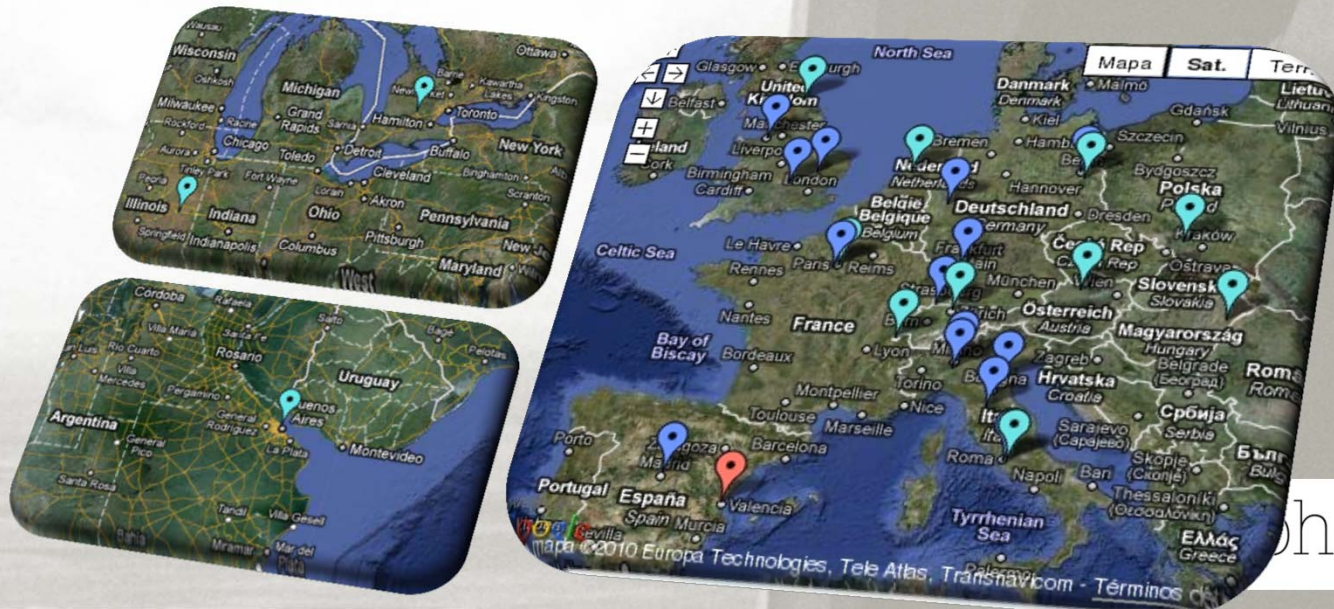# LHCphenOnet

Advanced Particle Phenomenology in the LHC era

Marie Curie Initial Training Network
PITN-GA-2010-264564 (2011–2014)

11 Partners + 3 AP in 13 countries, of which 3 industry partners (one at Level 1, two as AP), about 150 researchers from 30 institutions

Research goal

higher order perturbative corrections in the Standard Model and beyond, with emphasis on phenomenology at the LHC, and the development of customized open source software for **precision physics and discovery at colliders**.

LHCphenOnet

LHCPhenoNet node structure

Network Partners	Institutions involved	Scientist in charge
1 - Spain	CSIC, Universitat de València, Universidad Autónoma de Madrid	Germán Rodrigo
2 - Argentina	Universidad de Buenos Aires	Daniel de Florian
3 - France	CNRS, Université Paris VI, CEA	Matteo Cacciari
4 - Germany	DESY, Humboldt-Universität zu Berlin, KIT Karlsruhe, Universität Wuppertal, MPI München	Sven-Olaf Moch
5 - Hungary	Debreceni Egyetem	Zoltán Trócsányi
6 - Italy	INFN, Università di Firenze, Università di Milano-Bicocca, Università di Pavia, Università Roma Tre, Universitá di Ferrara	Vittorio Del Duca
7 - Netherlands	FOM	Eric Laenen
8 - Poland	Uniwersytet Slaski, IFJ-PAN Krakow	Janusz Gluza
9 - UK	Durham University, Liverpool University, Cambridge University, Oxford University	Adrian Signer ▶ **Daniel Maitre (Feb 2012)**
10 - Switzerland	Universität Zürich, ETH	Thomas Gehrmann
11 - RISC	RISC Software GmbH, Universität Linz	Wolfgang Freiseisen
AP1 - CERN	CERN	Michelangelo Mangano
AP2 – Wolfram Research	Wolfram Research, Inc	Roger Germundsson
AP3 – Maplesoft	Maplesoft™	Jürgen Gerhard

IFIC Valencia	Germán Rodrigo	
	Amparo Llorens	Network management
	Sebastian Buchta	ESR (Jan-Nov 2011)
	Lucia Hosekova	ESR (Nov 2011-Oct 2012)
	Ioannis Malamos	ER (Mar 2012-Feb 2013)
	Petros Draggiotis	
	Grigorios Chachamis	
	Francisco Campanario	
	Vicent Mateu	
	Michal Deak	
IFT Madrid	Agustín Sabio Vera	
	Riccardo Torre	ESR at Universität Zürich (Jan-Mar and Jul-Aug 2011)
	Martin Hentschinski	
	Clara Salas	
	Eduardo Serna	
	José Daniel Madrigal	

Research topics

- Top quark physics: charge asymmetries

- New perturbative methods in QFT: the duality theorem, reduction of multiloop amplitudes at the integrand level.

- Higgs boson in VBF

- Small-x resummation, Diffraction

Main collaborations within the network

- Karlsruhe, Firenze, Buenos Aires, CERN, Durham, Zürich

Meetings

- Kick-off meeting 2011

Progress on Training and Management Activities

http://www.lhcphenonet.eu/jobs

Thanks to Matteo Cacciari (LPTHE Paris)

- 4 calls for ER/ESR positions
- Next call in Sep-Oct

Call 4 -- ESR/ER grants 2012 in LHCPhenoNet

Online Application Procedure

INSTRUCTIONS

1. Please fill in the form below and click on the "Submit Online Application" button at the end of the form. Do NOT submit the application form more than once.

2. Shortly after submitting the form you will receive an automated confirmation e-mail containing your application ID number.

3. An email will be sent directly to your referees that you nominate in your online application. This email will contain their username and password and a link which will take them to a secure, confidential web interface. It is important that you inform your referees beforehand about your application to LHCPhenoNet, so that they expect an email from us.

4. The referees can use this web interface to submit their recommendation letter directly into your application file on the LHCPhenoNet server and they will receive a confirmation. This procedure is simple and secure.

All information and documents submitted by you and your referees is stored in a confidential database, which can be accessed only by the LHCPhenoNet Recruitment Board. We appreciate your cooperation with this application procedure.

If you have any difficulty in using this web interface, please send an email to cacciari AT lpthe.jussieu.fr

GENERAL INFORMATION (All fields are mandatory)

First name

Last name

Appointed fellows and visiting scientists 2011-Sep 2012

Partner	Fellow	ER ESR	Task	Starting Date	Ending Date
Spain	Sebastian Buchta	ESR	M1.4 M4.1	16/01/2011	30/11/2011
	Lucia Hosekova	ESR	M1.4 M2.1	16/11/2011	16/11/2013
	Ioannis Malamos	ER	M4.1	01/03/2012	28/02/2013
Argentina	Roger Hernández Pinto	ESR	M2.4 M3.2	01/06/2011	30/05/2014
France	Emanuele Bagnaschi	ESR	M2.3 M3.3	04/10/2011	03/10/2014
Germany	Jakob Ablinger	ESR	M3.2 M4.3	01/09/2011	31/08/2012
Hungary	Damiano Tommasini	ESR	M2.1 M3.3	04/05/2012	03/04/2013
	Roman Derco	ESR	M3.3	01/07/2012	30/06/2014
Italy	Leandro Cieri	ESR	M1.1 M2.1	01/02/2012	30/04/2013
Netherlands	Domenico Bonocore	ESR	M1.3 M3.3	01/12/2011	30/11/2014
Poland	Valery Yundin	ESR	M1.4	17/01/2011	16/09/2011
	Radomir Sevillano	ESR	M1.4 M2.4	07/11/2011	06/03/2014
UK	Marek Schönherr	ESR	M3.4	01/10/2011	30/09/2012
	Xuan Chen	ESR	M1.4 M3.3	01/12/2011	30/11/2012
Switzerland	Riccardo Torre	ESR	M2.3 M2.4	01/01/2011	31/03/2011
				01/07/2011	31/08/2011
	Damiano Tommasini	ESR	M2.1	01/03/2011	31/08/2011
	Matteo Fael	ESR	M2.3	01/01/2012	31/12/2012
	Oliver Dekkers	ESR	M4.1	01/02/2012	31/05/2012
Austria	Mark Round	ESR	M3.2 M4.2	06/10/2011	06/10/2013
Partner	**Visiting Scientist**			**Starting Date**	**Ending Date**
Germany	Andrzej Czarnecki (University of Alberta)			01/05/2012	31/05/2012
Italy	Vladimir A. Smirnov (Moscow State University)			06/10/2011	20/10/2011
				08/02/2012	18/02/2012

Appointed fellows in 2012 after the Mid-Term Meeting

Partner	Fellow	ER ESR	Task	Starting Date	Ending Date
Germany	Matthew Dowling	ESR	M1.2	01/10/2012	30/09/2013
	Clemens Raab	ESR	M4.3	01/10/2012	30/09/2013
Italy	Adam Kardos	ESR	M2.2 M3.3	01/01/2013	31/03/2014
Netherlands	Kasper Larsen	ER	M4.1	01/10/2012	30/09/2013
Poland	Ievgen Dubobyk	ER	M4.3	01/10/2012	30/09/2013
UK	Tomas Jezo	ESR	M1.3 M3.2	01/10/2012	30/09/2013
Switzerland	James Currie	ER	M3.3 M4.1	01/10/2012	30/09/2013
Austria	Alexander Hasselhuhn	ESR	M3.2 M4.3	01/10/2012	30/09/2014
Partner	**Visiting Scientist**			**Starting Date**	**Ending Date**
Italy	Vladimir A. Smirnov Moscow State University			09/09/2012	22/09/2012
Netherlands	Lorenzo Magnea Università di Torino			tbc	

