Simulation Tasks WP12.3

Witek Pokorski

replacing Anna Zaborowska

24.06.2021

Coordination

- Anna absent until 13 September
- (myself absent most of July)

Deliverables and Milestones

- D12.2 [month 45]: Fast shower simulation in Geant4
  - Fast shower simulation based on parameterisations and based on machine learning techniques fully integrated in Geant4, released with documentation and examples (Task 12.3)

- MS49 [month 22]: Prototype of ML based shower simulation
  - Runnable example code that simulates part of the showers with ML algorithms

- Lead beneficiary: CERN

University of Manchester (Marco Gersabeck)

- Research Software Engineer (Keith Evans) started in May, but mostly focused on a different project up to now
- Lamarr is ready for an alpha release and being tested within LHCb
- had initial discussions for a way to make Lamarr accessible also outside LHCb and Keith will start working on this in the coming weeks

IJCLab (David Rousseau)

- expect IJCLab involvement to be in the second part of the project

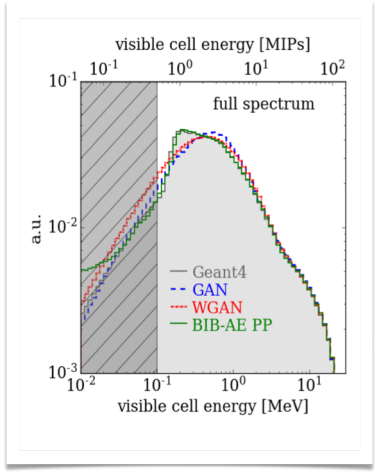
Generative methods for fast simulation

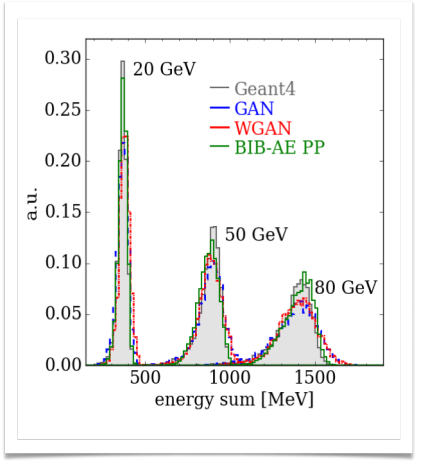
Frank Gaede

AIDAinnova contribution to WP12 carried out in working group at DESY and UHH: fast simulation of particle showers in highly granular calorimeters

- work planned in AIDAinnova:
- continue work on EM showers in ILD SiW Ecal using BIB-AE and GAN like architectures
- extend to arbitrary impact angles
  - extend to hadronic showers in ILD AHCal (scintillator-steel calorimeter)
  - integrate generative networks in ILC software framework via DD4hep
  - interested in comparison w/ classical parameterisations a la GFlash also developed in Task 12.2

- Hiring: plan to combine ppms from all task for a post doc (2-3y)
- current work done with matching personal

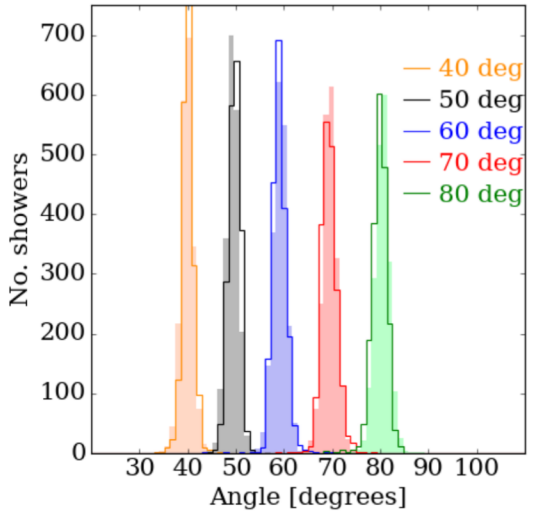




Getting High: High Fidelity Simulation of High Granularity Calorimeters with High Speed, Erik Buhmann (Hamburg U.) Sascha Diefenbacher (Hamburg U.), Engin Eren (DESY), Frank Gaede (DESY), Gregor Kasieczka (Hamburg U.) et al. (May 11, 2020), e-print: 2005.05334 to be published in Computing and Software for Big Science

