Activities in ATLAS-Freiburg

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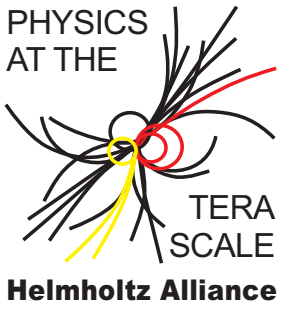

Introduction

Short overview of activities in the Schumacher group at Freiburg University related with MC.

MC tuning

Higgs Cross Sections

Vector Boson Fusion

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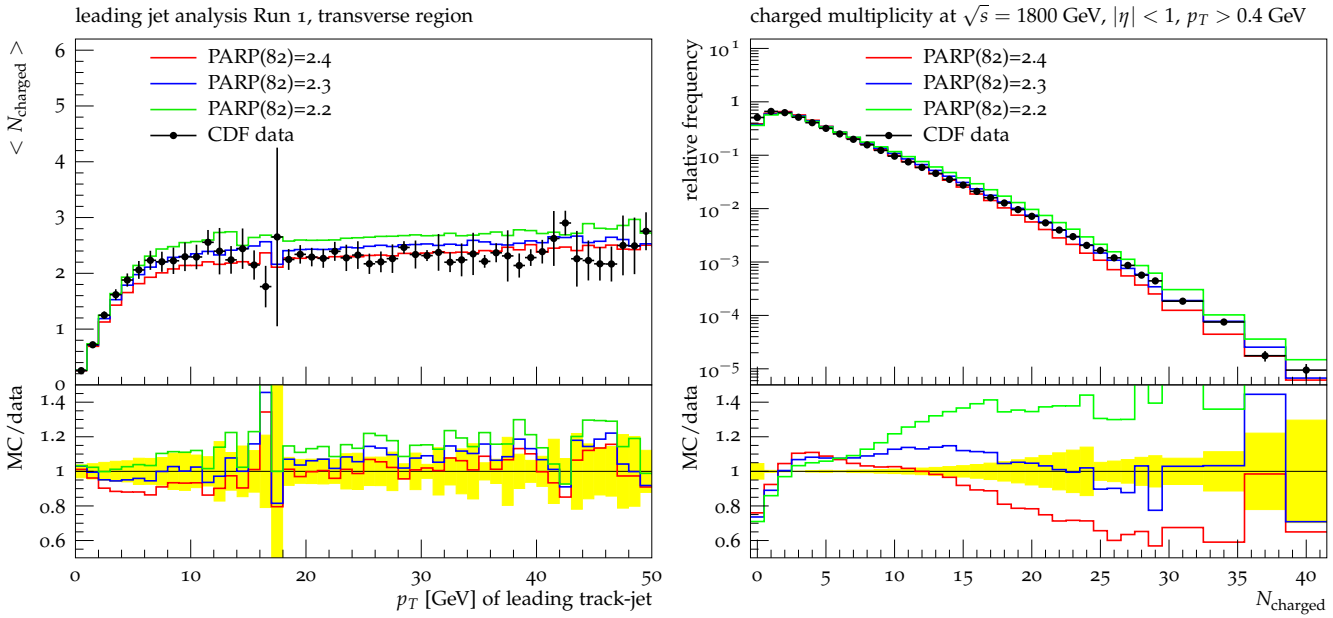
MC tuning

- Tuning of MPI parameters in Pythia 6 in ATLAS
  - done for 2009 MC production round (MC09)
  - basic setup based on previous ATLAS tune
  - tune to published Tevatron data, e.g.:



  - so far: manual tuning "by eye"
  - have started using PROFESSOR for (semi)automated tuning, good instructions and help from Holger Schulz (HU Berlin)

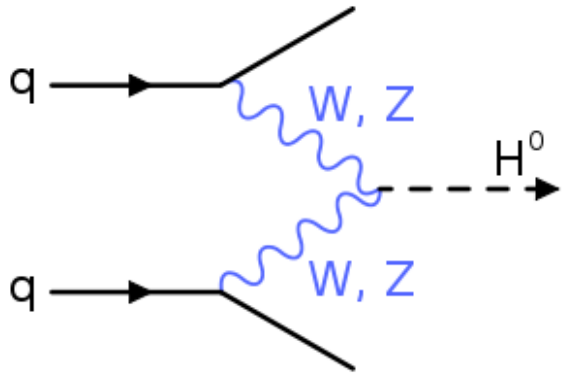
MC tuning

- Future:
  - use automated tools (started with PROFESSOR)
  - Include more data-sets (made possible with automatic tool such as PROFESSOR)
  - ATLAS-Note on current MC09 tune and comparison to other tunes in preparation
- Analysis side: Interested in measurements with $Z \rightarrow \mu\mu$, e.g. transverse momentum and later jet distributions in Z+jets (DØ experience by H. Nilsen)

