

Ćwiczenie W

Krzysztof Cieśla

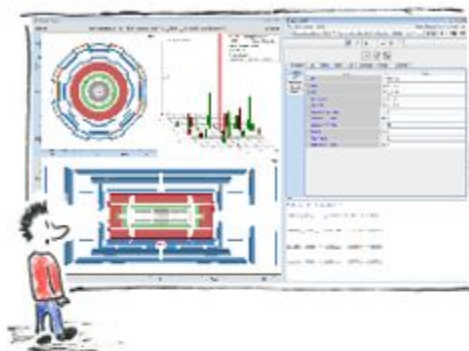


Warsztaty ATLAS Masterclasses
7 Marca 2025

Cel ćwiczenia



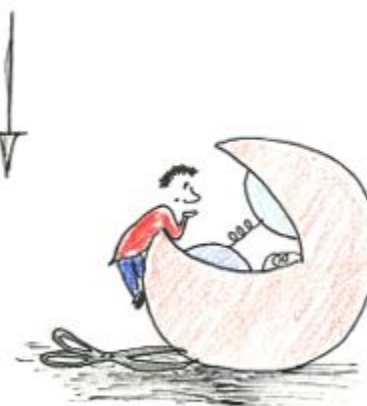
Identyfikacja cząstek



Identyfikacja przypadków

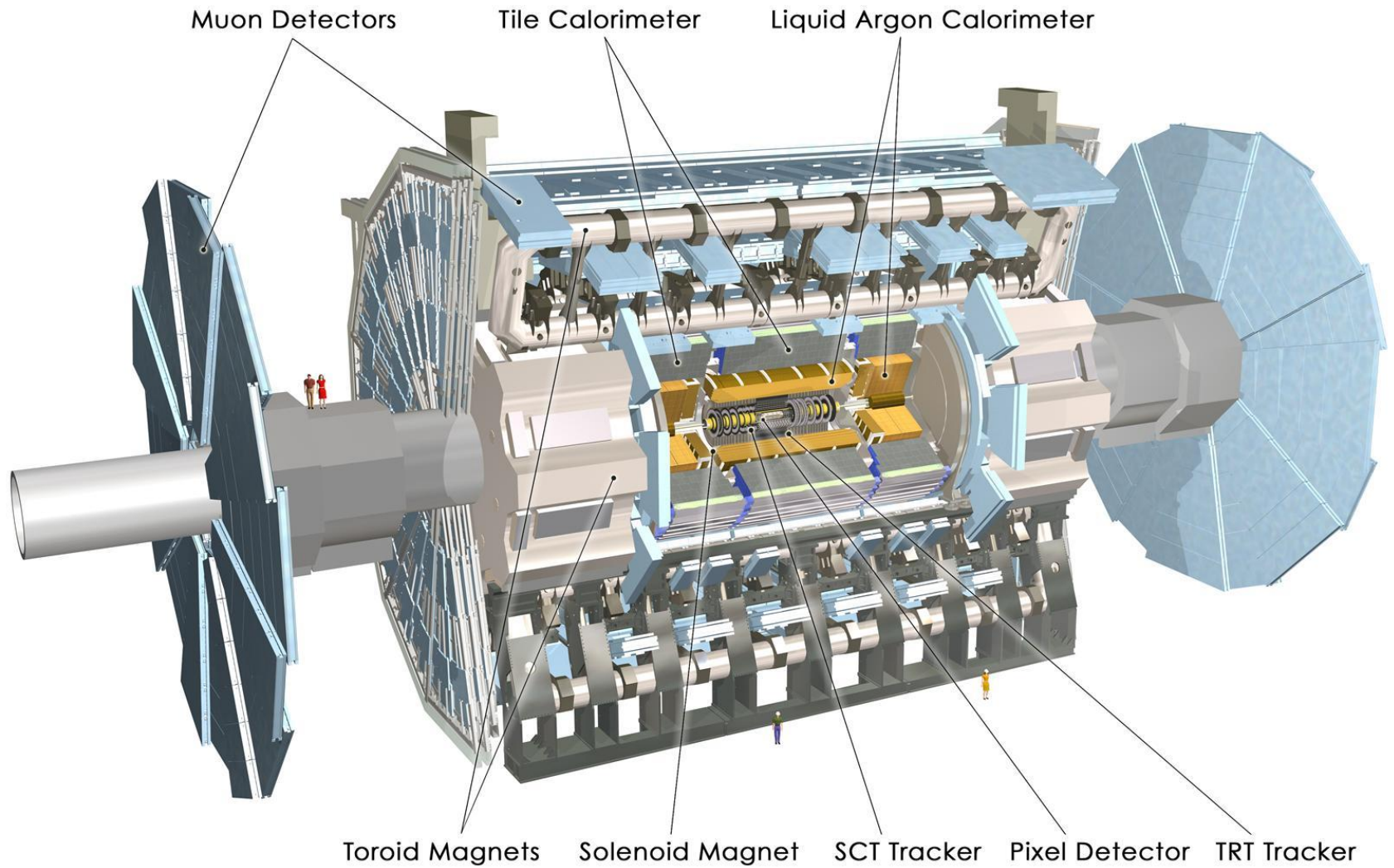


Poszukiwanie bozonu Higgsa



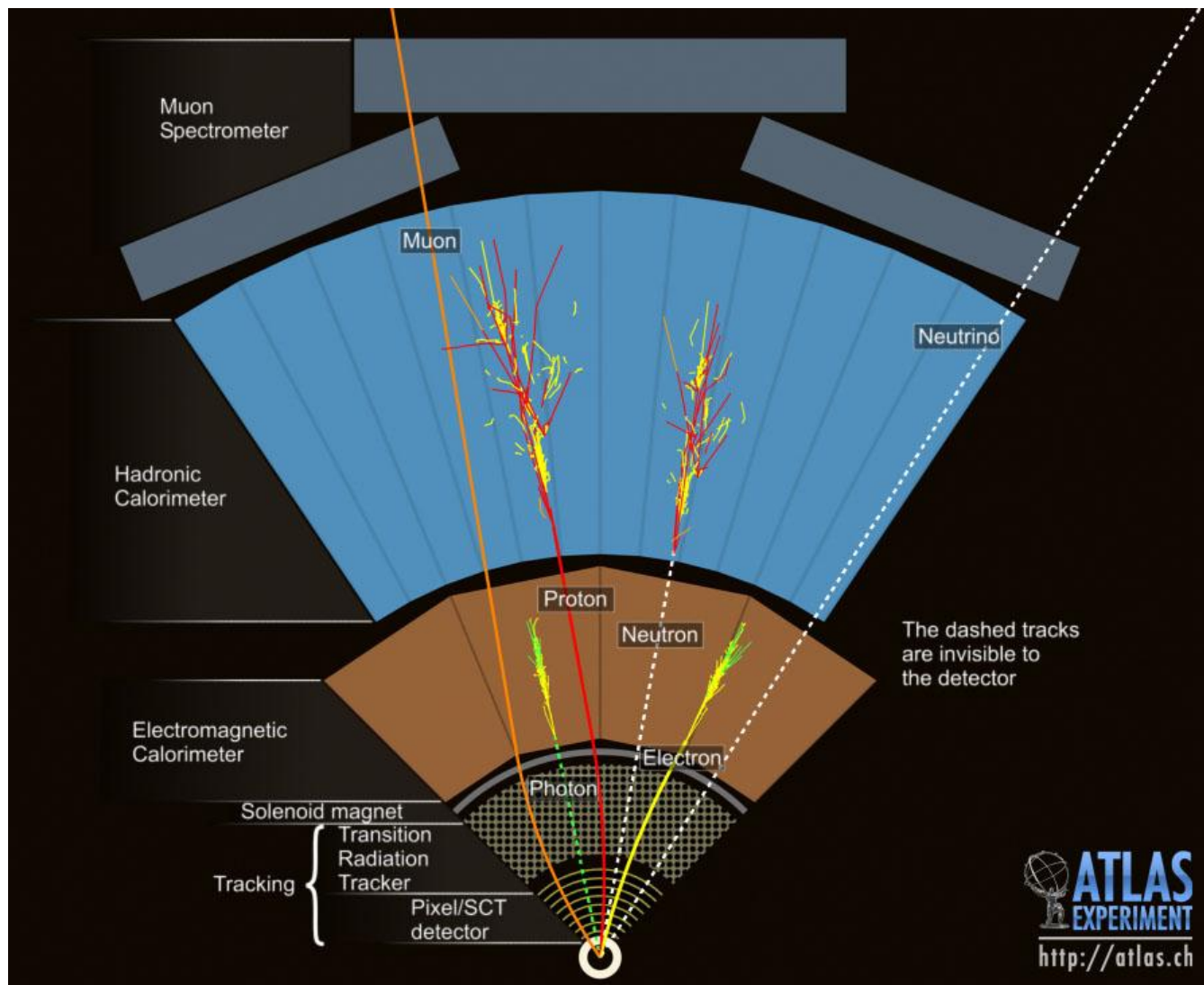
Badanie struktury protonu

Detektor ATLAS



Identyfikacja cząstek

Detekcja i identyfikacja cząstek w ATLASie



Tracer3D – <https://tracer-mc.web.cern.ch/>



INTERNATIONAL MASTERCLASSES



Kraków

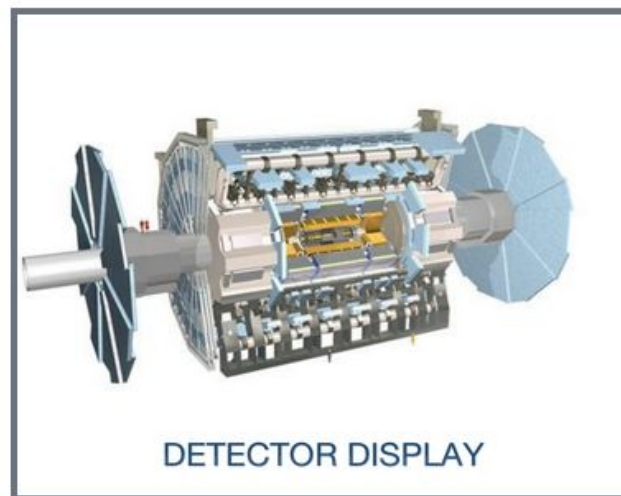
Group

1

1A

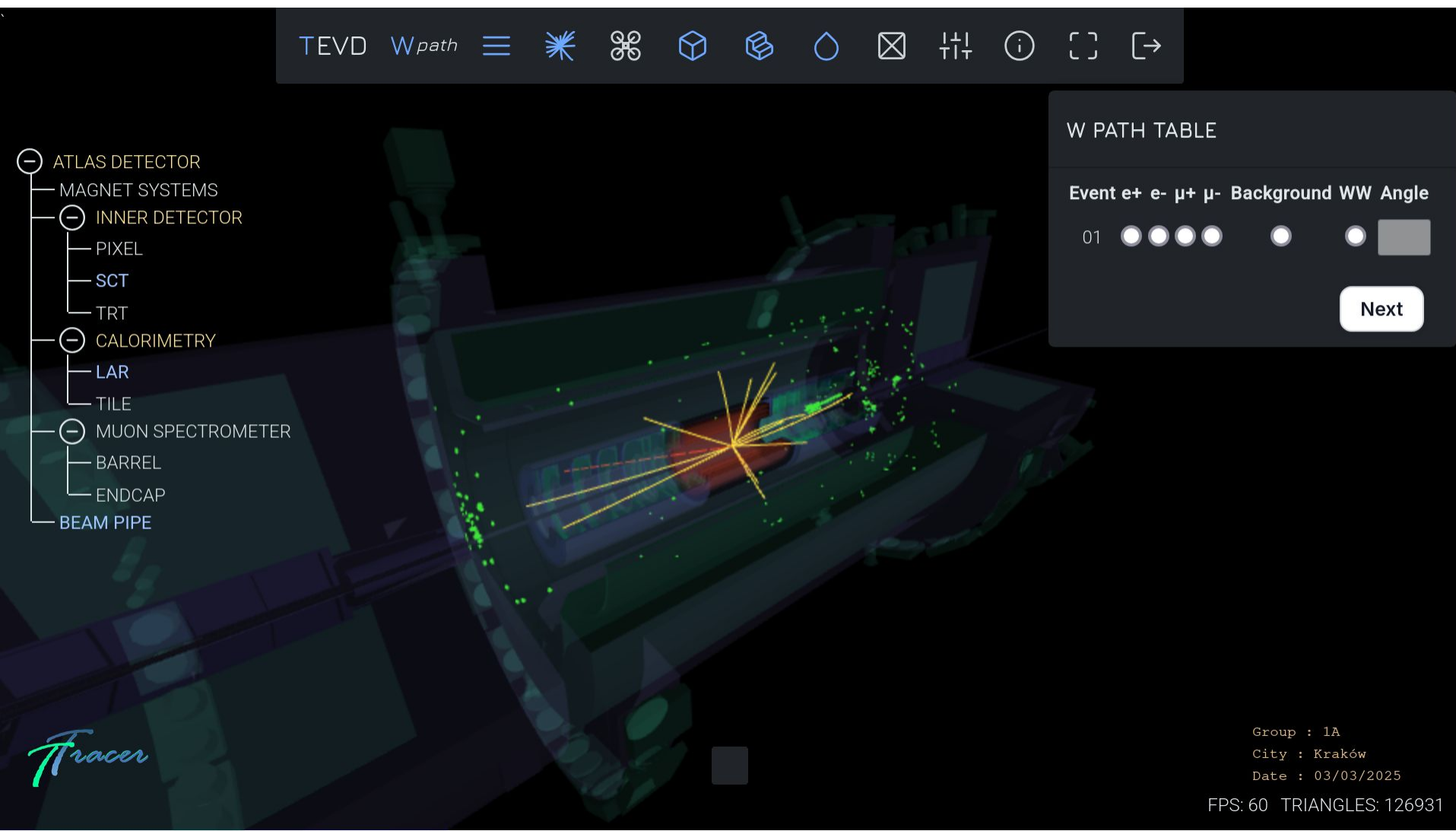
W

Z

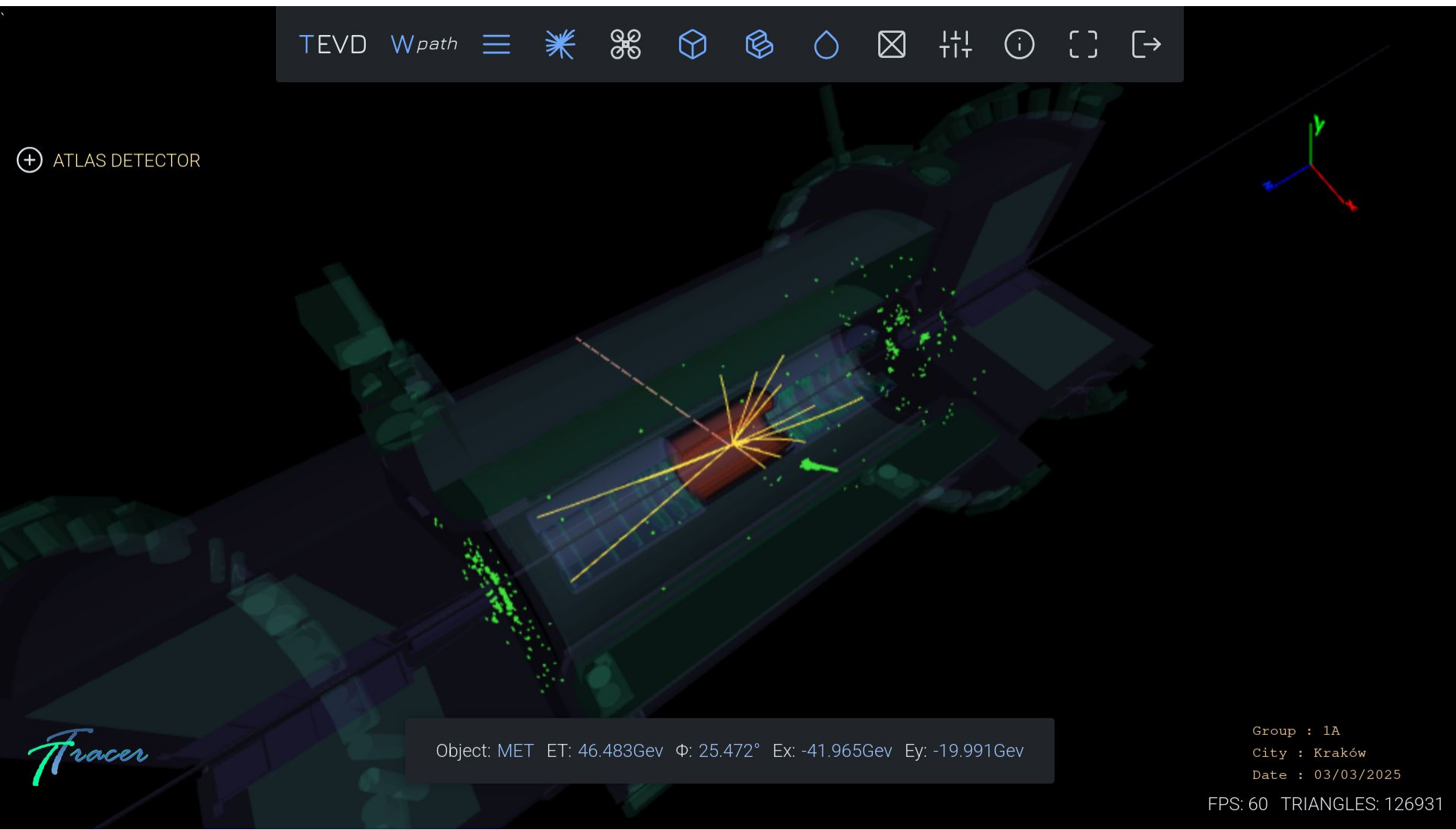


Tracer

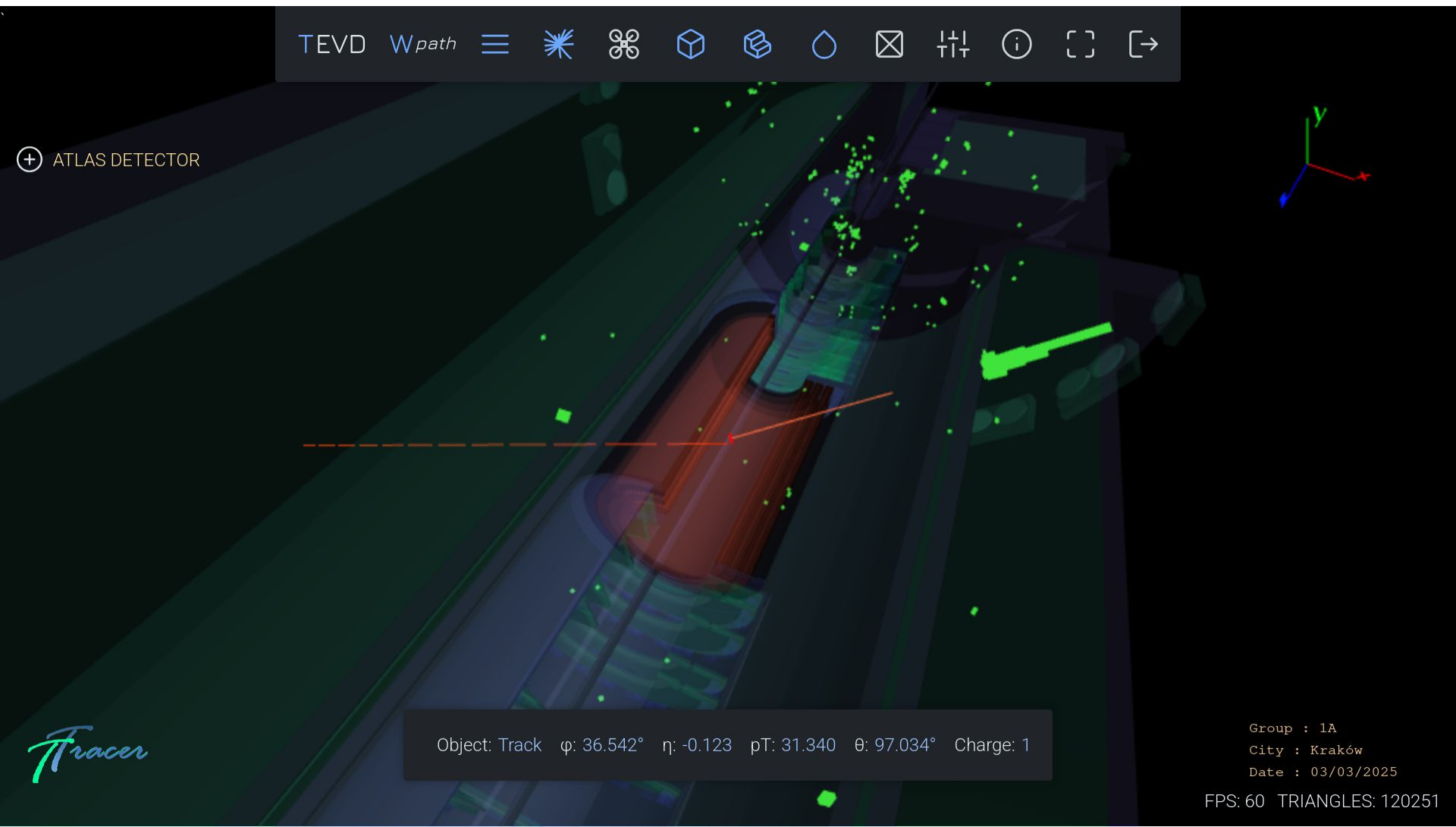
Tracer3D – <https://tracer-mc.web.cern.ch/>



