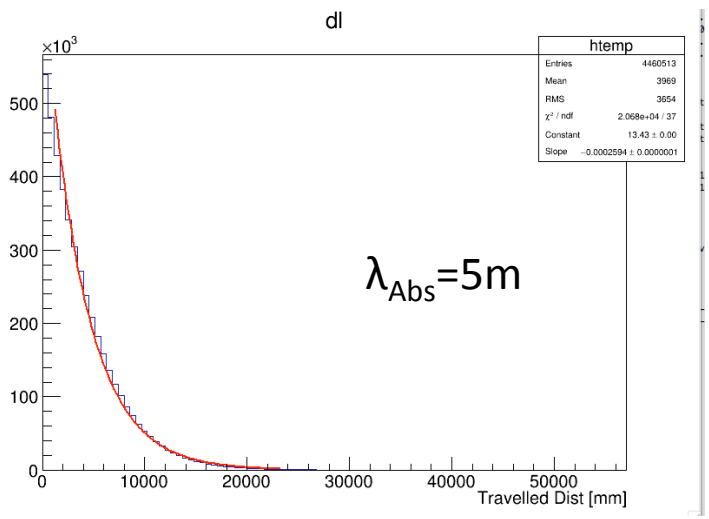
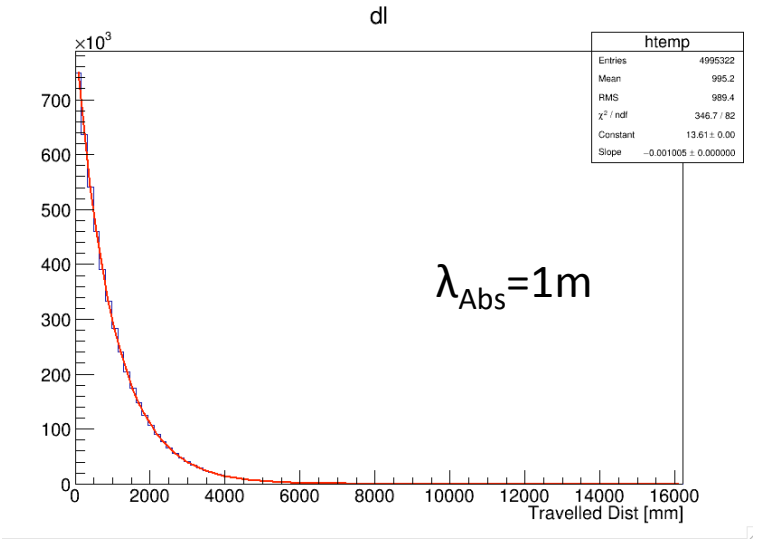
Complementary study with Qscan [Alessandra, Silvestro]

- We have checked the physical meaning in Geant4 of the absorption length λ_{Abs} , by plotting with LightSim the total travelled distance (L) of each photon until it is absorbed (Note: L is much larger than the distance from production point to absorption position, due to Rayleigh scattering).
- The same distribution is obtained by plotting the travel time, which is proportional to the total travelled distance: L=travel_time*c/n
- The distribution is an exp with slope=$1/\lambda_{Abs}$





With the light maps in Qscan, we compute the propagation time travel_time for each photon. We can use this to implement absorption in Qscan

Implementation of light absorption in Qscan

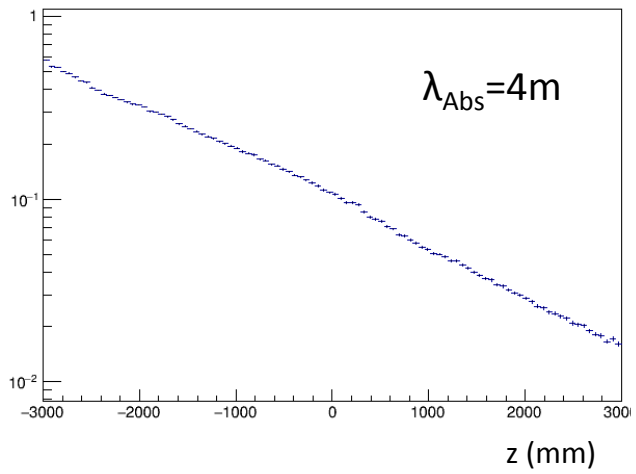
- A simple way to implement light absorption in Qscan, using the existing light maps calculated with $\lambda_{Abs}=\infty$: give to each photon a weight
  = exp(-(travel_time*c/n)/ λ_{Abs})

