Alianța Timișoara Universitară

Ministerul Cercetării, Inovării și Digitalizării

Ministerul Educației

Administrația Prezidențială

Academia Română

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Smart Diaspora 2023

www.diaspora-stiintifica.ro

10 - 13 Aprilie 2023, Timișoara

Eveniment aflat sub înaltul patronaj al Președintelui României

Masterclasses în Fizica Particulelor Elementare

Paul Gravila (UVT)

WWW.PHYSICSMASTERCLASSES.ORG

INTERNATIONAL MASTERCLASSES HANDS ON PARTICLE PHYSICS

Become Physicist for a Day!
Discover the World of Quarks and Leptons with real data from CERN.
For High-school students and teachers

Organiser:
Faculty of Physics, West University of Timisoara
International Particle Physics Outreach Group (IPPOG)
RO-CERN Collaboration

Timisoara, 11.03. 2023

INTERNATIONAL MASTERCLASSES
hands on particle physics

INTERNATIONAL MASTERCLASSES ATLAS
HANDS ON PARTICLE PHYSICS
~ Z-PATH ~

UVT, Timisoara, 11.03.2023

CERN – ATLAS Experiment
International Particle Physics Outreach Group
Institutul de Fizică si Inginerie Nucleară Horia Hulubei
Institutul de Fizică Atomică (IFA)
Facultatea de Fizică,
Universitatea de Vest din Timisoara

Romania

Intro

Content to be provided

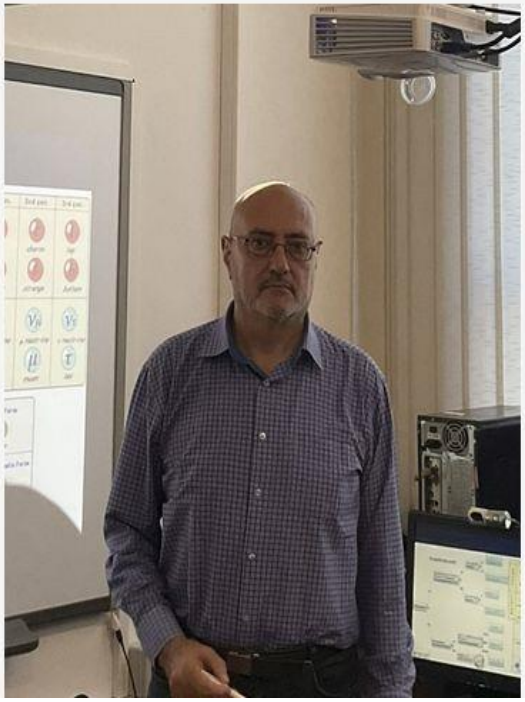
Content in local language to be provided

Details

JOINED: **2016**
CURRENT STATUS: **MEMBER**

JOINED: **2016**
CURRENT STATUS: **MEMBER**

Representative



Paul Gravila

After graduating in Physics from the University of Timisoara (that's my home town) (BSc), University of Bucharest (MSc), I was a doctoral student at the University of Zurich, Switzerland, and received the PhD degree in 1998. Back home in Timisoara, I held many courses in different disciplines such as Nuclear Physics, Elementary Particle Physics, Quantum Mechanics, Computational Physics, Numerical Methods, Detectors, Dosimetry and Radioprotection. In 2013 I joined the Romanian ATLAS Cluster. All these years I was involved in many outreach activities, promoting Physics in High Schools, Researchers Night, Open Days, Public conferences, organizing International Masterclasses in Timisoara. In 2022 I was nominated as the national representative in IPPOG.


ATLAS EXPERIMENT
UNIVERSITATEA DE VEST DIN TIMISOARA
Facultatea de Fizică
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CERN
ATLAS EXPERIMENT
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ifa

		3			3
Mon, 20.2.	Tue 21.2.	Wed 22.2.	Thu 24.2.	Fri 25.2.	
	VC 2	VC 2		VC 2	
	LHCb	ALICE		CMS	
	Valencia	Cagliari		Kharkiv	
	Bari	Thessaloniki		Trieste	
	Cagliari	Vienna			
	Ferrara				
	Genova				
	5	3		2	

Mon 27.2.	Tue 28.2.	Wed 1.3.	Thu 2.3.	Fri 3.3.	
VC 1	VC 1	VC 1	VC 1	VC 1	
ATLAS Z	ATLAS W	ATLAS Z	ATLAS Z	ATLAS Z	
Kielce	Valencia	Linz	Bragança	Genova	
	Cosenza	Vila Real	Colmar	Freiburg	
	Colmar	Oslo	Panjim, Goa	Pavia	
	Bern	Nitra		Braga	
	Alexandria	Prague, Charles U.		Rome Tor Vergata	
1	5	5	3	5	