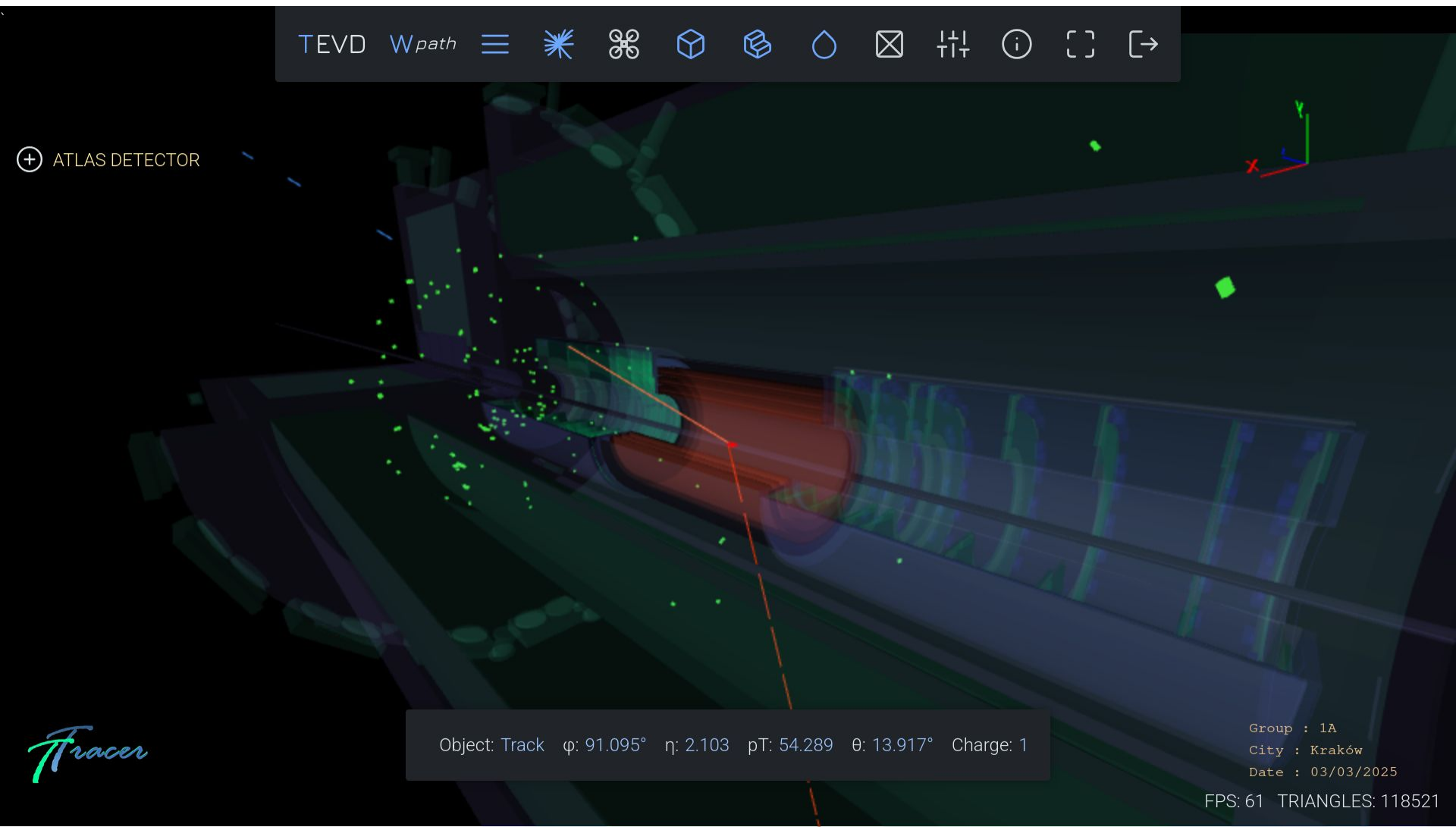
Identyfikacja cząstek – neutrino



Identyfikacja cząstek – elektron/pozyton

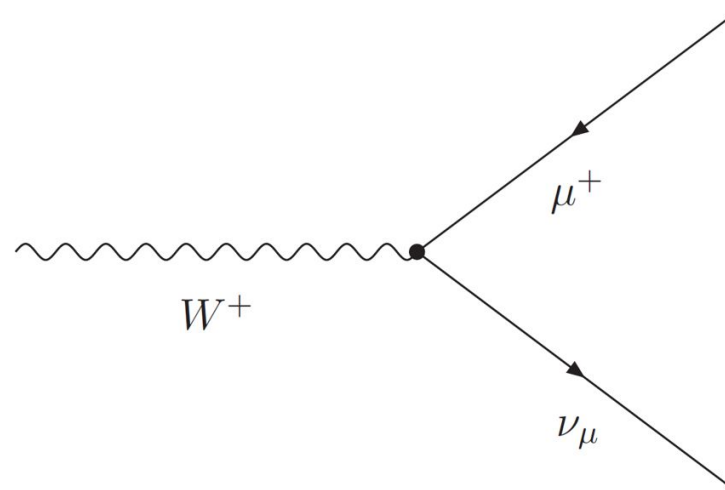
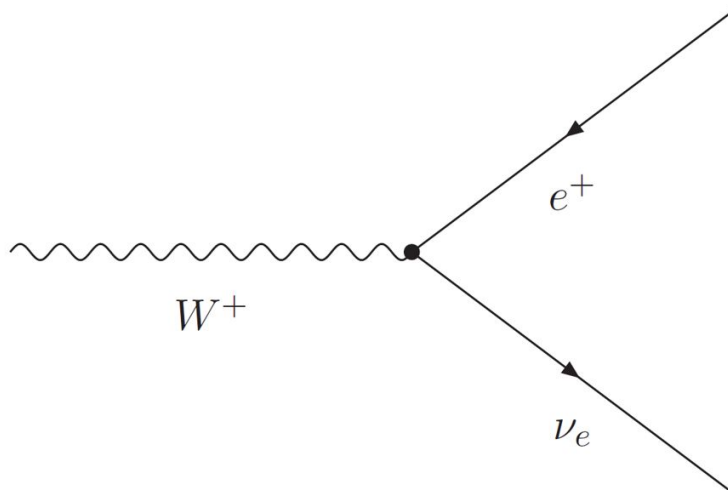
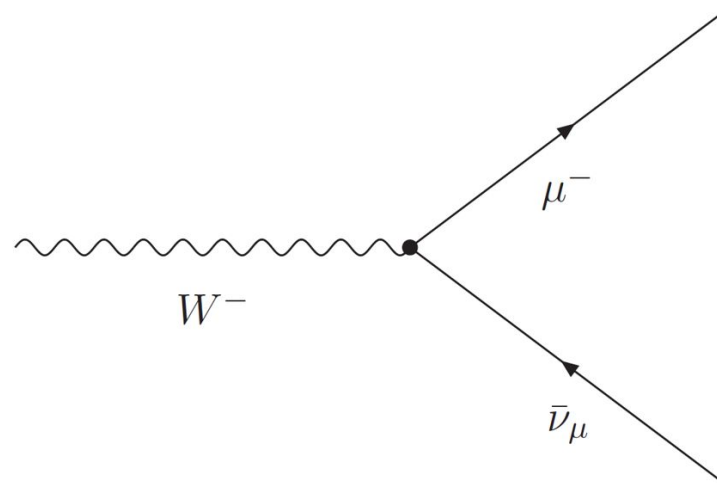
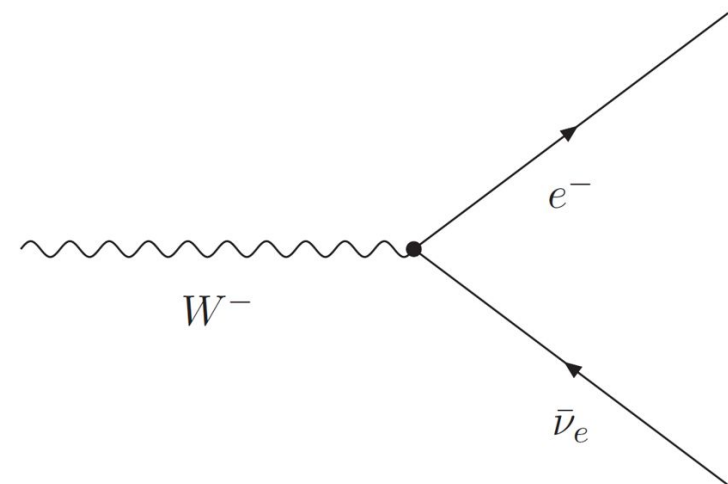


Identyfikacja cząstek – (anty) mion



Identyfikacja przypadków

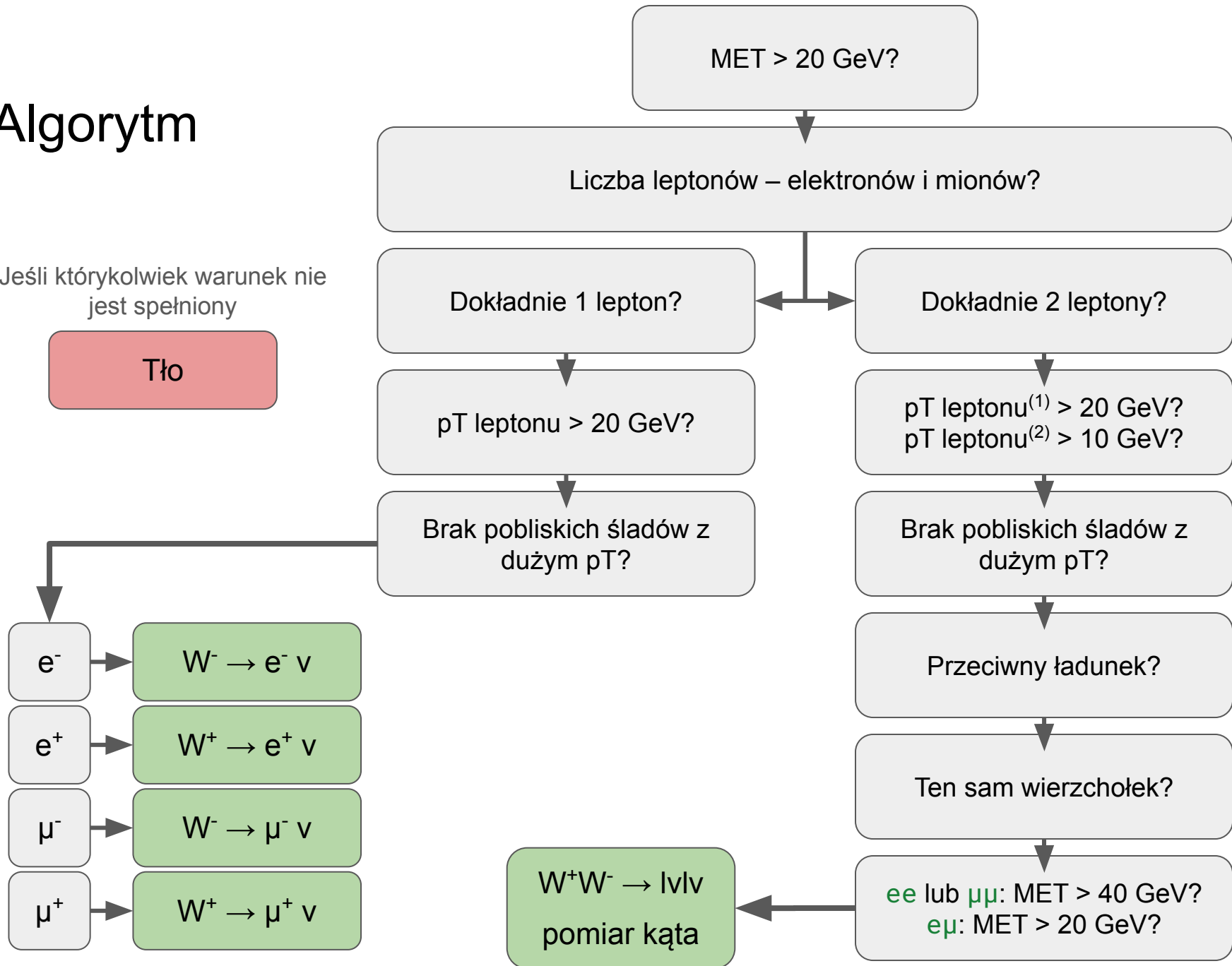
Rozpad bozonu W – sygnał



Algorytm

Jeśli którykolwiek warunek nie jest spełniony

Tło



Zapis wyników

TEVD W_{path}           

ATLAS data analysis

data sample: 1A

event number	signal with 1 lepton (I)				signal with 2 leptons (II)		Back-ground	Comment
	$W \rightarrow \nu + \dots$		$W \rightarrow \nu + \dots$		$WW \rightarrow \Gamma^+ \nu \Gamma^- \nu$	$\Delta\phi_{ll}$ round off to whole number		
	e^+	e^-	μ^+	μ^-				
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								

W PATH TABLE

Event e^+ e^- μ^+ μ^- Background WW Angle

01 ☒ ☒ ☒ ☒ ☒ ☒ ☒

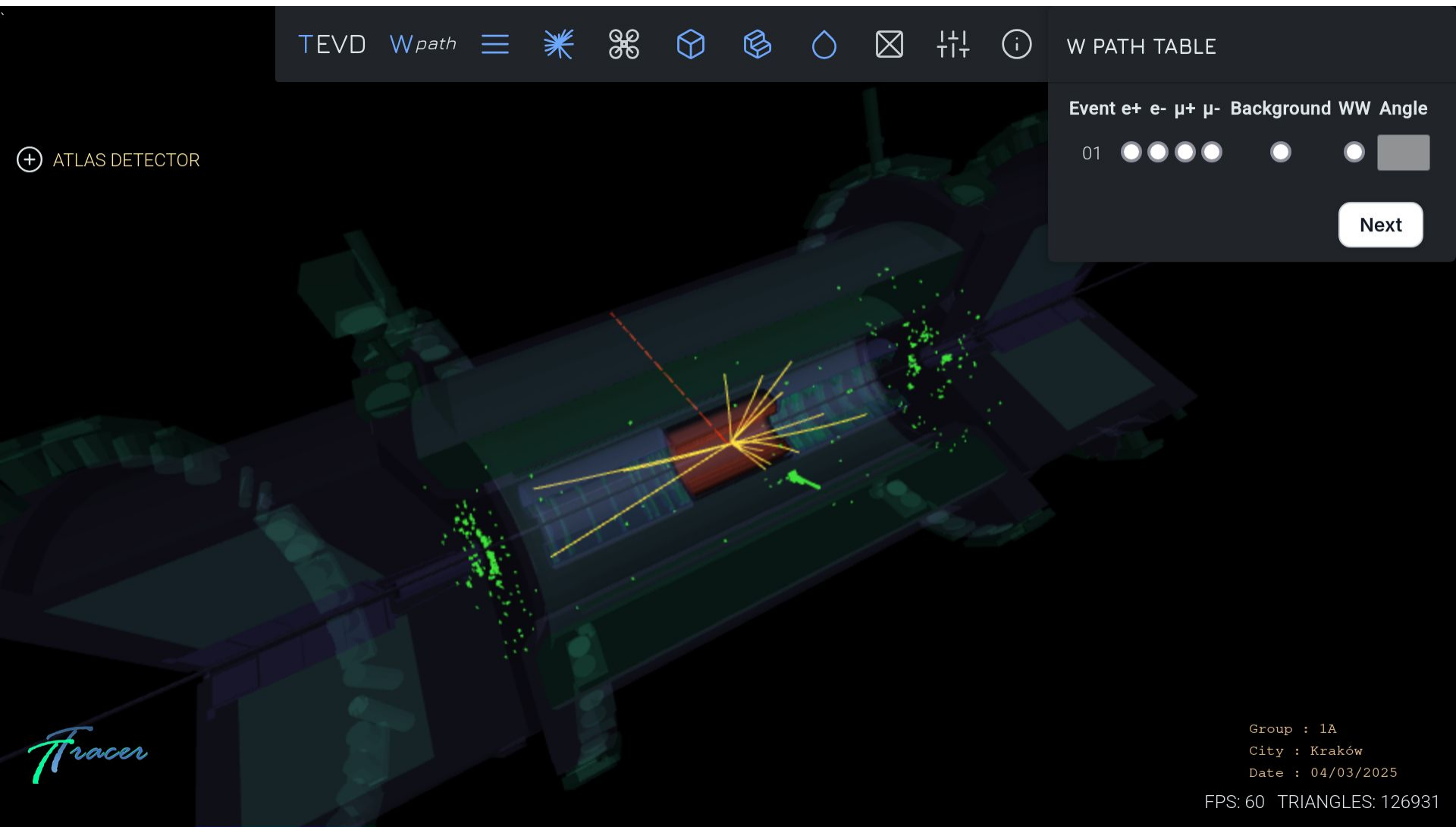
Next



Główna metoda zapisu wyników

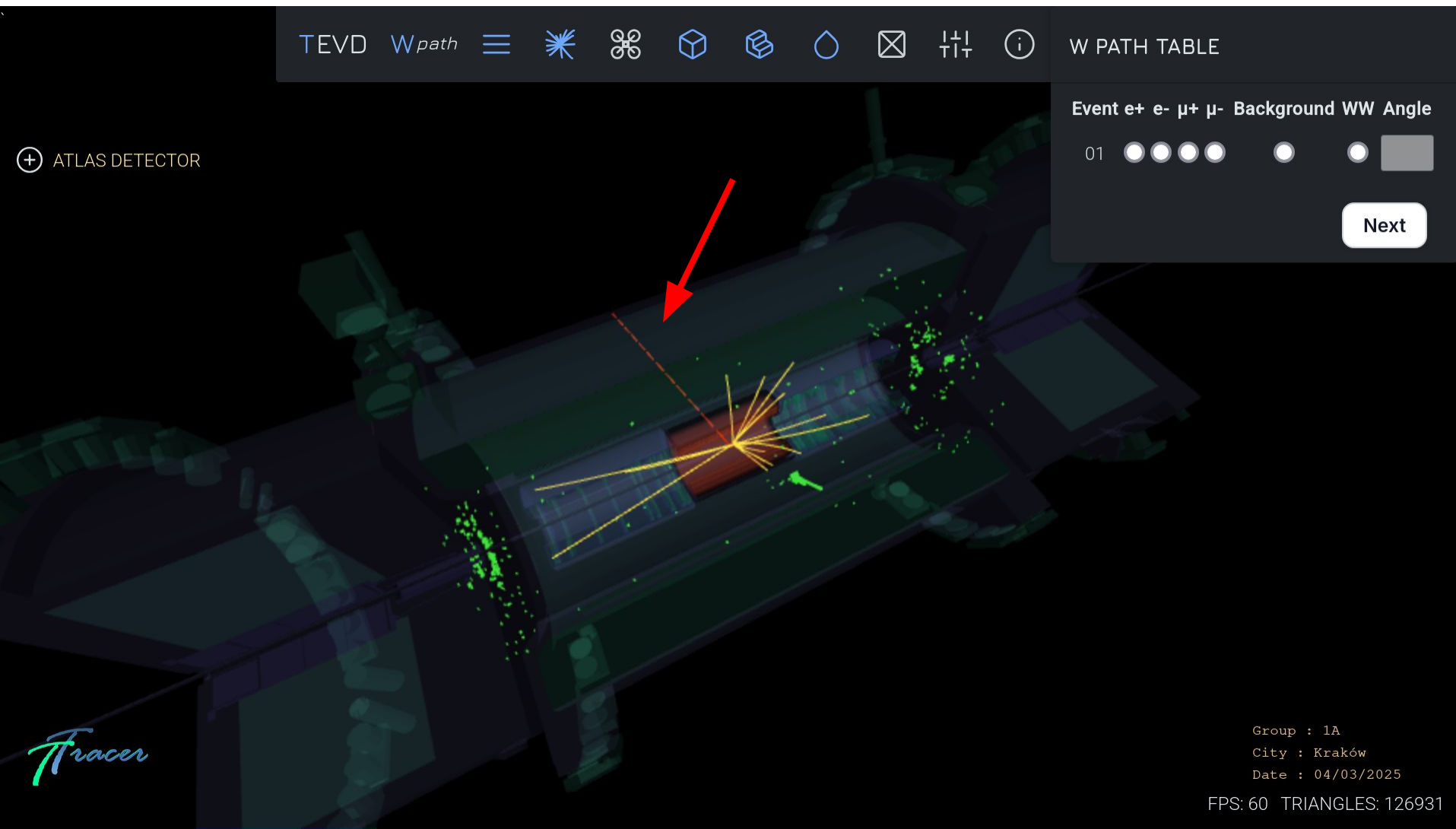
Przypadek #1

MET > 20 GeV?



