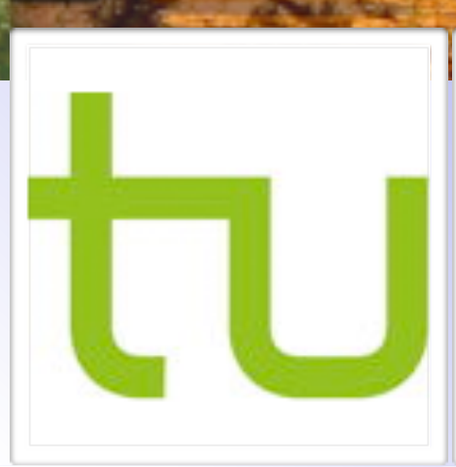
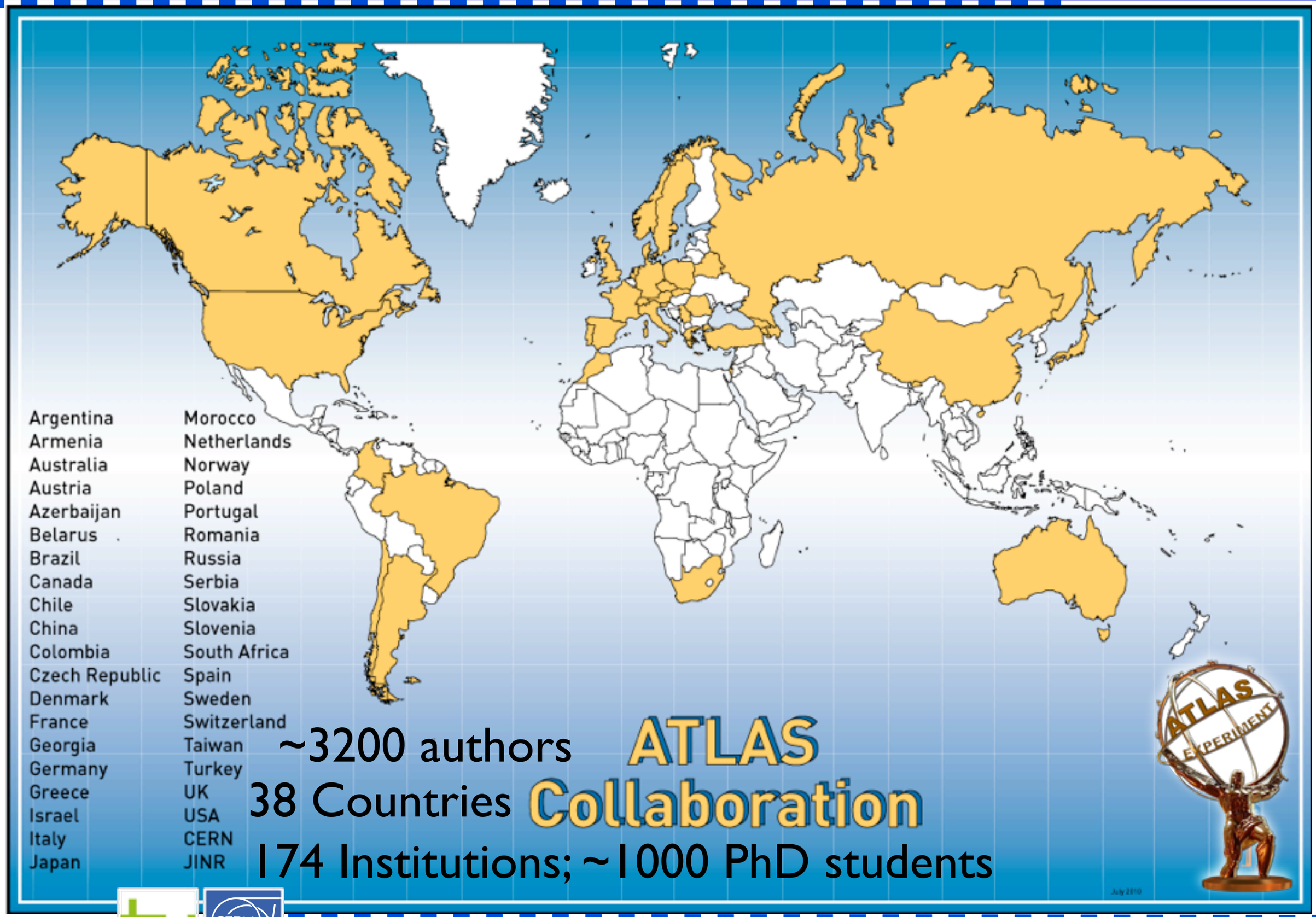
ATLAS Overview

Sub-detector Performance
Data Taking 2010
Highlights of Latest Results



06.12.2010, Kruger2010, Kruger Park, South Africa

ATLAS Collaboration



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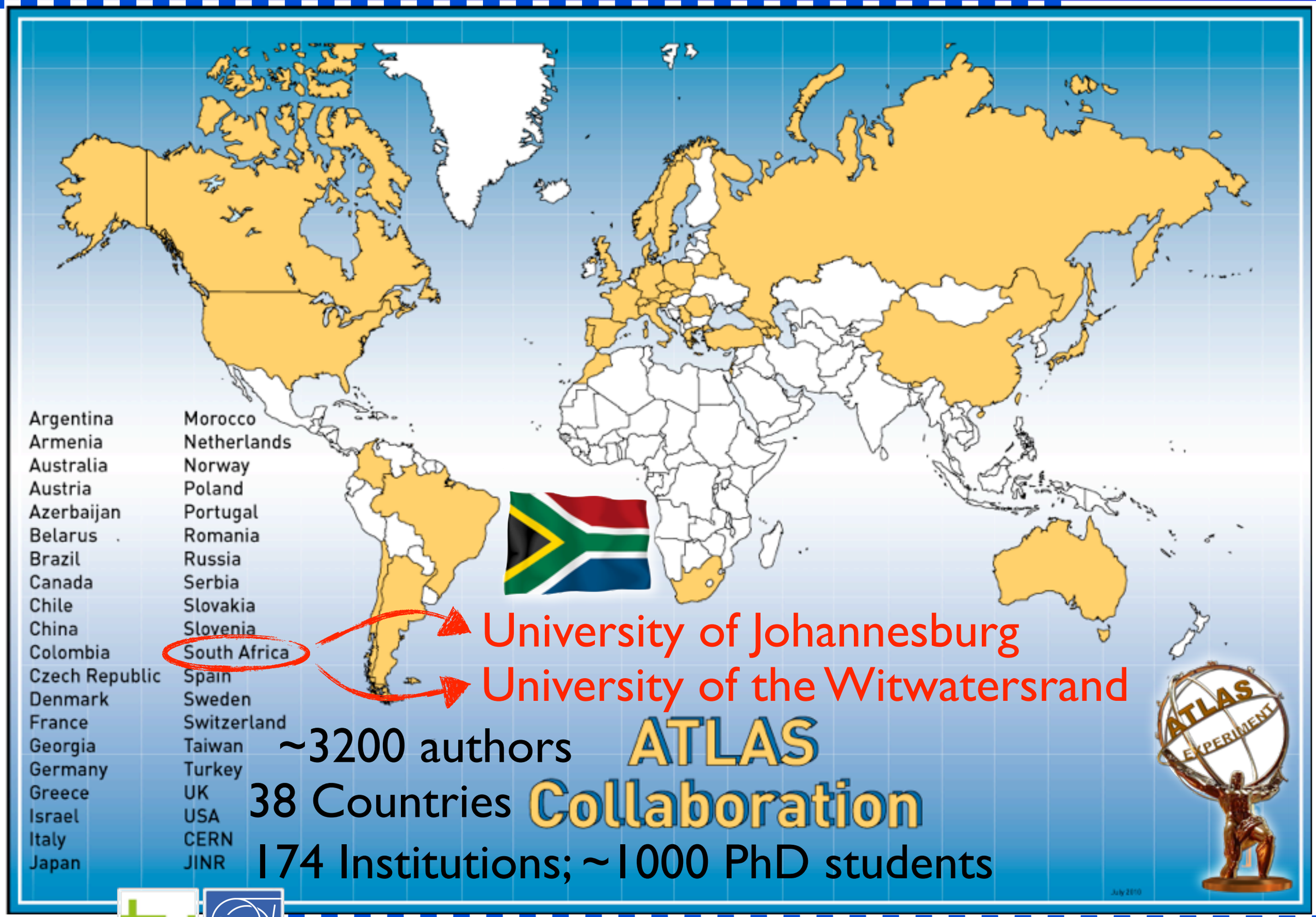
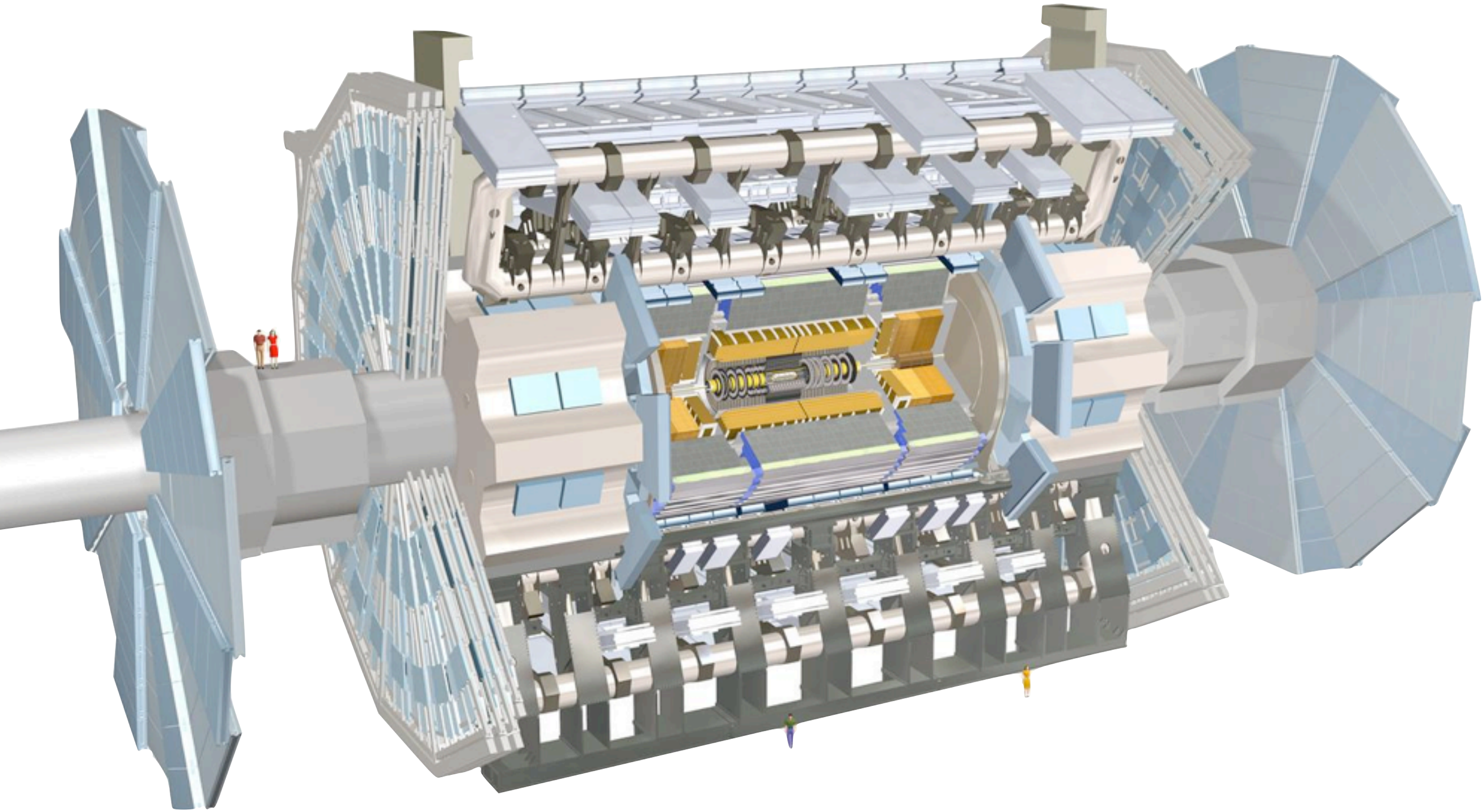
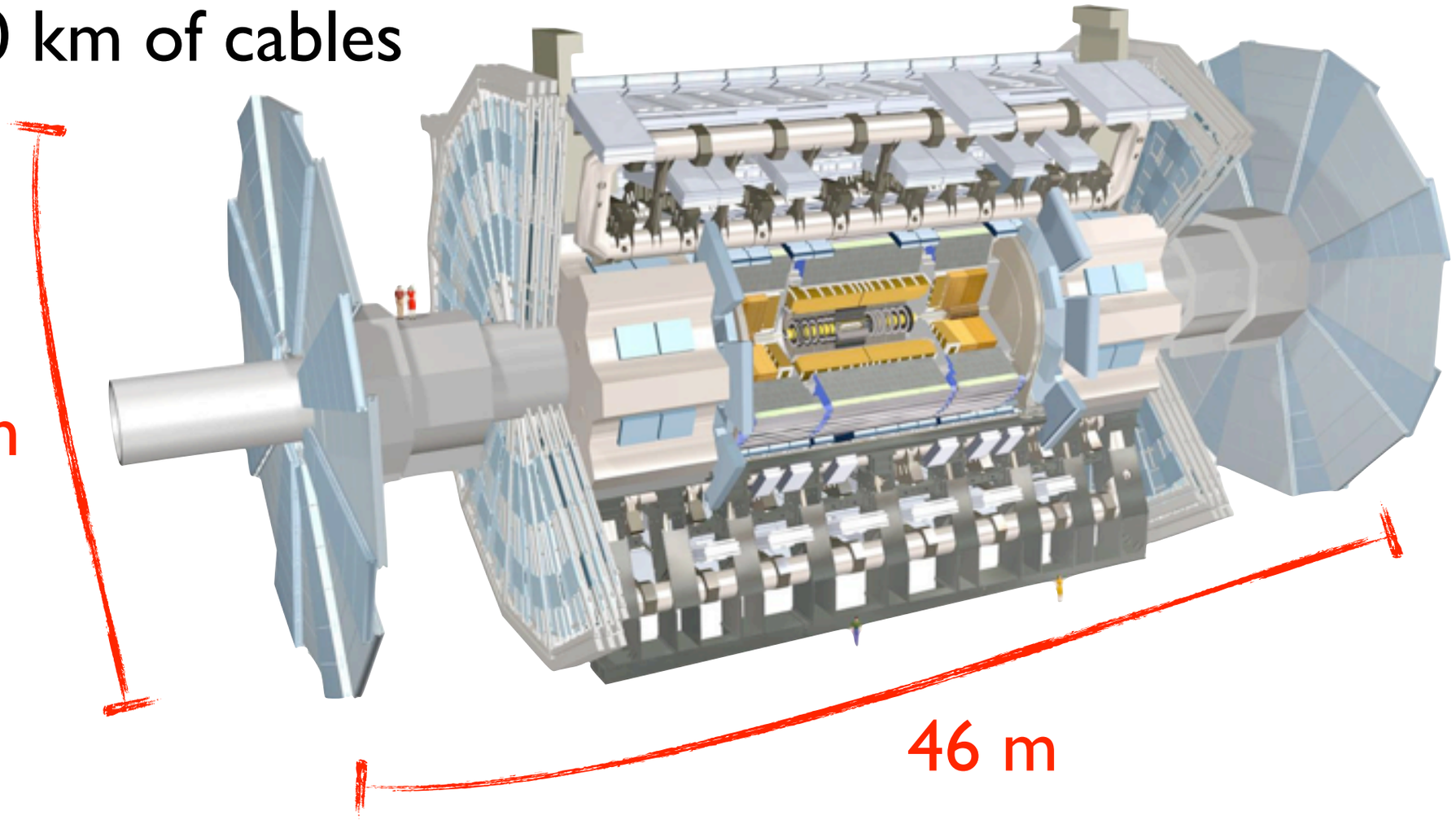


The ATLAS Detector



The ATLAS Detector

Length : ~ 46 m
Diameter : ~ 24 m
Weight : ~ 7000 tons
~10^8 electronic channels
3000 km of cables



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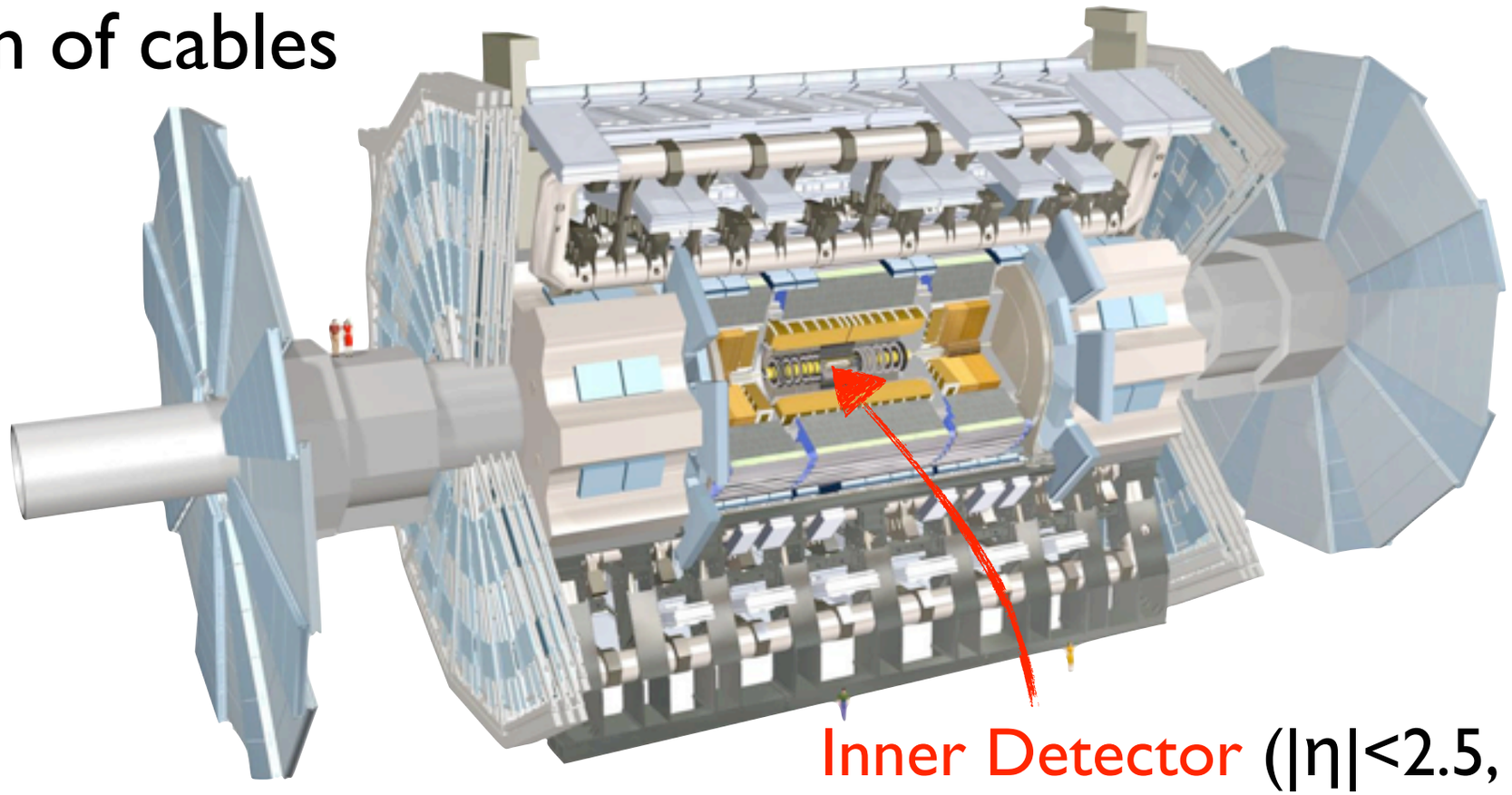

Inner Detector ($|\eta|<2.5$, B=2T): Si Pixels, Si strips, Transition Radiation detector (straws); Precise tracking and vertexing, e/π separation Momentum resolution:
$\sigma/p_T \sim 3.8\times10^{-4}\ p_T\ (\mathrm{GeV}) \oplus 0.015$
i.e. $\sigma/p_T < 2\%$ for $p_T < 35$ GeV

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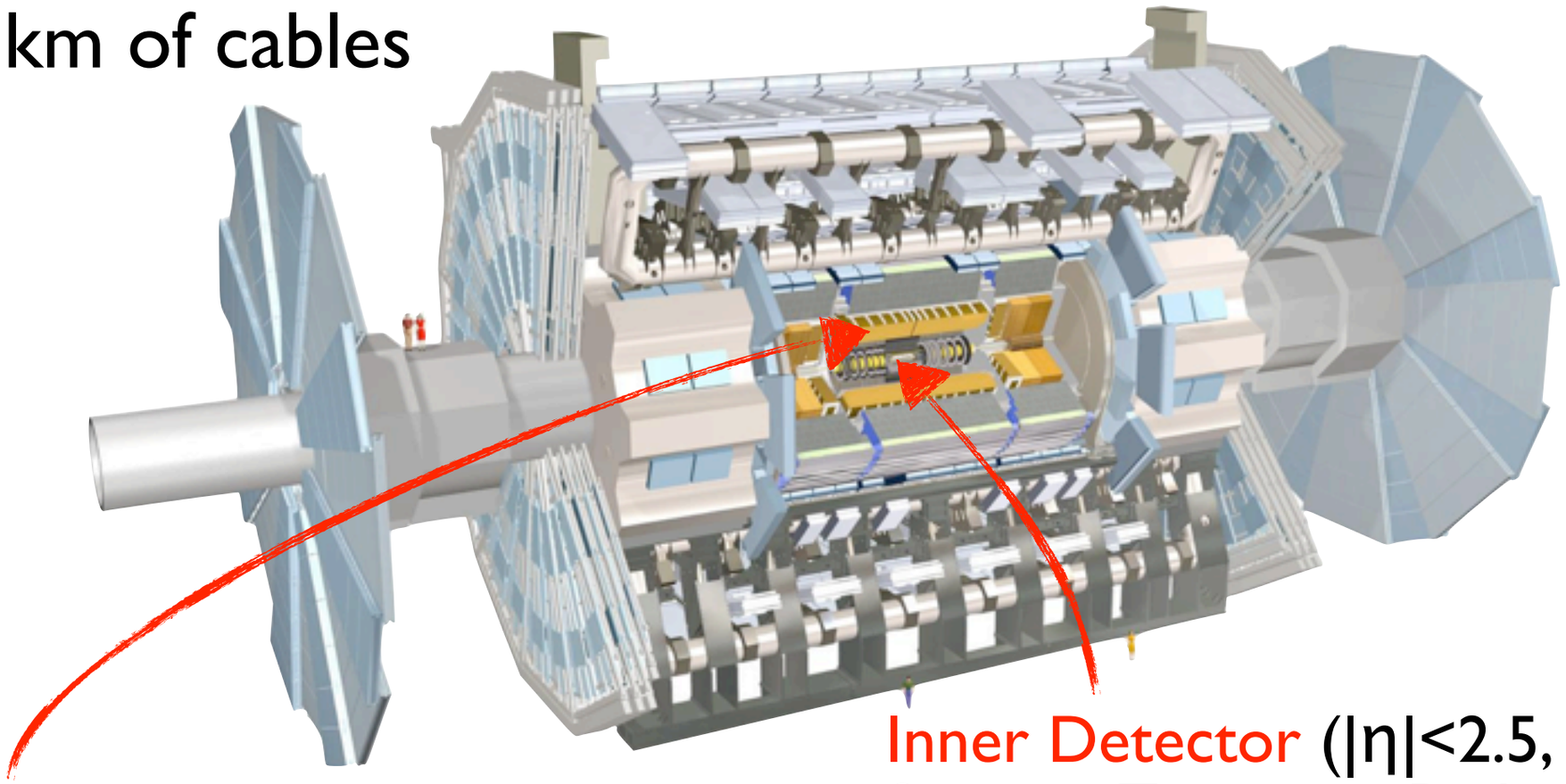

EM calorimeter ($|\eta|<3.2$):
Pb-LAr Accordion; e/γ trigger, identification and measurement
E-resolution: $\sigma/E \sim 10\%/\sqrt{E}$

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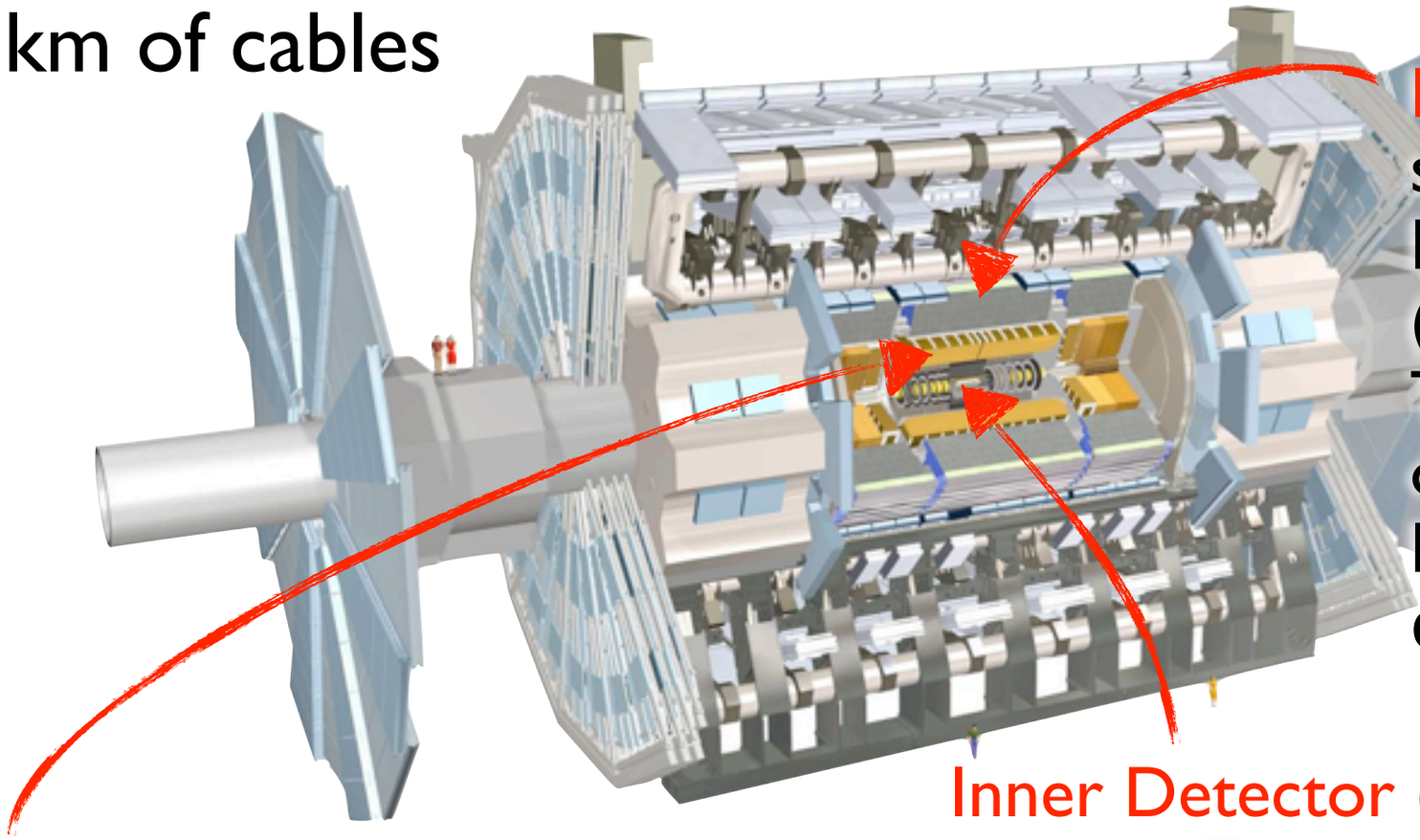

