

# Discussion on Common Projects in the LHC-D Top Group

## The LHC-D Top Convenors:

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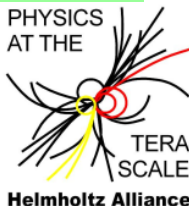
**Terascale Alliance 3<sup>rd</sup> Annual Meeting**

**DESY, 12/11/2009**

GEFÖRDERT VOM



Bundesministerium  
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- **Stimulate interaction of people in LHC-D working on Top Physics**
  - ❑ Exchange of knowledge
  - ❑ Theory vs Experiment
  - ❑ Common projects
  - ❑ New ideas
- **In the spirit of the Helmholtz Alliance**
  - ❑ But what could it mean in practice?
- **The Alliance comprises ATLAS, CMS and Theory groups**
  - ATLAS/CMS probably not eager to share their latest experimental methods etc with the competitor (and different s/w, detector etc.)
  - Naturally, common projects would sit at the boundary of theory and experiment (-> phenomenology, tools, etc.)

# Some possible projects

- **NLO ROOT Ntuple Output (F.-P. S., P. Uwer, J. Weng)**
  - ❑ **Started already** (see also next slides)
  - ❑ **Starting point for detailed comparisons of NLO codes in ttbar sector**
  
- **TopFitter project (P.Uwer et al.)**
  - ❑ **Use existing code to calculate sigma(ttbar) [Moch, Uwer; arXiv:0804.1476]**
    - o NLO / NLO+NLL resummation / NNLO(approx)
    - o Calc sigma(ttbar) as function of alpha(s), mtop, scale
  - ❑ **Polish & publicize code for use by experimenters**
  - ❑ **Extend with bound state effects, weak corrections etc.**
  - **Profit for theory: understand better needs of expt.**
  - **Profit for experiment: can run program themselves w.g. with new PDF**
  
- **Spin correlations (W. Bernreuther is interested)**
  - ❑ **Study ttbar spin correlations / top-spin induced distributions in dilepton and lepton+jets channel**
  
- **Ideas for Single Top?**
  
- **Wiki page for exchange of information (results, papers etc.)**

- The proposed projects may be not very sophisticated, but could serve as good starting point to bring people together and stimulate further collaboration
- Would be very nice way to extend the collaboration in the LHC-D Top group beyond the annual meetings ...
- **Your input / ideas / comments / participation are very welcome**

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# Common NLO Ntuple format

**Frank-Peter Schilling (KIT, CMS)**

**Peter Uwer (HU Berlin, Theorie)**

**Joanna Weng (ETH Zuerich, CMS)**

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- **Idea: common ROOT tree 4-vector output format for various existing NLO programs**
  - ❑ Useful for theory / experiment interaction
  - ❑ NLO author (== theorist) can provide tree with well tested content
    - ❑ E.g. if program itself is not ready for release
  - ❑ User (== experimentalist) can work on trees, make cuts, plots etc.
  - ❑ Common format for various NLO codes: easy comparisons
  - ❑ **NOTE: not in competition to LHE file format (need less information, oriented for plotting)**
- **Also within context of Les Houches 2009 Workshop**
- **Interaction with Joey Huston (+Nadolsky, Campbell)**
  - Existing FORTRAN based approach: FROOT (P. Nadolsky, J Campbell) which enables ROOT tree output in MCFM

- **Tree content:**
  - ❑ 4-vectors
  - ❑ x1,x2, PIDs
  - ❑ Scales
  - ❑ Weights
  - ❑ PDF weights
  - ❑ Pointers
  - ❑ ....

```

// 4-vectors of incoming and outgoing partons
std::vector<float> m_px,m_py,m_pz,m_e;
// x1 and x2 values
float m_x1,m_x2;
// initial state particle IDs
// (PDG convention: 0=g,1=u,2=d,...,6=t,-1=ubar,...,-6=tbar)
int m_id1,m_id2;
// factorization and renormalization scale
float m_fac_scale,m_ren_scale;
// event weight
float m_weight;
// user weights
std::vector<float> m_user_weights;

// unique event number
long m_evt_no;
// pointers to related (real emission / counterterm) events
std::vector<long> m_evt_pointers;

// PDF reweights
std::vector<float> m_pdf_weights;

```

- **Pointers store relations between real emission and virtual correction events**
- **C++ Wrapper classes shield ROOT storage details from user**

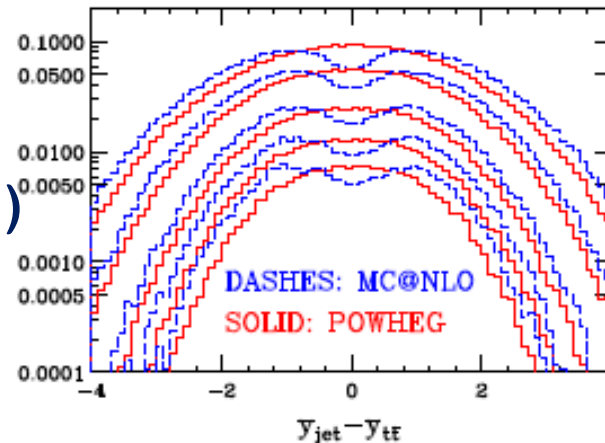
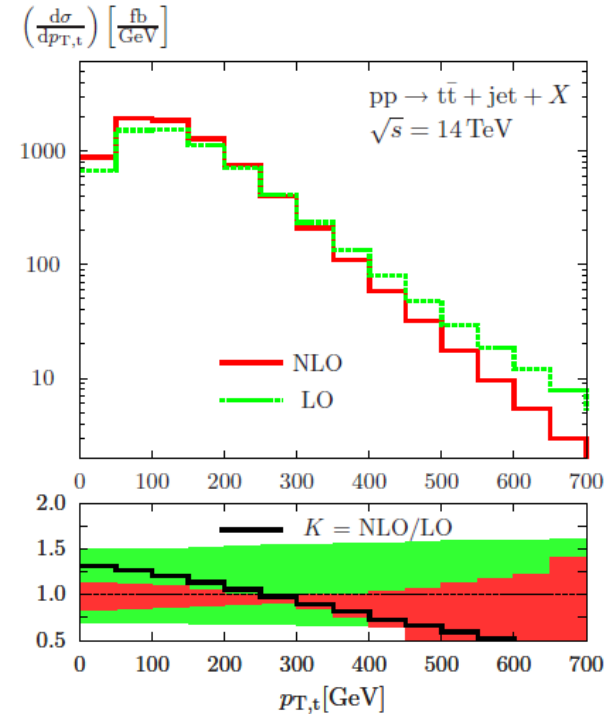
- Concrete application:  $tt$ +jet @ NLO calculation

- Dittmaier, Uwer, Weinzierl, Phys.Rev.Lett. 98 (2007) 262002.
- Dittmaier, Uwer, Weinzierl, Eur.Phys.J. C59 (2009) 625.

- Use as prototype for first implementation

- Comparison with other programs (MC@NLO, POWHEG, MADGRAPH etc.)

- Understand e.g. Infamous “MC@NLO dip”



POWHEG+HERWIG  
MC@NLO



- **TT+jet (LO) vs MCFM (NLO)**
  - Valid comparison since  $tt+j$  @LO is part of  $tt$  incl. @NLO

