



ATLAS MASTERCLASS

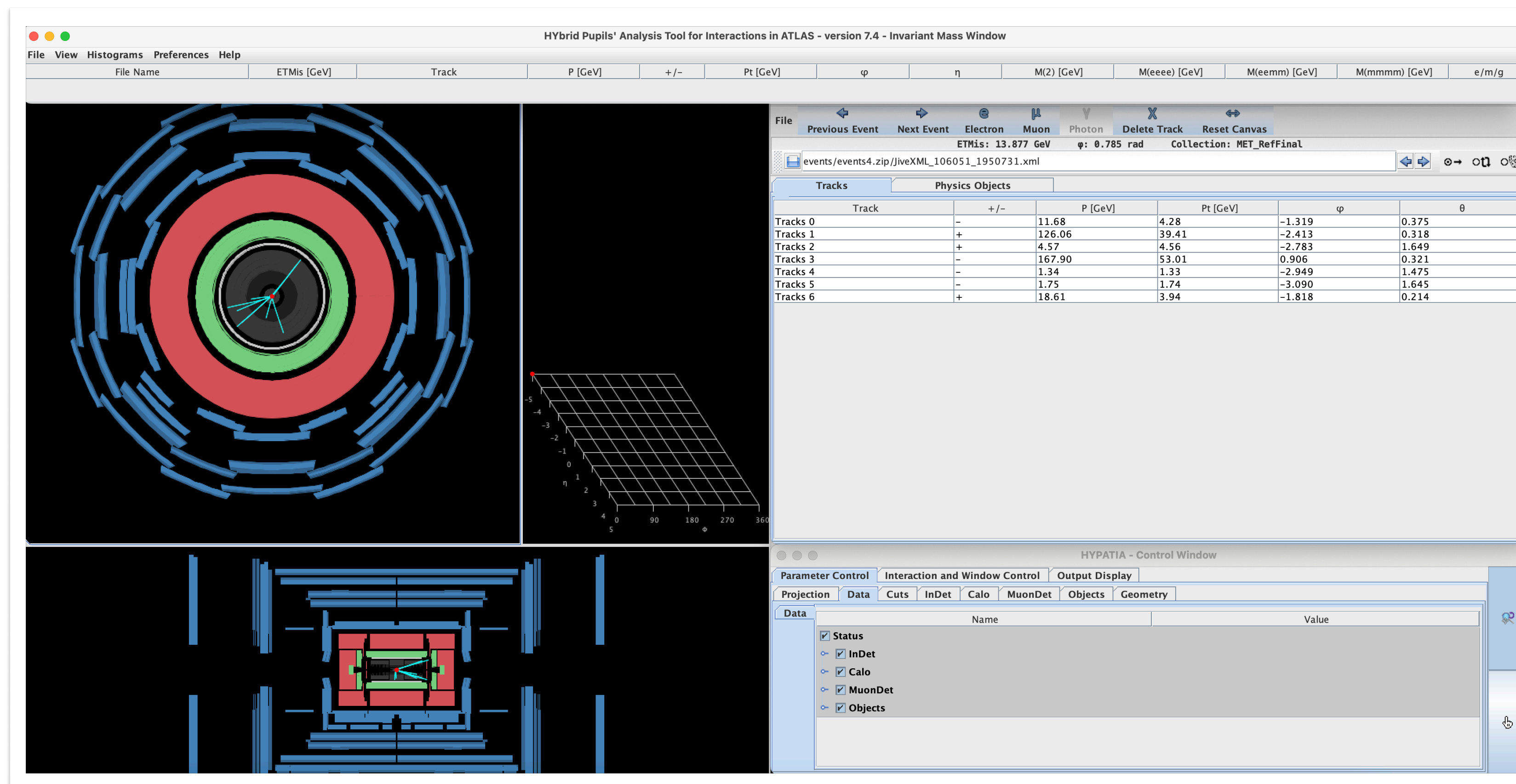
17. marec 2026

Tadej Novak
Institut Jožef Stefan



- **Uporabniško ime:** Tecaj01 - Tecaj15
- **Geslo:** Mat.032026

- Naložite program “Hypathia7” preko povezave:
 - physicsmasterclasses.org/downloads/Hypatia_7.4_Masterclass.zip
- Datoteko razpakirajte (recimo na namizje) in poženite program:
 - Hypatia_7.4_Masterclass.jar



- Preko spletne strani: cernmasterclass.uio.no/datasets/
- Začnemo s skupino 5, lahko pa tudi nadaljujete s 6, če boste hitri.

São Paulo, University	<u>5</u>	<u>6</u>				
Lund	<u>5</u>	<u>6</u>				
Hradec Kralove	<u>5</u>	<u>6</u>				
Thessaloniki, EKFE	<u>5</u>	<u>6</u>	<u>11</u>			
Ljubljana	<u>5</u>	<u>6</u>				
Bergen	<u>5</u>	<u>6</u>				
Oslo	<u>5</u>	<u>6</u>				
Lisbon	<u>5</u>	<u>6</u>	<u>18</u>	<u>19</u>	<u>20</u>	<u>21</u>
Belgrade	<u>5</u>	<u>6</u>				

-
- [groupA.zip](#) Tecaj01
 - [groupB.zip](#) Tecaj02
 - [groupC.zip](#) Tecaj03
 - [groupD.zip](#) Tecaj04
 - [groupE.zip](#) Tecaj05
 - [groupF.zip](#) Tecaj06
 - [groupG.zip](#) Tecaj07
 - [groupH.zip](#) Tecaj08
 - [groupI.zip](#) Tecaj09
 - [groupJ.zip](#) Tecaj10
 - [groupK.zip](#) Tecaj11
 - [groupL.zip](#) Tecaj12
 - [groupM.zip](#) Tecaj13
 - [groupN.zip](#) Tecaj14
 - [groupO.zip](#) Tecaj15

The screenshot displays the Hypathia software interface. At the top, there is a menu bar with options: File, Previous Event, Next Event, Electron, Muon, Photon, Delete Track, and Reset Canvas. Below the menu bar, the current event information is shown: ETMis: 13.877 GeV, φ : 0.785 rad, and Collection: MET_RefFinal. The file path is events/events4.zip/JiveXML_106051_1950731.xml. A red box highlights the 'Open local file' button. Below the file path, there is a 'Physics Objects' tab. The main area of the interface contains a table with the following data:

Track	+/-	P [GeV]	Pt [GeV]	φ	θ
Tracks 0	-	11.68	4.28	-1.319	0.375
Tracks 1	+	126.06	39.41	-2.413	0.318
Tracks 2	+	4.57	4.56	-2.783	1.649
Tracks 3	-	167.90	53.01	0.906	0.321
Tracks 4	-	1.34	1.33	-2.949	1.475
Tracks 5	-	1.75	1.74	-3.090	1.645
Tracks 6	+	18.61	3.94	-1.818	0.214

The screenshot shows the Hypathia software interface. At the top, there is a menu bar with options like 'File', 'Previous Event', 'Next Event', 'Electron', 'Muon', 'Photon', 'Delete Track', and 'Reset Canvas'. Below the menu bar, there is a status bar displaying 'ETMis: 13.877 GeV', 'φ: 0.785 rad', and 'Collection: MET_RefFinal'. The main window displays a table of tracks with columns for 'Track', '+/-', 'P [GeV]', 'Pt [GeV]', 'φ', and 'θ'. A red box highlights the 'Open local file' button, and a red arrow points from it to an 'Open' dialog box. The dialog box shows the 'Look In' field set to 'Downloads' and a list of files and folders, with 'groupA.zip' selected. The 'File Name' field contains 'groupA.zip' and the 'Files of Type' dropdown is set to '.xml, .zip, .gzip, .gz'. The 'Open' and 'Cancel' buttons are visible at the bottom of the dialog box.

Track	+/-	P [GeV]	Pt [GeV]	φ	θ
Tracks 0	-	11.68	4.28	-1.319	0.375
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Tracks 5	-	1.75	1.74	-3.090	1.645
Tracks 6	+	18.61	3.94	-1.818	0.214

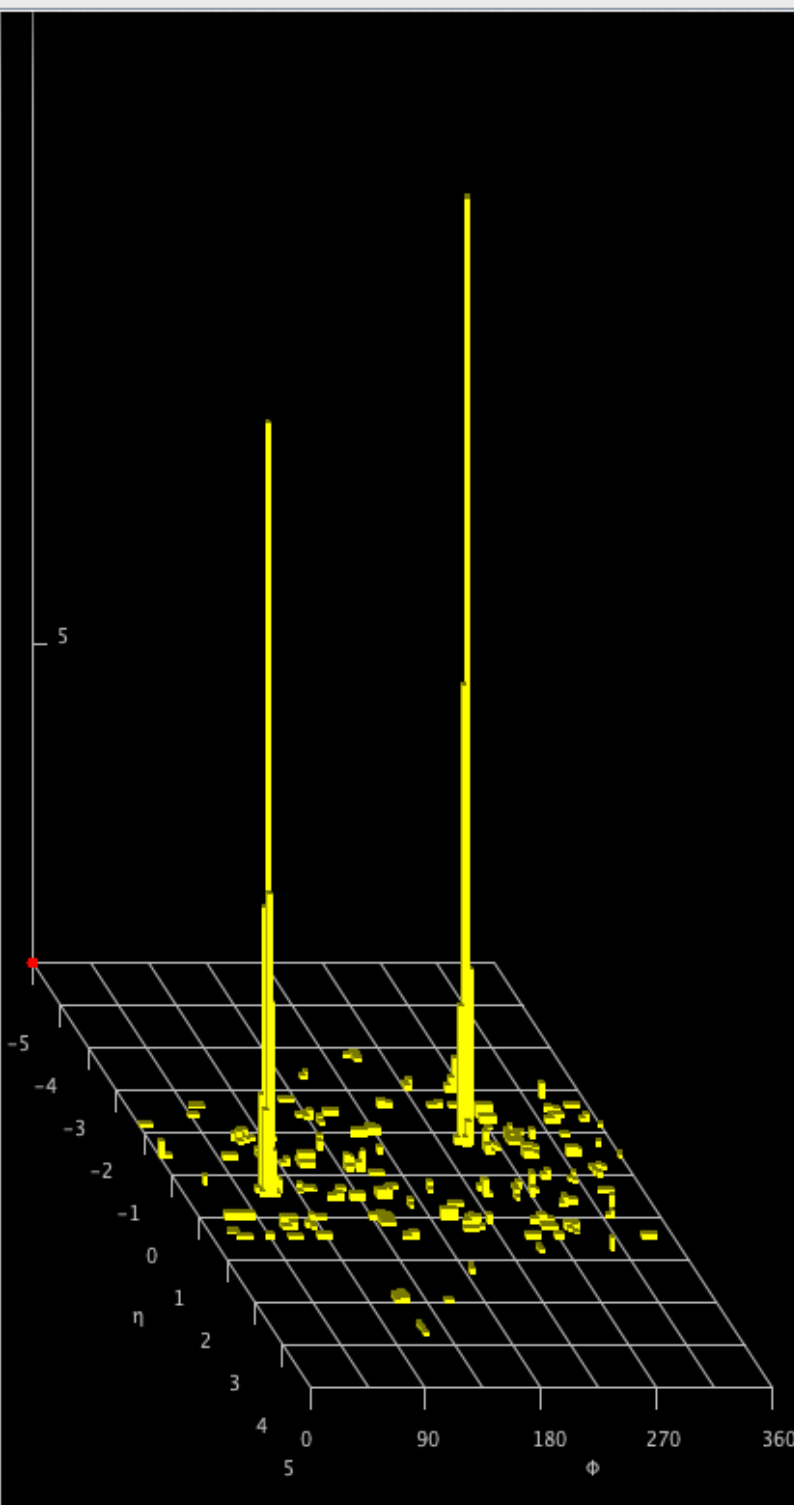
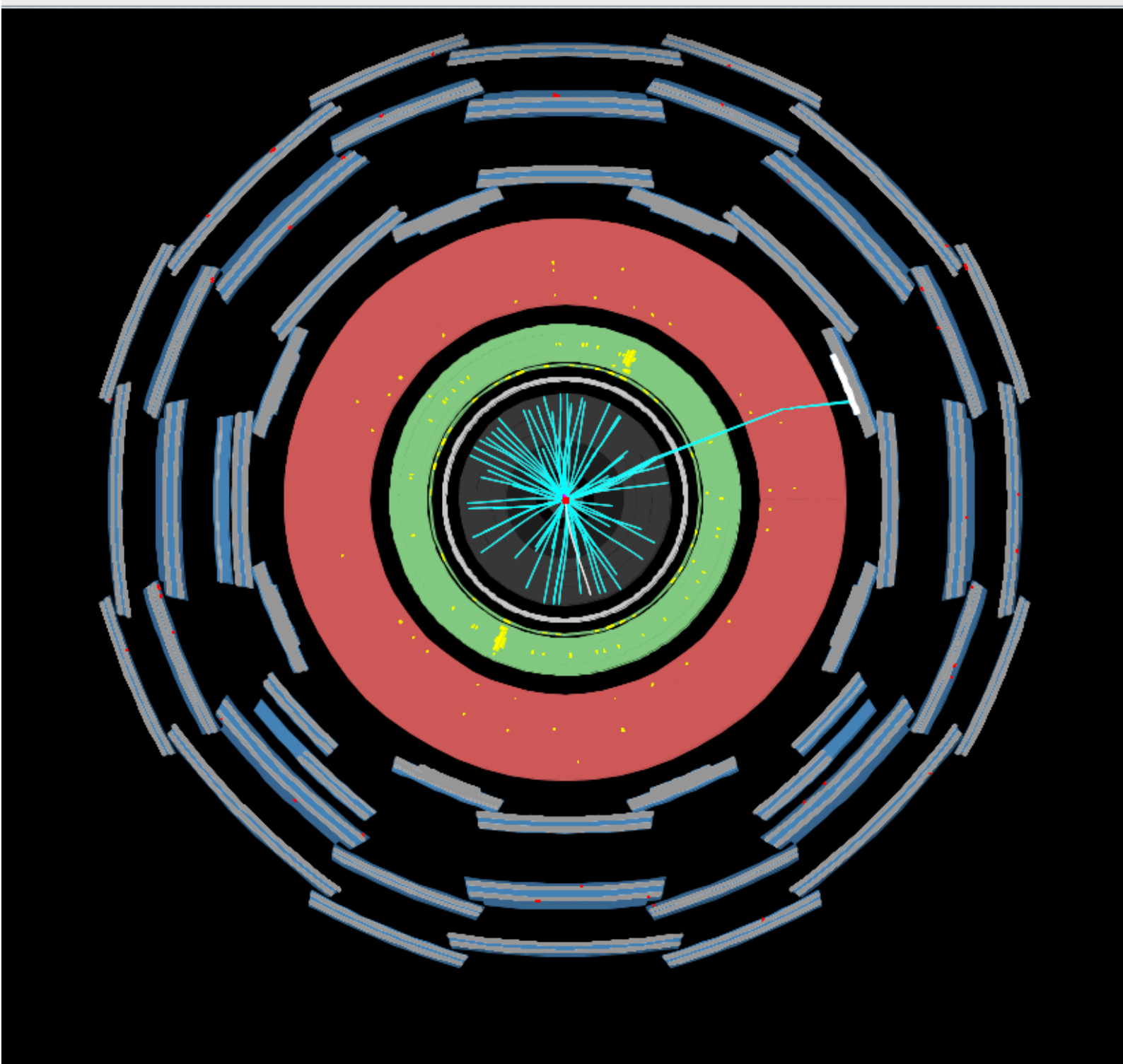
Vnašanje podatkov v program Hypathia



HTDPU Pupils Analysis Tool for Interactions in ATLAS - version 7.4 - Invariant Mass Window

e View Histograms Preferences Help

File Name	ETMis [GeV]	Track	P [GeV]	+/-	Pt [GeV]	ϕ	η	M(2) [GeV]	M(eeee) [GeV]	M(eemm) [GeV]	M(mmmm) [GeV]	e/m/g
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File Previous Event Next Event Electron Muon Photon Delete Track Reset Canvas