HAD calorimetry ($|\eta|<5$): segmentation, hermeticity Fe/scintillator Tiles (central), Cu/W-LAr (fwd) Trigger and measurement of jets and missing E_T
E-resolution:
$\sigma/E \sim 50\%/\sqrt{E} \oplus 0.03$

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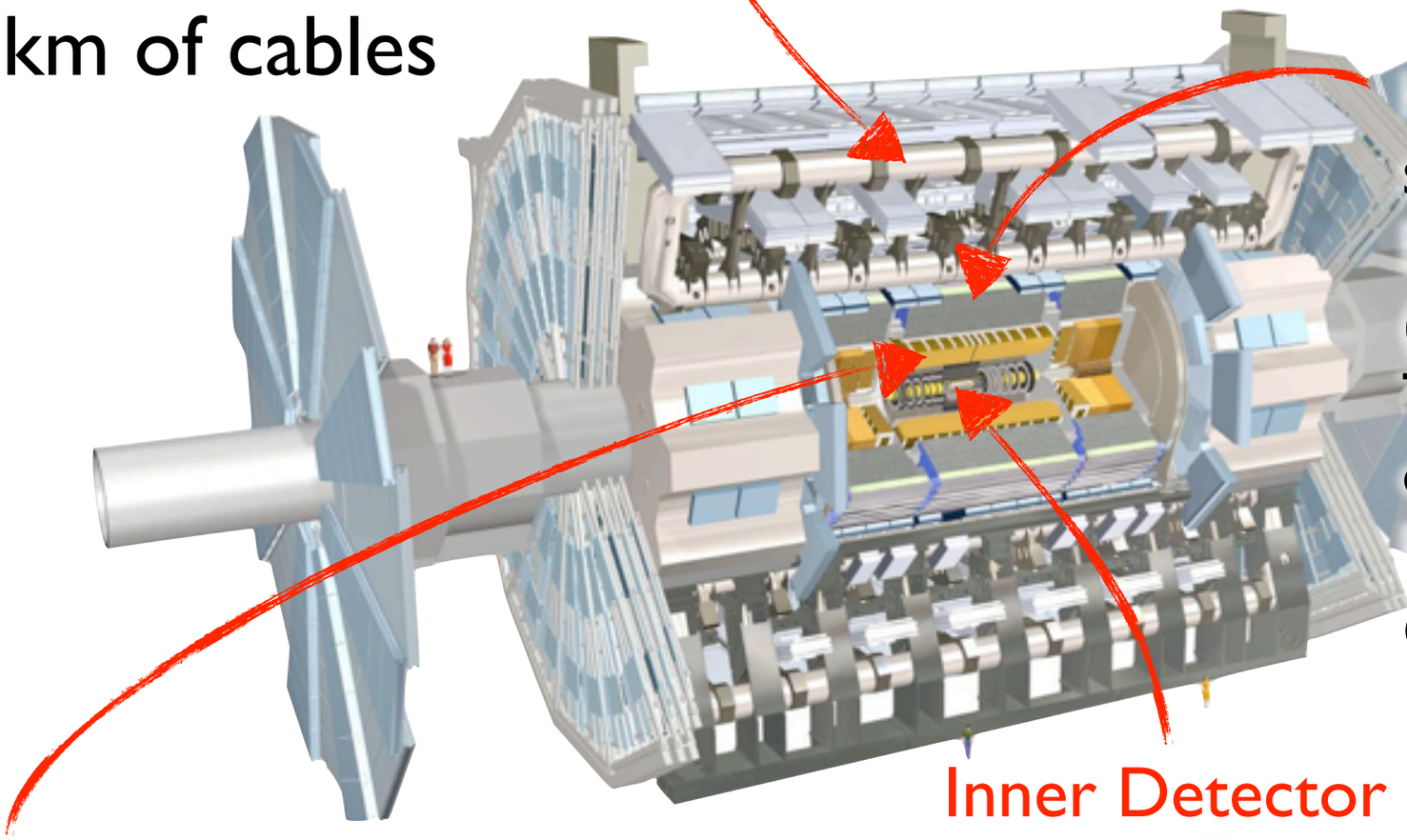
Muon Spectrometer ($|\eta|<2.7$) : air-core toroids with gas-based muon chambers; Muon trigger and measurement with momentum resolution < 10% up to E_μ ~ 1 TeV



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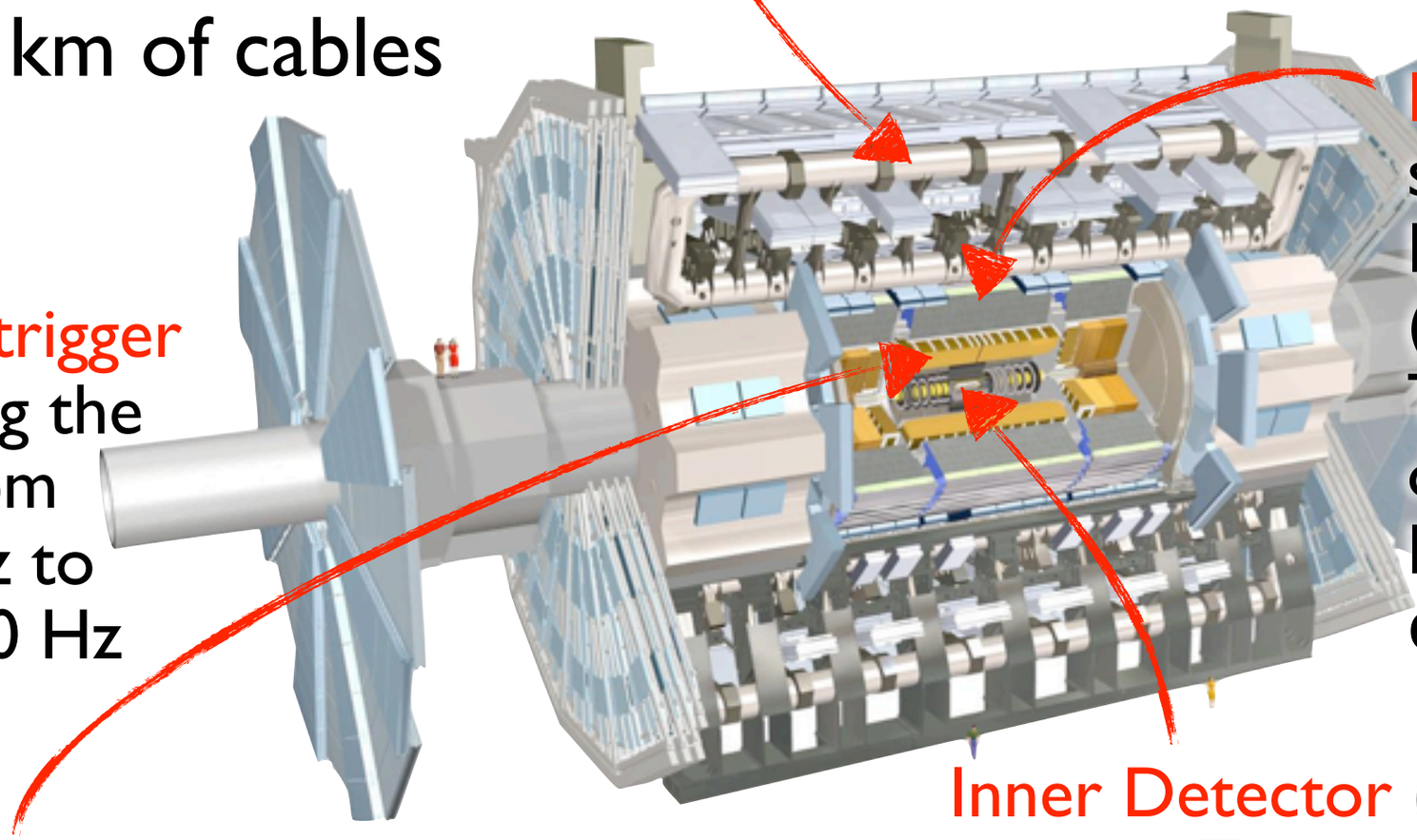

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3-level trigger reducing the rate from 40 MHz to 200-300 Hz

EM calorimeter ($|\eta|<3.2$):
Pb-LAr Accordion; e/γ trigger, identification and measurement
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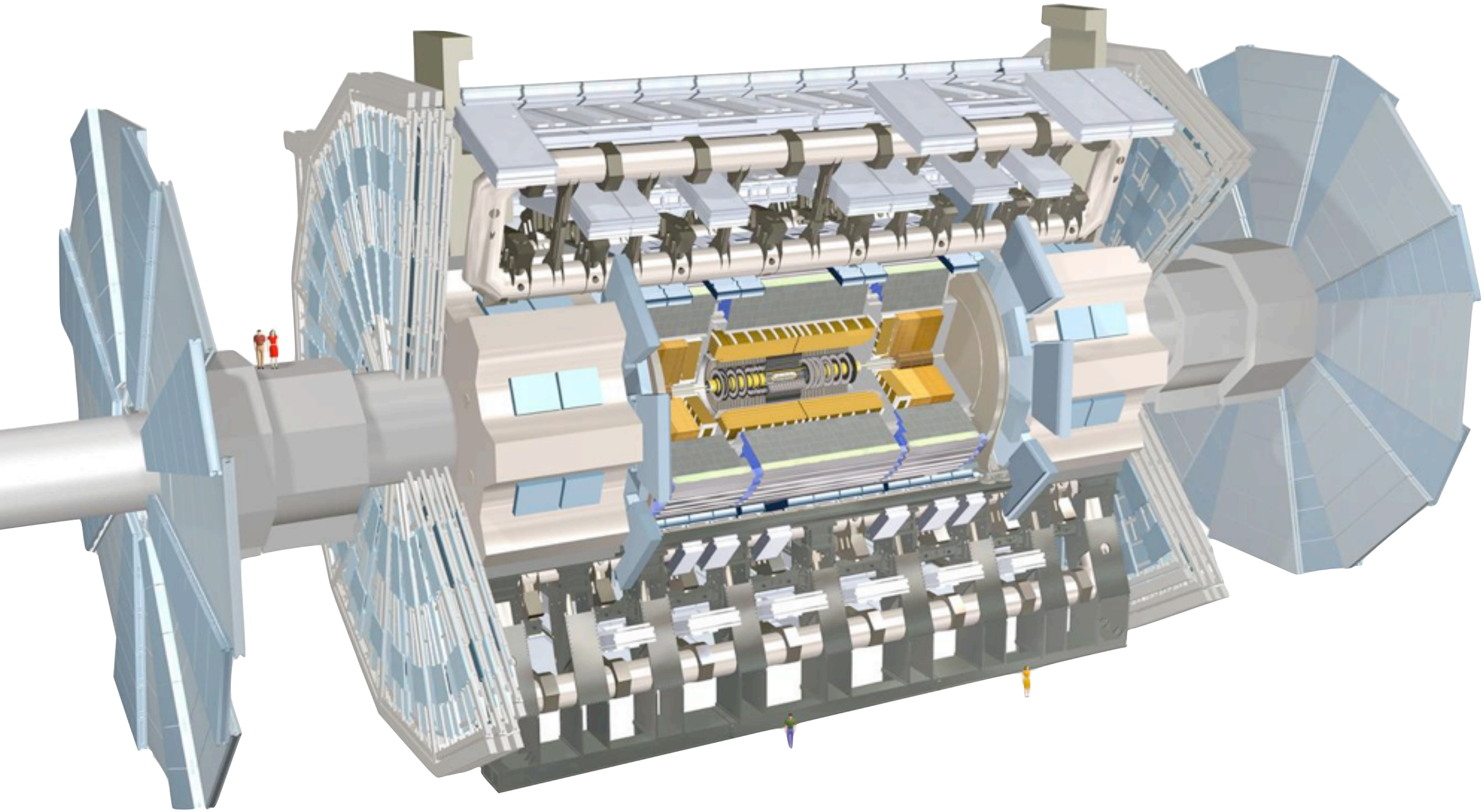
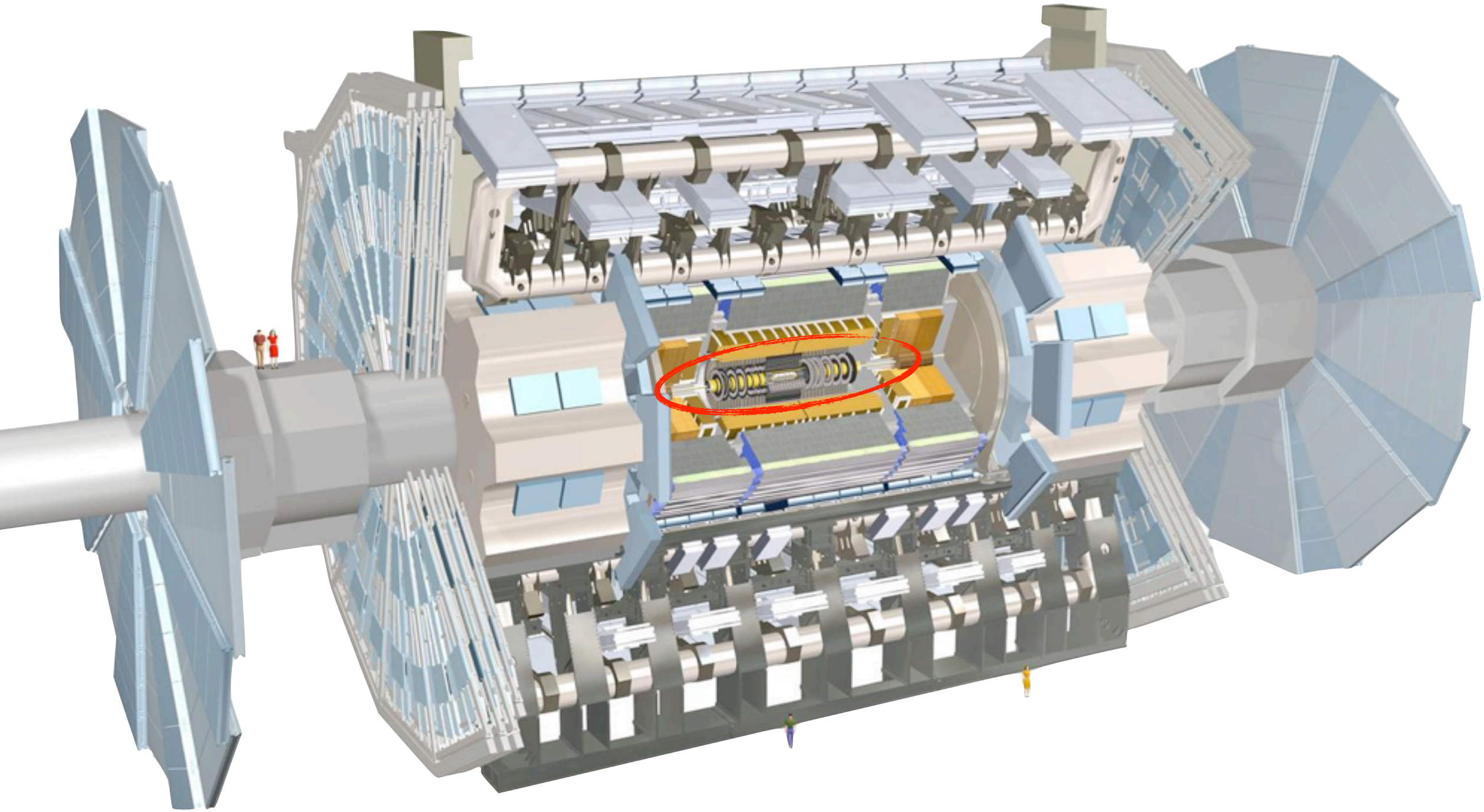
The ATLAS Detector



ATLAS Inner Detector



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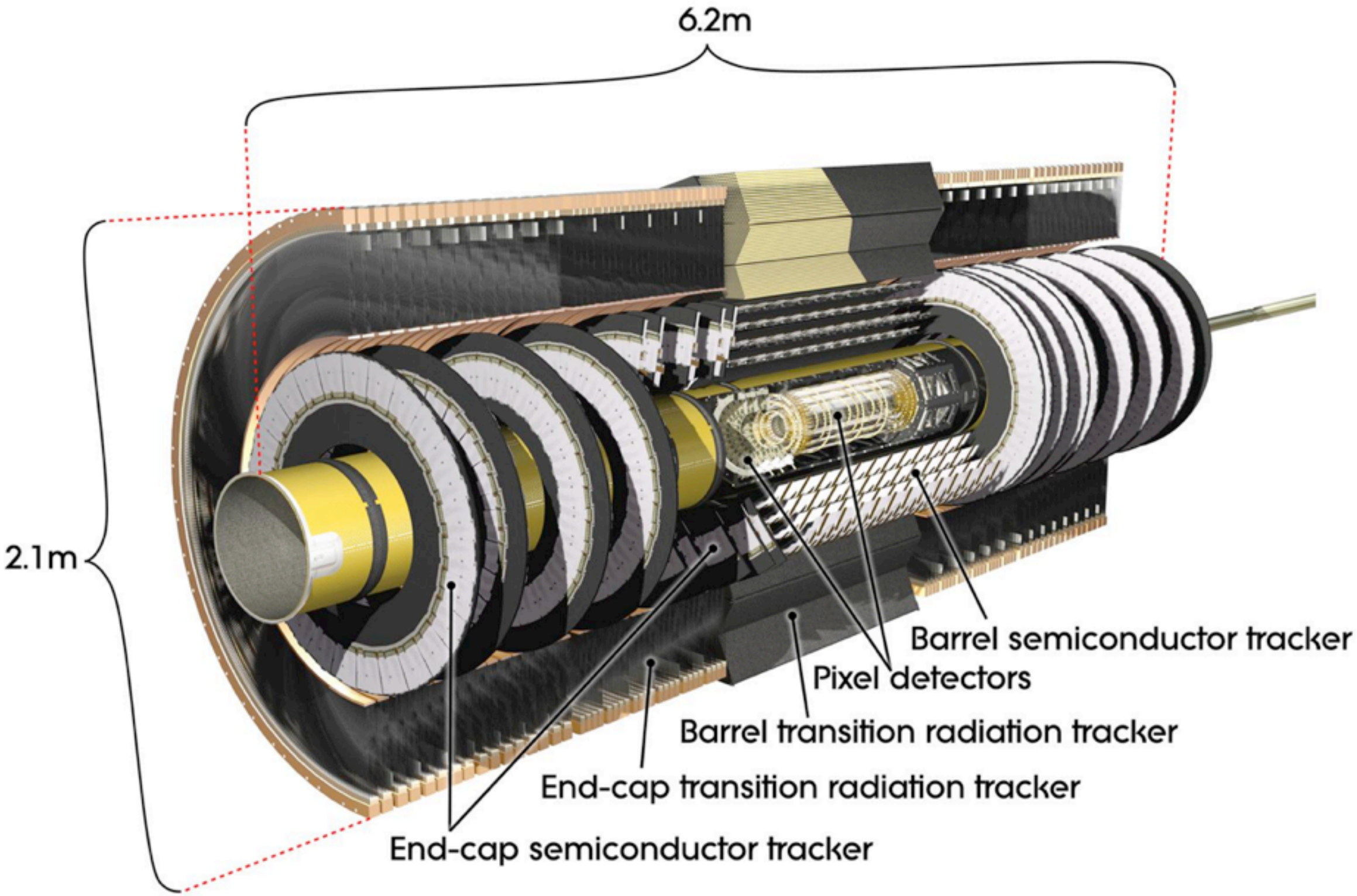

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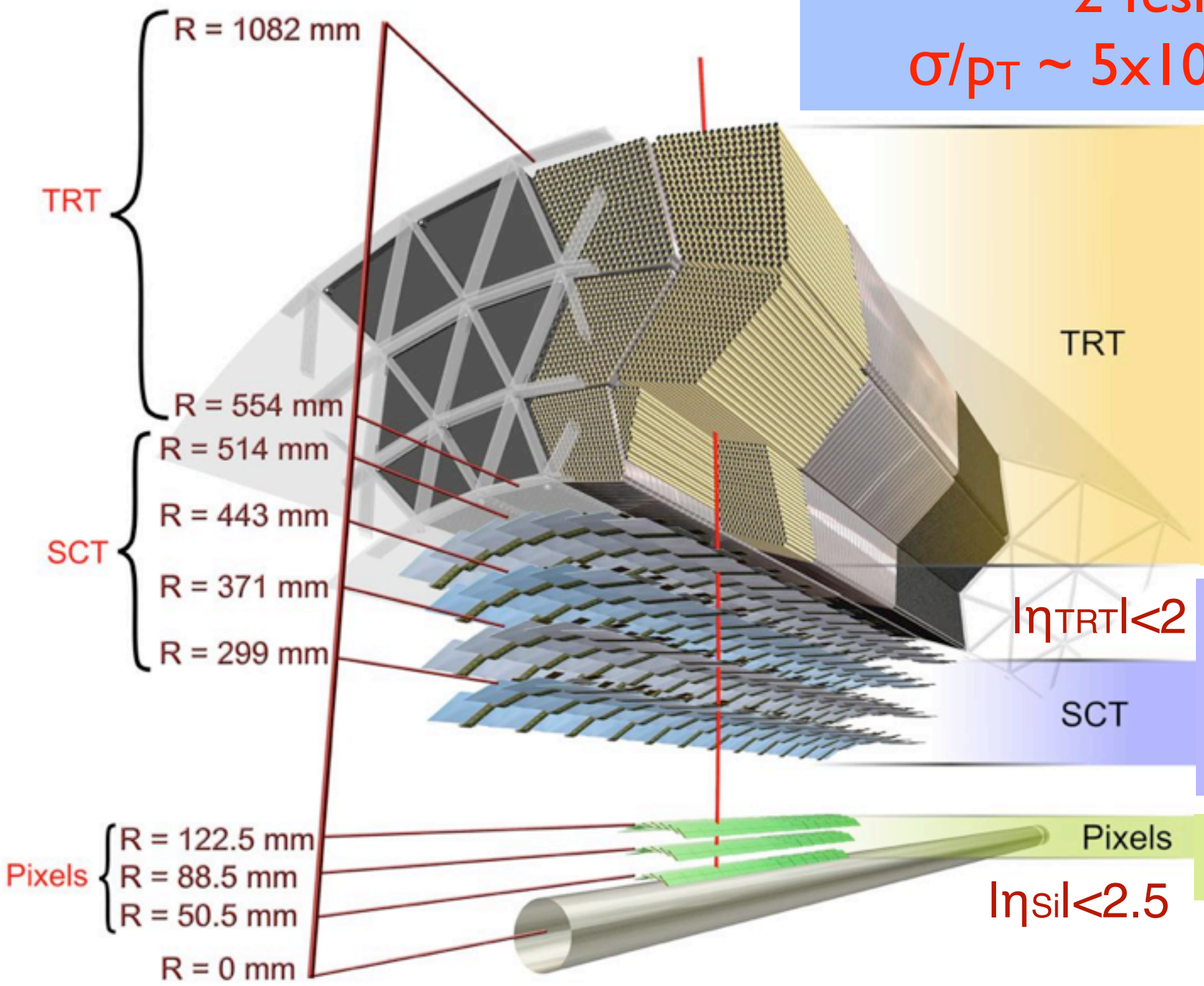


