PMT signal simulation **status**

photon generation part

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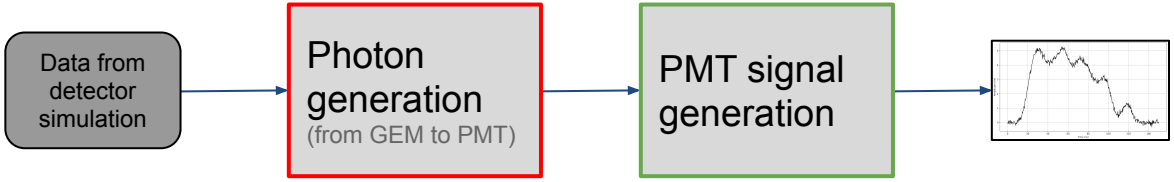
Summary



- Lines in space
- Detector dimensions and test
- Scan Results (scanning generation position on the GEM plane)
  - Comparing with real measurements

Lines in Space

Vector equation of a line

- Equation of a line in space:

from detector simulation

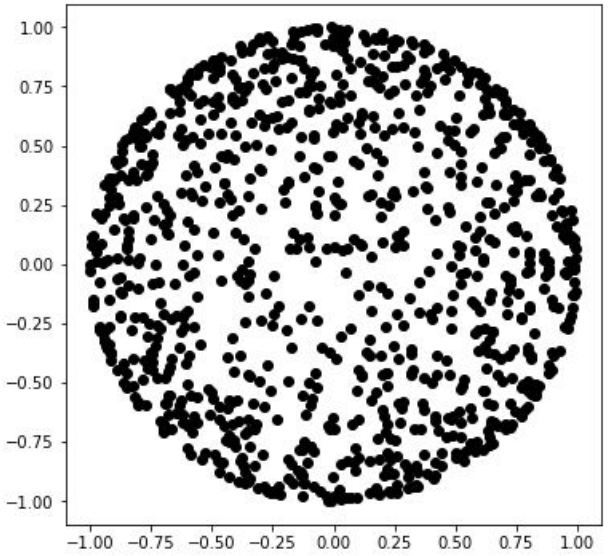
isotropic source

$$(x, y, z) = (x_0, y_0, z_0) + t(v_x, v_y, v_z)$$

- x_0, y_0 and z_0 define initial position of photon;
- v is the vector that describes the direction of the photon;
- t is a scalar parameter.

Direction vector

- A 3D unit vector was generated with a uniform spherical distribution (isotropic source).



Detector dimensions and test

Detector dimensions

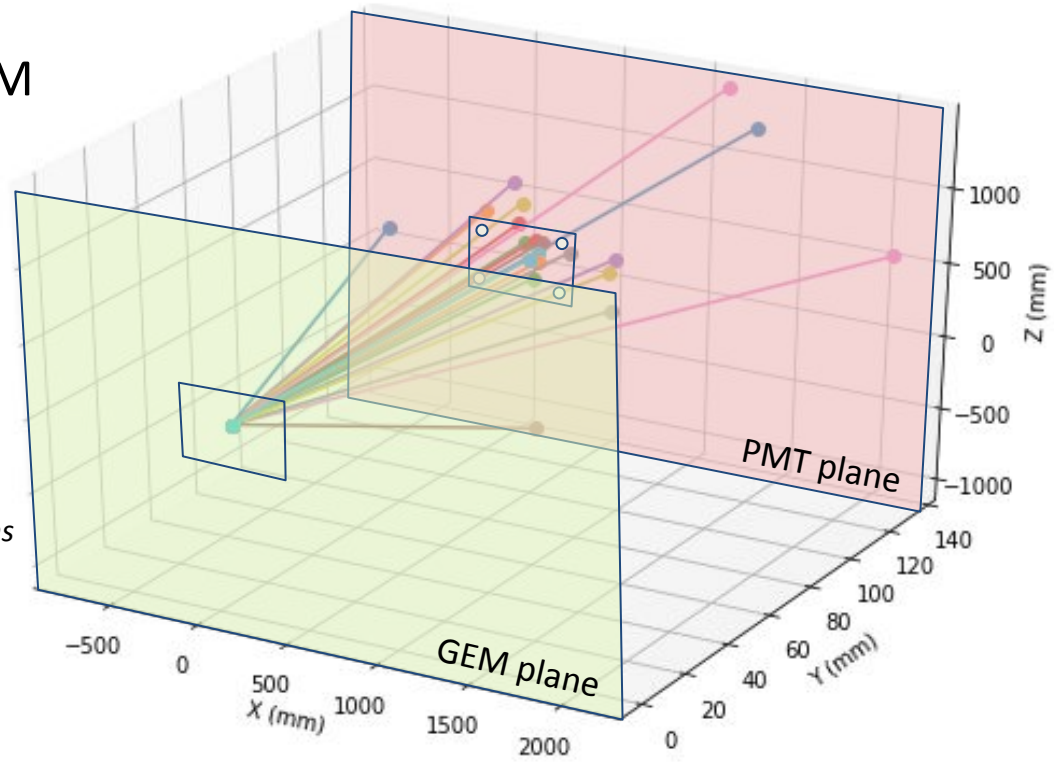
- It was assumed that the GEM plane has 330x330 mm^2 (X, Z plane);
- The GEM is located in Y = 0 mm and the PMTs are in Y = 134 mm;
- Distance between PMTs = 270 mm.

