

Fe55 MC-data comparison (diffusion parameter scans)

F. Petrucci, P. Meloni
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Standard digitization parameters

events per run= 100 events
detector dimensions = 346mm x 346mm
pixels = 2304 x 2304
sensor_size = 14.976 [mm]
pedestal = run 4432

beta= 1e-5
A= 1
z_vox_dim=0.1 mm

Saturation parameters

abs_len= 1000mm
z_gem = 5, 25, 35, 45 cm

GEM1_HV= 440V
GEM2_HV= 440V
GEM3_HV= 440V

Transversal diffusion par.

diff_const_sigma0T= 0.1225 mm² (350 μm)
diff_coeff_T= 0.01232 [mm/sqrt(cm)]² for 1 kV (110 μm/sqrt(cm))

diff_const_sigma0L= 0.0676 mm² (260 μm)
diff_coeff_L= 0.00978 [mm/sqrt(cm)]² for 1 kV (99 μm/sqrt(cm))

ion_pot = 0.0462 keV

photons_per_el = 0.07
counts_per_photon = 2.,
factor_camera_aperture = 0.95,

Reconstruction code version

branch: autumn 21
tag: winter22

Fe55 data

run = 4432-4469 (GEM1HV=440V , z= 5, 25, 35, 45, 49* cm)
pedestal 4432

* z = 49 cm not used because not able to see the signal... (same cuts as 45 cm)

Cuts on both data e MC

sc_integral > 600 and sc_integral<20000 and abs(sc_xmean-1152)<250 and abs(sc_ymean-1152)<250 and sc_tgausssigma/sc_lgausssigma>0.8

Diffusion parameter scans

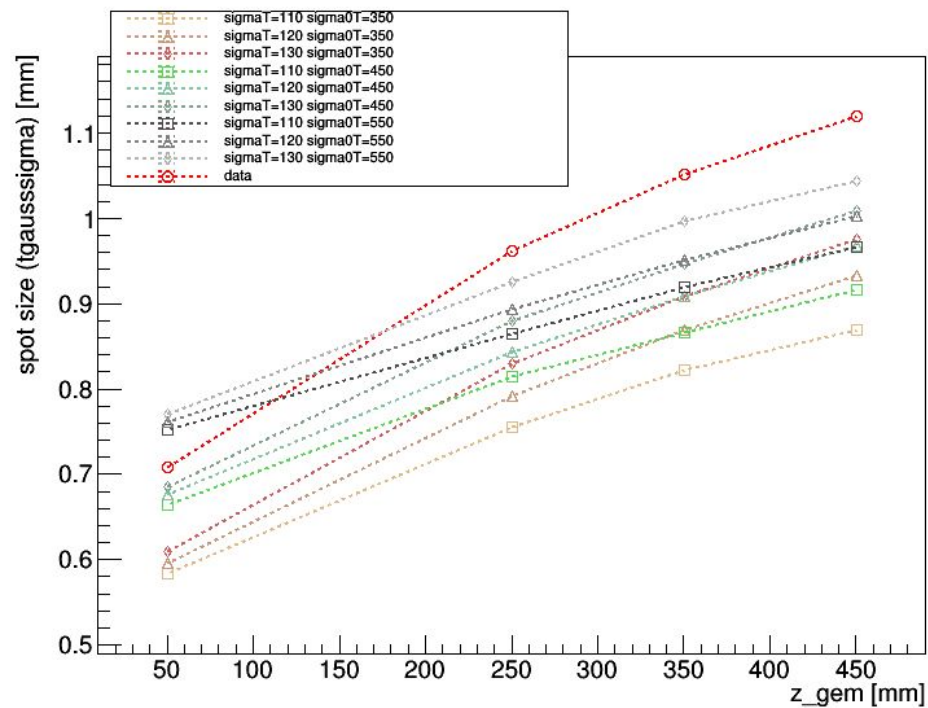
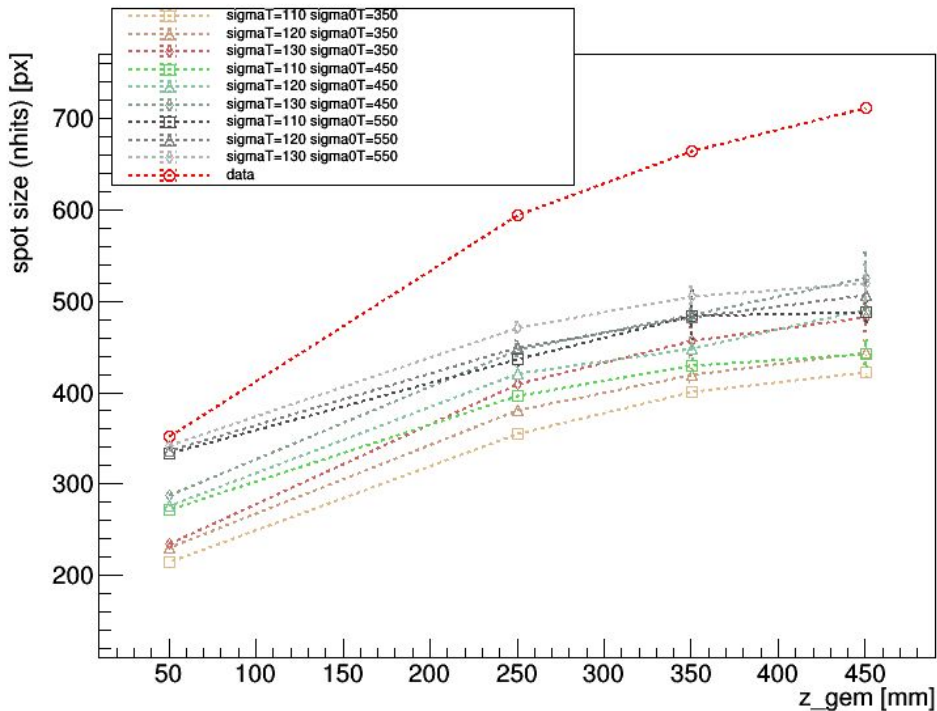
sigmaT = 110, 120, 130 μm/sqrt(cm)
sigma0T = 350, 450, 550 μm

Computing time

Digitization: 1-3 s per event (on the queue: ~15 minutes for 45 points with 100 events each).

