Analysis ^{55}Fe data

I.Abritta, E. Di Marco and D. Pinci • 12.19.2019

Overview

Example of an ^{55}Fe spot

Variables explanation

Examples of the distributions

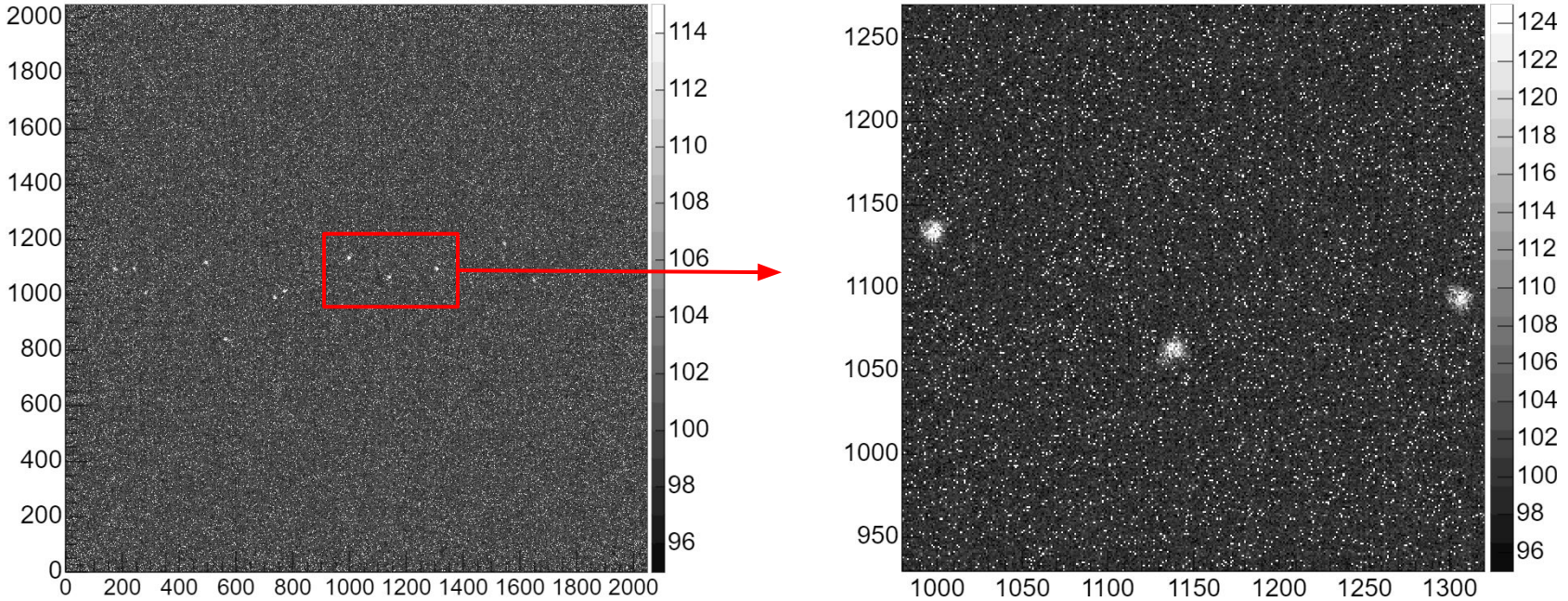
Z Scan (70/30 and 60/40 gas mixtures)

Z Scan and VGem Scan (60/40)

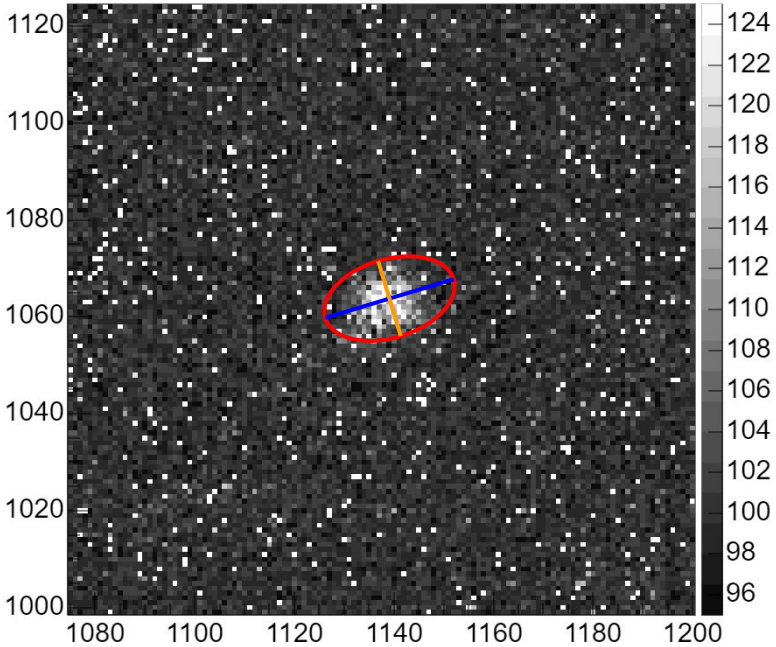
PMT Analysis (70/30)

Conclusions

Example of an ^{55}Fe spot



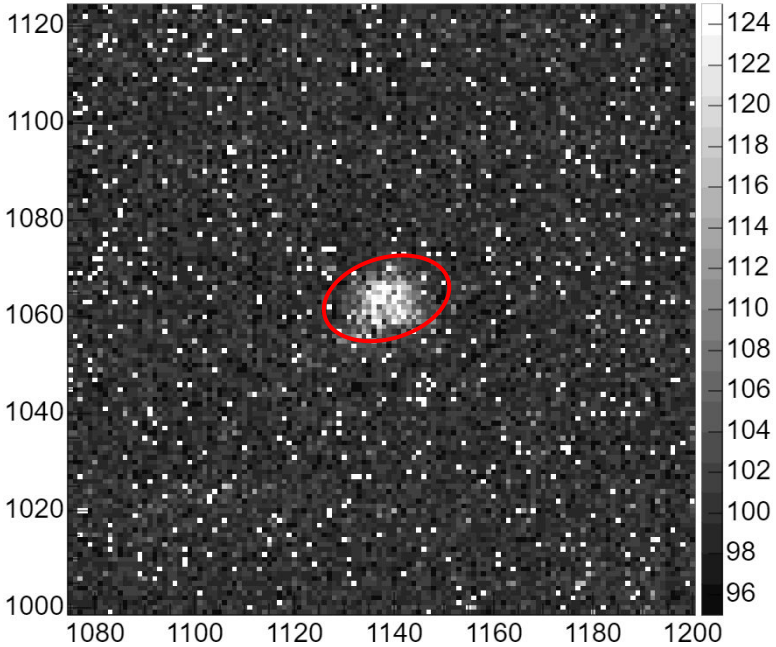
Variables on this presentation



Let's assume the ‘red ellipse’ as the boundaries of the cluster:

- **Length** is defined as the major axis of the ellipse (Blue line);
- **Width** is defined as the minor axis of the ellipse (Orange line);
- **Slimness** is defined as width divided by length.

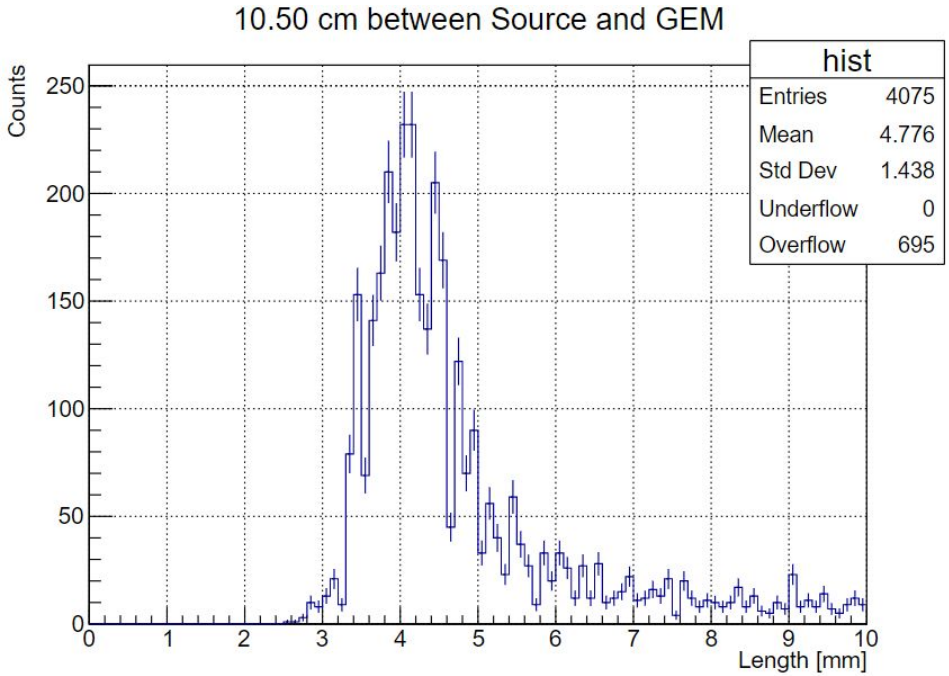
Variables on this presentation

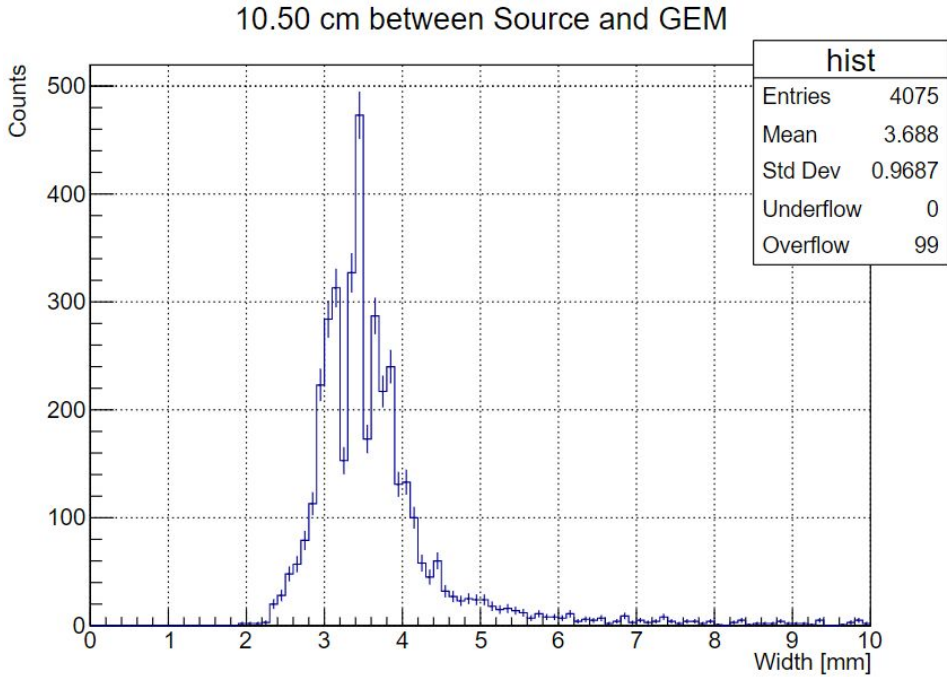


Let's assume the ‘red ellipse’ as the boundaries of the cluster:

