EM showers with PROPOSAL 7.4.1 (PR 445)

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New PROPOSAL version

- On CORSIKA 8 master: PROPOSAL 7.3.1
- Recently new PROPOSAL release 7.4.1
  - Several improvements of interest to CORSIKA 8

C8-relevant improvements and additions in PROPOSAL 7.4

- Photoeffect is included as a process, enabled by default; should have an effect on low-energy photons
- Kinematic limits for electron bremsstrahlung are now calculated in a more appropriate way (cf. presentation on August 11); should have an effect on low-energy electrons and positrons
- Calculation of interaction length is implemented as 1D-interpolation, should save ~20% of time spent in PROPOSAL within C8 (solves issue 519)

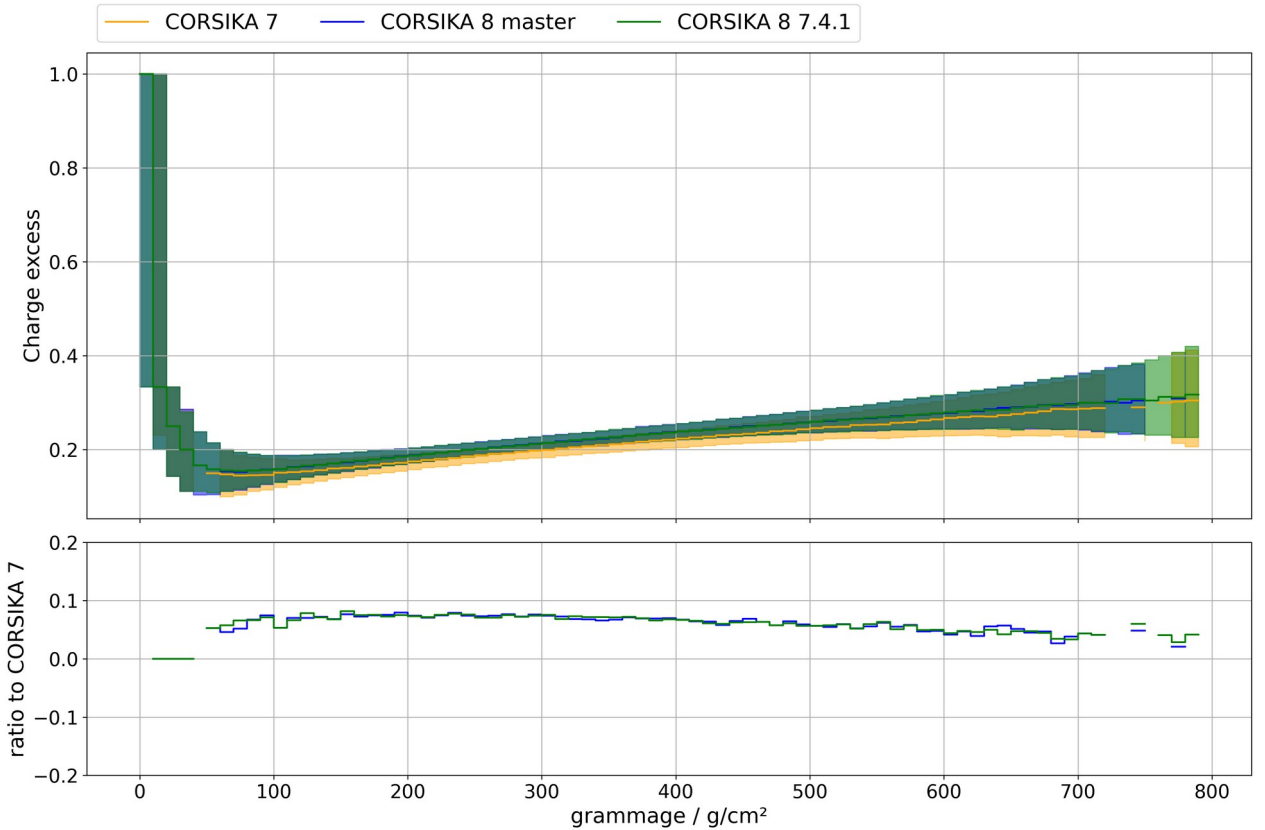
Charge excess & longitudinal profile

- Expected performance gain of ~20% confirmed
  - 1 TeV, E > 2 MeV: 43 s → 36 s per shower
  - 100 TeV, E > 2 MeV: 2552 s → 2027 s per shower
- These are without the «quick fix» in `Cascade.inl`, so effectively no multiple scattering (PR 426 still in draft stage)