ETMis: 4.167 GeV ϕ : 3.040 rad Collection: MET_RefFinal

/Users/mihamuskinj/Downloads/groupA.zip/event001.xml

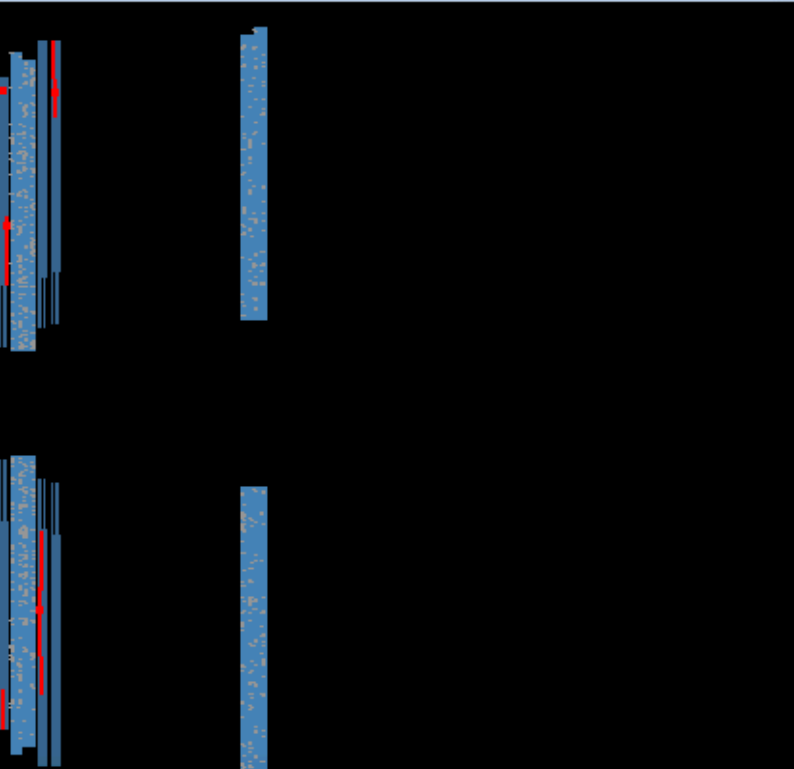
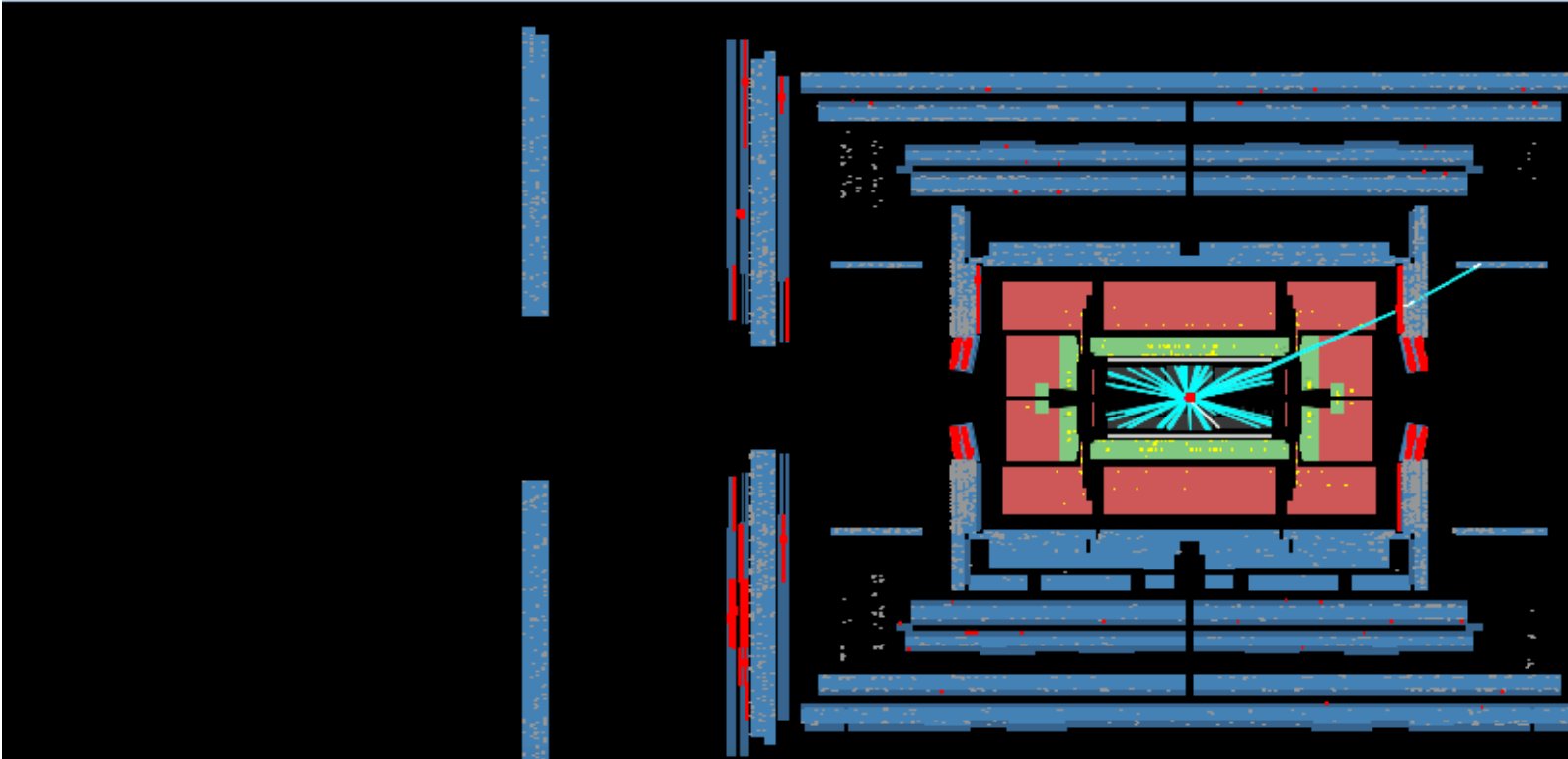
Tracks	Physics Objects				
Track	+/-	P [GeV]	Pt [GeV]	ϕ	θ
Tracks 4	-	5.83	1.43	0.509	0.248
Tracks 7	-	3.40	1.06	-2.977	0.316
Tracks 8	+	47.07	37.95	-1.978	2.204
Tracks 10	-	2.34	1.28	2.093	0.580
Tracks 11	-	5.42	1.44	0.516	0.269
Tracks 12	-	2.96	1.20	-2.802	2.724
Tracks 13	-	8.30	1.47	2.483	2.964
Tracks 14	-	6.58	2.03	-1.081	0.313
Tracks 15	+	7.59	1.50	-1.220	2.943
Tracks 17	-	2.00	1.12	2.214	2.546
Tracks 21	+	2.65	1.91	-0.290	2.338
Tracks 25	+	6.27	1.30	2.975	0.209
Tracks 27	-	4.12	1.43	0.256	0.355
Tracks 28	-	1.92	1.65	2.064	1.039
Tracks 31	-	1.58	1.54	-1.098	1.367
Tracks 33	-	3.08	1.21	-1.953	0.406
Tracks 35	-	2.88	1.13	-2.993	0.404
Tracks 36	+	2.09	1.86	-1.513	1.094
Tracks 41	-	2.52	1.86	2.745	0.832
Tracks 42	+	1.29	1.22	1.668	1.247
Tracks 44	+	3.95	1.00	-2.840	0.256
Tracks 48	+	3.90	1.10	2.977	0.286
Tracks 49	-	2.86	1.09	0.165	0.391
Tracks 58	+	1.95	1.95	2.874	1.561
Tracks 63	-	8.03	1.87	-0.613	2.906
Tracks 67	-	1.02	1.01	-2.092	1.491
Tracks 68	+	1.68	1.64	1.815	1.768
Tracks 69	+	10.96	2.05	2.045	0.188
Tracks 75	+	1.84	1.55	-1.469	1.003
Tracks 77	+	6.43	1.99	1.824	2.828
Tracks 80	+	2.38	1.24	1.732	2.594
Tracks 81	+	2.45	2.24	0.300	1.996
Tracks 82	-	2.20	1.51	-1.508	0.758
Tracks 84	-	2.35	1.08	-0.928	2.664
Tracks 85	-	1.54	1.16	1.708	2.293
Tracks 87	+	2.42	1.62	-2.037	0.733
Tracks 88	-	4.49	2.01	3.045	2.678
Tracks 89	-	1.97	1.70	-1.199	1.037
Tracks 91	+	2.07	1.52	-2.857	2.314

HYPATIA - Control Window

Parameter Control Interaction and Window Control Output Display

Projection Data Cuts InDet Calo MuonDet Objects Geometry

Data	Name	Value
<input checked="" type="checkbox"/>	Status	
<input checked="" type="checkbox"/>	InDet	
<input checked="" type="checkbox"/>	Calo	
<input checked="" type="checkbox"/>	MuonDet	
<input checked="" type="checkbox"/>	Objects	





- Preko strani “Indico” lahko prenesete prosojnice: indico.ijs.si/event/3241

13:00

→ 13:30

Uvod v analizo podatkov, ATLAS

Speaker: Tadej Novak (Jožef Stefan Institute)

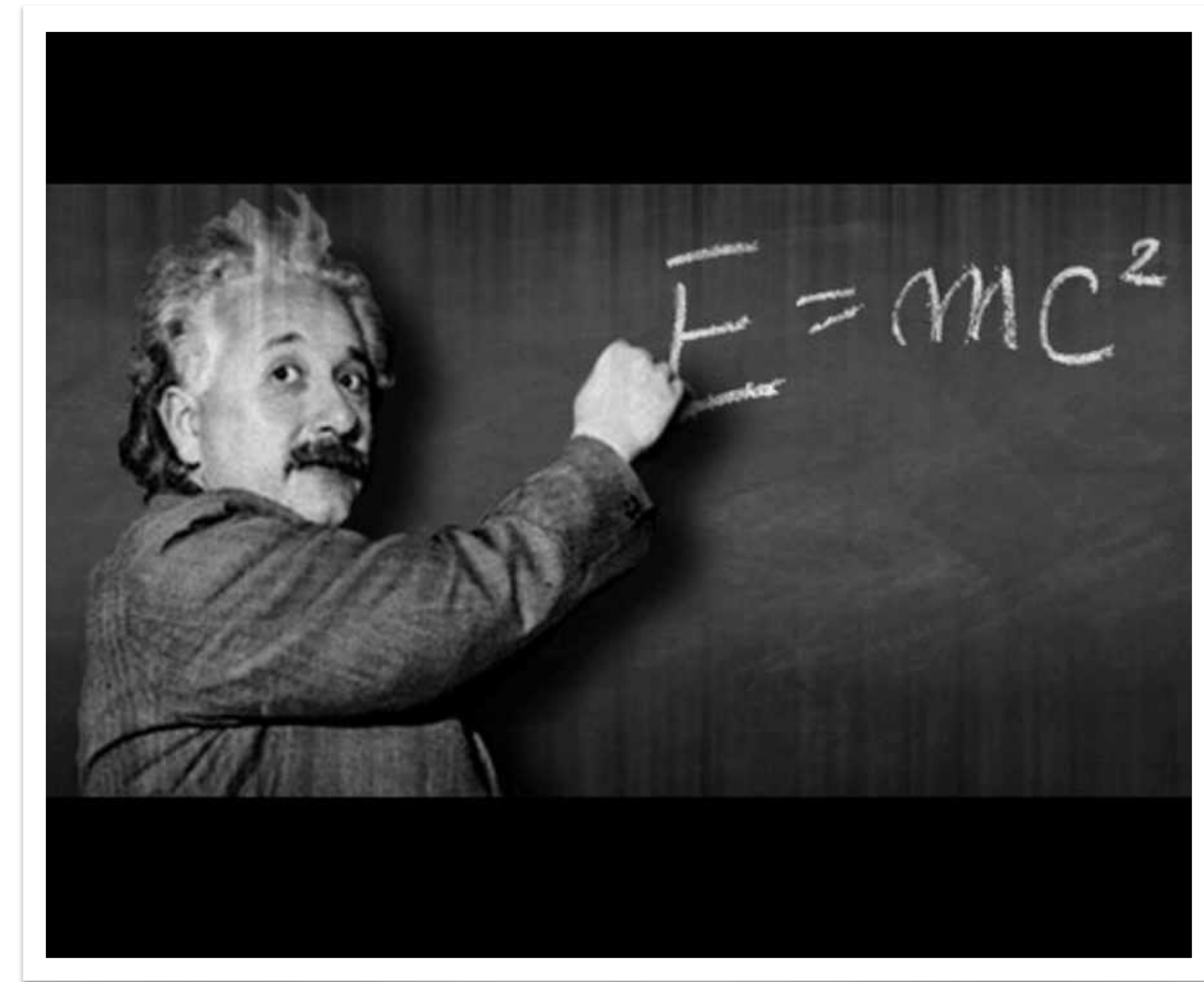
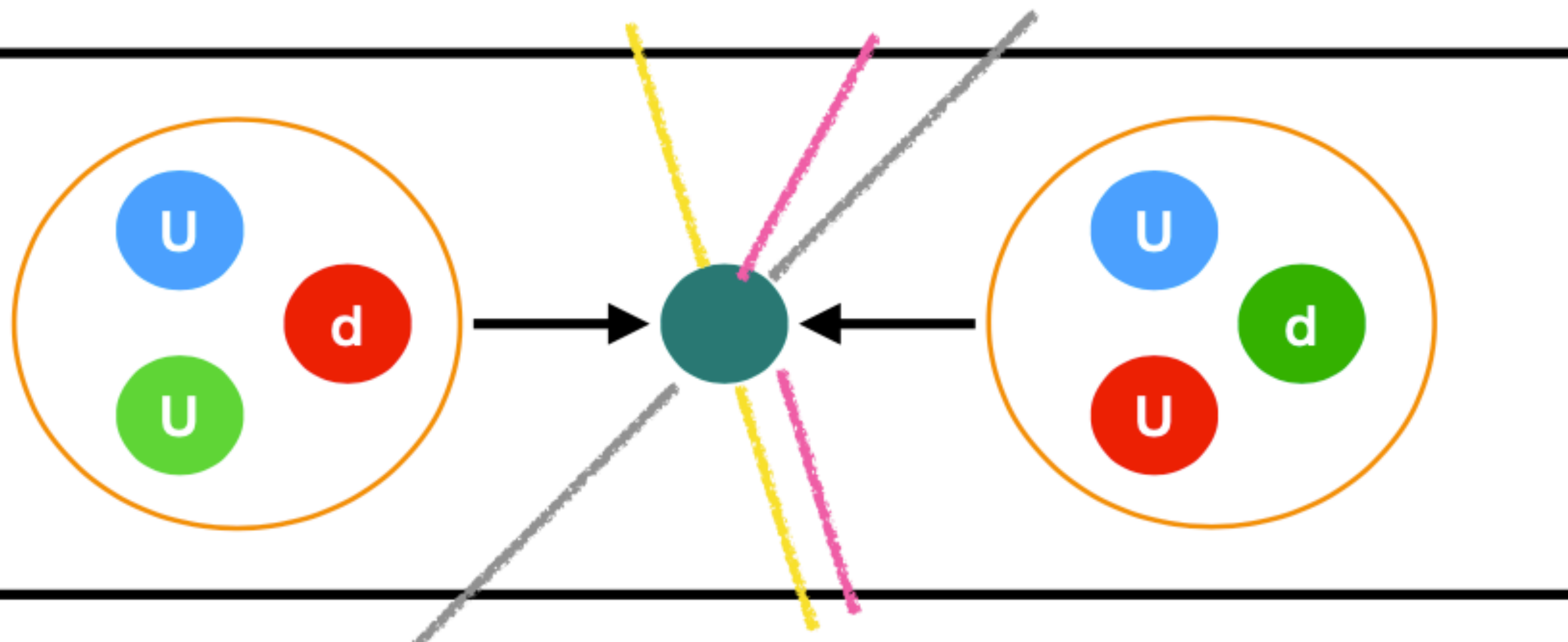
🕒 30m

📍 Predavalnica 3.12 (FMF)

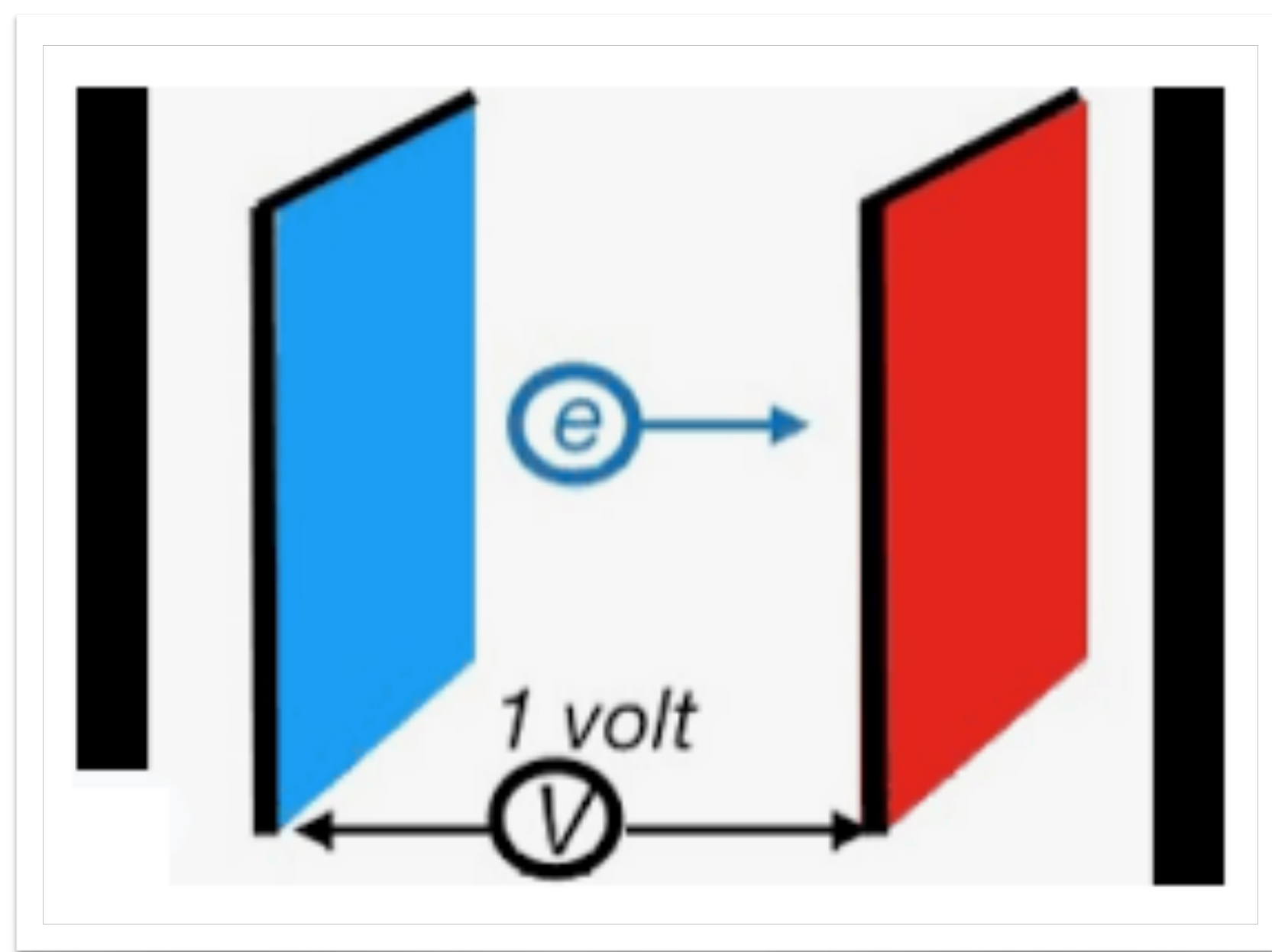


Katere delce bomo iskali?

- **Einstein:** energija in masa sta ekvivalentni!
- Trčenje delcev z visoko energijo proizvaja veliko novih delcev
- Uporabljamo Veliki hadronski trkalnik (LHC), da pospešimo protone na 0,999999999 hitrosti svetlobe in jih trčimo (za poznavalce: Lorentz boost $\gamma \approx 7500$)
- Med letoma 2015 in 2018 smo v ATLAS-u proizvedli približno 8.000.000 Higgsovih bozonov



- "0.999999999 hitrosti svetlobe" - nepraktično
- Namesto navajanja hitrosti raje govorimo o kinetični energiji
- Energija: 'Jouli'. Vendar raje uporabljamo enoto 'elektronvolt':



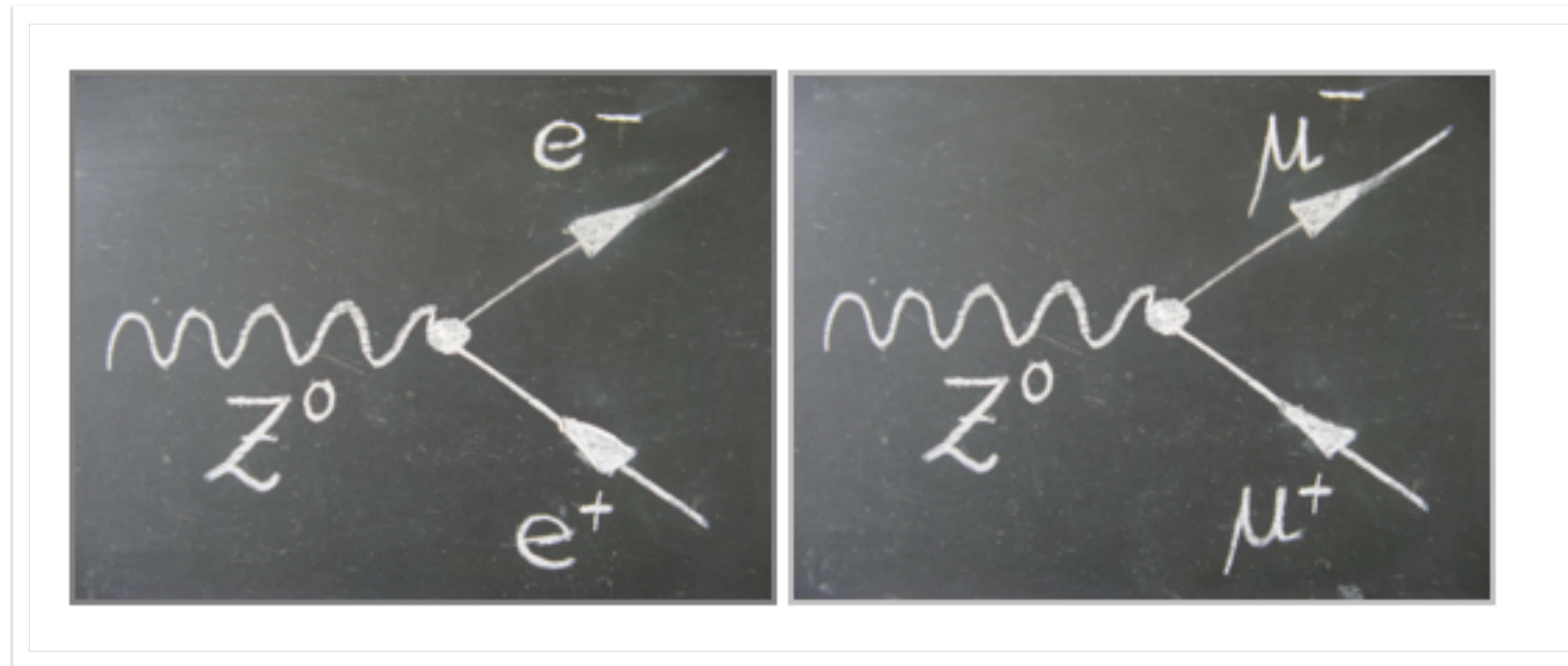
1 'electron Volt' ali 1 eV:

Energija, pridobljena s pospeševanjem elektrona z električnim potencialom enega volta

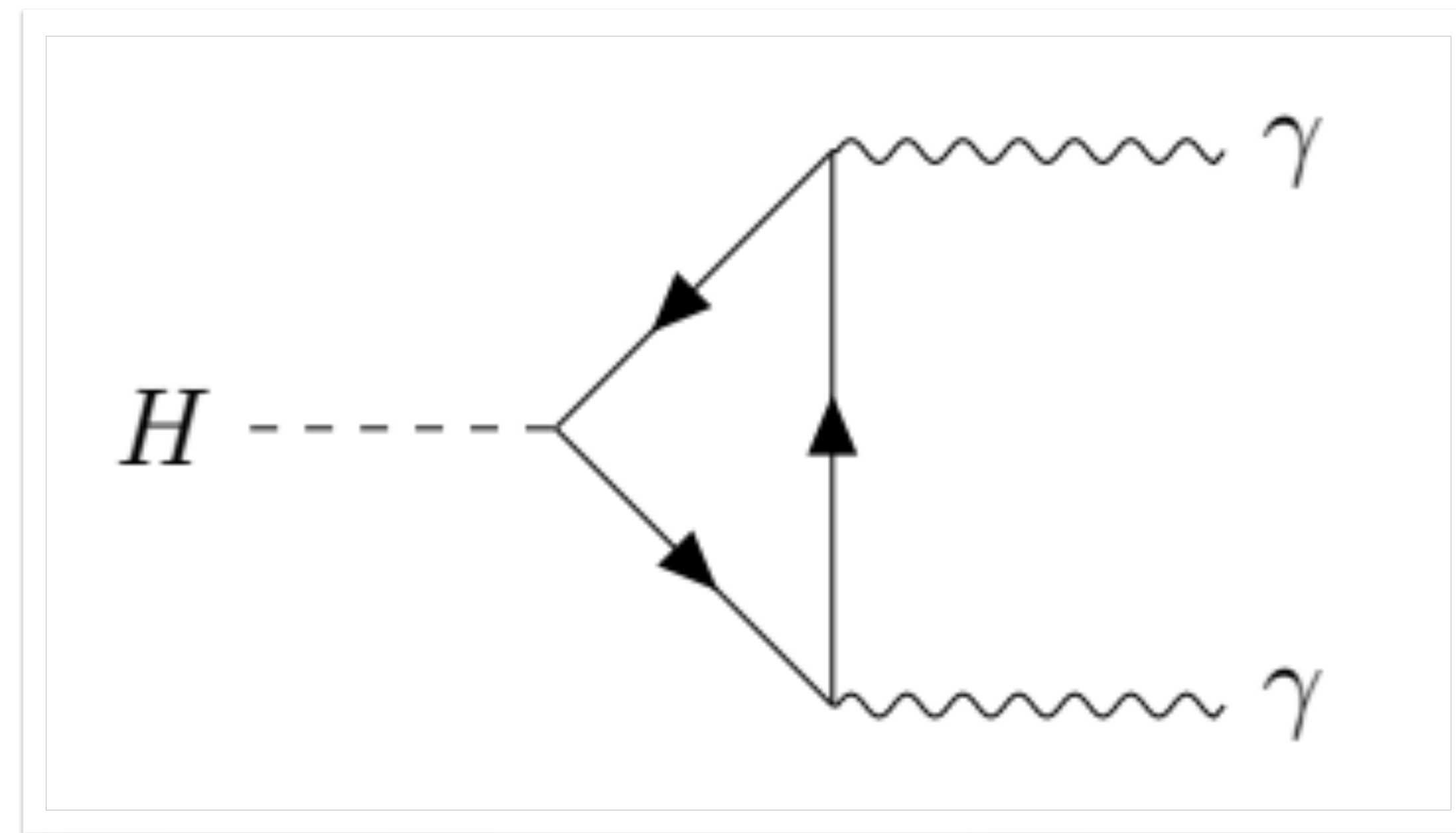
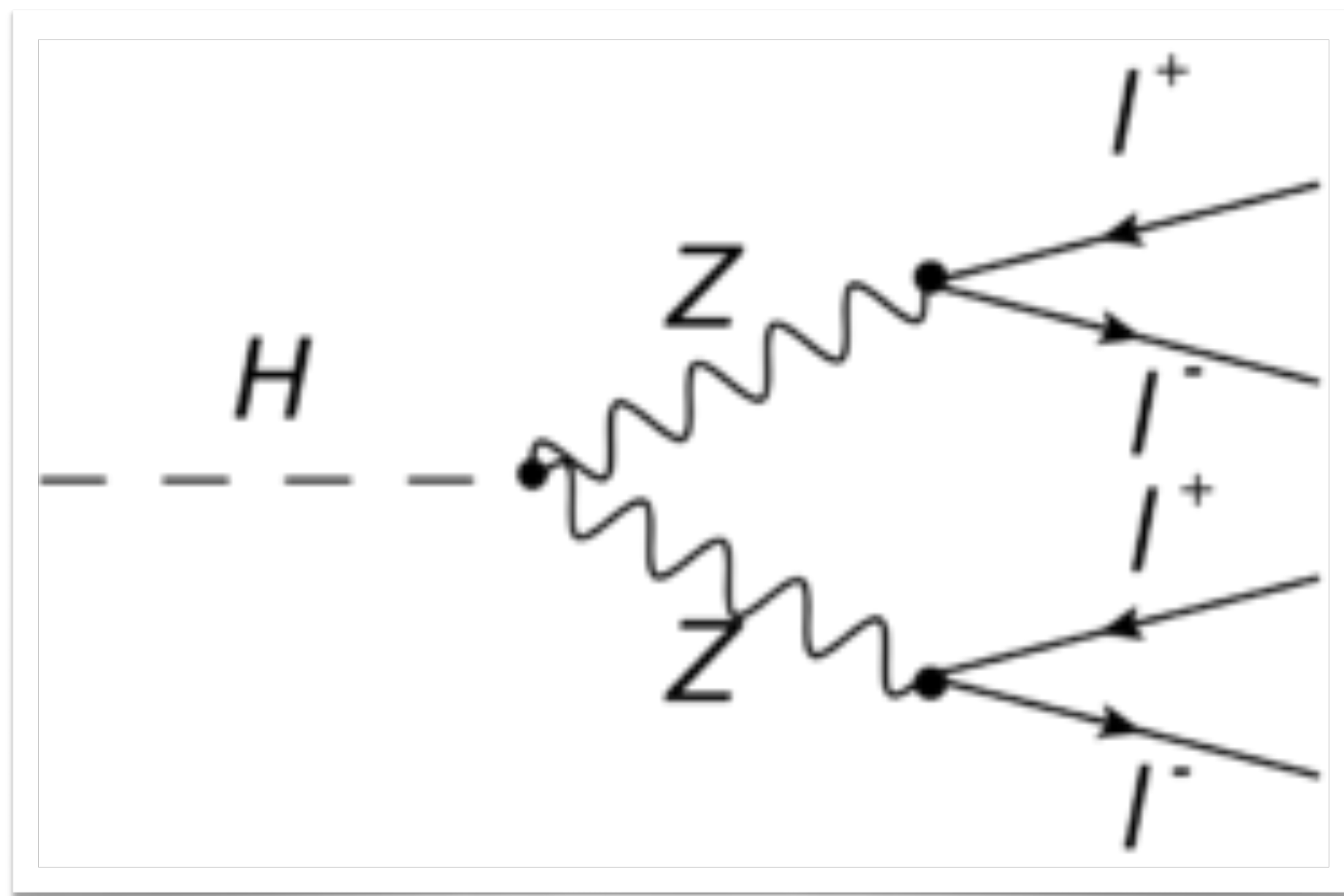
$$1 \text{ eV} = 1.6 \cdot 10^{-19} \text{ J}$$

- Na LHC trčimo protone z energijo $13 \text{ TeV} = 13.000.000.000 \text{ eV}$
- Novi delci, ustvarjeni v teh trkih, običajno imajo energijo okoli **1 do 100 GeV**

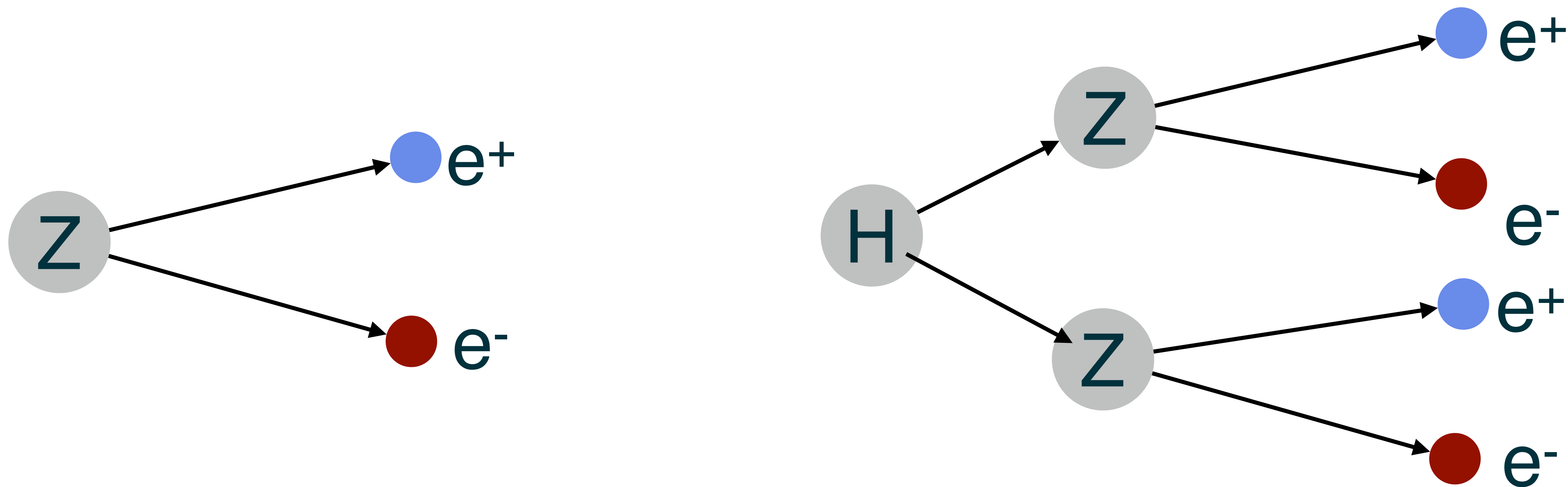
- Danes boste iskali razpade bozona Z:



- Bozon Z razpade bodisi v dva elektrona bodisi v dva miona (v naših podatkih)
- Bozon Z nima naboja
 - Zaradi ohranitve naboja imajo izhodni delci nasprotni naboj: e^- in e^+



- Prav tako boste iskali razpade Higgsovega bozona:
 - $H \rightarrow ZZ \rightarrow 4$ leptoni (elektroni ali mioni)
 - $H \rightarrow \gamma\gamma$ (2 fotona)
- S pravilno identifikacijo bozonov Z boste lahko rekonstruirali Higgsov bozon!

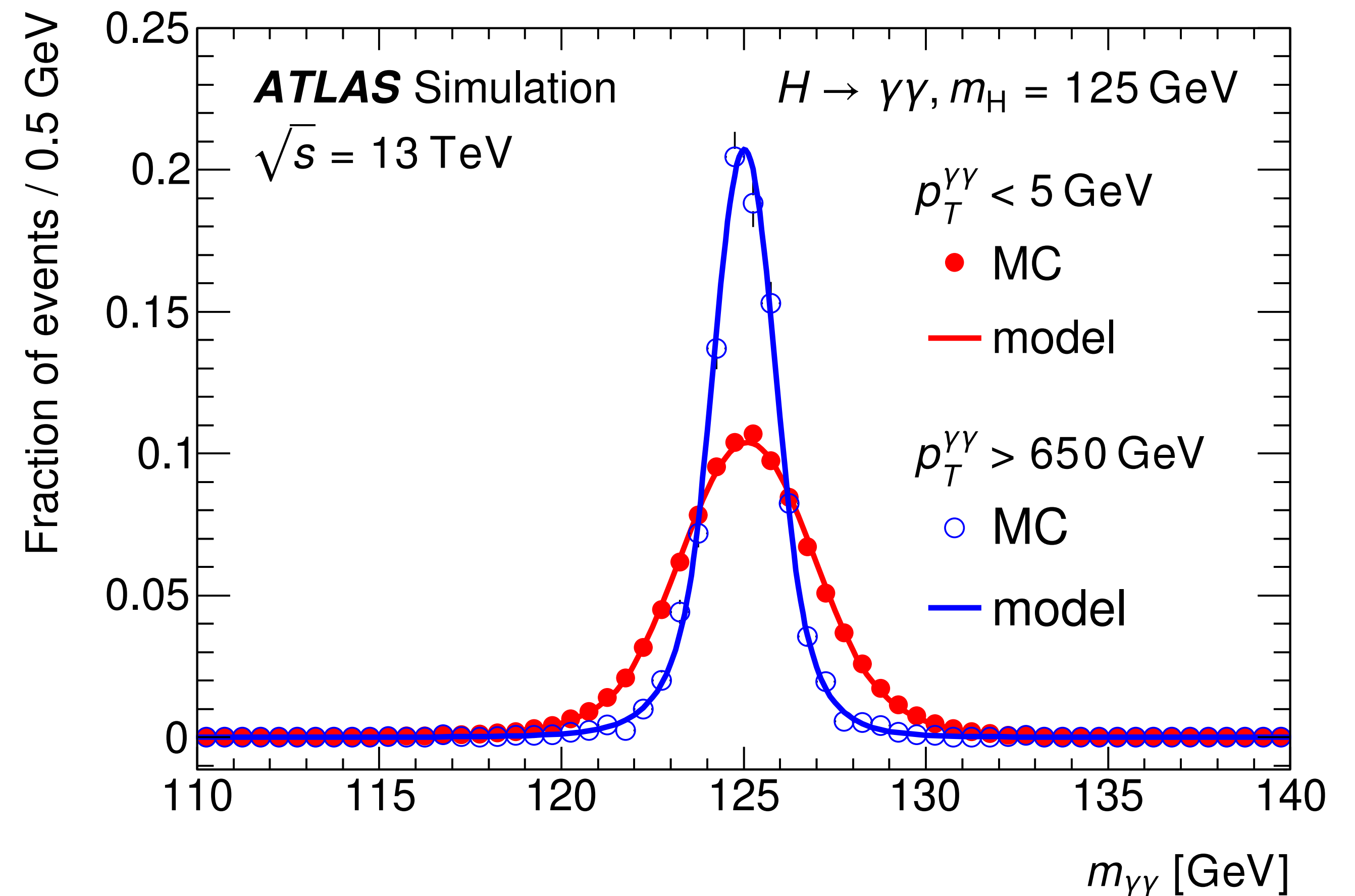
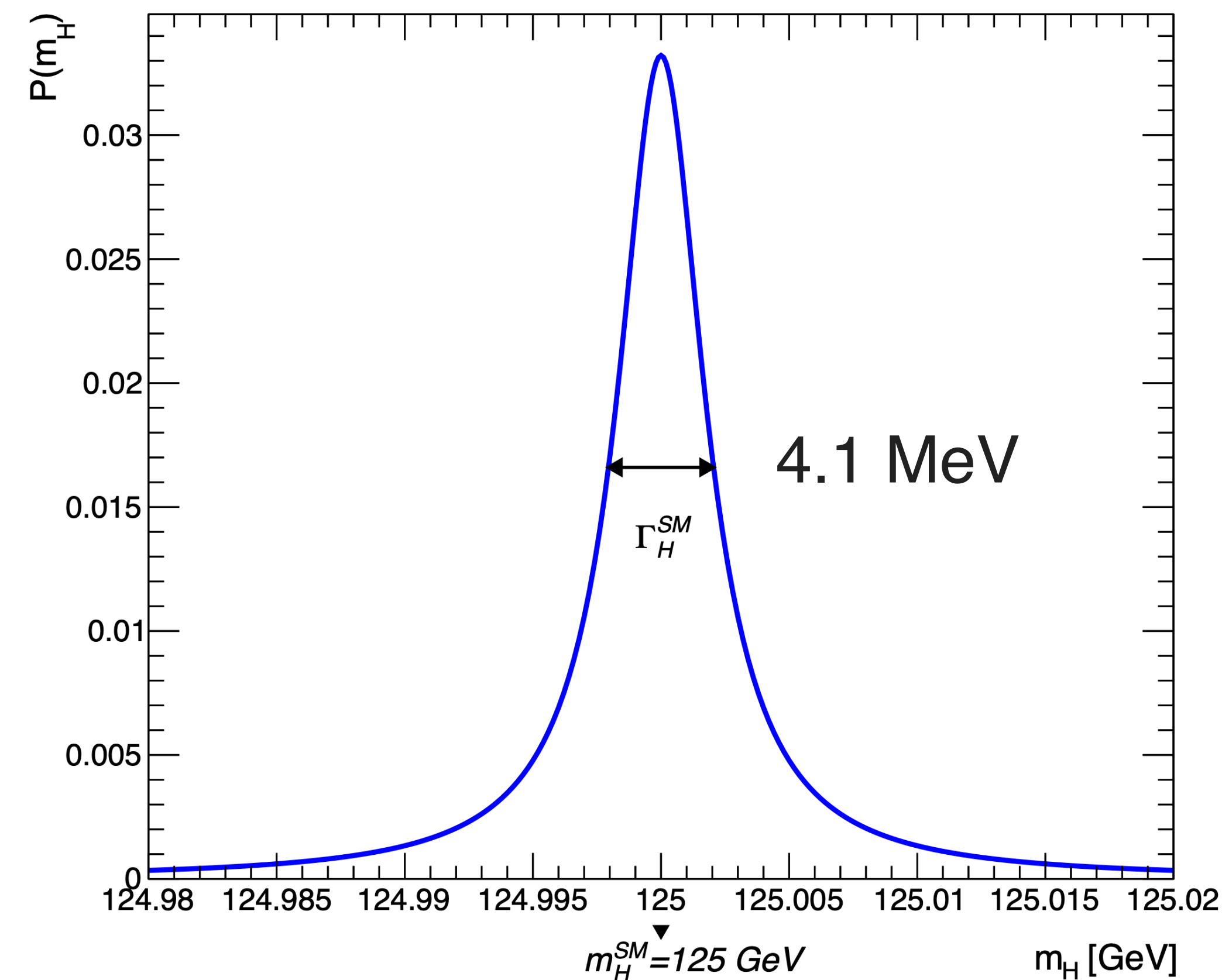