2 Tesla Solenoid

$\sigma/p_T \sim 5\times10^{-4}\ p_T/\text{GeV} \oplus 0.01$

Transition Radiation Tracker (TRT) (350k channels) with e/π separation

$|\eta_{TRT}|<2$

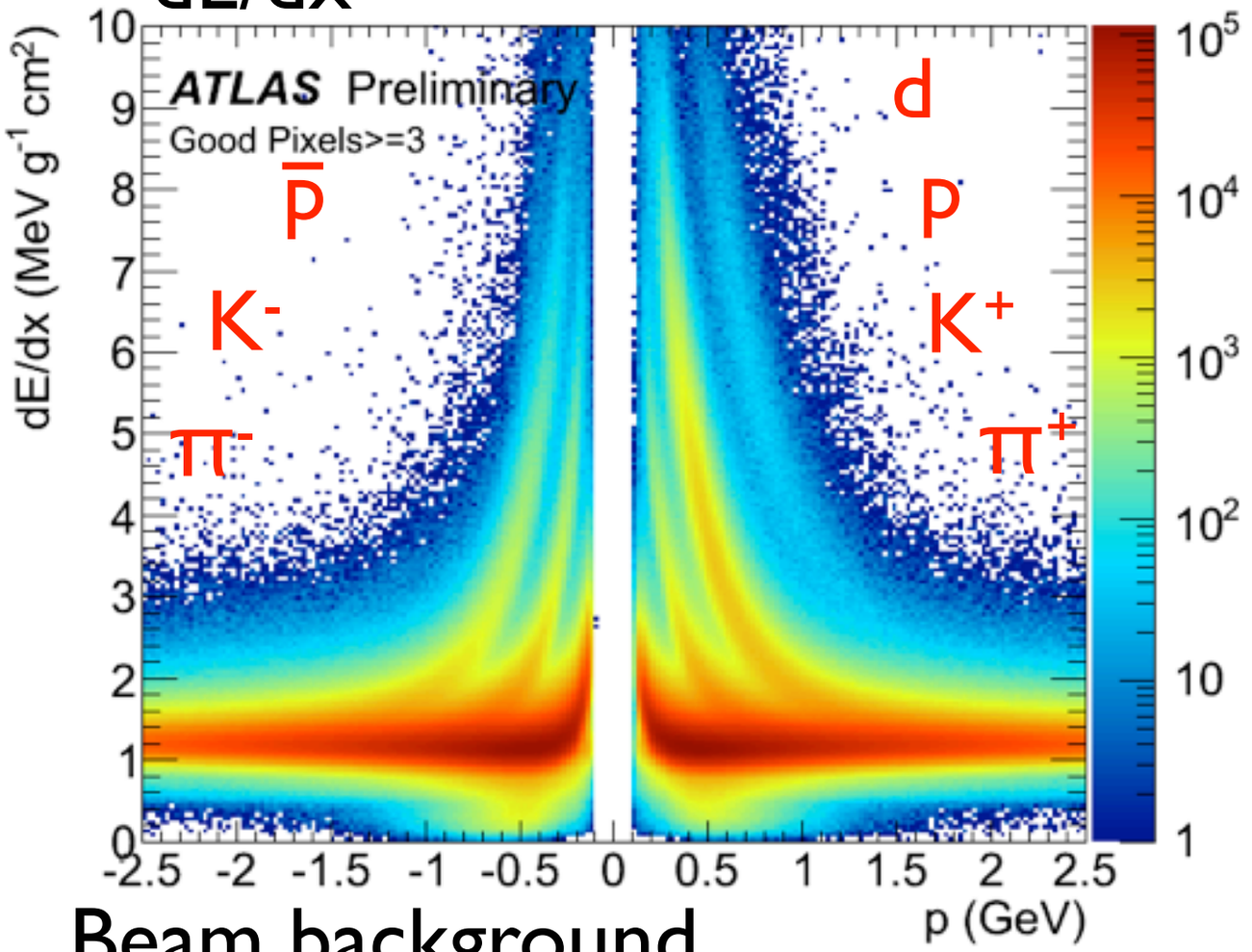
SemiConductor Tracker (SCT) ~6M silicon strips

Pixels: 80M channels

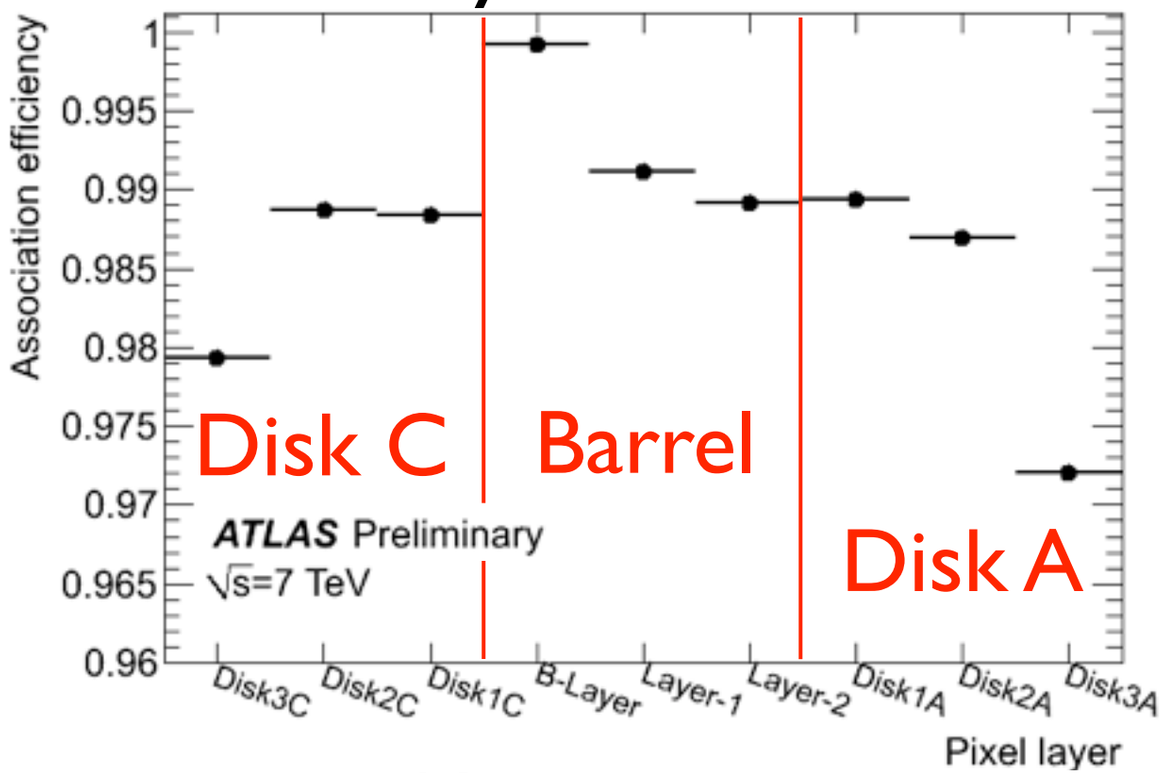
$|\eta_{Sil}|<2.5$

Pixel Detector Performance

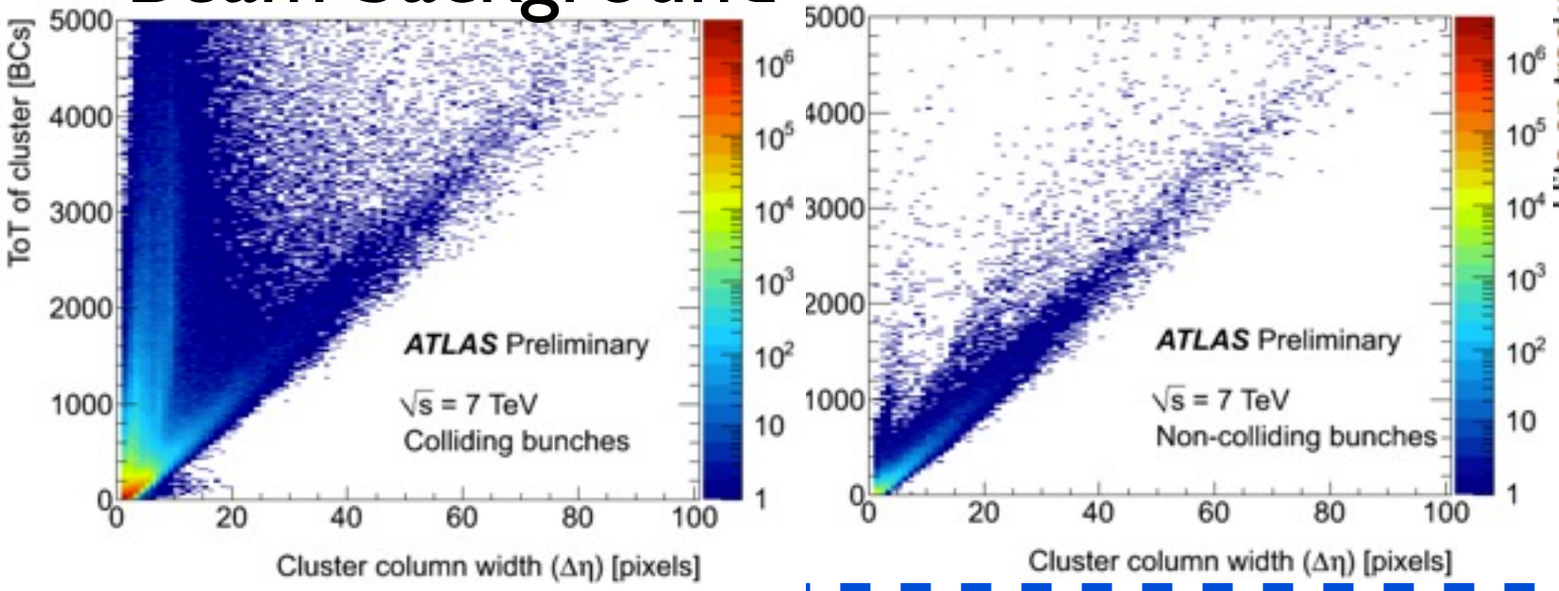
dE/dx



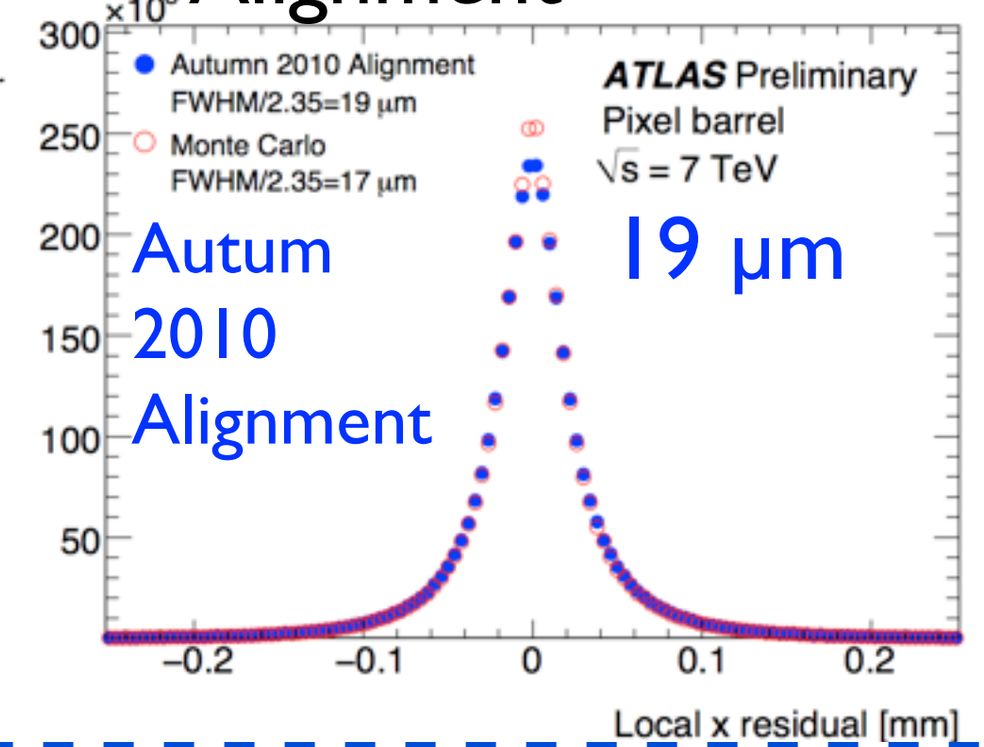
Efficiency



Beam background

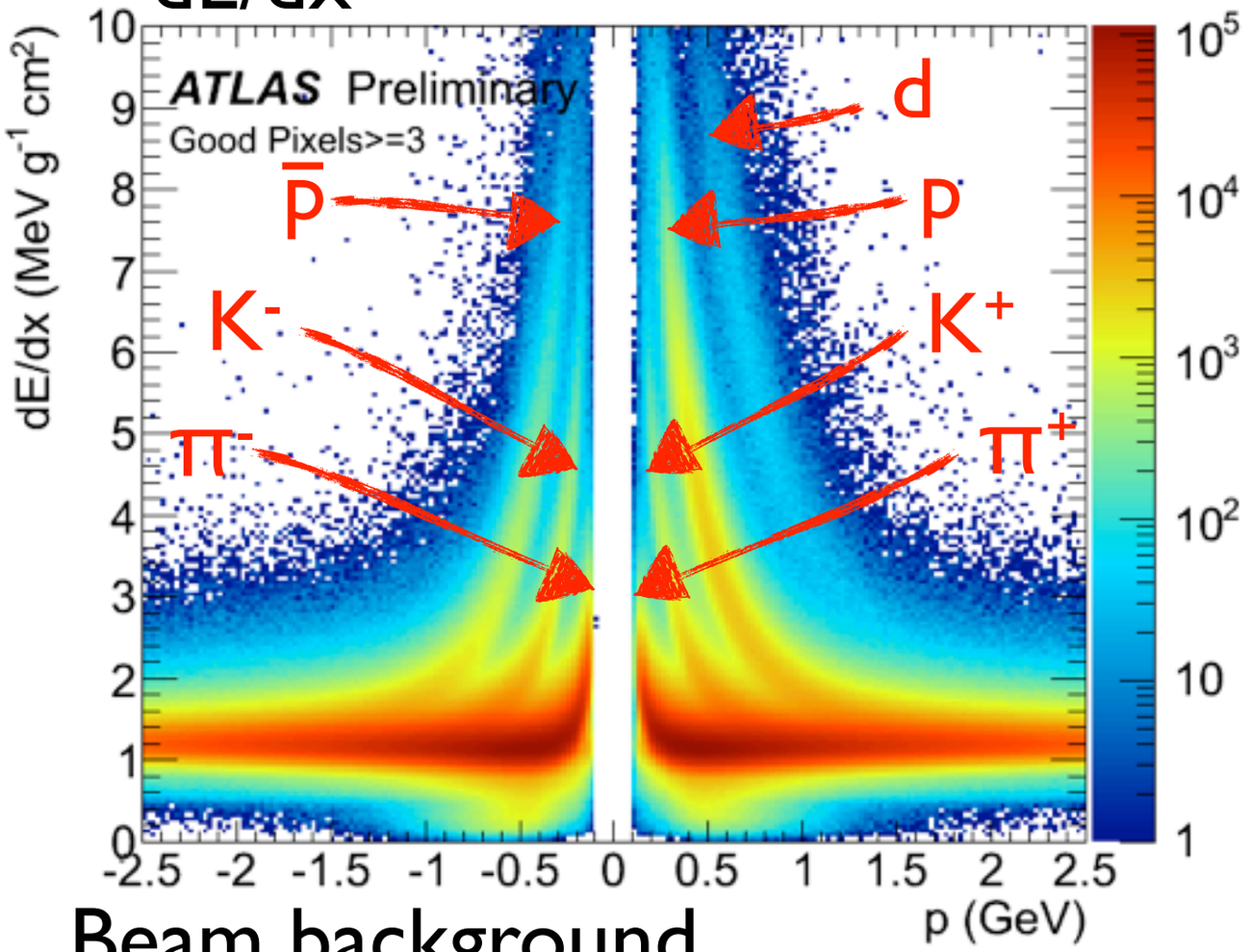


Alignment

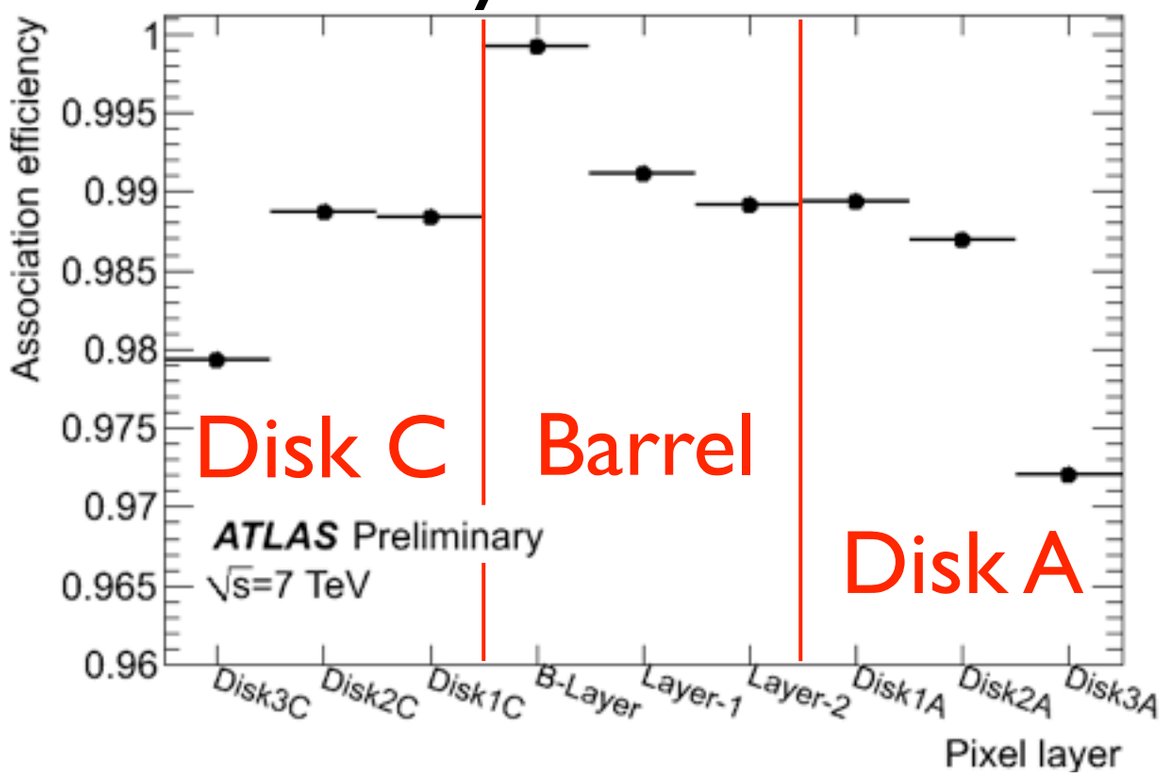


Pixel Detector Performance

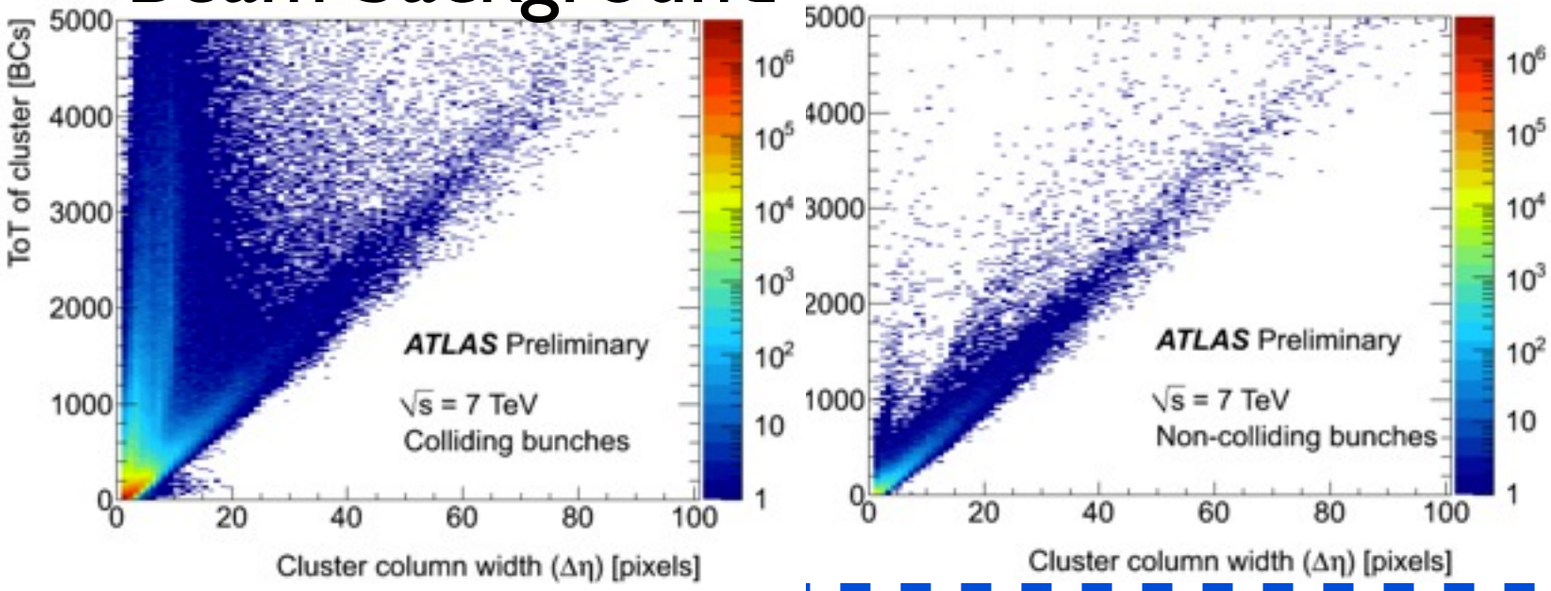
dE/dx



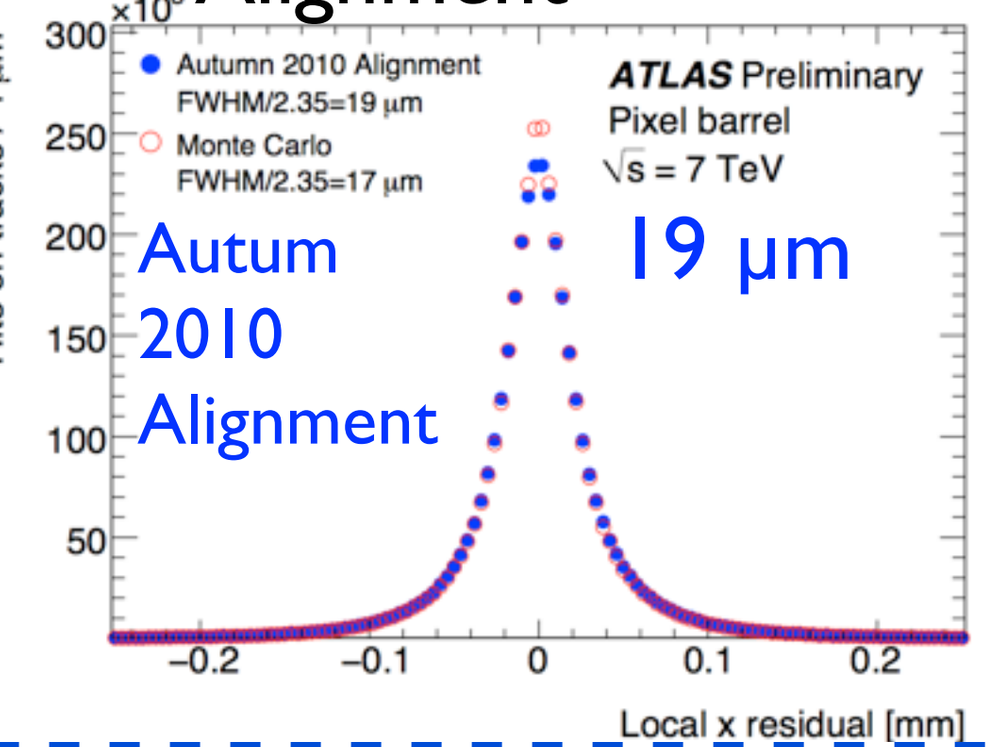
Efficiency



Beam background



Alignment

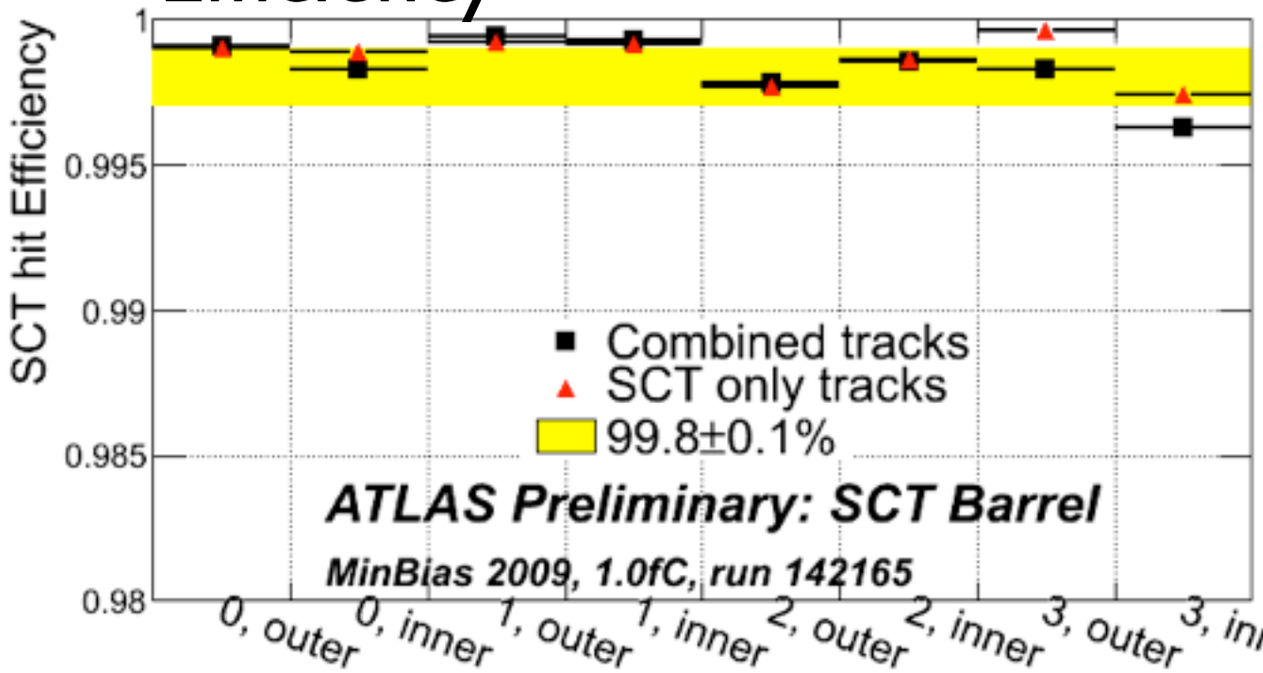


SemiConductor Tracker Detector Performance

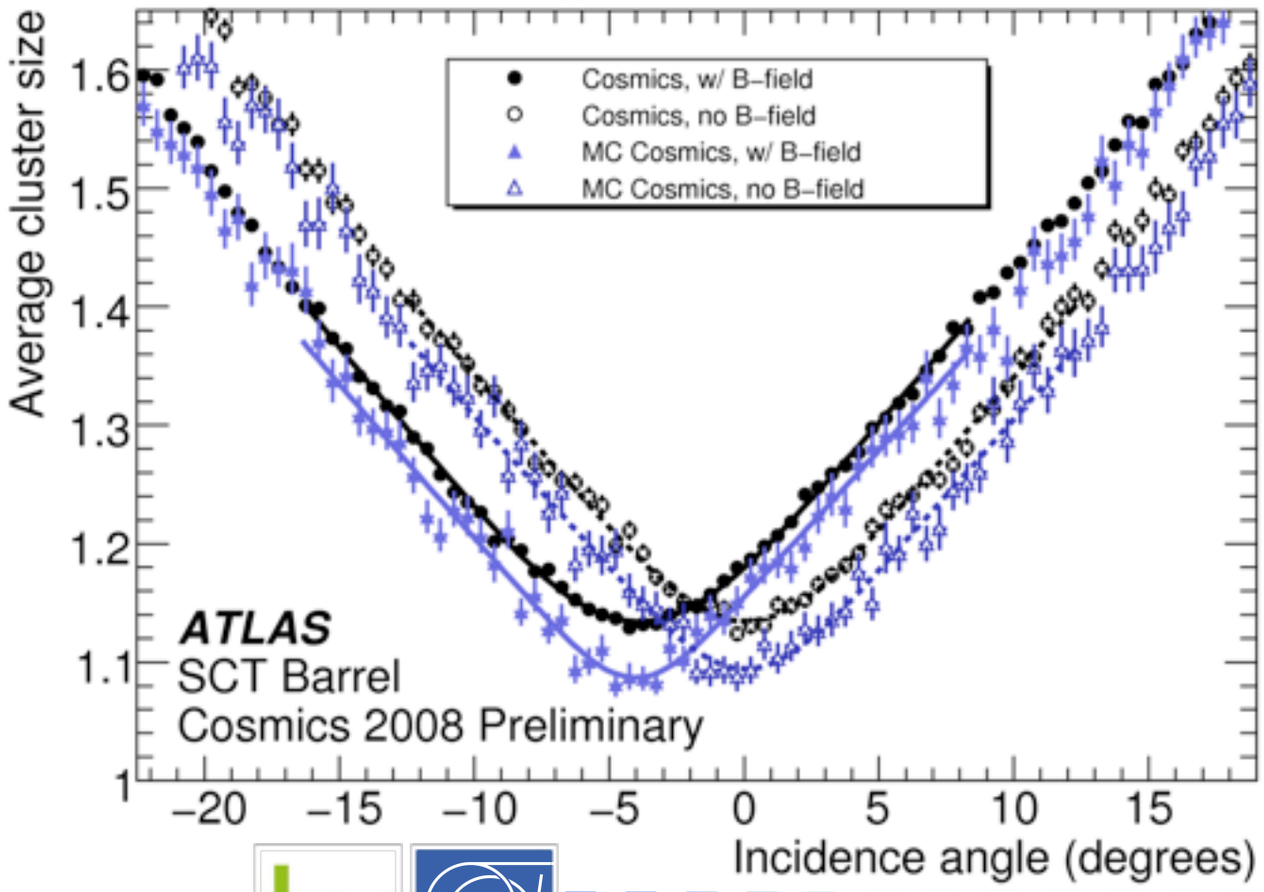
ATLAS SCT Configuration May 2010

Disabled Readout Components	Endcap A	Barrel	Endcap C	SCT	Fraction (%)
Disabled Modules	5	10	15	30	0.73
Disabled Chips	5	24	4	33	0.07
Masked Strips	3,364	3,681	3,628	10,673	0.17
Total Disabled Detector Region					0.97

