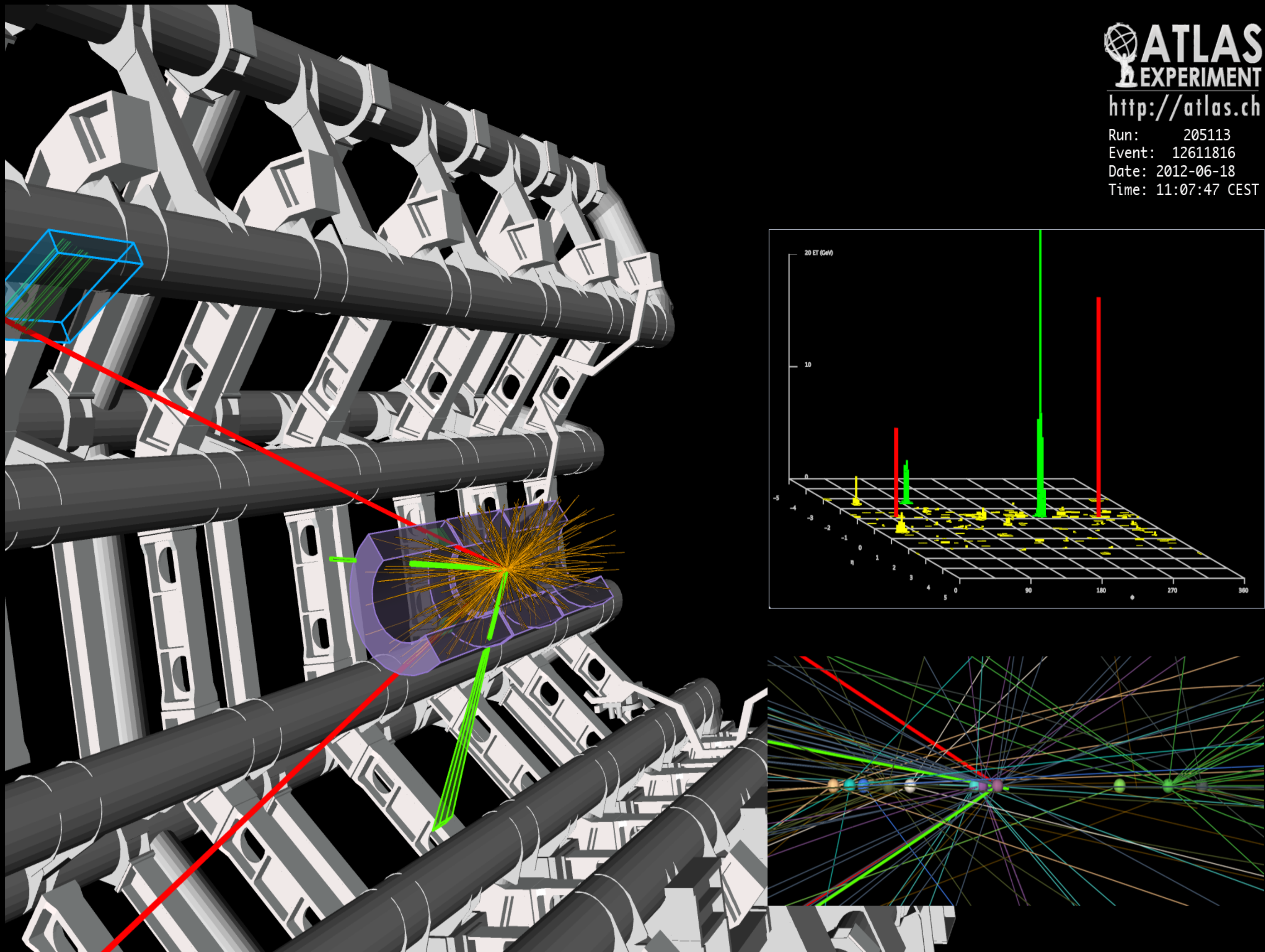
# ATLAS Report 2014




Edoardo Gorini

On behalf of the ATLAS Lecce Group

M.Aliev, M.Calabrese, G.Chiodini, A.De Lorenzis, E.M.V.Fasanelli, P.Fiore. A.Forte, E.Gorini, A.Innocente, L.Longo, P.Mazzotta, A.Miccoli, N.Orlando, M.Primavera, M.Reale, S.Spagnolo, A.Ventura

# Outline

- LHC Plans
- ATLAS
  - Phase I Muon Detector Upgrade
  - Physics Highlights
- Lecce Group Contributions and Activities

# LHC PLANS

# LHC plans (LS1, LS2, LS3)

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LS = Long Shutdown

# Revised LHC Schedule

## Revised LHC Schedule to LS2 and LS3

No Linac4 connection during Run2 – only EYETS* (13+6 weeks)
LS2 starting in 2018 (July) => 18 months + 3 months BC
LS3 LHC: starting in 2023 => 30 months + 3 months BC
Injectors: in 2024 => 13 months + 3 months BC

Physics
Shutdown
Beam commissioning
Technical stop


*) Extended Year End Technical Stop

**Meeting on 2nd December between CERN management and the experiments**
**New baseline schedule for LS2 and the start of LS3**

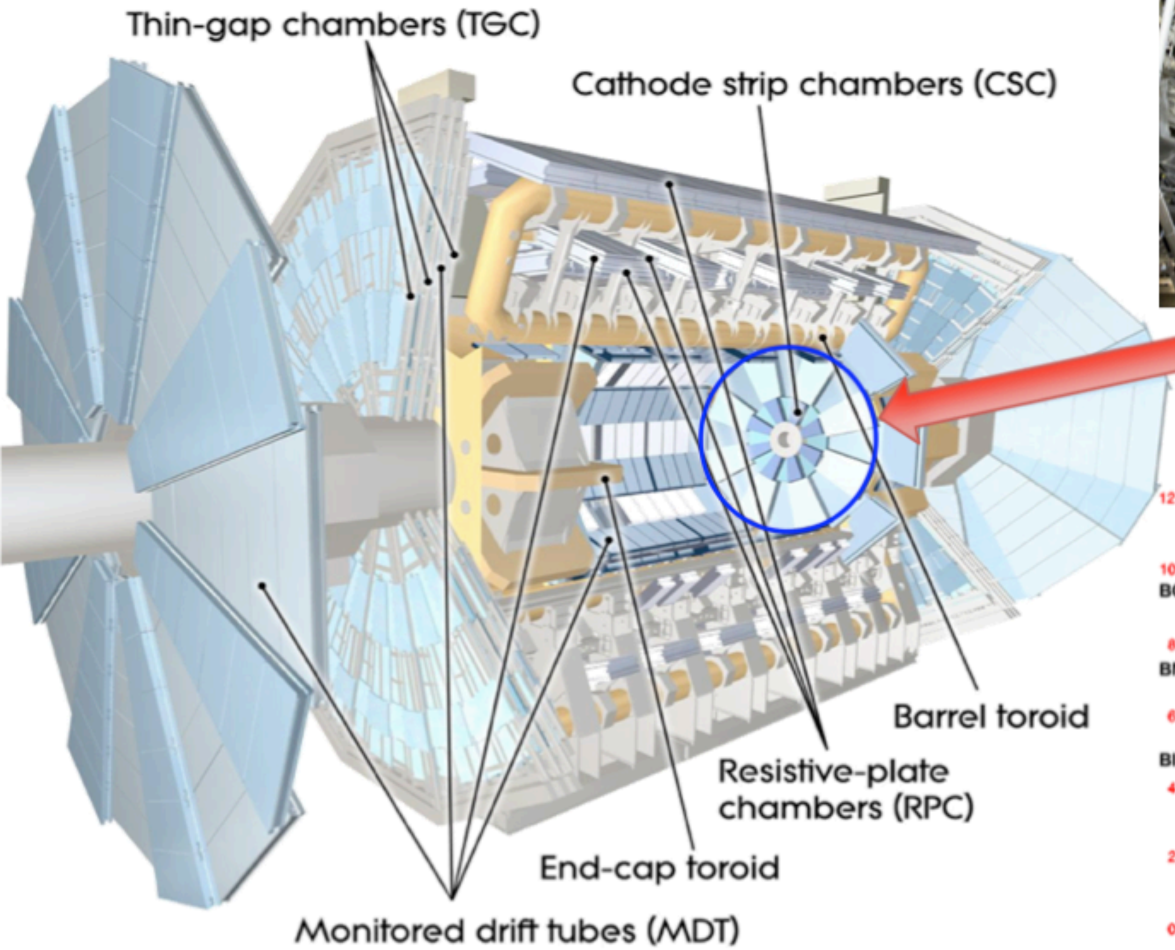
# PHASE I DETECTOR UPGRADE

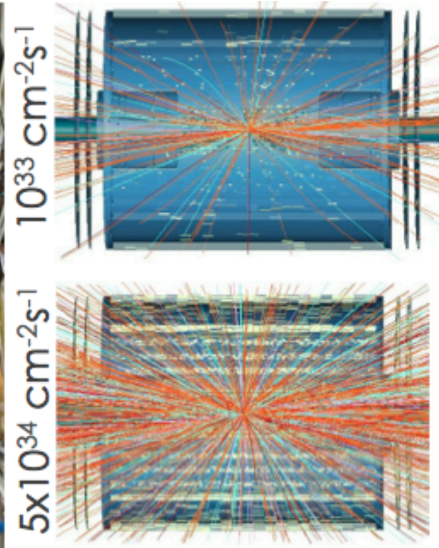
# The New Small Wheel

The **New Small Wheel** (NSW) upgrade is motivated primarily by the high background rate that is expected at L = 2..5×$10^{34}$cm$^{-2}$s$^{-1}$ during LHC Run-3 and HL-LHC

→Replace SW *with fast, high rate, precision* detectors

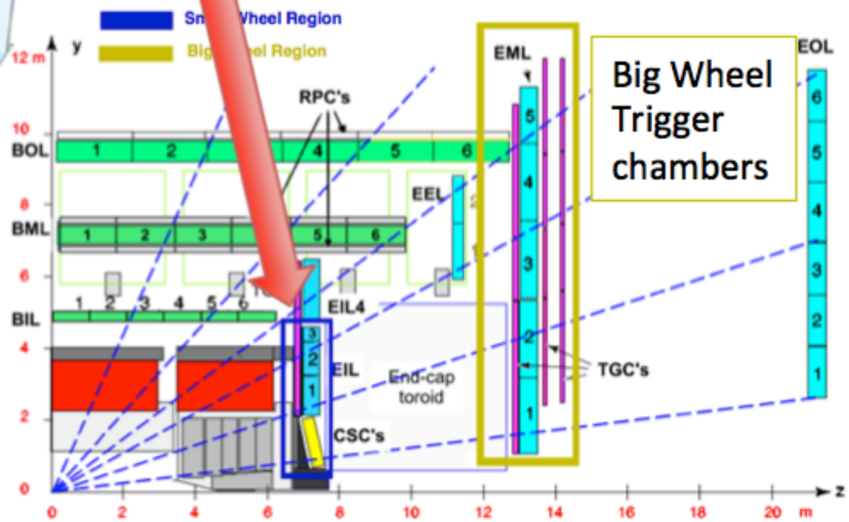
BCID < 10ns   up to 15 kHz   <100 μm/plane



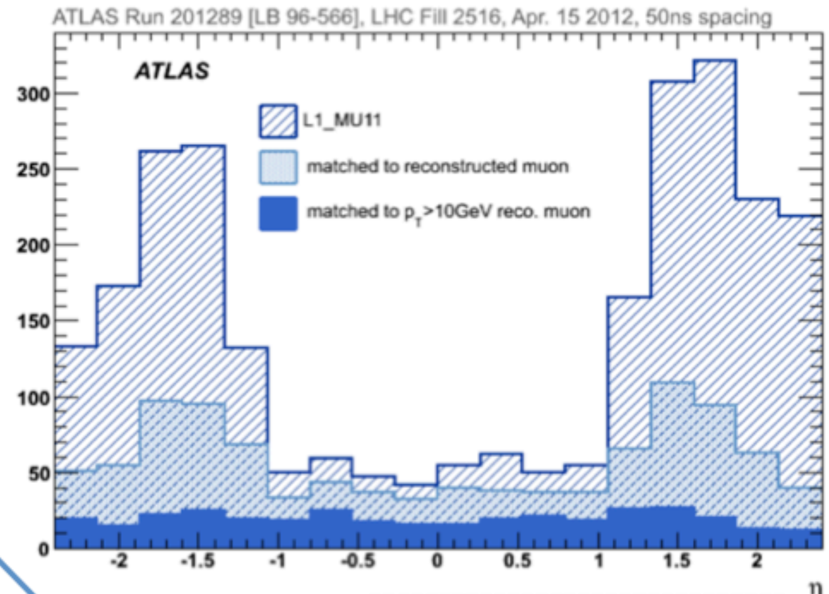

Coverage:
1.2 < |η| < 2.5

Small Wheel (SW)

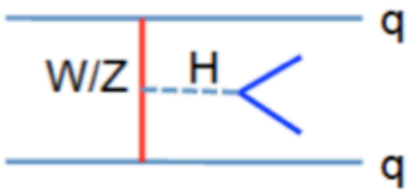


# Motivation

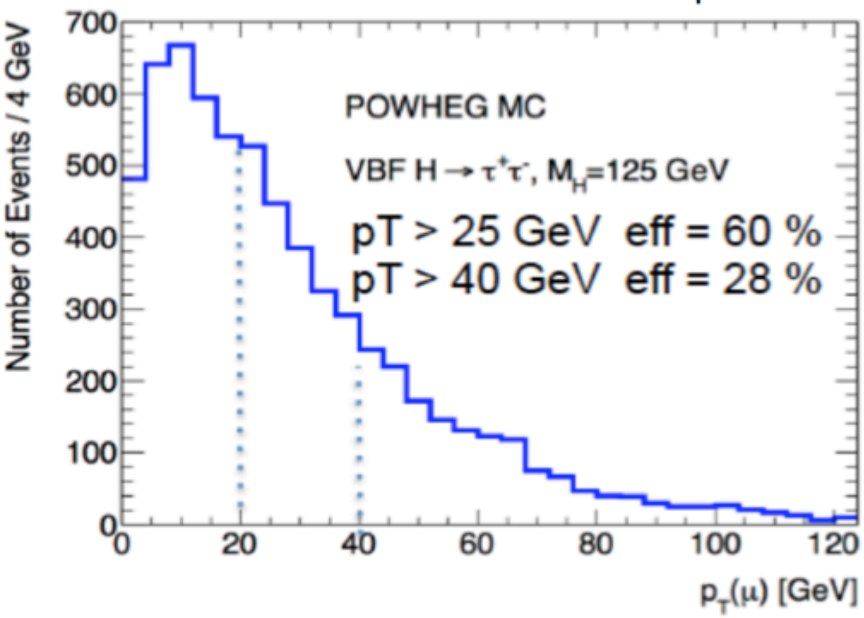
- Forward muon triggers have currently high fake rate
  - Simply raising muon trigger $p_T$ thresholds to reduce the trigger rate results in ***significant physics loss***
- SW chambers can't cope with expected rates ≈15 kHz
  - For high $p_T$ muons, resolution is dominated by the muon spectrometer → Losing SW → losing muons

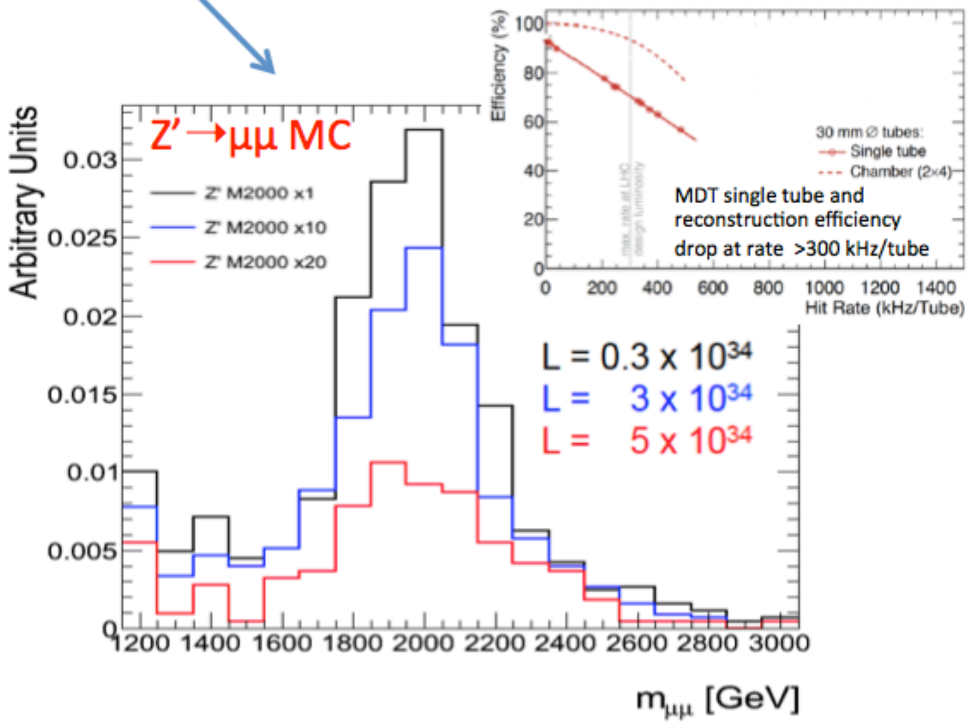



Example:
(single lepton trigger)

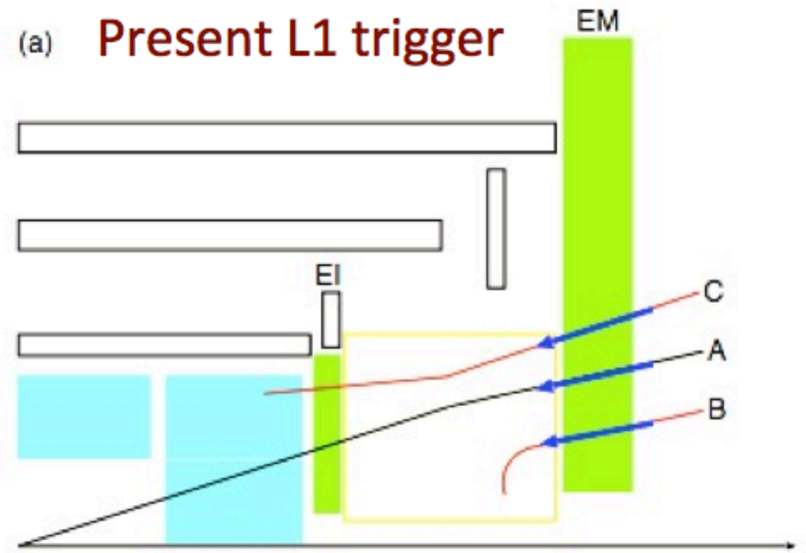



VBF H→$\tau_{lep}\tau_{had}$



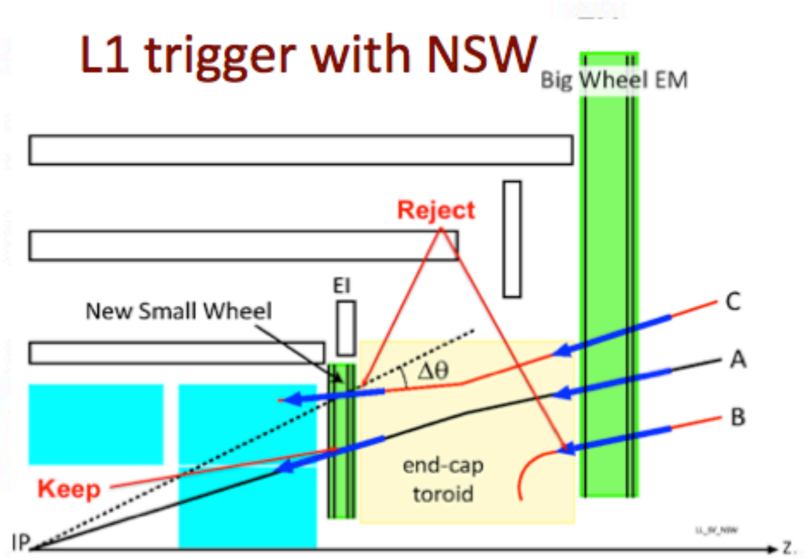
# Muon Trigger with NSW

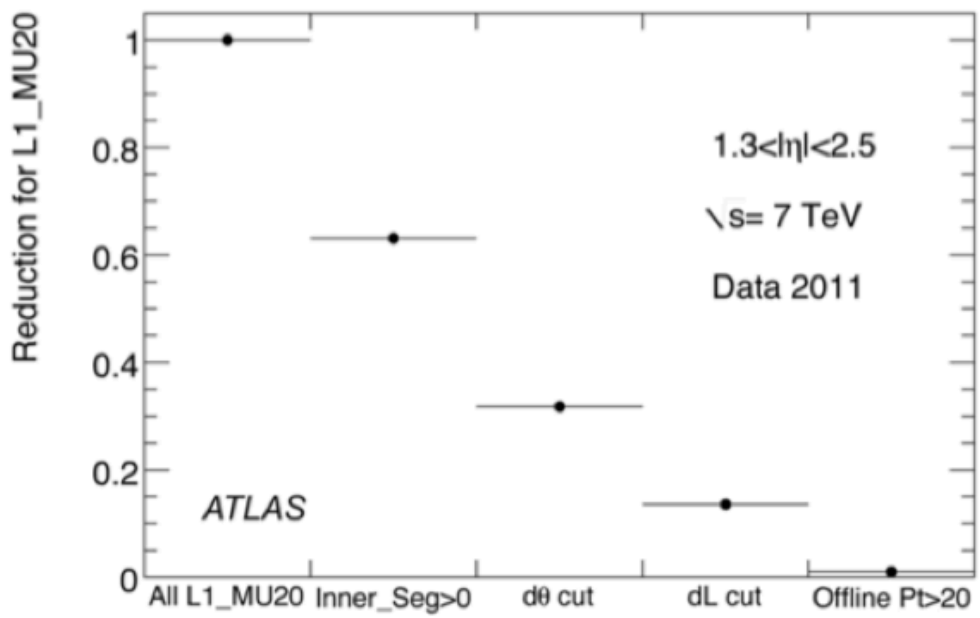



NSW will provide improved trigger for forward muons and improved tracking

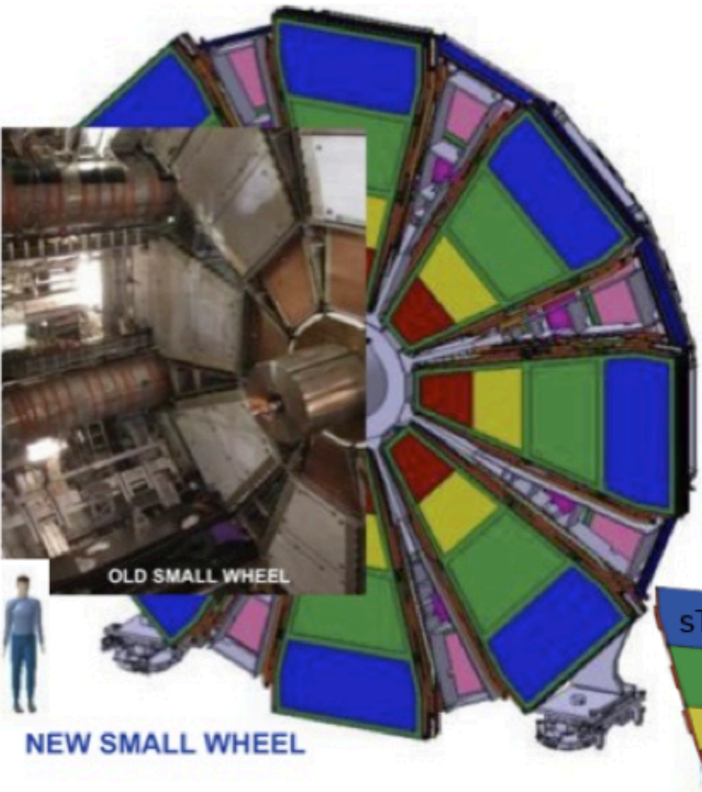
**New (fast) precision tracker in NSW**
that works up to the ultimate luminosity, with some safety margin

**Kill the fake triggers**
by requiring high quality ($\sigma_\theta$~ 1mrad) pointing segments in NSW



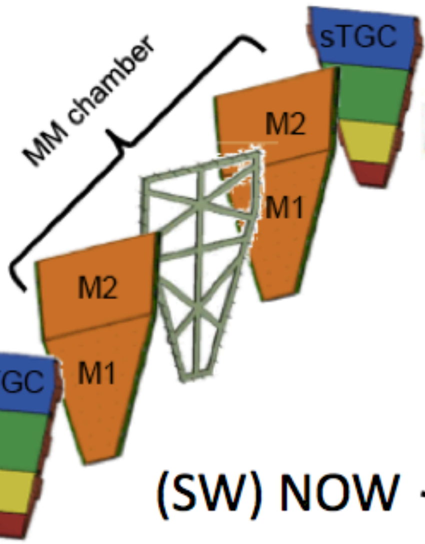



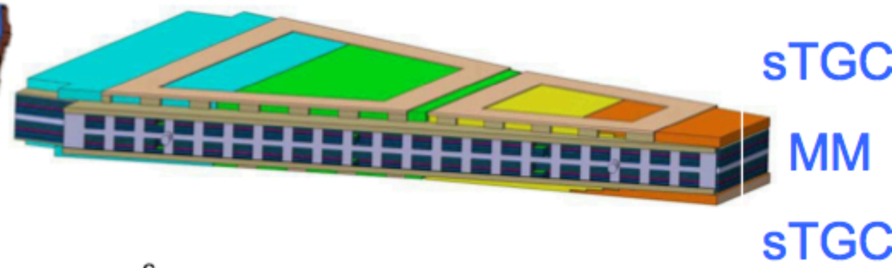
# NSW Detector Layout




**NSW will utilize two detector solutions:**

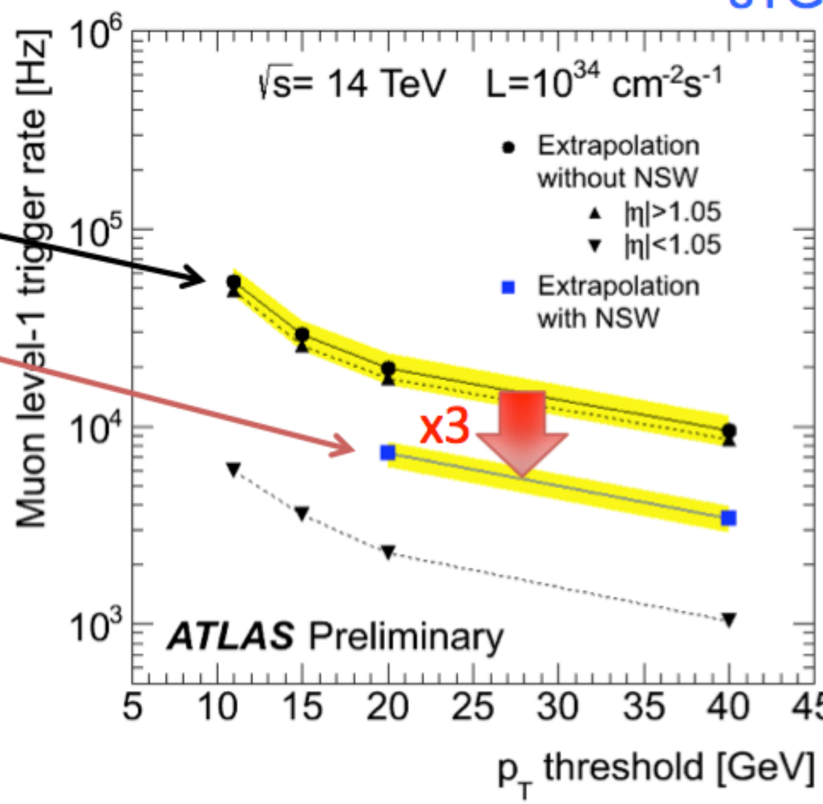
- Small strip Thin Gas Chambers (sTGC) as primary trigger
- Micromegas (MM) for primary precision tracker