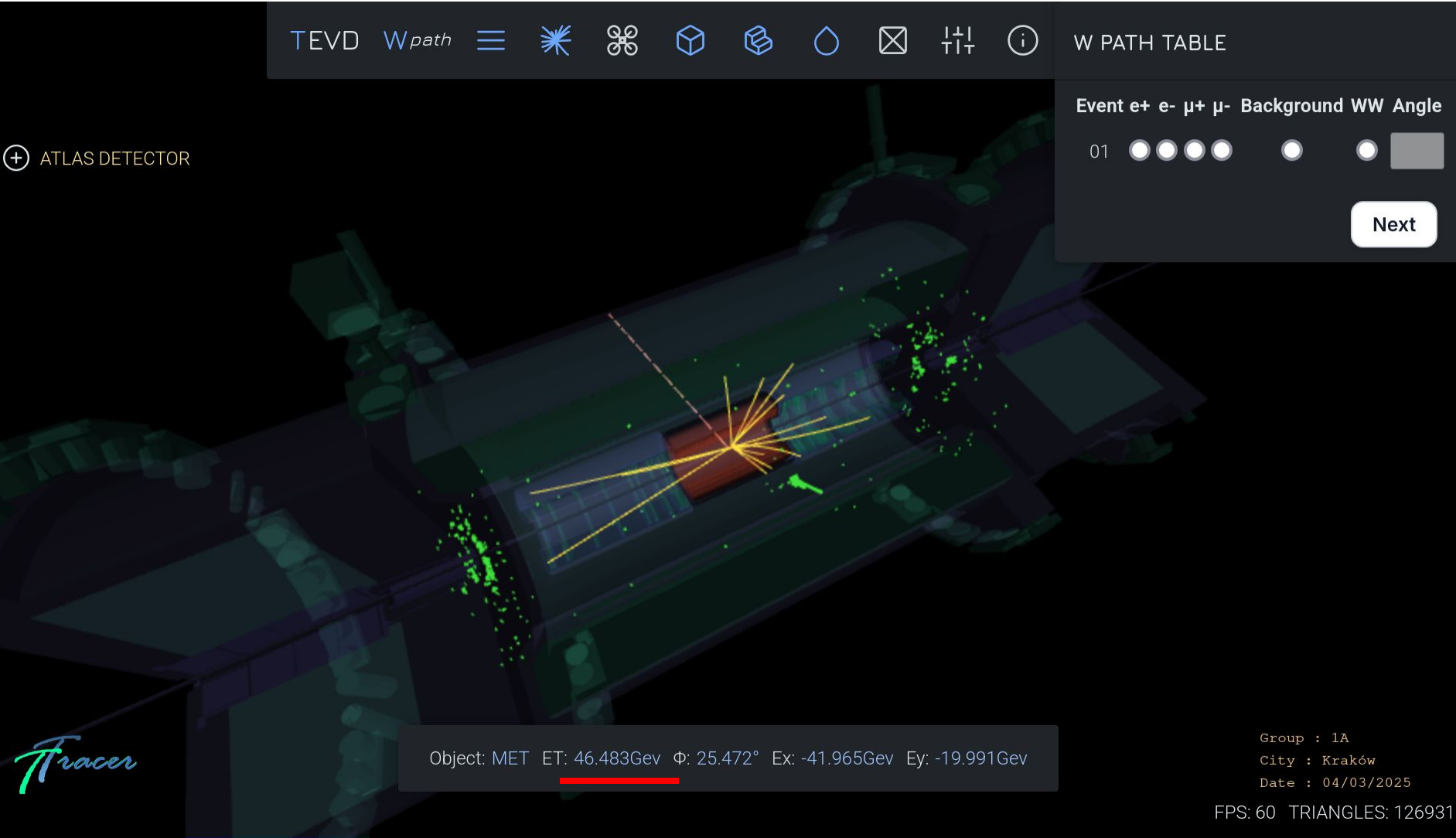
Przypadek #1

MET > 20 GeV?



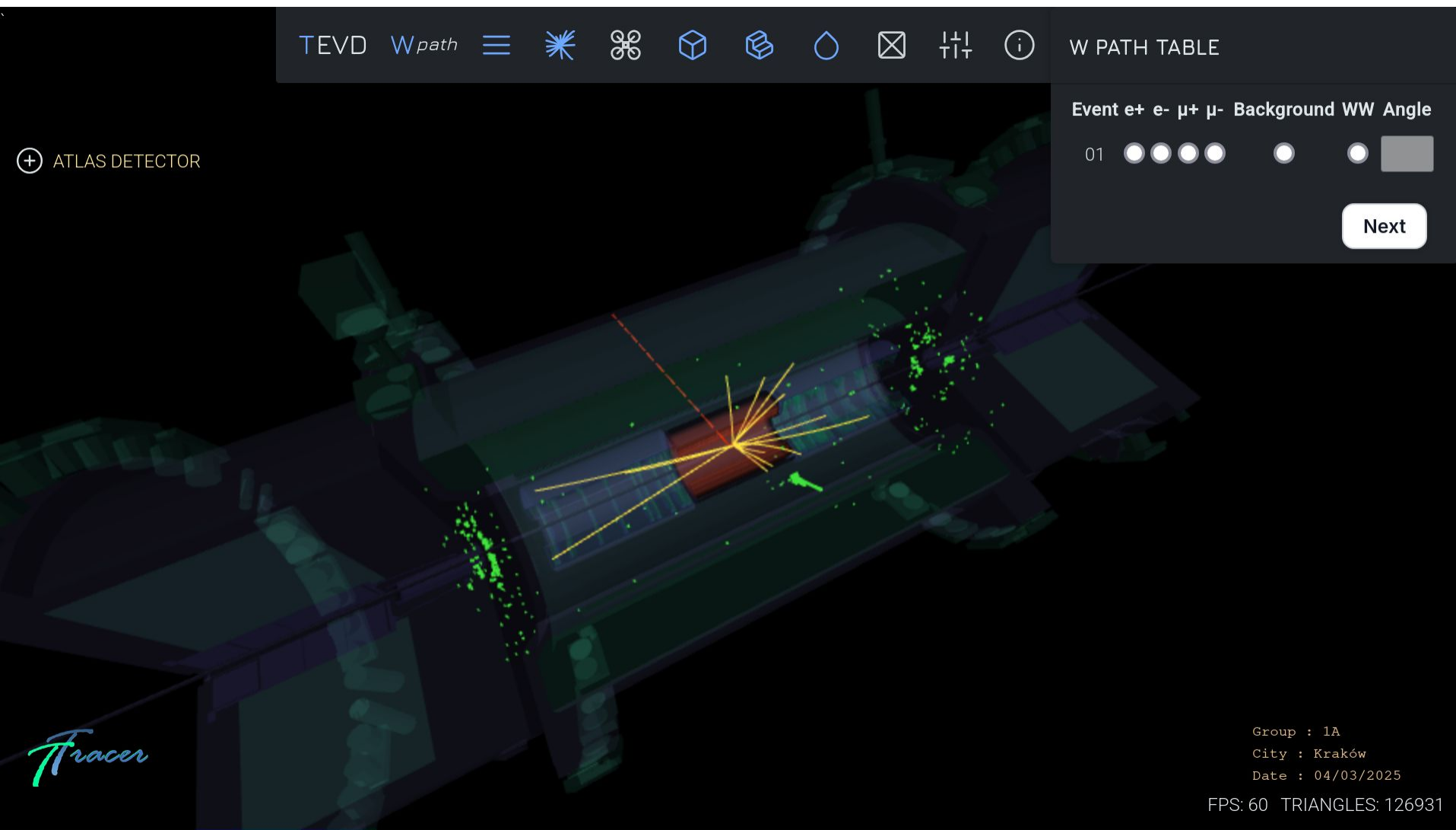
Przypadek #1

MET > 20 GeV



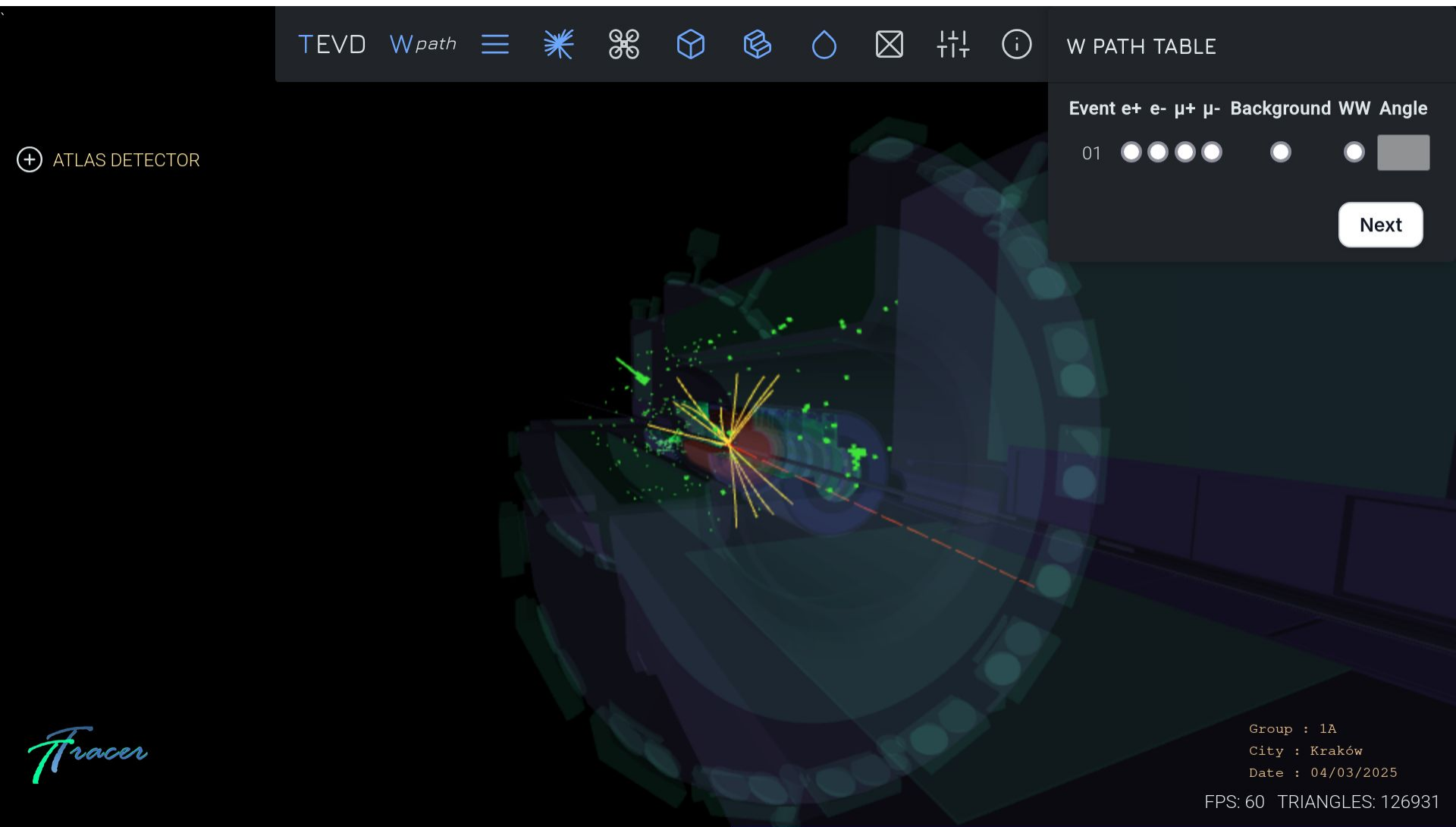
Przypadek #1

Liczba leptonów – elektronów i mionów?



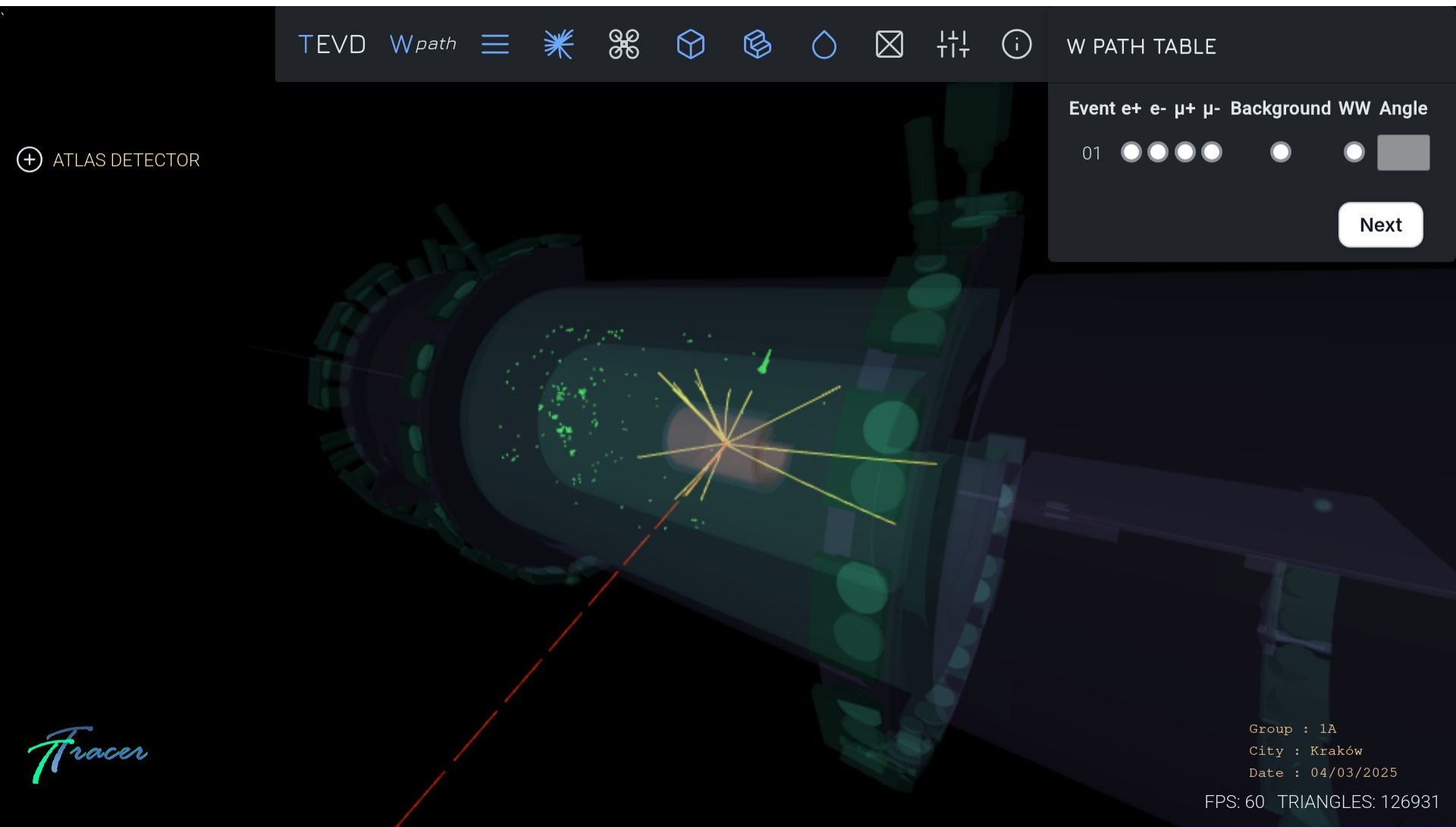
Przypadek #1

Liczba leptonów – elektronów i mionów?



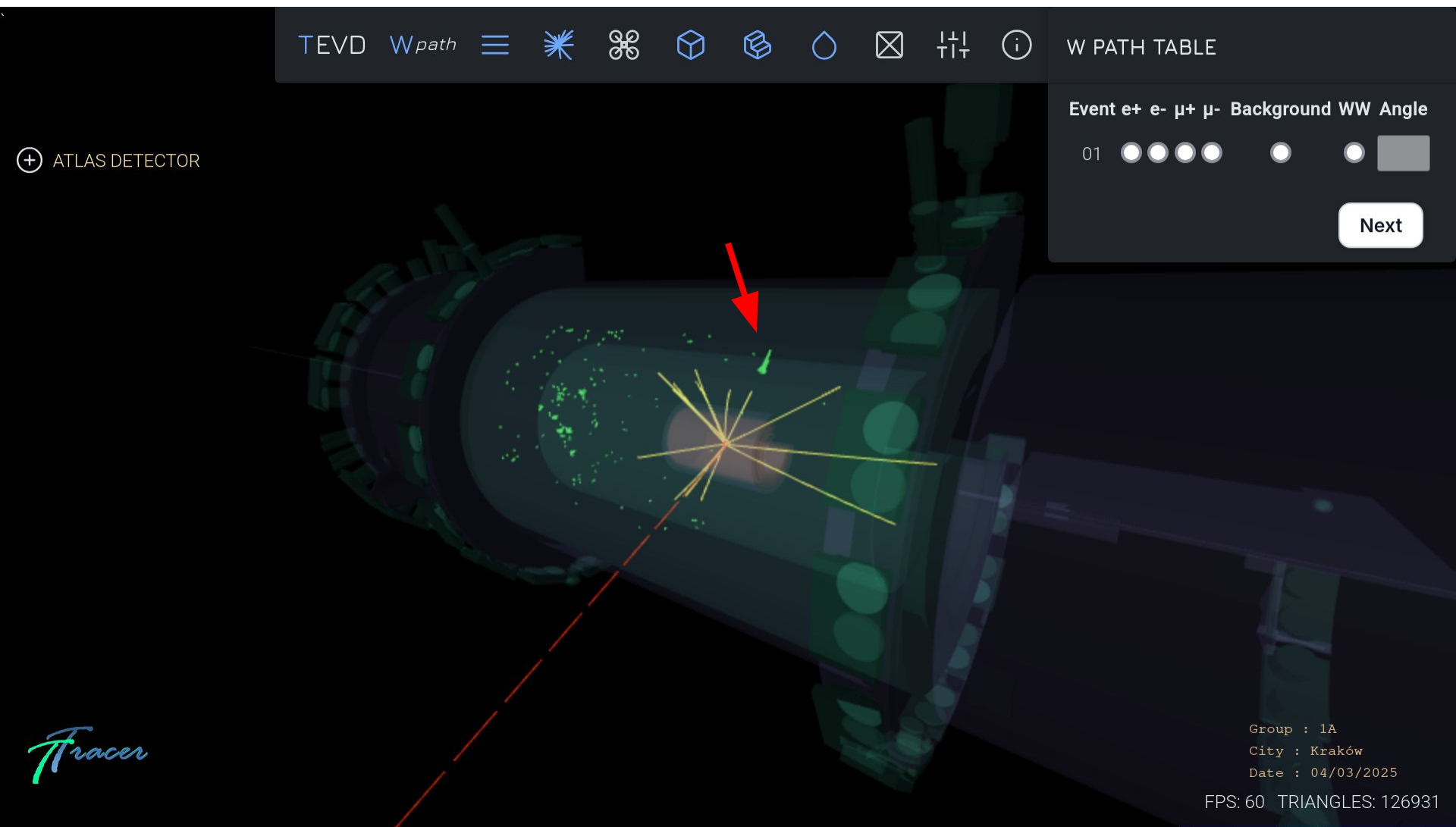
Przypadek #1

Liczba leptonów – elektronów i mionów?



Przypadek #1

Jeden kandydat na elektron



Przypadek #1

pT elektronu > 20 GeV?

