Les Houches Workshop Series "Physics at TeV Colliders" 2017 Session: 5 to 23 June

LES HOUCHES centre de physique

Introduction and Welcome
The Organisers

SESSION 1

Laboratoire d'Annecy-le-Vieux de Physique Théorique

Laboratoire d'Annecy-le-Vieux de Physique des Particules

Enigmass The enigma of mass

cnrs

Université Savoie Mont Blanc

haute savoie le Département

Liberté • Égalité • Fraternité
République Française
Ministère de l'Éducation nationale, de l'Enseignement supérieur et de la Recherche

10th PhysTeV Les Houches

LH PHYSTEV THROUGH THE YEARS

In 1999 about 65 participants over 12 days, 1 session

2001-> 85, 12 days

2003→ ~100 12 days

2005, 2 sessions 170 people, 3 weeks

2007, more than 300 applications! could not accommodate everyone, two sites,

2009 about the same as in 2007! One site: The Centre

2011 ⟷ 2017: about 250 applications as in 2015 imbalance between session 1 and session 2

Aim and Format of the Workshop

Aim and Format

This **Workshop** is the tenth in a series whose aim is to **bring together theorists and experimentalists** working on the phenomenology of **TeV colliders**. The emphasis in this series of workshops has been on the physics at the LHC. The highlight of the 2017 Les Houches Edition is to take full advantage of the data that has been collected at the LHC so far and prepare for the future runs. With this much data, following the discovery of a Higgs-like particle, one aim of this Workshop is how to best sharpen our tools and techniques in order to reconstruct the profile of this particle and possibly uncover New Physics. An equally important aim is to reassess some of the still open fundamental questions in the light of this discovery and investigate which kind of New Physics such a particle may be hinting at. The importance of precision measurements on the one hand and precision calculations and simulation on the other hand is central.

In view of the above considerations, the Workshop will devote particular attention to:

(i) Higgs physics, and how it shapes our view on the mechanism of electroweak symmetry breaking; (ii) related searches for New Physics and (iii) progress in new techniques for the calculations and simulation of Standard Model processes.

The Workshop will address issues such as **how to best exploit these data** as well as how to prepare for future LHC data, and **what is most desirable in LHC upgrades**. These activities will be conducted in close connection with the development and improvements of related theory tools, in particular of Monte-Carlo event generators.

The Workshop runs over one year, including two meetings in Les Houches in the month of June, and exchanges and collaborations before and after the meetings. The meetings in Les Houches will consist of **two sessions:**

WG Topics

Themes to be covered in the Workshop range from **Quantum ChromoDynamics** to the mechanism of **Electroweak Symmetry Breaking** to **Higgs Physics**, models of **New Physics** and their phenomenology. Four Working Groups have been set up covering these different aspects of the Physics at the LHC, the division into Working Groups being in many cases **artificial** – think of the interdependence between New-Physics signals and their respective backgrounds as the simplest example. We thus expect and aim towards very strong connections between these groups.

- **SM and NLO Multi-leg WG.** It will be concerned about the theoretical predictions for **multileg processes**, including beyond leading order, and the possibility of implementing these calculations in Monte Carlos. This WG aims at a cross breeding between novel approaches (twistors, unitarity cuts,...) and improvements in standard techniques. Particular attention will be devoted to electroweak corrections, to NLO Monte Carlo implementations and improvements, and to NNLO computations. A further topic to cover are new developments in the physics of jets (boosted objects, substructure,...). Many topics covered by this subgroup have a direct connection to precision Higgs physics as well as to New Physics (background but also boosted objects). This WG will convene during the first Les Houches session.

- **Higgs WG.** The task of this WG is twofold. A first concern is precision calculations and precision measurements together with improvements in search techniques and strategies. The aim is to arrive at a better reconstruction of the Higgs profile. A second concern is how Higgs physics constrains New Physics, either directly by the information it provides for particle searches, or indirectly by its role in, *e.g.*, flavour-physics, or its connection with Dark Matter. The first task will be covered during Session I, in overlap with the activities of the SM and NLO Multi-leg WG. The second task will be addressed during Session II in close connection with the New Physics WG.

- **New Physics WG.** A central question is how the Higgs-like signal may be used as guidance for models of New Physics and what is the role of Naturalness. Further issues will include model reconstruction and model-independent searches based on topologies as well as the connection with Dark Matter and the impact from astrophysics and cosmology – especially in consideration of the fresh data flowing from this field. This WG will convene during the second Les Houches session.

