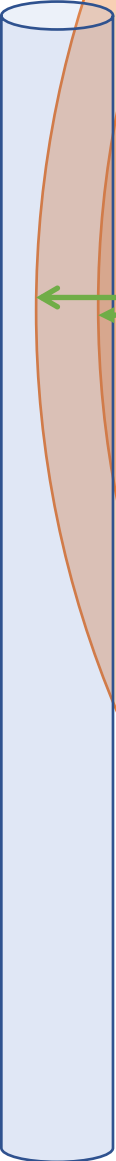


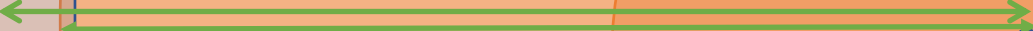
A second non-negligible acoustic signal from a geometrical effect

Clara Gatus Oliver, KM3Net group meeting - Nikhef, MSc thesis, 25/06/20

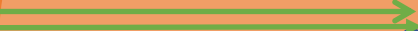
Shower volume



$$d_3 = t_3 c_s$$



$$d_2 = t_2 c_s$$

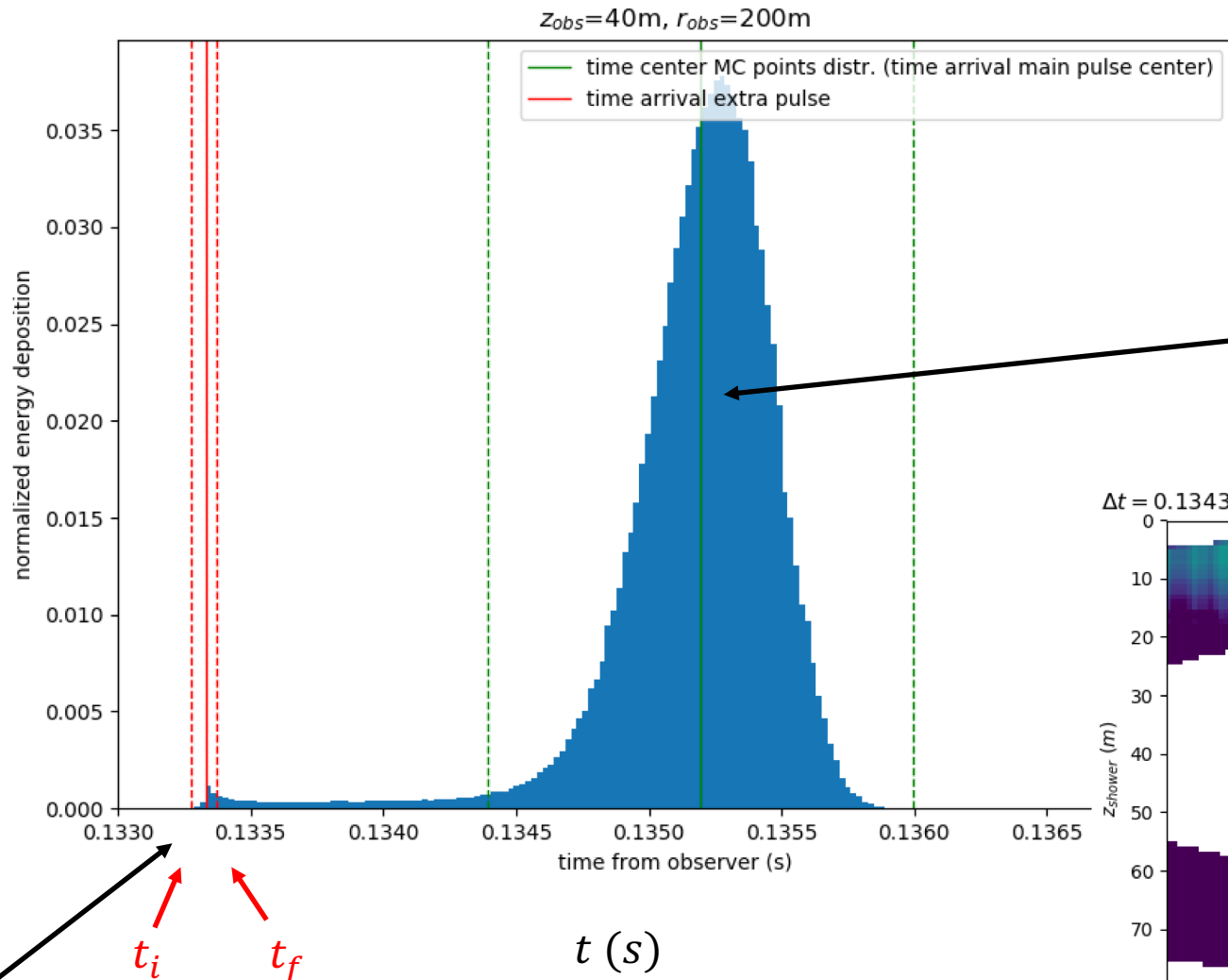


$$d_1 = t_1 c_s$$