⊕ ATLAS DETECTOR

TEVD W_{path}         

W PATH TABLE

Event	e+	e-	μ+	μ-	Background	WW	Angle
01	☒	☒	☒	☒	☒	☒	

Next

Tracer

Object: Track ϕ : 36.542° η : -0.123 pT: 31.340 θ : 97.034° Charge: 1

Group : 1A
City : Kraków
Date : 04/03/2025²²

FPS: 60 TRIANGLES: 124651

Przypadek #1

pT elektronu > 20 GeV

⊕ ATLAS DETECTOR

TEVD W_{path}         

W PATH TABLE

Event e+ e- μ^+ μ^- Background WW Angle

01       

Next

Tracer

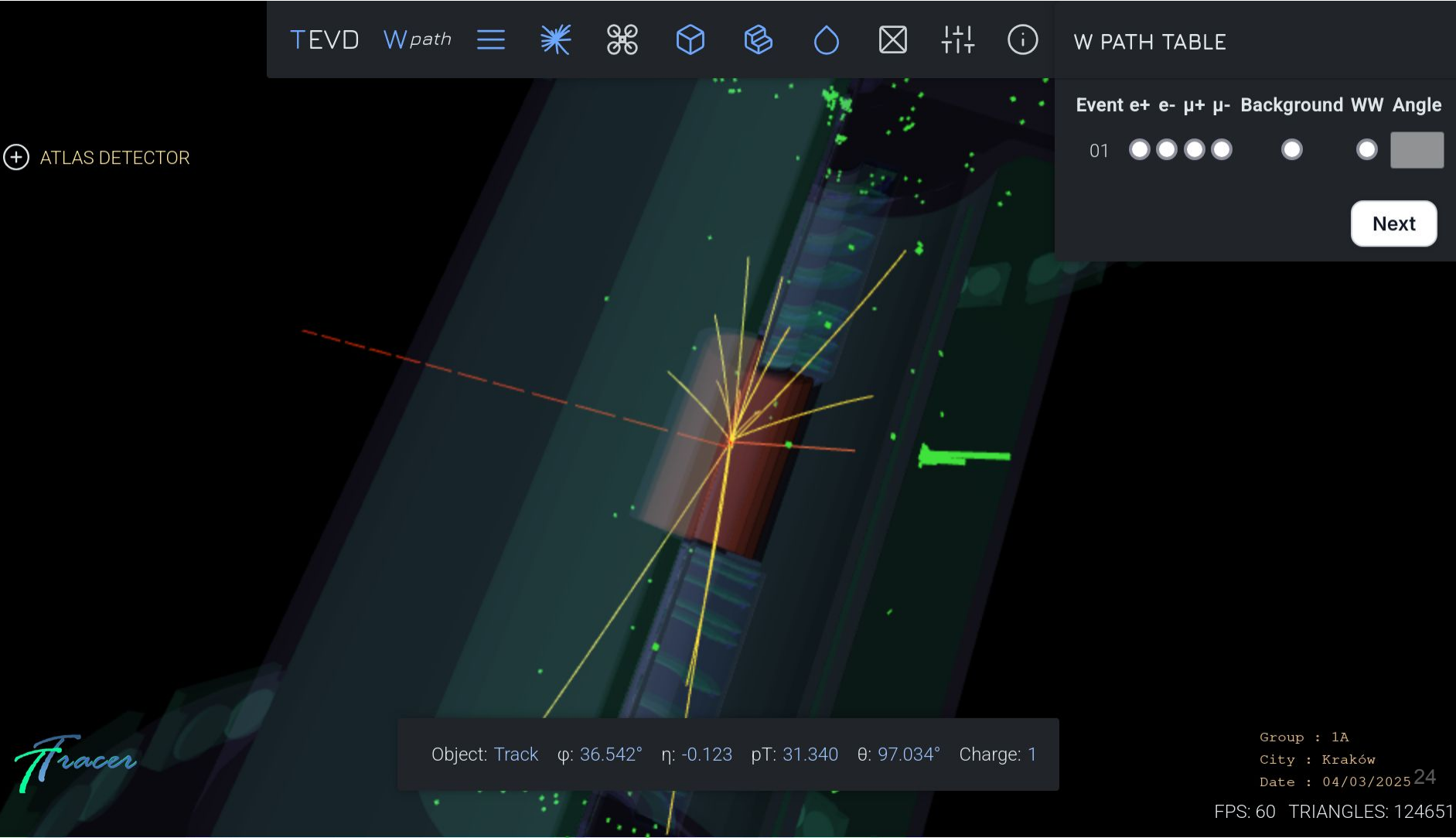
Object: Track ϕ : 36.542° η : -0.123 pT: 31.340 θ : 97.034° Charge: 1

Group : 1A
City : Kraków
Date : 04/03/2025²³

FPS: 60 TRIANGLES: 124651

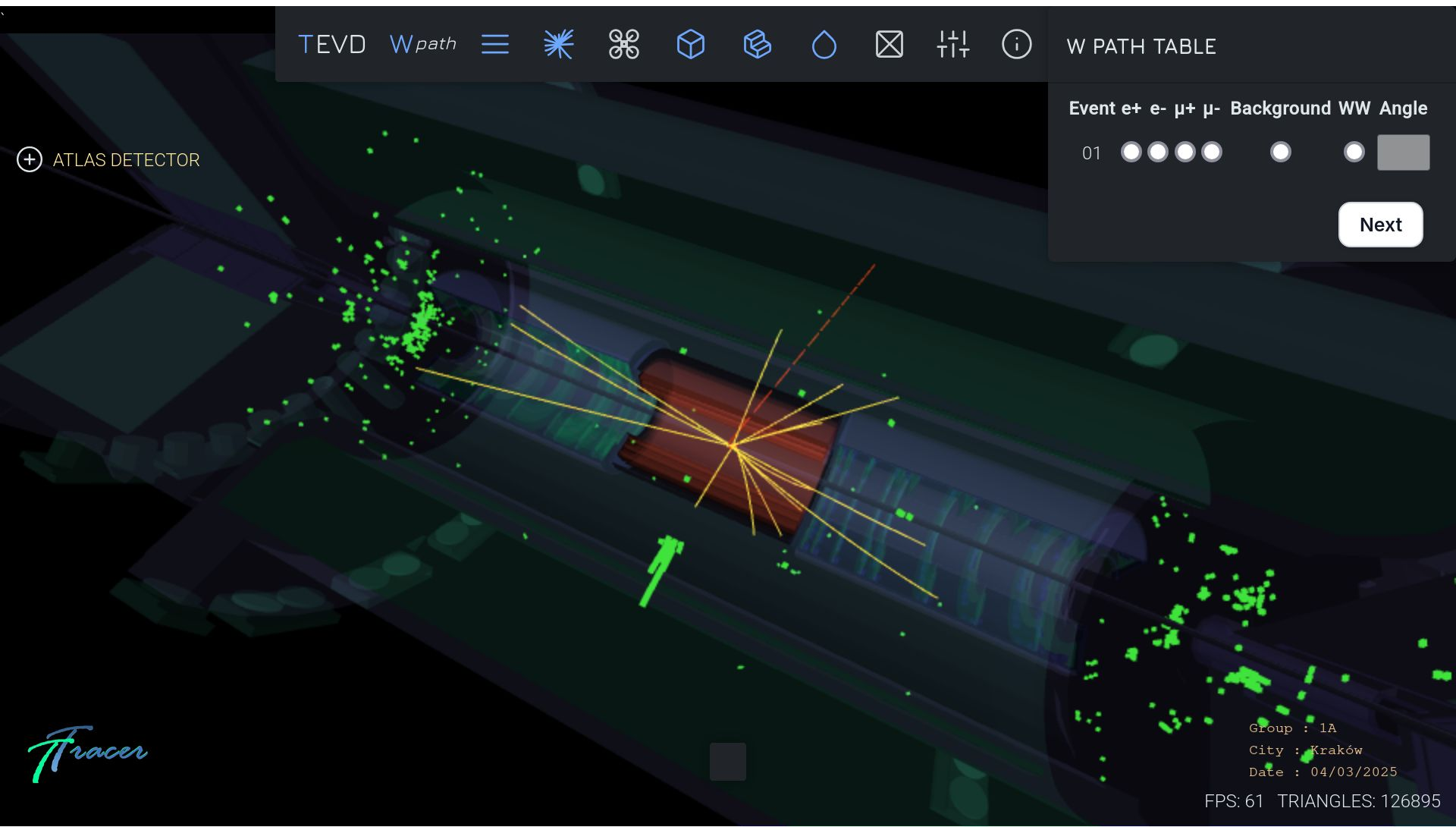
Przypadek #1

Brak pobliskich śladów z dużym pT?

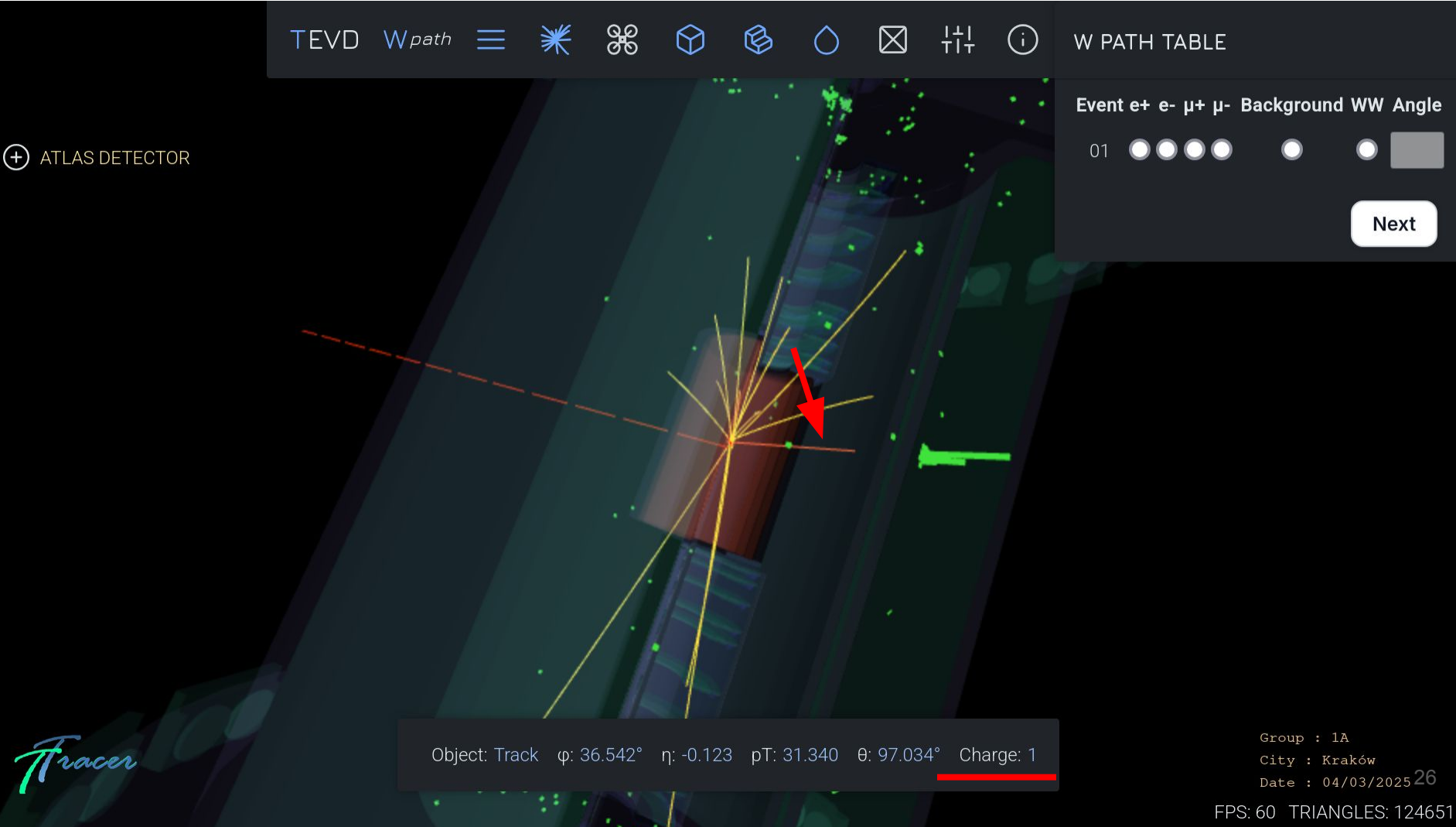
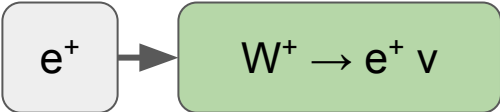


Przypadek #1

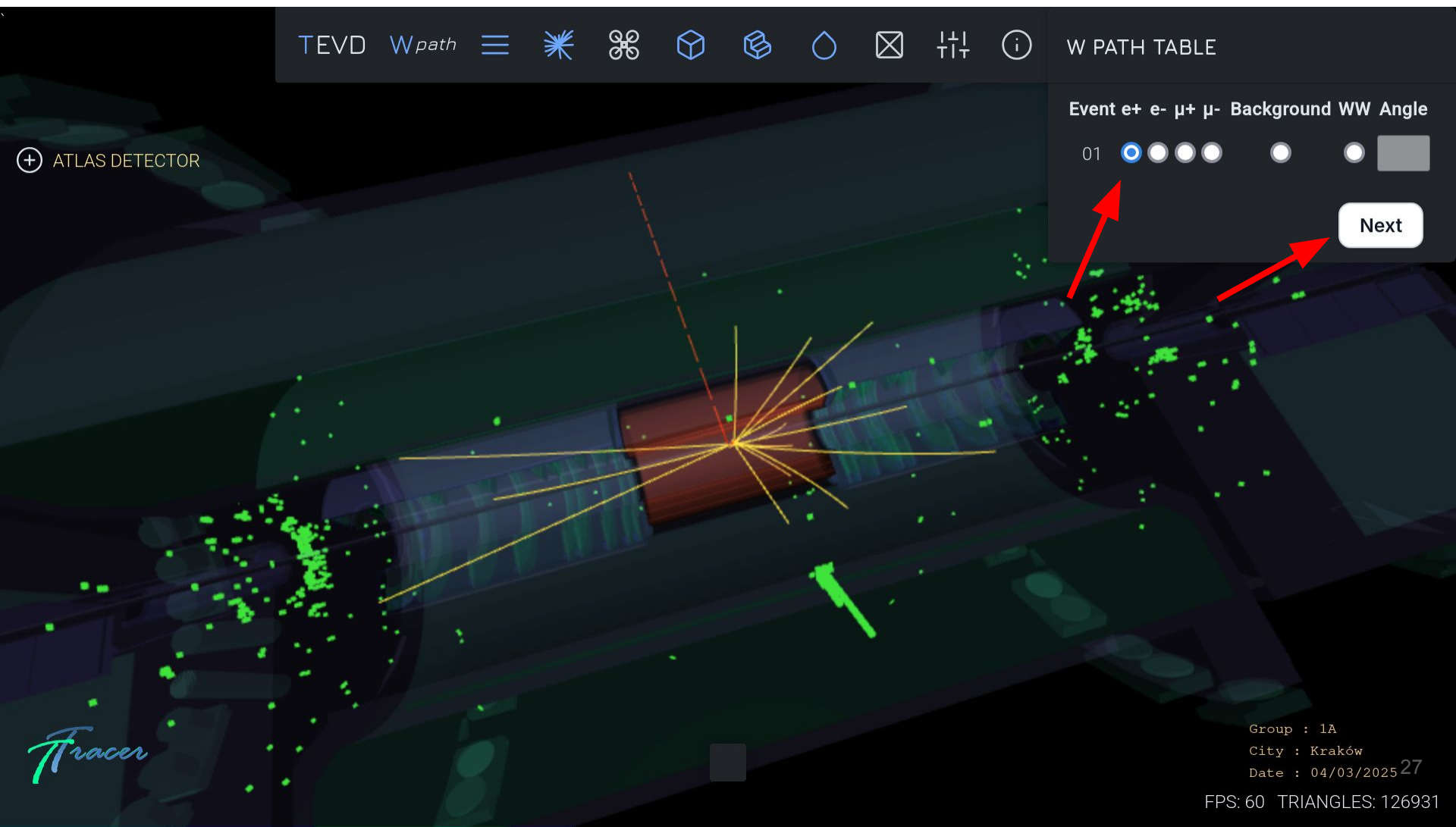
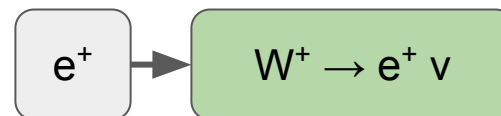
Brak pobliskich śladów z dużym p_T



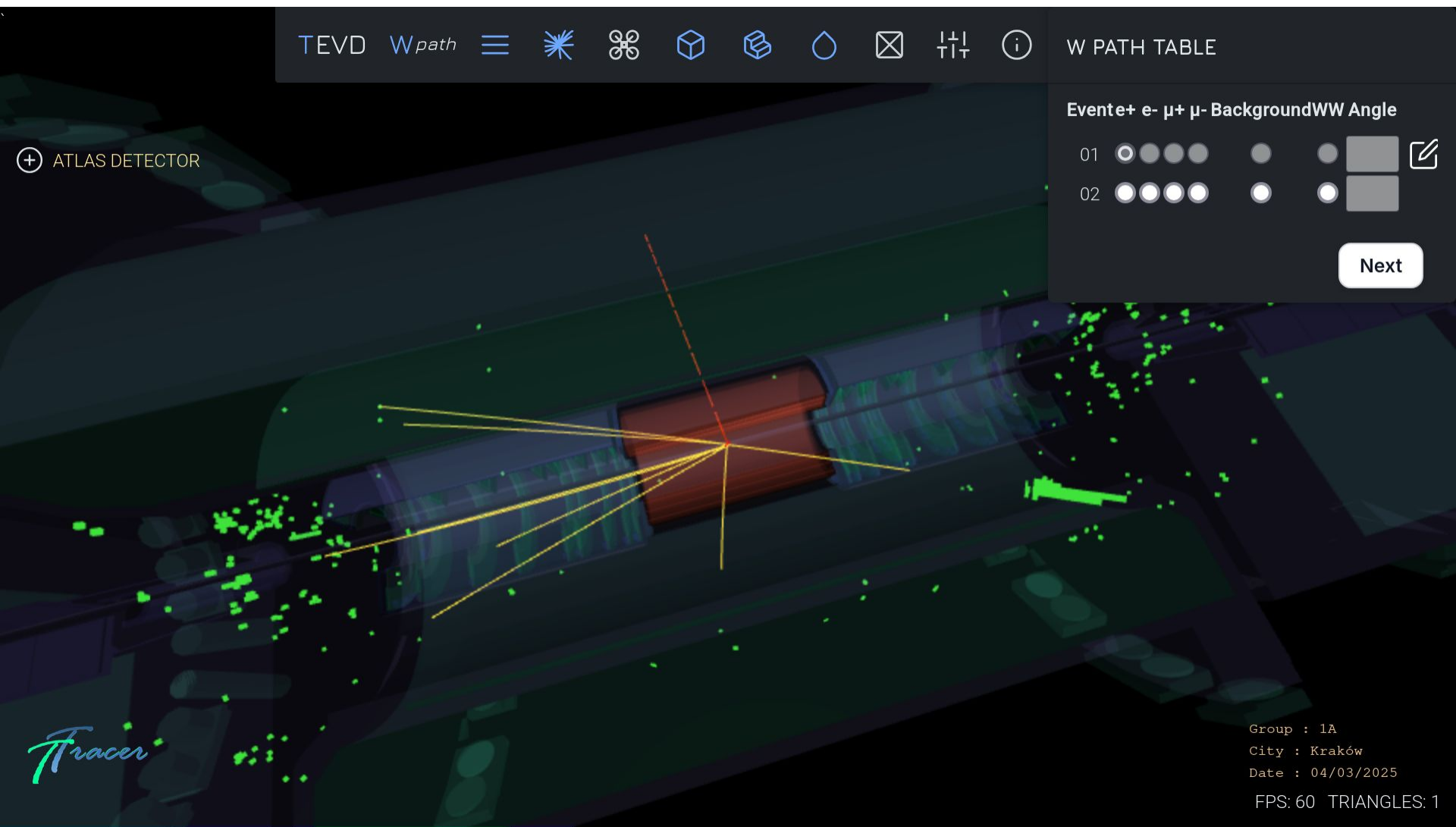
Przypadek #1



Przypadek #1



Kolejny przypadek...



