



parameterisations/Par04 example

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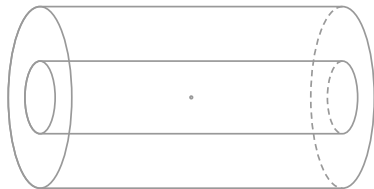
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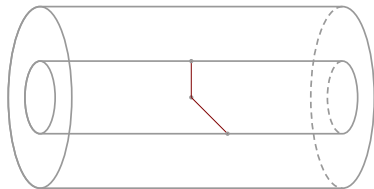
Geant4 Par04 example

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- Detector geometry is simplistic and easy to configure
- Collider-style concentric cylinders with up to two materials (active and optionally passive)



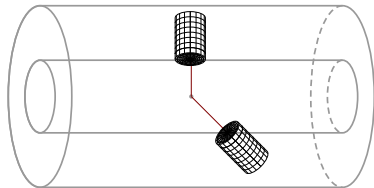
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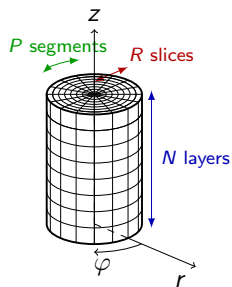
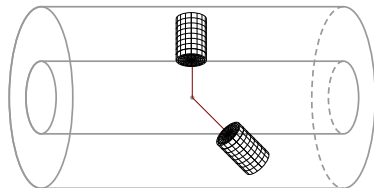
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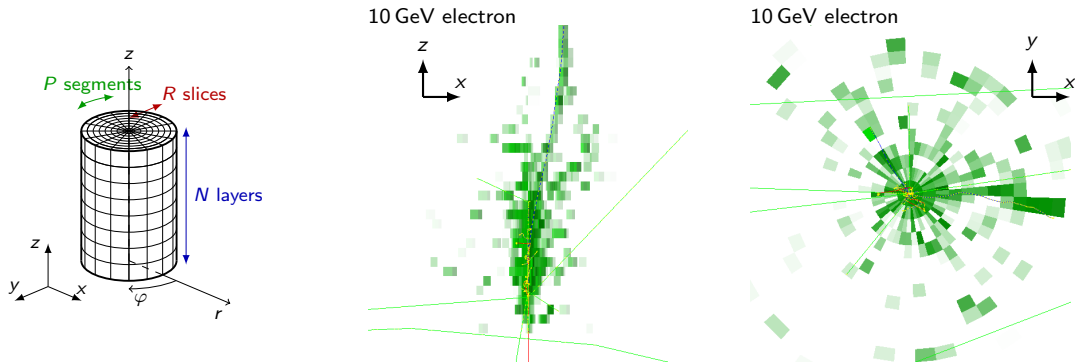


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- Granularity of shower deposition is configurable

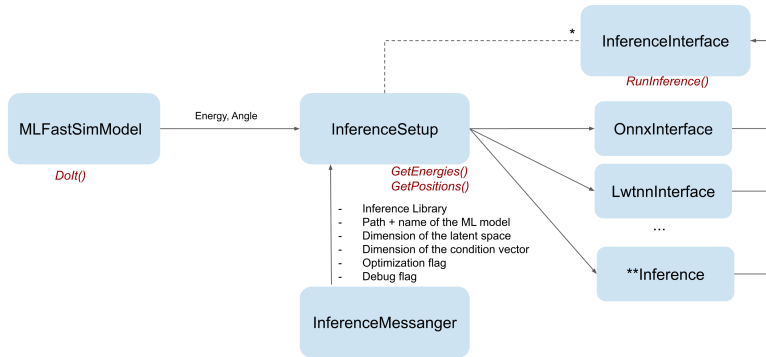


Geant4 Par04 example: showers



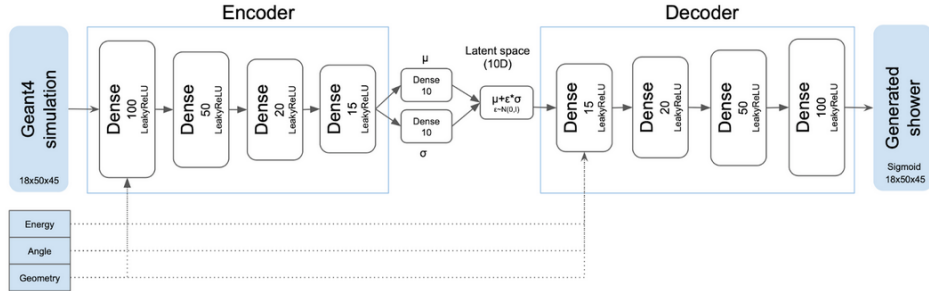
- Example uses 0.3 mm Si and 1.4 mm W layers
- Readout granularity is $\Delta r \times \Delta \phi \times \Delta z = 2.3 \text{ mm} \times \frac{2\pi}{50} \times 3.4 \text{ mm}$ aiming for $\Delta r \approx 0.25 R_M$ and $\Delta z \approx 0.6 X_0$
- Number of readout cells is $R \times P \times N = 18 \times 50 \times 45$ aiming for 95% containment of 1 TeV particles
- **Open access dataset for SiW (and scintillator-Pb) released [10.5281/zenodo.6082201](https://zenodo.org/record/6082201)**
- This dataset is a base of ML studies, including [CaloChallenge](#).

Geant4 Par04 example: inference within C++ framework



- Fast simulation with ML within Geant4
- Demonstrates how to incorporate inference libraries (ONNX Runtime, LWTNN)
- Par04 can run full and fast simulation (if any of the inference libraries is available, e.g. via LCG)

ML model



Variational autoencoder that is a subject of study in our group. Provided model is trained on the specified geometry, it **requires changes with the changes to the geometry**. More details on work on generalisation are discussed in our webpage: g4fastsim.web.cern.ch

Recent changes and WIP

- Bug fixes, especially with visualization (merged to geant4-dev)
- Python scripts for training (merged to geant4-dev)
- Integration of another inference library (Torch) as a result of AIDAinnova hackathon
(thanks to all colleagues from DESY: Engin Eren, Peter McKeown, and the LHCb: Michal Mazurek)
- GPU support, inference optimisation, as a result of summer students projects
(thanks to Priyam Mehta and Maciej Dragula)

All of the above should be included in the next release.