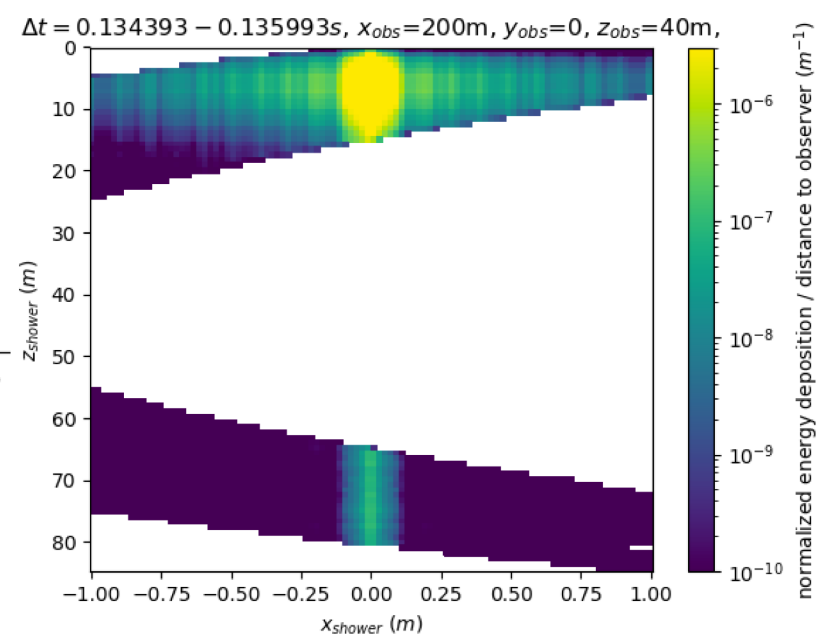
Observer



Energy deposition as a function of arrival time to observer

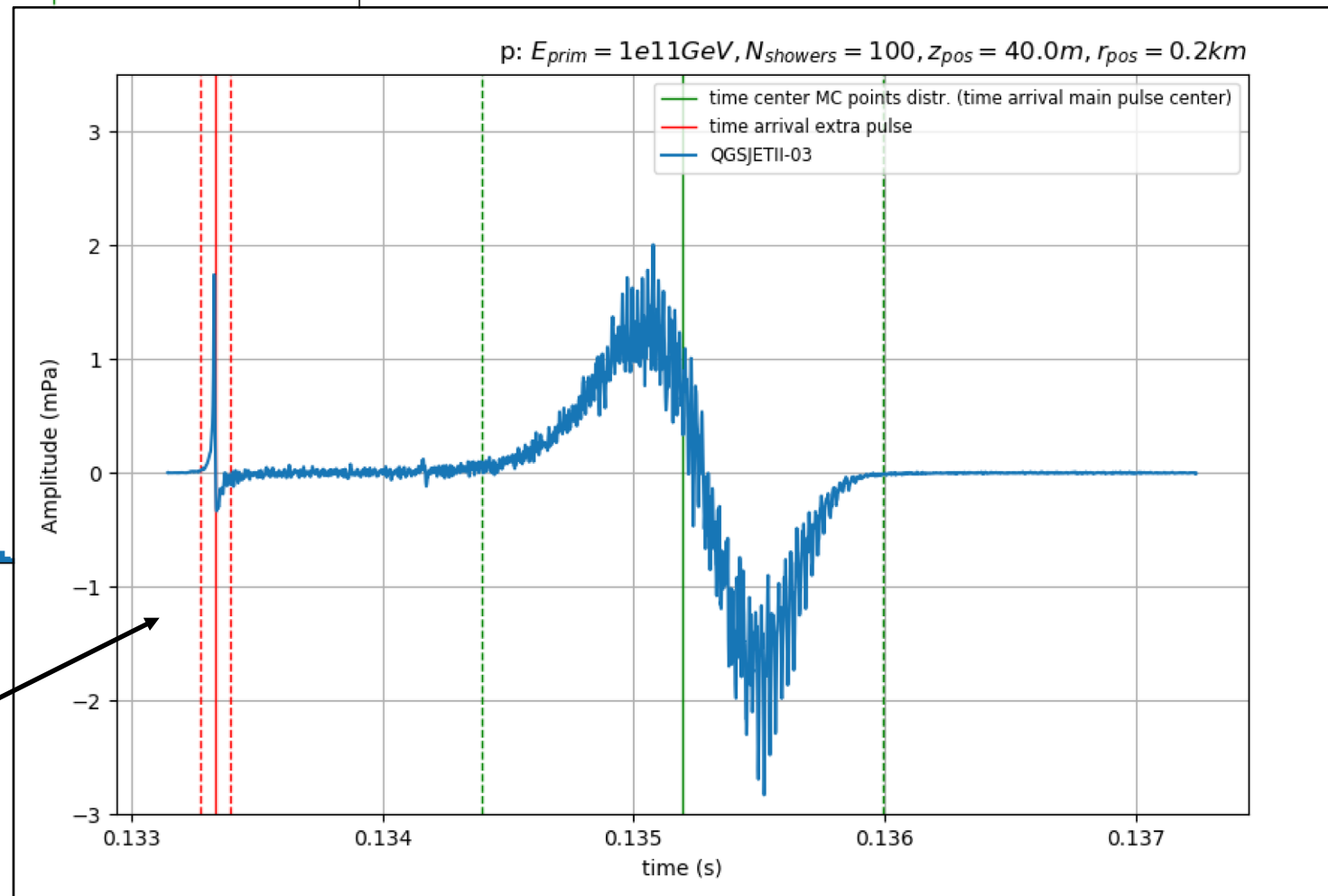
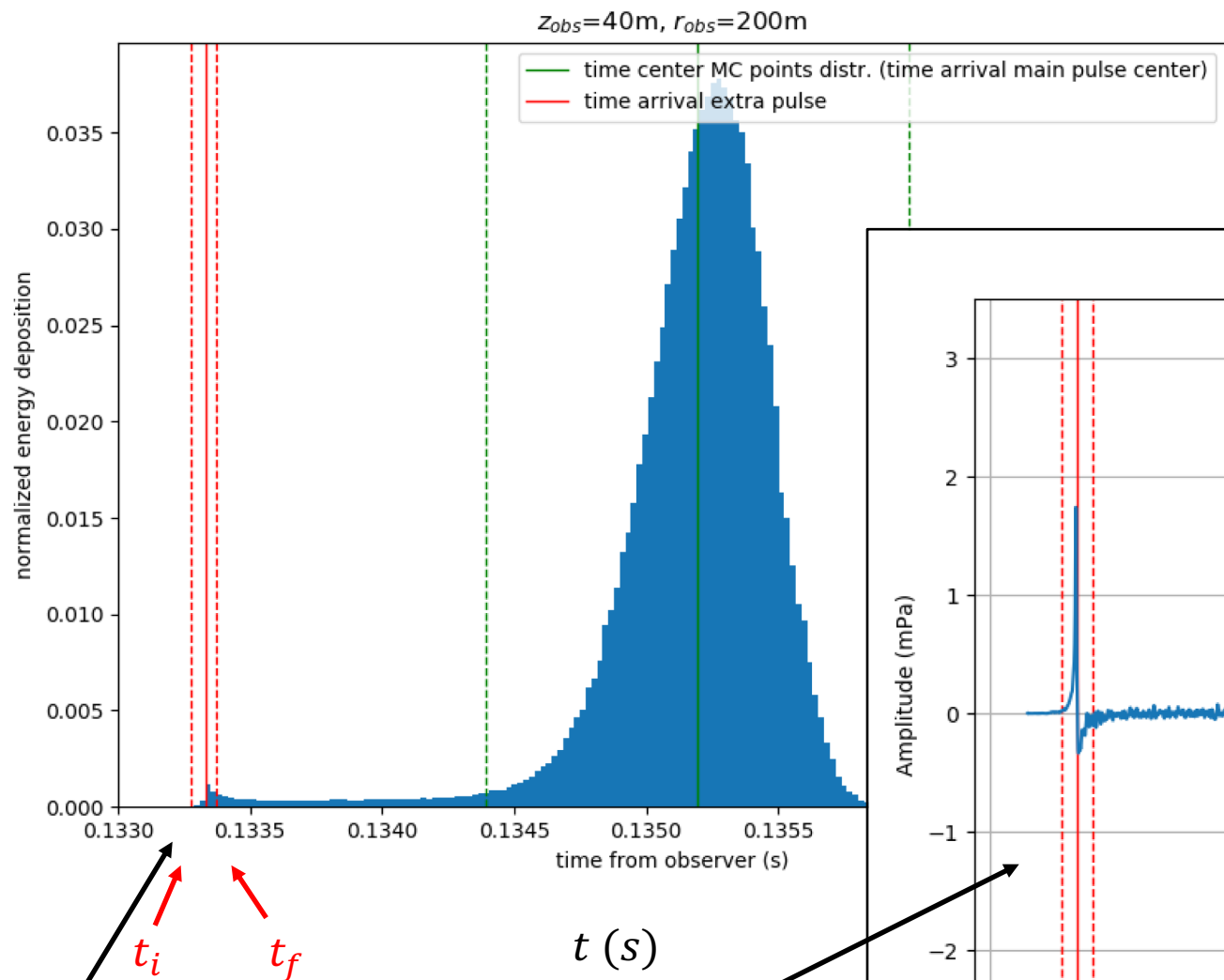


