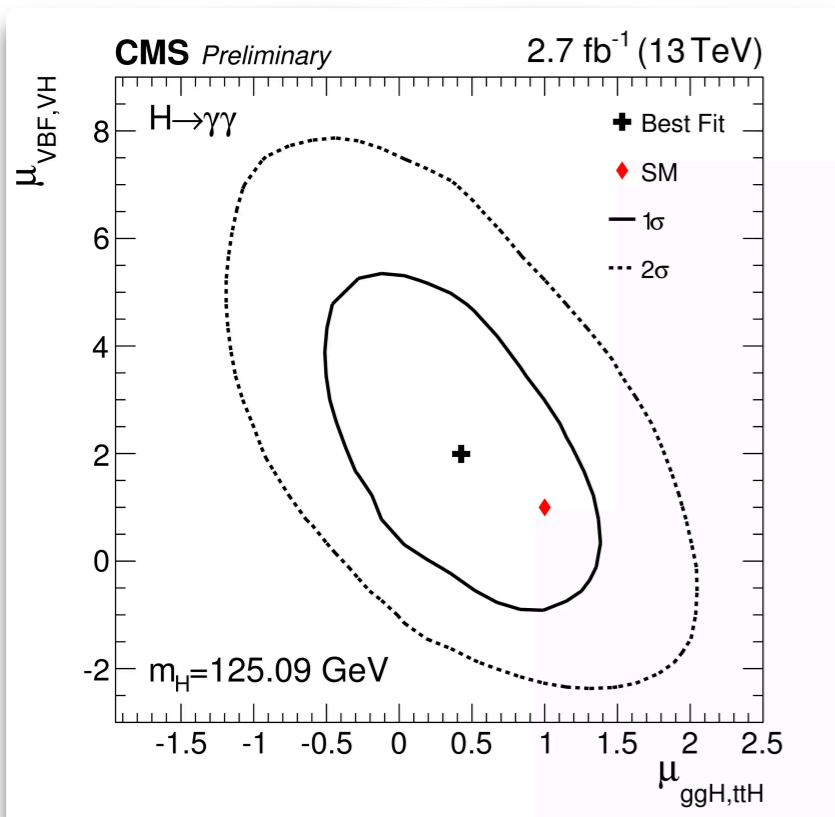


Higgs activities Imperial College

CMS $H \rightarrow \gamma\gamma$

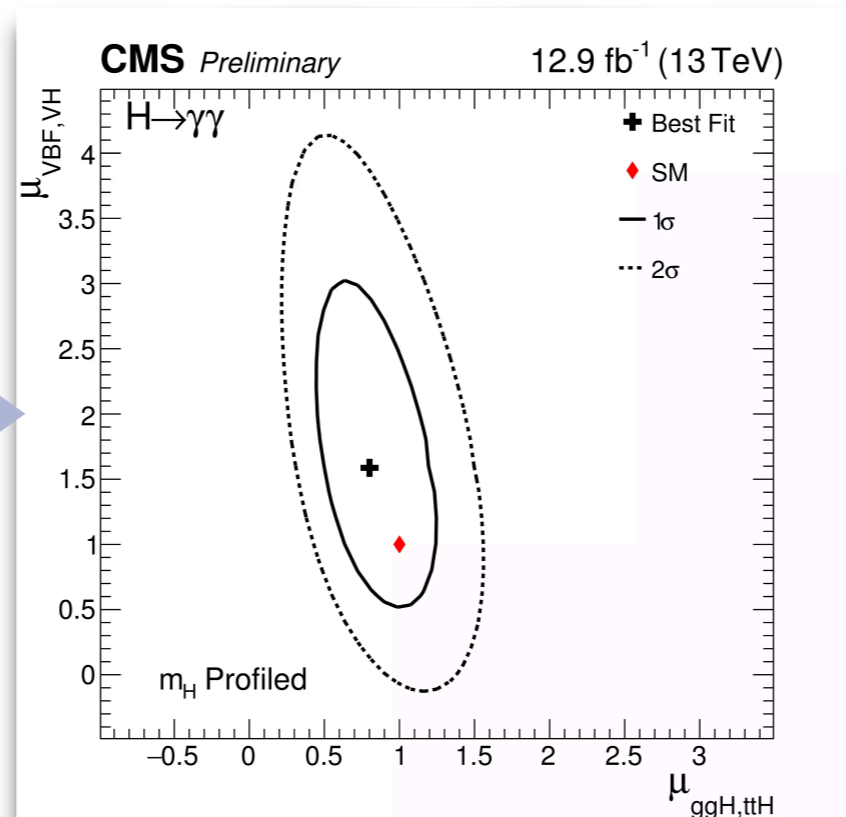
- CMS group @ Imperial College plays a leading role in Higgs area. The group manages different aspects of the analysis in particular:
 - VBF ($H \rightarrow \gamma\gamma$) productions mode tagging and validation of jets
 - Statistical fit and extraction of couplings for $H \rightarrow \gamma\gamma$
 - Simplified Template Cross-sections
 - Combined Higgs results
- Leading contribution of “rediscovering” Higgs boson @13TeV datasets in $H \rightarrow \gamma\gamma$ channel

