The Analysis Centre in the Helmholtz Alliance „Physics at the Terascale".
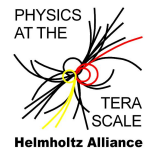
Enhancing the physics potential of the German LHC / ILC community

PHYSICS AT THE TERA SCALE
Helmholtz Alliance

The Mission.

> **Enhancing the physics potential** of the German LHC / ILC community.
> Providing **analysis infrastructure**.
> Supporting analysis-related issues of **general relevance**:
  ➔ Monte Carlo generators, parton distribution functions, and statistical tools.

Building blocks:
> **Education and training.**
  ◆ Well-established programme of schools and workshops.

> **Basic research and tools development** in relevant areas (MC, PDFs, Statistics Tools).
  ◆ Significant contributions to major LHC projects.

> **Supporting LHC** (and ILC) data analysis.
  ◆ To be developed.

> **Networking** – bringing people together.
  ◆ One of the strong points of the Alliance.

Education and Training.
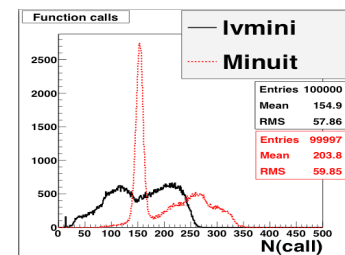
> **About 10 schools** / workshops per year with 40-100 participants.
> **Well accepted, excellent feedback**.
> Adapting to **needs of users**.
  ➔ One of the strong points of the Analysis Centre.

PDF Group.

The PDF group in the Analysis Centre
> Support of **HERA analyses** (extraction of PDFs).
> Comparison of different PDF analyses.
> **Theoretical calculations** for the improvement of ongoing *ep* and *pp* analyses.
> **Platform for analysis** of inclusive hard scattering data at the LHC (DY, ttbar, Higgs, etc.)

Study of influence of heavy-flavour treatment in PDF fits on Higgs production. Results of this study (coloured bands) compared to MSTW08.

Next deliverable: theoretically complete open-source code for NNLO PDF evolution
essential for high-precision studies at the LHC

Assorted issues.

> Establishing of the **Analysis Centre seminar** focusing on technical / phenomenological aspects.
> Currently being set up: **studentship programme**, attracting Ph.D. students to DESY (1-3 months) to work with the groups, learn, contribute and broaden their horizon.
> **Visitor programme** and discussion / phenomenology weeks in the groups.
> Under investigation: **MoSIS** – a **Mo**dern **S**cience **I**nformation **S**ystem.
> Under investigation: **Theorist of the week**.
> More ideas around, and **input welcome**!

HELMHOLTZ ASSOCIATION

Everybody is there!

Networking.

> The whole Alliance is about "**bringing people together**", building connections and collaborations, exploiting potential synergies.
> Example 1: **MC Network** of MC group in the Analysis Centre and all German MC activities. Regular active exchange.
> Example 2: **Network of statistics tools** projects in German HEP.

Special tool: Analysis Working groups!
> **Collaborations** between experimentalists from different experiments, or between experiment and theory on narrowly defined topics.
> A few established **examples** (like the Mtautau working group). Trying to expand.
> Use **topical workshops** like "Single-top production and fourth-generation quarks" as seeds.

Knowledge Database being set up
> **Collection of expertise** in German HEP.
> **Ideal for newcomers** and to identify fields of new activities

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Statistics Tools Group.

Education, support and development
> **Various topics**: Signal-background separation using MVA methods, searches, signal fitting, limit derivation, unfolding, systematic uncertainties, …
> **Two schools per year**, informal statistics meetings, software reviews, etc.
> Involvement at **core level of different tools** / programs: LVMINI, Millepede, TMVA, Tunfold, ….
> Excellent working **connections** via Alliance institutes: Fittino, Gfitter, BAT, Roostats, …
> Good **access to LHC experiments** via eperiments' statistics committees.
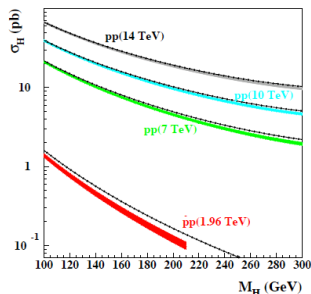> **Support function** to be further developed.

Number of function calls in test fitting / minimisation problem with LVMINI (black) and MINUIT (red). The reduction in the mean number of function calls is clearly visible.


Monte Carlo Group / Network.

The MC group in the Analysis Centre
> Systematic understanding of all **QCD aspects of LHC events**.
> **Unintegrated PDFs** and PDFs for MC,
> **Multiple interactions** and underlying event.
> **Parton shower** algorithms + matching schemes at LO / NLO; validation against pQCD field theory.
> **Tuning of MC generators** in / across experiments.
> **Many concrete projects**: PROFFIT, CASCADE, HEPMCAnalysis, PDF4MC, etc.
> **Regular meetings**, many visitors, intensive collaborations with other players (Lund, Durham, MCNet etc.)

The MC network in the Alliance
> Combining **all MC activities** in the Alliance.
> **Active exchange** of information and knowledge, regular meetings.
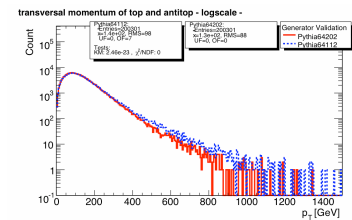
HEPMCAnalysis comparison of different PYTHIA versions. Shown is the simulated transverse-momentum distribution for ttbar pairs at the LHC.

Contact and Feedback.

> The Analysis Centre **relies on the input** from **and feedback** of the community to shape a successful programme..
> Feel free to send your **questions, wishes, criticisms, suggestions** etc. to us:

anacen@desy.de