setup



GAS Flow:
20 L/h
1 atm
He:CF_4 60/40

Looks at the 8x8 cm^2 window

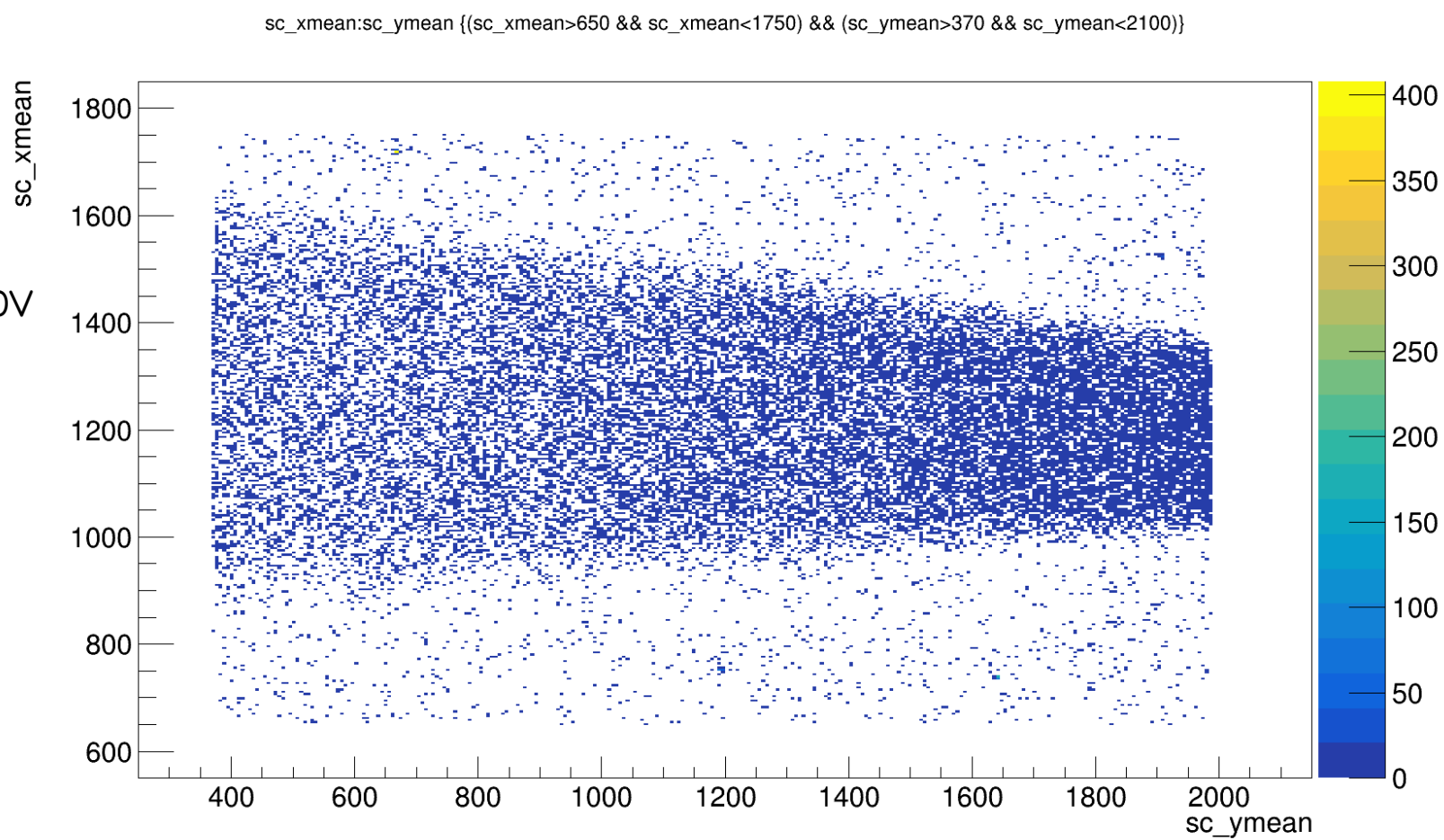
Pixel dimension 49x49 um^2

Geometry Study

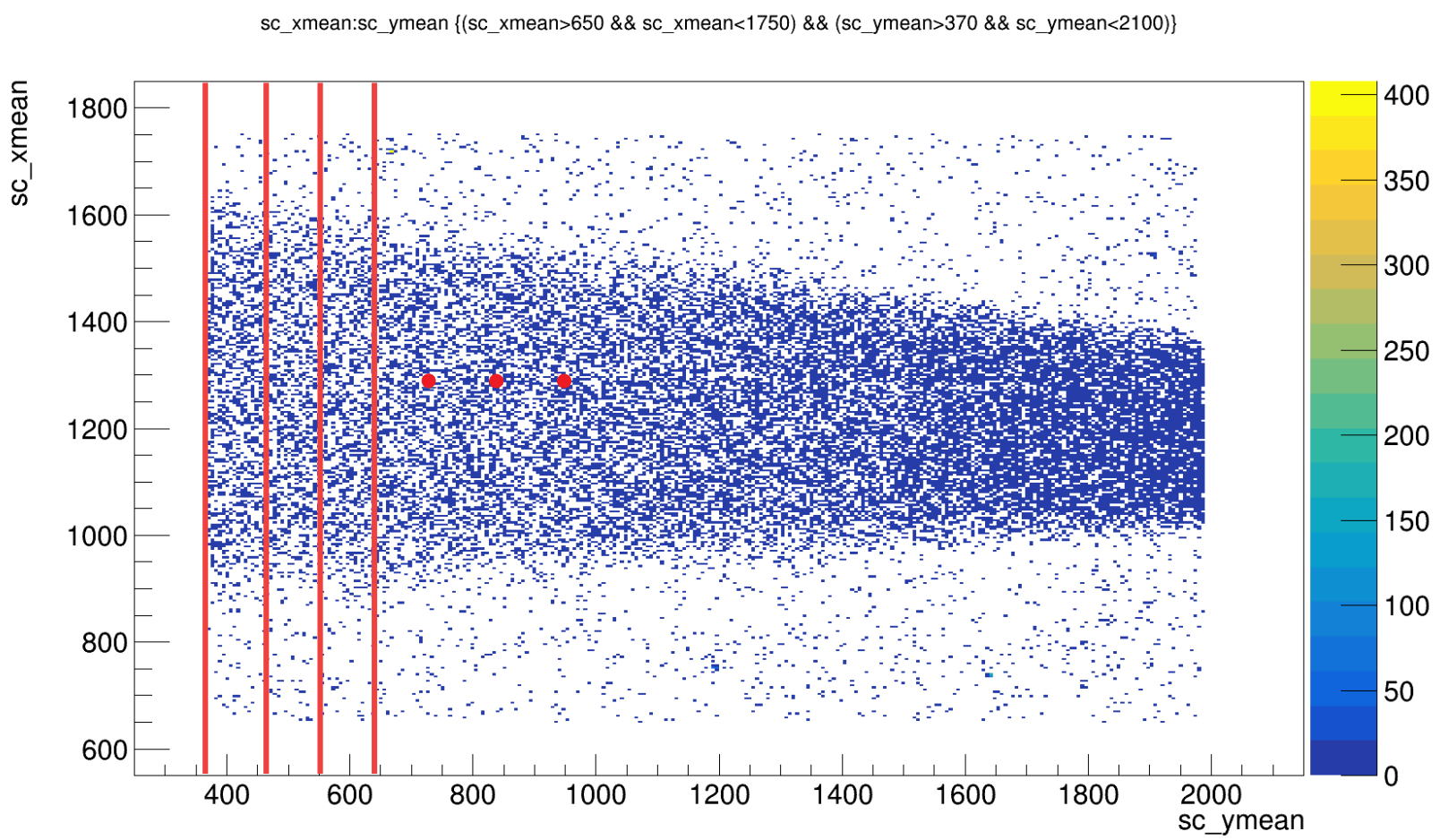
GEOMETRY

GEMs @ 420V

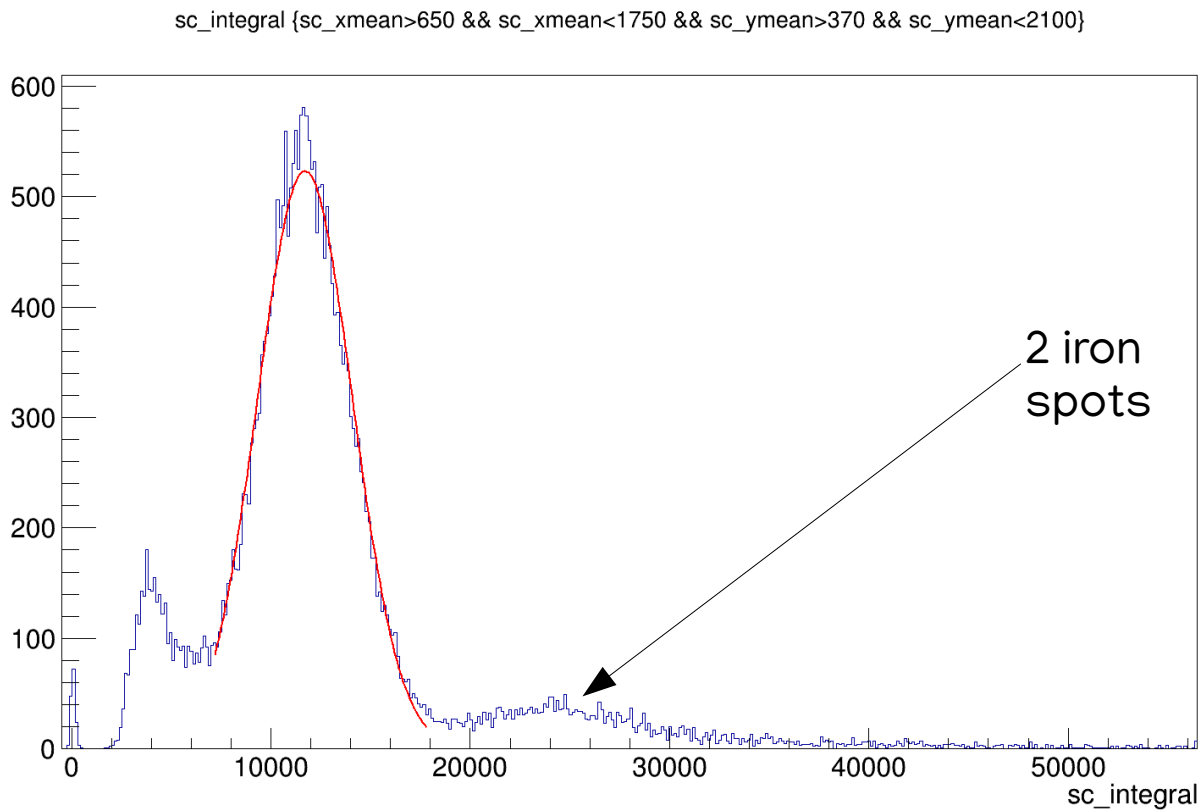
E_m=0 kV/cm



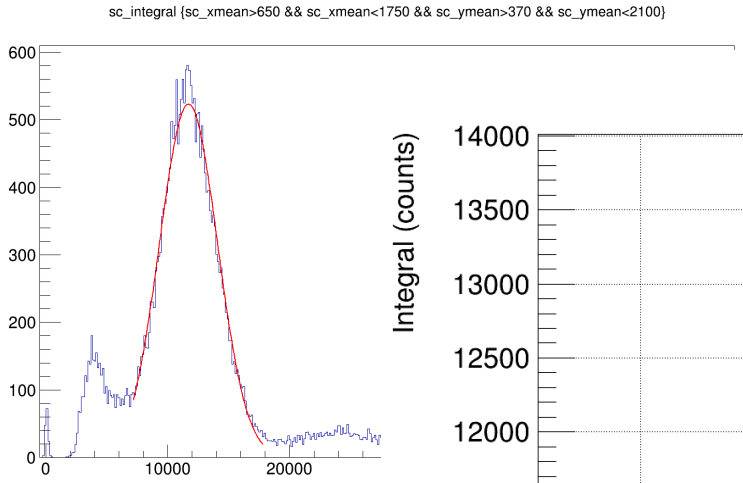
GEOMETRY

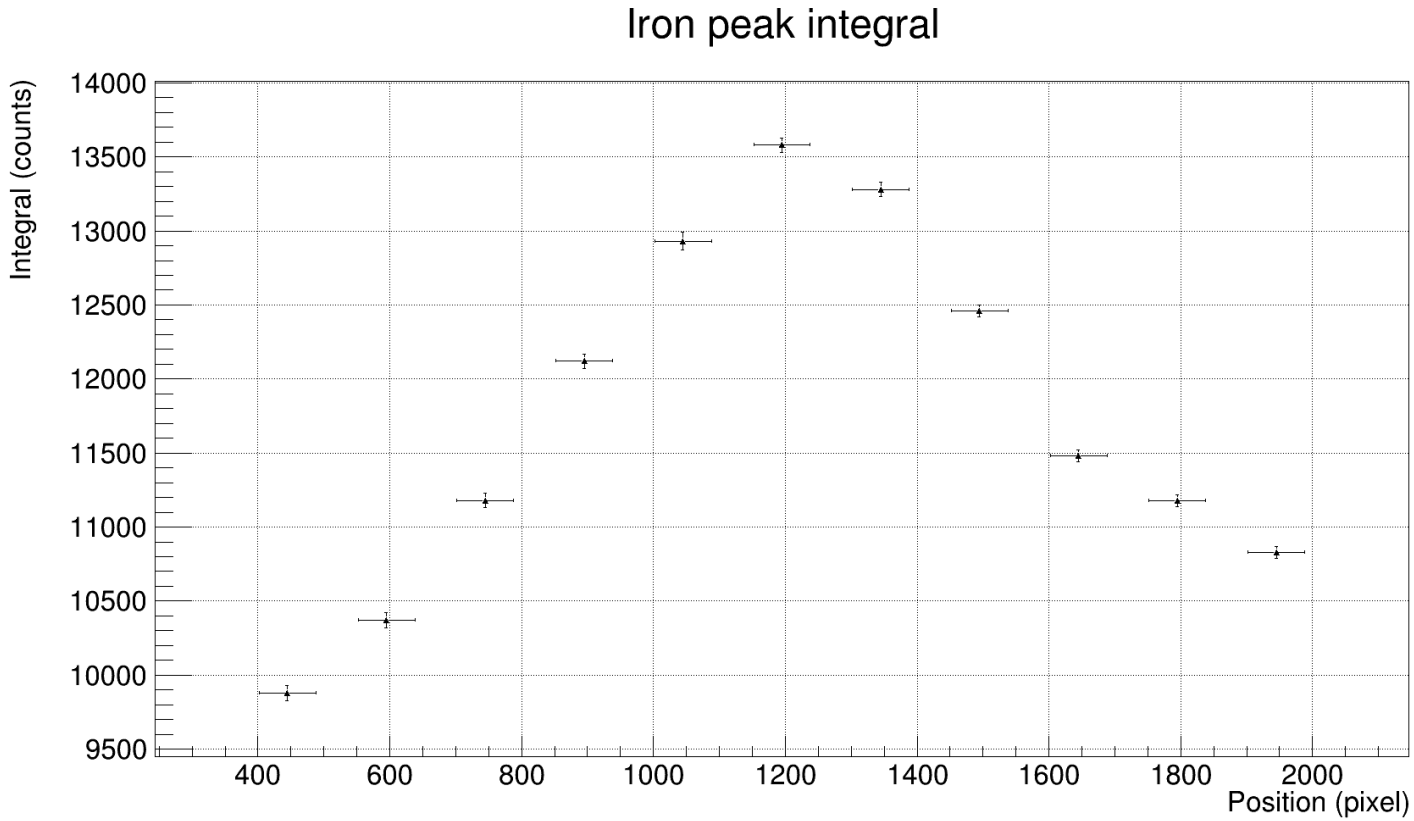

sc_xmean:sc_ymean {(sc_xmean>650 && sc_xmean<1750) && (sc_ymean>370 && sc_ymean<2100)}
sc_xmean
1800
1600
1400
1200
1000
800
600
400
600
800
1000
1200
1400
1600
1800
2000
sc_ymean
400
350
300
250
200
150
100
50
0