2015



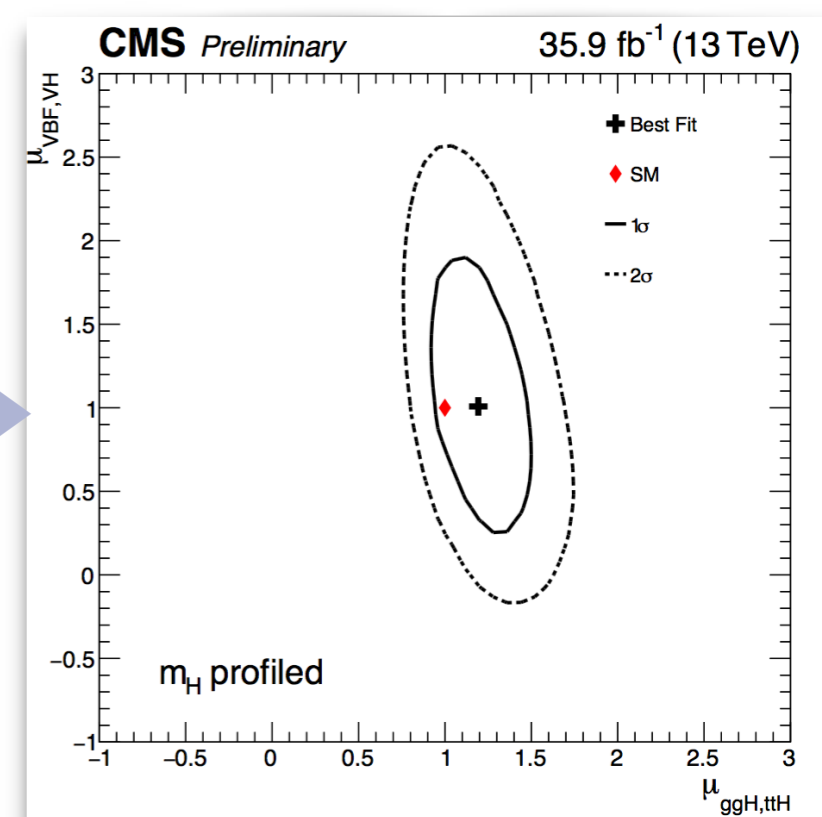
CMS-PAS-HIG-15-005

AUGUST 2016



CMS-PAS-HIG-16-020

FULL 2016

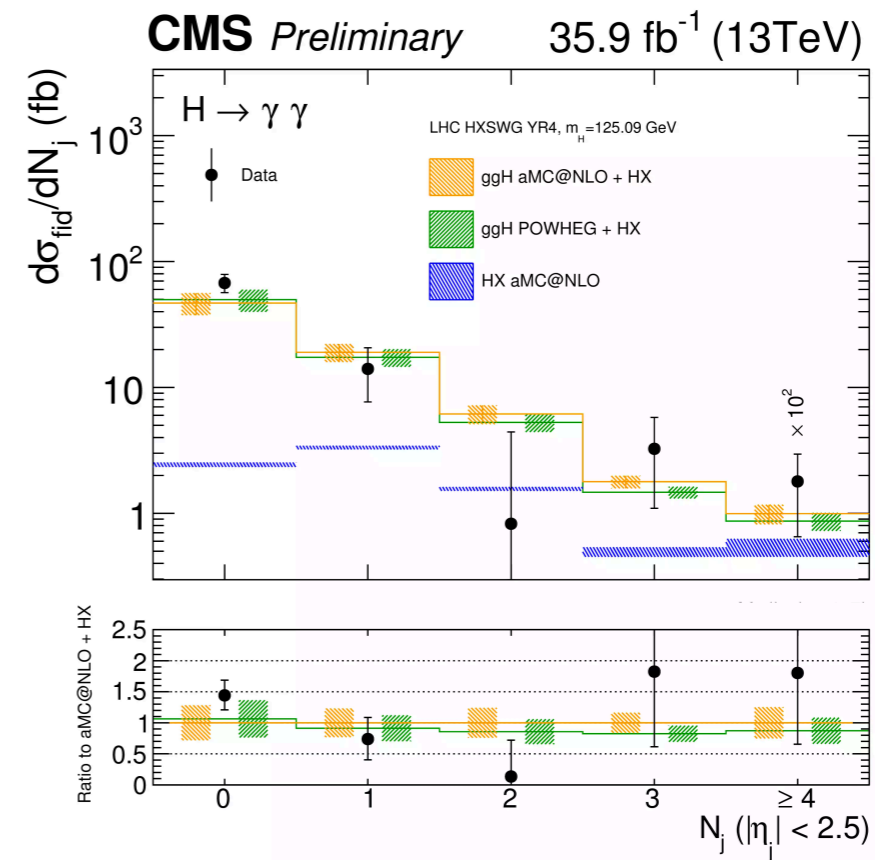
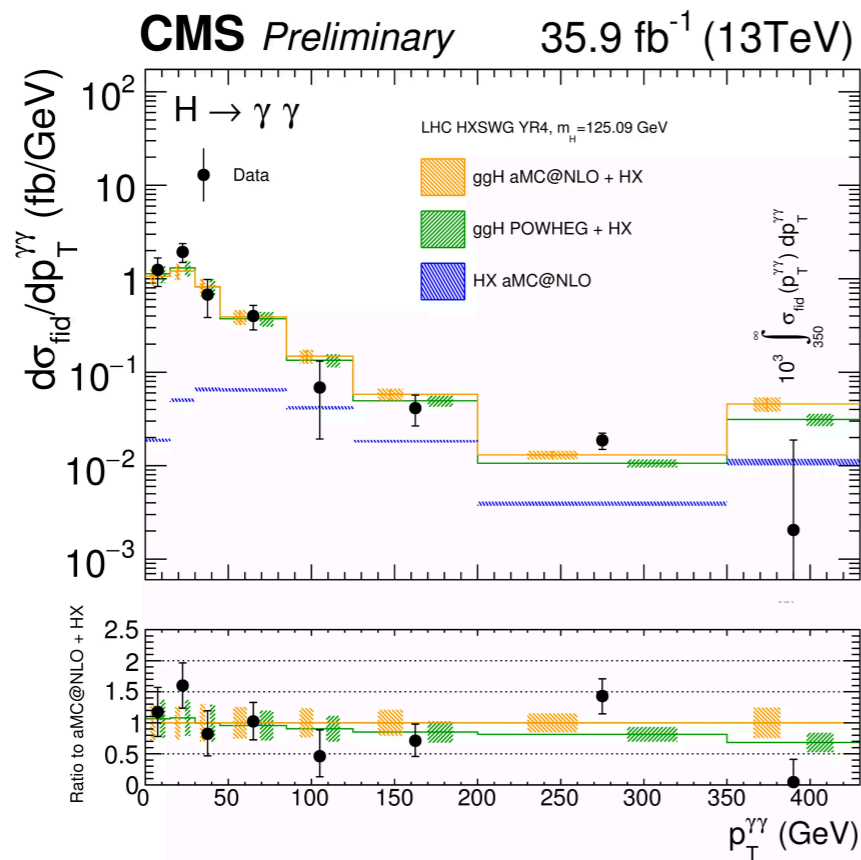


CMS-PAS-HIG-16-040

Higgs activities Imperial College

CMS $H \rightarrow \gamma\gamma$

- Differential cross-sections for quantities like $p_T(H)$ and jet multiplicity, unfolded to the particle level, have also been measured in Run 1 and updated with 2016 Data set
 - Statistical uncertainties (23%–75%) still dominate all the differential measurements. For 100fb^{-1} we expect to reduce these uncertainties by $\sim 30\%$



CMS-PAS-HIG-17-015

- Important to constrain the MC generator/model**
 - For example simulation of hadron activity simulation in gluon-gluon fusion: Additional jet related variables are highly encouraged
- These measurement will keep improving with the luminosity (more stats, more bins)

