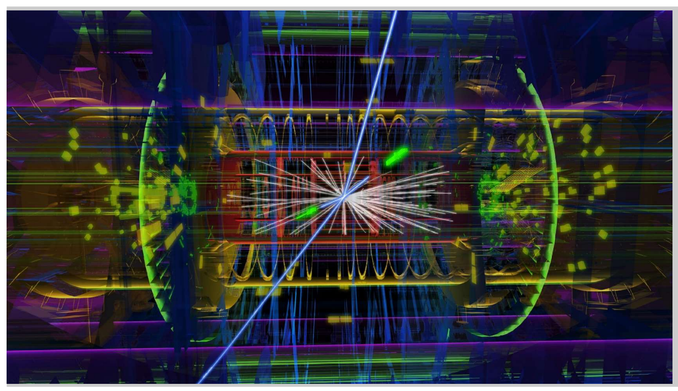

news

2/2015

Mass and Symmetries after the Discovery of the Higgs Particle at the LHC

GRK 2044

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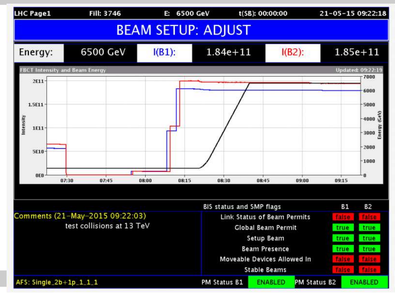


Welcome,
Our GRK 2044 „Mass and Symmetries after the Discovery of the Higgs Particle at the LHC“ has just started and here is the second newsletter. Hot off the press with first collisions at 13 TeV.
Feel free to send any input, ideas or suggestions to Susanne Kuehn.

DATES

Add to your calendar

All dates, news and updates are given on the website of the GRK 2044: **www.grk2044.uni-freiburg.de**

Seminar series of the GRK

Below you can find the current schedule for the seminar every few weeks on Wednesday afternoon 15 s.t. There wlll be coffee and cake afterwards.
The planning for the winter term is in preparation and please send any suggestions for speakers or topics to Fernando Febres Cordero or Susanne Kuehn.

Date	Speaker	Title	Abstract/pdf-file	time and place
10.06.2015	t.b.a.	Student talks		HS I, 15 st
24.06.2015	Werner Rodejohann (MPI Heidelberg)	Neutrinos mass and Lepton Mixing	abstract	HS I, 15 st
08.07.2015	Margarete Mühlleitner (KIT)	t.b.a.		HS I, 15 st
22.07.2015	Christian Steinwachs (Uni Freiburg)	Higgs inflation: a link between cosmology and particle physics	abstract	HS I, 15 st

Seminar series „Fundamentale Wechselwirkungen“ every Tuesday 16 c.t. at Hochhaus 0815. The agenda is given at http://www.tep.physik.uni-freiburg.de/seminars/fundi

Annual fall workshop of the GRK at the **Schwarzwald-Hotel Gengenbach** from **28.-30. September 2015.**
The programm will consist of lectures on QCD by Eric Laenen (NIKHEF), on cosmology by Matthias Bartelmann (Heidelberg) and on electronic noise by Peter Fischer (Heidelberg). Additionally, there will be student talks and posters. More details soon.

Inauguration meeting of the GRK with invited speakers and a BBQ

11. June 2015, starting 16 s.t.

Programme:
16:00 Welcome by the rectorate
16:10 Introduction by spokesperson S. Dittmaier
16:30 Theory talk by M. Krämer (RWTH Aachen)
17:30 Coffee break
17:50 Talk by student representatives
18:05 Experimental talk
19:30 BBQ

15.-21. June 2015 Exhibition „Von Einstein zu Higgs: eine interaktive Ausstellung„

We will be involved in guided tours and explanations of demonstrator pieces and experiments for school classes and the general public.

Further information can be found at https://www.ph-freiburg.de/physik/projekt/einstein-und-teilchenausstellung .

In case of questions please contact Markus.Schumacher@physik.uni-freiburg.de.

PHYSICS: Search for Supersymmetry in Run 2

Supersymmetry is a promising theory extending the Standard Model and solving several of its shortcomings. During LHC Run 1, many efforts have been devoted to the search for supersymmetric particles with the ATLAS experiment. Different final states and configurations of the mass spectrum of the supersymmetric particles have been investigated, but so far no significant excess of events over the expectation from Standard Model backgrounds has been observed.

