Acoustic detection of UHE neutrinos and the LPM effect

Group meeting 23/01/20, Clara Gatius Oliver

Two questions:

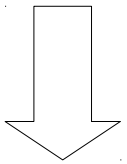
- Are the acoustic pulses from UHE neurtinos feasible to detect with a hydrophone array?

- How does the LPM (Landau–Pomeranchuk–Migdal) effect influences the shower profiles and specifically the acoustic pulses?

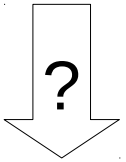
Characterization of the acoustic pulses

Current steps:

LPM effect



Hadronic energy deposition profile **!=** Electromagnetic energy deposition profile



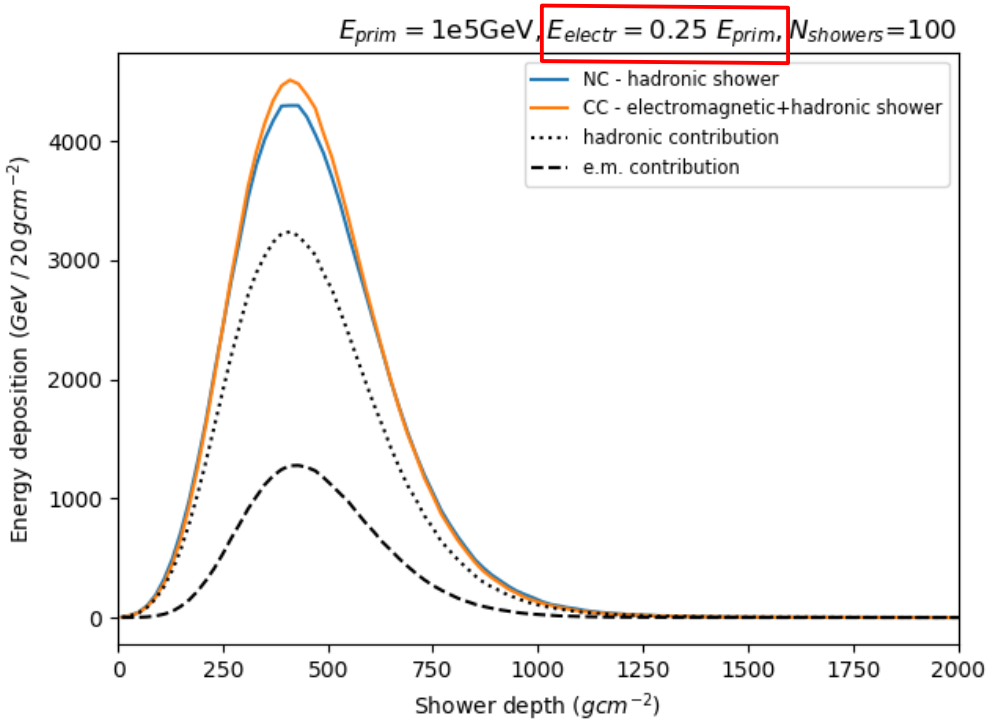
Acoustic pulse from hadronic shower **!=** Acoustic pulse from electromagnetic shower *****