Implemented versus foreseen ESR+ER person/months 2011 to Sep 2012
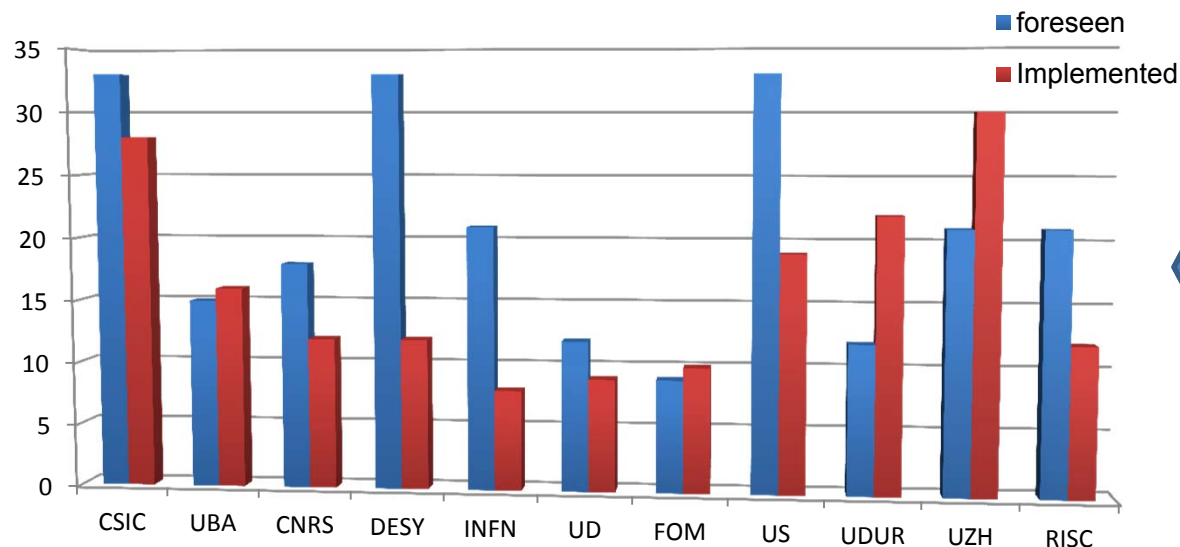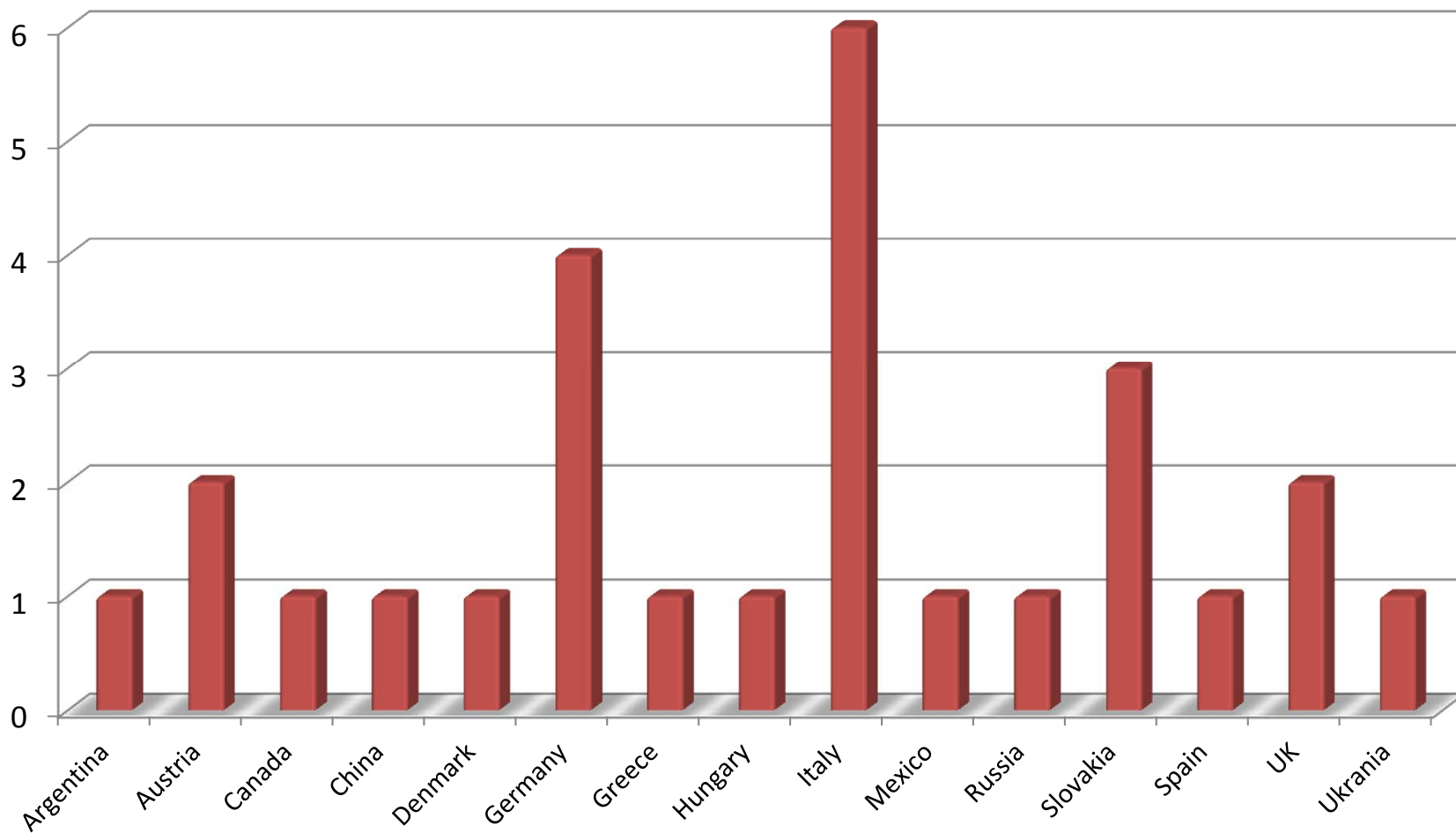

171 person/months implemented versus 228 foreseen

Appointed versus foreseen ESR+ER person/months 2011-2014
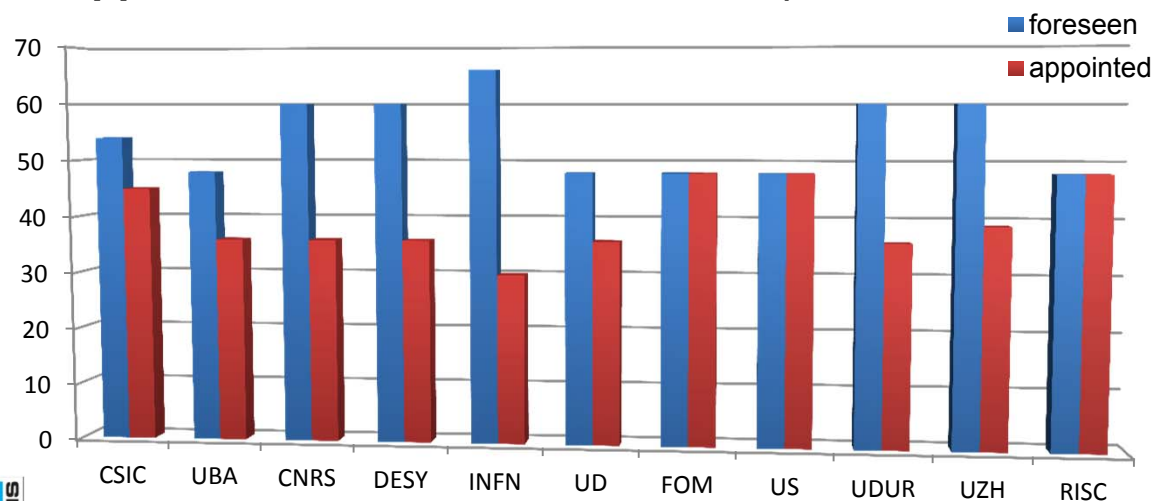
73 % appointed

New ER at UBA just accepted

ESR/ER nationality

LHCPhenoNet

Advanced Particle Phenomenology in the LHC era

Search...

Zeuthen Theory Postdoc positions

By **mallose**, September 11, 2012 9:43 am   💬 Comments Off

DESY is seeking: Several Postdoc (f/m) positions Work will start on 1 October 2013. Deadline for applications:10 January 2013.
For further information please contact Prof. Dr. Johannes Blümlein: johannes.bluemlein@desy.de.
For details see the webpage : http://theory-zeuthen.desy.de/.