Geometry: Integral

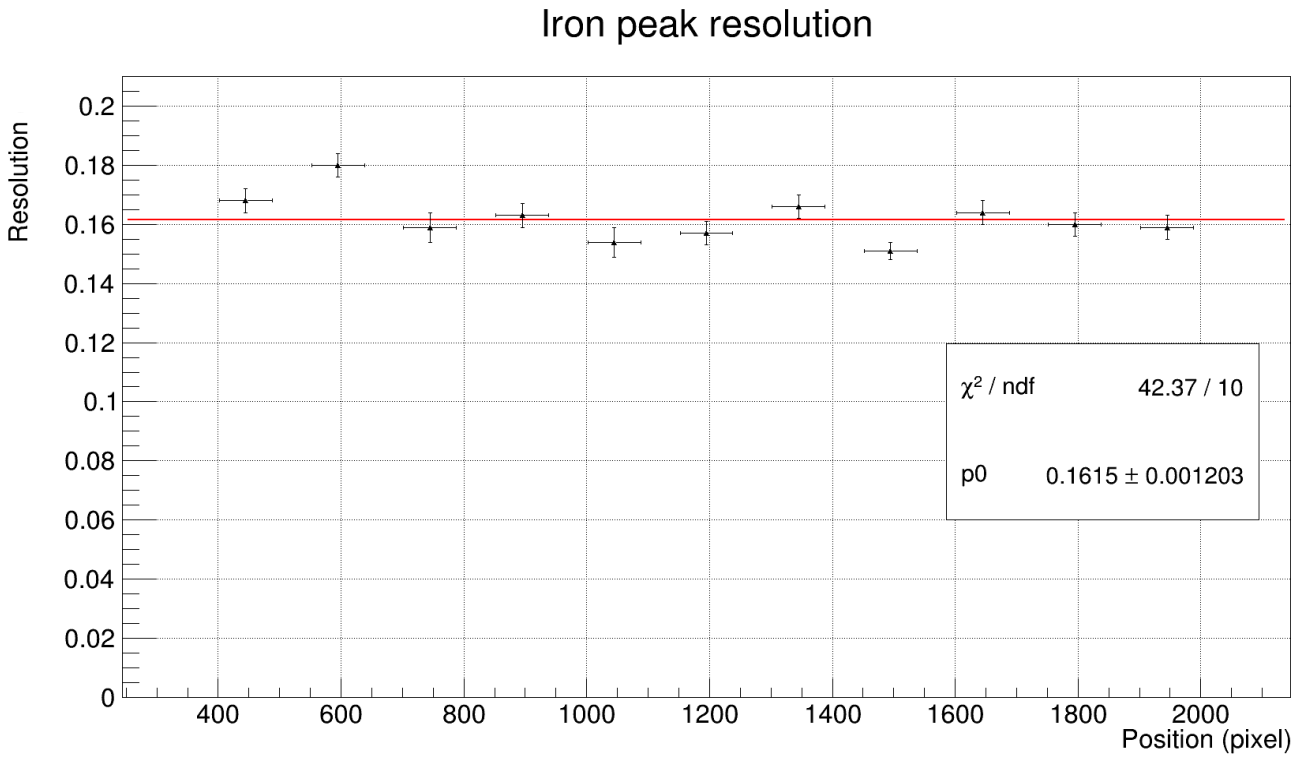


Geometry: Integral

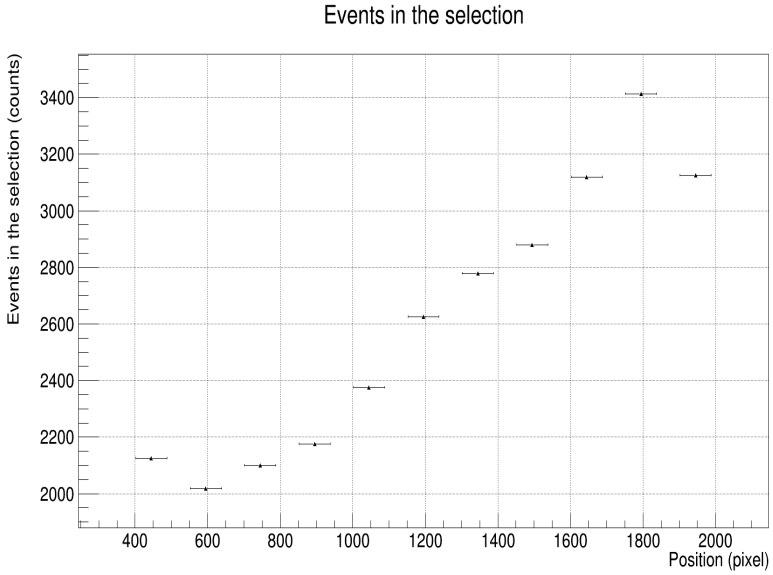




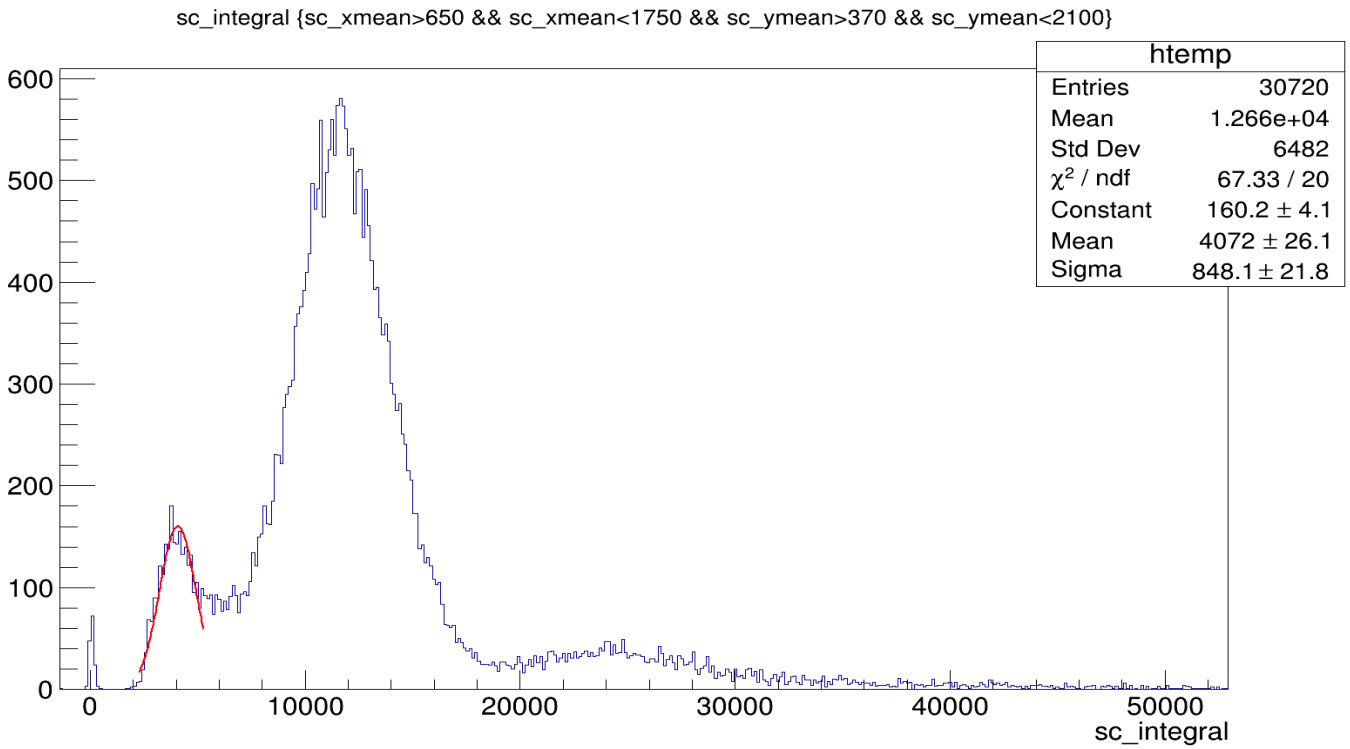
Geometry: Energy resolution and Statistics

