Back to the Future Triggers in L1Calo

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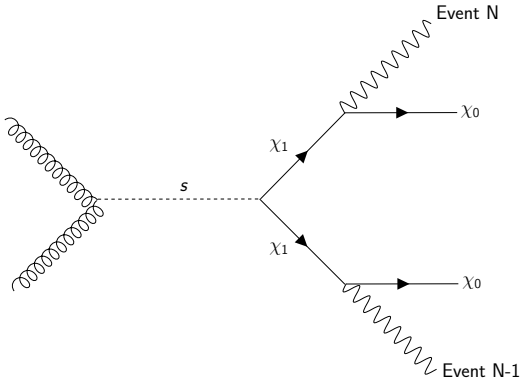
How to Benchmark: a Hidden EFT Approach



4 parameters in total

- Scalar particle, mass $m_s = \mathcal{O}(100\text{GeV} - 3\text{TeV})$
- DM fermion state χ_1, centre of mass boost $\beta^* = \sqrt{\frac{(m_s)^2 - (2m_1)^2}{(m_s)^2}} = \mathcal{O}(0.01 - 0.75)$,
- proper lifetime of χ_1 $c\tau = \mathcal{O}(\text{m})$
- DM fermion state χ_0, mass splitting $\Delta m_{01} := m_1 - m_0 = \mathcal{O}(50 - 150\,\text{GeV})$: Dictates the shower energy deposit scale (alongside $\beta_{\chi 1}$)

Trigger Simulation

- Acceptance cuts

$$|\eta_{h_1,h_2}| < 3.2 \quad \&\& \quad r_{\text{Vertex}} < 4\,\text{m} \quad \&\& \quad \Delta\varphi(j_1, j_2) > \pi - 1$$

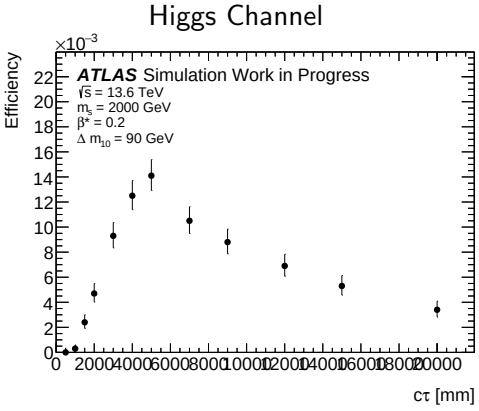
- Energy thresholds

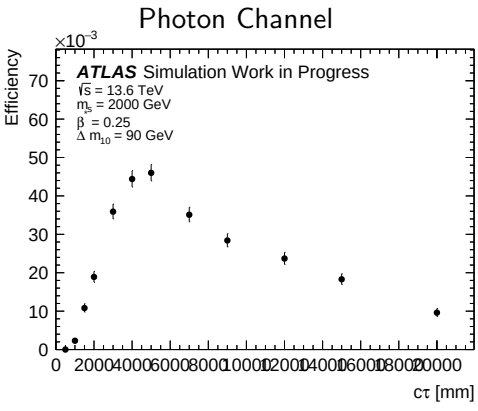
$$40 < E_T^{h_{\text{on-Time}}}/\text{GeV} < 100 \quad \&\& \quad 40 < E_T^{h_{\text{delayed}}}/\text{GeV}$$

- timing cuts (t starts at BC $N-1$):

$$0 < t_{\text{on-Time}}/\text{ns} < 10 \quad \&\& \quad 25 < t_{\text{delayed}}/\text{ns} < 35$$

