#### Synchrotron Radiation Studies - Update



Rey Cruz-Torres EIC RNC Meeting 10/11/2022

#### Single-photon events in hepmc files

Propagate through GEANT geometry and study hit distributions and rates



R. Cruz-Torres

Compose full synchrotron-radiation events given integration time window



Store these events in a universal "container" (e.g. hepmc)





Process we want to study: synchrotron radiation creating measurable signal in our detectors







These two are physically equivalent processes given that the photon only gets to our detectors after it emerges from the beampipe.

Process we want to study: synchrotron radiation creating measurable signal in our detectors

#### Simulation provided to us: single-photon events emerging from a virtual cylinder inside the beampipe





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#### **Vertices on virtual cylinder Photons**

R. Cruz-Torres

We sample from these single-photon events to compose many-photon events given an integration time window.

The output of this event generator is a hepmc file which should communicate the information on the diagram on the left to the next piece of software which uses these events as input

> Are we communicating this information properly?







### Sample hits after propagating through DD4HEP

VertexBarrelHits, gold coating 2 um

VertexBarrelHits, gold coating 0 un 1x10<sup>5</sup> 100-ns-long SR events 0 um gold Hits in vtx layers -100100 -10050 -50 x (mm) Physical  $\gamma$  status 1 VertexBarrelHits Unphysical  $\gamma$  status 1 1 2 - Bar Bar Connection & Barris Barris State States -50 No E thresholds imposed here -100

-100

-50

0

z (mm)

100

50

R. Cruz-Torres

VertexBarrelHits, gold coating 5 um









# Hit distribution in DD4HEP

The hit distributions are very backward.

Some tests revealed that the vertices are ignored and the physical photons are just assigned to (0,0,0)



The hepmc files themselves look right when compared to other hepmc files produced e.g. directly by PYTHIA

Is the issue in how DD4HEP reads in vertices?





#### How to move forward?

# Further investigate whether the issue comes from the hepmc structure or from DD4HEP.

- Wouter mentioned in the past that they had seen some issues with the reading of hepmc files with multiple vertices and that they had patched it, but maybe this was not properly done.
- Talk to a hepmc expert to make sure the current files have the right structure.

# Directly implement the generator within DD4HEP.

- Not completely clear to me how to do this, but in principle it is doable.
- I tend to dislike this solution because it limits the event generator to DD4HEP (e.g. cannot be compared to results in Fun4All).