Mon 27.2.	Tue 28.2.	Wed 1.3.	Thu 2.3.	Fri 3.3.	Sat 4.3. **13:00 CET**
VC 2	VC 2	VC 2		VC 2	VC 2
LHCb	CMS	ALICE		CMS	CMS
Barcelona, Univers	Bari	Pavia		Istanbul, Ozyegin	
Florence	Msila	São Paulo		Santo Andre, UFABC	
	Helsinki	Salerno		Perugia	
	Pazin / Rijeka			Santiago de Compostela	
	Székesfehérvár			São Paulo, SPRACE	
2	5	3		5	

for remote Masterclasses! Students connect individually to the videoconference

Mon 6.3.	Tue 7.3.	Wed 8.3.	Thu 9.3.	Fri 10.3.	Sat 11.3.
	VC 1			VC 1	VC 1
	ATLAS Z			ATLAS Z	ATLAS Z
	Banska Bystrica			Granada	Timisoara
	Kraków				Covilhã
	Orsay				

Programul International Masterclasses ATLAS, Timisoara 11.03.2023:

- ➢ 10:15 – 10:30 Sosirea elevilor
- ➢ 10:30 – 13:00 Cursuri (două a câte 35 de minute fiecare + timp pentru întrebări și discuții, cu o pauză de 10 minute între cursuri)
- Introducere în Fizica Particulelor Elementare.
- Modelul Standard al structurii materiei.
- Forţele fundamentale.
- Despre bozonii Z si Higgs. Masa invariantă.
- Metode de detecție și identificare a particulelor.
-
- ➢ 13:00-14:00 Pauză de prânz
-
- ➢ 14:00 – 14:45 Introducere în principiile masurătorilor ce vor fi efectuate.
- Clasificarea evenimentelor - exemple detaliate.

- ➢ 14:45 – 16:20 Masurătorile
- ➢ 16:20 – 16:30 Pauză
- ➢ 16:30 – 17:00 Discutarea rezultatelor și pregătirea videoconferinței
- ➢ 17:00 - 18:00 Videoconferința
- ➢ 18:00 - 18:15 Încheiere

Ce particula sunt?

- Ocup spatiu?
  - DA
    - Sunt particula de materie. Am spin 1/2 *(fermion)* Sunt sensibil la Forta Tare?
      - DA
        - Sunt QUARK Sarcina?
          - 2/3 — up, charm, top *(c: SLAC 1971) (t: Fermilab 1995)*
          - -1/3 — down, strange, bottom *(b: Fermilab 1977)*
      - NU
        - Sunt LEPTON Sarcina?
          - 0 — neutrini
          - -1 — electron, muon, tau *(τ: SLAC-LBL 1977)*
  - NU
    - Intermediez o forta fundamentala?
      - DA
        - Sunt un BOZON vectorial Am spin 1 Ce forta intermediez?
          - TARE — GLUON
          - EM — FOTON (γ)
          - SLABA — W+, W-, Z0 *(CERN-LEP 1983)*
      - NU
        - HIGGS! S=0 *(CERN-LHC 2013)*

	1st gen.	2nd gen.	3rd gen.
QUARK	u up	c charm	t top
	d down	s strange	b bottom
LEPTON	ν_e e neutrino	ν_μ μ neutrino	ν_τ τ neutrino
	e electron	μ muon	τ tau

