Generating single electrons with FSR

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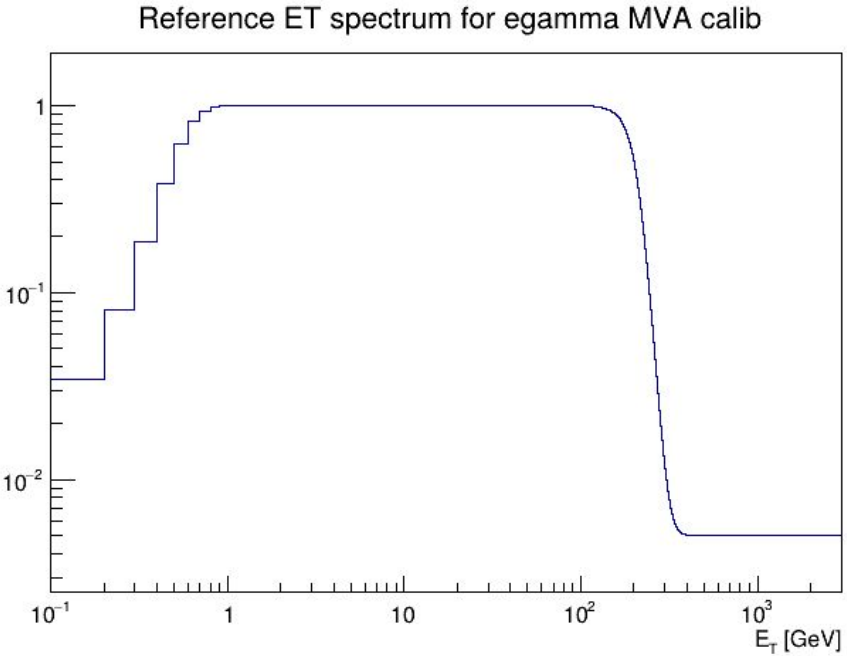
Overview

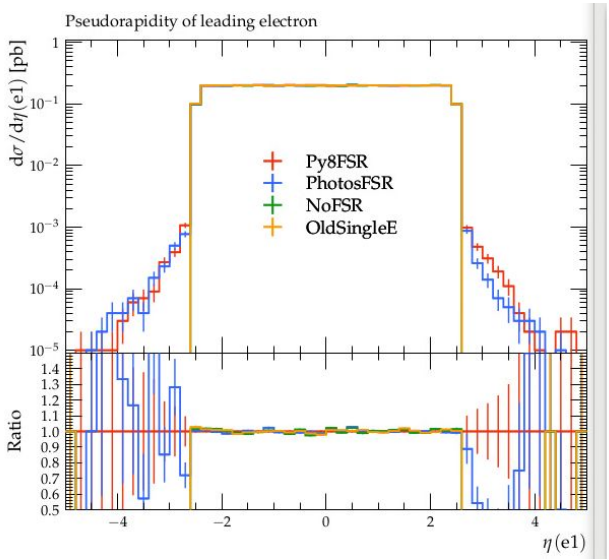
- Current e/gamma single electron samples are ‘particle gun’ without FSR (or any other physics)
- Current jO (correct?):
  https://gitlab.cern.ch/atlas-physics/pmg/mcjoboptions/-/blob/master/900xxx/900333/mc.PG_single_electron_egammaET.py
  - Technical distributions: same amount e+, e-, flat-ish pT distribution, flat eta [-2.5,2.5], flat phi
- Idea: generate single electron samples with the same distributions, but with physics-like FSR
- Path explored (personal bias – not sure ‘generator purists’ will like it):
  - Create a ‘fake’ pp → W → ev LHE file
  - Feed into Pythia8, disable QCD radiation and checks
  - Allows to use QED FSR radiation either by Pythia8 or Photos++ (Photos++ requires a W → ev vertex)
  - Events contain only:
    - one e+ or e- (+ optional FSR)
    - one neutrino (to make Photos++ happy) – nothing to be simulated or detected
- Test setup appears to work, 500k events and passed through Rivet, few distributions shown:
  - Py8FSR: new jO, FSR by Pythia8
  - PhotosFSR: new jO, FSR by Photos
  - NoFSR: new jO, FSR disabled (x-check)
  - OldSingleE: 900333 jO (x-check)
- Setup in principle ready for production:
  - Can easily produce some 1-10M events, proposal to use Photos++ FSR and setup as in previous single E runs… to be clarified