Generative methods for fast simulation: angular conditioning

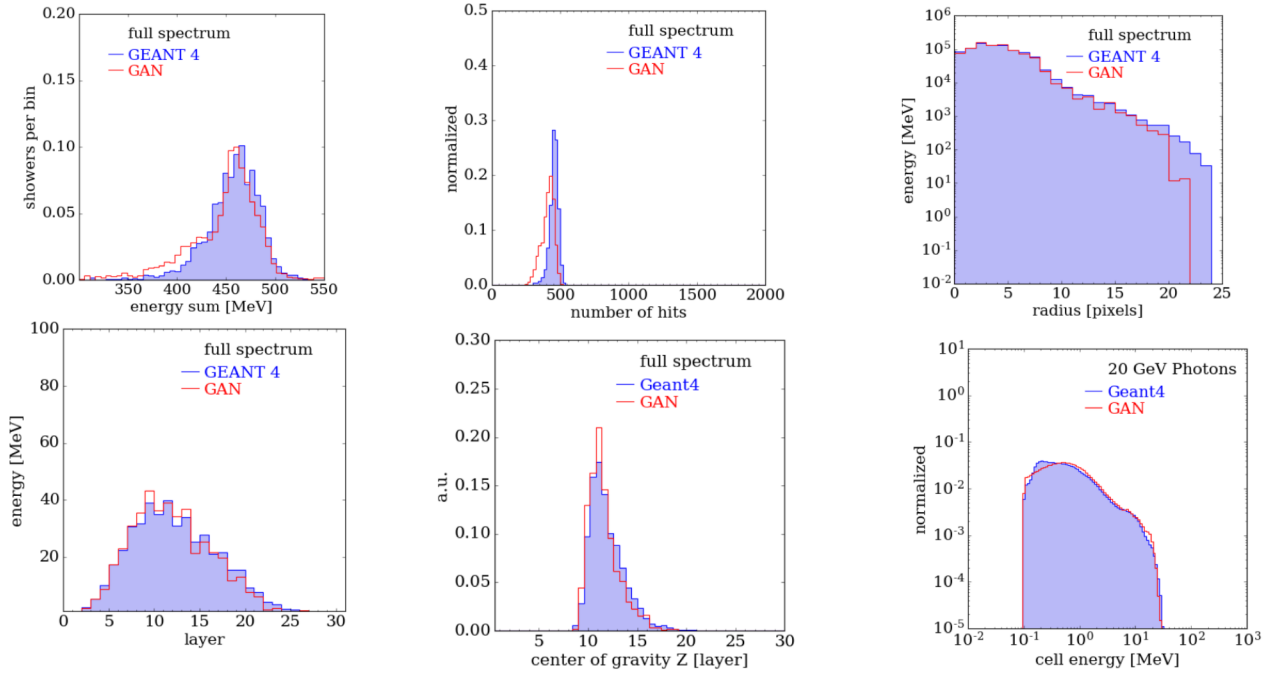
Frank Gaede



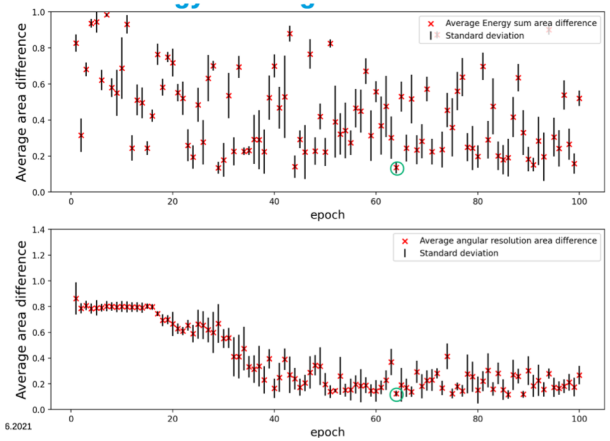
- angle of EM-showers in ILD ECal
- for Geant 4 and GAN
- reconstructed w/ PCA

Physics distributions- 60 degree showers

P.McKeown



- good progress with angular conditioning
- using a vanilla GAN with additional **angular constrainer network**
- select best epoch based on angle **and** energy sum
- also working on improving hadronic shower generation...



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- looking for a candidate to be hired as Project Associate (for up to 3 years) to work on the simulation tasks

- so far work done by Dalila Salamani (in the context of the CERN EP R&D fellowship)

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- Comparison of inference libraries LWTNN and ONNX (supported ML libraries, layers, activation functions, file format, simulation time, memory footprint)
- Memory footprint optimization using ONNX runtime (quantization, graph optimization)
- Design of a conditional Variational Autoencoder (VAE)
  - Conditioning on the incident angle of the particle
  - Conditioning on two detector geometries (PBWO4, SiW)

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- summer student joined the team (for the summer...)
- working with Dalila on Automated machine learning (AutoML, see https://github.com/windmaple/awesome-AutoML) for the fast simulation

- Dalila started a new forum ML4Sim gathering people interested in ML for fast simulation
  - started with a few overview meetings with different groups presenting their activities
  - plan to move towards more topical meetings discussing some specific elements and looking for common solutions
    - please contact Dalila if interested