⊕ ATLAS DETECTOR



FPS: 61 TRIANGLES: 130519

Przypadek #2

MET > 20 GeV

+ ATLAS DETECTOR

TEVD W_{path}         

W PATH TABLE

Event+ e- μ + μ - BackgroundWW Angle

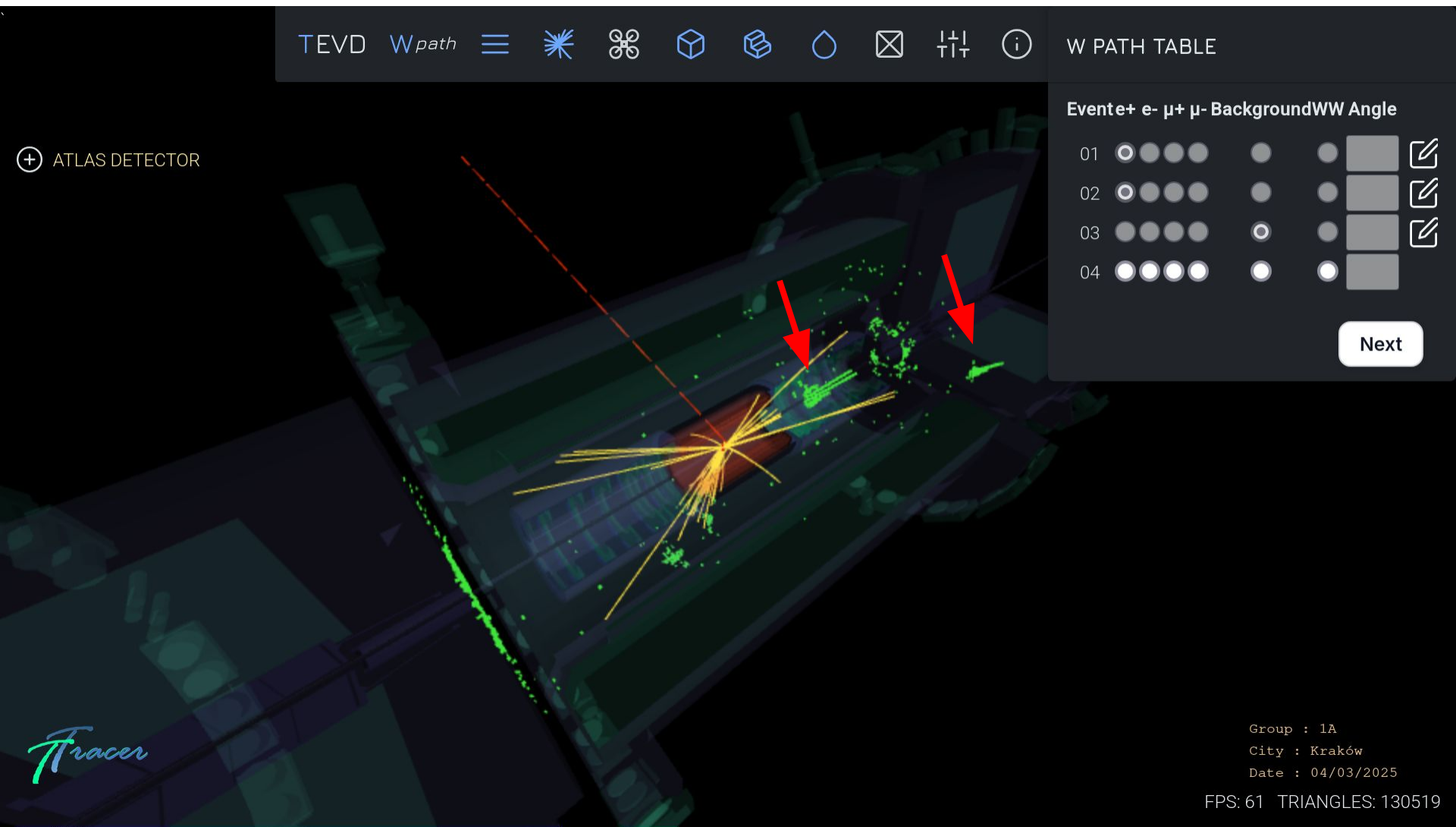
01	☒	☐	☐	☐	☐	☐	☐	☐	☐	
02	☒	☐	☐	☐	☐	☐	☐	☐	☐	
03	☐	☐	☐	☐	☐	☒	☐	☐	☐	
04	☒	☒	☒	☒	☒	☐	☐	☐	☐	

Next



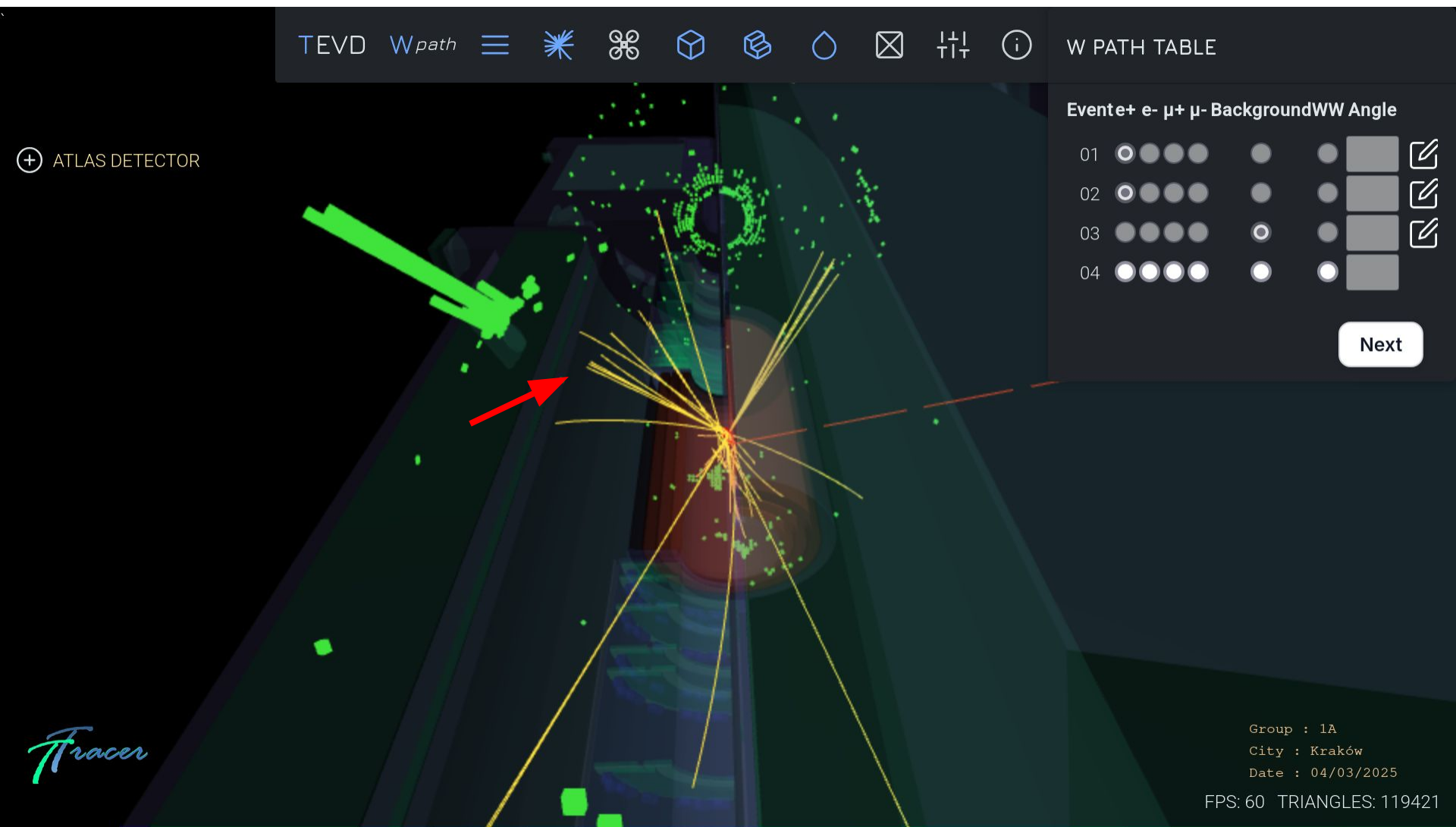
Object: MET ET: 72.897Gev Φ : -13.658° Ex: -70.835Gev Ey: 17.213Gev

Dwóch kandydatów na elektrony



Brak pobliskich śladów z dużym pT?

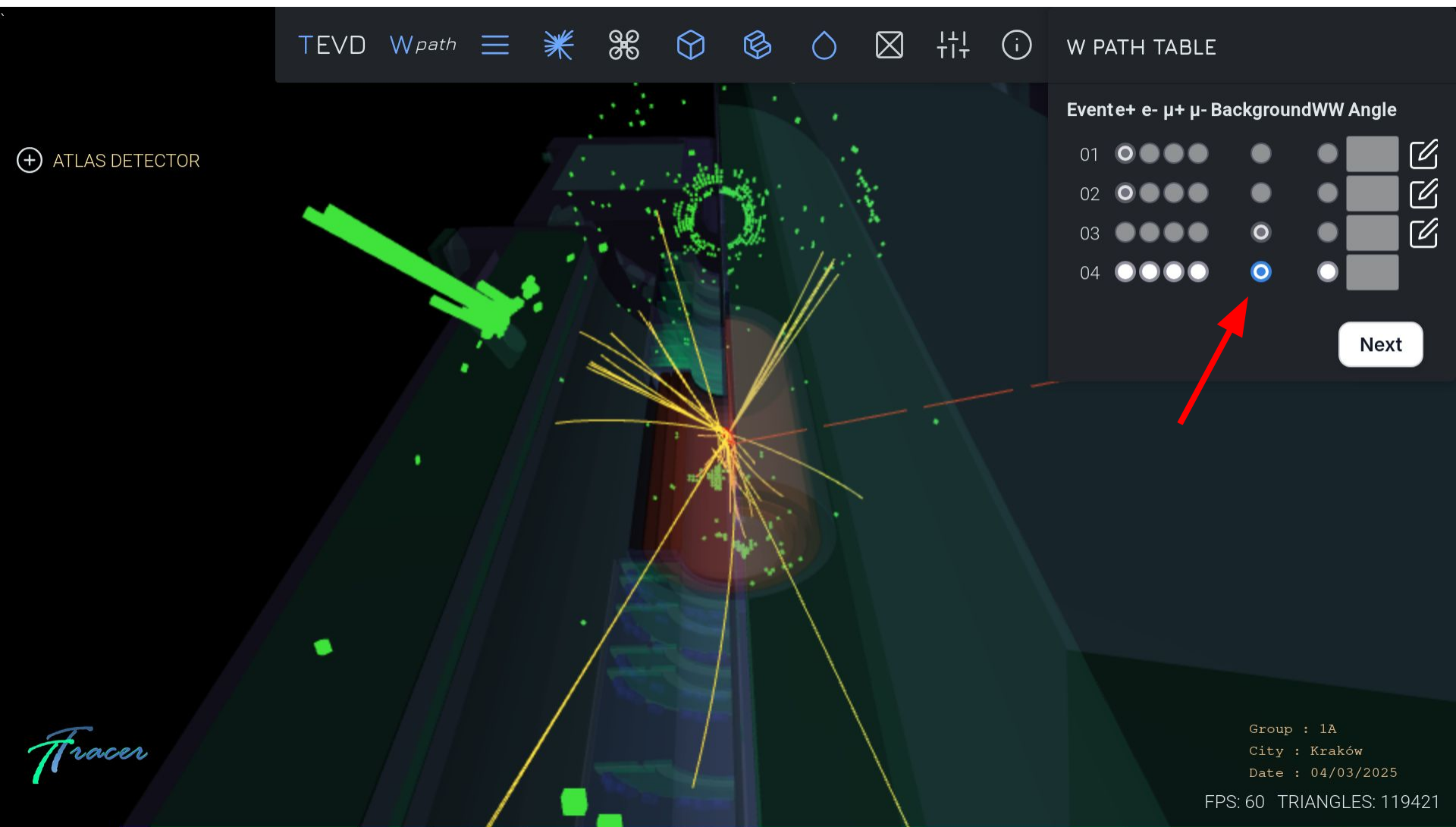
pT leptonu⁽¹⁾ > 20 GeV?
pT leptonu⁽²⁾ > 10 GeV?



