New Extended Example: *Parameterisations/**Par02***

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Motivation

- To show how to do "track and energy smearing" in Geant4, in order to have a very fast simulation based on assumed detector resolutions
  - Complementary with respect to the shower parameterization examples already present in Geant4

- Based on an application developed by the *Ph.D.* student Anna Zaborowska for the Future Circular Collider (FCC) project

Structure

- The geometry is read in from a GDML file
  - Simplified (but not trivial) collider detector set-up used for the first FCC studies, inspired by ALEPH, ATLAS and CMS detectors
  - Made of 4 sub-detectors
    1. Tracker
    2. Electromagnetic calorimeter
    3. Hadronic calorimeter
    4. Muon sub-detector
- Primary particles generated with G4ParticleGun
  - Default: 1000 events, each consisting of a 50 GeV electron
  - For FCC studies, Pythia8 events read in HepMC format were used
- Special physics list
  - Only decays and fast simulation models (see next slide)
- Output
  - A Root file, containing 3 histograms and 1 ntuple

Fast Simulation Models

3 models, each bound to a sub-detector

- Tracker
  - When a charged particle enters the tracker, it is placed to the end of the tracker (where it would exit if transported normally) but with a (gaussian) smeared momentum
- Electromagnetic Calorimeter (ECAL)
  - When a primary electron, positron or gamma enters the ECAL, it is killed and its (gaussian) smeared energy is deposited
- Hadronic Calorimeter (HCAL)
  - When a primary hadron enters the HCAL, it is killed and its (gaussian) smeared energy is deposited

No fast simulation model is used in the muon subdetector

Plans for the future

- Currently, only the simple track momentum smearing is considered in the tracker
- Anna is working to extend the fast simulation model in the tracker to include the complete track-smearing, i.e. of the 5 parameters that describes a track
  - Following ATLAS successful experience in this type of fast simulation
  - Smearing parameters should be obtained by running (only once) the full, detailed Geant4 simulation
    - and then reconstructing the tracks from the hits deposited in the tracker
  - This is quite complex, so we have to see whether it makes sense to included it as a Geant4 example
    - either extending the current Par02 example, or creating a new one