Strong Force

g *Gluon*

Electro-Magnetic Force

γ *photon*

Weak Force

W^+ W^- *W bosons*

Z *Z boson*

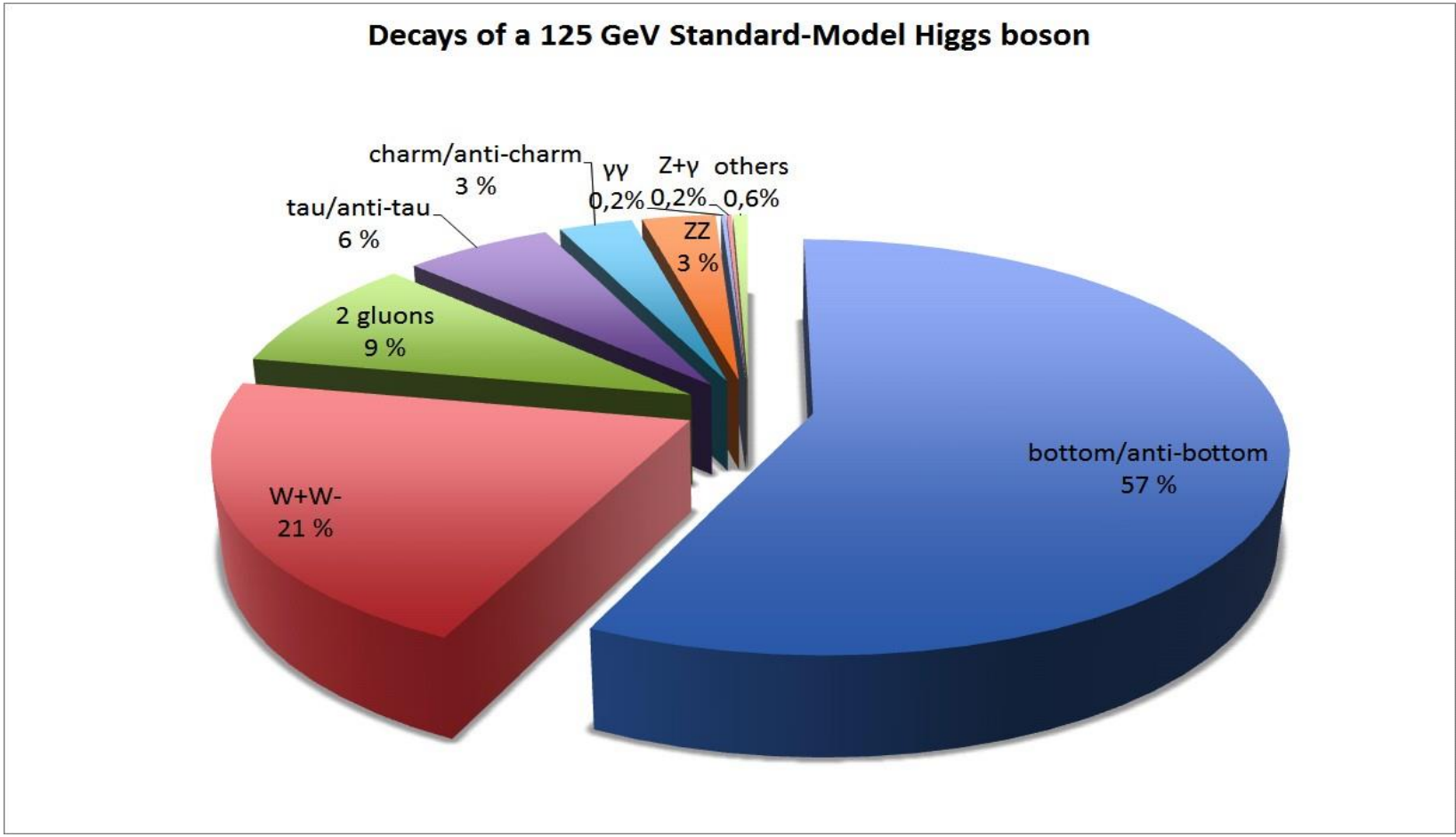
Fortele fundamentale

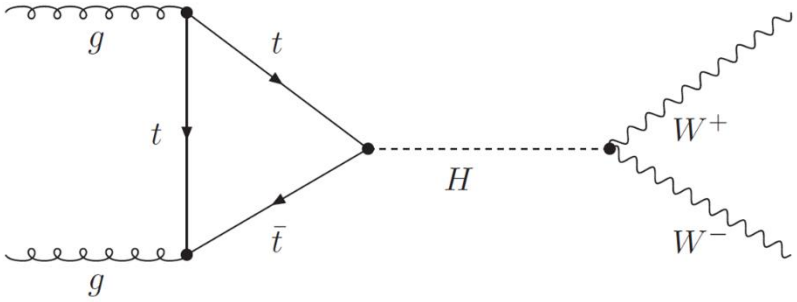
Forta	Cuplaj (tărie)	R (m)	Bozon de interactiune	Sarcina fortei	Actiune asupra:
Nucleară Tare	1	10^{-15}	8 x gluon (g) m=0, s=1, Q=0	"Culoare" RGB	Quarkuri, hadroni
EM (Electro-magnetică)	10^{-2} (1/137)	∞	Foton (γ) m=0, s=1, Q=0	Sarcina electrica +/-	Particule incarcate electric
Nucleară Slabă	10^{-5}	10^{-18}	3 bozoni Weinberg: W^+, W^- m=80 GeV* **Z^0 m=91 GeV**; s=1	Izospinul slab	Universal
Gravitatie	10^{-40}	∞	Graviton (?) M=0, s=2, Q=0	Masa	Universal

* Obs. In Fizica Particulelor masuram atat energii, cat si impulsuri si mase, in multipli de eV (MeV, GeV, …)