Efficiencies

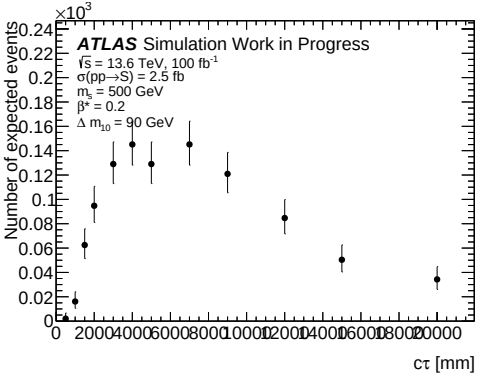




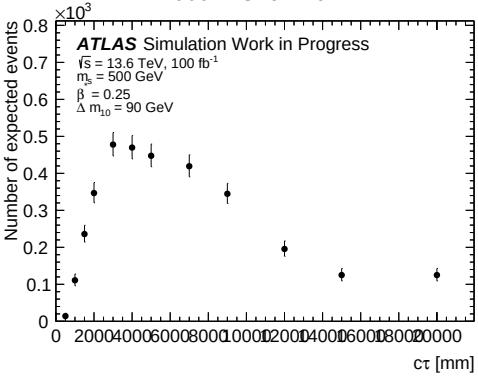
Number of expected events

I multiply the efficiencies with Jose's production cross section and with a Luminosity of 100fb^{-1} (though, the recorded Lumi is currently a bit higher)