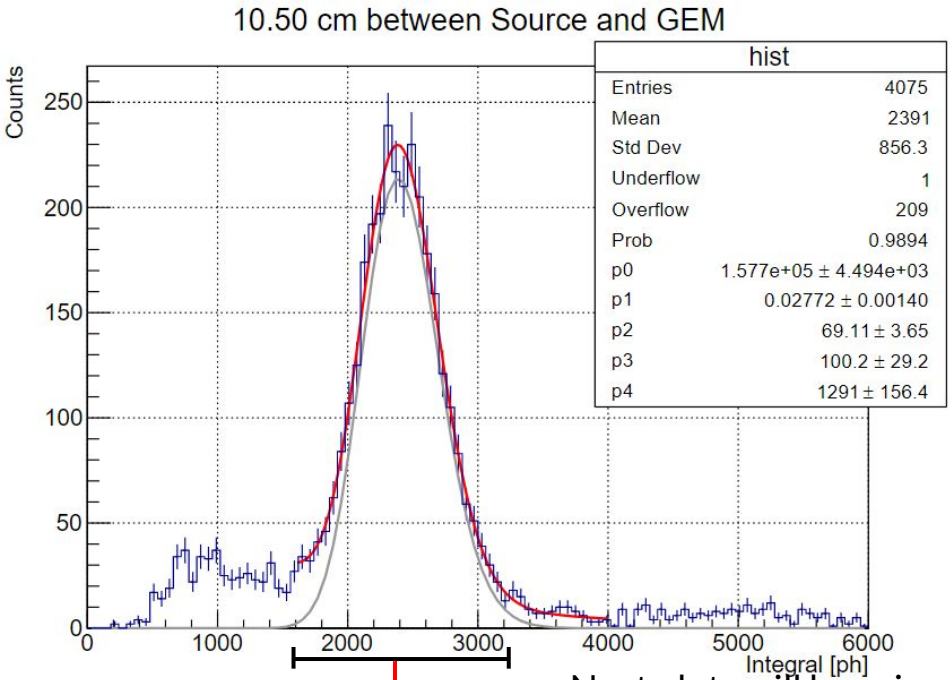
- **Integral** is defined as the sum of the intensities of the pixels that have passed a threshold;
- **Size** is defined number of pixels that have passed a threshold.

