Una vita al top

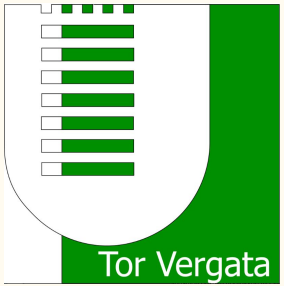
Attenzione: l'immagine può differire dal prodotto originale

Marco Vanadia

INFN Sezione di Roma Tor Vergata

Tor Vergata

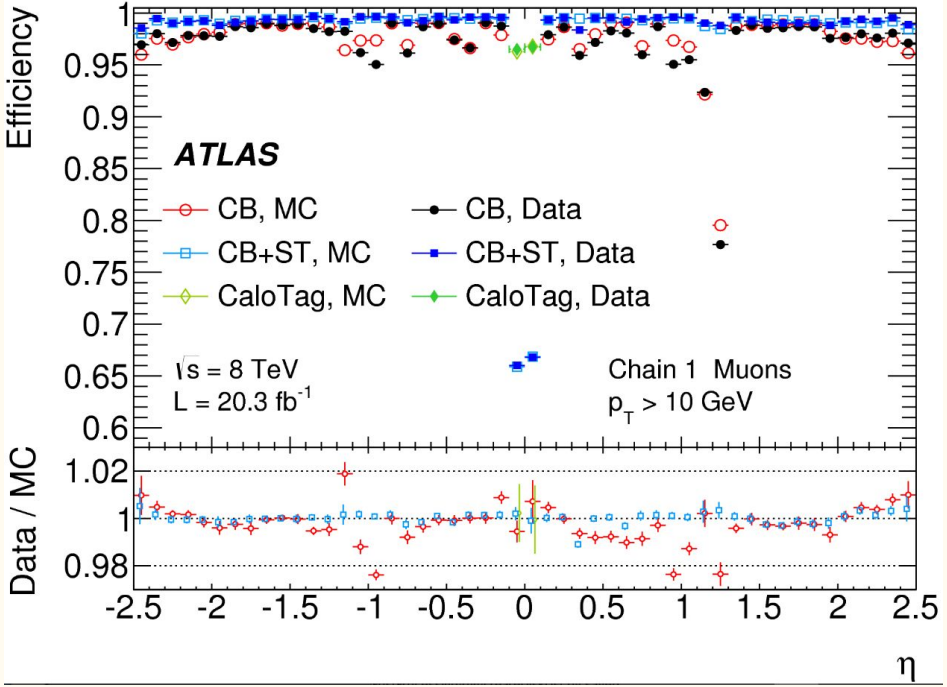
Overview

- Born in Rome, 25/12/1985 (yes, I know)
- 2007: Bachelor Degree @ Sapienza
- 2010: Master Degree @ Sapienza. Thesis: Calibration and Data Quality of Monitored Drift Tube chambers in ATLAS
- 2010-2013: Ph.D. project in Max-Planck-Institut, Munich, ATLAS group
- June 2013: Ph.D. from Technische Universität München + MPI
- 2013-2015: postdoc @ Sapienza (ATLAS)
- 2015-2016: postdoc @ Sapienza (ATLAS)
- 2016-: 

ATLAS muon spectrometer

Eur. Phys. J. C (2014) 74:3034
Eur.Phys.J. C74 (2014) 3130

- During **master thesis**, worked on data quality of the **ATLAS muon spectrometer**
- During **Ph.D., efficiency** measurements for the identification and reconstruction of **muons** in the **ATLAS spectrometer**
- **Z boson** decaying to two muons provide very clean events for measuring the muon efficiency!
- Several millions **Z→μμ** decays reconstructed in LHC run1

