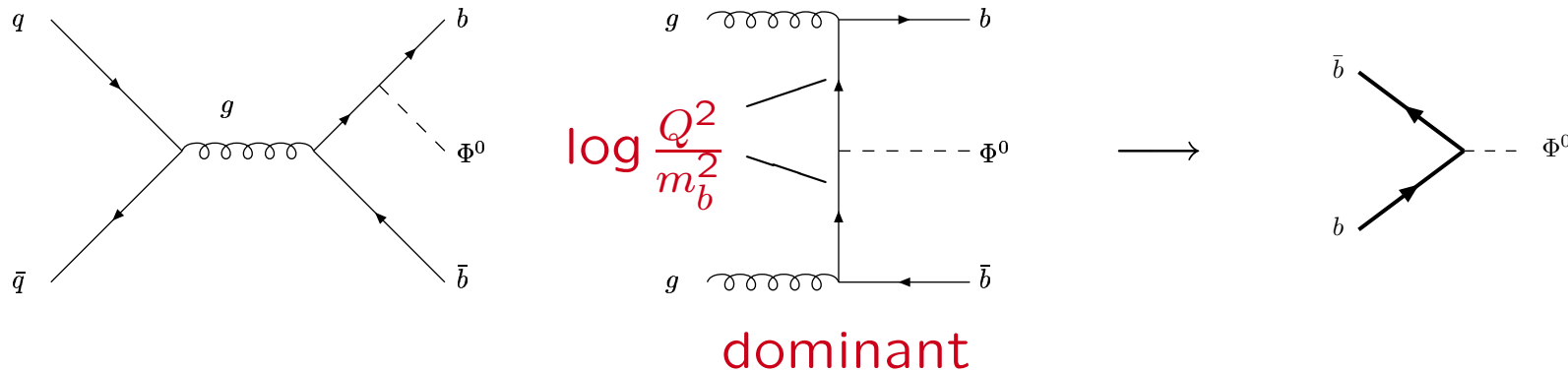


4 – FLAVOUR $b\bar{b}H$ CALCULATIONS

Michael Spira (PSI)

Theory convenors: Michael Spira, Georg Weiglein

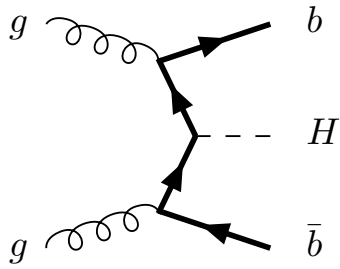
Experimental convenors: Monica Vazquez Acosta (CMS), Markus Warrin-sky (ATLAS)



large logs from phase space integration \longrightarrow bottom PDF
 resummation \equiv DGLAP evolution
 $Q \sim \frac{1}{4} \dots \frac{1}{10} M_H$

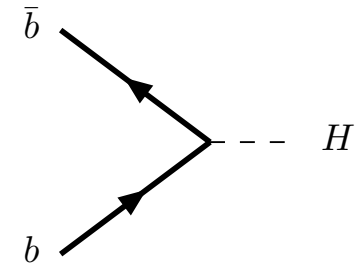
4-Flavour Scheme

- massive top, bottom, gluinos and squarks decoupled from α_s
 \rightarrow 4 active flavours
- PDF: $\overline{\text{MS}}$ scheme [4 flavours] \rightarrow no b -PDF [courtesy of MSTW2008]
- grids H, A : 80-200 GeV: $\Delta = 5$ GeV, 200-500 GeV: $\Delta = 20$ GeV
 scale uncertainties
- error PDFs?



