Les Houches Workshop Series "Physics at TeV Colliders" 2013 Session: 3-21 June

LES HOUCHES centre de physique

Ce n'est qu'un au revoir

AULD LANG SYNE

WE'LL MEET AGAIN

The Organisers

SESSION 11

Enigmass The enigma of mass

cnrs

UNIVERSITÉ DE SAVOIE Chambery Annecy

Liberté • Égalité • Fraternité RÉPUBLIQUE FRANÇAISE MINISTÈRE DES AFFAIRES ÉTRANGÈRES

haute savoie Conseil Général

LES HOUCHES SPIRIT ?

LH SPIRIT

1 tt̄ QCD NNLO inclusive ✓
{tt̄+1jet 2jet} NLO
R3jet/2jet
2 dijet QCD NNLO gg ✓
*3 H+jet QCD NNLO gg ✓
? mt ?
Z γ
W γ
*4 V+jet QCD NNLO
*5 VV' QCD NNLO {onshell/offshell Caukan/Mitov onshell
*6 γγ QCD NNLO fully exclusive ✓
offshell NLO needed for Searches cf multi parton
7) single top | b mass
W+b
8) W+c (fragmentation)
9) γ+jet (b?)
10) H+W fully differential
11) H+Z almost done
jet vetos
12) 3jet
*) Add G²H⁴H operators in POWHEG
*) Implement bosonic Effective operators into CALCHEP (MG?)
*) Derive constraints from existing experiments (ex: triple gauge couplings)
*) Try to find new strategies to extract coefficients (ex: h→ZZ)
*) Estimate future sensitivity at LHC

Les Houches

Trace: • start • programme • sm • tools

Les Houches

- Website
- Wiki
- Contact

2013 Session

- Home
- **Programme in LH**
- Participants Present in LH
  - Session 1
  - Session 2
- Working Groups Pages:
  - General List of Topics
  - Higgs
  - SM: Loops and Multilegs
  - New Physics
  - Tools and Monte-Carlos
- Conveners (Restricted Access)
- Participants (Restricted Access)

Previous Session

- 2011

Help

- How to: Latex, Tables,
- Wiki Manual

Tools and Monte Carlos

Table of Contents

- Tools and Monte Carlos
  - A list of topics common for sessions 1 and 2
  - A list of topics for session 1
  - A list of topics for session 2

A list of topics common for sessions 1 and 2

- **Data vs Theory (Tools and MC)**
  - make use of Rivet→have Rivet tutorial early in workshop
  - dressed leptons: what is the best way of making comparisons between data and theory
  - more sophisticated looks at analyses with background subtractions
  - try to constrain jet content of UE
- **Update of LHE file format**; more information also **here**

A list of topics for session 1

- **Schemes to systematically evaluate uncertainties in the new NLO tools**
  - which scales to vary: standard renormalisation and factorisation scales in matrix elements
  - also in showers? if so, how?
  - starting scales of shower? how about contact to resummation calculations?
  - systematic variation of underlying event simulation: eigentunes? other ideas?
  - PDF uncertainties: how to do them properly in the shower? is this important?
- **Comparison of NLO tools (continuation/extension of HiggsWG activity)**
  - testcase: Higgs boson production in gluon fusion
  - inclusive quantities: Higgs pt, y distributions, Njets etc. & uncertainties
  - testing the high-pt regime
  - testing the two jet regime with weak boson fusion cuts
- **Inclusion of ew corrections for TeV-scale processes**
  - understanding the requirements for a systematic implementation
- **Comparison of recent NLO matching/merging tools**
  - review tools & techniques
  - highlight issues through example processes
  - aim for short write-up for non-experts on matching / merging, focusing on NLO merging, ending with roadmap for where further improvement is desired / necessary / not necessary.

A list of topics for session 2

- Proposal for a new event file format (to get rid of the huge stdhep and hepmc files)
- Extending the SLHA to include cross section information (automate event-by-event weighting with higher order cross sections)
- SMS decomposition: Libraries with simplified models, the associated analyses, LHC results as well as

Some topics for Session 2

a1) Higgs Effective Lagrangian (HEL)

- implementation of HEL in MC generators (ex: $gg \to h$, $h \to 4f$)
- wishlist of NLO calculations within the HEL approach
- updated and complete analysis of current constraints from Higgs, flavor and precision data on the coefficients of HEL
- estimate of future sensitivity of the LHC on the coefficients of HEL

a2) Triple Gauge Couplings (TGC)

Interplay of triple gauge couplings and Higgs measurements in the effective Lagrangian.

b) Identify most promising Higgs observables and processes to discover New Physics, given the current constraints and exclusion limits:

1. from the viewpoint of specific models. Ex: natural SUSY, composite Higgs
2. from the viewpoint of the HEL

c) Higgs and Dark Matter: Higgs portal models, Higgs→invisible, Higgs + invisible associated production

d) Higgs in decays of New Heavy particles

e) effects of NP on Higgs BR's, using existing contraints (SUSY was done during last Les Houches)

f) Naturalness:

g) Exotic Higgs Decays

h) Theoretical uncertainties in the global Higgs fits

i) Constraints on "other" Higgses in multi-Higgs models and ways how to look for them at LHC (including heavy Higgs –> hh decays, where h is the 125 GeV state).

