

# CYGNO simulation of saturation

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02/11/21

CYGNO simulation meeting

# Simulation of GEM gain + light production

- Single GEM gain for HV @450V from portugues group measurement
- Extraction x Collection efficiency of electrons in GEM1 and GEM2 from F&K measurements
- Light yield: 0.07 photons/electrons
- ORCA Fusion:
  - 2304 x 2304 pixels
  - Camera aperture 0.95
  - Sensor size 14.976 mm
  - Sensor calibration → 1 photon = 2 sensor counts
- Active area: 35 cm x 35 cm
- Distance from the GEM: 20 cm
- Diffusion parameters from <https://arxiv.org/pdf/2007.00608.pdf>
  - sigmaT0 : 350 um, sigmaT : 0.11 mm/sqrt(cm)
  - sigmaL0 : 260 um, sigmaL : 0.099 mm/sqrt(cm)
- Geometry factor of light collection:  $\Omega=1/(4(d+1)*a)^2$ 
  - d = ratio between image size (350 mm) and sensor size (14.976 mm)
  - a = camera aperture (0.95)

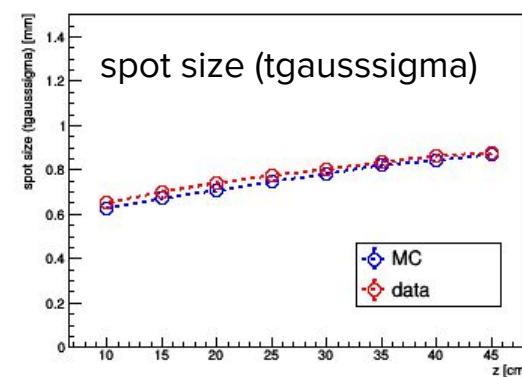
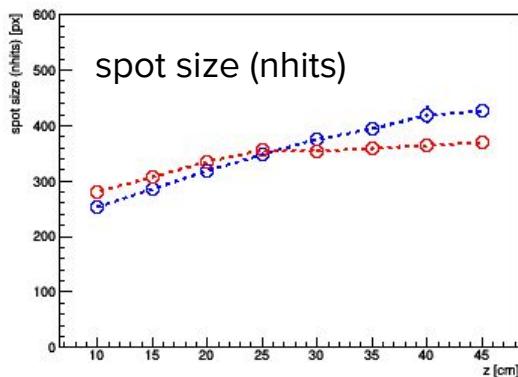
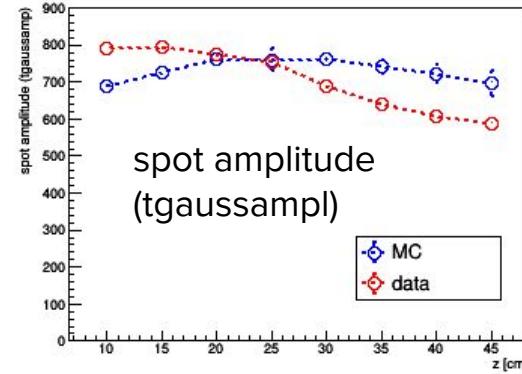
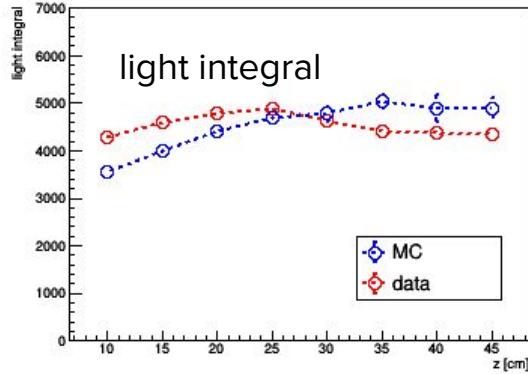
# Comparison with $^{55}\text{Fe}$ data