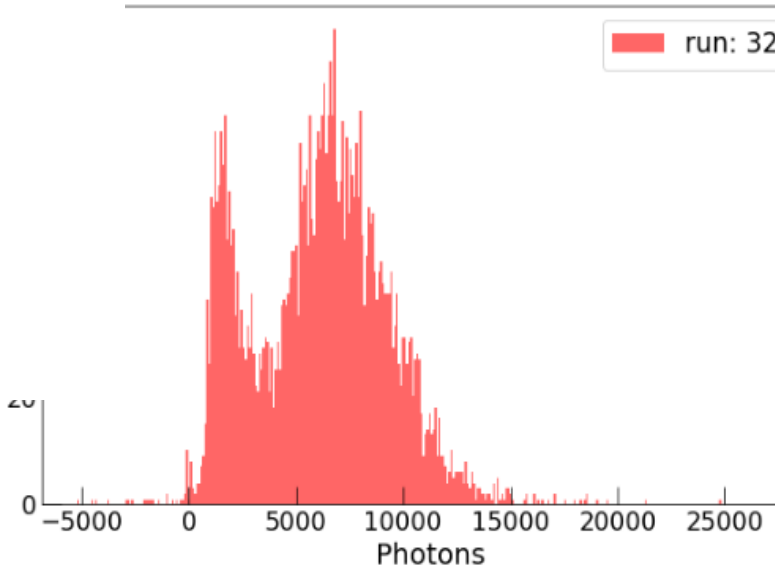


Res=peak/sigma



Geometry: Escape peak

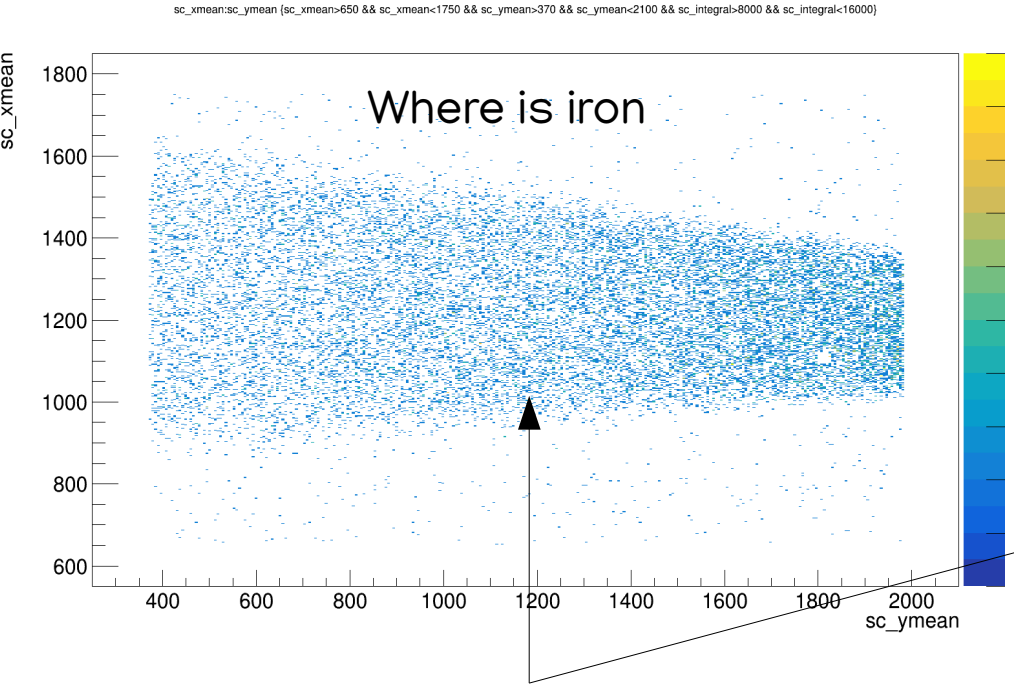


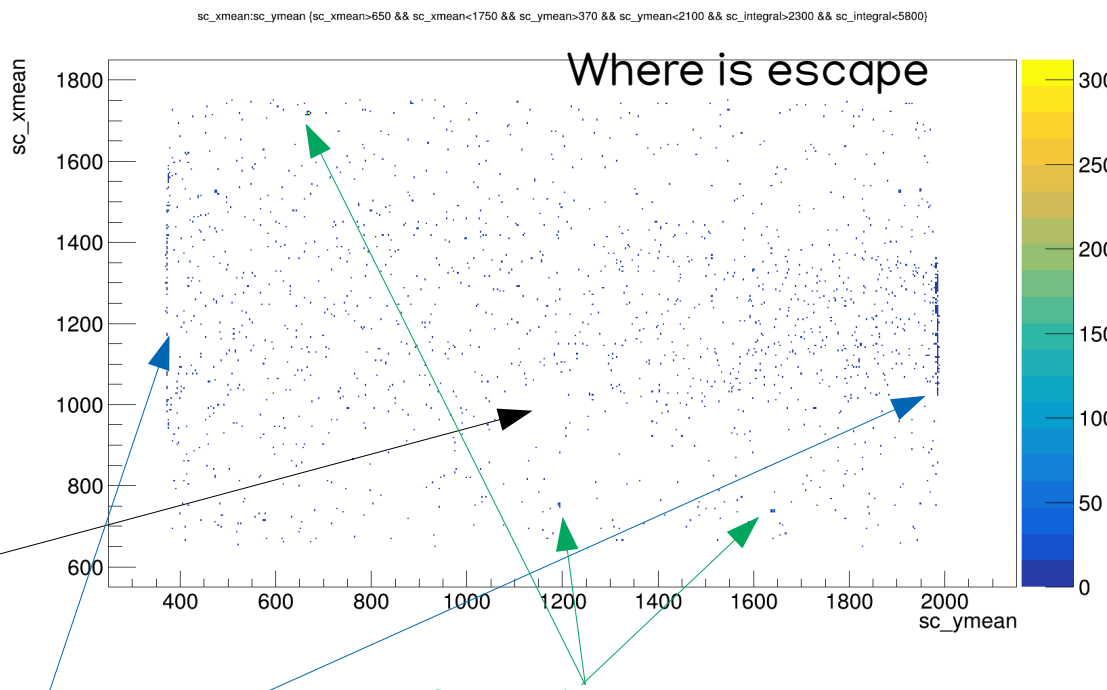


Consistent with 2 keV

Res ~20,8%

Geometry: Escape peak





Same region where most of the points are

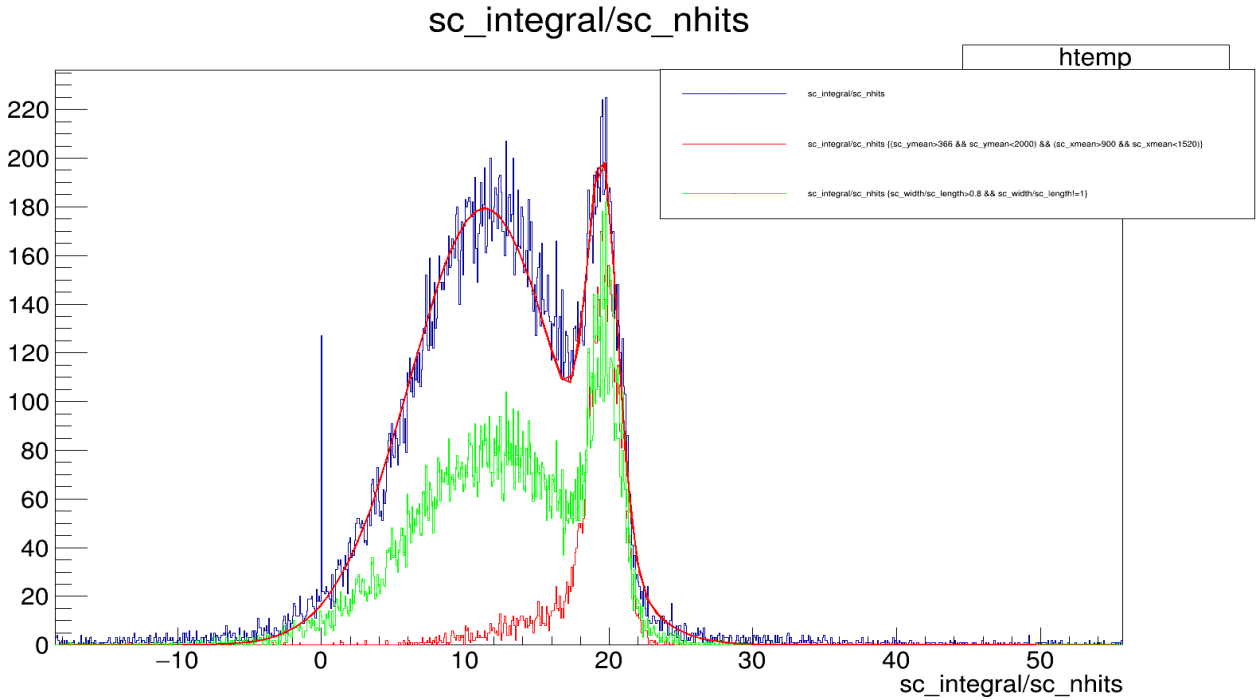
Some hot spots

Many very close to the border

Could be escape peak?

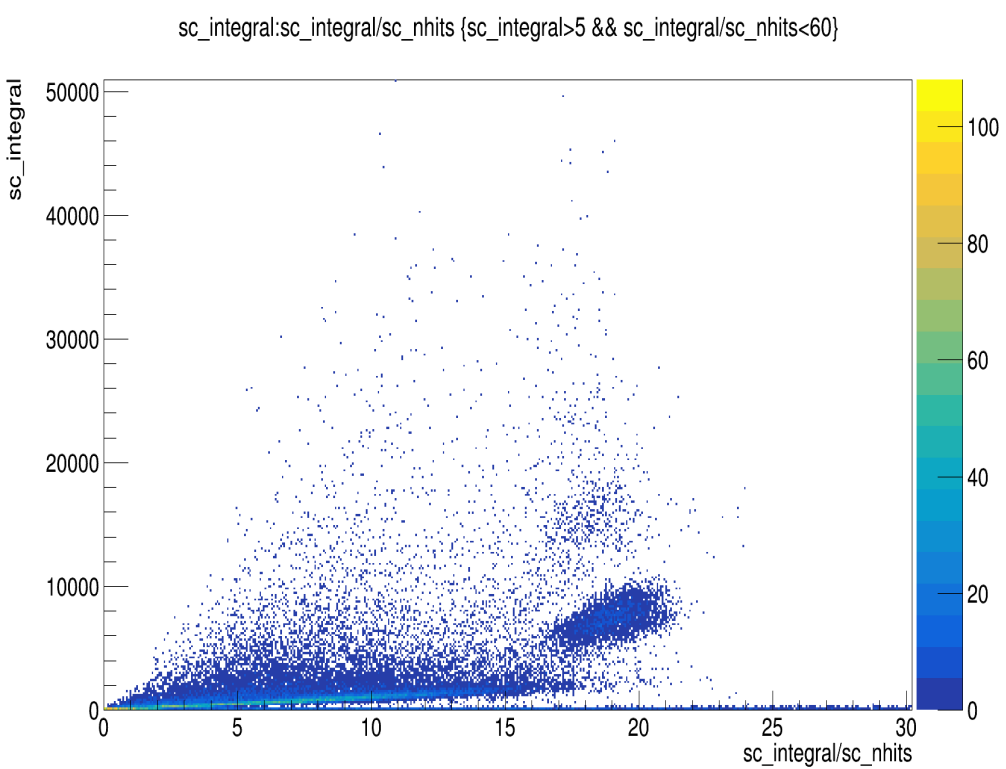
Curve Gain

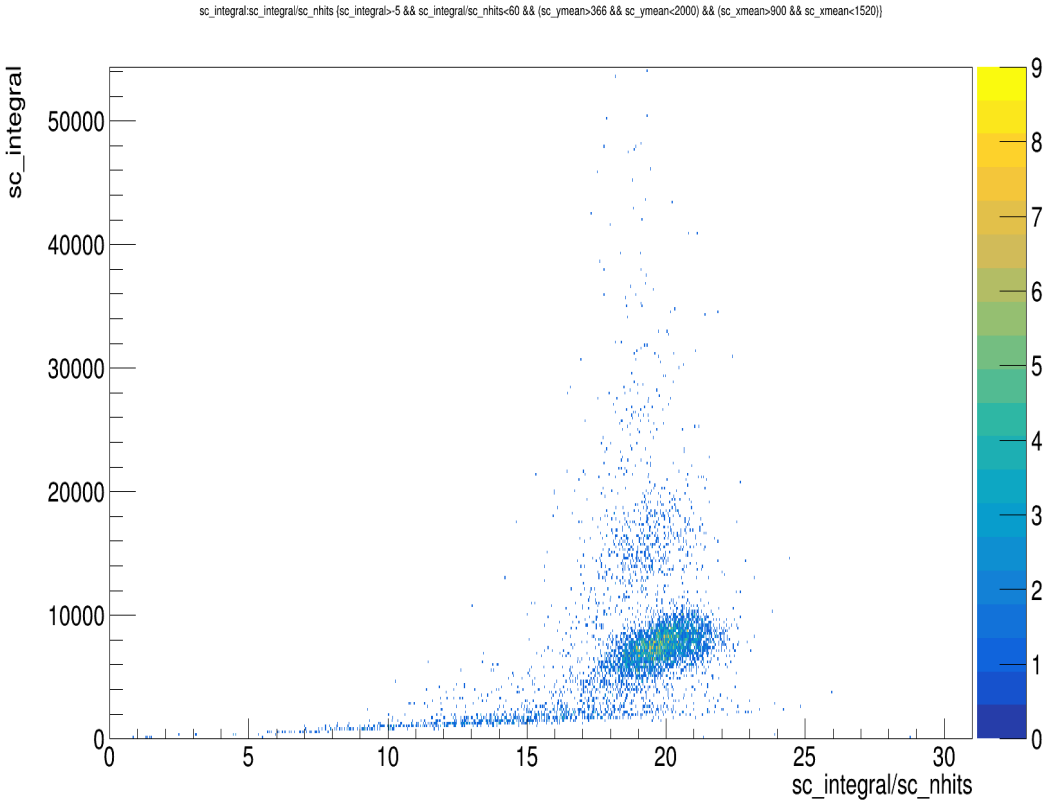
Curve Gain: Cuts



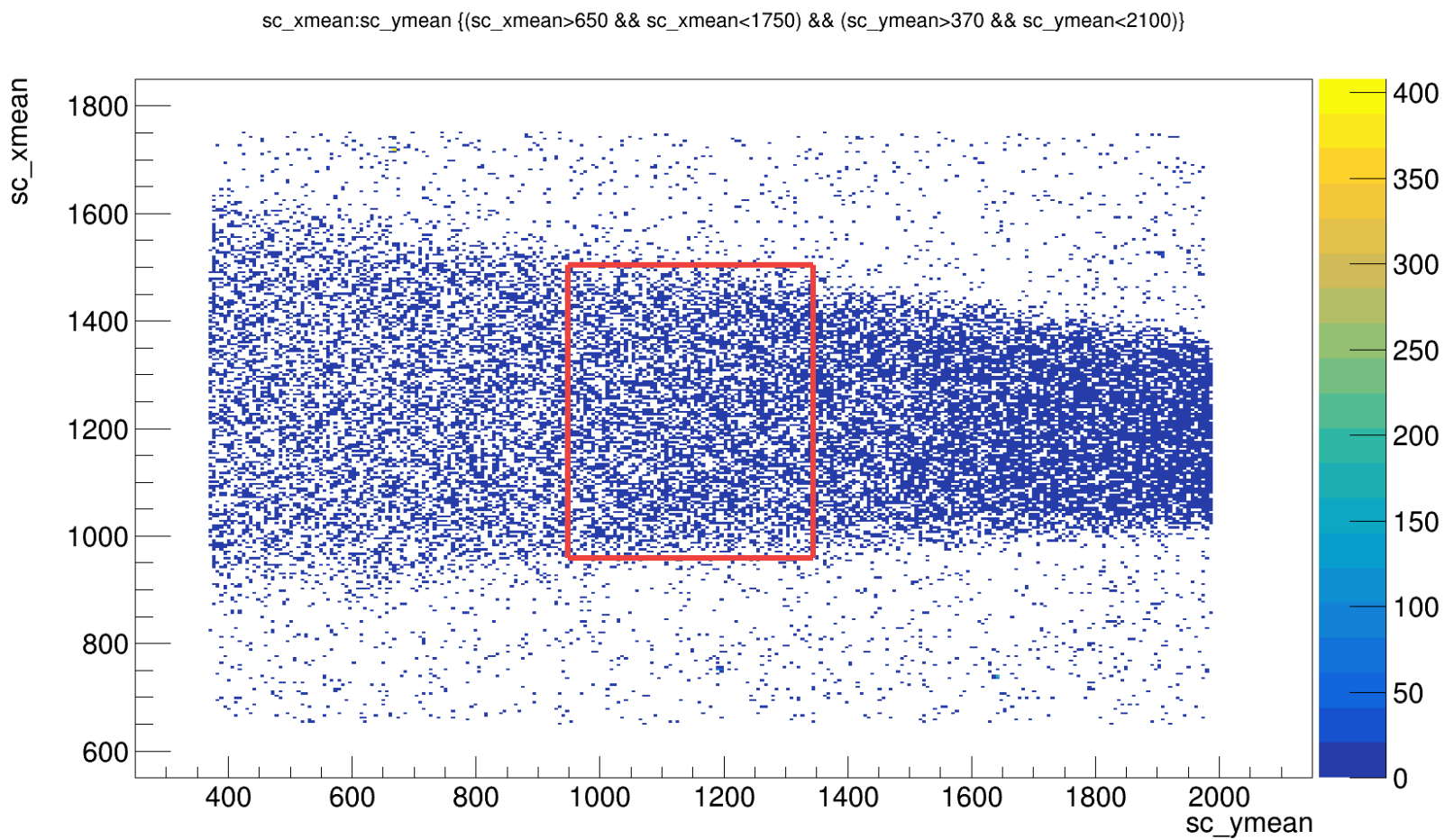
- In the end a simple geometrical cut was used to take the spots in the very centre, also considering the geometrical deformations

Curve Gain: Cuts





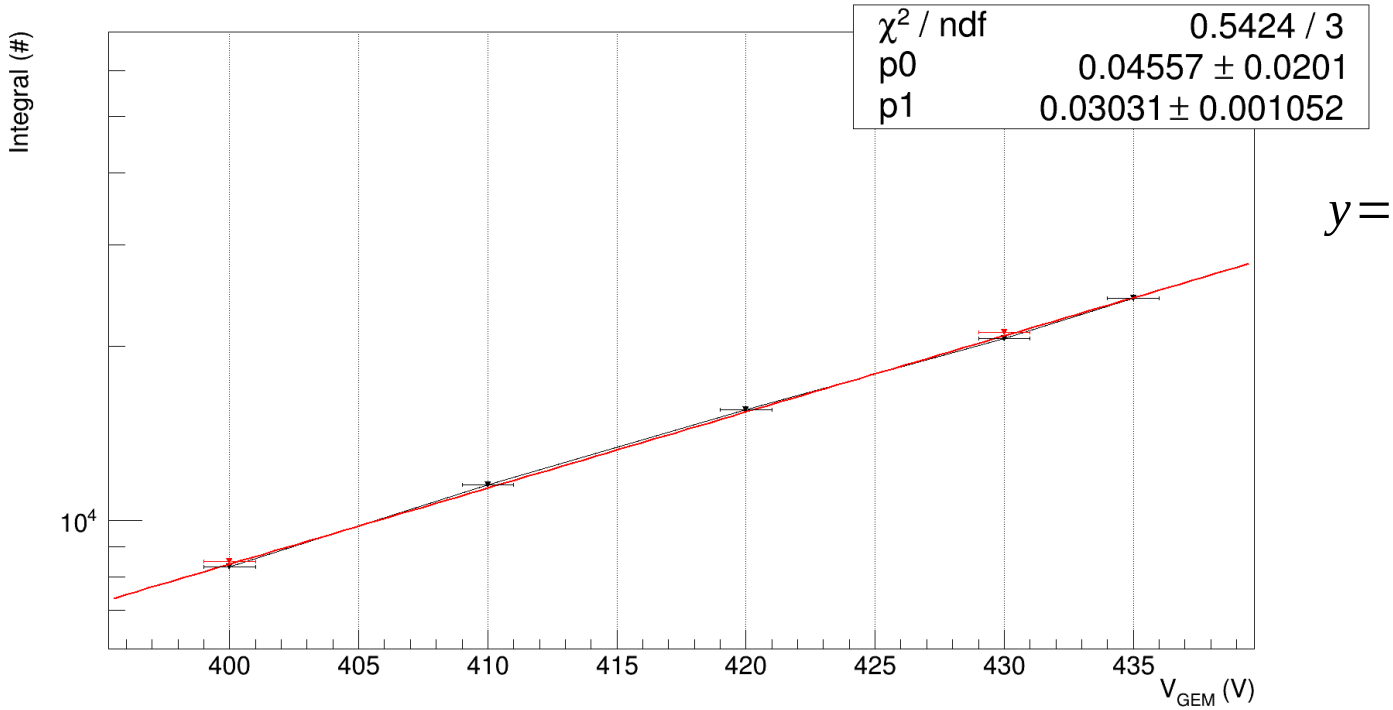
Curve Gain: Cuts



Curve Gain: Gain

- GEM voltages changed together from 400 V to 435 V

- Only a couple of points were analysed with the code after the new Friday's patch (red points)



$$y = p0 \cdot e^{p1 \cdot V_{Gem}}$$

Curve Gain: Gain

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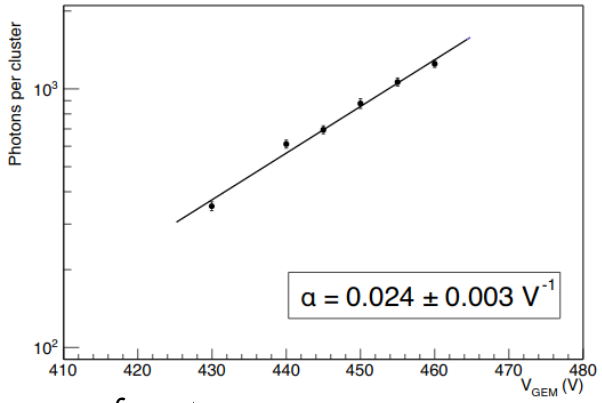
- Only a couple of points were analysed with the code after the new Friday's patch (red points)