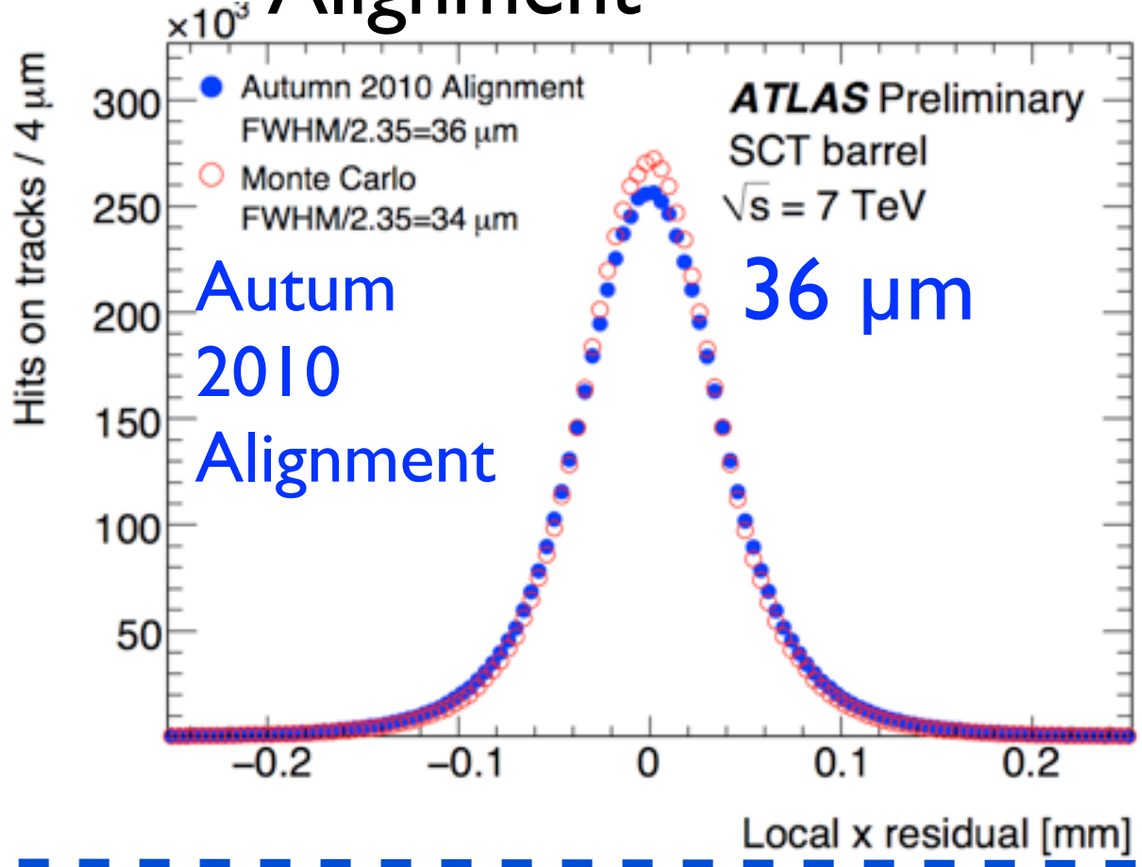
Efficiency



Lorentz Angle

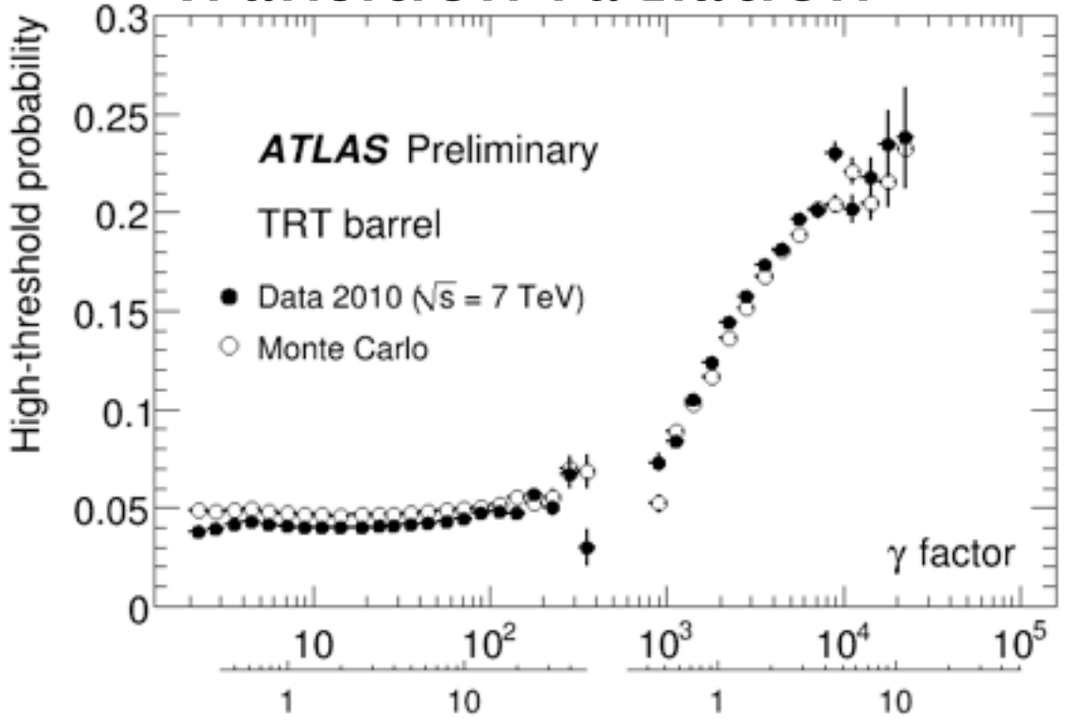


Alignment

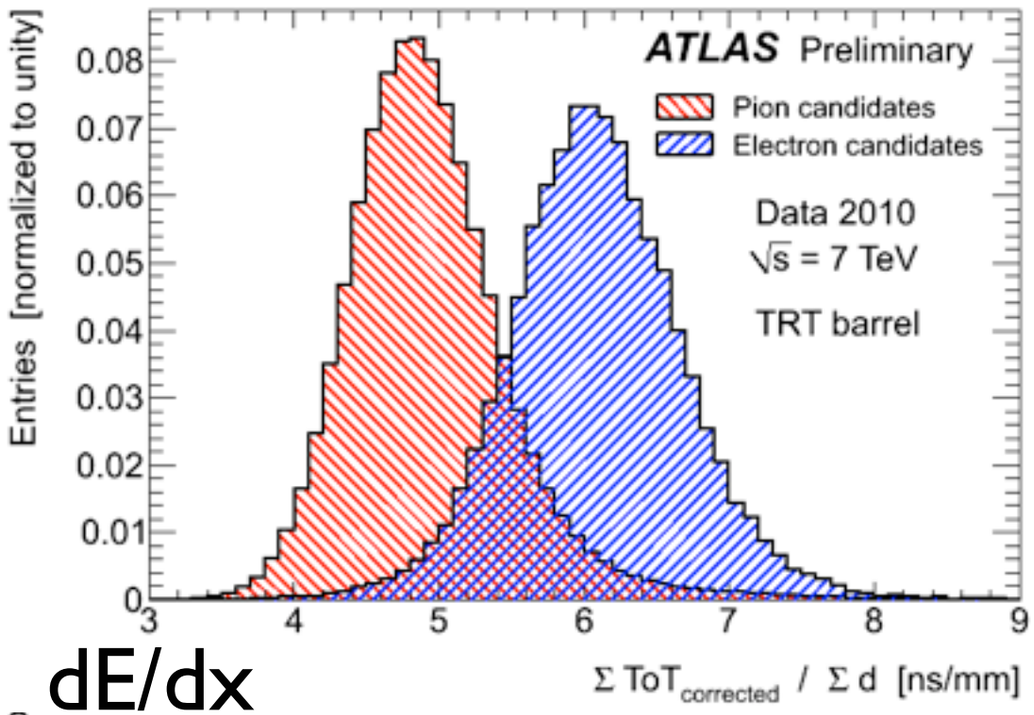


Transition Radiation Tracker Detector Performance

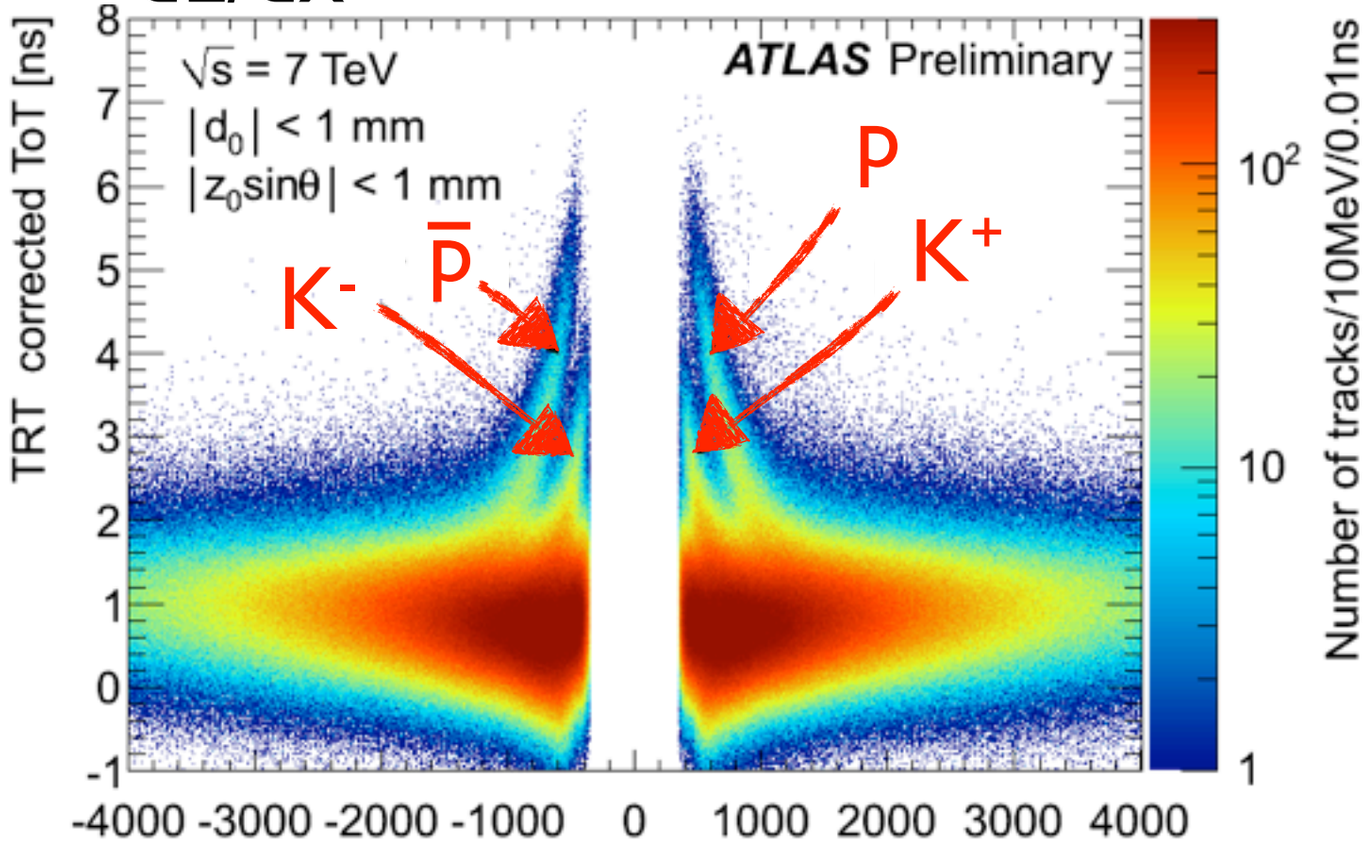
Transition radiation



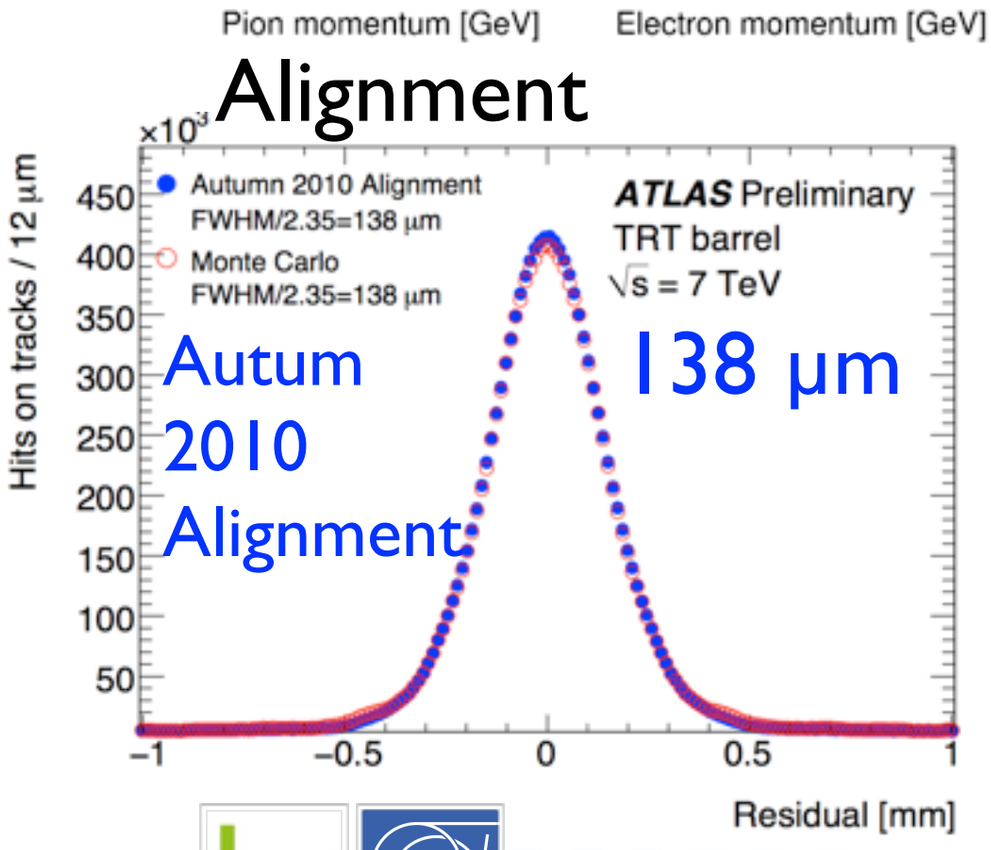
Particle ID



dE/dx



Alignment

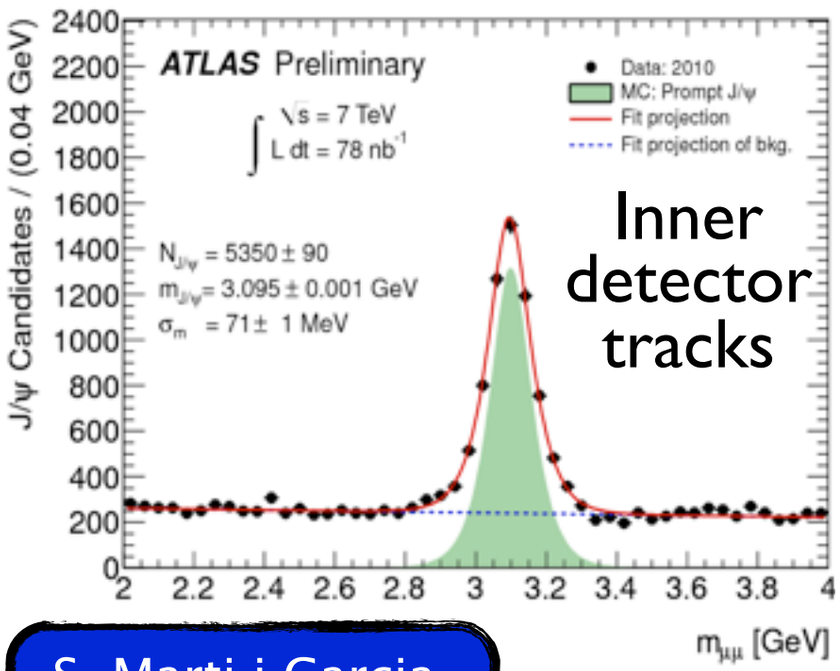


Autum 2010 Alignment

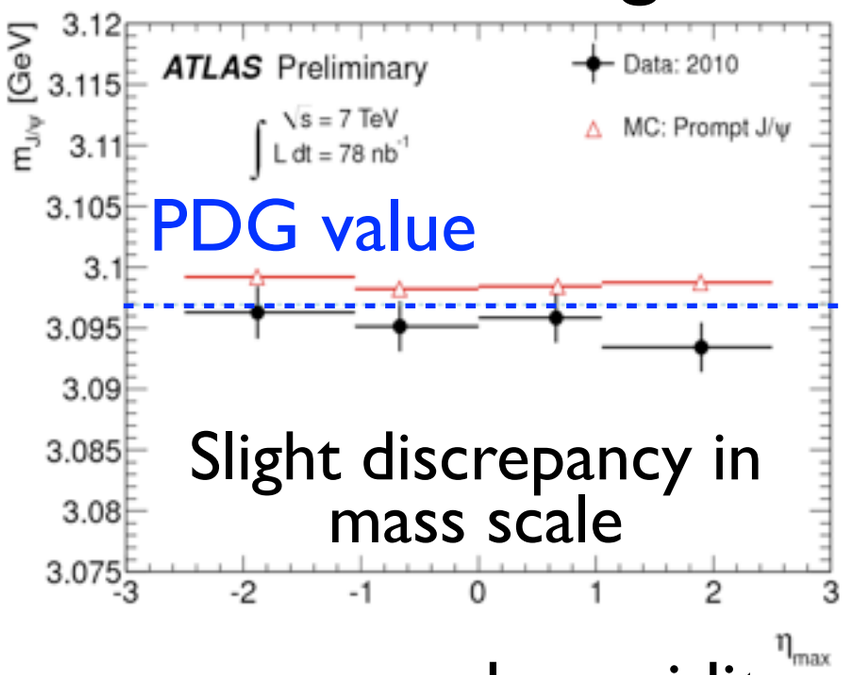
138 μm

Inner Detector Tracking Performance

Momentum resolution and scale using resonances: J/ψ example

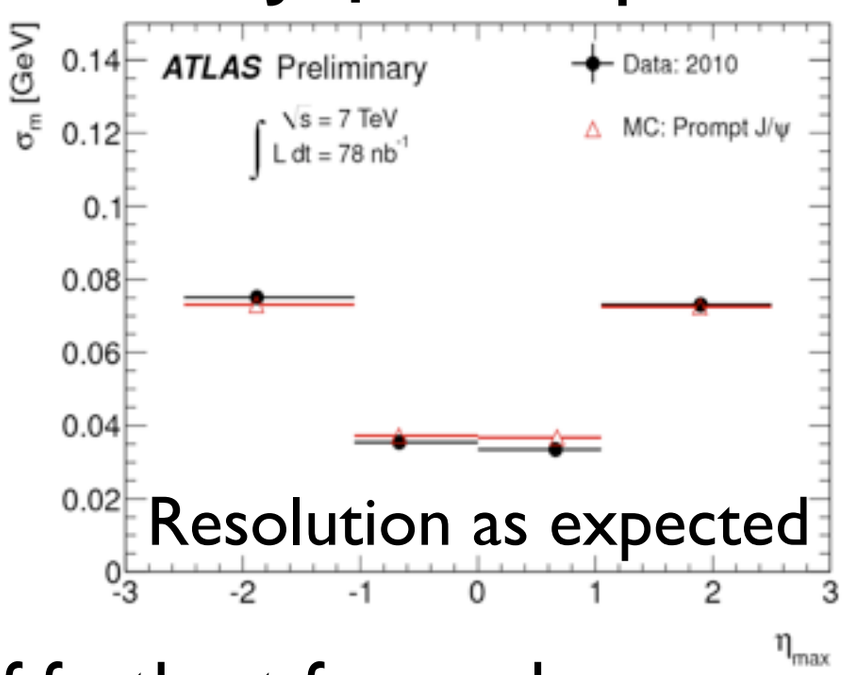


Inner detector tracks



PDG value

Slight discrepancy in mass scale

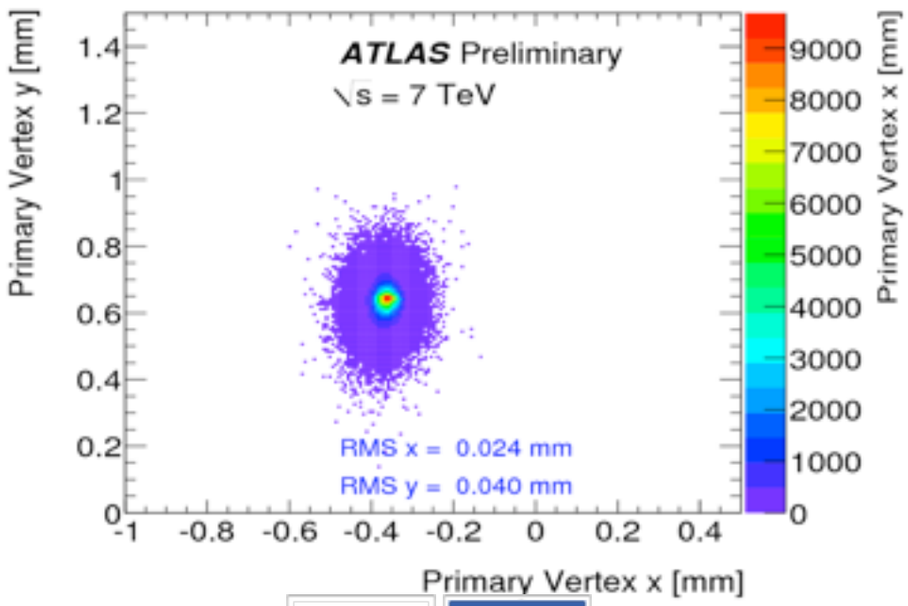


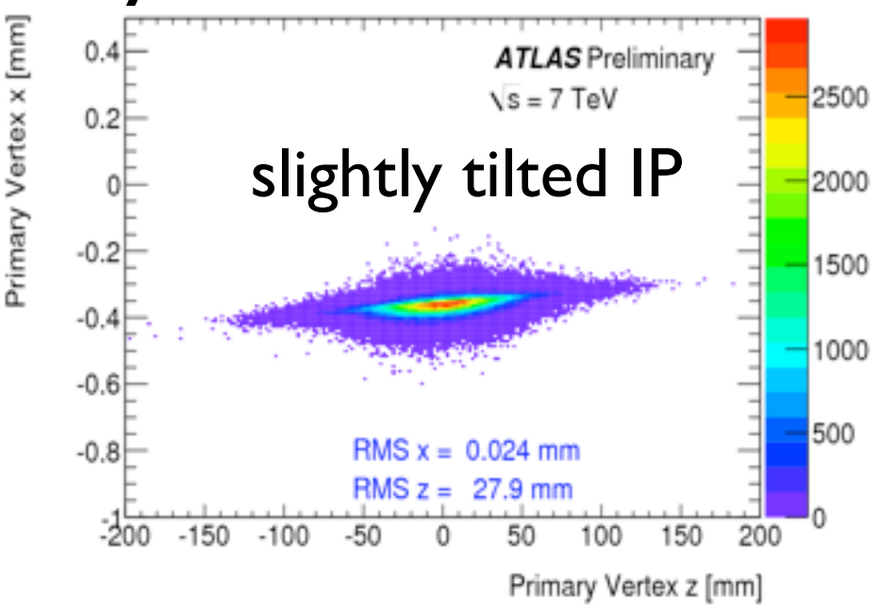
Resolution as expected

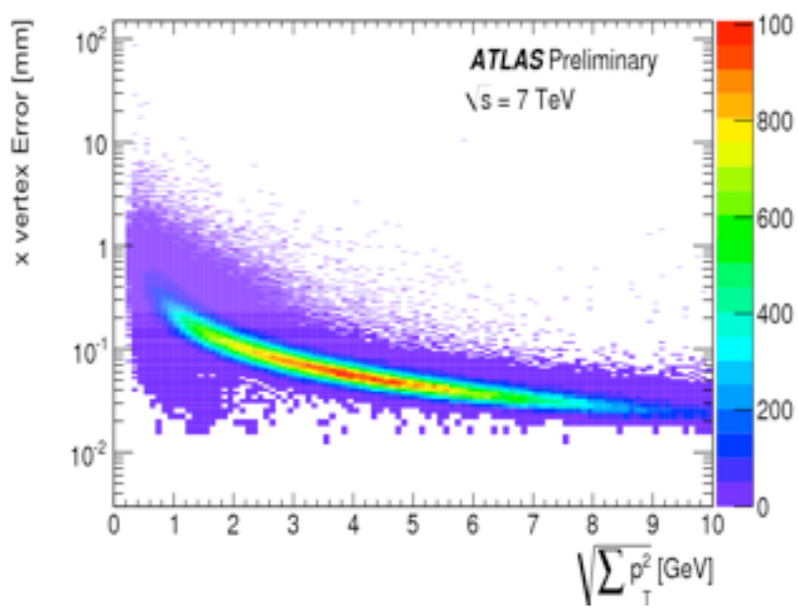
pseudo-rapidity of furthest forward muon