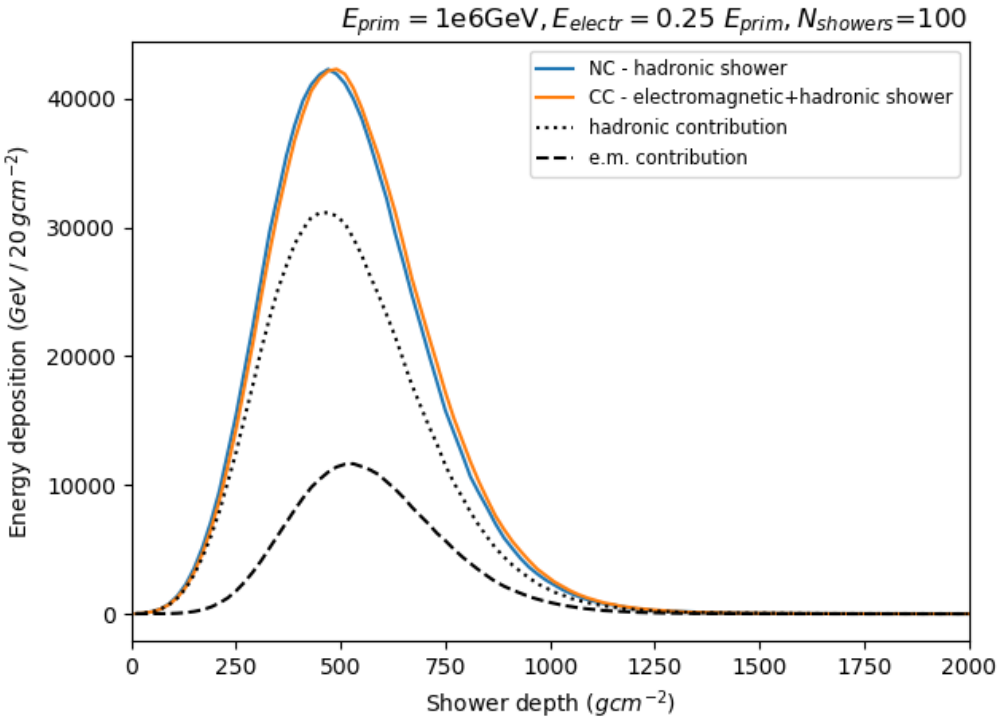
*** Could it be a way of differentiating electron neutrino CC from NC interactions?**

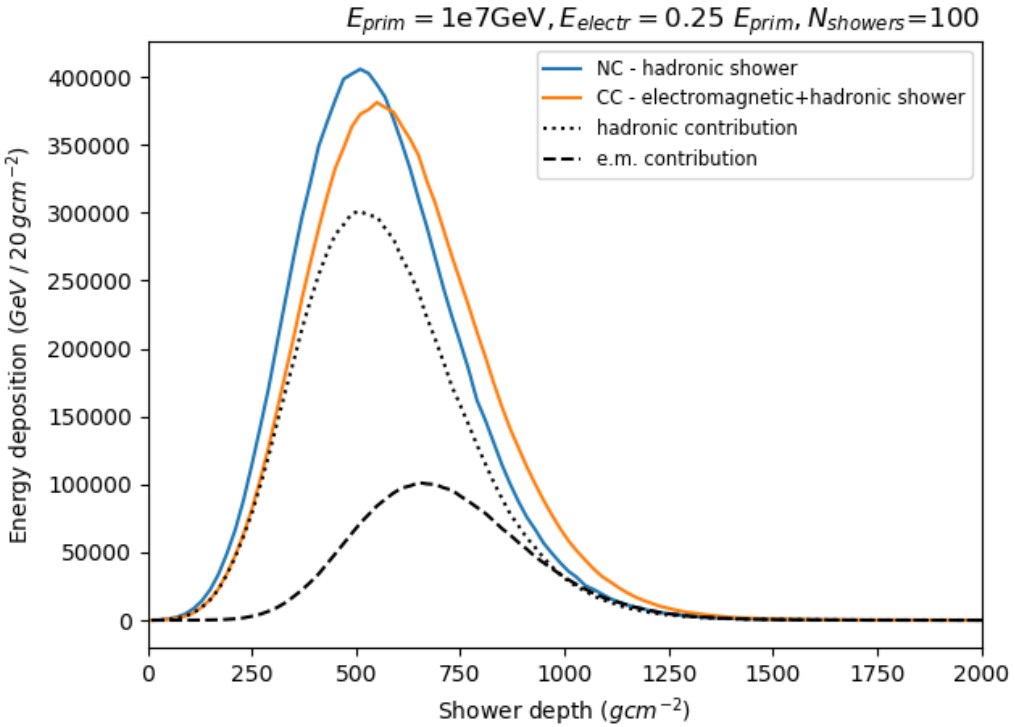
Generation of CC current interactions showers → approx. by proton + electron showers