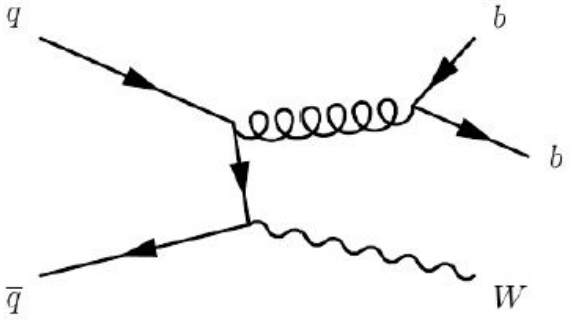


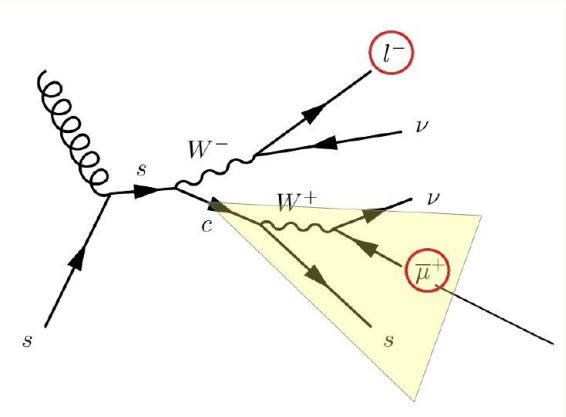
Example of **efficiency** measurement for muon reconstruction in **different regions** of the ATLAS detector

Ph.D. - W+b-jets and W+c-jets

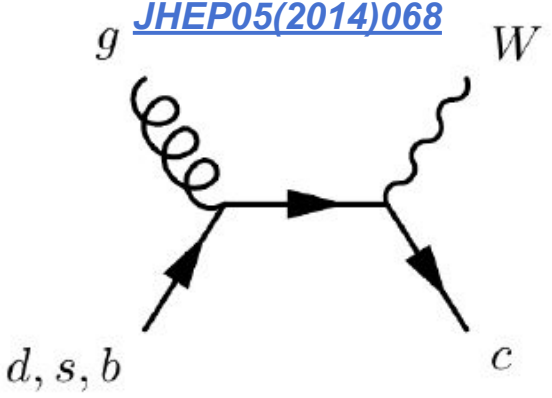
- Measurement of **cross section** for the production of a **W** boson + **b** or **c** quarks
- Test for perturbative **QCD predictions**
- Important **background** for **Higgs** and **Beyond Standard Model** physics
- Input to **Parton Density Function** measurement
- **W** identified thanks to **e/μ decay**
- **b/c** measured as a **jet** of particles in the detector and identified e.g. thanks to semileptonic decays -> see later

[Phys.Lett. B707 (2012) 418-437]



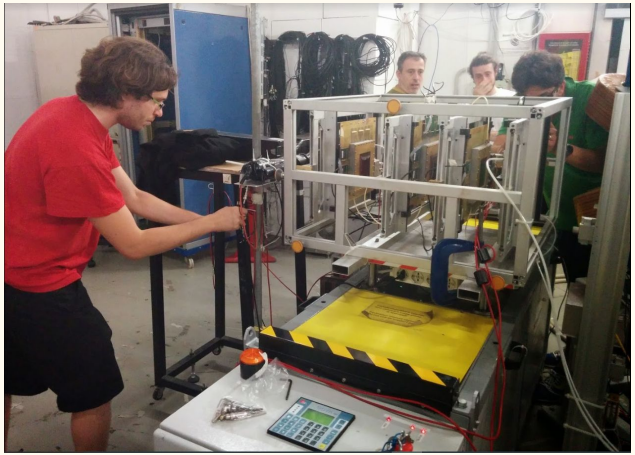


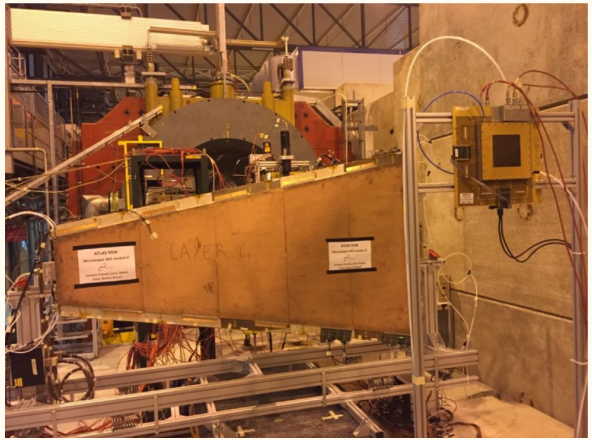
[JHEP05(2014)068]