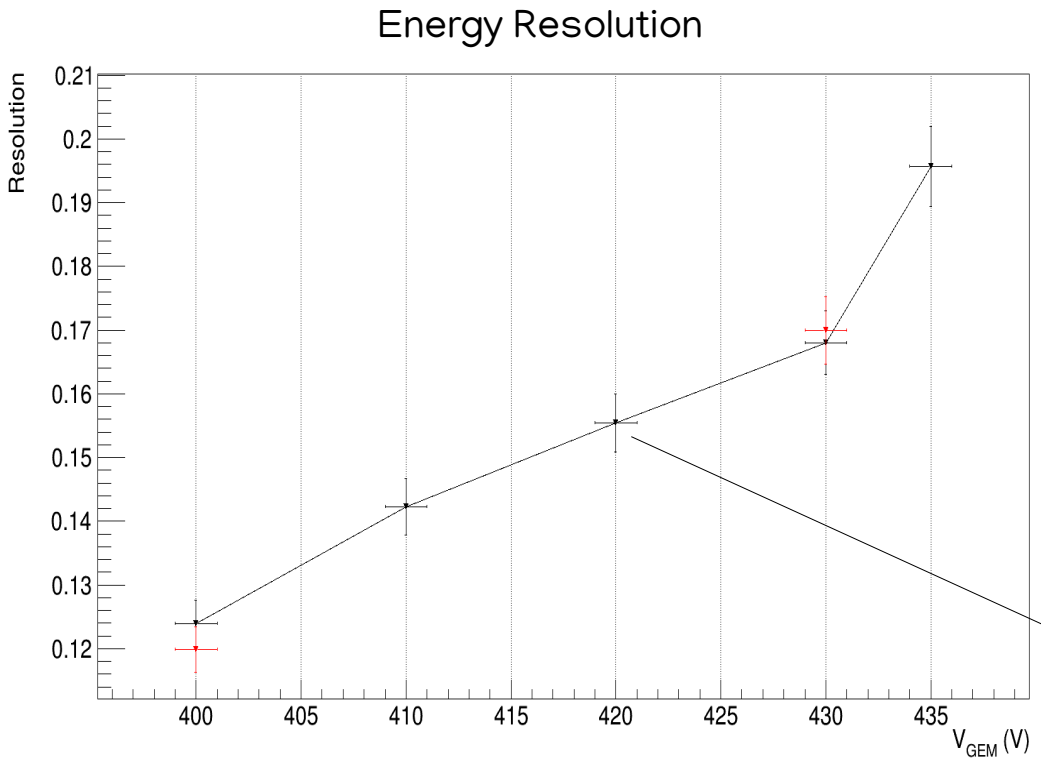


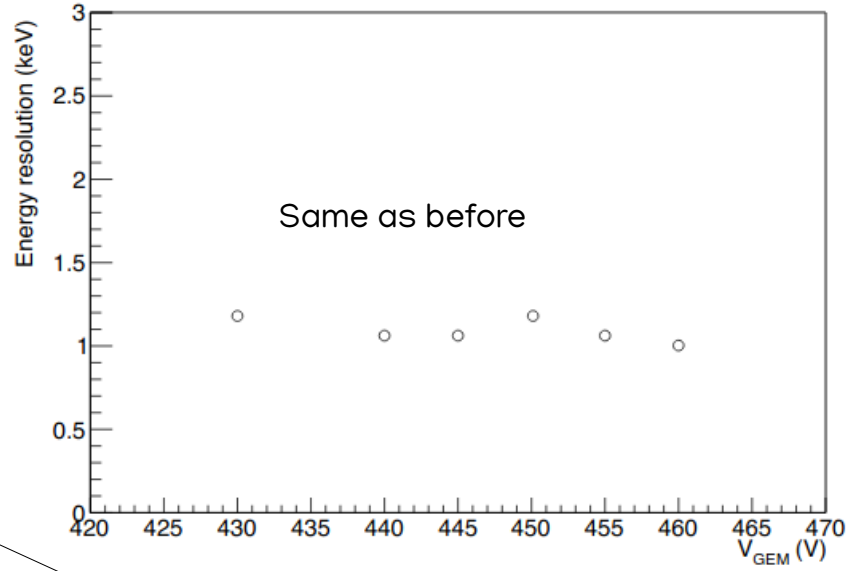
$$y = p0 \cdot e^{p1 \cdot V_{Gem}}$$

From *Performance of Optically Readout GEM-based TPCwith a ^{55}Fe source*

Ever done this scan with new code?

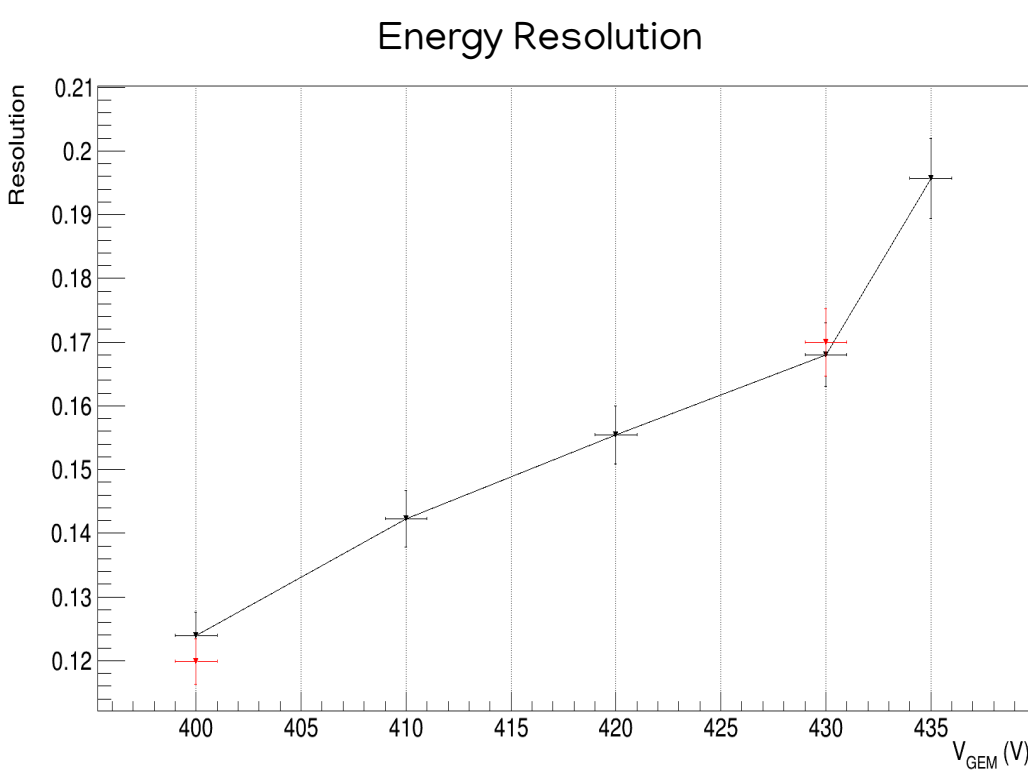
Curve Gain: Energy and spatial resolution

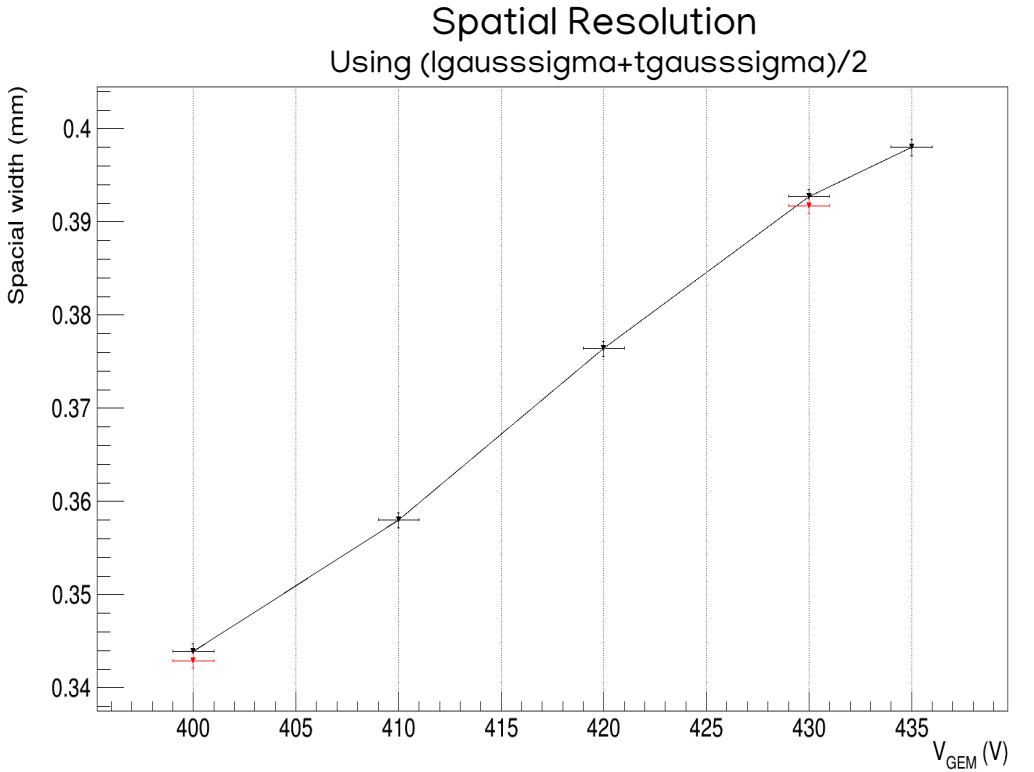




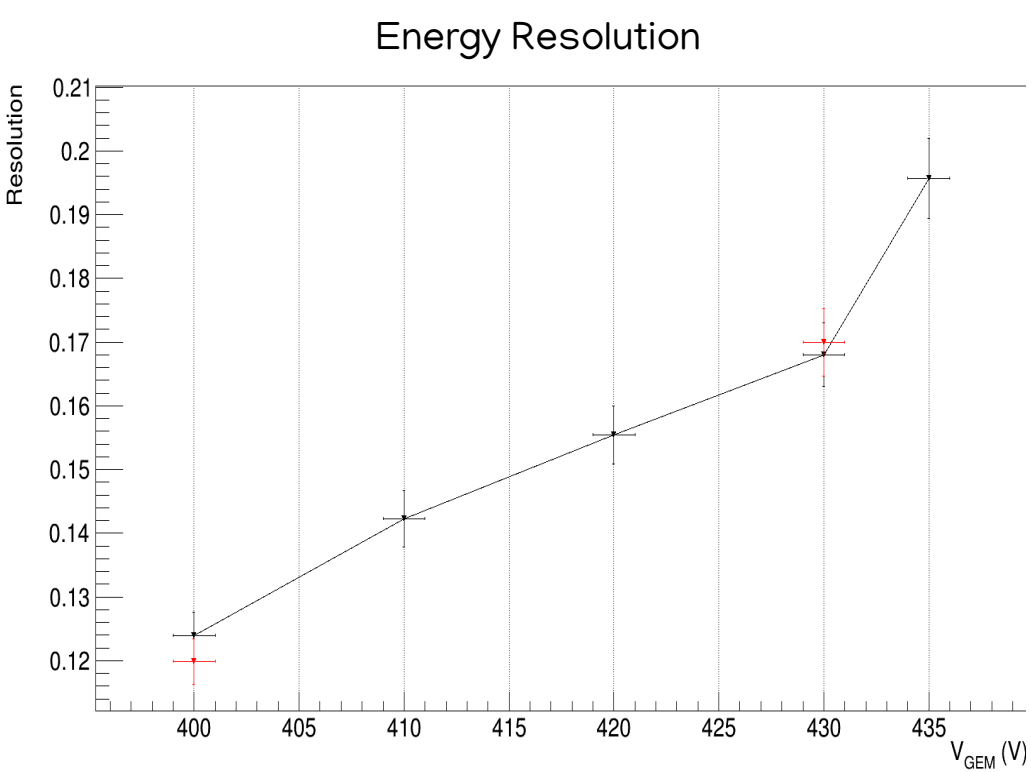
Consistent value with the geometry study with data taken in **different weeks**

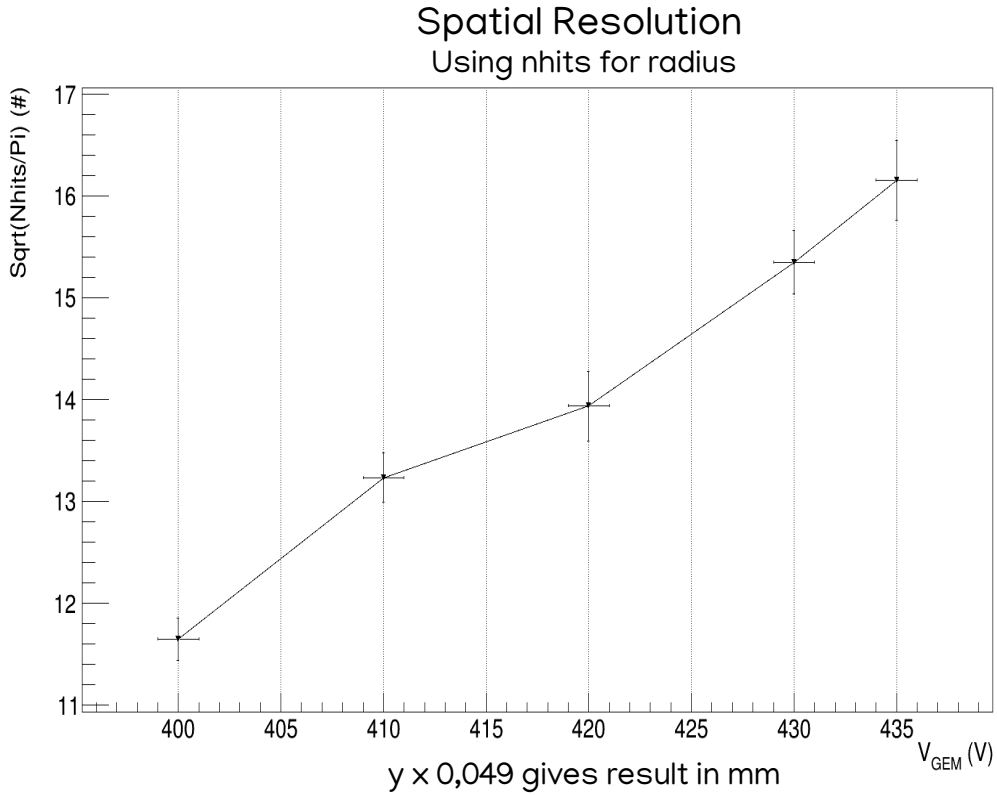
Curve Gain: Energy and spatial resolution