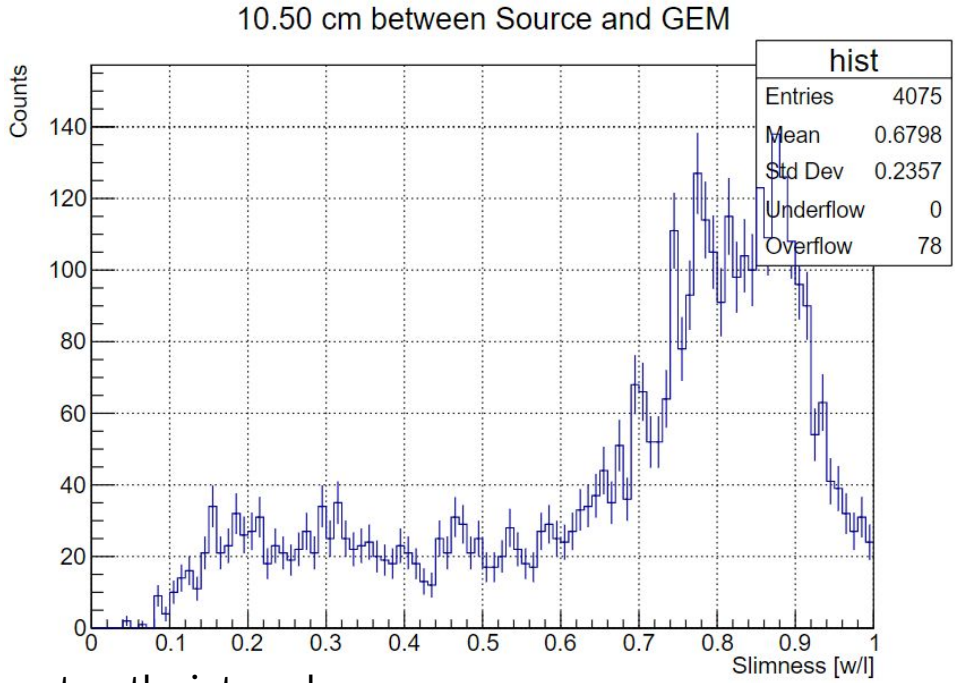
Examples of the distributions





Examples of the distributions

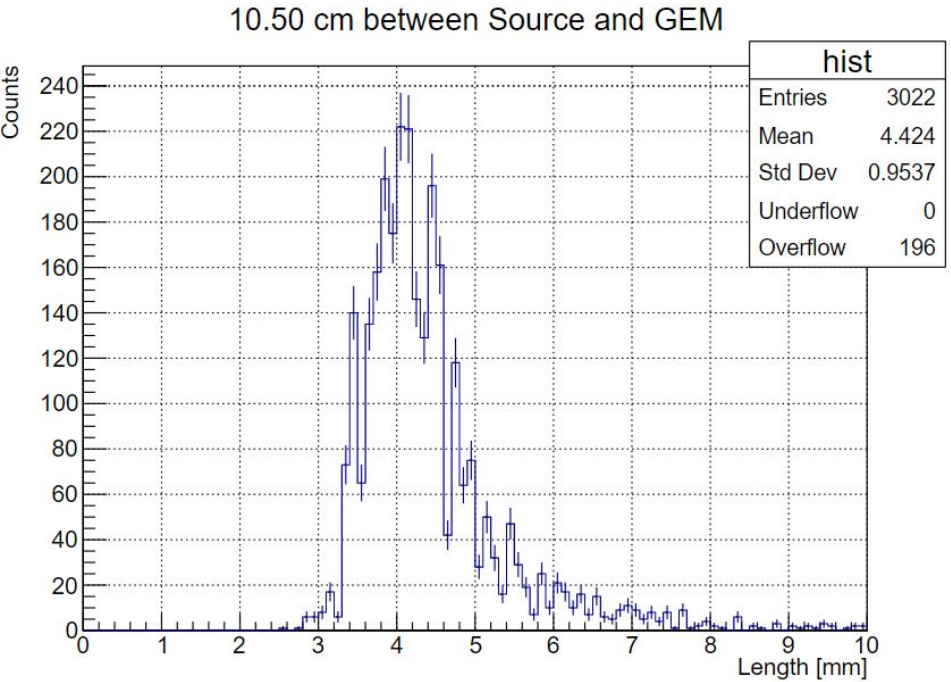


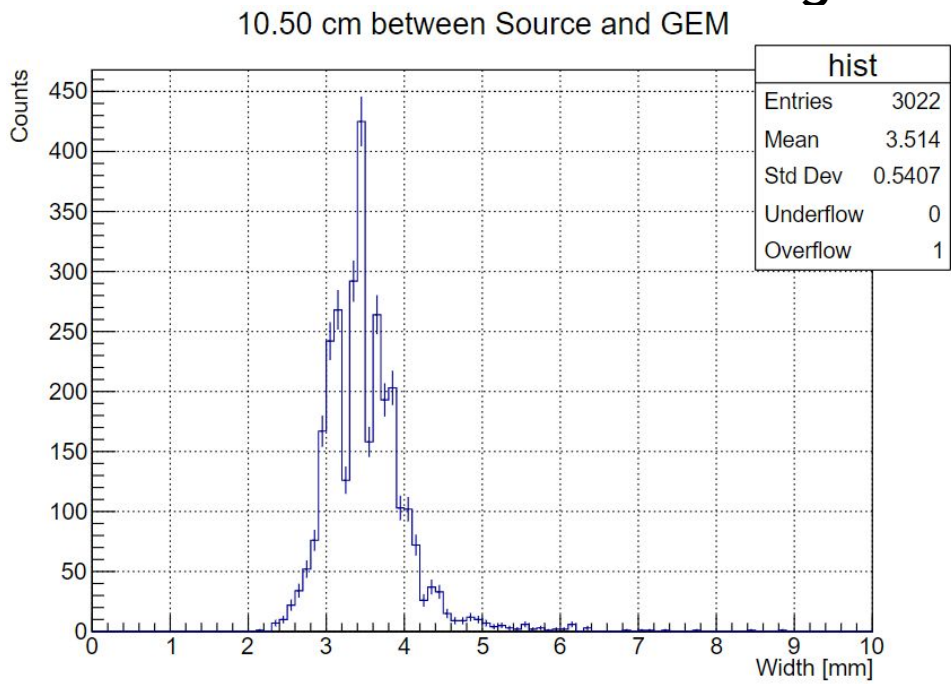


Next plots will be using a cut on the integral

Examples of the distributions

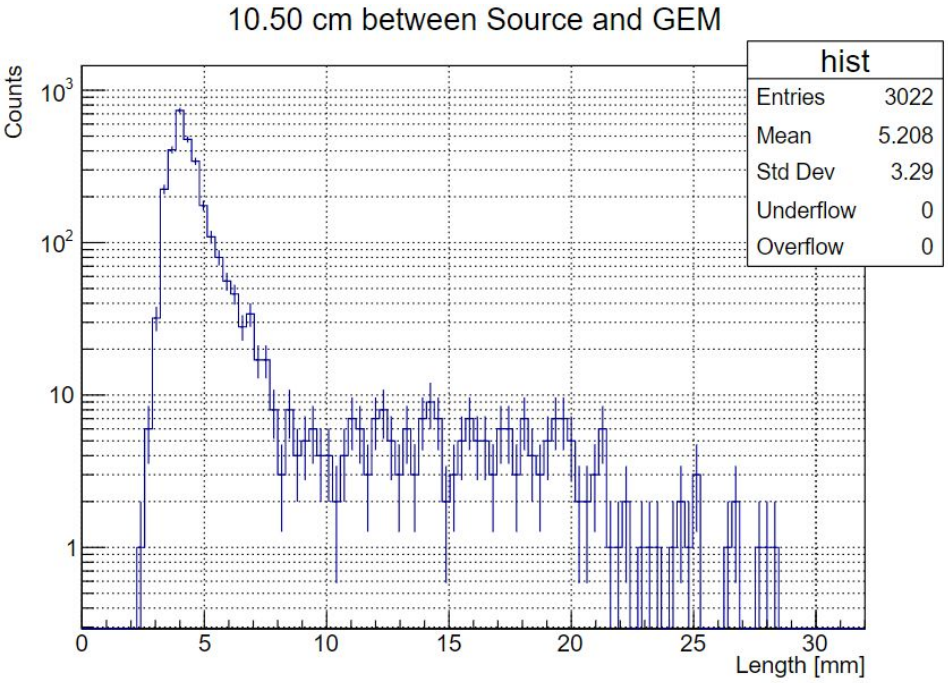
(with the cut on the integral)

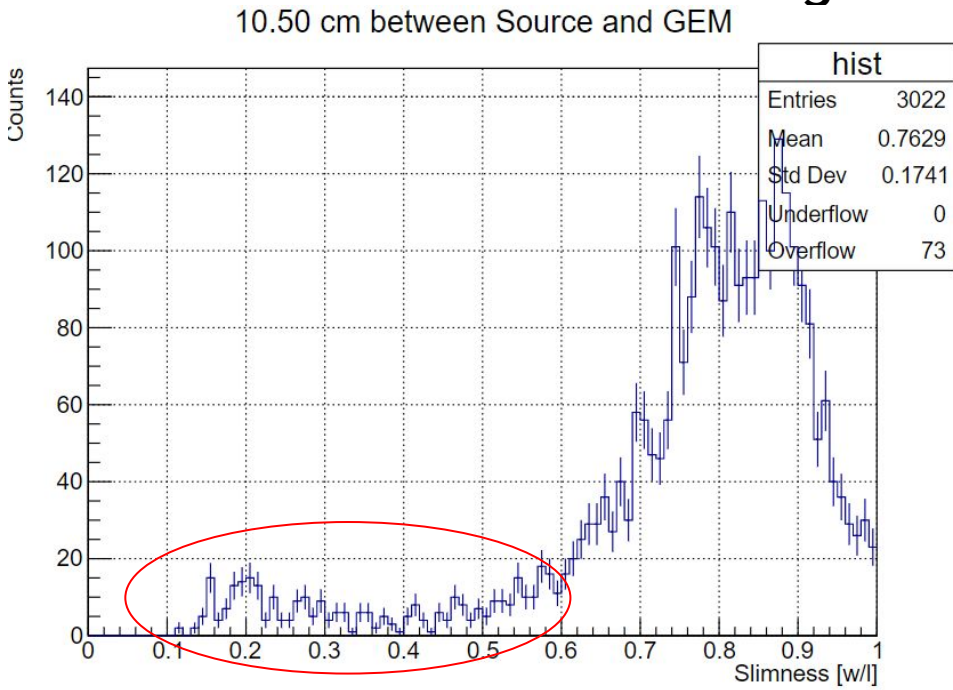




Examples of the distributions

(with the cut on the integral)





Considerable reduction of cluster with Slimness lesser than 0.5

Z Scan

(70/30 and 60/40 gas mixtures)

Integral and Current

Spot Number

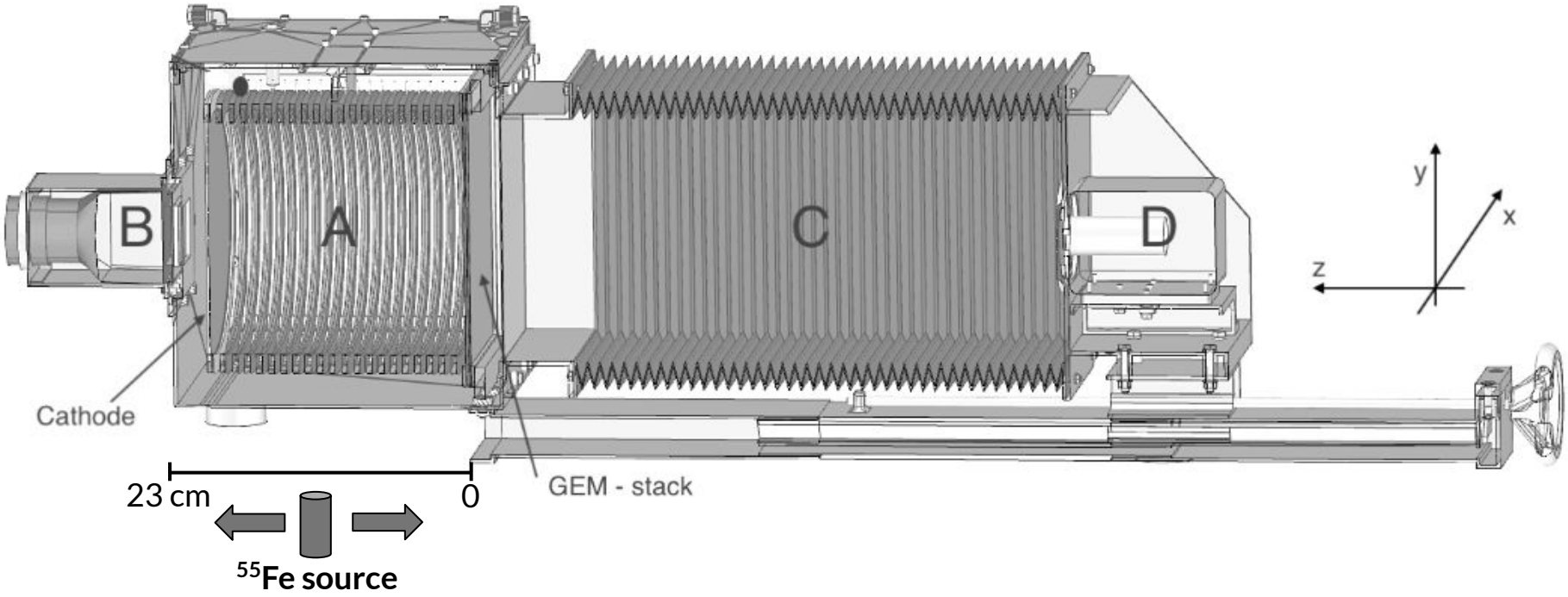
Length and Width

Slimness

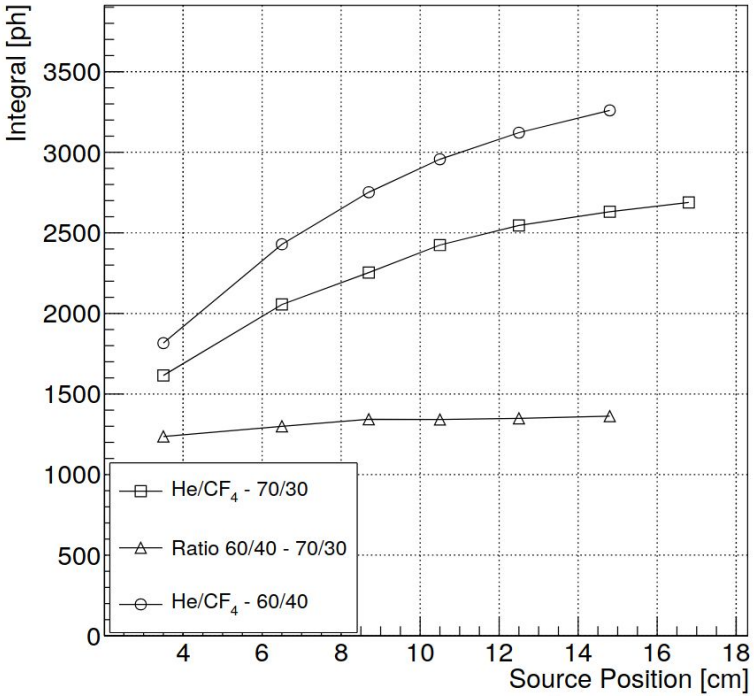
Size

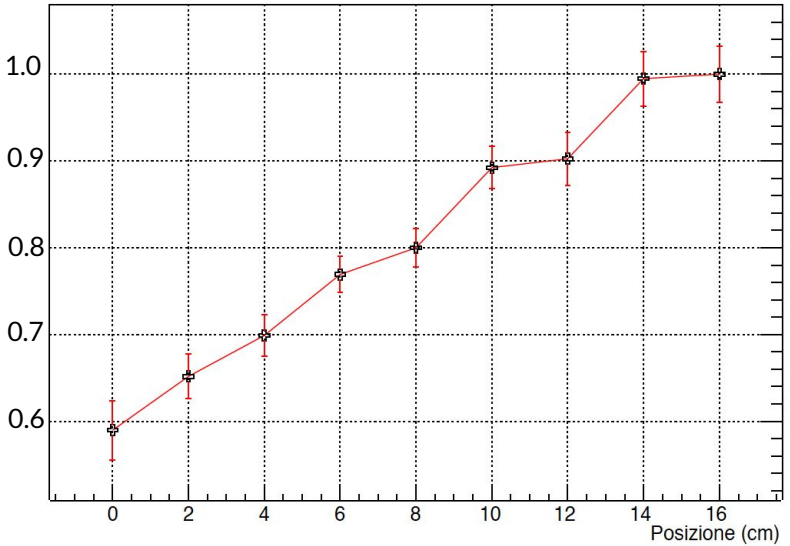
Integral/Size

Z Scan (70/30 and 60/40 gas mixtures)