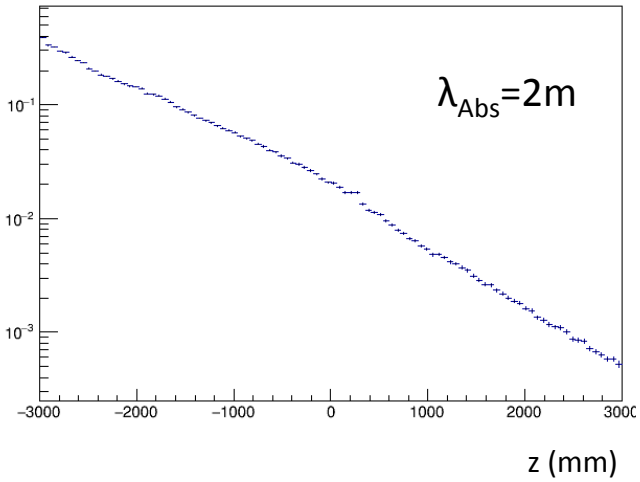
λ_{Abs} can be added to the Qscan datacards: no need to regenerate the light maps

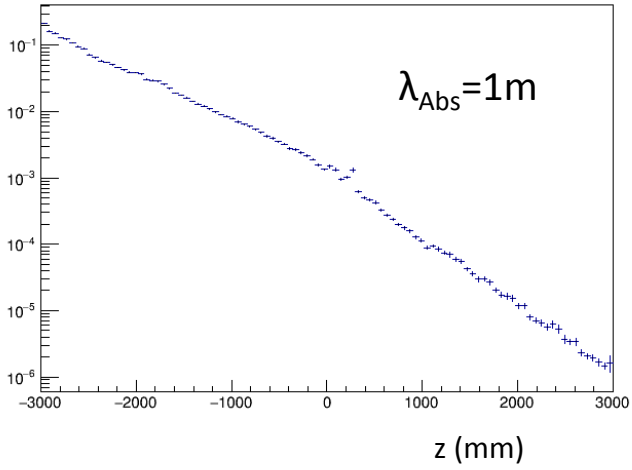
We have plotted the average value of this weight, representing the light reduction factor w.r.t. $\lambda_{Abs}=\infty$, as a function of the z coordinate of the photon production point

- at z=+3m, it represents the attenuation factor of S2; at z=0, the average attenuation of S1.

