

# Constrains on the top quark width from cross section and branching ratio measurements using EFTfitter

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# Procedure for constraining the top quark width

- Motivation: Top quark width cannot be measured with experiments directly
- Main objective: calculate a pdf for the top quark width
- Build a model with observables, measurements and parameters
- Implement dependencies of the observables from the parameters from chosen model
- Include measurements
- EFTfitter is used in order to implement that model and perform the calculation
- EFTfitter is a tool based on Bayesian Analysis and used for generic interpretation of effective field theories

# Overview of the model

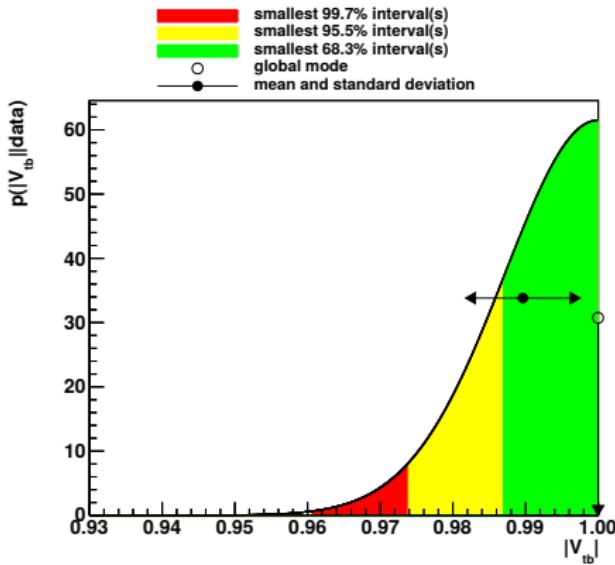
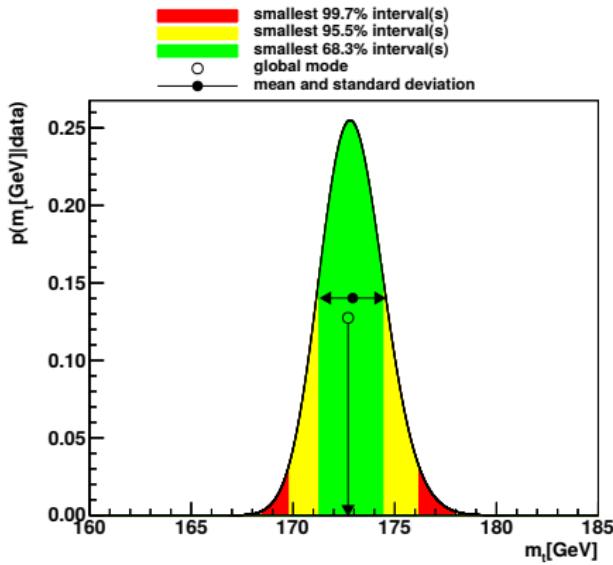
Parameter	Observables	Parameters of the observables	Measurement
$m_t$	$\sigma_{t\bar{t}}$	$m_t$	available
	$\sigma_{st}$	$m_t, V_{tb}$	available
$V_{tb}$	$BR(t \rightarrow W+b)$	$V_{tb}$	available
	$\Gamma_t$	$m_t$	not available

- $\sigma_{t\bar{t}}(m_t)$  and  $\sigma_{st}(m_t)$  obtained by using HATHOR and fits for the distributions
- $\Gamma_t$  is added as observable even though no direct measurement will be included
- Relation of  $\Gamma_t$  and the top quark pole mass  $m_t$ :

$$\Gamma = \frac{G_F m_t^3}{8 \pi \sqrt{2}} \left(1 - \frac{M_W^2}{m_t^2}\right)^2 \left(1 + 2 \frac{M_W^2}{m_t^2}\right) \left[1 - \frac{2 \alpha_s}{3 \pi} \left(\frac{2 \pi^2}{3} - \frac{5}{2}\right)\right]$$

# The results

- Providing the model and measurements to the EFTfitter it provides the posterior probabilities



- Comparison between global mode (GM) and world combination (WC) values of the calculated top quark width using the values of the mass:

$$\Gamma_t^{GM} = (1.335 \pm 0.040) \text{ GeV} \quad \text{with} \quad m_t^{GM} = (172.707 \pm 1.554) \text{ GeV}$$

$$\Gamma_t^{WC} = (1.352 \pm 0.020) \text{ GeV} \quad \text{with} \quad m_t^{WC} = (173.34 \pm 0.76) \text{ GeV}$$

- Global mode values agree within one standard deviation
- Resulting plots fit expectations
- Possible next steps
  - ▶ Expand the model with more observables
  - ▶ Add more (also multiple of the same) measurements
  - ▶ Create a "global fit" on physical quantities that cannot be measured directly
- Thanks for your attention