

- 1) Theory predictions for Higgs + backgrounds to Higgs
  - a. can we have a dynamic collection of cross sections (detailing methods and parameters used to calculate these cross sections) for all Higgs production processes and main backgrounds?
  - b. understanding consistency and best use of predictions at LO, NLO, NNLO, NLO+NLL, NNLO+NNLL
    - i. how consistent are the predictions from CTEQ, MSTW, NNPDF?
    - ii. how to properly include the cross section/PDF uncertainty due to the uncertainty on  $\alpha_s$ ?
    - iii. what is the best way of adding PDF and scale uncertainties?
    - iv. should the factorization and renormalization scales be varied separately or together?
    - v. can we assume similar scales for related processes?
    - vi. how best to treat the PDF correlations between cross sections?
    - vii. can we improve the PDF and scale uncertainties by normalizing to the W/Z cross section?
    - viii. how do we relate these higher order predictions to the LO event generators that we most often use?
    - ix. how to deal with higher order information for differential distributions ; for example, for the Higgs  $p_T$  distribution or for n-jet distributions?
    - x. what theory uncertainties do we have to include as acceptance uncertainties when setting a limit on a cross section, such as  $gg \rightarrow H + X \cdot BR(H \rightarrow WW)$ ?
    - xi. is there a consensus on how to deal with calculations of MSSM Higgs and their uncertainties in 4- and 5-flavor schemes?
  - c. using knowledge of NLO calculations to provide best LO estimates for multi-parton final state calculations for Higgs + backgrounds
    - i. best scale choices
    - ii. impact of jet choices
    - iii. dynamic K-factors for re-weighting of LO distributions
  - d. using NNLO/NNLL calculations to provide best estimates for NLO
    - i. best scale choices
    - ii. dynamical K-factors for reweighting
  - e. what is the impact of jet vetoing on the theoretical uncertainty for a signal cross section; for a background cross section? How do we evaluate the efficiency uncertainties for the central jet veto for the classical VBF Higgs signature? What are the experimental benchmarks that allow us to choose between the different predictions?
  - f. how do we tie the theoretical predictions into data-driven background predictions?
  - g. how do we properly split the Higgs signal into 0-jet , 1-jet samples? How do we evaluate the theoretical uncertainties?

- h. photon isolation; can a meaningful definition of isolation that works for both theory and experiment be adopted a la the Les Houches working group?
- 2) Calculations needed (see also Les Houches wishlist)
  - a. WW production (to NNLO)
    - i.  $gg \rightarrow WW$  at NLO
  - b. WW production (NLO + resummed)
  - c. VVjj
  - d. VVbB (related to VVjj)
  - e.  $tTjj$  (related to  $tTbB$ )
  - f. VBF to NNLO
  - g.  $gg \rightarrow \text{Higgs} + \text{jet}$  to NNLO
  - h. updated PDF sets with QED corrections
- 3) How might the MSSM make Higgs measurements/discovery more difficult?
- 4) Public codes (or ROOT ntuples) for
  - a.  $tTH \rightarrow bB$
  - b.  $tTbB$
  - c.  $tTj$
  - d. Wjjj
- 5) Saving the Higgs (in difficult channels)
  - a. boosted Higgs
  - b.  $tTH$  (using NLO knowledge of  $tTbB$  to discriminate)

#### Questions from theorists to experimentalists

1. Analysis techniques
  - a. Can experimentalists make more information available to theorists, such as (simplified) neural nets, or decision trees? This is especially true for some Tevatron analyses where the S/B ratio is very difficult.
  - b. There is a significant discrepancy between NLO theory and experiment for  $W + b$ . What impact does this/might this have for Higgs exclusion limits?