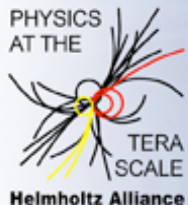
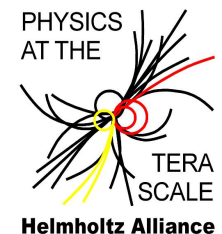


THE ANALYSIS CENTRE

IN THE HELMHOLTZ ALLIANCE "PHYSICS AT THE TERASCALE"

Thomas Schörner-Sadenius (DESY)
Physics Seminar, DESY Zeuthen
14 January 2009



PHYSICS AT THE TERASCALE
Strategic Helmholtz Alliance



OUTLINE

Reminder: The Helmholtz Alliance “Physics at the Terascale” and its Analysis Centre

- Helmholtz Alliances, “Physics at the Terascale”
- The Analysis Centre
- DESY and the Analysis Centre
- A working example: The LPC @ FermiLab

The Analysis Centre: Activities, groups, services

- The MC, Statistics Tools and PDF groups
- Education: Schools, Workshops, Discussion Days, Seminars, Lectures
- Analysis Working Groups
- Further activities: Support, web/WIKI, ...

Status and Outlook

- Achievements
- Problems, handicaps, obstacles
- Questions and discussion ...

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100% free of physics!!!!

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Status and Outlook

- Achievements
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100% free of physics!!!!

My true intention:

- To convince you of the idea behind the centre;
- to attract you to the centre and
- to get you involved.

HELMHOLTZ ALLIANCES

Helmholtz Alliances

- New funding scheme for research topics of current interest.
- Significant financial and material resources (5-10 MEuro / year).
- Aim to strategically enhance the profile of the Helmholtz centre (DESY).

Research

- Brings together universities, Helmholtz Centres and other non-university research institutions.
- Covers all fields of science: Examples of granted alliances:
 - * Cosmic Matter in the Laboratory (Extremes of Density and Temperature)
 - * Immunotherapy of Cancer
 - * Systems Biology
 - * MEM-BRAIN
 - * Mental Health in an Ageing Society
 - * Physics at the Terascale
 - * Planetary Evolution and Life

DESY

... and the Terascale Alliance were the first Helmholtz Alliance.

HELMHOLTZ ALLIANCES

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 - * Physics at the Terascale
 - * Planetary Evolution

DESY

... and the Terascale

Central insight: Complementarity of Helmholtz centres (like DESY) and universities. Centres ...

... can provide broader support and services than universities.

... have long-standing expertise for running large-scale facilities.

... don't have to be responsible for the daily research work, can concentrate on issues of more general relevance / impact.

"PHYSICS AT THE TERASCALE"

Quotation from the Alliance web page (<http://www.terascale.de>):

With the start-up of CERN's Large Hadron Collider (LHC) in 2007 and preparations for the International Linear Collider (ILC) in full swing, we expect revolutionary results explaining the origin of matter, unravelling the nature of dark matter and providing glimpses of extra spatial dimensions or grand unification of forces. Any of these insights would dramatically change our view of the world.

In order to optimally place German particle physics in an increasingly global environment, it is now the right moment to create new and improved structures for particle physics in Germany.

The Strategic Helmholtz Alliance 'Physics at the Terascale' is a structured research network comprising 17 universities, 2 Helmholtz institutes and 1 Max Planck Institute. The Alliance acts as a tool for a more effective collaboration, in particular between experimentalists and theorists.

"PHYSICS AT THE TERASCALE"

Quotation from the Alliance web page (<http://www.terascale.de>):

With the start-up of CERN's LHC, the international community is preparing for the International Large Hadron Collider (ILHC) and the International Dark Matter Experiment (IDME). These experiments will provide revolutionary results explaining dark matter and providing a glimpse into the unification of forces. Any of the experiments of the world.

In order to optimally place Germany in the international environment, it is now the right time for particle physics in Germany.

The Strategic Helmholtz Alliance is a research network comprising 1 Max Planck Institute. The Alliance is a collaboration, in particular between

DESY cannot maintain status as THE large German HEP lab by doing the same as universities do!

=> Concentrate on services / facilities / infrastructure not easily accessible at universities (test beams, detector labs, "Analysis Centre", ...).

=> benefit for DESY AND the universities.

DESY and the Terascale Alliance:

- Long experience in running large facilities, but no big project after the end of HERA
- Competency in areas not in general covered by universities (e.g. PDFs from HERA times, ...)
- Experience in hosting large groups of scientists; acting as a central hub for activities.

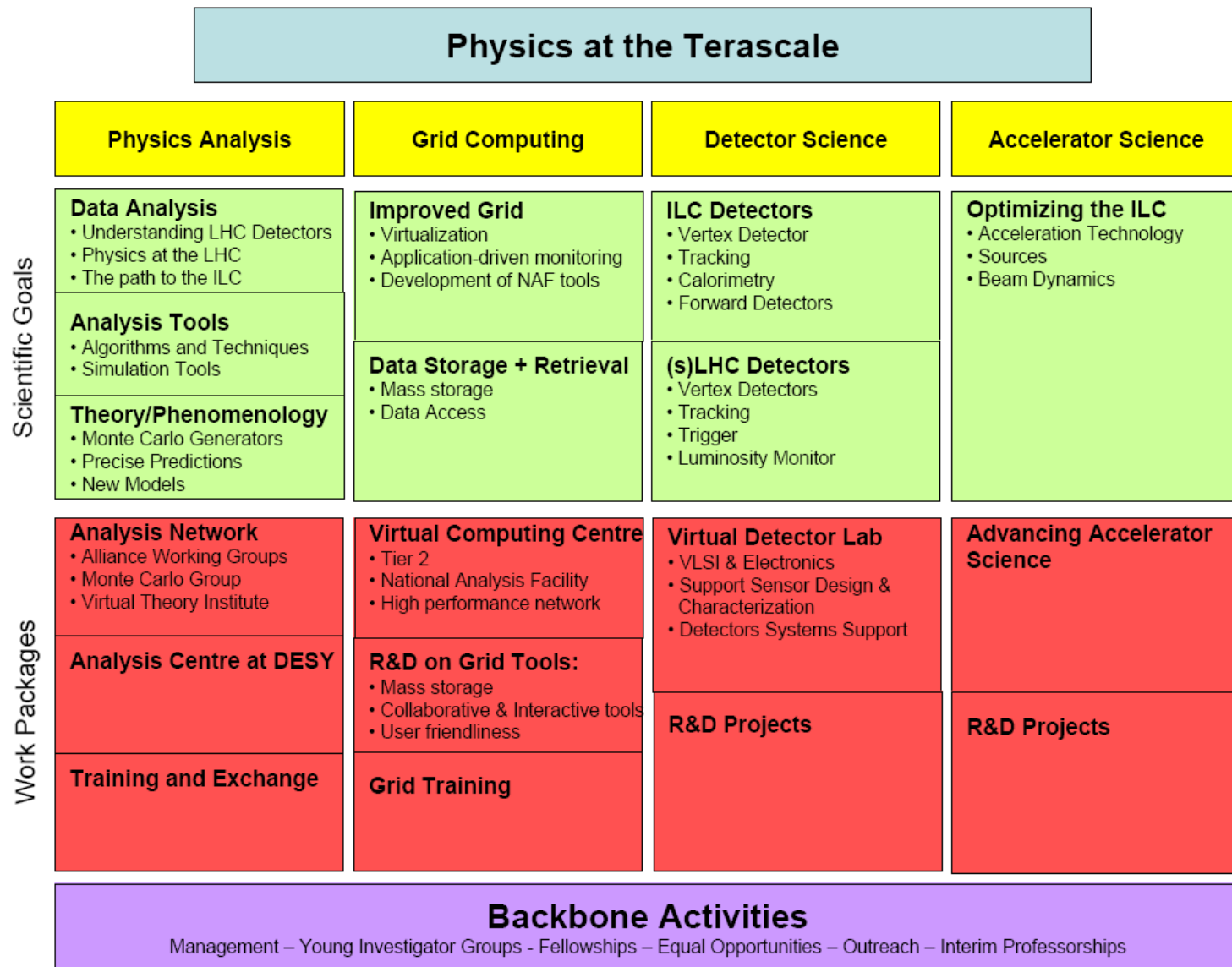
ICS AT THE TERASCALE

The map displays the following German states and their associated TSS locations (indicated by red circles):

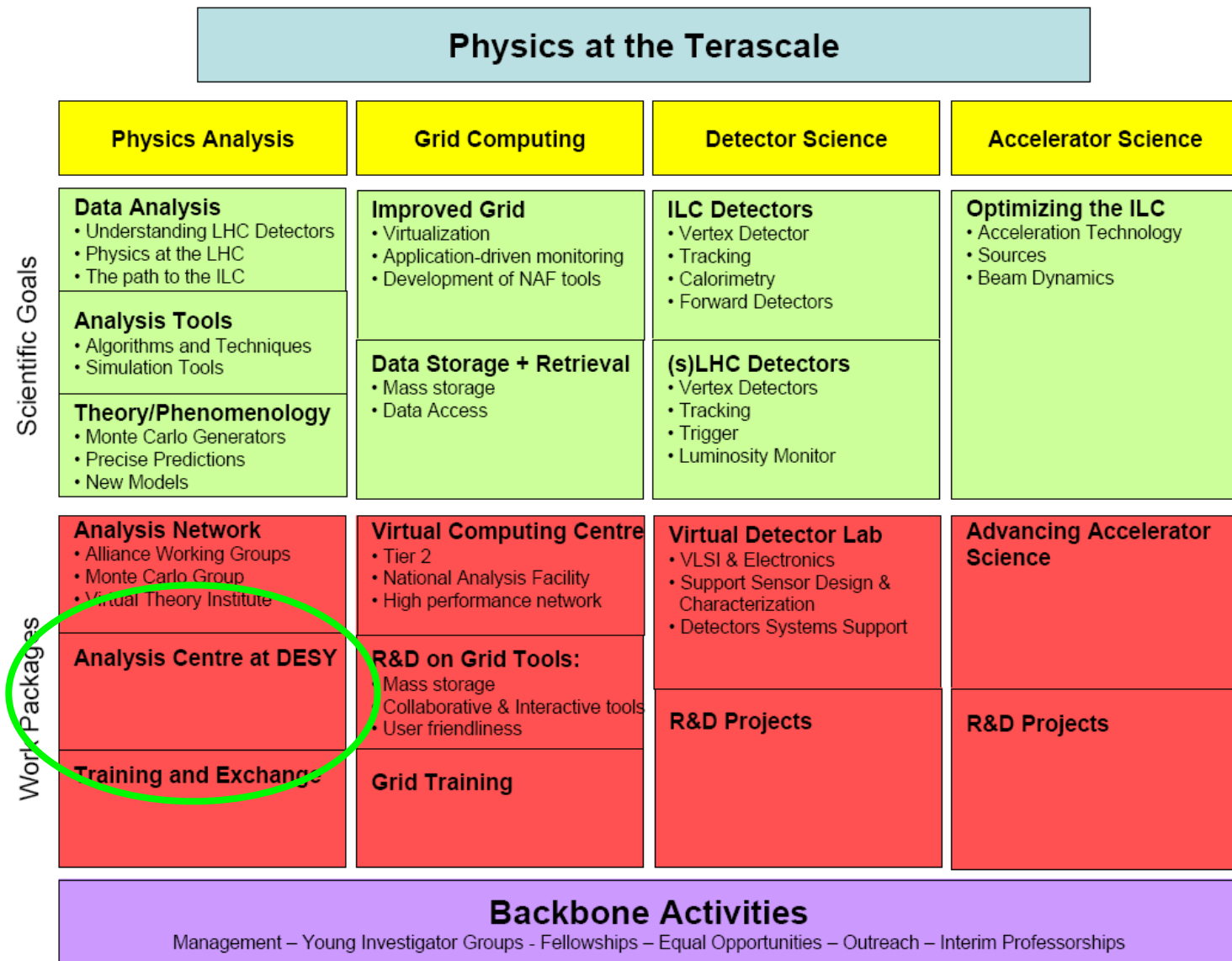
- SCHLESWIG-HOLSTEIN:** Flensburg, Kiel, Lübeck, Puttgarden, Sagsnitz.
- HAMBURG:** Hamburg (2 locations).
- MECKLENBURG-VORPOMMERN:** Stralsund, Greifswald, Wismar, Schwerin, Rostock.
- BRANDENBURG:** Wittenberge, Potsdam, Berlin (3 locations), Frankfurt, Cottbus.
- SACHSEN-ANHALT:** Magdeburg, Dessau, Halle, Leipzig.
- SACHSEN:** Dresden, Chemnitz, Zwickau, Görlitz.
- THÜRINGEN:** Erfurt, Jena, Gera, Triptis, Hof, Bayreuth, Bamberg, Nürnberg, Erlangen.
- BAYERN:** Regensburg, Landshut, Passau, Augsburg, Garmisch-Partenkirchen, Obersdorf, Ulm.
- BADEN-WÜRTTEMBERG:** Stuttgart, Konstanz, Tübingen, Heilbronn, Karlsruhe (2 locations), Mannheim, Saarbrücken, Koblenz, Wiesbaden, Frankfurt am Main, Koblenz, Trier, Bonn, Köln, Düsseldorf, Essen, Dortmund, Duisburg, Osnabrück, Münster, Bielefeld, Hannover, Wolfsburg, Braunschweig, Göttingen, Kassel, Bad Hersfeld, Kassel, Eisenach, Jena, Gera, Triptis, Hof, Bayreuth, Bamberg, Nürnberg, Erlangen.
- NIEDERSACHSEN:** Oldenburg, Emden, Wilhelmshaven, Bremerhaven, Bremen.
- NORDRHEIN-WESTFALEN:** Düsseldorf, Essen, Dortmund, Duisburg, Köln, Bonn, Koblenz, Wiesbaden, Frankfurt am Main, Koblenz, Trier, Bonn, Köln, Düsseldorf, Essen, Dortmund, Duisburg.
- RHEINLAND-PFALZ:** Koblenz, Wiesbaden, Frankfurt am Main, Koblenz, Trier, Bonn, Köln, Düsseldorf, Essen, Dortmund, Duisburg.
- SAARLAND:** Saarbrücken.
- SAAR:** Saarbrücken.