Przypadek #2

Pobliskie ślady z dużym p_T

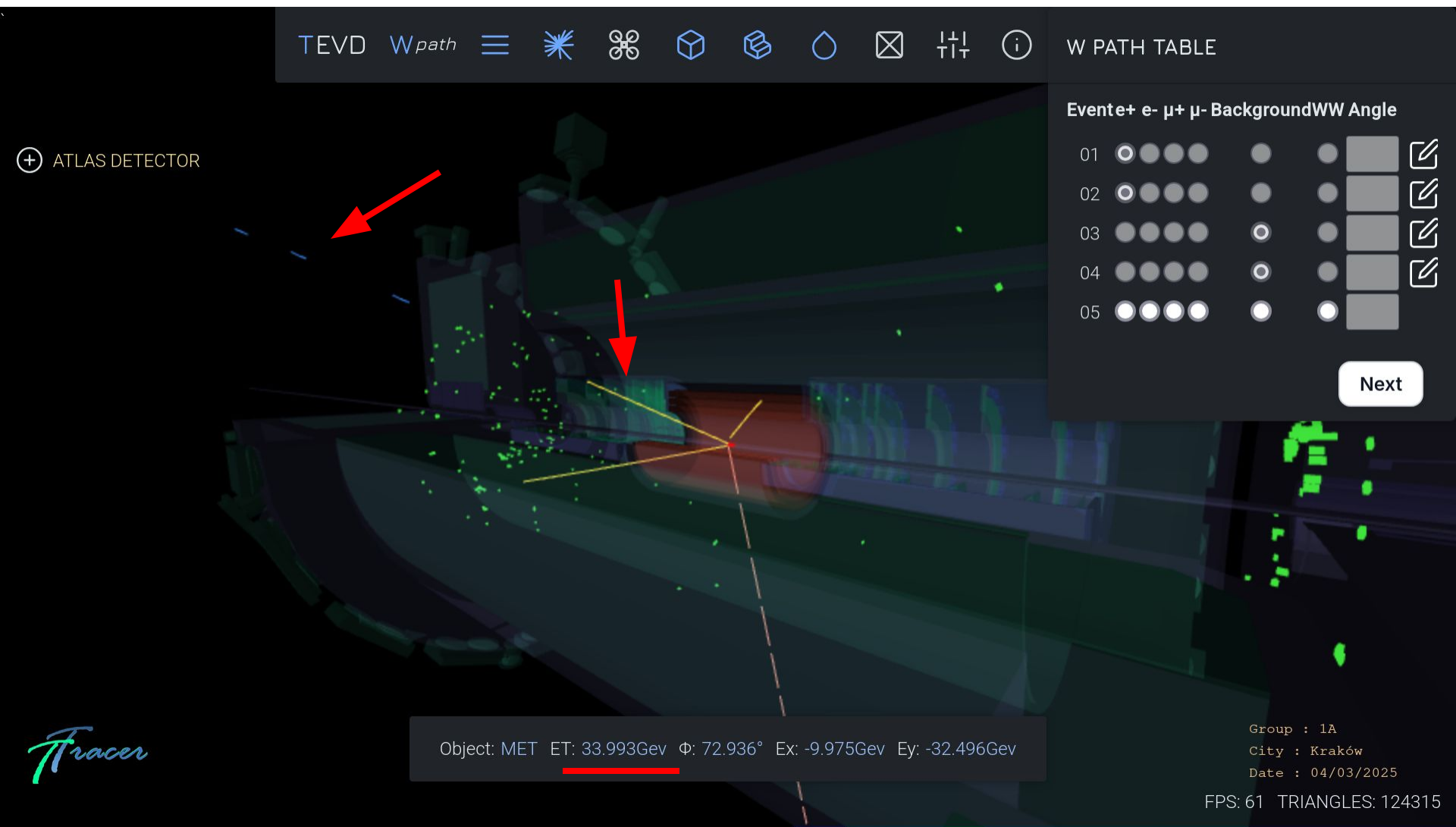
Tło



Przypadek #3

MET > 20 GeV

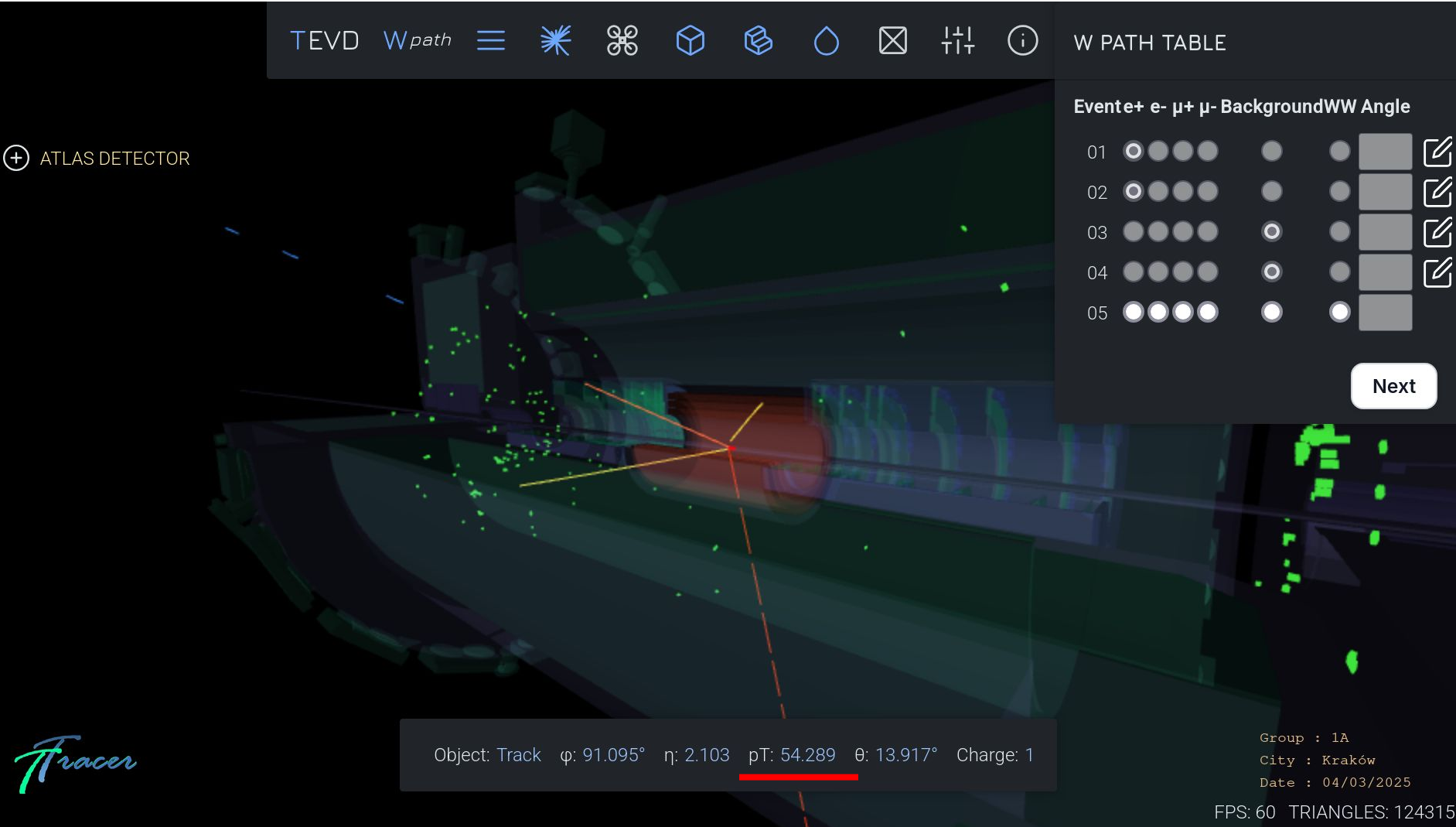
Jeden kandydat na mion



Przypadek #3

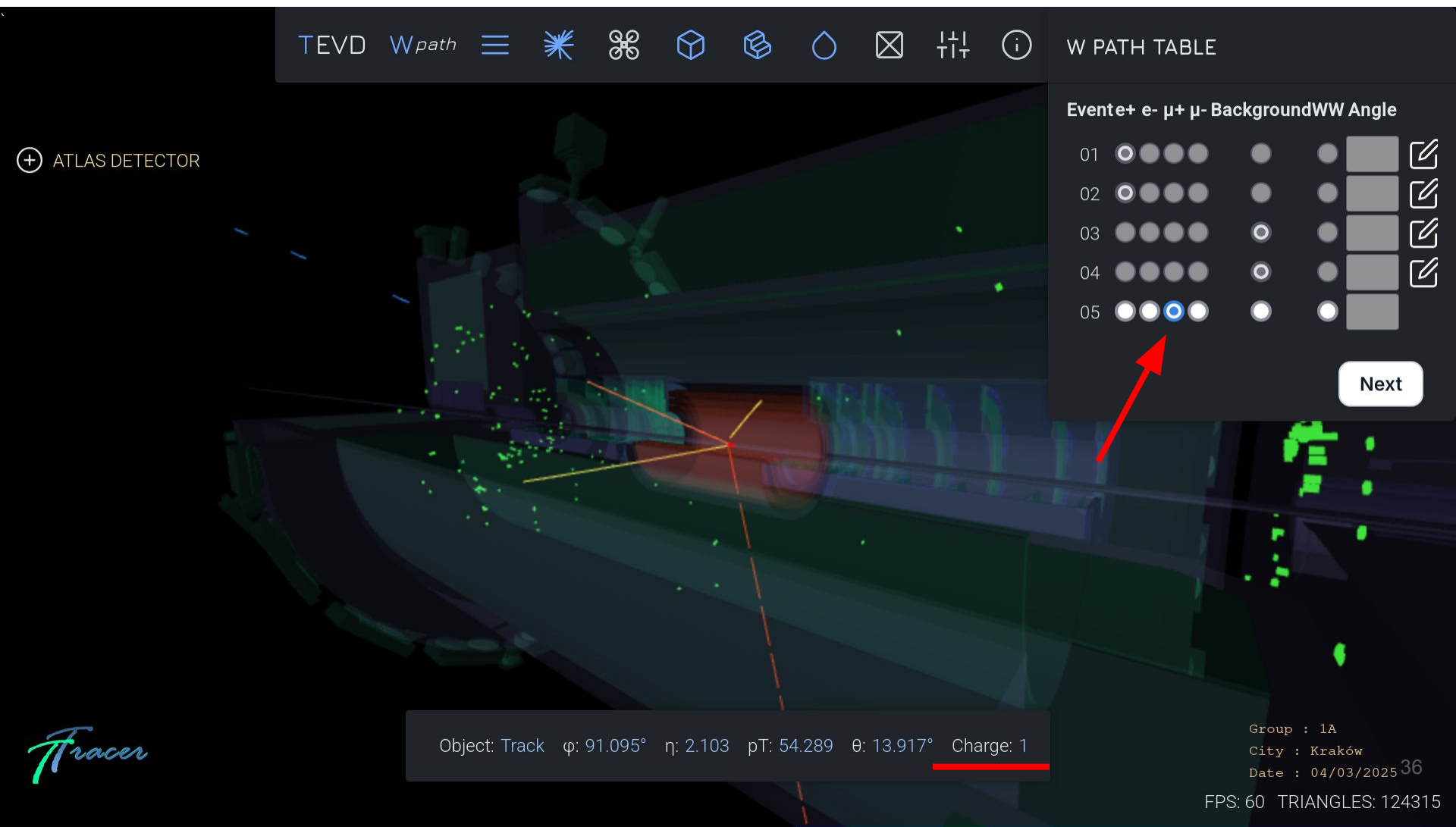
Brak pobliskich śladów z dużym pT

pT mionu > 20 GeV



```

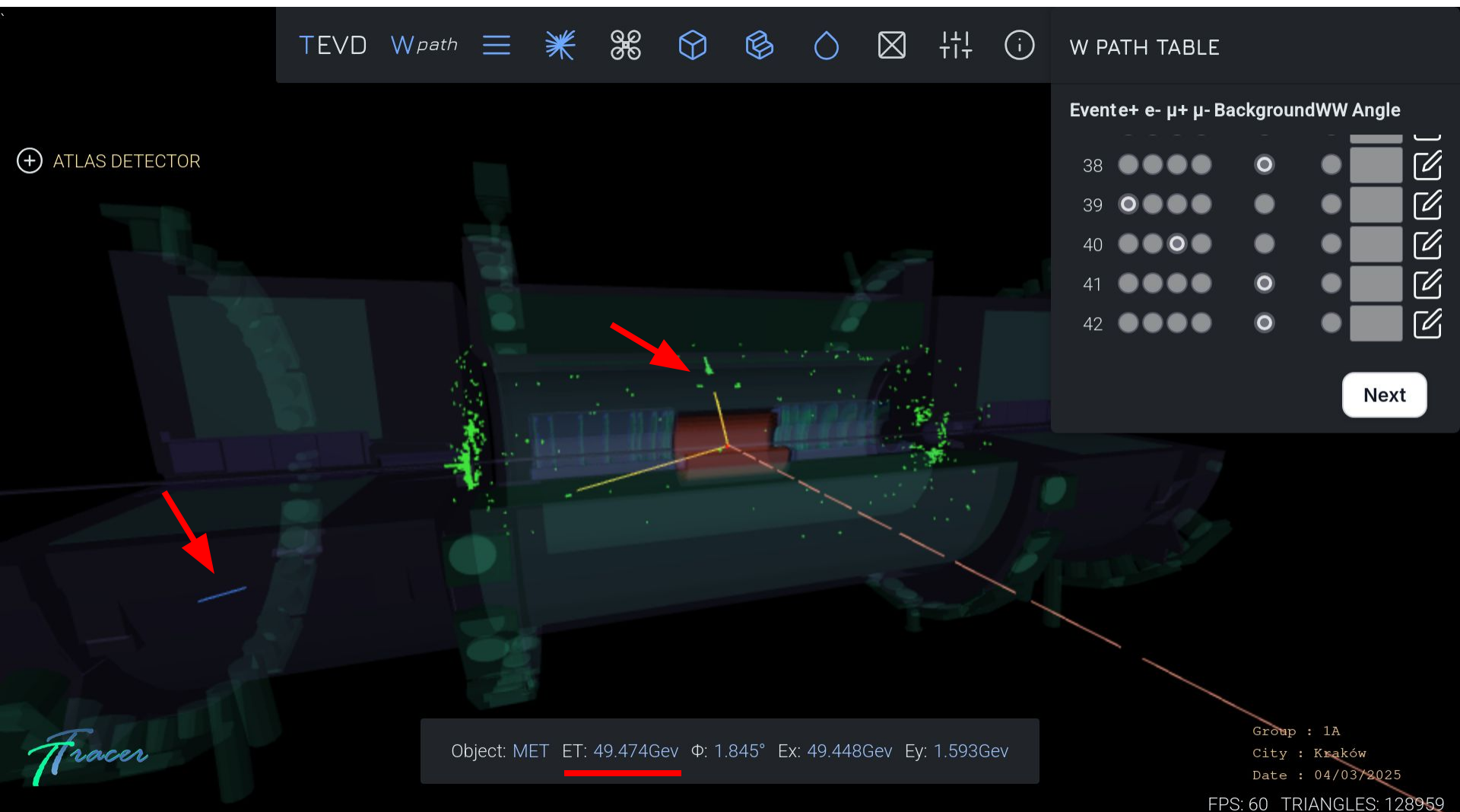
graph LR
    A["μ+"] --> B["W+ → μ+ ν"]
  
```



Przypadek #4

MET > 20 GeV

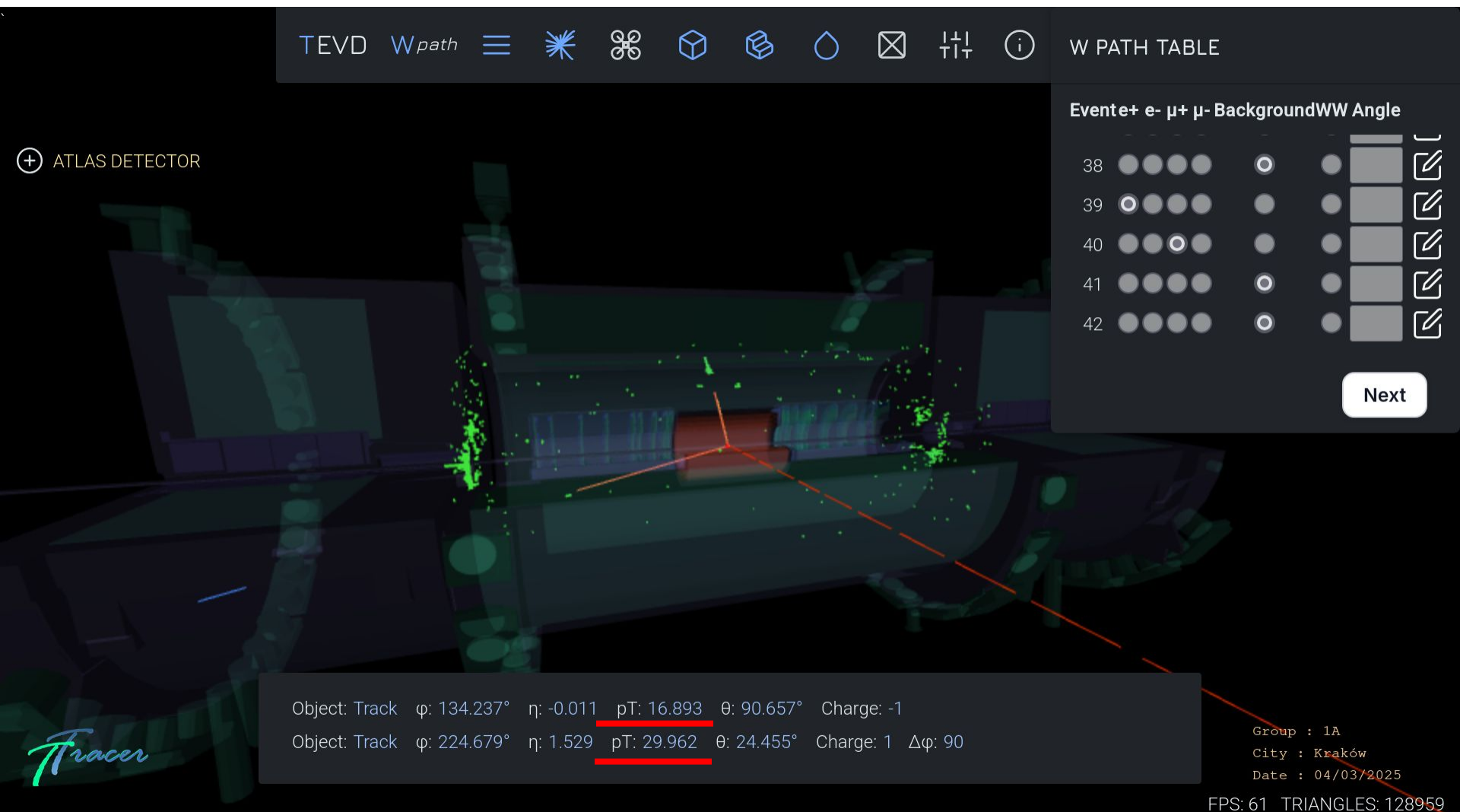
Jeden kandydat na mion
Jeden kandydat na elektron



Przypadek #4

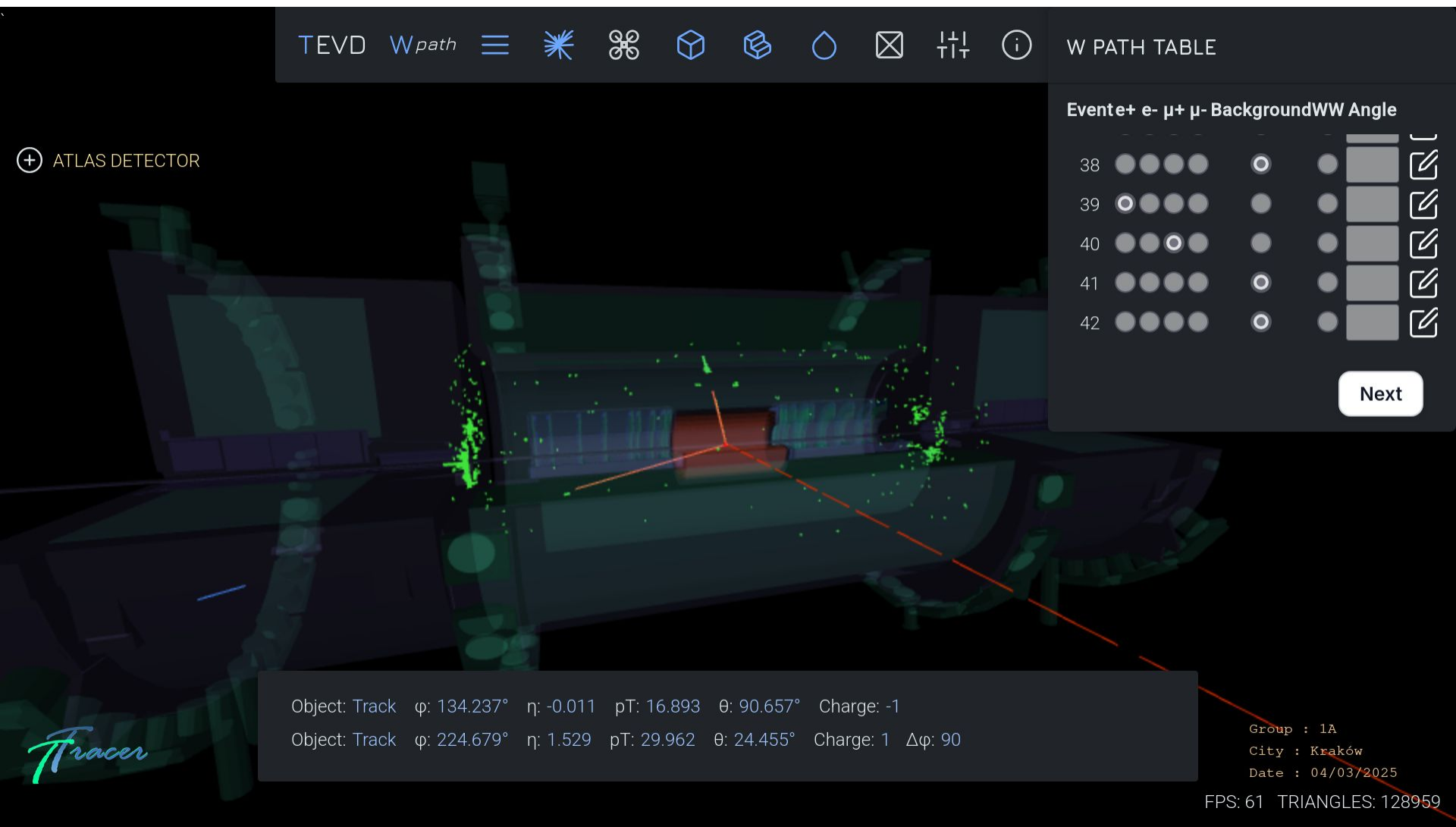
Brak pobliskich śladów z dużym pT

$p_T \text{ leptonu}^{(1)} > 20 \text{ GeV}$
 $p_T \text{ leptonu}^{(2)} > 10 \text{ GeV}$



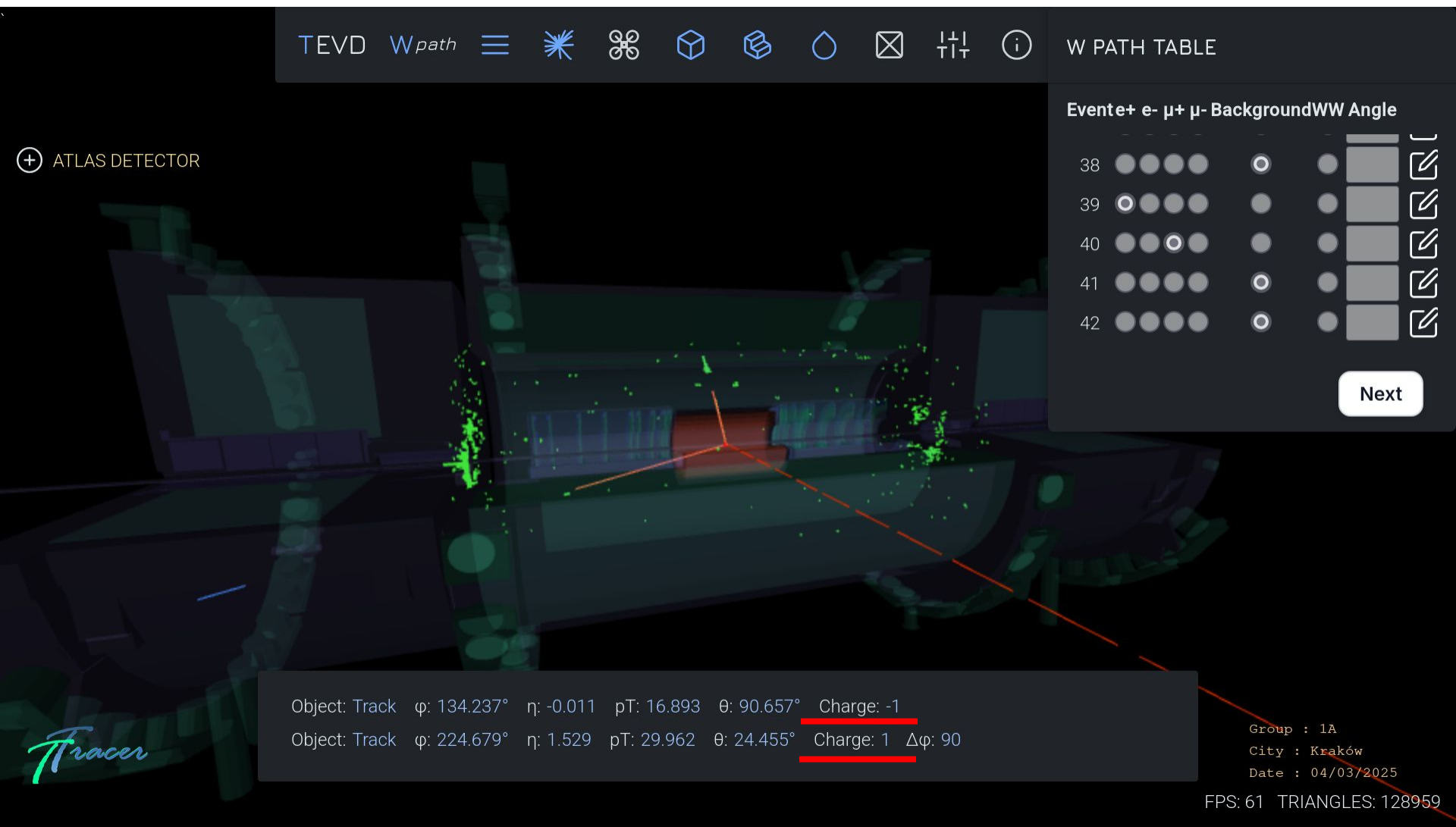
Przypadek #4

Przeciwny ładunek?