Photon generation example *(center of the GEM)*

- N photons generated in the GEM plane throughout an uniform distribution (X, Y)

Just to do a first test

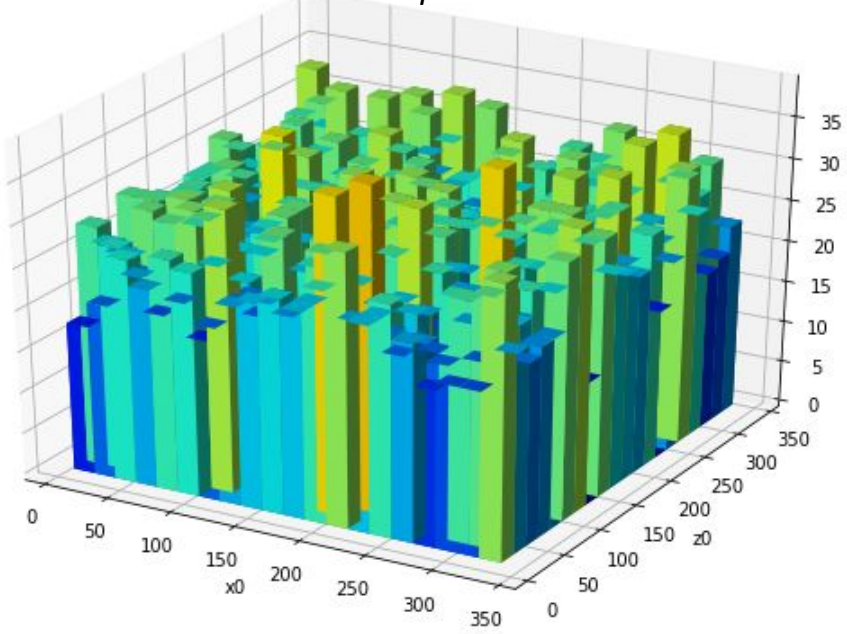
Visual example generating ~20 photons from a single GEM position



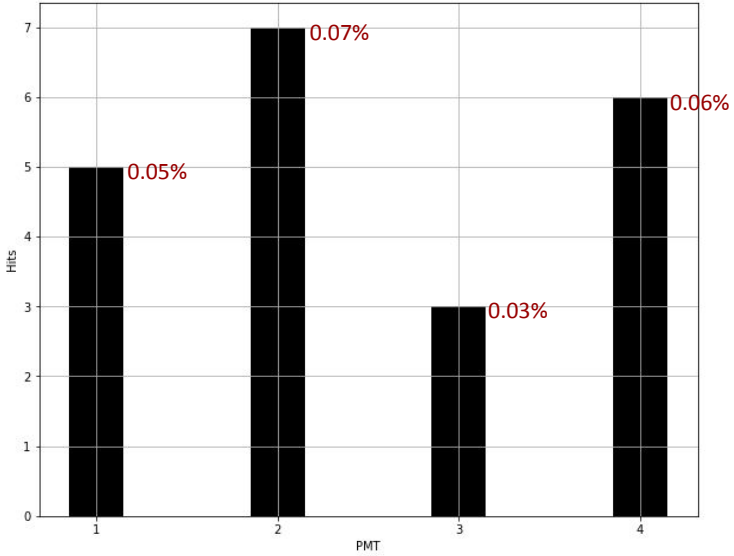
Test generating photons uniformly across the GEM plane