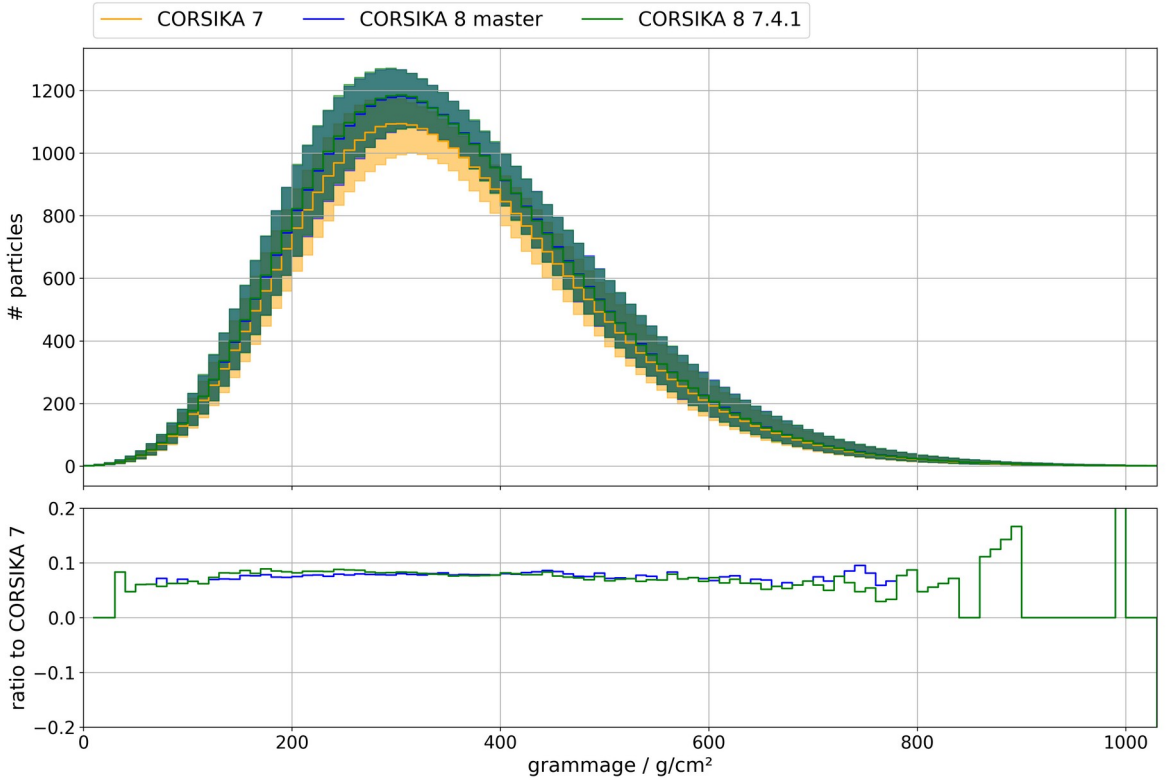
Simulated showers

- 5000 showers of 1 TeV with E > 2 MeV
- 5000 showers of 1 TeV with E > 200 MeV
- 100 showers of 100 TeV with E > 2 MeV
- 100 showers of 100 TeV with E > 200 MeV