- **Tools and Monte Carlos WG.** This WG will liaise with the **SM** and **New Physics** WGs, with the task *(i)* of incorporating in these simulation tools new ideas, novel techniques and new models discussed in the other WG's *(ii)* of setting **standards and accords** among the simulation codes to better meet the experimental needs. Issues concerning pdf's and jets will also be covered within this WG, that will run throughout the two sessions. In session I the emphasis will be on SM issues, in close connection with the SM/NLO Working Group, while in session II the emphasis will be on the implementation of new models.

It should be clear from these considerations that, **in the spirit of the Les Houches PhysTev series, we expect a strong interplay and collaboration between the different groups and their subgroups.** The projects are to start in **February 2017** and should be completed by the **end of the year 2017**.

Les Houches Tools and Monte-Carlo Working Group. (to be updated)

Edit

Table of Contents

Session 1

- **Getting ready**: Tools & MCs topics: Here, we paste the first circular about Tools & MCs topics. Discussion sessions on these topics will be organized as needed. Some suggested discussion topics:

1. **Uncertainties in HEP event generators**: Monte Carlo Event Generators come with a host of perturbative (PU) and non-perturbative (NPU) uncertainties. If PU and NPU are correlated, can we find recipes that do not underestimate the uncertainties, while at the same time not being overly conservative? Many of the PU scale uncertainties are again intertwined. Can we find a common recipe to assess perturbative uncertainties while retaining consistency for each variation?
2. **Applicability of matched/merged fixed-order+parton shower calculations**: If matched/merged calculations are presented as accurate & precise fixed-order + resummed calculations, how do they compare against dedicated calculations employing higher-order QCD resummation and/or electroweak corrections? What is the impact of calculations including beyond-narrow-width effects on precision extractions of SM parameters, and what are the uncertainties we expect in "resonance-aware" calculations? Can the details of matching/merging schemes interfere with/be exposed by jet substructure measurements?
3. **Treatment of charm/bottom quarks in parton showers, and in fixed order+parton shower calculations:** Do we need to worry about the treatment of the $g \rightarrow Q\bar{Q}$ in parton showers when describing/interpreting heavy flavor measurements? Should the description of $g \rightarrow Q\bar{Q}$ in timelike and spacelike evolution be improved, or its uncertainty assessed? Does the parton-shower modeling feed down into commonly used fixed-order+parton shower calculations?
4. **Assessing higher-order parton shower effects:** If a major uncertainty of matched/merged calculations is inherited from their parton shower parts, can we find observables that expose higher-order effects? If so, can we find observables (e.g. through jet substructure studies) that inform parton shower developments and improvements?
5. **Addendums to common interfaces**: Do we need to reconsider some features for the LHEF format? Or does a new more detailed - description of the current format suffice? Do we need to/want to think how to simulate long-lived particles which traverse active detector material? Are there particles for which a more dynamic interface of detector simulations and event generators is desirable (e.g. long-lived B-mesons)?

Les Houches Spirit?

LES HOUCHES SPIRIT IN ACTION

- Avoid succession of formal, *normal* talks

Lectures….in a very informal style

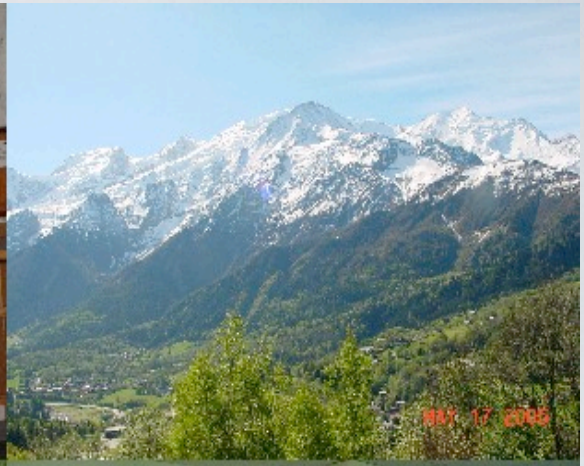
CONTINUES EVEN IN THE BAR

Alas, 2017
No grass
No Sun?