Source: TSS: The Analysis Centre

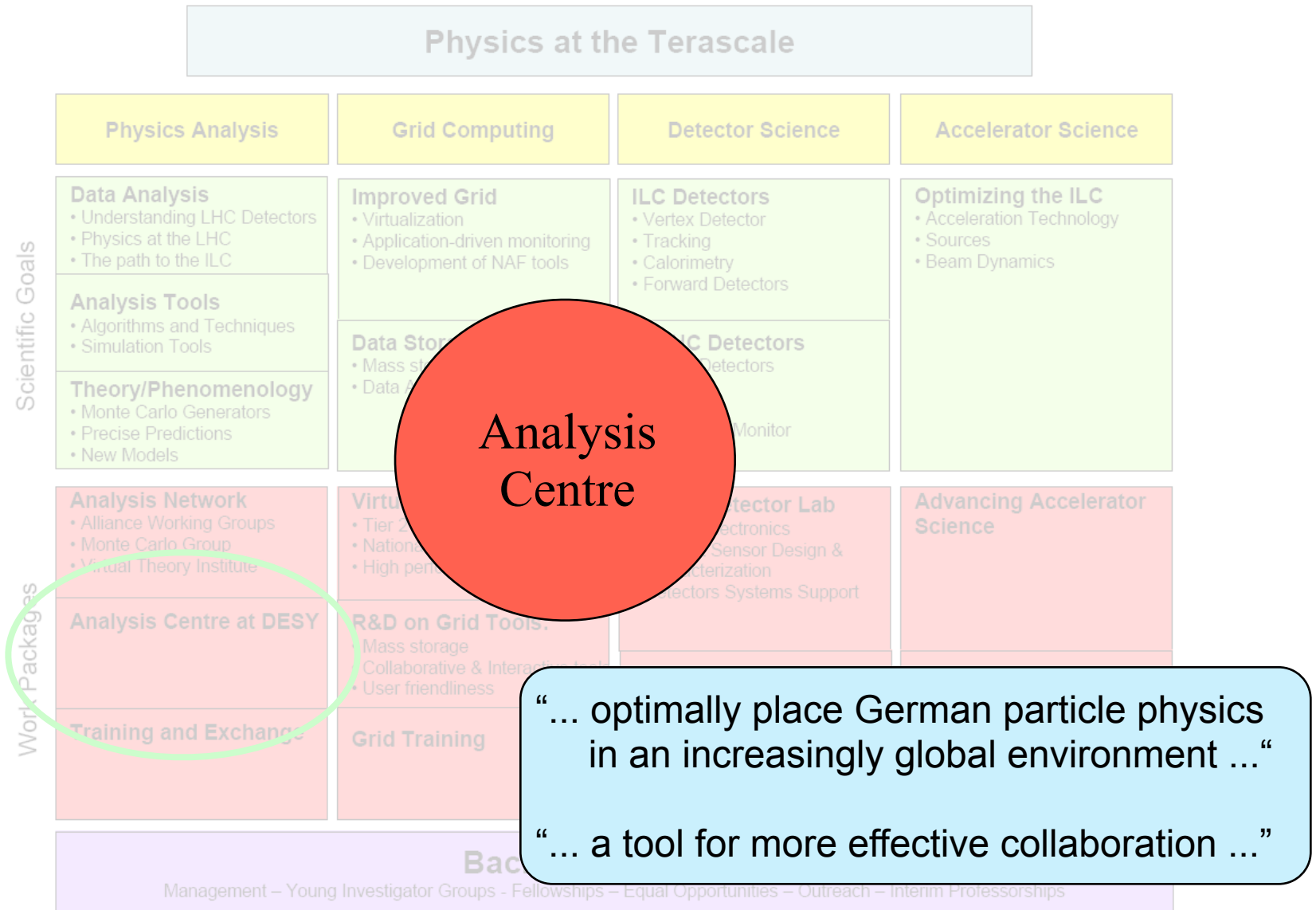
"PHYSICS AT THE TERASCALE"



"PHYSICS AT THE TERASCALE"



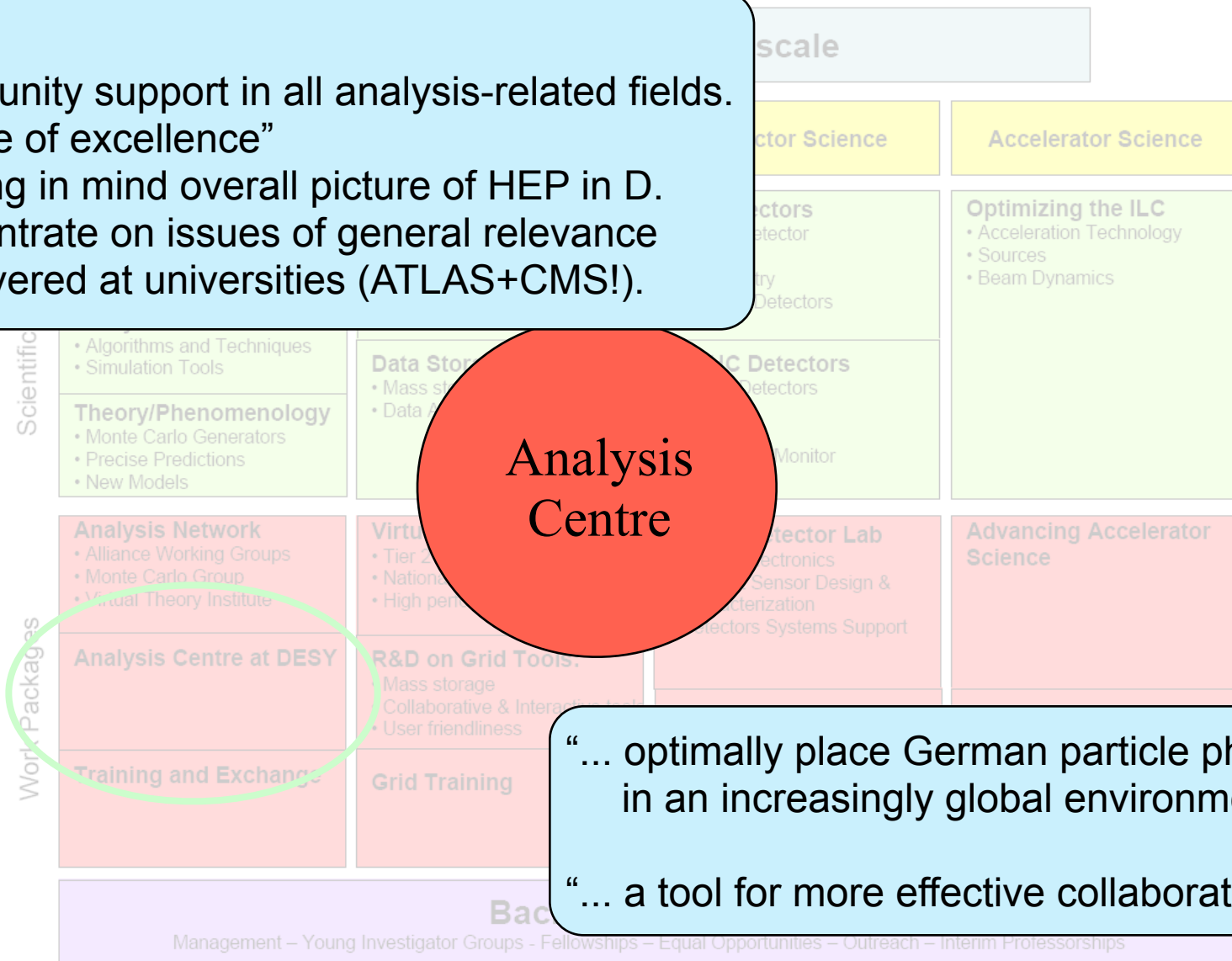
THE ANALYSIS CENTRE



THE ANALYSIS CENTRE

Tasks:

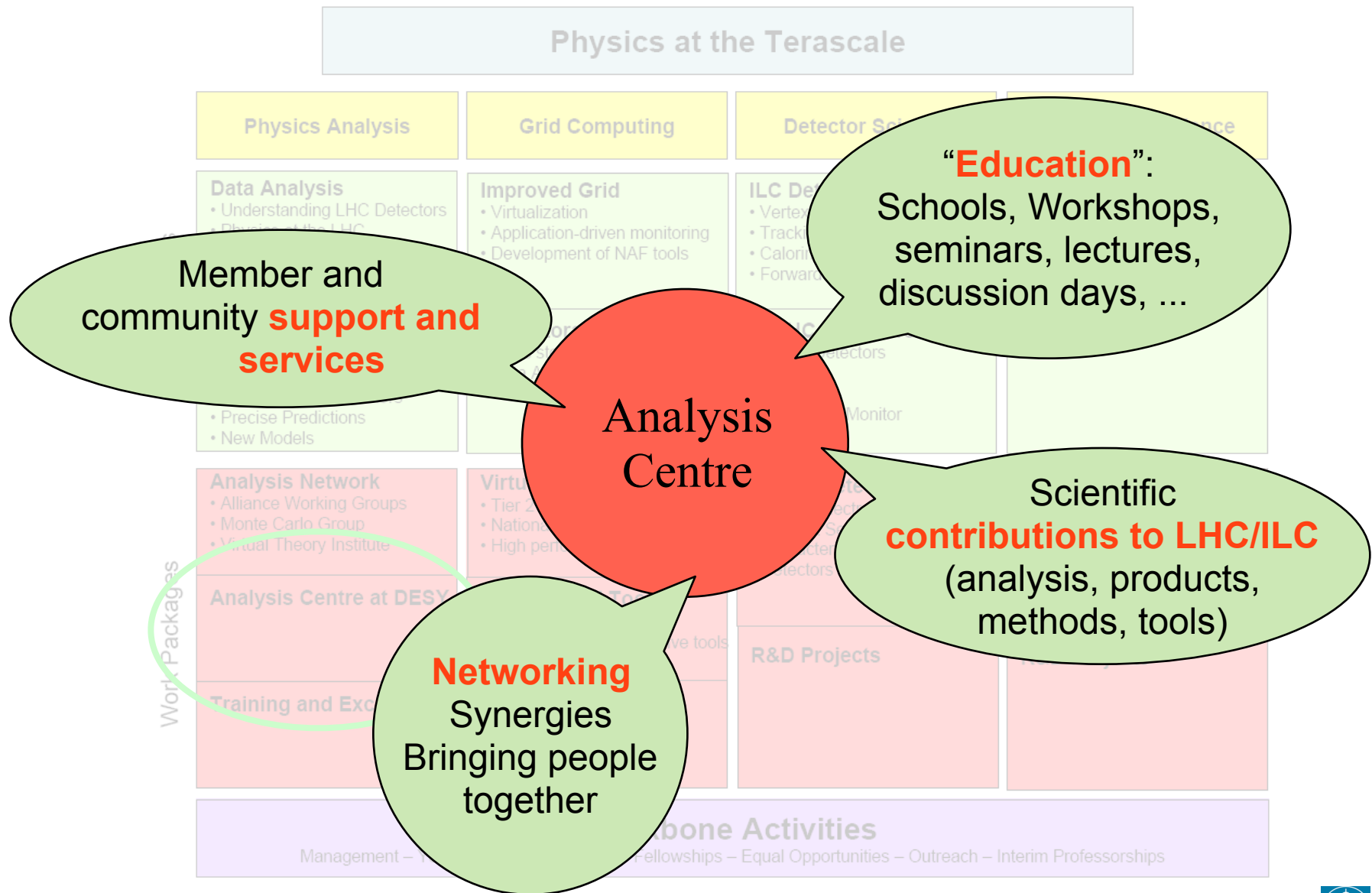
- Community support in all analysis-related fields.
- “Centre of excellence”
- Keeping in mind overall picture of HEP in D.
- Concentrate on issues of general relevance not covered at universities (ATLAS+CMS!).



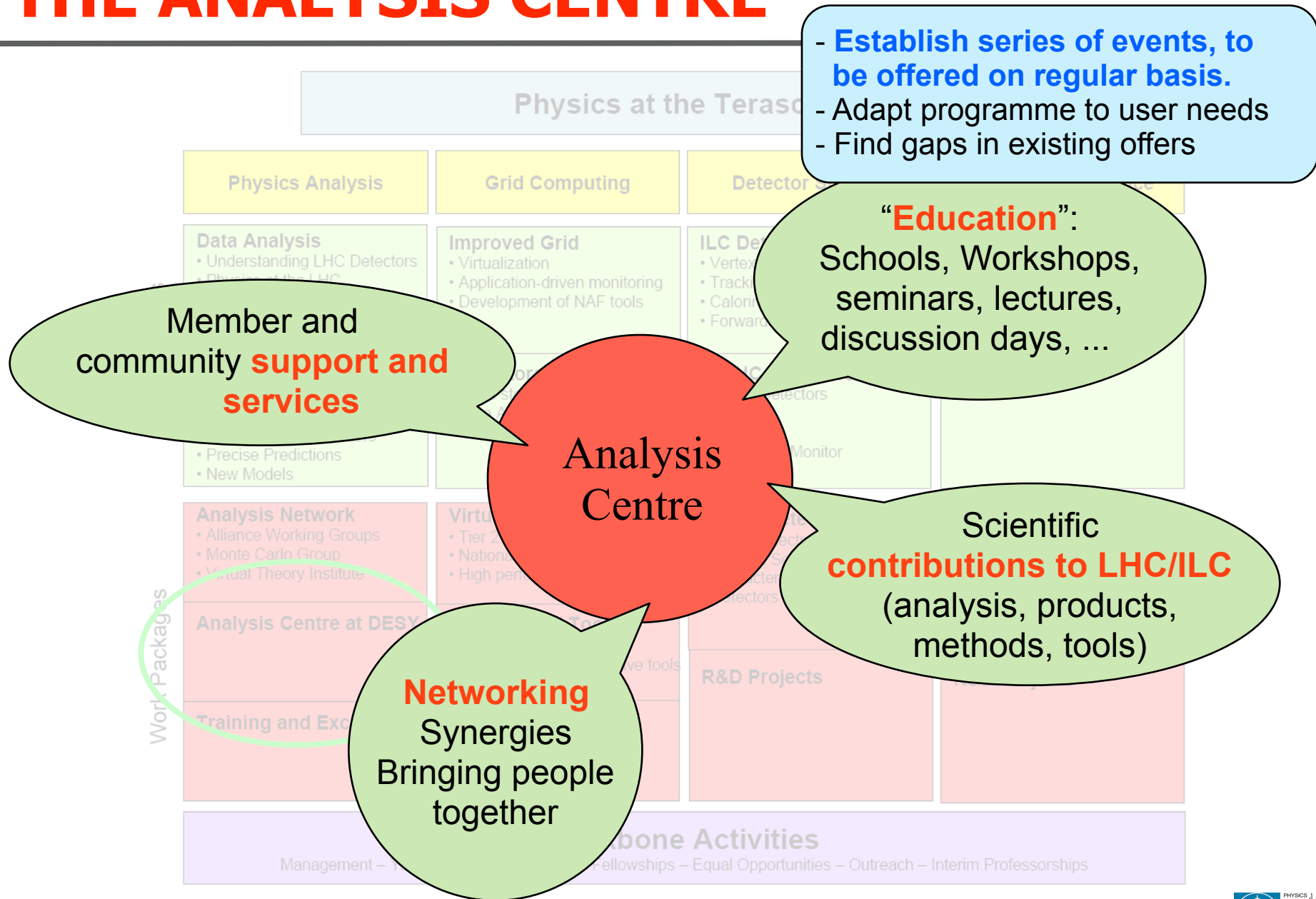
“... optimally place German particle physics in an increasingly global environment ...”

“... a tool for more effective collaboration ...”

