Updates from EM and Radio

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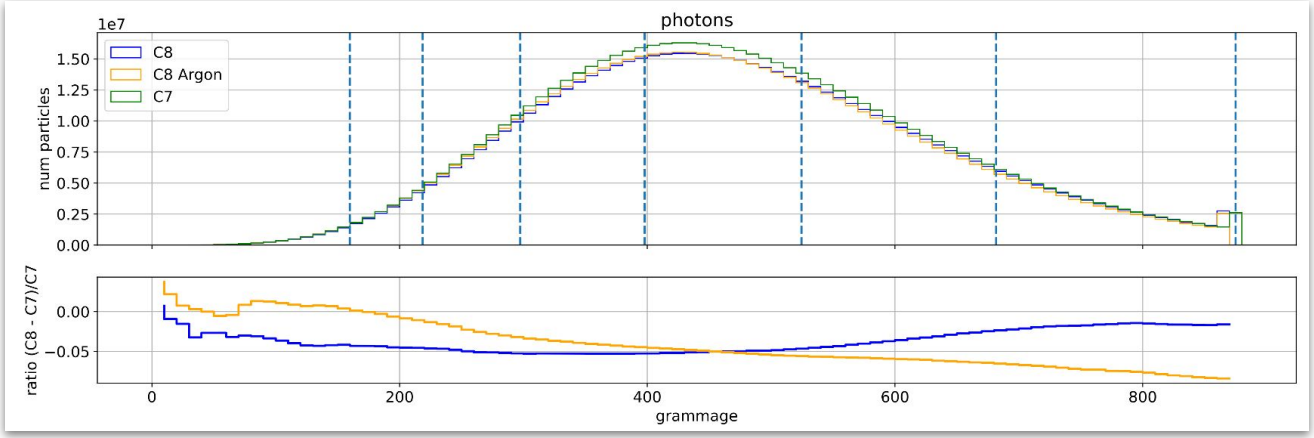
Update from EM Shower simulations - Current status

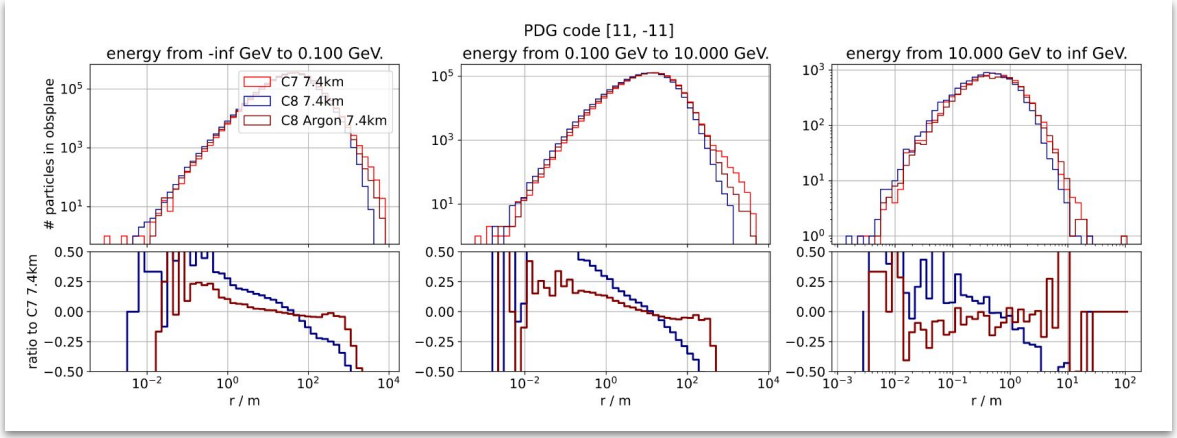
- Newest PROPOSAL version: **v7.1.2**
  - Several fixes of runtime errors (runs flawlessly now)
  - Not used on master branch yet (PR !396)
- Extensive analysis of simulations of EM showers
  - 10 TeV showers, 5 MeV ParticleCut, statistic of 500, no magnetic field
  - Ran on the radio branch



➔ Longitudinal profiles and charge excess agree within 5%

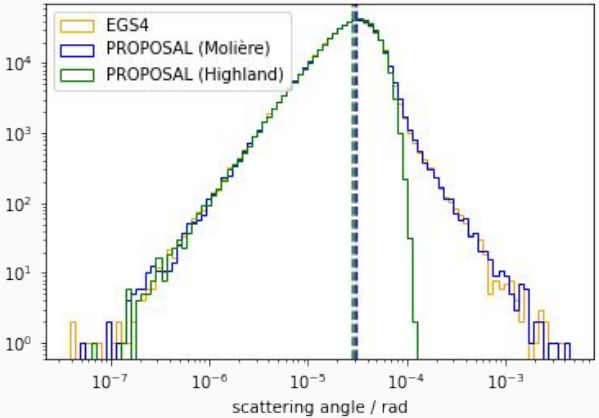
➔ Argon with a significant impact on shower development

Update from EM Shower simulations - Current status



- Lateral profiles are improved by using Molière instead of Highland as a scattering model
- However, profiles still do not agree
  - Especially particles very far away from the shower core (>1 km) are poorly simulated

Direct comparison of EGS4 and PROPOSAL scattering routines!?