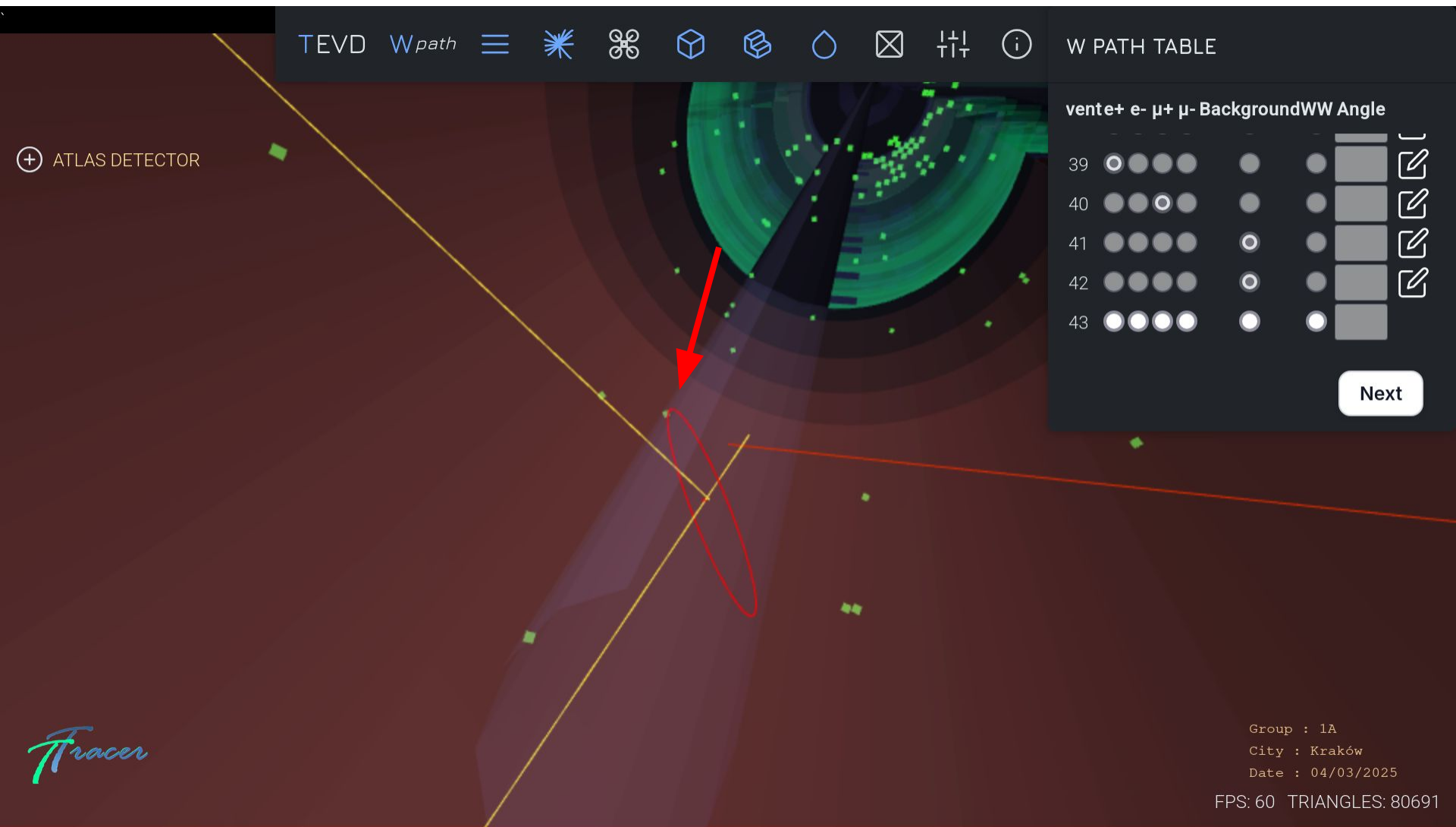
Przypadek #4

Przeciwny ładunek



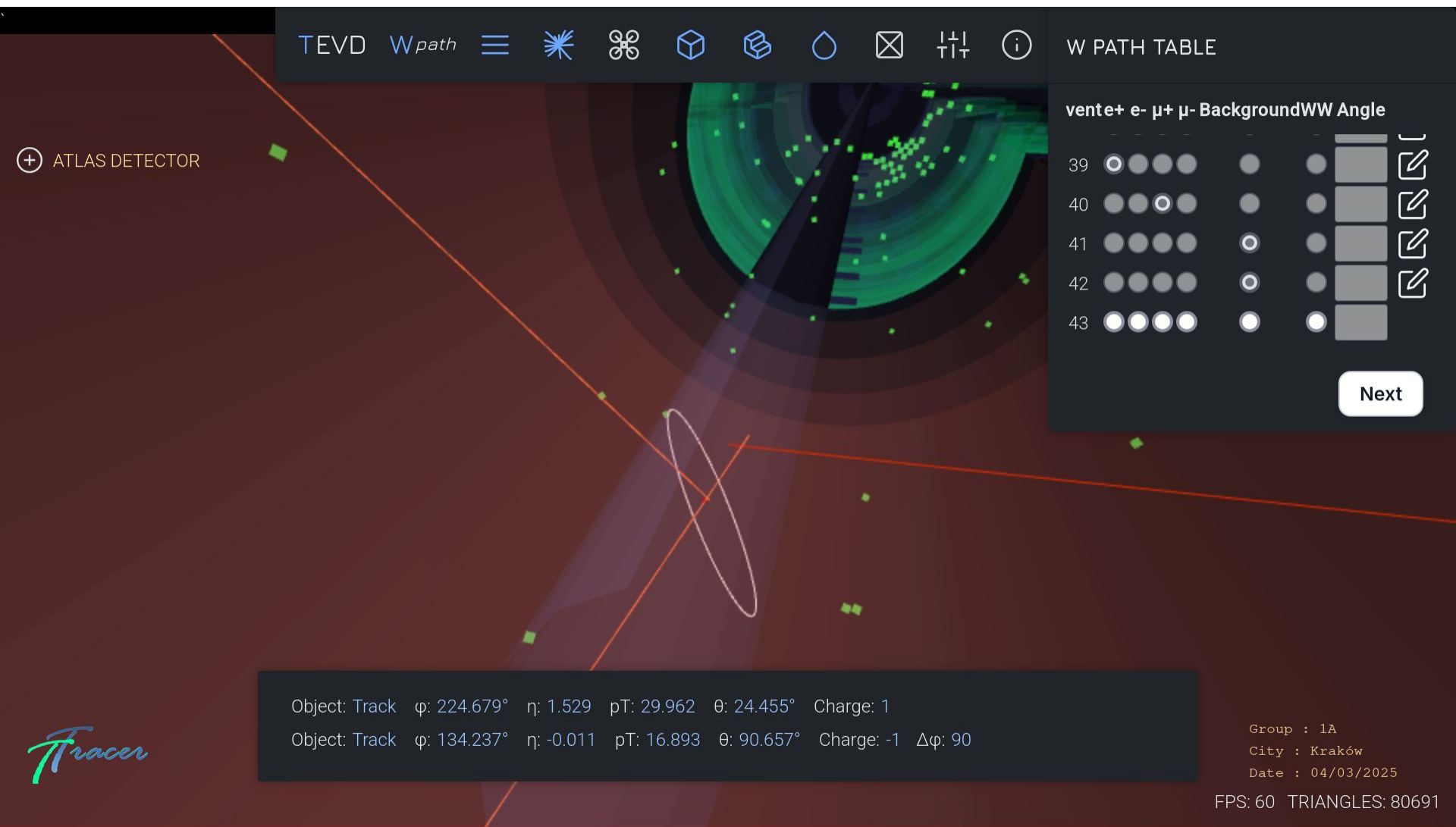
Przypadek #4

Ten sam wierzchołek?



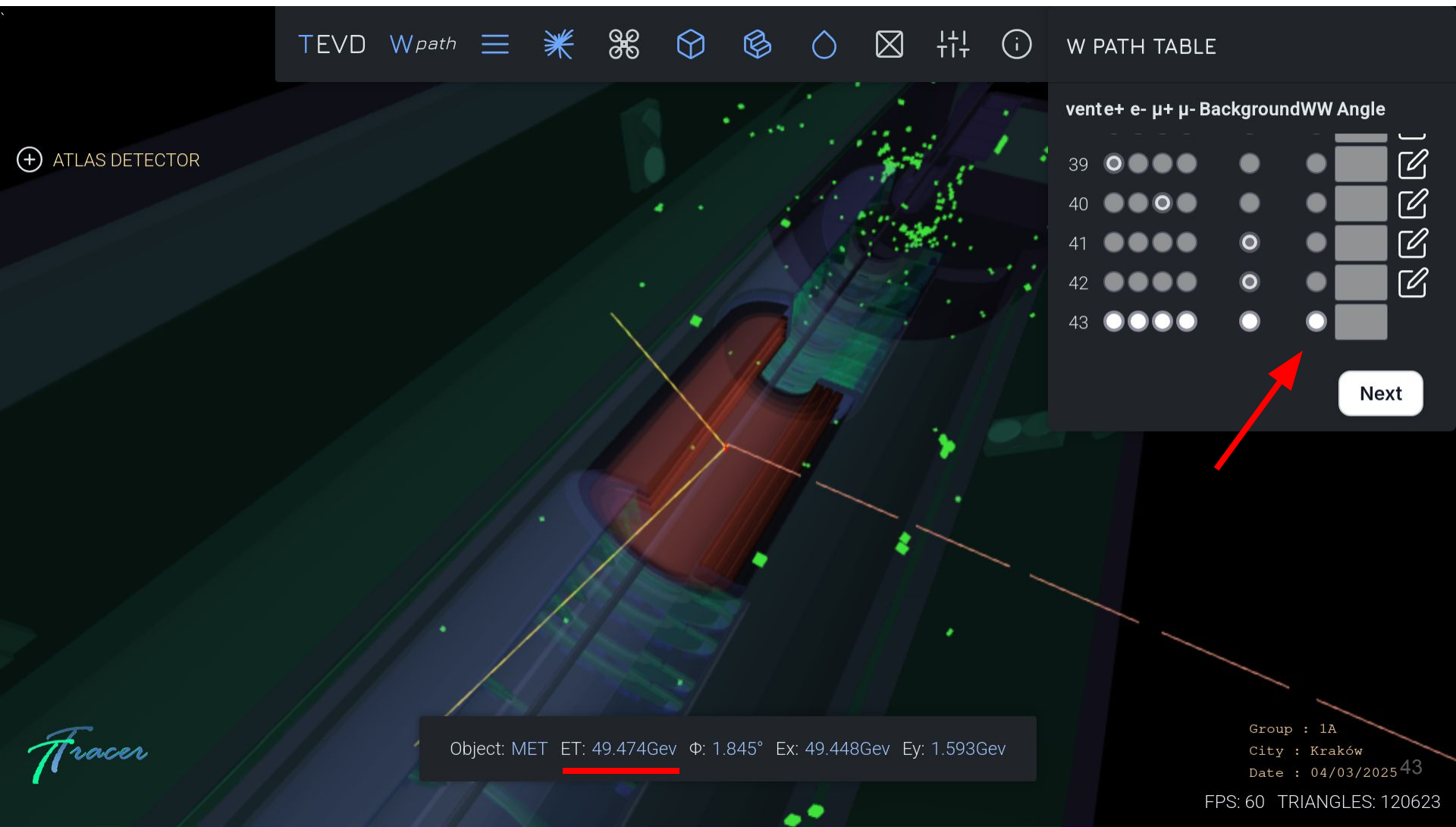
Przypadek #4

Ten sam wierzchołek



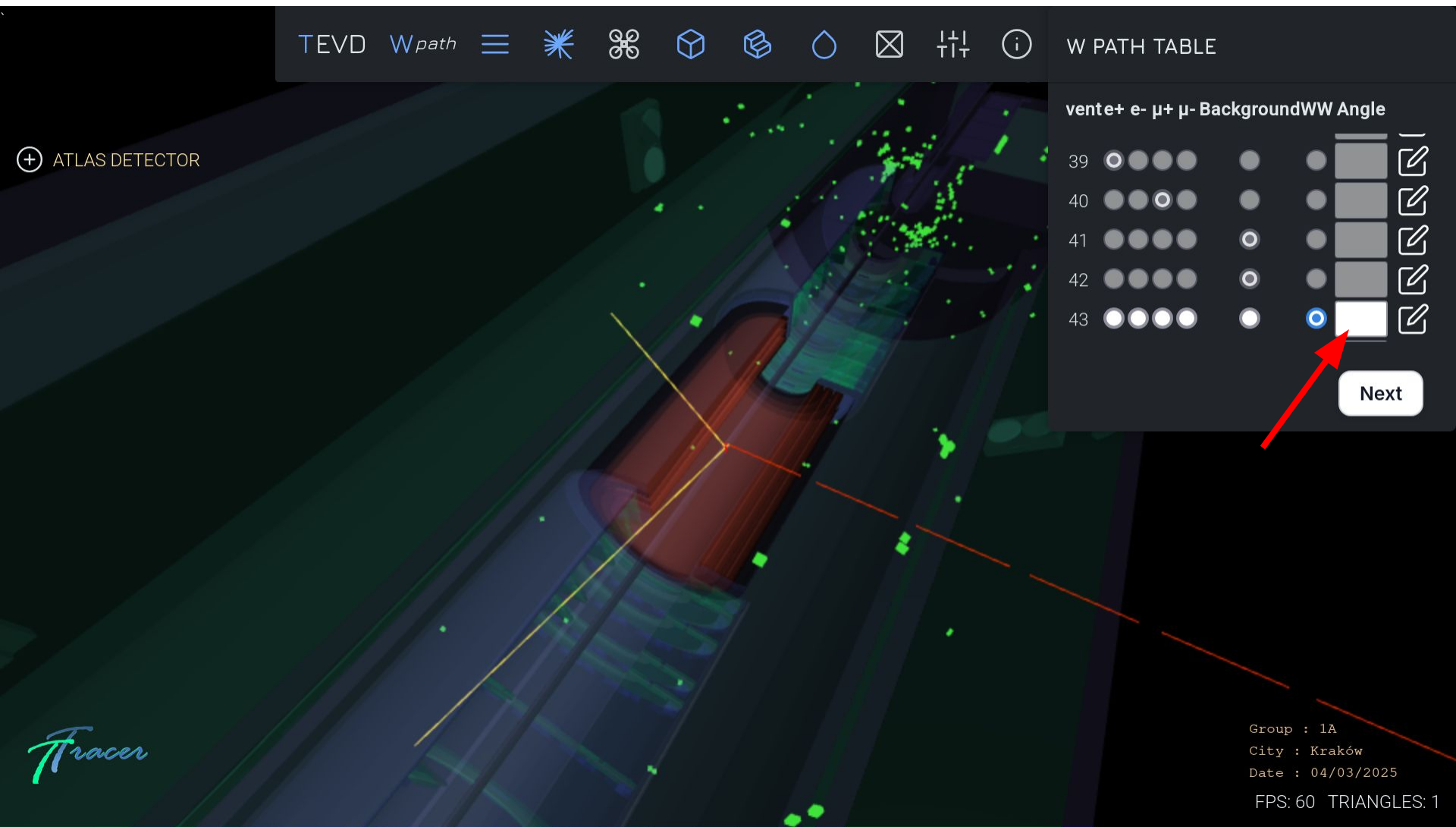
Przypadek #4

ee lub $\mu\mu$: MET > 40 GeV?
 $e\mu$: MET > 20 GeV?