S. Marti i Garcia, Mon. 14:30 Detector 1

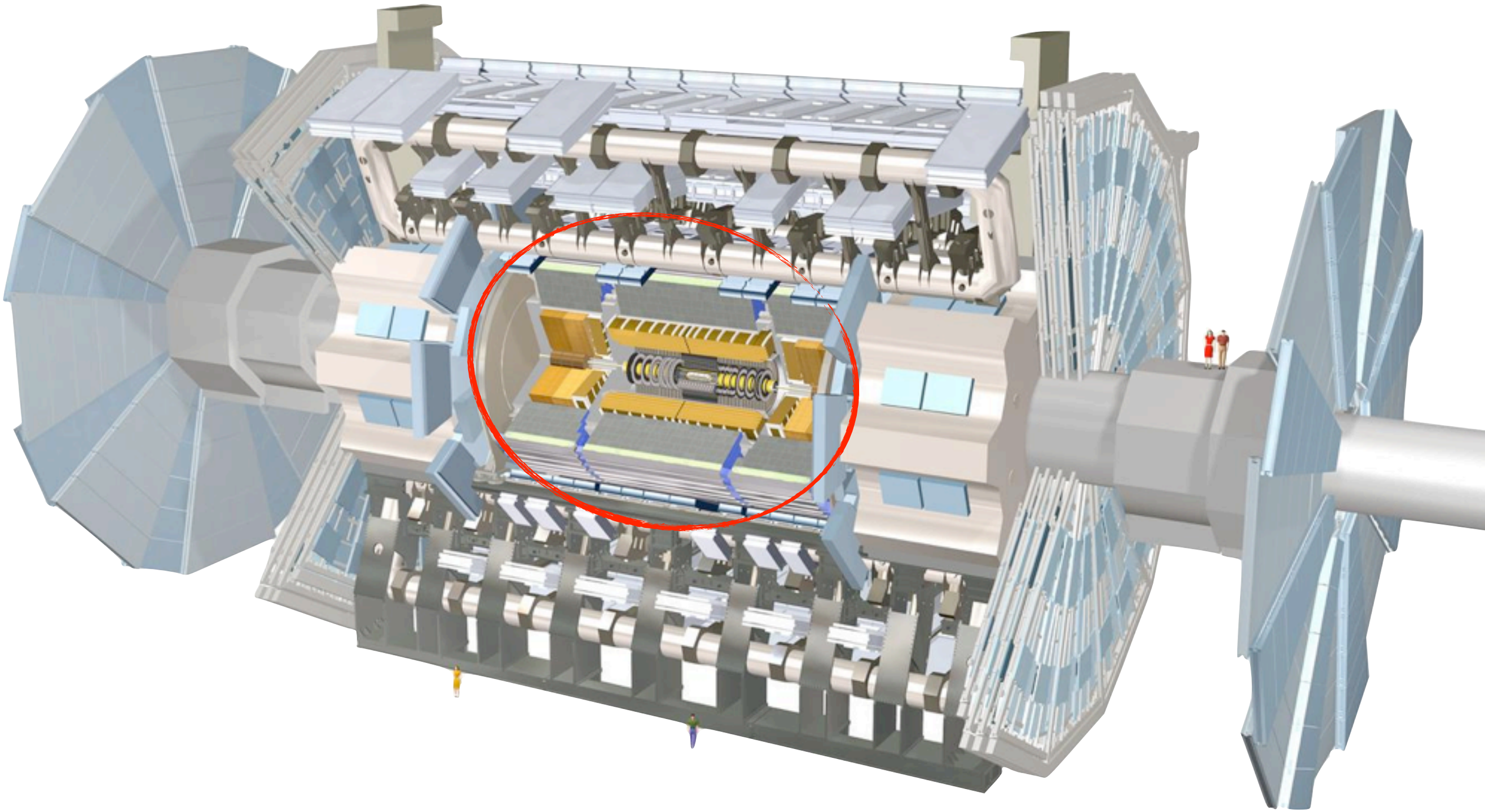
Primary vertex reconstruction







ATLAS Calorimeters



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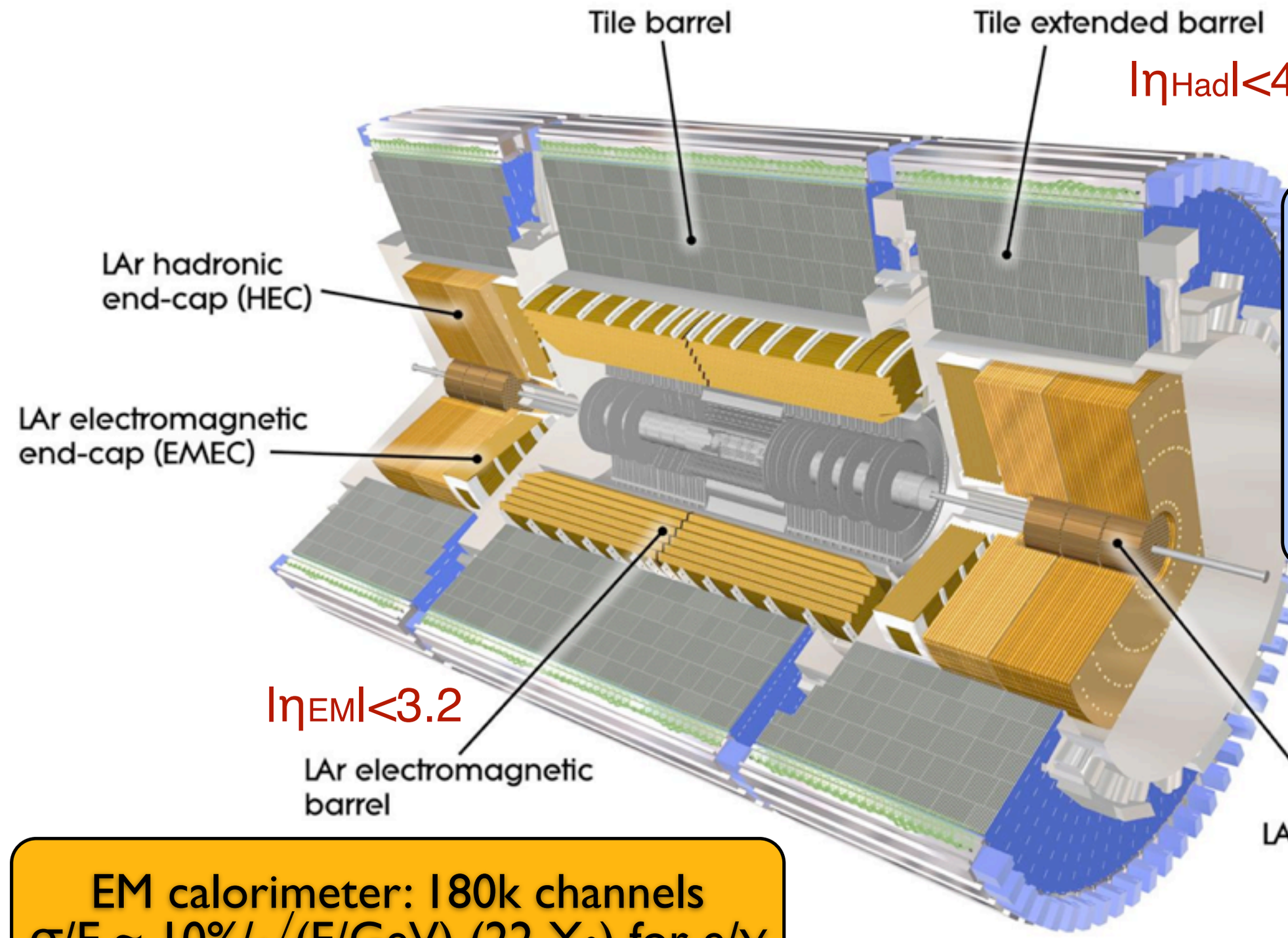
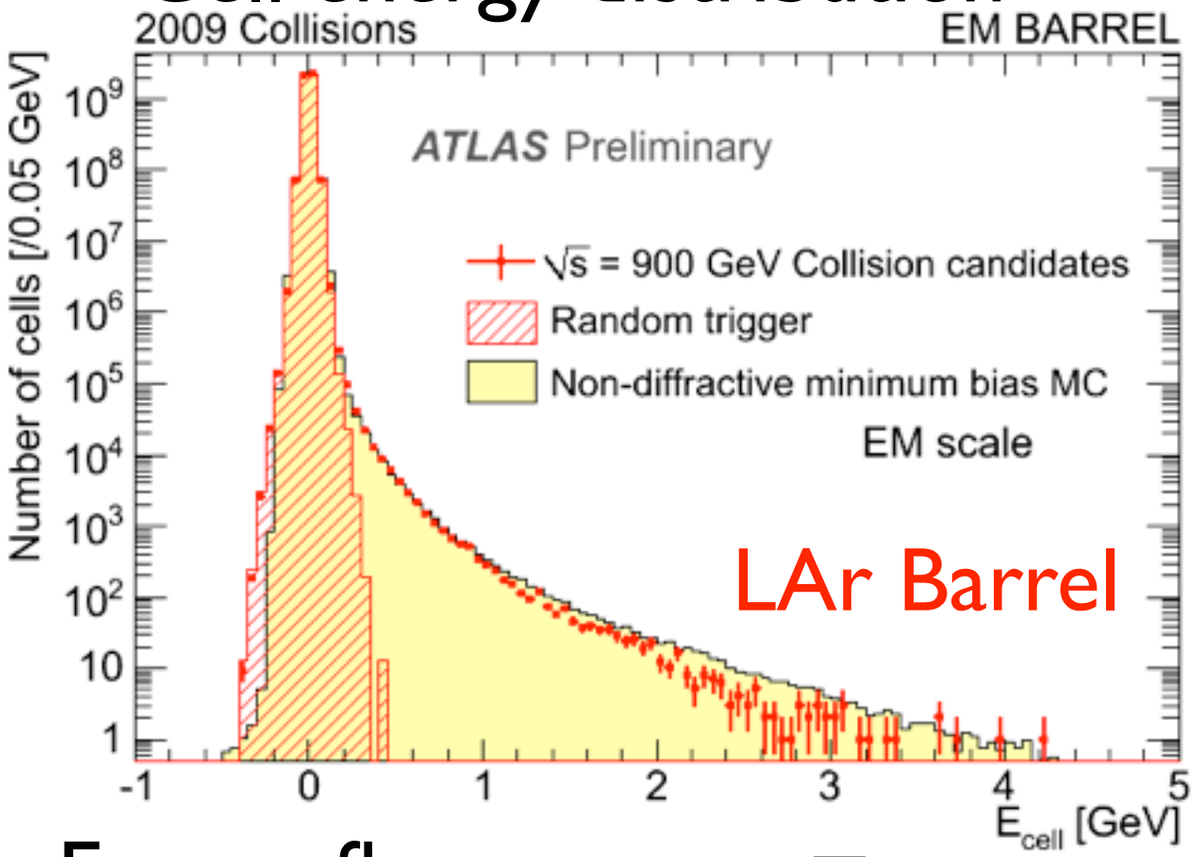


Hadronic calorimeter: 20k channels
σ/E: $\sim 60\%/\sqrt{(E/GeV)} \oplus 0.03$
(10λ) for jets

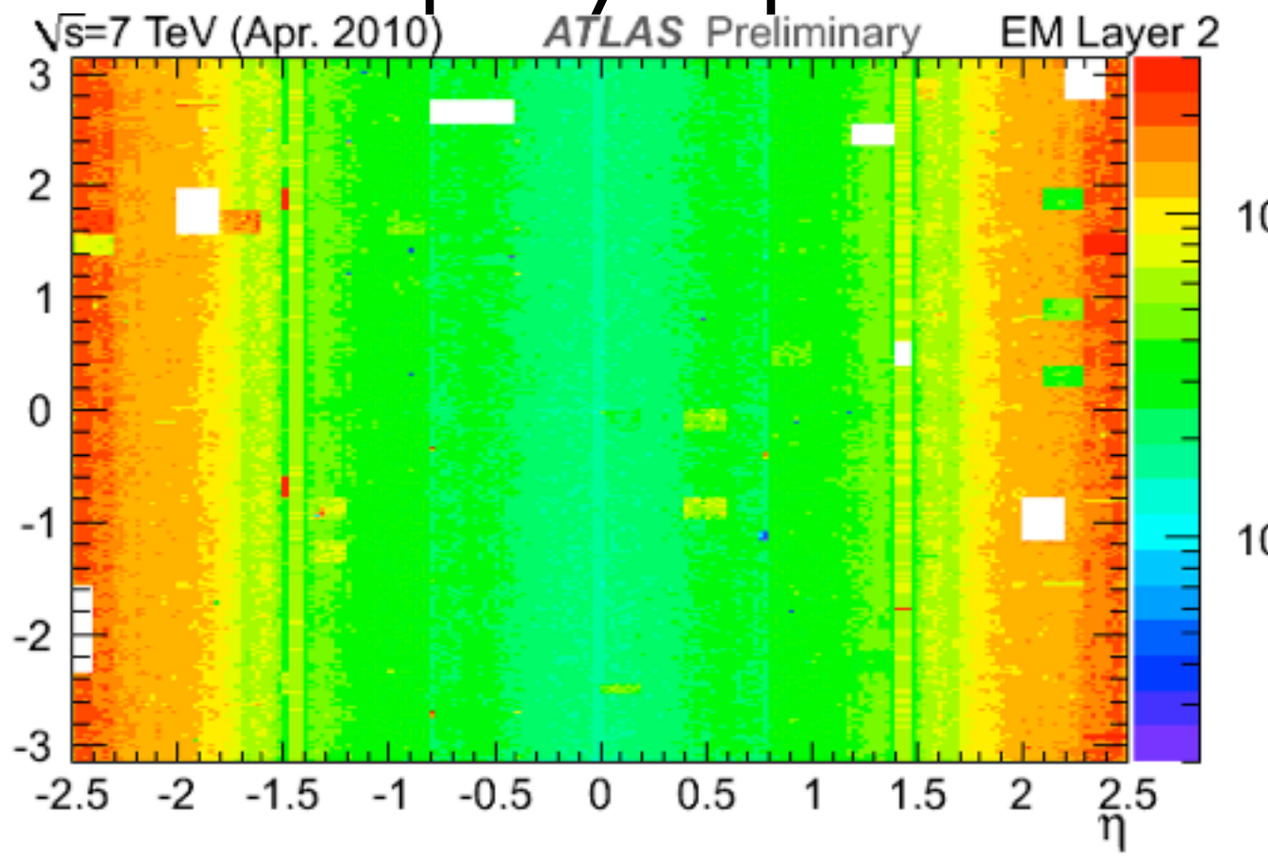
EM calorimeter: 180k channels
$\sigma/E \sim 10\%/\sqrt{(E/GeV)}$ $(22\ X_0)$ for e/γ

Liquid Argon Calorimeter Performance

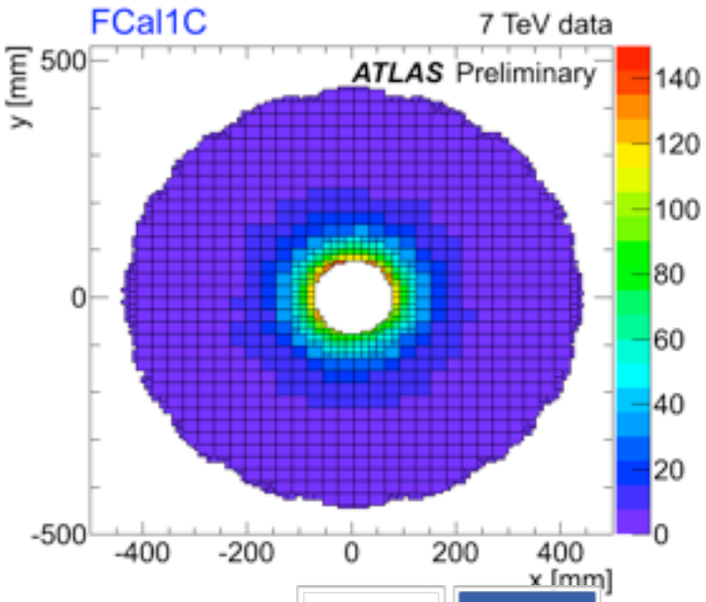
Cell energy distribution



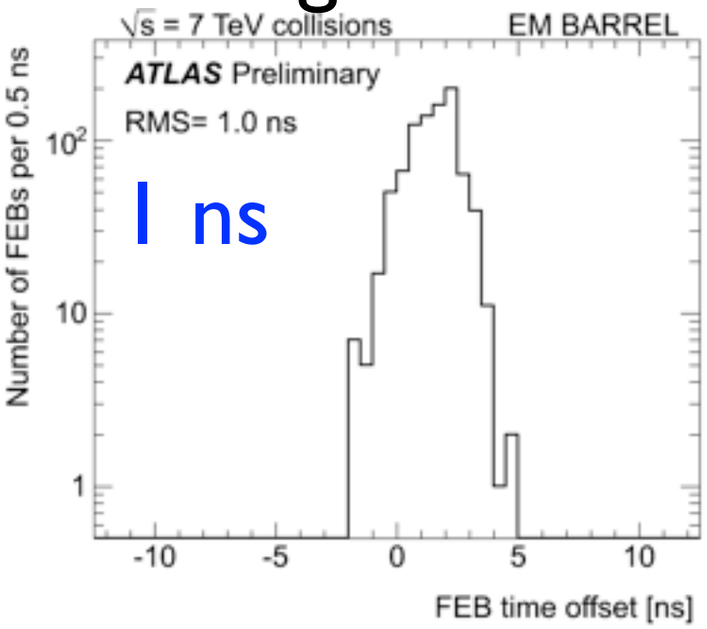
Cell occupancy map



Energy flow



Timing



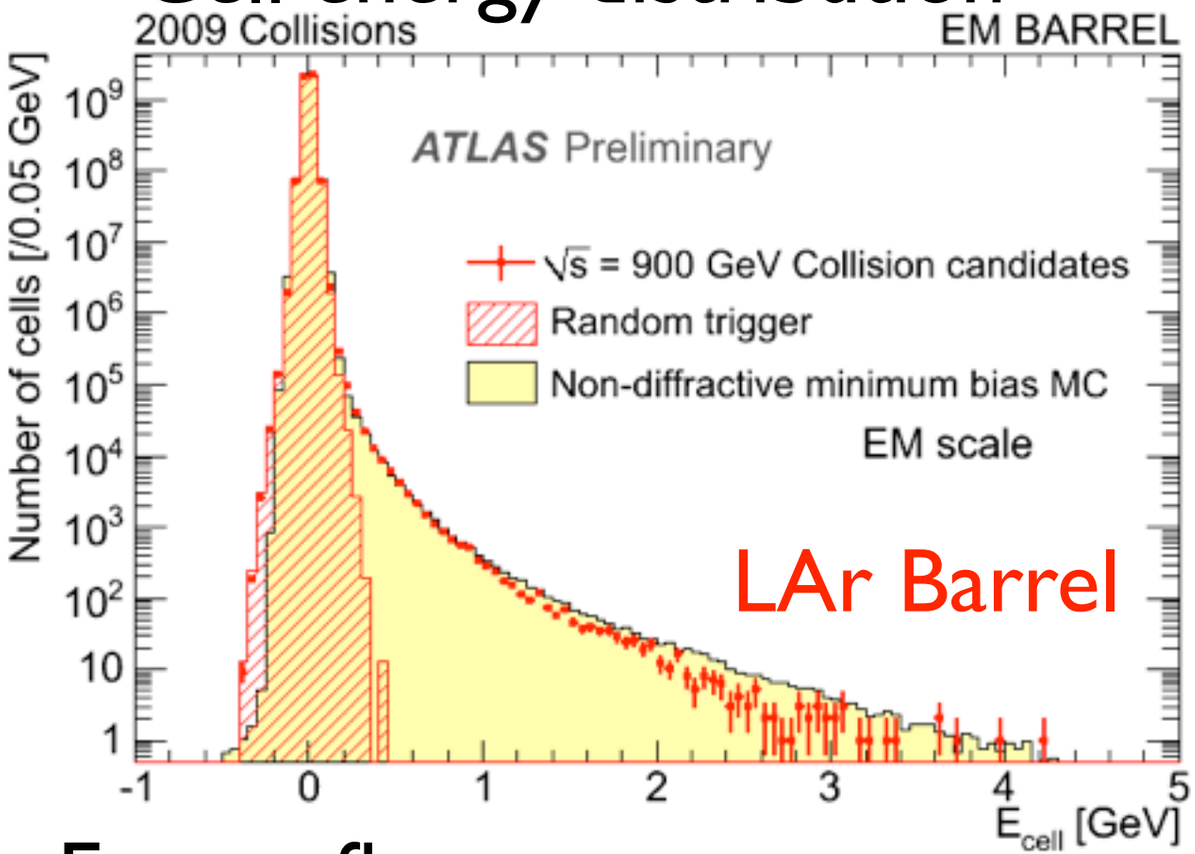
problematic cells (0.1%)

dead readout (1.3%)

non-nominal HV regions (6%) cell energy corrections increase noise

Liquid Argon Calorimeter Performance

Cell energy distribution



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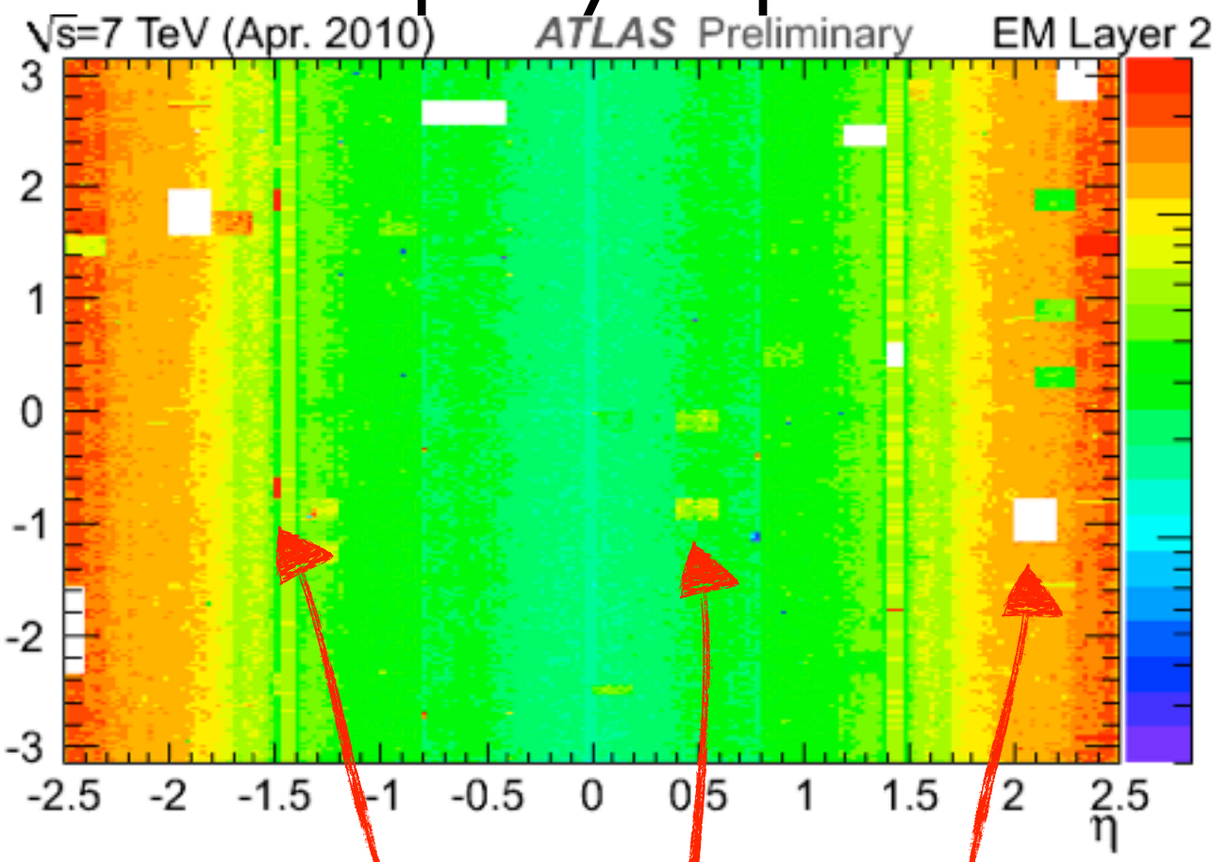
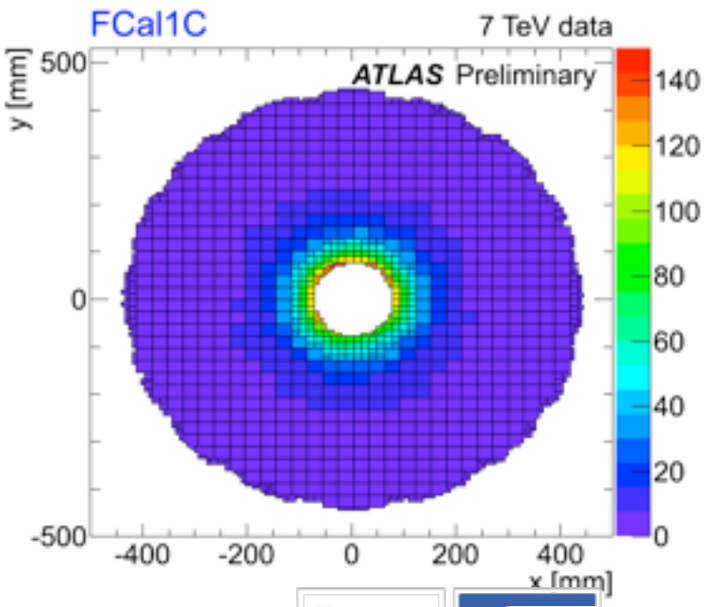