A LES HOUCHES ACCORD


MAY 19 2005

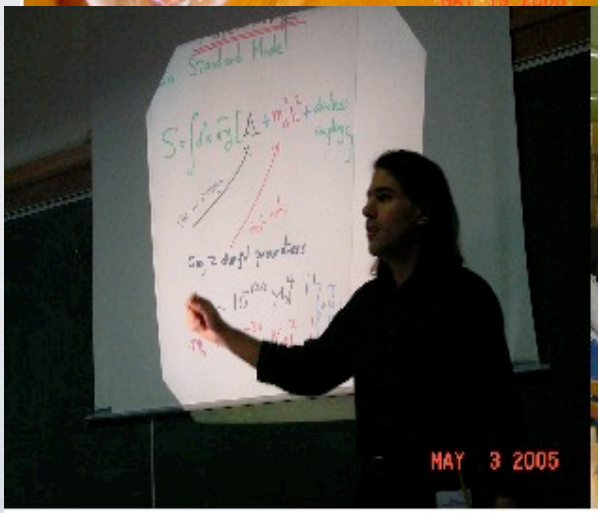

MAY 4 2005


MAY 17 2005


MAY 19 2005


MAY 17 2005


MAY 19 2005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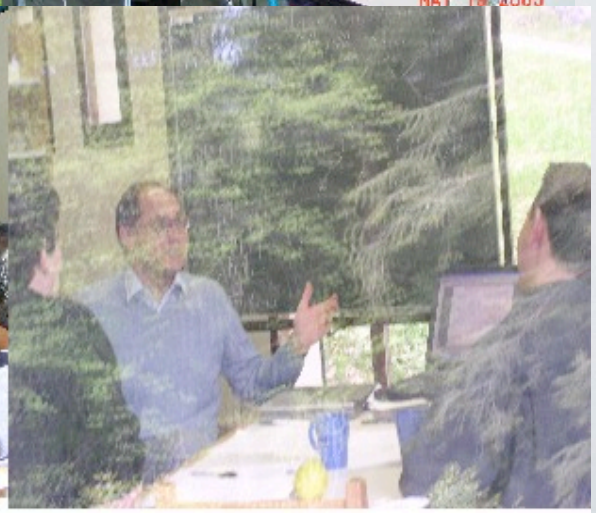


LH Accords, Discords, Proposals, Wishlists

The *(original)* Les Houches Accords

HepUP Event Record

- Successful!
  - Majority of MC talks at Les Houches mention it.
  - Every ME/PS project that I've heard discussed in last 12 months uses it.
- Should extra info for ME/PS be included?
  - No: generic information content is not yet established, everyone is trying new/different things. Still need max. freedom.
- Requests for a specified file format,-- but fear that forcing such a format would limit users.
  - Tevatron uses FNAL MCFIO
  - CERN MCDB using XML-like text files.