📁 **Jobs**

TH/LPCC Institute on SM at the LHC

By **mallose**, August 13, 2012 8:55 am   💬 Comments Off

October 1, 2012 to October 12, 2012

TH/LPCC Institute on SM at the LHC
CERN, Geneva, 1-12 Octubre 2012

📁 **Events**

Un tè con Peter Higgs

By **lhcphenonet**, July 9, 2012 10:53 am   💬 Comments (0)

An interview with Peter Higgs by Vittorio del Duca, published by the **INFN journal, Asimmetrie**

English version

📁 **Highlights**

Event Calendar

« Aug   🔊   Oct »

September 2012

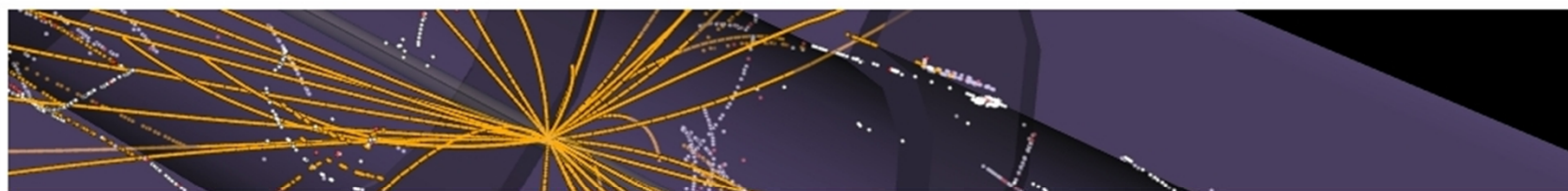| M	T	W	T	F	S	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

🔊CERN @ twitter

⊞ RT @isgtw: A year's amount of #LHC data would be 600 million years of #music. #Higgs boson would appear as a few minutes of music. http: ... about 1 month ago from web

⊞ LHC 2012 proton run extended by seven weeks http://t.co/9f78Jkfj about 1 month ago from web

⊞ Of Mind and (sub-atomic) Matter – European Brain Council @CERN http://t.co/fTRvJkyl about 1 month ago from web

⊞ How CERN's LEIR accelerator could help serve biomedicine http://t.co/XAiQHmBQ about 1 month ago from

LHCPhenoNet

Advanced Particle Phenomenology in the LHC era

Search...

Navigation

Home | About | Deliverables ▾ | Fellows site | Highlights | ITN Events | Jobs ▾ | Outreach ▾ | Research ▾ | Teams

Teams

By **lhcphenonet**, August 5, 2010 2:43 pm

The consortium consists of 12 teams from 28 European Universities and Research Institutes, the University of Buenos Aires, CERN, and 3 partners from the industrial sector.

To see **LHCPhenoNet** in a larger map

List of people under construction

Show 10 entries   Search:

Event Calendar

« Aug   Oct »

September 2012

M	T	W	T	F	S	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

CERN @ twitter

RT @isgtw: A year's amount of #LHC data would be 600 million years of #music. #Higgs boson would appear as a few minutes of music. http: ... about 1 month ago from web

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How CERN's LEIR accelerator could help serve biomedicine http://t.co /XAiQHmBQ about 1 month ago from

Network wide Events

⦿ Annual meetings to coordinate the network activities and asses the research progress (Supervisory Board meeting).

⦿ Network schools to complement local training by leading experts.

⦿ Priority to presentations by young researchers (not only ESR and ER) to enhance their presentation skills in a relaxed atmosphere.

⦿ Training in complementary skills: ESR and ER become members of the Local Organizing Committees.

⦿ Create a networked community, open new collaborations.

LHCphenOnet

Kick-off meeting of the LHCPhenoNet Initial Training Network, Valencia, Spain, 1-4 February 2011

http://www.lhcphenonet.eu/valencia2011

about 70 participants

One session devoted to ESRs presentations:
Sebastian Buchta, Valery Yundin and Riccardo Torre

Presentations by industry partners:
Dave Hare (Maplesoft), Oleksander Pavlik (Wolfram)
and Roman Stainko (RISC)

LHCPhenoNet Annual Meeting   Lumley Castle County Durham   19-22 March 2012

51 participants, including industry partners, 37 presentations

School of Analytic Computing in Theoretical High-Energy Physics

Atrani, Italy, 6-11 October 2011
http://www.lhcphenonet.eu/atrani2011

Simon Caron-Huot	*Aspect of scattering amplitudes*
Johannes Henn	*Wilson loops in N=4 SYM*
Luis F. Alday	*Scattering amplitudes at strong coupling*
Claude Duhr	*Momentum twistors, special functions and symbols*
Henrik Johansson	*N=4 SYM and N=8 supergravity amplitudes*
Volodya Smirnov	*Modern methods for multiloop Feynman integrals*

27 PhD students and postdocs, 23 lectures.

LHCPhenoNet Winter School

Stefano Franscini Conference Centre at
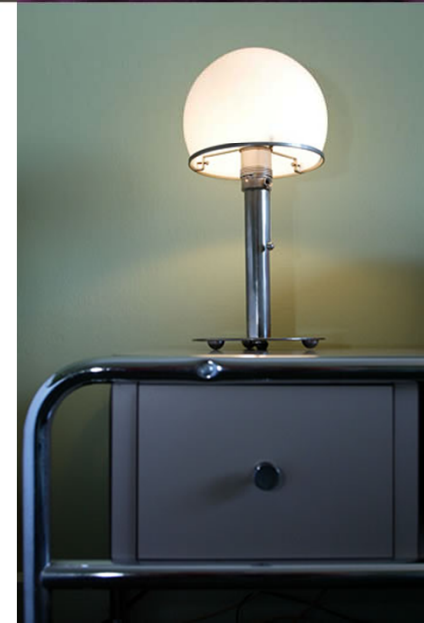Monte Verità, Ascona, Switzerland
22 - 29 January 2012

Lectures

QCD and jet physics,	by M. Cacciari
Methods for higher order calculations,	by L. Dixon
Physics beyond the Standard Model,	by A. Romanino
Monte Carlo event generators,	by R. Frederix
Parton Distribution Functions,	by M. Ubiali
Results from the Tevatron,	by T. Junk
Results from the LHC,	by G. Dissertori

53 students, of them 10 ESR of the network, 30 lectures
http://www.lhcphenonet.eu/ascona2012

LHCPhenoNet Winter School

Stefano Franscini Conference Centre at
Monte Verità, Ascona, Switzerland
22 - 29 January 2012

Students session: 11 presentations

LHCPhenoNet School on Integration, Summation and Special Functions in Quantum Field Theory

RISC at Schloss Hagenberg near Linz, Austria, 9-13 July 2012

http://www.lhcphenonet.eu/linz2012

22 PhD students and young scientists,
17 leading experts including industry partners

evaluation questionnaires of the network schools

Question	Atrani 2011	Ascona 2012	Linz 2012
What is your overall evaluation of the School? (1=very negative, 5=very positive)	4.3	4.5	4.1
Would you recommend the School to a colleague? (1=definitely not, 5 =definitely)	4.2	4.7	4.0
Did the School give sufficient technical details for your interests? (1=never, 5=always)	4.1	4.1	3.8
What do you think about the length of the School? 1=far too short, 5=way too long)	2.8	3.2	3.4
What do you think about the location of the School? (1=horrible, 5=excellent)	4.7	4.1	4.3
What is your general impression of the lectures? (1=not at all useful, 5=very useful)	4.0	4.3	4.0
What is your opinion on the amount of lectures? (1=far too few, 5=far too many)	3.0	3.5	3.6

MARIE CURIE ACTIONS

LHCphenOnet

Network event	Web site	Participants	Month
LHCPhenoNet Kick-off Meeting, Valencia, Spain, Feb 1-4, 2011	http://www.lhcphenonet.eu/valencia2011	70	2
LHCPhenoNet School on Analytic Computation in High Energy Physics, Atrani, Italy, Oct 7-11, 2011	http://www.lhcphenonet.eu/atrani2011	36 (27)	10
LHCPhenoNet Winter School, Ascona, Switzerland, Jan 22-29, 2012	http://www.lhcphenonet.eu/ascona2012	62 (53)	13
LHCPhenoNet Annual Meeting 2012, Durham, UK, 19-22 Mar 2012	http://www.lhcphenonet.eu/durham2012	51	15
LHCPhenoNet School on Integration, Summation and Special Functions in QFT, Linz, Austria, 9-13 Jul 2012	http://www.lhcphenonet.eu/linz2012	39 (22)	19
LHCPhenoNet Mid-Term Meeting Ravello, Italy, Sep 16-20, 2012	http://www.lhcphenonet.eu/ravello2012	43	21
Next meetings			
Computer Algebra in Particle Physics, DESY Zeuthen, Germany, Mar 10-15, 2013			27
Summer School	Katowice 2013		33
Annual Meeting	CERN 2013		36
Summer School	Debrecen 2014		44
Final Meeting	Berlin 2014		48

Secondments to the industry partners
coordinated by Johannes Blümlein

♯ Roman Derco (Debrecen)	Sep-Dec 2012
♯ Domenico Bonocore (Paris)	Sep-Dec 2012
♯ Emanuele Bagnaschi (Amsterdam)	Sep-Dec 2012

♯ Lucia Hosekova (Valencia)	Jan-Mar 2013
♯ Xuan Chen (Durham)	tbc

♯ Radomir Sevillano (Katowice)	Oct-Dec 2012
♯ Michael Ochman (Katowice)	Oct-Dec 2012

LHCphenonet

Outreach
Kick-off Meeting Valencia 2011

The LHC: living with the Uncertainty Principle
Public talk by **David Kaplan** (Johns Hopkins University)
at the Kick-off meeting
Video from http://www.lhcphenonet.eu/outreach

About 150 attendants

Outreach
Annual Meeting Durham 2012

LHCphenonet Annual Meeting 2012
Special Event for Sixth Form Students

A unique opportunity to experience the atmosphere of an international conference and talk with world leading scientists

Wednesday March 21st 2012
Talk starts at 1:30pm
'Ask a particle physicist' panel at 2:30pm
Coffee at 3:00pm

'A TUNNEL TO THE BEGINNING OF TIME'
by Dr. Pete Edwards

In November 2009, following repairs, the start button for the biggest scientific experiment in the history of mankind was pressed. Using the Large Hadron Collider (LHC) we hope to travel back to the Big Bang, create mini black holes, and reveal the nature of the dark side of the universe. Come along to explore the immense scale of the experiment, find out how the LHC works, and ponder some of the big questions it will address.