Energy flow



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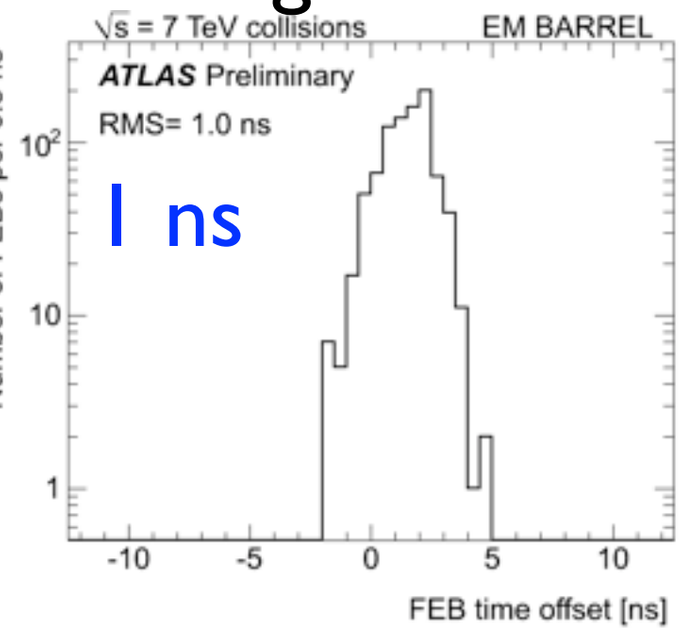
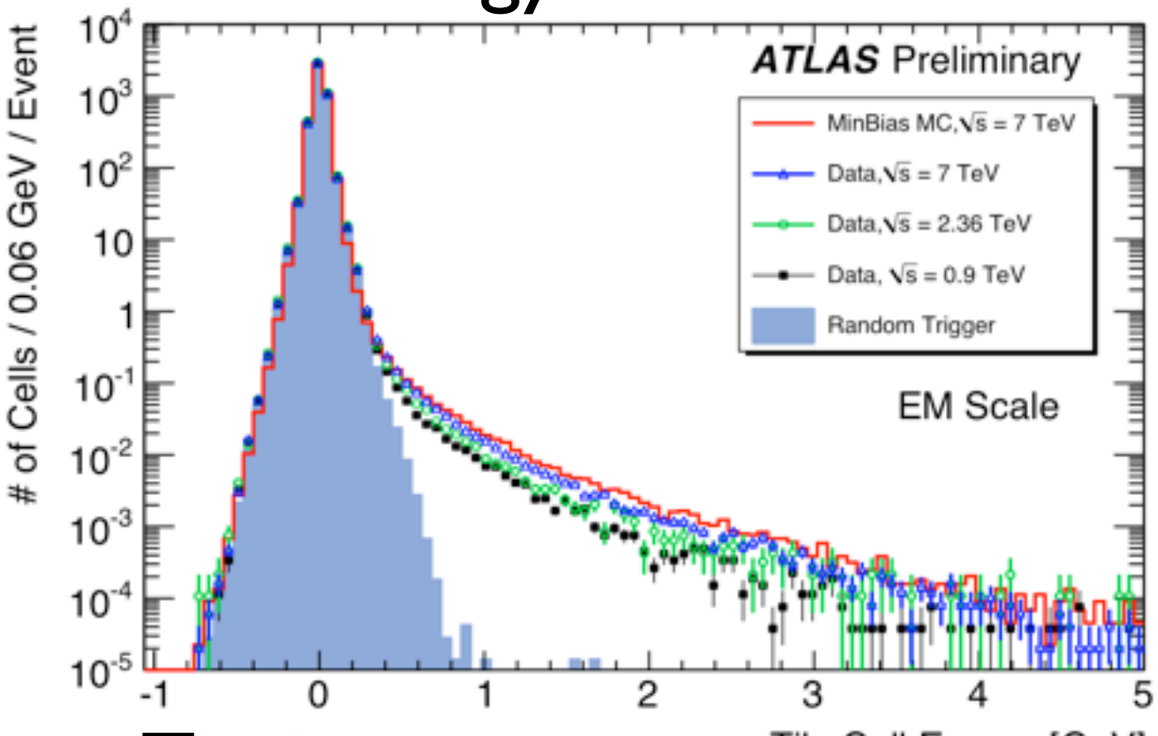
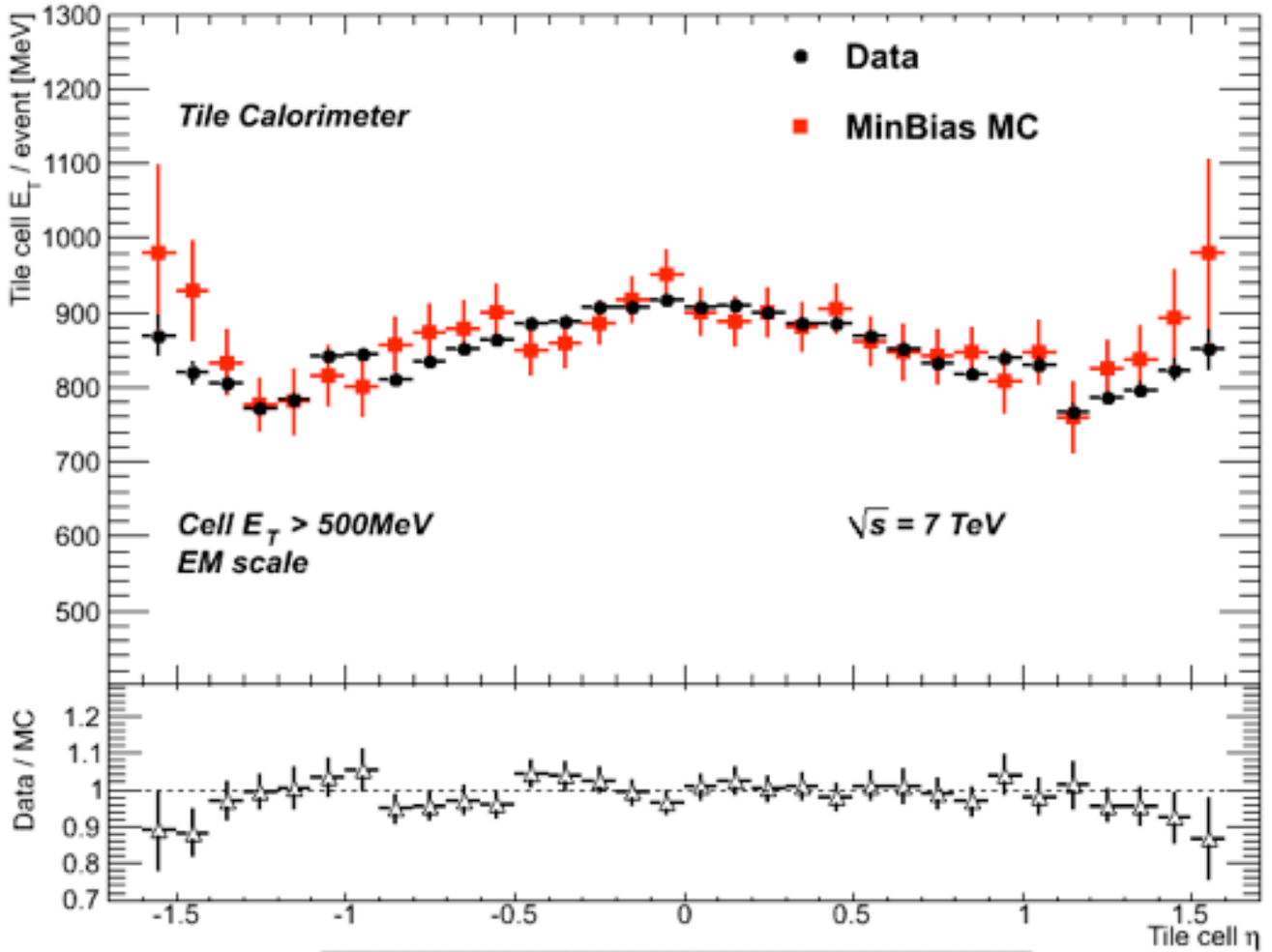


Hadronic Tile Calorimeter Perfomance

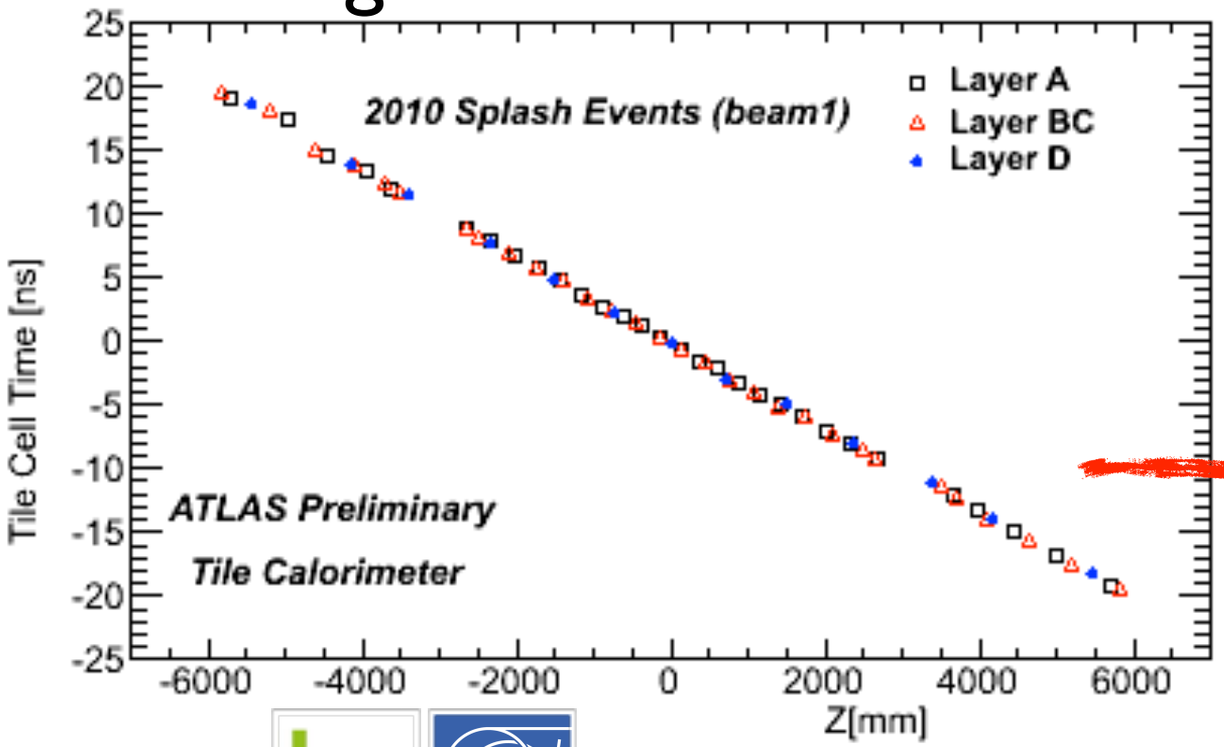
Cell energy distribution

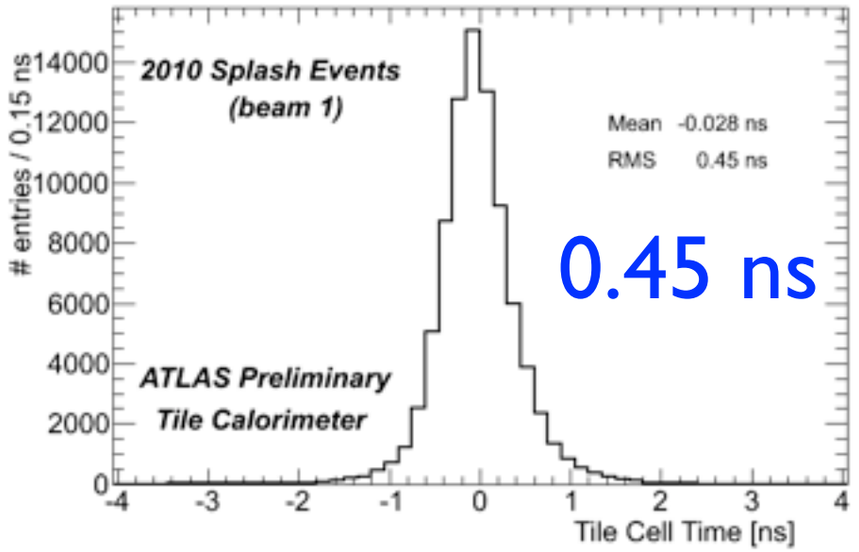


Cell energy vs. η



Timing



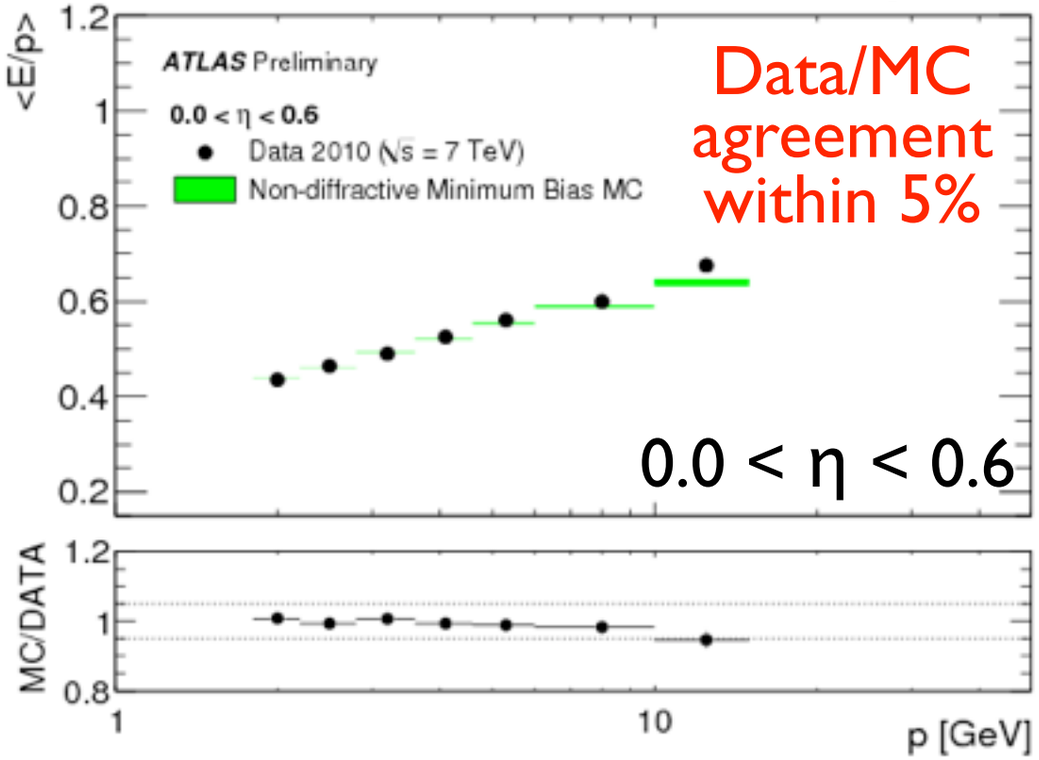


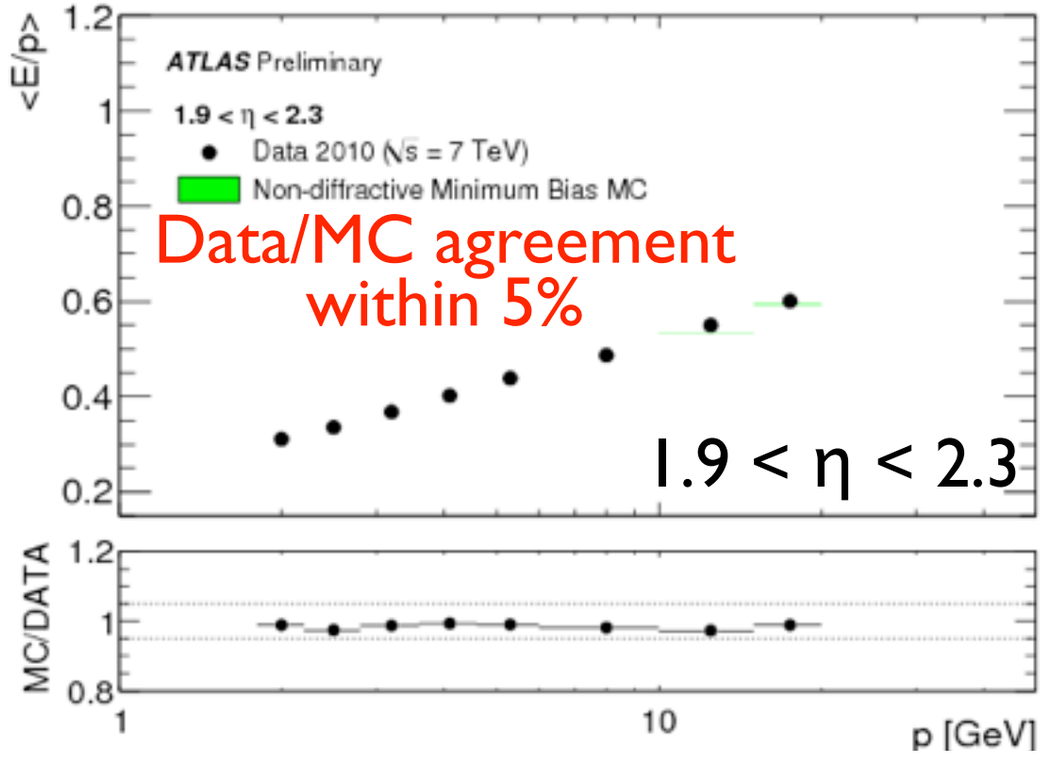
0.45 ns

Calorimeter E/p Performance & Efficiency

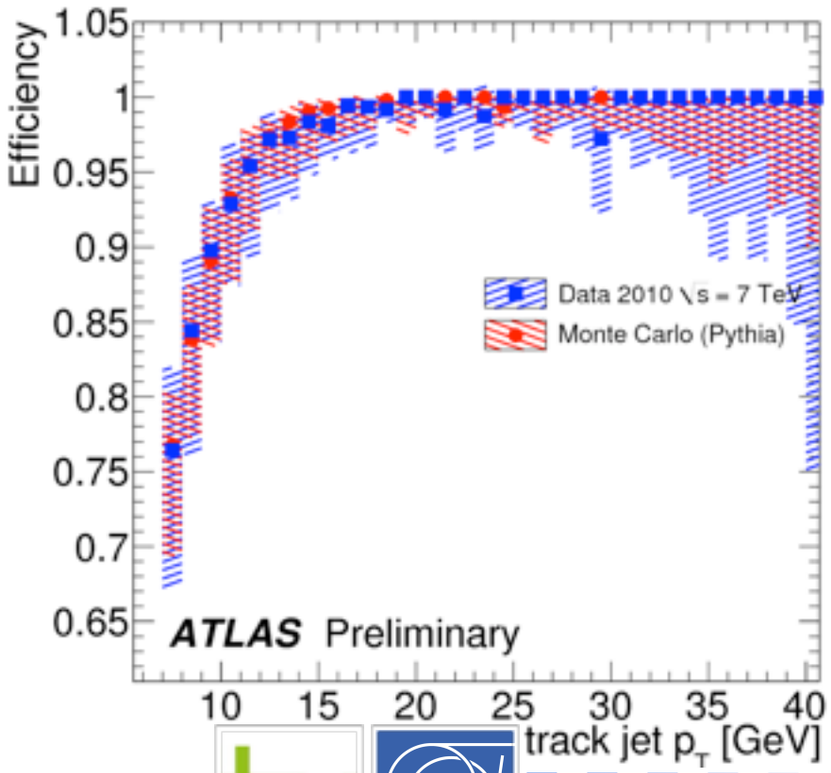
C. Santoni, Mon. 15:30 Detector 1

E/p vs. track momentum

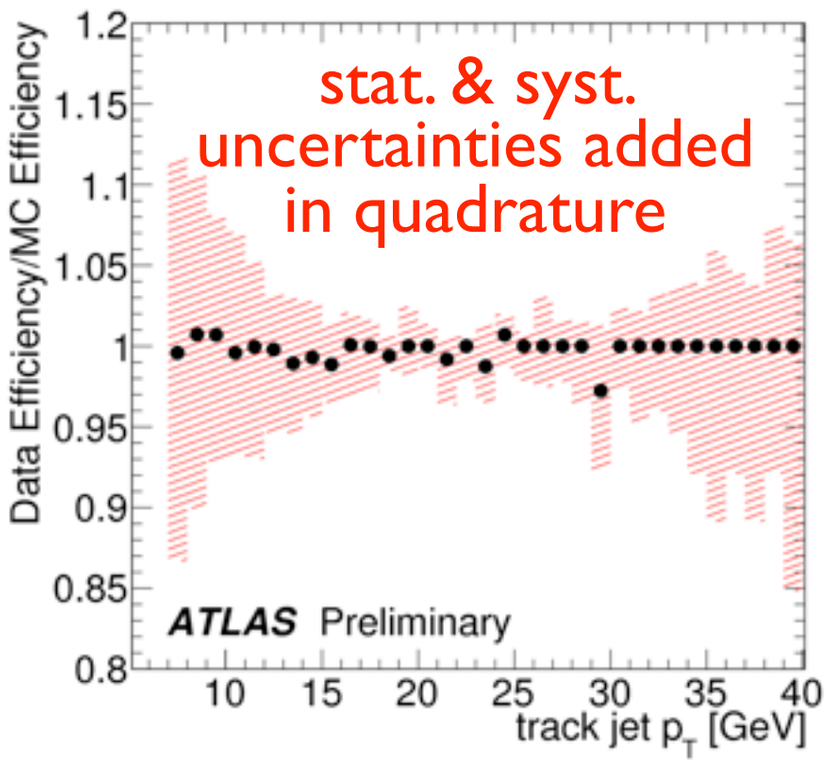




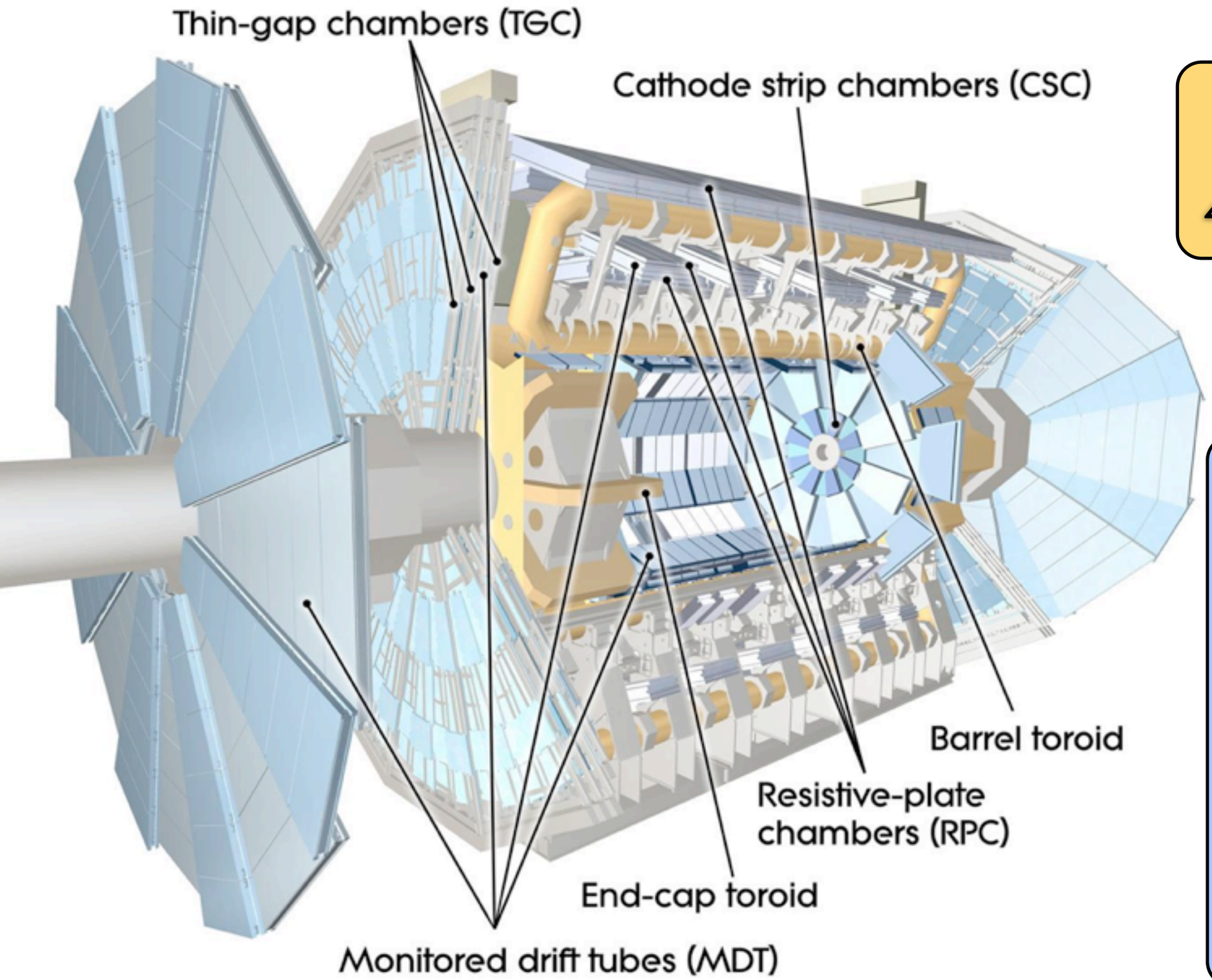
Selection efficiency relative to track jets



ratio of the relative efficiency in data to that in Monte Carlo



ATLAS Muon Spectrometer



Toroid:
2-6 Tm $|\eta|<1.3$
4-8 Tm $1.6<|\eta|<2.7$

$|\eta|<2.7$

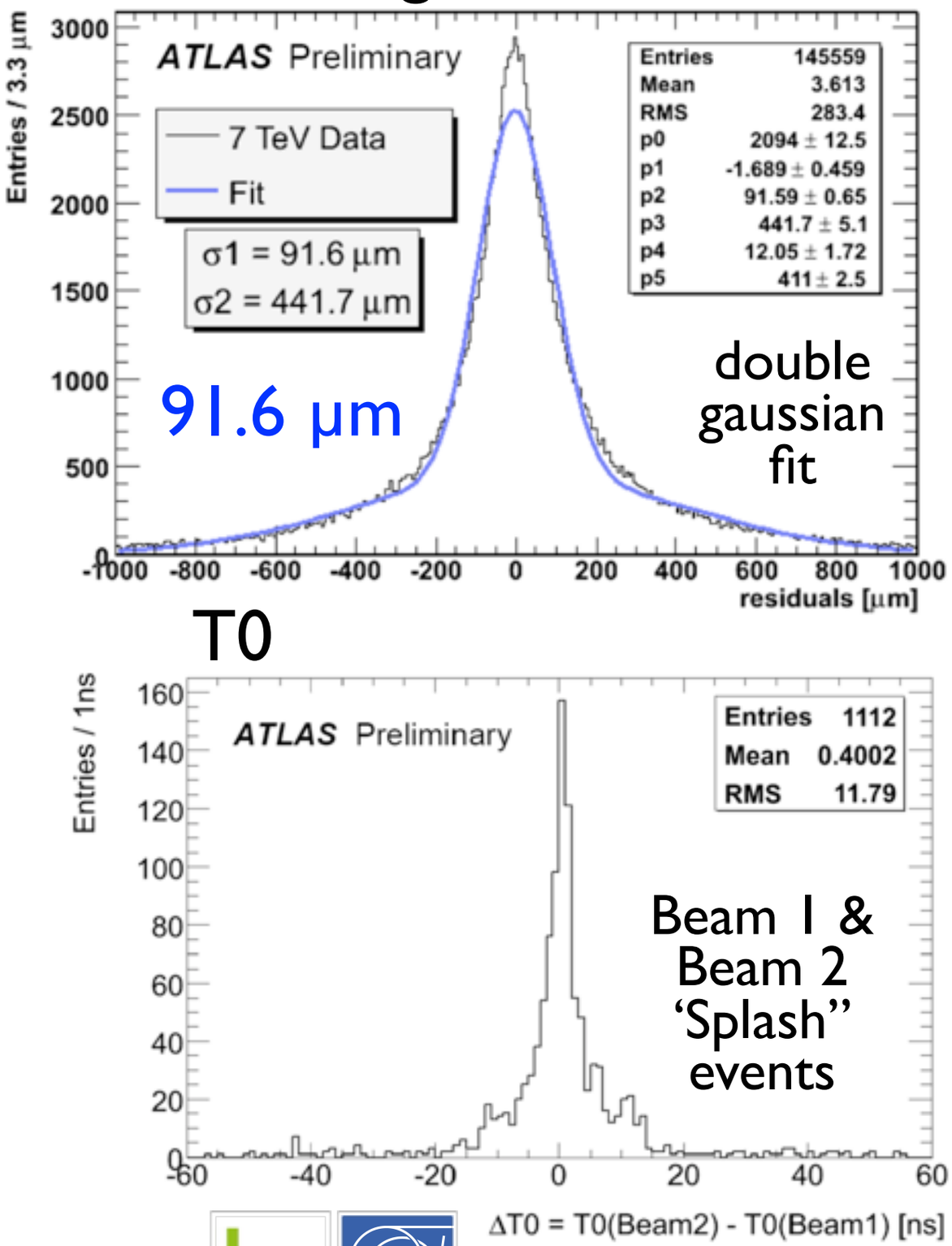
Muon spectrometer:
$\sigma/p_T < 10\%$
up to 1 TeV