Peak created at the times where the maximum energy deposition is located



Presence also of the extra bump

Energy deposition as a function of arrival time to observer



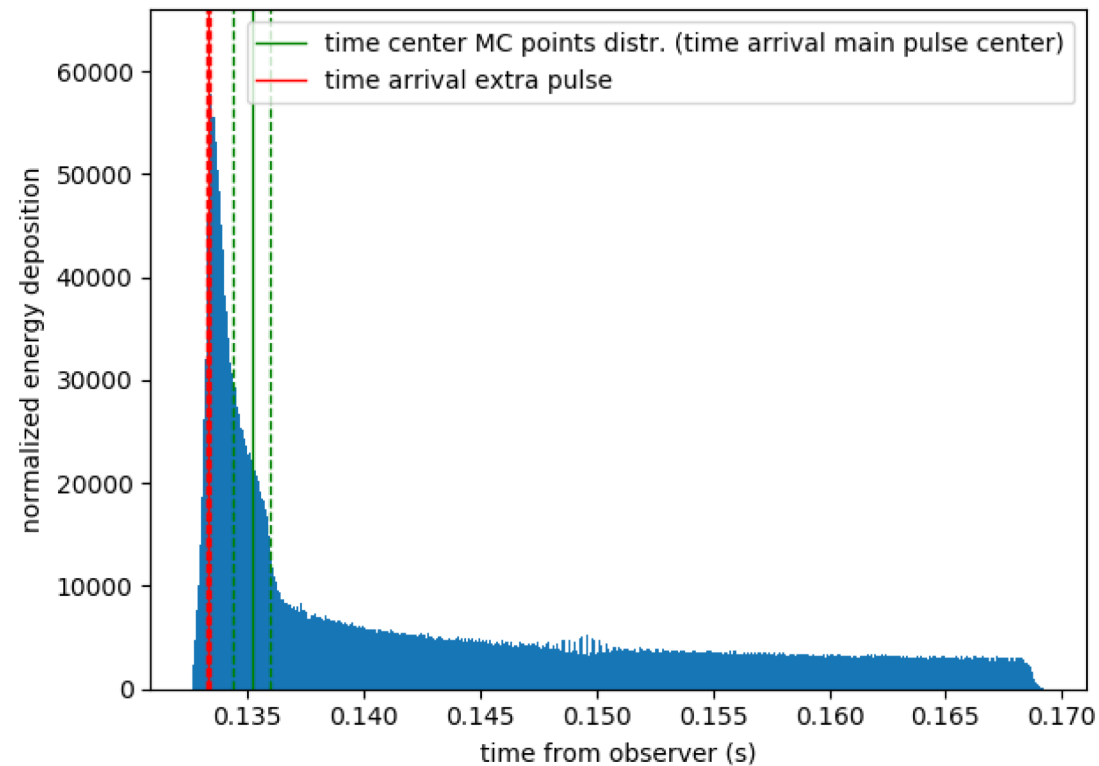
Presence also of the extra bump

Geometrical effect:

Radius of the observer sphere for which a maximum area of the sphere is contained in the shower volume.

Constant energy deposition

$Z_{obs}=40\text{m}, r_{obs}=200\text{m}$

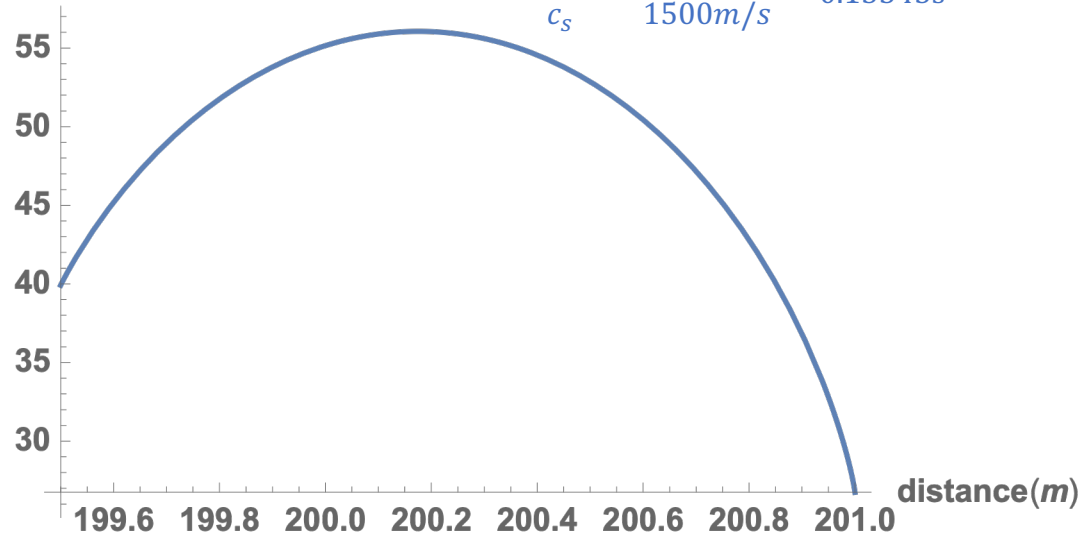


$$A_{\text{contained}} = 2d^2 \int_{\theta_i}^{\theta_f} \sin(\theta) \cos^{-1}\left(\frac{d^2 - lr^2 + x_{\text{obs}}^2 - d^2 \cos(\theta)^2}{2d x_{\text{obs}} \sin(\theta)}\right) d\theta$$