- Example with N=10k photons

Distribution over the GEM plane



Number of hits for each PMT

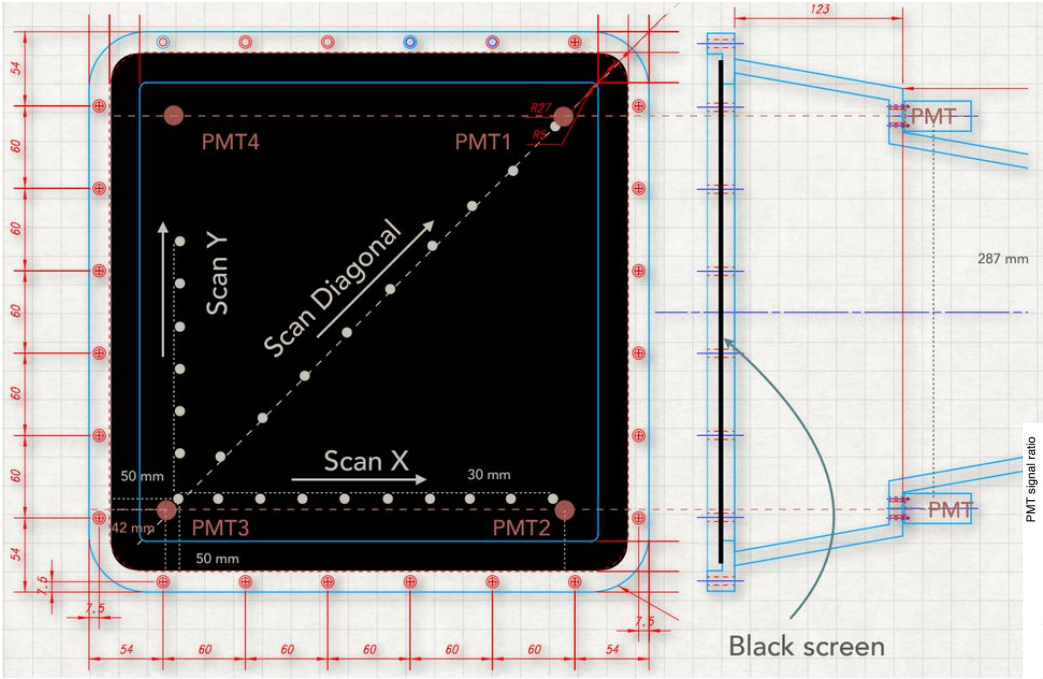


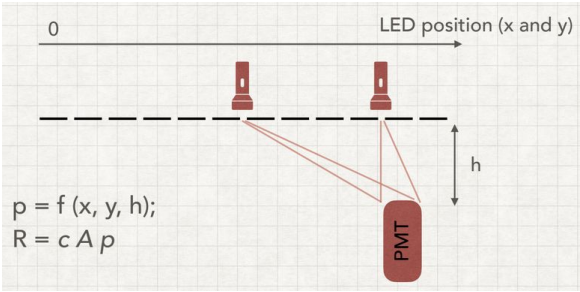
Scan Results

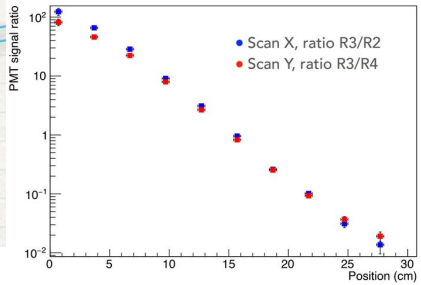
scanning generation position on the GEM plane

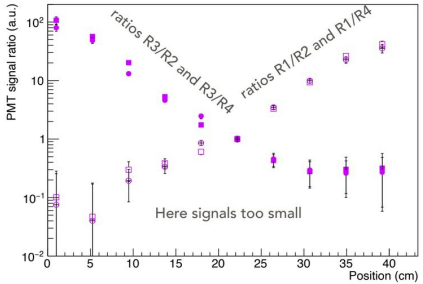
Real measurements

— Francesco I. and Davide P.









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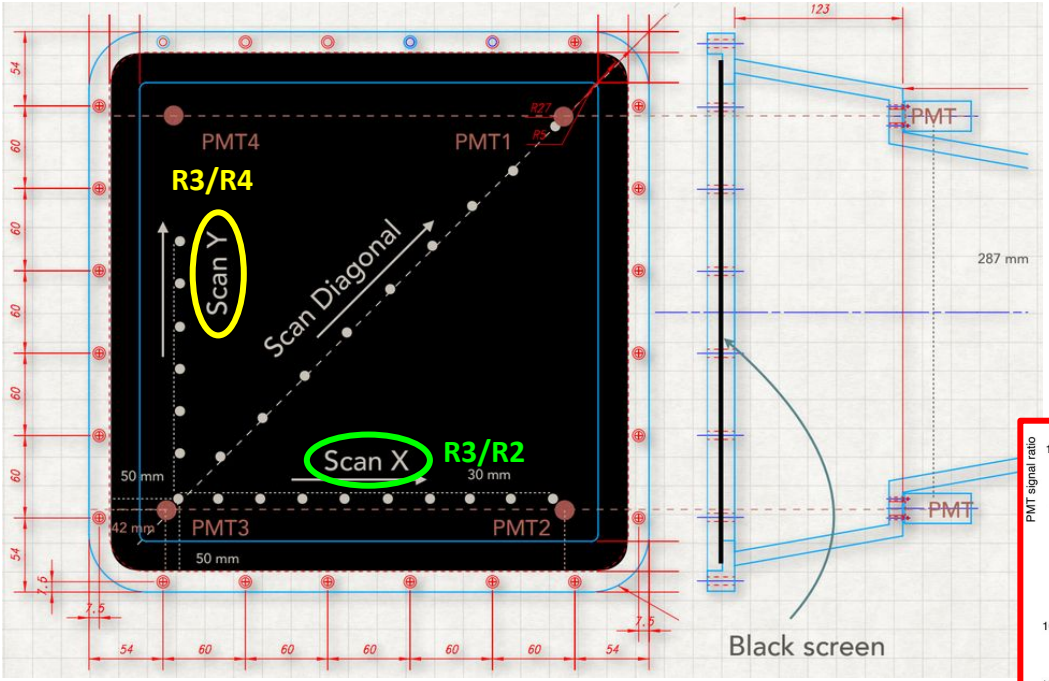