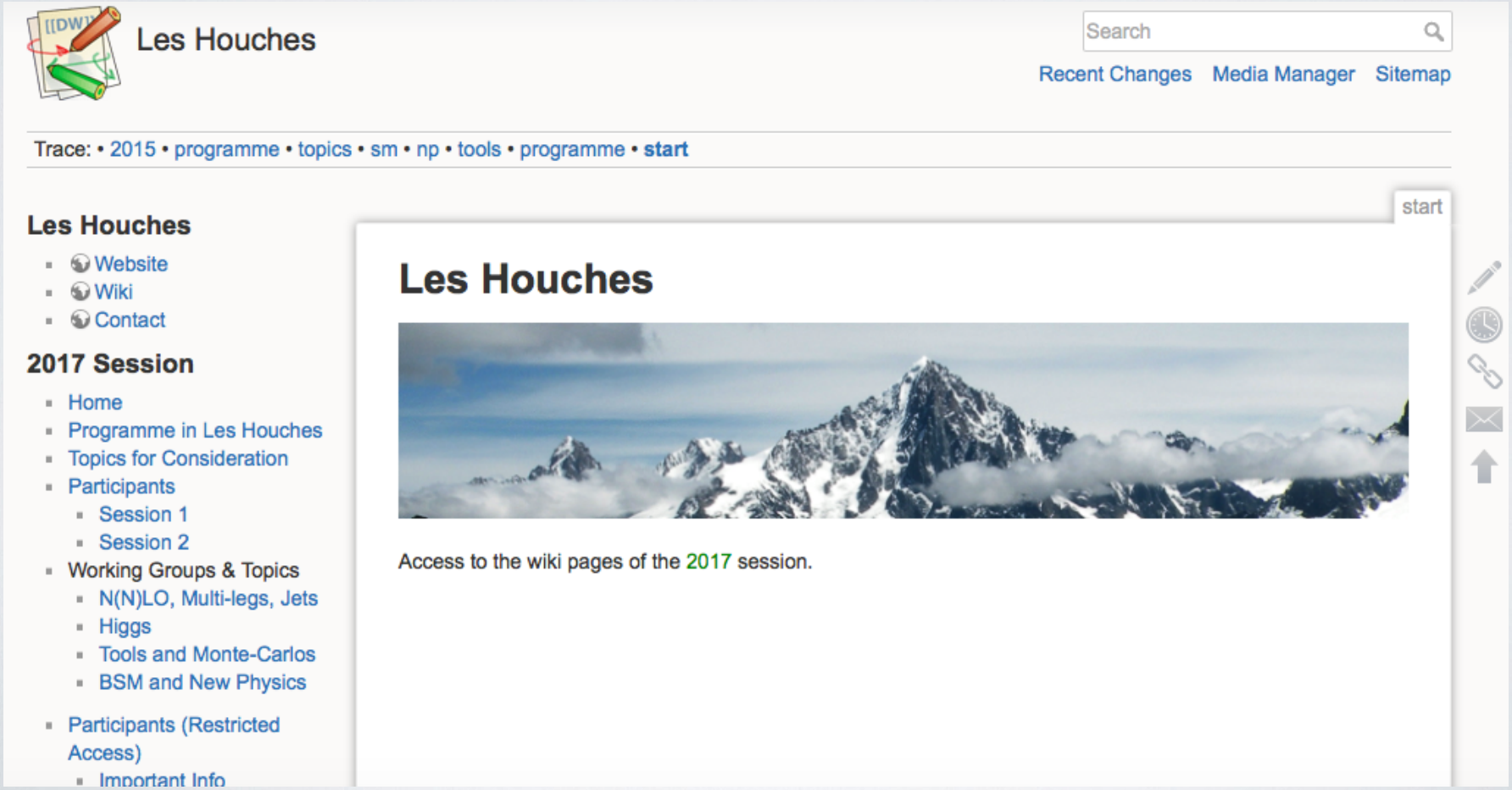
LHAPDF (structure functions)

- fewer users.
- evolves PDFs ... no long lookup tables
- Includes code==maintenance
  - To be moved to Durham, maintained by Mike Whalley
- To do:
  - Need to allow possibility of having many PDFs in memory at one time, to facilitate use of PDFs with uncertainties.
  - Need access to:
    - Λ_4 Λ_5 $c_{threshold}$ $b_{threshold}$, Q_{min}, x_{min}
  - allow for $p \rightarrow \gamma$ (need to include evolution)
  - and other beam particles, π, ...
  - Other smaller changes.
    - Map author strings onto integer
  - Try to make everything backwards compatible.
- J. Huston to coordinate.


Les Houches Discord
Les Houches 2001 accord between matrix element generators, Monte-Carlo programs
Idea is to set same thing up between SUSY spectrum generators and other programs (co-ordinator: P Skands)
Reduces number of different interfaces from n^2 problem to n
long discussions
SUSY SPECTRUM
DECAY
MC
At Les Houches 2003, then implemented one simple case (CMSSM); it threw up problems in the interface design
Design principles: general structure which can be extended, conventions for particular case etc., higher loops very thorny
JUN 6 2003

PROGRAMME

Programme and Planning updated daily, CONSULT the WiKi and do the Wiki, Wiki



Les Houches Spirit 2015

Les Houches Spirit 2015

What is a Quark Jet?

From lunch/dinner discussions

14h30-16h00	General Discussion & Task Assignment, Round Table	All	Auditorium
16h00-16h30	Coffee/Tea Break		Lounge in Main Building

19h00-19h30	Welcome Drink, …	LH Restaurant
19h30-	Dinner, …	LH Restaurant

Wednesday 7 June

09h00-10h00	Parton shower: uncertaintes, matching/merging	working group	Auditorium
10h30-12h30	NNLO	working group	Auditorium
16h30-18h00	STXS discussion 1	Higgs	Library

Thursday 8 June

10h30-12h30	STXS discussion 2	Higgs	Library
14h00-15h30	Ntuples, APPLfast	working group	
16h30-18h00	STXS discussion 3	Higgs	Library

PROGRAMME

Programme and Planning updated daily, see also the board in the entrance hall, outside the auditorium