➔ Does explain why Molière works better than Highland, but EGS4 and PROPOSAL look very consistent

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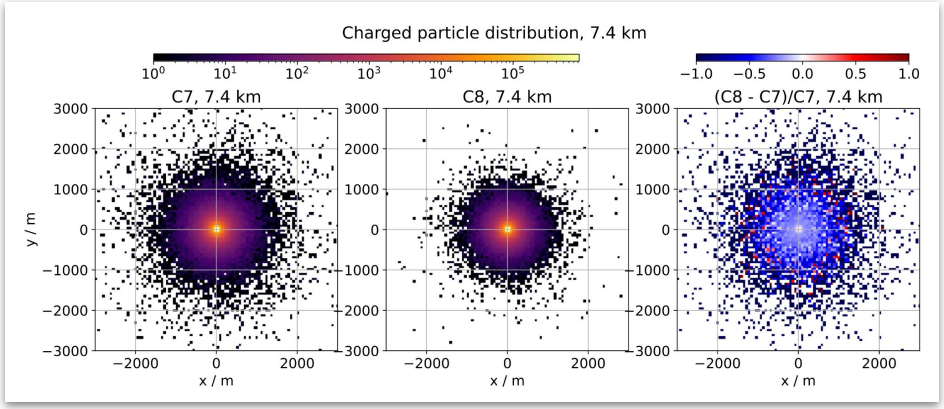
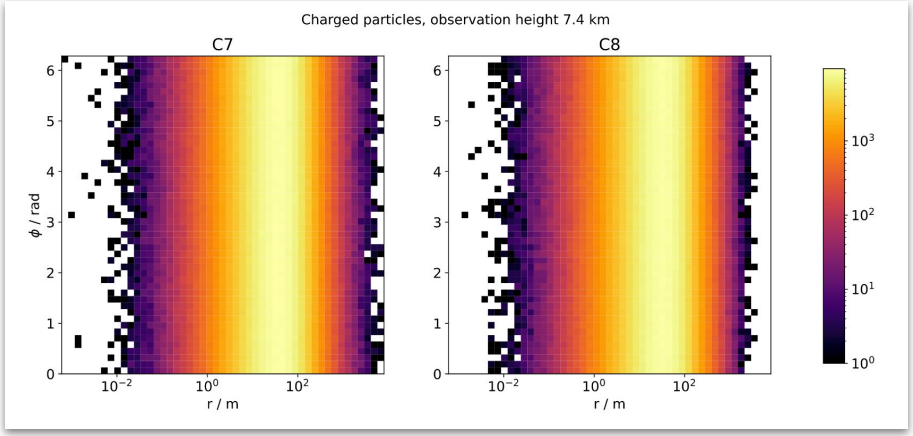
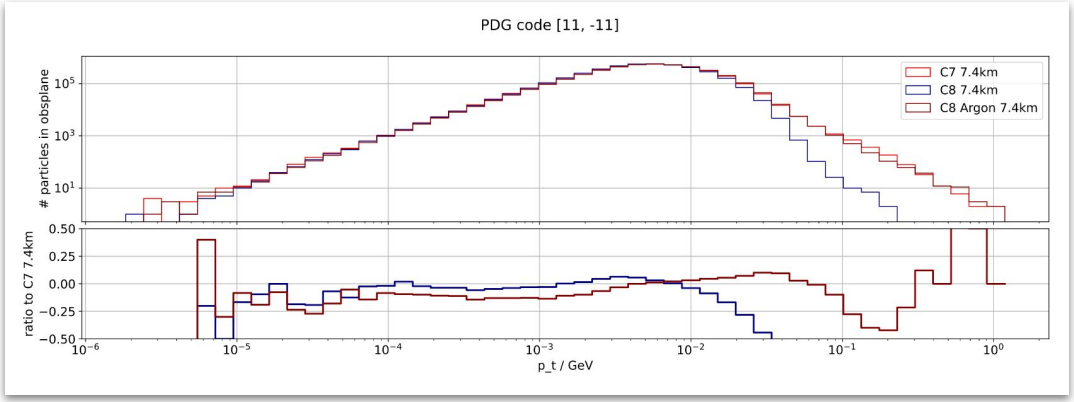