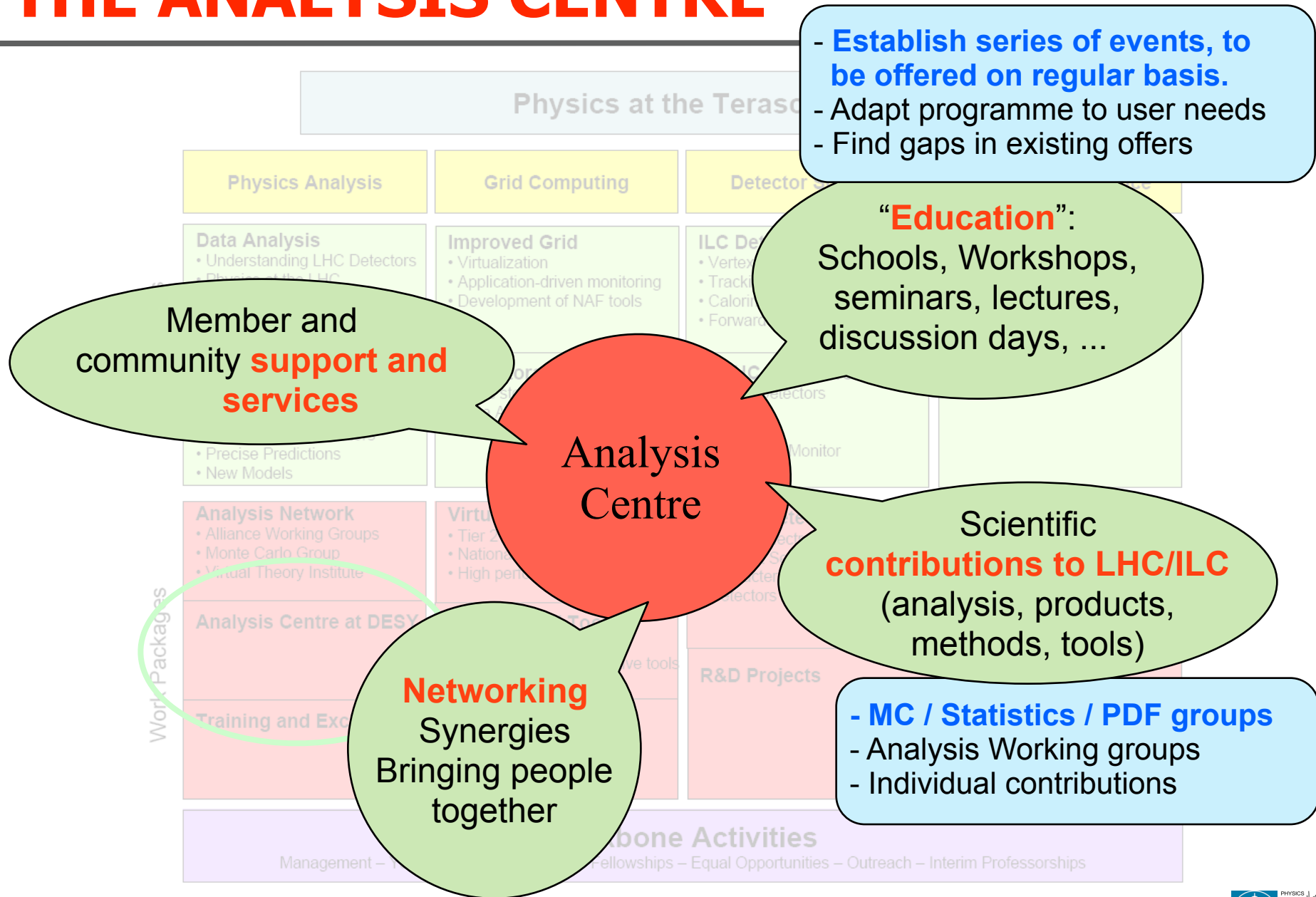
THE ANALYSIS CENTRE



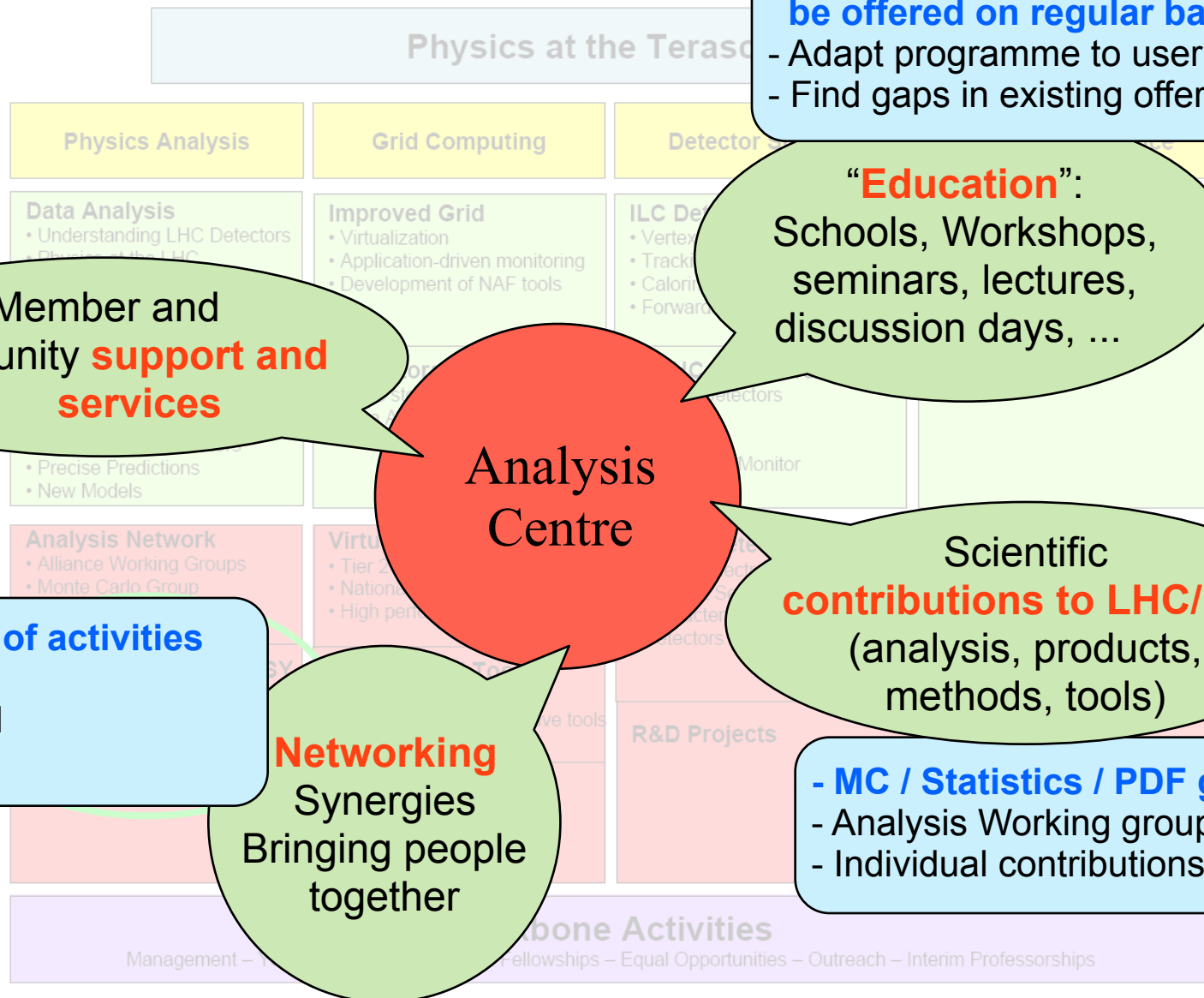
THE ANALYSIS CENTRE



THE ANALYSIS CENTRE



THE ANALYSIS CENTRE



- Establish series of events, to be offered on regular basis.
- Adapt programme to user needs
- Find gaps in existing offers

“Education”:
Schools, Workshops, seminars, lectures, discussion days, ...

Scientific contributions to LHC/ILC
(analysis, products, methods, tools)

- **MC / Statistics / PDF groups**
- Analysis Working groups
- Individual contributions

- **Data base of activities**
- All groups
- Web / WIKI
- Contacts

Networking Synergies
Bringing people together

Management – Fellowships – Equal Opportunities – Outreach – Interim Professorships

THE ANALYSIS CENTRE

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Member and community **support and services**

Analysis Centre

Scientific **contributions to LHC/ILC**
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Networking

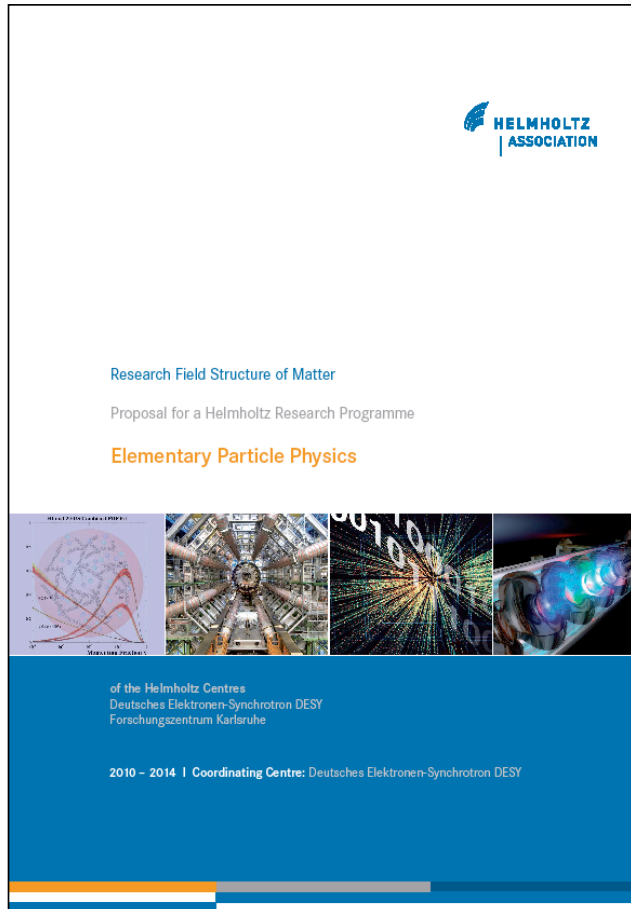
Synergies
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- MC / Statistics / PDF groups

- Analysis Working groups
- Individual contributions

DESY AND THE ANALYSIS CENTRE

DESY Five Years Planning (PoF) 2010-14



> Programme Elementary Particle Physics

> Seven programme topics

- HERA
- LHC
- Preparation for a future lepton collider
- Theoretical particle physics
- **Experimental facilities**
- Large-scale facility GridKa
- Large-scale facility DESY Grid centre

> Valuable input received from

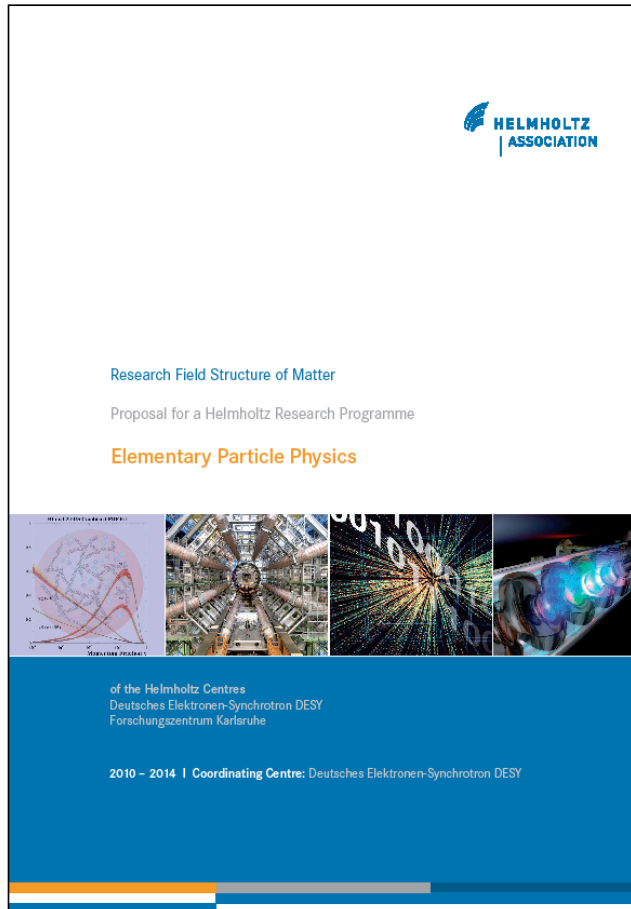
- DESY advisory boards (WA, PRC, ESC)
- German community (KET)
- European community (ECFA)

> **Many thanks!!!**



DESY AND THE ANALYSIS CENTRE

DESY Five Years Planning (PoF) 2010-14



- > Programme Elementary Particle Physics
- > Seven programme topics

- HERA
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- Theoretical particle physics
- Ex
- La
- La

For DESY, the Terascale Alliance plays a major, if not a key role.

- > Val
- After the end of HERA, DESY's role as a major particle physics lab depends on facilities like the Analysis Centre, or the Virtual Detector Laboratory.

- This central role is reflected in the planning for the next 5 years!
- > Ma

THE LPC @ FERMILAB

LPC = LHC Physics Centre

- Centre of ~50 US CMS universities.
- Started ~ 5 years ago.
- Needed because of large distance to CERN, difficulties to contribute to LHC.

U.S. CMS - U.S. CMS @ Work - The LHC Physics Center (LPC)

http://www.uscms.org/uscms_at_work/physics/lpc/

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U.S. CMS - U.S. CMS @ Work - T...

CMS CT MUON SOLENOID

Search

uscms.org uscms.fnal.gov www

The LHC Physics Center (LPC)

Search LPC

Today's Meetings - Weekly All US CMS Meeting

A Comprehensive Tutorial on "Using Physics Analysis Toolkit (PAT) in your analysis"- (13 Jan. 2009 - 27 Feb. 2009) [Registration and Agenda](#)

LPC Organization Chart:

US CMS
LPC AB

- G&V
- Fellows
- Housing
- Offices

US CMS Blogs

Click photo to read author's blog

Legend:

- Stakeholders
- Working Group
- Points of Contact

LPC Facilitators

Enabling Analysis

- Trigger
- ROC, DQM
- Gen/Simul
- Physics Support
- LPC CAF

DPG, POG

- Tracking
- b tag/Vertex
- e/gamma
- Muon
- Tau
- Jet/MET

Physics Topologies

- Dijets
- Jets + MET
- Diphotons
- Lepton + Jets + MET
- Dileptons
- Dileptons + Jets + MET

Data Ops

LPC Physics Forum

Outreach **Astro** **USCMS Phys. Coordinator** **Theory** **LHC**

THE LPC @ FERMILAB

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- Centre of ~50 US CMS universities.
- Started ~ 5 years ago.
- Needed because of large distance to CERN, difficulties to contribute to LHC.

“Mission” and activities:

- Provide maximum service to CMS.
- Allow US residents to contribute.
- Training and workshops.
- Remote operations centre.
- “Get people going”.
- Many active groups.

Status:

- Up to 100 people at FNAL.
- Significant contributions to CMS.
- “Home” to US CMS members.