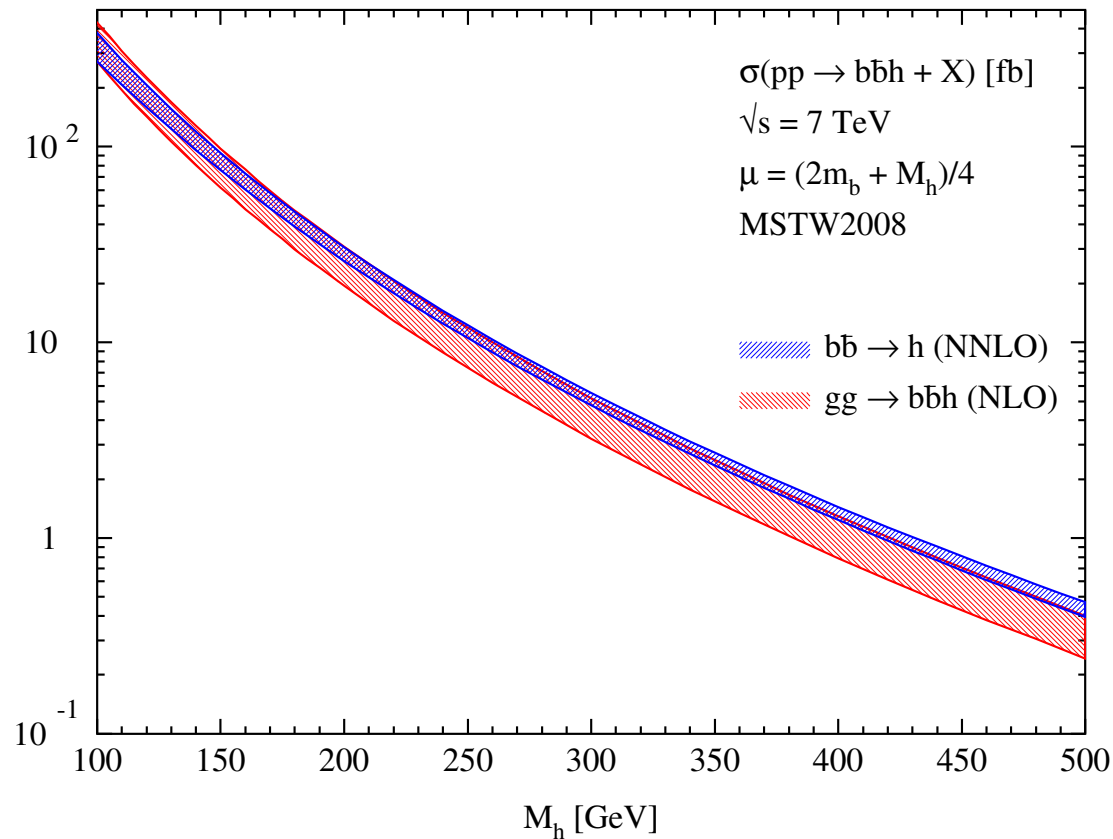
NLO

exact $g \rightarrow b\bar{b}$ splitting & mass/off-shell effects
 no resummation of $\log M_H^2/m_b^2$ terms



NNLO

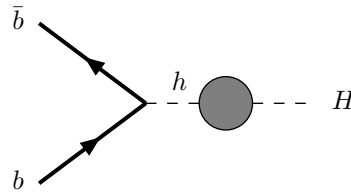
massless/on-shell b 's, no p_{Tb}
 resummation of $\log M_H^2/m_b^2$ terms



Dittmaier, Krämer, S.
 Dawson, Jackson, Reina, Wackerroth
 Harlander, Kilgore

- rescale with Yukawa coefficients

- Z -matrix



Hahn, Heinemeyer, Hollik, Weiglein

SUSY-QCD Corrections to $b\bar{b}\phi^0$

$$\mathcal{L}_{eff} = -\frac{m_b/v}{1 + \Delta_b} \bar{b} \left[g_b^h \left(1 - \frac{\Delta_b}{\text{tg}\alpha \text{tg}\beta} \right) h + g_b^H \left(1 + \Delta_b \frac{\text{tg}\alpha}{\text{tg}\beta} \right) H - g_b^A \left(1 - \frac{\Delta_b}{\text{tg}^2\beta} \right) i\gamma_5 A \right] b$$

$$\Delta_b = \frac{2}{3} \frac{\alpha_s}{\pi} m_{\tilde{g}} \mu \text{tg}\beta I(m_{\tilde{b}_1}^2, m_{\tilde{b}_2}^2, m_{\tilde{g}}^2) \quad I(a, b, c) = -\frac{ab \log \frac{a}{b} + bc \log \frac{b}{c} + ca \log \frac{c}{a}}{(a-b)(b-c)(c-a)}$$

⇒ resummed Yukawa couplings

Carena, Garcia, Nierste, Wagner
Guasch, Häfliger, S.

- NNLO: $\mathcal{O}(10\%)$, $\mu = M_{SUSY}$

Noth, S.

- approximation of NLO SUSY-QCD corrections within $< 1\%$

Dittmaier, Häfliger, Krämer, S., Walser

SUMMARY

$b\bar{b}\phi^0$

- 4FS: QCD corrections $\lesssim 100\%$ for total cxn
 $\Rightarrow \Delta \lesssim 30\%$ [only scale]
- SUSY-QCD corrections: small after resummation [Δ_b] for large $\text{tg}\beta$
- grids for 4FS central + scale error available for H and A
- 5FS: QCD corrections moderate for total cxn
 $\Rightarrow \Delta \lesssim 10 - 20\%$ [scale+PDF+ α_s]
- grids/parametrizations for 5FS central + errors [scale+PDF+ α_s]
available
- 4-flavour error PDFs??? \leftarrow recommendation PDF4LHC?