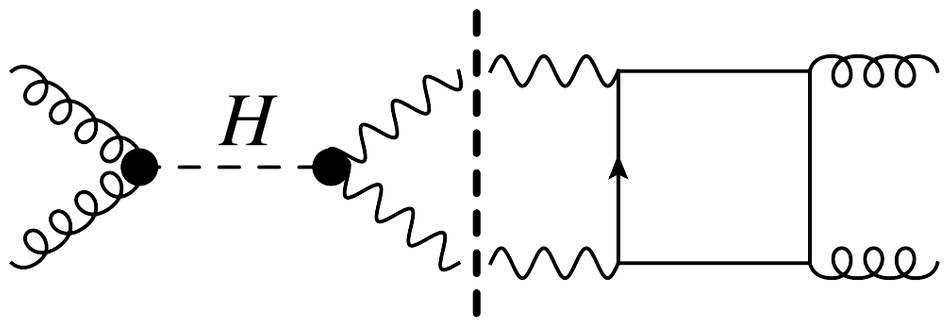
ATLAS Questions for Higgs to Diphoton Interference & Width:

LO (gg): 

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Introduction

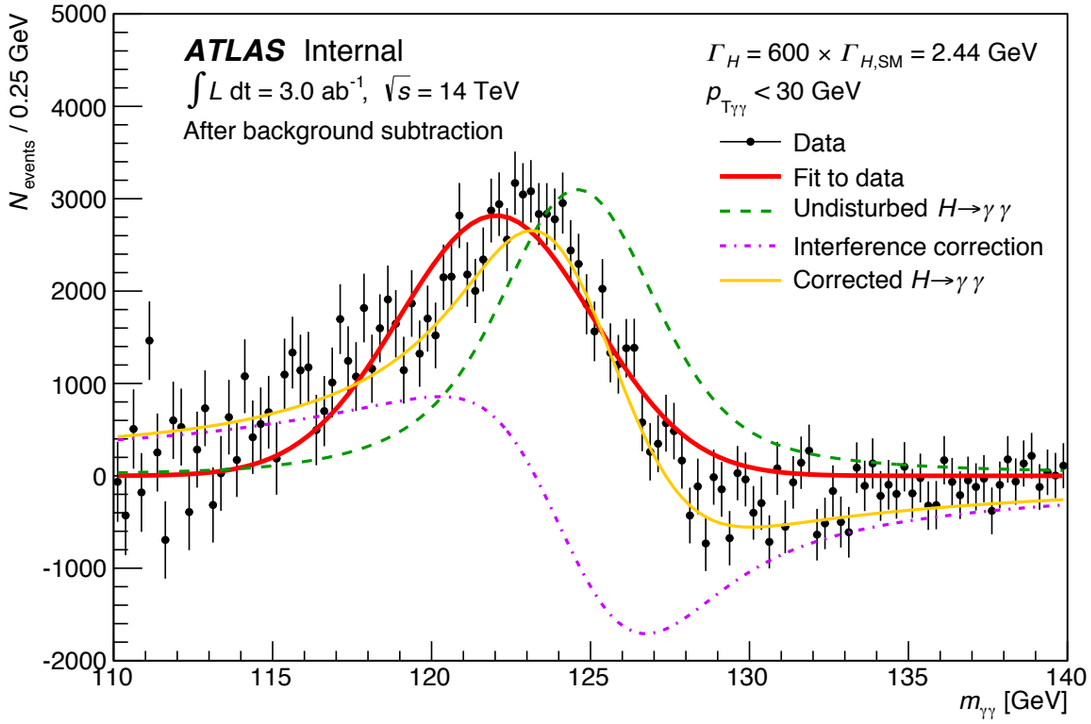
The total line shape for H→ɣɣ we expect due to continuum interference is the sum of

BW (ggH) + ***Continuum Interference*** + ***BW*** *(VBF,VH,ttH)*

where the size of the continuum interference depends among other things on μ_{ggH} , $\sigma_{Continuum}$, the p_T of the Higgs and the Width of the Higgs.

We are thinking of performing an analysis of the mass shift in a split of a low p_T and a high p_T region and one idea is to perform a direct fit for the width using this line shape and a combined fit in both regions.

To do so, we need to have an error estimate on the line shape though.



Also want to consider other scenarios, but the range of questions stay about the same.

Questions

- *What uncertainties source were considered for $\sigma_{Continuum}$ & σ_{ggH} ?* (scale, PDF?)
- *Higher order corrections are large in* gg → H, *do you think these changes are covered by the usual scale variations?*
- *The quark initial diagrams are formally at leading order; what effort would be needed to bring this up to NLO?*
- ***How does the summed line-shape change if these uncertainty sources are varied?***

- ***How should we deal with μ?***
  - *Magnitude of the interference scales with ~1 / √μ (relative to the BW term). Since used NLO cross section σ_{ggH} and NNLO/NNLL cross section will be very different, should one try to use a relative μ to correct for the line shape?*
  - Alternatively one could assume μ = 1 for the interference contribution. But not very satisfactorily.
  - ***Which approach do you think is more satisfactorily form a theory point of view?***

- *Linked to the question of μ: The continuum diphoton production cross section is measured, but of course cannot be split into the gg →γγ contribution. To get a bit a feeling for the dependence on $\sigma_{Continuum}$ one could take the measured cross section and 'split' the gg →γγ* out from the expected ratios for all production modes. What would be the effect on the interference if this value would be found very different from the value of $\sigma_{Continuum}$ used in the interference?