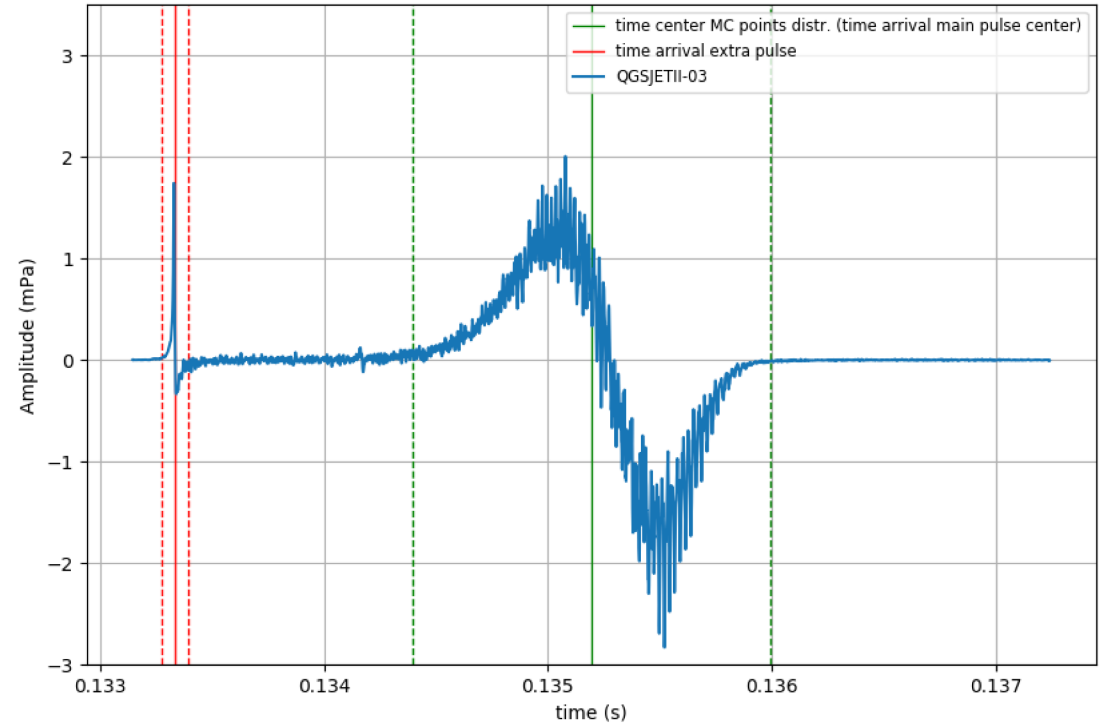
$z_{\text{obs}} = 40\text{m}, r_{\text{obs}} = 200\text{m}$

