

Mighty Tracker: Fibre Part

Attenuation maps

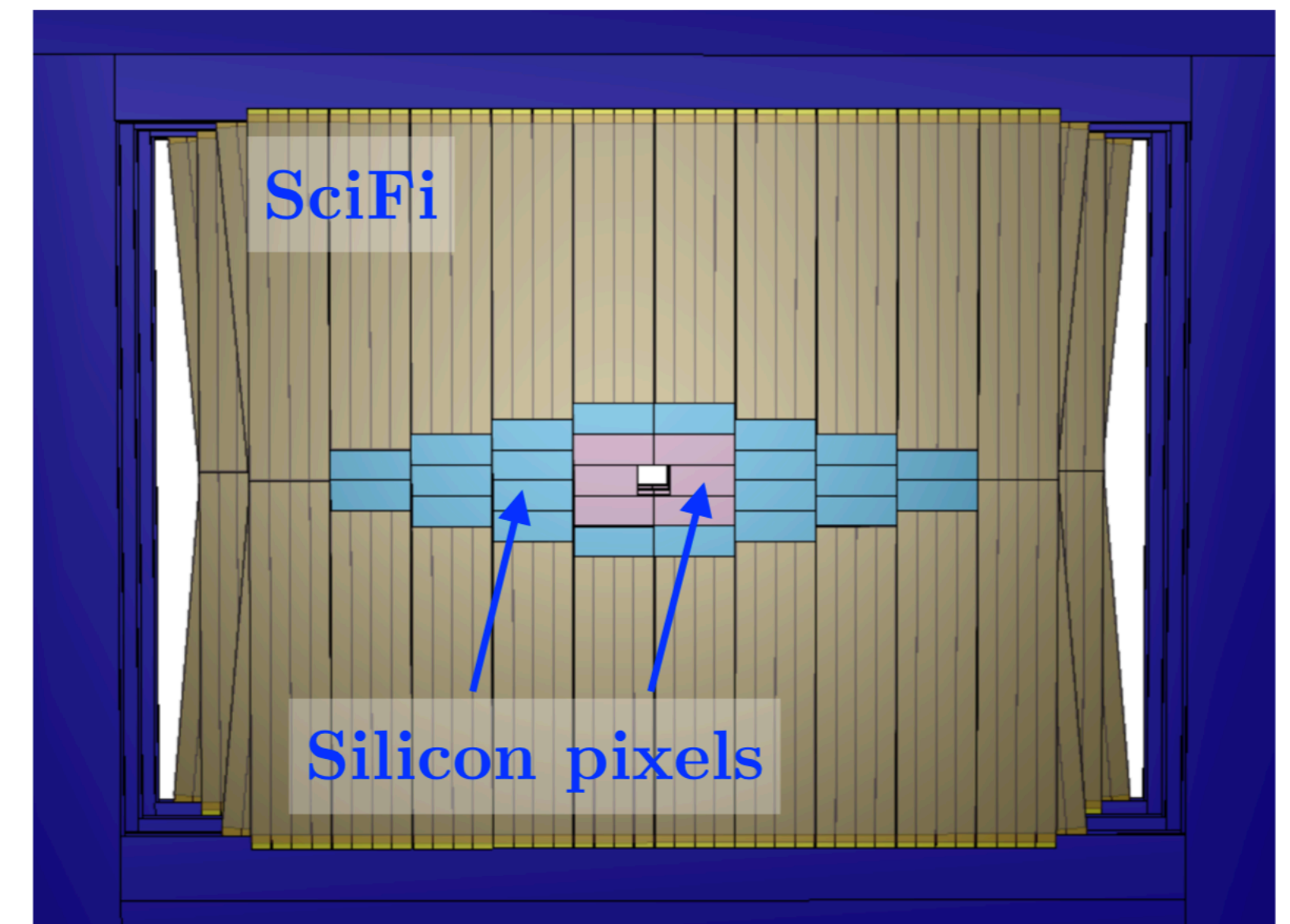
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U2 tracking virtual workshop
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EPFL

Mighty tracker

- Mixed technologies of silicon pixels (closer to the beam pipe) and scintillating fibres (outer region)
- Fibres: similar setup as for the SciFi, however:
 - Ongoing R&D for Run5 (4?) targeting to mitigate radiation damage.