Higgs Cross Sections and Distributions

- Recently finished activity
- collection of (inclusive) Higgs boson production cross sections at $\sqrt{s} = 7, 10, 14\,\mathrm{TeV}$
- also: Scale and PDF uncertainities!
- needed to place first limits
- personal involvement:
  - Vector boson fusion (VBF)
  - MSSM neutral Higgs boson: b-associated production and gluon-gluon-fusion
- will show an example of a VBF study a bit more related to MC

Vector Boson Fusion (VBF)

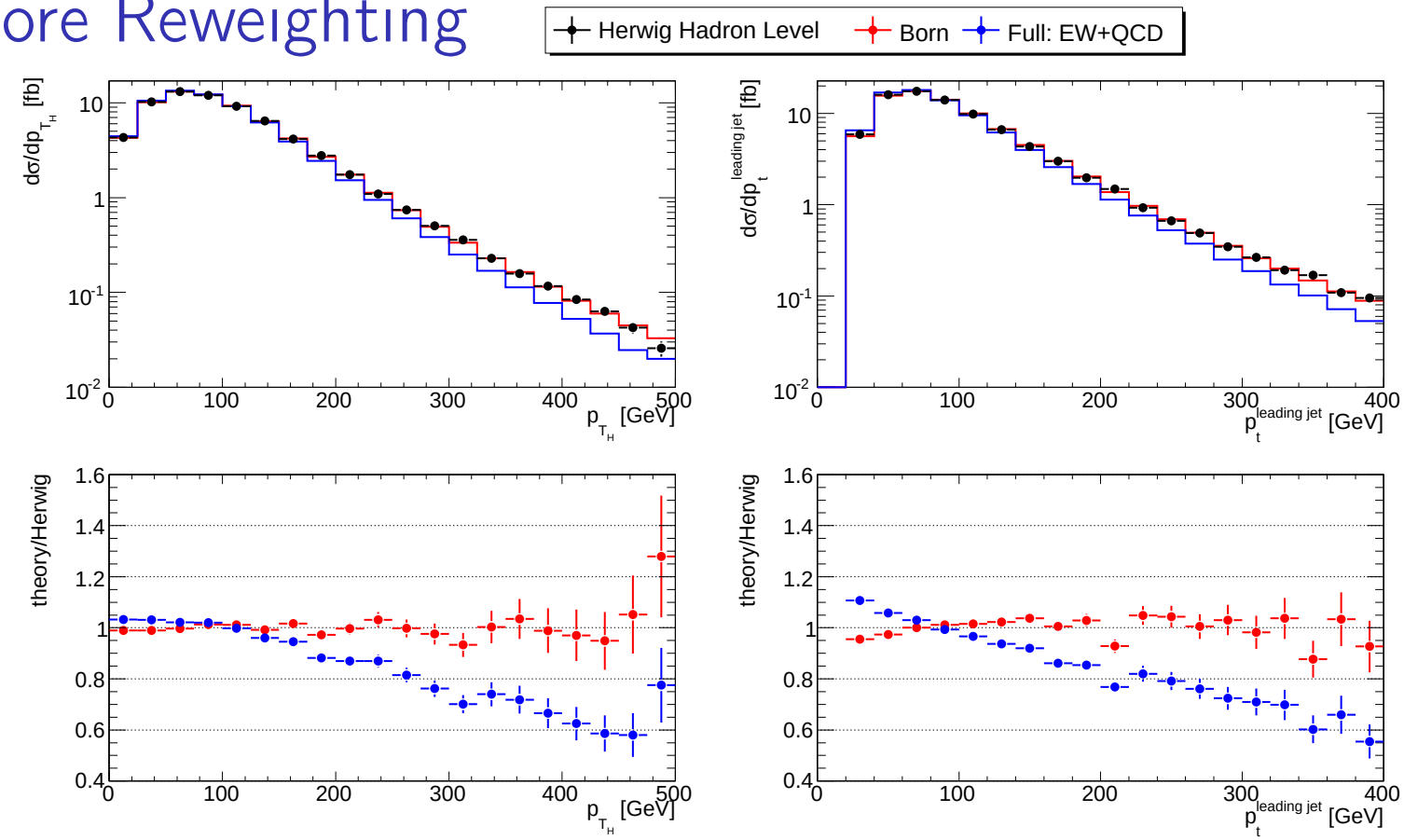


- Vector boson fusion important discovery channel for SM Higgs with low mass.
- two tagging jet in forward direction
- no color-flow in between, used to suppress backgrounds
- Best available cross section:
  - NLO Electroweak+QCD , implemented in program by M. Ciccolini, A. Denner, S. Dittmaier (CDD, arXiv:0710.4749 [hep-ph]) – possible to place cuts and get distributions