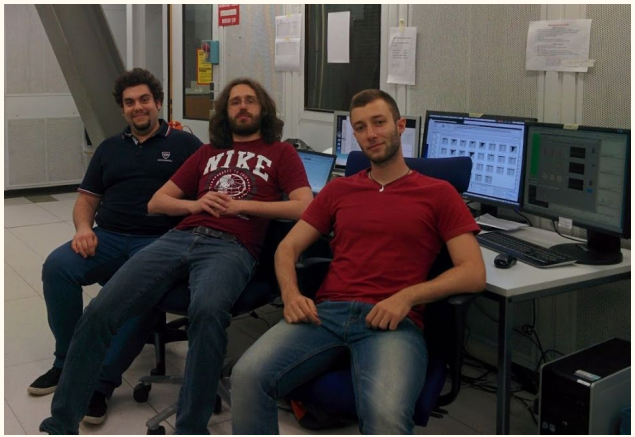


Postdoc - Micromegas chambers

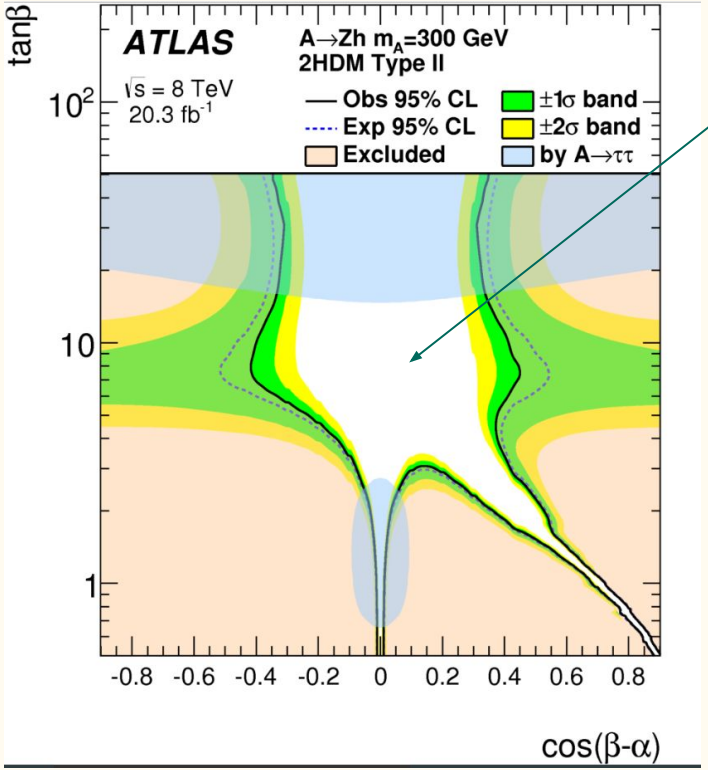
- **Gas detector** with a novel design for the upgrade of the **ATLAS spectrometer** in 2019
- Work on prototype **construction**, **test** on beam, **performance** measurement and development of the **reconstruction**