(SW) NOW

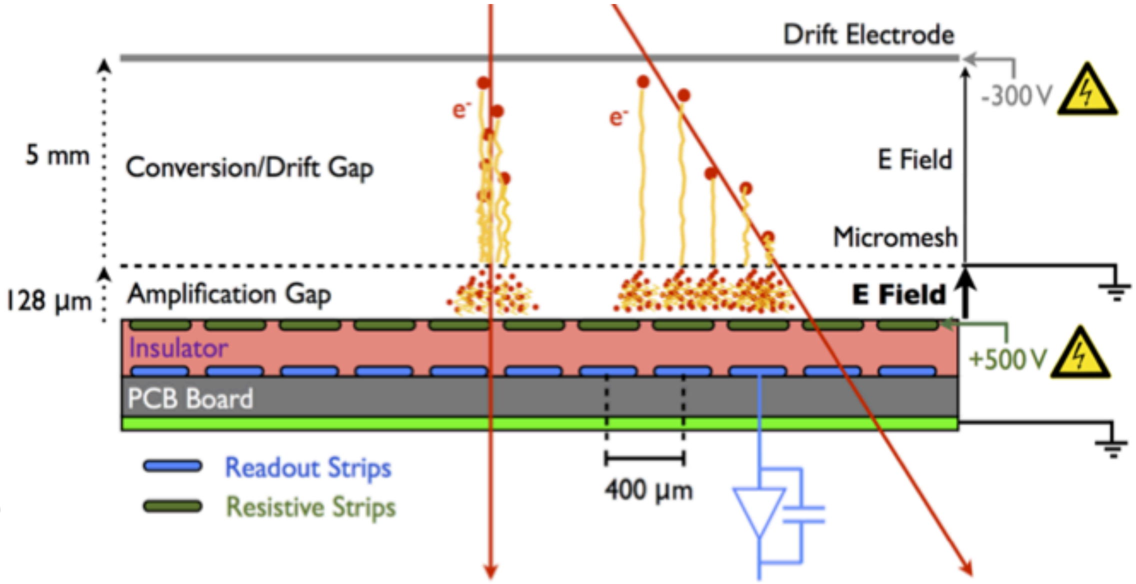
with NSW

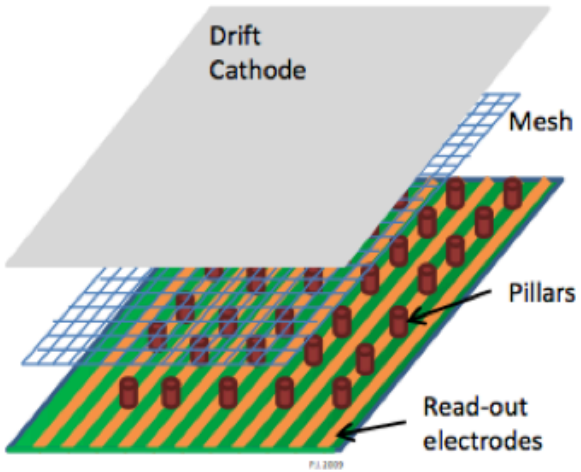


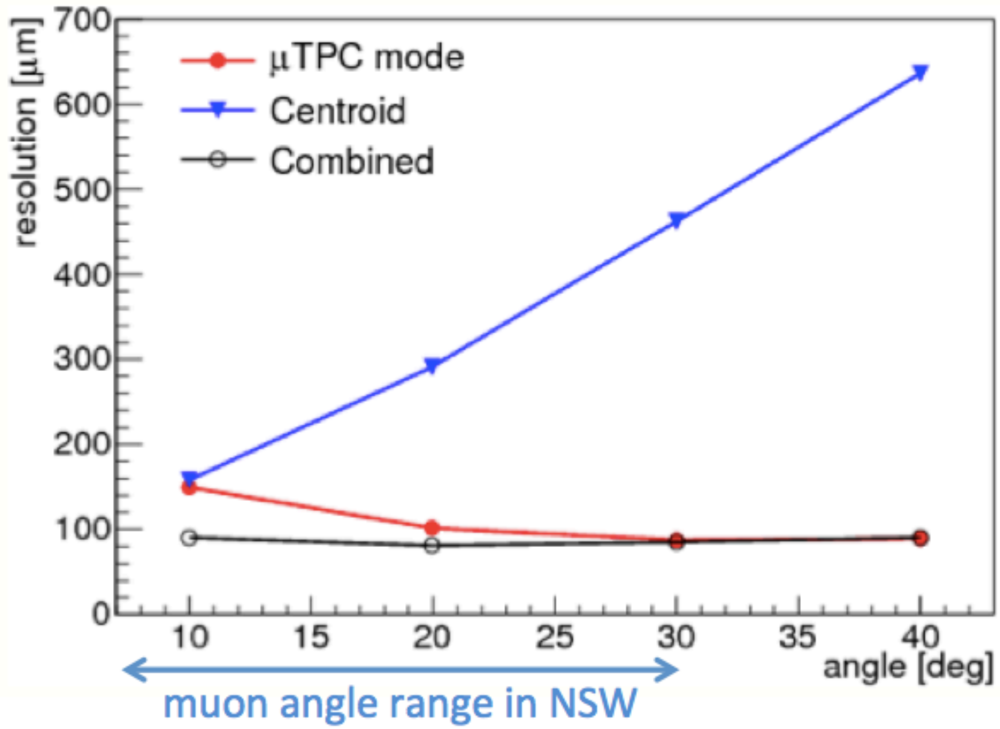

- 16 Sectors per wheel (8 large, 8 small)
- 4 Layers per Wedge (quadruplets) for each technology (sTGC and Micromegas)
- 2 quadruplets per sector
- Position determination of the precision coordinate readout elements better than 30-40 μm

# Micromegas Technology

- Parallel plate chambers where the amplification takes place in a ***thin amplification gap*** (128μm) separated from the drift gap by a fine micromesh
- Read-out strips (0.5 mm) covered by resistive strip layer
- Novel technology with excellent high rate capability due to thin amplification gap and small space charge effects.
- Primary Precision Tracker with spatial resolution better than 100 μm *independent* of track incident angle.

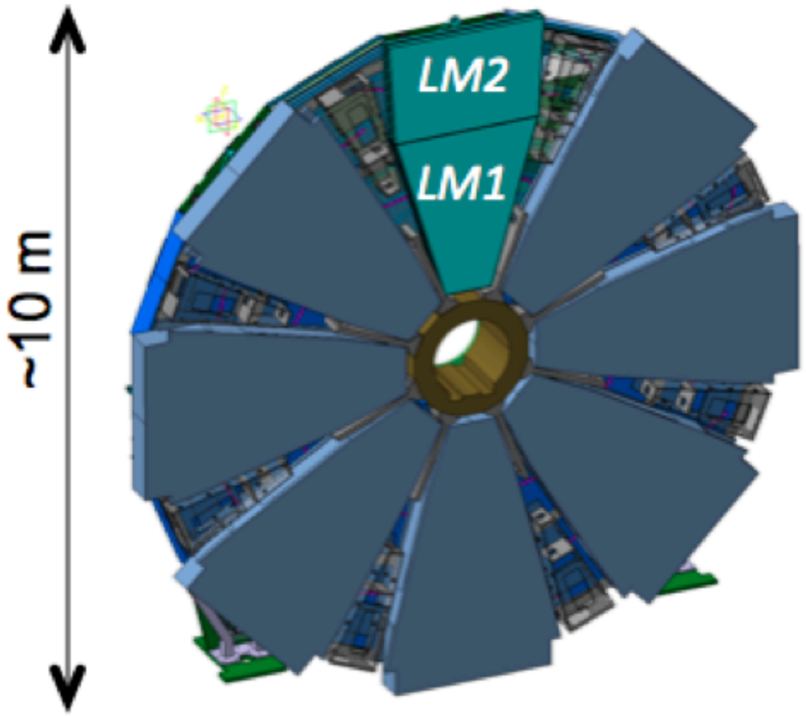


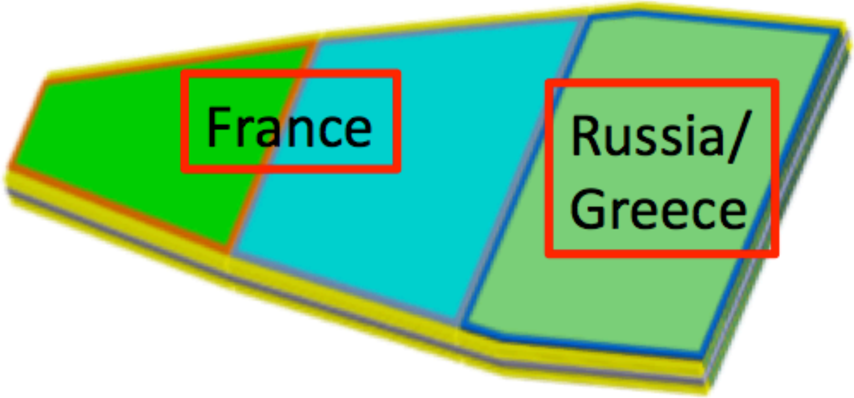



# Micromegas Production

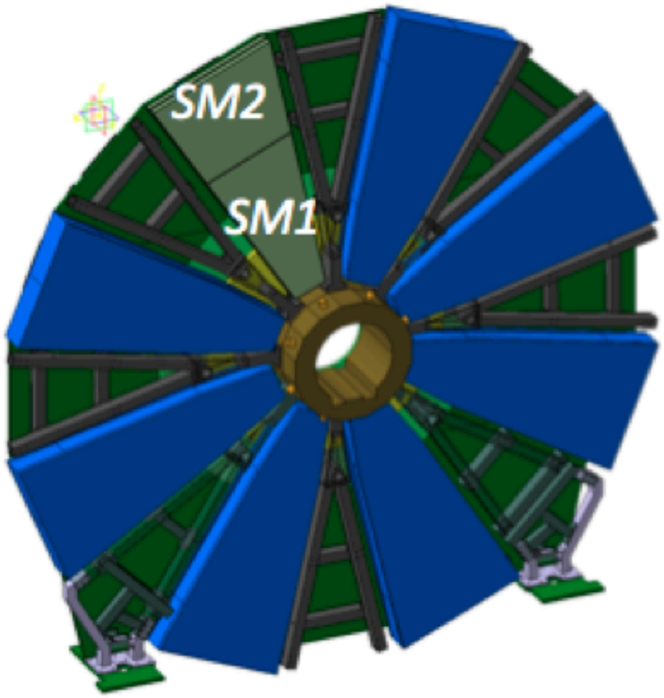
## MM Large Sector



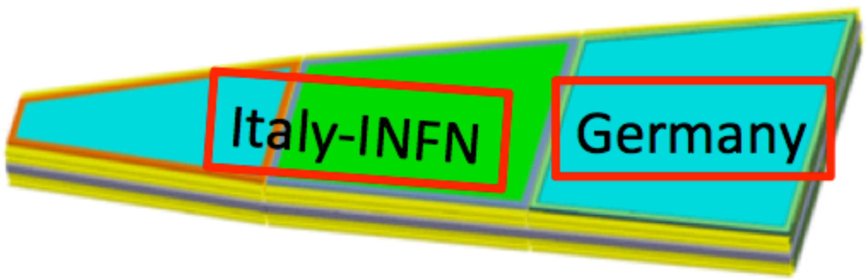




## MM Small Sector

Four types of Micromegas quadruplets



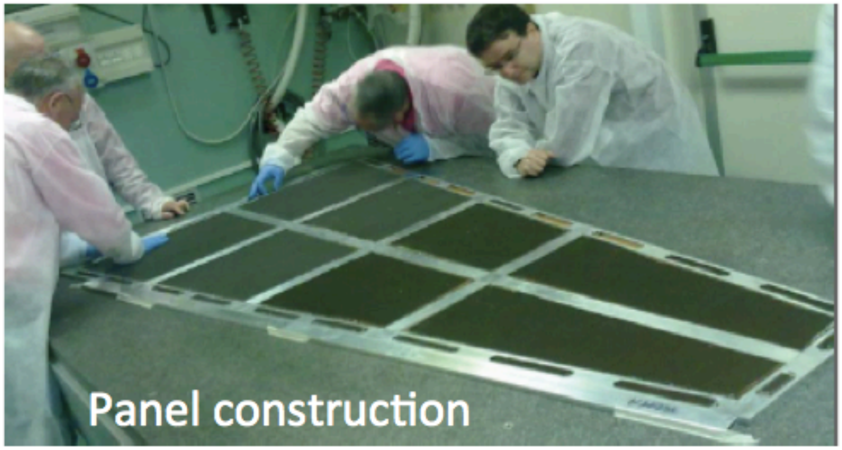

All with trapezoidal shapes, dimensions between 2-3 $m^2$




*Full site wide production starting in 2015.*

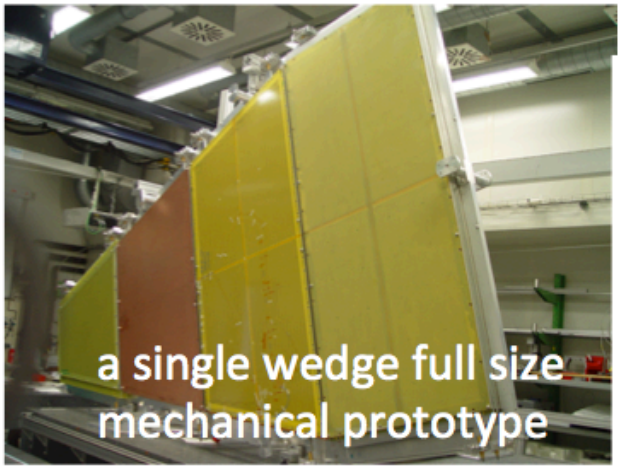
# Micromegas Prototypes

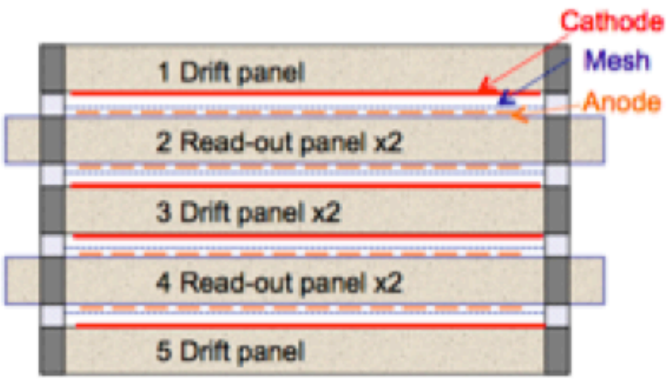
- Several prototypes constructed and in production
- Precision requirements on production methods
  - ✧ Position of read-out strip along precision coordinate better than 30 μm
  - ✧ Position of each plane perpendicular to chamber surface better than 80 μm
  - ✧ Large surfaces of the individual detector elements are susceptible to internal mechanical stress

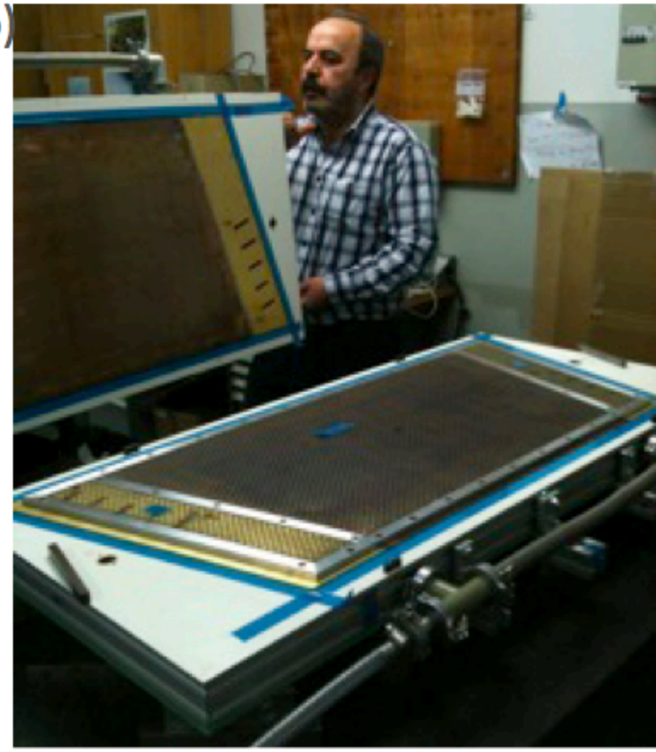




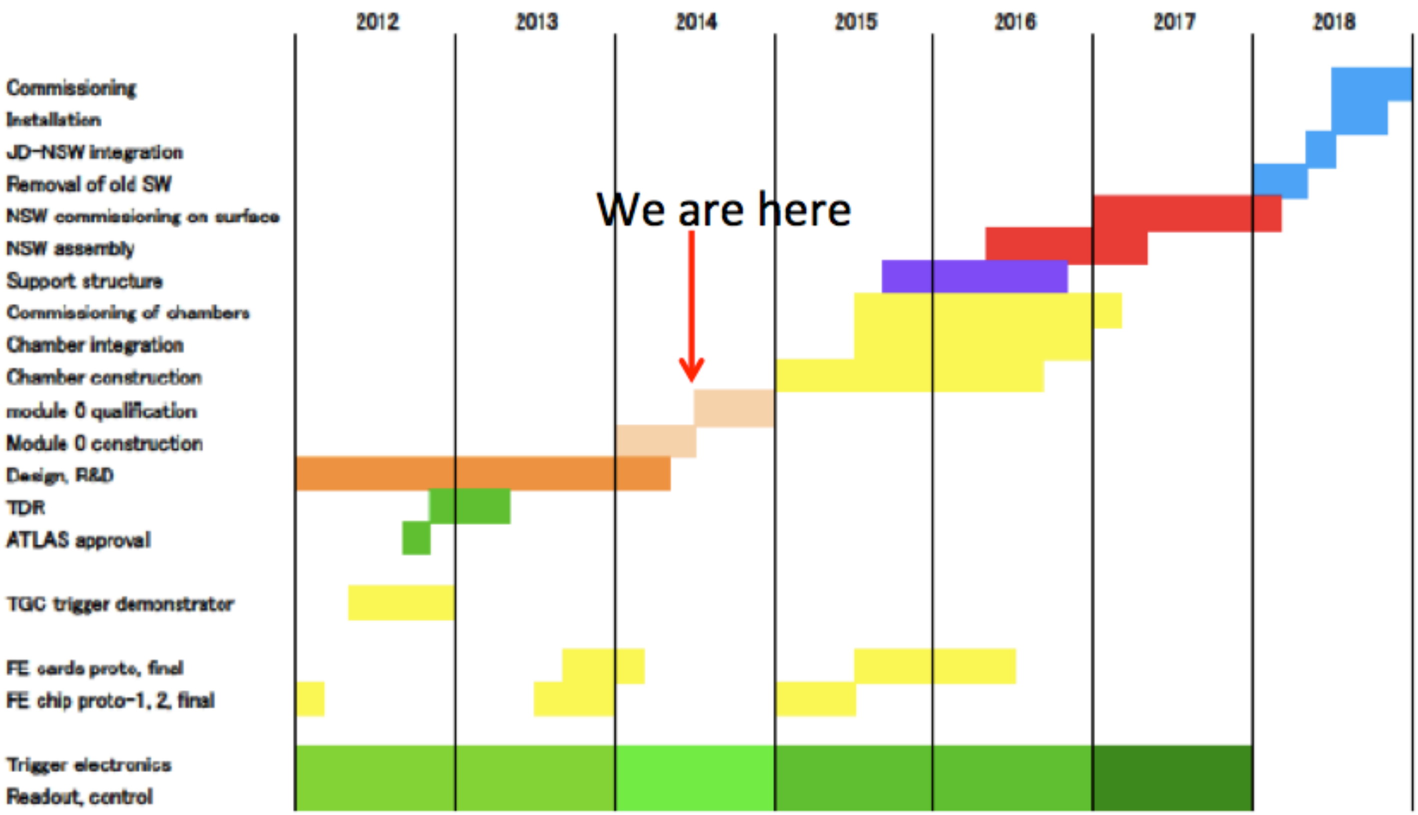
- Prototype (1.2x0.5 m$^2$) will be installed in ATLAS (in July)
  - ✧ 4 layers (2 eta and 2 stereo)
  - ✧ Pitch 0.425mm
  - ✧ 1024 strips per plane
  - ✧ All panels finished
- 3 additional prototypes
  - ✧ Qualify procedures

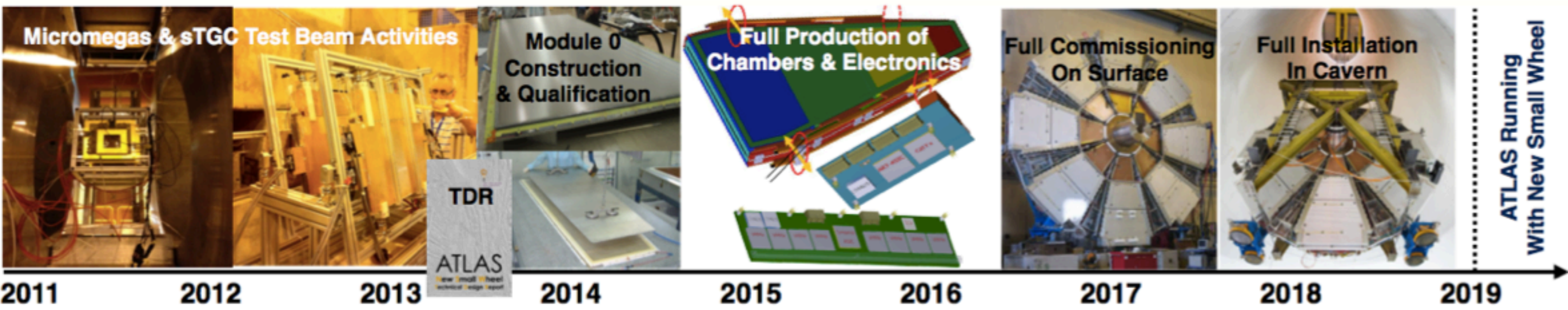


# Schedule


2012
2013
2014
2015
2016
2017
2018
Commissioning
Installation
JD-NSW integration
Removal of old SW
NSW commissioning on surface
NSW assembly
Support structure
Commissioning of chambers
Chamber integration
Chamber construction
module 0 qualification
Module 0 construction
Design, R&D
TDR
ATLAS approval
TGC trigger demonstrator
FE cards proto, final
FE chip proto-1, 2, final
Trigger electronics
Readout, control
We are here


Micromegas & sTGC Test Beam Activities
Module 0
Construction
& Qualification
TDR
ATLAS
Full Production of
Chambers & Electronics
Full Commissioning
On Surface
Full Installation
In Cavern
ATLAS Running
With New Small Wheel
2011
2012
2013
2014
2015
2016
2017
2018
2019

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3. **Measurement of the production of a W boson in association with a charm quark in pp collisions at root s=7 TeV with the ATLAS detector**
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4. **Search for Higgs boson decays to a photon and a Z boson in pp collisions at root s=7 and 8 TeV with the ATLAS detector**
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5. **Measurement of the production cross section of prompt j/psi mesons in association with a W (+/-) boson in pp collisions root s=7 TeV with the ATLAS detector**
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6. **Search for direct production of charginos and neutralinos in events with three leptons and missing transverse momentum in root s=8 TeV pp collisions with the ATLAS detector**
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7. **Study of heavy-flavor quarks produced in association with top-quark pairs at root s=7 TeV using the ATLAS detector**
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| **Combined search for the Standard Model Higgs boson using up to 4.9 fb(-1) of pp collision data at root s=7 TeV with the ATLAS detector at the LHC**<br>By: Aad, G.; Abbott, B.; Abdallah, J.; et al.<br>Group Author(s): ATLAS Collaboration<br>PHYSICS LETTERS B Volume: 710 Issue: 1 Pages: 49-66 Published: MAR 29 2012 | 0 | 0 | 223 | 77 | 10 | 310 | 103.33 |
| **The ATLAS Simulation Infrastructure**<br>By: Aad, G.; Abbott, B.; Abdallah, J.; et al.<br>Group Author(s): ATLAS Collaboration<br>EUROPEAN PHYSICAL JOURNAL C Volume: 70 Issue: 3 Pages: 823-874 Published: DEC 2010 | 1 | 53 | 117 | 73 | 17 | 261 | 52.20 |
| **Observation of a Centrality-Dependent Dijet Asymmetry in Lead-Lead Collisions at root s(NN)=2.76 TeV with the ATLAS Detector at the LHC**<br>By: Aad, G.; Abbott, B.; Abdallah, J.; et al.<br>Group Author(s): ATLAS Collaboration<br>PHYSICAL REVIEW LETTERS Volume: 105 Issue: 25 Article Number: 252303 Published: DEC 13 2010 | 0 | 39 | 70 | 52 | 7 | 168 | 33.60 |
| **Search for squarks and gluinos using final states with jets and missing transverse momentum with the ATLAS detector in root s=7 TeV proton-proton collisions**<br>By: Aad, G.; Abbott, B.; Abdallah, J.; et al.<br>Group Author(s): ATLAS Collaboration<br>PHYSICS LETTERS B Volume: 710 Issue: 1 Pages: 67-85 Published: MAR 29 2012 | 0 | 0 | 92 | 39 | 3 | 134 | 44.67 |
| **Search for squarks and gluinos using final states with jets and missing transverse momentum with the ATLAS detector in root s=7 TeV proton-proton collisions**<br>By: Aad, G.; Abdallah, J.; Abdelalim, A. A.; et al.<br>Group Author(s): ATLAS Collaboration<br>PHYSICS LETTERS B Volume: 701 Issue: 2 Pages: 186-203 Published: JUL 4 2011 | 0 | 35 | 60 | 10 | 4 | 109 | 27.25 |
| **Charged-particle multiplicities in pp interactions at root s=900 GeV measured with the ATLAS detector at the LHC ATLAS Collaboration**<br>By: Aad, G.; Abat, E.; Abbott, B.; et al.<br>Group Author(s): ATLAS Collaboration<br>PHYSICS LETTERS B Volume: 688 Issue: 1 Pages: 21-42 Published: APR 26 2010 | 28 | 44 | 15 | 13 | 2 | 102 | 20.40 |
| **Search for Supersymmetry Using Final States with One Lepton, Jets, and Missing Transverse Momentum with the ATLAS Detector in root s=7 TeV pp Collisions**<br>By: Aad, G.; Abbott, B.; Abdallah, J.; et al.<br>Group Author(s): ATLAS Collaboration<br>PHYSICAL REVIEW LETTERS Volume: 106 Issue: 13 Article Number: 131802 Published: MAR 28 2011 | 0 | 41 | 38 | 5 | 2 | 86 | 21.50 |
| **Search for the Standard Model Higgs Boson in the Diphoton Decay Channel with 4.9 fb(-1) of pp Collision Data at root s=7 TeV with ATLAS**<br>By: Aad, G.; Abbott, B.; Abdallah, J.; et al.<br>Group Author(s): ATLAS Collaboration<br>PHYSICAL REVIEW LETTERS Volume: 108 Issue: 11 Article Number: 111803 Published: MAR 13 2012 | 0 | 0 | 48 | 15 | 4 | 67 | 22.33 |
| **Measurement of the pseudorapidity and transverse momentum dependence of the elliptic flow of charged particles in lead-lead collisions at root s(NN)=2.76 TeV with the ATLAS detector**<br>By: Aad, G.; Abbott, B.; Abdallah, J.; et al.<br>Group Author(s): ATLAS Collaboration<br>PHYSICS LETTERS B Volume: 707 Issue: 3-4 Pages: 330-348 Published: FEB 1 2012 | 0 | 0 | 18 | 37 | 8 | 63 | 21.00 |

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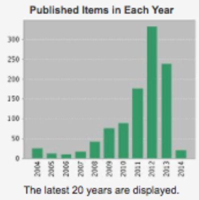

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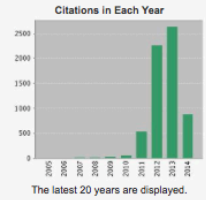