Effective DM theory:

- Fox et. al. http://arxiv.org/abs/1109.4398v1 (the key to understanding the plots in the CMS paper!)
- Tait et. al. http://arxiv.org/abs/1108.1196
- ...

Mediator production:

- Dijet resonances: An et al. http://arxiv.org/abs/1202.2894v1
- Associated production: An et al. http://arxiv.org/abs/1212.2221
- and references therein

Edit

Beyond Effective dark matter

- How can limits easily be translated to models with multiple mediators / multiple effective operators?
- How can the relevance (or irrelevance) of effective operator limits to full models like SUSY best be expressed?
- What DM-motivated searches can not be expressed in an effective operators / single mediator picture?

Edit

Breit-Wigner cross-section

$$\sigma_{LHC}(pp \to \chi\bar{\chi} + X) \sim \left| \frac{g_q g_\chi E}{(s - M_X^2) + i M_X \Gamma_X / 2} \right|^2 \sim \frac{1}{\Lambda^4}$$

where E is of order the partonic center-of-mass energy.
Two regions to study/search

- $M_X >> M_\chi, E_{cut}$
- $M_X \geq M_\chi, E_{cut}$

Edit

Workshop is not over yet just started...

Session 2: 12-21 June 2013

The discovery of a Higgs-like signal at the LHC will be at the centre of the work and discussions in this session. Among the topics to be reviewed is the rôle of naturalness for example. Another issu
is the impact of the discovered scalar on scenarios of Beyond-the-SM physics. Connected to searches for New Physics is in turn the issue of how to present the data, also discussed here. Further ho
subjects are the consequences on and from flavour physics and Dark Matter.

Higgs: New Physics

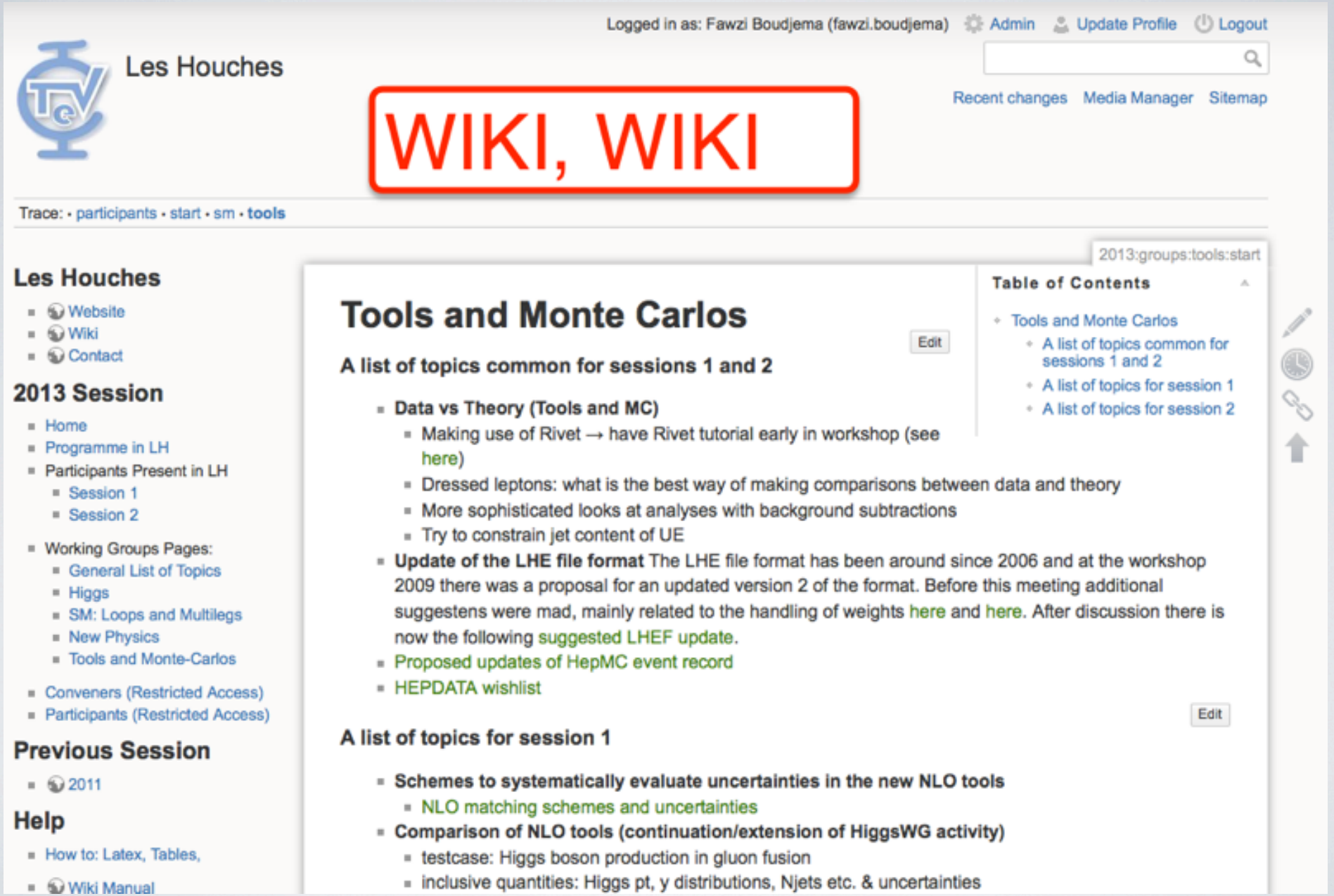
Theory	Experiment
R. Contino, Univ. Roma I "La Sapienza", Italy	F. Moortgat (CMS), ETH Zurich, Switzerland