Postdoc - physics beyond the Standard Model

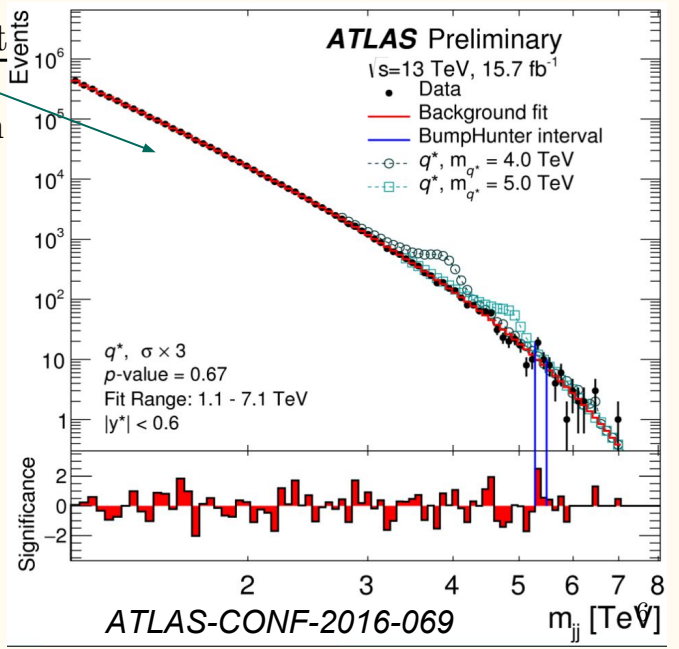


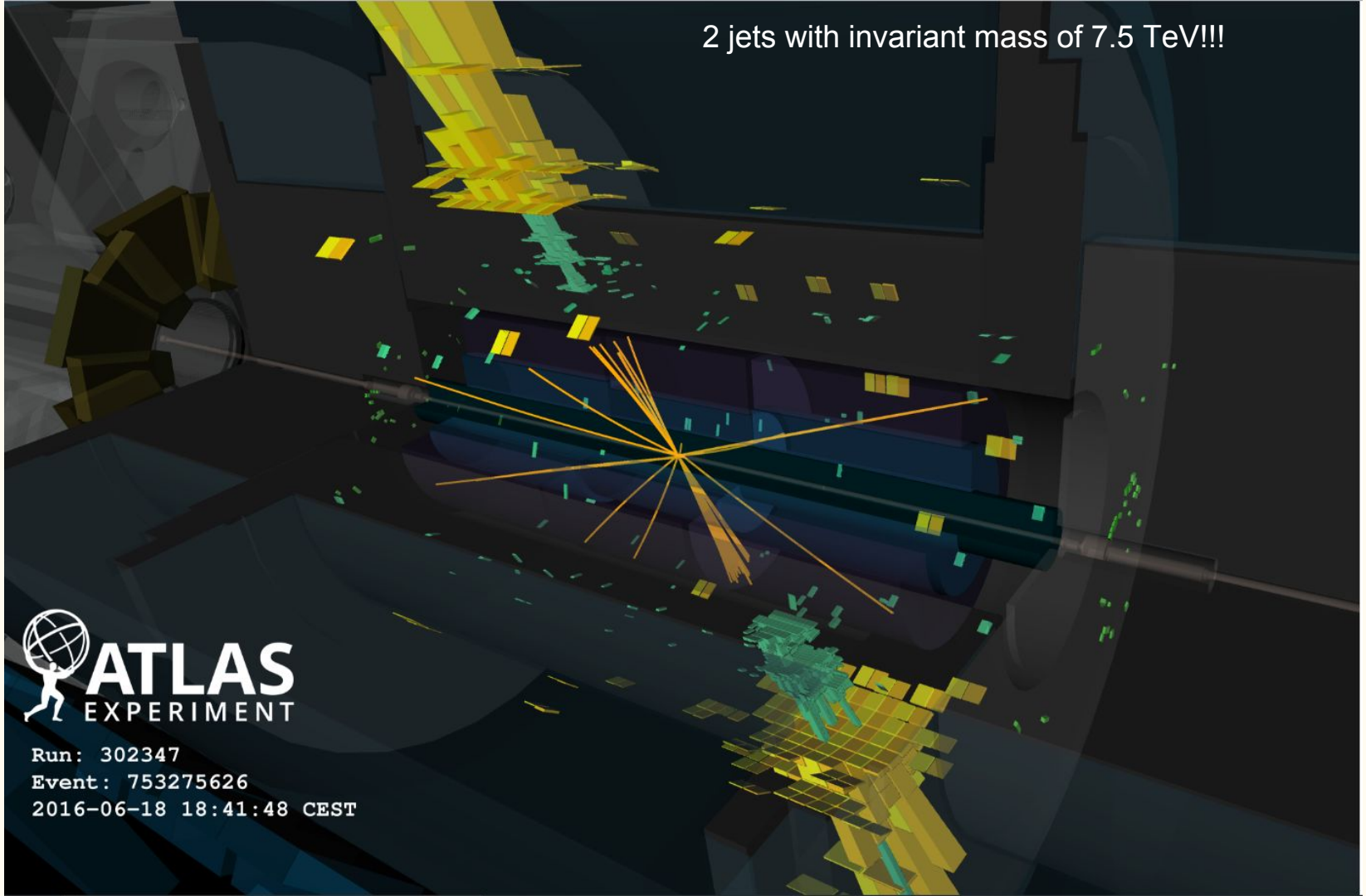
Search for new, pseudoscalar Higgs boson *PLB 744 (2015) 163*