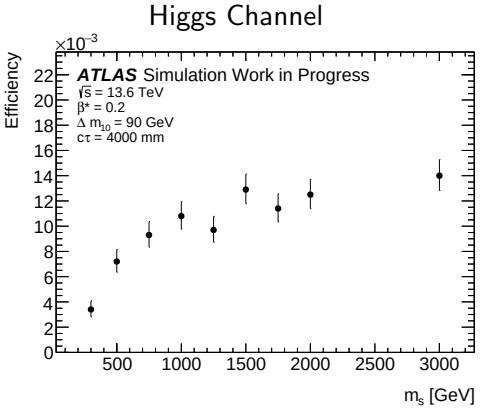
Higgs Channel

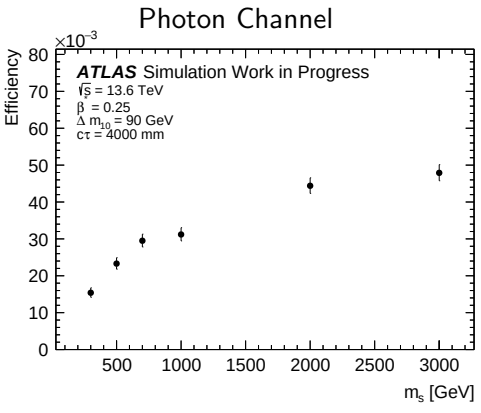


Photon Channel

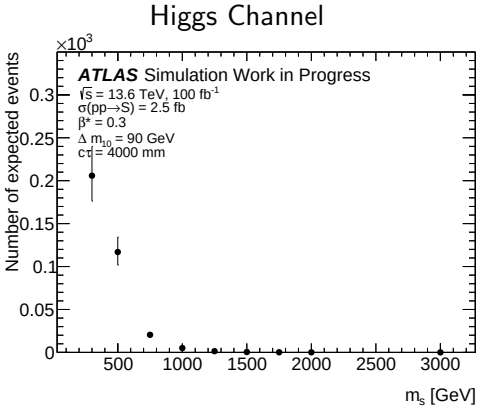


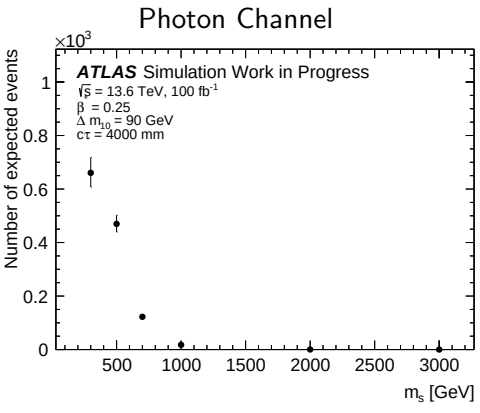
Efficiencies



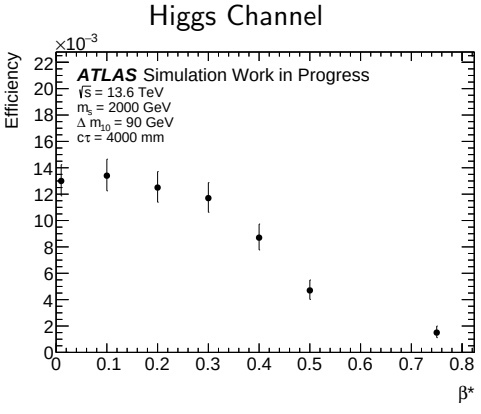


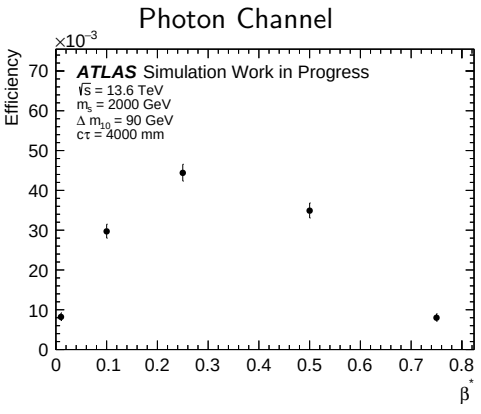
Number of expected events



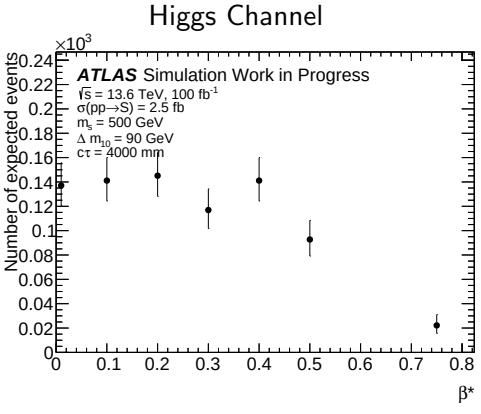


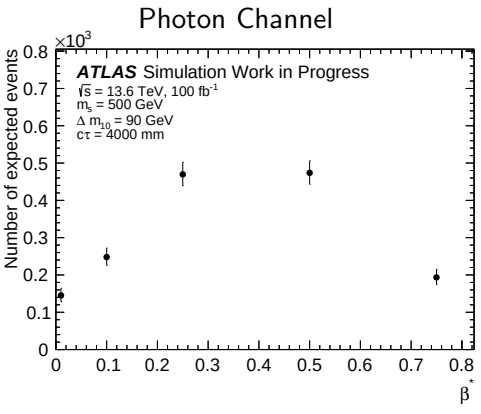
Efficiencies





Number of expected events





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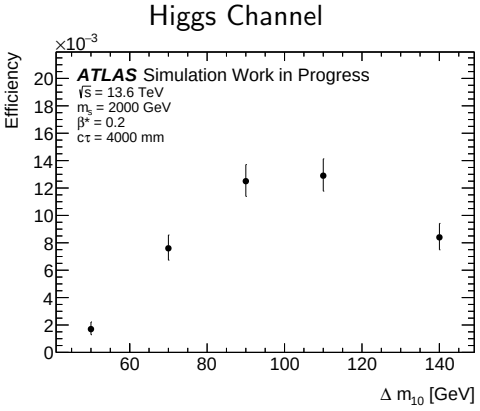