- Config file parameters in digitization code to reproduce LIME April 21 data
  - Distance from GEM scan: 10, 15, 20, 25, 30, 35, 40, 45 cm
  - GEM1\_HV scan: 350, 386, 406, 420, 431, 440 V
  - GEM2\_HV = 440 V
  - GEM3\_HV = 440 V
  - A = 1 (free parameter of the model, to be fixed)
  - beta = 1e-5
  - absorption\_l = 1 m
  - noise from pedestal run 4159
- Data and MC reconstructed and analyzed with the same code
  - reconstruction code by Emanuele, “autumn21” unstable branch
- all plots at: [https://www.roma1.infn.it/~dimperig/CYGNO/reco/dataMC\\_55Fe/](https://www.roma1.infn.it/~dimperig/CYGNO/reco/dataMC_55Fe/)

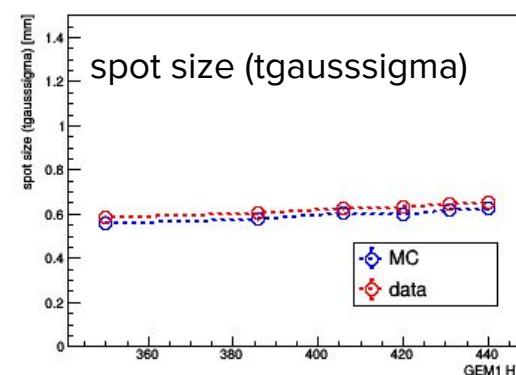
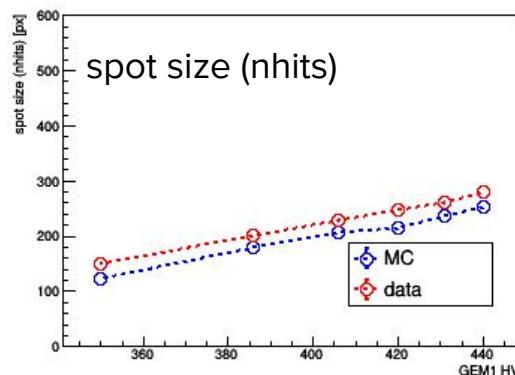
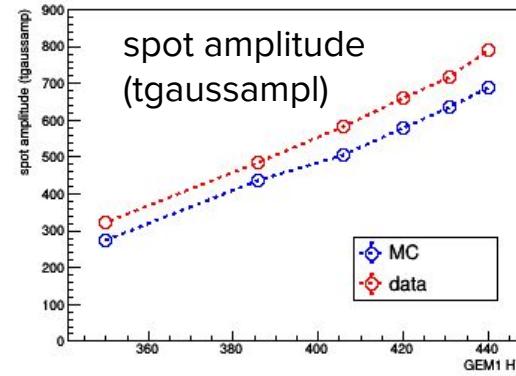
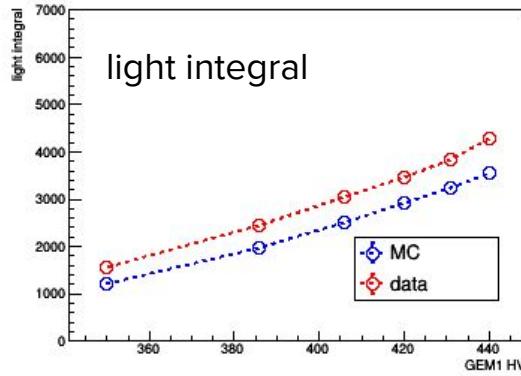
# Selection

- Data:
  - center of the sensor:  $\text{abs}(\text{sc\_xmean}-1152) < 250 \ \&\& \ \text{abs}(\text{sc\_ymean}-1152) < 250$
  - light threshold:  $\text{sc\_integral} > 600 \ \&\& \ \text{sc\_integral} < 20000$
  - round spot:  $\text{sc\_tgausssigma}/\text{sc\_lgausssigma} > 0.6$
  - sc length:  $\text{sc\_length} < 100$
- Monte Carlo:
  - center of the sensor:  $\text{abs}(\text{sc\_xmean}-1152) < 250 \ \&\& \ \text{abs}(\text{sc\_ymean}-1152) < 250$
  - light threshold:  $\text{sc\_integral} > 600 \ \&\& \ \text{sc\_integral} < 20000$
  - checked that for MC fake rate  $\sim 0$  and efficiency 1