Many details available in the presentations at the [SciFi General meeting](#) [F. Blanc] and at the [U2 workshop in Barcelona](#) [G. Haefeli]
 - Varying lengths, different irradiation profiles: will focus here on the (very preliminary) ongoing work regarding the light yield attenuation maps



F. Blanc, SciFi meeting, 7/12/2020

Attenuation maps: 2 step process

- Simulation of a **single fibre**
 - Round fibre, two cladding layers, placed in vacuum with a mirror in one end and a detector in the other.
 - Each simulation sets a (x,y) point along the fibre, produces n photons and propagates them.
 - Use FLUKA maps to account for the radiation dose (available for 50invfb)
- **Attenuation map**
 - The photon detection efficiency and reflection losses are accounted for on an event-per-event basis as multiplicative factors and applied to the simulation output to generate the attenuation maps
 - The (x,y) coordinates cover one quadrant of a SciFi detection plane, the rest of the map is obtained by symmetrising this.

Baseline

- Code available in two git repositories
 - SciFiSimG4: single fibre GEANT4 simulation ([link](#))
 - LightYieldMapTools: combines the simulation outputs creating an attenuation map ([link](#))
- Documentation available in a public LHCb note ([LHCb-PUB-2019-007](#))
- Making life easier for debugging/crosschecks:
 - Current xml files with the maps used by BOOLE for the SciFi maps available ([link](#))
 - Actual (root) output files from the single fibre simulations used to create the non-irradiated attenuation map for the SciFi available in the SciFi eos space.

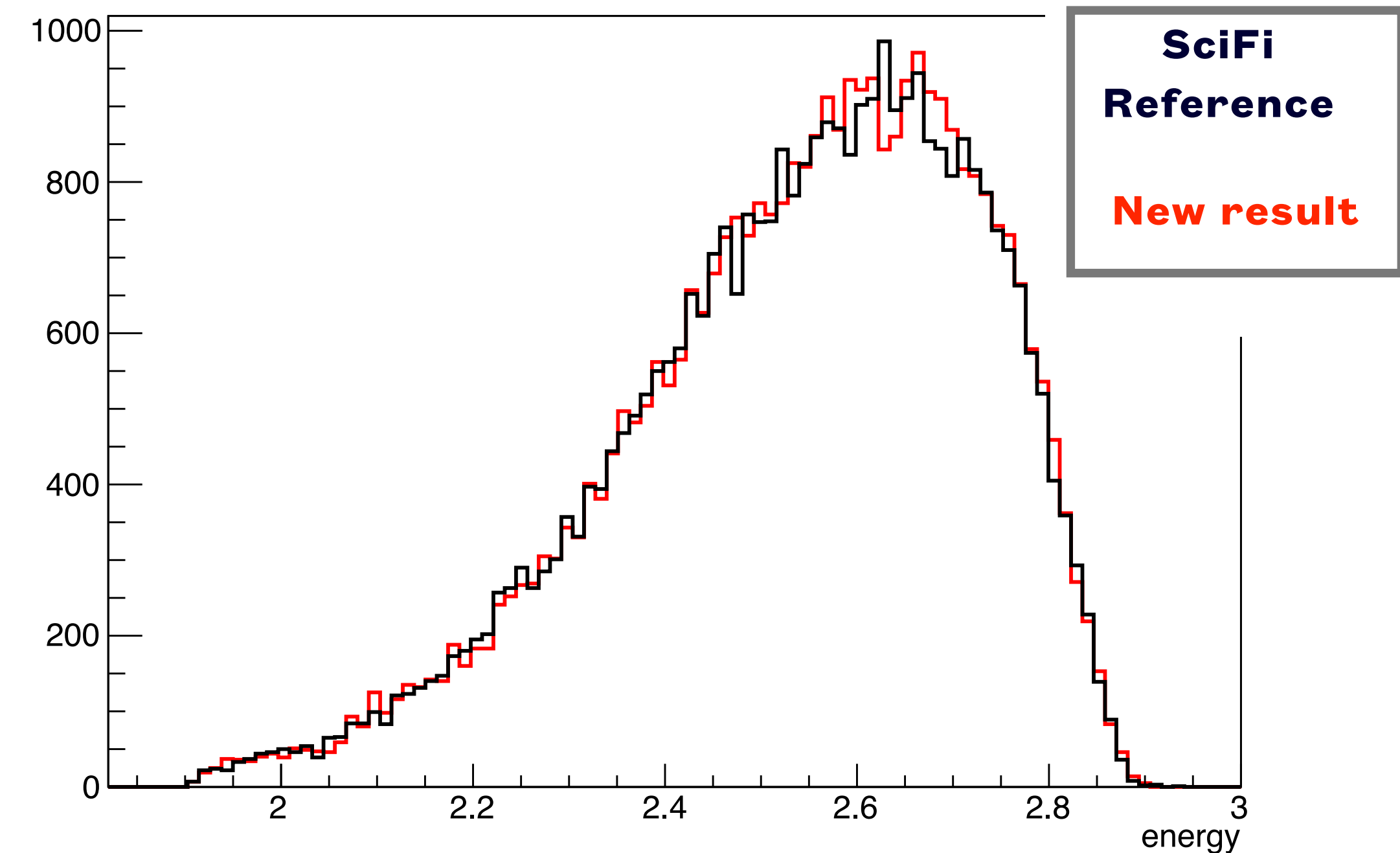
Preparing to run the code

- Adapting the code to run in lxplus:
 - Essentially finding the right environment and exporting a compatible set of libraries. Found what seems a generic recipe that works for several LHCb software releases.
- Running the simulation is computationally very demanding (~12000 jobs/map, about 6 days running)
 - Set-up using Condor, needs two steps to be able to save the output in eos but still run the submission from afs (eos submission is not available)
- Agreed with SciFi management to use some of their eos storage space for the maps) (~1.9 TB/map)