- predicted by several models (e.g. supersymmetry)
- it can decay to a Z boson and a "standard" higgs!
- we did not find it: we're reducing the living space for new physics

Search for new physics in dijet events

- LHC 8 TeV->15 TeV in 2015
- Production of heavy resonances or high scale new physics greatly enhanced!
- If it comes from partons, it can go to partons…
- No new physics found yet, previous limits (e.g. W') improved up to 50%




2 jets with invariant mass of 7.5 TeV!!!
ATLAS
EXPERIMENT
Run: 302347
Event: 753275626
2016-06-18 18:41:48 CEST

Teaching

- **Assistant** for “Nuclear and subnuclear particle physics 1” on relativistic kinematics, particle interactions with matter, particle detectors, SM reactions and decays, … **for >100 students per year** (2 years)

SAPIENZA
UNIVERSITÀ DI ROMA

Facoltà di Scienze Matematiche Fisiche e Naturali

Laboratorio di Fisica Nucleare e Subnucleare

Studio della caratterizzazione della camera MicroMeGas

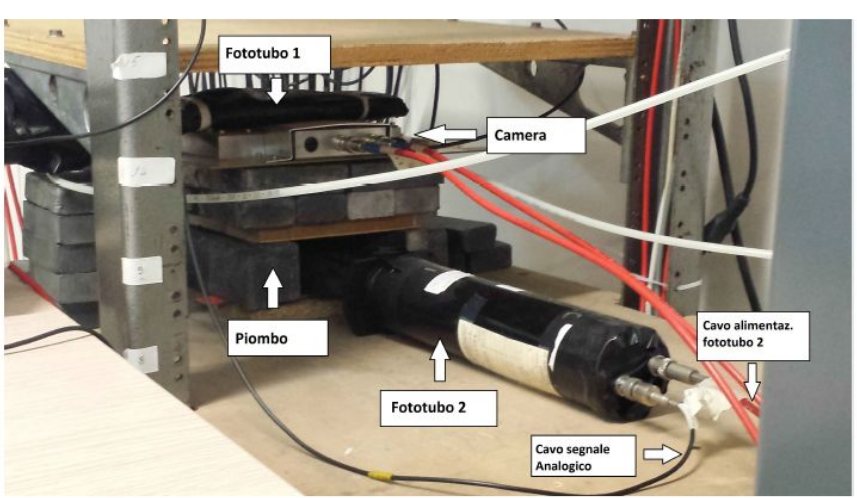
Coordinatori

Prof. Andrea Messina
Marco Vanadia

Candidati

Amedeo Capotosti
Ambra Mariani
Massimo Mastrodicasa
Cristiano Sebastiani

anno accademico 2015-2016

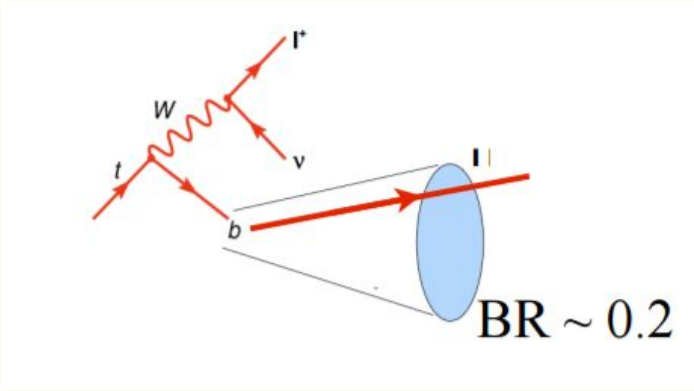


- **Responsible** for three years for an experiment for master students (4-6 months) with a MicroMegas chambers on cosmic muons.

What am I doing now?