BSM: Beyond the SM

Theory	Experiment
A. Weiler, DESY, Germany	G. Brooijmans (ATLAS), Columbia Univ., USA

Tools and Monte-Carlos

Theory	Experiment
P. Richardson, IPPP Durham, UK	S. Sekmen (CMS), CERN, Switzerland
B. Fuks, IPHC Strasbourg, France and CERN, Switzerland	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Les Houches
Recent changes Media Manager Sitemap
WIKI, WIKI
Trace: • participants • start • sm • tools
Les Houches
Website
Wiki
Contact
2013 Session
Home
Programme in LH
Participants Present in LH
Session 1
Session 2
Working Groups Pages:
General List of Topics
Higgs
SM: Loops and Multilegs
New Physics
Tools and Monte-Carlos
Conveners (Restricted Access)
Participants (Restricted Access)
Previous Session
2011
Help
How to: Latex, Tables,
Wiki Manual
2013:groups:tools:start
Table of Contents
Tools and Monte Carlos
A list of topics common for sessions 1 and 2
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A list of topics for session 2
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Edit
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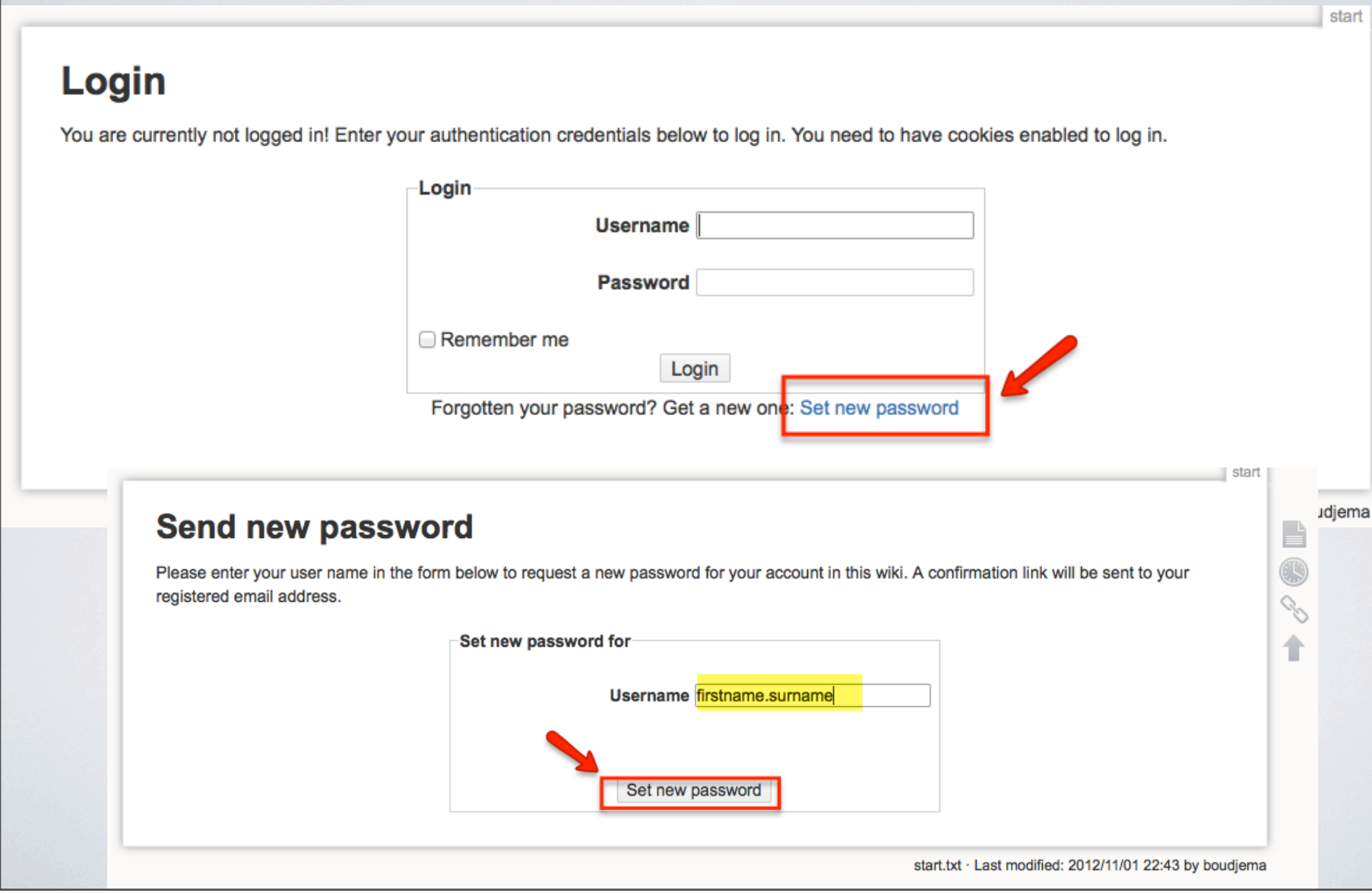
Making use of Rivet → have Rivet tutorial early in workshop (see here)
Dressed leptons: what is the best way of making comparisons between data and theory
More sophisticated looks at analyses with background subtractions
Try to constrain jet content of UE
Update of the LHE file format The LHE file format has been around since 2006 and at the workshop 2009 there was a proposal for an updated version 2 of the format. Before this meeting additional suggestens were mad, mainly related to the handling of weights here and here. After discussion there is now the following suggested LHEF update.
Proposed updates of HepMC event record
HEPDATA wishlist
Edit
A list of topics for session 1
Schemes to systematically evaluate uncertainties in the new NLO tools
NLO matching schemes and uncertainties
Comparison of NLO tools (continuation/extension of HiggsWG activity)
testcase: Higgs boson production in gluon fusion
inclusive quantities: Higgs pt, y distributions, Njets etc. & uncertainties