Les Houches

Login

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

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 betwee
  - 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

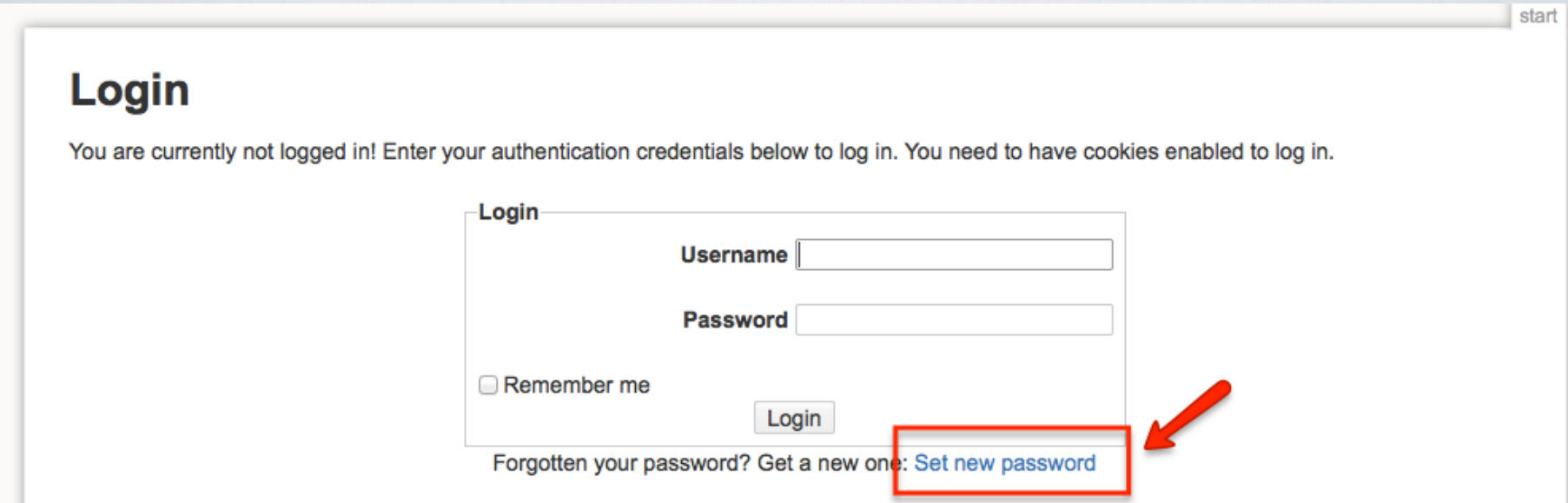
- **Schemes to systematically evaluate uncertainties in the new NLO tools**
  - which scales to vary: standard renormalisation and factorisation scales in matrix elements
  - also in showers? if so, how?
  - starting scales of shower? how about contact to resummation calculations?
  - systematic variation 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.