You must register to attend this event.
Please email: trudy.forster@durham.ac.uk
Closing date for applications is Sunday 4th March 2012

Lumley Castle Hotel
Chester le Street
County Durham
DH3 4NX

http://www.ippp.du

About 50 students (ages 17 to 18) from six local schools.

Outreach

Mid-Term Meeting Ravello 2012

LHCPhenoNet Mid-Term Meeting

Il CERN, l'acceleratore LHC e il bosone di Higgs

Aleandro Nisati | *INFN - Sapienza*

interviene
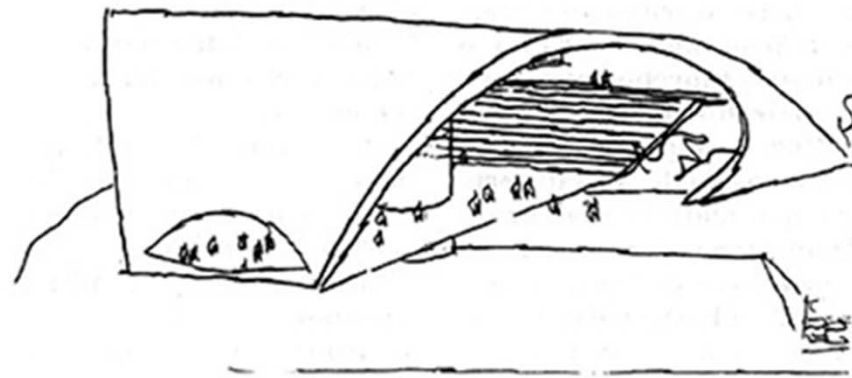Paolo Vuilleumier | *sindaco di Ravello*

Auditorium Niemeyer
Ravello, Italy
www.lhcphenonet.eu/ravello2012

giovedì 20 settembre 2012 | 18:30
ingresso libero

Networking

- Network wide events

- Web site at http://www.lhcphenonet.eu

- Network mailing lists: lhcphenonet@listas.csic.es and lhcphenonet_fellows@listas.csic.es

- @lhcphenonet

- Two supervisors from two partners

- Secondments, including industry

- 56% of the publications from networked research:
  61 papers with two partners, 31 with three,
  and 12 with four or more

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Issue No. 15-16/2011 - Monday 11 April 2011
Printable version

New EU project supports LHC theorists

LHCPhenonet, a new EU-funded research network aimed at improving the theoretical predictions that guide the LHC experiments, has begun its 4-year run as a Marie Curie Initial Training Network. CERN joins the network as an associate partner, along with almost 30 multinational institutions and computing companies.

Theorists from around the world gathered in Valencia to attend LHCPhenonet's kick-off meeting.

LHCPhenonet will create research opportunities for young, talented European theorists, providing funding for both doctoral and post-doctoral positions across the various participating institutions – including the University of Durham, DESY, and the Istituto Nazionale di Fisica Nucleare (INFN). LHCPhenoNet aims to improve the Quantum Field Theory calculations that set the parameters of the LHC experiments, focusing on the LHC phenomenology that gave it its name. The 4.5 million euro project is funded by the EU's 7th Research Framework Programme and will be coordinated through the Spanish Research Council (CSIC) and

Progress on Research Tasks

http://www.lhcphenonet.eu/publications

Thanks to Tobias Kasprzik and Matthias Steinhauser

KIT
Karlsruhe Institute of Technology

Institute for Theoretical Particle Physics (TTP)

LHCPhenoNet Preprints 2012

2011   Recent

All about LHCPhenoNet preprints

- **LPN12-092**
  t tbar W and t tbar Z Hadroproduction at NLO accuracy in QCD with Parton Shower and Hadronization effects
  by M.V. Garzelli, A. Kardos, C.G. Papadopoulos, Z. Trocsanyi
  also available as arxiv: 1208.2665

- **LPN12-087**
  Supersymmetric next-to-next-to-leading order corrections to Higgs boson production in gluon fusion
  by Alexey Pak, Matthias Steinhauser, Nikolai Zerf
  also available as arxiv: 1208.1588

- **LPN12-086**
  ABM11 parton distributions and benchmarks
  by S. Alekhin, J. Blümlein, S. Moch
  also available as arxiv: 1208.1444

- **LPN12-084**
  Single-top t-channel hadroproduction in the four-flavour scheme with POWHEG and aMC@NLO
  by Rikkert Frederix, Emanuele Re, Paolo Torrielli
  also available as arxiv: 1207.5391

- **LPN12-083**
  Resummed small-x and first-moment evolution of fragmentation functions in perturbative QCD
  by C.-H. Kom, A. Vogt and K. Yeats
  also available as arxiv: 1207.5631

- **LPN12-082**
  Diphoton spectrum in the mass range 120-140 GeV at the LHC
  by Leandro Cieri
  also available as arxiv: 1207.3252

MARIE CURIE ACTIONS

enonet

Work Packages

WP1: Precision

WP2: Discovery

WP3: Support to Experiments

WP4: Technological Innovations

WP1: Precision

The WP1 aims at advances in the complete modelling of hard interaction events at the LHC for a large variety of Standard Model (SM) processes at high precision:

⦿ M1.1 V(VV) + n jets

⦿ M1.2 Top quarks + n jets

⦿ M1.3 Resummation

⦿ M1.4 On-shell NLO amplitudes

LHCphenOnet

M1.1 precise predictions at NLO or NNLO for the production of W, Z and γ bosons

- di-boson events WW, ZZ and WZ, in association with jets (LPN11-11, LPN11-20, LPN11-22, LPN12-024, LPN12-025, LPN12-040, LPN12-051, LPN12-058), photons (LPN11-14, LPN11-32, LPN11-38), or bottom quarks (LPN11-85),

- dedicated analyses of the decays (LPN11-37),

- Two loop helicity amplitudes for Wγ and Zγ (LPN11-92),

- multi-jet production within QCD (LPN12-063, LPN11-30) for new physics studies,

- **Diphoton production** a classical signal within the SM and an important background for Higgs boson and new-physics searches (LPN11-74, LPN12-082, Cieri) and **parton-level Monte Carlo program 2γNNLO**.
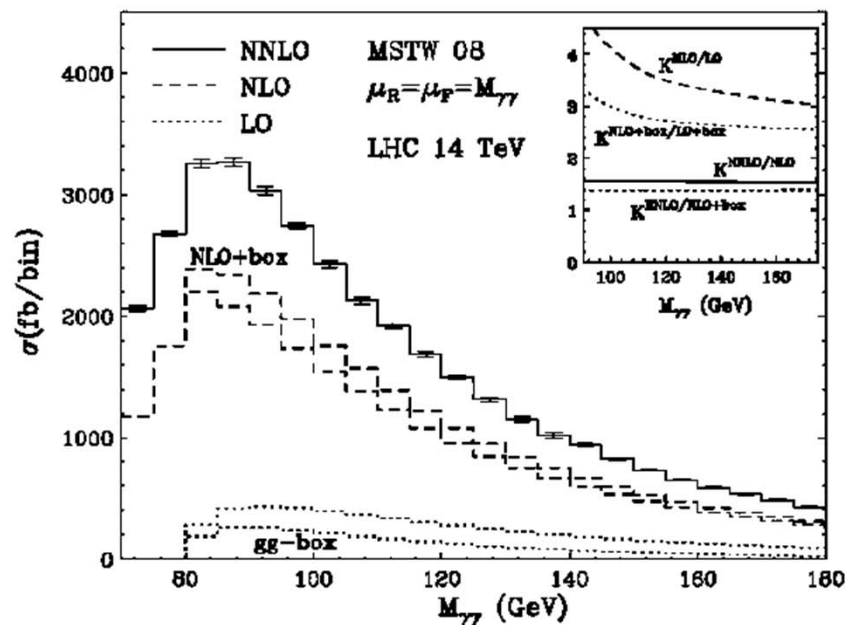
Distribution of the invariant mass of the photon pair at the LHC (14 TeV): LO (dots), NLO (dashes) and NNLO (solid) results. The inset plot shows the corresponding K-factors, defined by the ratios NLO/LO and NNLO/NLO (LPN11-74, LPN12-082, Cieri).
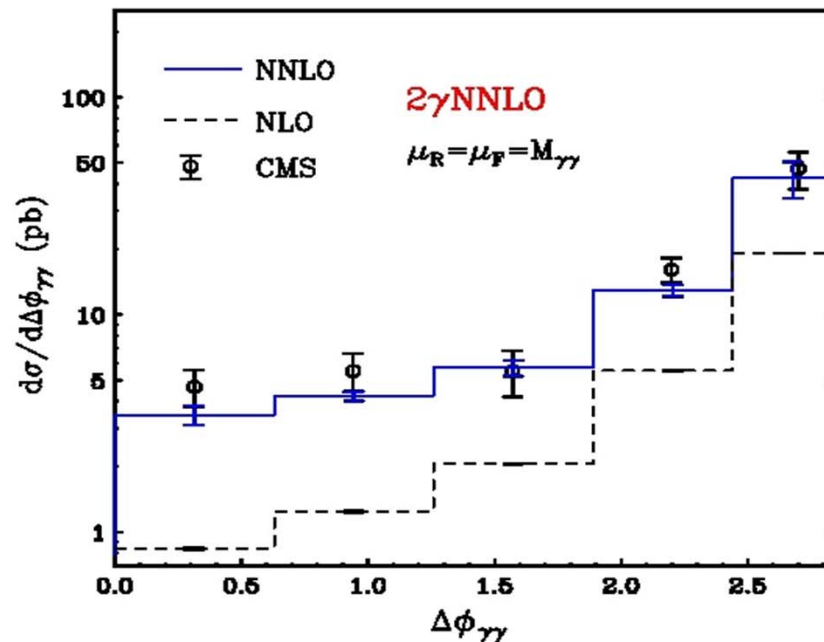
Diphoton cross section as a function of the azimuthal separation of the two photons. Data from CMS at 7 TeV are compared with the NLO and NNLO calculations (LPN11-74, LPN12-082, Cieri)

M1.2 top-quark physics
the heaviest known elementary particle

- Off-shell effects (LPN11-09),

- precision predictions for the $t\bar{t}$ production cross-section (LPN11-80, LPN12-016, LPN12-42),

- top quark pair production in association with jets (LPN11-39),

- properties of the top quark, the **charge or forward-backward** asymmetry (LPN11-52, LPN11-78, LPN11-81, LPN12-012, LPN12-074),

- New theoretical tools for high precision calculations at higher orders with heavy quarks have also been developed (LPN11-82, LPN12-003, LPN12-004).