Several other comparisons…

➔ No signs of azimuthal asymmetries

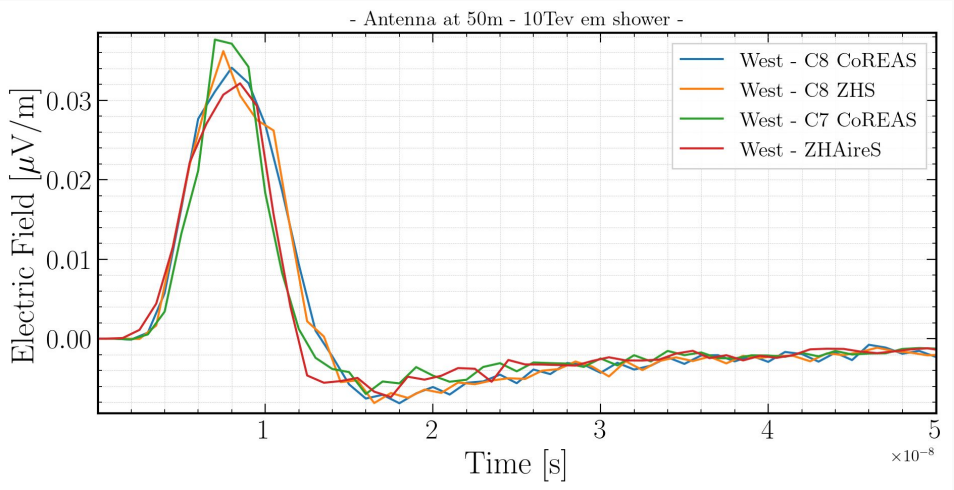
➔ No unexpected structures

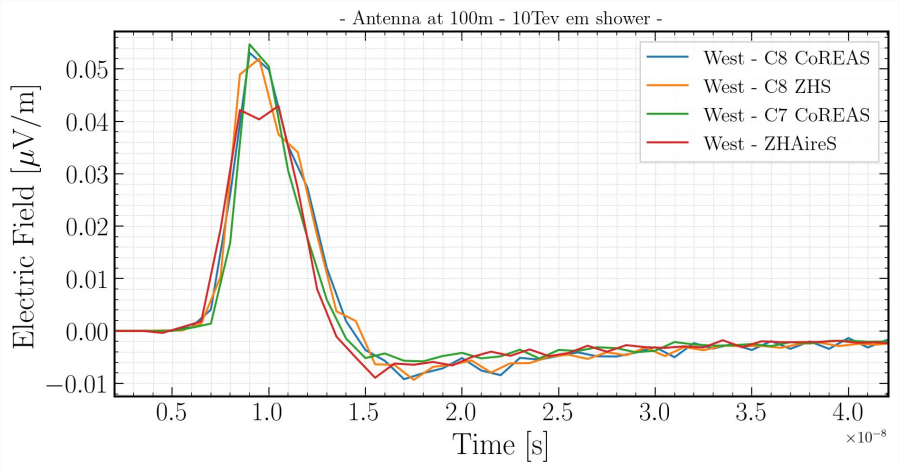
Update from EM Shower simulations - Next steps

- Run simulations with higher statistics
- Check multiple scattering subroutine in EGS4 and compare it with PROPOSAL routine
  - First results indicate that both routines seem to produce the same results
- Implement **γ + Hadron** interactions in CORSIKA
  - Recently merged into PROPOSAL master, **v7.2.0** release imminent
  - Need to work on the interface to a hadronic event generator in the CORSIKA interface now
  - Possible influence on lateral/longitudinal shower development?
- Including LPM effect in inhomogeneous media
  - We developed some ideas on how to treat the LPM effect (see slides by Alexander)
  - Need to start implementing

Update from Radio branch - Current status

- Radio uses PROPOSAL version: **v7.1.1**
- Good agreement for antennas close to shower core, then pulses are off
- Polarization characteristics of pulses looks correct
- An issue is evident in the charge excess
- Radio is used to investigate the emission of an electron, a positron and a pair of a positron and an electron