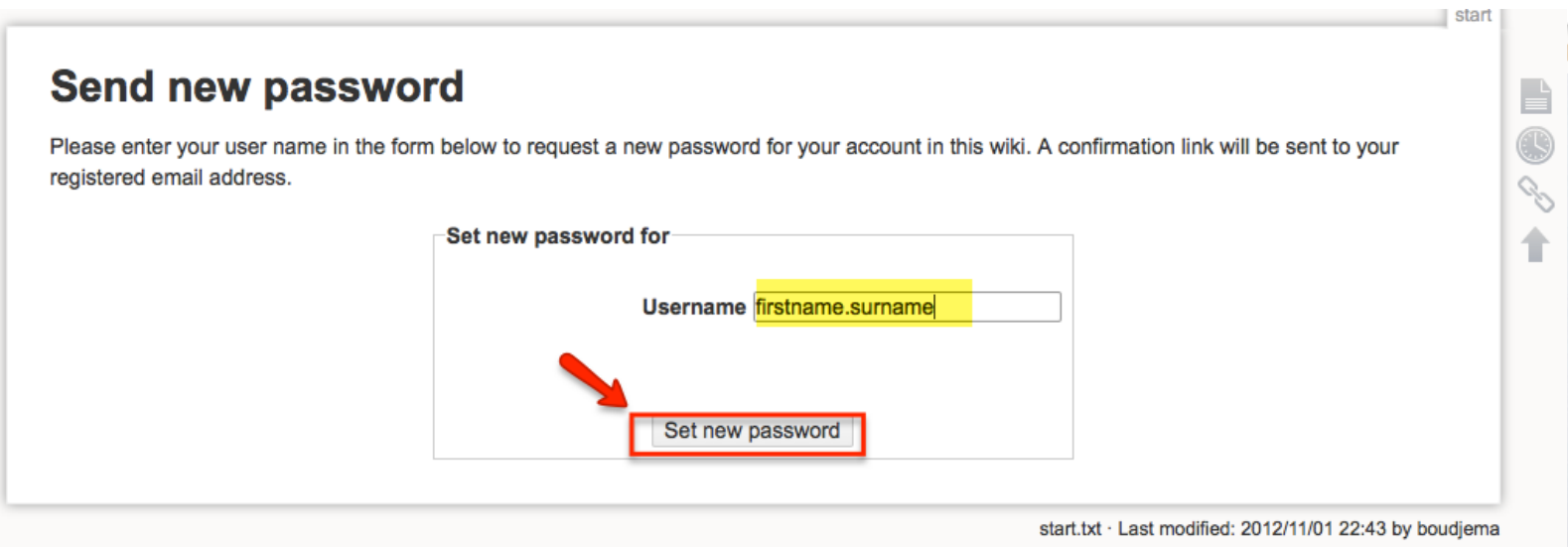
A list of topics for session 2

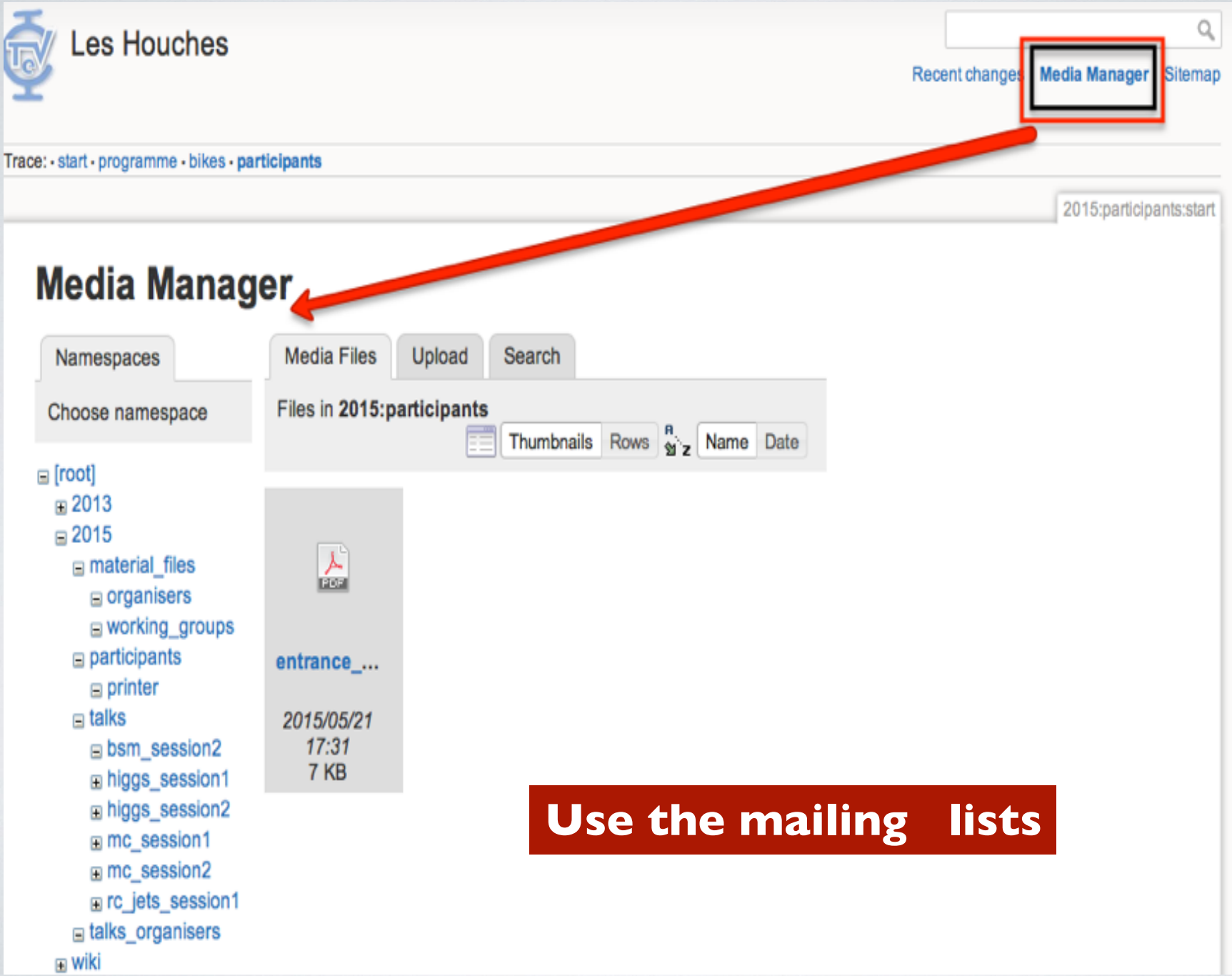
- Proposal for a new event file format (to get rid of the huge stdhep and hepmc files)
- Extending the SLHA to include cross section information (automate event-by-event weighting with higher order cross sections)
- SMS decomposition: Libraries with simplified models, the associated analyses, LHC results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