LHCphenOnet

M1.3 resummation of large logarithms to improve accuracy of fixed order calculations

- Resummation of small-x logarithms in DIS (LPN11-44, LPN12-037) and the first-moment evolution of fragmentation functions (LPN12-083).

- **BFKL** to jet phenomenology (LPN11-55,LPN12-054), formal developments (LPN11-64,LPN11-95,LPN12-014,LPN12-072,LPN11-27), numerical impl. (LPN12-070).

- Running of heavy quark masses to high precision (LPN11-05,LPN11-08,LPN11-36).

- Thrust distribution (LPN11-76, LPN12-023).

- New developments in threshold resummations (LPN12-037), Sivers function numerical evolution (LPN12-027).

- A general expression for the leading **Reggeization-breaking** operator at higher orders (LPN11-49, LPN11-50).

- The development of **new resummation techniques** for soft divergences (Bonocore) by means of a first quantized path integral approach with Next-to-Eikonal (NE) accuracy, and application to Dell-Yan and DIS.

LHCphenOnet

M1.4 efficient methods for the calculation of scattering amplitudes at NLO and higher orders

- The program **PJFry** for numerical evaluation of 5-point tensor integrals (LPN12-008, LPN11-72, Yundin),

- New tools and methods for one-loop integrals (Hosekova, Sevillano, LPN11-03, LPN11-07, LPN11-26, LPN11-65),

- Analytic results for hexagon integrals (LPN11-18, LPN11-21, LPN11-23),

- Optimized one-loop helicity amplitudes with $t\bar{t}$ pairs (LPN11-06, Yundin),

- Higgs plus multi-gluon scattering amplitudes at tree and one-loop level by using BCFW and CSW recursion relations (Chen),

- Numerical implementation of the loop-tree duality at the one-loop level (Buchta),

- Review articles published (LPN11-18, LPN11-47).

2011 PJFry
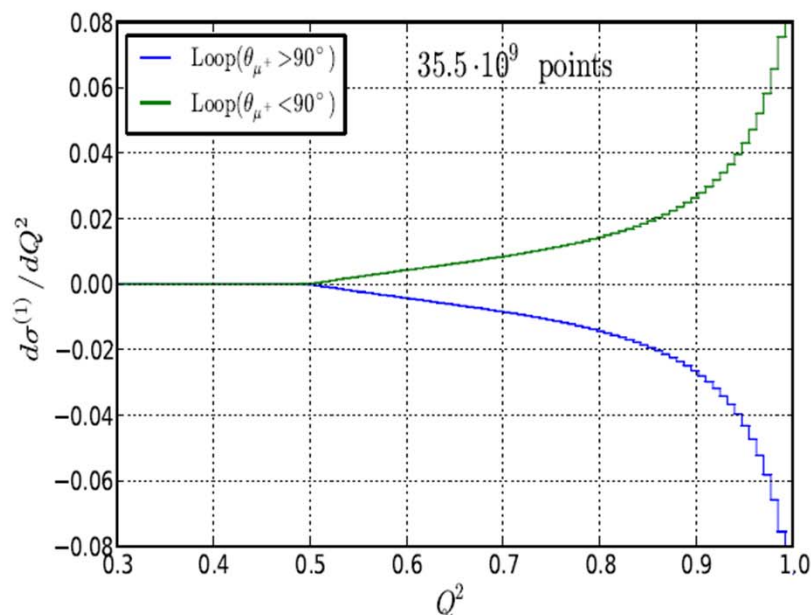
2009 LoopTools
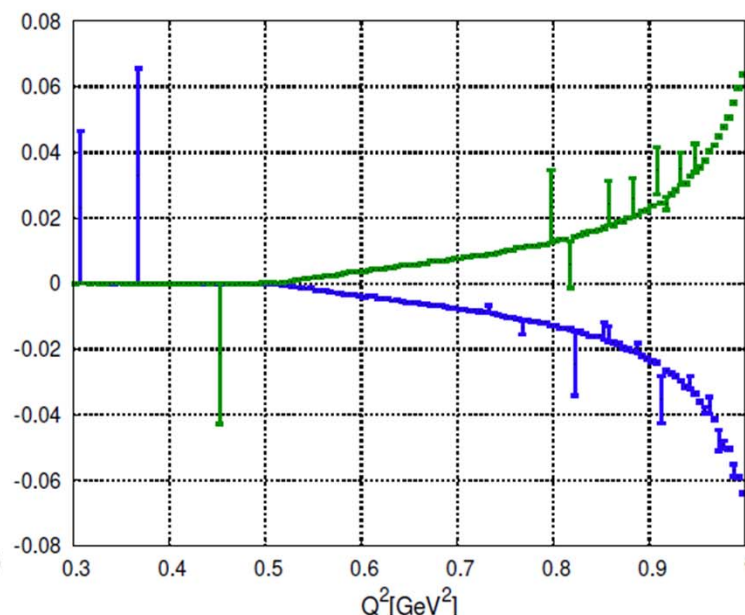
Numerical stability of one-loop corrections to photon-associated muon-pair production with the program PJFry in comparion with the LoopTools code (LPN12-008, LPN11-72, Yundin).

WP2: Discovery

The primary goal of the LHC is the search for the **Higgs boson** and the comprehension of the mechanism of electroweak symmetry breaking, this is the core topic of WP2. As well as to explore signatures of new physics beyond the Standard Model (BSM):

⊙ M2.1 Higgs in vector-boson fusion (VBF)

⊙ M2.2 Higgs-strahlung

⊙ M2.3 BSM particles + n jets

⊙ M2.4 BSM decays

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EL PAÍS

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ESTÁ PASANDO · Bosón Higgs · Amnistía fiscal · Códice Calixtino · Incendios Valencia · Caso Barclays · Caso Bettencourt · Volcá

DIRECTO — Los científicos del CERN anuncian el descubrimiento de una partícula que podría ser Higgs. Sigue el videoconferencia explicando un avance que, de confirmarse, supondría un paso esencial de la física para explicar el origen de la materia. »

Hallada "la más sólida evidencia" de la existencia del bosón de Higgs

El posible descubrimiento de la partícula es un paso esencial hacia la explicación del origen de la materia

"Puedo confirmar que se ha descubierto una partícula que es consistente con la teoría del bosón de Higgs", dicen los científicos. El descubrimiento de la partícula ayudaría a explicar el origen de la masa. Los físicos del CERN explican en estos momentos sus hallazgos.

- Diccionario para entender en qué consiste el hallazgo
- La "caza" del bosón de Higgs, por A. RUIZ JIMENO
- VÍDEO — Una explicación del bosón de Higgs
- Sigue en directo la conferencia del CERN
- FOTOGALERÍA — Indicios hallados de la 'partícula de Dios'
- 'Hacia la partícula de Dios', por JAVIER SAMPEDRO

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theguardian

Website of the year | 4 July 2012 | Last updated less than one minute ago

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Breaking news: Weather not limitations end Mount McKinley climb – AP

Diamond set to come out fighting as he faces MPs

Chief executive to reveal role of City watchdogs and Whitehall in Libor rate-fixing scandal

- The key questions for MPs to ponder
- The late exchanges that led to Diamond's demise
- Cameron and Miliband clash over inquiry
- Barclays likely to balk at vast severance deal
- Would you interpret this as guidance to lower rate?
- Datablog: Bank Libor rate submissions 2005-08
- Daughter tweets her support: 'Osborne #HMD'
- Full coverage of the Libor rate-fixing scandal

The definite particle?
Higgs boson discovered? Live co

MARCJACOBS.COM

The New York Times

Wednesday, July 4, 2012 · Last Update: 4:00 AM ET

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Rapid H.I.V. Home Test Wins Federal Approval

By DONALD G. McNEIL, Jr.

The OraQuick test, which uses a cheek swab and gives results in 20 to 40 minutes, is the first chance for Americans to learn in the privacy of their own homes whether they are infected.

DEALBOOK — **As Obama Frames a Defense, Barclays' G**

OPINION »
EDITORIAL
Too Quiet, Again, on Health Care

The Obama campaign is not forcefully countered Republican misinformation on the reform law.

- Dowd: Gaelic Guerrilla
- Friedman: Morsi, Israel
- Douthat: Books for Obama
- Fixes: Rwanda's Miracle
- Kurt Andersen: The Downside of Obama
- Op-Ed: Anderson Cooper

MARKETS » at 4:02 AM ET

	Britain FTSE 100	Germany DAX	France CAC 40
	5,673.04	6,553.19	3,248.93
	+14.68	−25.02	−22.27
	−0.26%	−0.38%	−0.08%

Data delayed at least 15 minutes

New Particle Could Be Physics' Holy Grail
By DENNIS OVERBYE · 4 mins ago

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Higgs of niet, het is een spectaculaire ontdekking

Door: Pieter Sabel – 04/07/12, 11.29

'I think we have if', zei de president-directeur van het Zwitserse onderzoeksinstituut CERN vandaag na afloop van een persconferentie over de zoektocht naar het zogenoemde Higgs-deeltje. Hij sprak van een 'historische mijlpaal'. Maar met voorzichtigheid omgeven – er is meer onderzoek nodig. Wat is er nu ontdekt?