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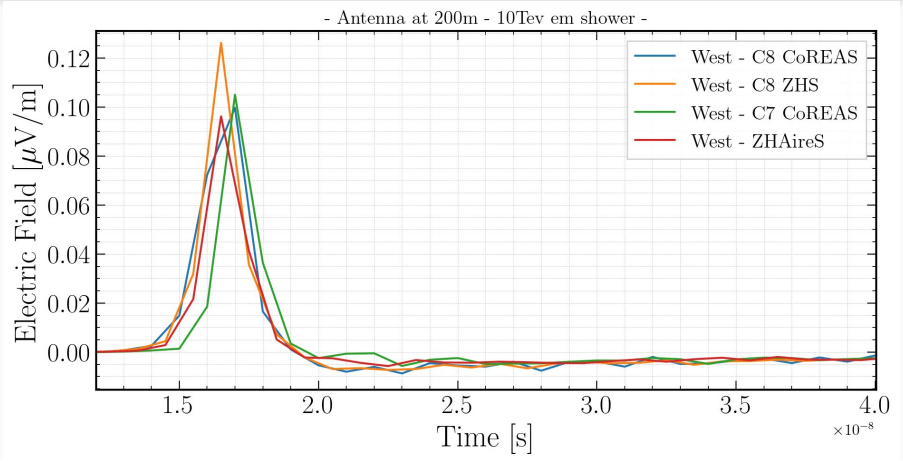
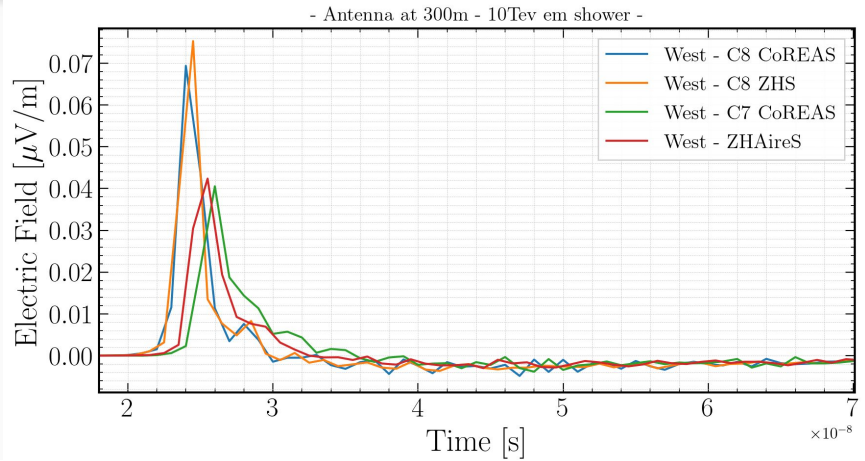
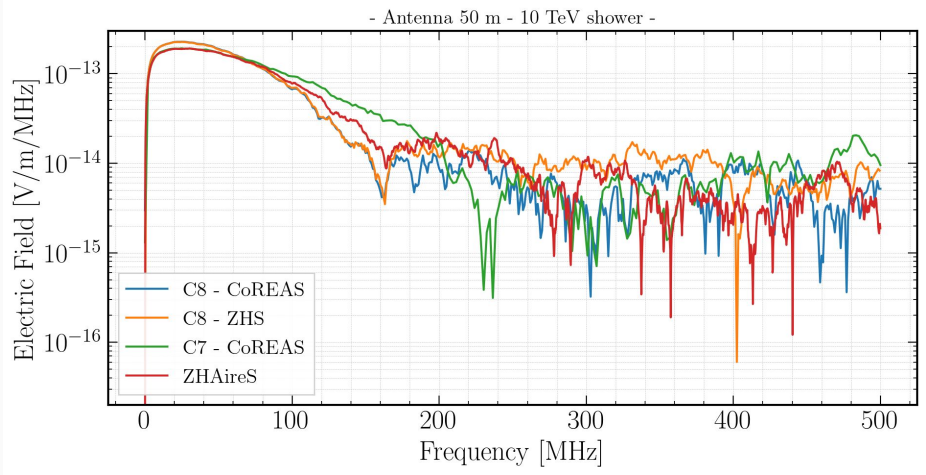
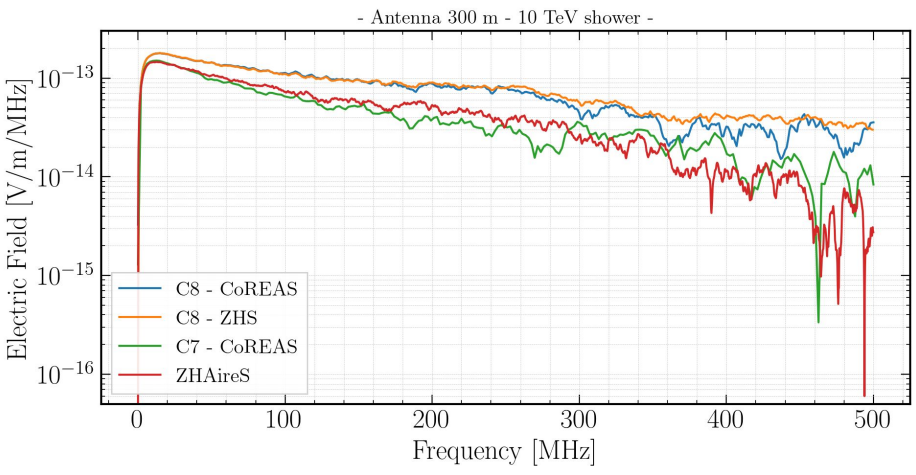