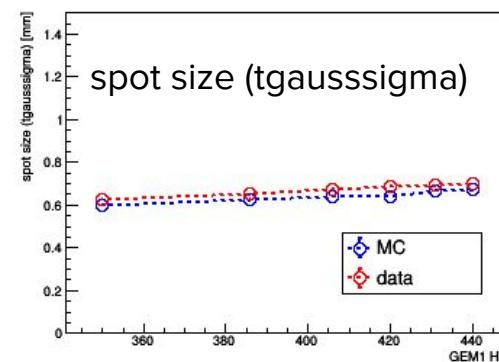
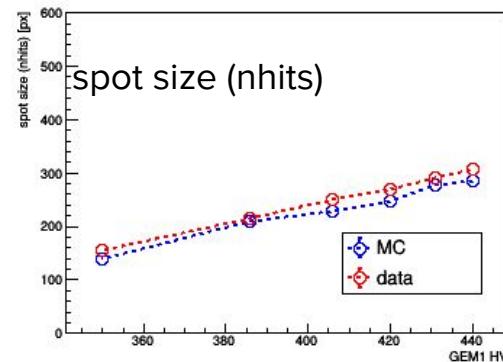
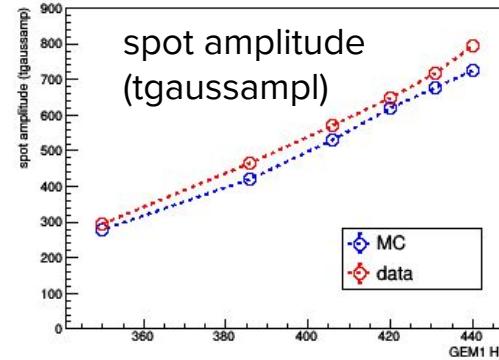
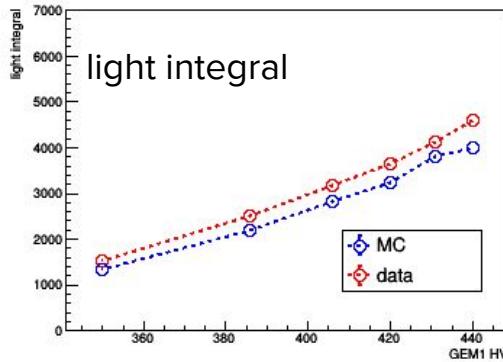
# $z$ scan, HV = 440 V



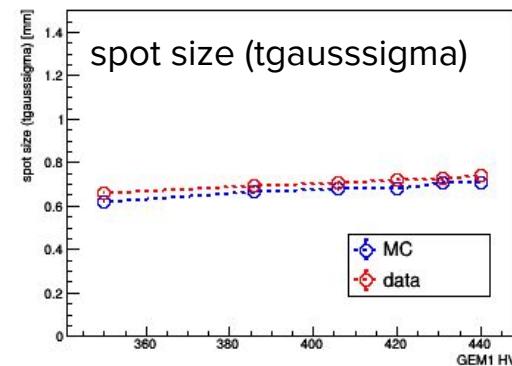
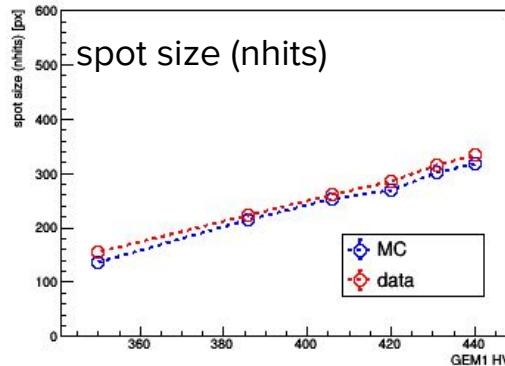
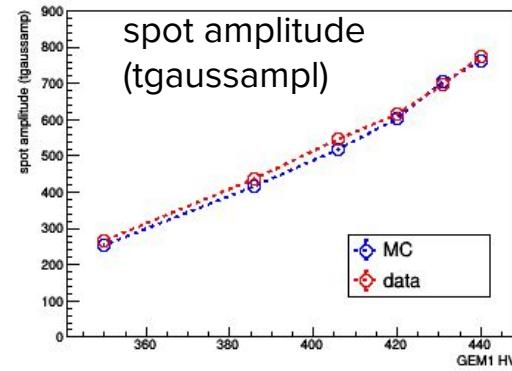
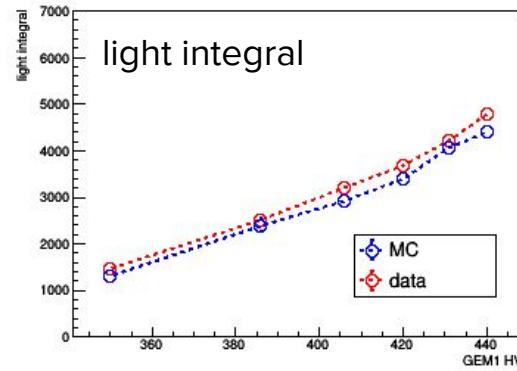
# HV scan, z = 10 cm