Trigger chambers:
RPC &TGC

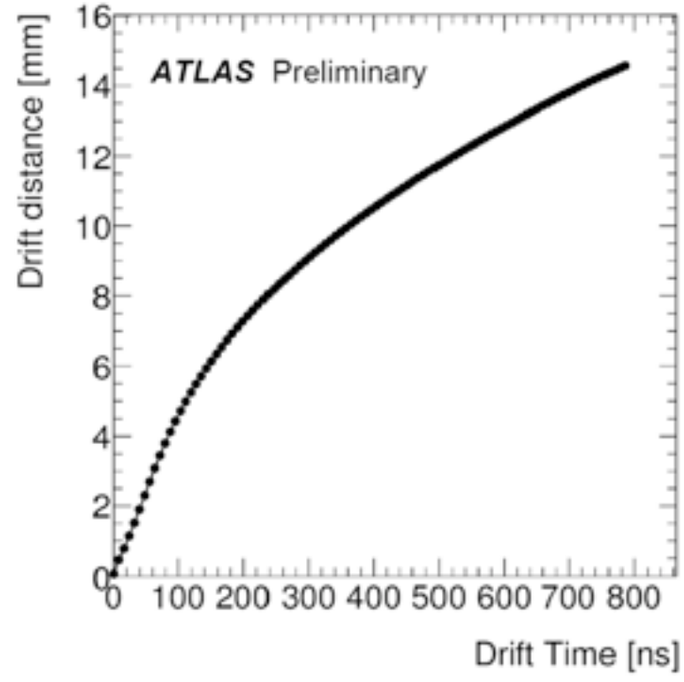
Precision chamber:
MDT & CSC

Muon Spectrometer Performance

MDT segment residuals

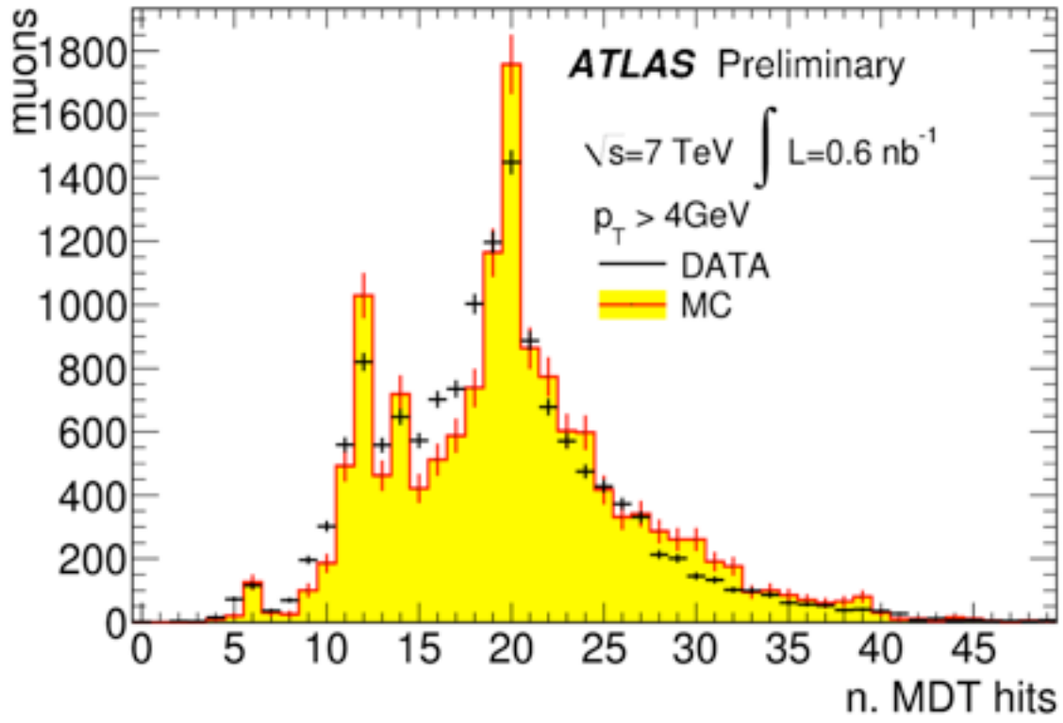


Space time relationship



T0

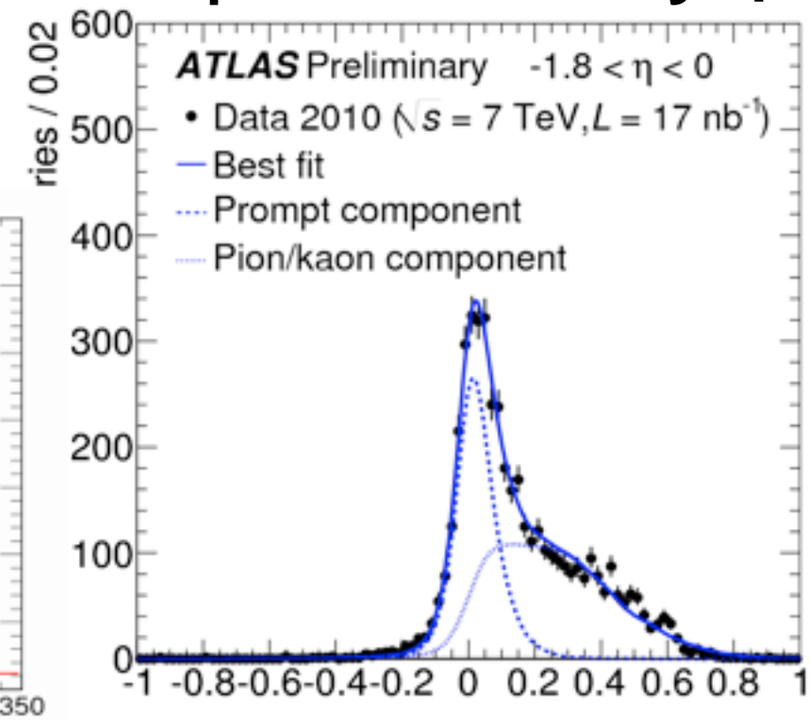
MDT hits on combined μ tracks



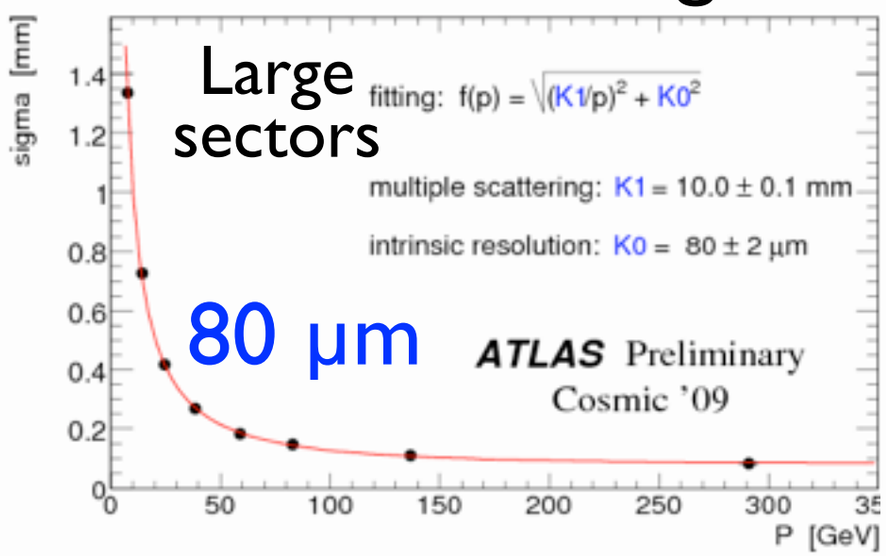
Muon Spectrometer Performance

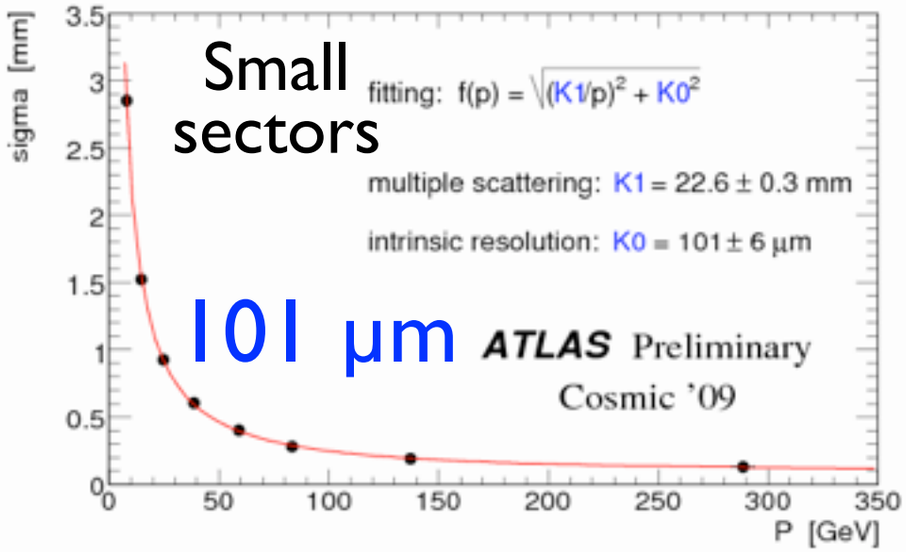
M. Bindi,
Mon. 16:00
Detector 1

Validate prompt muon component with J/ψ

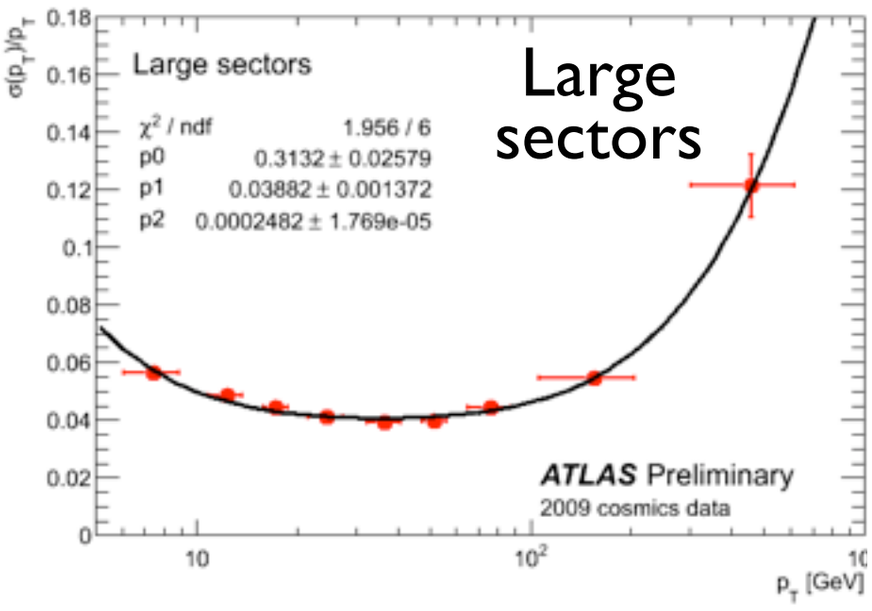


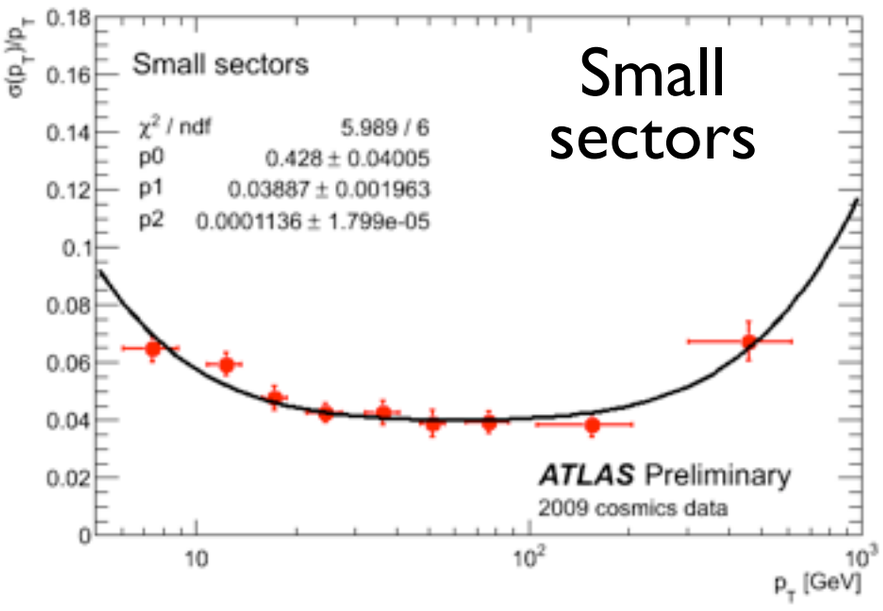
Sagitta resolution



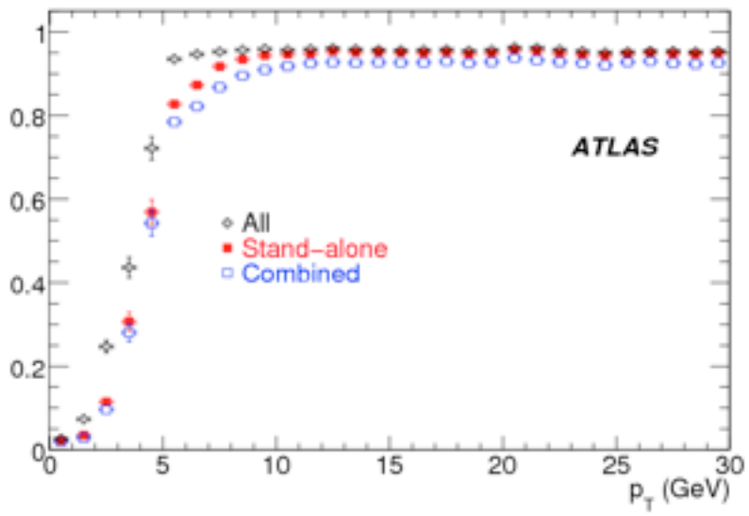


Momentum resolution



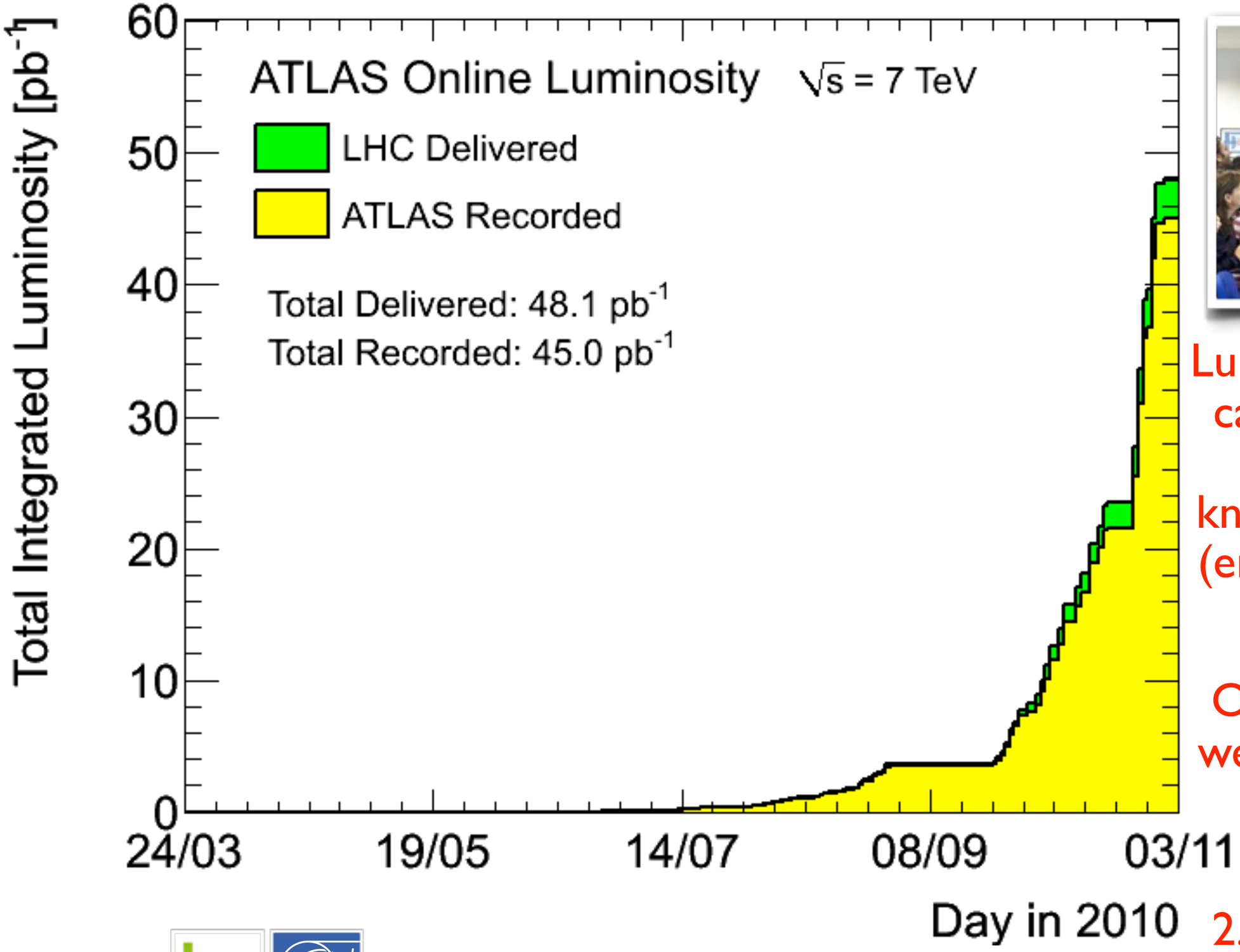


Reconstruction efficiency



Operation: Integrated Luminosity vs. Time (Protons)

(2010: from first $\sqrt{s}$ =7 TeV collisions on 30 March to 31 October)



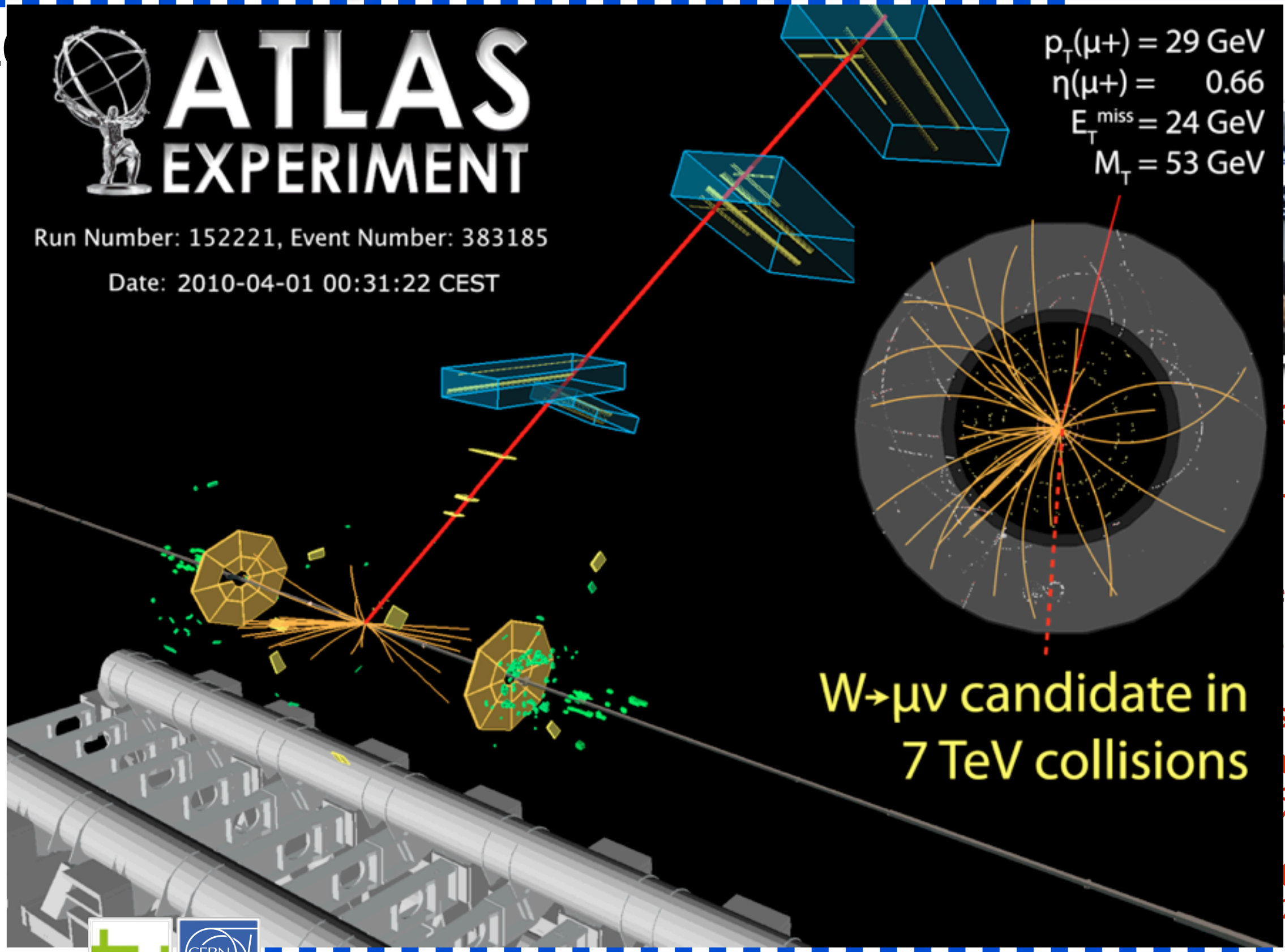
Luminosity detectors calibrated with van der Meer scans. known today to 11% (error dominated by beam currents)

Overall luminosity-weighted data taking efficiency: 94%

Peak luminosity: 2.07×10^{32} cm^{-2} s^{-1}

Operation: Integrated Luminosity vs. Time (Protons)

(2 ...er)