Curve Gain: Energy and spatial resolution



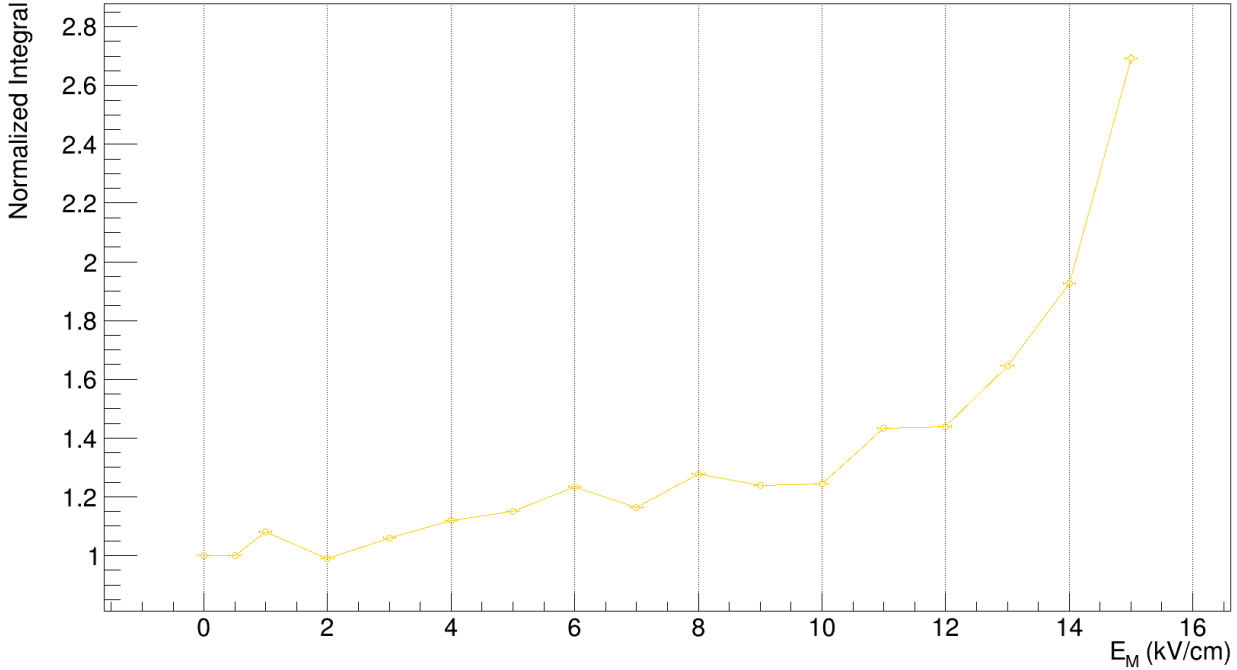


Electroluminescence

EL: Long Exposure

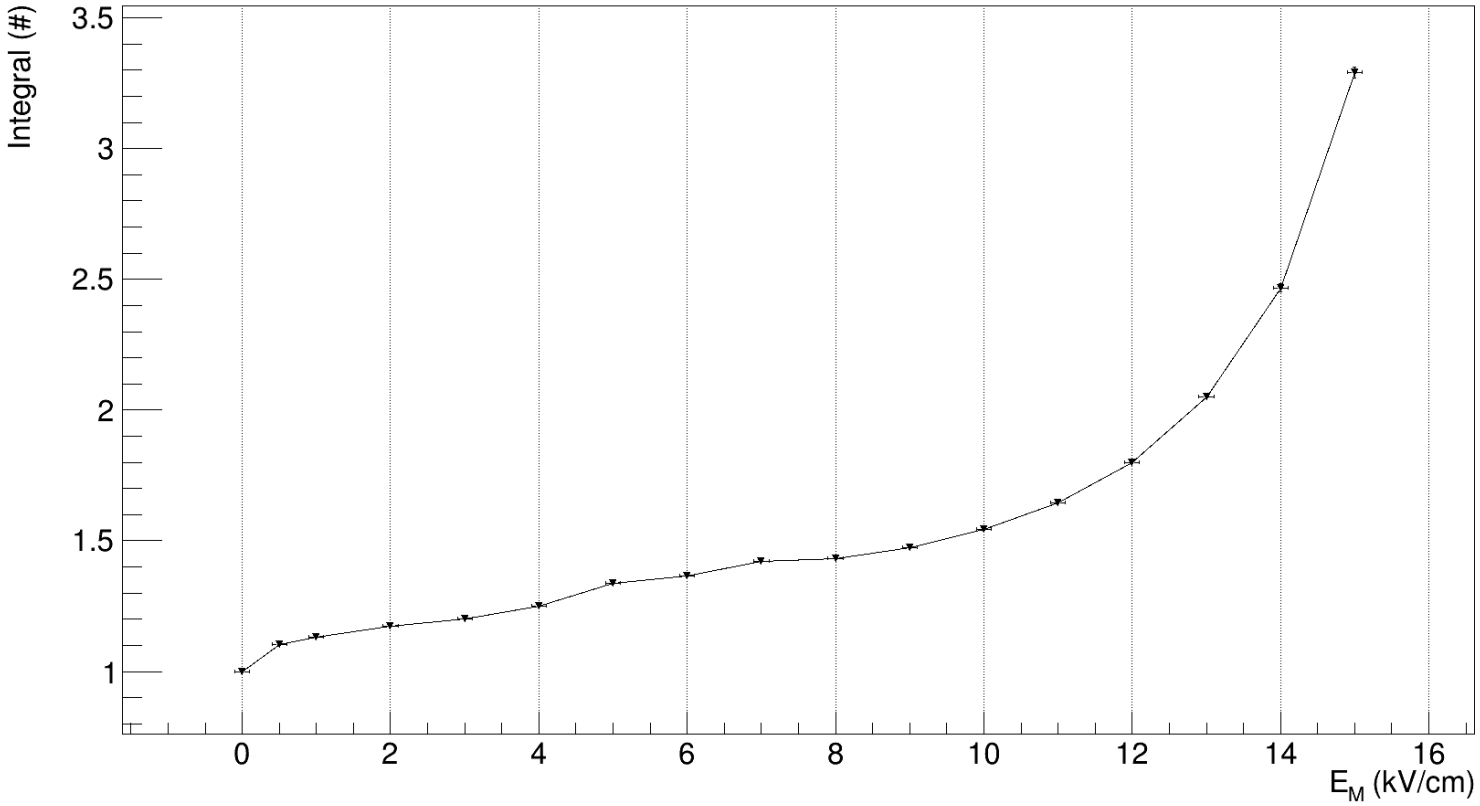
- Central region is taken and, after pedestal subtraction, all the light is integrated.

- Being close with the camera and the source not as intense as the one in Frascati, the outcome is fairly dependent on how many iron spots are present in that part of the picture



EL: Short Exposure with Iron spots Analysis

- Same cuts applied as in the gain part



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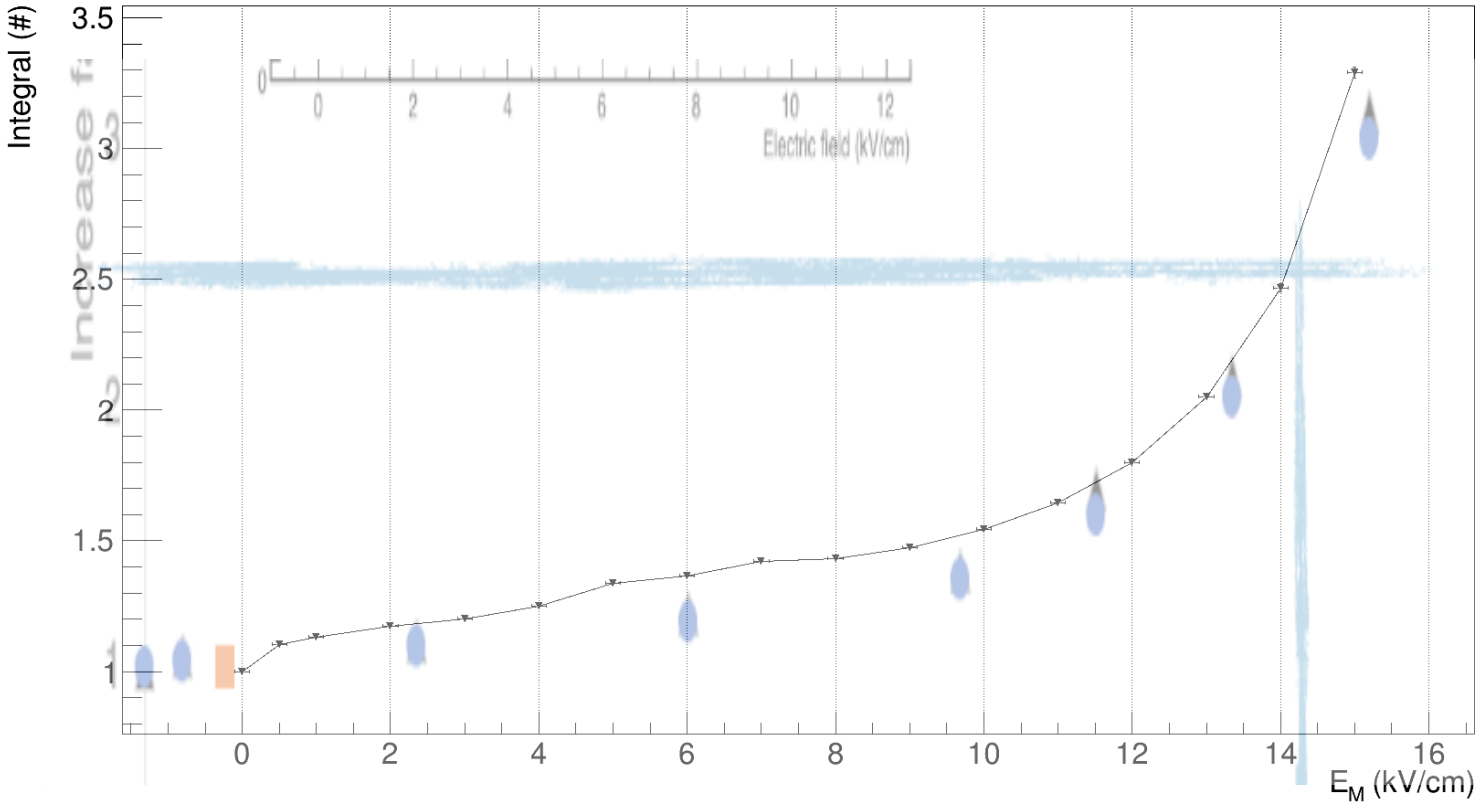

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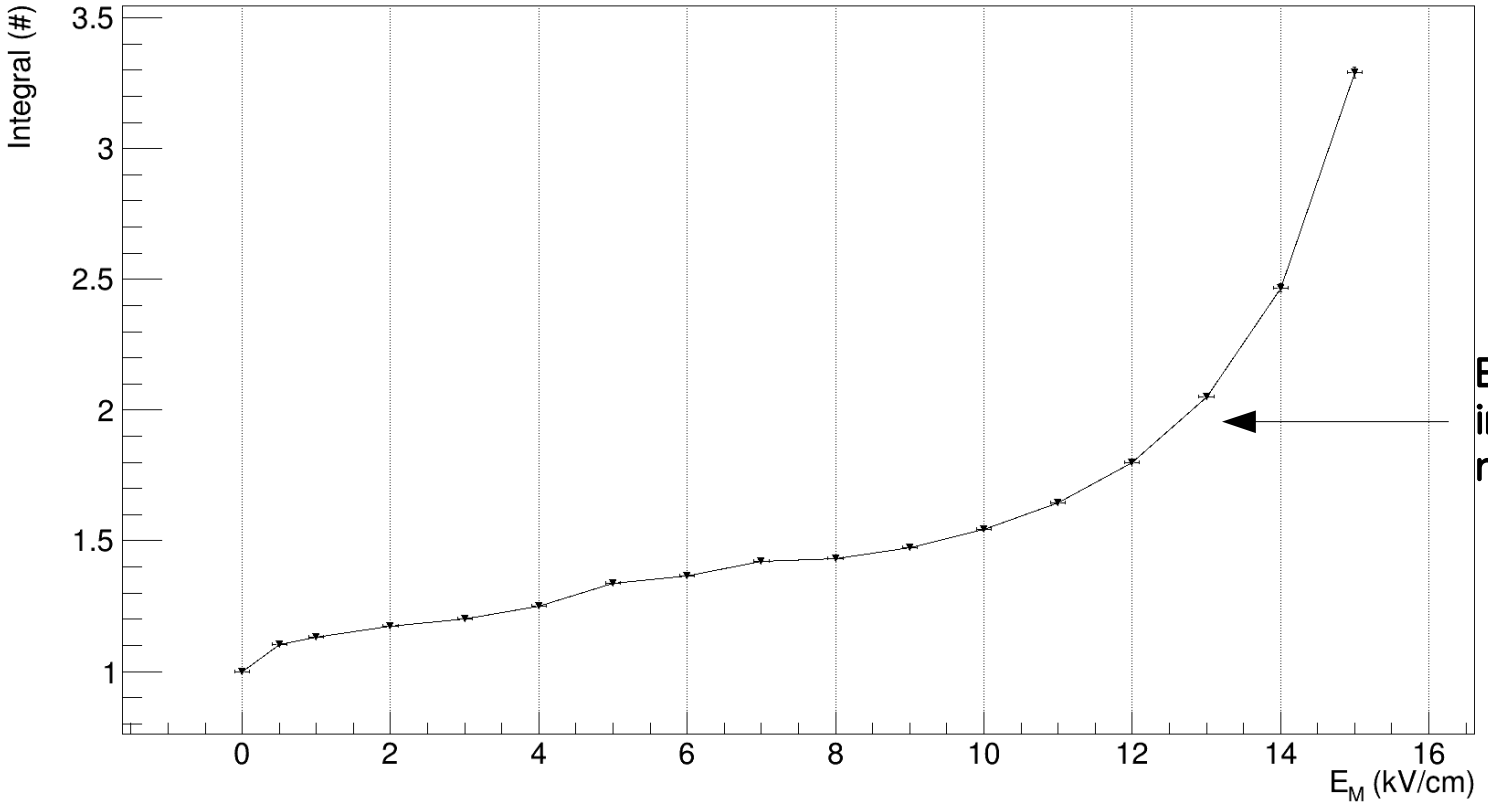