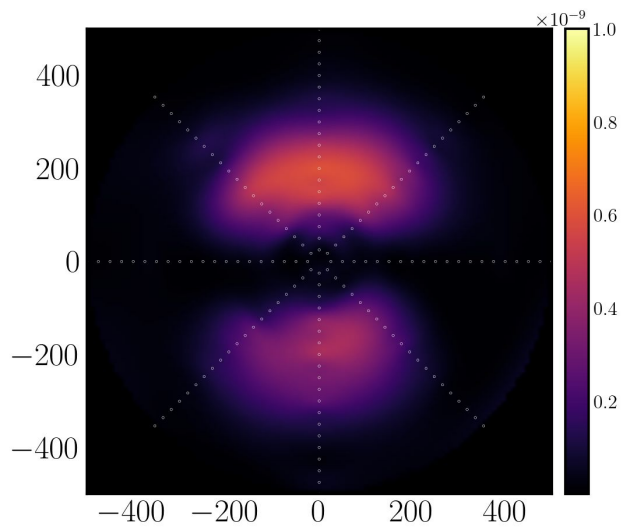




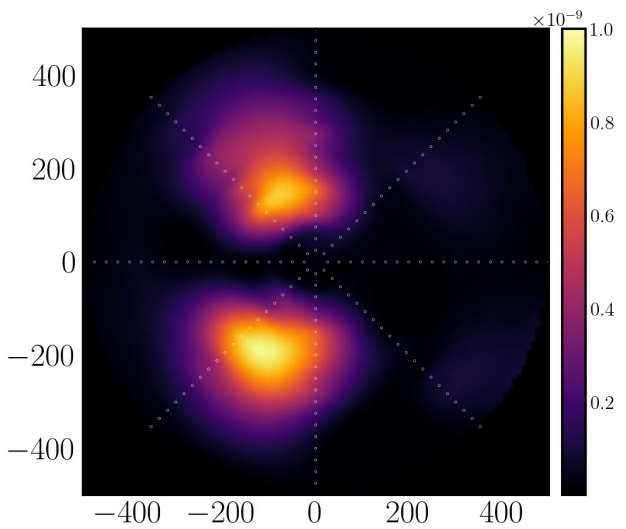


North polarization

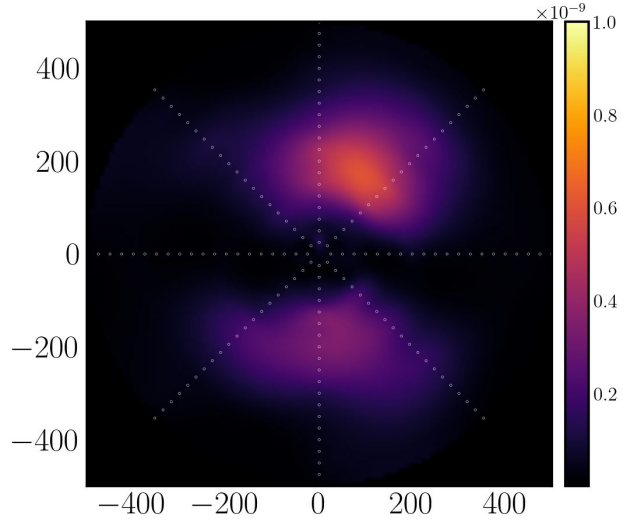
Corsika 7



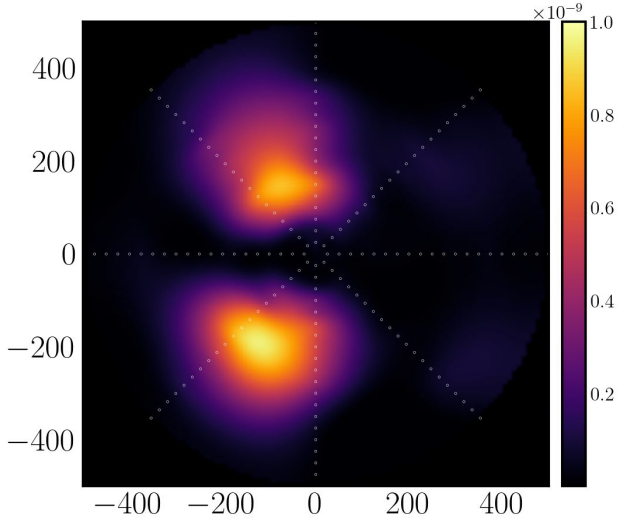
C8 - CoREAS



ZHAireS

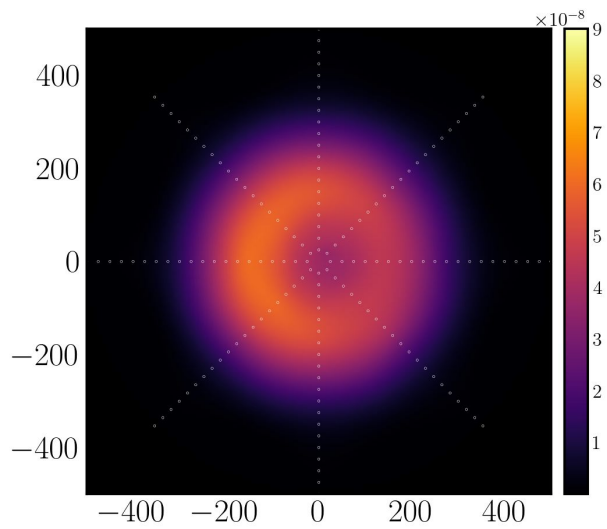


C8 - ZHS



West polarization

Corsika 7



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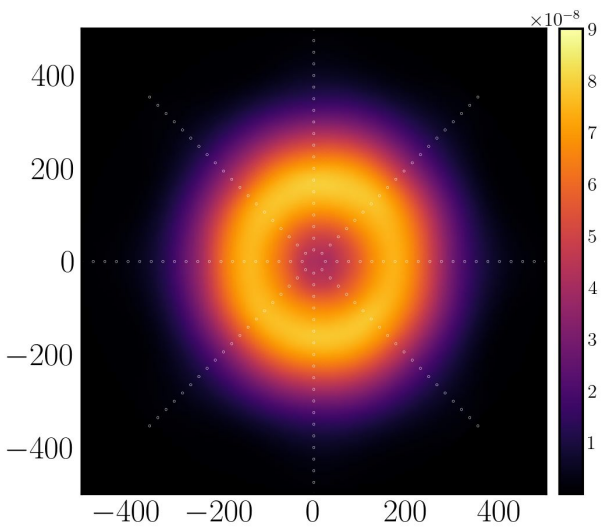