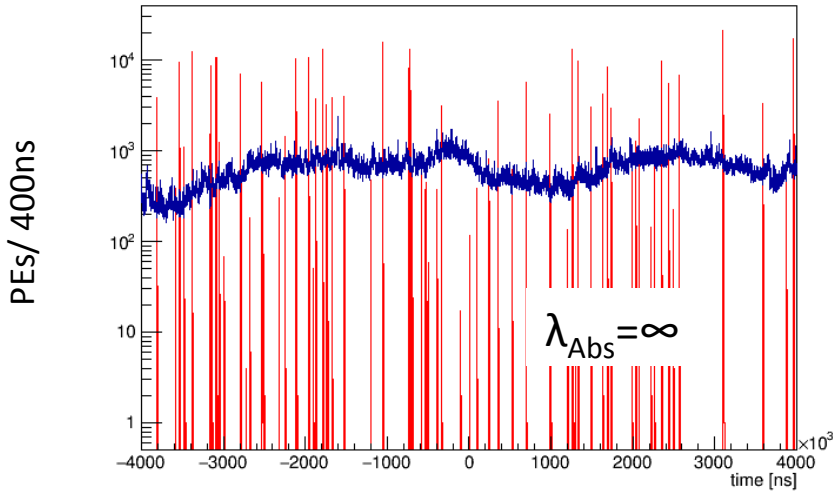
mean photon weight vs z

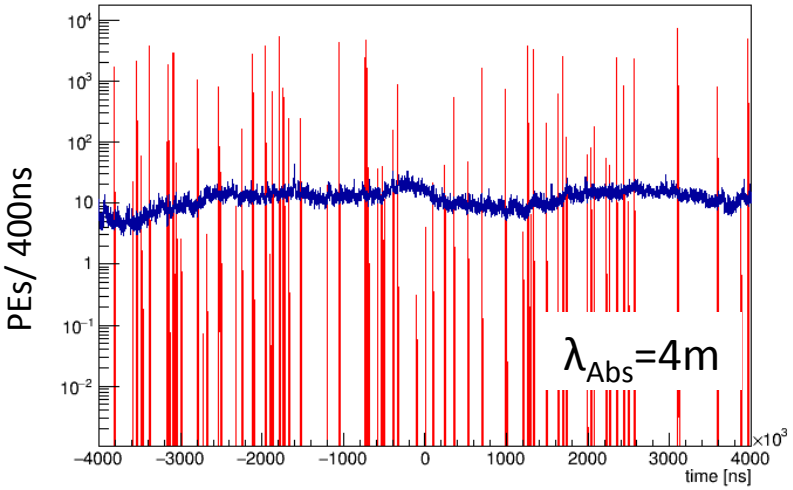




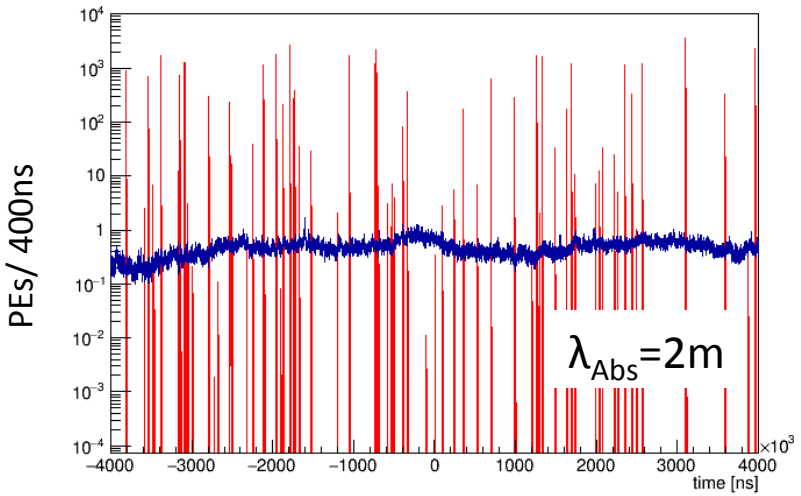


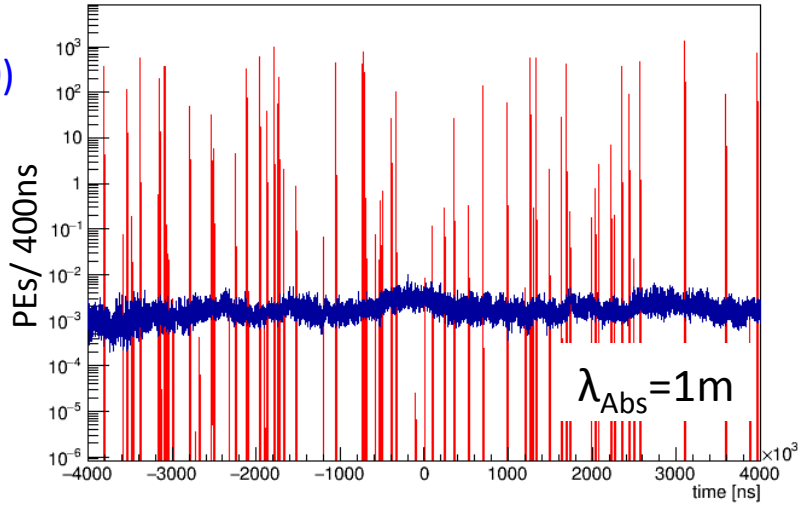
Effect of absorption on physics events: muon background in 8 ms