Expected light increase up to more than 3 times

EL: Short Exposure with Iron spots Analysis

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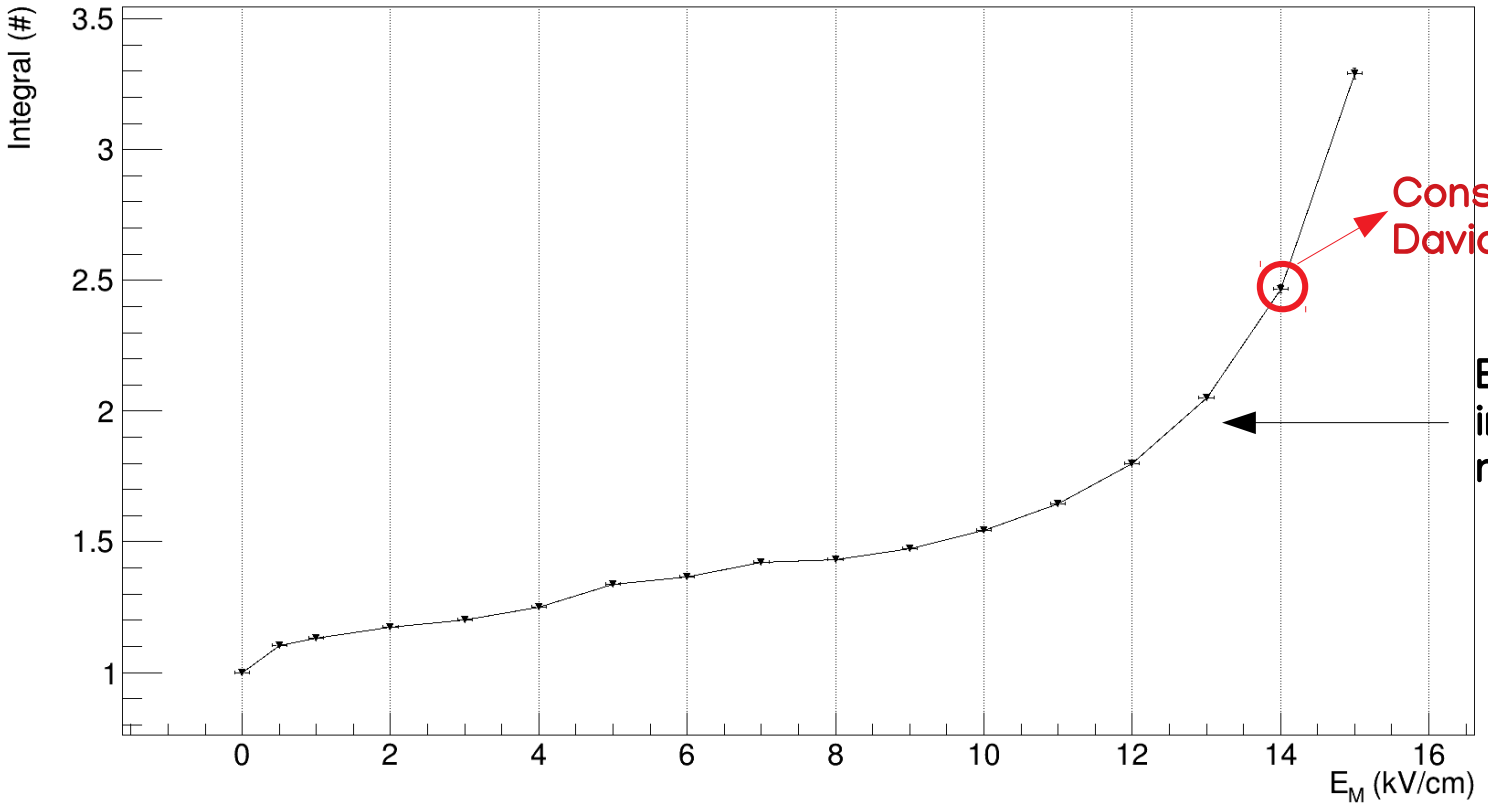

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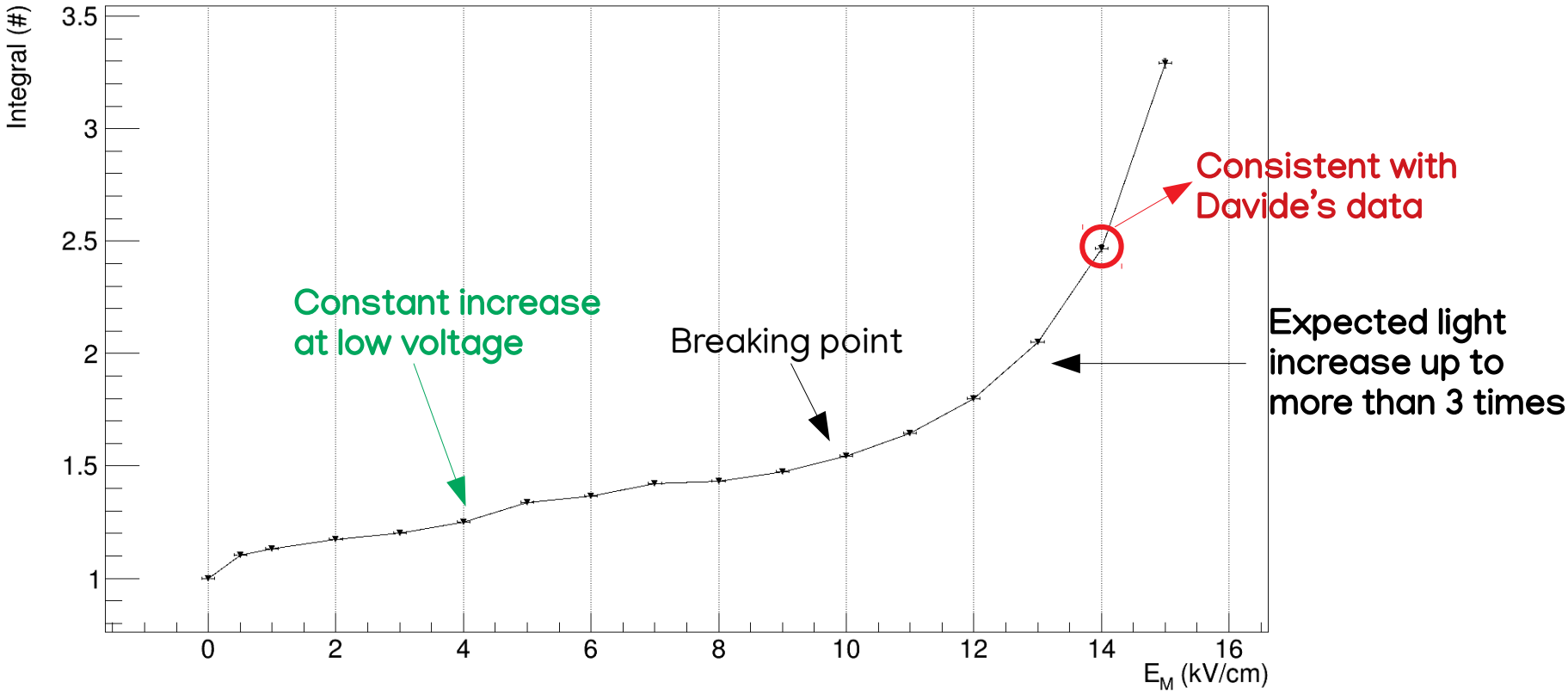
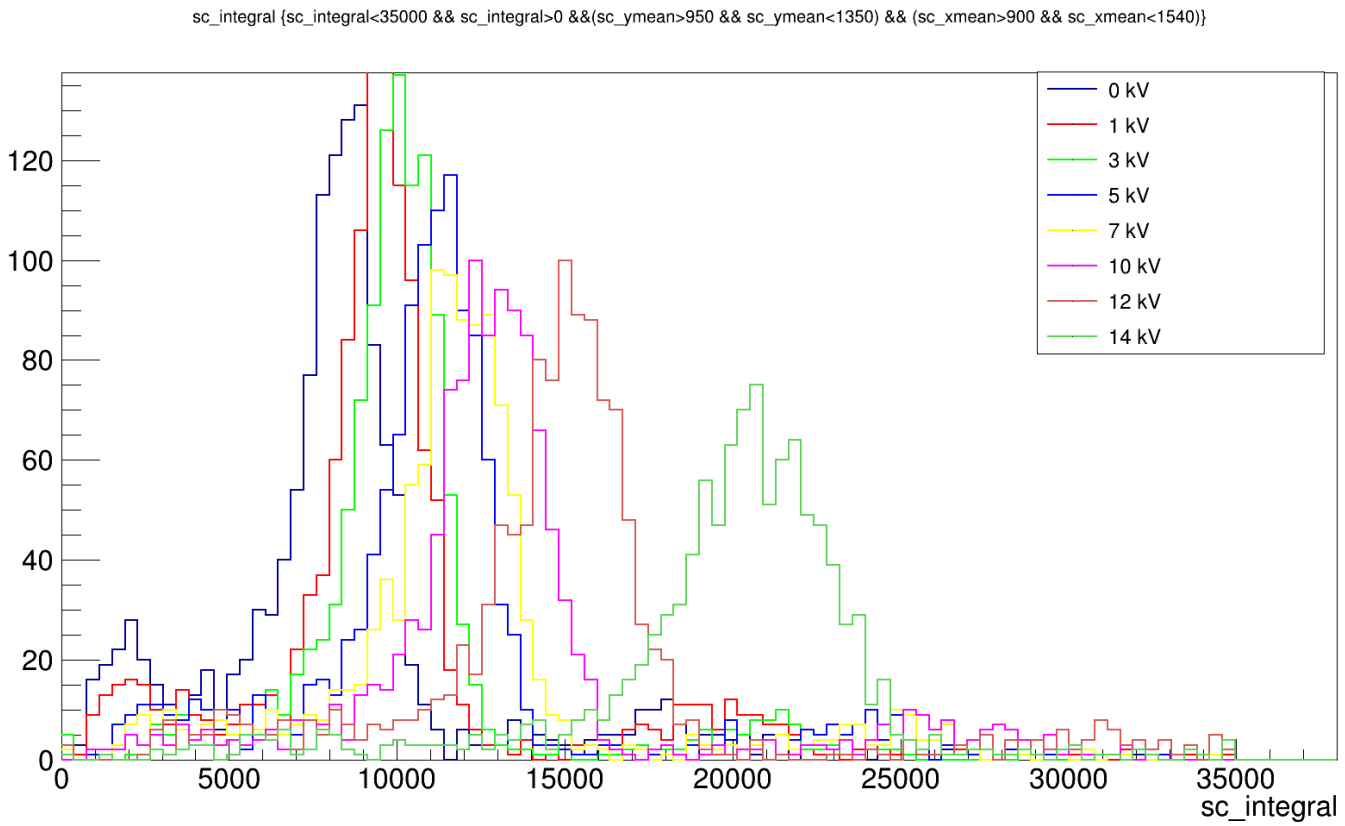


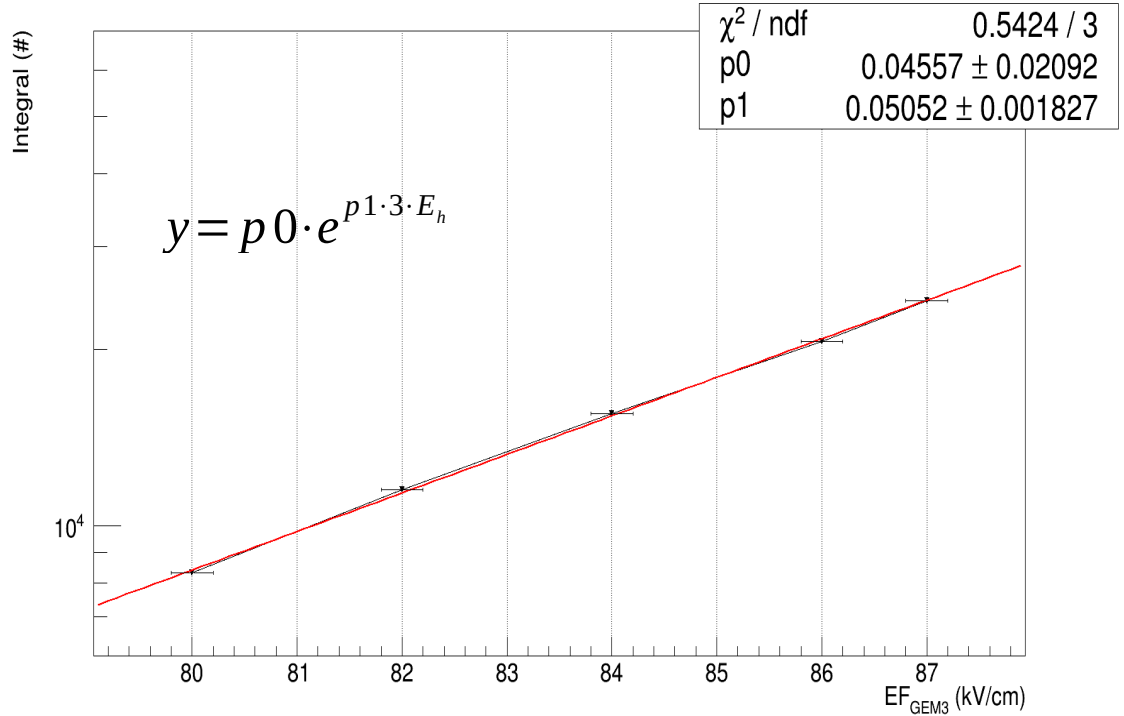
EL: Short Exposure with Iron spots Analysis

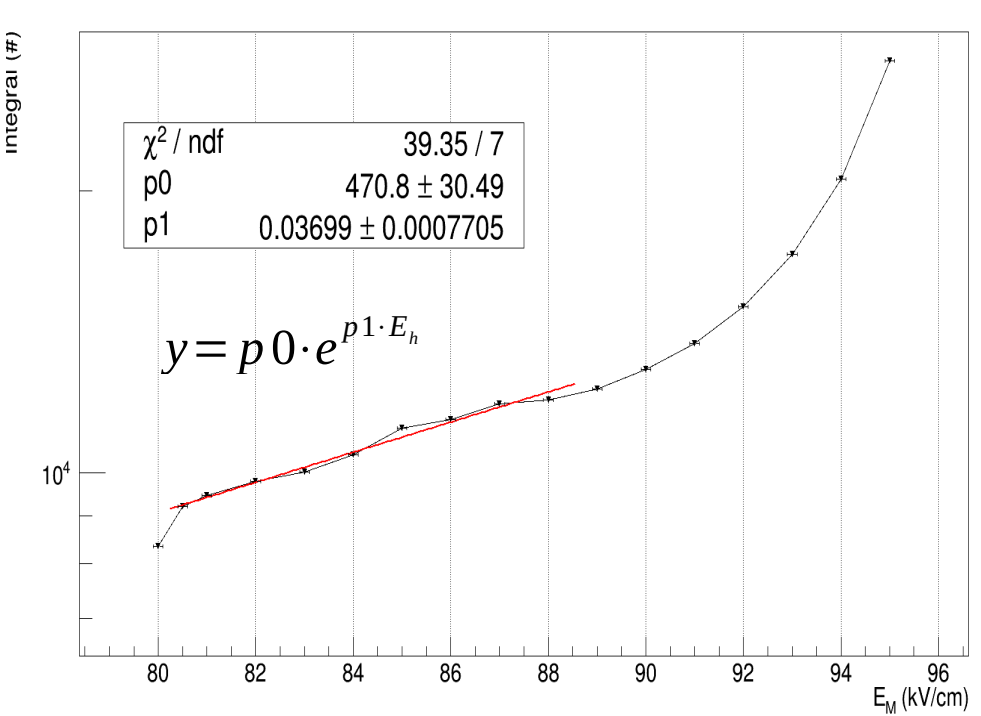


EL: Short Exposure with Iron spots Analysis

- Are we increasing the EF in the hole by adding a field between GEM and Mesh?