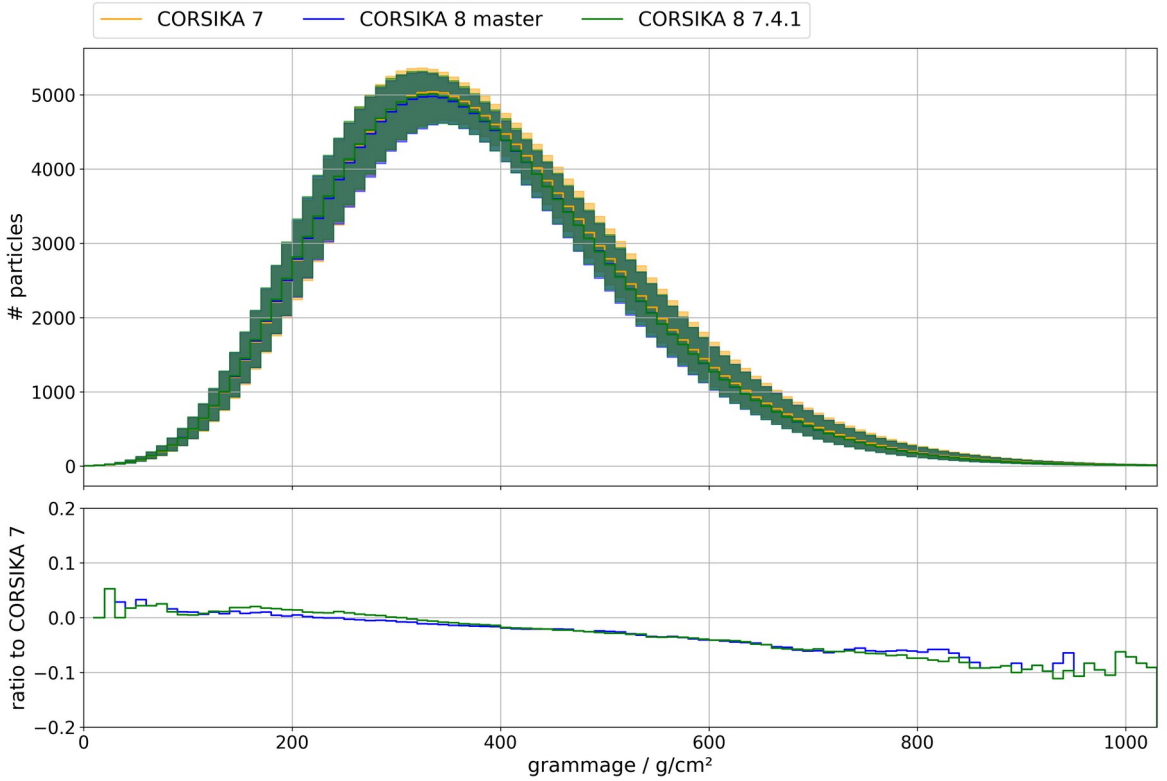
1 TeV, charge excess, E > 2 MeV



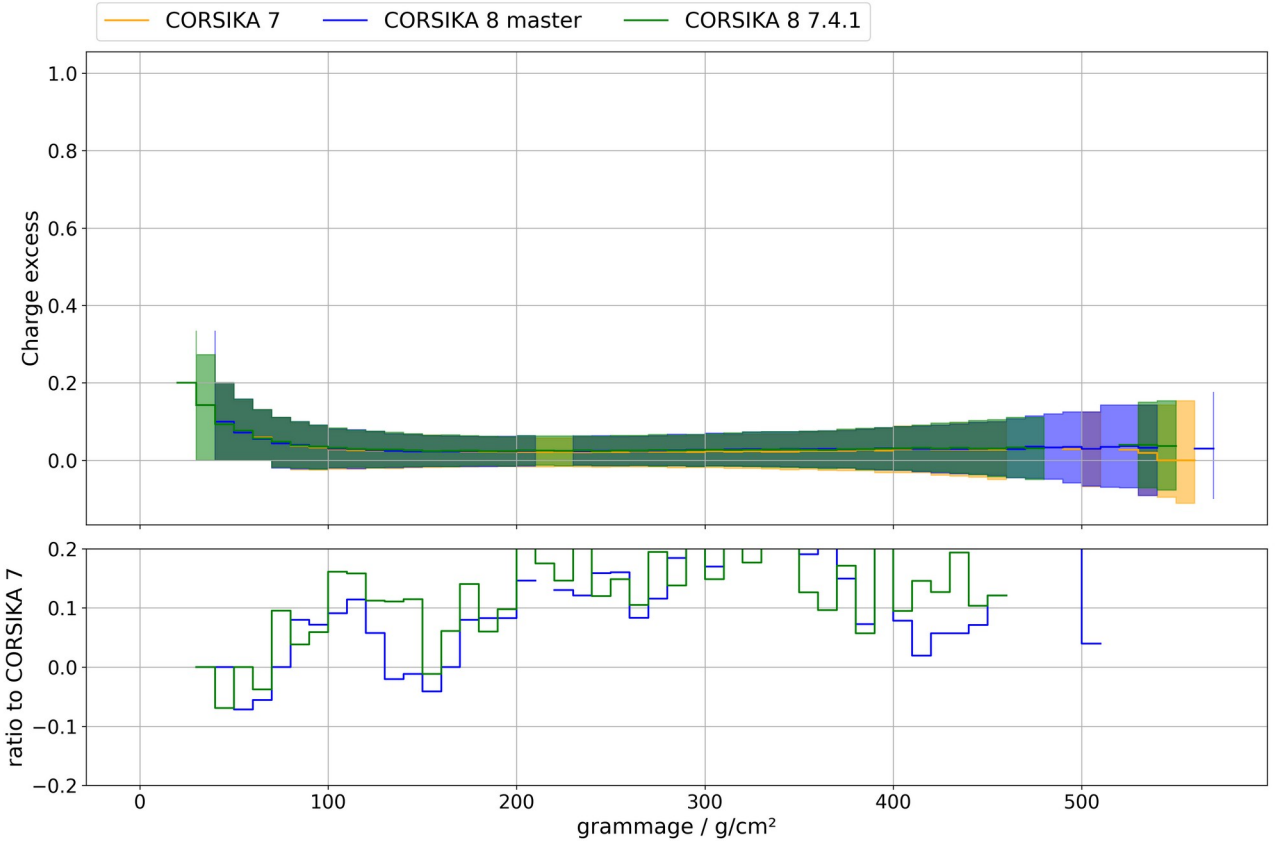
1 TeV, longitudinal profile, charged particles, E > 2 MeV