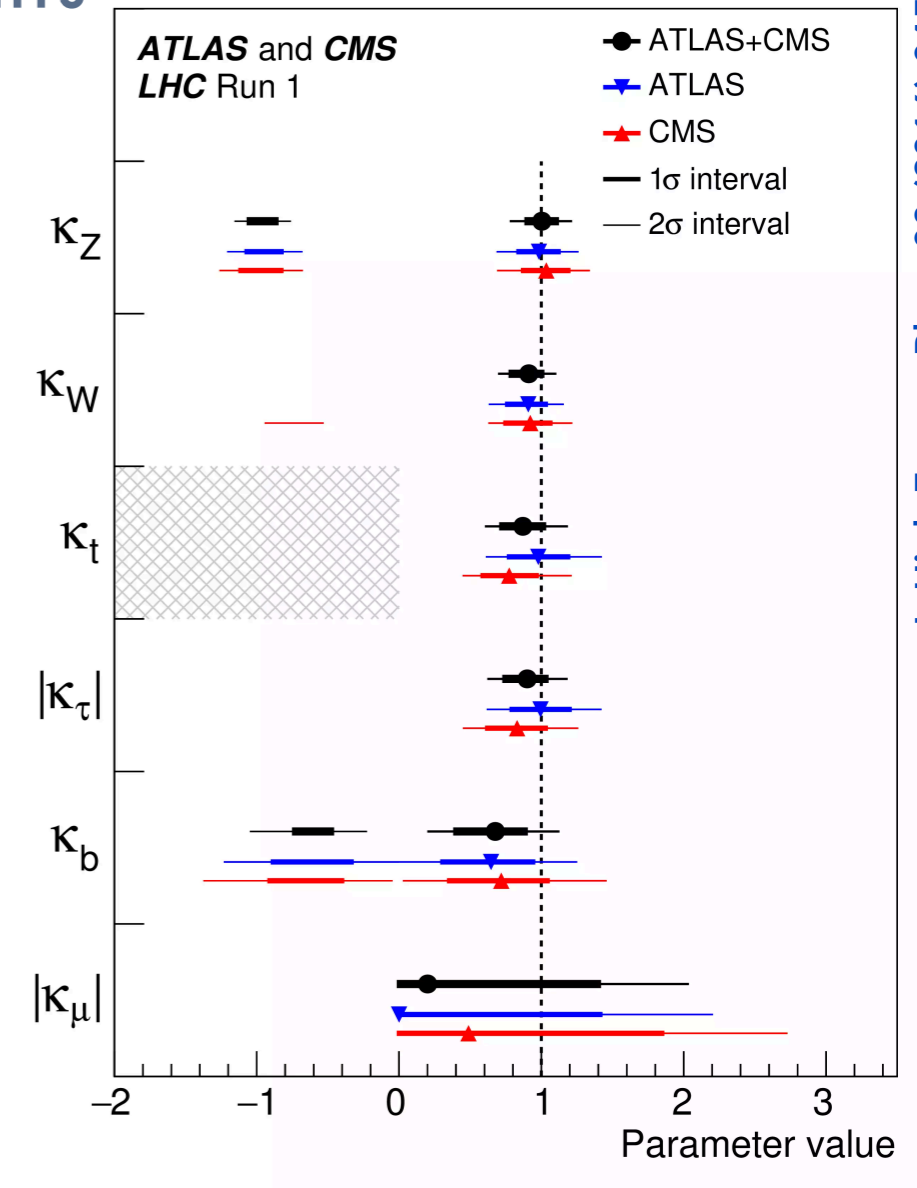
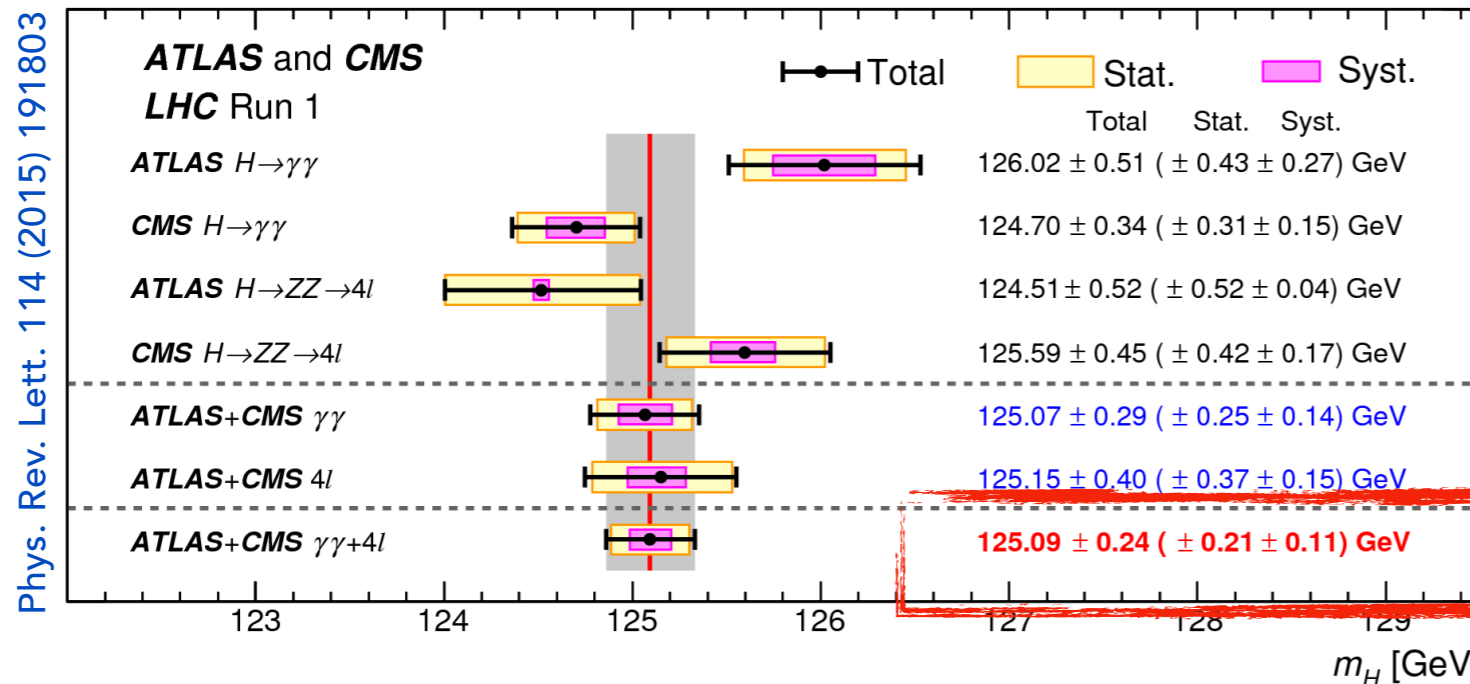
Run 1 : Combined Higgs boson measurements