WIKI

All of you have an account






Les Houches
Recent changes
Media Manager
Sitemap
Trace: • start • programme • bikes • participants
2015:participants:start
Media Manager
Namespaces
Choose namespace
[root]
2013
2015
material_files
organisers
working_groups
participants
printer
talks
bsm_session2
higgs_session1
higgs_session2
mc_session1
mc_session2
rc_jets_session1
talks_organisers
wiki
Media Files
Upload
Search
Files in 2015:participants
Thumbnails
Rows
Name
Date
PDF
entrance_...
2015/05/21
17:31
7 KB
Use the mailing lists


Main Hall


QCD Room


Library (Cosy)


Library (serious)


Extra Room


Printer Corner

MEETING AND DISCUSSION ROOMS: ALL WITH BLACKBOARD, VIDEO PROJECTORS

- Auditorium =70 people
- QCD Room~22 (25 max)
- Library~15+15~30

Reservation of video projectors, (slide projectors): See local organisers

JPG, FB, Philippe G, Nicolas B.

Seminar Room allocation: Reserve on the boards outside the auditorium, or on the wiki

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THE WEATHER

In a letter to DeWitt-Morette, Freeman Dyson wrote,

"As I remember it, the school was an overwhelming experience. We were sharing every waking hour with a bunch of ebullient young people ... But **the lectures were the least important part of the school. Much more memorable were the informal sessions, the meals and the walks, the daily hardships of mud and rain we all shared ..** We all lived together in a cowshed and gave lectures in a barn ... living together under primitive conditions is a wonderful way to make friends. **Bad weather makes friendships closer."**

FINANCIAL TIMES
ft.com > life&arts >

House & Home

Country house guests now regard WiFi as more important than staff,

May 24, 2013 7:36 pm

The importance of a gizmo-friendly bathroom with WiFi

By David Tang

Should homes be redesigned to anticipate a changing world? Excellent internet access is key

Sir David Tang, entrepreneur and founder of ICorrect, offers advice on questions about property, interiors – and modern manners for globetrotters

In view of the ever-changing internet world, should there be design elements for homes, whether newly built or not, to anticipate a changing world of living?

I would concentrate on the bathroom and make it larger and soften it with pieces of furniture and dispense with, as much as possible, all the hard surfaces like marble floors or tiling walls. The reason is because, increasingly, people are going to spend

EDITOR

VIDEO

Jane Ov
Flower
annivers

MOST P

NETWORK & COMPUTING

- what we used to say

- don't expect your usual internet connection speed when 40 people are on skype and others on youtube,

share ?????

Networks

1. EDUROAM

2. WIFI ACCESS
look at the folder in your pigeon hole, credentials to use this network are given..


MAY 31 2001
ROUSSETTE DE SAVOIE
APPELLATION ROUSSETTE DE SAVOIE CONTRÔLÉE
PRODUCE
OF FRANCE
Adrien Vacher
73800 Les Marches
MAY 31 2001

- **Restaurant**:
  - Lunch: 12.30 (exception today 12.45) sharp, coffee (free) after lunch at the bar (below the restaurant)
  - Dinner: 19.30. Try and Enjoy the local wines to make new friends. A jar of wine per table is part of the deal. More you pay.
- **Bar** open after dinner. Count how much you drink, alcohol, beer included, not free
- Coffee and tea breaks: please wash your cups. Soda not free, write your name on the list, settle bill before departure. (Expresso free)
- Lunch boxes: order the night before. If you plan to skip lunch let us know