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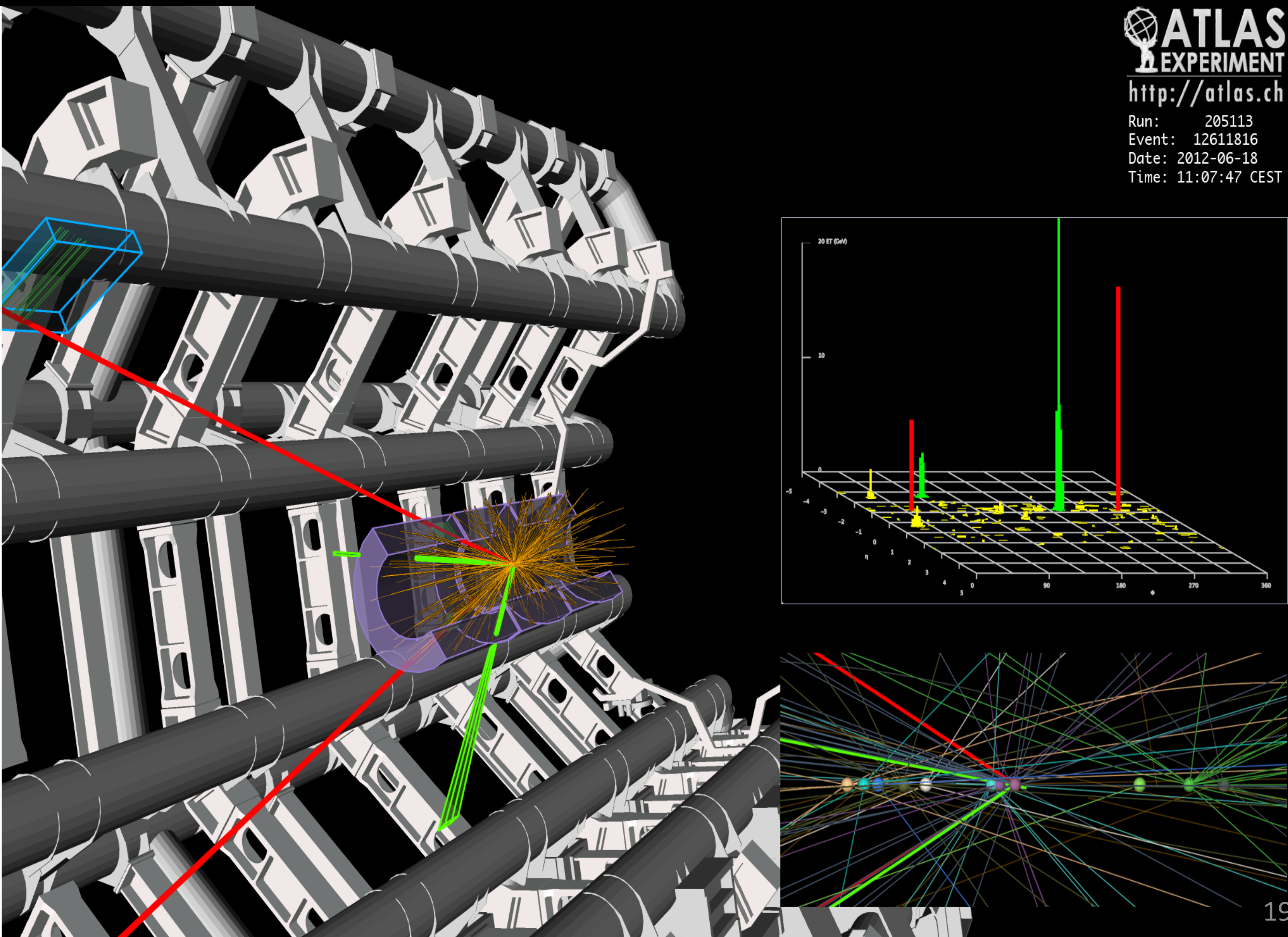
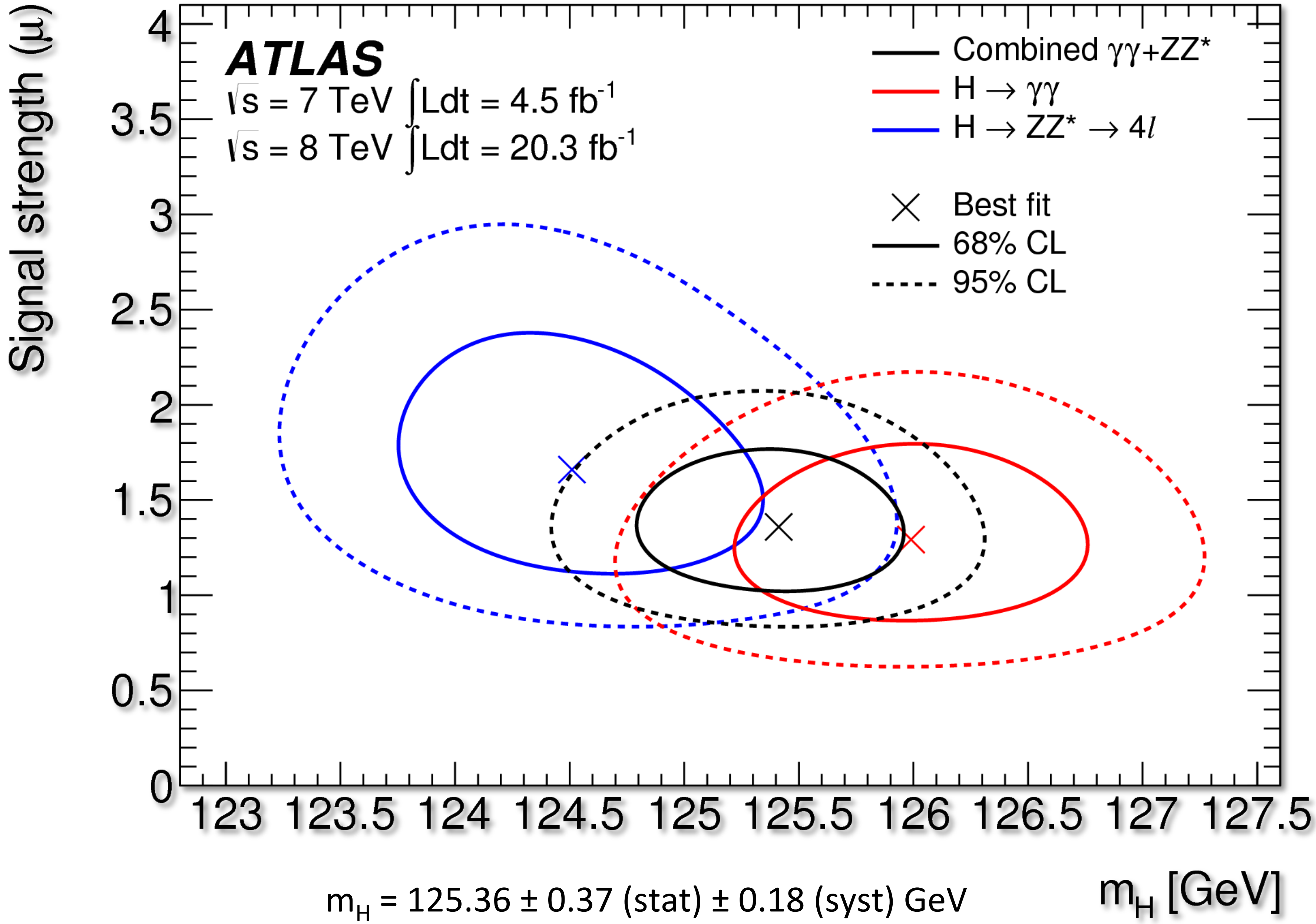
# Higgs Boson

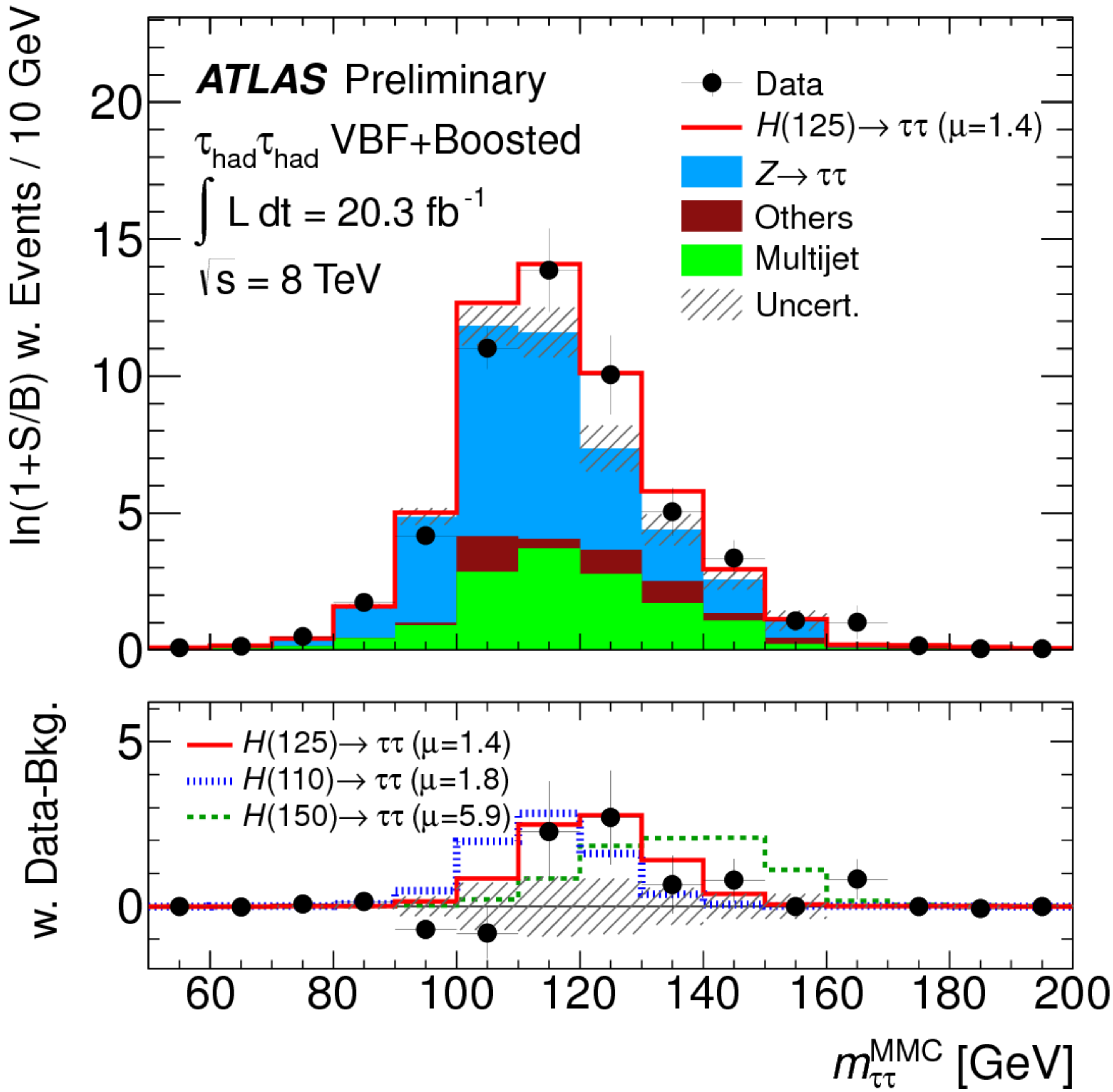

ATLAS
EXPERIMENT
http://atlas.ch
Run: 205113
Event: 12611816
Date: 2012-06-18
Time: 11:07:47 CEST
20 ET (GeV)
10
0
90
180
270
360