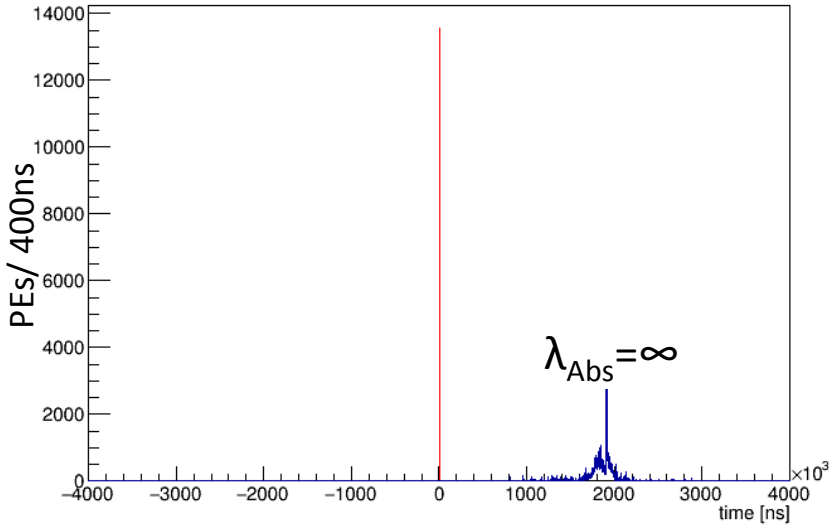


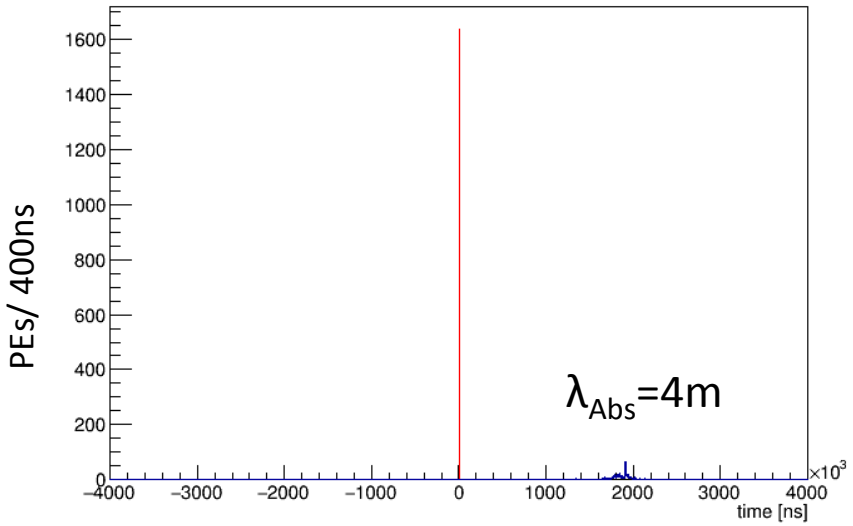
S1
S2
(G=300)