Wat we in elk geval met voldoende zekerheid kunnen zeggen, is dat er een deeltje is gevonden met een massa, waarvan het bestaan in de natuurkunde nog niet eerder bekend was. En dat deeltje lijkt op het Higgs-deeltje of Higgs-boson, zegt Martijn van Calmthout van de wetenschapsredactie van de Volkskrant.

VERWANT NIEUWS
- 'Tranen van geluk, Higgs-boson bestaat' – 04/07/12
- Higgs-deeltje 'zeer waarschijnlijk gevonden' – 04/07/12
- 'Maatschappij heeft nog niks aan Higgs' – 04/07/12

MEER OVER · Natuurkunde · Wetenschap
- Deeltjesfysici wacht spannende dag
- Delftse fysici doen spectaculaire ontdekking
- The Guardian over het Higgs-deeltje
- Wat is dat Higgs-deeltje?

5 MEE
1. Licha
2. Verte klap[...]
3. Higgs
4. Fopp veel
5. Higgs

André Kuipers weer terug op aarde

Eenzame George (+/- 1912 - 2012)

FOTOSPECIAL

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Úgy tűnik, megvan az 'isteni' részecske

Az Európai Részecskefizikai Központ, a genfi CERN ma reggeli sajtótájékoztatóján bejelentették, hogy nagy valószínűséggel megtalálták egy új szubatomi részecskét, amely feltehetőleg azonos az évtizedek óta keresett Higgs-bozonnal, mely a fizika úgynevezett standard modelljének egyetlen hiányzó 'alkatrészének' számít.

Palugyai István · HOL · 2012. július 4. · 5 komment

GALÉRIÁK

Olcsó szállás
Dupla va[...]
jutalom[...]

Későbbi fog[...] kedvez[...]

Foglaljon most!

Hány gólt szeretel [...] a futball Európa-bajnokságon?

Tribune de Genève

La Une | Mercredi 4 juillet 2012 | Dernière mise à jour 10:09

CARNET NOIR — L'acteur de télévision Andy Griffith est mort à 86 ans

CHAMP-DOLLON — Pour s'être plaint sur Facebook, un gardien est puni

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PHYSIQUE
Une nouvelle particule a été découverte

Bourse ▸

	SWISSC[...]
SMI	6'191.43 −0.[...]
Stoxx50	2'437.70 −3[...]
DJIA	12'943.82 +[...]

Les plus lus ▸
1. Le Conseil d'Etat a fixé ses cadres. Une premièr[...]
2. Les fontaines de Dubai pleurent Whitney Houston
3. Champ-Dollon: pour s'être plaint sur Facebook, un gardien est puni
4. La pilote Maria De Villota grièvement blessée [...]
5. Sentier des Toblerones: Apple censure la ville de Gland

Une nouvelle particule a été découverte par des chercheurs du CERN lancés sur la trace du boson de Higgs. Plus...
Mis à jour il y a 2 minutes

Le Monde.fr

Mise à jour 10h02 – Paris

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EN CE MOMENT · Nicolas Sarkozy · Mali · Boson de Higgs · 1962 : l'indépendance algérienne · Microsoft · Tour de Fra

Le boson de Higgs découvert avec 99,9999 % de certitude

Voici la confirmation tant attendue : une nouvelle particule a été découverte au Centre européen de recherche nucléaire (CERN), près de Genève.

Boson de Higgs : la fin de la traque · Le boson de Higgs : les raisons d'une quête

Les plus partag[...]
1. Perquisition dans les bur[...] Sarkozy
2. "Strip-Teaser" (ne) vient p[...]
3. Jean Libon [...] une mine fo[...] ethnologue [...]
4. La Syrie au [...] torture ?[...]
5. Le dealer [...] Jean-Luc D[...] exigences d[...]
6. Vous avez t[...] vous parlen[...]
7. Le célèbre [...] Sergio Pinin[...]
8. Selon Al-J[...]

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La partícula de Dios

Hallan una nueva partícula que podría ser el bosón de Higgs

Los científicos advirtieron que aún no pueden confirmar su existencia; "Hemos superado una nueva etapa en nuestra comprensión de la naturaleza", aseguran

GINEBRA – Una nueva partícula "coherente" con el bosón de Higgs fue descubierta por los científicos, pero todavía hacen falta mayores investigaciones para saber si se trata o no de la "partícula de Dios", indicó el Centro Europeo de Investigación Nuclear, según sus siglas en francés).

La "partícula de Dios" es considerada por los físicos como la clave para entender la estructura fundamental de la materia y la partícula que atribuye la masa a todas las demás, según la teoría llamada "modelo estándar". "Hemos superado una nueva etapa en nuestra comprensión de la naturaleza", dijo en un comunicado el director general del CERN, Rolf Heuer, en un comunicado.

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Protocolo: las malas costumbres de los presidentes argentinos

Guía práctica de la partícula más buscada

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Euro 2012 · Samobójstwo Petralickieg[...] · Polska od kuchni

Pracowniczka hipsterskiej knajpy o pierwszym dniu pracy: Przyszłam i nic...

Właścicielka restauracji: Stałam się niewolnikiem tego miejsca [POLSKA OD KUCHNI]

List od czytelnika: Nie plułem do drinków. Miałem inny sposób [POLSKA OD KUCHNI]

Wiadomości · Wiadomości dnia

Naukowcy z CERN niemal pewni, że złapali "boską cząstkę". Jest zgodna z bozonem Higgsa

mtg, pap, AP, Reuters · 04.07.2012 · aktualizacja: 04.07.2012 12:30

Najczęściej czytane
1. Zakowski przepytuje wojewódzkiego. "Omijali fakt, że
2. Naukowcy z CERN niemal pewni, że złapali "boską cząstkę". Jest
3. Wojna parafian z Karpnik z byłym proboszczem [FOTO]
4. 13-letnia Jagoda się odnalazła. Nie chce powiedzieć, gdzie była
5. Zmasowany atak Chińczyków na białostocki handel
6. Hofman: Smoleńsk, 2-letni Szymon, w Polsce winni zbrodni na
7. Tusk wobec Gowina? "Ważniejsza walka z przemocą niż

MARIE CURIE ACTIONS

M2.1 Higgs in vector-boson fusion (VBF) and M2.2 Higgs-strahlung
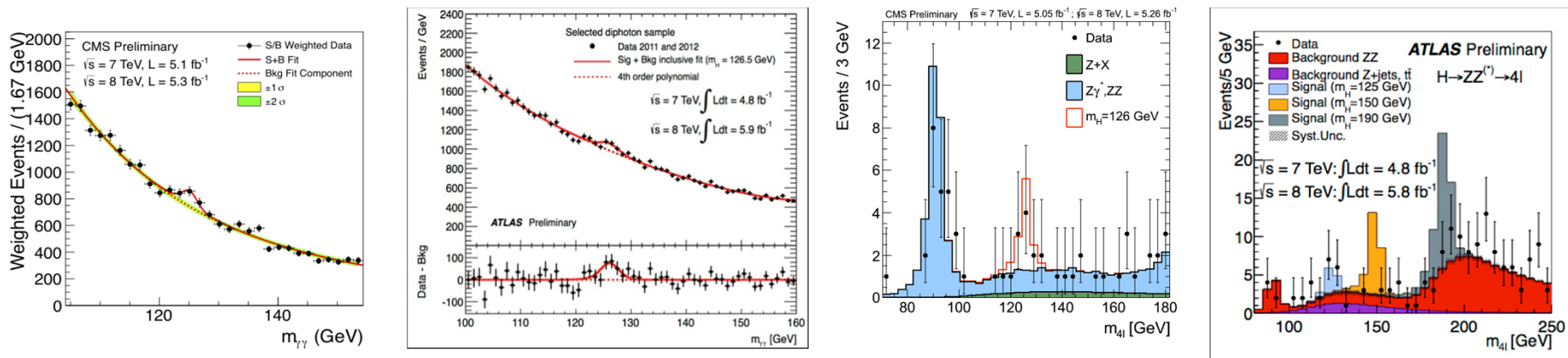

- These experimental analyses have received great support for the theory side and the activities of members of the network within WP2 have been essential for the success of the endeavor, by supplying theoretical predictions of an unprecedented precision.