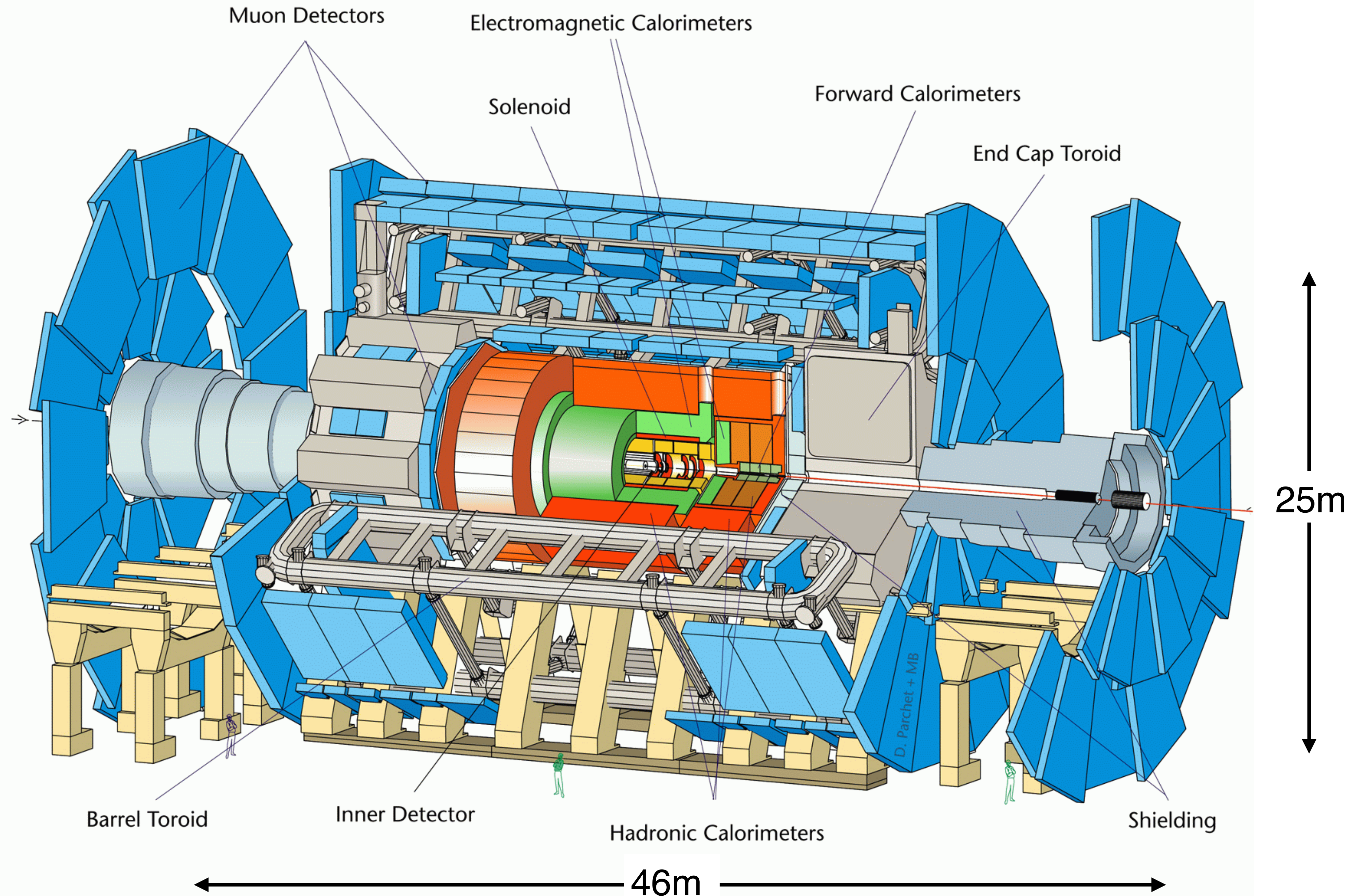
- Detektor ATLAS meri samo gibalno količino in energijo končnih delcev (e , μ , γ , ...)
- S temi podatki lahko rekonstruiramo maso začetnega delca (bozona Z ali H)
 - Bozon Z : 90 GeV
 - Bozon H : 125 GeV
- Vendar pa zaradi merskih napak rekonstruirana masa odstopa od prave mase

- Razpadna širina Higgsovega bozona je 4.1 MeV— povezano z njegovim razpadnim časom
- Vendar je rekonstruirana masa Higgsovega bozona zaradi končne natančnosti detektorja širša
 - Eden izmed najbolj natančnih kanalov je $H \rightarrow \gamma\gamma$, kjer dosežemo resolucijo do 1.5 GeV

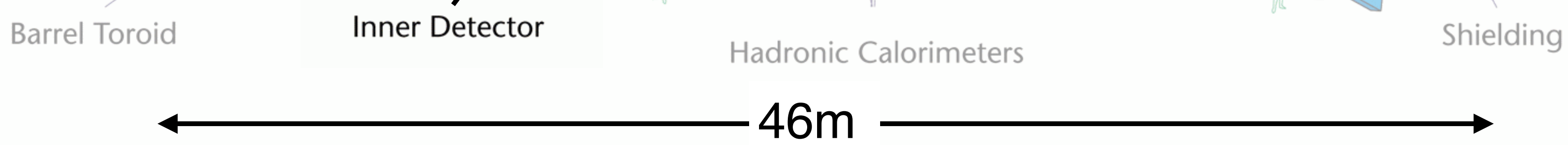
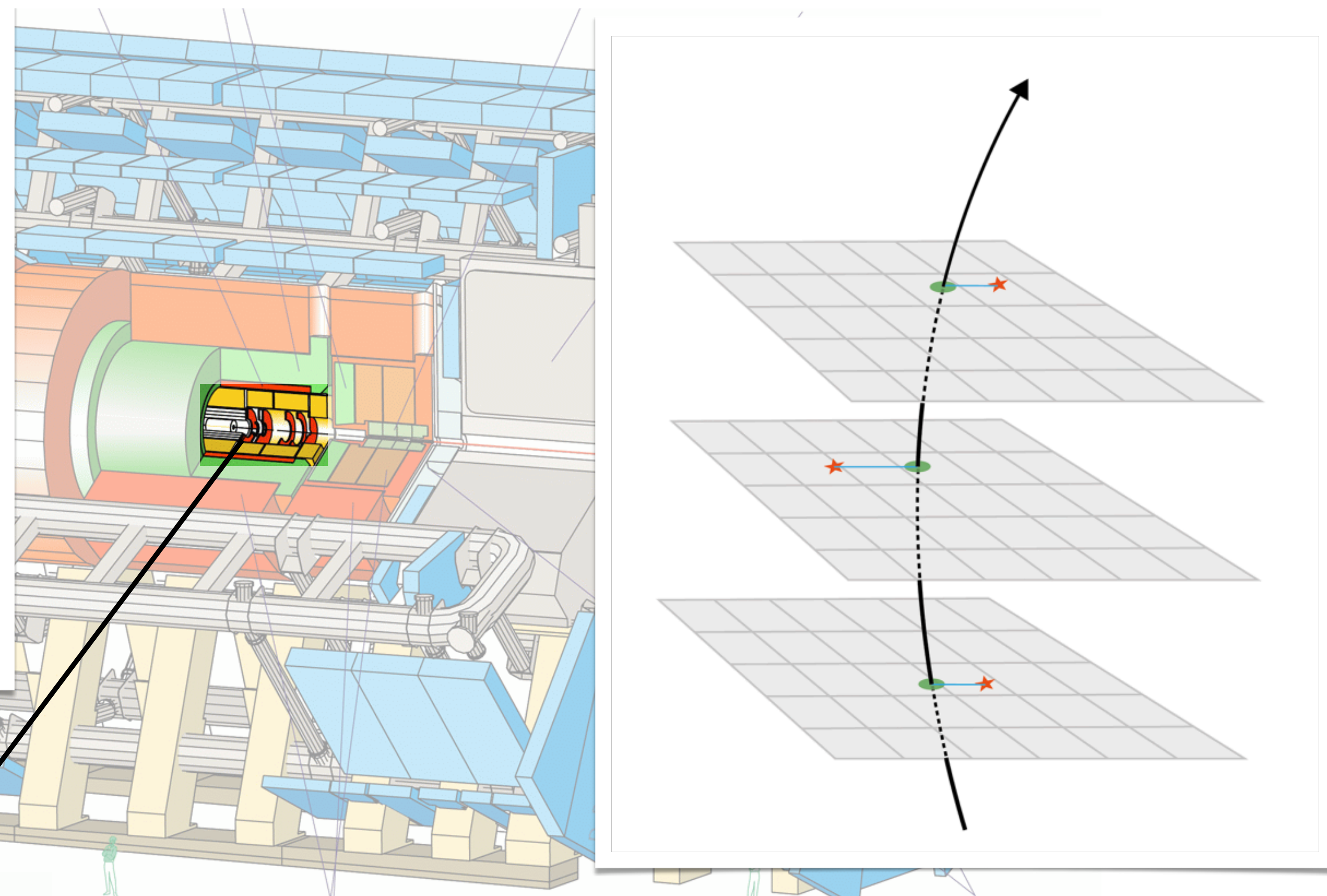
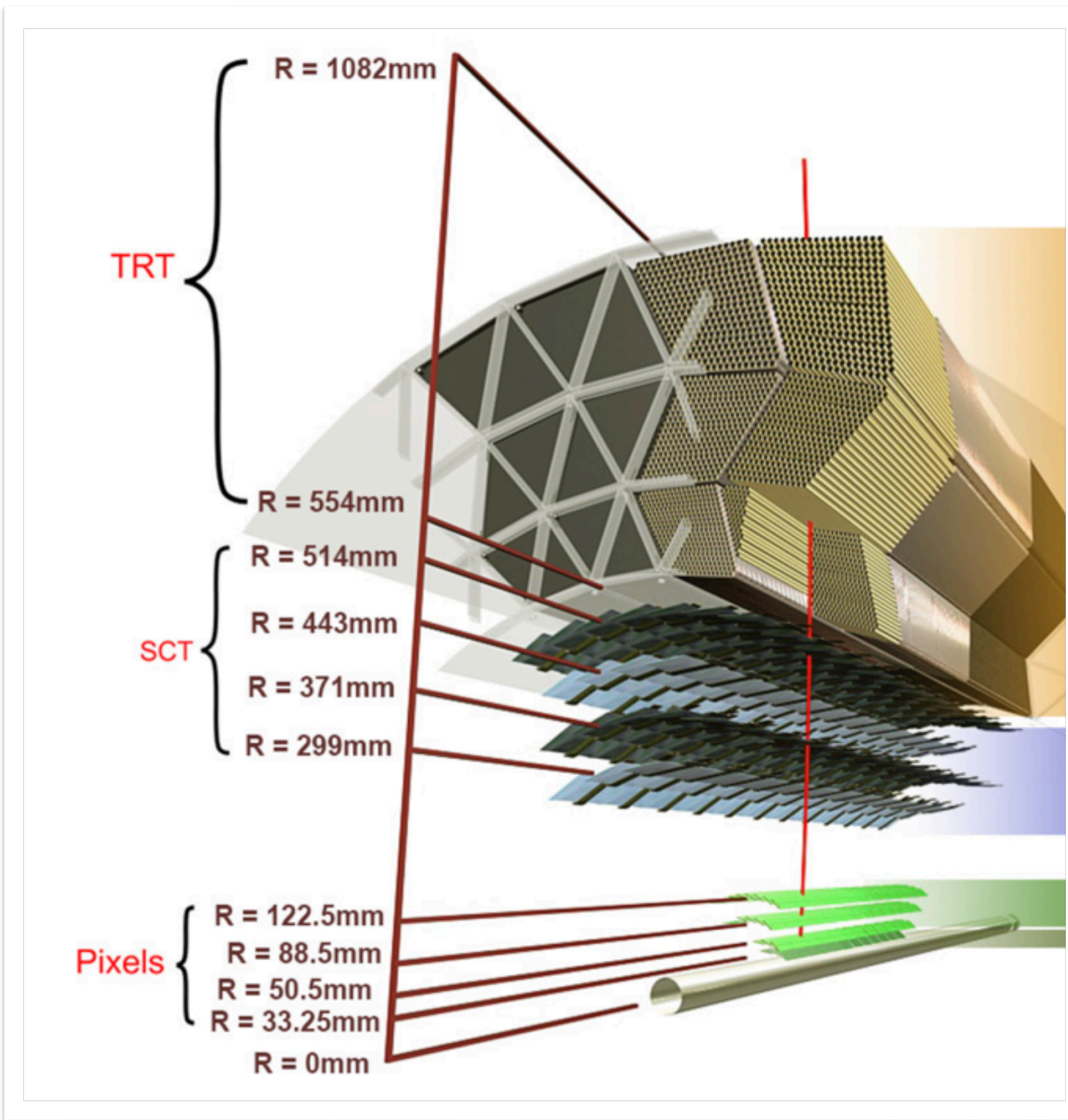
$$\Gamma = \hbar/\tau$$

$$\tau = \hbar/(4.1 \text{ MeV}) = 1.6 \times 10^{-22} \text{ s}$$





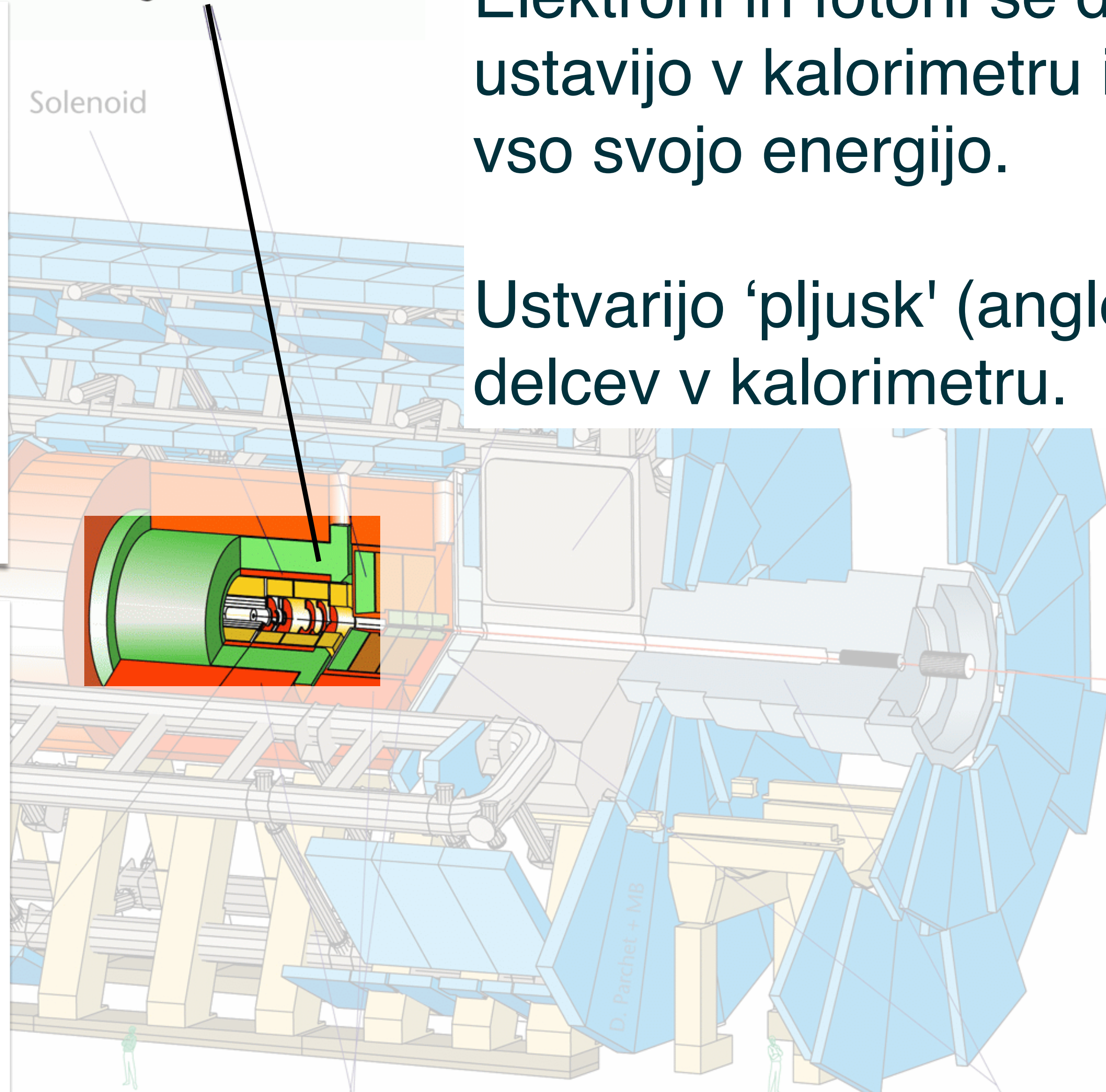
Nabiti delci (npr. elektroni) se ukrivijo v močnem magnetnem polju in pustijo signal v sledilnih detektorjih.