U.S. CMS – U.S. CMS @ Work – The LHC Physics Center (LPC)

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Data Ops

LPC Physics Forum

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THE LPC @ FERMILAB

Lessons to be learned from LPC:

- need long breath and critical mass.
- need high-level people to push the idea.
- need a good use-case (why do it?).

... but quite different situation for us:

- Close to CERN.
- Two (or more) experiments.
- ...

U.S. CMS - U.S. CMS @ Work - The LHC Physics Center (LPC)

http://www.uscms.org/uscms_at_work/physics/lpc/

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USCMS THE COMPACT MUON SOLENOID

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Click photo to read author's blog

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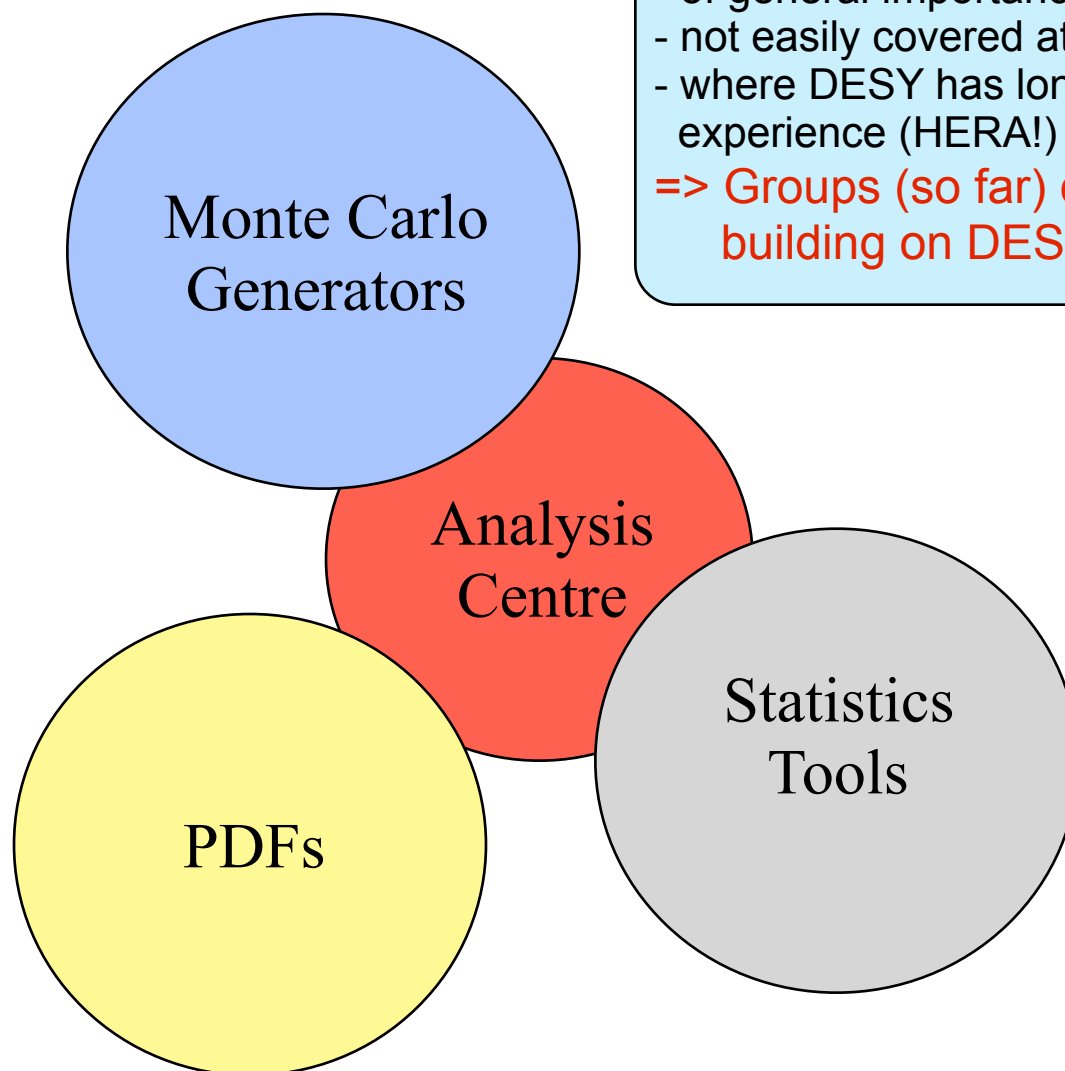
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Status and Outlook

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ACTIVITIES



Set-up of (so far) 3 working groups.
focusing on issues

- of general importance
- not easily covered at universities
- where DESY has long-standing experience (HERA!)

=> Groups (so far) centered at DESY,
building on DESY experience!

THE MONTE CARLO GROUP

C. Ay,
S. Gieseke
M. Worek
... and more and
more others ...

Monte Carlo Generators

Hannes Jung
Judith Katzy
Serguei Levonian
Zoltan Nagy

Analysis
Centre

- Experimentalists and theorists working on all aspects of MC generators.
- Support of MC validation and tuning.
- GeneratorServices (GENSER) mirror at DESY.
- Group members working on HepMCAnalyser tool, MC tuning, and (grid) tools for this purpose, new developments in k_T factorisation, new LO+NLO parton shower schemes, further development of CASCADE.
- Z. Nagy started 1.9.2008; further position announced soon.

THE MC GROUP: PROGRAMME

C. Ay,
S. Gieseke
M. Worek
... and more and
more others ...

Monte Carlo Generators

Hannes Jung
Judith Katzy
Serguei Levonian
Zoltan Nagy

Analysis

Systematic attempt for tuning of MC generators:

- determine PDF4MC using HERA data
- validate/x-check parton showering in MCs (multijets, energy flow, particle spectra).
- validate/tune Tevatron measurements

Phenomenology of parton showers

Phenomenology of UE/MPI

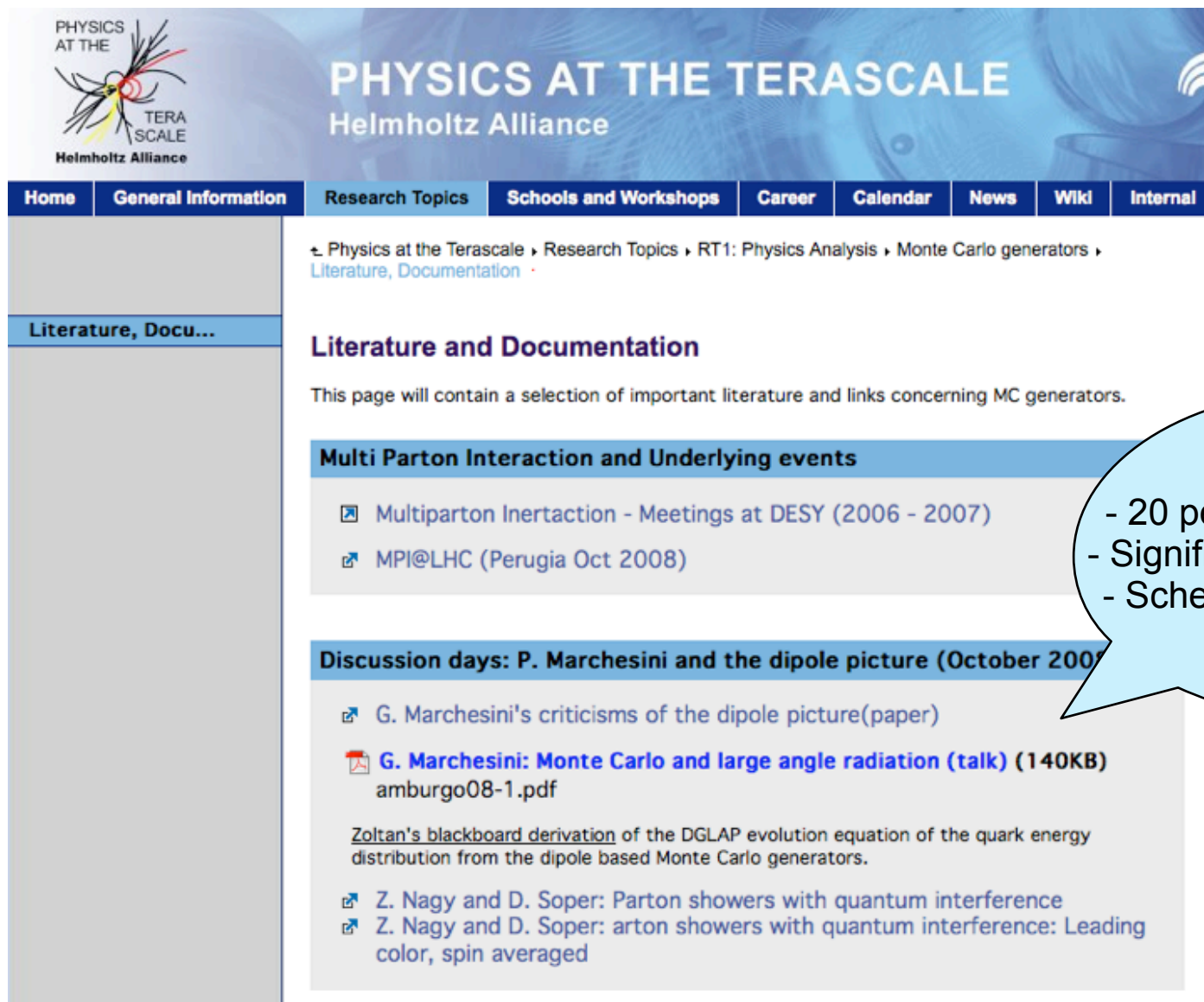
- Review of experimental evidence for MPI
- Review/predictions of non-MPI approaches including higher order calculations
- Systematic investigations of uncertainties
- Attempts for MPI: is it a soft or hard process?

Pheno weeks / discussion days:

- parton showers
- UE / MPI
- automated calculations.

Recent events very successful!

THE MC GROUP: WIKI / DOCU



The screenshot shows the website for 'PHYSICS AT THE TERASCALE' under the 'Helmholtz Alliance'. The header features a logo on the left and the site title on the right. A navigation bar includes links for Home, General Information, Research Topics, Schools and Workshops, Career, Calendar, News, Wiki, and Internal. A breadcrumb trail indicates the current location: Physics at the Terascale > Research Topics > RT1: Physics Analysis > Monte Carlo generators > Literature, Documentation. The main content area is titled 'Literature and Documentation' and contains a paragraph about MC generators. Below this are two sections: 'Multi Parton Interaction and Underlying events' and 'Discussion days: P. Marchesini and the dipole picture (October 2007)'. The first section lists two events: 'Multiparton Interaction - Meetings at DESY (2006 - 2007)' and 'MPI@LHC (Perugia Oct 2008)'. The second section lists three items: a link to 'G. Marchesini's criticisms of the dipole picture(paper)', a PDF link for 'G. Marchesini: Monte Carlo and large angle radiation (talk) (140KB) amburgo08-1.pdf', and a link to 'Zoltan's blackboard derivation of the DGLAP evolution equation of the quark energy distribution from the dipole based Monte Carlo generators.' At the bottom of this section are two links to papers by 'Z. Nagy and D. Soper' regarding parton showers with quantum interference. A light blue speech bubble on the right contains the text: '- 20 people attending.', '- Significant output ...', and '- Scheme to be continued!'.