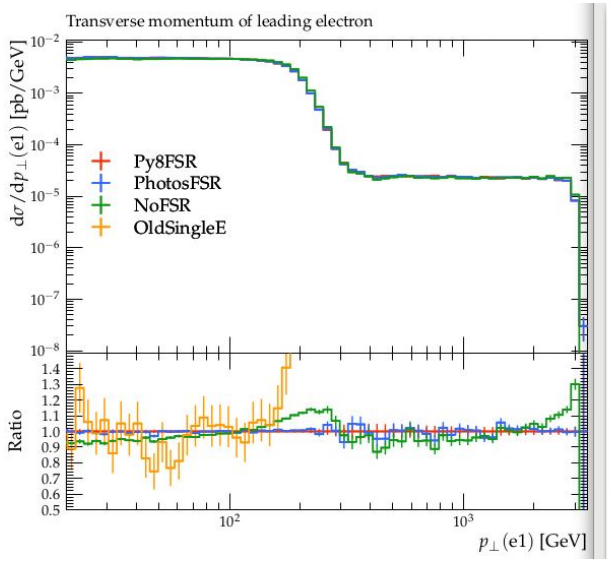
Reference E_T spectrum

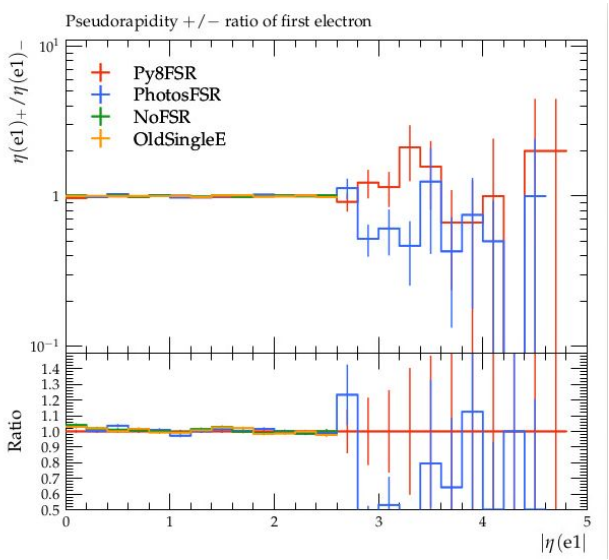


- From jO 900333 just to check what spectrum we should expect

Basic eta, pT, charge

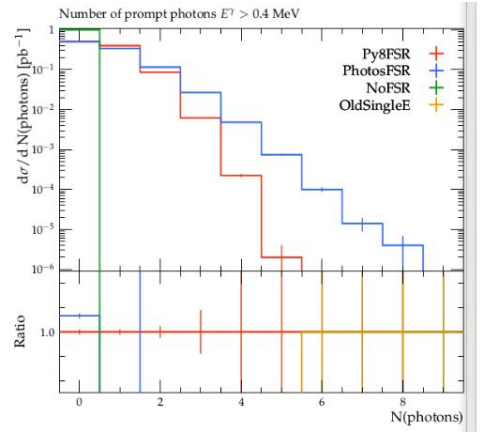


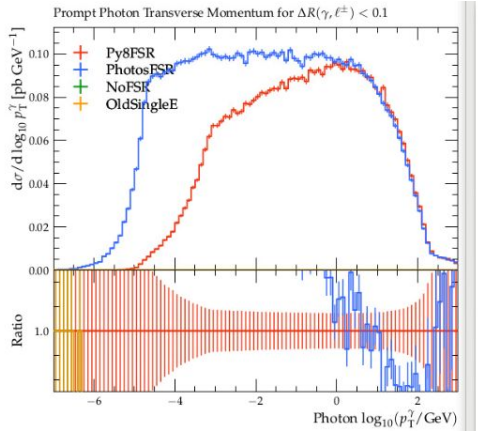


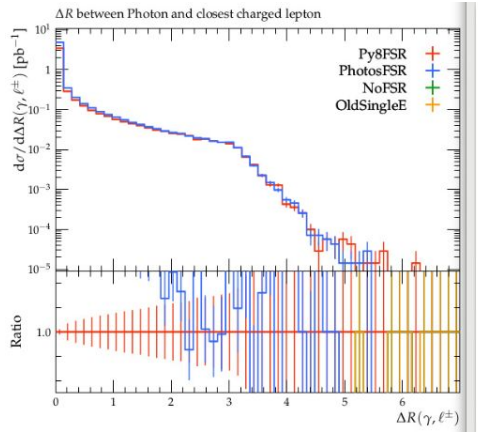


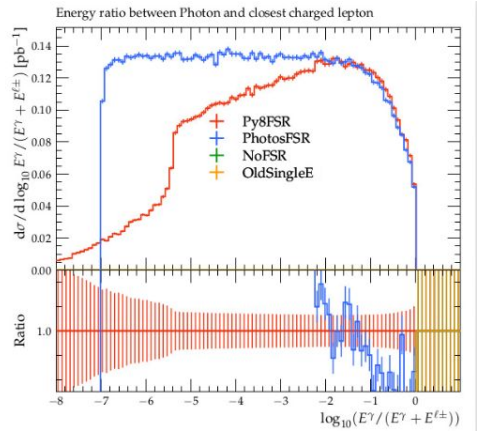
Looks sensible, Rivet apparently doesn't like the old single E sample (not sure how much to read into it, but basic distributions should be checked on a smaller test sample)

FSR distributions









- About 50% of all events have at least one FSR photon with E > 0.4 GeV, similar between Pythia8 and Photos FSR
- Photos produces a few more very low pT photons close to electron (lower effective cutoff)
- DeltaR(l,y) peaked at low value with a tail
- Overall FSR between Photos and Pythia8 quite close in range of energy loss from ~1% to 100%, although some differences
- Small word of warning: could need some extra code downstream to define event-by-event true electron energy, ‘Born level’ electron probably does not exist in latest generator https://its.cern.ch/jira/browse/AGENE-2313 - maybe use ‘dressed electron’ as calibration target?