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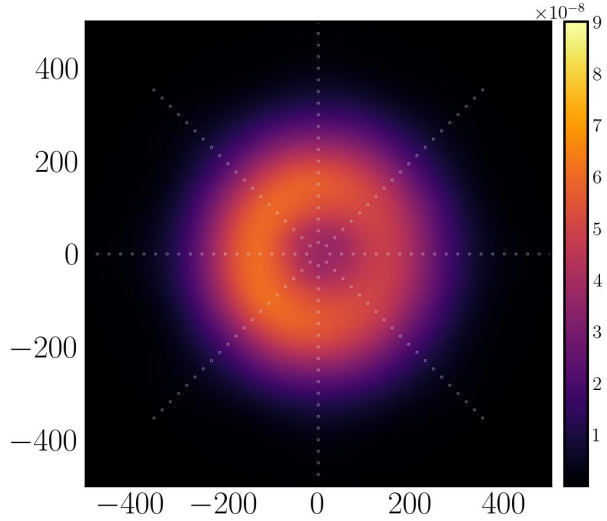

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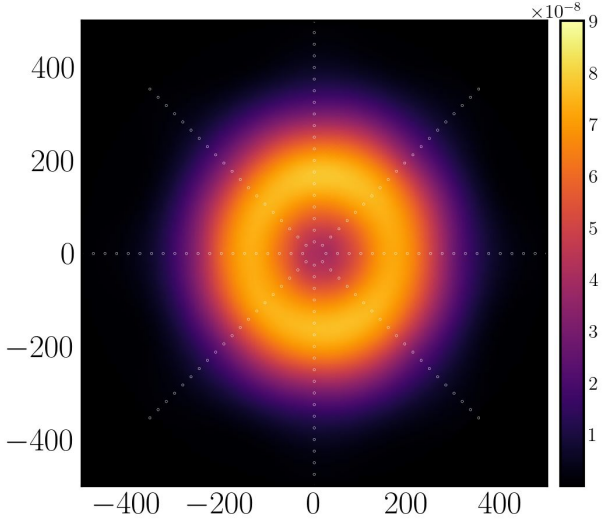
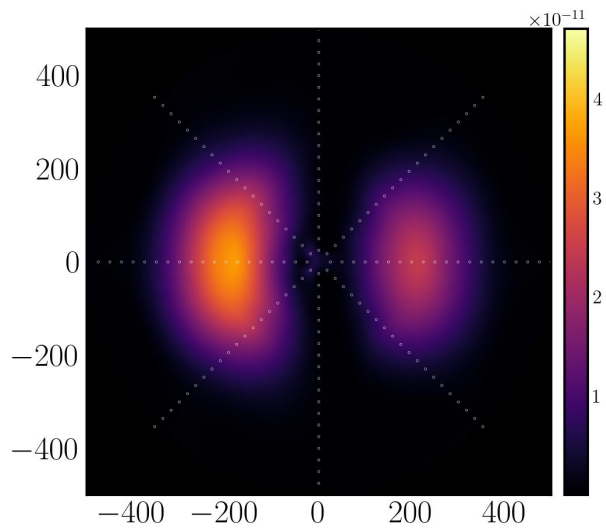


Vertical polarization

Corsika 7



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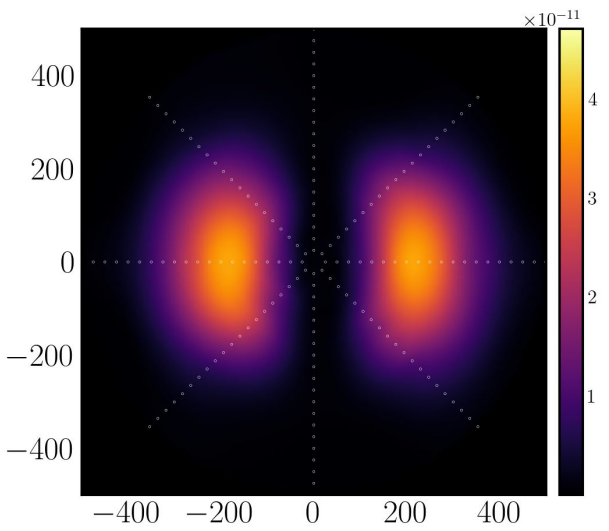

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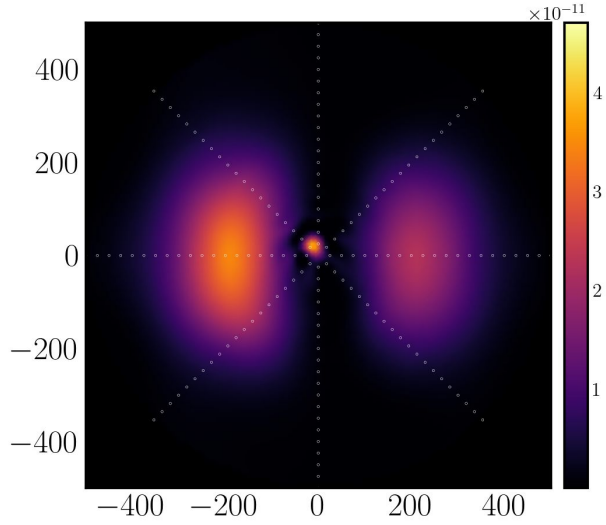