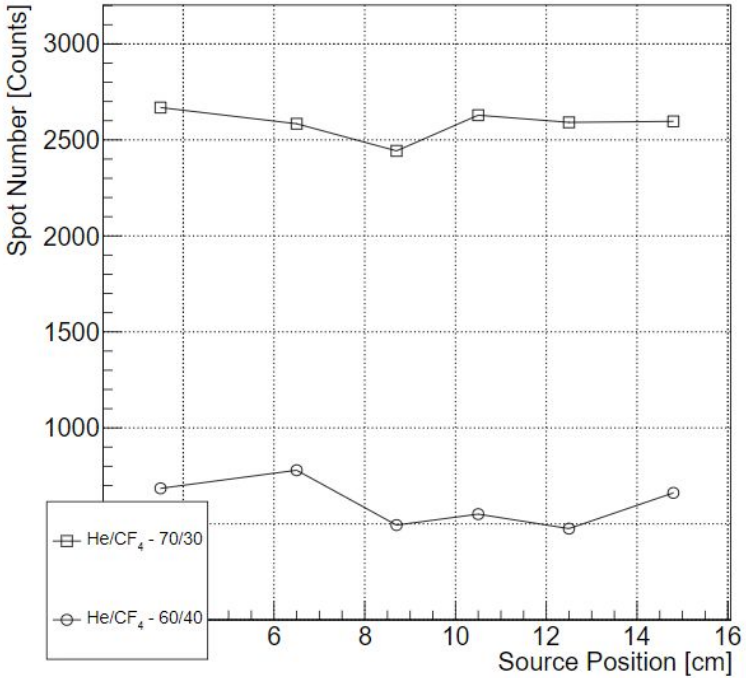
Integral and Current





Both (Integral and Current) are increasing when the source goes far from the GEM, which indicates that this behavior is not due to an optics effect.

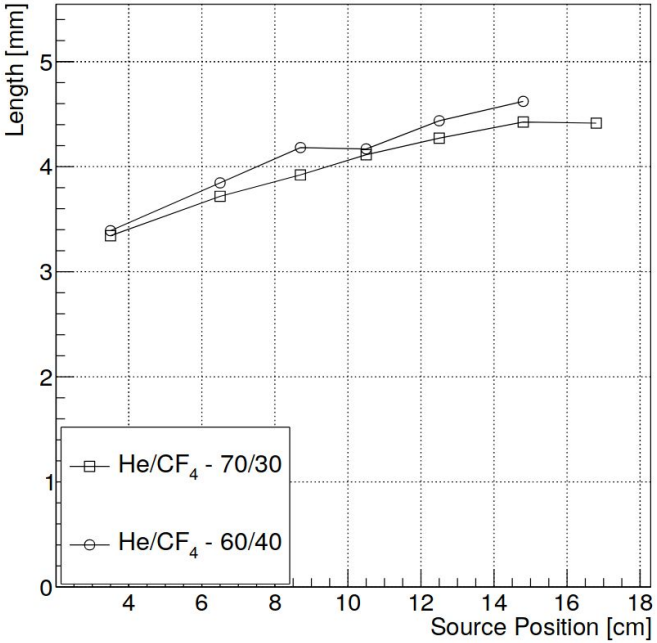
Spot Number (integral of the polya fit)

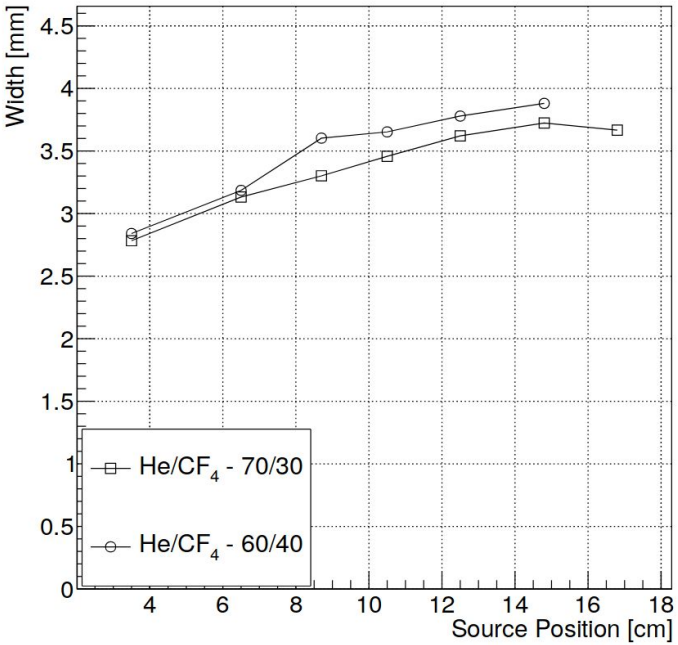


It’s possible to see that the Spot Number seems to be constant of Z.

And the difference between the two gas mixture is the collimator, the 70/30 was taken using a more efficient collimator.

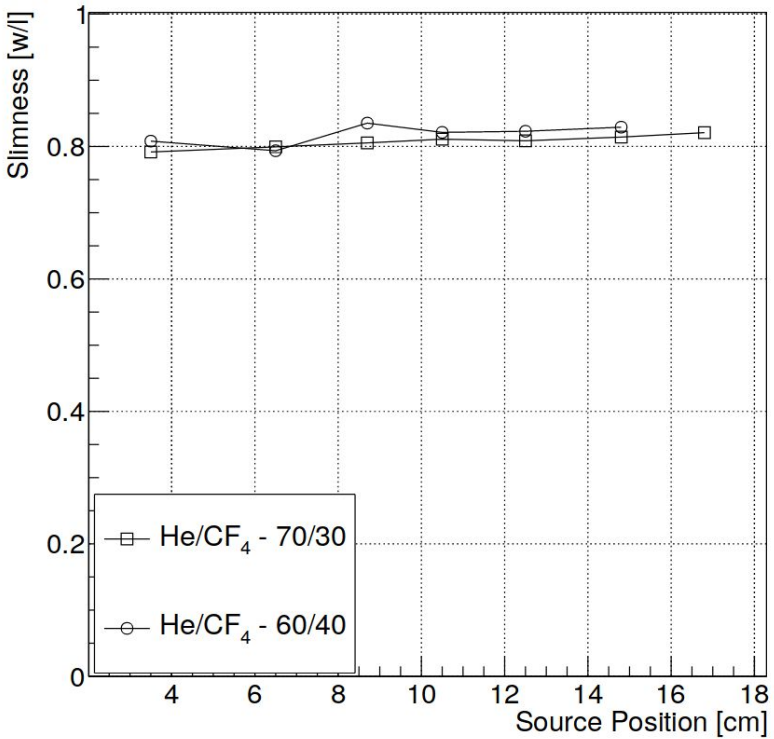
Length and Width





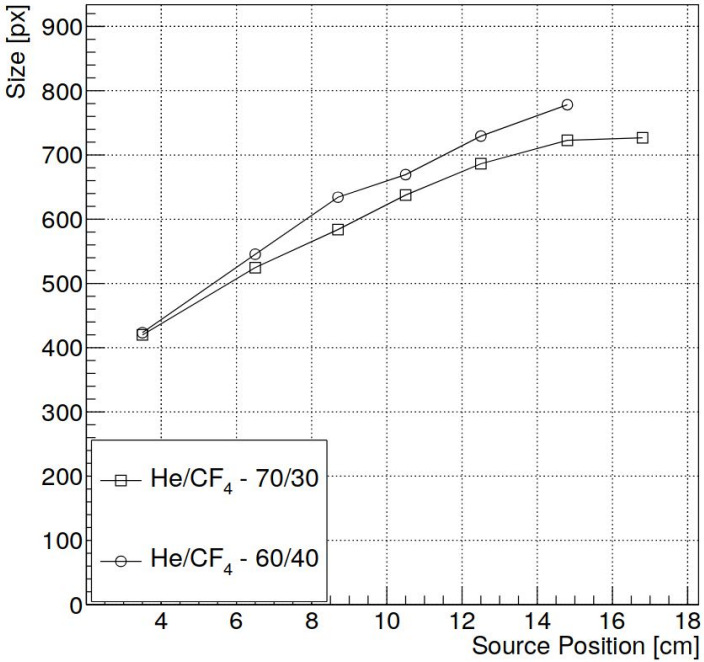
As expected Length and Width increases when going far from the GEM, due to the diffusion effect.

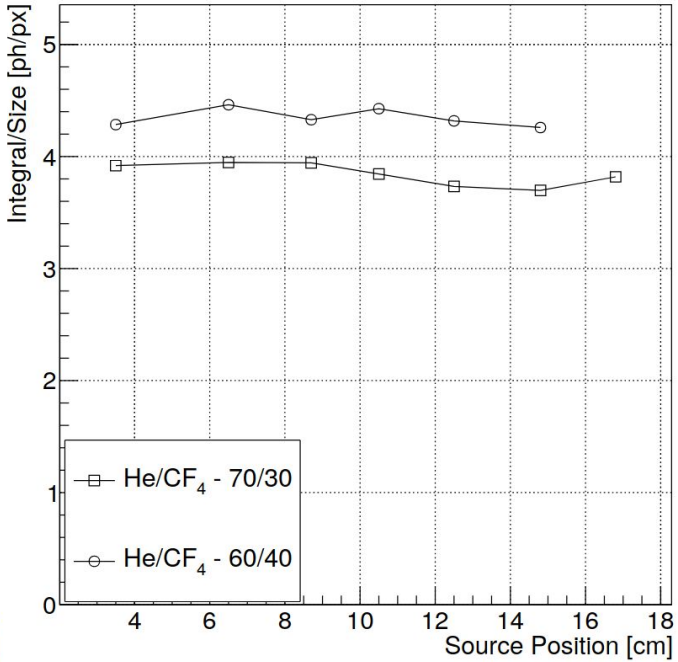
Slimness



This plot shows for both gas mixtures that the slimness of the ^{55}Fe spot keeps constant which seems to indicate that the going to 70/30 wouldn't change the 'roundness' of the particle.