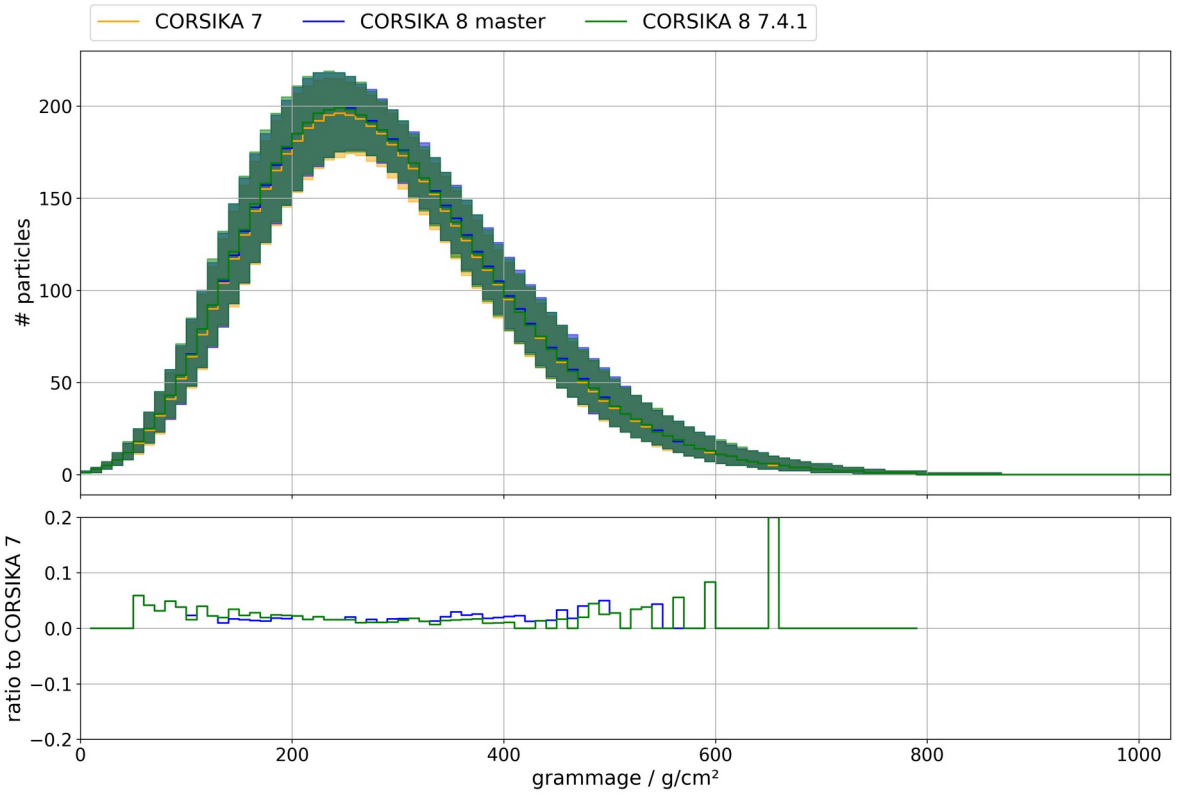
1 TeV, longitudinal profile, photons, E > 2 MeV