# Mass

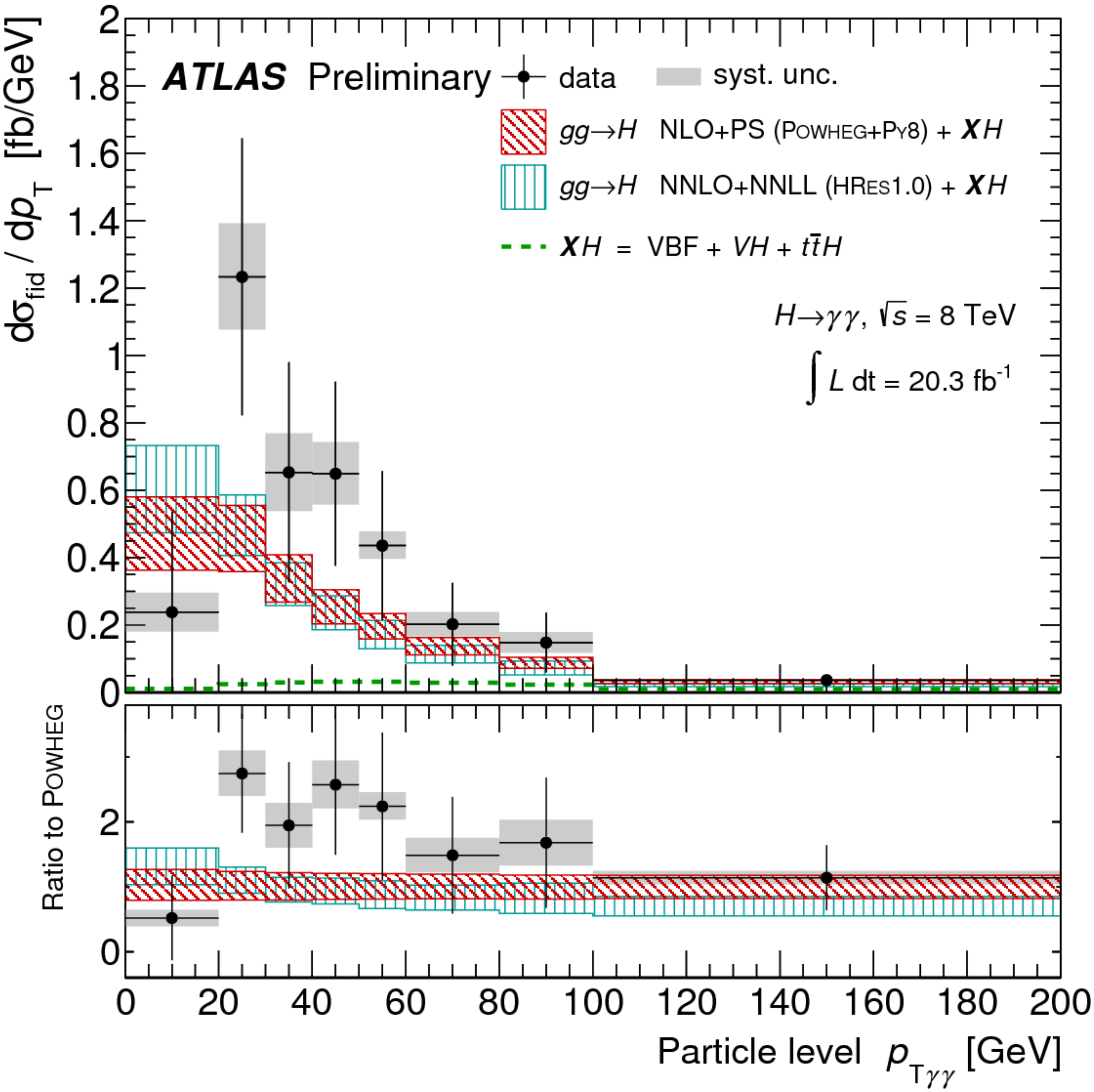



$m_H = 125.36 \pm 0.37$ (stat) $\pm 0.18$ (syst) GeV

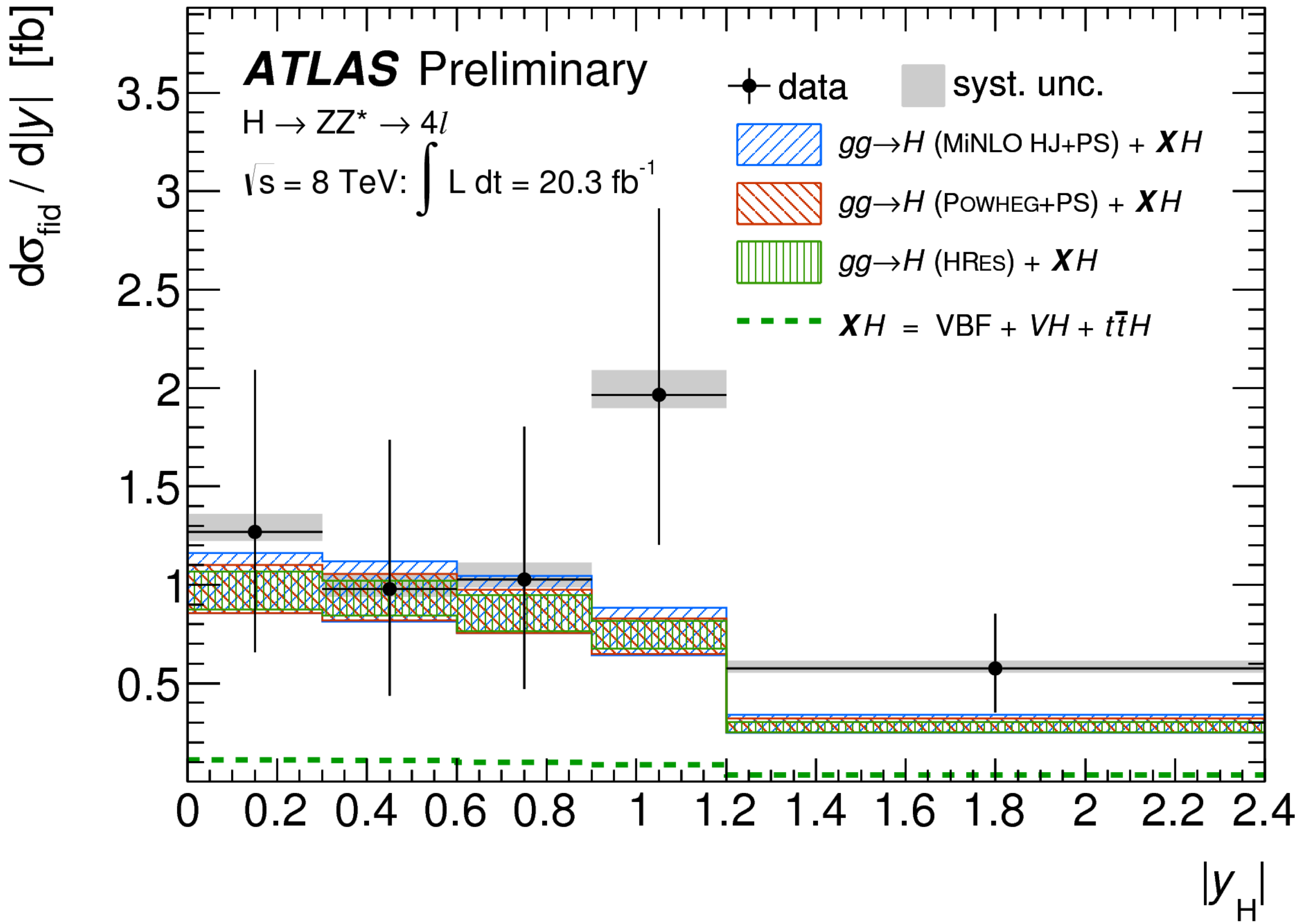
# Higgs Search in ττ



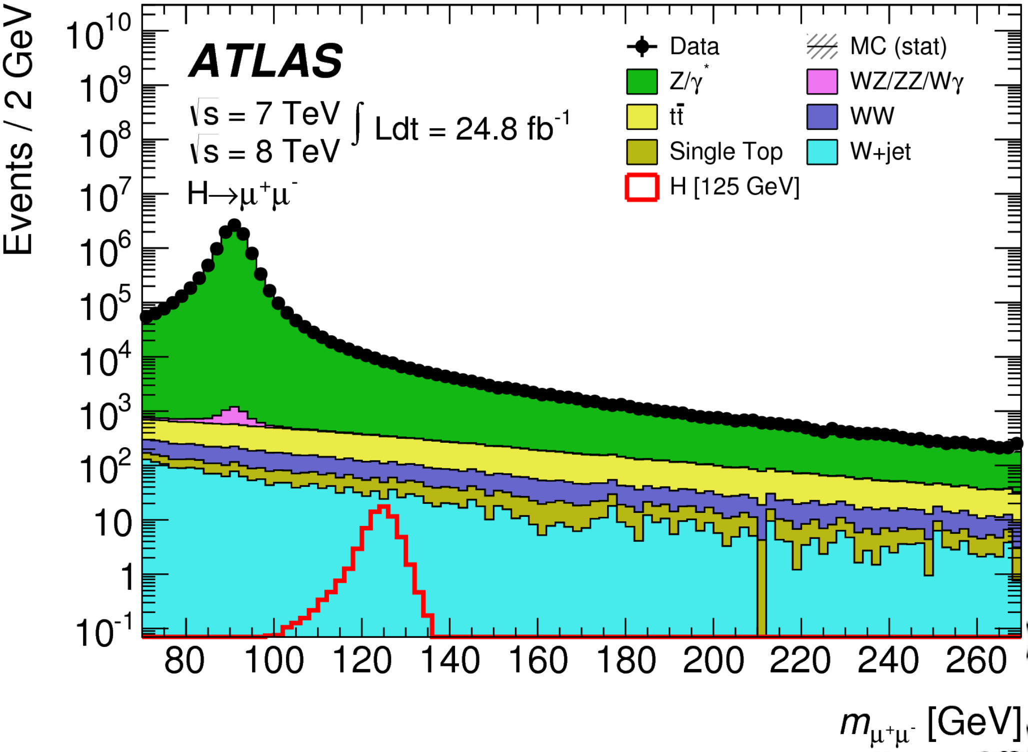
# Higgs Differential Cross Sections, γγ

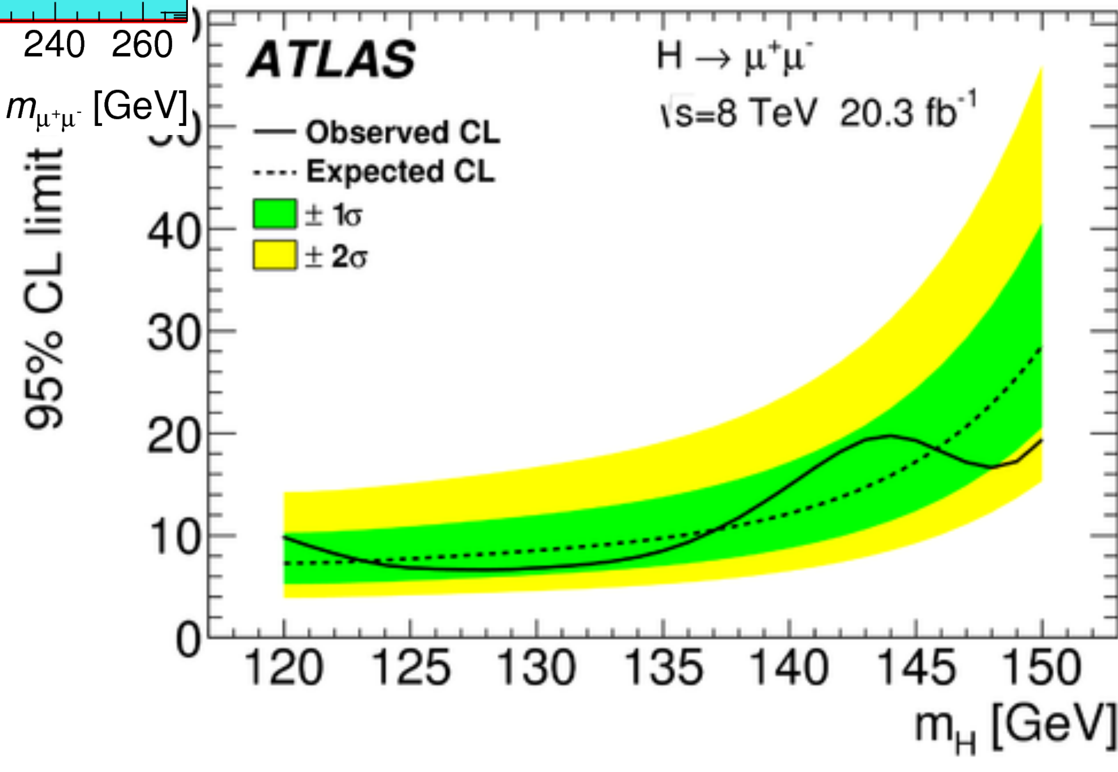


# Higgs Diff. Cross Sections, ZZ→4l

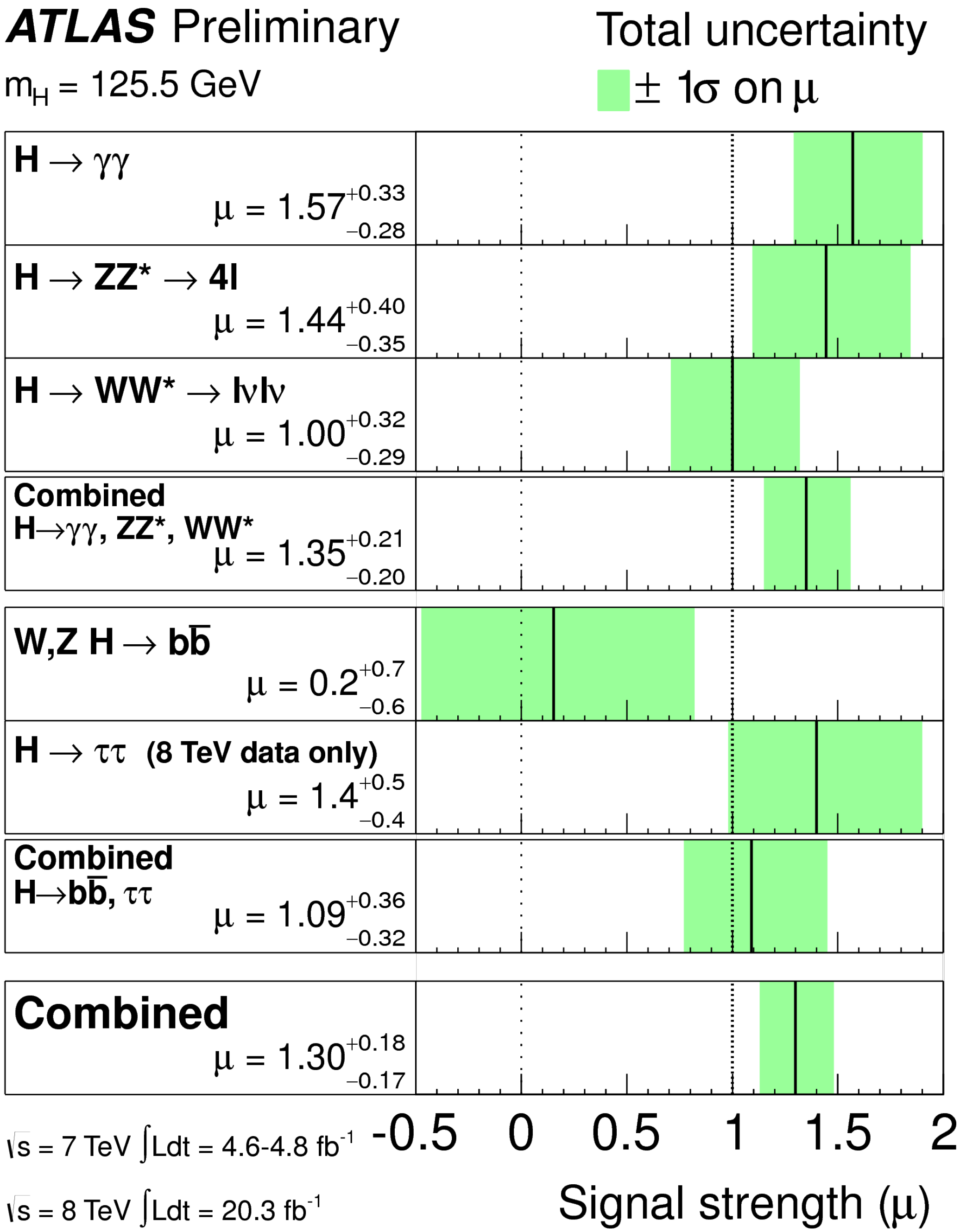


# Search for H→μμ

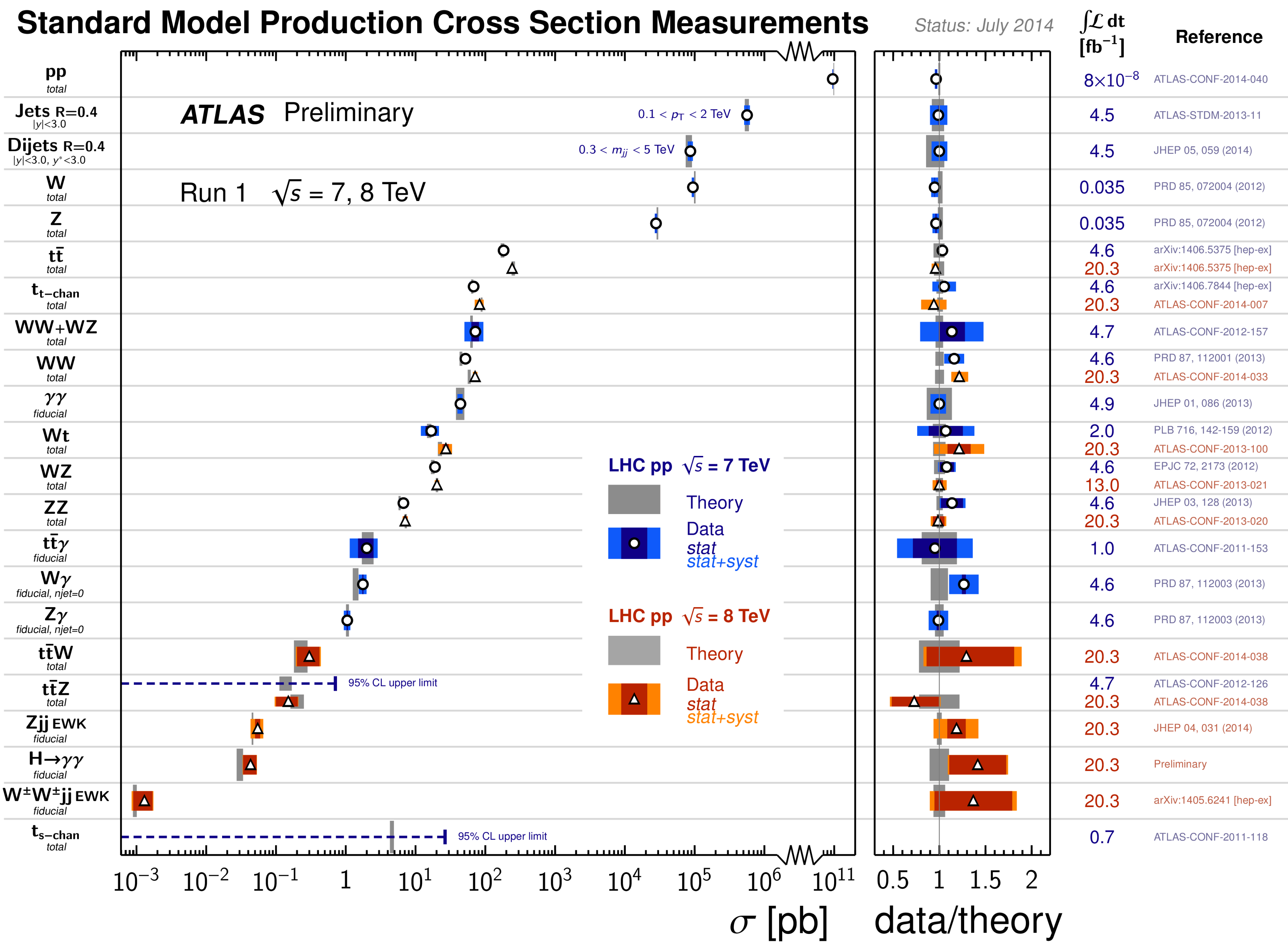


# Signal Strength

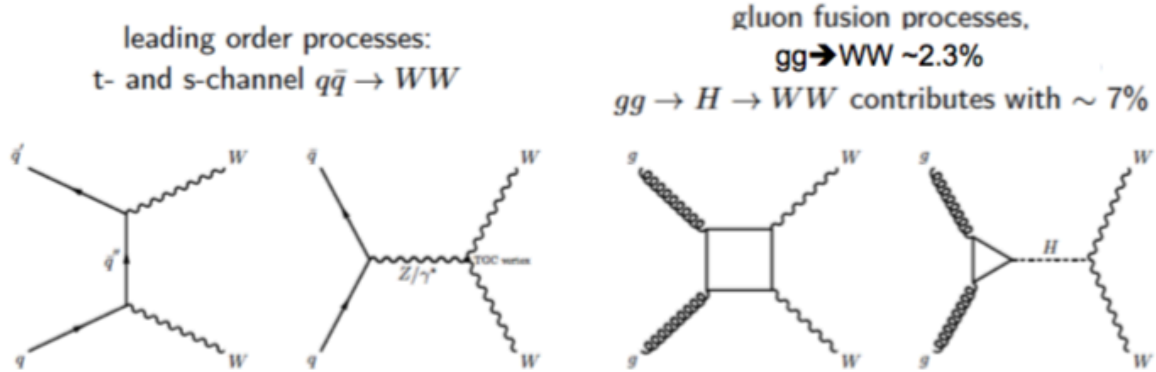


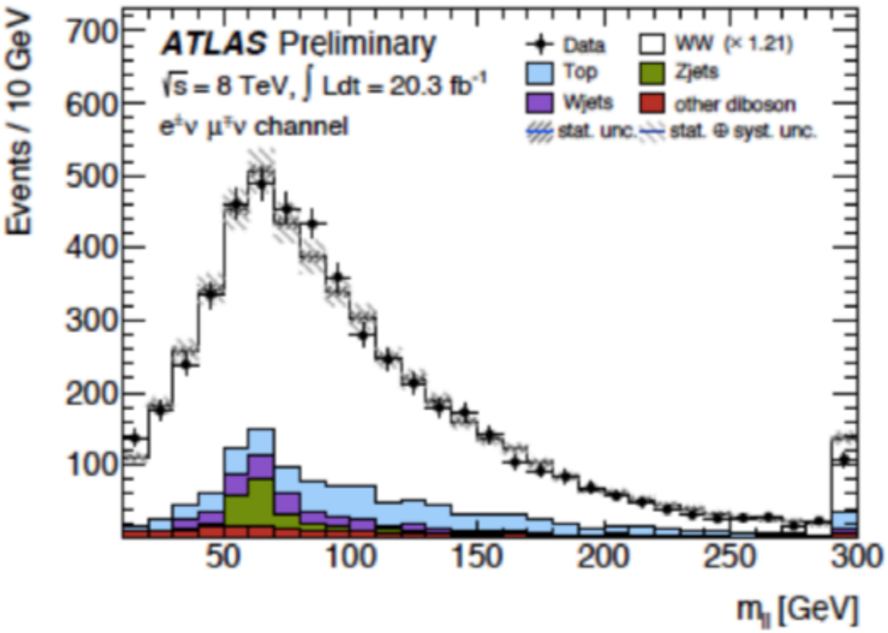
# Summary of SM Cross Section Measurements

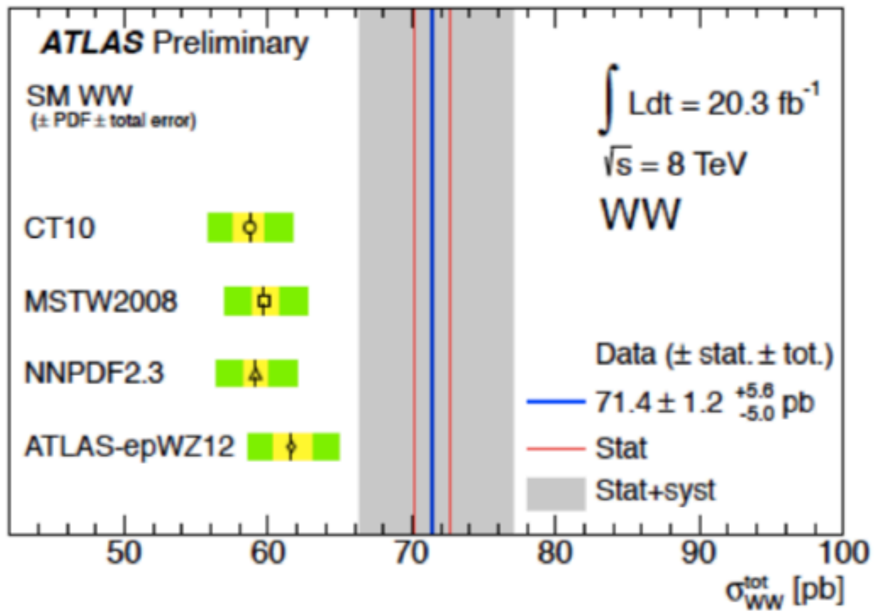


# $W^+W^-$ production at 8 TeV

- Important test of EWK and QCD calculations
- Interesting data-theory discrepancy by ~2σ

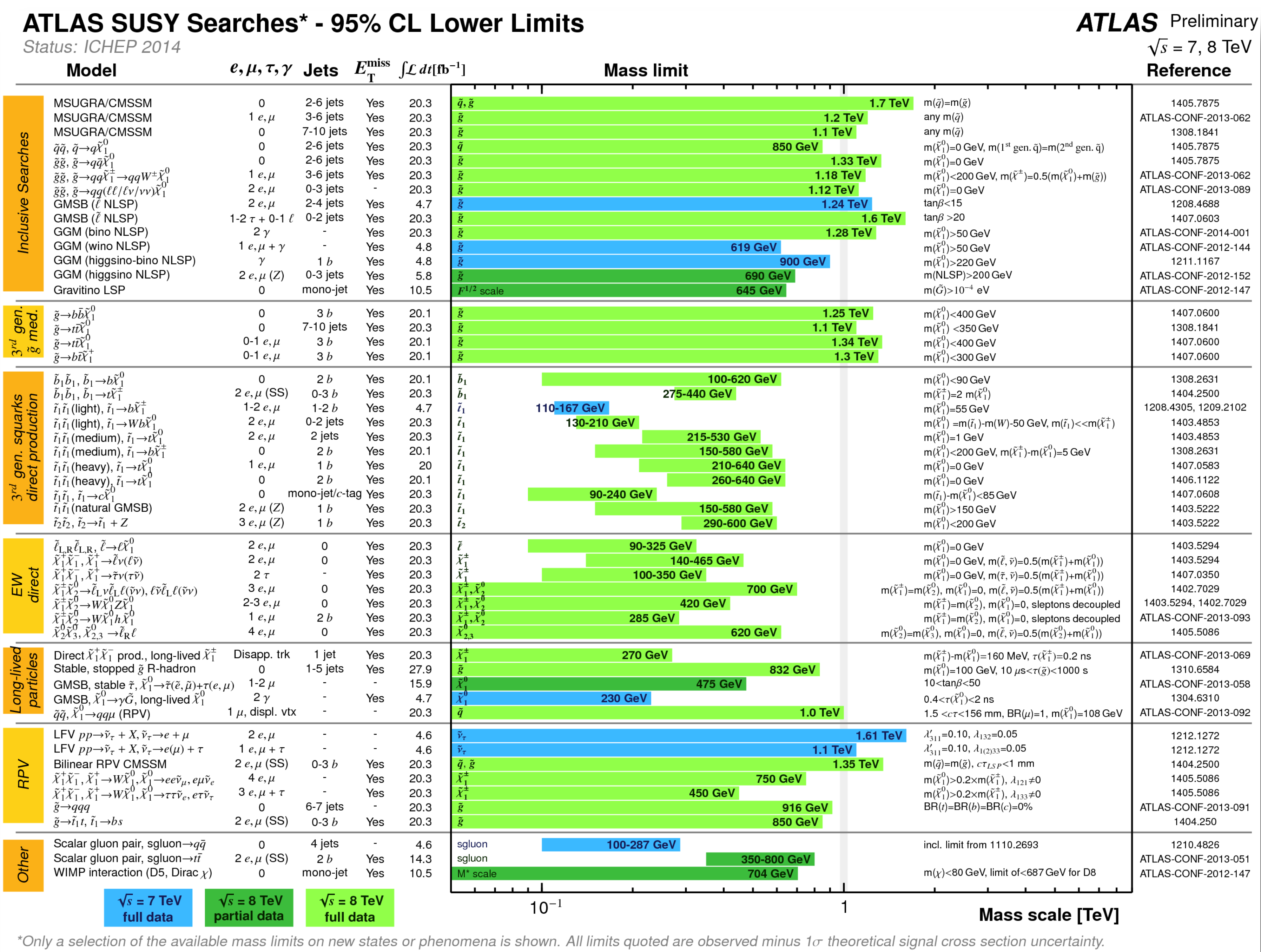



ATLAS PDF (with larger strange-quark) closer to data by 5%

# SUSY searches



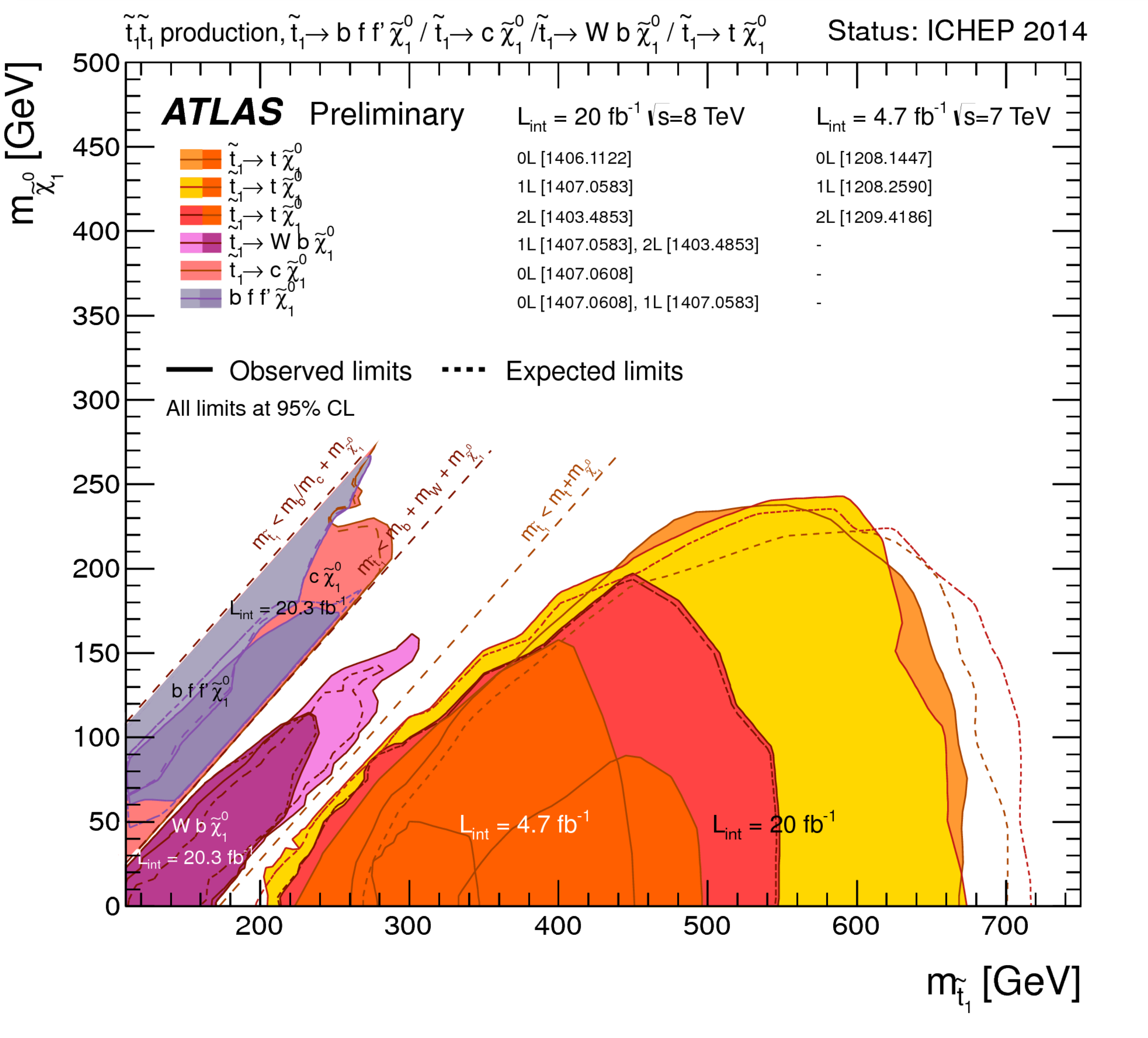

**ATLAS SUSY Searches* - 95% CL Lower Limits**

*Status: ICHEP 2014*

| | Model | $e,\mu,\tau,\gamma$ | Jets | $E_T^{miss}$ | $\int\mathcal{L}\,dt[\text{fb}^{-1}]$ | Mass limit | | | Reference |
|---|---|---|---|---|---|---|---|---|---|
| Inclusive Searches | MSUGRA/CMSSM | 0 | 2-6 jets | Yes | 20.3 | $\tilde q, \tilde g$ | 1.7 TeV | $m(\tilde q)=m(\tilde g)$ | 1405.7875 |
| | MSUGRA/CMSSM | 1 $e,\mu$ | 3-6 jets | Yes | 20.3 | $\tilde g$ | 1.2 TeV | any $m(\tilde q)$ | ATLAS-CONF-2013-062 |
| | MSUGRA/CMSSM | 0 | 7-10 jets | Yes | 20.3 | $\tilde g$ | 1.1 TeV | any $m(\tilde q)$ | 1308.1841 |
| | $\tilde q\tilde q$, $\tilde q \to q\tilde\chi_1^0$ | 0 | 2-6 jets | Yes | 20.3 | $\tilde q$ | 850 GeV | $m(\tilde\chi_1^0)$=0 GeV, m(1$^{st}$ gen. $\tilde q$)=m(2$^{nd}$ gen. $\tilde q$) | 1405.7875 |
| | $\tilde g\tilde g$, $\tilde g \to q\bar q\tilde\chi_1^0$ | 0 | 2-6 jets | Yes | 20.3 | $\tilde g$ | 1.33 TeV | $m(\tilde\chi_1^0)$=0 GeV | 1405.7875 |
| | $\tilde g\tilde g$, $\tilde g \to qq\tilde\chi_1^\pm \to qqW^\pm\tilde\chi_1^0$ | 1 $e,\mu$ | 3-6 jets | Yes | 20.3 | $\tilde g$ | 1.18 TeV | $m(\tilde\chi_1^0)$<200 GeV, $m(\tilde\chi^\pm)=0.5(m(\tilde\chi_1^0)+m(\tilde g))$ | ATLAS-CONF-2013-062 |
| | $\tilde g\tilde g$, $\tilde g \to qq(\ell\ell/\ell\nu/\nu\nu)\tilde\chi_1^0$ | 2 $e,\mu$ | 0-3 jets | - | 20.3 | $\tilde g$ | 1.12 TeV | $m(\tilde\chi_1^0)$=0 GeV | ATLAS-CONF-2013-089 |
| | GMSB ($\tilde\ell$ NLSP) | 2 $e,\mu$ | 2-4 jets | Yes | 4.7 | $\tilde g$ | 1.24 TeV | $\tan\beta$<15 | 1208.4688 |
| | GMSB ($\tilde\ell$ NLSP) | 1-2 $\tau$ + 0-1 $\ell$ | 0-2 jets | Yes | 20.3 | $\tilde g$ | 1.6 TeV | $\tan\beta$ >20 | 1407.0603 |
| | GGM (bino NLSP) | 2 $\gamma$ | - | Yes | 20.3 | $\tilde g$ | 1.28 TeV | $m(\tilde\chi_1^0)$>50 GeV | ATLAS-CONF-2014-001 |
| | GGM (wino NLSP) | 1 $e,\mu+\gamma$ | - | Yes | 4.8 | $\tilde g$ | 619 GeV | $m(\tilde\chi_1^0)$>50 GeV | ATLAS-CONF-2012-144 |
| | GGM (higgsino-bino NLSP) | $\gamma$ | 1 $b$ | Yes | 4.8 | $\tilde g$ | 900 GeV | $m(\tilde\chi_1^0)$>220 GeV | 1211.1167 |
| | GGM (higgsino NLSP) | 2 $e,\mu$ ($Z$) | 0-3 jets | Yes | 5.8 | $\tilde g$ | 690 GeV | m(NLSP)>200 GeV | ATLAS-CONF-2012-152 |
| | Gravitino LSP | 0 | mono-jet | Yes | 10.5 | $F^{1/2}$ scale | 645 GeV | $m(\tilde G)>10^{-4}$ eV | ATLAS-CONF-2012-147 |
| 3$^{rd}$ gen. $\tilde g$ med. | $\tilde g \to b\bar b\tilde\chi_1^0$ | 0 | 3 $b$ | Yes | 20.1 | $\tilde g$ | 1.25 TeV | $m(\tilde\chi_1^0)$<400 GeV | 1407.0600 |
| | $\tilde g \to t\bar t\tilde\chi_1^0$ | 0 | 7-10 jets | Yes | 20.3 | $\tilde g$ | 1.1 TeV | $m(\tilde\chi_1^0)$ <350 GeV | 1308.1841 |
| | $\tilde g \to t\bar t\tilde\chi_1^0$ | 0-1 $e,\mu$ | 3 $b$ | Yes | 20.1 | $\tilde g$ | 1.34 TeV | $m(\tilde\chi_1^0)$<400 GeV | 1407.0600 |
| | $\tilde g \to b\bar t\tilde\chi_1^+$ | 0-1 $e,\mu$ | 3 $b$ | Yes | 20.1 | $\tilde g$ | 1.3 TeV | $m(\tilde\chi_1^0)$<300 GeV | 1407.0600 |
| 3$^{rd}$ gen. squarks direct production | $\tilde b_1\tilde b_1$, $\tilde b_1 \to b\tilde\chi_1^0$ | 0 | 2 $b$ | Yes | 20.1 | $\tilde b_1$ | 100-620 GeV | $m(\tilde\chi_1^0)$<90 GeV | 1308.2631 |
| | $\tilde b_1\tilde b_1$, $\tilde b_1 \to t\tilde\chi_1^\pm$ | 2 $e,\mu$ (SS) | 0-3 $b$ | Yes | 20.3 | $\tilde b_1$ | 275-440 GeV | $m(\tilde\chi_1^\pm)$=2 $m(\tilde\chi_1^0)$ | 1404.2500 |
| | $\tilde t_1\tilde t_1$(light), $\tilde t_1 \to b\tilde\chi_1^\pm$ | 1-2 $e,\mu$ | 1-2 $b$ | Yes | 4.7 | $\tilde t_1$ | 110-167 GeV | $m(\tilde\chi_1^0)$=55 GeV | 1208.4305, 1209.2102 |
| | $\tilde t_1\tilde t_1$(light), $\tilde t_1 \to Wb\tilde\chi_1^0$ | 2 $e,\mu$ | 0-2 jets | Yes | 20.3 | $\tilde t_1$ | 130-210 GeV | $m(\tilde\chi_1^0)$ =$m(\tilde t_1)$-$m(W)$-50 GeV, $m(\tilde t_1)$<<$m(\tilde\chi_1^\pm)$ | 1403.4853 |
| | $\tilde t_1\tilde t_1$(medium), $\tilde t_1 \to t\tilde\chi_1^0$ | 2 $e,\mu$ | 2 jets | Yes | 20.3 | $\tilde t_1$ | 215-530 GeV | $m(\tilde\chi_1^0)$=1 GeV | 1403.4853 |
| | $\tilde t_1\tilde t_1$(medium), $\tilde t_1 \to b\tilde\chi_1^\pm$ | 0 | 2 $b$ | Yes | 20.1 | $\tilde t_1$ | 150-580 GeV | $m(\tilde\chi_1^0)$<200 GeV, $m(\tilde\chi_1^\pm)$-$m(\tilde\chi_1^0)$=5 GeV | 1308.2631 |
| | $\tilde t_1\tilde t_1$(heavy), $\tilde t_1 \to t\tilde\chi_1^0$ | 1 $e,\mu$ | 1 $b$ | Yes | 20 | $\tilde t_1$ | 210-640 GeV | $m(\tilde\chi_1^0)$=0 GeV | 1407.0583 |
| | $\tilde t_1\tilde t_1$(heavy), $\tilde t_1 \to t\tilde\chi_1^0$ | 0 | 2 $b$ | Yes | 20.1 | $\tilde t_1$ | 260-640 GeV | $m(\tilde\chi_1^0)$=0 GeV | 1406.1122 |
| | $\tilde t_1\tilde t_1$, $\tilde t_1 \to c\tilde\chi_1^0$ | 0 | mono-jet/$c$-tag | Yes | 20.3 | $\tilde t_1$ | 90-240 GeV | $m(\tilde t_1)$-$m(\tilde\chi_1^0)$<85 GeV | 1407.0608 |
| | $\tilde t_1\tilde t_1$(natural GMSB) | 2 $e,\mu$ ($Z$) | 1 $b$ | Yes | 20.3 | $\tilde t_1$ | 150-580 GeV | $m(\tilde\chi_1^0)$>150 GeV | 1403.5222 |
| | $\tilde t_2\tilde t_2$, $\tilde t_2 \to \tilde t_1 + Z$ | 3 $e,\mu$ ($Z$) | 1 $b$ | Yes | 20.3 | $\tilde t_2$ | 290-600 GeV | $m(\tilde\chi_1^0)$<200 GeV | 1403.5222 |
| EW direct | $\tilde\ell_{L,R}\tilde\ell_{L,R}$, $\tilde\ell \to \ell\tilde\chi_1^0$ | 2 $e,\mu$ | 0 | Yes | 20.3 | $\tilde\ell$ | 90-325 GeV | $m(\tilde\chi_1^0)$=0 GeV | 1403.5294 |
| | $\tilde\chi_1^+\tilde\chi_1^-$, $\tilde\chi_1^+ \to \tilde\ell\nu(\ell\tilde\nu)$ | 2 $e,\mu$ | 0 | Yes | 20.3 | $\tilde\chi_1^\pm$ | 140-465 GeV | $m(\tilde\chi_1^0)$=0 GeV, $m(\tilde\ell,\tilde\nu)=0.5(m(\tilde\chi_1^\pm)+m(\tilde\chi_1^0))$ | 1403.5294 |
| | $\tilde\chi_1^+\tilde\chi_1^-$, $\tilde\chi_1^+ \to \tilde\tau\nu(\tau\tilde\nu)$ | 2 $\tau$ | - | Yes | 20.3 | $\tilde\chi_1^\pm$ | 100-350 GeV | $m(\tilde\chi_1^0)$=0 GeV, $m(\tilde\tau,\tilde\nu)=0.5(m(\tilde\chi_1^\pm)+m(\tilde\chi_1^0))$ | 1407.0350 |
| | $\tilde\chi_1^\pm\tilde\chi_2^0 \to \tilde\ell_L\nu\tilde\ell_L\ell(\tilde\nu\nu)$, $\ell\tilde\nu\tilde\ell_L\ell(\tilde\nu\nu)$ | 3 $e,\mu$ | 0 | Yes | 20.3 | $\tilde\chi_1^\pm, \tilde\chi_2^0$ | 700 GeV | $m(\tilde\chi_1^\pm)=m(\tilde\chi_2^0)$, $m(\tilde\chi_1^0)$=0, $m(\tilde\ell,\tilde\nu)=0.5(m(\tilde\chi_1^\pm)+m(\tilde\chi_1^0))$ | 1402.7029 |
| | $\tilde\chi_1^\pm\tilde\chi_2^0 \to W\tilde\chi_1^0 Z\tilde\chi_1^0$ | 2-3 $e,\mu$ | 0 | Yes | 20.3 | $\tilde\chi_1^\pm, \tilde\chi_2^0$ | 420 GeV | $m(\tilde\chi_1^\pm)=m(\tilde\chi_2^0)$, $m(\tilde\chi_1^0)$=0, sleptons decoupled | 1403.5294, 1402.7029 |
| | $\tilde\chi_1^\pm\tilde\chi_2^0 \to W\tilde\chi_1^0 h\tilde\chi_1^0$ | 1 $e,\mu$ | 2 $b$ | Yes | 20.3 | $\tilde\chi_1^\pm, \tilde\chi_2^0$ | 285 GeV | $m(\tilde\chi_1^\pm)=m(\tilde\chi_2^0)$, $m(\tilde\chi_1^0)$=0, sleptons decoupled | ATLAS-CONF-2013-093 |
| | $\tilde\chi_2^0\tilde\chi_3^0$, $\tilde\chi_{2,3}^0 \to \tilde\ell_R\ell$ | 4 $e,\mu$ | 0 | Yes | 20.3 | $\tilde\chi_{2,3}^0$ | 620 GeV | $m(\tilde\chi_2^0)=m(\tilde\chi_3^0)$, $m(\tilde\chi_1^0)$=0, $m(\tilde\ell,\tilde\nu)=0.5(m(\tilde\chi_2^0)+m(\tilde\chi_1^0))$ | 1405.5086 |
| Long-lived particles | Direct $\tilde\chi_1^+\tilde\chi_1^-$ prod., long-lived $\tilde\chi_1^\pm$ | Disapp. trk | 1 jet | Yes | 20.3 | $\tilde\chi_1^\pm$ | 270 GeV | $m(\tilde\chi_1^\pm)$-$m(\tilde\chi_1^0)$=160 MeV, $\tau(\tilde\chi_1^\pm)$=0.2 ns | ATLAS-CONF-2013-069 |
| | Stable, stopped $\tilde g$ R-hadron | 0 | 1-5 jets | Yes | 27.9 | $\tilde g$ | 832 GeV | $m(\tilde\chi_1^0)$=100 GeV, 10 $\mu$s<$\tau(\tilde g)$<1000 s | 1310.6584 |
| | GMSB, stable $\tilde\tau$, $\tilde\chi_1^0 \to \tilde\tau(\tilde e,\tilde\mu)+\tau(e,\mu)$ | 1-2 $\mu$ | - | - | 15.9 | $\tilde\chi_1^0$ | 475 GeV | 10<$\tan\beta$<50 | ATLAS-CONF-2013-058 |
| | GMSB, $\tilde\chi_1^0 \to \gamma\tilde G$, long-lived $\tilde\chi_1^0$ | 2 $\gamma$ | - | Yes | 4.7 | $\tilde\chi_1^0$ | 230 GeV | 0.4<$\tau(\tilde\chi_1^0)$<2 ns | 1304.6310 |
| | $\tilde q\tilde q$, $\tilde\chi_1^0 \to qq\mu$ (RPV) | 1 $\mu$, displ. vtx | - | - | 20.3 | $\tilde q$ | 1.0 TeV | 1.5 <$c\tau$<156 mm, BR($\mu$)=1, $m(\tilde\chi_1^0)$=108 GeV | ATLAS-CONF-2013-092 |
| RPV | LFV $pp \to \tilde\nu_\tau + X$, $\tilde\nu_\tau \to e + \mu$ | 2 $e,\mu$ | - | - | 4.6 | $\tilde\nu_\tau$ | 1.61 TeV | $\lambda'_{311}$=0.10, $\lambda_{132}$=0.05 | 1212.1272 |
| | LFV $pp \to \tilde\nu_\tau + X$, $\tilde\nu_\tau \to e(\mu) + \tau$ | 1 $e,\mu + \tau$ | - | - | 4.6 | $\tilde\nu_\tau$ | 1.1 TeV | $\lambda'_{311}$=0.10, $\lambda_{1(2)33}$=0.05 | 1212.1272 |
| | Bilinear RPV CMSSM | 2 $e,\mu$ (SS) | 0-3 $b$ | Yes | 20.3 | $\tilde q, \tilde g$ | 1.35 TeV | $m(\tilde q)=m(\tilde g)$, $c\tau_{LSP}$<1 mm | 1404.2500 |
| | $\tilde\chi_1^+\tilde\chi_1^-$, $\tilde\chi_1^+ \to W\tilde\chi_1^0$, $\tilde\chi_1^0 \to ee\tilde\nu_\mu, e\mu\tilde\nu_e$ | 4 $e,\mu$ | - | Yes | 20.3 | $\tilde\chi_1^\pm$ | 750 GeV | $m(\tilde\chi_1^0)$>0.2×$m(\tilde\chi_1^\pm)$, $\lambda_{121}\neq0$ | 1405.5086 |
| | $\tilde\chi_1^+\tilde\chi_1^-$, $\tilde\chi_1^+ \to W\tilde\chi_1^0$, $\tilde\chi_1^0 \to \tau\tau\tilde\nu_e, e\tau\tilde\nu_\tau$ | 3 $e,\mu + \tau$ | - | Yes | 20.3 | $\tilde\chi_1^\pm$ | 450 GeV | $m(\tilde\chi_1^0)$>0.2×$m(\tilde\chi_1^\pm)$, $\lambda_{133}\neq0$ | 1405.5086 |
| | $\tilde g \to qqq$ | 0 | 6-7 jets | - | 20.3 | $\tilde g$ | 916 GeV | BR($t$)=BR($b$)=BR($c$)=0% | ATLAS-CONF-2013-091 |
| | $\tilde g \to \tilde t_1 t$, $\tilde t_1 \to bs$ | 2 $e,\mu$ (SS) | 0-3 $b$ | Yes | 20.3 | $\tilde g$ | 850 GeV | | 1404.250 |
| Other | Scalar gluon pair, sgluon$\to q\bar q$ | 0 | 4 jets | - | 4.6 | sgluon | 100-287 GeV | incl. limit from 1110.2693 | 1210.4826 |
| | Scalar gluon pair, sgluon$\to t\bar t$ | 2 $e,\mu$ (SS) | 2 $b$ | Yes | 14.3 | sgluon | 350-800 GeV | | ATLAS-CONF-2013-051 |
| | WIMP interaction (D5, Dirac $\chi$) | 0 | mono-jet | Yes | 10.5 | M* scale | 704 GeV | $m(\chi)$<80 GeV, limit of<687 GeV for D8 | ATLAS-CONF-2012-147 |