WIKI

All of you have an account



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Session 1
Monday 3 June
19h30
Dinner
21h00
Tuesday 4 June
09h00-09h15
General Intro

Houches 2013: Participants

Access Reserved

Edit

Session 1 & 2 Participants

- Mailing Lists (send mail the conveners, participants to session 1, session2,..)
- User's Guide to Computing and Network in Les Houches, download
- Share your pictures. Picasa, upload. Use the following
  - - username: leshouches13
  - - pswd: [redacted]

Session 1 Participants

- Saturday June 8th is our day off, Important information concerning hiking, etc....
- Please fill the on-line questionnaire here

Session 2 Participants

Table of Con

- Houches 201
  - Session 1 &
  - Session 1 P
  - Session 2 P

PROCEEDINGS

- Deadline **31 December 2013**

- The conveners will send a mail asking for statements of interest, coordinating the efforts and page length etc. Some topics will be collected in a single contribution with a contact person to be chosen by the conveners.

- Authors list: not all participants in Les Houches can sign as authors. The author list will also have contributions from those taking part in the activities of the Workshop from people who were not present in Les Houches.

SVN

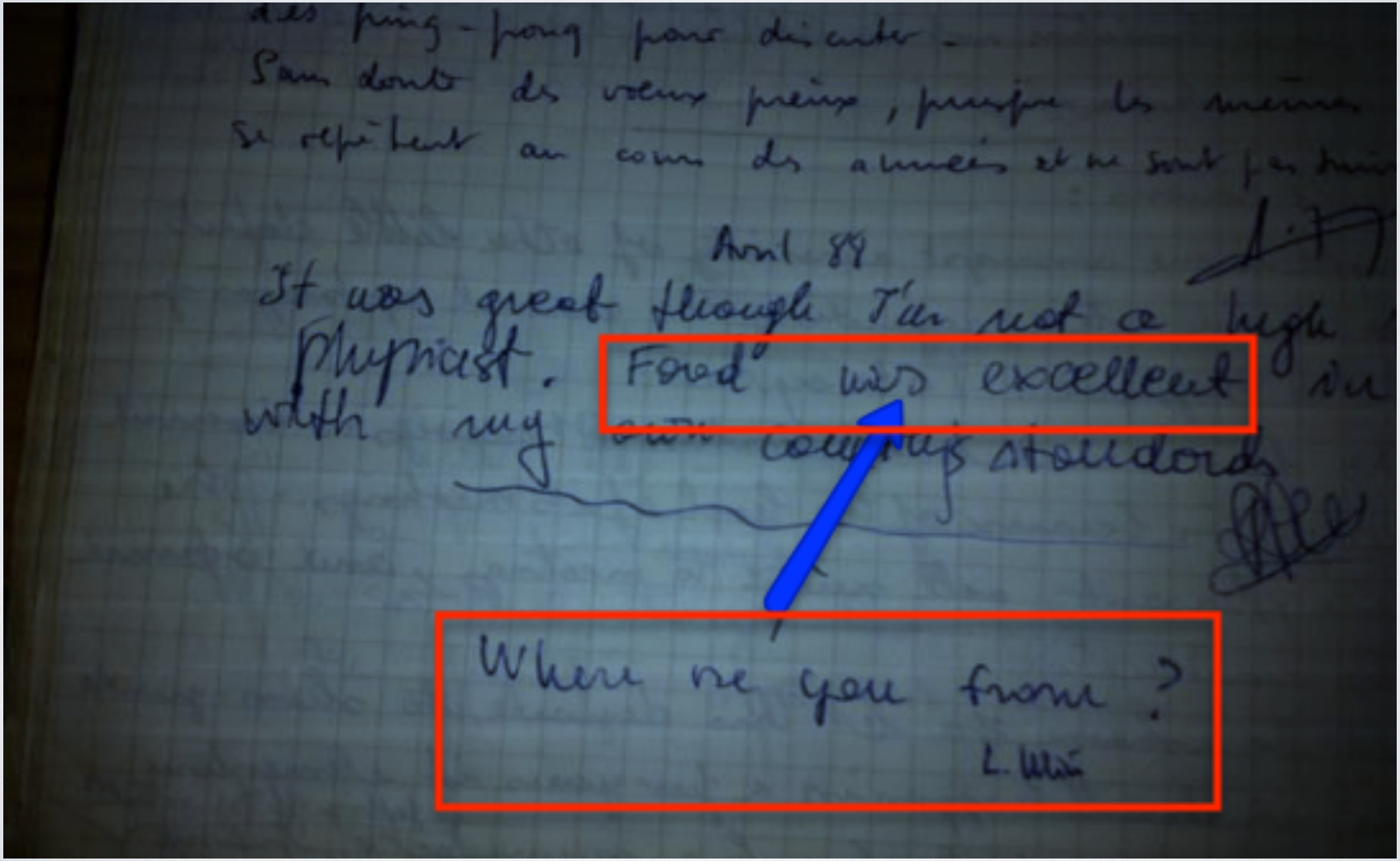
- **Please do not submit a copy of your sub contribution to the archives (unless it's in an expanded form for a paper of course!)**

FOOD HAS IMPROVED

ASK THOSE WHO HAVE BEEN COMING HERE FOR YEARS

FOOD HAS IMPROVED !