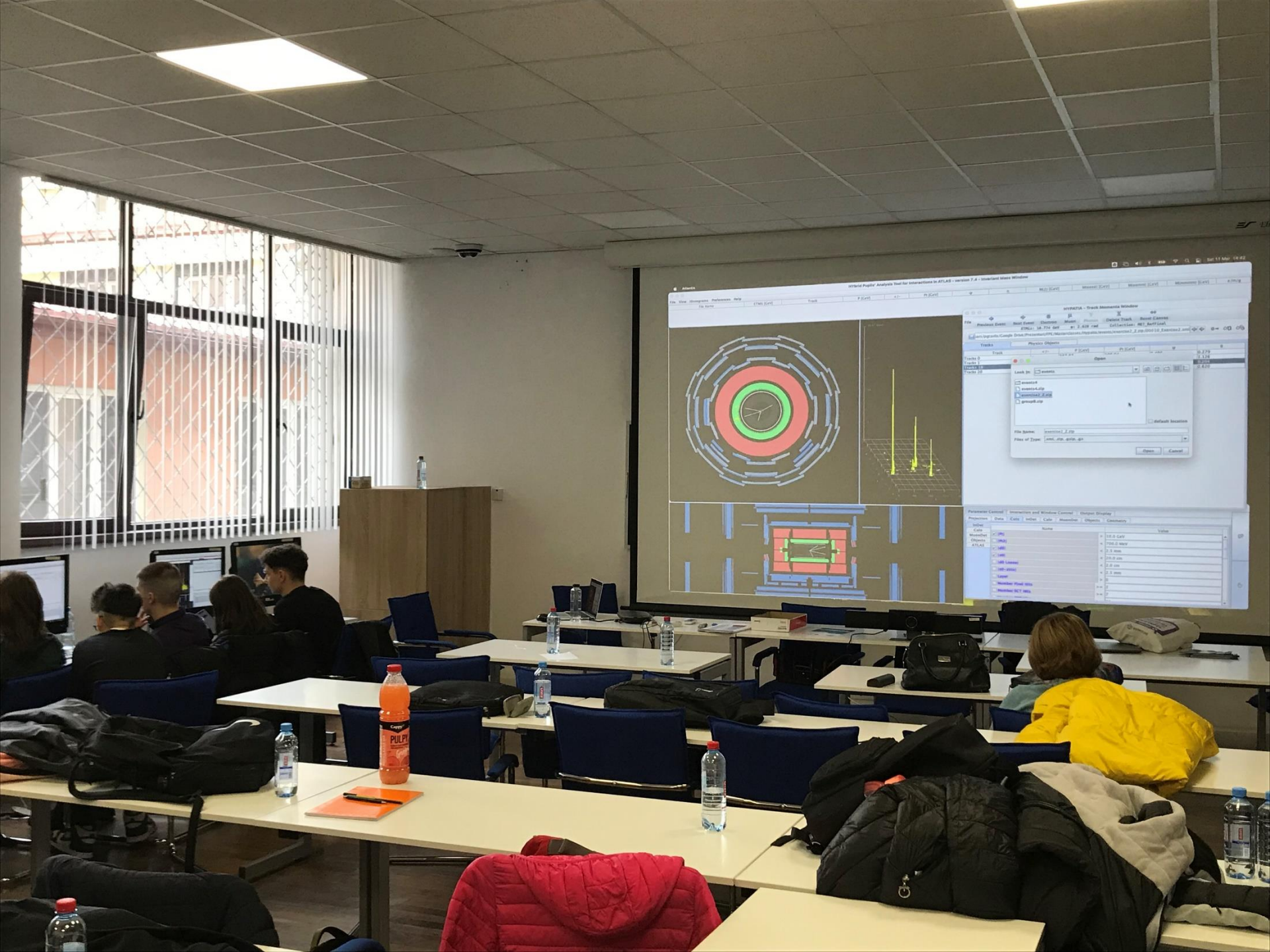
Imagini: http://particleadventure.org/standard_model.html