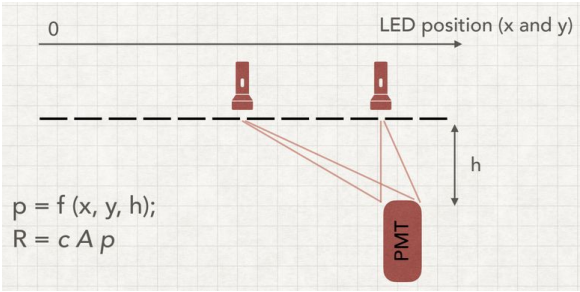

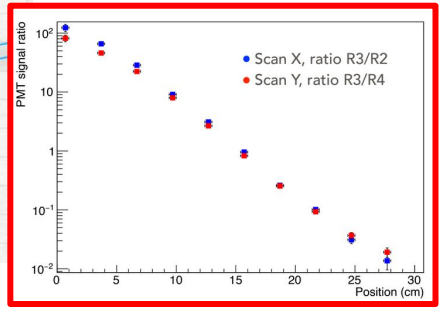

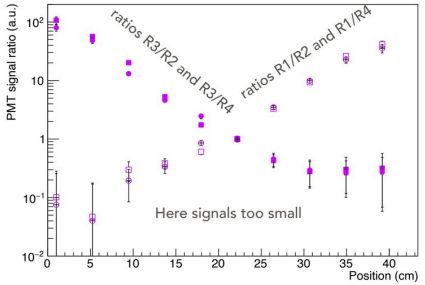

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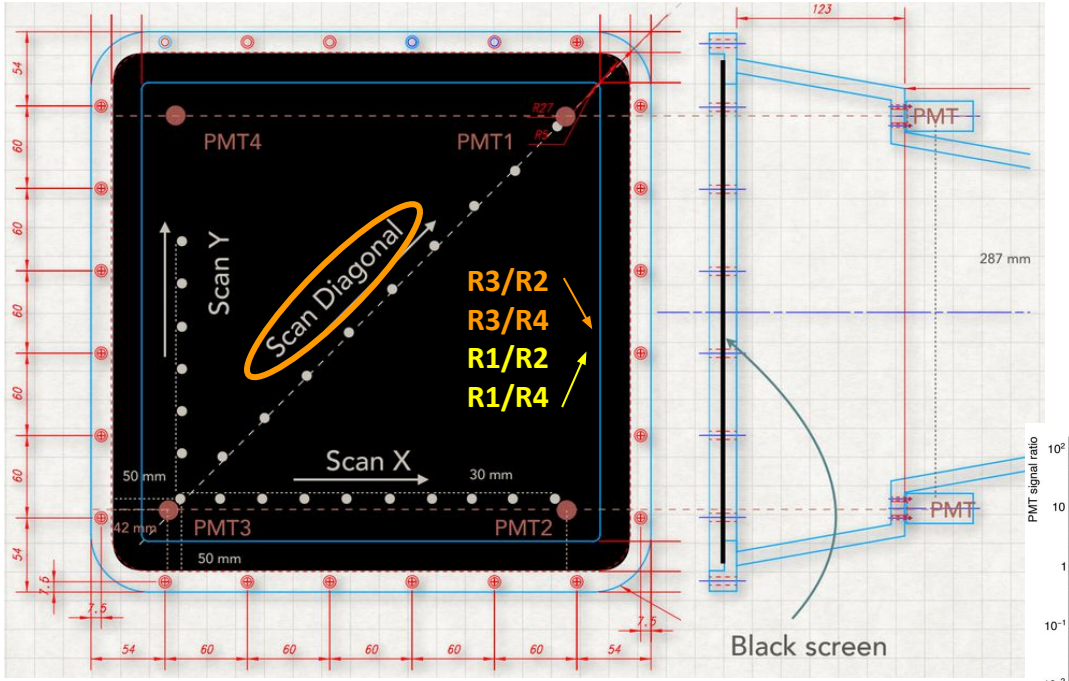