ASK THOSE WHO HAVE BEEN COMING HERE FOR YEARS



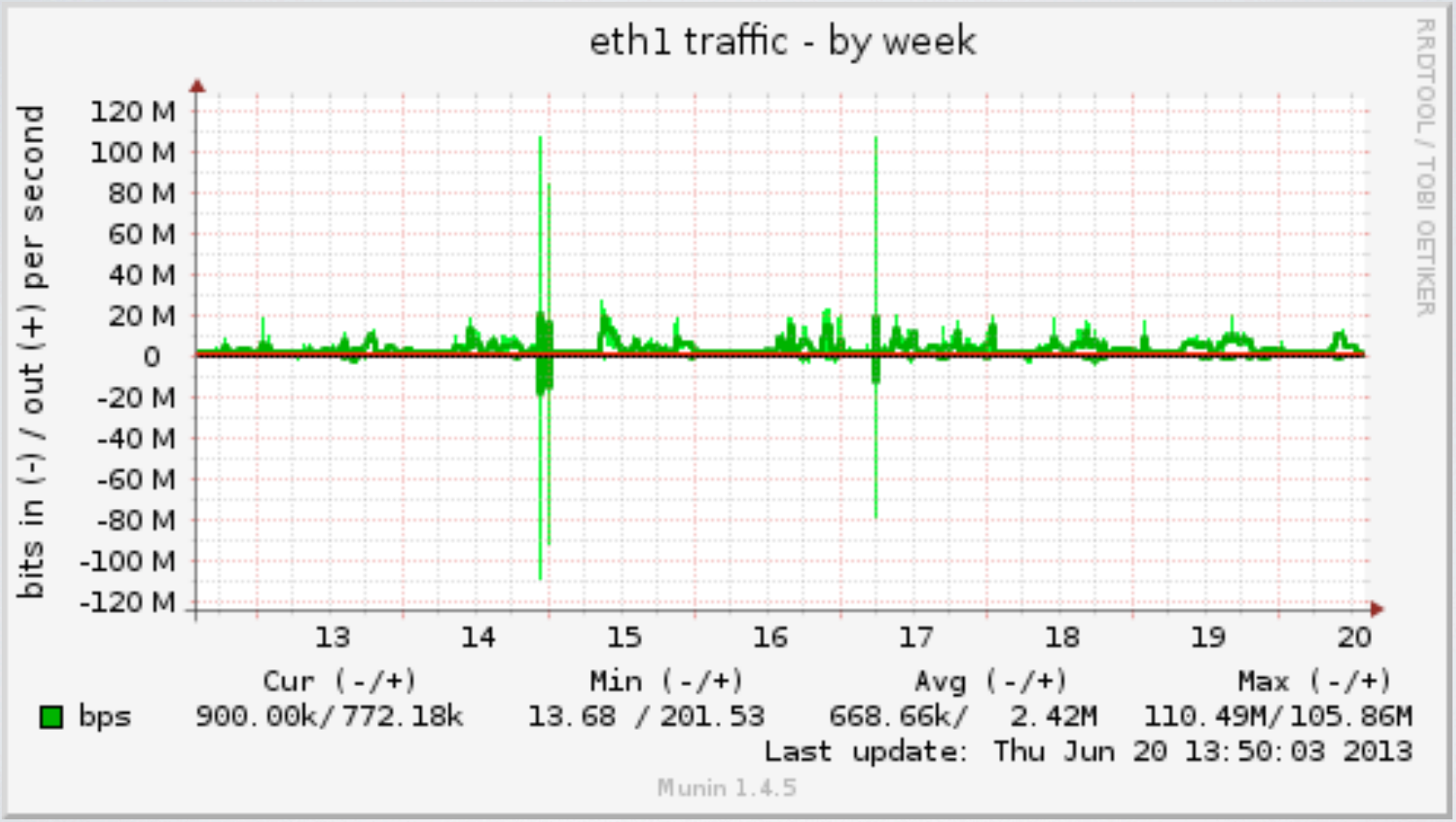
99.5% availability

NETWORK

Host State Breakdowns:

State	Type / Reason	Time	% Total Time	% Known Time
UP	Unscheduled	8d 13h 15m 20s	99.510%	99.510%
	Scheduled	0d 0h 0m 0s	0.000%	0.000%
	Total	**8d 13h 15m 20s**	**99.510%**	**99.510%**
DOWN	Unscheduled	0d 1h 0m 37s	0.490%	0.490%
	Scheduled	0d 0h 0m 0s	0.000%	0.000%
	Total	**0d 1h 0m 37s**	**0.490%**	**0.490%**
UNREACHABLE	Unscheduled	0d 0h 0m 0s	0.000%	0.000%
	Scheduled	0d 0h 0m 0s	0.000%	0.000%
	Total	**0d 0h 0m 0s**	**0.000%**	**0.000%**
Undetermined	Nagios Not Running	0d 0h 0m 0s	0.000%	
	Insufficient Data	0d 0h 0m 0s	0.000%	
	Total	0d 0h 0m 0s	0.000%	
All	Total	8d 14h 15m 57s	100.000%	100.000%

NETWORK


eth1 traffic - by week
bits in (-) / out (+) per second
120 M
100 M
80 M
60 M
40 M
20 M
0
-20 M
-40 M
-60 M
-80 M
-100 M
-120 M
13
14
15
16
17
18
19
20
Cur (-/+)
Min (-/+)
Avg (-/+)
Max (-/+)
bps
900.00k/772.18k
13.68 /201.53
668.66k/ 2.42M
110.49M/105.86M
Last update: Thu Jun 20 13:50:03 2013
Munin 1.4.5
RRDTOOL / TOBI OETIKER

NETWORK & COMPUTING

- Had to set up a new network with servers from LAPP-LAPTh, but we still have to rely on the local infrastructure

bandwith improved

- Compare:

- 2009,2011

Evaluation

7. In your opinion which were the good and bad points of the Workshop?

7a) Good Points

7b) Bad Points

Please fill in the questionnaire

8. Which are the educational methods (lectures, discussion groups, practical work, ...) proposed during this workshop

9. Which of the following occasions provided a better environment for exchanges with the participants and the conver

a) ☐ Plenary sessions
b) ☐ Working groups
c) ☐ Meals
d) ☐ Other(s), specify :

10. Would you like this series of workshops to continue? yes

If yes,

- With the same format? yes
- On what subject/topic(s)?
- For which audience?