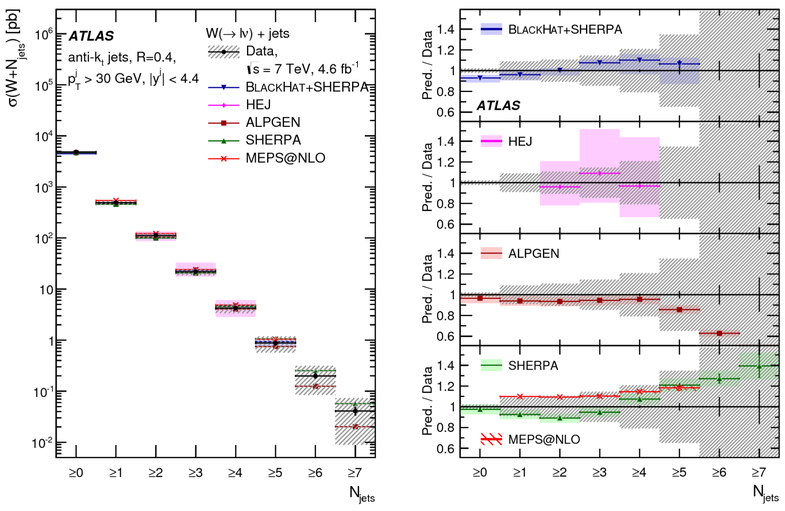
The search for signals of supersymmetric particles will continue to be a crucial part of the physics programme of the ATLAS experiment also with the data that will be collected by the ATLAS experiment during LHC Run 2.
The higher centre-of-mass energy of the proton-proton collisions will allow to test mass regions which have not been accessible so far. During the first months of data-taking, particular attention will be given to the search for supersymmetric particles that are produced via strong interaction of the partons within the protons.
Already with the data to be collected by this summer the ATLAS experiment will be able to test the existence of gluinos (the supersymmetric partners of the gluons) and first two generations of squarks (the supersymmetric partners of the quarks) of significantly higher masses.
Fabio Cardillo, Valerio Consorti, Andrea di Simone, Tomas Javurek, Martina Pagacova, Manfredi Ronzani and Zuzana Rurikova are working on the definition and optimisation of the analysis strategy for these important searches.
Also the search for the supersymmetric partner of the top quark, particularly important to address the hierarchy problem, will benefit from the data to be collected at an increased centre-of-mass energy of the proton-proton collisions. Claudia Giuliani, Christian Lüdtke, Philipp Mogg, Kilian Rosbach, Frederik Rühr, Thorben Swirski and Francesca Ungaro are studying how to maximise the sensitivity to this particle for the analysis that will be performed on the full dataset to be collected this year.

New members of the GRK: Fernando Febres Cordero

In recent years I have been interested in the development of tools to allow precise predictions for hadron colliders. In particular, I have studied in detail two general types of processes at hadron colliders, that of the production of weak vector bosons in association with many jets, and that of the associated production of a weak vector boson (W or Z) and *b* jets. These contributions have been oriented to support the physics program of hadron colliders, particularly the Tevatron and the LHC. In the years to come I expect to study in even more details these processes, and also to widen the scope to which tools like BlackHat can be applied to.

Associated Production of a W and b jets: Over the last few years there has been a lot of interest in the production of a W boson in association with *b* jets at hadron colliders. This signal relates two objects of special interest at hadron colliders. Their associated study produces non-trivial tests of the Standard Model and allows to understand (and calibrate) the response of experiments at hadron colliders to the production of leptons and jets including heavy mesons. In addition to this, the signal also plays a key role in Higgs boson physics, when the weak boson radiates a Higgs boson which decays into a bottom-quark-antiquark system. At the Tevatron this was one of the key signatures to find evidence for a light Higgs boson, and at the LHC it can serve as a way to constrain the Yukawa coupling for the bbH interaction. Also Wb production plays an interesting role in several Beyond the Standard Model scenarios, specially when b-Yukawa couplings are enhanced. For a full account see the recent review [1].

Characterizing Large Multiplicity Processes: The upcoming Run 2 at the LHC will significantly increase collision energies and luminosity compared to the previous run. This implies that a number of large-jet-multiplicity events can be analyzed with increased precision. To illustrate the potential, the Figure below, taken from [2], shows cross sections for W boson production in association with up to 7 jets as measured by the ATLAS collaboration employing data at 7 TeV. Comparisons to the first principle NLO QCD results obtained employing BlackHat show good agreement between theory and data. This gives confidence to keep exploring these highly complex signatures, which play important roles in searches for new physics.



Cross section for W boson production in association with up to 7 jets as measured by the ATLAS collaboration employing data at 7 TeV, taken from [2].