*Only a selection of the available mass limits on new states or phenomena is shown. All limits quoted are observed minus 1$\sigma$ theoretical signal cross section uncertainty.

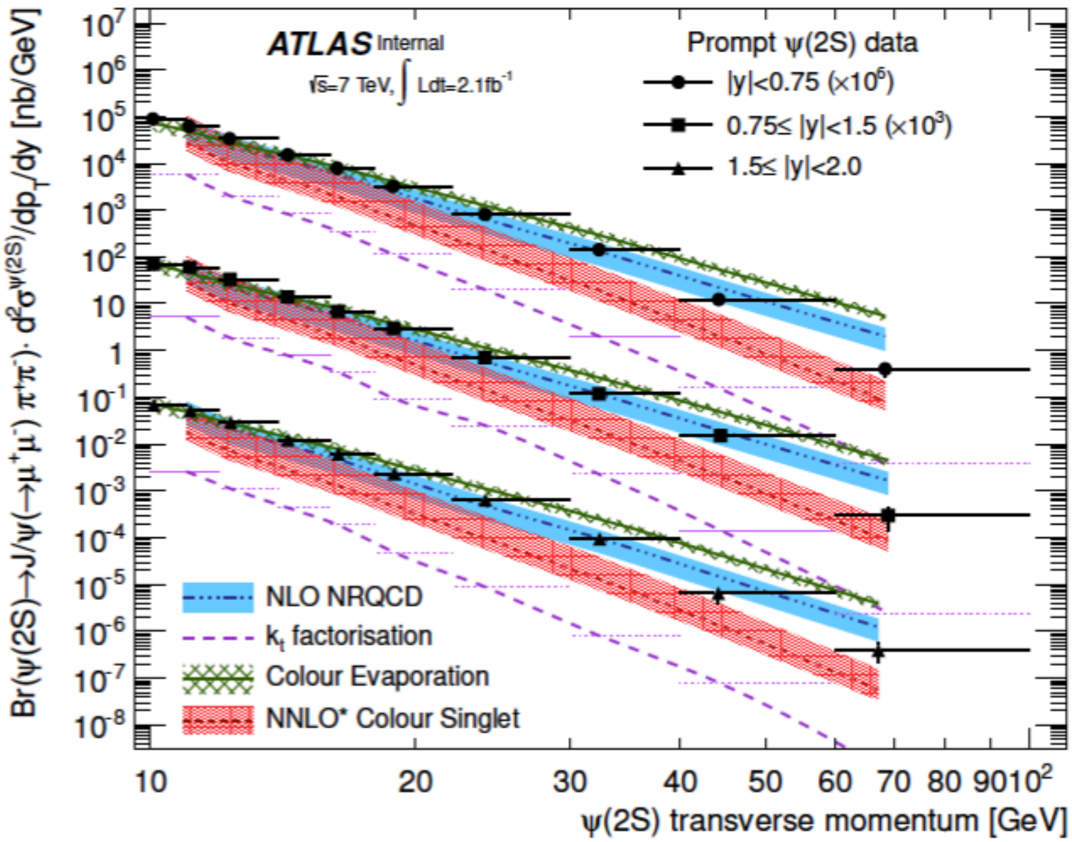
# SUSY searches: Direct Stop pair production



# B Physics

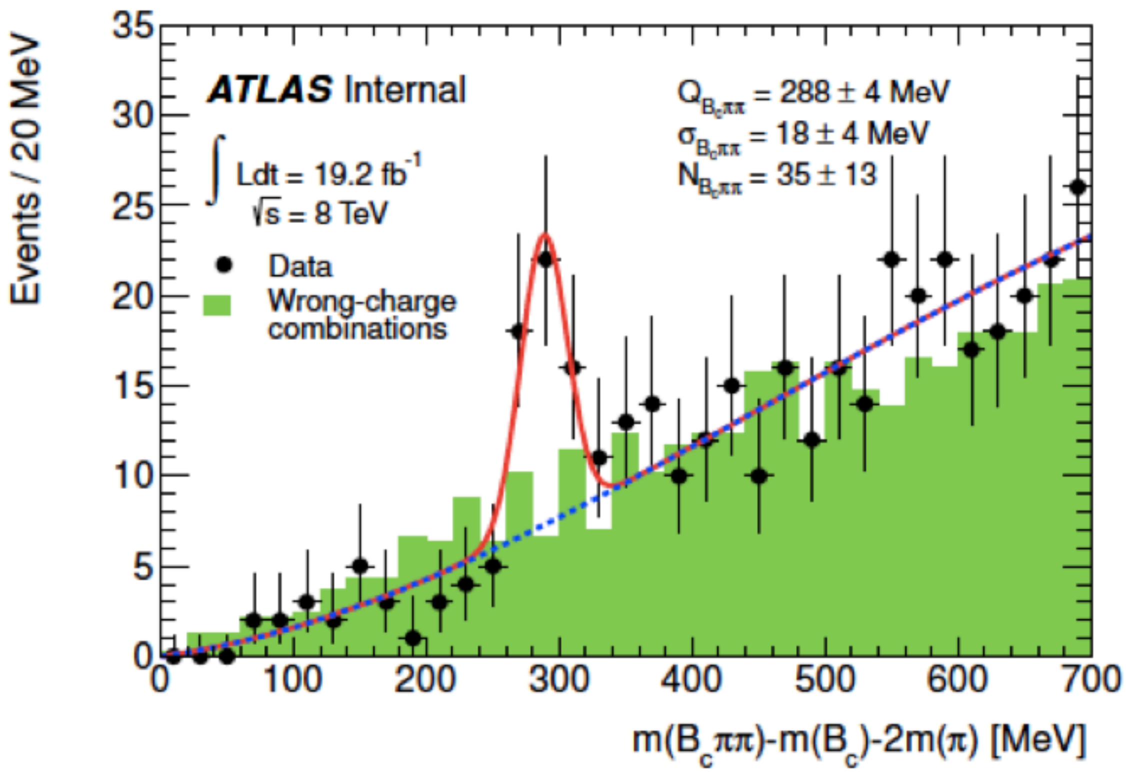
## $\psi(2S) \to J/\psi(\to\mu^+\mu^-)\pi^+\pi^-$ at 7 TeV

- Prompt and non-prompt $\psi(2S)$ meson production
- $\psi(2S)$ measured in the $p_T$ range of 10 – 100 GeV and |y| < 2.0
- Differential cross sections are compared with previous measurements and predictions for $\psi(2S)$ prompt and non-prompt



# Excited $B_c^{\pm}$ at 7 and 8 TeV

- *New excited state observed* with 5.2σ at Mass = 6842 ± 7 ± 4 MeV
- Mass and decay consistent with $B_c^{\pm}(2S)$
- Reconstructed via its decay to $B_c^{\pm}$ and 2 OS π 's, with $B_c^{\pm}$ being reconstructed by its decay $B_c^{\pm} \to J/\psi(\mu^+\mu^-)\pi^{\pm}$




Peak sought in distribution of $m(B_c^{\pm}\pi\pi) - m(B_c^{\pm}) - 2m(\pi^{\pm})$

# LECCE ACTIVITY & CONTRIBUTIONS

# Activities

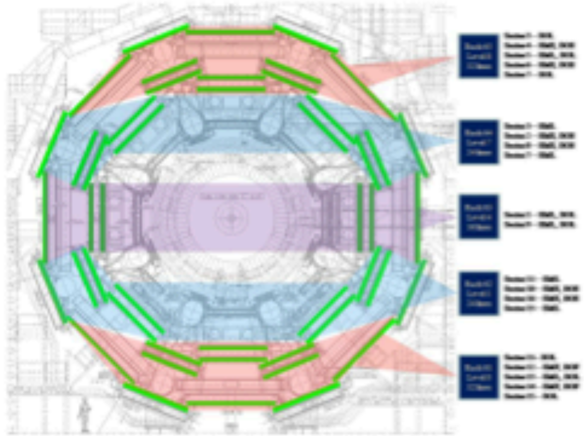
- Hardware
  - RPC: riparazioni gas inlets (GF, AI, AM, PM)
  - Micromegas: Progettazione e Lavorazioni Meccaniche (MC, EG, GF, AI, AM, PM)
  - Micromegas: Partecipazione a Test Beams (EG, MP, AV)
- Detector Performance
  - Muon High Level Trigger Performance (MP, AV)
  - Muon Trigger Validation (AV)
  - Micromegas Test Beams Analyses, starting up (MA,EG, MP, AV)
  - RPC maintenance, simulazioni e R&D (GC, NO, SS)
  - Muon Performance at low pt with Data (GC ,NO ,SS)
- Physics
  - Z/W+ b production (GC, NO, SS)
  - Analisi di produzione diretta di stop con decadimenti con 2 leptoni (MA, AD, EG, LL, MP, MR, AV)
    - Stop->t+neutralino
    - Stop->b+chargino
    - Stop->stau+b+neutrino

# RPC

G.Fiore,A.Innocente,A.Miccoli,P.Mazzotta

# RPC Gas Repairs

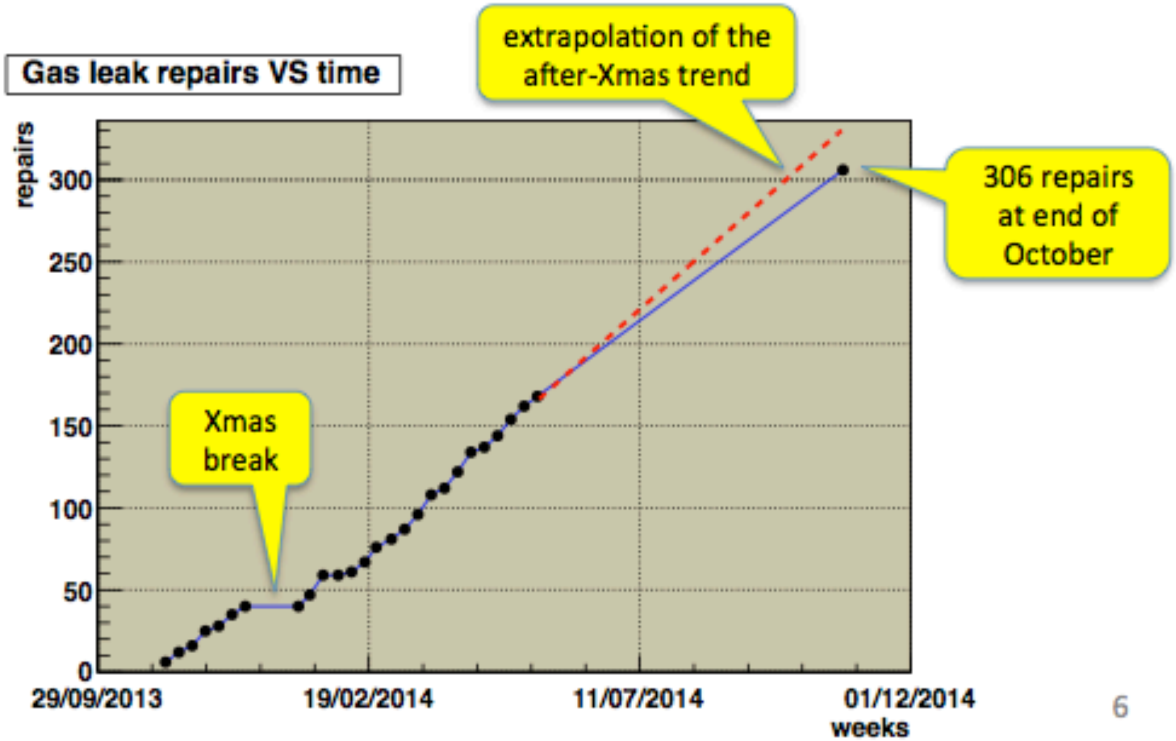
Total number of detected leaks: **306**
(as from the full system check done last year by K.Levterov, D.Kharchenko, U.Kruchonak)



Repaired leaks → ~**170**

~Every week two teams (1 russian + 1 italian) working in parallel with the 2 available endoscopes

Repair rate seems reasonably good

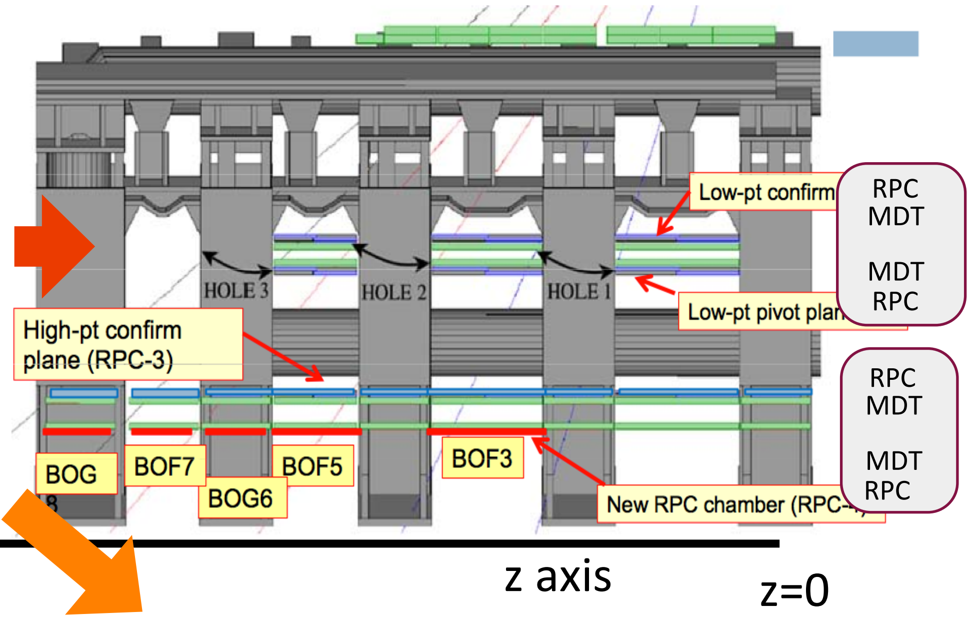


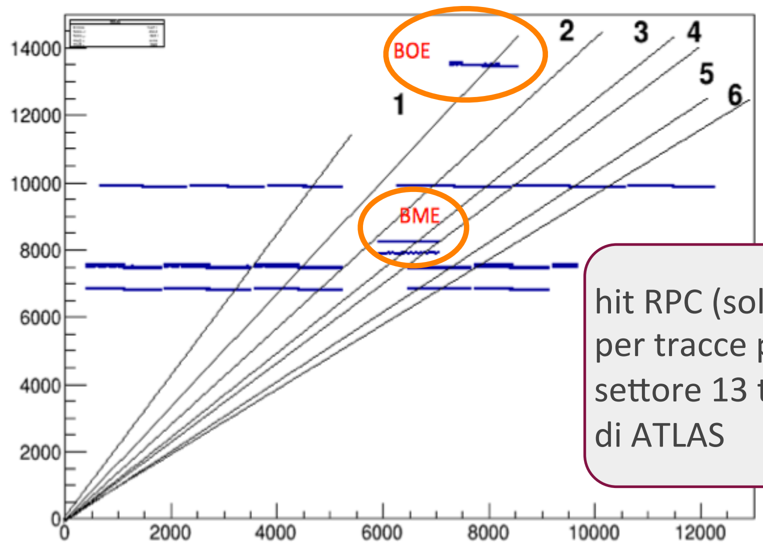

6

# RPC detector maintenance, studi, simulazioni

- durante questo shut-down sono state installate
  - le schede di lettura (e trigger) delle **camere extra nei settori (14 e 15) dei piedi**
  - **alcune camere** MDT+**RPC in buchi di accettanza** (per ascensori nel settore tra i piedi) settore 13
- nostro ruolo: integrazione di queste nuove camere nella simulazione e nel data model di ATLAS, per consentire la lettura, decodifica, configurazione delle strade di trigger e utilizzo dei dati *(lavoro in corso)*
  - update del software di cabling, decodifica, integrazione nel monitoring offline, simulazione e ricostruzione
  - commissioning con i dati

## Update on new lev-1 feet trigger




hit RPC (soltanto) per tracce prompt settore 13 tra i piedi di ATLAS

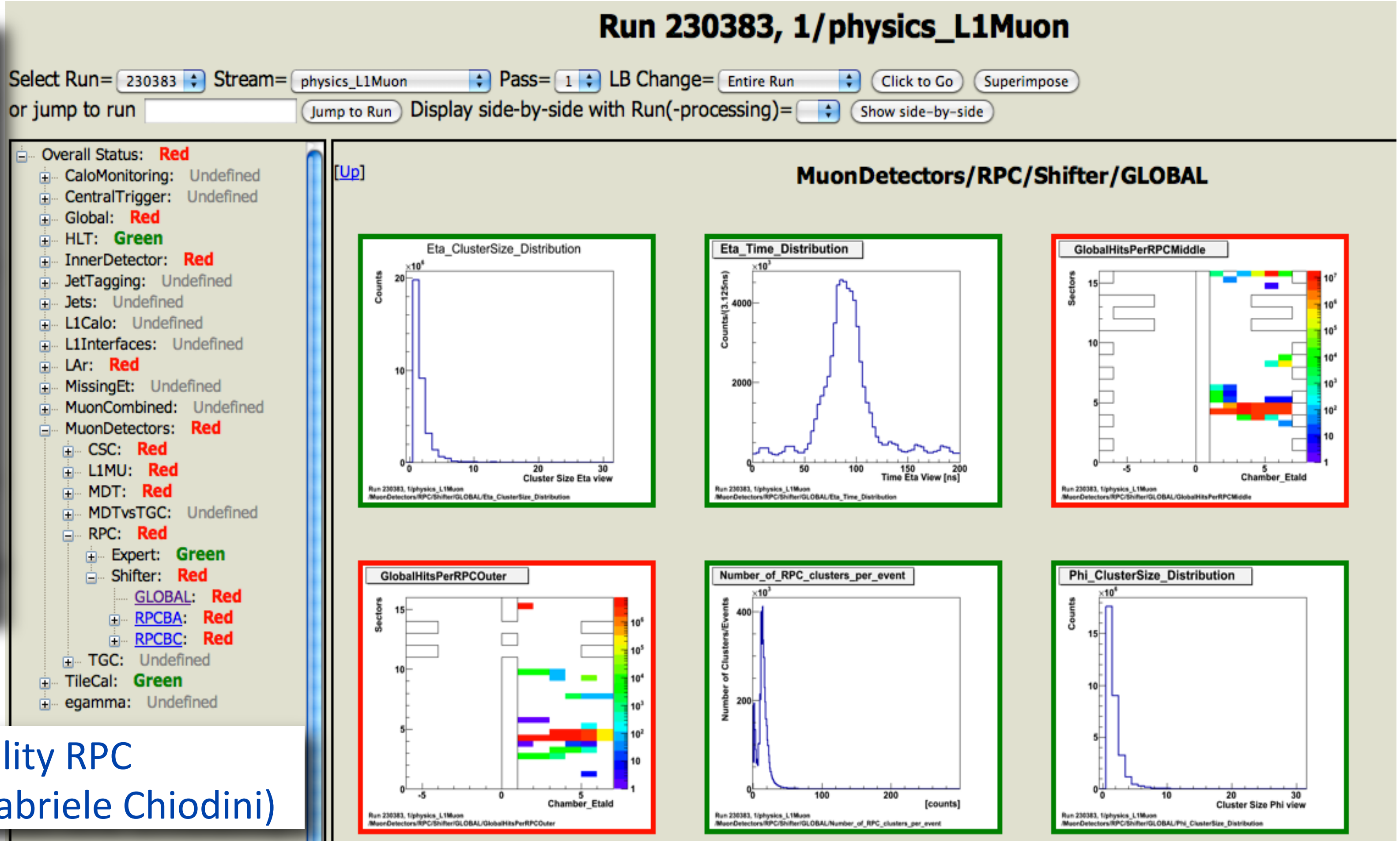
G.Chiodini, N.Orlando,

# RPC detector maintenance, studi, simulazioni

Ri-commissioning del detector dopo lo stop

A maggio 2 prese dati di cosmici per esercitare il sistema

Ri-commissioning delle procedure di data-quality ensurance durante la presa dati




web display dal processing ufficiale al Tier0 di un run di cosmici di Maggio

Offline data quality RPC (responsabile Gabriele Chiodini)

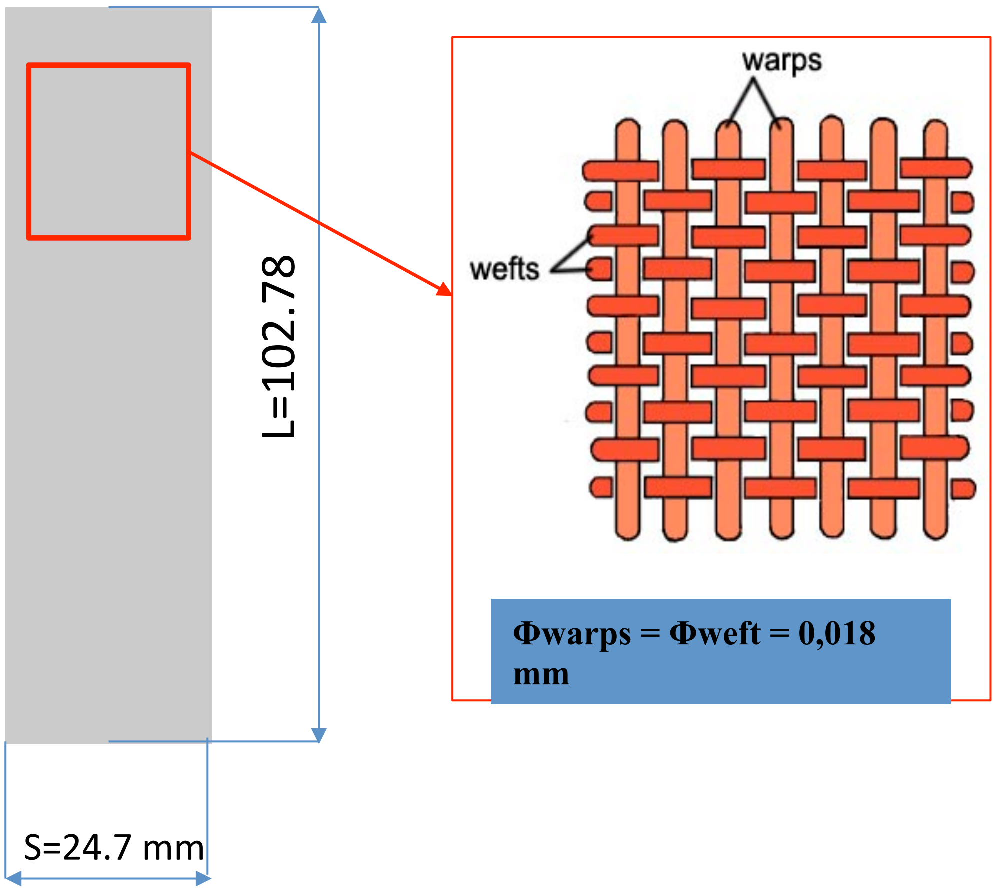
Adeguamento del software di monitoring RPC a vari cambiamenti generali nel software offline di ATLAS completato

In ripartenza l'attività di studio sistematico dei dati e confronto/tuning del MC (G. Chiodini, Nicola O. )