Muon Detectors

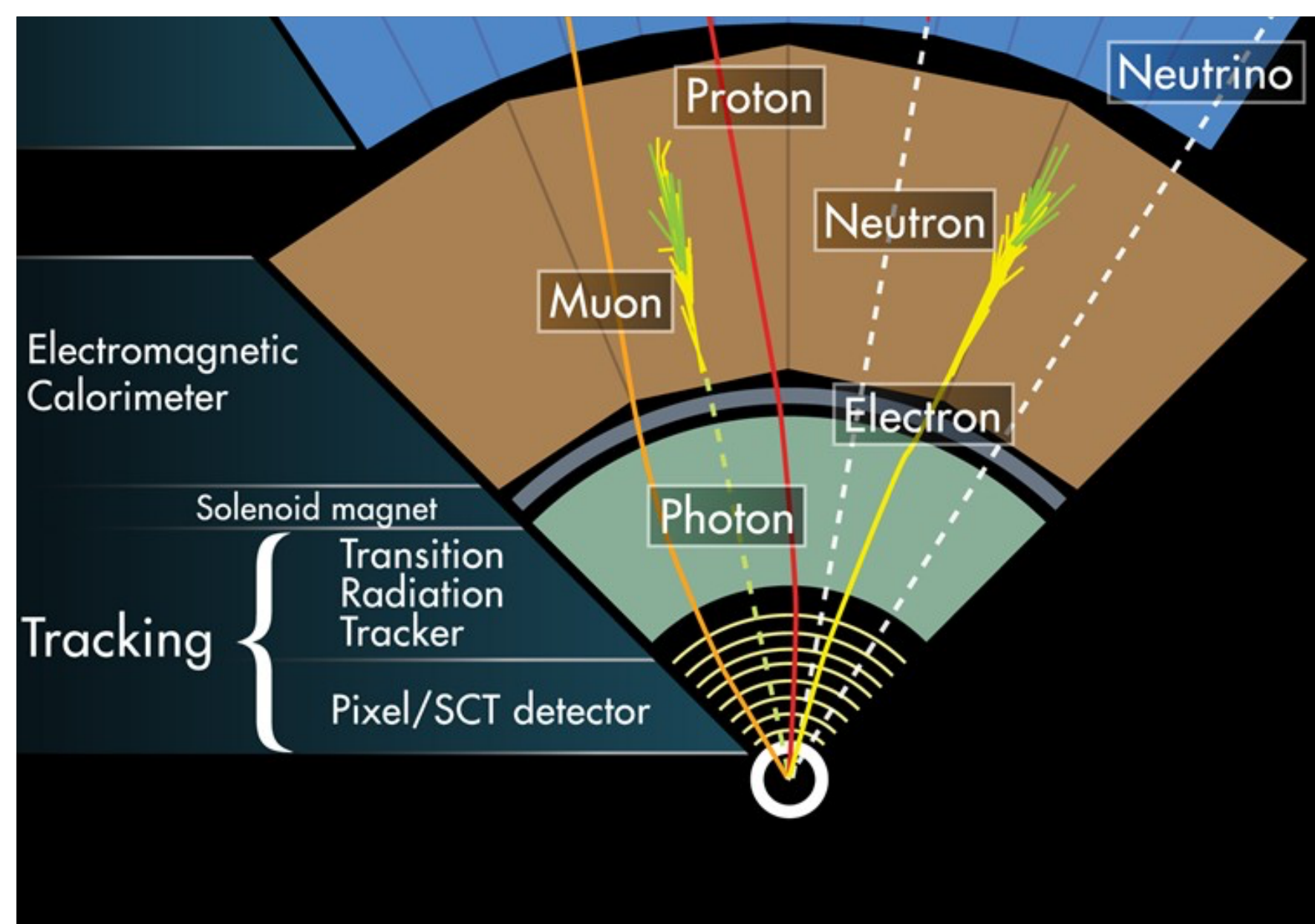


Electromagnetic Calorimeters



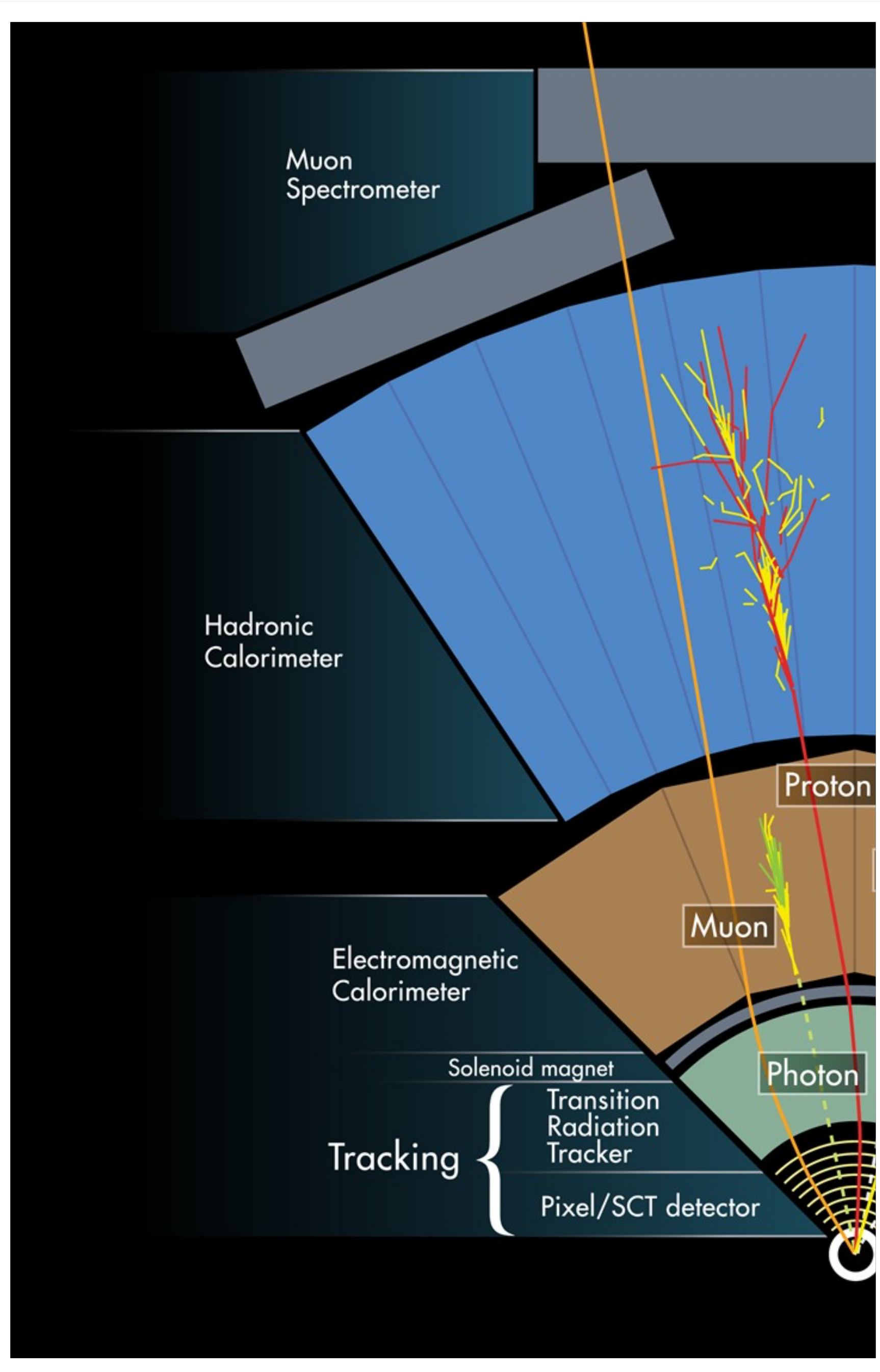
Elektroni in fotoni se destruktivno ustavijo v kalorimetru in oddajo vso svojo energijo.

Ustvarijo 'pljuski' (angleško 'jet') delcev v kalorimetru.

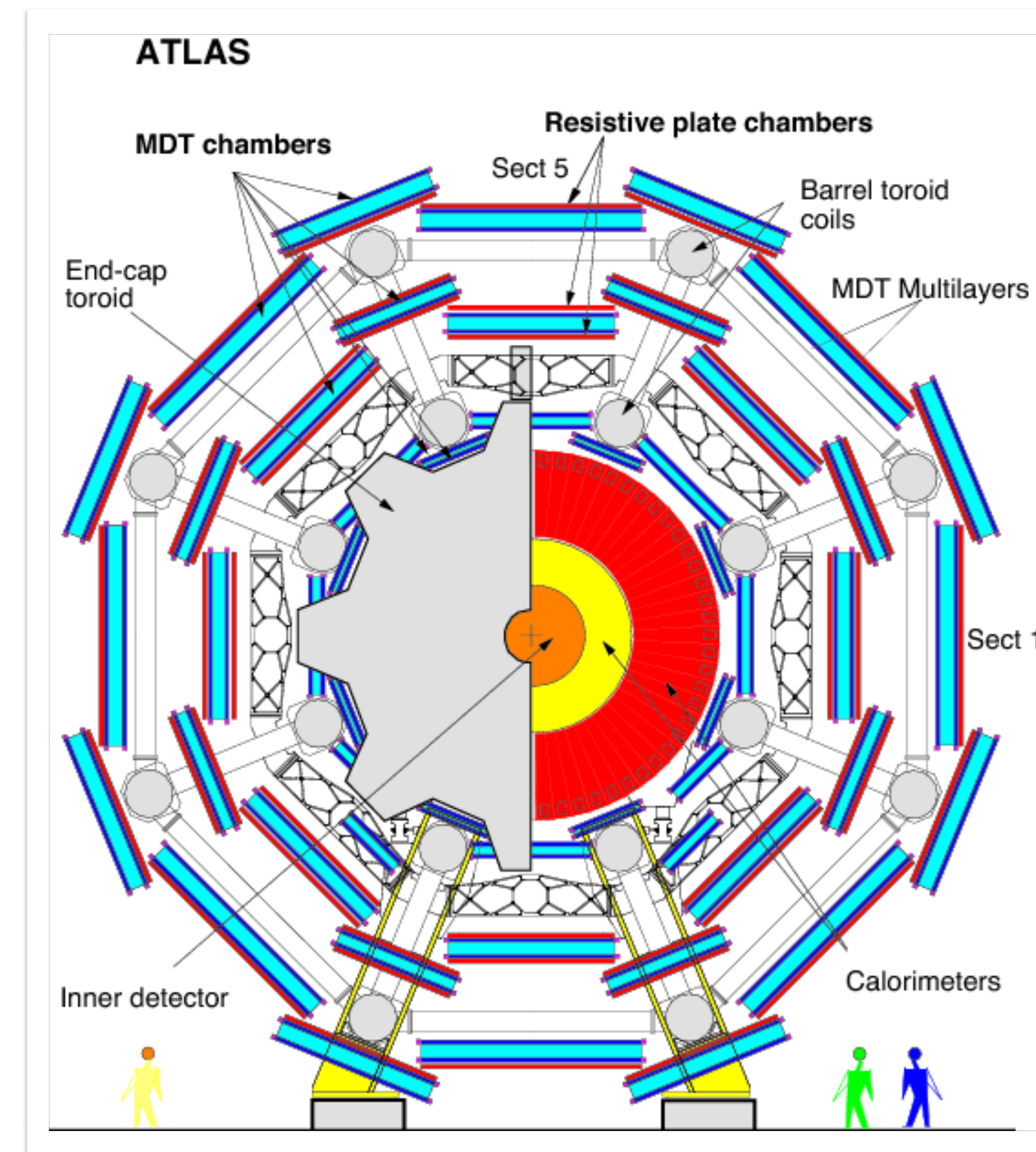


Hadronic Calorimeters

Shielding

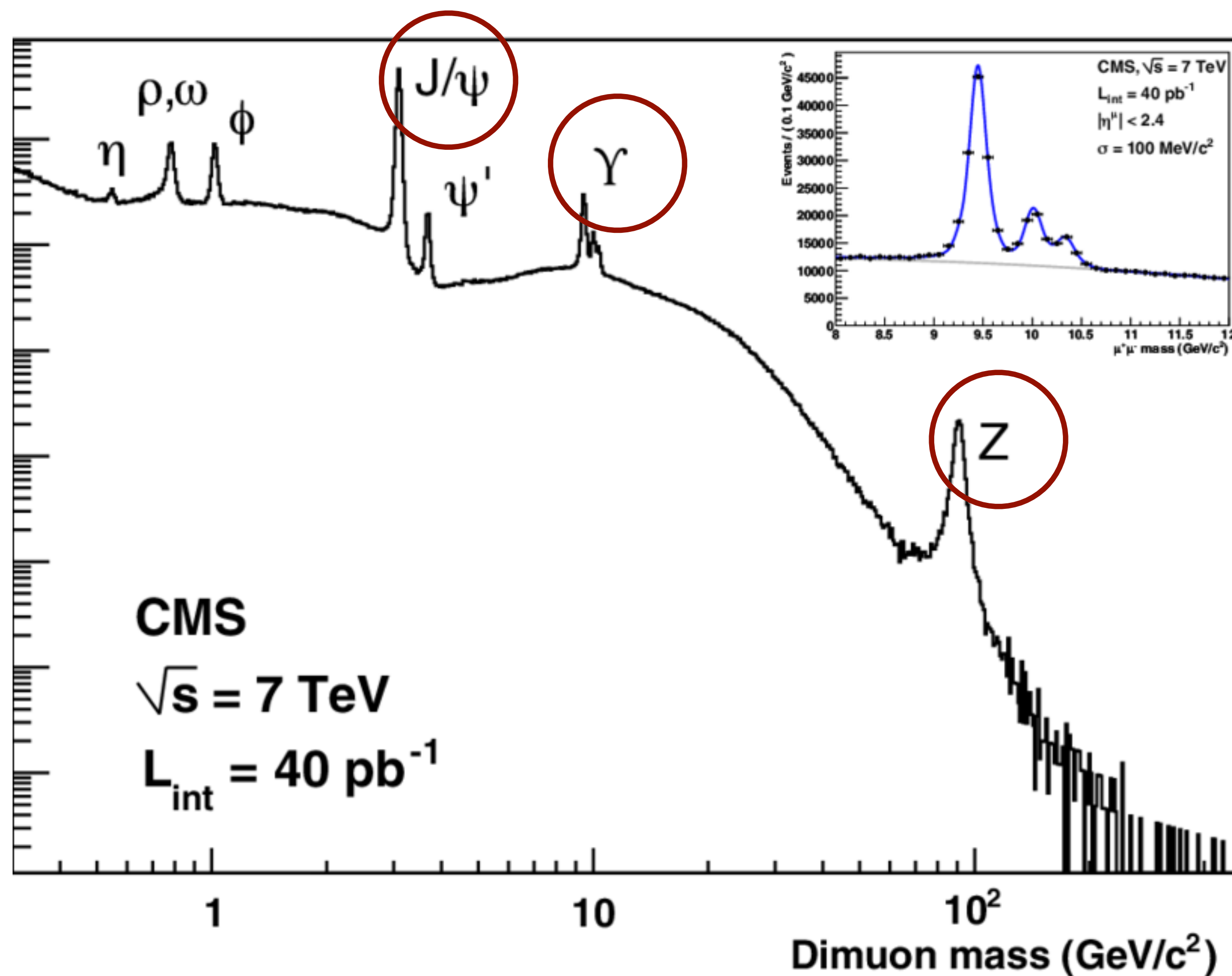


Mioni so težji bratje elektronov. Manj pogosto interagirajo z materialom detektorja in potujejo vse do konca. Zaznamo jih z zunanjimi mionskimi detektorji.



Identifikacija delcev s programom Hypathia

- V podatkovnih nizih so skriti tudi dodatni delci:
 - $J/\psi \rightarrow \mu^+\mu^- / e^+e^-$ (3.1 GeV)
 - $Y \rightarrow \mu^+\mu^- / e^+e^-$ (10.5 GeV)



- Kaj pa če zaznamo nove delce?
 Jih lahko najdete v naših podatkih?

- Štiri okna — ‘invariant mass’, prikazi trkov, podatki o delcih, nastavitve.

The screenshot displays the 'HYbrid Pupils' Analysis Tool for Interactions in ATLAS - version 7.4 - Invariant Mass Window'. The interface is divided into four main sections:

- Top-Left:** A circular detector view showing concentric layers of blue, red, and green segments, with a central interaction point and tracks.
- Top-Right:** A table of track data with columns for Track, +/-, P [GeV], Pt [GeV], ϕ , and θ . The data is as follows:

Track	+/-	P [GeV]	Pt [GeV]	ϕ	θ
Tracks 0	-	11.68	4.28	-1.319	0.375
Tracks 1	+	126.06	39.41	-2.413	0.318
Tracks 2	+	4.57	4.56	-2.783	1.649
Tracks 3	-	167.90	53.01	0.906	0.321
Tracks 4	-	1.34	1.33	-2.949	1.475
Tracks 5	-	1.75	1.74	-3.090	1.645
Tracks 6	+	18.61	3.94	-1.818	0.214
- Bottom-Left:** A rectangular detector view showing a central interaction point with tracks extending outwards.
- Bottom-Right:** The 'HYPATHIA - Control Window' containing a 'Data' table with columns for Name and Value. The 'Data' table is currently empty. There are also checkboxes for 'Status', 'InDet', 'Calo', 'MuonDet', and 'Objects'.

Hypathia: Dodajanje rezov / izbira zanimivih sledi delcev



HTD10 Pupils Analysis tool for interactions in ATLAS - version 7.4 - invariant mass window

e View Histograms Preferences Help

File Name	ETMis [GeV]	Track	P [GeV]	+/-	Pt [GeV]	ϕ	η	M(2) [GeV]	M(eeee) [GeV]	M(eemm) [GeV]	M(mmmm) [GeV]	e/m/g
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File Previous Event Next Event Electron Muon Photon Delete Track Reset Canvas

ETMis: 4.167 GeV ϕ : 3.040 rad Collection: MET_RefFinal

/Users/mihamuskinj/Downloads/groupA.zip/event001.xml

Track	+/-	P [GeV]	Pt [GeV]	ϕ	θ
Tracks 4	-	5.83	1.43	0.509	0.248
Tracks 7	-	3.40	1.06	-2.977	0.316
Tracks 8	+	47.07	37.95	-1.978	2.204
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Tracks 11	-	5.42	1.44	0.516	0.269
Tracks 12	-	2.96	1.20	-2.802	2.724
Tracks 13	-	8.30	1.47	2.483	2.964
Tracks 14	-	6.58	2.03	-1.081	0.313
Tracks 15	+	7.59	1.50	-1.220	2.943
Tracks 17	-	2.00	1.12	2.214	2.546
Tracks 21	+	2.65	1.91	-0.290	2.338
Tracks 25	+	6.27	1.30	2.975	0.209
Tracks 27	-	4.12	1.43	0.256	0.355
Tracks 28	-	1.92	1.65	2.064	1.039
Tracks 31	-	1.58	1.54	-1.098	1.367
Tracks 33	-	3.08	1.21	-1.953	0.406
Tracks 35	-	2.88	1.13	-2.993	0.404
Tracks 36	+	2.09	1.86	-1.513	1.094
Tracks 41	-	2.52	1.86	2.745	0.832
Tracks 42	+	1.29	1.22	1.668	1.247
Tracks 44	+	3.95	1.00	-2.840	0.256
Tracks 48	+	3.90	1.10	2.977	0.286
Tracks 49	-	2.86	1.09	0.165	0.391
Tracks 58	+	1.95	1.95	2.874	1.561
Tracks 63	-	8.03	1.87	-0.613	2.906
Tracks 67	-	1.02	1.01	-2.092	1.491
Tracks 68	+	1.68	1.64	1.815	1.768
Tracks 69	+	10.96	2.05	2.045	0.188
Tracks 75	+	1.84	1.55	-1.469	1.003
Tracks 77	+	6.43	1.99	1.824	2.828
Tracks 80	+	2.38	1.24	1.732	2.594
Tracks 81	+	2.45	2.24	0.300	1.996
Tracks 82	-	2.20	1.51	-1.508	0.758
Tracks 84	-	2.35	1.08	-0.928	2.664
Tracks 85	-	1.54	1.16	1.708	2.293
Tracks 87	+	2.42	1.62	-2.037	0.733
Tracks 88	-	4.49	2.01	3.045	2.678
Tracks 89	-	1.97	1.70	-1.199	1.037
Tracks 91	+	2.07	1.52	-2.857	2.314

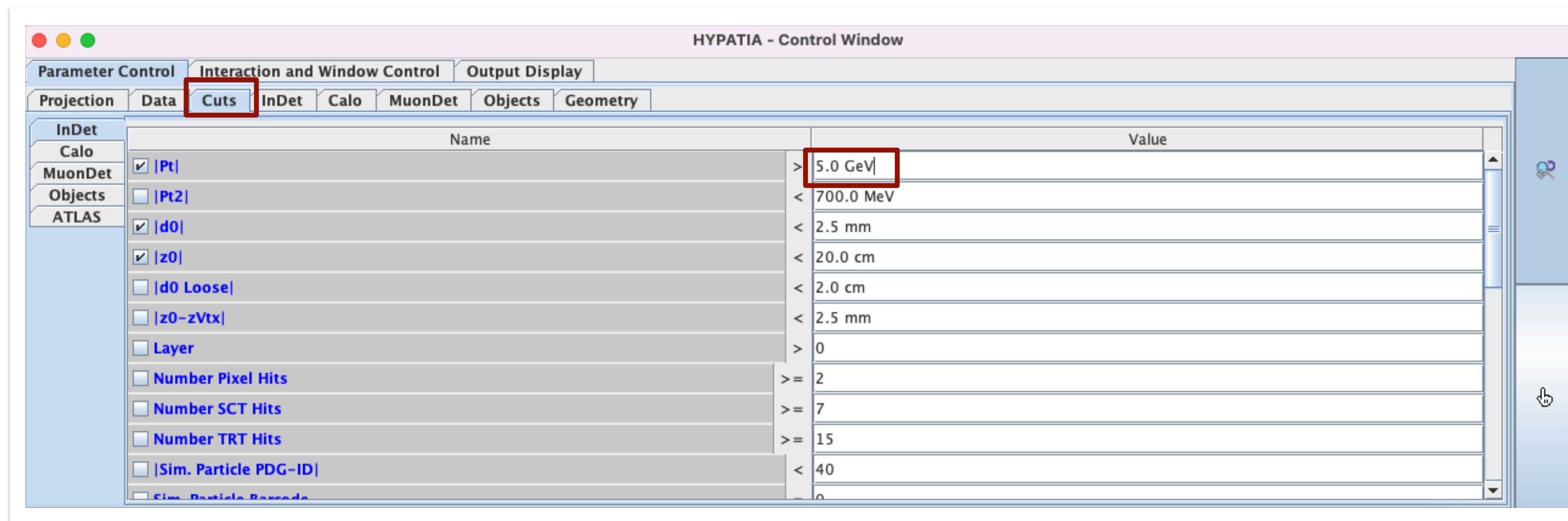
HYPATHIA - Control Window

Parameter Control Interaction and Window Control Output Display

Projection Data Cuts InDet Calo MuonDet Objects Geometry

Data	Name	Value
<input checked="" type="checkbox"/>	Status	
<input checked="" type="checkbox"/>	InDet	
<input checked="" type="checkbox"/>	Calo	
<input checked="" type="checkbox"/>	MuonDet	
<input checked="" type="checkbox"/>	Objects	

- Spremenimo gibalno količino sledi p_T na vsaj 10 GeV da zmanjšamo število slabih oz. nepravilno rekonstruiranih sledi.