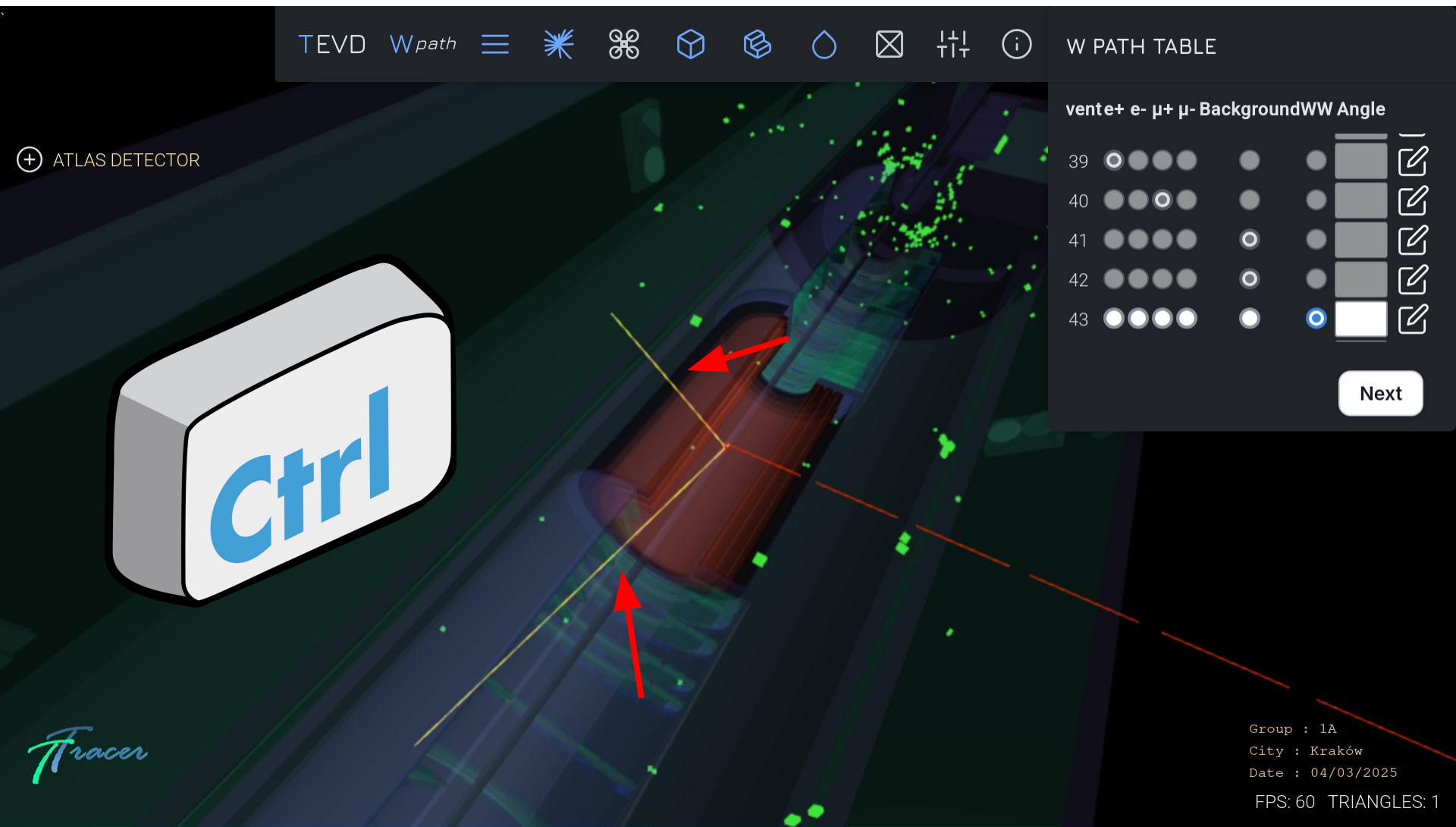
Przypadek #4

$W^+W^- \rightarrow l\nu l\nu$
pomiar kąta



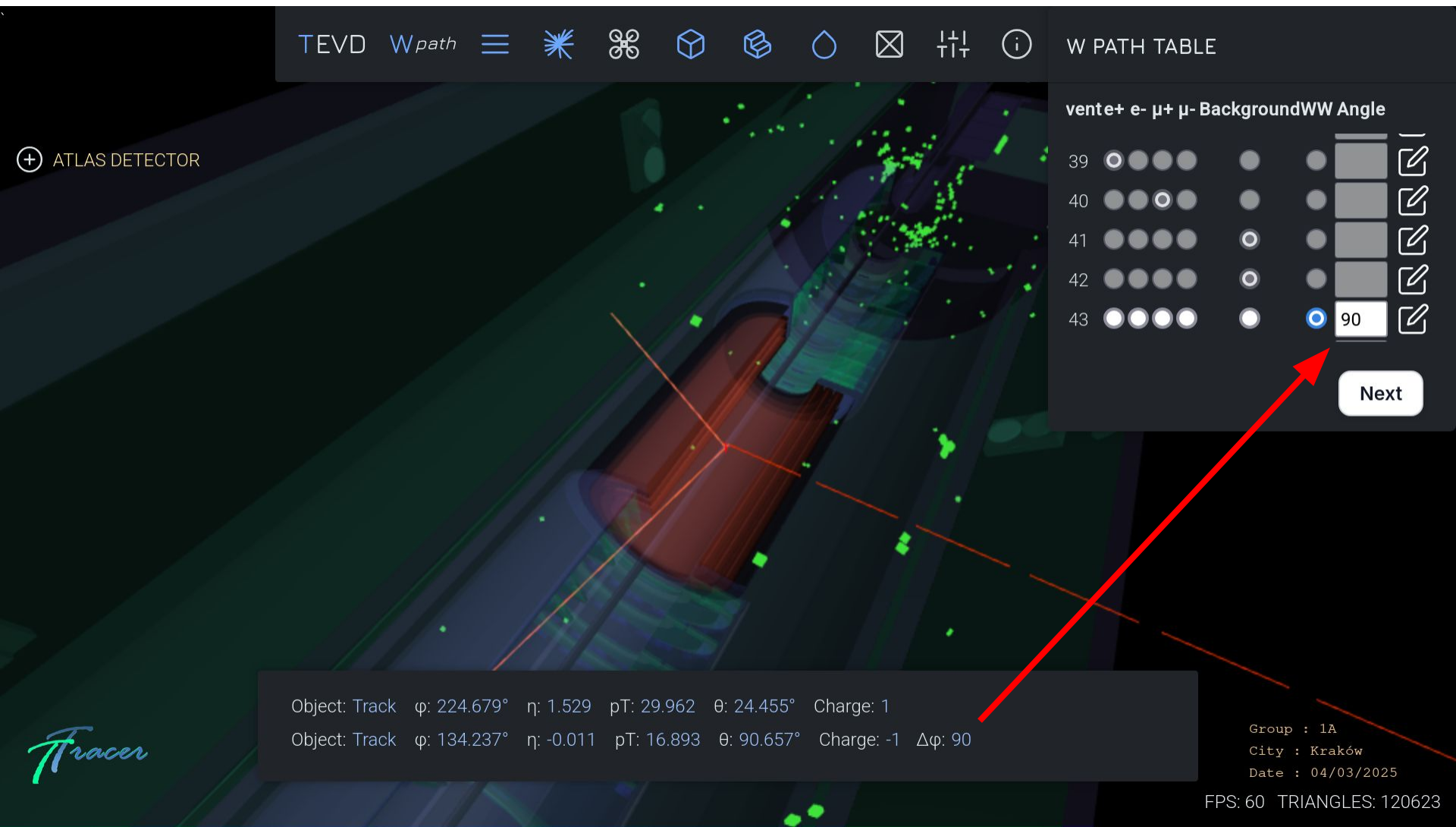
Przypadek #4

$W^+W^- \rightarrow l\nu l\nu$
pomiar kąta

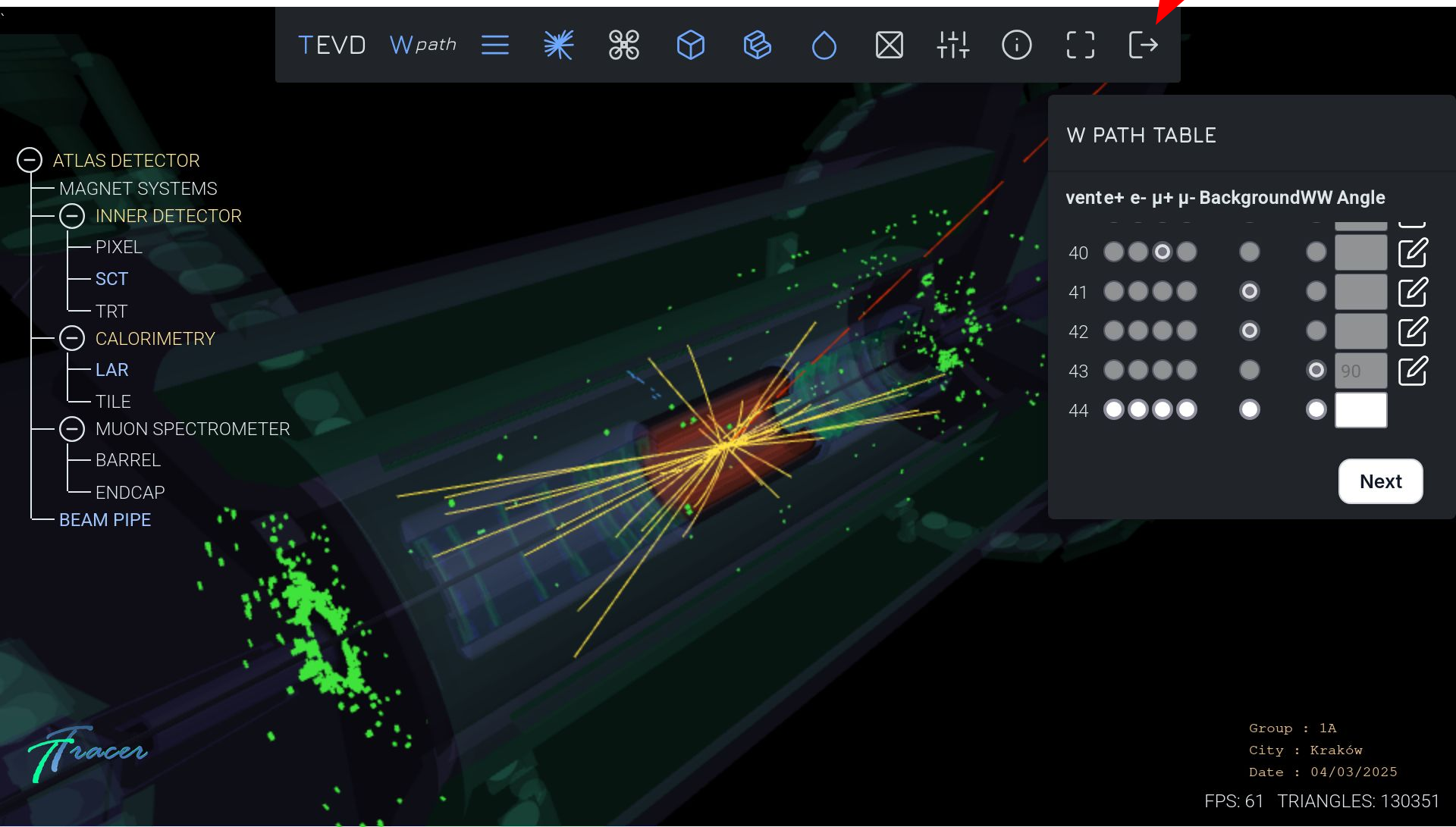


Przypadek #4

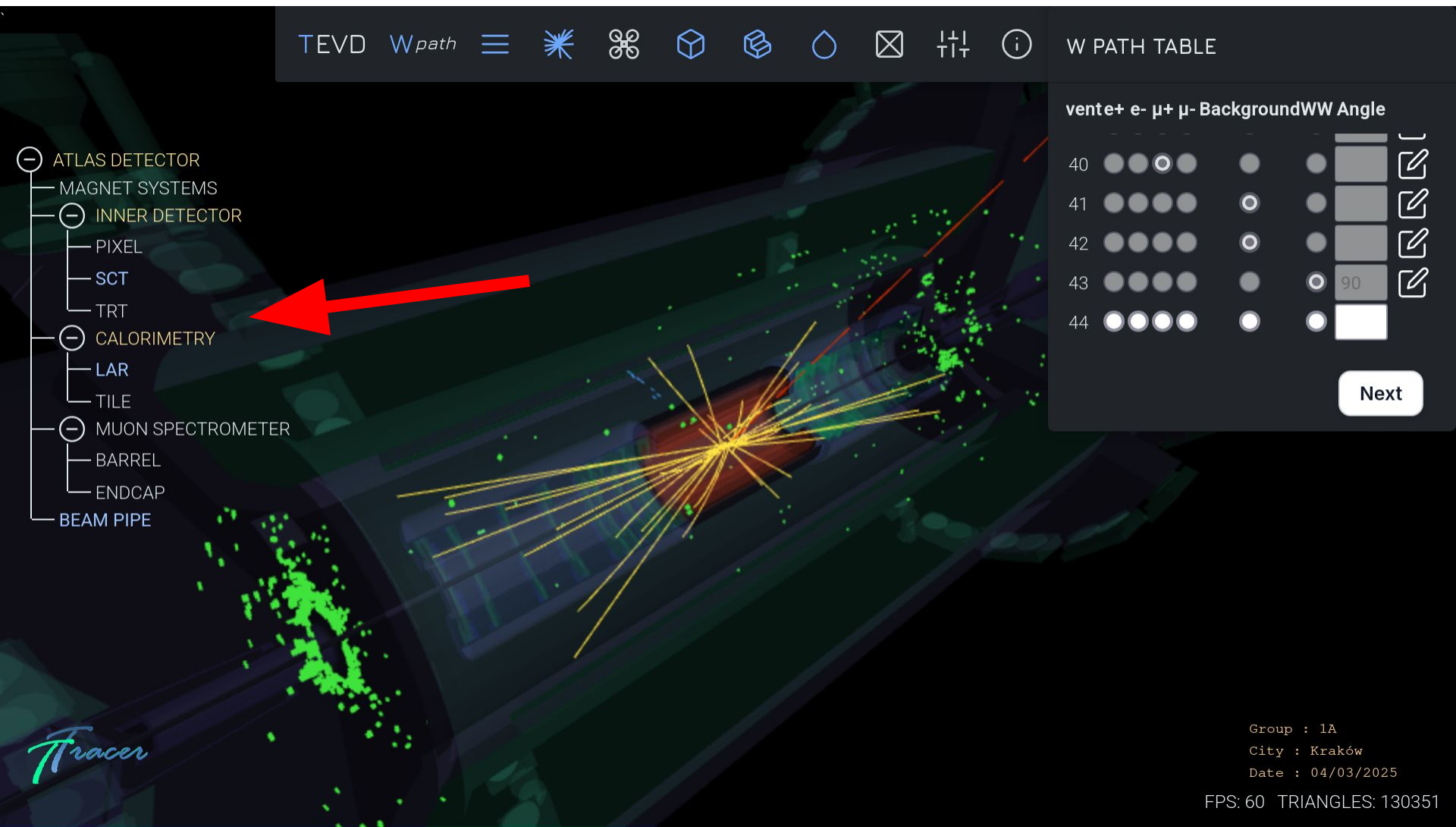
$W^+W^- \rightarrow l\nu l\nu$
pomiar kąta



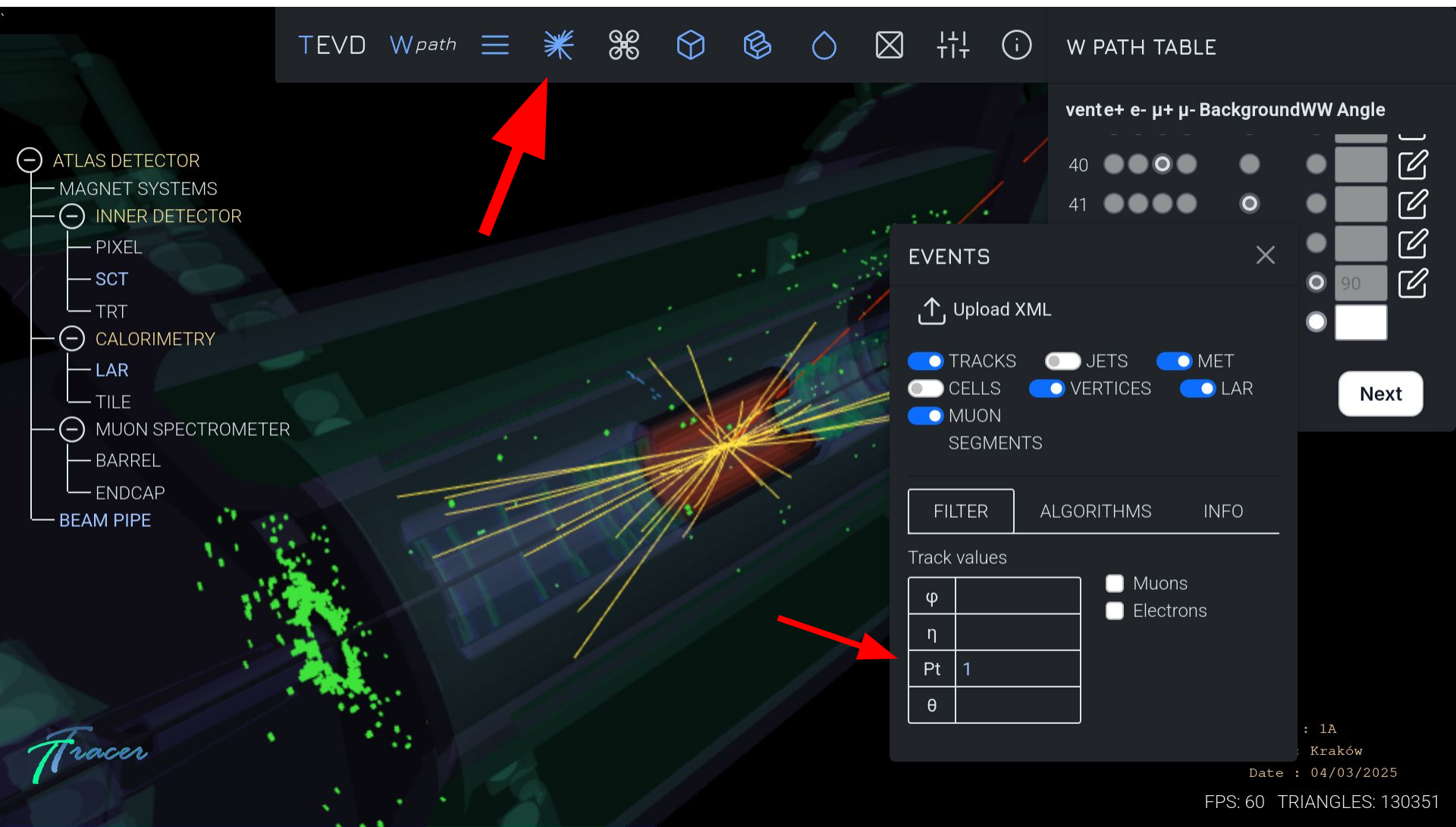
Koniec pracy



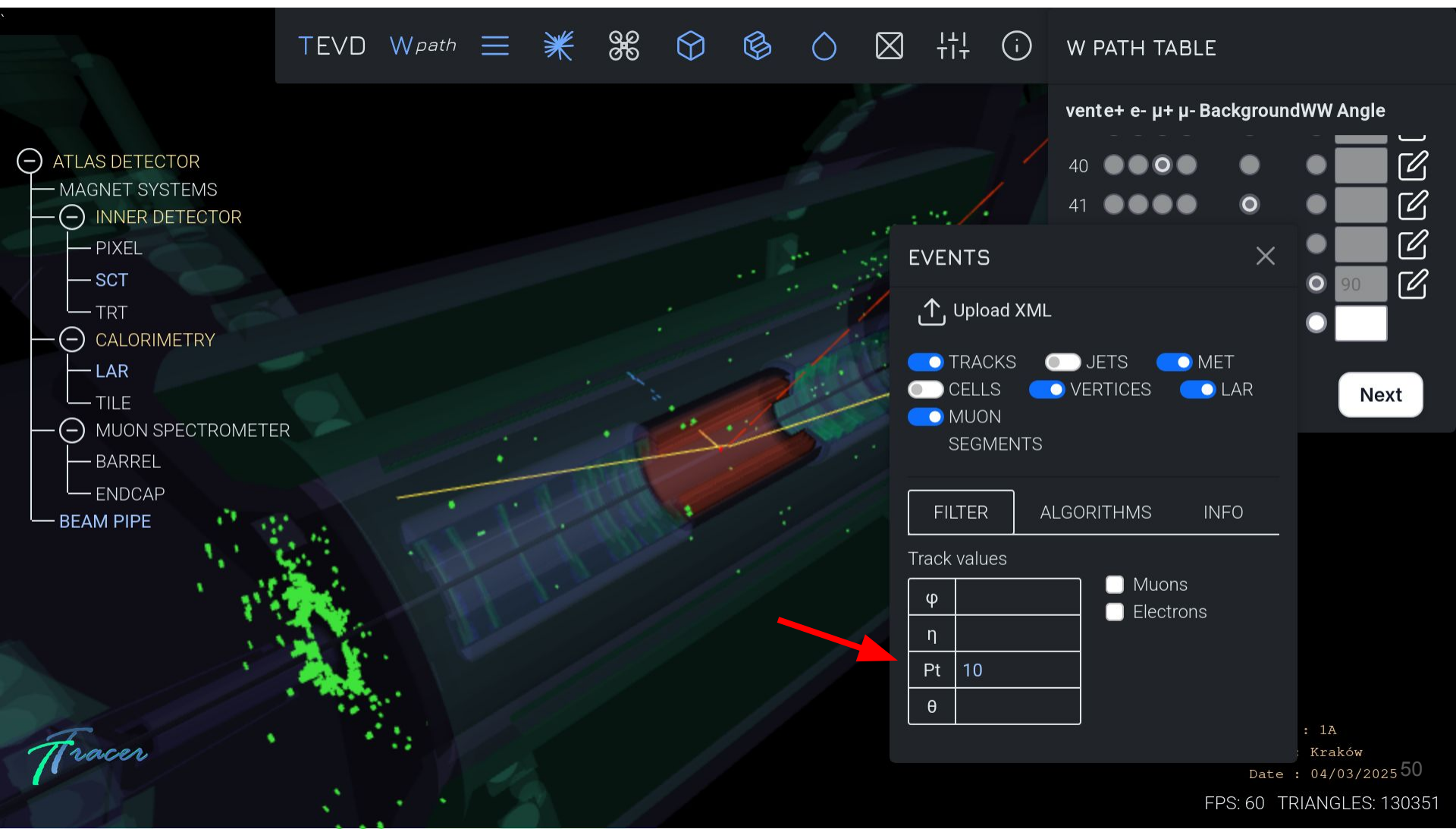
Włączanie/wyłączanie elementów detektora



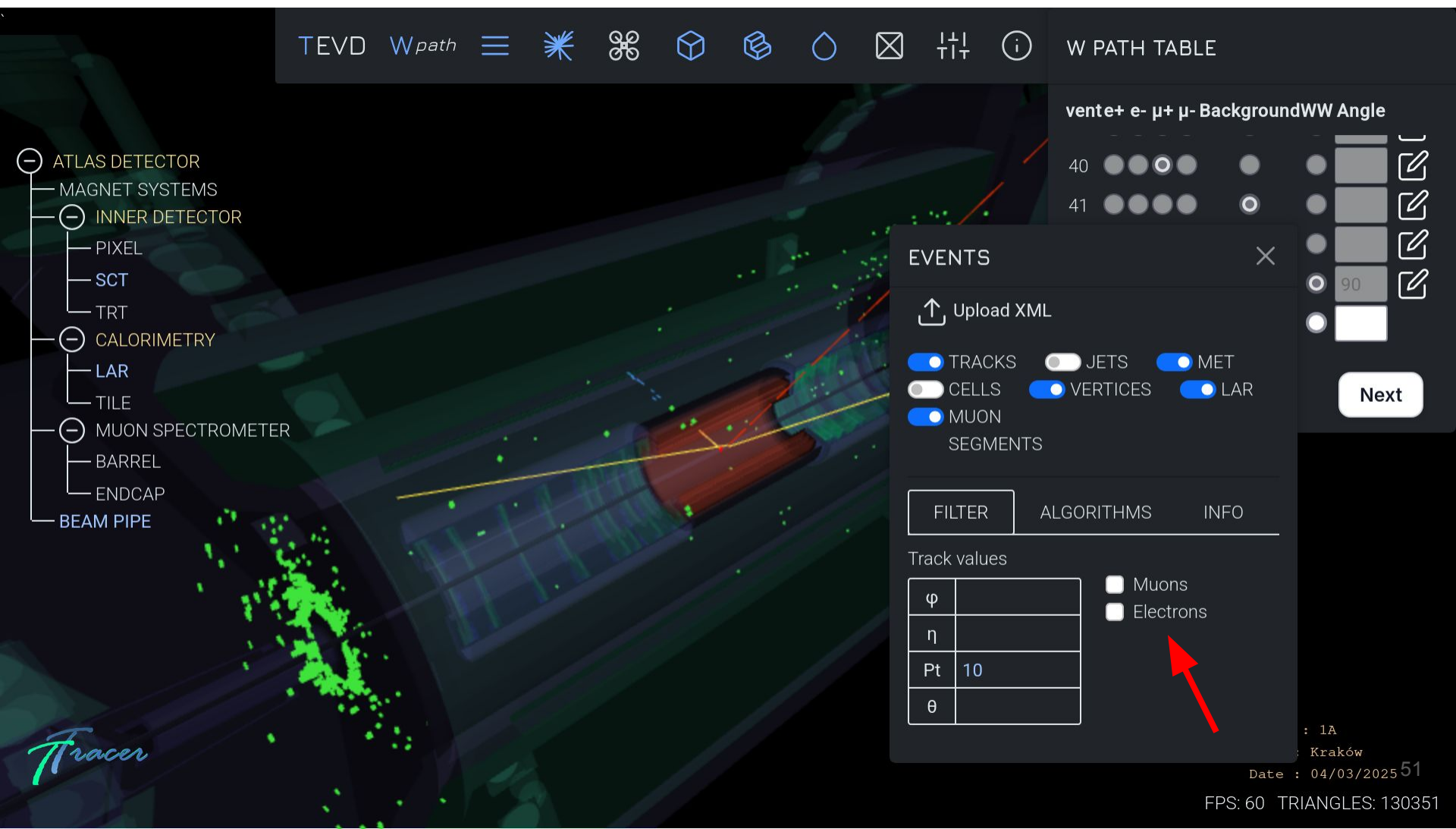
Cięcia na ślady



Cięcia na ślady



Cięcia na ślady



⊕ ATLAS DETECTOR

TEVD W_{path}           

EVENTS

×

↑ Upload XML

TRACKS

CELLS

MUON

JETS

VERTICES

SEGMENTS

MET

LAR

FILTER

ALGORITHMS

INFO

Track values

ϕ	
η	
Pt	1
θ	

☐ Muons

☐ Electrons

W PATH TABLE

	vente+	e-	μ^+	μ^-	Background	WW	Angle	
01	☒	☐	☐	☐	☐	☐	☐	☐
02	☐	☐	☐	☐	☐	☐	☐	☐
03	☐	☐	☐	☐	☐	☐	☐	☐
04	☐	☐	☐	☐	☐	☐	☐	☐
05	☐	☐	☒	☐	☐	☐	☐	☐

Next

⊕ ATLAS DETECTOR

⊕ ATLAS DETECTOR

⊕ ATLAS DETECTOR

⊕ ATLAS DETECTOR

Dziękuję za uwagę!