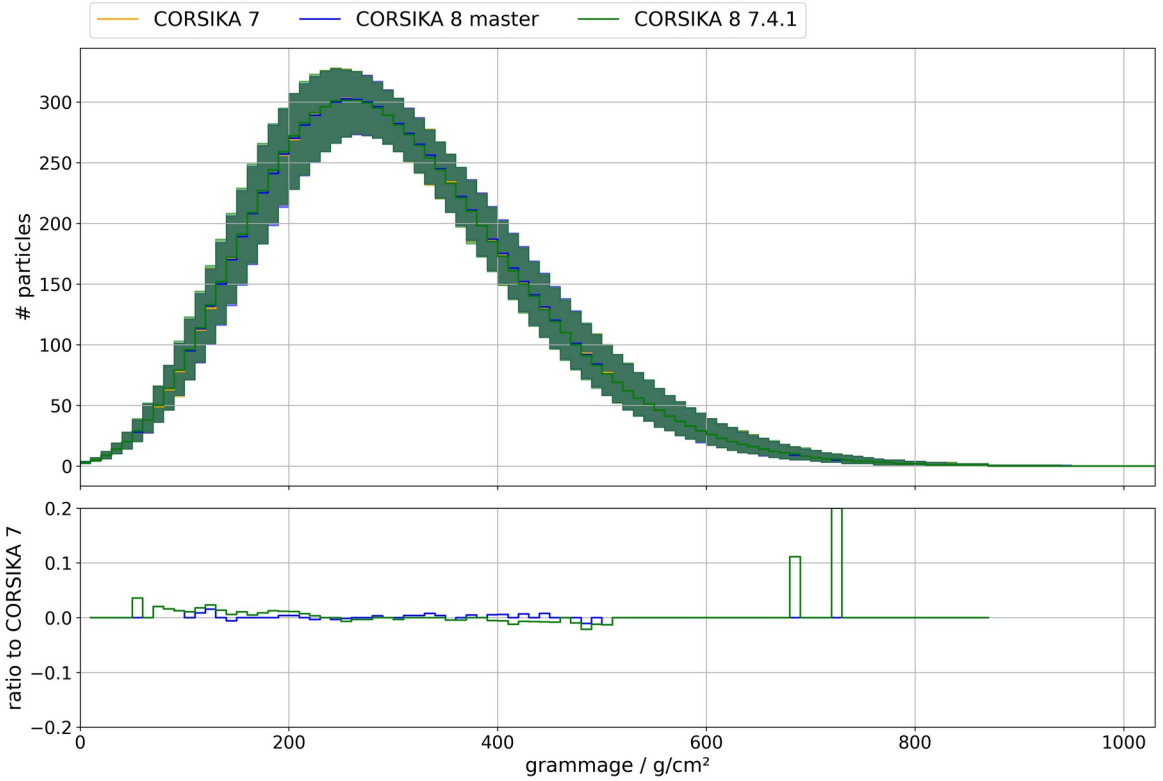
1 TeV, charge excess, E > 200 MeV



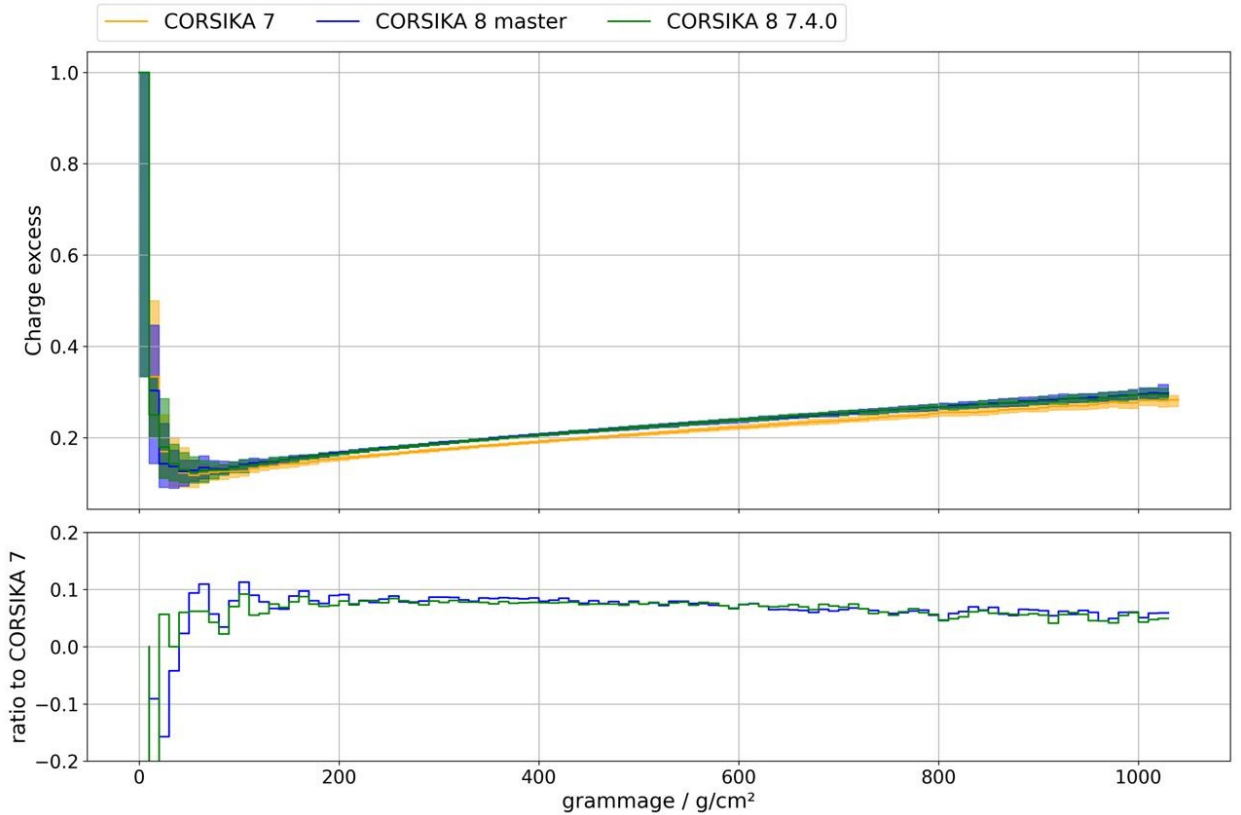
1 TeV, longitudinal profile, charged particles, E > 200 MeV