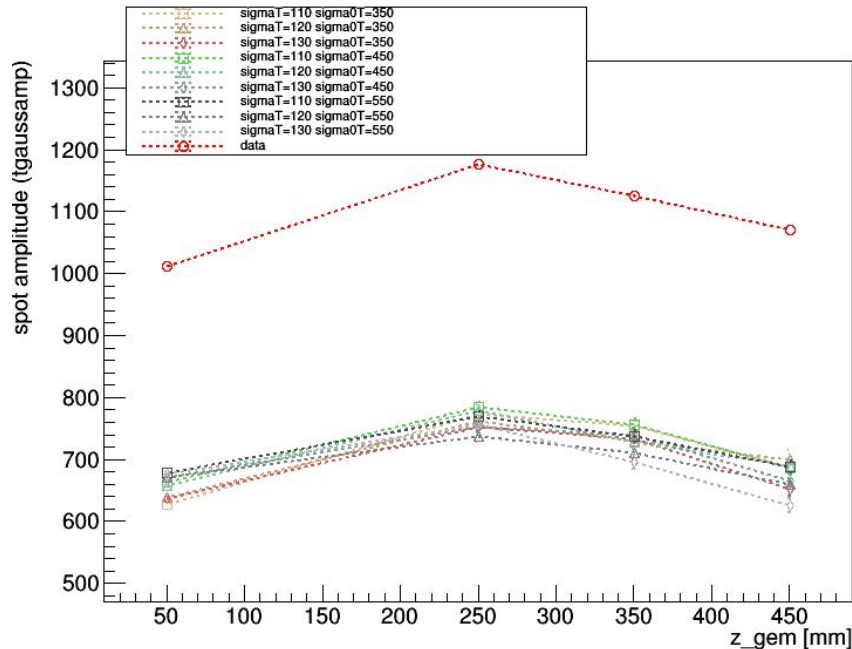
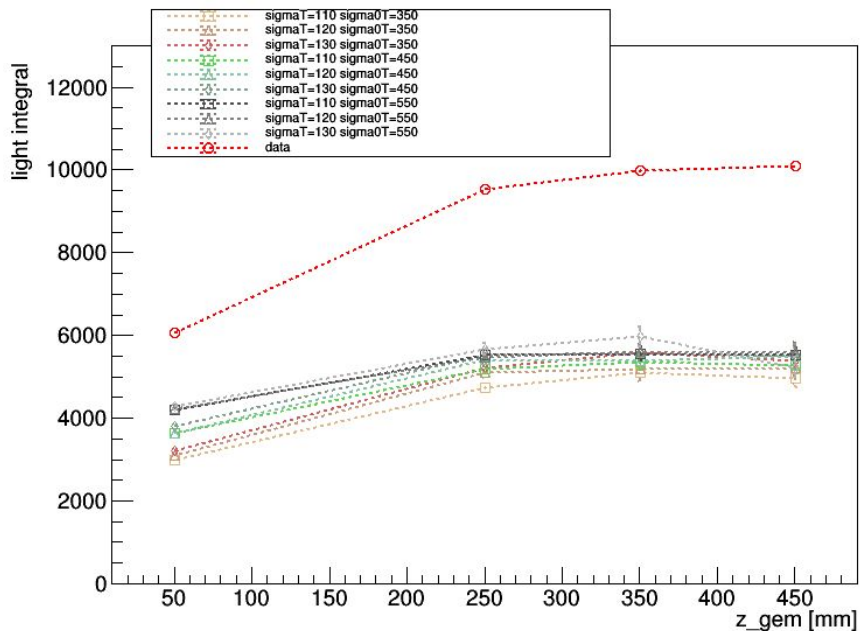
Reconstruction: (on the queue: ~20 minutes for 45 points with 100 events each).

z scan (different T diff parameters)



Best diffusion parameters (light grey points):
 $\sigma_T = 130 \mu\text{m}/\sqrt{(\text{cm})}$ and **$\sigma_{0T} = 550 \mu\text{m}$**