Integral/Size and Size





Also the Size increases when far from the GEM. When looking to the ratio between Integral and Size, it possible to see a constant value, but the 60/40 mixture seems to have more number of photons per pixel (area).

Z Scan + VGEM Scan

(for 60/40 - 440 V and 460 V)

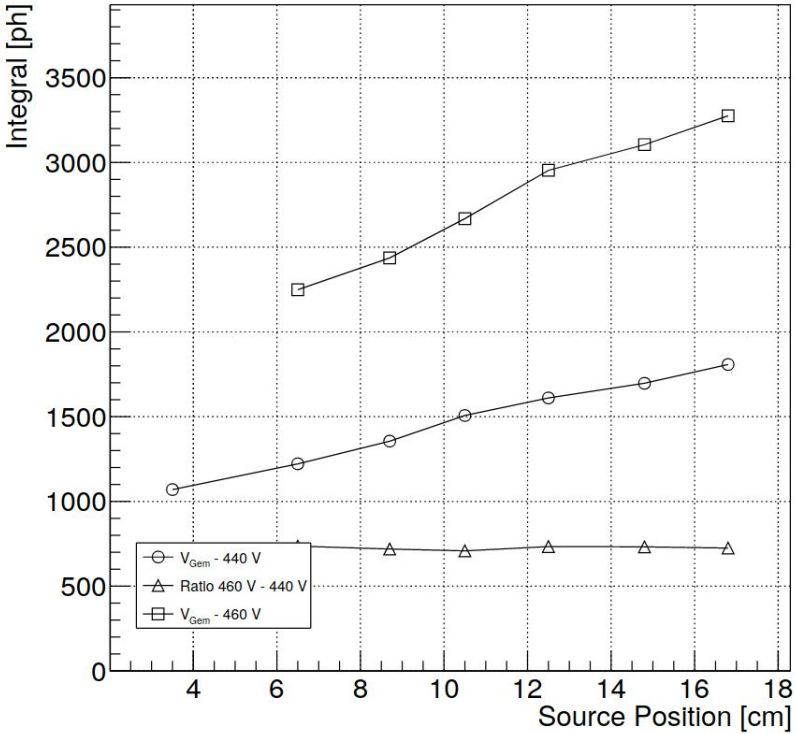
Integral

Integral/Size

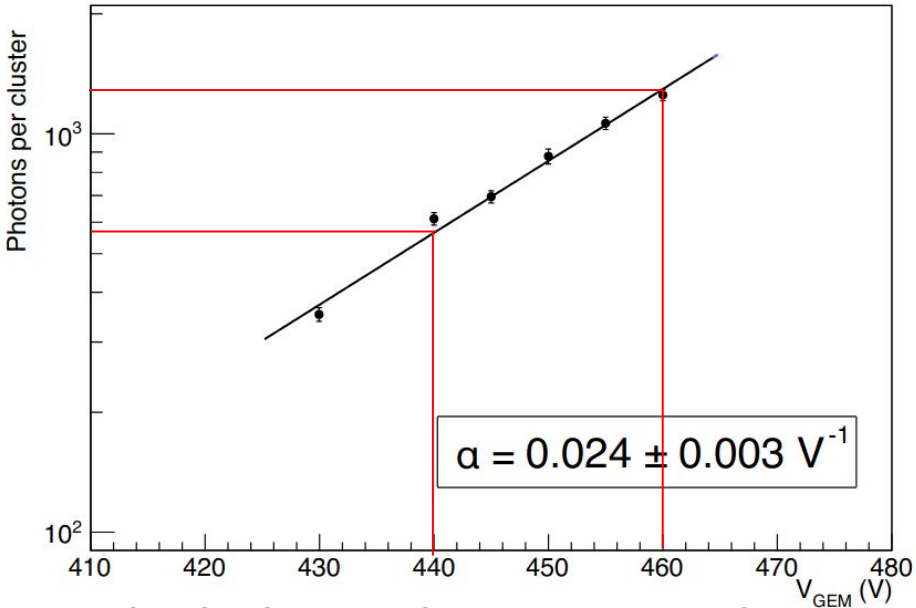
Sigma and Amplitude/Sigma

$Slimness_{W/L}$ / $Slimness_{Sigma}$

Integral



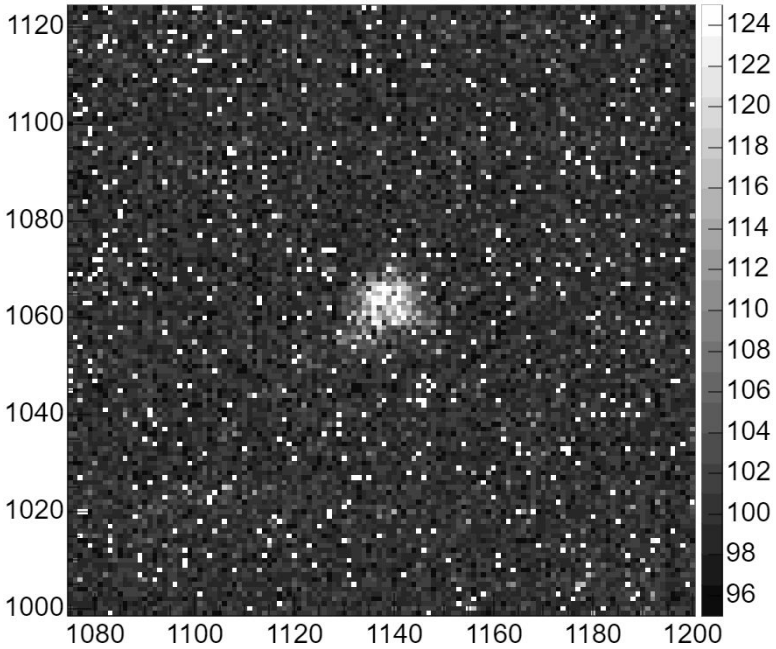
Plot extracted from the published paper



From both plots we have a **factor 2** between 440 V and 460 V and the ratio between the two GEM voltages is constant.

As we have the same slope from both GEM voltages the integral increasing by Z doesn't seems to be due to a saturation effect.

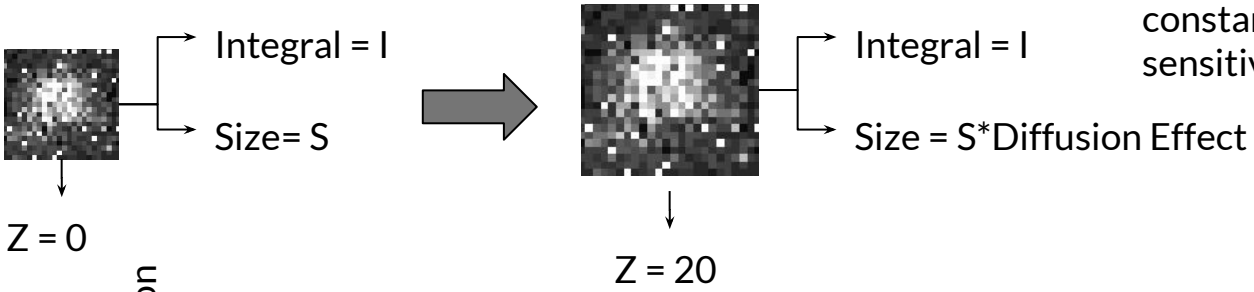
New Variables



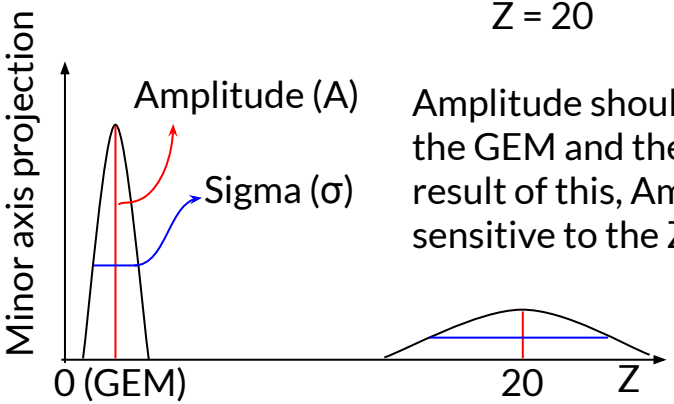
Let's assume the ‘red ellipse’ as the boundaries of the cluster:

- **Amplitude** is defined as peak of the intensities looking at the projection of the cluster in one axis, after a gaussian fit;
- **Sigma** is defined as the rms of the the gaussian fit in the same axis.

Integral and Size vs Z

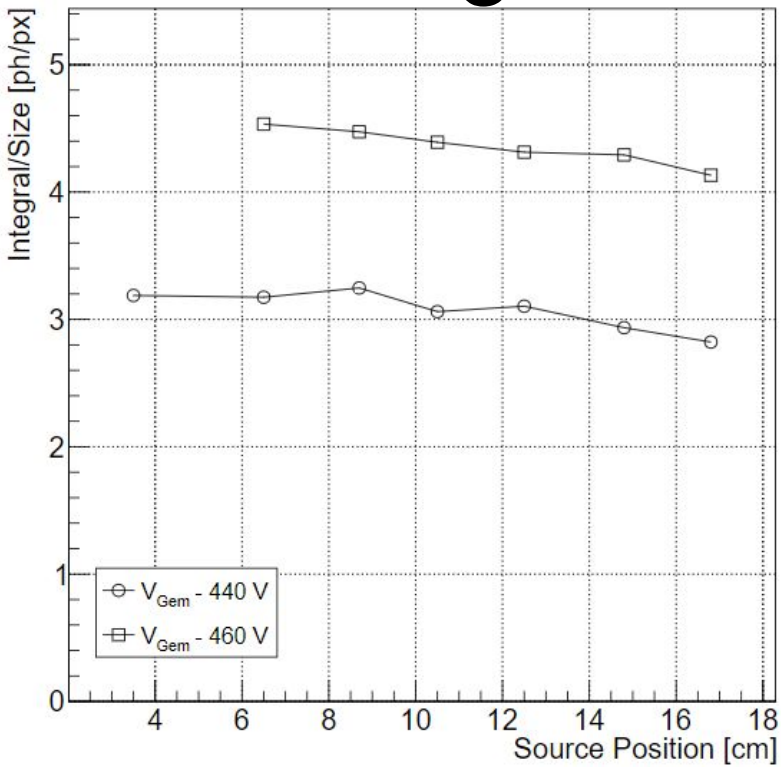


Integral/Size shouldn't be constant and also be sensitive to the Z.