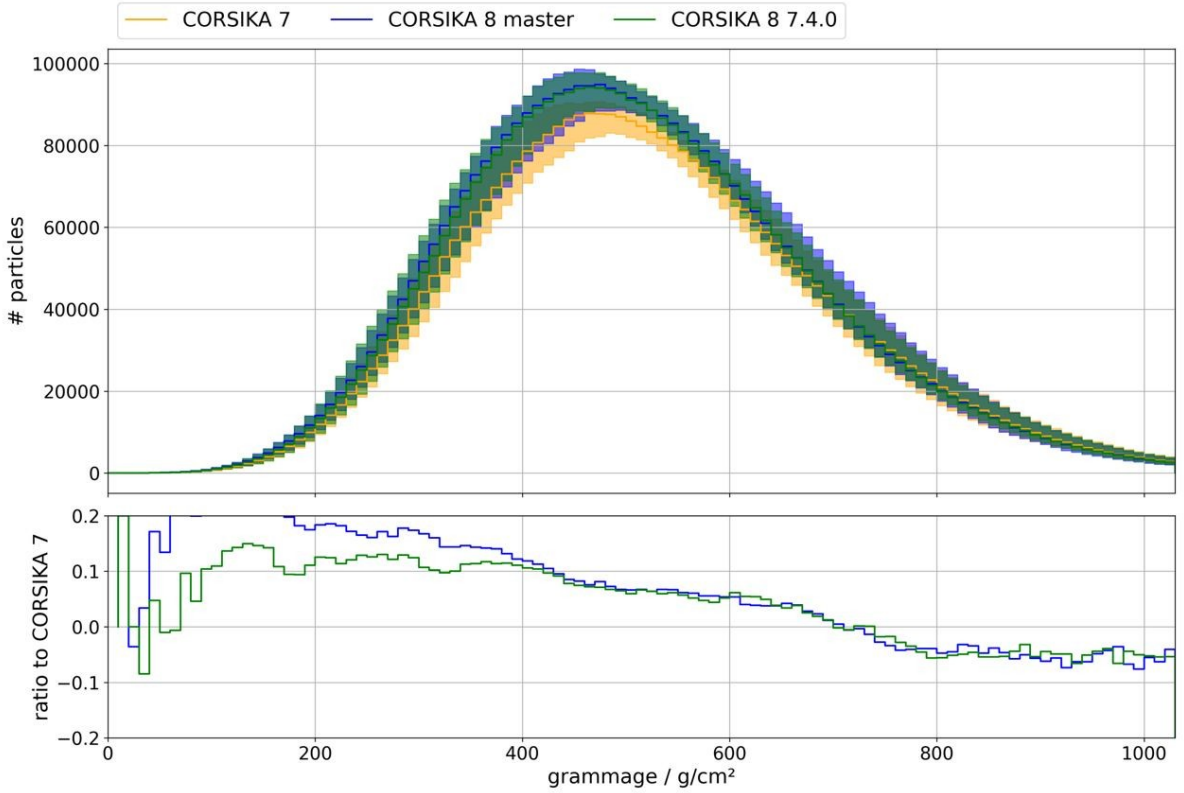
1 TeV, longitudinal profile, photons, E > 200 MeV



