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Integration

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LPCC Fast Detector Simulation
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Integration

- How is fast simulation integrated into the experiment's framework?
  - We run it in Athena storing the full calorimeter parametrisation in a single file stored in memory
- How is the ML trained model stored (file format)?
  - TF checkpoints
- Are there any specific files to store in addition to the ML model?
  - The voxelisation information is needed to assign the voxel to a position in the detector
  - Other detector specific information such as phiMod and lateral shape to improve the simulation of hits from voxels
  - AF3 parametrization is stored as custom root classes in one large parametrization file (doc)
- Which inference library is used?
  - LWTNN
- How much time does it take to generate one event?
  - ~50ms

Integration

- What is the memory footprint?
  - AF3 store the full detector parametrisation in a single file which requires ~5GB of memory that can be share between cores
  - GANs require a smaller amount of memory than FCSV2. The full detector footprint in FastCaloGAN was ~0.5 GB. To be precise, an Athena job with the full parametrisation required 2.5GB of memory with Athena using ~2GB.
- Are there any optimization approaches considered to reduce the memory?
  - ONNX will be considered for VAE and FastCaloGANv2 that will require more memory
  - FCSV2 can be optimised by changing the granularity of the histograms in the lateral tails (merge bins at high r)
- Has the ML simulation been tested on GPU?
  - This is WIP. In AF3 the time is dominated by the simulation of the inner detector, so a speed up of the calorimeter simulation would not be significant. We have plans to run on GPUs which are relevant for HL-LHC when all ATLAS will be fast simulated; FCSV2 (calorimeters-only) can be speed up by a factor 5-10.