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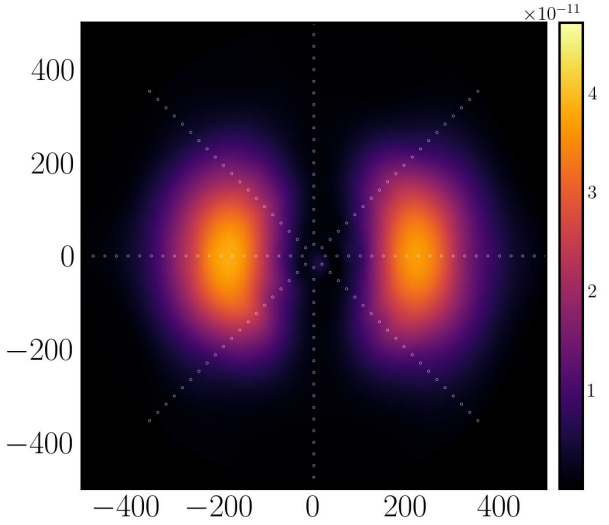
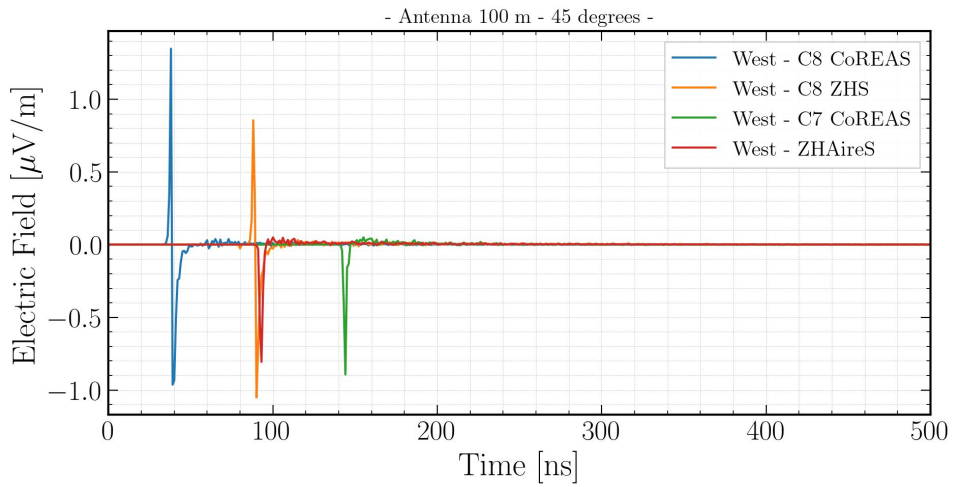
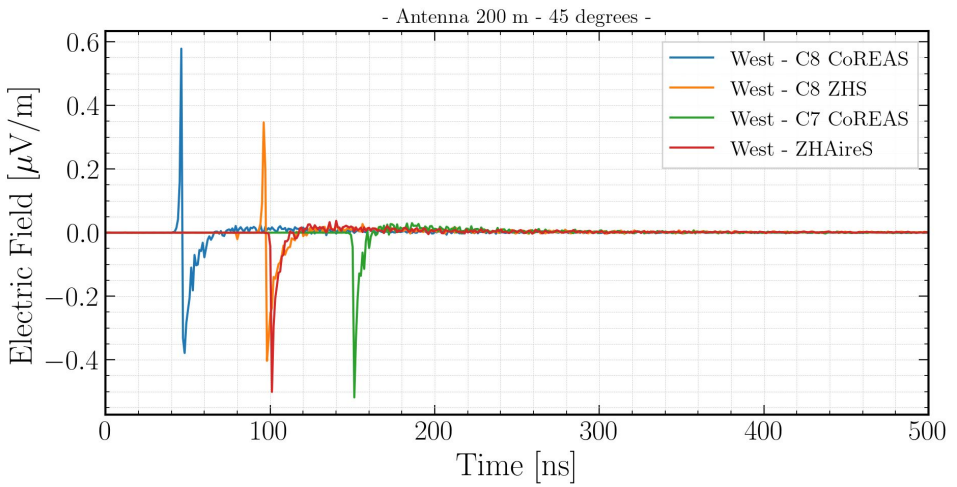


Update from Radio branch - Current status

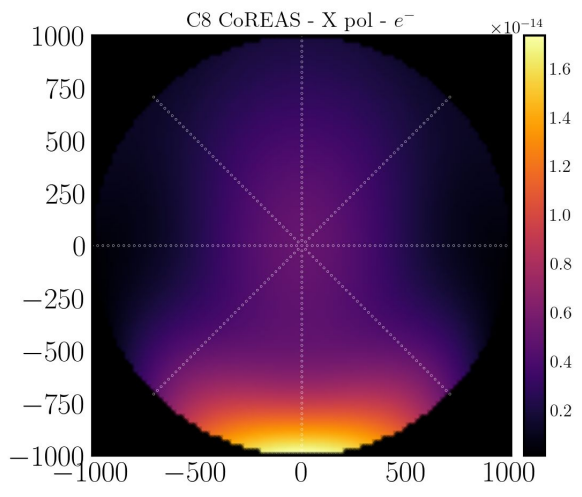
Askaryan emission for 1 PeV shower illustrates the issue in charge excess