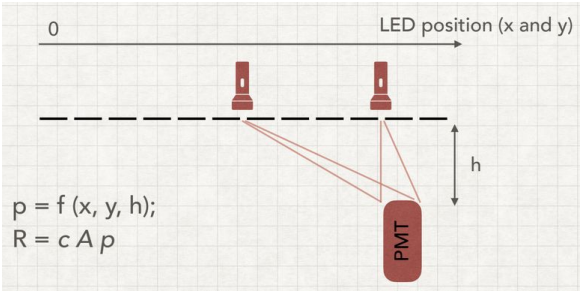
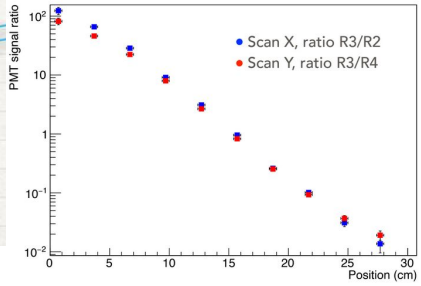
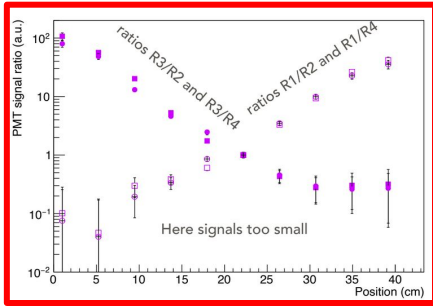
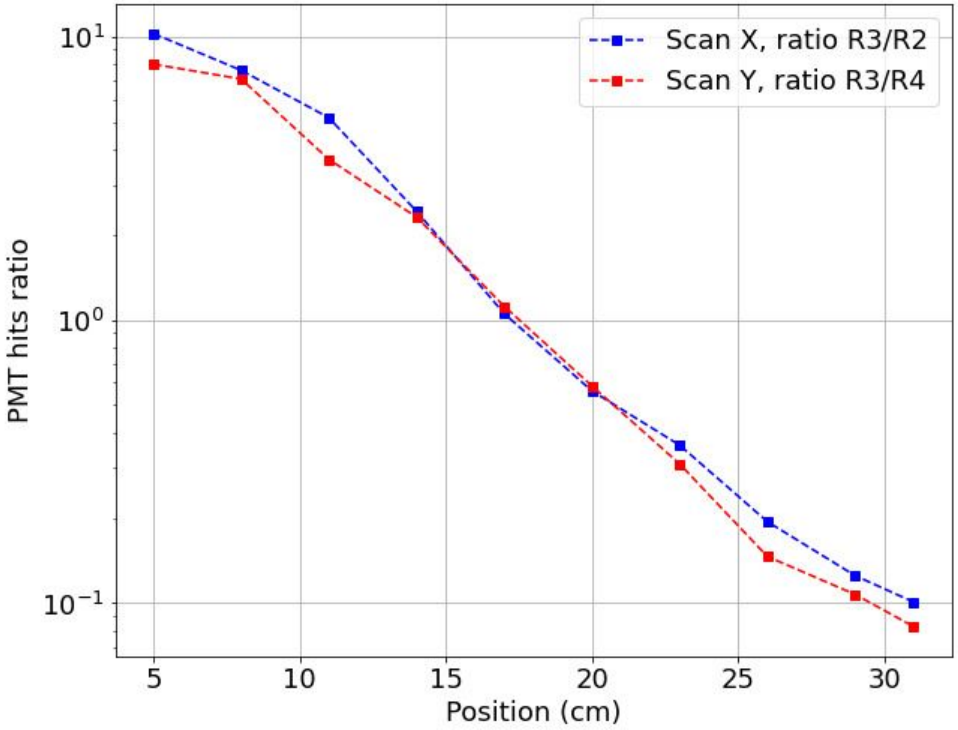