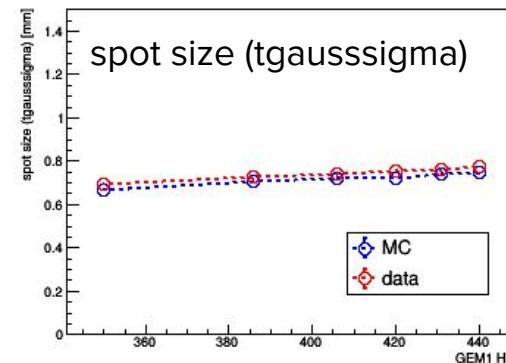
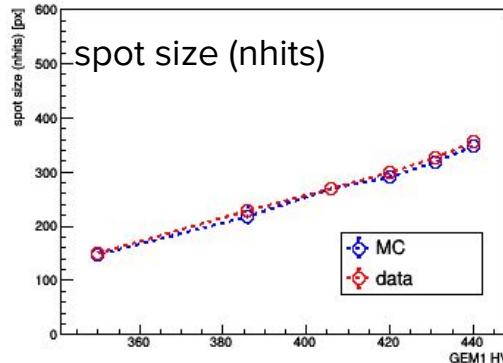
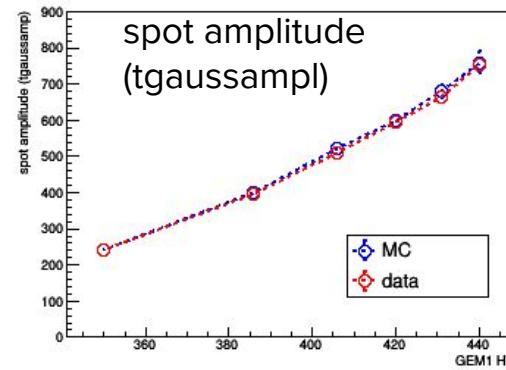
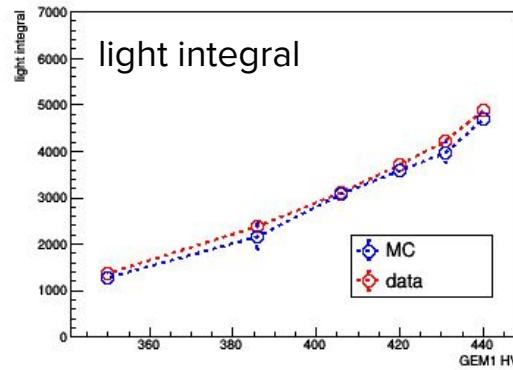
# HV scan, z = 15 cm