- Today 19.00 Welcome Drink
  - The Centre Restaurant/Cafeteria

- Monday June 12th Workshop Dinner

OUTDOOR ACTIVITY

OUTDOOR ACTIVITY

- Climbing, hiking, walks, maps: Jean-Philippe G
  - weather permitting, Sunday is a "rest" day.
- Cycling
- Please inform at least one of the organisers, let them know where you are going, fill **the book in the hall,** give approximate time of when you'll be back
  - It's a good idea to write

down your mobile phone number

Mountain Bikes

There are 5 mountain bikes, first come, first served. The keys are on a board by the Secretariat. Write your name and indicate the bike number and the time you are reserving for.

The bikes are kept in the shed (building 951) by the restaurant, see intranet=wiki participants


Follow the guide

SECRETARIAT IN THE CENTRE

- Secretariat: fees, accommodation issues
  Open from 8.45-12.30 & 13.30-17.30 (closed week end)

  - Please pay your fees (non FP support)
  - FP (those working in the French system): please leave the *attestation* in my pigeon hole
  - All non FP will have to contact the Les Houches secretariat and pay the fees directly to them starting from 2pm today
  - Ticket (pass) for the Chamonix Valley (buses and train): ask Secretariat

EMERGENCY NUMBERS

- Fawzi : +33 6 87 82 87 83
- Jean-Philippe: +33 6 52 77 49 50
- Philippe + 33 6 77 78 05 98
- Emanuele +33 7 68 22 86 21 or +41 7 62 78 14 49
- In case of emergency contact the caretaker, Jean Francois Aubrun, Alpens, Apt 3, +33 6 78 98 52 40. On WE replaced by agents form a security firm, same tel. number

Important Information for the 2017 Participants

Some information for those attending the Workshop in Les Houches will be posted here.

Use of Wiki: go here

- **Network and Wifi Connection**: Please Read and Set up BEFORE you come to Les Houches: go here
- **Book your seat on the Workshop Bus** (CERN ←→ Les Houches): go here
  - Session 1: **WARNING (Sat. June 3)** The bus for the trip on Monday 5th from CERN to Les Houches is **FULL** (49 passengers). Unless someone cancels, you can no longer add your name. We will stick by the list as of Sat. June 3 at 11.57am (French Time)!. The list is here. If you have any problem send an email to houches@lapth.cnrs.fr.
    - If you are registered to take the bus but at the last minute will not be able to take the bus (plane late,..), please call Philippe (Gras) on his mobile at CERN: +41 75 411 1971.
    - For Monday 5th, the car driver's telephone number is +33 6 87 32 05 76. The bus company is SABA.
  - Session 2: If you are registered to take the bus but at the last minute will not be able to take the bus (plane late,..), please call Gregory (Moreau) on his mobile: + 33 6 64 88 17 26 (French number).

More info will be posted in due time. Please consult the sections below. Emails will be sent when updates will be made. You can also subscribe to changes to this page.

Session 1

- **Lodging Plan**
  - The plan will show you where your room and chalet is. The lodging plan for session 1 is now available, you can download it if you wish Download the lodging plan for session 1
  - You will also need the **pin code** to enter the buildings/chalets in Les Houches and access your room See here. Once you get your pin code it is advisable that you save it on your phone address book.
- **Emergency Numbers**
  - Fawzi: +33 6 87 82 87 83 (on WhatsApp also)
  - Jean-Philippe: +33 6 52 77 49 50
  - Emanuele: +33 7 68 22 86 21 (Fr) or +41 7 62 78 14 49 (CH)
  - In case of a serious problem, contact the caretaker, Jean-Francois AUBRUN, Alpens, Apartment 9, 3rd floor, Tel. +33 6 78 98 52 40
- **31 May Bulletin** here
- **1st Sunday of Session 1 Bulletin: Programme/Outing for Sunday** here
- **12 June Bulletin : A few important things before you leave** here

contact the organisers present in session 1

Email all the participants of session 1 (present in LH)

In Memoriam

Guido Altarelli
Pierre Binétruy
DP Roy
Yoshimitsu Shimizu

(Cécile DeWitt-Morette)
(Raymond Stora)

HAVE A NICE WORKSHOP!!