- Based @ CERN thanks to INFN grant until next 30/6
- Convenor of the **Hadronic Jets and Dark Matter** subgroup of ATLAS-Exotics
  - we search for new physics in events with **jets** and/or **invisible objects** (e.g. dark matter!)
  - quite large group, **>10 analyses, >140 people** involved
  - started on 1/11/2016
- And, of course, **Top Physics!** NPTEV-TQP
  - top is the **heaviest** quark
  - it's so heavy it decays before forming any bounded state!
  - we want to measure its **mass**, to use it as a laboratory for **Standard Model physics**, and as a probe for **new physics!** -> see next talks
  - the top quark decays ~100% in W boson + b quark
  - we want to exploit **b** decays to **muons** (+X) for most of these measurements

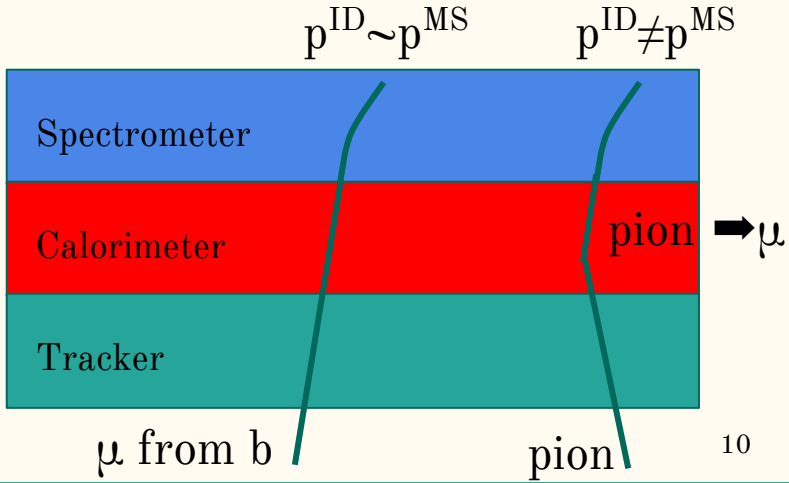
The Soft Muon Tagger



- less statistics (b➡μ+X ~20%) but **cleaner signature**
- **complementary** to other tagging strategies, different systematics ➡ helps combination!
- muon in jets not coming from heavy hadrons have different properties ➡ we can use that to **reject the background!**
- **optimization and measurement of muon reconstruction performance is the key!**

see *2016 JINST 11 P04008*

- a standard strategy to **identify a jet originated from a b quark** is to identify tracks from a b-hadron decay in a tracker
- with the soft muon tagger we instead **tag** b-jets by identifying a muon coming from a b-hadron



Outlook

- 7 years in ATLAS and counting
- Worked on ATLAS muon spectrometer, detector R&D, Standard Model measurements, beyond Standard Model searches
- The present and the future is the **top quark physics**
- My first goal will now be the development the Soft Muon Tagger for LHC Run-2
- I already worked on that during LHC Run-1 for W+c cross section measurement during the Ph.D.
- The performance of muon reconstruction, identification and of the tagger must be optimised and precisely measured in data: we are doing precision physics!
- This is challening at very low momentum, which is most relevant for us
- But we need to do that in order to be at the **TOP**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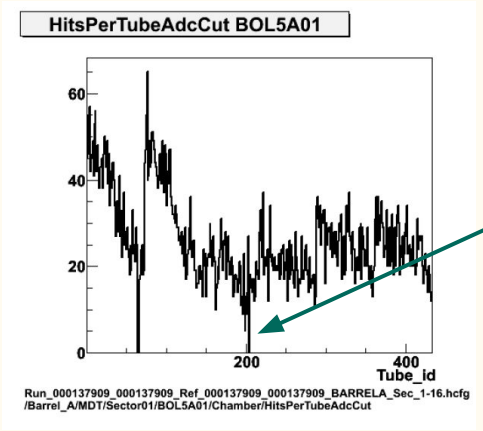
NPTEV-TQP2020

BACKUP

The walking dead tubes

- Master thesis: data quality assessment for the ATLAS muon drift tube chambers
- Web interface to an automatized system to understand if everything's ok or not for the ATLAS spectrometer
- Analysis performed on high-stat calibration-dedicated stream



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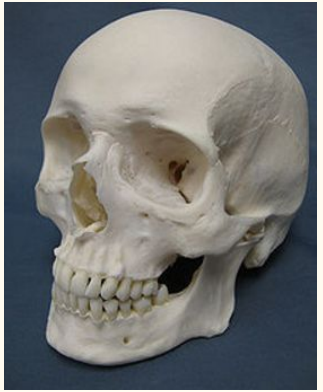

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