HYBRID Pupils' Analysis tool for interactions in ATLAS - version 7.4 - invariant mass window

View Histograms Preferences Help

File Name ETMis [GeV] Track P [GeV] +/- Pt [GeV] φ η M(2) [GeV] M(eeee) [GeV] M(eemm) [GeV] M(mmmm) [GeV] e/m/g

File Previous Event Next Event Electron Muon Photon Delete Track Reset Canvas

ETMis: 4.167 GeV φ : 3.040 rad Collection: MET_RefFinal

/Users/mihamuskinj/Downloads/groupA.zip/event001.xml

Track	+/-	P [GeV]	Pt [GeV]	φ	θ
Tracks 8	+	47.07	37.95	-1.978	2.204
Tracks 173	-	36.59	32.59	1.132	1.098
Tracks 239	+	827.36	311.58	0.983	0.386
Tracks 243	+	37.38	20.42	1.010	0.578

naboj p_T [GeV]

HYPATIA - Control Window

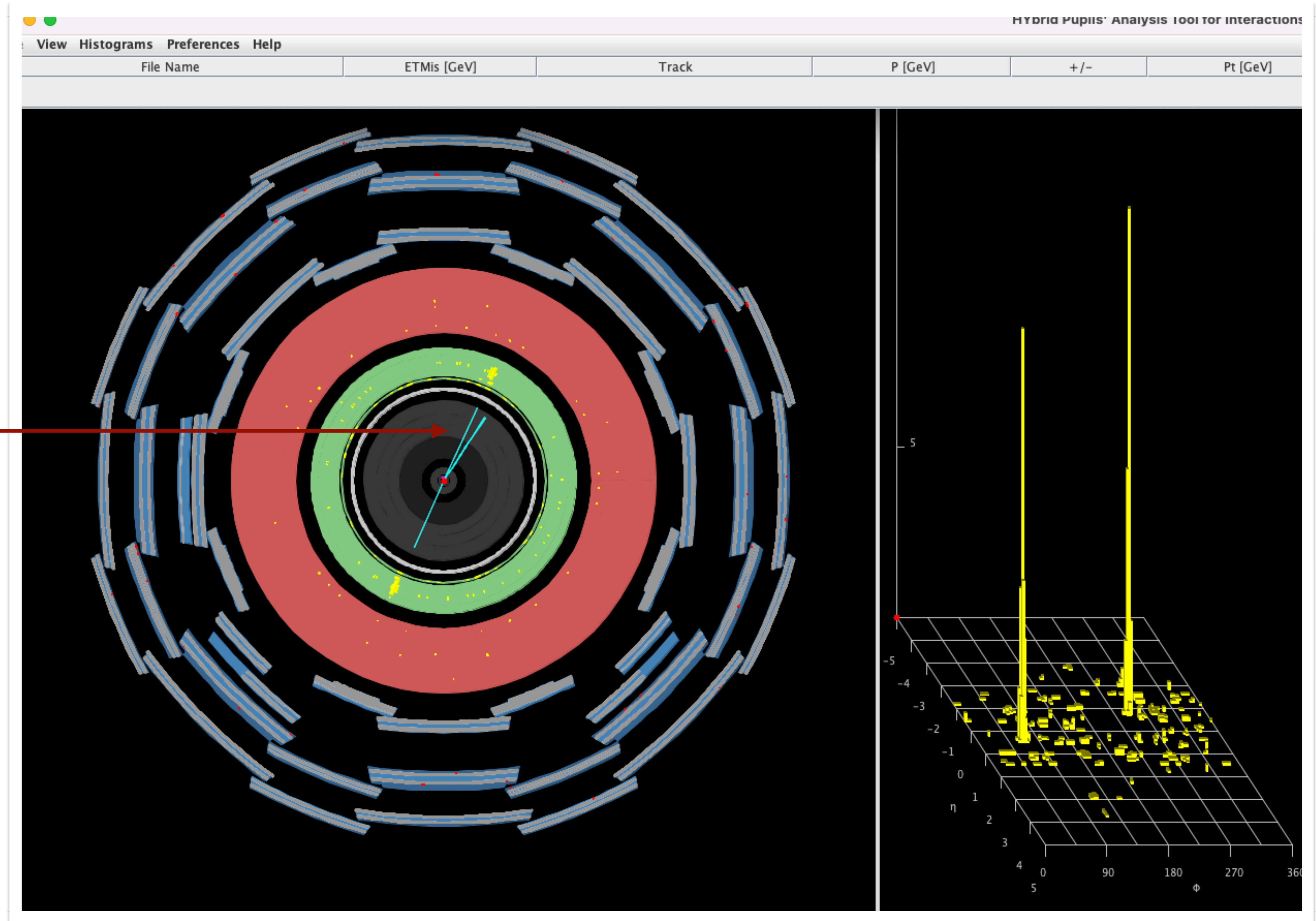
Parameter Control Interaction and Window Control Output Display

Projection Data Cuts InDet Calo MuonDet Objects Geometry

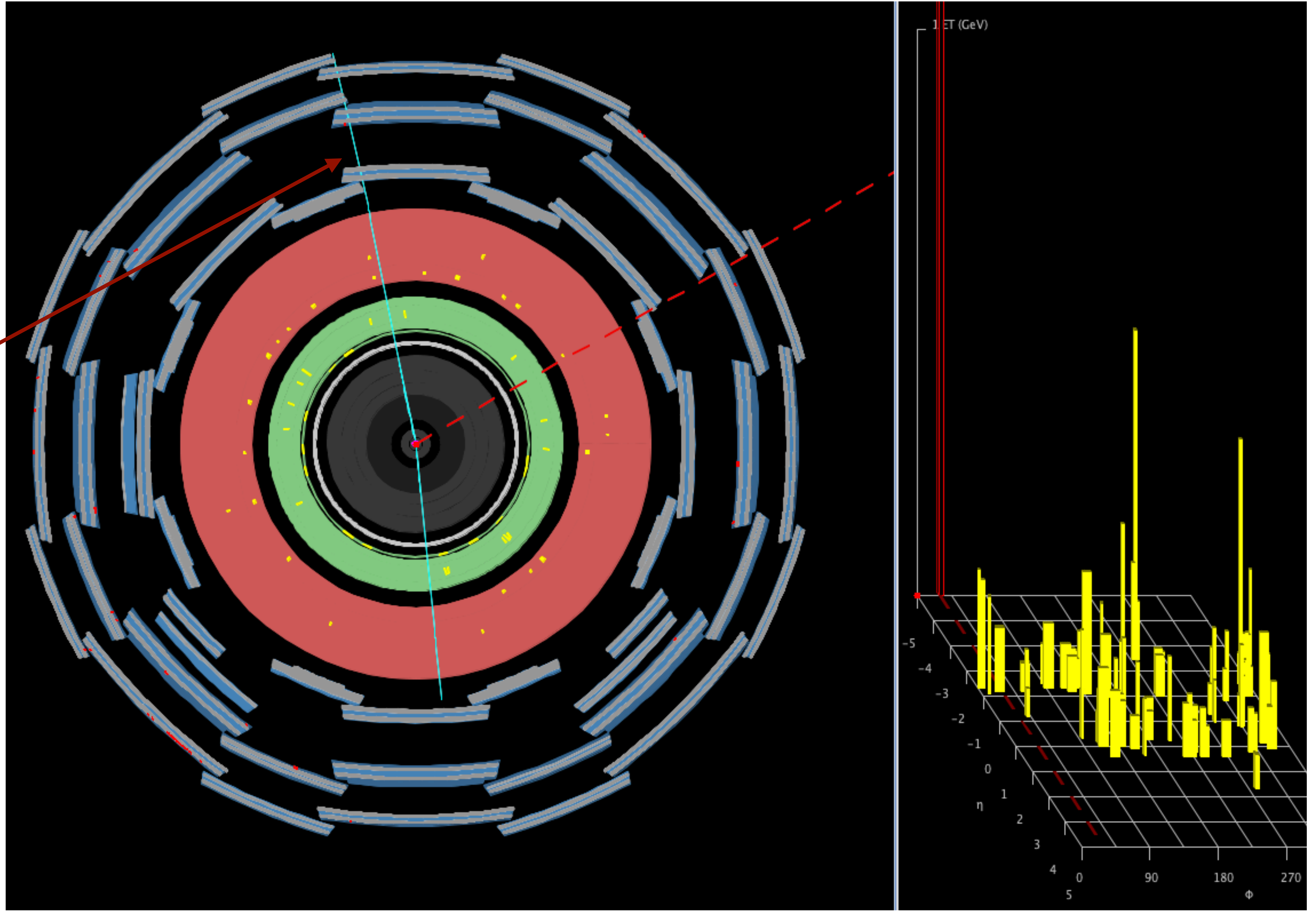
Name	Value
<input checked="" type="checkbox"/> Pt	> 5.0 GeV
<input type="checkbox"/> Pt2	< 700.0 MeV
<input checked="" type="checkbox"/> d0	< 2.5 mm
<input checked="" type="checkbox"/> z0	< 20.0 cm
<input type="checkbox"/> d0 Loose	< 2.0 cm
<input type="checkbox"/> z0-zVtx	< 2.5 mm
<input type="checkbox"/> Layer	> 0
<input type="checkbox"/> Number Pixel Hits	>= 2
<input type="checkbox"/> Number SCT Hits	>= 7
<input type="checkbox"/> Number TRT Hits	>= 15
<input type="checkbox"/> Sim. Particle PDG-ID	< 40
<input type="checkbox"/> Sim. Particle Name	< 0

Elektron:

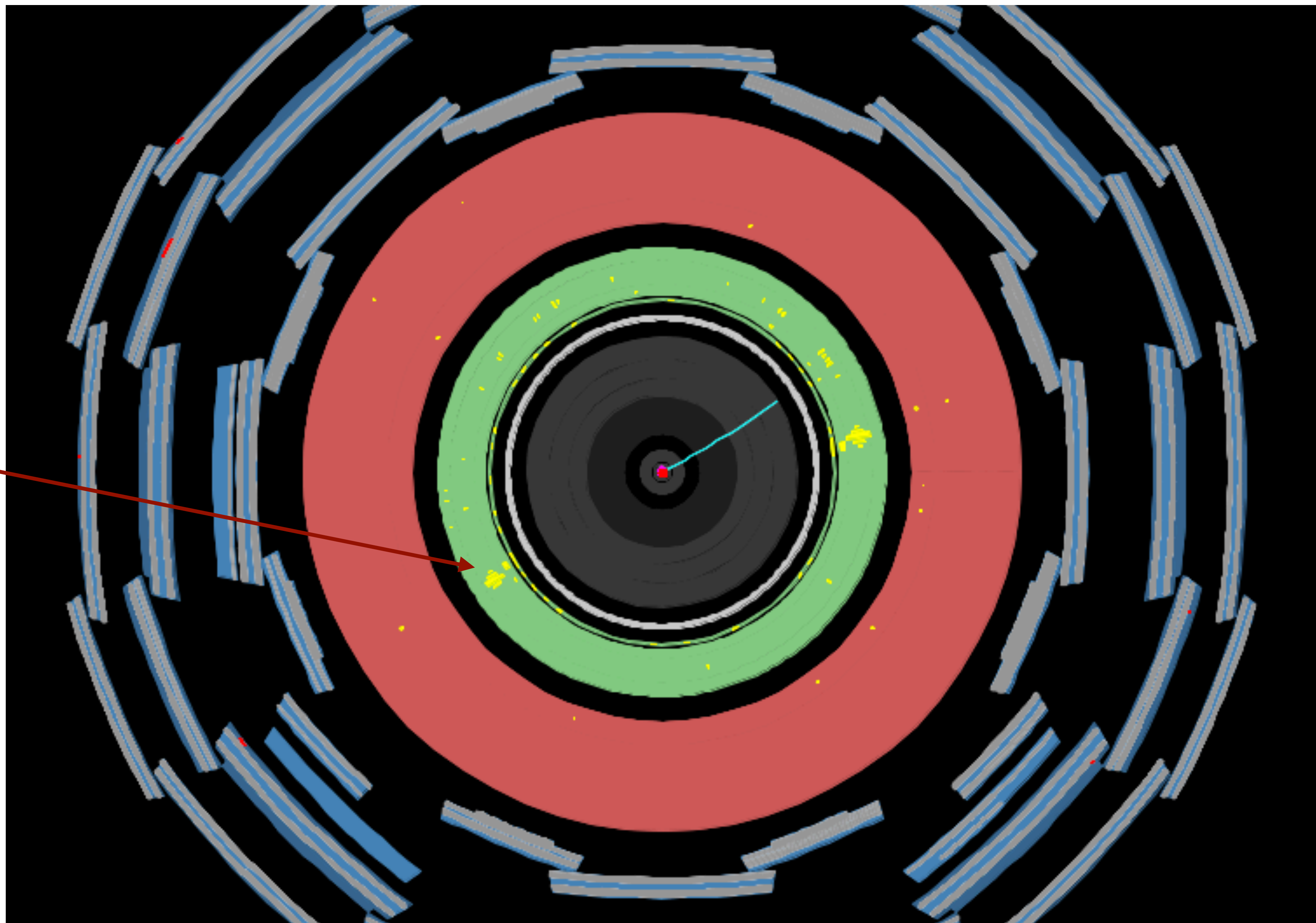
- Sled delca
- Energija v kalorimetru

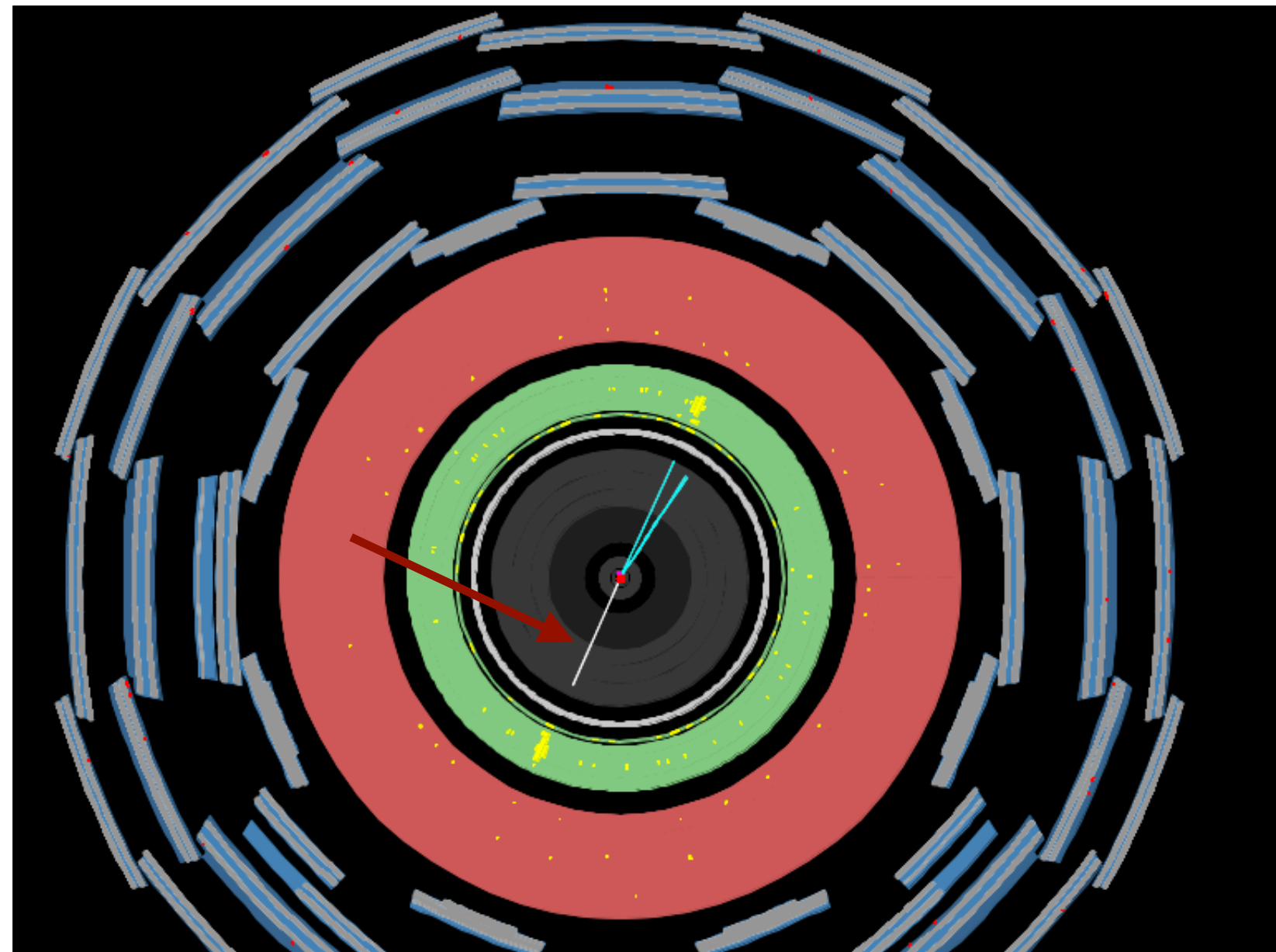


Mion:
- sled delca
tudi v mionskih
detektorjih



Foton:
- Energija v kalorimetru
- Brez sledi





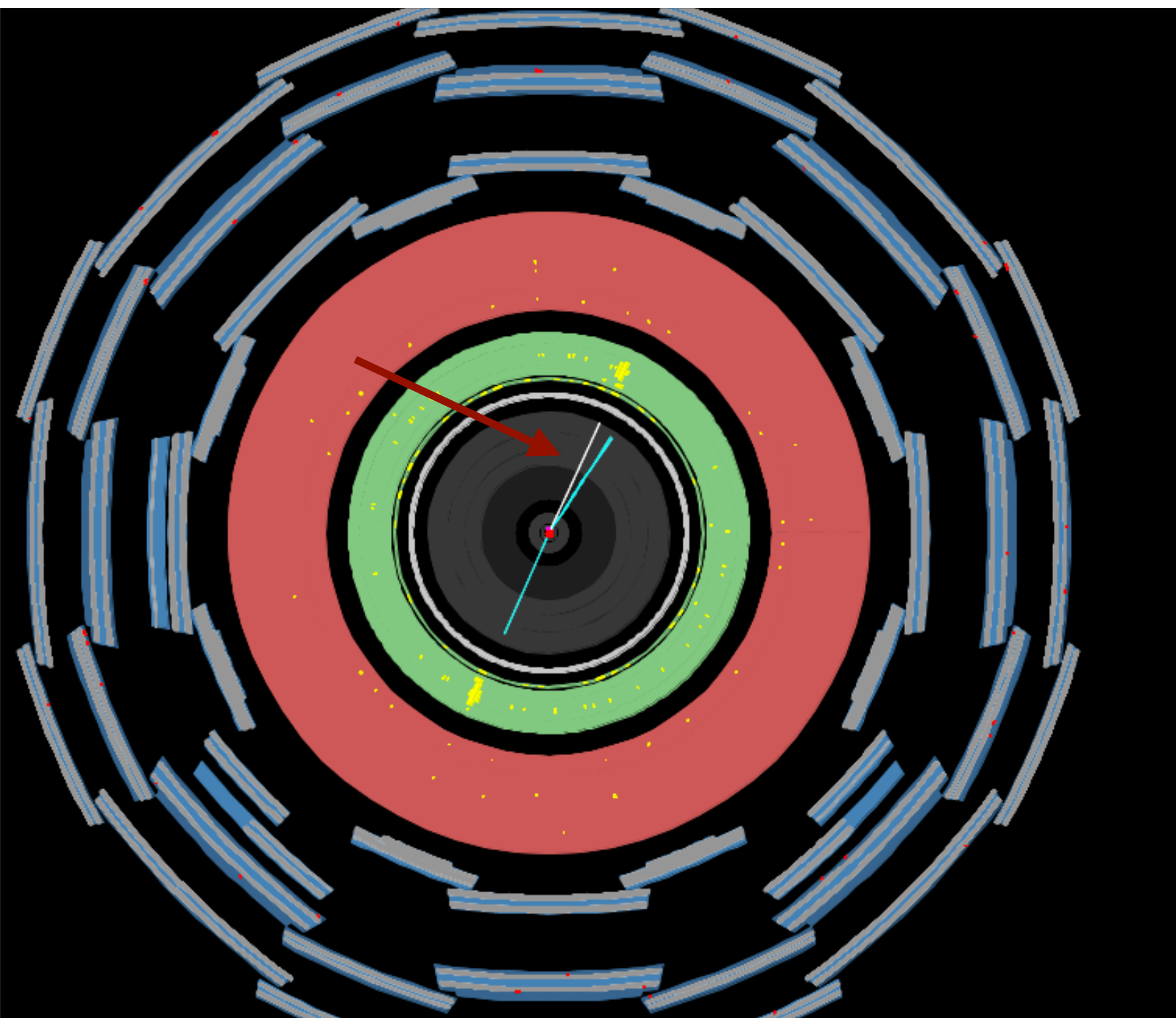
HYPATIA - Track Momenta Window

File Previous Event Next Event **Electron** Muon Photon Delete Track Reset Canvas