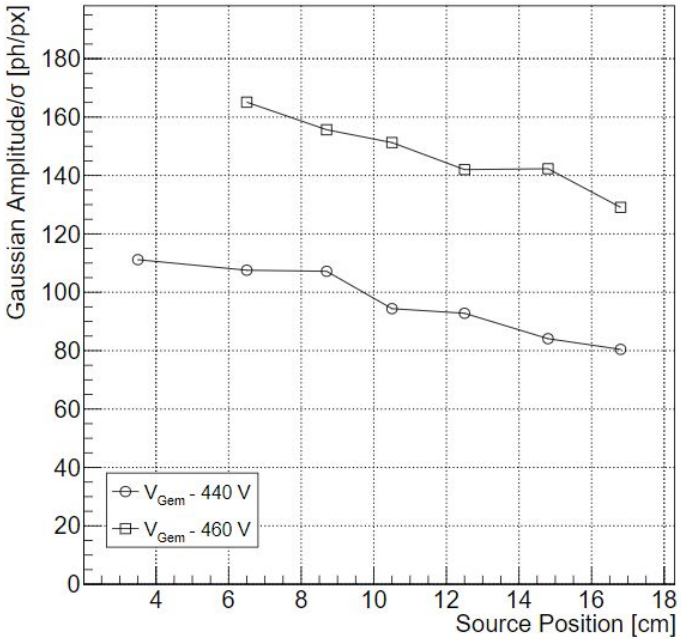
Amplitude should decrease when going far from the GEM and the sigma should increase, as a result of this, Amplitude/Sigma should be a very sensitive to the Z.

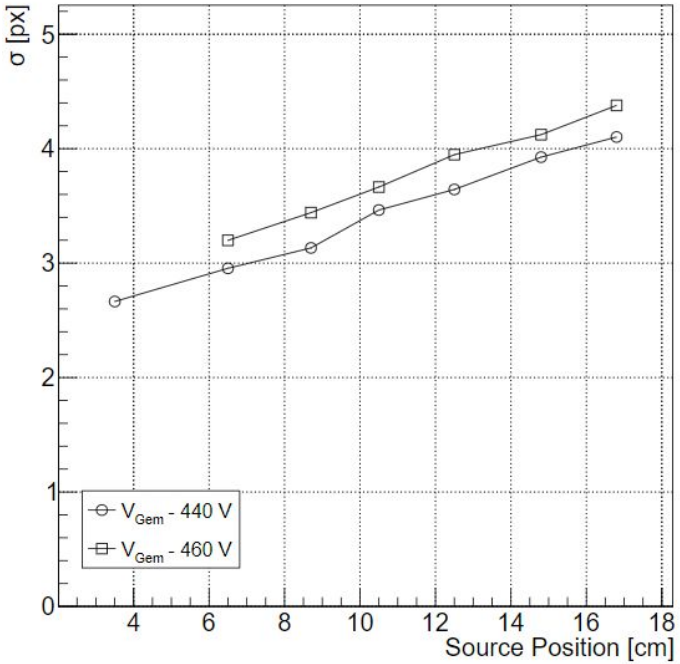
Integral/Size



It is possible to see a little slope, but we know that the Integral is not constant fact that decrease the sensitive to Z.

Amplitude/Sigma and Sigma





Also the Size increases when far from the GEM. When looking to the ratio between Integral and Size, it possible to see a constant value, but the 60/40 mixture seems to have more number of photons per pixel (area).

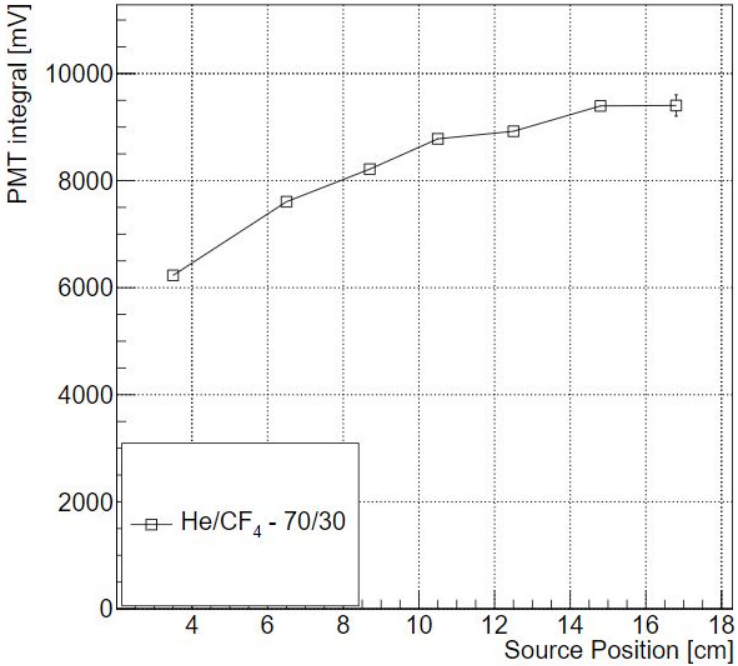
PMT Analysis

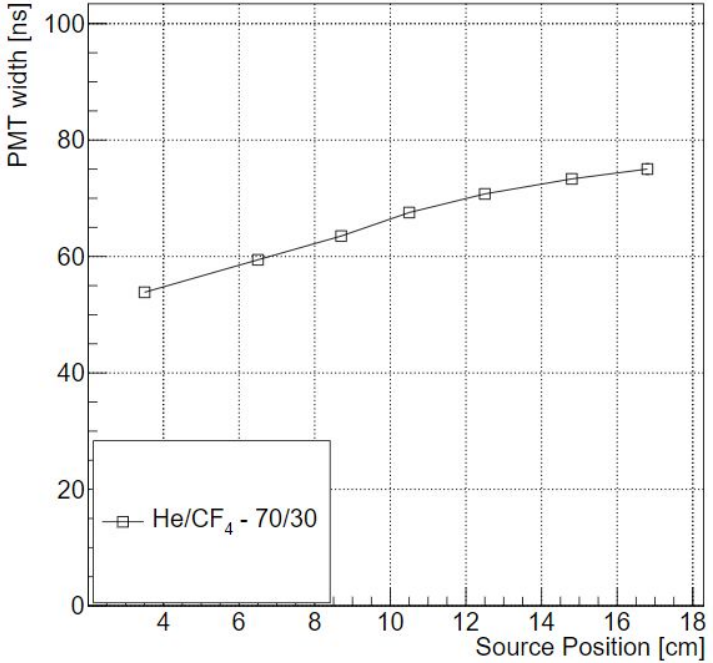
(for 70/30 - 460 V)

Integral and Width

Correlation between
Camera Width and PMT Width

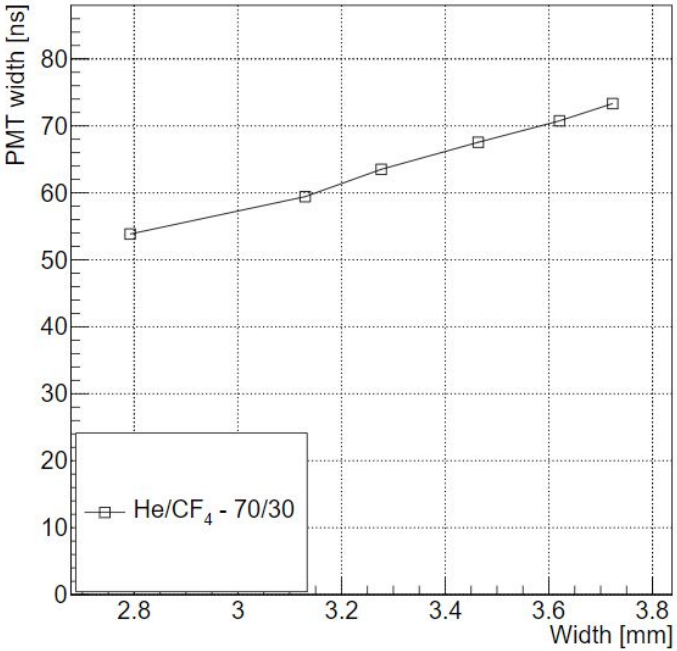
PMT Integral and Width

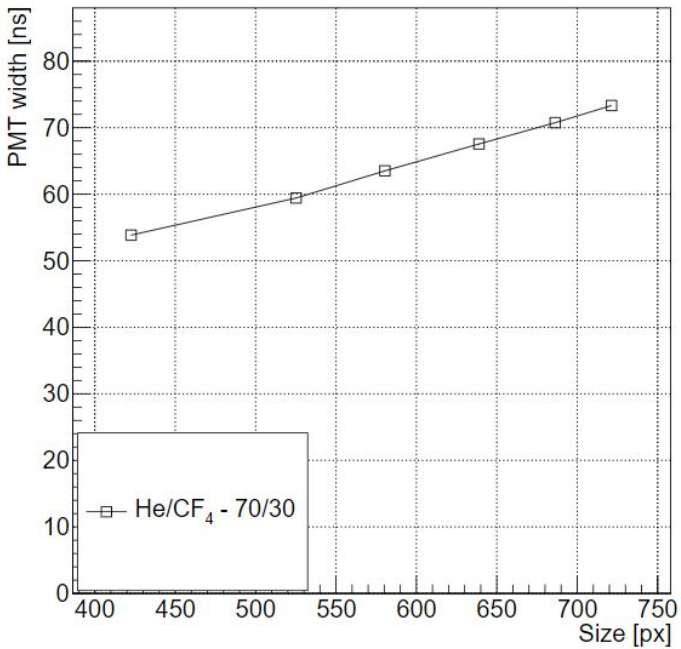




PMT variables are showing the same behavior observed on the camera variables, that is the increasing of the energy when going for from the GEM.