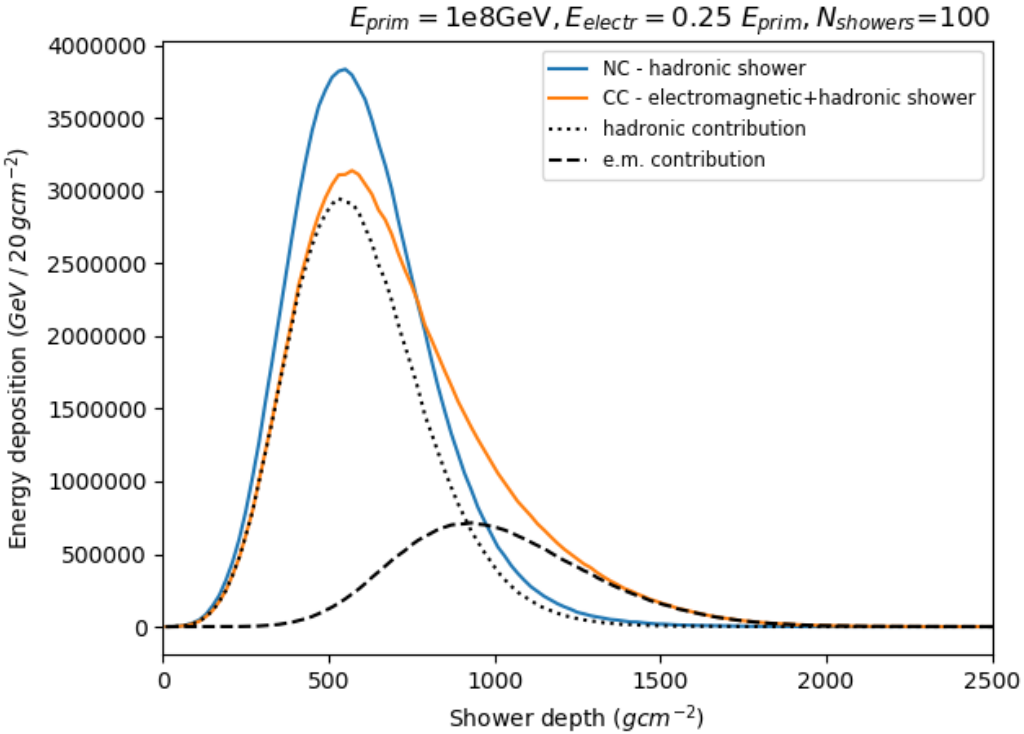
...with different energy distribution:
Ee = 0.25*Eshower, Ee = 0.5*Eshower, Ee = 0.75*Eshower, Ee = Eshower