# MICROMEGAS

# TENSILE TESTING OF MESH MATERIAL

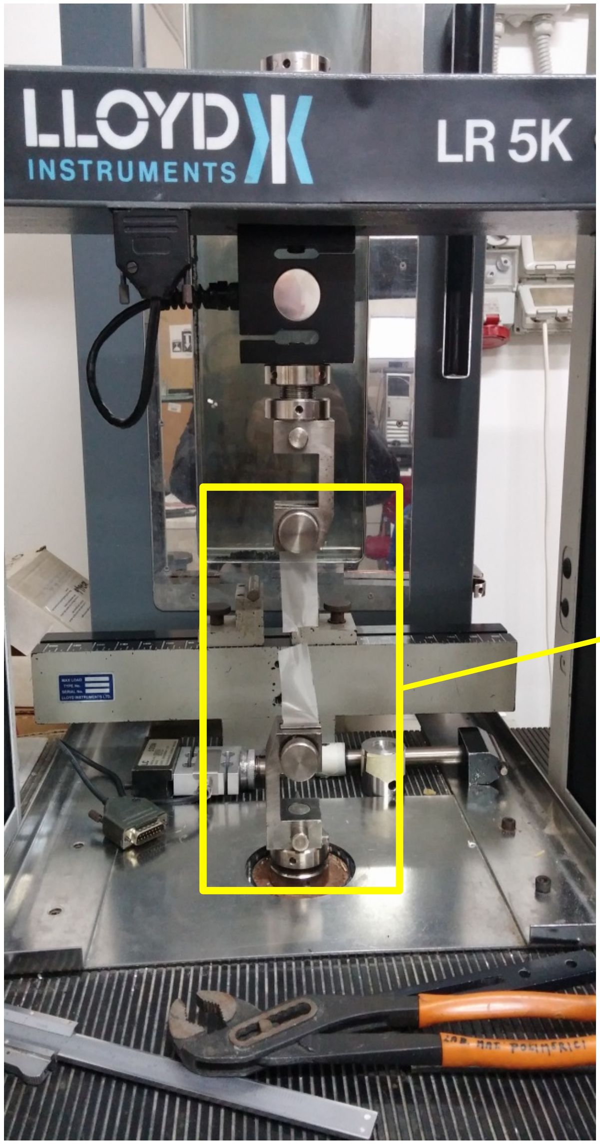
## TENSILE SPECIMEN




## TENSILE TESTING MACHINE

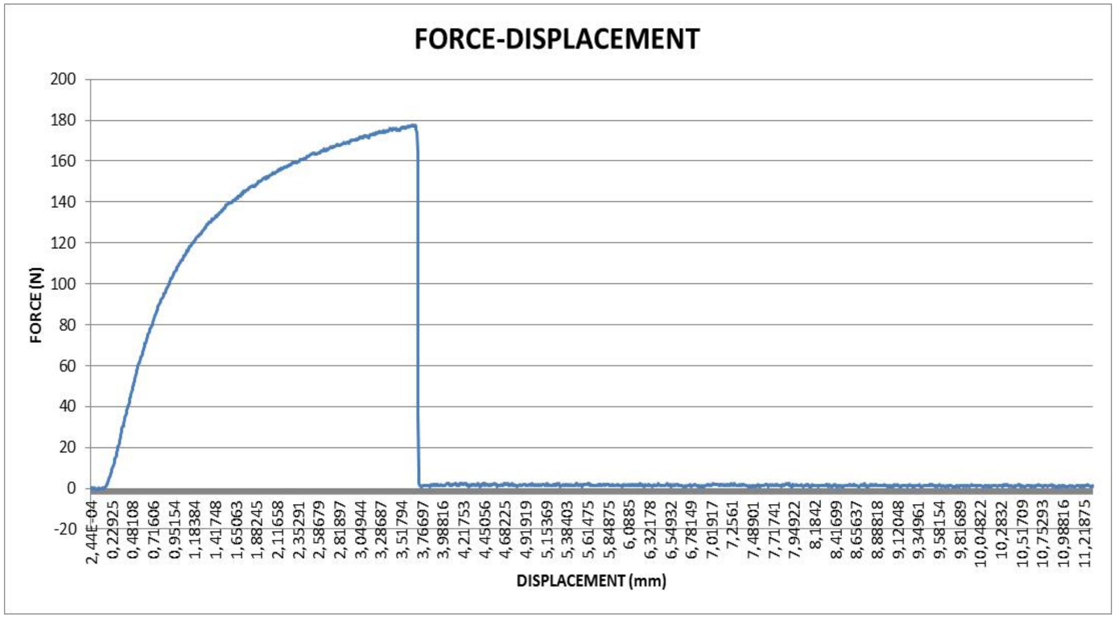

**MACHINE MODEL LLOYD LR 5K**

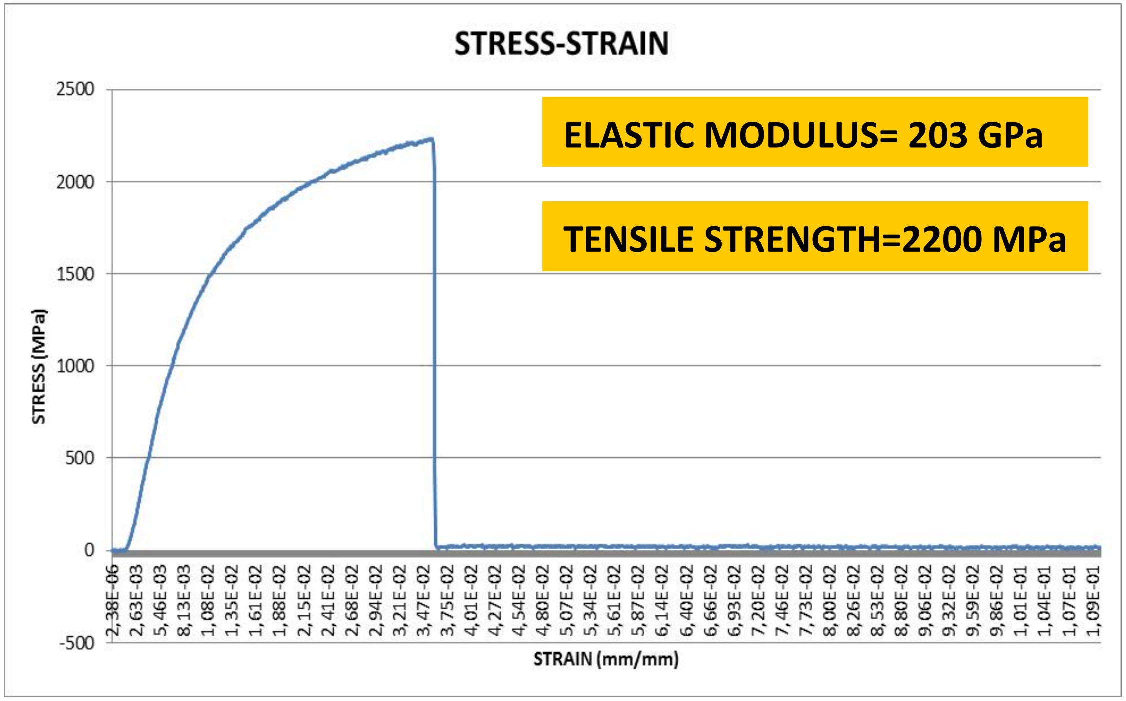
# TENSILE TESTING RESULTS




TENSILE RUPTURE SPECIMEN

# TENSILE TESTING RESULTS




STRESS
$\sigma = FORCE/SECTION$

Section= $Area_{wire} * N°_{wire}$
(N°wire=313)

STRAIN
$\epsilon = DISPLACEMENT/L$

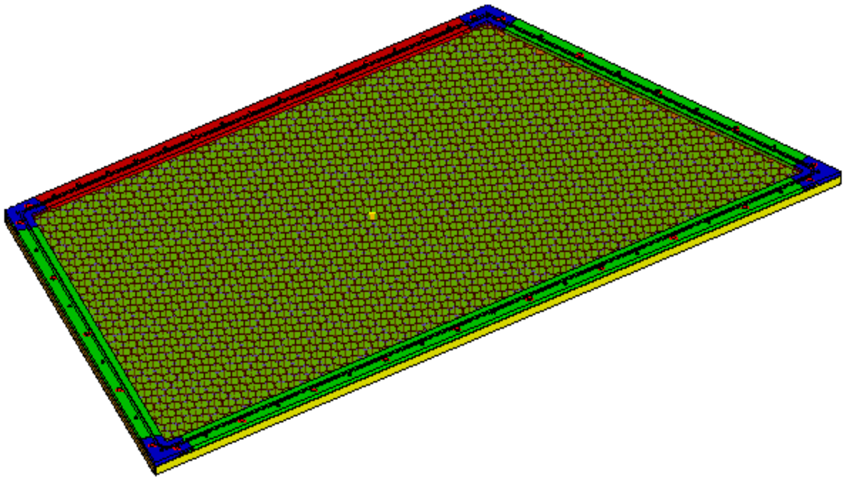
# PROTOTYPE FE MODEL

Testing test result are used to model the mesh material in the numerical analysis

Now we have modelled the CERN prototype ( drift panel)

We are making a small panel of composite material in order to calibrate the FE model.

Future developments are to make and test a new equipment that allows to reduce the panel deformation induced by mesh gluing



# Micromegas Test Beam Analysis

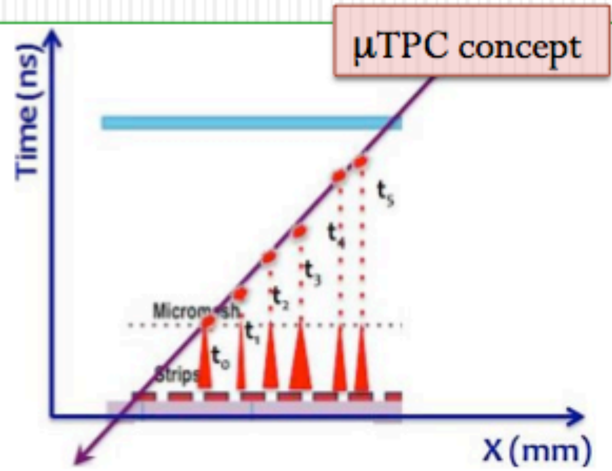
## Results: space resolution - I

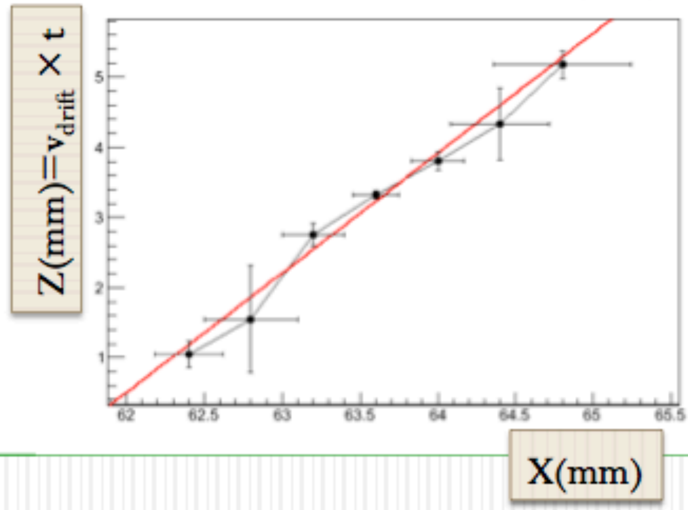
- X coordinate obtained:
  - charge centroid
  - µTPC (position at half gap after tracklet fit $Z=mX+c$)

$$X_{cent} = \frac{\sum_{k=1}^{N} q_k x_k}{\sum_{k=1}^{N} q_k}$$

$$X_{half} = \frac{Z_{half} - c}{m}$$

- The two values of X are combined to improve the resolution especially in the 10° region (where the two methods provide comparable resolutions)
- Resolution extracted from the difference between two chambers (due to the negligible effect of the beam divergence)



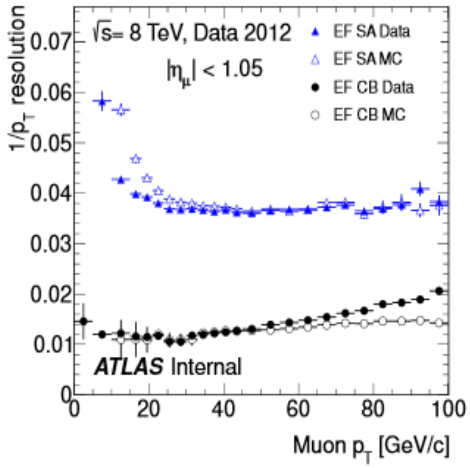




12

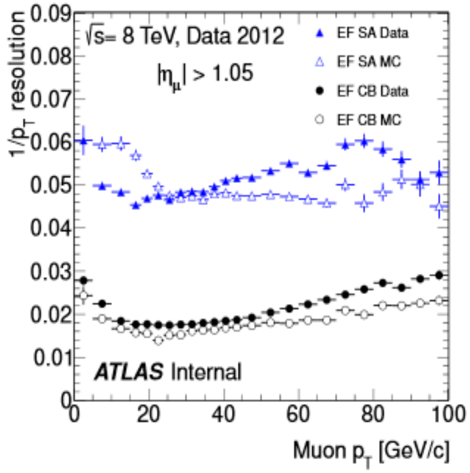
# MUON TRIGGER

# Muon Event Filter Performance

- **General performance studies** (based on T&P using Z -> mumu decays) at L2 and EF are done in Lecce since many years.
- **Resolution** studies for EF standalone and combined algorithms have been provided for *2012 Trigger Performance* : ATLAS-TRIG-2012-03-001 ; CERN-PH-EP-2014-154: **«Performance of the ATLAS muon trigger in pp collisions at √s=8 TeV»** submitted to **Eur. Phys. J. C**
    - **M. Primavera** and **A. Ventura** are among the editors of the corresponding ATLAS note

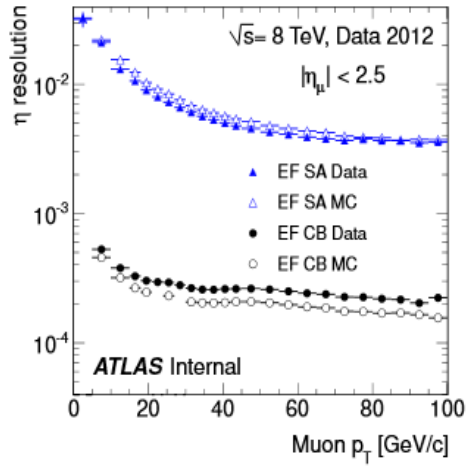



(a) Resolution on $p_T$ in the barrel region as a function of offline $p_T$.

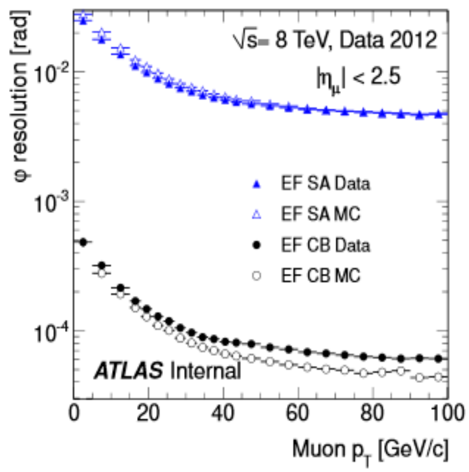



(b) Resolution on $p_T$ in the endcap region as a function of offline $p_T$.

**Fig. 5** Resolution on $p_T$ reconstruction by the EF algorithms, as a function of $p_T$ of offline reconstruction. Separately shown for (a) the barrel region and (b) the endcap region.




(a) Resolution on $\eta$ as a function of offline $p_T$.



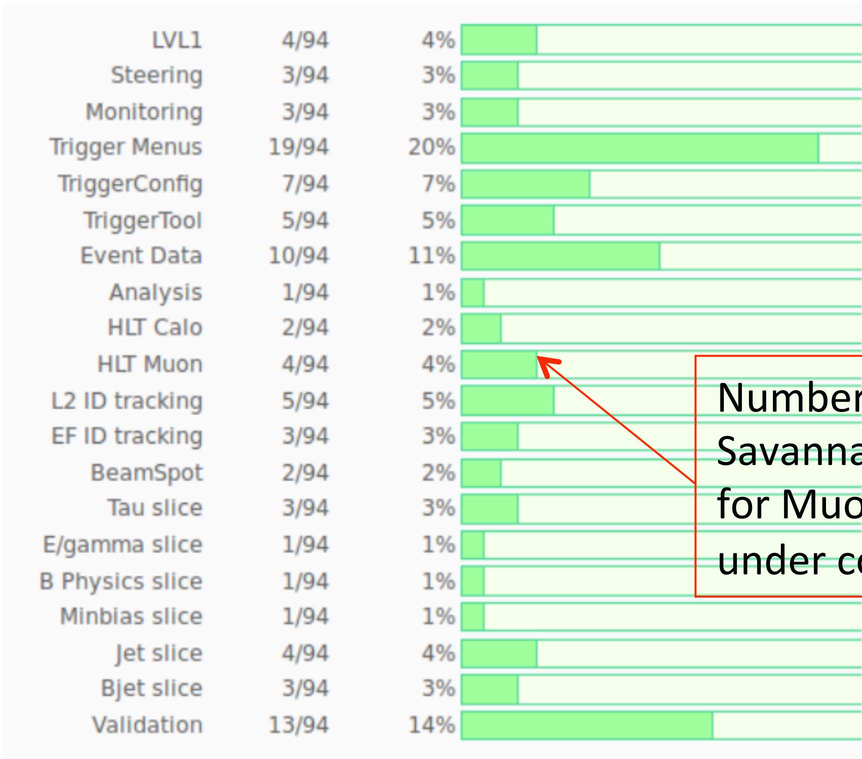

(b) Resolution on $\phi$ as a function of offline $p_T$.

**Fig. 6** Resolution on $\eta$ and $\phi$ reconstruction by the EF algorithms, as a function of $p_T$ of offline reconstruction.

# Muon Trigger Validation

- Muon trigger validation team is fully italian (Cosenza+Lecce+Roma1+Roma3)
  - **A. Ventura** is presently also coordinating the central *ATLAS Trigger Validation* (corresponding to a total of 10 ATLAS-wide signature groups)
- Muon L1/L2/EF performance validated on data and MC samples
  - Contribution to Physics Validation rounds in terms of performance and count checks
- Trigger menu validation (presently «M4») ongoing
  - New chains on MC and data

- Presently validating muon trigger Event Data Model (EDM) for rel. 19.0.X production caches in order to get ready for next Data Challenge (DC14) planned for the forthcoming Run-2 (year 2015)




Number of Savannah bugs for Muons is under control

# ELECTROWEAK PHYSICS

# Z+b production at LHC with ATLAS

test per pQCD e potenziale sensitivita' alla pdf del b; misura di un background importante alla ricerca di Higgs in ZZ* con b nello stato finale

- **misura d'urto differenziale di b-jets in associazione con Z** con i dati di ATLAS a √s=7 TeV (run 2011, 4.7fb$^{-1}$)
  - evoluzione di sezione d'urto totale di b-jets + Z con i dati 2010
    - ATL-COM-PHYS-2011-685 (internal doc. ) Phys.Lett. B706 (2012) 295-313
- lungo processo di review terminato a inizio Giugno 2014
  - Lecce + Liverpool + UCL + contributi minori di LMU + Bonn -
  - **ruolo leccese centrale in tutti gli aspetti dell'analisi** (selezione, unfolding, background data driven, yield extraction, derivazione delle predizioni teoriche **[collaborazione con F. Maltoni, M Zaro, ospite 2013, e altri ...])**
  - **Risultati: presentati da ATLAS a varie conferenze di questa estate:**
    - LHCP, New York, **QCD2014 Montpellier Nicola Orlando,** ICHEP Valencia
  - **Articolo:**
    - ultimi commenti di stile per "Spokesperson sign-off" 9-7-2014
    - **invio a JHEP entro questa settimana**
- argomento della tesi di dottorato di Nicola O. (esame finale 15 Luglio)

ATLAS Draft

**Measurement of differential production cross-sections for a $Z$ boson in association with $b$-jets in 7 TeV proton-proton collisions with the ATLAS detector**

STDM-2012-15

**Version:** 2.0

**To be submitted to:** JHEP

**Supporting internal notes**

ATL-COM-PHYS-2012-1504 https://cds.cern.ch/record/1484442

**...mments are due by:** May 30, 2014

THE ASSOCIATED PRODUCTION OF A Z GAUGE BOSON AND B-JETS AT LHC WITH THE ATLAS EXPERIMENT: FIRST DIFFERENTIAL CROSS SECTION MEASUREMENTS

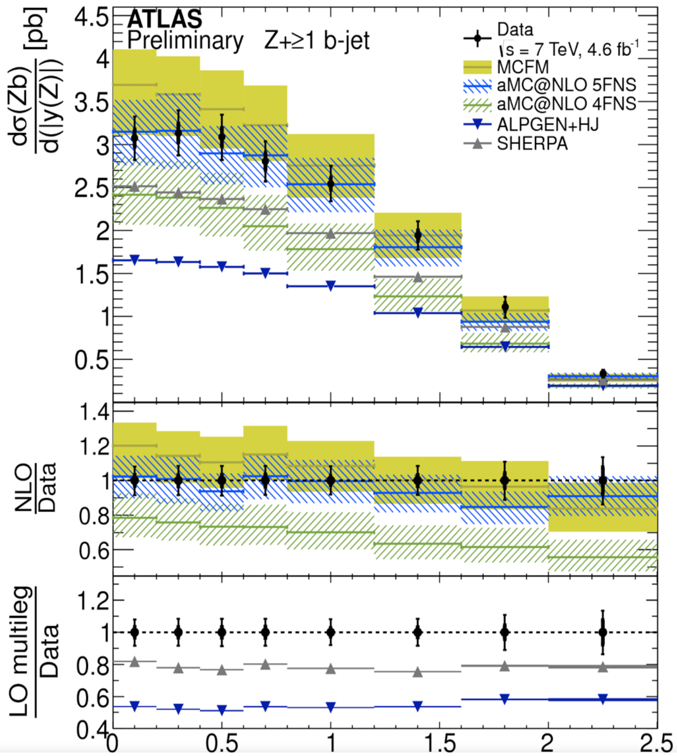
PhD Candidate
Dr. Nicola Orlando

Referee esterno: Pippa Wells, CERN
chair dell'editorial board di STDM-2012-15

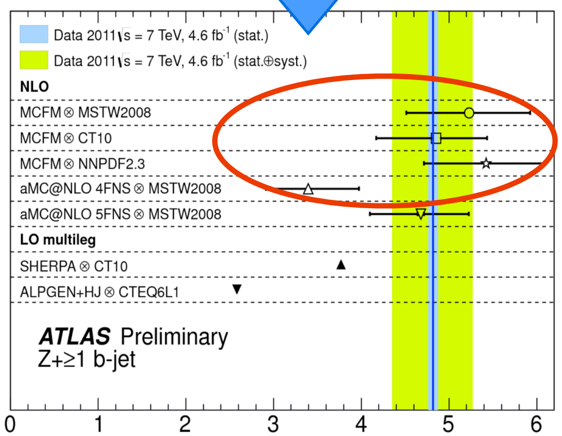
# Z+b production at LHC with ATLAS

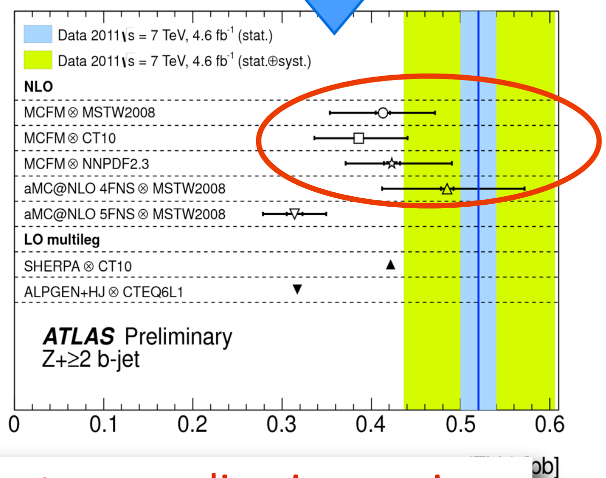
Prima misura differenziale corretta per effetti di detector (confrontabile con predizioni di generatori) e integrale dei **due stati finali Zb+X e Zbb+X**

**perciò più sensibile** a differenti approssimazioni nelle predizioni teoriche finora confrontate a misure analoghe




sezione d'urto differenziale in rapidità della Z
sezione d'urto integrale (nella regione fiduciale dell'analisi) per Zb+X e Zbb+X




Cosa si impara:

predizioni per HQ production ancora affette da errori teorici importanti; alcuni schemi di calcolo sfavoriti dai dati

Nicola O. a University College London, per lavoro di tuning sistematico con i dati dei MC per HQ production (finanziato dal progetto europeo MCnet)

tra le predizioni dello stesso ordine in $\alpha_s$ spicca la discrepanza rispetto ai dati del calcolo in 4 flavor number scheme per Zb

# Z+b production at LHC with ATLAS

- ☐ dal coinvolgimento nell'analisi e nel wg SM +criteri ATLAS per assegnazione dei talks:
  - ☐ G. Chiodini, W/Z+jet production (including HQ) SM@LHC, CIEMAT 8-11Aprile 2014, ATL-PHYS-SLIDE-2014-166, https://cds.cern.ch/record/1698097
  - ☐ N. Orlando, ATLAS measurements of vector boson production, inclusive and with associated jets, QCD-14 Montpellier, 30June-4Jul 2014, ATL-PHYS-SLIDE-2014-402, https://cds.cern.ch/record/1741167
- ☐ Nicola O. contatto del gruppo di fisica SM per b-tagging nel working group "Analysis Harmonization" che cerca di uniformare utilizzo/selezioni/correzioni degli oggetti di fisica nelle varie analisi

# μ performance at low $p_T$ from data

- ☐ N. Orlando,
  - ☐ contributo agli studi di risoluzione in momento trasverso degli algoritmi di ricostruzione di muoni di basso impulso trasverso nel run 1 - dati 2012
- ☐ pubblicato l'articolo sulle performance della ricostruzione di muoni con i primi dati (2010) http://arxiv.org/abs/1404.4562v1- sottomesso a EPJC
  - ☐ ATL-COM-PHYS-2012-069 contiene nostri risultati su efficienza a basso pT

# SUPERSYMMETRY

# Documenti

. **Performance of the ATLAS muon trigger in pp collisions at sqrt(s)=8 TeV** / Almond, J (University of Manchester); Aoki, M (KEK); Biglietti, M (INFN Sezione di Roma Tre); Black, K (Boston University); Catastini, P (Harvard University); Corradi, M (INFN Sezione di Bologna); Della Volpe, D (Universita di Napoli Federico II); Dell'Asta, L (Boston University); DiMattia, A (Michigan State University); Farrington, S (University of Warwick) *et al.*
Given the harsh detector environment produced by collisions of high energy protons at the LHC, events with muons in the final state are an important signature for many physics analyses. The ATLAS experiment employs a multi-level trigger architecture that selects the events in three sequential steps of increasing complexity and accuracy. [...]
ATL-COM-DAQ-2013-147.- Geneva : CERN, 2013

**Search for a scalar top in final states with two leptons and intermediate values of m_T2** / Besana, M; Bianco, M; Brazzale, S; Dondero, P; Gaudio, G; Giordani, M; Gorini, R; Lari, T; Polesello, G; Primavera, M *et al.*
A search is presented for the pair production of scalar top quarks decaying to a lepton (electron or muon), neutrino and the lightest supersymmetric particle (\ninoone) via a $b$-quark and a chargino. The analysis uses $20.3$ \ifb of data collected at $\sqrt{s} = 8$\TeV. [...]
ATL-COM-PHYS-2014-754.- Geneva : CERN, 2014

. **Search for a heavy top partner in final states with two leptons using a multivariate analysis technique** / Besana, ML; Bianco, M; Brazzale, S; Darmora, S; Dondero, P; Favareto, A; Gaudio, G; Giordani, MP; Gorini, E; Lari, T *et al.*
A search is presented for a heavy SUSY top partner decaying in top and neutralino in events with two leptons in the final state by means of a multi-variate analysis technique and using the data collected by ATLAS in 2012 at √s = 8 TeV, corresponding to a total integrated luminosity of 20.3 fb−1. This note updates the results presented in ATLAS-CONF-2013-065..
ATL-COM-PHYS-2013-1318.- Geneva : CERN, 2013 - 122 p.