Descoperirea bozonului Higgs. Canalele γγ, W^+ W^- , ZZ





http://www.scholarpedia.org/article/The_Higgs_Boson_discovery

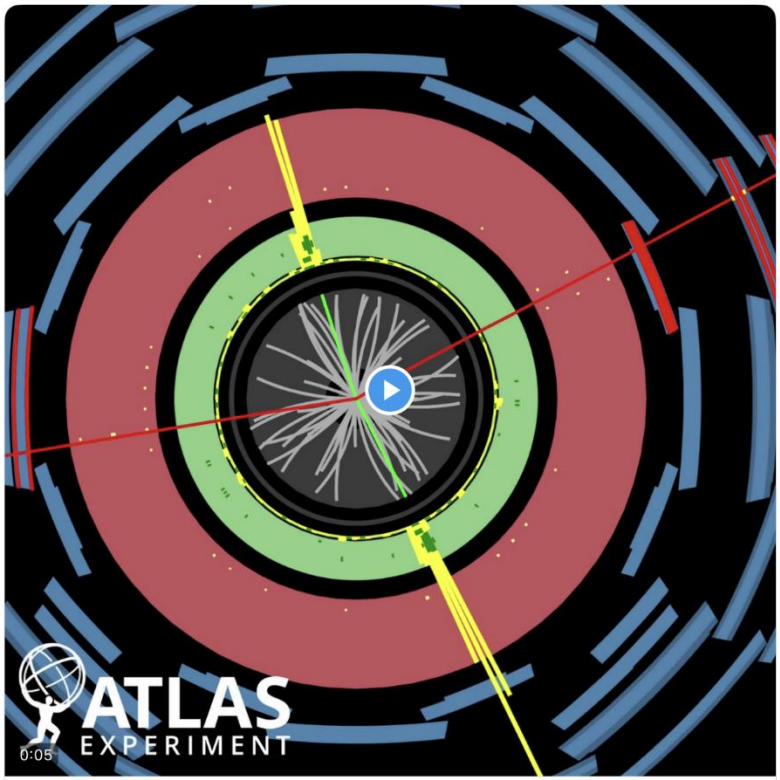

PULPY

Programul de vizualizare rulează pe monitoare in camera de control ATLAS

ATLAS Experiment
@ATLASexperiment

Where did all the #antimatter go?

A new @ATLASexperiment study shown at #moriond probes the fundamental symmetries of nature with the Higgs boson – looking for the violation of charge-parity (CP) symmetry, which could explain the excess of matter in the Universe! Learn more ⬇️



atlas.cern
Probing fundamental symmetries of nature with the Higgs boson

17:54 · 31.03.2023 · **3.653** Views

Tweet your reply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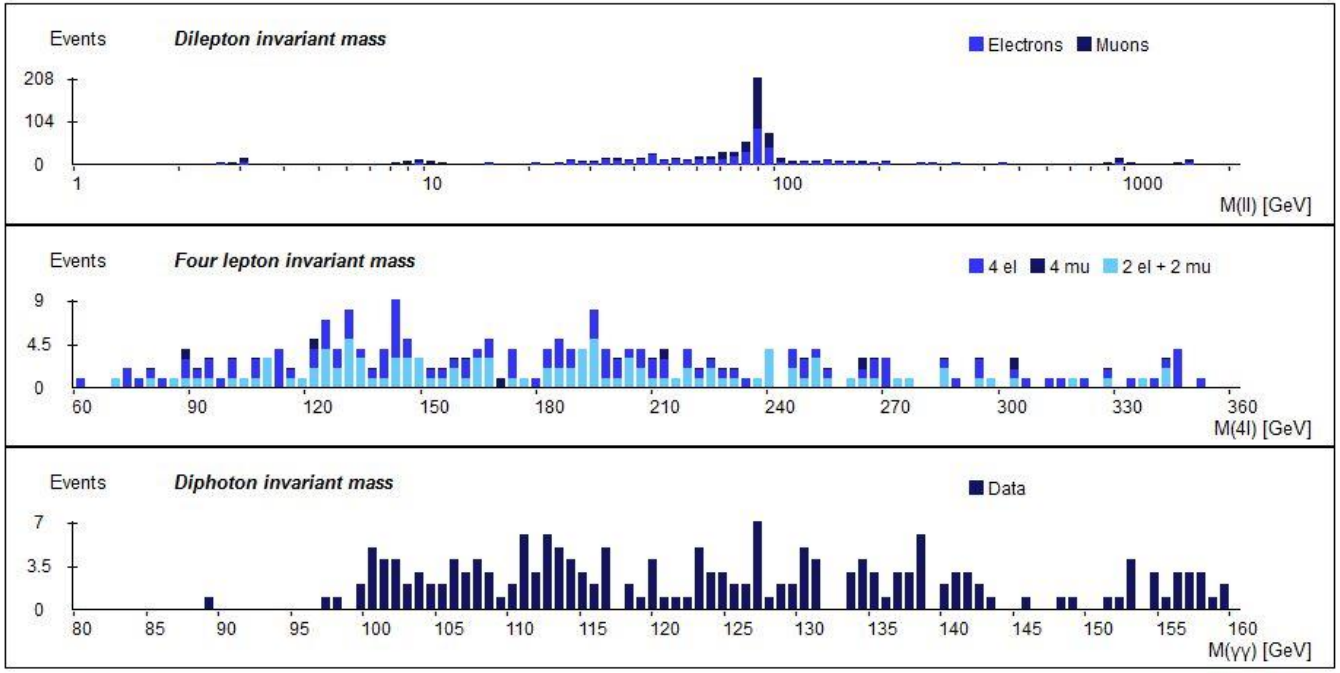
CERN
Timisoara
Covilha
Beja
500 km
STEPMAP


EliteSCREENS

OPloT – MasterClass – Combination for Timisoara on March 11 2023

Start Student Moderator Tutor Administrator

Sunday, March 12th 2023 - 12:30:07 UTC



Plot type:

ll+4l+γγ overview

Dilepton statistics

Electrons

Region	R1	R2	R3	R4	R5
Events	22	20	161	11	11
Mean	2.91	9.70	90.09	981.83	1,490.94
Width	0.40	1.26	4.20	24.94	14.18