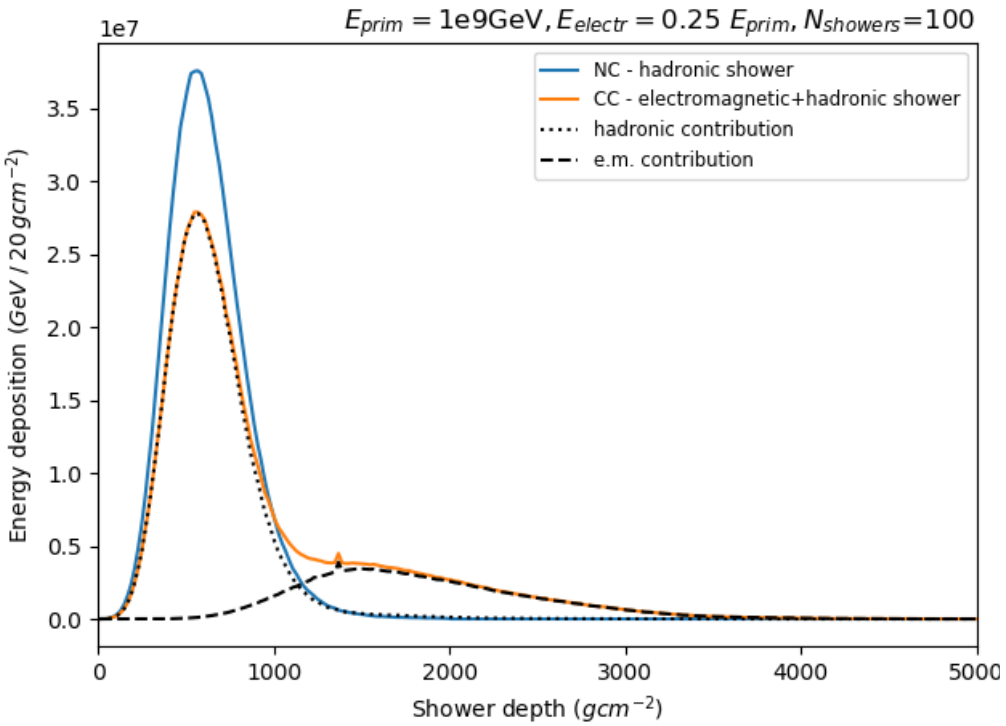
Longitudinal energy deposition profiles

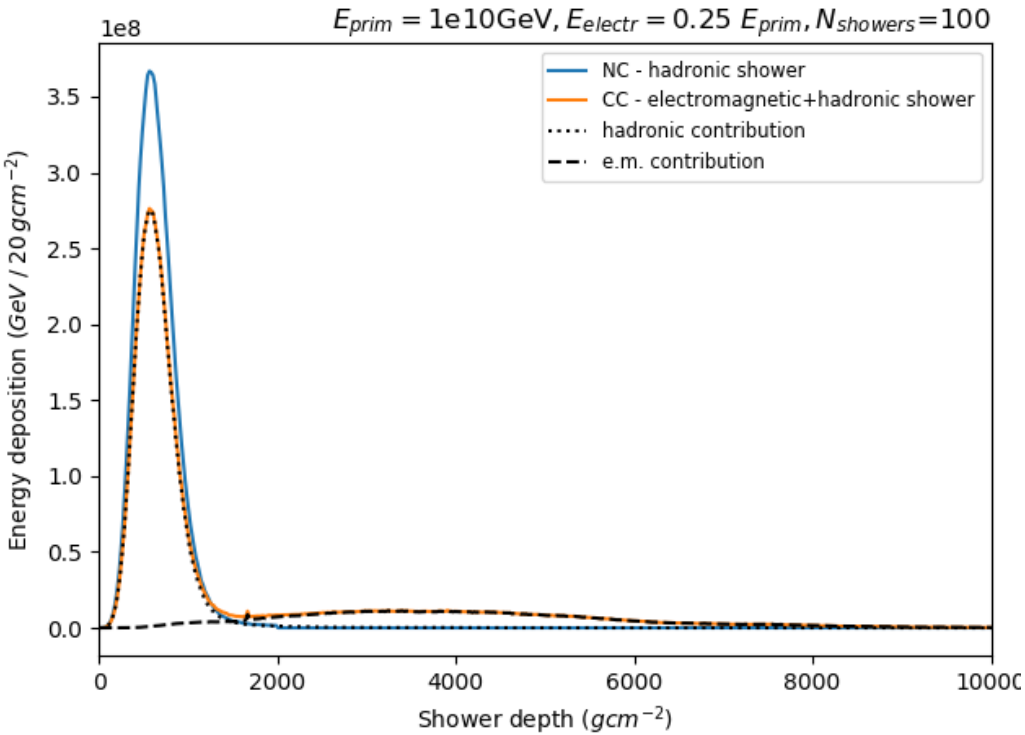


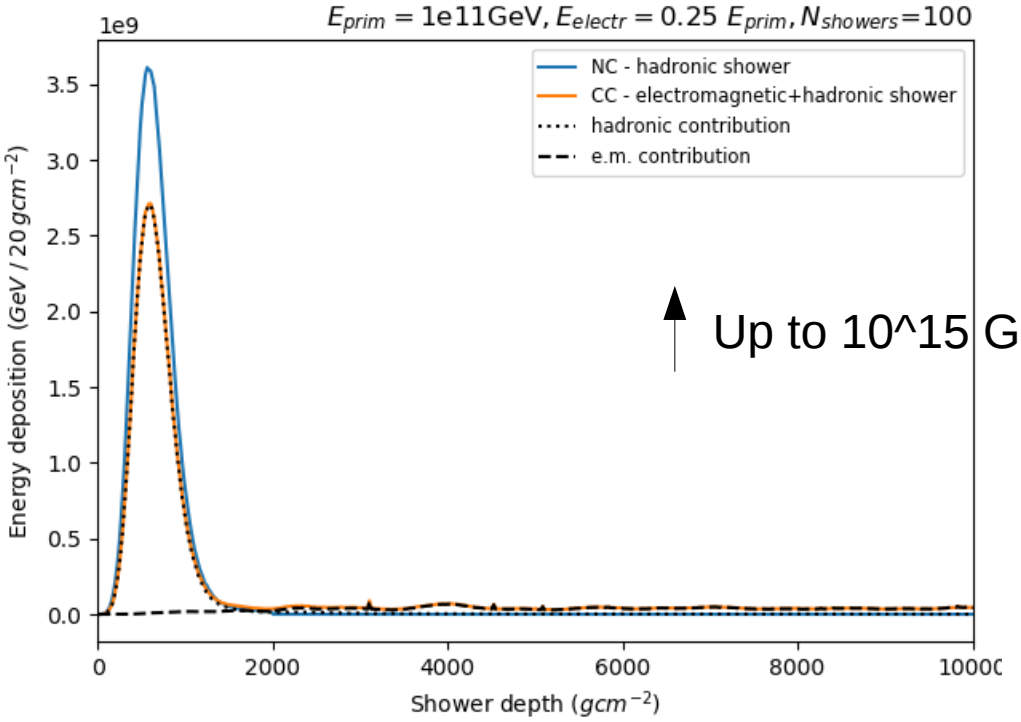