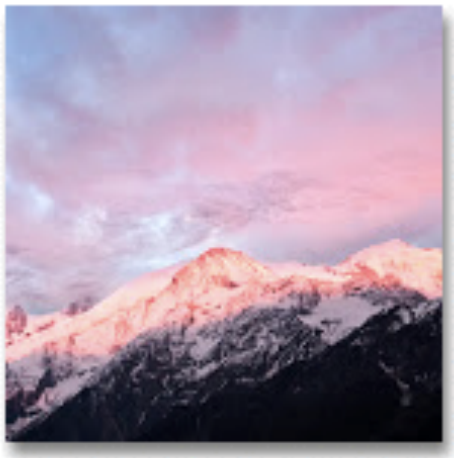
11 . Network, Computing

SHARE YOUR PICS & VIDEOS

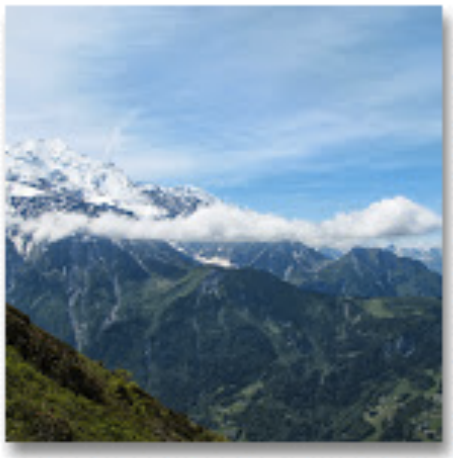
Picasa™ Albums Web | Découverte | Galerie de Phys TeV

Galerie de Phys TeV Albums (3)

Jon Session 1
9 juin 2013
photos : 6



AK
7 juin 2013
photos : 4



Session 1, Fawzi
1 juin 2013
photos : 14

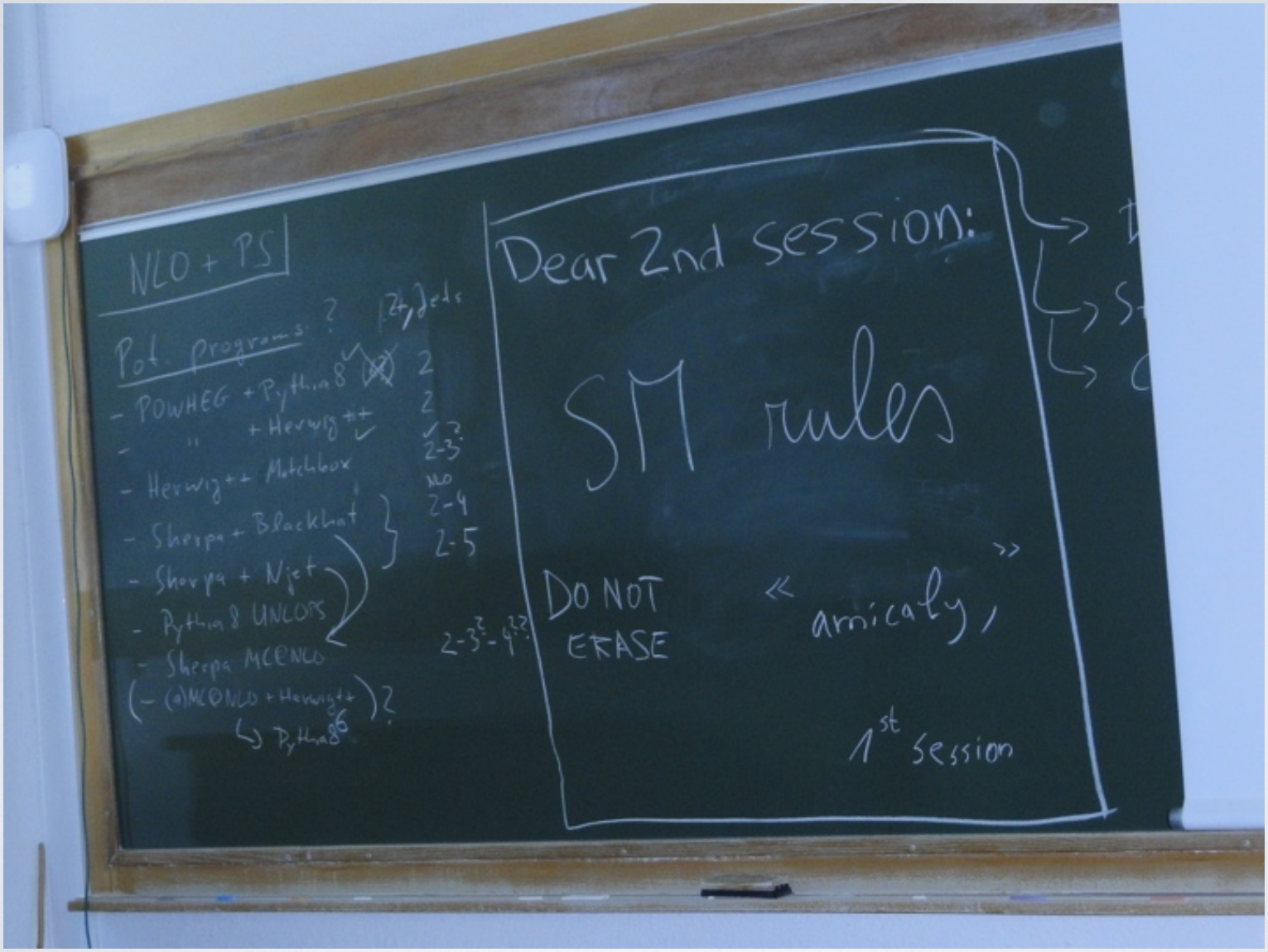
Suggestions on how to improve, how to allow more people, not to allow more people,