$$E_h = \frac{V_{GEM}}{50\mu m} + E_M$$





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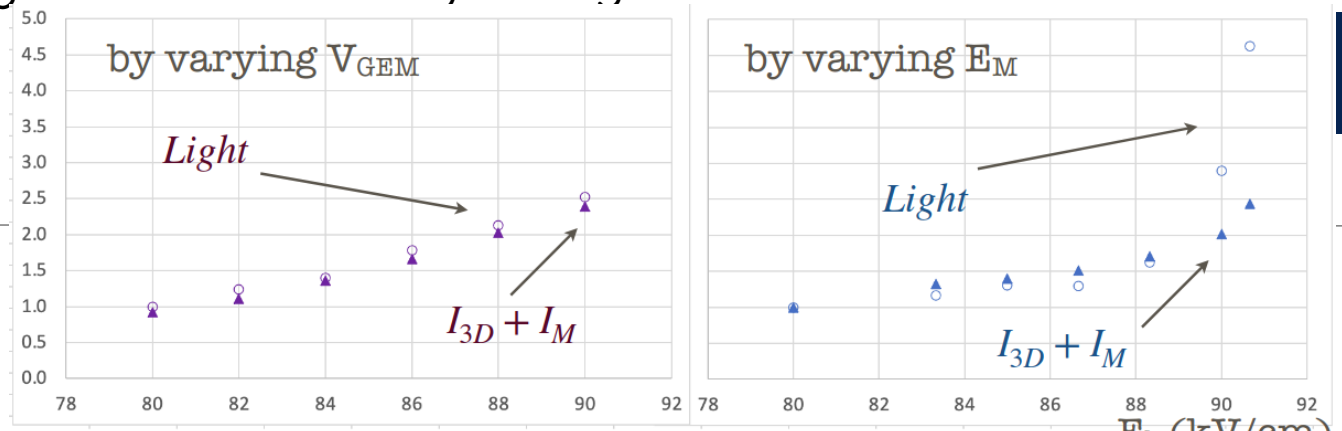
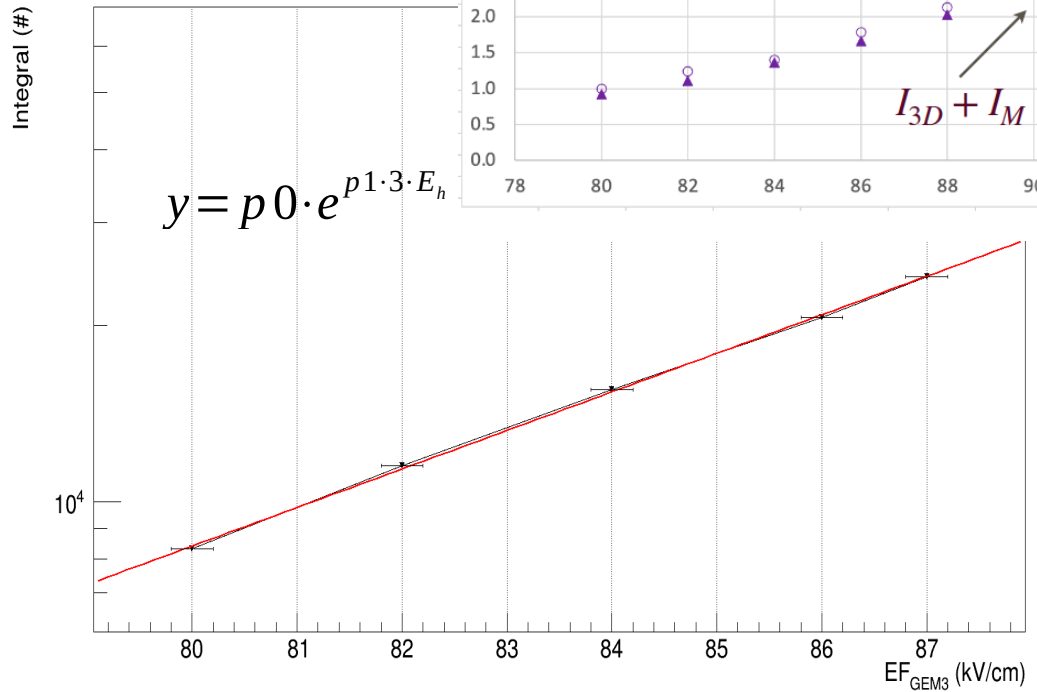
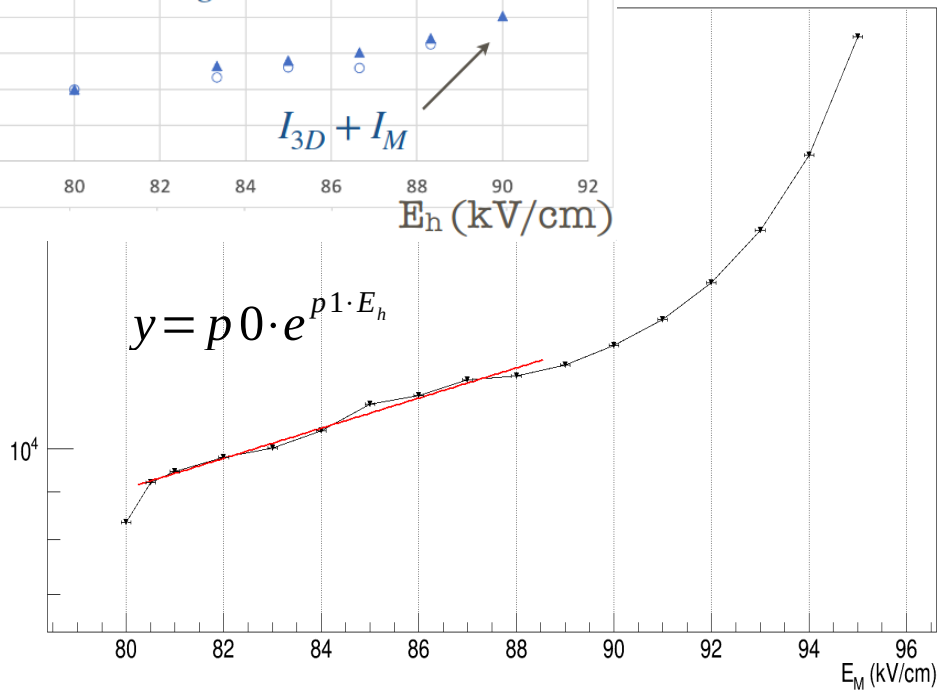
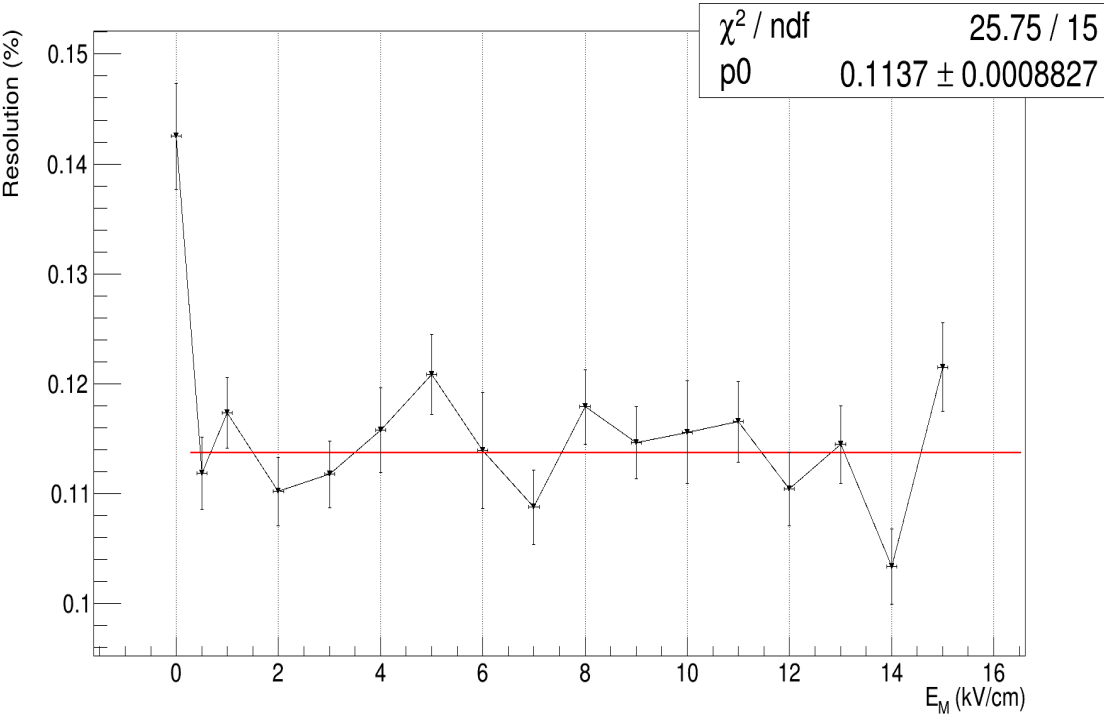


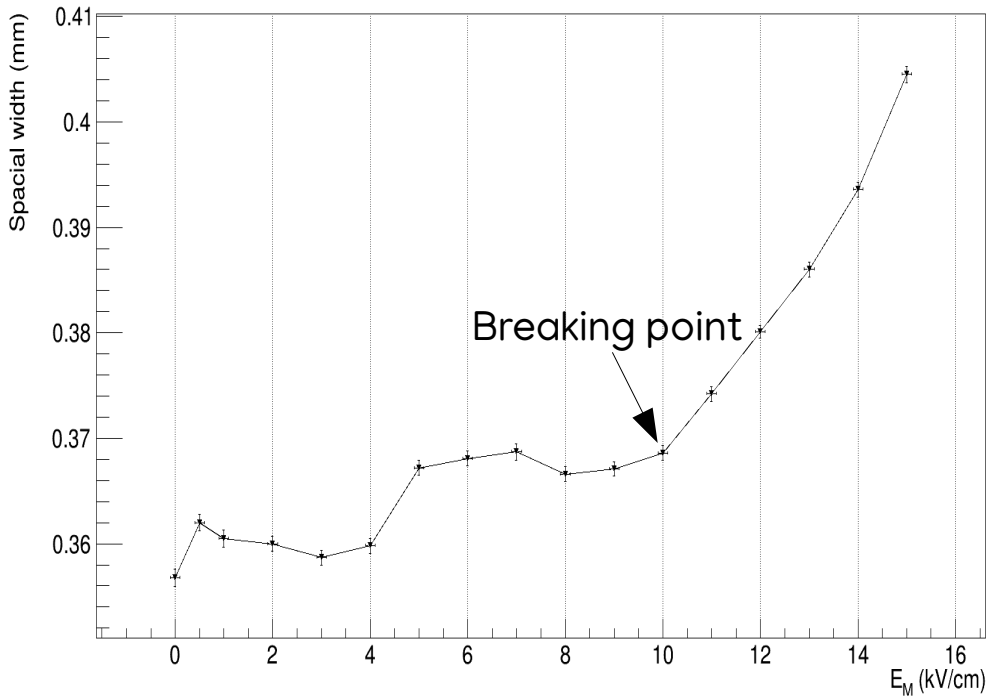




EL: Short Exposure Energy and Spatial Resolution

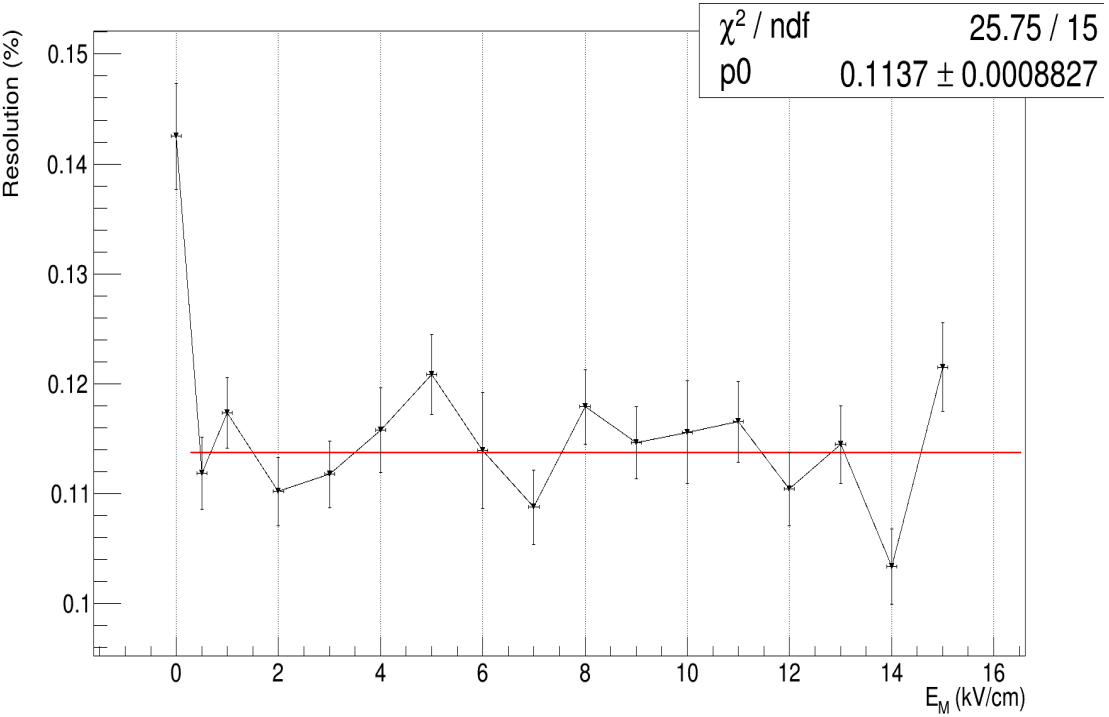
- Are we increasing the EF in the hole by adding a field between GEM and Mesh?