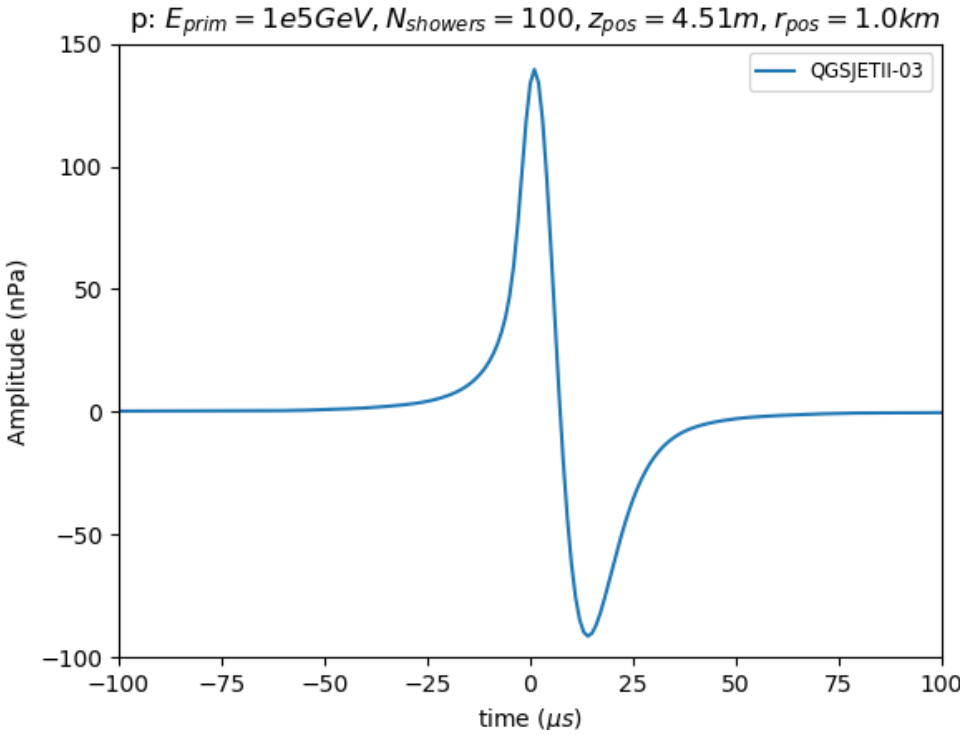
Up to 10^15 GeV

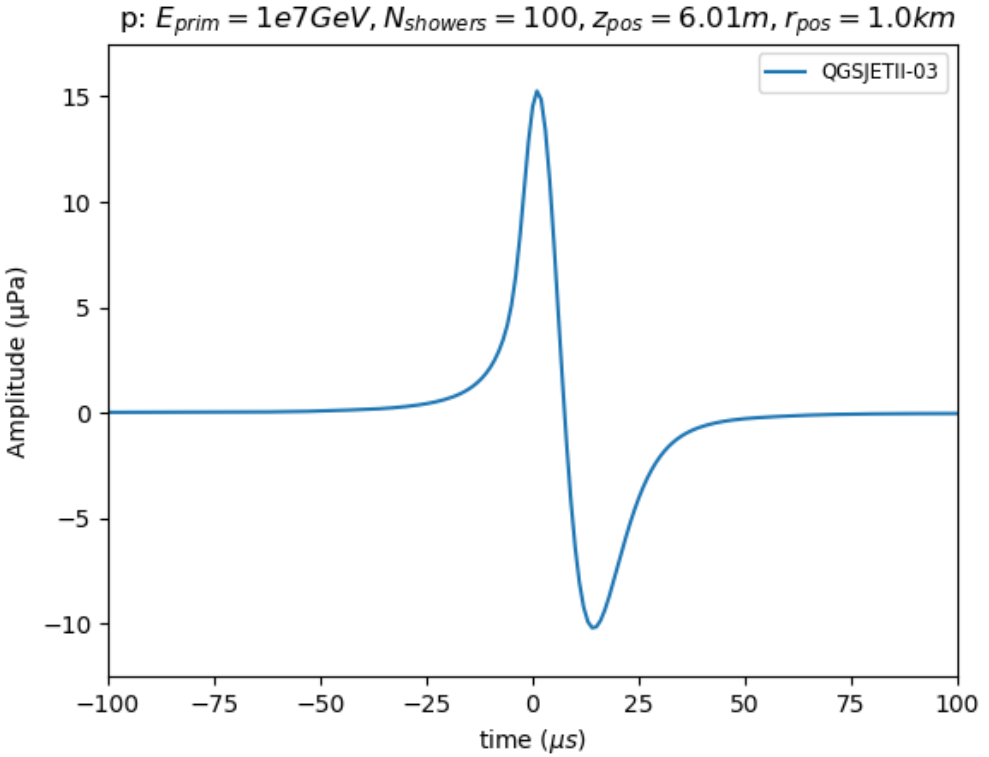
Difficulties to generate electromagnetic acoustic pulses:

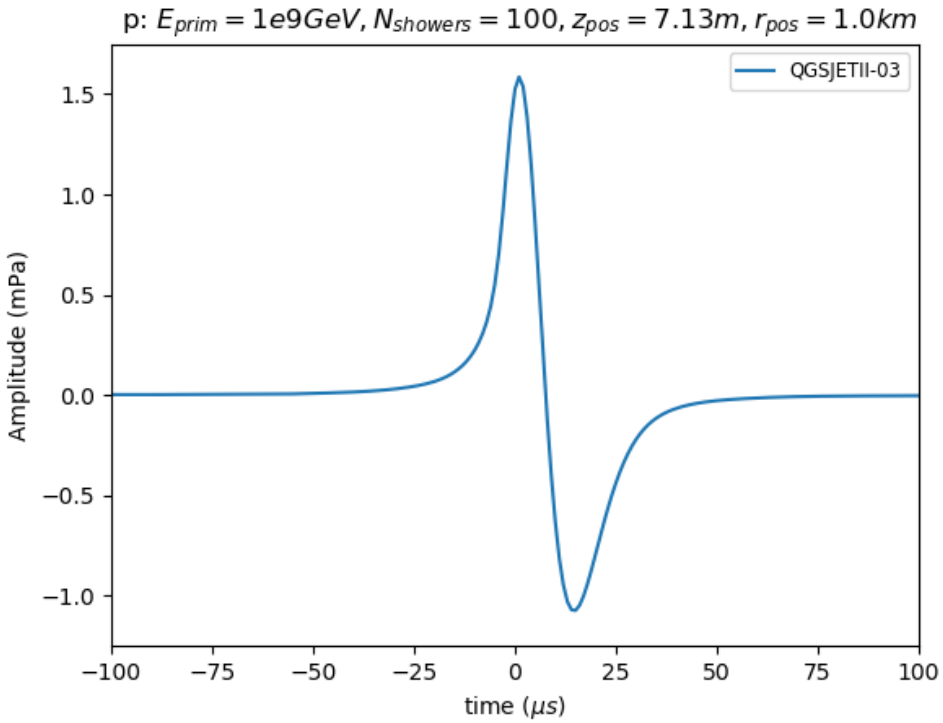
- Large **shower to shower variation** of energy deposition profile → have to include **fluctuations** in the study