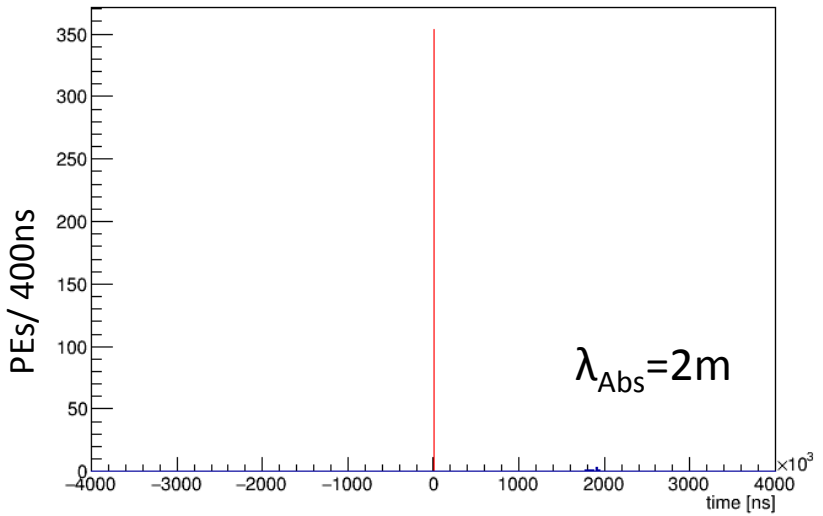


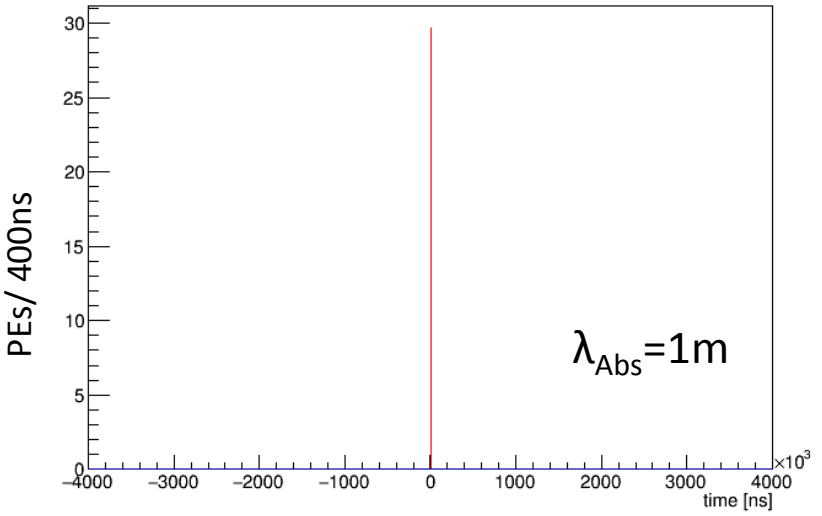


Effect of absorption on physics events: 5 GeV pi+ beam

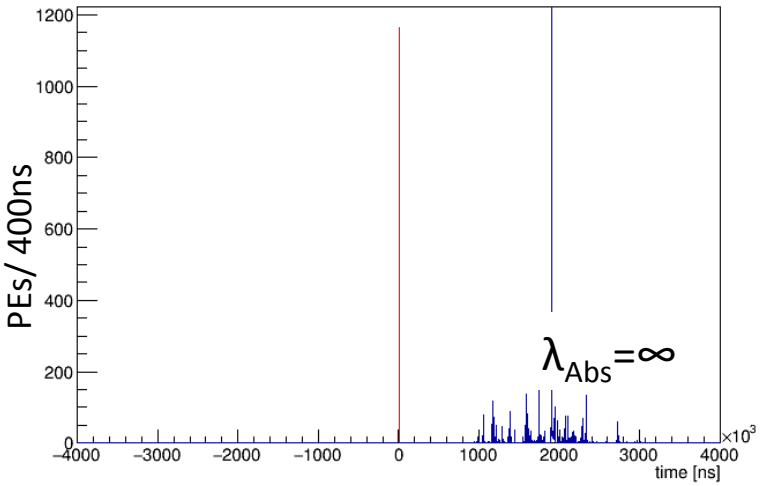


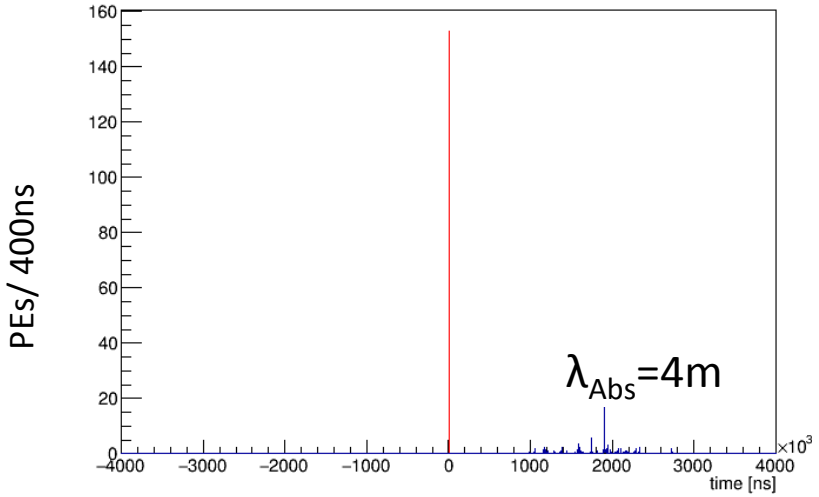