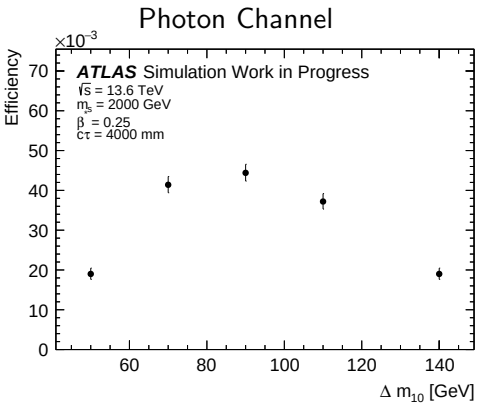

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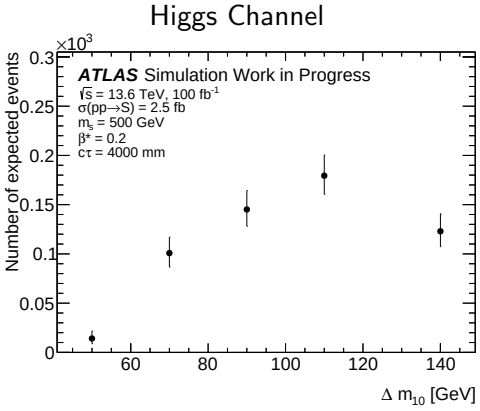

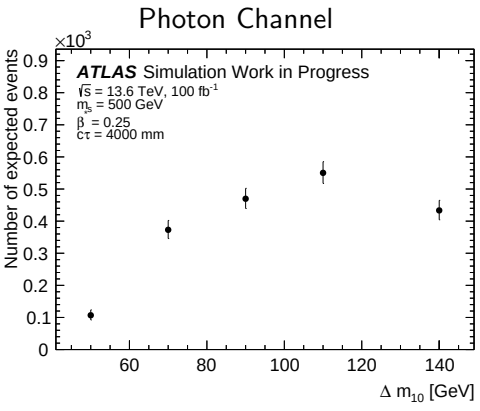

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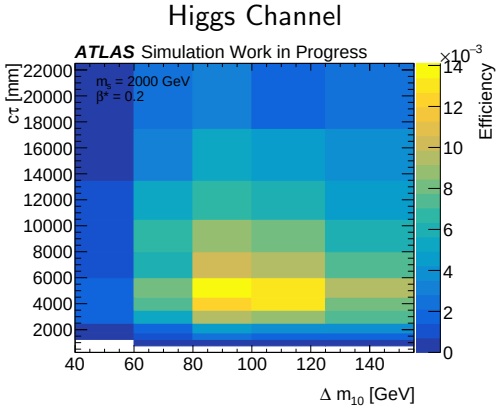