- Rich program of Higgs physics at Run-1 culminated in combined measurements of its properties :

- Combination of channels and dataset CMS + ATLAS

- Big challenges :

- Correlations of theory uncertainties (feedback to LHCHSWG)
- dealing with more than 4200 nuisance parameters (couplings)!



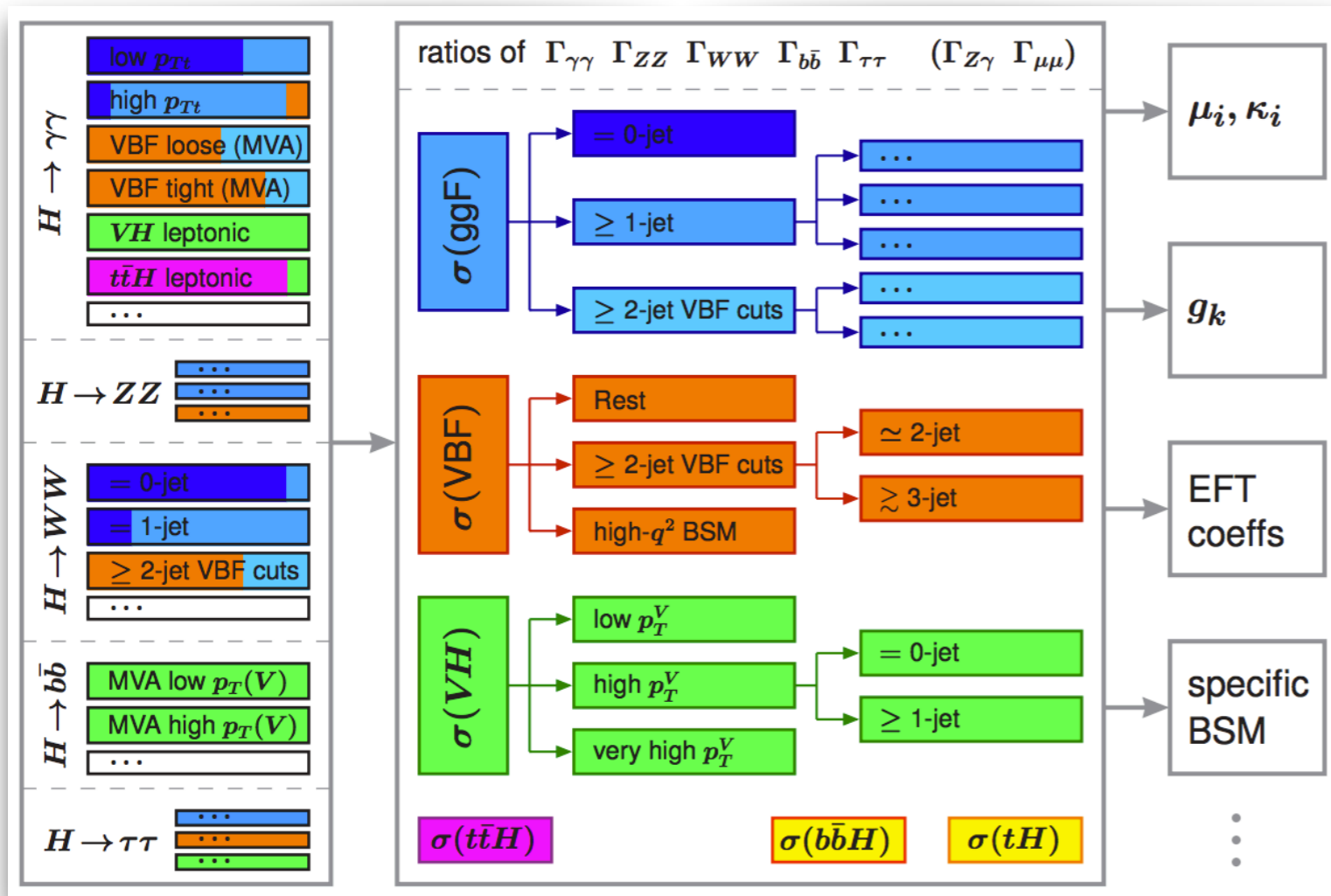
J. High Energy Phys. 08 (2016) 045

- Massive achievement; The mass of the Higgs boson is not predicted in the SM
 - ATLAS and CMS combined measurement of the Higgs boson mass <0.2% precision!
- Good agreement with Standard model predictions
- Higgs mass measurement in CMS with 2016 (2017) dataset at 13TeV coming soon

Higgs activities Imperial College

Simplified Template Cross-sections

- Provide interface between Measurement and Interpretations
- Describe Higgs prod/decay processes in “generator bins”



- Evolve beyond μ/κ - framework in 3-“stages”
- As luminosity increases, splitting becomes finer but also maintaining “combinability”
- Idea is to allow useful re-interpretations of results outside experiments

YR4 arXiv:1610.07922

- Imperial College is currently leading measurement using STXS framework for $H \rightarrow \gamma\gamma$ channel