PHYSICS AT THE TERASCALE
Helmholtz Alliance

Home General Information Research Topics Schools and Workshops Career Calendar News Wiki Internal

Physics at the Terascale > Research Topics > RT1: Physics Analysis > Monte Carlo generators > Literature, Documentation

Literature and Documentation

This page will contain a selection of important literature and links concerning MC generators.

Multi Parton Interaction and Underlying events

- [Multiparton Interaction - Meetings at DESY \(2006 - 2007\)](#)
- [MPI@LHC \(Perugia Oct 2008\)](#)

Discussion days: P. Marchesini and the dipole picture (October 2007)

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- [Z. Nagy and D. Soper: Parton showers with quantum interference](#)
- [Z. Nagy and D. Soper: arton showers with quantum interference: Leading color, spin averaged](#)

- 20 people attending.
- Significant output ...
- Scheme to be continued!

MC GROUP: EXAMPLE PROJECT

[Main Page](#) | [Namespace List](#) | [Class Hierarchy](#) | [Class List](#) | [Directories](#) | [File List](#) | [Class Members](#) |
[File Members](#)

HepMCAnalysis tool

Author:

Cano Ay, Sebastian Johnert, Judith Katzy, Zhonghua Qin

December 2008

Introduction

HepMCAnalyser is a tool for generator validation and comparisons. The main idea is to have a stable, easy-to-use and extendable framework to provide a fast access point to generator level analysis.

A class library with benchmark physics processes has been written to analyse HepMC generator output and fill root histograms. The source code of the classes is in the HepMCAnalysis/include and src directories.

A web-interface is provided to display all or selected histograms, compare to references and validate the results based on Kolmogorov Tests. These scripts are in HepMCAnalysis/examples/macros

Steerable example programs can be used for event generation and conversion to HepMC format. The steering is tuned to produce best agreement between the distributions of the different generators. The programs are in HepMCAnalysis/examples/generatorX where generatorX stands e.g. for pythia6, pythia8, herwigpp... .

MC GROUP: EXAMPLE PROJECT

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December 2008

Introduction

HepMCAnalyser is an
extendable frame

A class library with
histogramms. The

A web-interface is
based on Kolmog


Steerable examples
to produce best a
HepMCAnalysis/e

[Main Page](#) | [Namespace List](#) | [Class Hierarchy](#) | [Class List](#) | [Directories](#) | [File List](#) | [Class Members](#) | [File Members](#)

HepMCAnalysis Class Hierarchy

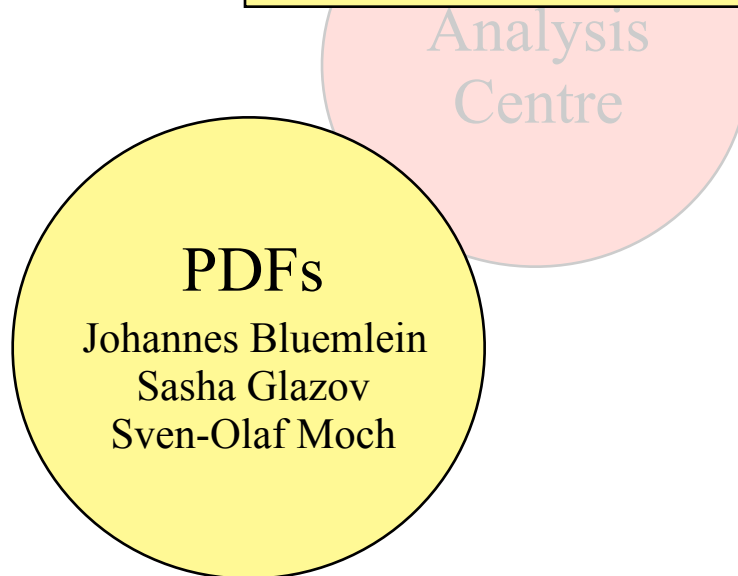
This inheritance list is sorted roughly, but not completely, alphabetically:

- **baseAnalysis**
 - **DiJetAnalysis**
 - **TauAnalysis**
 - **TopAnalysis**
 - **UEAnalysis**
 - **WplusJetAnalysis**
 - **ZAnalysis**
- **Configuration**
- **ThePEG::HepMCTraits** < **HepMC::GenEvent** >

Generated on Fri Jan 9 13:20:49 2009 for HepMCAnalysis by  1.3.9.1

THE PDF GROUP

- General support for PDFs
- Theory contributions (higher orders for hard scattering processes, PDFs and heavy flavours,)
- Goal: (contributions to) global PDF fitting activity (developing around HERA PDF activities?). Provision of open-source PDF fitting tools.
- Beginning of more intense discussions between group members and the H1 and ZEUS fitting group(s).



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- Beginning of more intense discussions between group members and the H1 and ZEUS fitting group(s).

Analysis
Centre

PDFs

Johannes Bluemlein
Sasha Glazov
Sven-Olaf Moch

- Involvement of group members in other contexts like PDF4LHC, ATLAS PDF people.
- More international collaborations thinkable?

THE STATISTICS TOOLS GROUPS

- Development + implementation of statistics tools
- Contact to CERN statistics committee etc.
- Service for students (and all analysers).
- Open analysis centre position to be filled soon.
- Since a few months: Informal monthly meeting to discuss any upcoming statistics question.

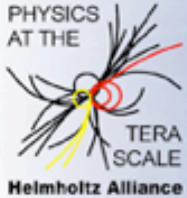
Analysis
Centre

Statistics Tools

Olaf Behnke
Claus Kleinwort
Stefan Schmitt

P. Bechtle
F. Ellinghaus
M. Goebel
B. List
K. Kroeninger
G. Schott
... and others

STATISTICS TOOLS GROUPS: WIKI



PHYSICS AT THE TERASCALE

Strategic Helmholtz Alliance

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Analysis Centre

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- [Parton Distribution Functions](#)

Detector Technologies

- [VLDT](#)

LHC-D

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Experiments

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External Links

From Wofwiki

Statistical Tools

site notice:

Contents

[\[hide\]](#)

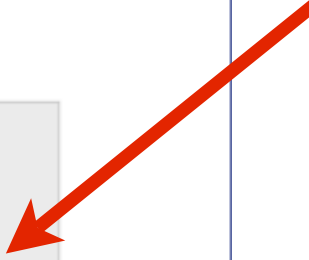
- [1 The Statistics Tools Group: Introduction](#)
- [2 Activities in the Statistics Tools group and around](#)
 - [2.1 Informal Statistics Meetings](#)
 - [2.2 Meeting 20 November 2008: Survey of statistics tools and projects](#)
- [3 General information](#)
 - [3.1 Contact:](#)
 - [3.2 Meetings](#)

The Statistics Tools Group: Introduction

[\[Edit\]](#)

The general goals of the statistical tools group are to provide tools, support & education for people doing physics analyses at ATLAS or CMS. The following topics are covered, following the logical flow of an data analysis:

1. Optimal Signal/Background separation (e.g. using multivariate analysis techniques)
2. Signal Determination with maximum likelihood Fits, in case of no significant signal determination of Limits
3. Data Corrections ([Unfolding](#) etc.)
4. Systematic errors & and further practical tasks/problems



STATISTICS TOOLS: PROJECTS

November 2008: Survey on statistics projects in Alliance institutes:

- RooStatsCms, a combination and limit tool (D. Piparo, G. Schott, G. Quast).
- BAT - a Bayesian Analysis Tool (A. Caldwell, D. Kollar, K. Kroeninger - see also the arXiv paper)
- Fittino - a tool for measuring MSSM parameters using collider and low-energy observables (P. Bechtle et al.)
- GFITTER - a generic fitting package for HEP model testing (M. Goebel, J. Haller et al.)
- Millepede II - linear least square fits with a large number of parameters] (V. Blobel)
- lvmini - a fitting tool for large-scale optimization (V. Blobel)
- Unfolding package (S. Schmitt)

Role of Statistics Tools group:

- Keep contact to these projects.
- Help them to finalise their work and “sell” it.
- Help to promote the projects.
- Own scientific contributions.

CERN interests (examples):

- Implementation of V. Blobel’s lvmini ...
- Concrete suggestions for work on TMVA from A. Hoecker ...

INFORMAL STAT. MEETINGS

Informal statistics meetings

[\[Edit\]](#)

The Statistics Tools group has started an informal meeting (at DESY, on a monthly basis) in which everybody's statistics questions and real-life problems can be discussed. The meetings are (normally) scheduled every third thursday in a month.

The next dates are:

[\[Edit\]](#)

- 18 December 2008, 10 o'clock, SR 5
- 15 January 2009, 10 o'clock, SR 3a
- 19 February 2009, 10 o'clock, SR 3a

Short documentations of questions

[\[Edit\]](#)

that were discussed during the meetings are provided. Check them out!

- [Leptoquark limits](#) determination as a function of the mass.
- [Upsilon resonances](#) (1s,2s,3s) mass peak fit.
- [Kinematic constraint fit](#) of a decay length
- [Averaging two correlated measurement.](#)
- Treatment of [asymmetric errors](#).

INFORMAL STAT. MEETINGS

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- Treatment of [asymmetric](#)

From Wofwiki

Kinematic constraint fit

site notice:

Kinematic constraint fit of a decay length with unknowns

[\[Edit\]](#)

E.g. determining the decay length of K_0 s $\rightarrow \pi^0 \pi^0 \rightarrow 4 \gamma$.

the K_0 s is produced in $p\bar{p}$ $\rightarrow K_0 K^+ \pi^-$. The problem is in that case there is no 'visible' information at the decay vertex, constraints are the K_0 s and π^0 masses, the K_0 s momentum is known as the recoil from the K^- and π^- since the primary reaction is at rest.