Correlation between Camera Width and PMT Width





Each point is one position of the source on Z

Conclusions

- There is coherence between Camera variables and PMT variables;
- The integral is bigger using 60/40 than 70/30;
- The results here are coherence with the published paper;
- And we still need to understand the reason of the increasing on the integral over Z.

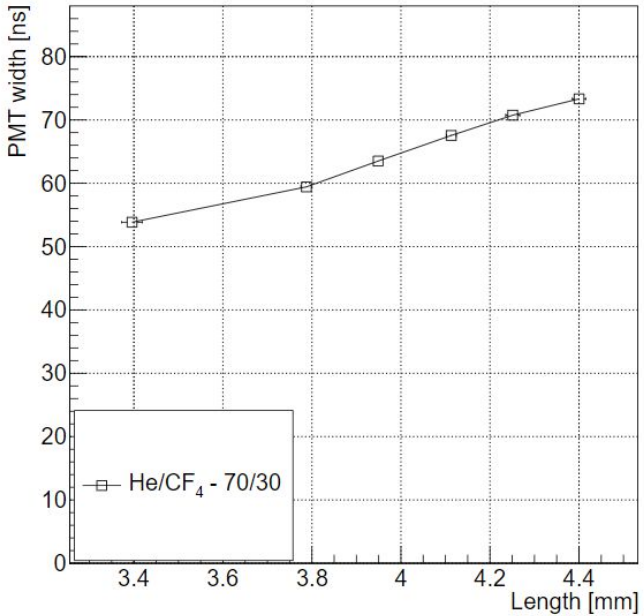
The End

Backup

Width and Length

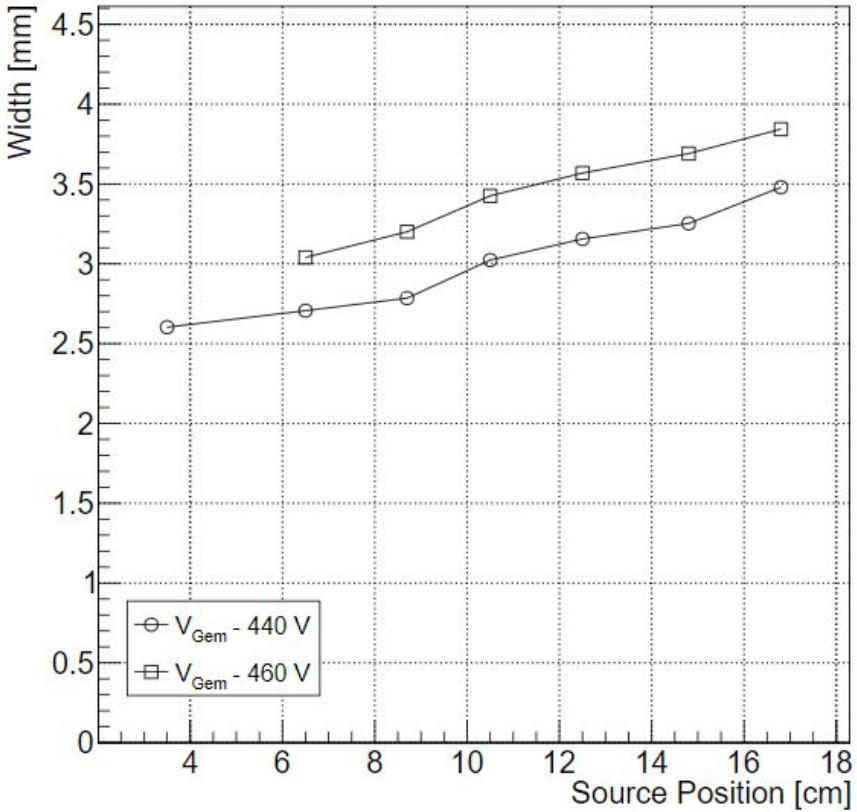
Amplitude

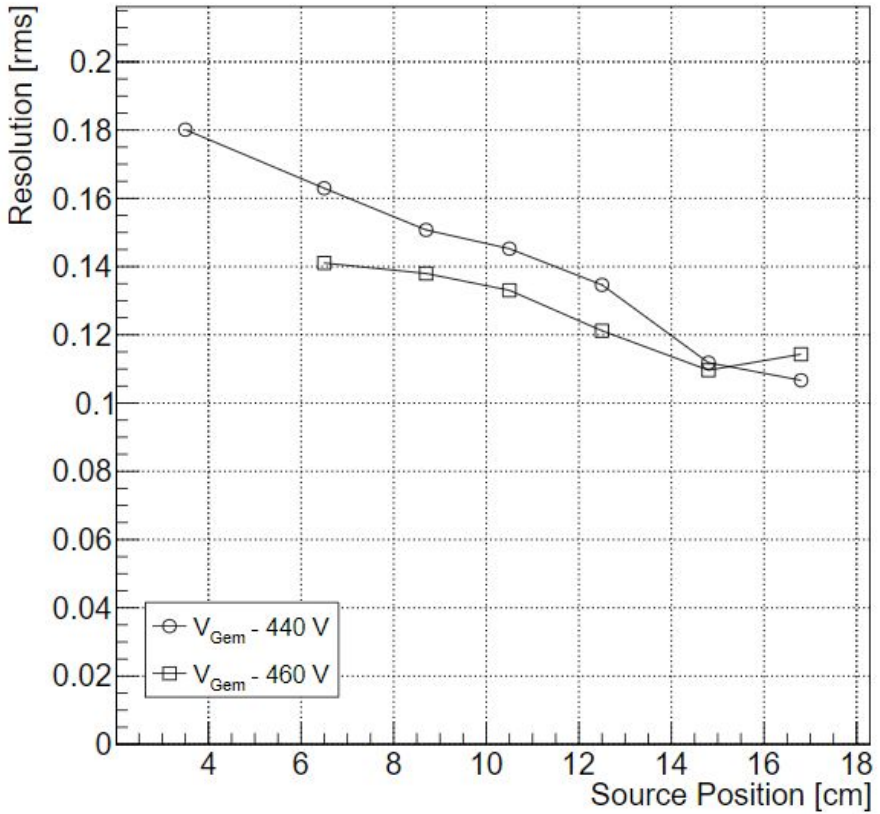
Correlation between Camera Width and PMT Width



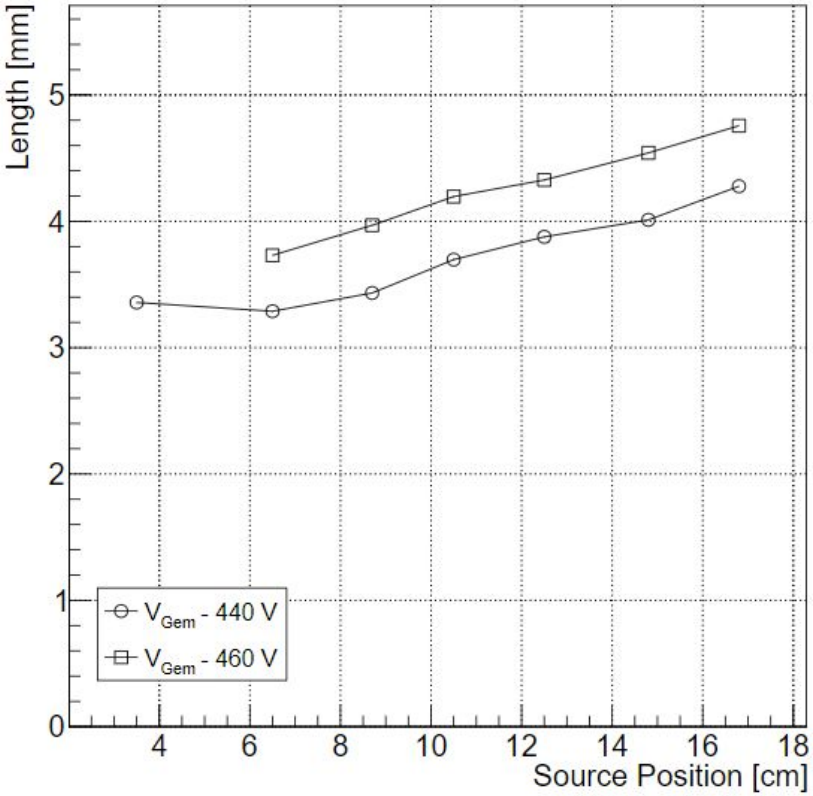
Each point is one position of the source on Z

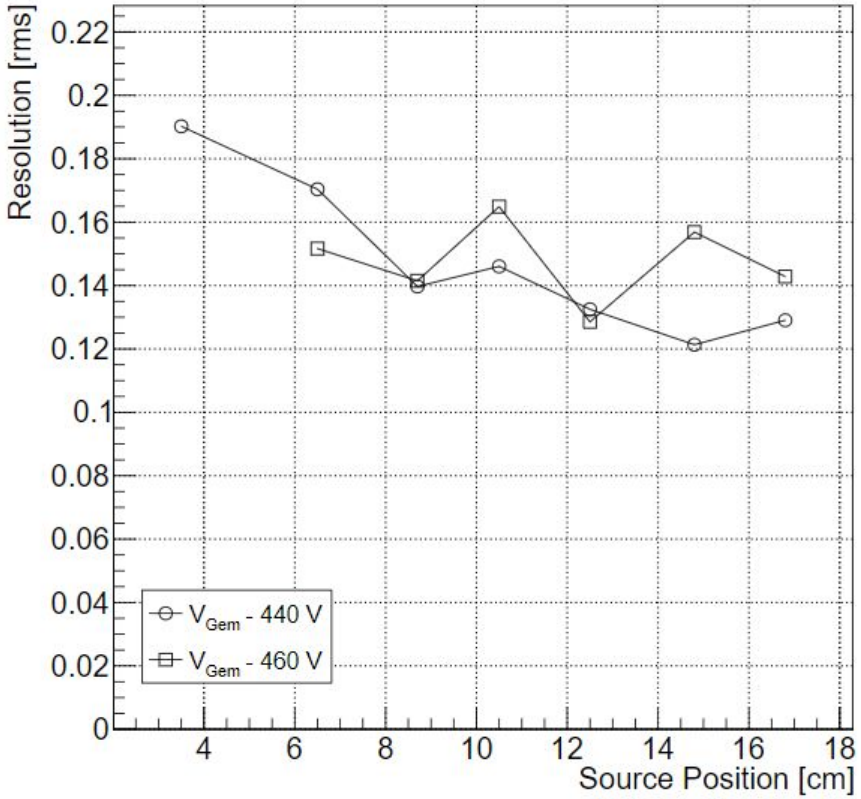
Width[minor axis] for different VGEM 440 vs 460