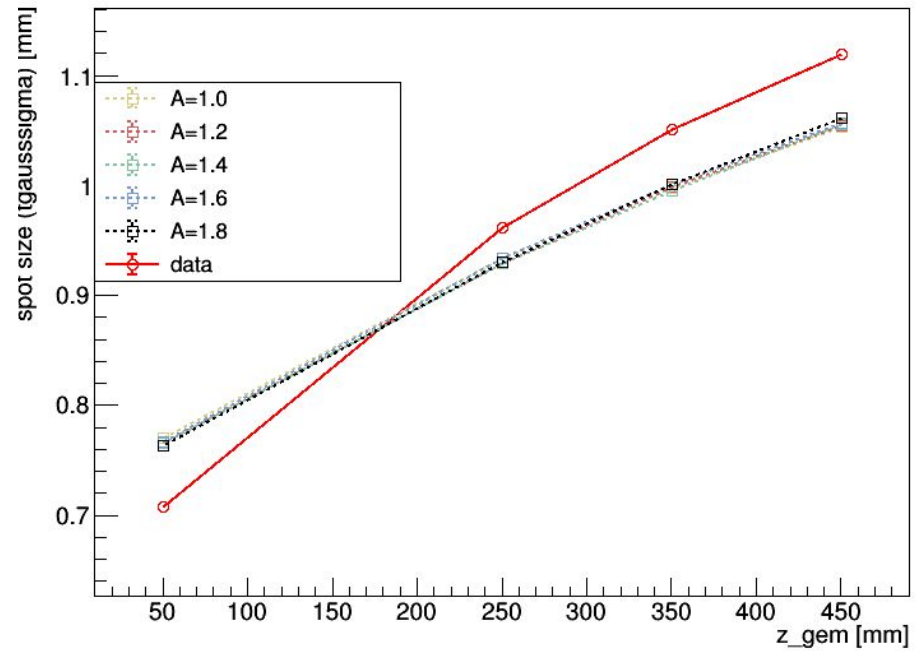
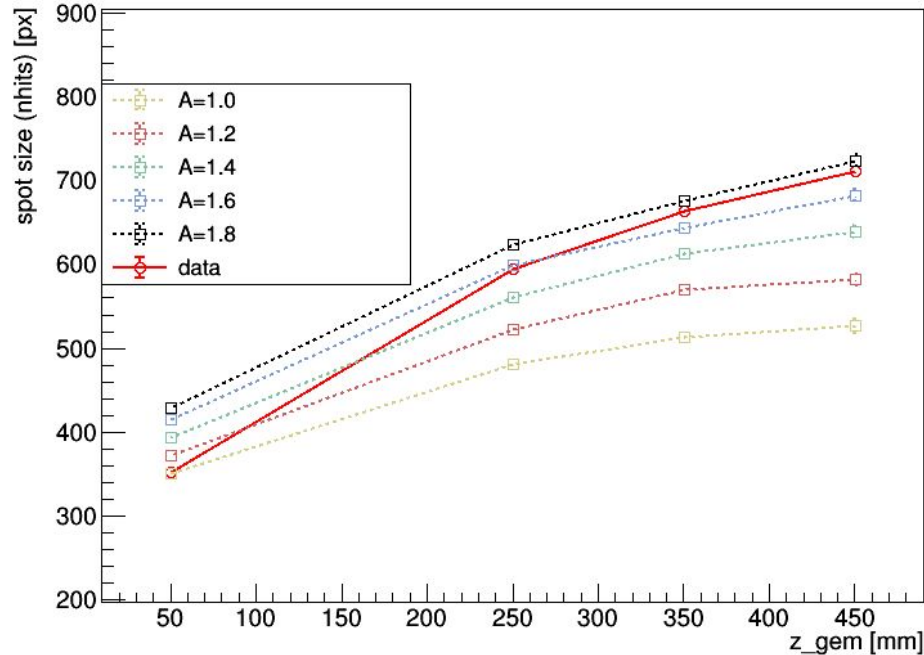
z scan (different T diff parameters)



As expected, no great improvements on integral and spot amplitude

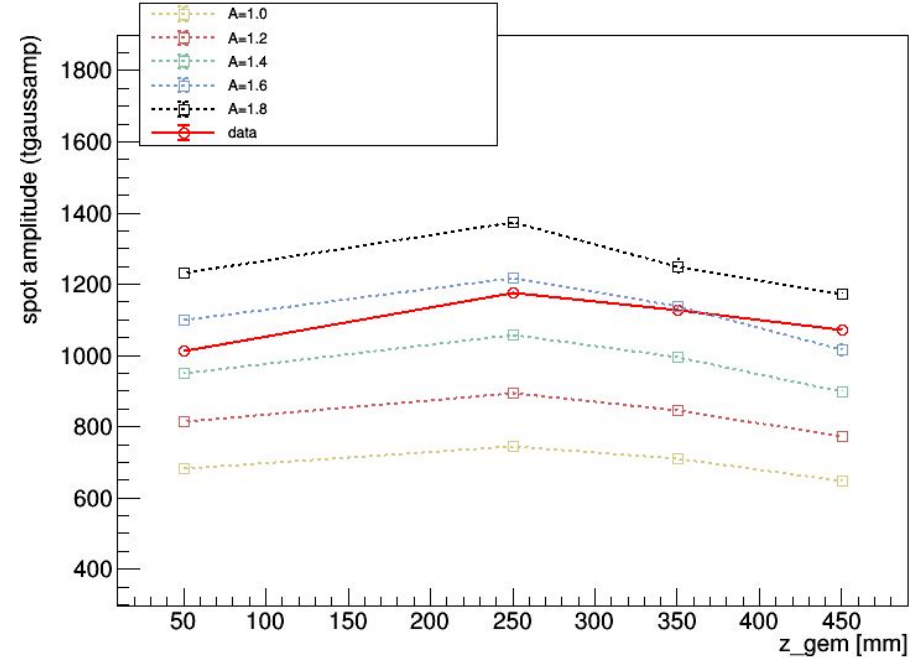
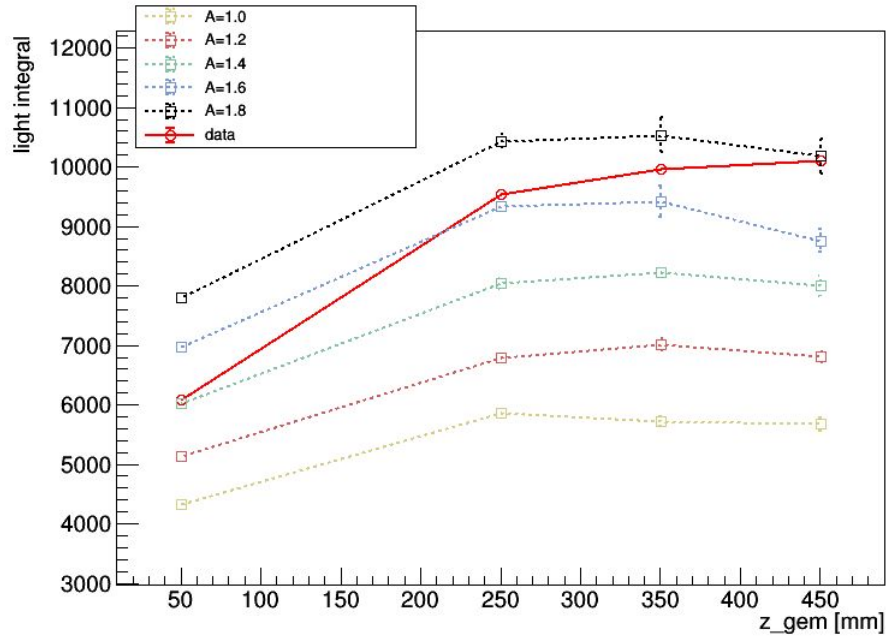
Improving integral by varying “A”
with $\sigma_T = 130 \mu\text{m}/\sqrt{\text{cm}}$
 $\sigma_{0T} = 550 \mu\text{m}$