Muons

Region	R1	R2	R3	R4	R5
Events	12	16	172	12	3
Mean	3.03	9.84	90.18	988.30	1,467.23
Width	0.29	0.93	3.59	50.07	64.47

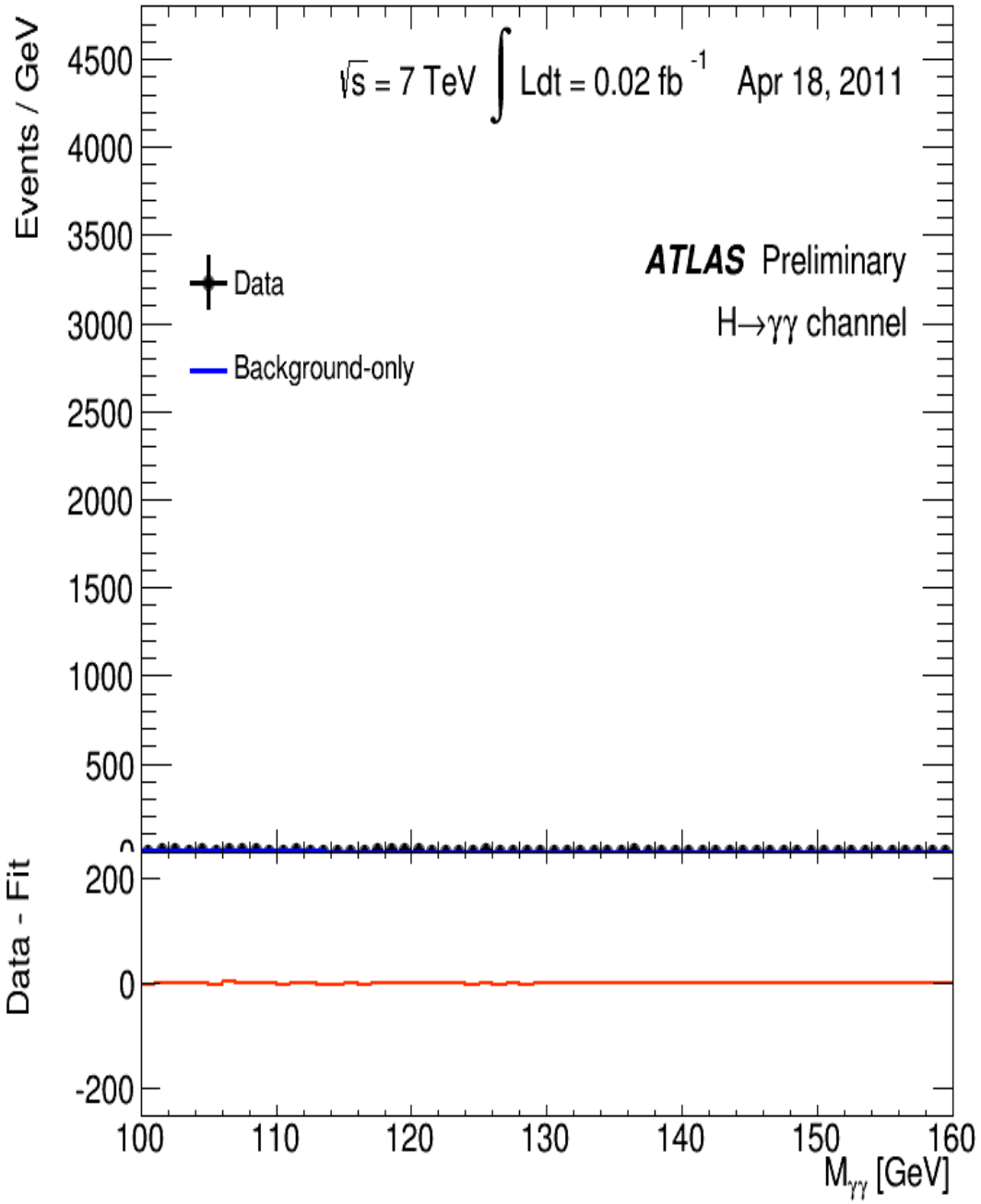
Number of events

	Student distribution	Expected
ll	873	553
4l	293	40
γγ	197	255
Sum	1363	848

Bins: 100

Update plot Reset

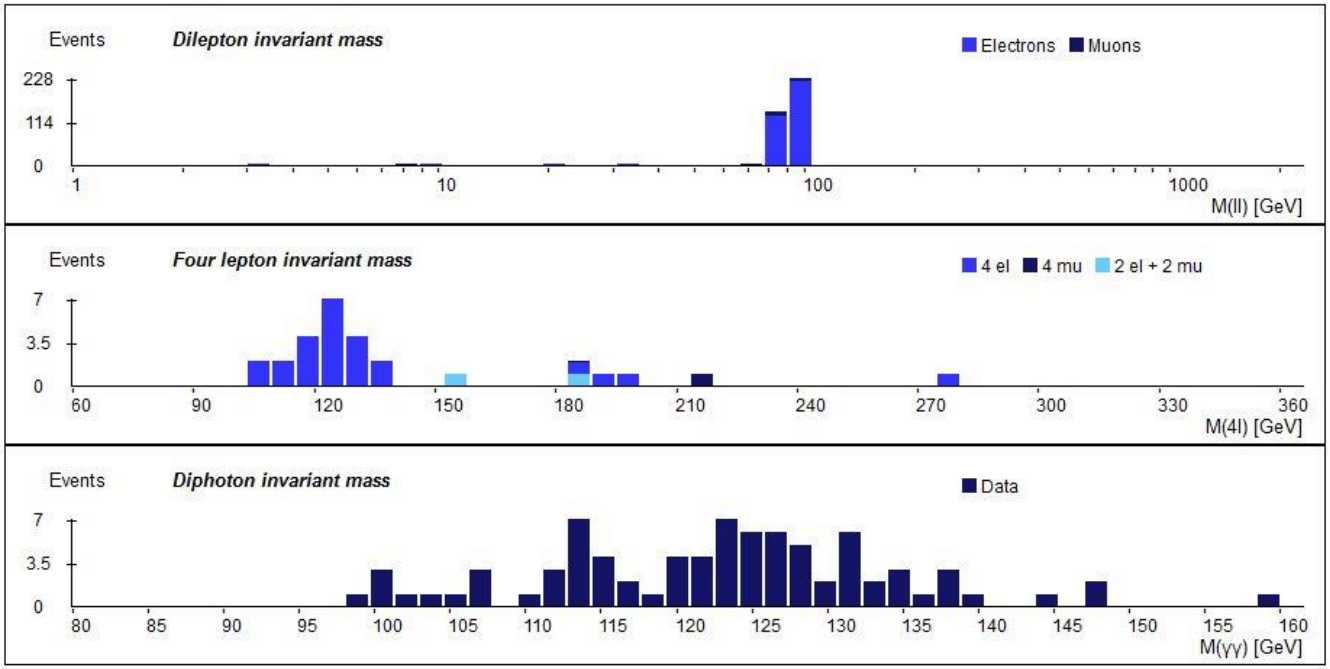
Animation of the reconstructed mass from Higgs candidate events in two-photon decays.



OPloT – MasterClass – Combination for Covilha on March 11 2023

Start Student Moderator Tutor Administrator

Wednesday, March 15th 2023 - 11:49:26 UTC



Plot type:

ll+4l+γγ overview

Dilepton statistics

	Electrons				
Region	R1	R2	R3	R4	R5
Events	10	9	351	2	1
Mean	2.78	8.74	90.73	1,031.46	1,506.27
Width	0.36	0.91	2.93	11.31	0.00

	Muons				
Region	R1	R2	R3	R4	R5
Events	0	1	18	0	0
Mean	0.00	8.52	88.95	0.00	0.00
Width	0.00	0.00	2.85	0.00	0.00