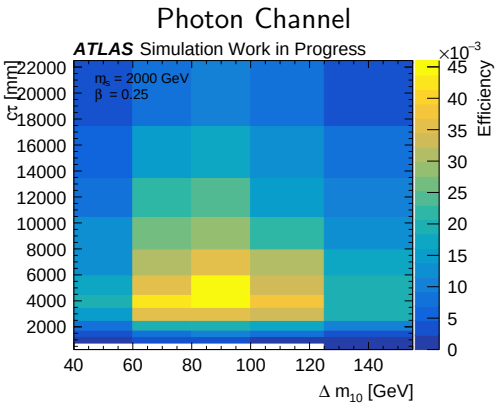

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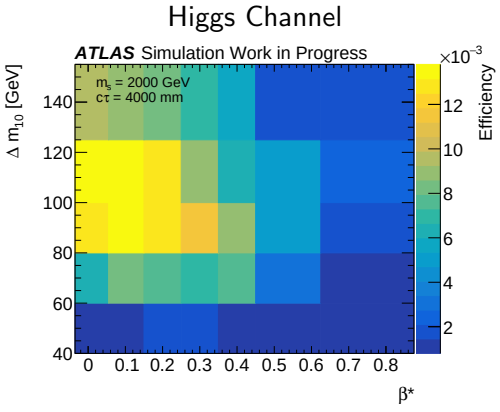
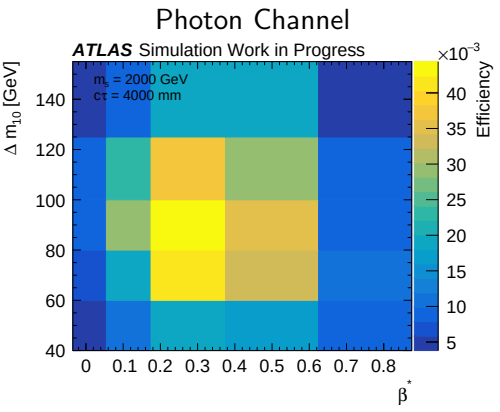
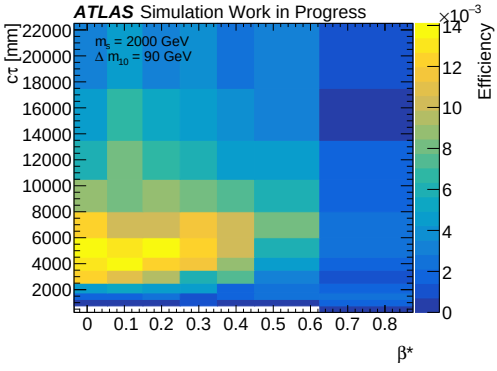


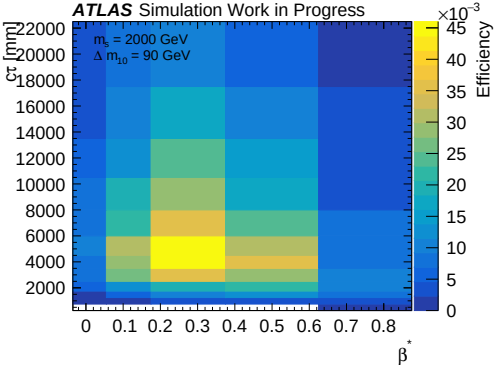


Efficiencies

Higgs Channel



Photon Channel



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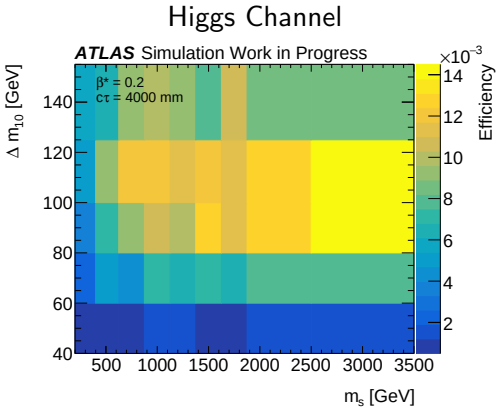

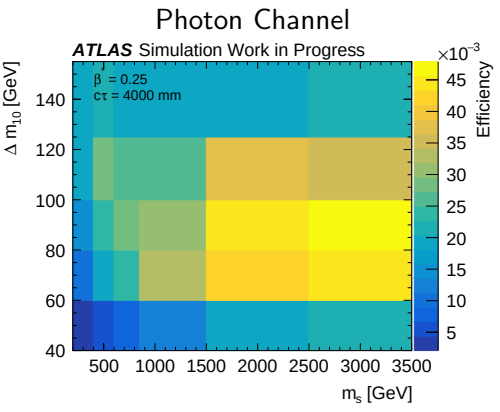

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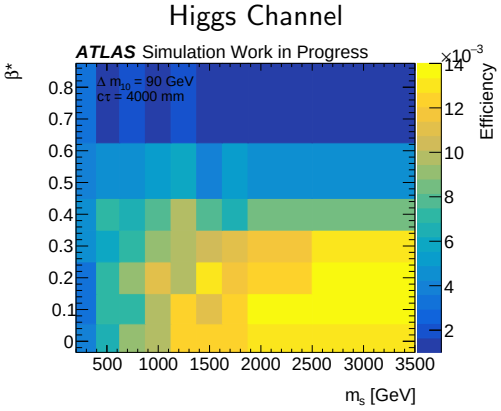