z scan (different A)



Improvements on nhits. Best parameter: $A = 1.4-1.6$

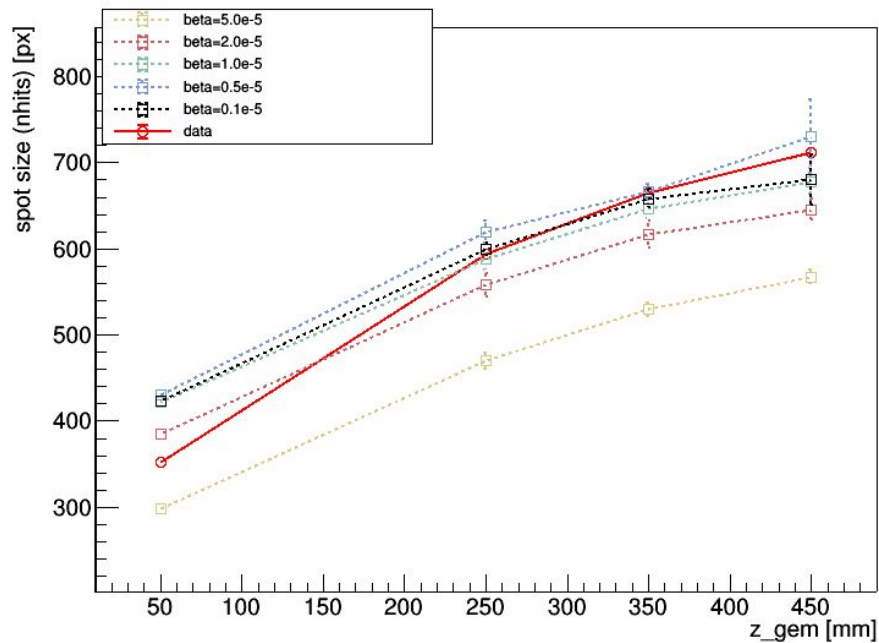
z scan (different A)



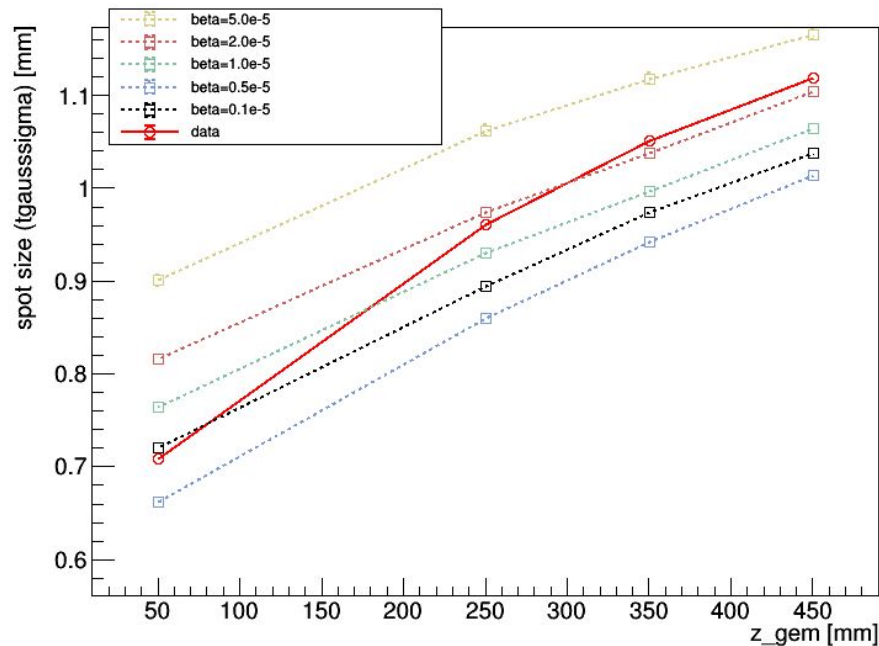
Best parameter: A=1.6

Trying by varying “beta”
with $\sigma_T = 130 \mu\text{m}/\sqrt{\text{cm}}$
 $\sigma_{0T} = 550 \mu\text{m}$
 $A = 1.6$