Higgs activities Imperial College

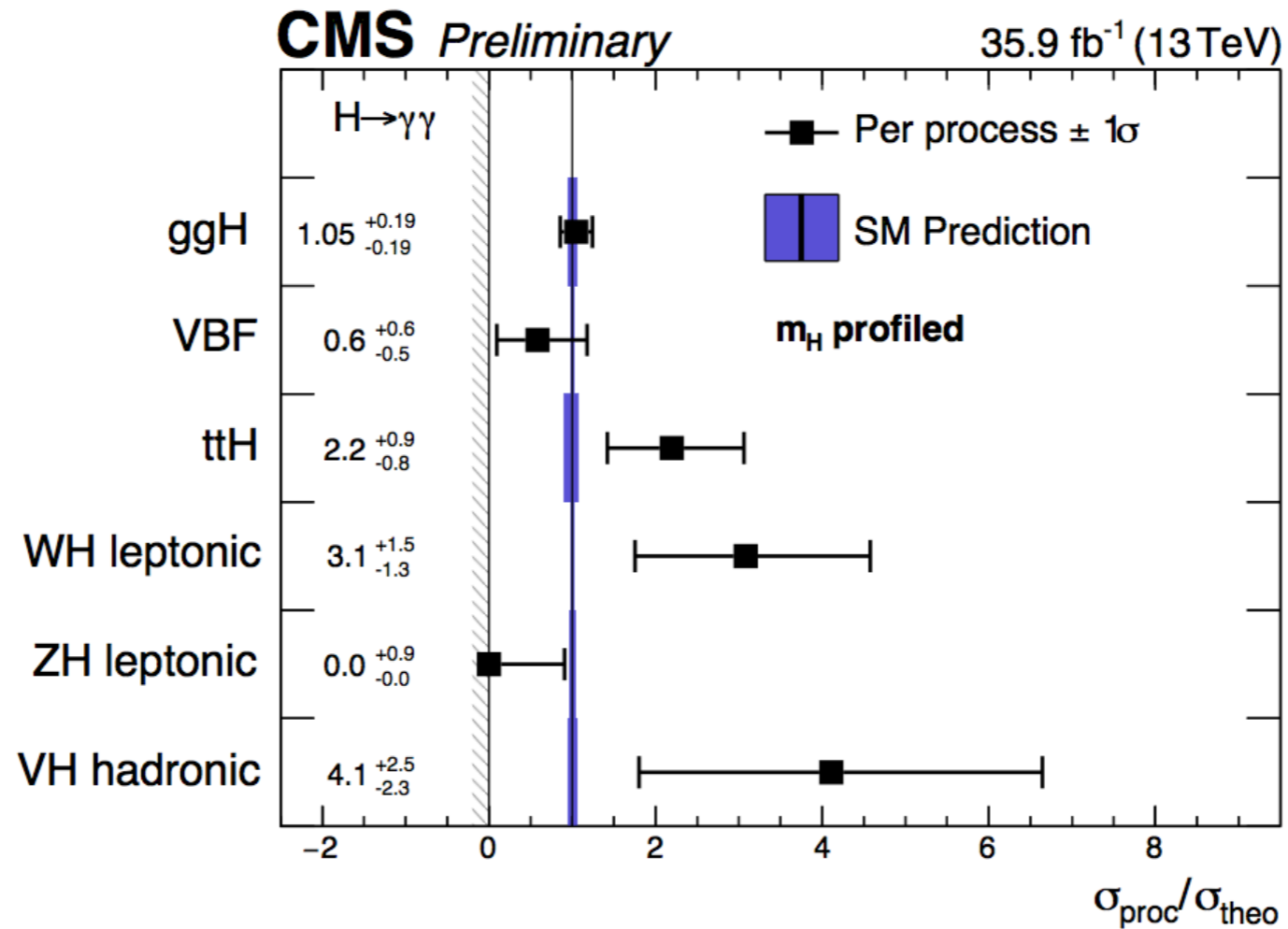
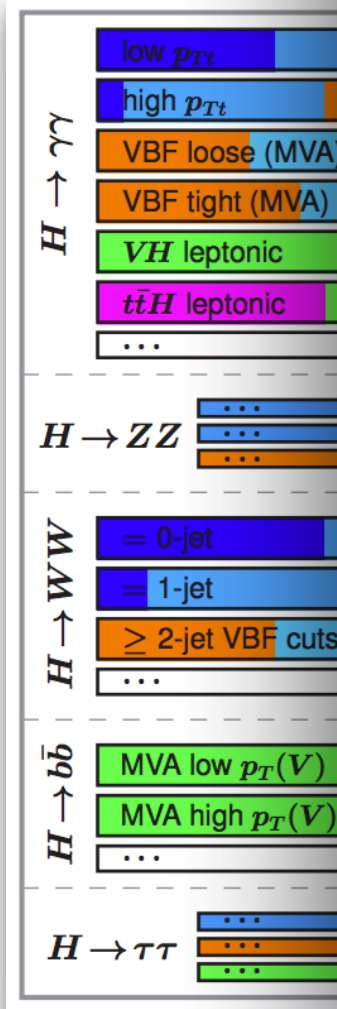
Simplified Template Cross-sections

- Provide interface between Measurement and Interpretations

- Describe

- Preliminary results for stage 0 using the full 2016 dataset

YR4 arXiv:1610.07922



CMS-PAS-HIG-16-040

etwork

splitting

ty”

outside

- Imperial College is currently leading measurement using STXS framework for $H \rightarrow \gamma\gamma$ channel