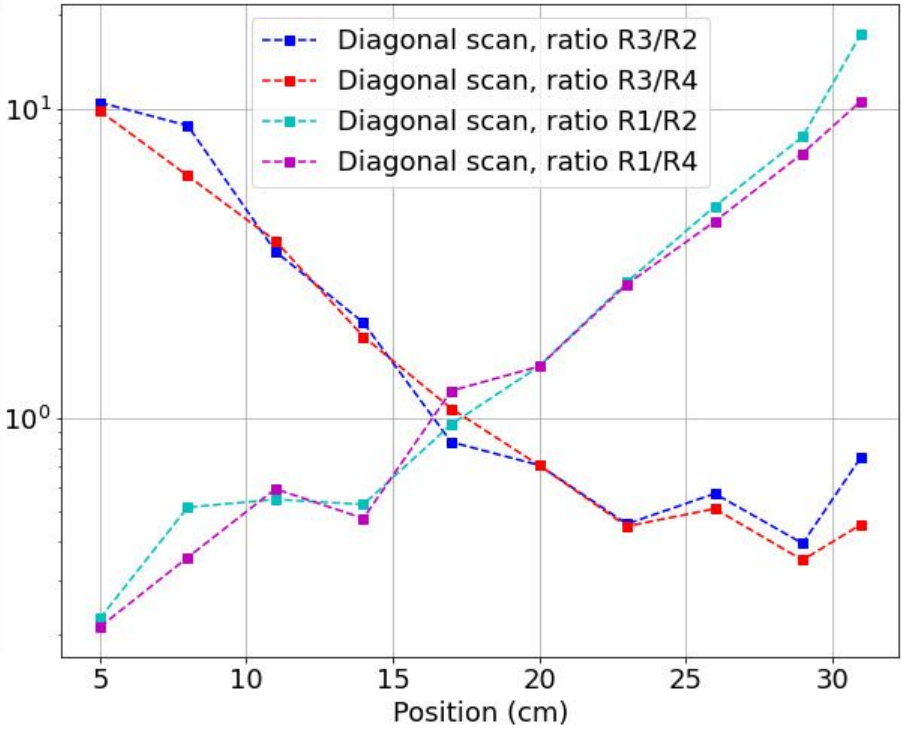






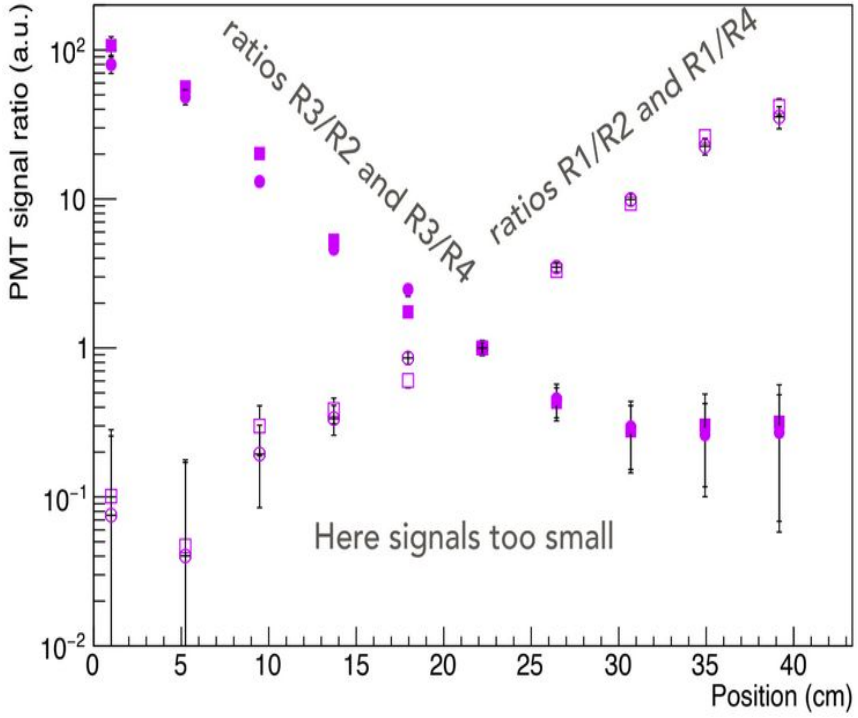
Simulation scan using N=100k photons



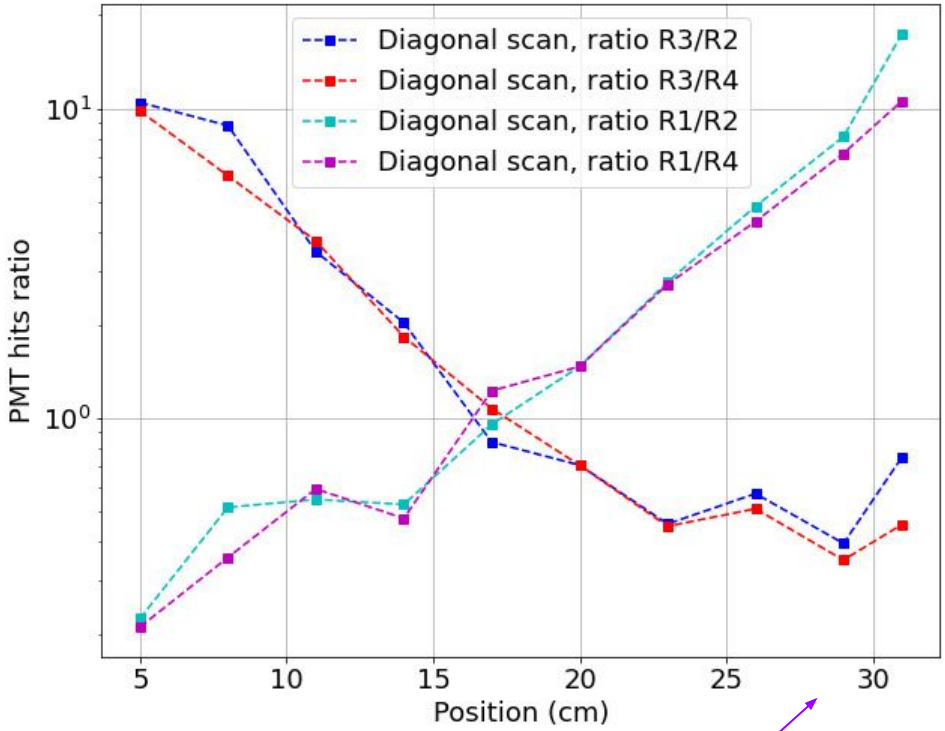


Simulation *vs.* Real data