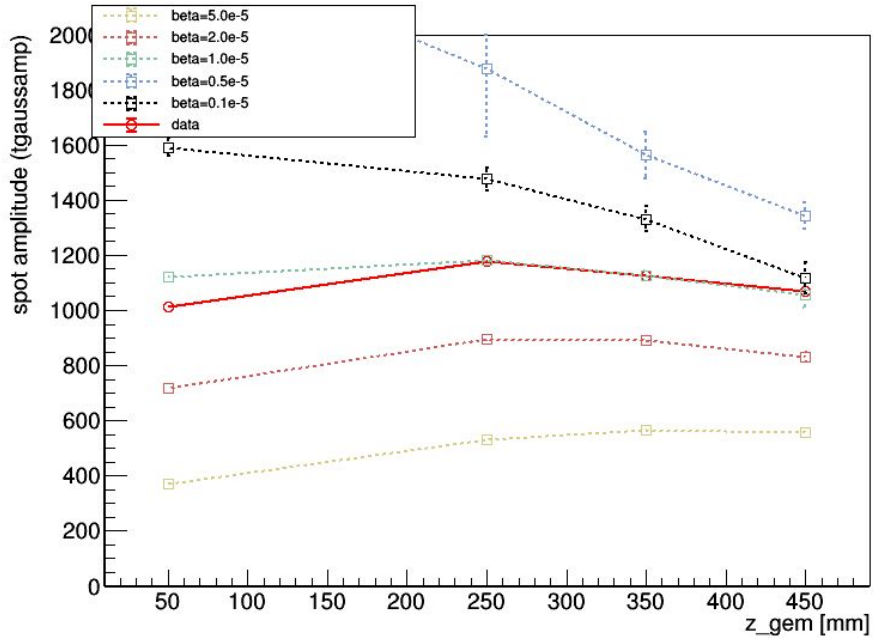
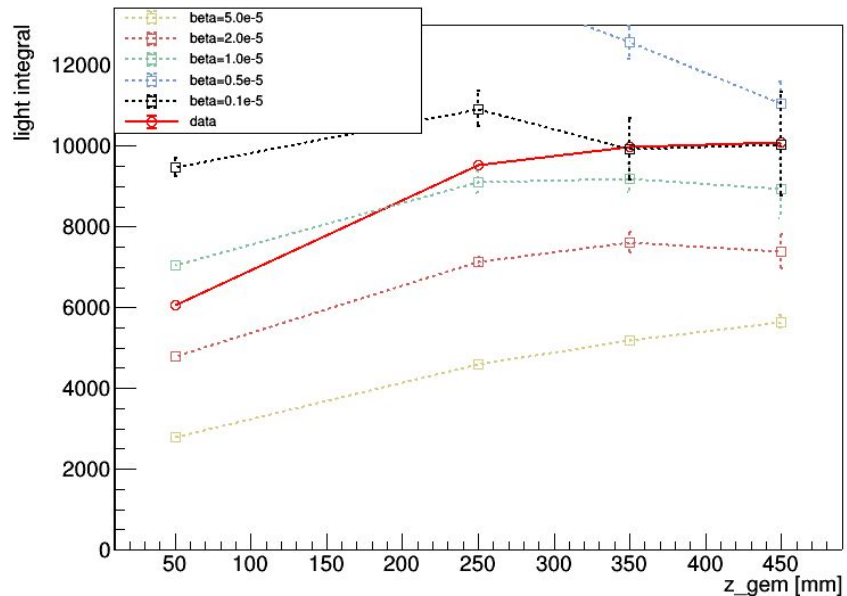
z scan (different beta)



Best parameter: $\beta = 1.0 \times 10^{-5}$ (standard value)



z scan (different beta)

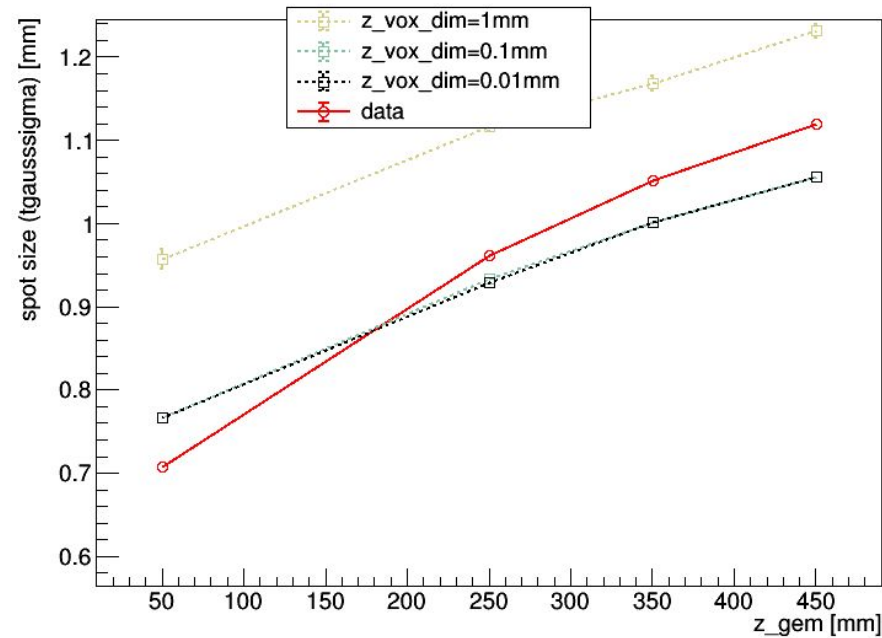
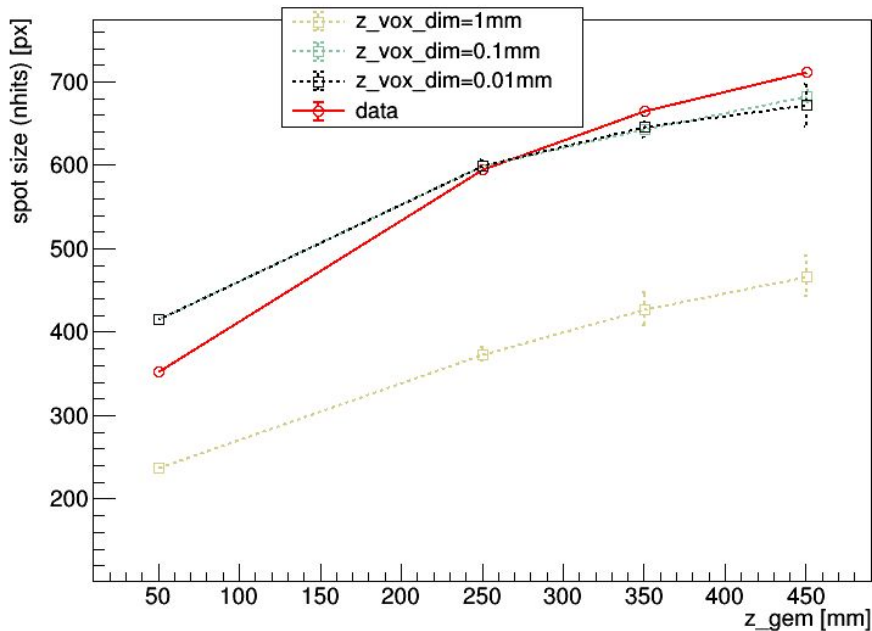