First validation of the new setup

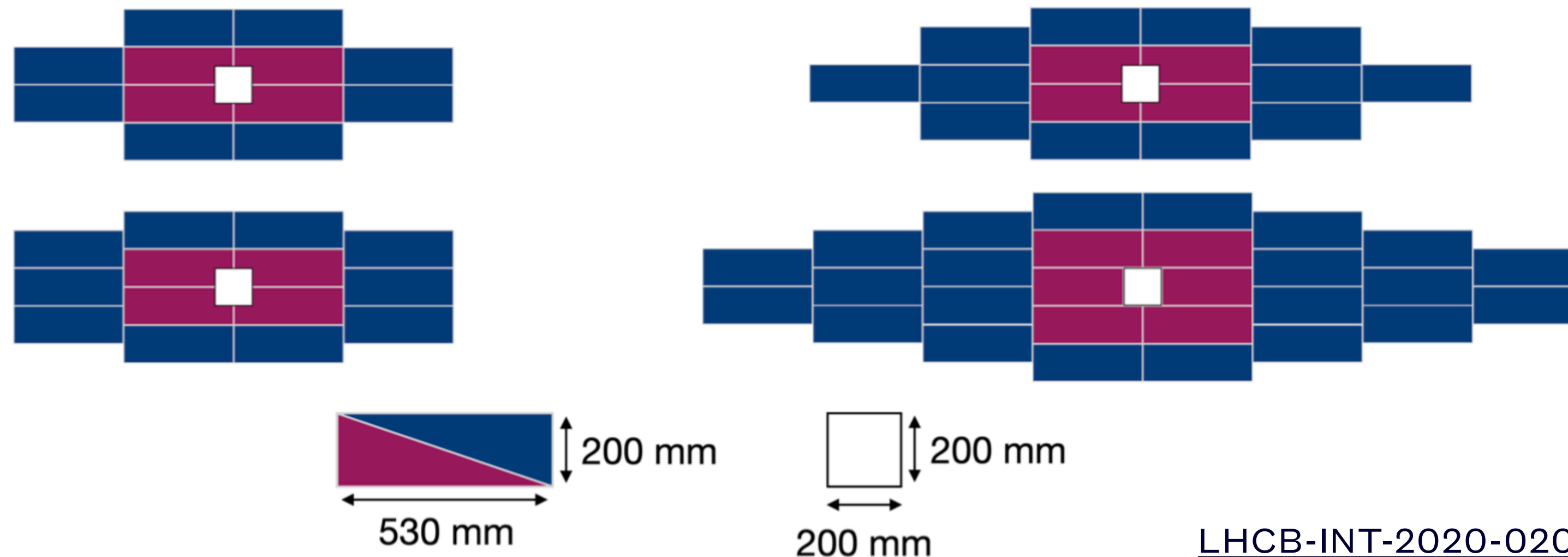
- Objective: re-obtain the attenuation maps for the SciFi fibre configuration, no radiation effects (0 invfb)
 - Comparing to the reference used in BOOLE
 - All distributions and attenuation map compatible within statistical fluctuations
 - Differences likely related to the different GEANT versions used (10.2.1 vs **10.4.3**)
 - Couldn't find a Geant 10.2.1 distribution that works within a lb environment yet-> would like to do so and crosscheck that identical results are obtained

Single fibre simulation output
(Energy of detected photons)



Current work

- (ongoing) make the 'geometry' configurable to be able to produce maps for different Inner/Middle tracker layouts
 - Dimensions of the SciFi and the beam pipe hole hard coded everywhere (direct inputs for the number of bins, which then set specific coordinates in the plane) -> adapt this, aiming for a more flexible code



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Conclusions and summary

- Default SciFi setup for producing attenuation maps successfully running in Ixplus/Condor
 - Full reproducibility from the SciFi files not checked yet (Geant4 version issue)
- First adaptation for the MightyTracker ongoing: configurable geometry
- Next steps will be to also include other improvements to the single fibre simulation (type of fibre, effective PDE,...)
- Currently using radiation maps produced for the SciFi (single dose, 50invfb)