[1] arXiv:1504.07177 [hep-ph]
[2] Eur. Phys. J. C 75, no. 2, 82 (2015) [arXiv:1409.8639 [hep-ex]

From the GRK PhD student speakers:

Dear PhD students,

With the first talk of the new GRK given by Alberto Guffanti, we also tried out the newly created introductory session: we want to thank Fernando Febres Cordero once more for giving a very nice and comprehensive introduction to PDFs and making the premiere a success! We also want to apologize for cutting his time due to a misunderstanding on the starting time of the official part of the GRK seminar. (It will always start s.t. unless indicated otherwise...) Luckily, Fernando agreed that we can make his slides available on the GRK homepage for later study. We will get in touch with other people qualifying to give such introduction sessions for the upcoming seminar talks. If you volunteer for a certain topic or have other feedback to the introductory session, please don't hesitate to contact us!
Furthermore, we will start with the “closed session” at the end of the seminar, i.e. Q&A for PhD students, whilst the professors get a head start on the way to the cake buffet with the next seminar - after Alberto's talk was such a lively discussion that we decided to skip it.

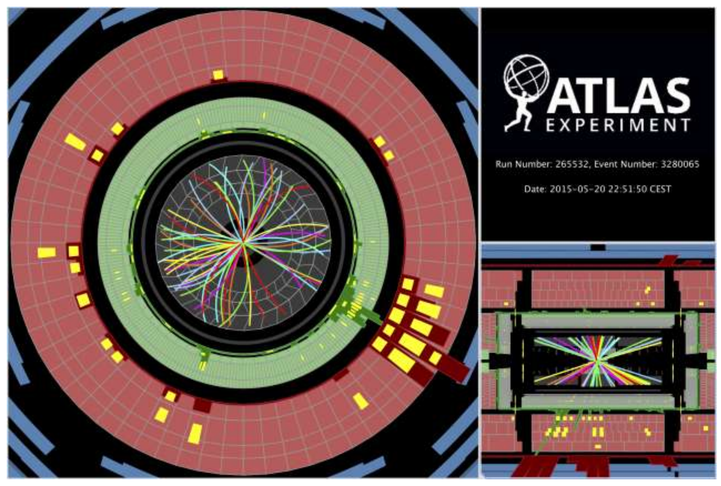
You voted (or had the chance to vote) for the day and time of the regular GRK lunch: it will take place every first Friday, 12:00, in the Mensa. Meeting point is the entrance. The main purpose of the GRK lunch is to get to know / stay in touch with fellow HEP PhD students in Freiburg. Should there be any issues that need to be discussed, we`ll have short coffee meetings, e.g. subsequent to the common lunch in the high rise.

Please contact us in case you have questions, comments or additional suggestions or meet us at the up-coming GRK lunch – we hope to see most of you there!

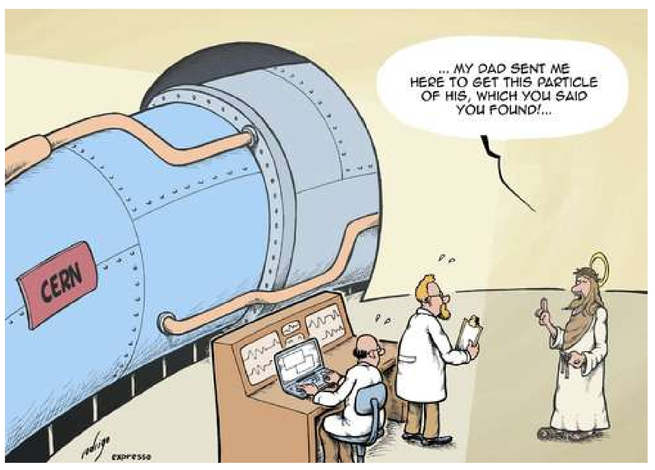
Cheers,
Hannah & Felix A.

Photos from the HiggsTools workshop and public lecture by Rolf Heuer in April 2015:

LHC is back: Display of a proton-proton collision event recorded by ATLAS on 20 May 2015, at 13 TeV collision energy.



ATLAS-PHO-Event-2015-009-2



http://www.toonpool.com/user/1631/files/god_particle_found_1728655.jpg

„Non-physics“ : Enjoy a Strausse

It's asparagus, strawberry and cherry season (soon).
What about going to one of the Strausse of the region?
Just try the regional food and enjoy the sunshine!

- Lorenz Strausse, Ehrenkirchen, http://www.lorenz-straussi.de/
- Schlatthöfe, Tiengen, http://www.home.regioseiten.com/schlatthof
- Martinshof, Ihringen, http://www.martinshof-schenke.de/
- Griestalstrausse, Tuniberg, http://www.griestal-strausse.de/
- Sonner's Heinehof, St.Ulrich, http://www.heinehof.de

Opening hours and details on:
www.straussen-kalender.de/pdf/gesamt_2015.pdf

Thank you for contributions to: Felix Anger, Hannah Arnold, Felix Bührer, Fernando Febres Cordero, Christina Skorek, Philip Sommer, Markus Schumacher, Francesca Ungaro and Christian Weiser.