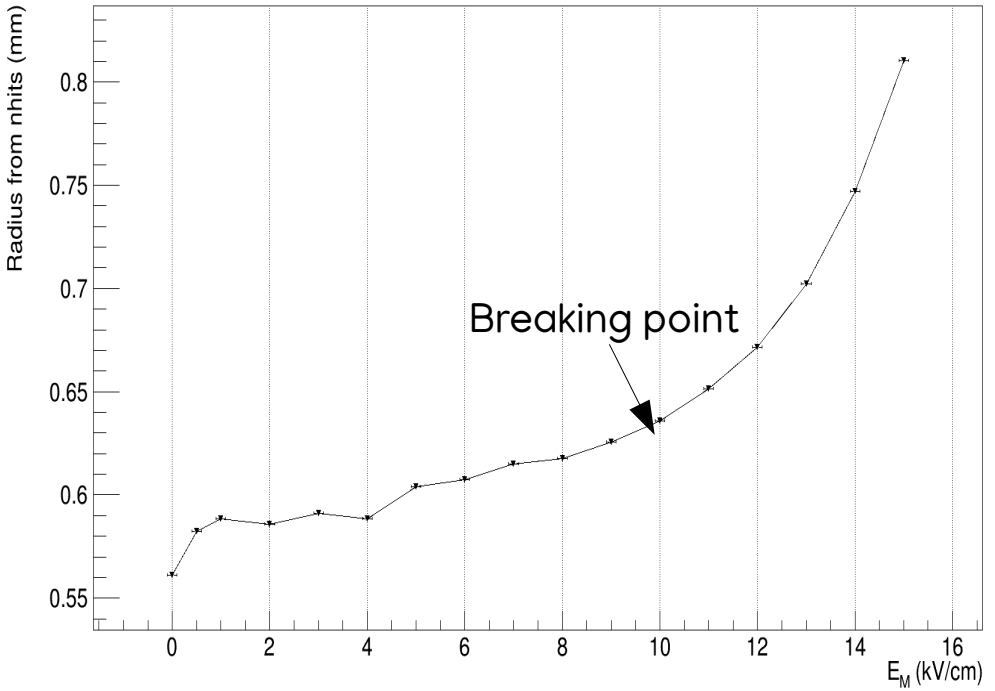




EL: Short Exposure Energy and Spatial Resolution

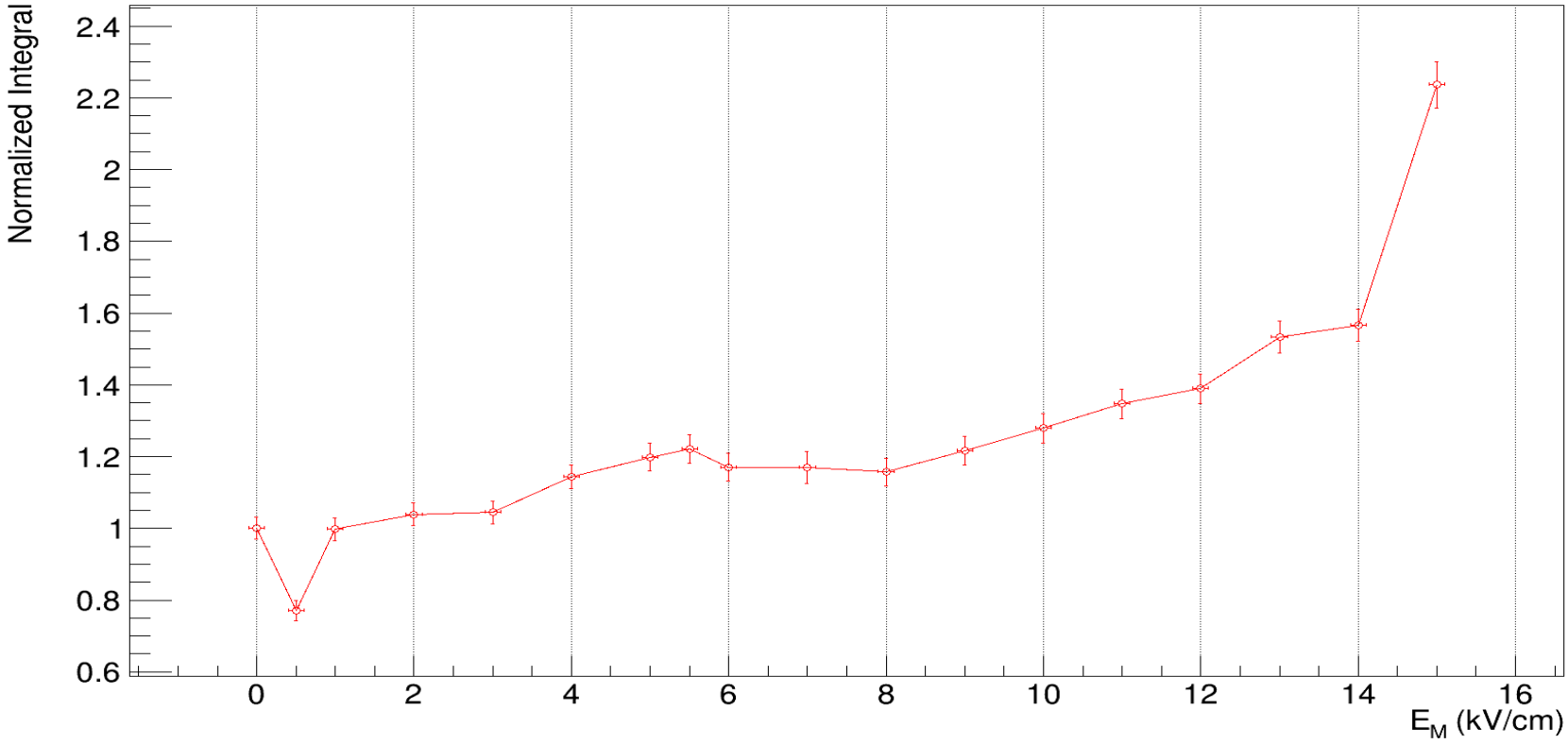
- Are we increasing the EF in the hole by adding a field between GEM and Mesh?





EL: Short Exposure PMT

- Waveforms are integrated from the oscilloscope and the iron peak is found also here



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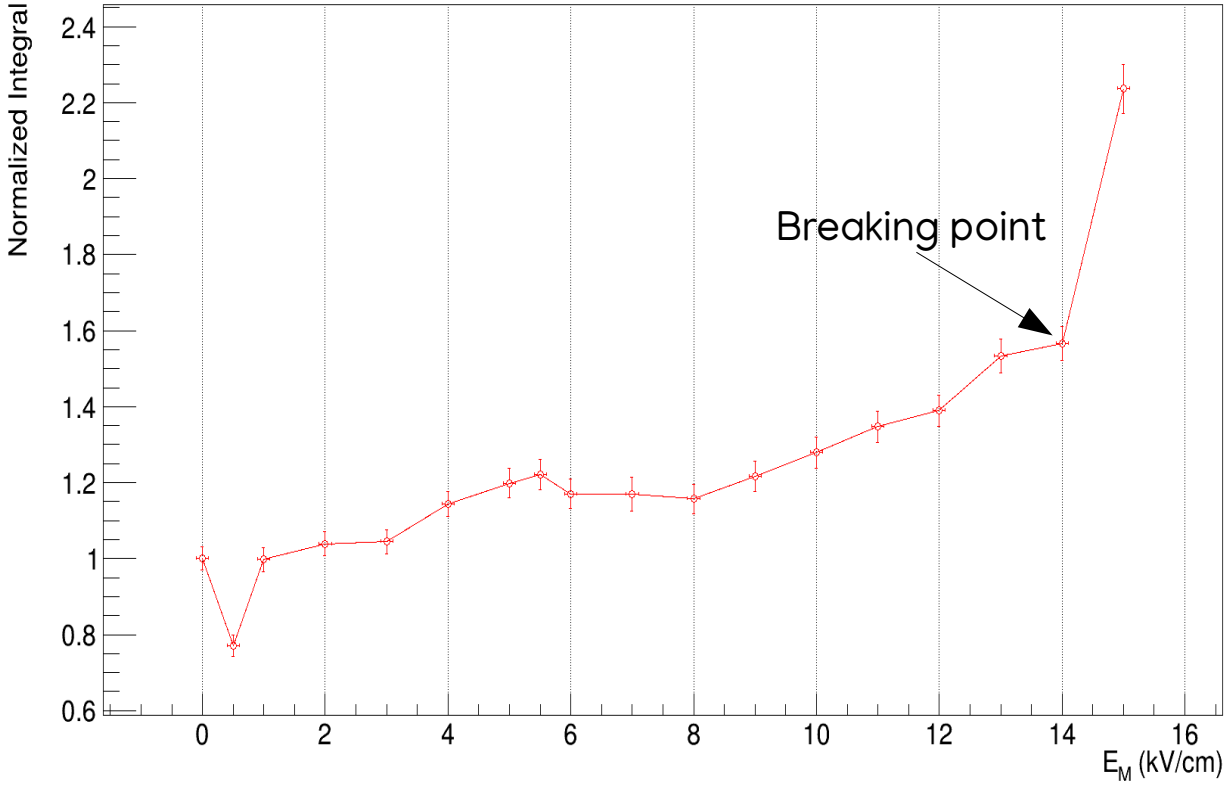
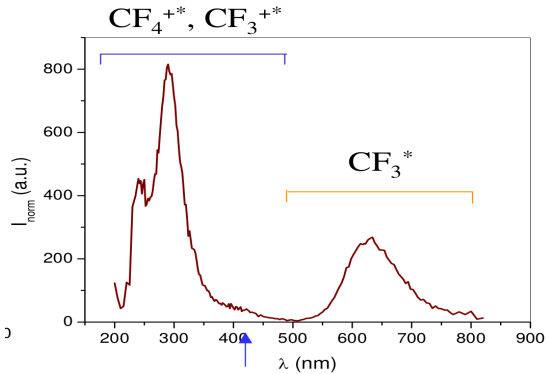


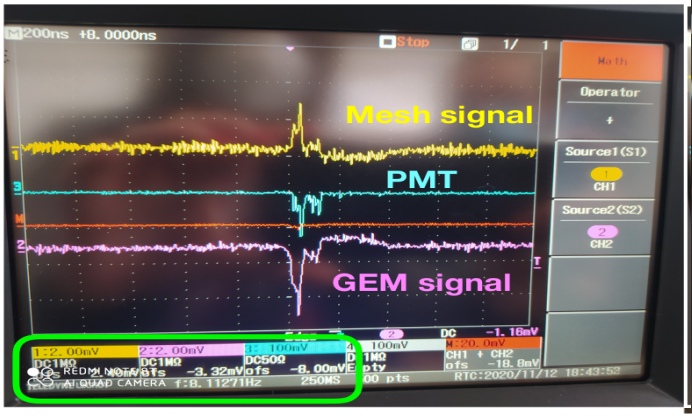
PMT more sensitive to UV



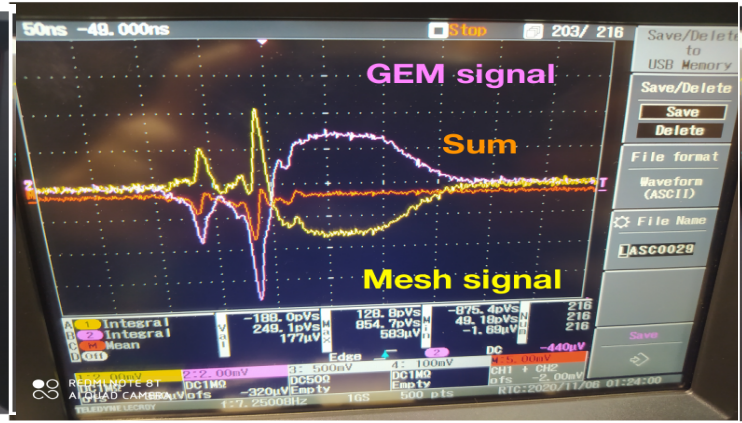
Electronic excitation (dissociation into neutral fragments)†	12.5 (10)	12.5 (10)
Dissociative ionization†	15.9	15.9

EL: Charge Analysis

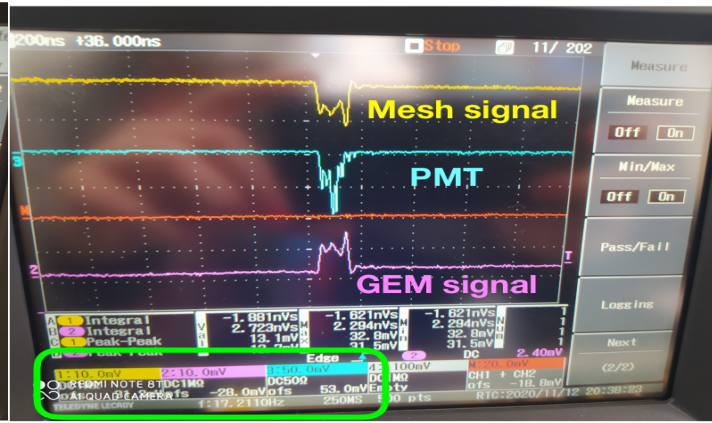
0 kV



0,3 kV



12 kV

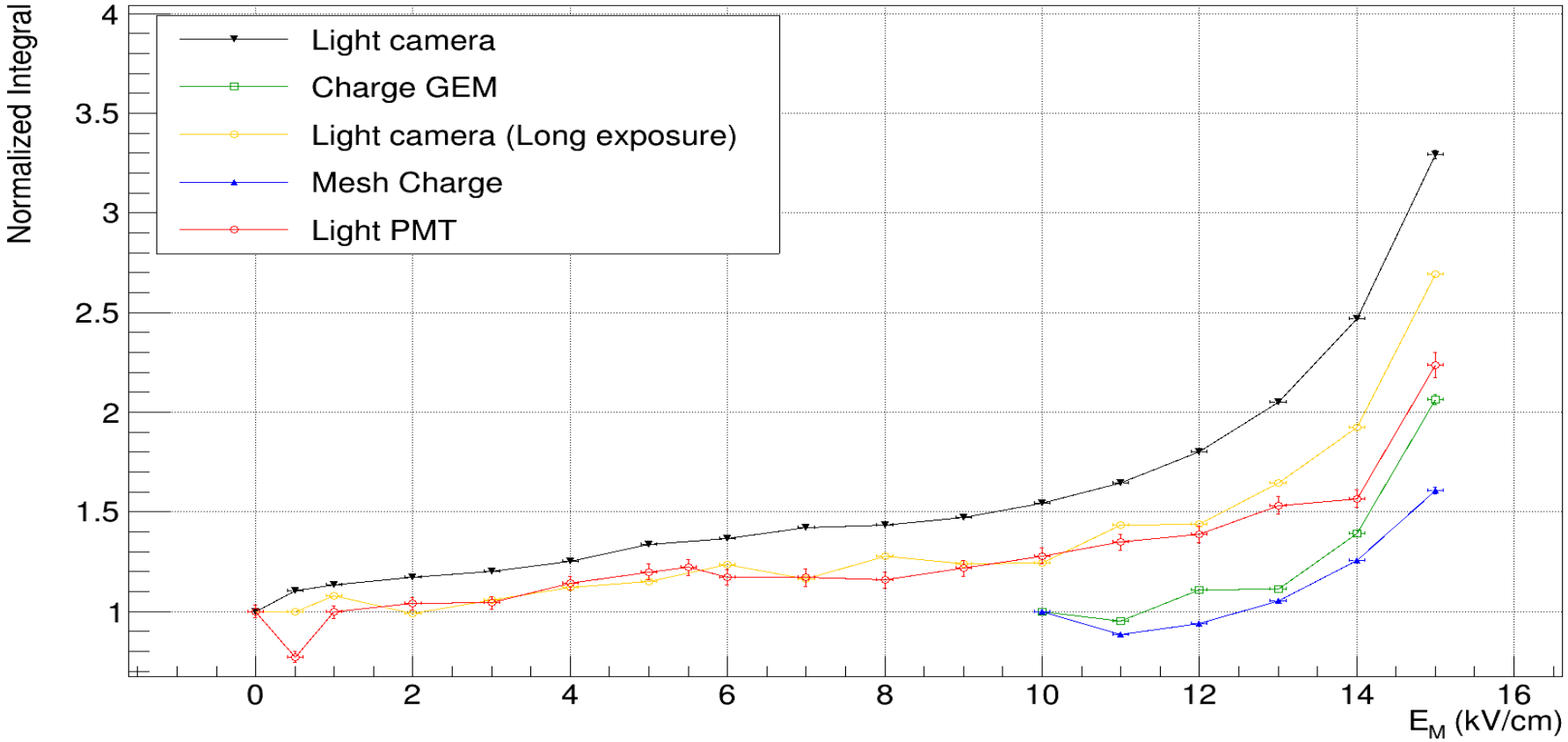


EL: Charge Analysis

- We have the integral of the waveforms calculated by the oscilloscope
- We can select the integral related to the iron spots
- After discussing with Luciano we think that:
  Due to the RC circuit we do not read the whole charge but probably only the fast component

Electron time for crossing the GEM–mesh gap	~ 40 ns
Ion time for crossing the GEM–mesh gap	~ ms
RC constant	~ 200 us

EL: All Together



Conclusion

- Data was taken with MANGO with iron 55 source at LNGS
- We observe a geometrical dependency of the light output
- Some analysis on the energy and spatial resolution were performed as a function of GEM voltage and induction field
- With GEM at 435 V we do not see clear signs of saturation
- The electroluminescence study is consistent with data taken in Frascati and points at a clear increase in light output with reduced increase in charge without affecting the energy resolution