Real data



Simulation data

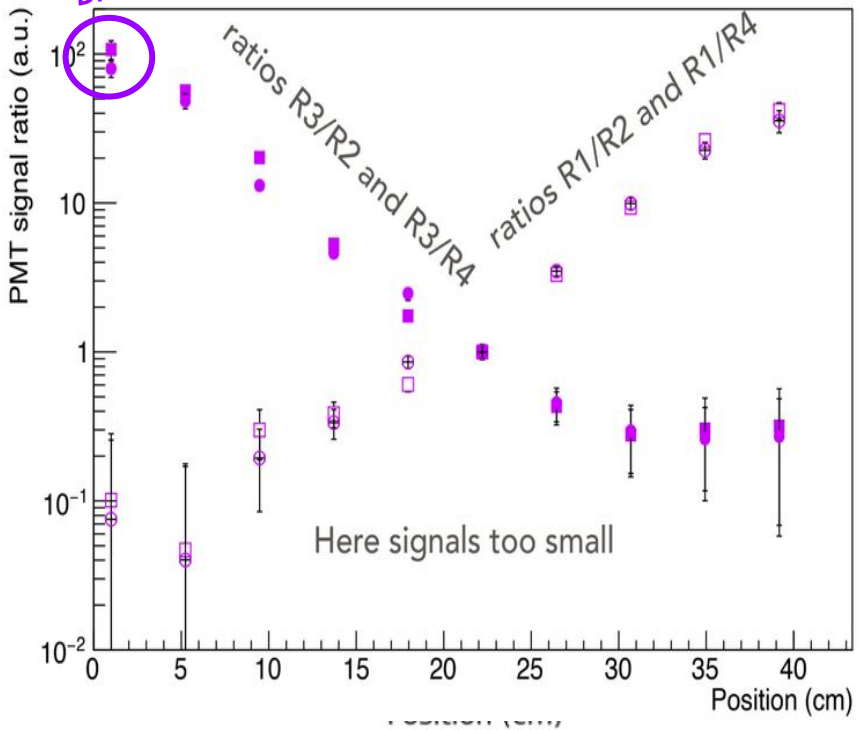


X range need to be adjusted

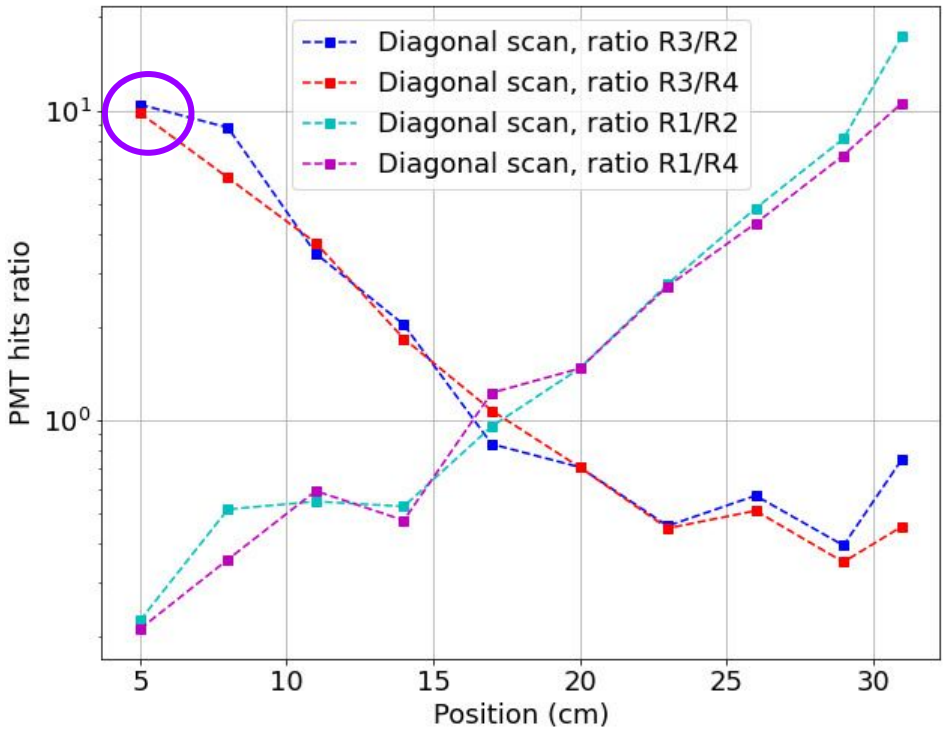
Simulation *vs.* Real data

Directional light source??

