Explore the proton and search for the Higgs: Physics Discussion of the ATLAS W-path

BY JULIA WOITHE INTERNATIONAL MASTERCLASSES 2014 - MODERATORS ORIENTATION

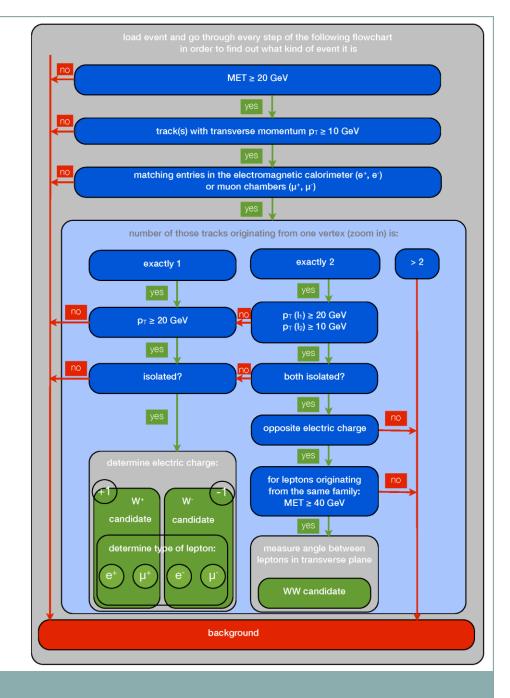
Student's tasks 1

- 1. Explore the structure of the proton by counting the number of W+ and W- events
 - Students identify W candidate events, decay products and (if possible) their electric charge, calculate ratio $R \pm = |W + | / |W |$
- 2. Search for the Higgs in $l^+vl^-v + 0,1$ Jets final state
 - 693 real WW-> $l^+vl^-v + 0.1$ Jets were mixed with 5307 real data events
 - Students identify WW candidate events and measure the angle $\Delta\phi_{ll}$

Data sample: 1 A		Signal 1				Signal 2		Back-	
		$W \to \nu + \cdots$		$W \rightarrow \nu + \cdots$		WW → lvlv	$\Delta\Phi_{11}$	ground	Comment
Ottorational Materializates	Event #	e ⁺	e ⁻	μ+	μ_	VV VV > 1V1V	4	9	
	1								
	2								
	3								
	4								

Student's tasks 2

Decisions to be made by the students for every single event:



Data samples

- Same as last year:
- 6 data samples à 1000 events (marked 1, 2, ..., 6)
 - o each containing 20 sub-samples (marked A, B, ..., T)
 - o every pair of students analyses 1 sub-sample à 50 events
- (first step: combination of sub-samples)
- Video-Conference: Combination of all results

The essence 1

1. Report of measurement (15')

Each venue presents:

- measured ratio R± of number of W⁺ to number of W⁻ events in W
 candidate events
- Number of events of found WW candidate events

The only thing you have to do is: Lead through the circulation and share the combined online spread sheet.

The essence 2

2. Combination and discussion of measurement (10')

- Go to the ATLAS <u>W-path analysis moderator website</u>
- Discuss development of R± after combination and compare with current ATLAS measurement on the combined online spread sheet, which you will obtain by choosing the current date from the first drop-down menu on the moderator's website
- Discuss the meaning of that result

The essence 2

- 2. Combination and discussion of measurement (10')
 - Go to the ATLAS <u>W-path analysis moderator website</u>
 - Discuss development of **R**± after combination and compare with current ATLAS measurement on the combined online spread sheet, which you will obtain by choosing the current date from the first drop-down menu on the moderator's website
 - Discuss the meaning of that result
 - Discuss development of combined histogram, which can be obtained by choosing the current date from the second drop-down menu
 - Discuss selection of events, pre-conditions for claiming a discovery, shape of the angular distribution and current result of this search
 - Discuss difficulties occurred during the measurement

Material

- Masterclasses schedule
- Website explaining the measurement
- Moderator's website: Link
- W path Guide for tutors (Version 1)
- <u>(Version 2 will be uploaded soon here</u> → ATLAS W path)
- <u>ATLAS paper</u>: Measurement of the W→lv and $\mathbb{Z}/\gamma * \to \mathbb{I}$ production cross sections in proton-proton collisions at $\sqrt{s} = 7$ TeV with the ATLAS detector
- <u>ATLAS Conf Note</u>: Search for the Standard Model Higgs boson in the H->WW->llnunu decay mode using 1.7 fb-1 of data collected with the ATLAS detector at sqrt(s)=7TeV

Enjoy your Masterclass!