Best parameter: beta=1.0e-5 (standard value)

Trying by varying z_vox_dim
with $\sigma_T = 130 \mu\text{m}/\sqrt{\text{cm}}$
 $\sigma_{0T} = 550 \mu\text{m}$
 $A = 1.6$
($\beta = 1.0e-5$)

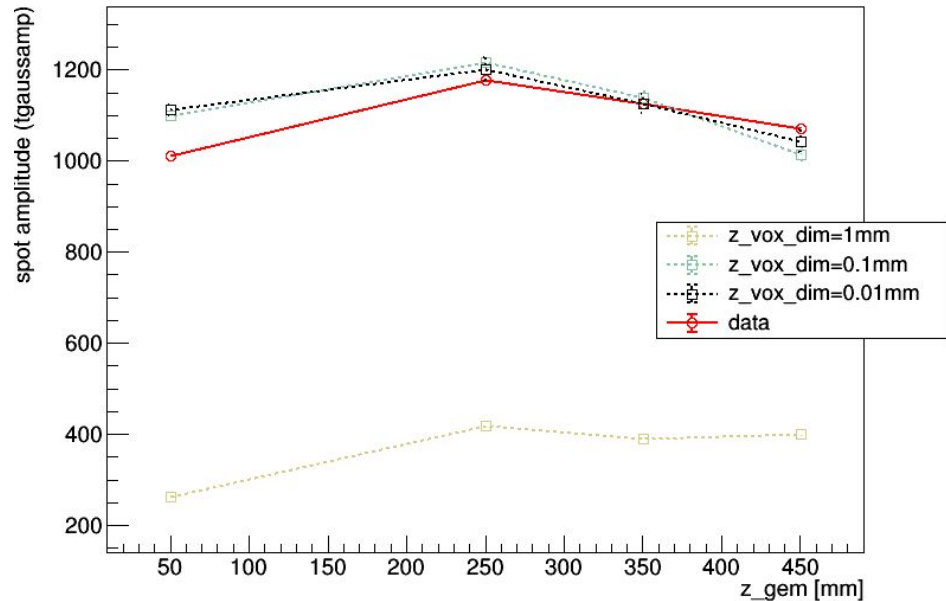
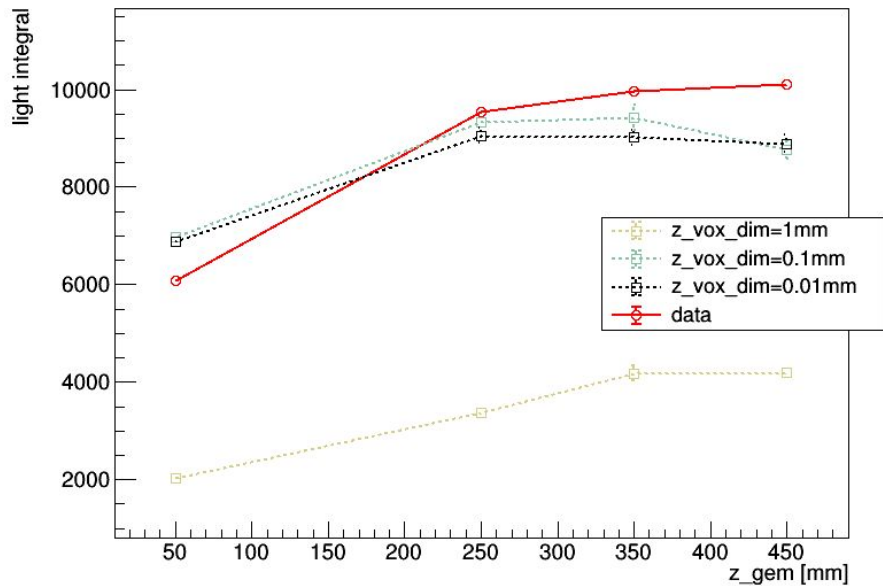
Note: using z_vox_dim smaller than 0.001 mm requires 16 GB of RAM (so stopping at 0.01 mm)

z scan (different z_vox_dim)