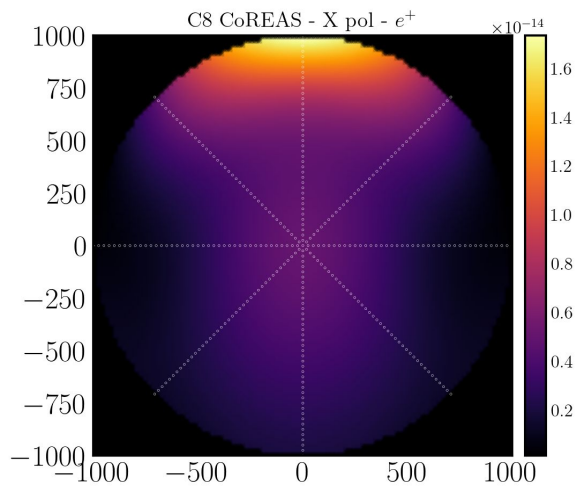


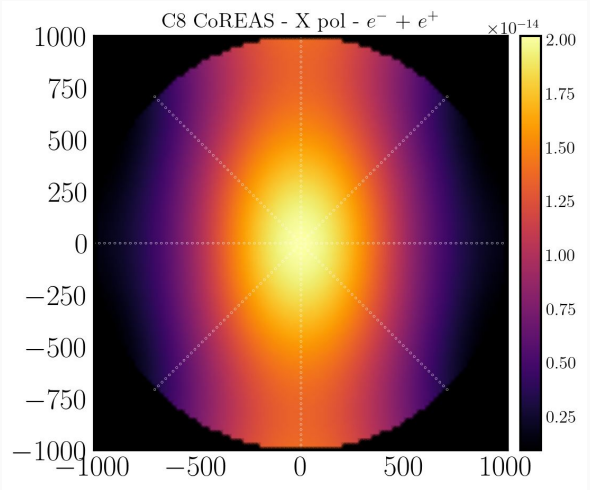


Update from Radio branch - Current status

vXB polarization for electron, positron & electron-positron pair







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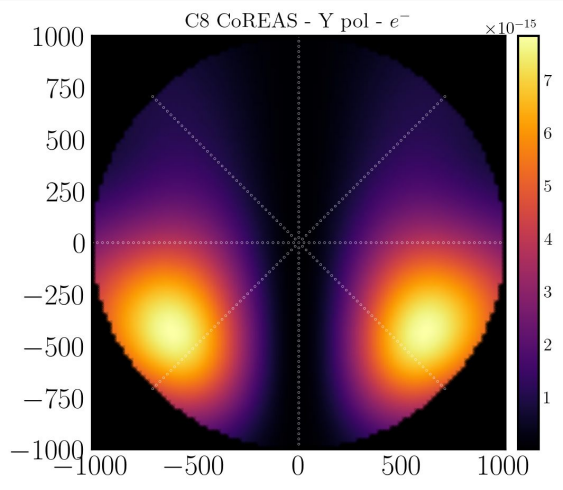

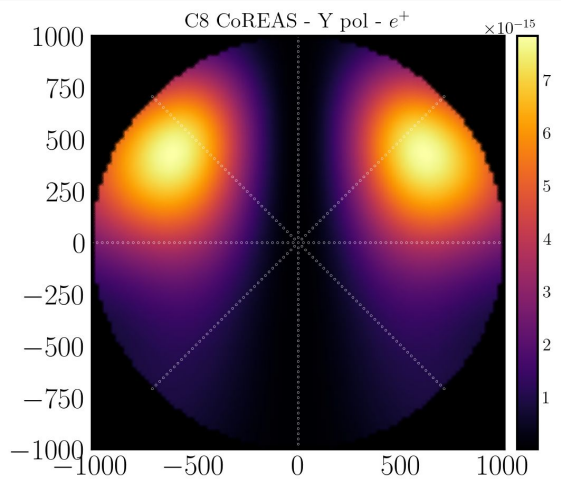

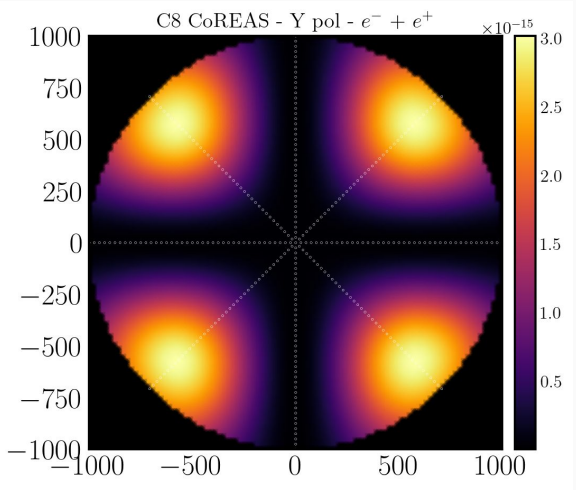

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