ETMis: 4.167 GeV φ : 3.040 rad Collection: MET_Reffinal

/Users/mihamuskinj/Downloads/groupA.zip/event001.xml

Track	+/-	P [GeV]	Pt [GeV]
Tracks 8	+	47.07	37.95
Tracks 173	-	36.59	32.59
Tracks 239	+	827.36	311.58
Tracks 243	+	37.38	20.42



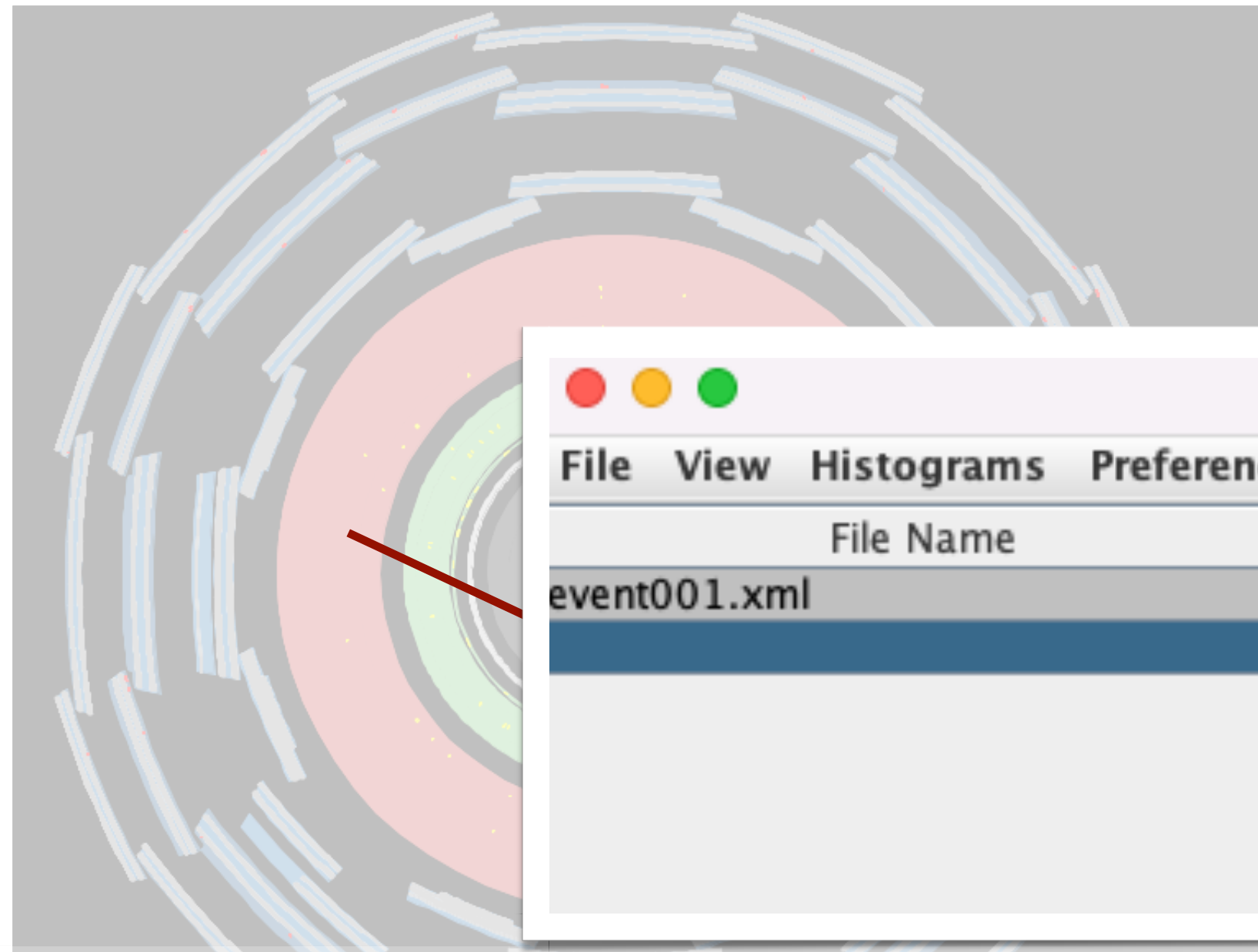
HYPATIA - Track Momenta Window

File Previous Event Next Event **Electron** Muon Photon Delete Track Reset Canvas

ETMis: 4.167 GeV φ : 3.040 rad Collection: MET_Reffinal

/Users/mihamuskinj/Downloads/groupA.zip/event001.xml

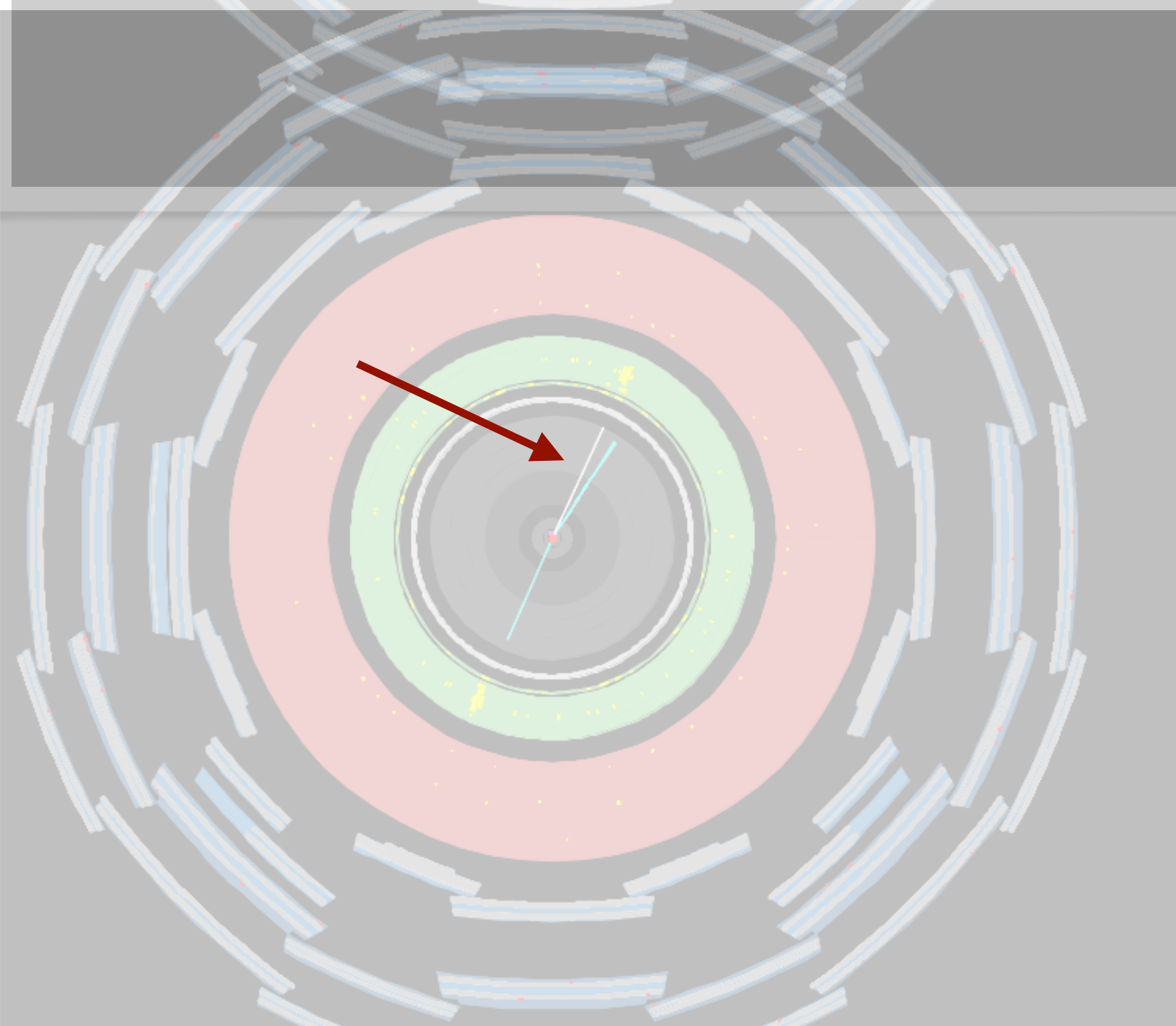
Track	+/-	P [GeV]	Pt [GeV]
Tracks 8	+	47.07	37.95
Tracks 173	-	36.59	32.59
Tracks 239	+	827.36	311.58
Tracks 243	+	37.38	20.42



Track	+/-	P [GeV]	Pt [GeV]
Tracks 8	+	47.07	37.95

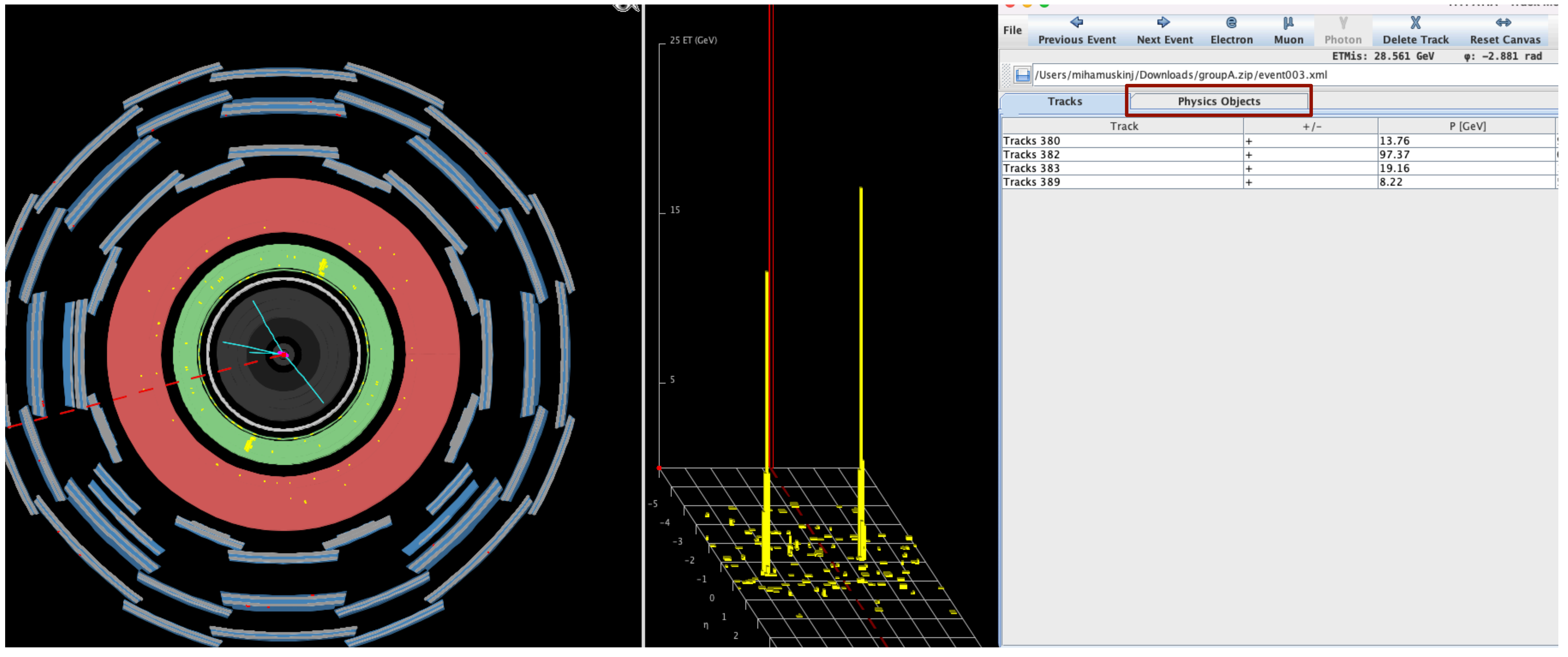
File Name	ETMis [GeV]	Track	P [GeV]	+...	Pt [GeV]	φ	η	M(2) [GeV]
event001.xml	4.167	Tracks 8	47.1	+	37.9	-1.978	-0.680	82.729
		Tracks 173	36.6	-	32.6	1.132	0.491	

Probably $Z \rightarrow e^+ e^-$



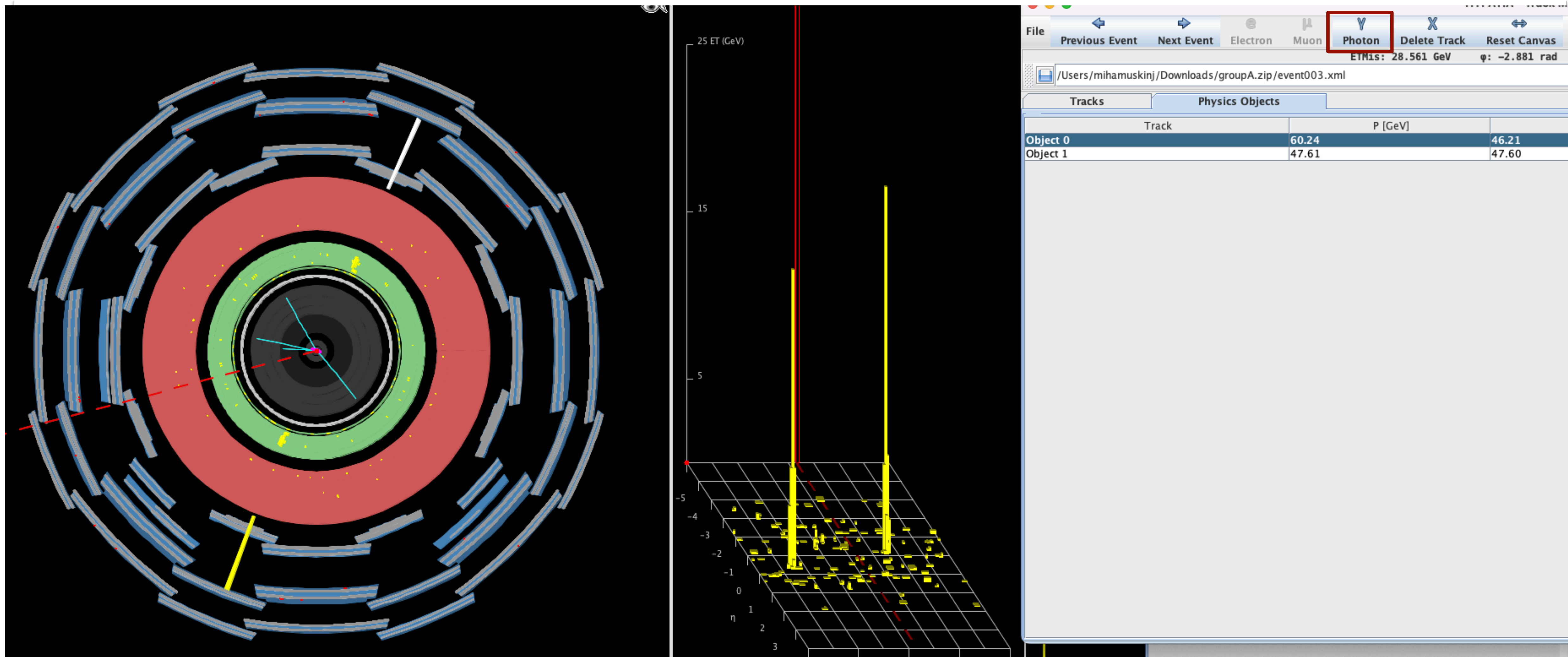
Track	+/-	P [GeV]	Pt [GeV]
Tracks 8	+	47.07	37.95
Tracks 173	-	36.59	32.59
Tracks 239	+	827.36	311.58
Tracks 243	+	37.38	20.42

- Za fotone je potrebno klikniti na zavihek “**Physics Objects**”.





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- Nato se jih lahko izbere.



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- Nato se jih lahko izbere.