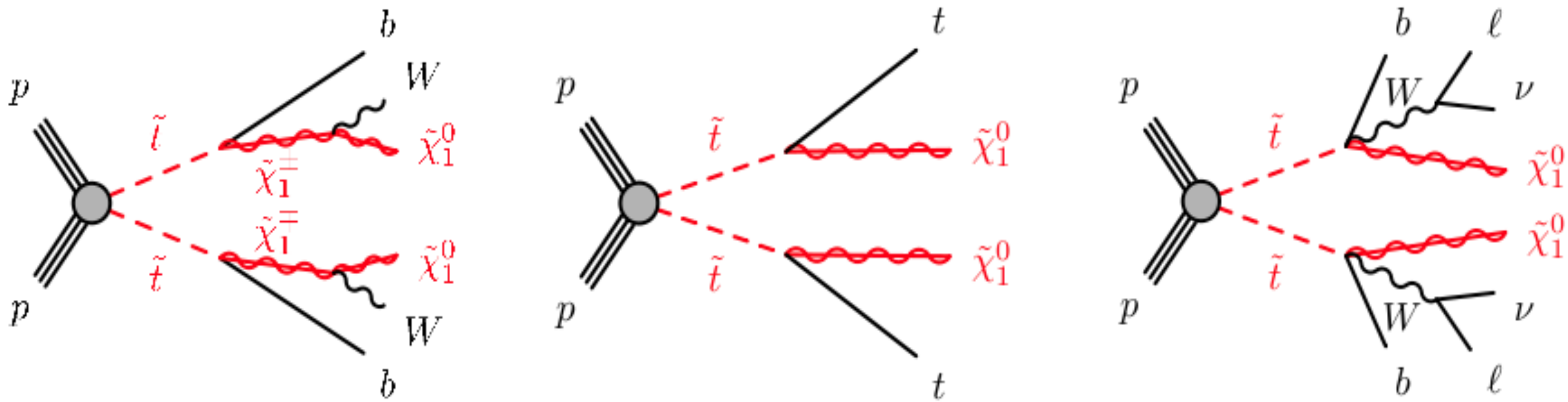
**Search for a scalar top in final states with two leptons and large values of $M_{T2}^{ll}$** / Besana, M I; Bianco, M; Brazzale, S; Dondero, P; Favareto, A; Gaudio, G; Giordani, M P; Gorini, E; Lari, T; Meloni, F *et al.*
A search is presented for the pair production of scalar top quarks decaying to a lepton (electron or muon), neutrino and the lightest supersymmetric particle ($\tilde{\chi}_1^0$), either via a $b$-quark and a chargino or via an off-shell top. The analysis uses $20.3\ fb^{-1}$ of data collected at $\sqrt{s} = 8$ TeV and updates the results presented in ATLAS-CONF-2013-056..
ATL-COM-PHYS-2013-1077.- Geneva : CERN, 2013 - 63 p.

**Search for a scalar top decaying to $\tau$-sleptons, $b$-jets and neutrinos in final states with two leptons** / Besana, M I; Lari, T
A search is presented for the pair production of scalar top quarks decaying into $\tau$-sleptons, $b$-jets and neutrinos, with the $\tau$-slepton decaying to $\tau$+gravitino. Events with both $\tau$ decaying into leptons are targeted. [...]
ATL-COM-PHYS-2013-1656.- Geneva : CERN, 2013

# Produzione diretta e decadimenti dello stop con 2 leptoni nello stato finale

- Finalizzate le analisi e pubblicato l'articolo:

(http://link.springer.com/article/10.1007/JHEP06(2014)124)



$\tilde{t}\tilde{t} \to b\tilde{\chi}^{\pm} b\tilde{\chi}^{\mp}$ $\quad$ $\tilde{t}\tilde{t} \to t\tilde{\chi}_1^0 t\tilde{\chi}_1^0$ $\quad$ $\tilde{t}\tilde{t} \to bW\tilde{\chi}_1^0 bW\tilde{\chi}_1^0$

**CUT & COUNT**
1. **Leptonic $m_{T2}$**: targets b+$\tilde{\chi}^{\pm}$ with large $\Delta m\left(\tilde{\chi}_1^{\pm}, \tilde{\chi}_1^0\right)$, 3-body decay
2. **Hadronic $m_{T2}$**: targets b+$\tilde{\chi}^{\pm}$ with large $\Delta m\left(\tilde{t}_1, \tilde{\chi}_1^{\pm}\right)$

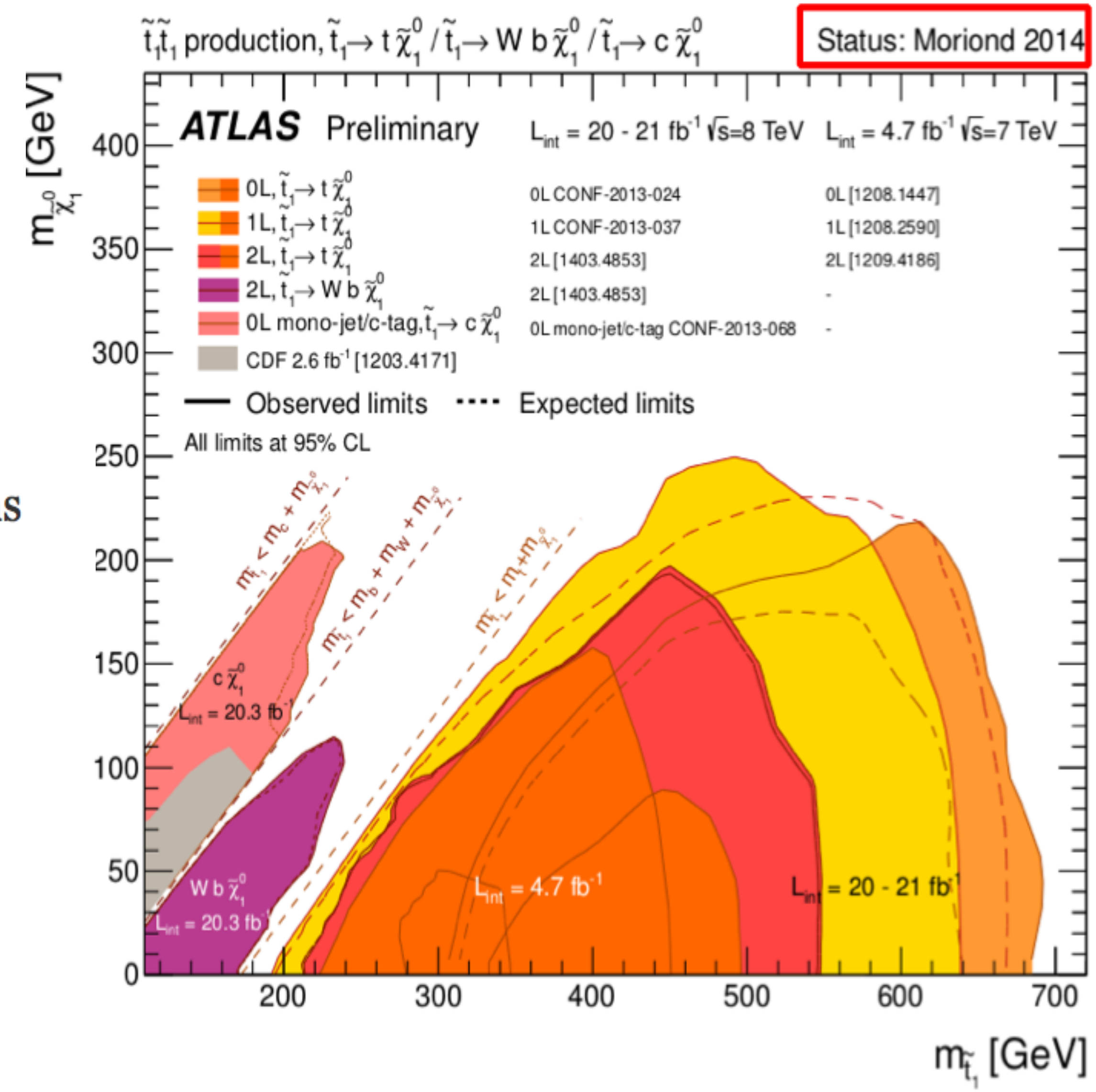
**MVA**
3. **MVA**: targets t + $\tilde{\chi}_1^0$

# stop -> top+neutralino con 2 leptoni nello stato finale

Journal of High Energy Physics
June 2014, 2014:124,
Open Access

Search for direct top-squark pair production in final states with two leptons in pp collisions at $\sqrt{s}$ = 8 TeV with the ATLAS detector

M. Primavera fra gli editors della CONF note presentata a EPS2013 (Stoccolma) e dell'articolo

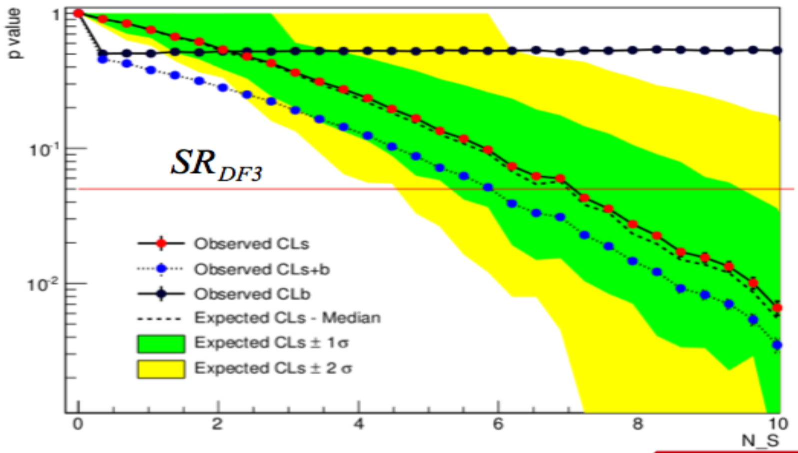


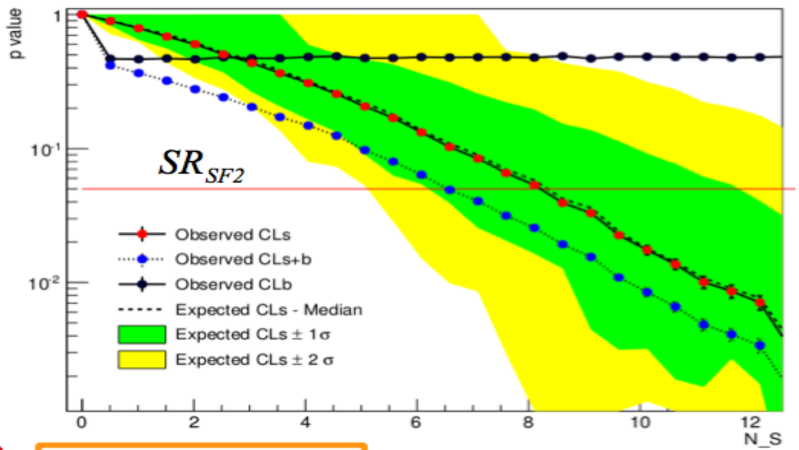
## Regioni di segnale dopo il fit:

| | $SR_{DF1}$ | $SR_{DF2}$ | $SR_{DF3}$ | $SR_{DF4}$ | $SR_{DF5}$ |
|---|---|---|---|---|---|
| Eventi osservati | 9 | 11 | 5 | 3 | 1 |
| Eventi attesi | 5.79±1.94 | 13.32±3.99 | 5.13±1.95 | 1.33±0.95 | 1.04±0.53 |
| Eventi $t\bar{t}$ | 5.02±1.85 | 10.72±3.64 | 3.13±1.65 | 0.56±0.76 | 0.29±0.35 |

| | $SR_{SF1}$ | $SR_{SF2}$ | $SR_{SF3}$ | $SR_{SF4}$ |
|---|---|---|---|---|
| Eventi osservati | 6 | 9 | 0 | 5 |
| Eventi attesi | 7.62±2.24 | 9.48±2.13 | 1.14±0.73 | 2.54±1.04 |
| Eventi $t\bar{t}$ | 7.09±2.22 | 3.81±1.58 | 0.74±0.68 | 0.55±0.49 |

**Nessun eccesso significativo**



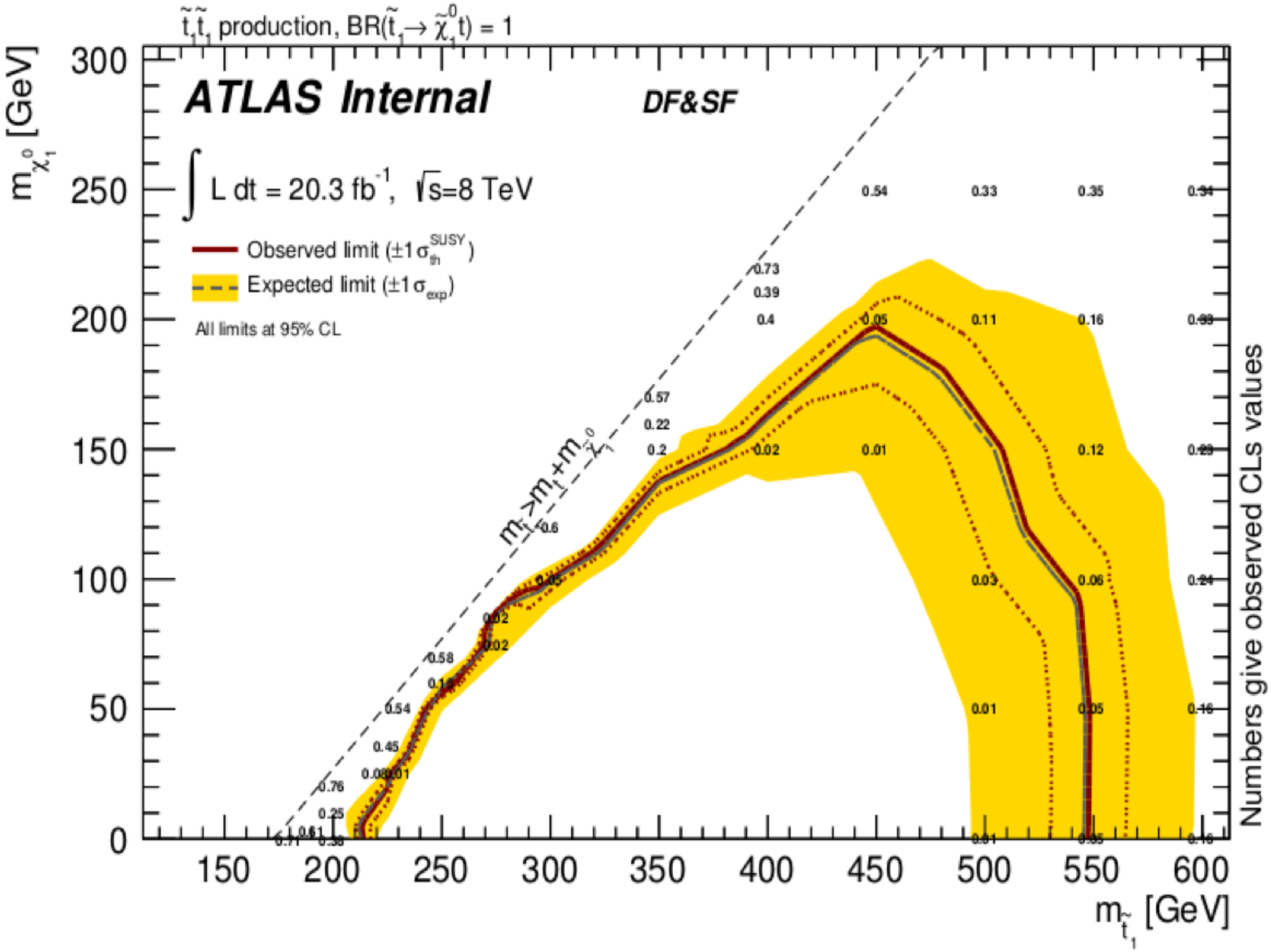




Upper-Limit sulla sezione d'urto visibile ←

| | $\langle \epsilon A \sigma \rangle^{95}_{\rm obs}$[fb] | $S^{95}_{\rm obs}$ | $S^{95}_{\rm exp}$ |
|---|---|---|---|
| $SR_{DF1}$ | 0.48 | 9.7 | $7.7^{+3.1}_{-2.2}$ |
| $SR_{DF2}$ | 0.46 | 9.4 | $10.5^{+3.9}_{-2.9}$ |
| $SR_{DF3}$ | 0.35 | 7.1 | $7.1^{+2.5}_{-1.7}$ |
| $SR_{DF4}$ | 0.32 | 6.5 | $4.5^{+1.8}_{-0.7}$ |
| $SR_{DF5}$ | 0.18 | 3.7 | $3.7^{+1.3}_{-0.4}$ |
| $SR_{SF1}$ | 0.33 | 6.7 | $7.6^{+3.0}_{-2.0}$ |
| $SR_{SF2}$ | 0.41 | 8.2 | $8.4^{+3.4}_{-2.1}$ |
| $SR_{SF3}$ | 0.15 | 3.1 | $3.1^{+1.2}_{-0.0}$ |
| $SR_{SF4}$ | 0.39 | 8.0 | $5.2^{+2.2}_{-1.1}$ |

→ Limite superiore al numero di eventi di segnale

# Stop to Top Neutralino




.... ma ora intendiamo valutare la sensibilità della MVA anche a 1. & 2. !

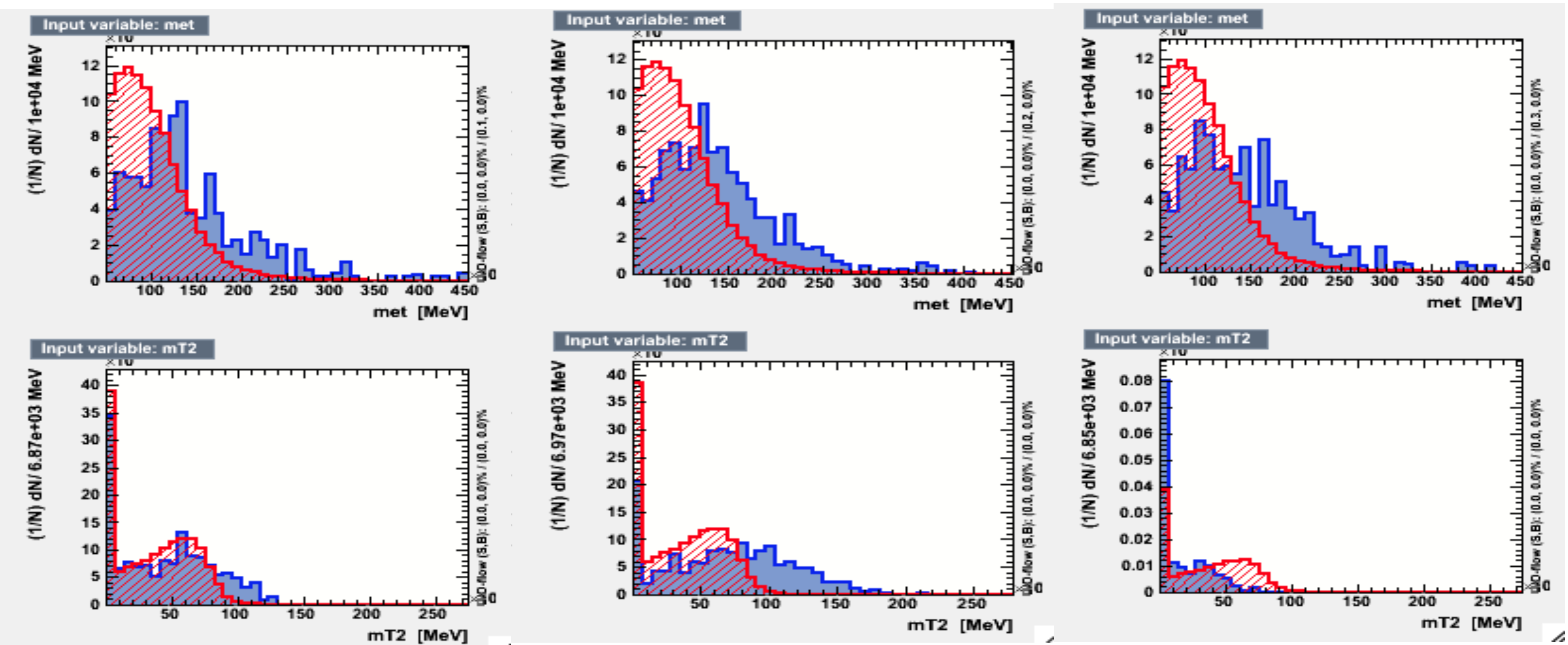
# stop -> b+chargino con 2 leptoni nello stato finale

- ✓ $E_T^{miss}$, $m_{T2}$ , $m_{ll}$ , $\Delta\phi(l_1,E_T^{miss})$, $\Delta\phi(l_1,j_1)$ , $\Delta\phi(l_1,l_2)$, $\Delta\eta(l_1,l_2)$, $\Sigma p_T^{l_i}$, $\Sigma p_T^{j_i}/\Sigma p_T^{l_i}$, $\Delta\phi(E_T^{miss}, p_{Tb}^{ll})$ with $p_{Tb}^{ll}$: $\vec{p}_{Tb}^{\,ll} = \vec{p}_T(l_1) + \vec{p}_T(l_2) + \vec{E}_T^{miss}$
  - ✓ The first 6 variables are the same used in the 2-lepton MVA search
  - ✓ $\Sigma p_T^{li}$ and $\Sigma p_T^{ji}/\Sigma p_T^{li}$ from *arXiv:1304.3148[hep-ph]*
  - ✓ $\Delta\phi(E_T^{miss}, p_{Tb}^{ll})$ already used by cut&count analysis 1.

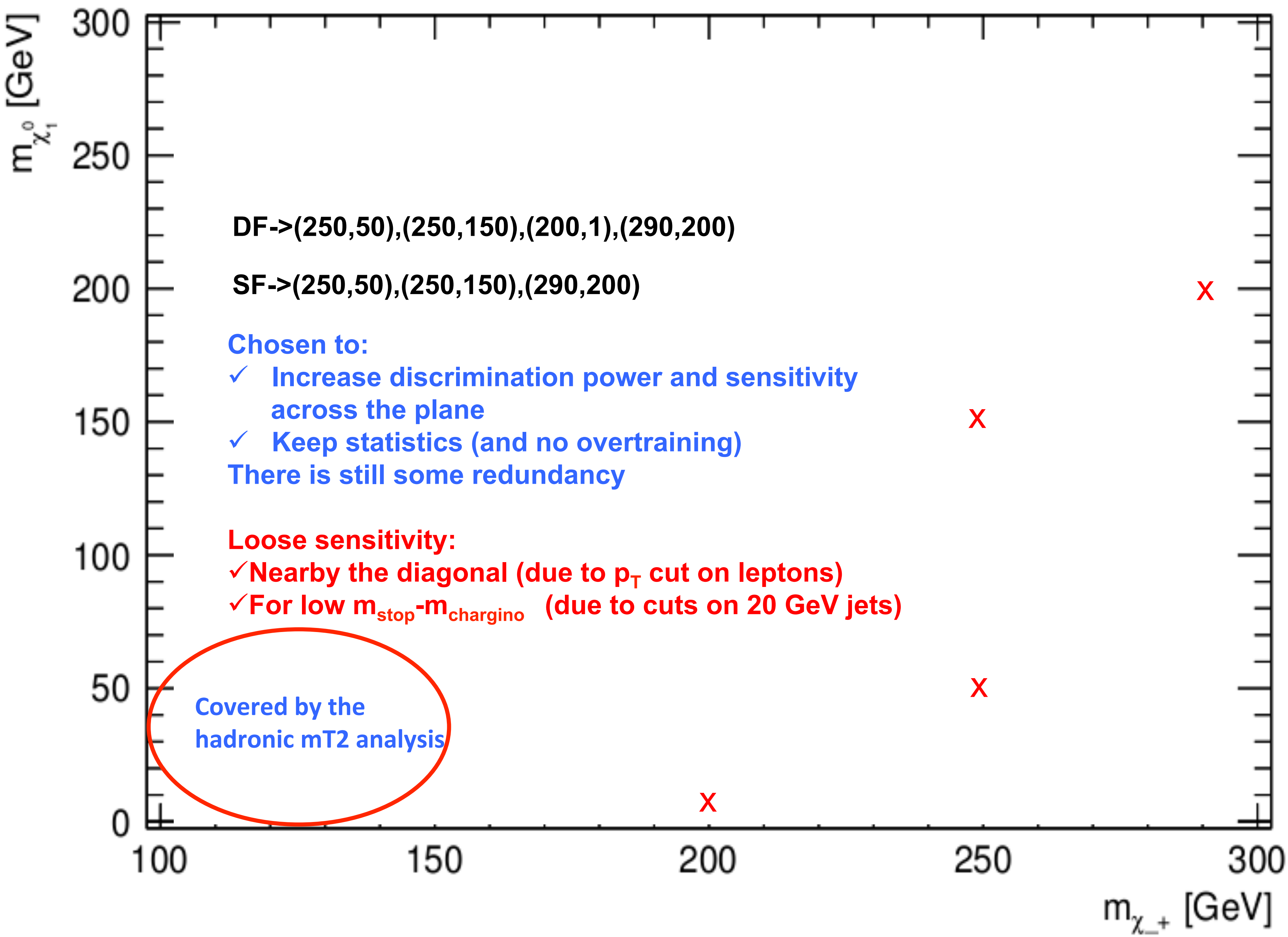
$m(\tilde{\chi}_1^\pm, \tilde{\chi}_1^0)=(250,150)$ DF

$m(\tilde{\chi}_1^\pm, \tilde{\chi}_1^0)=(250,50)$ DF

$m(\tilde{\chi}_1^\pm, \tilde{\chi}_1^0)=(150,100)$ DF



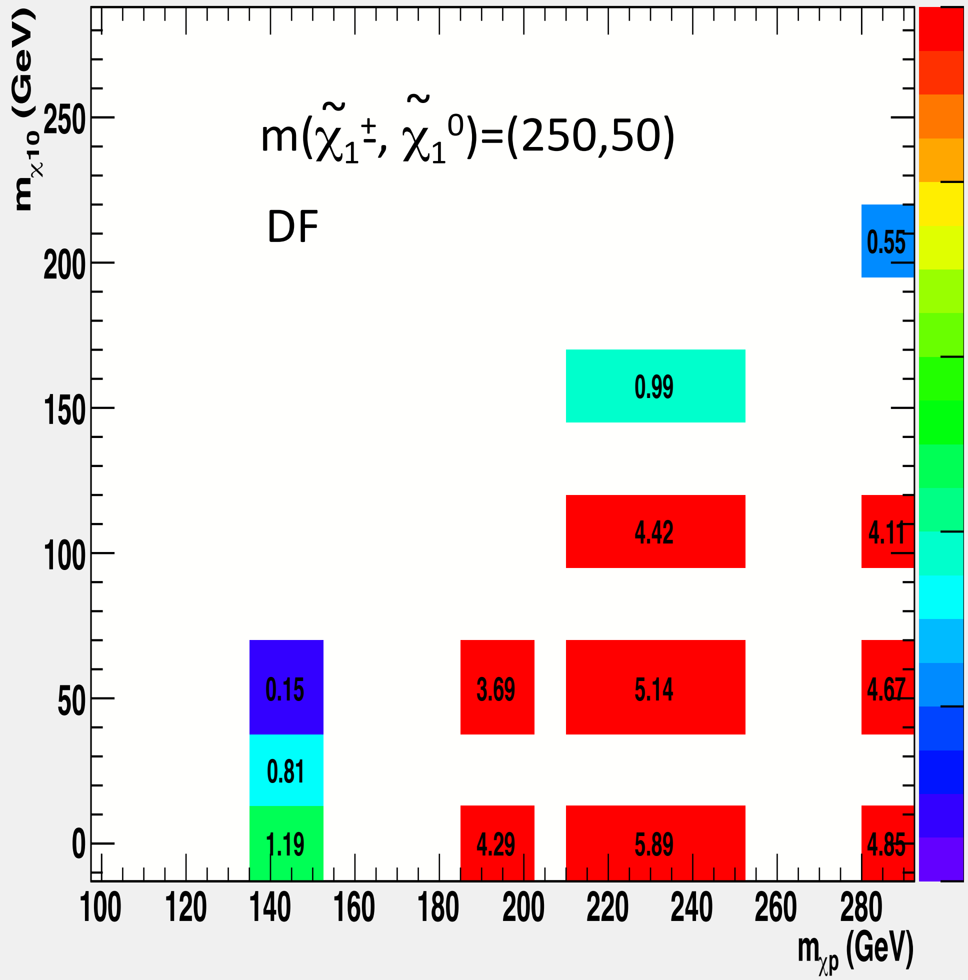
# MVA trainings points



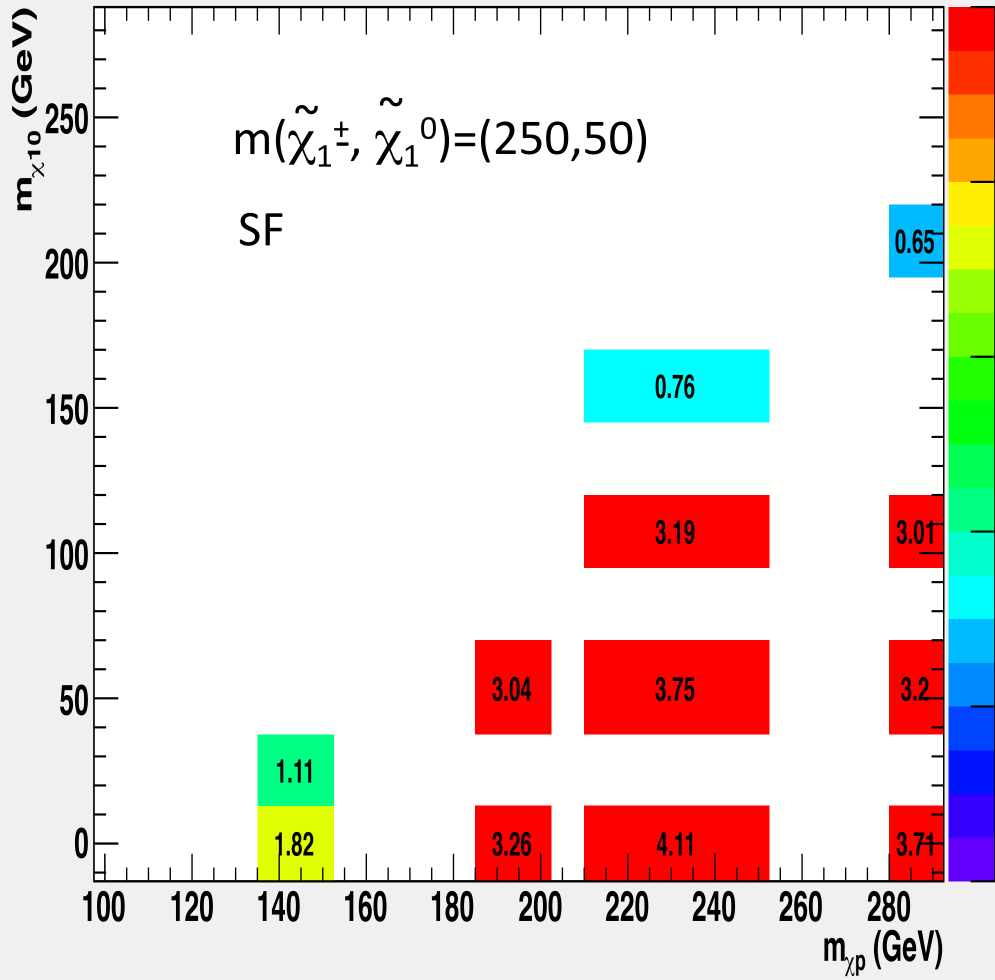
# Significance

E.g. (only (250,50) is shown here)