Differential Distributions

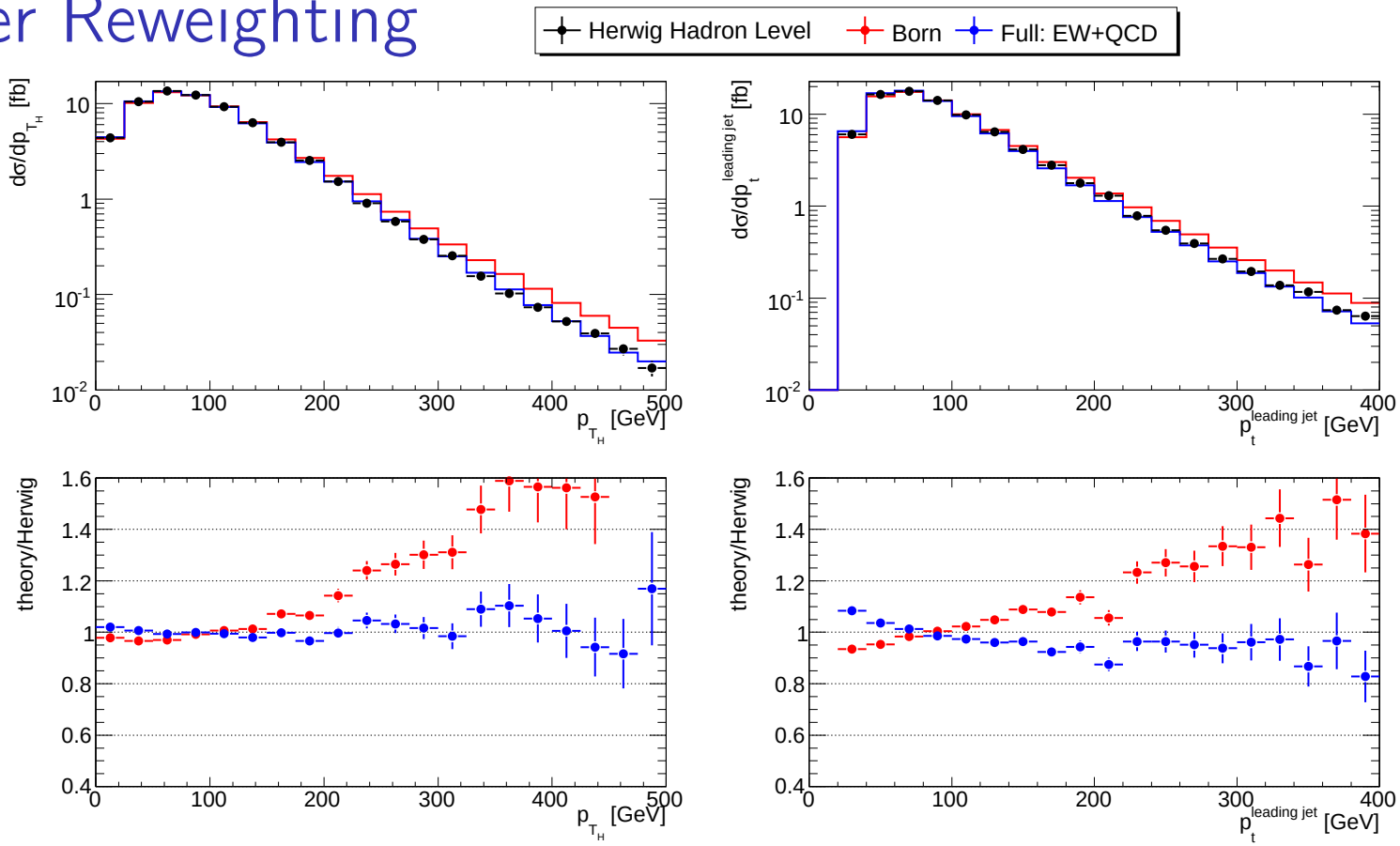
- So far in ATLAS: main parton-shower generator for VBF description: Fortran Herwig (Herwig++: not yet)
- BUT: NLO corrections do not only affect total cross sections, but also differential distributions
- Project together with Stefan Dittmaier (Freiburg): compare Herwig (after shower and hadronization) with CDD program on born and EW+QCD level (no shower and hadronization)
  - $M_H = 120\,\mathrm{GeV}$
  - 2 highest p_T jets ($k_T, D = 0.8, p_T > 20\,\mathrm{GeV}$) as tagging jets
  - $\Delta\eta \geq 4.0$, jets in opposite hemispheres
- Herwig scaled to born cross section
- can we reweight Herwig in one variable and improve on other variables?

Before Reweighting



- Herwig at hadron-level and born-result agree very well in shape of differential distributions!
- Try to reweight events according to Higgs p_T distribution

After Reweighting



- Much better agreement also for p_T of tagging jet (also other distributions better)
- Contribution to Les Houches proceedings (more statistics)

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- Instead of a summary...
- Organizing an alliance analysis working group together with Robert Harlander
- Topic: Higgs and heavy quarks, e.g. $b\bar{b}H$, $t\bar{t}H$ and $gg \rightarrow H$
- Goals: evaluation of acceptance uncertainties, theory uncertainties, how to make use of available predictions
- Mostly theorists (from those making NLO calculations) and experimentalists so far, would perhaps also be nice to have people from the MC community there, since experimentalists are using MC generators to evaluate acceptances!
- First meeting in spring (date tbd) in Wuppertal
- If you are interested, please give preference on this doodle: *http://www.doodle.com/ibeexcxtpctteqa8*