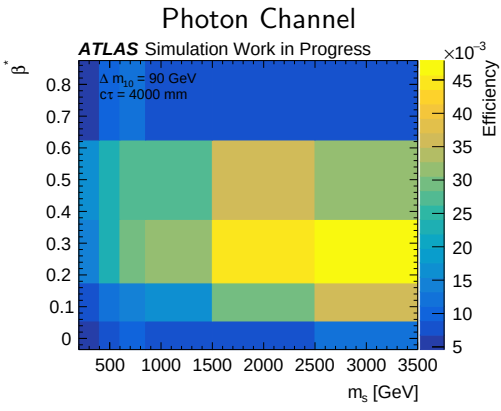

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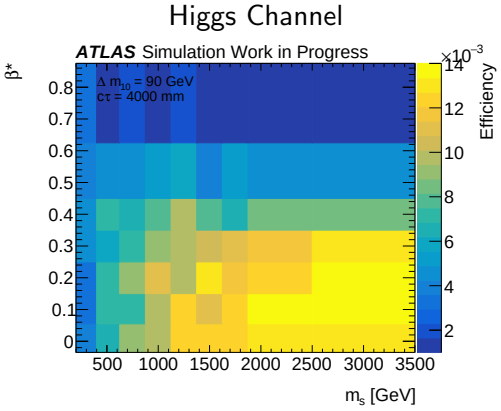