- Important contribution to the *Report of the LHC Higgs Cross Section Working Group* (LPN12-007, Bagnaschi, Cieri, Kardos, Schönherr, Tommasini), which summarizes the state-of-the-art theory predictions for the main Higgs boson production and decay channels at the LHC .
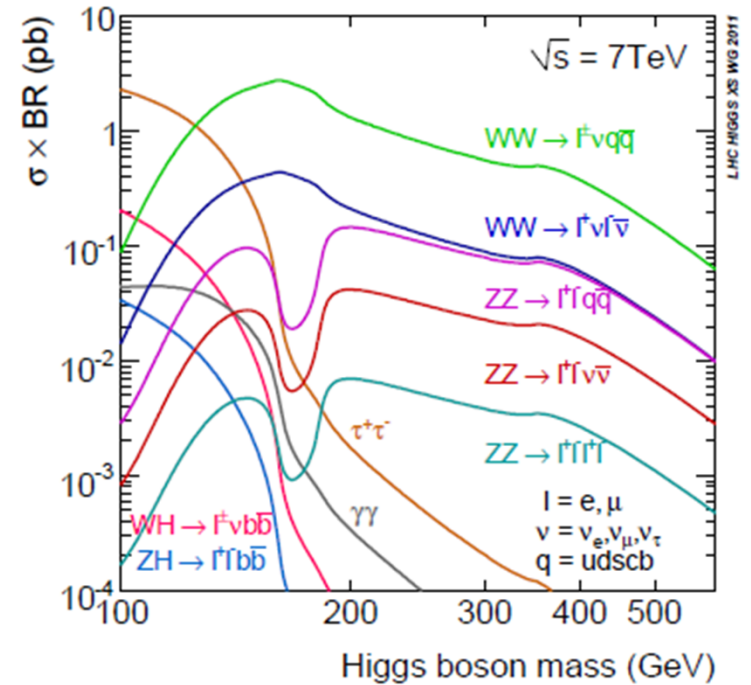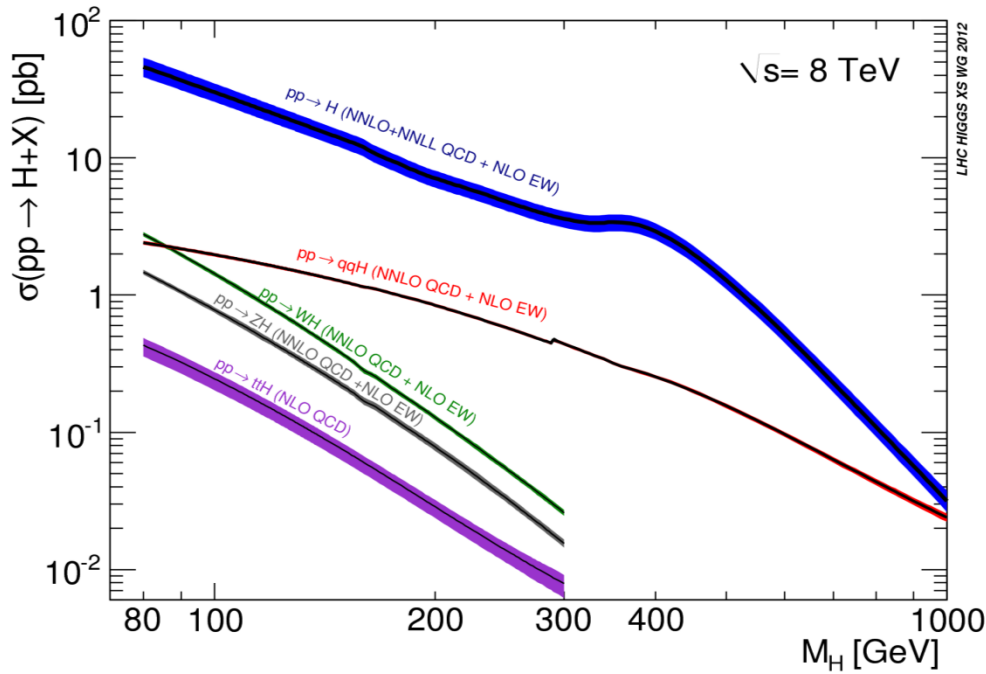
SM Higgs boson production cross sections at the LHC with 8 TeV (left), and total cross section times the branching ratio (right). The transition for VBF at M_H=300 GeV is due to change from zero-width approximation to the complex-pole-scheme. Plot based on contributions of members and ESRs of the network (LPN12-007, Bagnaschi, Cieri, Kardos, Schönherr, Tommasini).

M2.3 BSM particles + n jets and M2.4 BSM decays

- **Modifications of the Higgs sector** in composite Models (LPN12-011, Torre, LPN12-062),

- Anomalous couplings in double Higgs boson production (LPN12-069)

- photophilic Higgs boson from sgoldstino mixing (LPN12-075, Torre)

- Production of pseudo-scalar Higgs bosons to NNLO (LPN11-27), Dark Higgs (LPN11-56) , Evasive Higgs (LPN11-61), skyrmions in Little Higgs models (LPN11-57)

- **Top-quark** polarisation studies in Ht and Wt production (LPN12-028)

- Anomalous top-quark production at the LHC (LPN11-79).

- **Supersymmetry** (LPN12-064, LPN12-068, LPN11-45,LPN11-60, LPN12-041, LPN12-087, LPN12-029,LPN11-46, LPN11-48).

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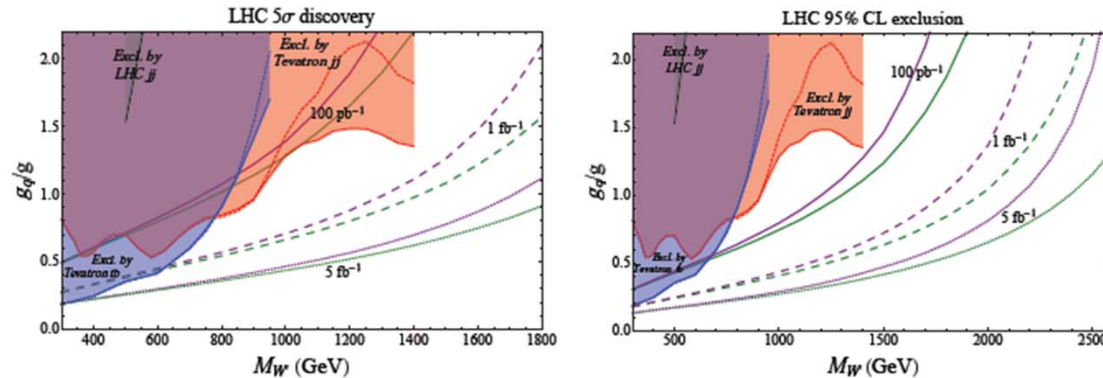
Contours in the ($M_{W'}$, g_q/g) plane for 5σ discovery (left) and 95% CL exclusion (right) at 7 and 8 TeV LHC for an integrated luminosity of 0.1, 1 and 5 fb^{-1} corresponding to the continuous, dashed and dotted lines. Also shown are the Tevatron dijet (red) and tb (blue) exclusions, together with CMS exclusion with 2.9 pb^{-1} (Torre).

- **Extended gauge sector:** narrow resonances (LPN11-12, Torre), weakly constrained W' (LPN11-10, Torre) leptophobic W' (LPN12-010, Torre) or isosinglet W' (LPN12-046, Torre)

- **Left-right symmetric models** (LPN12-044, Sevillano)

- neutral triple electroweak gauge boson production in the ADD model (LPN11-68)

- graviton emission in Einstein-Hilbert gravity (LPN11-96)

WP3: Support to Experiments

The final goal of this WP is to establish a **fluent collaboration with our experimental colleagues**, by providing codes and tools for the next generation of event generators and parton level Monte Carlo generators, incorporating the most recent computations in perturbative QCD and in electroweak theory, and supplemented by parton shower tools, decay packages and efficient implementations of jet algorithms. Precise parton distributions in the proton, which are determined from global analysis, are also an indispensable ingredient in every cross section prediction at hadron colliders.

- ◉ M3.1 Jetography
- ◉ M3.2 PDFs from LHC
- ◉ M3.3 Parton level Monte Carlos
- ◉ M3.4 Resummation vs. exact higher orders

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M3.1 efficient implementation and improving of jet algorithms

Jet

Jet

Hadrons are clustered together to make jets
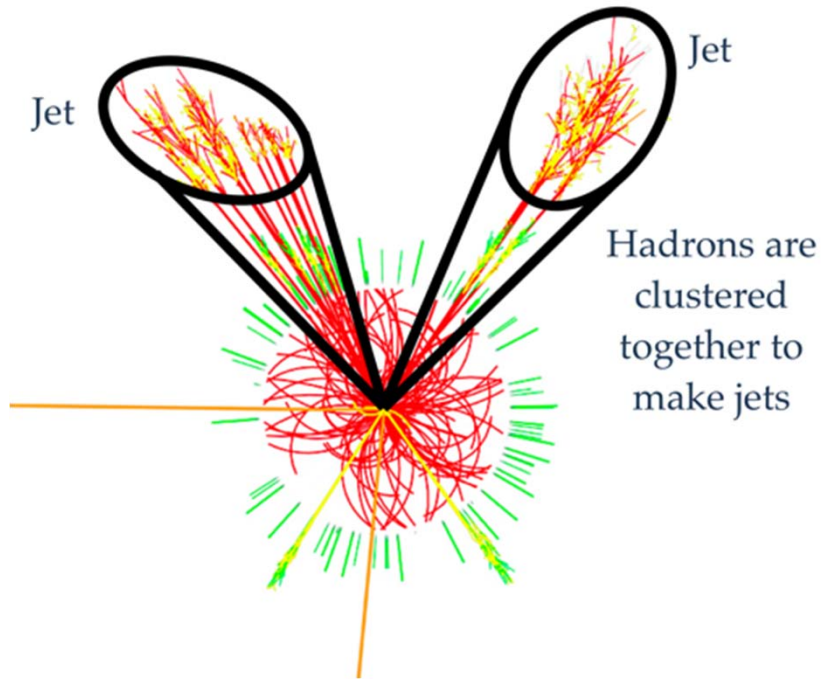
- new version of FastJet (http://fastjet.fr/), a C++ package that provides a broad range of jet finding and analysis tools, released (LPN12-015),

- Jet properties in heavy ion collisions (LPN12-017).