Summary 2009: Let's s hope we will have data at the next LH..

Summary 2011: *At the next LH, a signal ?*

For 2015?

Message from Session I



Imagine there is no SUSY
It's easy if you try
Only Higgs below us
Above us only Planck
Imagine all the people, drinking in Les Houches

Imagine there's no signal
It isn't hard to do
Nothing to kill or exclude
And no background too
Imagine all the people, living by SU(2)

You may say I'm a dreamer
But I'm not the only U(1)
I hope some day at some scale
All the forces will be as one

Imagine no trileptons
I wonder if you can
Ne need for razor or MT2
Standard Model for all
Imagine all the people, fitting just the Higgs

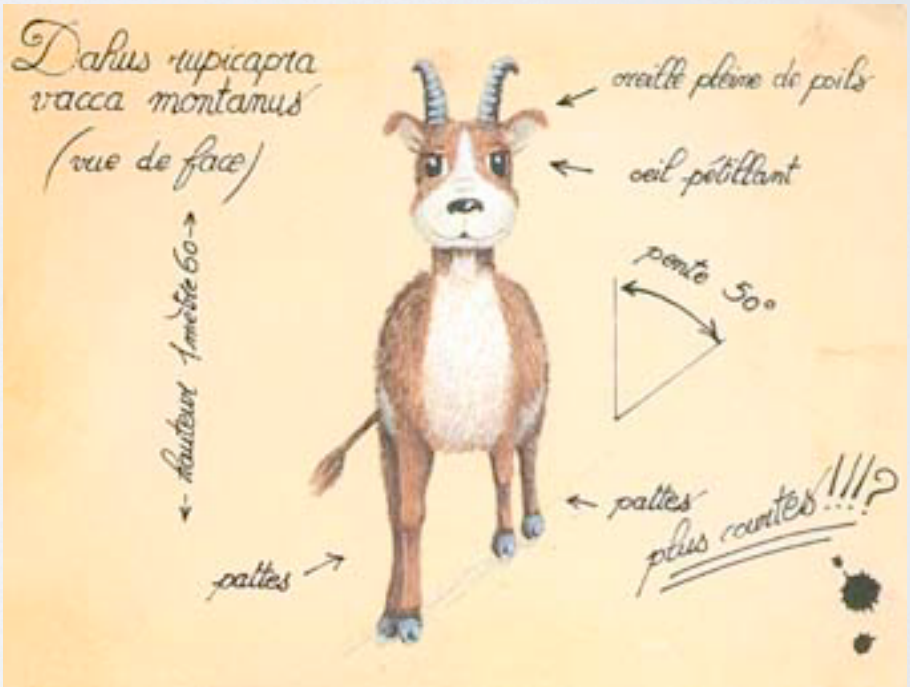
You may say I'm a dreamer
But I'm not the only U(1)
I hope some day with more data
New physics will have won

THANKS

- Suzanne, Philippe, Eric, Jean-Philippe
- Secretariat in LH and at LAPTh
- Computer people at LAPTh and LAPP (Mathieu and Sylvain)
- Conveners
- All of you!

HAVE A NICE JOURNEY

- Beware of the DAHU !



Dummst AnzumeHmender User
(from Stefan D.)