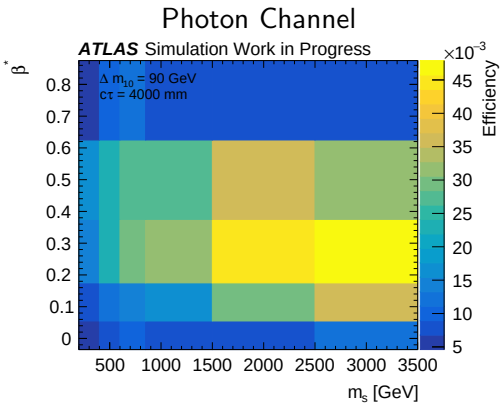

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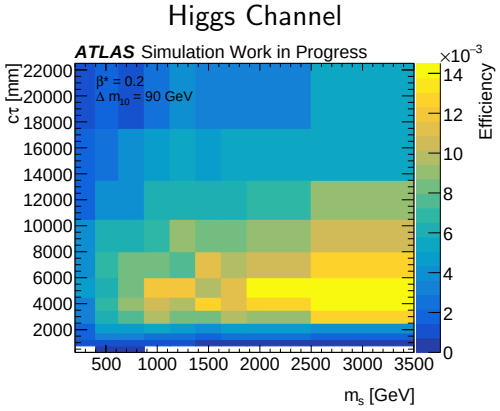
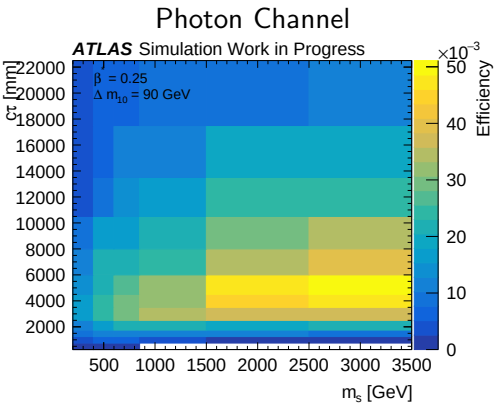
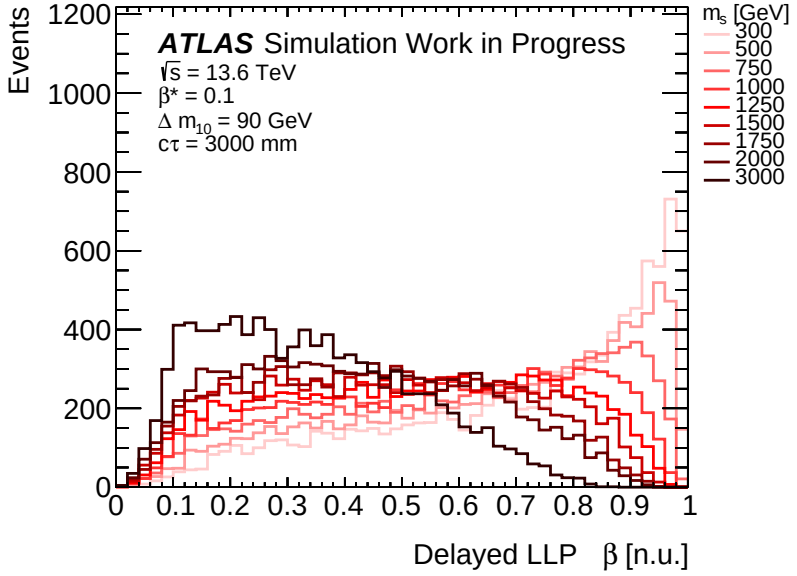
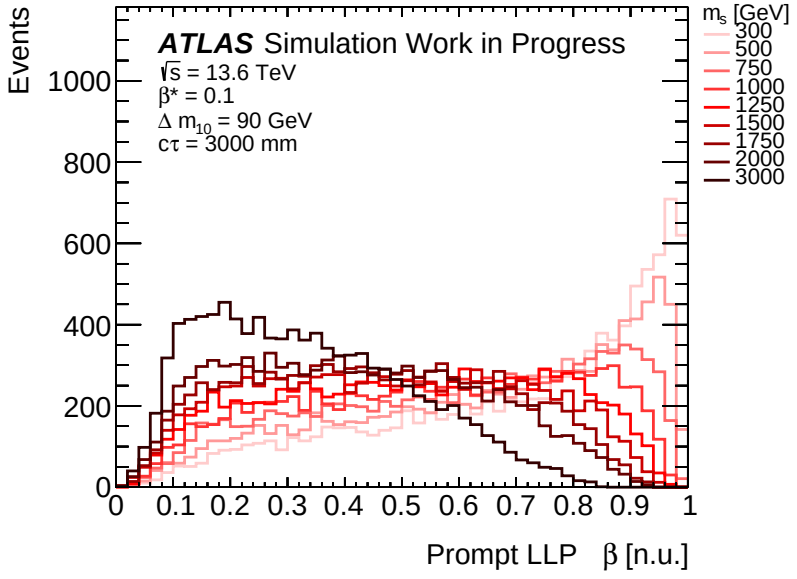




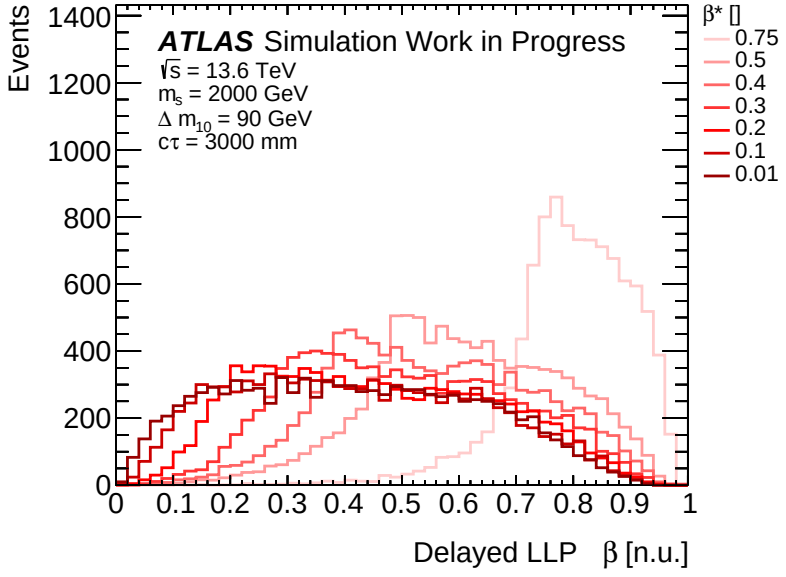
Boost of out-of-Time χ_1 for different m_s values (Before Trigger)