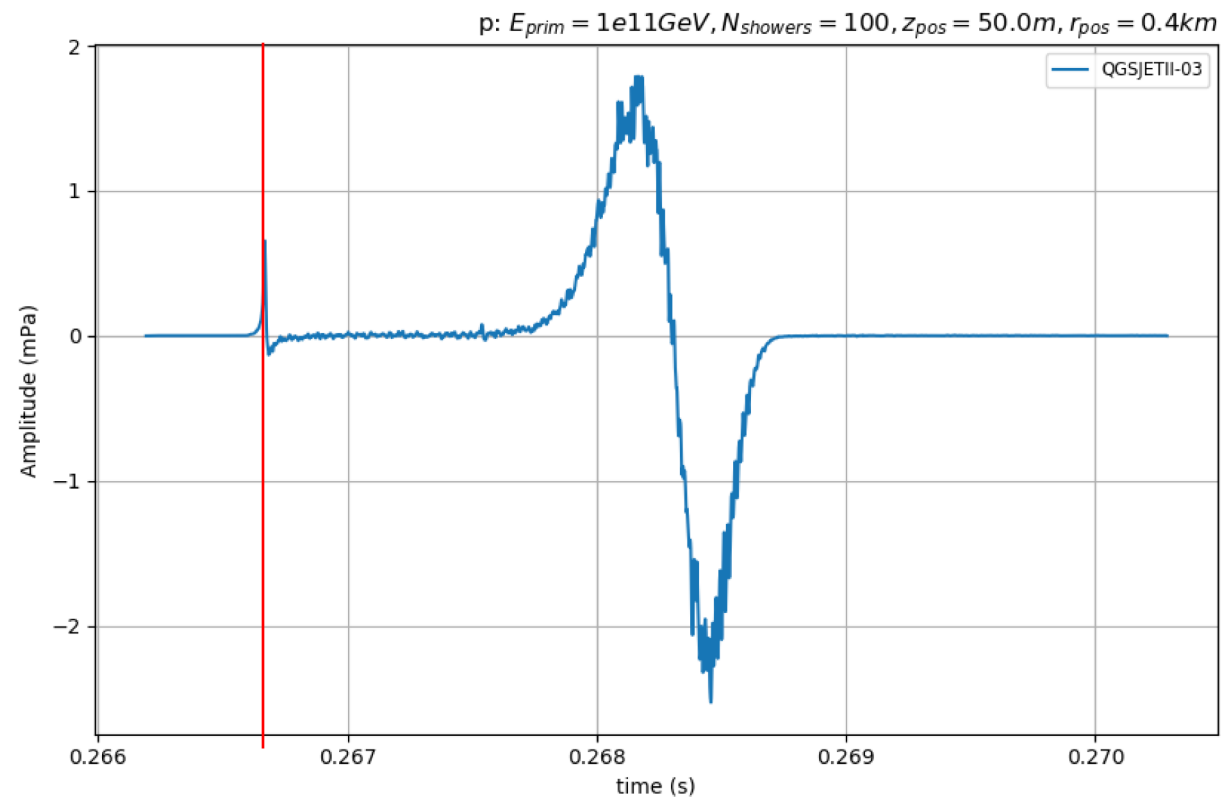
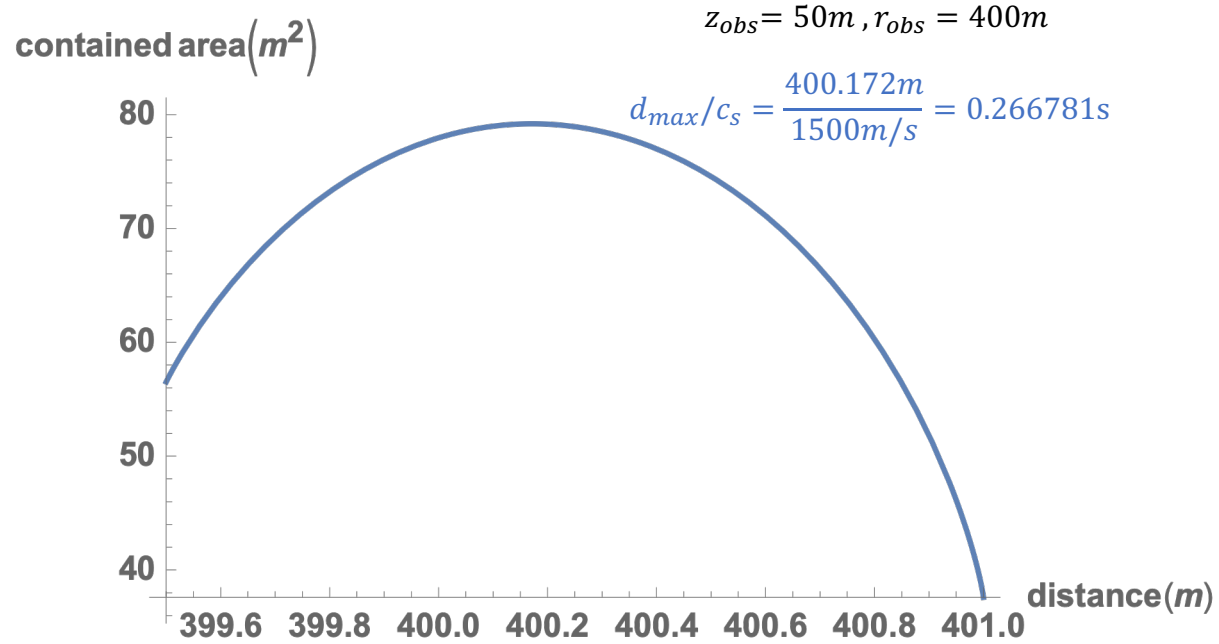
contained area (m^2)

$$\frac{d_{\text{max}}}{c_s} = \frac{200.175\text{m}}{1500\text{m/s}} = 0.13345\text{s}$$



$p: E_{\text{prim}} = 1\text{e}11\text{GeV}, N_{\text{showers}} = 100, z_{\text{pos}} = 40.0\text{m}, r_{\text{pos}} = 0.2\text{km}$





Conclusion:

Not only an acoustic pulse from the maximum energy deposit of the shower is created, but also an acoustic pulse coming from the maximum observer sphere area contained in the shower volume.