MARIE CURIE ACTIONS

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M3.2 parton distribution functions

- **New analytic results** at three loops that are relevant for the extraction of parton distribution functions from the data in DIS (LPN12-036, LPN11-35, Ablinger, Hasselhuhn, LPN12-048 , LPN12-079, LPN11-34)

- Fast and precise **Mellin-space** implementation to extract the strange quark distribution in neutrino-nucleon scattering (LPN11-19, Hasselhuhn),

- Unfolding procedure to fit parton distributions (LPN12-002),

- New global analysis of **nuclear parton distribution functions** (LPN12-005),

- Unintegrated sea quark density from forward Z boson production (LPN12-050), and BFKL resummation to fit DIS data (LPN12-071),

- Fixed-flavour-number scheme (LPN12-039) used in the ABM11 parton distribution set (LPN12-086, LPN11-29) established,

- **Benchmarking** of cross-sections at NNLO and comparison of different PDF sets (LPN12-033).

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M3.3 Monte Carlo event generators
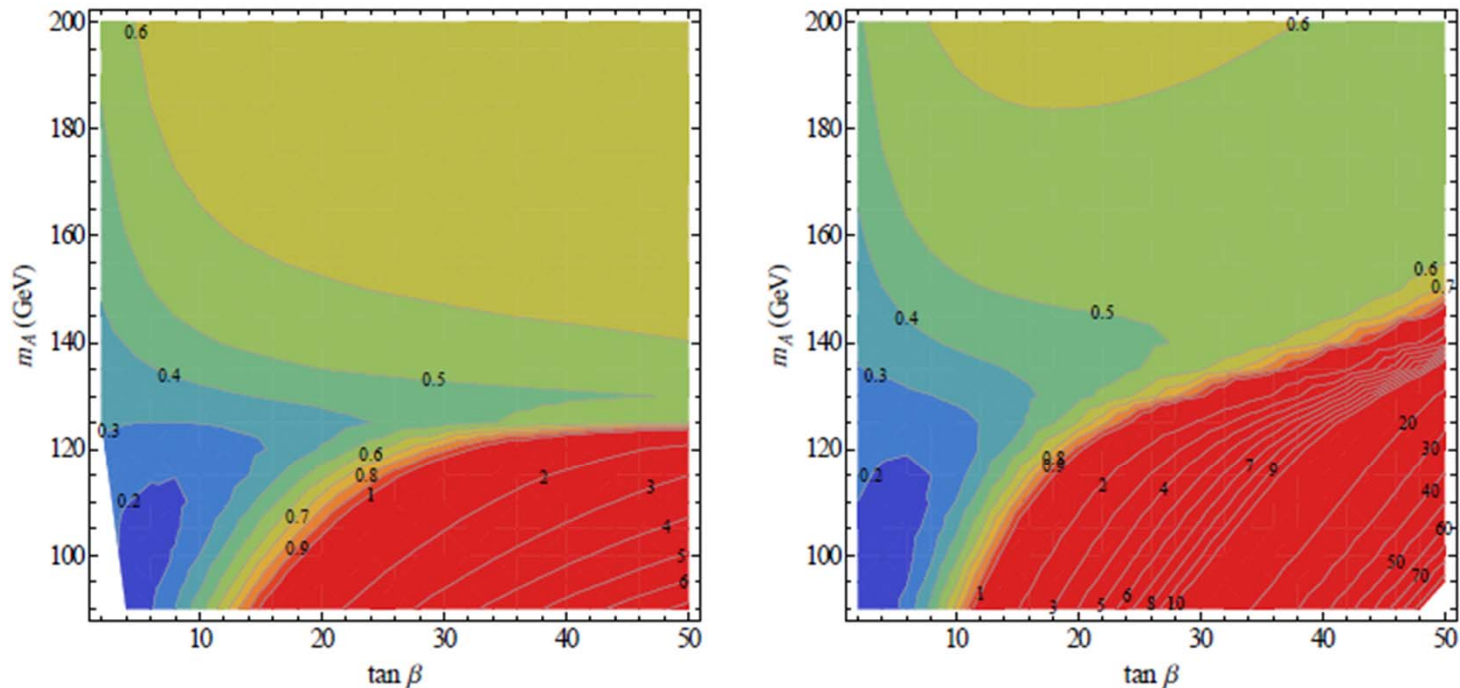
Ratio of the total cross section for *h* production in the MSSM over the cross section for the production of a SM Higgs boson with the same mass. The plot on the left is for μ>0 while the plot on the right is for μ<0 (LPN11-93, Bagnaschi).

- implementation in the POWHEG approach of Higgs boson production via gluon fusion in the SM and in the MSSM (LPN11-93, Bagnaschi).

example of cooperation between theory and experiment within the network

collaboration between the CMS group at ETH Zürich and the theory group at Debrecen leading to the first observation measurement of $t\bar{t}W$ and $t\bar{t}Z$ at the LHC.

A public conference note exists, and soon a CMS paper will appear. In this collaboration, the theory group provided the NLO predictions (LPN12-009, LPN11-91, Kardos).

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M3.4 parton showers
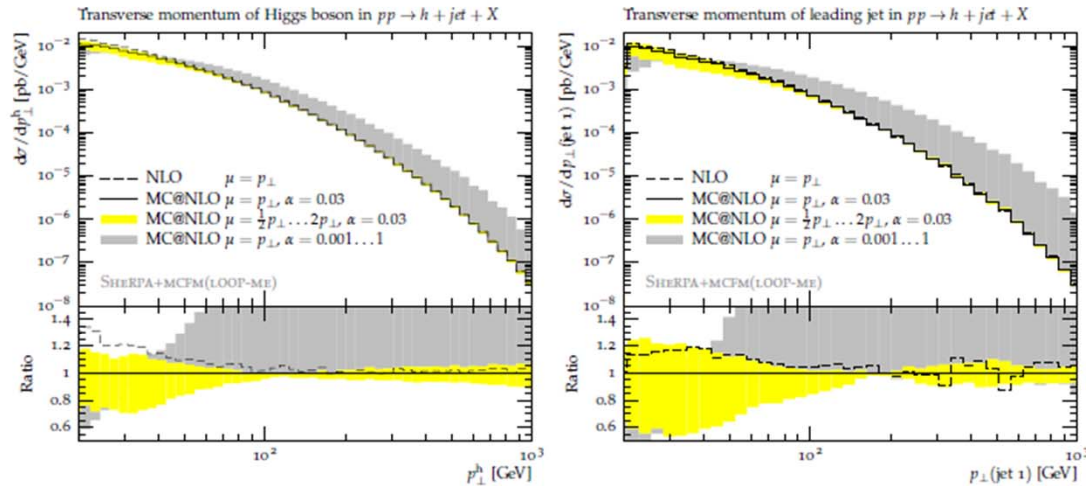
Predictions and uncertainties for the transverse momentum of the Higgs boson (left) and the leading jet (right) in Higgs boson plus jet events (m_H=120 GeV) at LHC 7 TeV (LPN11-58, Schönherr).

- A new process-independent technique to consistently combine NLO parton-level calculations and parton showers (LPN12-045, LPN12-080, LPN12-081, Schönherr), providing a significant reduction of theoretical uncertainties,

- A Bayesian model to characterise the perturbative theoretical uncertainty in terms of a credibility interval for the remainder of the series (LPN12-018),

- Multi-scale scheme for the assignment of factorization and renormalization scales (LPN12-059), NLO extension of reweighting in merging algorithms.

WP4: Technological Innovations

To face the challenge for collider phenomenology in the development, implementation and application of efficient and fast **beyond the state-of-the art** algorithms for multi-loop and multi-leg calculations, both at the numerical and the symbolical level. Fundamental innovations in quantum field theory. Manipulating large sequences of algebraic expressions and fast factoring of polynomials by innovative algorithms.

◉ M4.1 Multi-loop on-shell recursions

◉ M4.2 Equation solver

◉ M4.3 Computer algebra 2.0

◉ M4.4 Open FORM

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M4.1 Multi-loop on-shell recursions

- Reduction methods at the integrand level for one- and two-loop amplitudes (LPN12-076, Malamos),

- Multiple propagators compatible with generalized unitarity (LPN12-020), and the loop-tree duality method (LPN12-57, Buchta, Malamos),

- Novel substraction methods of infrared divergences at NNLO for massless partons (LPN11-75, LP11-99), and massive final state quarks (LPN12-035, Dekkers),

- SecDec 2.0, a program for the numerical evaluation of multi-loop integrals (LPN12-049),

- Generalized version of the collinear factorization theorem at all orders in the space-like region (LPN11-94).

M4.2 Equation solver and
M4.3 Computer algebra 2.0: how to manipulate large sequences of algebraic expressions and fast factoring of polynomials and special functions

- a Mathematica package with a new algorithm to find **holonomic recurrences** (Round).

- Generalized harmonic sums and polylogarithms, algebra, relations and asymptotic expansions (LPN11-24, LPN11-100, LPN12-38, Ablinger, Hasselhuhn).

- Mathematica packages **HarmonicSums and MultiIntegrate** (Ablinger),

- computation of 2- and 3- loop massive Feynman diagrams (LPN11-41, LPN11-67, LPN11-13, LPN12-052, LPN12-055, Ablinger, Hasselhuhn).

- Major achievement in analytical computations with **symbols** in multi-loop calculations (LPN11-53).

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Summary: Overview of Deliverables

Del. No	Deliverable Title	Expected date	Delivery date	Comments
1	LHCPhenoNet logo and website	-2	-6	http://www.lhcphenonet.eu
2	1st Annual Report	13	14	1st version delivered on month 13
3	Mid-Term Report	19-21	20	Mid Term Review Meeting in month 21
4	ESR positions filled	42	21	390 person/months appointed out of 492
5	ER positions filled	36	21	48 (+12) person/months appointed out of 108
6	Scientific Publications	Throughout	20	187 publications from Jan 2011 to Sep 2012, 39 co-authored by the ER and ESR fellows
7	Open source codes	Throughout	20	See Tables 7, 8 ,9 and 10

MARIE CURIE ACTIONS

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