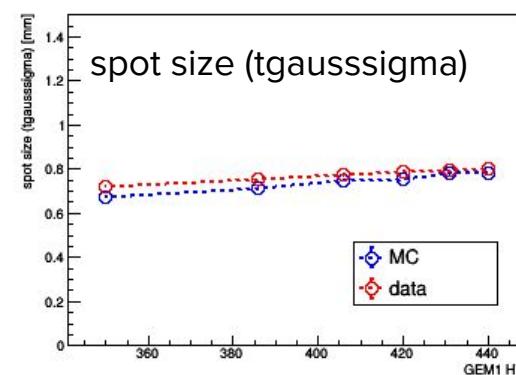
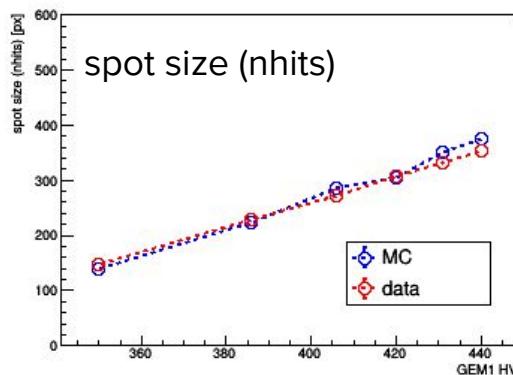
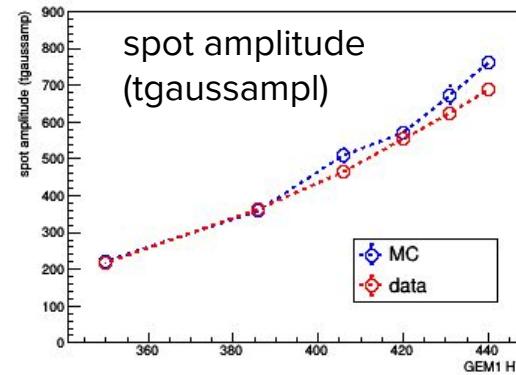
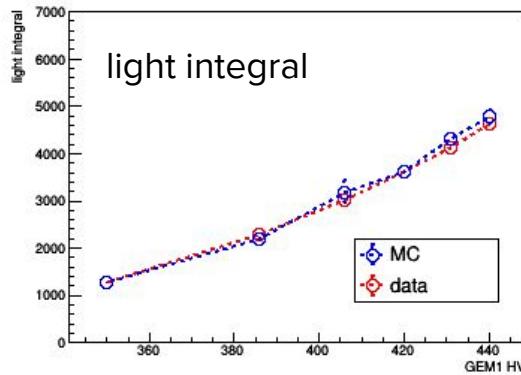
# HV scan z, = 20 cm



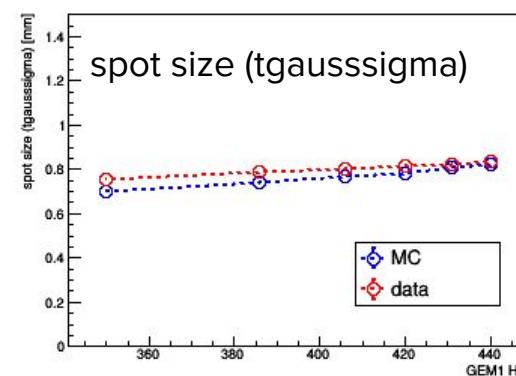
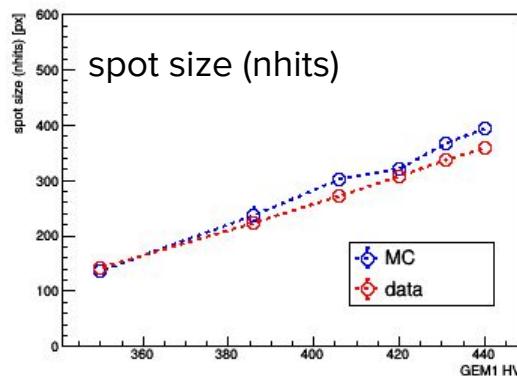
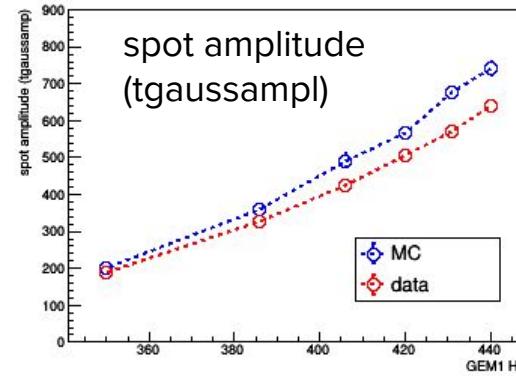
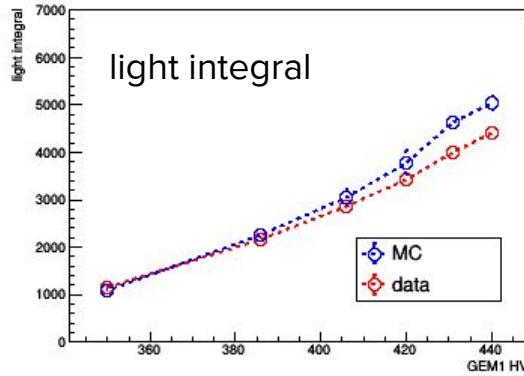
# HV scan z, = 25 cm