Number of events

	Student distribution	Expected
ll	443	715
4l	32	40
γγ	82	330
Sum	557	1085

Bins: 50

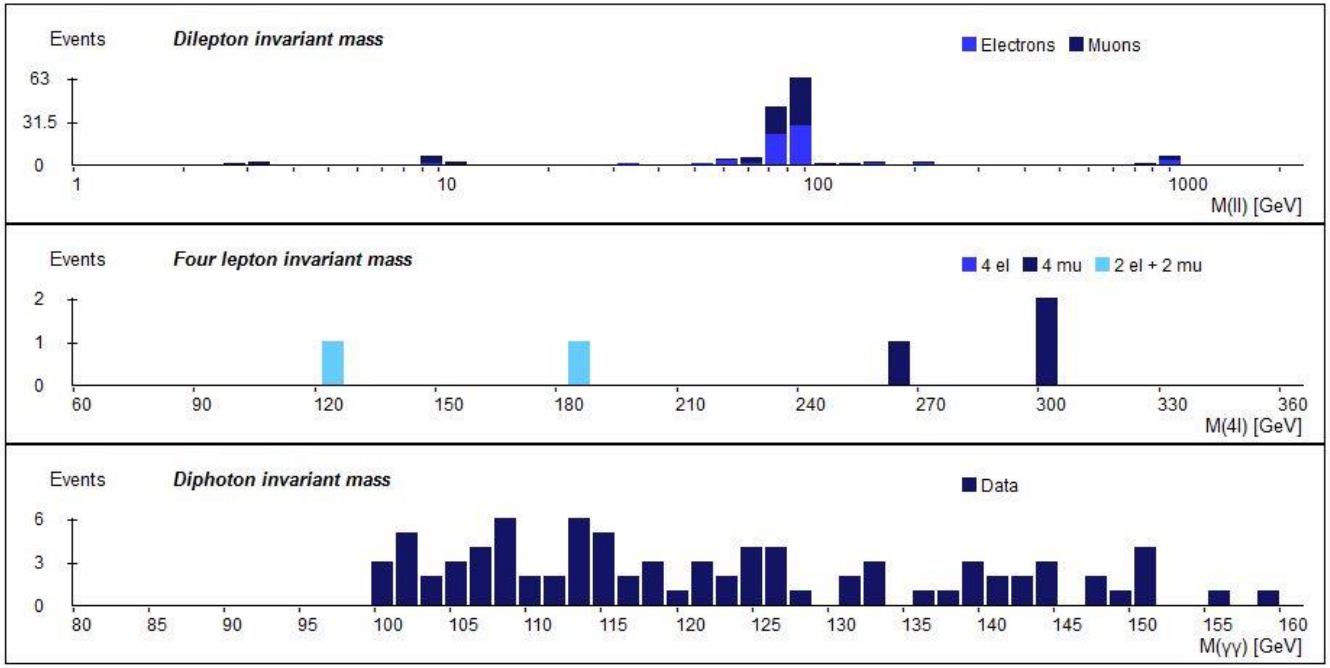
Update plot Reset

epf-mc (AT) fys.uio.no

OPloT – MasterClass – Combination for Beja on March 11 2023

Start Student Moderator Tutor Administrator

Wednesday, March 15th 2023 - 11:51:56 UTC



Plot type:

ll+4l+γγ overview

Dilepton statistics

	Electrons				
Region	R1	R2	R3	R4	R5
Events	2	3	50	4	0
Mean	2.75	9.71	89.71	985.66	0.00
Width	0.46	0.46	4.09	13.16	0.00

	Muons				
Region	R1	R2	R3	R4	R5
Events	4	8	53	3	0
Mean	2.94	9.67	90.29	1,033.58	0.00
Width	0.24	0.80	3.37	39.90	0.00

Number of events

	Student distribution	Expected
ll	171	195
4l	8	15
γγ	86	90
Sum	265	300

Bins: 50

Update plot Reset

epf-mc (AT) fys.uio.no

GR what are the CERN masterclasses ?

CERN (the European Organization for Nuclear Research) Masterclasses are educational programs that allow high school students to participate in real particle physics research at CERN. The program provides an opportunity for students to work with physicists and use real data from CERN's Large Hadron Collider (LHC) to learn about the principles of particle physics and how scientists conduct research in the field.

During a CERN Masterclass, students attend lectures and workshops that cover the basics of particle physics, including the structure of matter, the fundamental forces of nature, and the Standard Model of particle physics. They also learn about CERN's experiments and research projects, including the LHC.

After completing the training, students analyze real data from experiments conducted at CERN and work with physicists to interpret their findings. This provides students with a unique opportunity to participate in cutting-edge research and gain experience in the field of particle physics.

CERN Masterclasses are held at CERN facilities around the world, as well as online, and are open to high school students and teachers. The program aims to inspire and engage the next generation of scientists and promote public understanding of particle physics and its importance in our understanding of the universe.

Sat 11.3.
VC 1
ATLAS Z
Timisoara
Covilhã

„**International Masterclasses ATLAS – Z-Path**'' on **11th of March 2023**
at **West University of Timișoara (Faculty of Phyiscs)** and online
@CERN

„**International Masterclasses ATLAS – W-Path**" on **18th of March 2023**
at **University of Bucharest (Faculty of Phyiscs)** and online **@CERN**

Sat 18.3.
VC 1
ATLAS W
Lisbon
Bucharest

International Particle Physics Outreach Group

INTERNATIONAL MASTERCLASSES

hands on particle physics

- https://physicsmasterclasses.org/

- High school students come to a nearby university or research centres for one day in order to unravel the mysteries of particle physics (lectures from active scientists enabling the students to perform measurements on real data from particle physics experiments themselves). At the end of each day, like in an international research collaboration, the participants join in a video conference for discussion and combination of their results.)

- **Bucharest/ Măgurele, Iași, Timișoara, Cluj-Napoca**

Sat 11.3.
VC 1
ATLAS Z
Timisoara
Covilhã

Sat 18.3.
VC 1
ATLAS W
Lisbon
Bucharest

Thu 30.3.
VC 1
ATLAS W
Würzburg
Iasi
Mainz
Bonn

- **Bucharest/ Măgurele, Suceava**

Fri 17.3.
VC 2
LHCb
Suceava
Barcelona, Univers
Prague, CTU
Bologna
Plymouth

JOINT „**International Masterclasses ATLAS**'' on **27th of May 2023** at the **4 Romanian Faculties of Physics** from **Bucharest/ Măgurele, Cluj-Napoca, Iași** and **Timișoara**