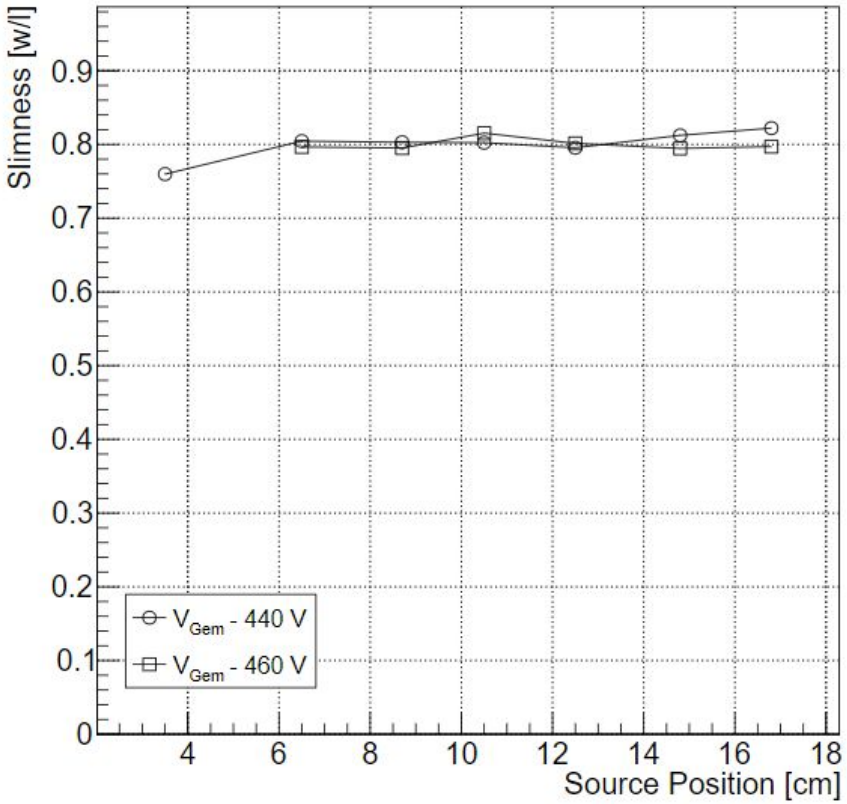


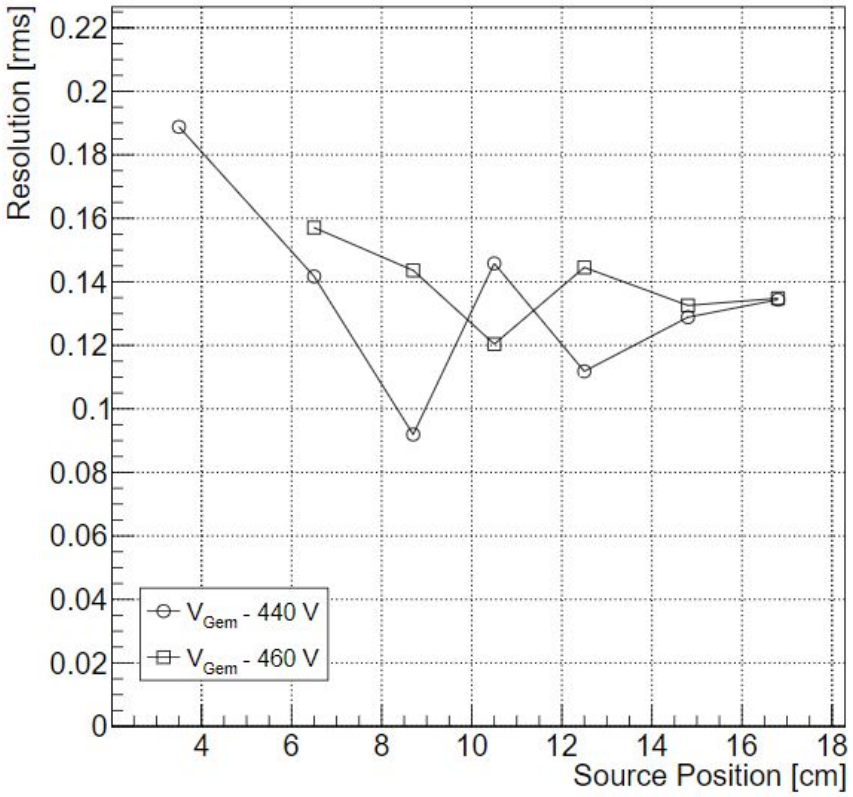
Length[major axis] for different VGEM 440 vs 460



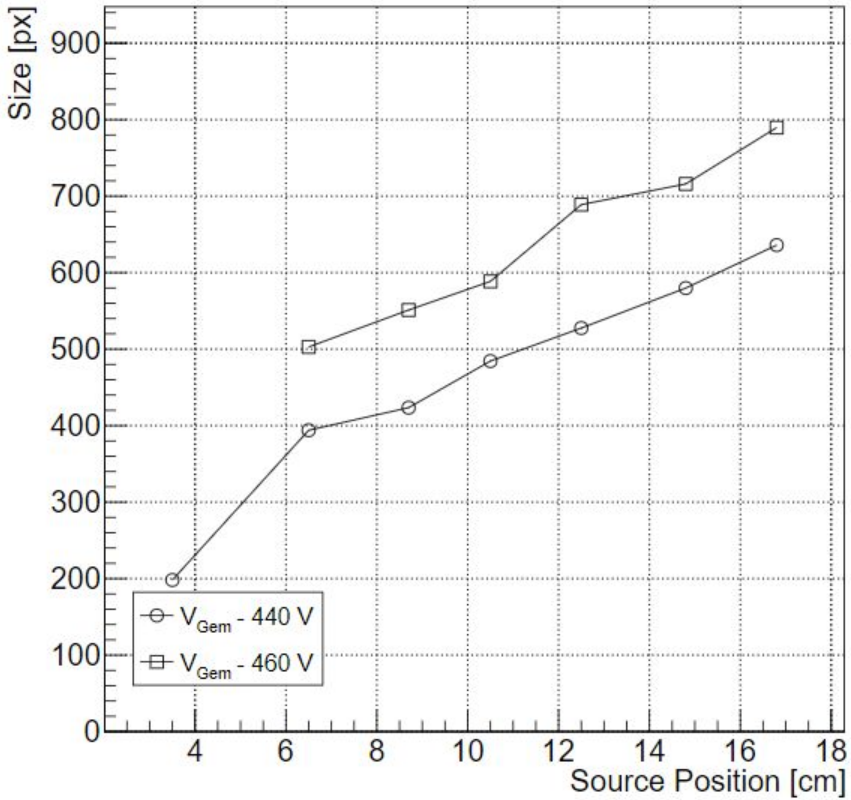


Slimness for different VGEM 440 vs 460

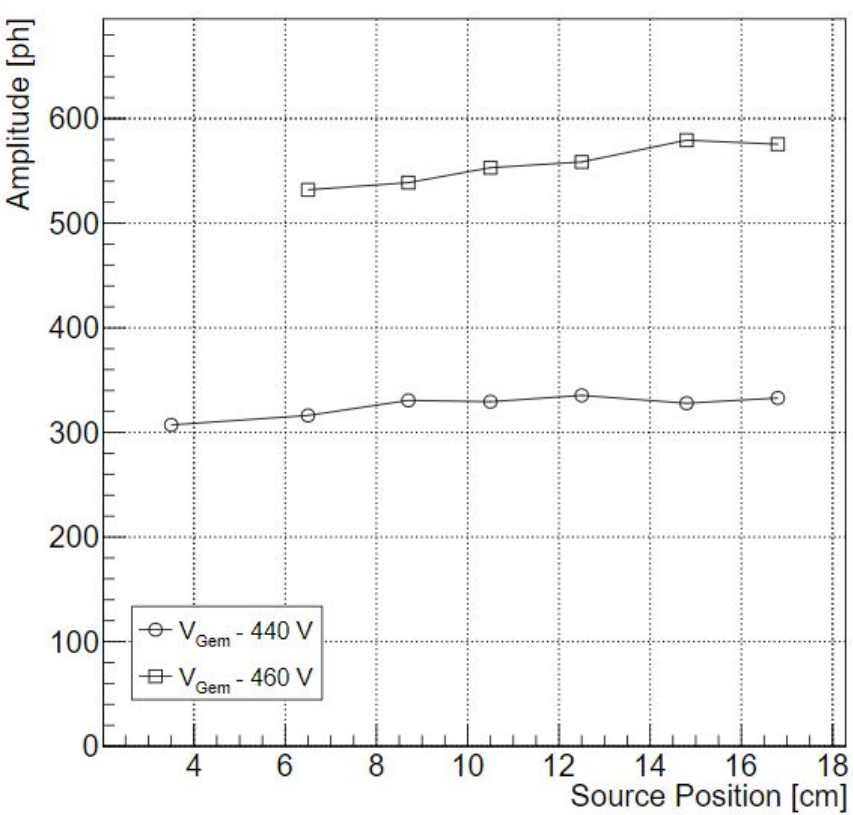




Size for different VGEM 440 vs 460



Amplitude for different VGEM 440 vs 460



Amplitude/Size for different VGEM 440 vs 460

Size = (width + length)/2