File Name	ETMis [GeV]	Track	P [GeV]	+...	Pt [GeV]	φ	η	M(2) [GeV]
event001.xml	4.167	Tracks 8	47.1	+	37.9	-1.978	-0.680	82.729
event003.xml	28.561	Tracks 173	36.6	-	32.6	1.132	0.491	
		Object 0	60.2		46.2	1.154	0.761	100.334
		Object 1	47.6		47.6	-1.931	0.017	

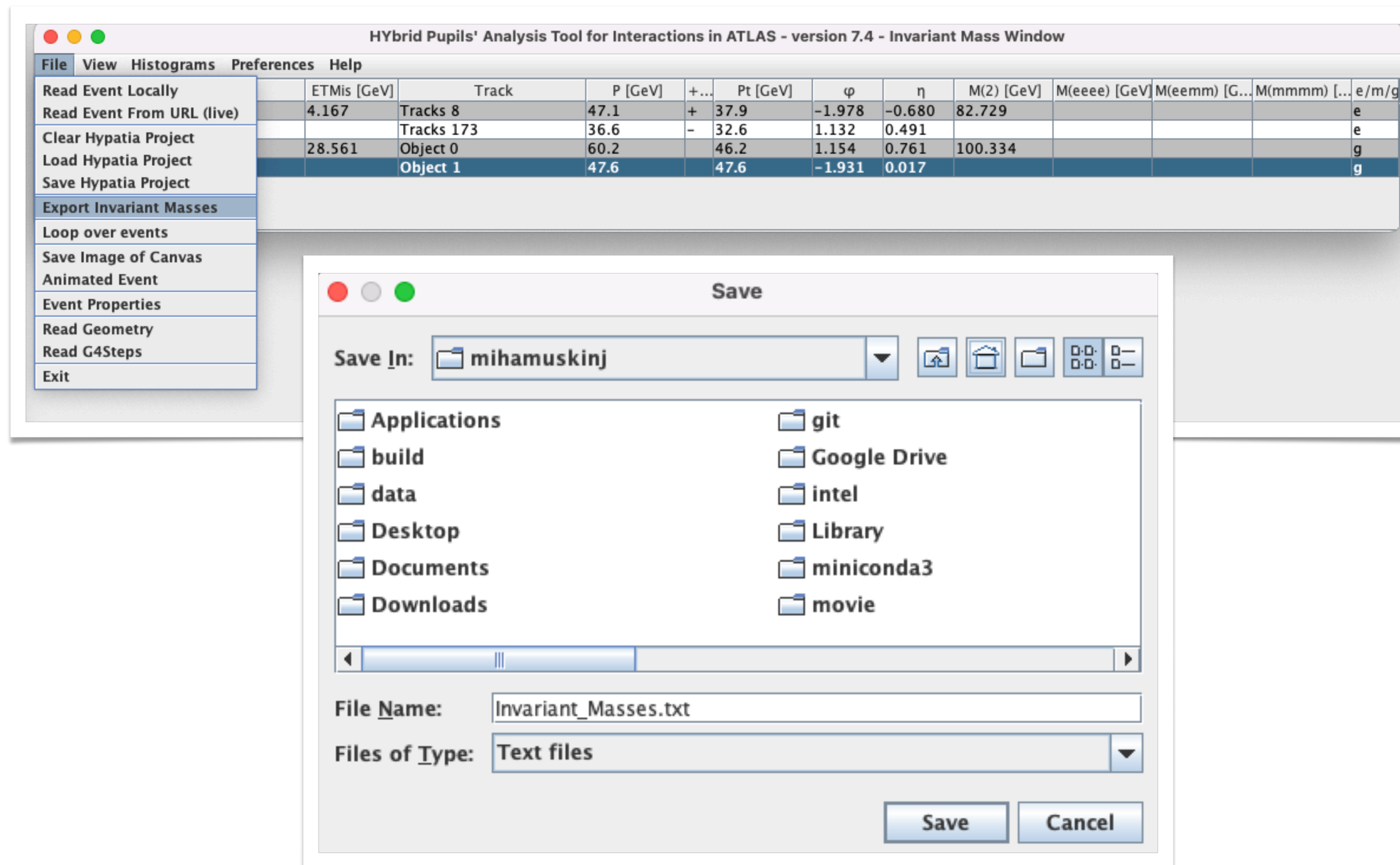
Verjetno $H \rightarrow \gamma\gamma$

- Na koncu je treba zaključke vaše analize izvoziti
- Grafi in histogrami se bodo ustvarili samodejno na spletni strani
- Ob koncu dneva si bomo pogledali vaše podatke skupaj z ostalimi skupinami po Evropi, ki danes tudi opravljajo isto vajo

HYbrid Pupils' Analysis Tool for Interactions in ATLAS - version 7.4 - Invariant Mass Window

File	View	Histograms	Preferences	Help	ETMis [GeV]	Track	P [GeV]	+...	Pt [GeV]	φ	η	M(2) [GeV]	M(eeee) [GeV]	M(eemm) [G...	M(mmmm) [...	e/m/g	
Read Event Locally					4.167	Tracks 8	47.1	+	37.9	-1.978	-0.680	82.729					e
Read Event From URL (live)						Tracks 173	36.6	-	32.6	1.132	0.491						e
Clear Hypatia Project					28.561	Object 0	60.2		46.2	1.154	0.761	100.334					g
Load Hypatia Project						Object 1	47.6		47.6	-1.931	0.017						g
Save Hypatia Project																	
Export Invariant Masses																	
Loop over events																	
Save Image of Canvas																	
Animated Event																	
Event Properties																	
Read Geometry																	
Read G4Steps																	
Exit																	

- Na koncu je treba zaključke vaše analize izvoziti
- Grafi in histogrami se bodo ustvarili samodejno na spletni strani
- Ob koncu dneva si bomo pogledali vaše podatke skupaj z ostalimi skupinami po Evropi, ki danes tudi opravljajo isto vajo




- Povezava: <https://zpathweb.hepp.uiocloud.no/OPloT/index.php>

OPloT – MasterClass – Start Page

Start **Student** Moderator Tutor Administrator

Welcome to the plotting-tool for Hands-on-CERN Masterclasses!

If you are a student, choose "Student" from the top menu.
If you are a tutor, choose "Tutor".
If you are a moderator at the videoconference, choose "Moderator".

If you need support or have any suggestions for improvements, send an email to [epf-mc\(at\)fys.uio.no](mailto:epf-mc(at)fys.uio.no) 

If you are an extraordinary superduper user, then read this: [To reset the session, visit this page again.](#)

- Povezava: <https://zpathweb.hepp.uiocloud.no/OPloT/index.php>

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If you are an extraordinary superduper user, then read this: [To reset the session](#)

Log in to cernmasterclass.uio.no:443
Your login information will be sent securely.

ippog

●●●

Remember this password

Cancel Log In

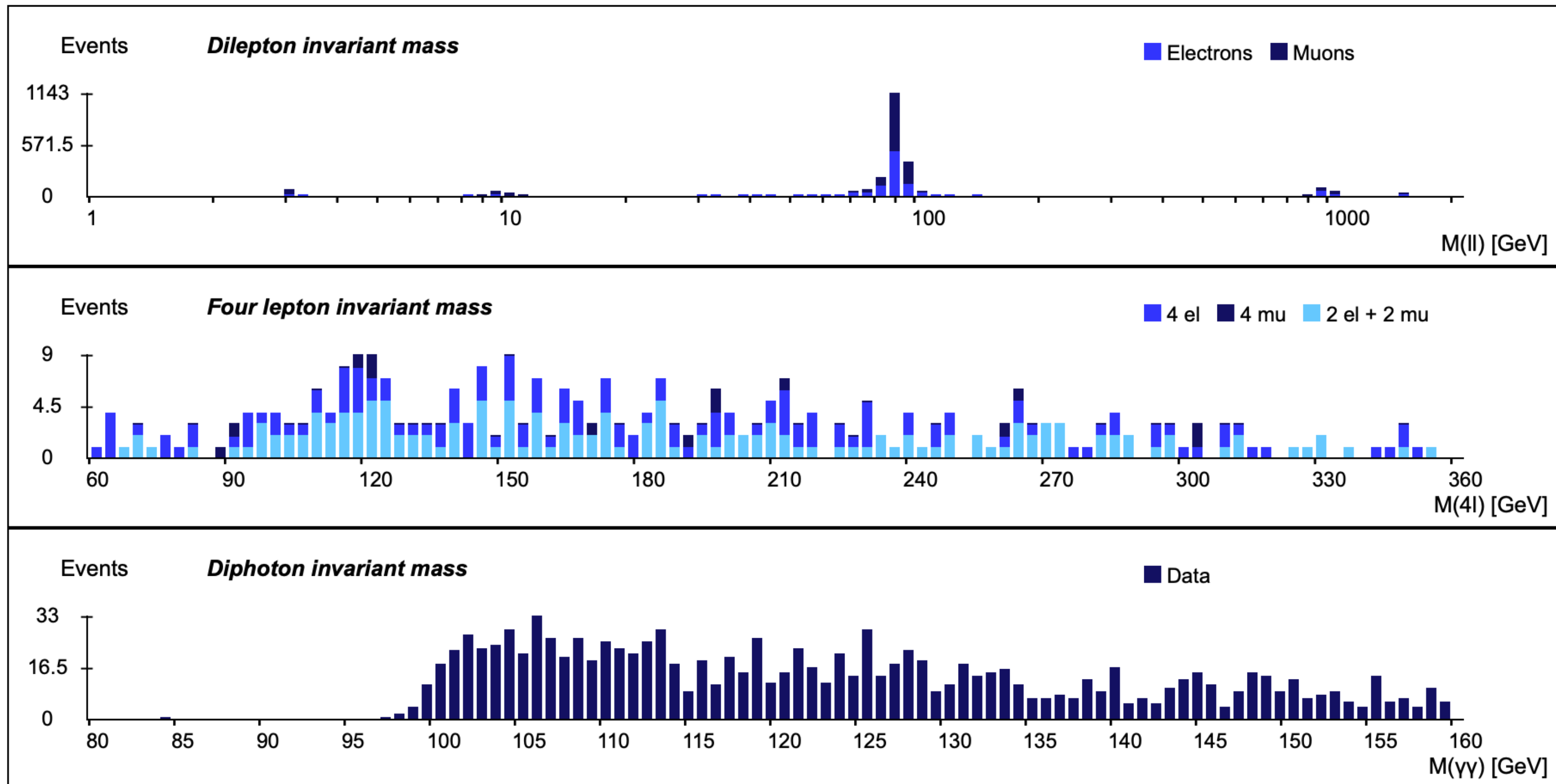
Account: ippog
Password: imc

- Povezava: <https://zpathweb.hepp.uiocloud.no/OPIoT/index.php>
- Ob koncu bomo skupaj ponovili te korake

The screenshot shows the 'OPIoT – MasterClass – Student page'. At the top, there is a navigation menu with links for 'Start', 'Student', 'Moderator', 'Tutor', and 'Administrator'. Below the menu, the page title is 'OPIoT – MasterClass – Student page'. Underneath, there is a section titled 'Student Tasks' with the instruction: 'Please select items from the drop-down boxes to submit your results!'. The form contains six drop-down boxes: '2022', 'March', '05', 'Berkeley', 'Group number', and 'Group letter'. The 'Group letter' box is highlighted with a blue border. At the bottom right of the form, there are two buttons: 'Cancel' and 'Log In'.

OPlot – MasterClass with CERN – Combination for all institutes on 2023-03-01

Start Student Moderator Tutor Administrator



Plot type:

Dilepton statistics

Region	Electrons			
	R1	R2	R3	R4
Events	93	109	780	104
Mean	3.12	9.47	89.79	997.51
Width	0.49	1.24	3.83	34.30

Region	Muons			
	R1	R2	R3	R4
Events	83	101	964	79
Mean	3.11	9.80	90.66	993.31
Width	0.27	0.73	3.51	53.18

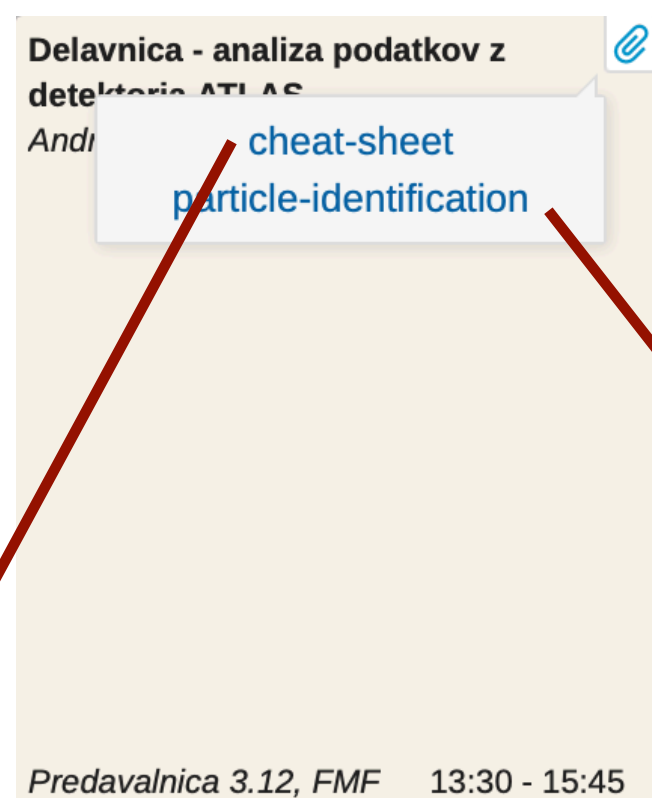
Number of events

	Student distribution	Expected
ll	3438	3315
4l	425	40
γγ	1184	1530
Sum	5047	4885

Bins:

Update plot

Reset



GET STARTED ON THE WEB WITH HYPATIA AND OPlOT

You will now analyze up to 50 particle collisions (events) by using the visualization application HYPATIA.

From these collisions, you shall try to find the footprints from heavy neutral particles, like for instance the Z-boson or the Higgs boson.

All you need can be found at

http://atlas.physicsmasterclasses.org/en/zpath_measurement.htm (replace /en/ with your language)

This is:

1. The HYPATIA application and instructions
2. Your unique dataset - ask your tutor if you need help
3. The web plotting tool OPlOT: <http://cernmasterclass.uio.no/OPlOT/>
 - username: ippog
 - password: imc

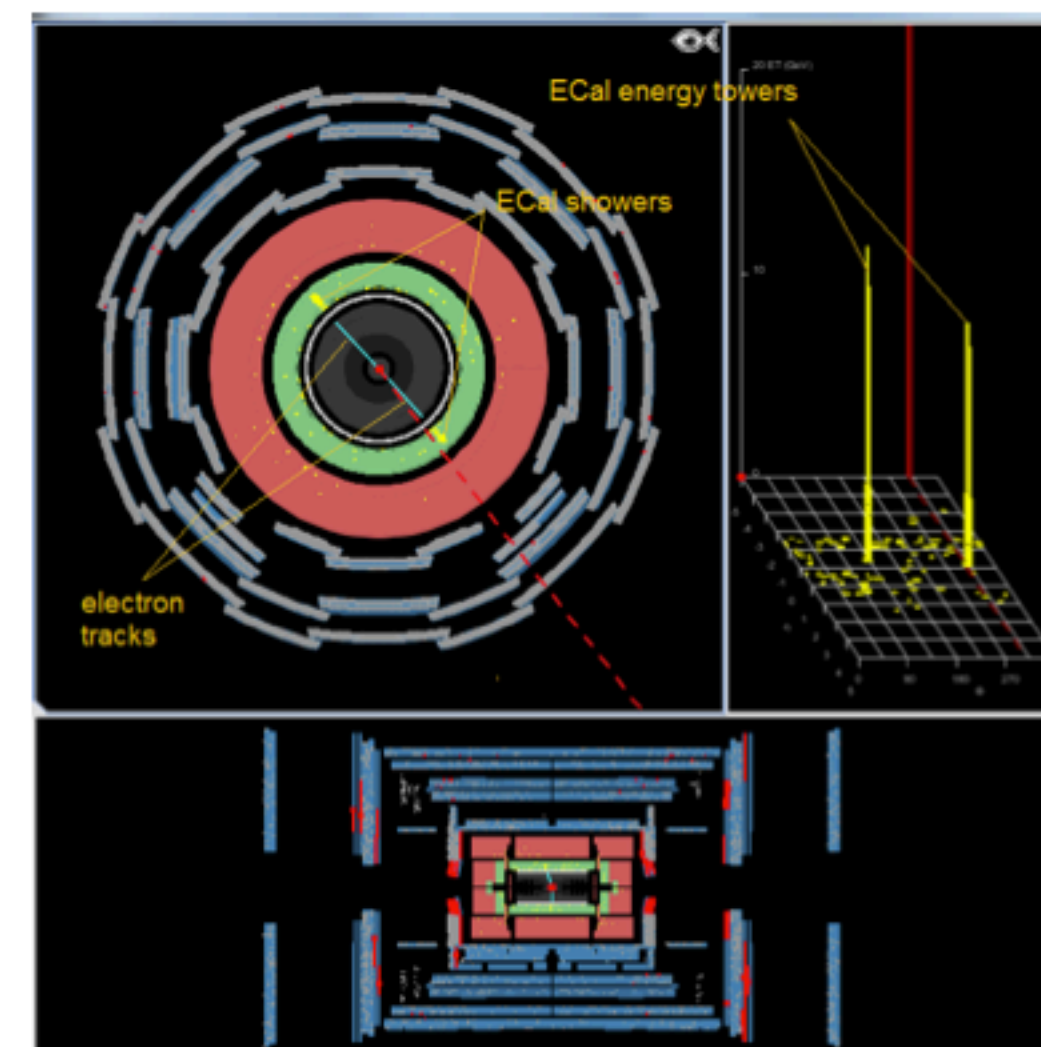
Do the following:

Go to the Z-Path: http://atlas.physicsmasterclasses.org/en/zpath_measurement.htm

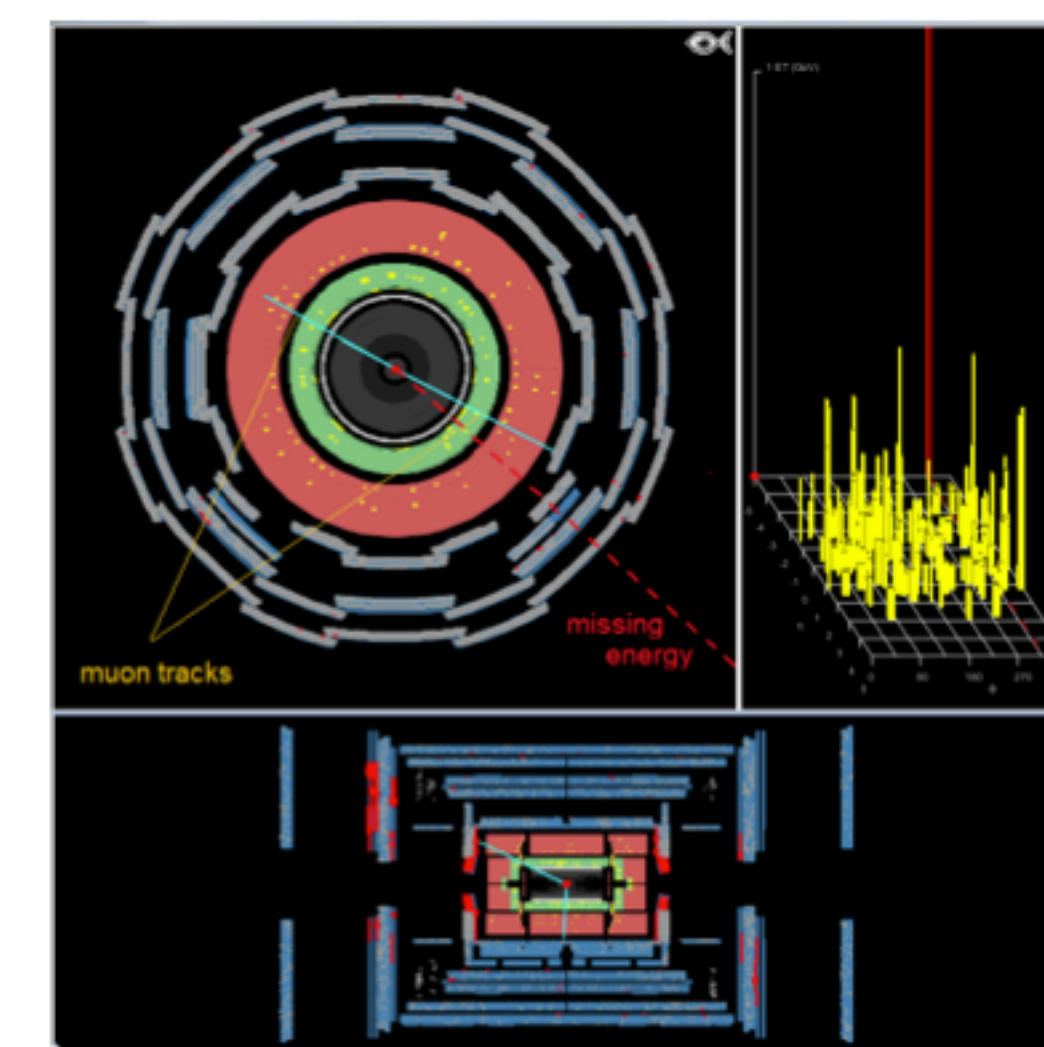
1. Instructions of what to do can be found under the sub-menu items of "Get to work":
 - Get to work→Data samples and tools
 - Get to work→Do it!
 - Get to work→Analyze your result (together with rest of students and tutors)
2. Find and download your data sample - follow instructions found at "Data samples and tools".
 - To start HYPATIA
 - On a Windows or Mac:
 - Double-click the file Hypatia_7.4_Masterclass.jar
 - On Linux:
 - Right-click the file: HYPATIA_for_Linux.sh
 - Change the permissions to make it executable
 - Double-click the HYPATIA_for_Linux.sh file
 - Unzip data sample
 - Load events in HYPATIA with File→Read Events Locally - Navigate to your downloaded and unzipped data sample

ATLAS Z-path Masterclass "Cheat Sheet"

2-lepton events



Dielectron or e^+e^- event.



Dimuon or $\mu^+\mu^-$ event.