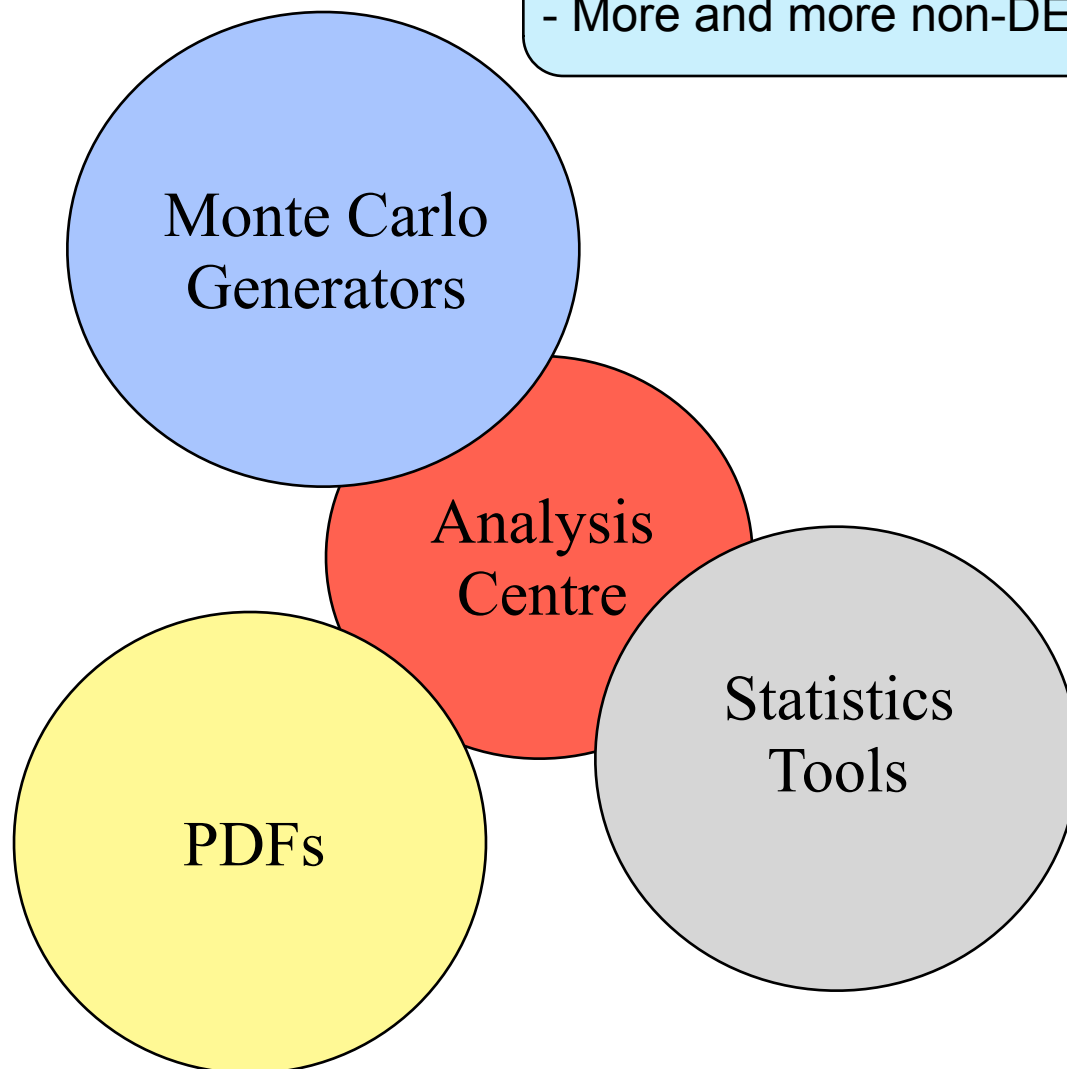
Recommendations:

[\[Edit\]](#)

- It is recommended to try in a constraint fit to replace unknowns directly by constraint information, e.g. not to introduce the K_0 s momentum as unknown and have lagrange multipliers for the momentum constraints but rather directly to replace $\vec{P}_{K_0} = -\vec{P}_{K^+} - \vec{P}_{\pi^-}$
- It might be that certain kinematic configurations cannot be reconstructed, for instance if all the decays happen in a plane. Such events could be identified and rejected.

ACTIVITIES

- Introductory schools.
- Regular group meetings.
- More and more non-DESY contributions.



ACTIVITIES

- Introductory schools.
- Regular group meetings.
- More and more non-DESY contributions.

Monte Carlo
Generators

Analysis

Vision: These (and other?) groups become

- THE place for R&D in their fields in Germany!
- THE place to turn for questions!
- THE point of reference for related information or for contacts to experts.
- THE providers of training and education in their fields.

Keep in mind: LPC took 5 years to build up!

EDUCATION

Past:

- MC School, 100 participants
- Statistics Tools School, 120 participants
- PDF School, 40 participants.



Analysis
Centre

In preparation:

- Fitting Workshop, March 30 - April 1.
- MC School 2009, April 20-24.
- Computer Alg. School, March 29 - April 3.

EDUCATION

Past:

- MC School, 100 participants
- Statistics Tools School, 120 participants
- PDF School, 40 participants.

Lessons we learned:

- **Basic level needed!** Do not only bind in world experts but experience from universities!
- Clearly define and announce the intended audience and prerequisites!
- Record and publish as web lectures.
- Also prepare exercises as self-contained tutorials that everybody can follow on their own.

Education aspect of centre considered by many the most relevant point of centre!

In preparation:

- Fitting Workshop, March 30 - April 1.
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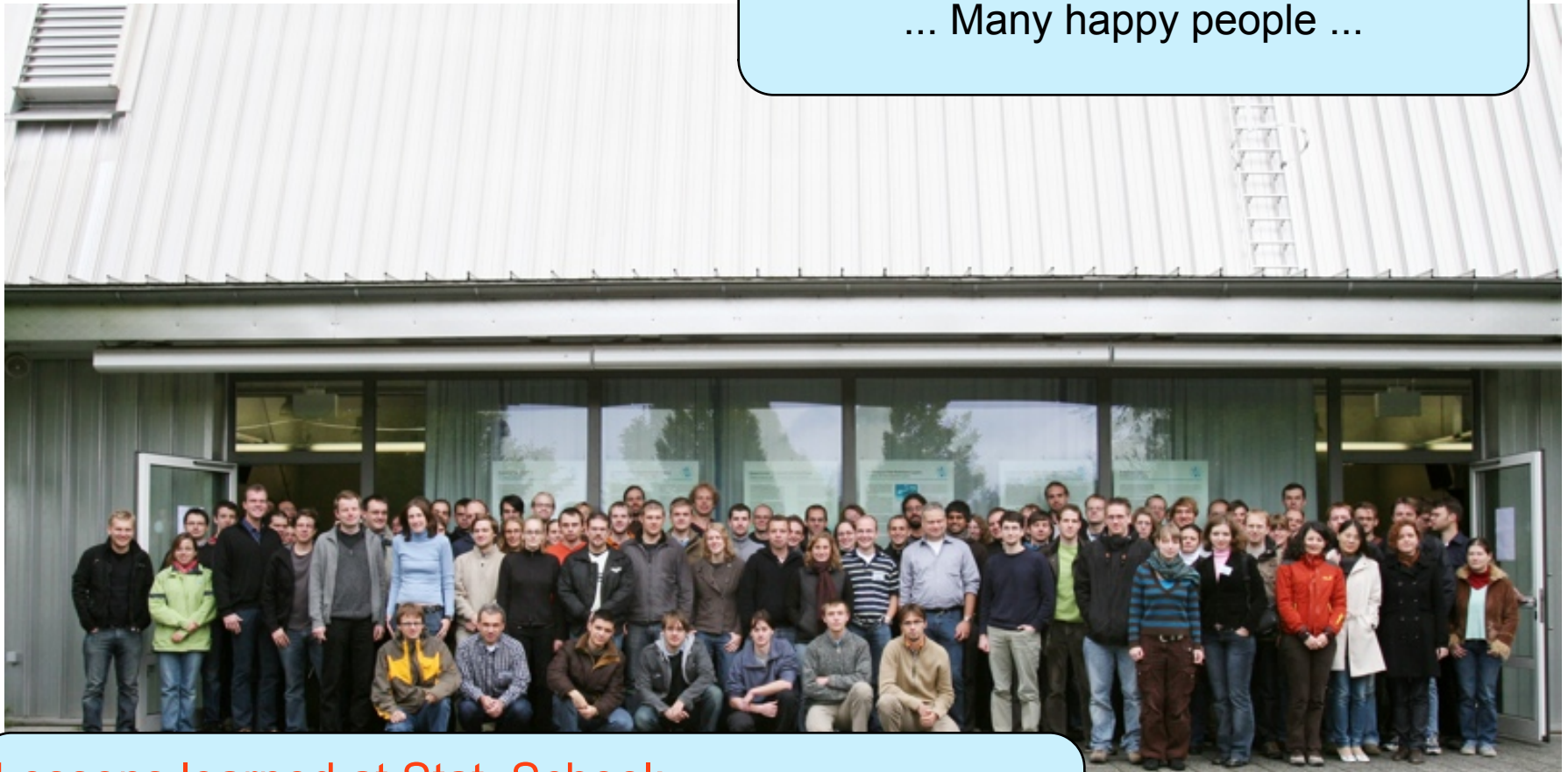
EDUCATION

Stat. Tools School, November 2008:
... Many happy people ...



EDUCATION

Stat. Tools School, November 2008:
... Many happy people ...



Lessons learned at Stat. School:

- Details of Frequentist versus Bayesian approach.
- Developments in multi-variate analysis techniques.
- No cut variations for systematic checks!
- Most discoveries are wrong (L. Demortier).

EXAMPLE : MC SCHOOL 2008

Physics studies:

For all studies following, run CASCADE to produce a HEPMC output file (or use the already generated one, to have enough statistics) and analyse the output with the help of the program `hepmc_analysis.exe` in

`/afs/desy.de/group/alliance/mcg/public/mcschool2008/examples/HepMC`

Please copy the files to your cascade directory, and edit the file `hepmc_analysis.cc` according to your needs.

- **physics to be investigated: $t\bar{t}$ production at the LHC**
 - Process Nr for heavy quark production is: `IPRO=11`. You also need to select, which of the heavy quarks you want to produce, this is done via `IHFL=6` (`top=6`, `bottom=5` and `charm=4`).
 - find out, where the top quark sits in the event record
 - what are the different entries ?
 - in the program `hepmc_analysis.cc` print a listing of the event record for 5 events (which is already in the code)
 - try to draw the color stings which combine the top quarks with the proton remnants
 - understand how the event record is build, and how to extract information
 - consult the HEPMC primer how to extract infos from the event record
- **plot:**
 - p_{\perp} and η of top quark
 - calculate p_{\perp} of $t\bar{t}$ pair
 - charged particle multiplicity in central region for top events ($|\eta| < 2.5$)
 - charged particle multiplicity in central region ($|\eta| < 2.5$) also as function of energy deposit in fwd region. Require summed energy in $6 < \eta < 7$ to be larger than $E_{fwd} > 100, 500, 1000$ GeV
- **studies:**
 - effect of initial & final state PS on p_{\perp} and η of top quark
 - effect of initial & final state PS on p_{\perp} of $t\bar{t}$ pair
 - effect of initial & final state PS on charged particle multiplicity ($|\eta| < 2.5$)
 - to switch on/off initial and final state parton shower, user switch `IFPS` in steering file
 - use DGLAP instead of CCFM evolution (via switch `ICCFM=0/1` in steering file) and check the effect of the different initial state parton shower evolution on p_{\perp} and η of top quark and the p_{\perp} of $t\bar{t}$ pair
 - understand why there is a difference at large p_{\perp} of $t\bar{t}$ pair
 - use high statistics sample with already generated files available on `/afs/desy.de/group/alliance/mcg/public/mcschool2008/examples/Cascade` to study effect at large transverse momenta.
 - compare your result using DGLAP and CCFM uPDFs with the distribution obtained from [MC@NLO](#) (hep-ph/0305252)

- **physics to be investigated: Higgs production at the LHC (if time left, otherwise leave it as a homework exercise)**
 - run Higgs production at LHC (`IPRO=102`)
 - plot pt of Higgs
 - effect of initial and final state PS
 - "jet" (high pt parton) multiplicity
- **investigation of random number generators**
 - CASCADE uses RLUXGO: find a description on the web... cernlib
 - check effect on p_{\perp} and charged particle multiplicity by changing random number seed
 - check effect on p_{\perp} and charged particle multiplicity by changing to different luxury levels of the random number generator (what do they mean ?)

Learn about

- underlying physics
- MC techniques
- implementation
- problems and potentials in physics studies
- other people working on similar topics
- ...