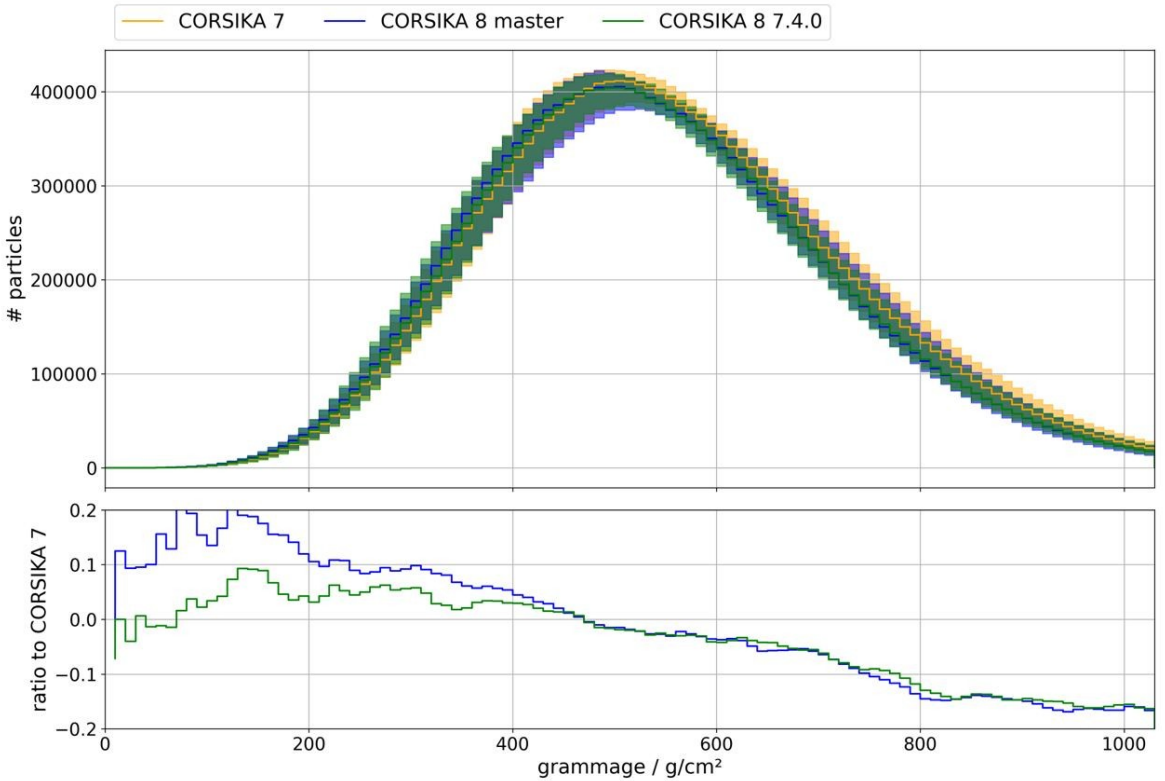
100 TeV, charge excess, E > 2 MeV



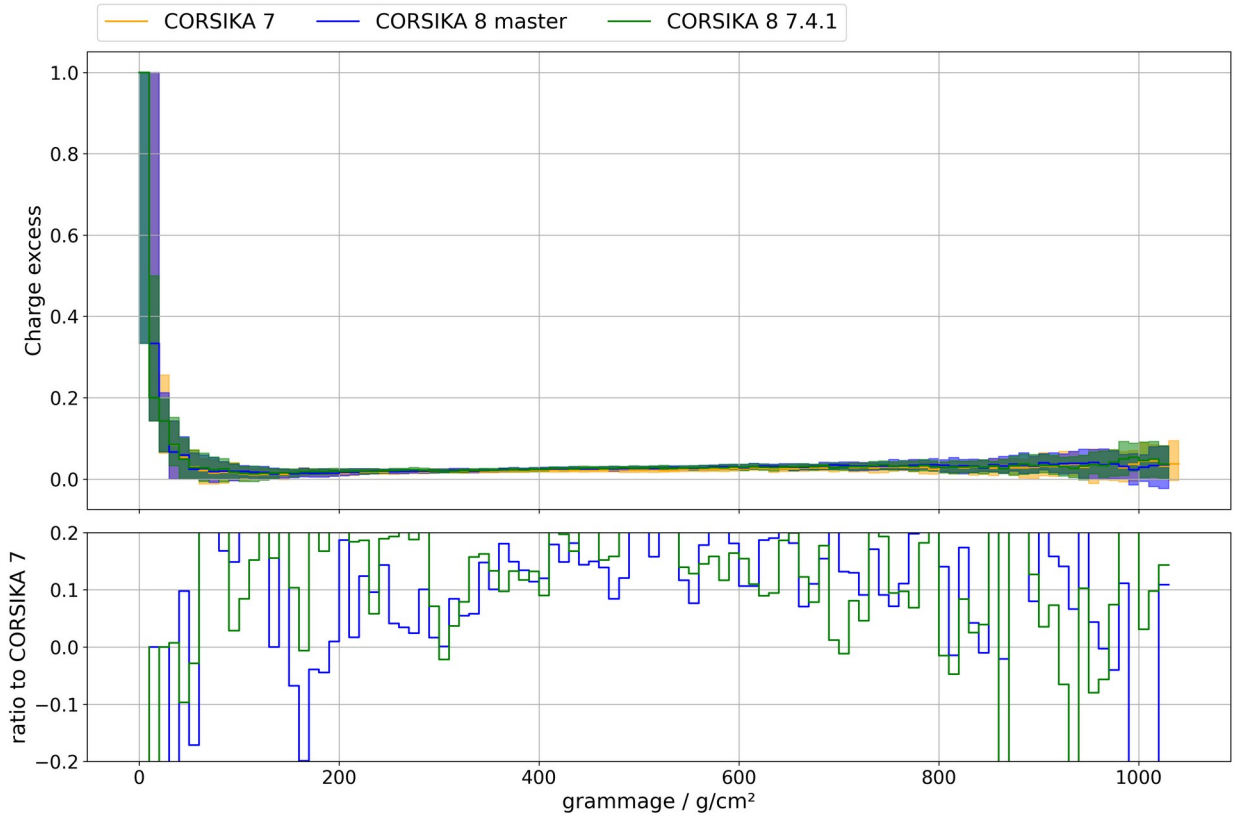
100 TeV, longitudinal profile, charged particles, E > 2 MeV



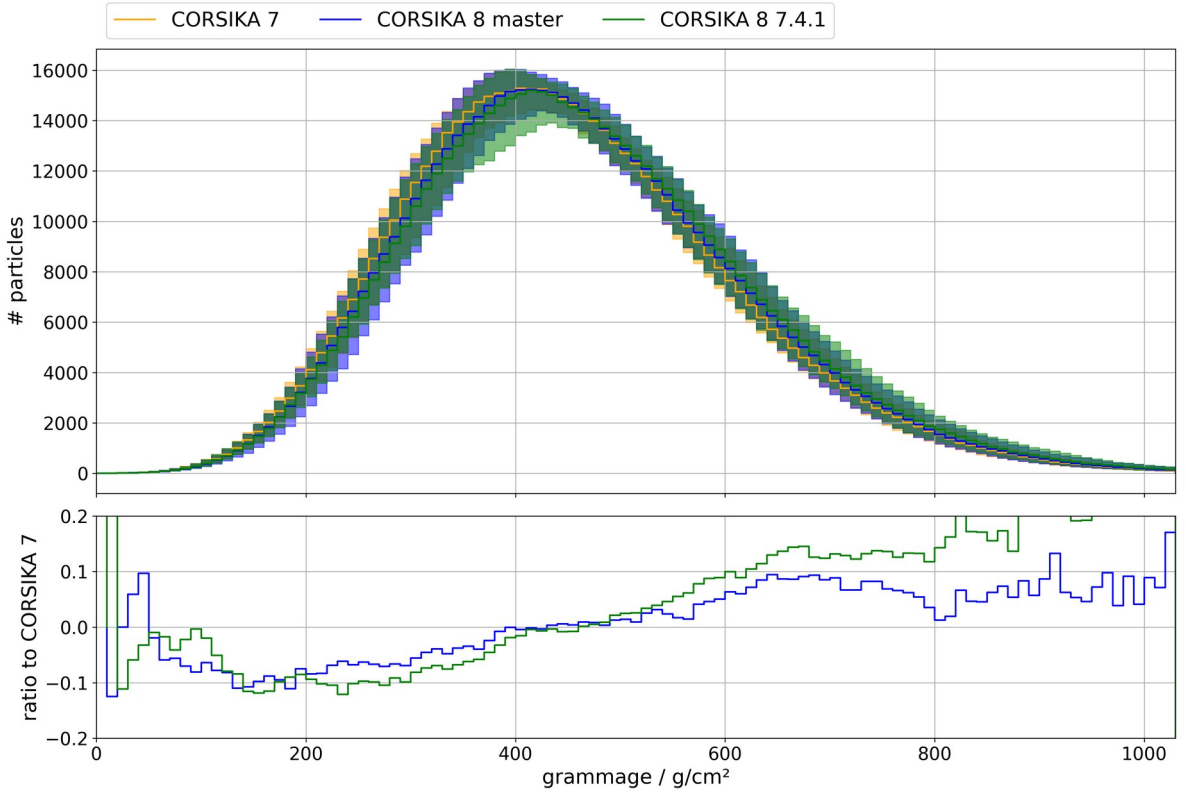
100 TeV, longitudinal profile, photons, E > 2 MeV



