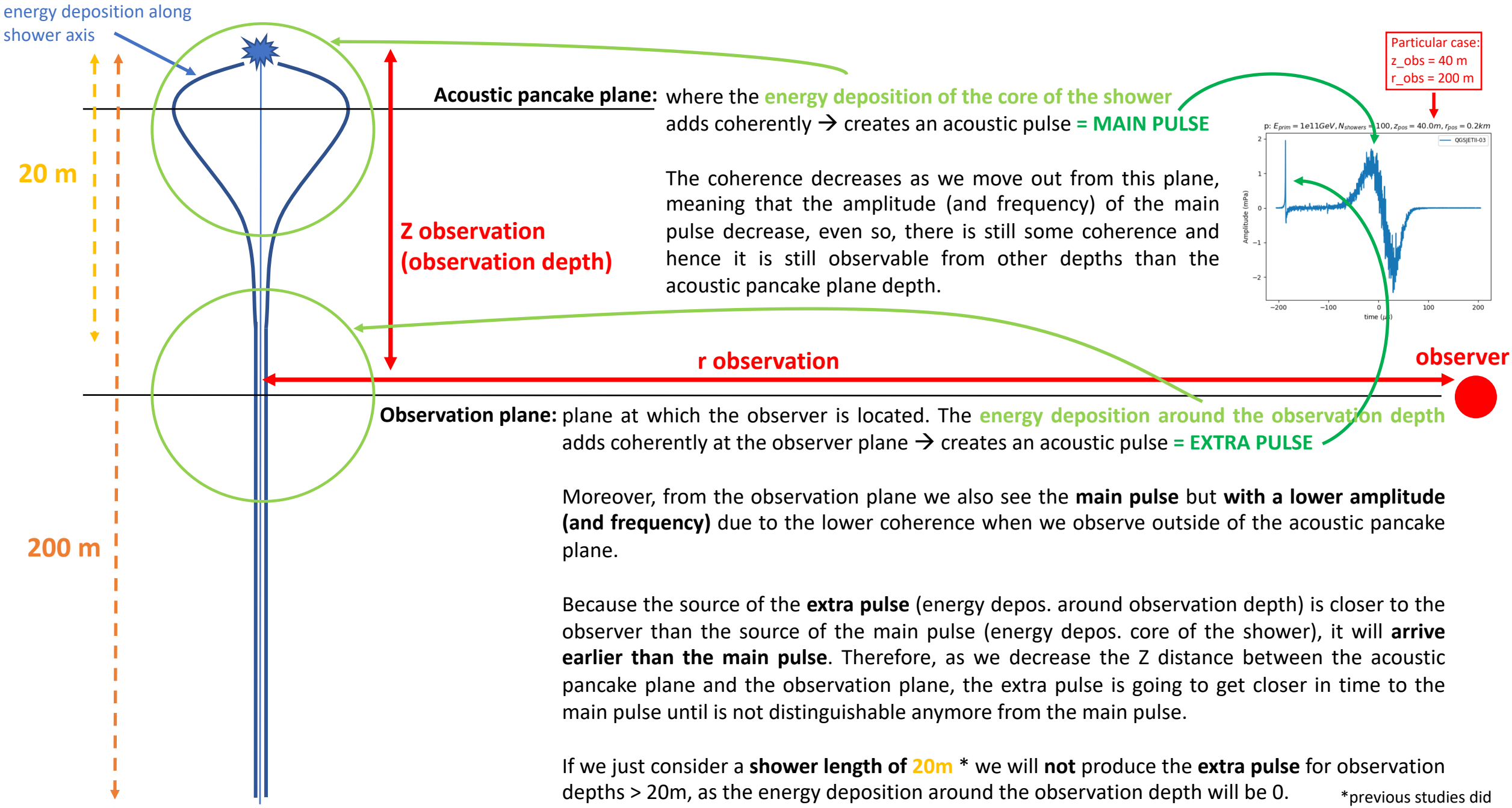
Hadronic shower energy deposition



Acoustic pancake plane: where the energy deposition of the core of the shower adds coherently → creates an acoustic pulse **= MAIN PULSE**

The coherence decreases as we move out from this plane, meaning that the amplitude (and frequency) of the main pulse decrease, even so, there is still some coherence and hence it is still observable from other depths than the acoustic pancake plane depth.

Observation plane: plane at which the observer is located. The energy deposition around the observation depth adds coherently at the observer plane → creates an acoustic pulse **= EXTRA PULSE**

Moreover, from the observation plane we also see the **main pulse** but **with a lower amplitude (and frequency)** due to the lower coherence when we observe outside of the acoustic pancake plane.

Because the source of the **extra pulse** (energy depos. around observation depth) is closer to the observer than the source of the main pulse (energy depos. core of the shower), it will **arrive earlier than the main pulse**. Therefore, as we decrease the Z distance between the acoustic pancake plane and the observation plane, the extra pulse is going to get closer in time to the main pulse until is not distinguishable anymore from the main pulse.

If we just consider a **shower length of 20m** * we will **not** produce the **extra pulse** for observation depths > 20m, as the energy deposition around the observation depth will be 0.

*previous studies did