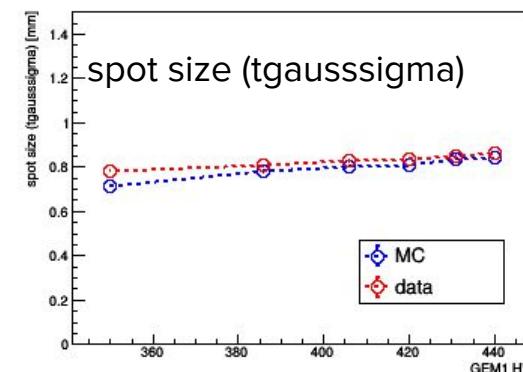
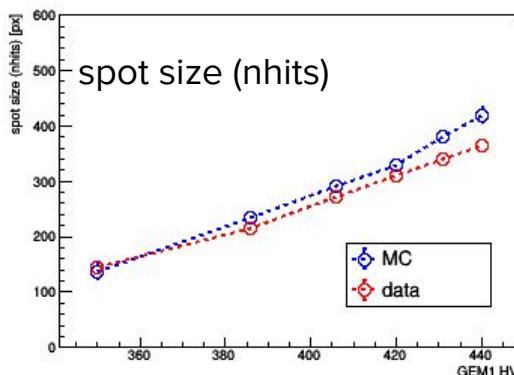
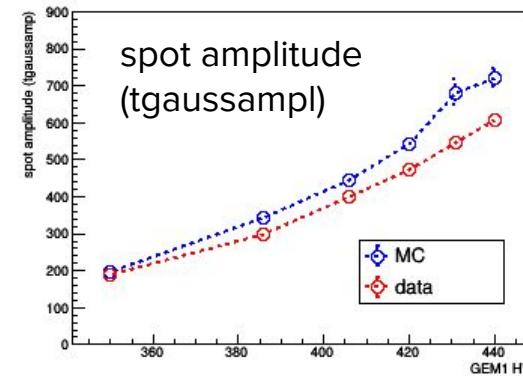
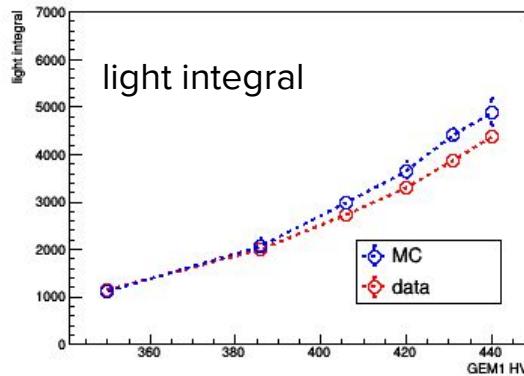
# HV scan z, = 30 cm



# HV scan z, = 35 cm



# HV scan z, = 40 cm



# HV scan z, = 45 cm