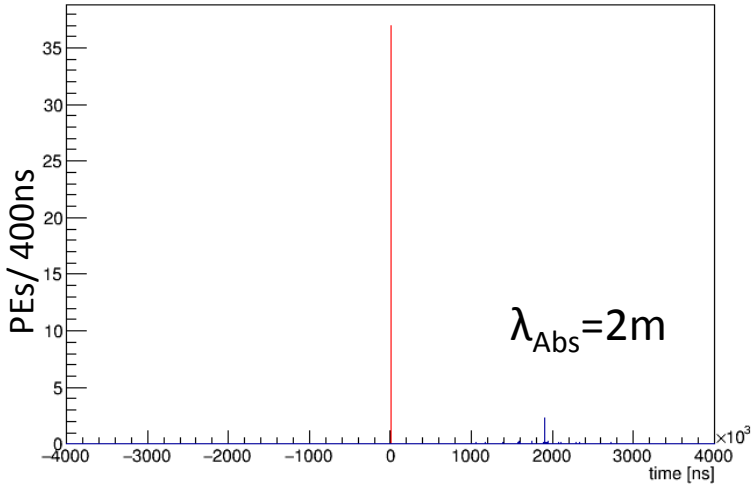


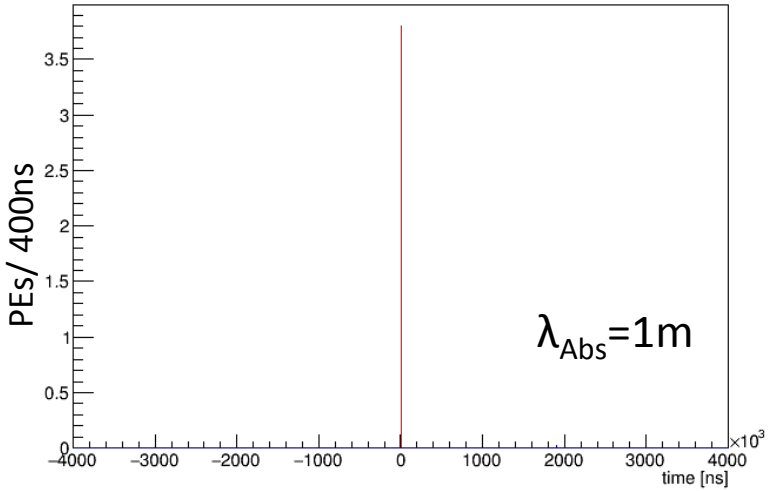


Effect of absorption on physics events: 1 GeV pi+ beam









Effect of absorption on physics events: 1 GeV pi+ beam, PMT occupancy for S1