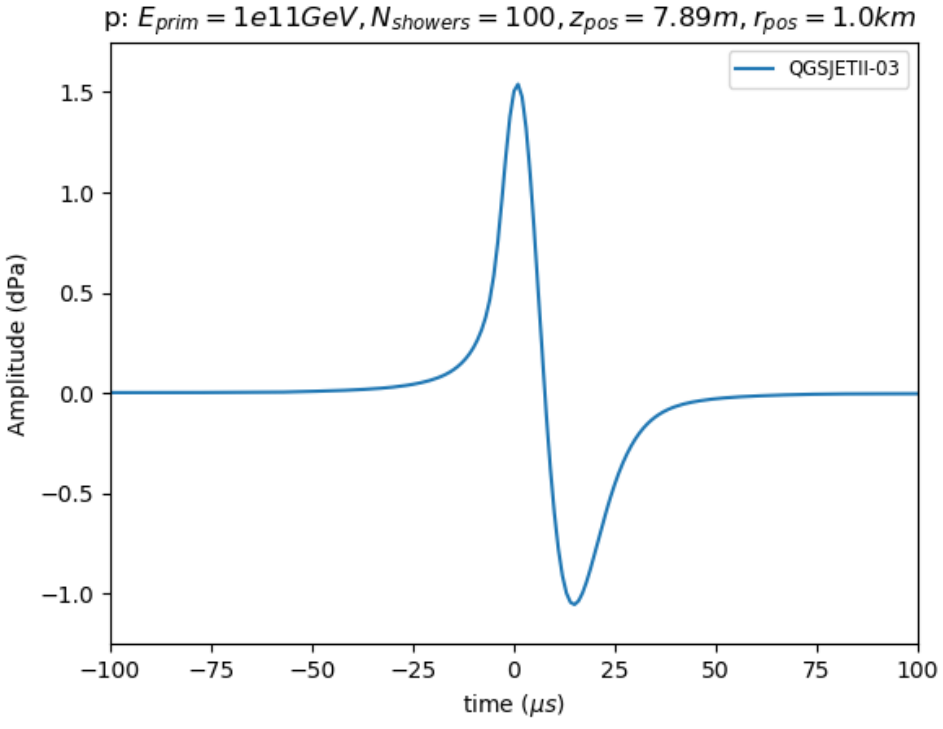
- **Multipeak structure** of the energy deposition profile →multiple pulses...