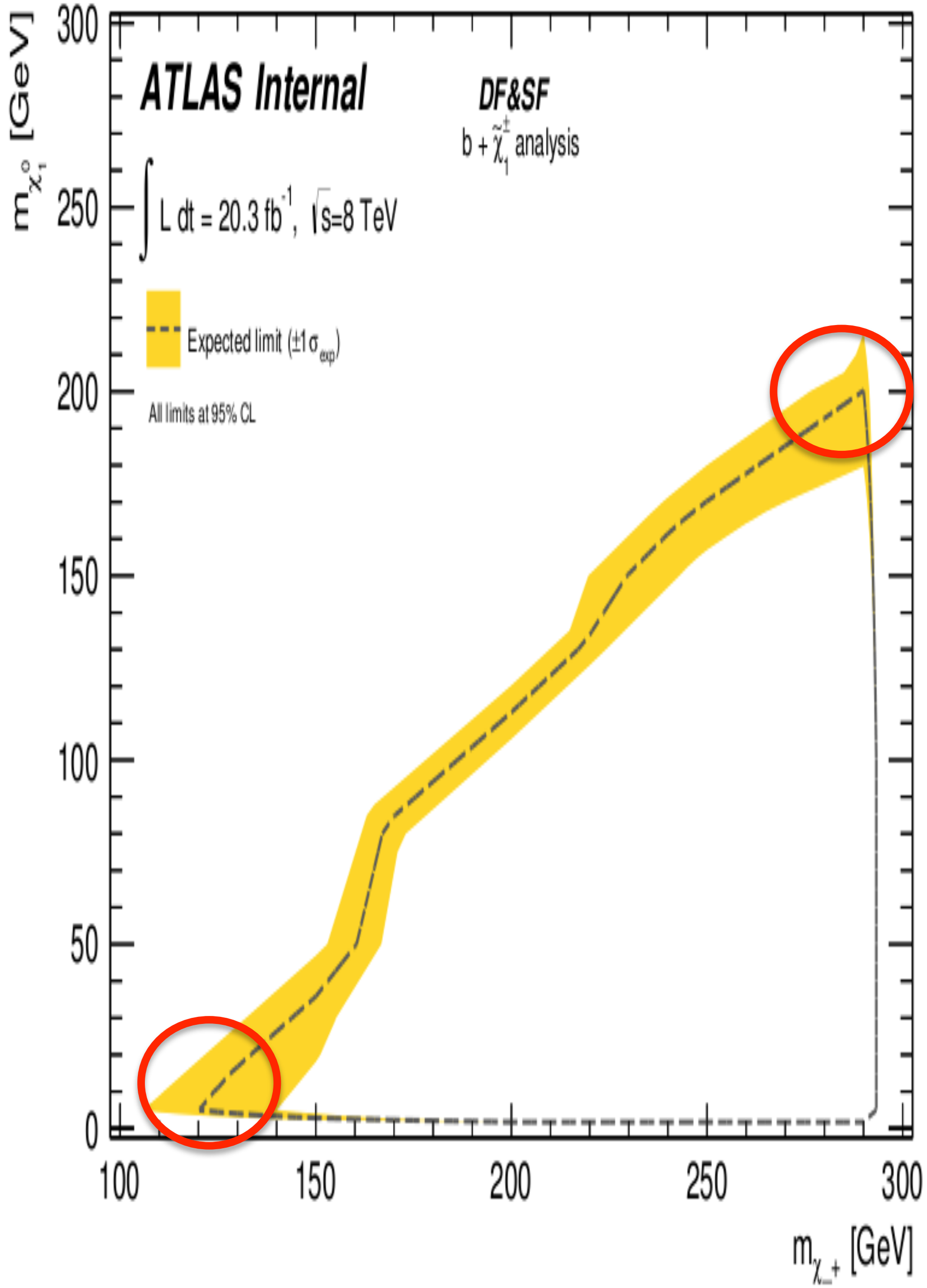
Significance for 20.3 $fb^{-1}$ with cut at 0.37 SR1



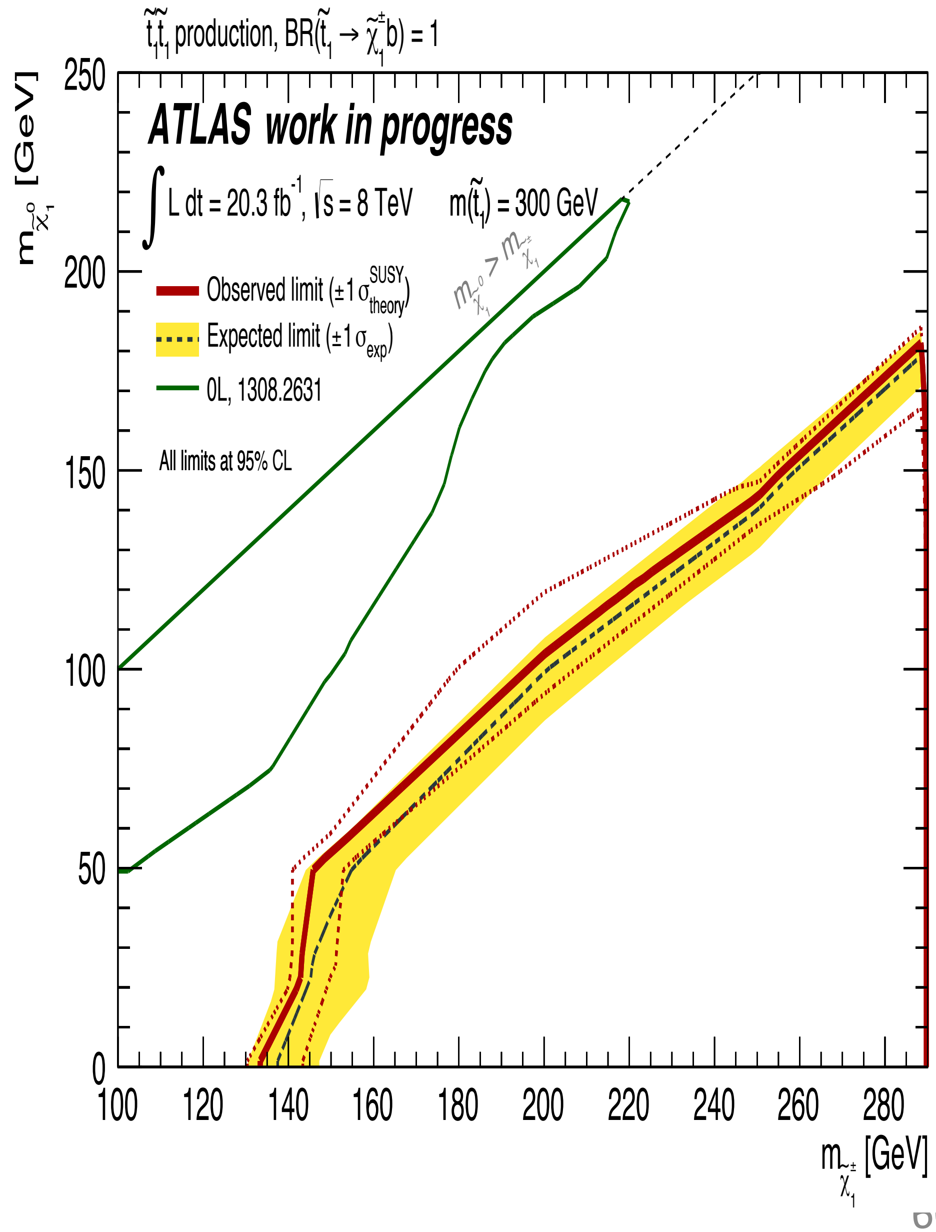

Significance for 20.3 $fb^{-1}$ with cut at 0.3 SR2



# Exclusion compared with the 2-lepton mT2 leptonic cut&count analysis




Preselection cuts were more specifically optimized over the grid in cut&count analysis



# Stop to b chargino with soft leptons

- Up to here, improvement (wrt cut&count, if any) seems to be marginal.
- Then analize also soft di-leptons to improve sensitivity for small $\Delta m_{\text{chargino-neutralino}}$ :
  - met triggers-> EF_xe80T_tclcw_loose || EF_xe80_tclcw_loose
  - lepton selection-> Object definition requires 2 “baseline” leptons, $p_T$>6 GeV
  - Events with exactly 2 isolated leptons
    -> Different Flavour (DF) and Same Flavour (SF) separately studied
  - Opposite charge

✓ 11 MVA variables: $E_T^{miss}$, $m_{T2}$ , $m_{ll}$ , $\Delta\phi(l_1,E_T^{miss})$, $\Delta\phi(l_1,j_1)$ , $\Delta\phi(l_1,l_2)$, $\Delta\eta(l_1,l_2)$, $\Sigma p_T^{l_i}$, $\Sigma p_T^{j_i} / \Sigma p_T^{l_i}$, $\Delta\phi(E_T^{miss}, p_{Tb}^{ll})$ with + hadronic $m_{T2}$

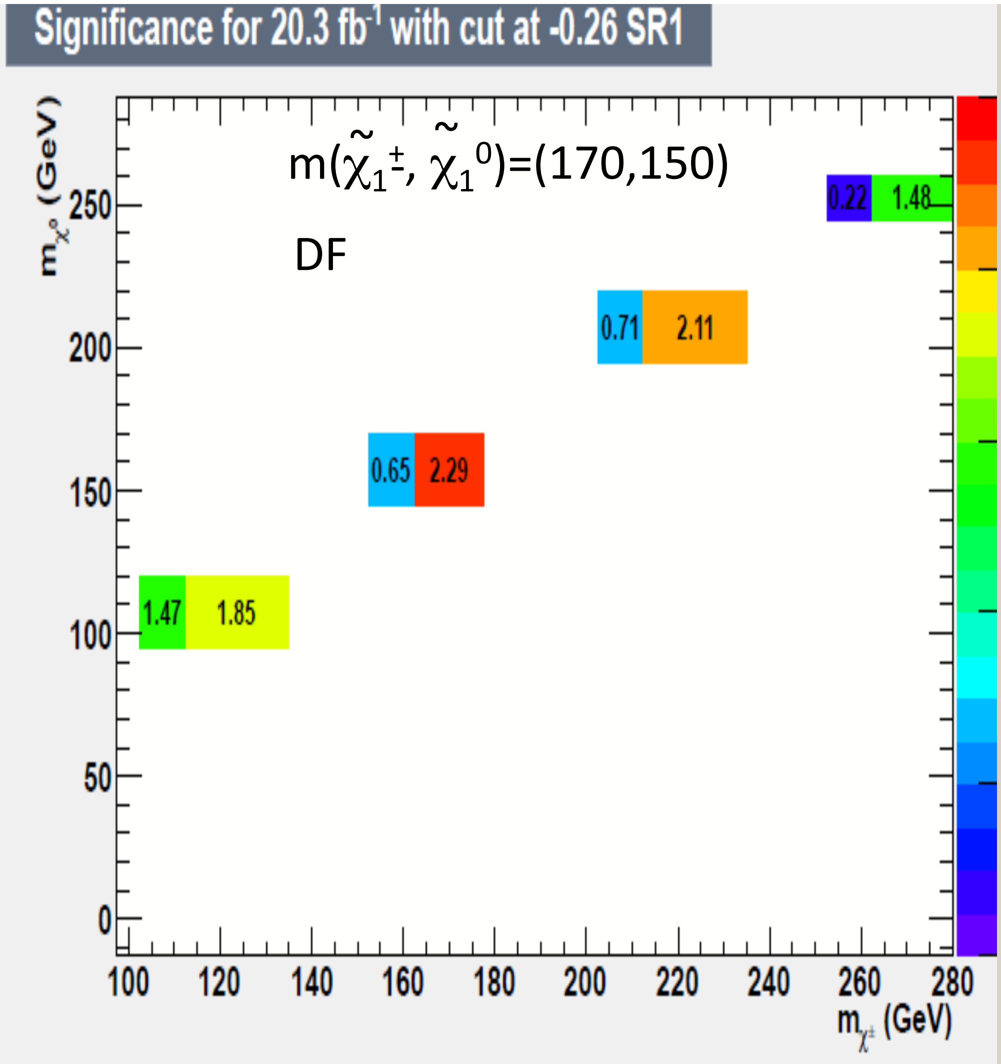
$p_{Tb}^{ll}$: $$\vec{p}_{Tb}^{\,ll} = \vec{p}_T(l_1) + \vec{p}_T(l_2) + \vec{E}_T^{miss}$$

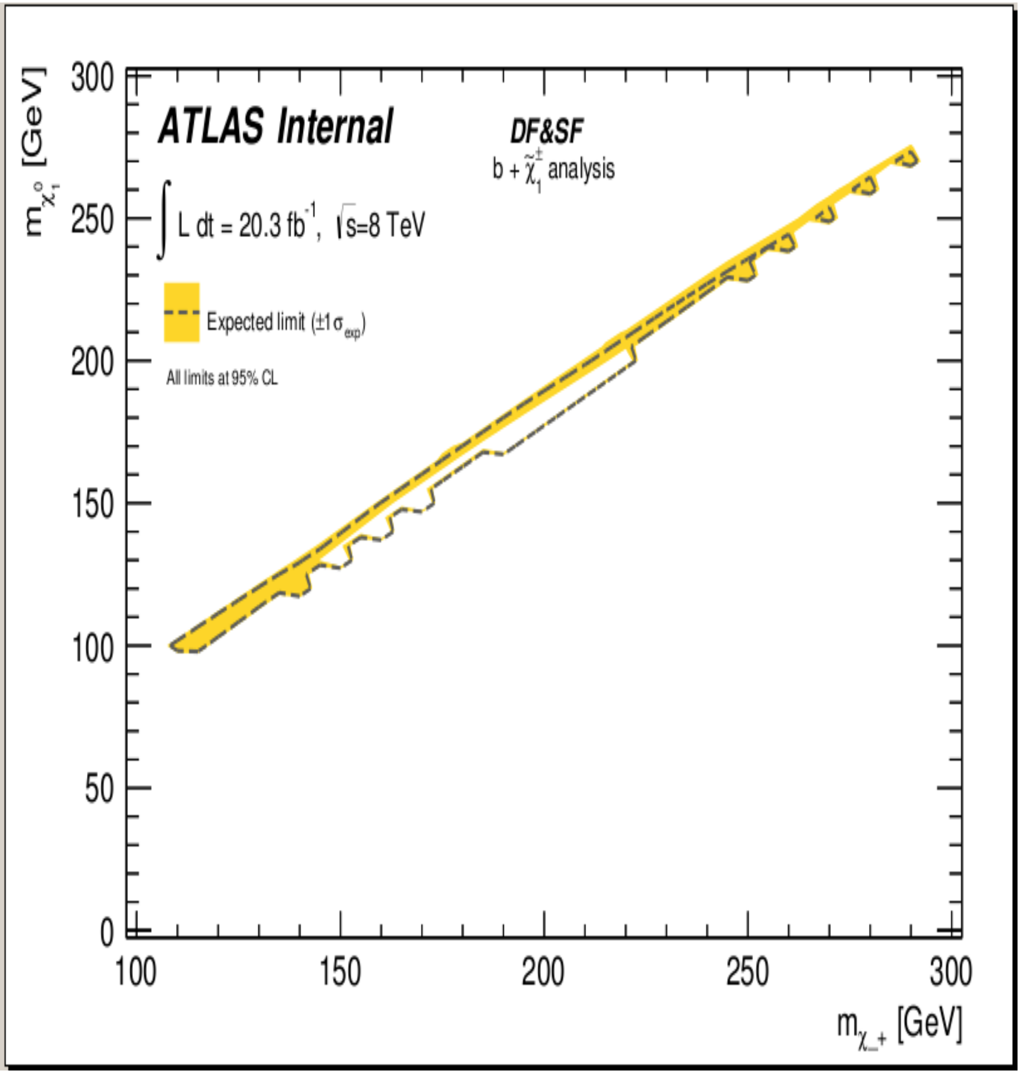
**STILL PRELIMINARY STUDIES at 8 TEV!**

# Significance for DF

$$\xi = \frac{N_S}{\sqrt{N_S + N_B + (\Delta N_B)^2_{syst}}}$$

$\Delta N_B = 50\% \cdot N_B$

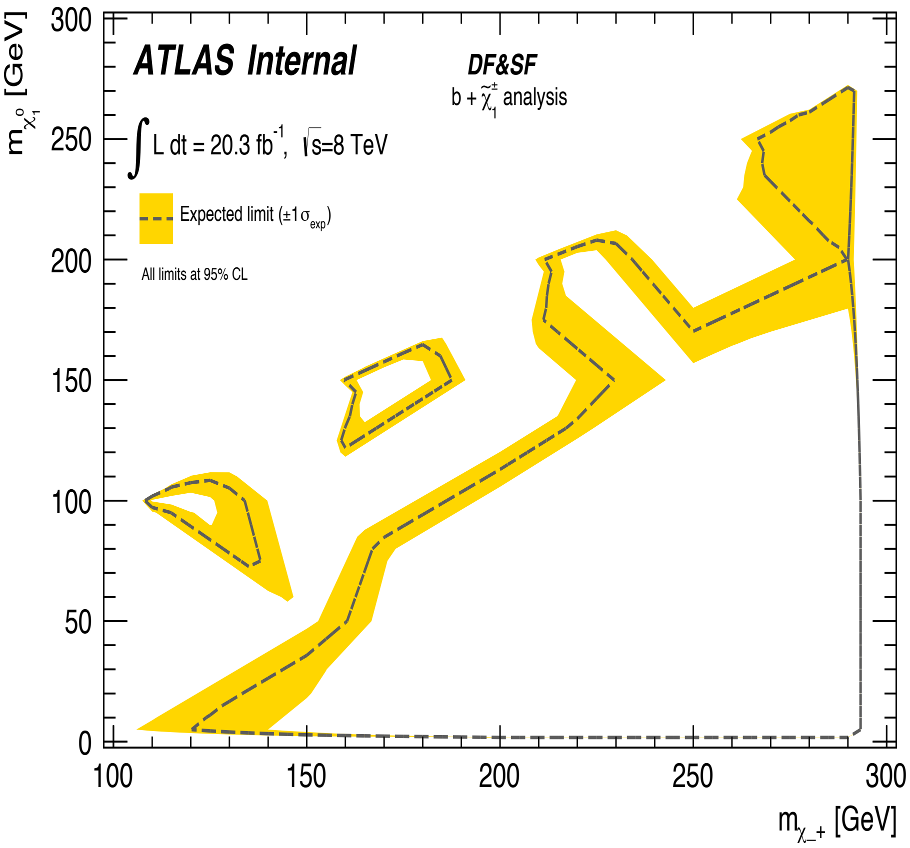


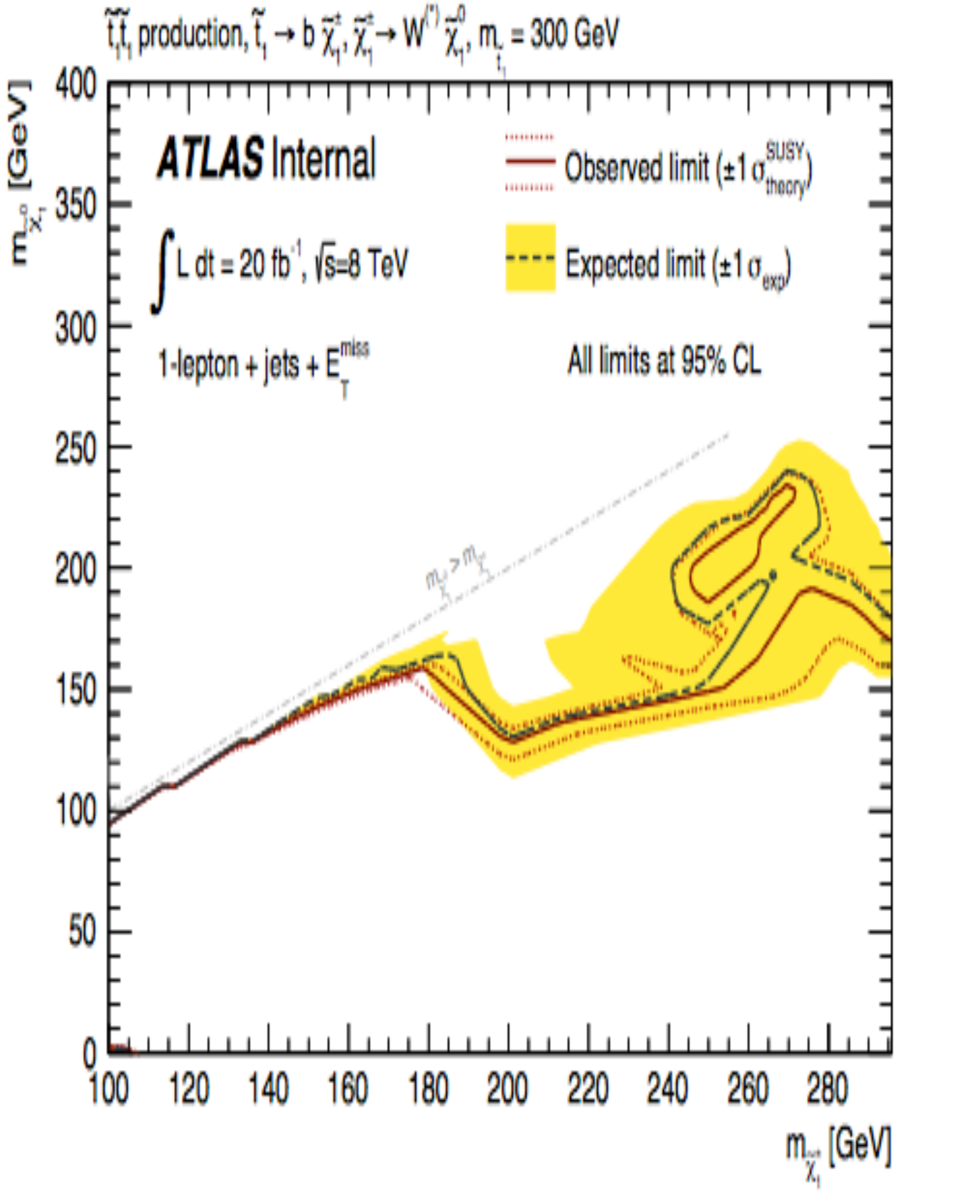




**With only one training (170,150) we obtain the plot on the right**

# Combinazione delle 2 selezioni

(leptonica e con met):




Benchmark 1 lepton analysis
ATLAS-SUSY-2013-15-002; CERN-PH-EP-2014-143

# Altre attività e responsabilità

- S. Spagnolo
  - partecipazioni a Editorial Boards per varie analisi (ricerche di stati esotici che decadono in WZ con stati finali leptonici). Chair di un editorial board da poco costituito per la ricerca di risonanze di stati a 3 leptoni (per vincolare masse/sezioni d'urto di produzione di leptoni pesanti in modelli see-saw di tipo III)
  - da Luglio 2014 componente dell'ATLAS Speaker Committee (eletta nel Collaboration Board di Giugno) che sovrintende all'attribuzione di talk ATLAS e interagisce con le conferenze che chiedono contributi alla collaborazione
- G. Chiodini
  - responsabile della stesura della sezione del TDR di AFP (Atlas Forward Physics) che descrive l'utilizzo di rivelatori a diamante per timing e trigger standalone [contributo al TR per la review di AFP nel 2013]
    - A seguito della review interna di fine 2013-inizio 2014, ATLAS ha approvato l'avanzamento del progetto AFP per il commissioning e il run del detector in condizioni speciali dei fasci di LHC (bassa luminosità e condizioni di background rilassate - possibili misure specifiche di QCD fisica diffrattiva)
      - TDR atteso a fine anno
  - Comunità italiana interessata al progetto (Lecce, Roma, Bologna) in stand-by a causa delle limitate risorse INFN per upgrade e scope di fisica ridimensionato del progetto attualmente approvato
- N. Orlando in partenza (fine Agosto) per un post-doc a Thessaloniki (ATLAS, fisica di di-bosoni)
  - intendiamo mantenere una proficua collaborazione con una persona che è stata un importante contributor di ATLAS

# Studenti

- Triennale
  - Matteo Rosafio
    Tesi: Caratterizzazione di una Micromegas R20 con elettronica di lettura basata sul chip APV25, luglio 2013 (Gorini/Primavera)
  - Giulia Musardo
    Tesi: Studio di scenari di nuova fisica all'Esperimento ATLAS all'LHC mediante l'applicazione di tecniche di analisi multivariata, luglio 2013 (Primavera/Gorini)
- Magistrale
  - Annalisa De Lorenzis
    **Tesi:** *Ricerca della produzione diretta di squark top con tecniche di analisi multivariata*, 29 aprile 2014 (Gorini/Primavera)
  - Luigi Longo, Borsa Erasmus al CERN (giugno-settembre 2013)
    **Tesi:** *Limiti sulle masse dello squark top e della particella supersimmetrica più leggera in processi con due leptoni nello stato finale all'esperimento ATLAS a LHC*, 29 aprile 2014 (Primavera/Gorini)
  - Marilea Reale, Borsa Erasmus al CERN (giugno-settembre 2013)
    **Tesi:** *Studio di decadimenti di partner supersimmetrici del quark top con stati finali a due leptoni attraverso tecniche di analisi multivariata con l'esperimento ATLAS* , 23 luglio 2014 ) (Ventura/Gorini)
- Dottorato
  - Nicola Orlando
    **Tesi:** *The associated production of a Z gauge boson and b-jets at LHC with the ATLAS experiment: first differential cross section measurements* (Spagnolo/Chiodini)
- CERN Summer Student
  - Marinaci Stefano: con Gerardo Ganis, sta lavorando su PROOF il Parallel Computing di ROOT
- Progetto MIUR Messaggeri della Conoscenza (luglio-agosto al CERN, Micromegas)
  - Gravili Francesco Giuseppe: Simulazione Micromegas su Geant4 (A.Dell'Acqua)
  - Nesca Rosaria: Micromegas Mesh Stretching (P.Iengo)
  - Oceano Isabella: Micromegas Toy Simulation (M.Iodice)
  - Savina Pierpaolo: Analisi dati delle Micromegas con Roofit e Roostat (S.Palestini)