EDUCATION: IDEAS AND PLANS

- HEP basics lecture series based on university experience.
- Introductory course twice (?) a year (level: below Maria Laach):
pp physics, statistics, ROOT, experiment software,
- Course “HEP Statistics for beginners”.
- Course “MC for beginners”: Distributions, integration, parton showers, ...
- “Data analysis for theorists”, “Theory for experimentalists!": LHC physics!
- Scientific computing (bugs, memory leaks, non-standard ROOT/C++)
- Detector understanding with first data: reconstruction, calibration, etc.
- Minimum bias physics: What to learn from it? What is it?
- Established analysis techniques (from HERA and the Tevatron).
- Continuation, improvement, standardisation of existing schools.

Intense discussion with Analysis Project Board and universities!
Currently setting up (final) list of events for 2009 and 2010!

Analysis Centre - Mozilla Firefox

Datei Bearbeiten Ansicht Chronik Lesezeichen Extras Hilfe

http://www.terascale.de/research_topics/rt1_physics_analysis/analysis_centre/

Getting Started symphonie

PHYSICS AT THE TERASCALE
Strategic Helmholtz Alliance

HELMHOLTZ GEMEINSCHAFT

Home General Information Research Topics Workshops Schools Career Calendar News Internal

Analysis Centre

- Monte Carlo Group
- Statistics Tools Group
- PDF Group
- Making use of the centre
- People in the centre
- Old news

Physics at the Terascale » Research Topics » RT1: Physics Analysis » Analysis Centre

Analysis Centre

News

October 10, 2008: The [Analysis Centre web pages](#) are starting to build up!

October 9, 2008: All talks (and exercises with solutions) of the [statistics school](#) available via [index!](#)

Forthcoming events

November 12-14, 2008: [PDF school](#) at DESY/Zentrum

Mission of the Analysis Centre

The Analysis Centre of the Helmholtz Alliance supports physicists from German groups on general data analysis issues. This is done by

- providing training and education on analysis-related topics through schools, workshops and seminars;
- providing support and assistance for individual user problems;
- strengthening the collaboration between different institutes and experiments and between experiment and theory;
- carrying out own research and creating significant contributions to the data analysis project.

The Analysis Centre currently comprises three main activities, namely Monte Carlo generators, parton distribution functions, and statistics tools.

The [Monte Carlo Generator group](#) works towards providing training, support and own contributions in the field of Monte Carlo generators. For this purpose, it is building on the experience already present at DESY and is forming a network of Monte Carlo-related activities in German and other institutes. Besides organising schools and workshops and being a place for discussion, the group is working on the tuning and validation of MC models with the first LHC data, on the development of [Higgs](#) and [Rivet](#), and on the (further) development of parton showers models and certain MC generators (CASCADE).

The activities of the [Statistics Tools group](#) comprise the development of statistics tools necessary for support of the community in statistics-related questions. The group is organising a series of workshops and seminars.

The [PDF group](#) activities build on in-house expertise in the analysis of DIS structure function data to assist in precision determinations of the parton luminosity at the LHC.

One click to the Terascale
Alliance this month

Impressum | Contact | Sitemap | Recommend page | © 2008 Deutscher Elektronen-Synchrotron DESY

Fertig

Start Instant Client Analysis Centre - Moz... Microsoft Photo Edit...

EN 16:46

- Analysis Centre web pages!
- WIKI starting to build up => FAQ, services, discussion forum, contacts, documentation, literature etc.
- project: "QCDPedia"

WHAT ELSE?

Seminars and presentations:

- Setting up **statistics seminar series**.
- **Lecture series on HEP basics**.
- Open for **wishes and suggestions!**

Opportunities in the groups

- Present your work to a larger / different (experiment-independent) audience.
- Contribute to one of the group projects.
- For universities: Spend time at DESY?

Analysis
Centre

Support:

- MC: anacentre-mc@desy.de
- Statistics Tools:
anacentre-statistics@desy.de
- PDF: anacentre-pdf@desy.de

“Discussion days”, “Pheno weeks”

- Bring together few experts for few days.
- Experience: Very productive! (Marchesini, Huston, ...)
- Collaboration of experiment and theory - important!
- Many ideas around.

“Knowledge data base”

Who is doing what where and is willing to answer questions.
=> see next 2 slides.

ANALYSIS WORKING GROUPS

According to Alliance proposal:

- Analysis working groups combine people from both experiment and theory and/or from both ATLAS and CMS.
- Analysis working groups bring together people from different institutes.
- Working groups supported by Analysis Project Board or Virtual Theory Institute.

Established groups:

- Mtautau working group (see next slide)
- Central jet veto in vector-boson fusion.
- Higgs production in association with heavy quarks
- BSM parameter determination at the LHC
- plus two theory groups (supported by VTI) and one exp. idea.

Question: Can we / should we go further?

- More activities?
- Also support more initiatives within the experiments (a la LPC@Fermilab)?
- Necessity? Overview?
- Some political issues with funding agencies / BMBF / FSPs?

ANALYSIS WORKING GROUPS

“Knowledge data base”:

Who is doing what where and is willing to answer questions?

Purpose:

- Overview of activities
- Starting-point for newcomers
- Crystallisation seed for small, focused (multi-institute) “analysis working groups”





	Fitting	PDF	MC	jet cal	Z->ee	tau ID	
A.B.	X						
C.D.	X		Herwig	X			
city				X	X		
group			Herwig			X	
I			Sherpa	X		X	
you	X					X	
we	X						
nobody				X			
...							


Use cases (examples from real life!):

1. New Ph.D. student at university XYZ spends one year to learn basics of mini black holes in ATLAS. Then he/she + supervisor find out topic is covered and their achievements are since long obsolete.
2. Newcomer is looking for low-threshold introduction to topic ABC, and for necessary technical expertise. Too shy to ask CERN working group convenors.

=> Overview of activities and “responsibles” (experienced postdocs, credits!) helps.
Covered by experiment working groups? My feeling: Not always!

WORKING GROUPS: EXAMPLE





- ❖ Task
- ❖ Workshop-Agendas
- ❖ Registration
- ❖ Participants
- ❖ Travel

[Sitemap](#)

[Print Version](#)

[Mailform](#)

Last update:
July 17. 2008 18:13:55

Task

Task

The $m_{\text{Tau-Tau}}$ working group has been officially funded within the Helmholtz Alliance in April 2008. Its main aims are:

- establishing procedures to extract the shape and normalisation of Tau-Tau mass distributions from data
- assess their experimental and theoretical uncertainties

Its members come from various ATLAS, CMS and Theory institutions.

The current conveners are:
Michael Kobel (ATLAS, TU Dresden)
Günter Quast (CMS, Uni Karlsruhe)

Please direct any comments and suggestions to
tautauag@physik.tu-dresden.de

TOP

Next meeting:
26/27 February,
Goettingen.

OUTLINE

Reminder: The Helmholtz Alliance “Physics at the Terascale” and its Analysis Centre

- Helmholtz Alliances, “Physics at the Terascale”
- The Analysis Centre
- DESY and the Analysis Centre
- A working example: The LPC @ FermiLab

The Analysis Centre: Activities, groups, services

- The MC, Statistics Tools and PDF groups
- Education: Schools, Workshops, Discussion Days, Seminars, Lectures
- Analysis Working Groups
- Further activities: Support, web/WIKI, ...

Status and Outlook

- Achievements
- Problems, handicaps obstacles
- Questions and discussion ...

ACHIEVEMENTS

Active working groups!

- MC, Statistics Tools and PDF groups.
- Rich research programmes of group members and groups.
- Good connections to the relevant communities
=> good opportunities for impact and visibility!

Well-accepted education programme!

- Past schools well received. Some lessons learned!
- Rich future programme currently under discussion / being implemented.
- Open for suggestions and wishes.

Analysis working groups!

- Some prototypes for groups connecting different communities: mtautau, jet veto in VBF, theory projects, ...
- Some more ideas for projects around b tagging / tau ID, alignment, ...?
- Some “political” issues? Discussion of real necessity?

... and some more smaller activities (WIKI, meetings, ...)

ACHIEVEMENTS AND HANDICAPS

The Analysis Centre: A useful structure!

- The goals of the Alliance and the centre are widely accepted.
- The Alliance and the centre offer large resources (money, contacts, knowledge, spirit, ideas ...).
- The networking approach as a source for more efficiency, communication, and impact.

The Analysis Centre: A structure with handicaps?

- Networks require more than one active node. Input from universities? => tendency towards hesitation: “What is in it for us?”
- Try to find more “niches” for activities - avoid pure doubling of structure and information!
- Necessity of “critical mass”: DESY (and we all) will only profit from the centre if many of us contribute one way or the other.

Handicaps ...

... see next page

CHALLENGES

Time scale of the Alliance: End in 2012! Three more years to establish Alliance / Analysis Centre. First reasonable LHC data only in 2010(?)! Need to get going.

Doubling of information, structures, efforts? Overlap with experiment-specific structures? Otherwise only irrelevant work? Feedback from experiments?

“Oh, this alliance is **just a means for DESY** to maintain their status as a major particle physics lab - but there is nothing in it for us ...”

Support of **experiment-specific activities politically difficult** (problem of double-financing with FSPs / BMBF). But increase of efficiency mainly in experiment-specific daily work.

“But what is in it for me? I mean - **what credits do I get** for my contributions? Who acknowledges my work for the alliance?”

Interest from DESY colleagues. Only 11 out of ~100 scientists connected, most with small fractions of their time.

... many activities just started very recently (many positions only filled in September or October - some not yet filled at all)! => **slow start.**

FINALLY ... QUESTIONS

- “Why go to DESY when all the fun is at CERN?”
- Who needs it?
- Where can we really have an impact? How? How to justify all the Helmholtz money?
- What kind of results do we expect from the Alliance ?
- When do we consider it a success?
- Where can we contribute in addition to existing projects?
- How can we, as DESY staff, formulate a vision for DESY’s HEP future?
- How to convince the universities that the Alliance can be beneficial for them?
- Why not get eastern-european (long DESY tradition) and maybe even scandinavian colleagues involved?
- Why not have more (informal) discussions among DESY HEP colleagues about Alliance / Analysis Centre / future ...?
- ...

JOIN THE ANALYSIS CENTRE ...

- ... because you will receive recognition for your contribution to this new and promising structure.
- ... because DESY's HEP future (and the future of those interested in HEP at DESY) depends on the Alliance and the centre.
- ... it's a good place to do the service to the community that you before did on the HERA experiments.
- ... because there are so many friendly people involved ;-)
- ... DESY, the Alliance and the community need you!
- ... because there are many interesting projects and opportunities!

**Thank you very much
for your attention!**

BACKUP

THE LPC @ FERMILAB

LPC Mission Statement:

The LHC Physics Center (LPC) at FNAL was created so the USCMS community can provide the maximum possible service to the CMS experiment. Our goal is to ensure that those physicists who must reside inside the United States can still contribute optimally to the many tasks required for the CMS experiment to produce physics and be full members of the CMS team. The components of the LPC are:

- A "brick and mortar" location for CMS physicists to find experts on all aspects of data analysis, particle ID, software, and event processing within the US, working during hours convenient for U.S.-based physicists.
- A center of physics excellence within the US for LHC physics.
- A place for workshops/conferences/gatherings on LHC physics.
- A place for the training of graduate and postgraduate scientists.
- A center for the development of software and physics analysis in the U.S.
- A "remote operations center" that CMS physicists can use to participate in data taking and quality control for the CMS experiment in the U.S.
- A tool to help provide a graceful transition between the Tevatron and LHC experiments for those physicists participating in both, maximizing the manpower available to each during the transition time.