1st step: Acoustic pulses from proton showers

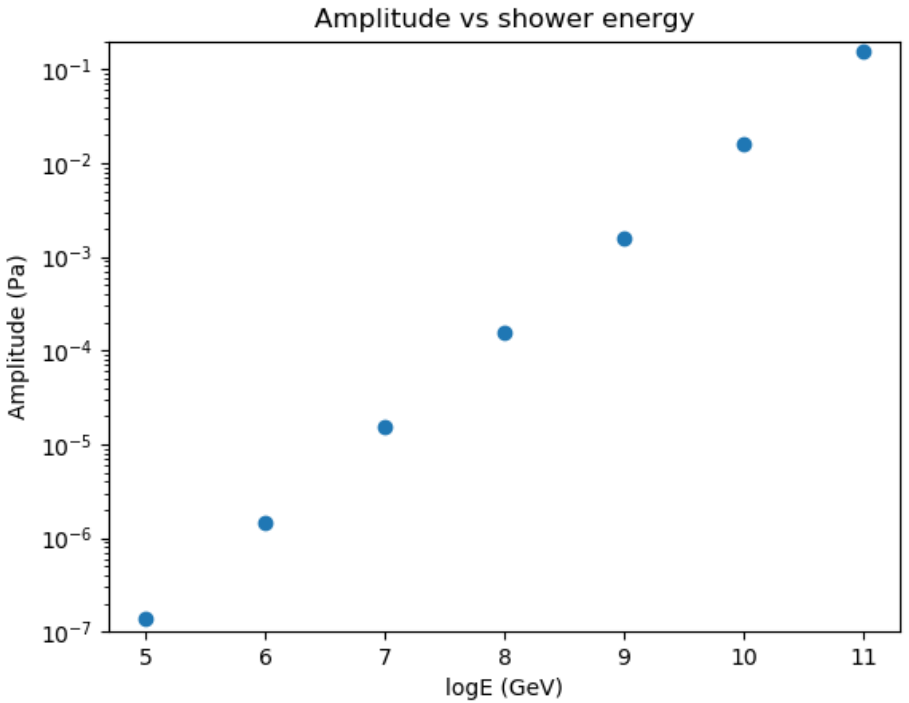


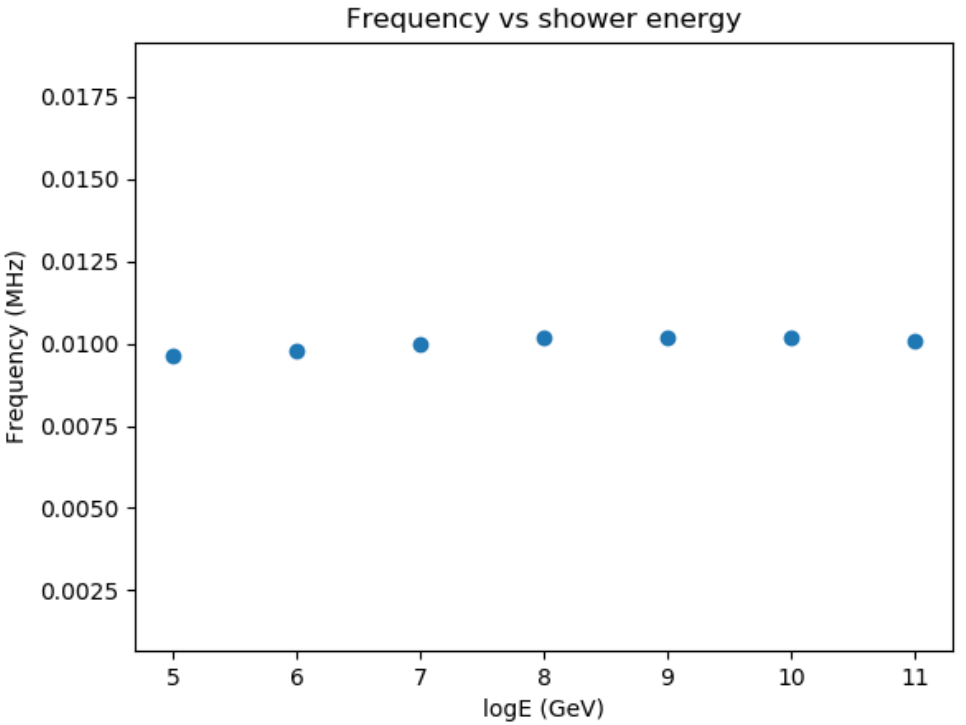






Pulse characteristics...





Next steps:

- Explore all the variable space for: distance from shower axis, depth, acoustic pulse shape

- Characterize electromagnetic showers including its fluctuations → acoustic pulses