Updated reference x-sections
ttH status report

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Status of computations

- With respect to the presentation of April:
  - tH numbers unchanged, can be considered as final.
  - For tH in the t-channel: scale/scheme uncertainties are slightly larger than other results in literature, but consistent with YR4. Relative position of 4FS and 5FS change: effect of PDF4LHC combination?

$\sqrt{s}$ [TeV]	m_H [GeV]	σ [fb]	δ_μ	$\delta_{\rm PDF}$	δ_{α_s}
13.0	124.60	76.17	$^{+6.5}_{-15.0}$	1.8	1.2
13.0	125.00	76.04	$^{+6.4}_{-15.9}$	1.8	1.2

(4FS: 68.25) New numbers (PDF4LHC21)

$M_{\rm H}$[GeV]	$\sigma_{tH+\bar{t}H}$[fb]	$K_{\rm QCD}$	Scale+FS [%]	α_S [%]	PDF [%]	PDF+α_S [%]	σ_{tH}[fb]	$\sigma_{\bar{t}H}$[fb]
125.0	74.25	1.20	$+6.5\ -14.9$	±1.2	±3.5	±3.7	48.89	25.42

YR4/13TeV (PDF4LHC15)

Pagani et al, 2006.10086 (NNPDF31)

Accuracy	Channel	FS	tHj
$\rm NLO_{QCD}$	t-ch.	4FS	$68.1(1)^{+2.7(+4.0\%)}_{-4.5(-6.6\%)}\ ^{+0.4(+0.5\%)}_{-0.4(-0.5\%)}$
		5FS	$71.3(1)^{+5.2(+7.2\%)}_{-1.7(-2.4\%)}\ ^{+0.3(+0.5\%)}_{-0.3(-0.5\%)}$
		$\rm 5FS^{scale}_{4-5}$	$71.3(1)^{+5.2(+7.2\%)}_{-7.7(-10.9\%)}\ ^{+0.3(+0.5\%)}_{-0.3(-0.5\%)}$

ttH:

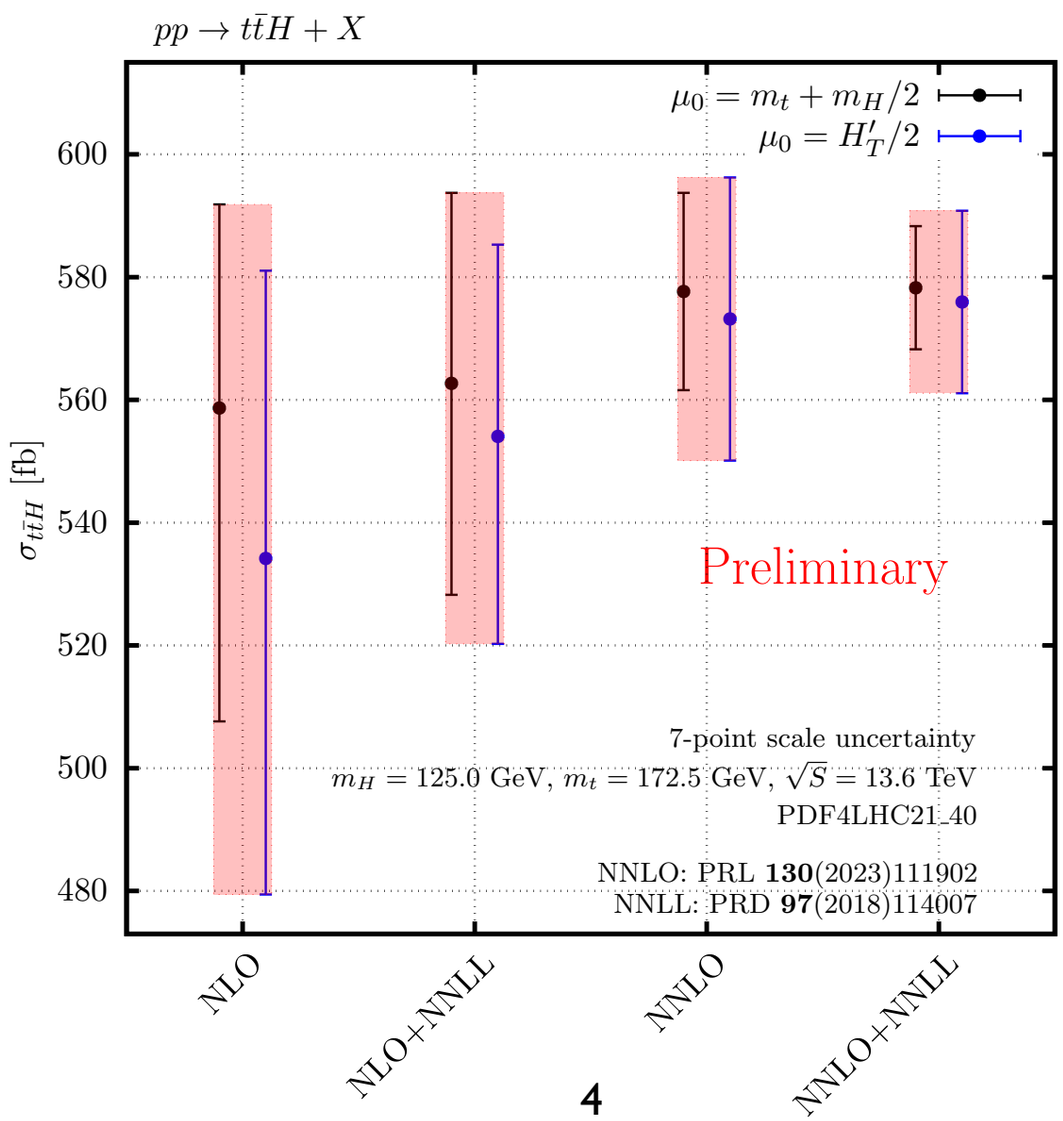
- NNLO QCD + NNLL soft + complete NLO EW. First individual results available
- Out of the 3 set of numbers (two NNLL+NLO+EW, and the NNLO+EW), we want to have a **single** reference cross section
  - NNLL I Broggio et al, 1907.04343;
    NNLL II Kulesza et al, 2001.030301;
    NNLO Catani et al, 2210.07846
- Two possibilities discussed:
  - Use the NNLO+EW, but with proper referencing also to the resummation results, which are useful to estimate MHOU
  - Obtain the NNLO+NNLL+EW prediction with proper additive matching
- The two NNLL collabs. volunteered to provide the ingredients for the matched predictions

ttH@NNLO+NNLL (very preliminary)

- Additive matching:

$$\sigma_{\mathrm{NNLO+NNLL}} = \sigma_{\mathrm{NNLO}} + \sigma_{\mathrm{NNLL}} - \sigma_{\mathrm{NNLL}}|_{\mathrm{NNLO}}$$

- First results (thanks A. Kulesza; only QCD, only scale unc.)



Outlook

- Complete the combination for ttH and provide final reference numbers
- Write ttH WG note, possibly published on some journal