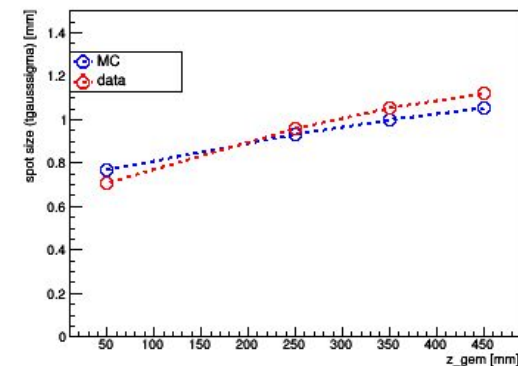
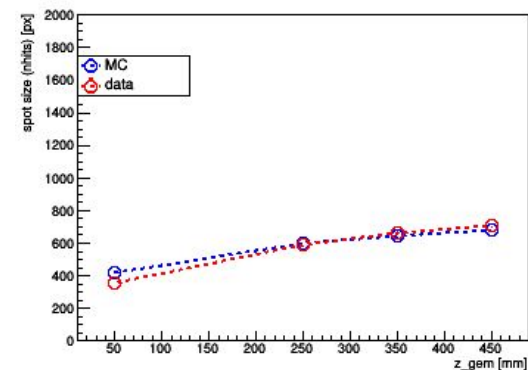
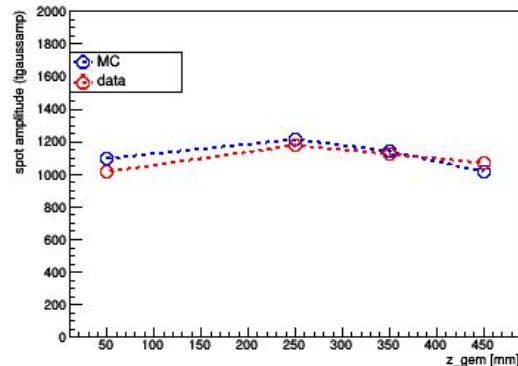
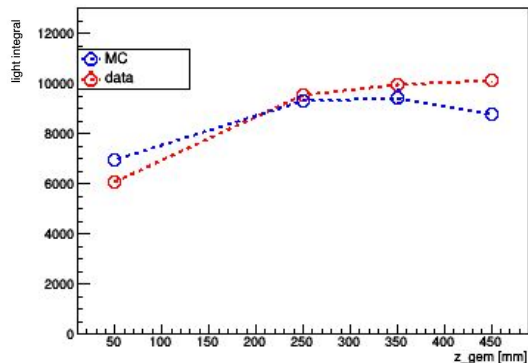
Best parameter: 0.1 mm (standard value)

z scan (different z_vox_dim)



Best parameter: 0.1 mm (standard value)

Final result



Digitization parameters

events per run= 100 events
 detector dimensions = 346cm x 346cm
 pixels = 2032 x 2032
 pedestal = run 4432

beta= 1e-5

A= 1.6

z_vox_dim=0.1 mm

abs_len= 1000mm

z_gem = 5, 25, 35, 45 cm

GEM1_HV= 440V

GEM2_HV= 440V

GEM3_HV= 440V

diff_const_sigma0T= 0.3025 mm² (550 μm)

diff_coeff_T= 0.0169 [mm/sqrt(cm)]² (130 μm/sqrt(cm))

diff_const_sigma0L= 0.0676 mm² (260 μm)

diff_coeff_L= 0.00978 [mm/sqrt(cm)]² (99 μm/sqrt(cm))

ion_pot = 0.0462 keV

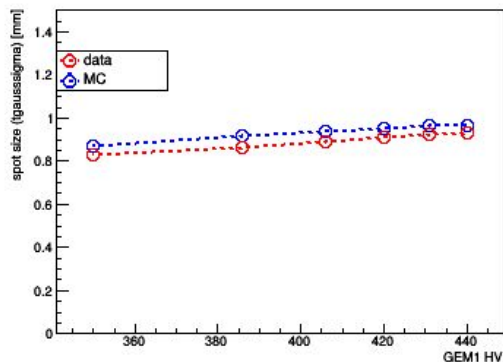
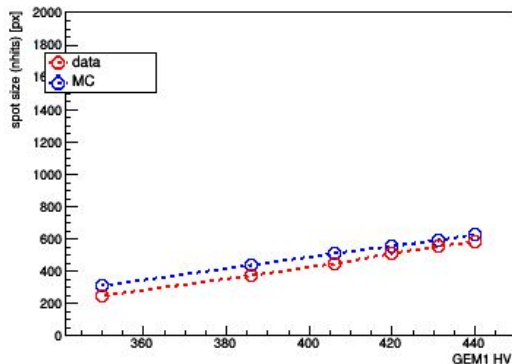
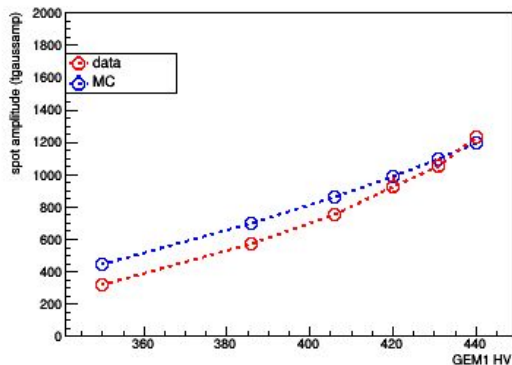
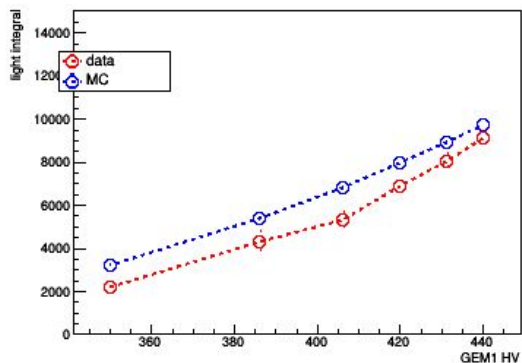
photons_per_el = 0.07