Real data

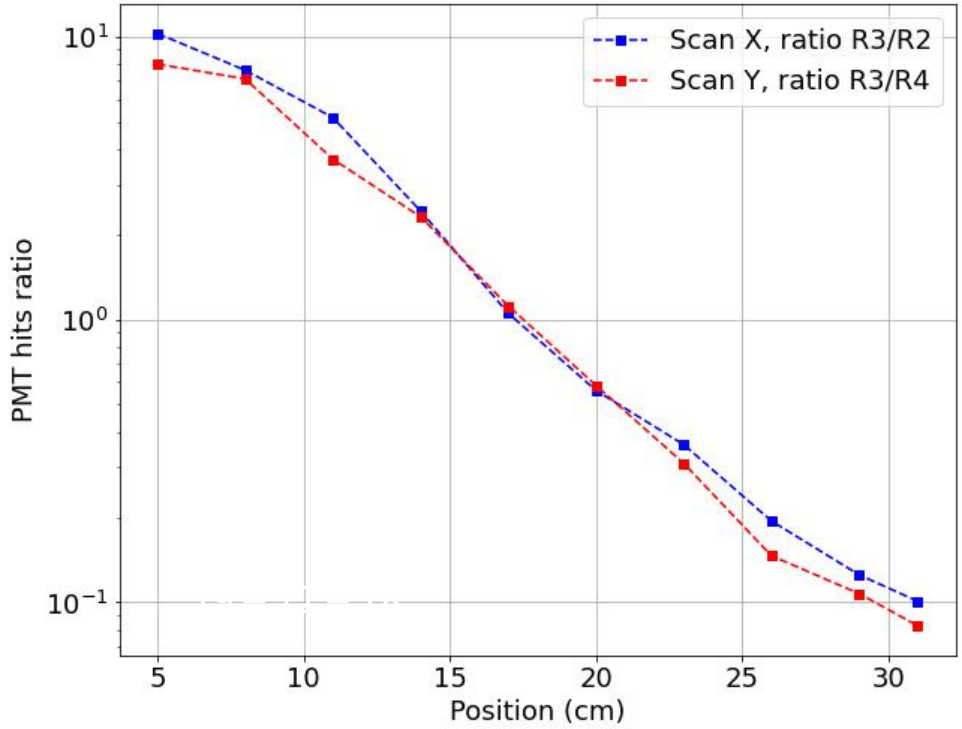


Simulation data

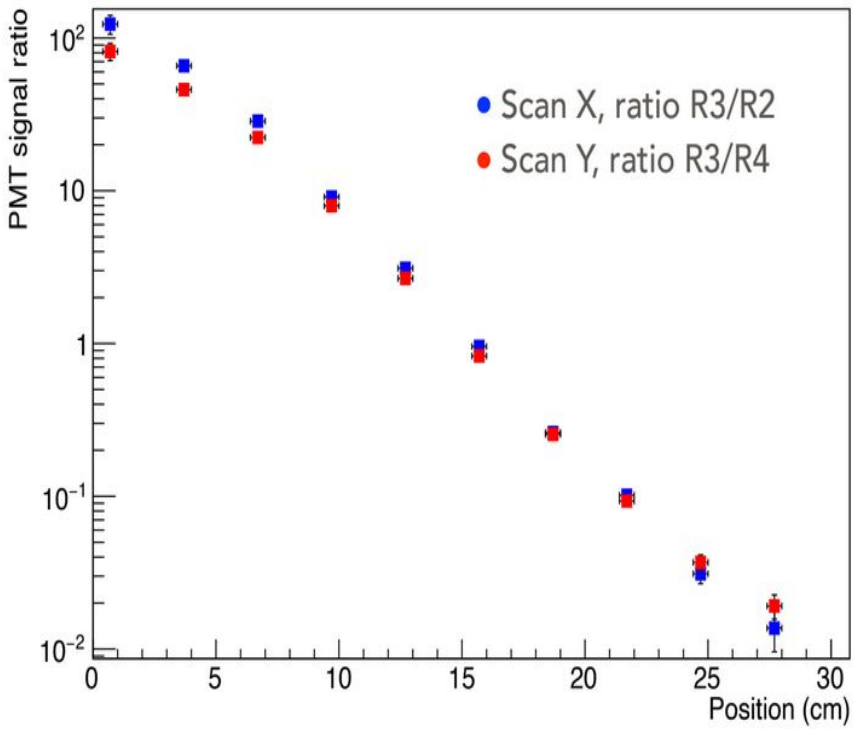


Simulation *vs.* Real data

Simulation data



Real data



Next steps

- Include PMT quantum efficiency
- Integrate photon generation with the signal generation code
- Integrate with detector simulation *(detector simulation input)*
- Check single photoelectron signal *(Davide will send data)*
- *Make it available by github*
- *Generate useful results*