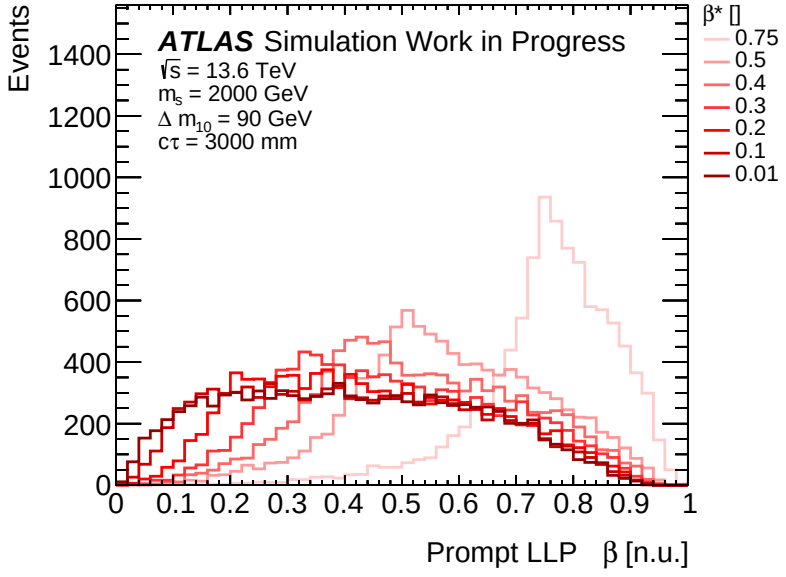
Boost of on-Time χ_1 for different m_s values (Before Trigger)



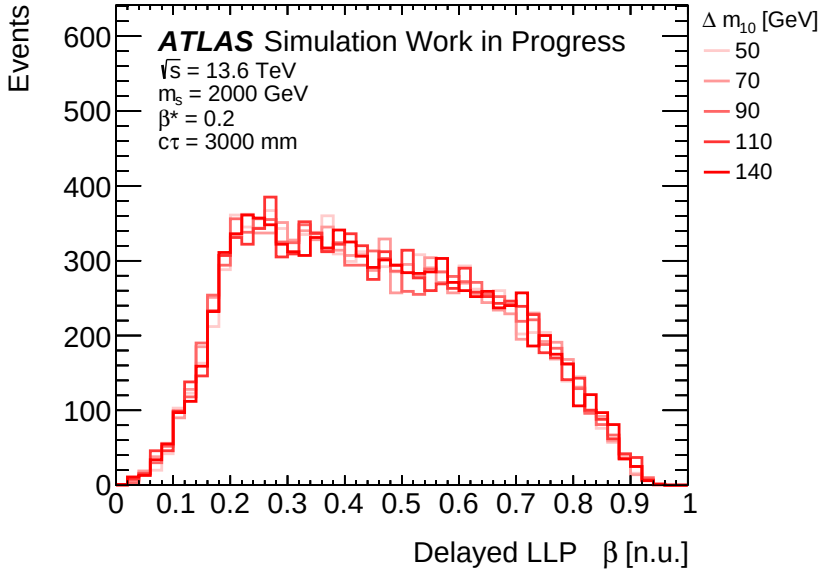
Boost of out-of-Time χ_1 for different β^* values (Before Trigger)



Boost of on-Time χ_1 for different β^* values (Before Trigger)



Boost of out-of-Time χ_1 for different Δm_{10} values (Before Trigger)



Boost of on-Time χ_1 for different Δm_{10} values (Before Trigger)