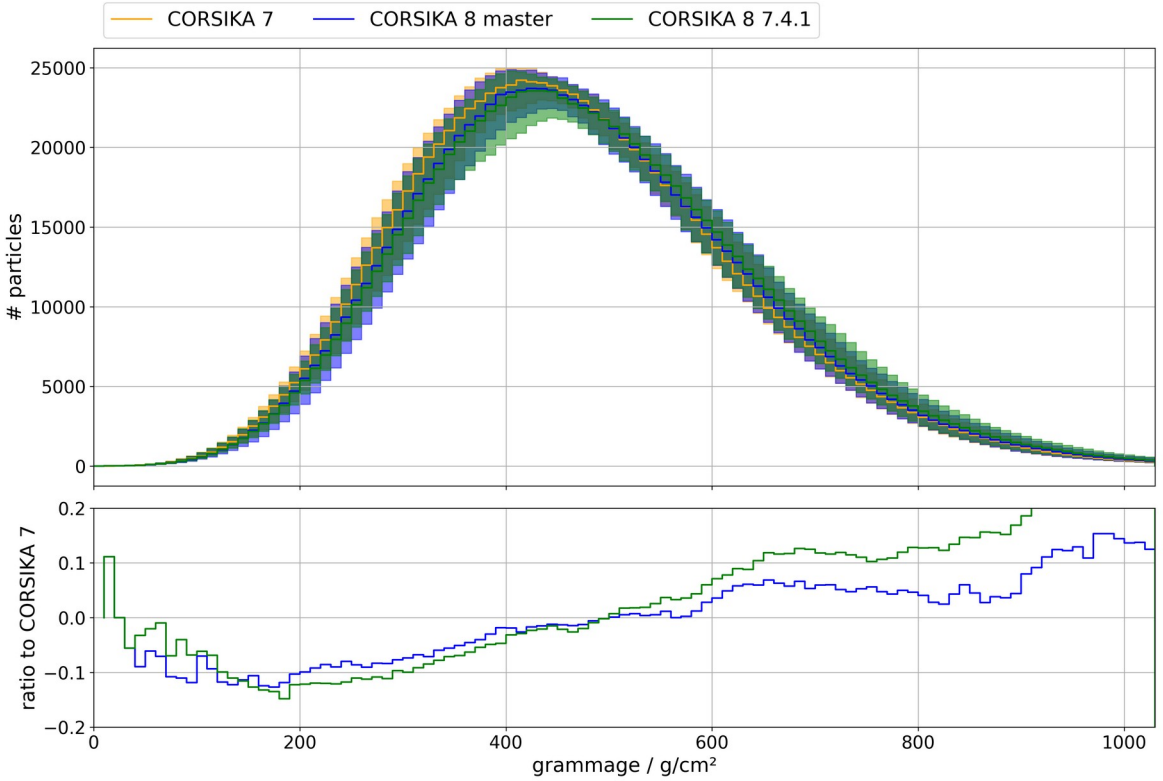
100 TeV, charge excess, E > 200 MeV



100 TeV, longitudinal profile, charged particles, E > 200 MeV



100 TeV, longitudinal profile, photons, E > 200 MeV



Conclusions

- Agreement to C7 is better with E > 200 MeV than with E > 2 MeV
- Agreement in 1 TeV showers almost the same
- Agreement in 100 TeV showers improves with PROPOSAL 7.4.1 for E > 2 MeV; about the same level of agreement for E > 200 MeV
- Runtime improves by ~ 20%
- We saw better agreement with the «quickfix» for multiple scattering in Heidelberg → hoping for solution in PR 426