counts_per_photon = 2.,

factor camera_aperture = 0.95,

Looking at some HV scans
with $\sigma_T = 130 \mu\text{m}/\sqrt{\text{cm}}$
 $\sigma_{0T} = 550 \mu\text{m}$
 $A = 1.6$
($\beta = 1.0 \times 10^{-5}$, $z_{\text{vox_dim}} = 0.1 \text{mm}$)

HV scan @ 25cm



Digitization parameters

events per run= 100 events
detector dimensions = 346cm x 346cm
pixels = 2032 x 2032
pedestal = run 4432

beta= 1e-5

A= 1.6

z_vox_dim=0.1 mm

abs_len= 1000mm

z_gem = 25 cm

GEM1_HV= 350, 386, 420, 431, 440V

GEM2_HV= 440V

GEM3_HV= 440V

diff_const_sigma0T= 0.3025 mm² (550 μm)

diff_coeff_T= 0.0169 [mm/sqrt(cm)]² (130 μm/sqrt(cm))

diff_const_sigma0L= 0.0676 mm² (260 μm)

diff_coeff_L= 0.00978 [mm/sqrt(cm)]² (99 μm/sqrt(cm))

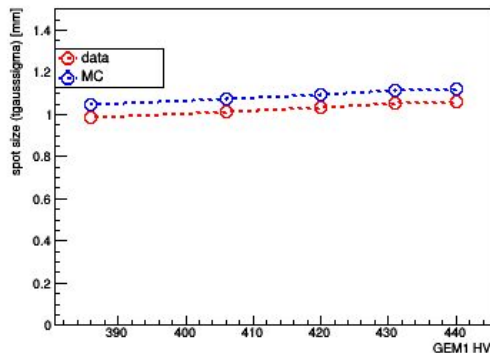
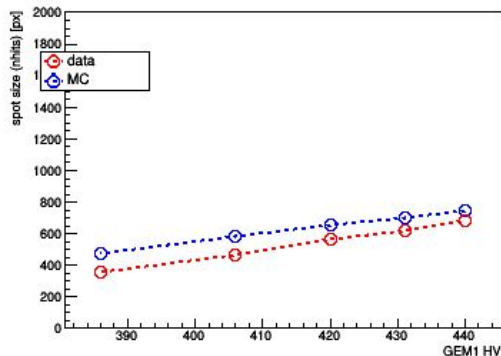
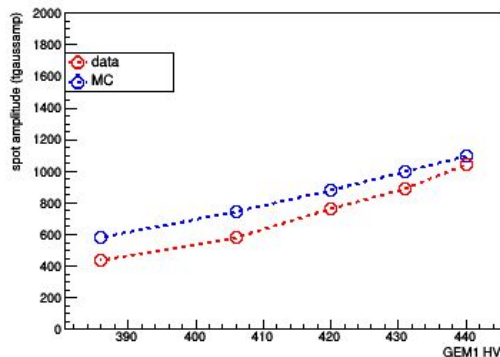
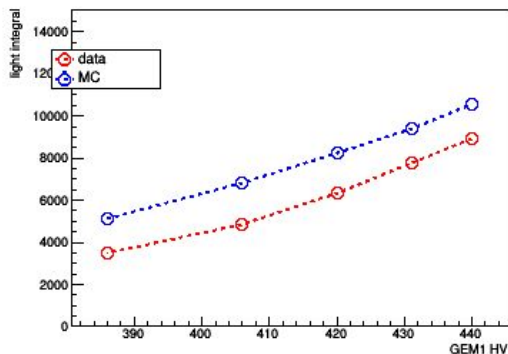
ion_pot = 0.0462 keV

photons_per_el = 0.07

counts_per_photon = 2.,

factor camera_aperture = 0.95,

HV scan @ 45cm



Digitization parameters

events per run= 100 events
detector dimensions = 346cm x 346cm
pixels = 2032 x 2032
pedestal = run 4432

beta= 1e-5

A= 1.6

z_vox_dim=0.1 mm

abs_len= 1000mm

z_gem = 45 cm

GEM1_HV= 386, 420, 431, 440V

GEM2_HV= 440V

GEM3_HV= 440V

diff_const_sigma0T= 0.3025 mm² (550 μm)

diff_coeff_T= 0.0169 [mm/sqrt(cm)]² (130 μm/sqrt(cm))

diff_const_sigma0L= 0.0676 mm² (260 μm)

diff_coeff_L= 0.00978 [mm/sqrt(cm)]² (99 μm/sqrt(cm))

ion_pot = 0.0462 keV

photons_per_el = 0.07

counts_per_photon = 2.,

factor camera_aperture = 0.95,

Possible improvements

- a triple scan (A, beta , z_vox_dim) could help (like the one on diff. parameters). Also to understand how important **z_vox_dim*** is.
- similarly an abs_lenght scan (0.5 m - 1.5 m)

* last time I showed z_vox_dim scans that were changing a lot at A=1, and low diffusion parameters: need to investigate further