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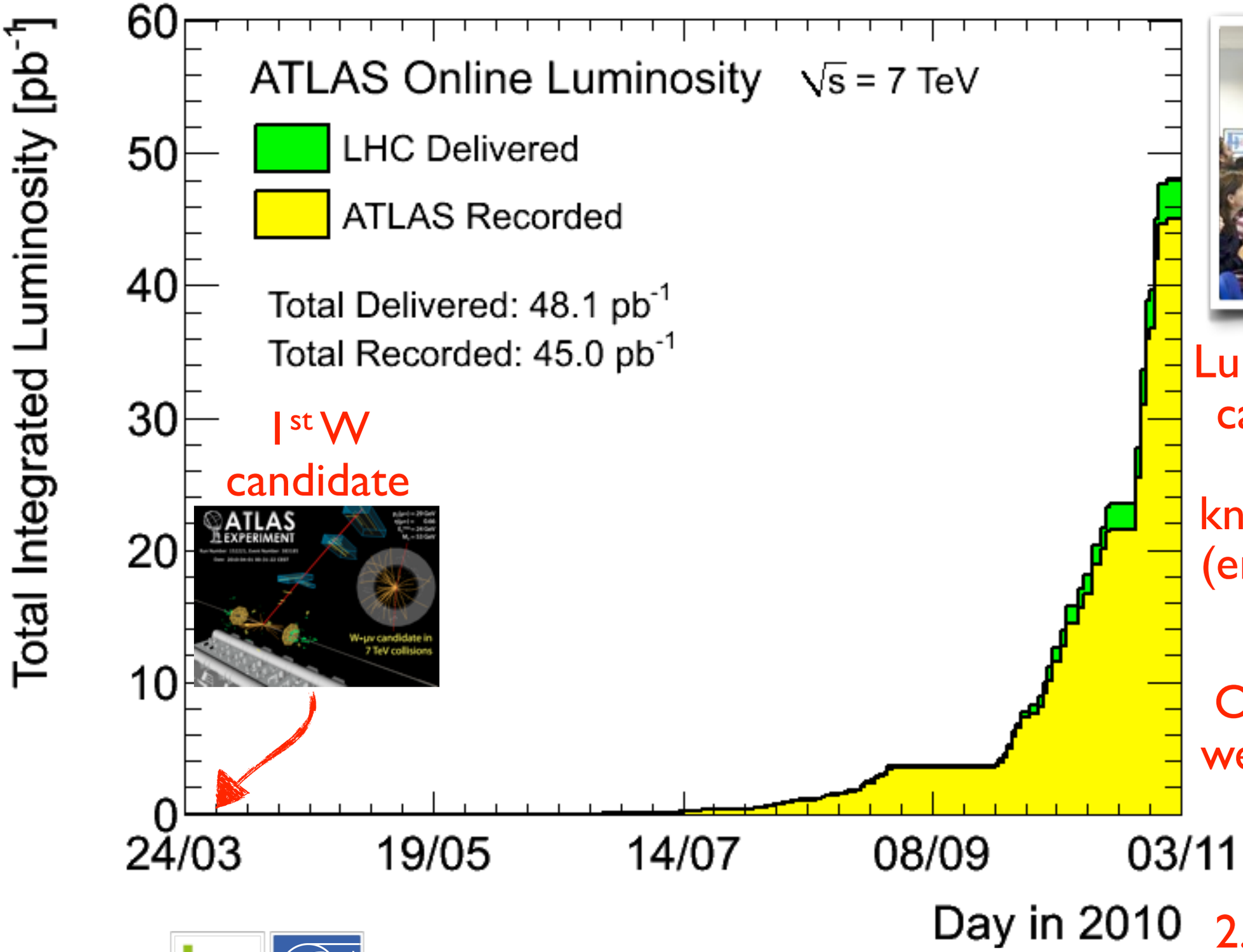

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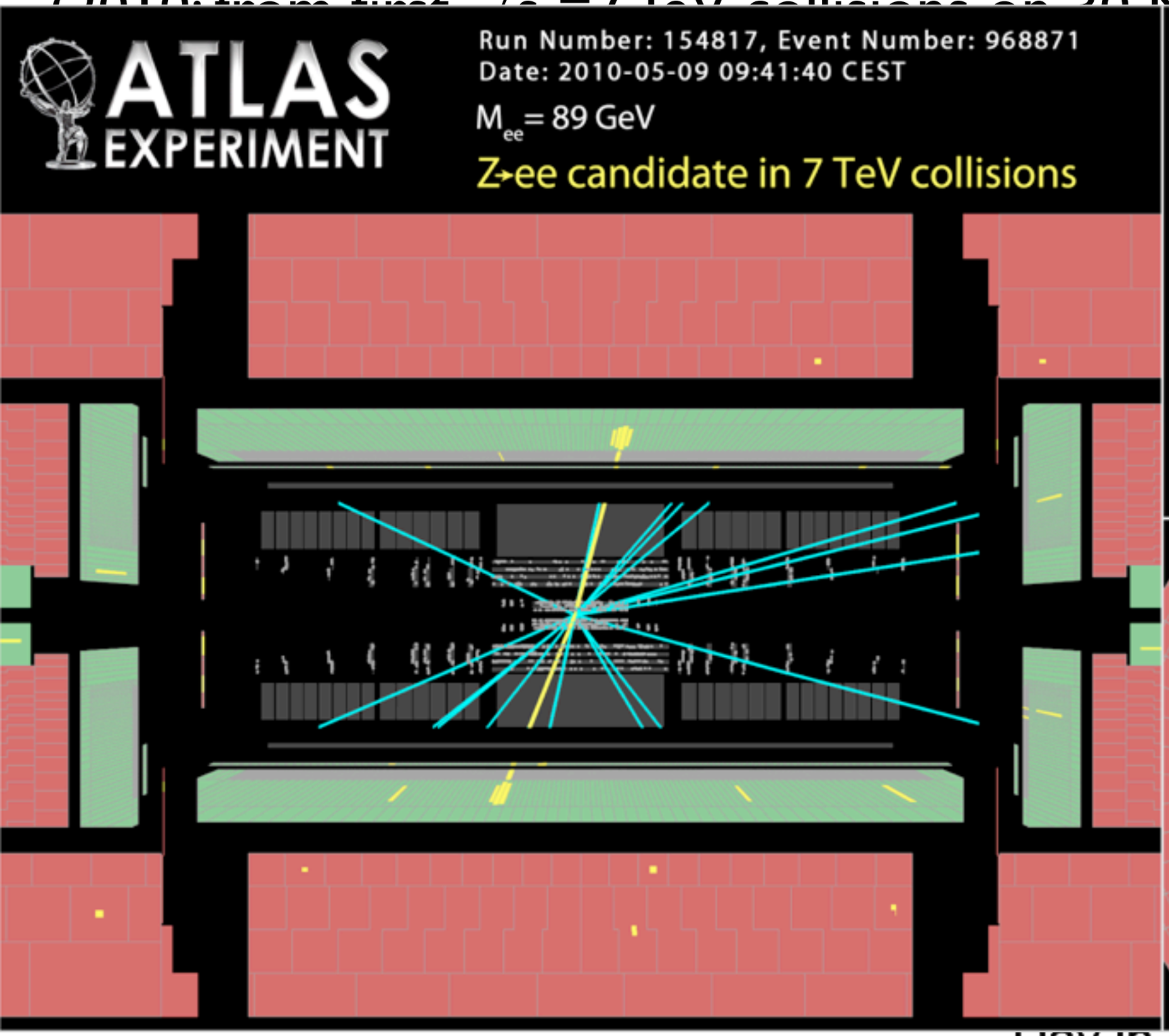

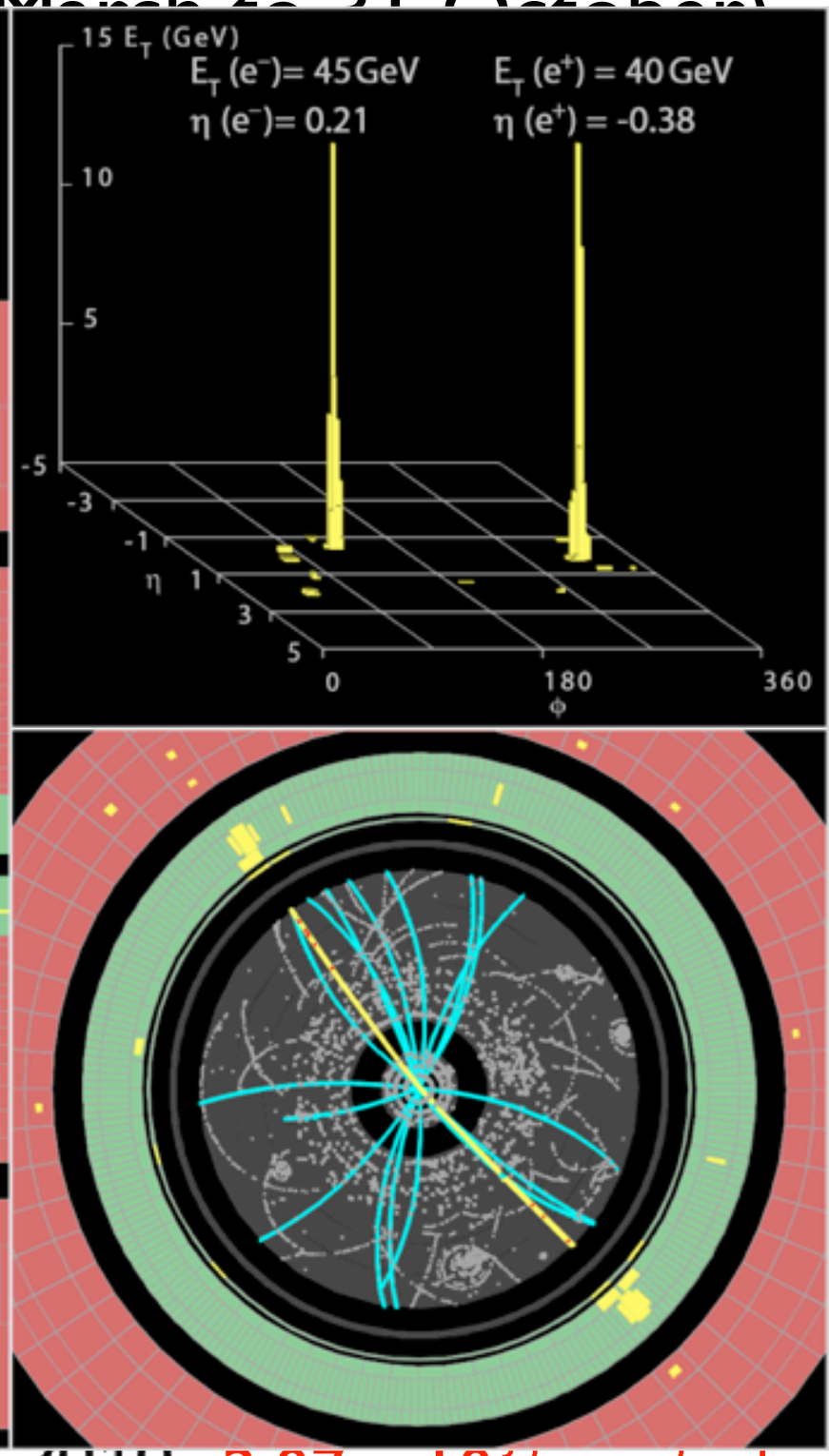

Day in 2010 2.07×10^{32} cm^{-2} s^{-1}

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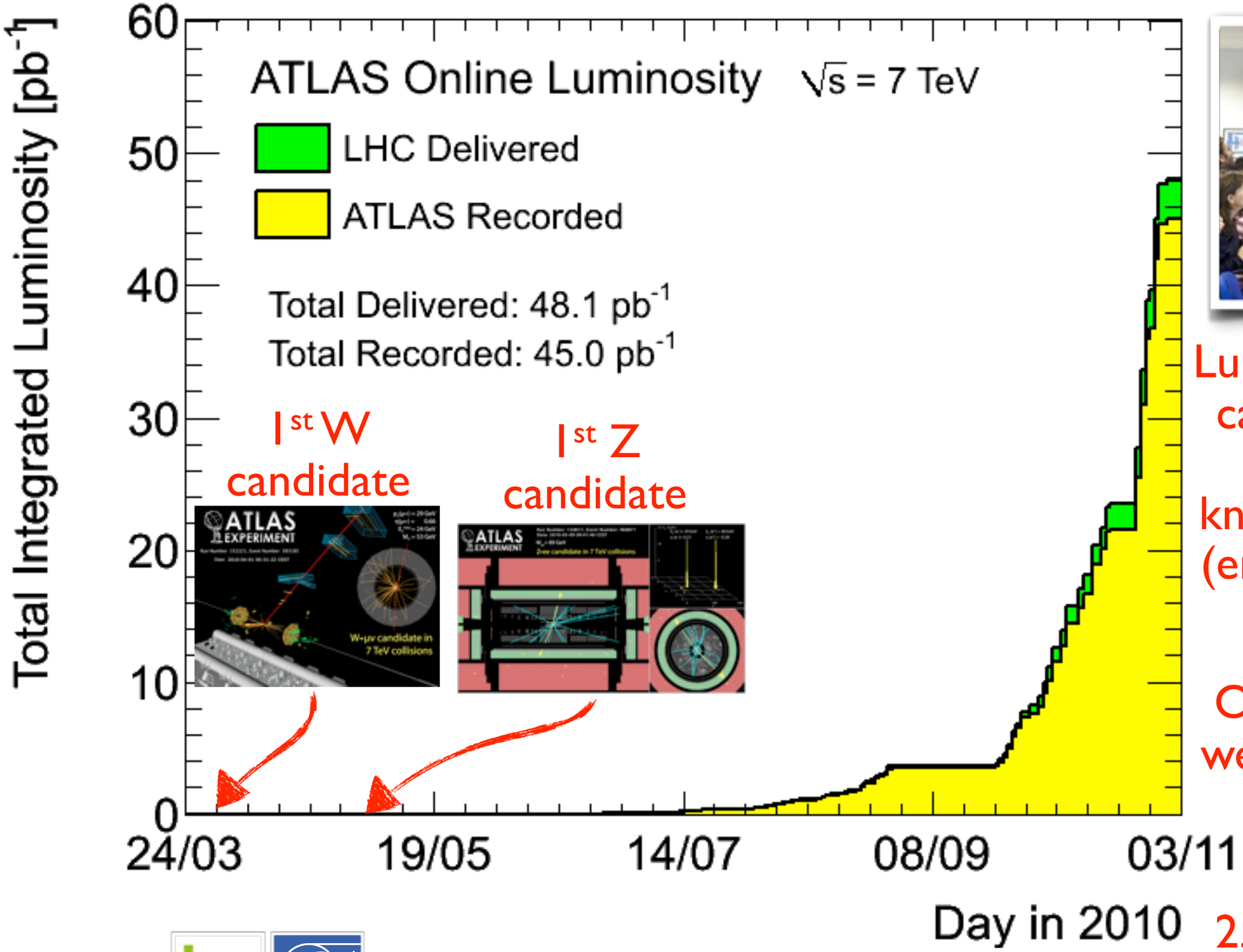

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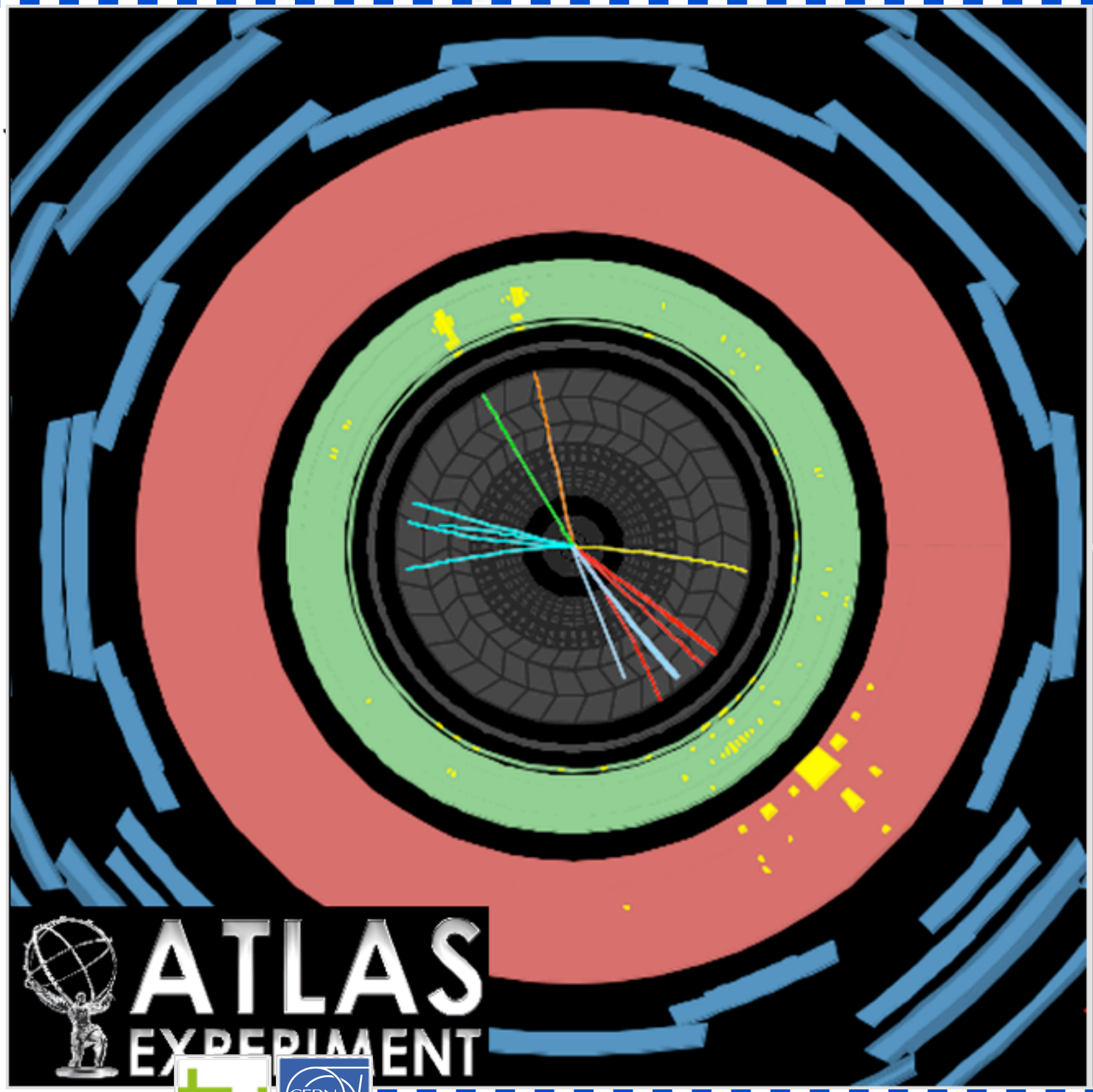

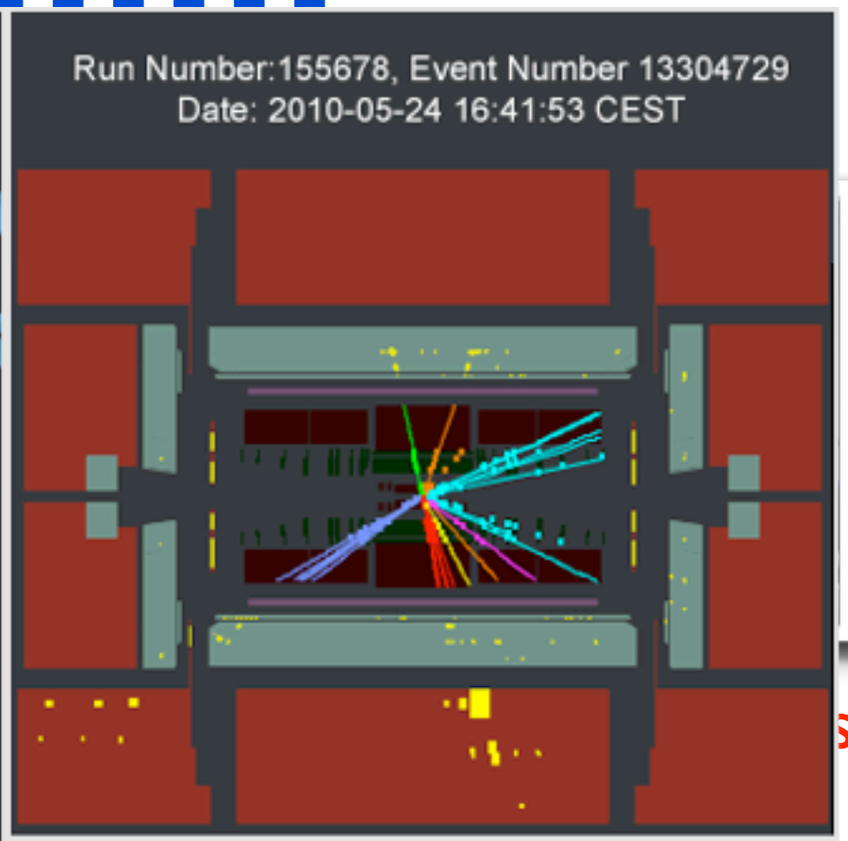

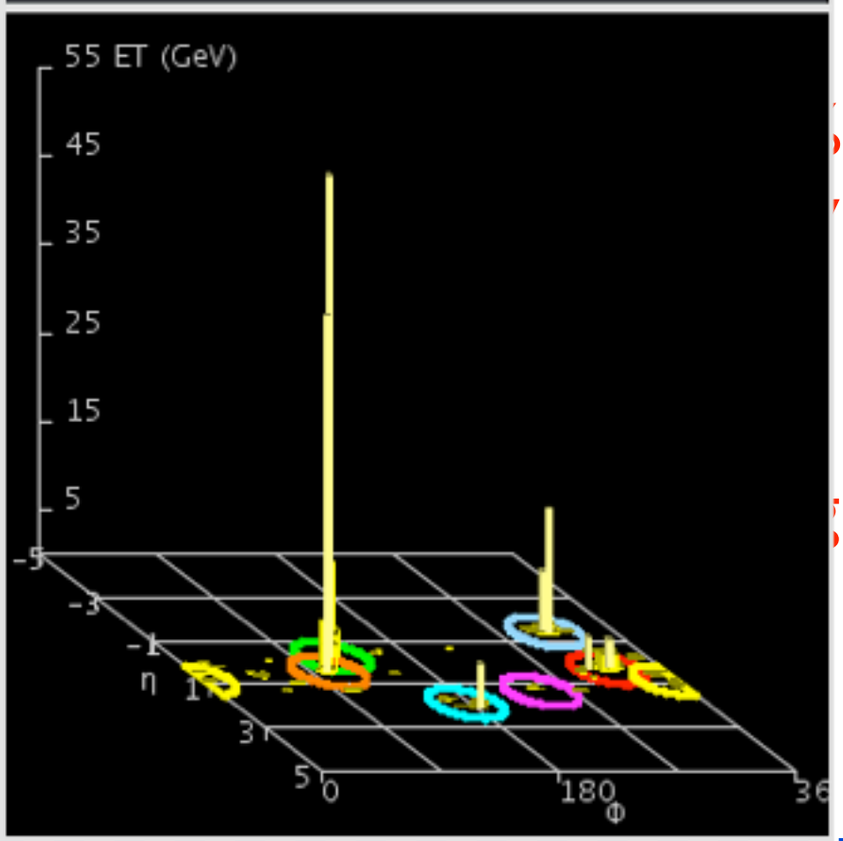

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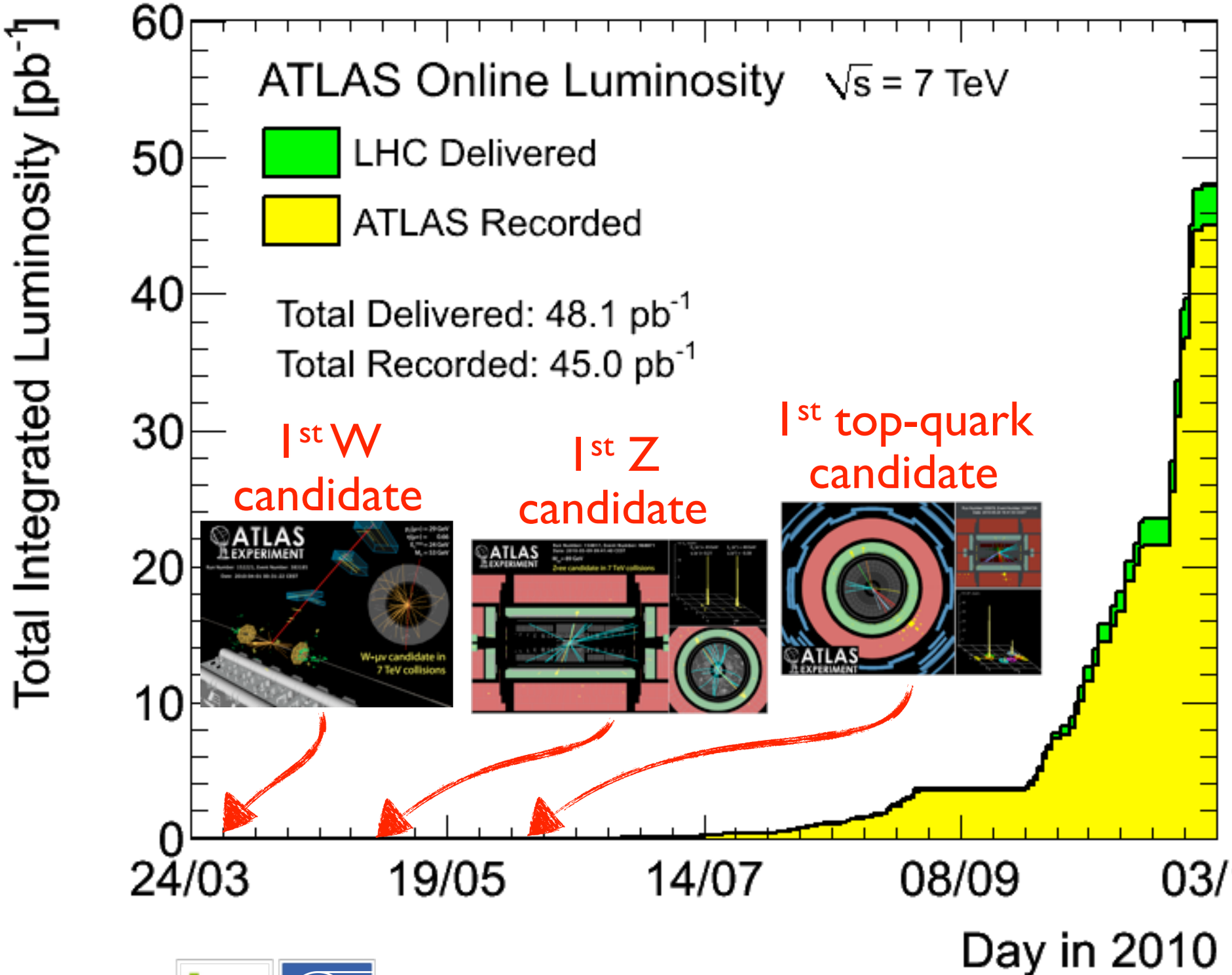

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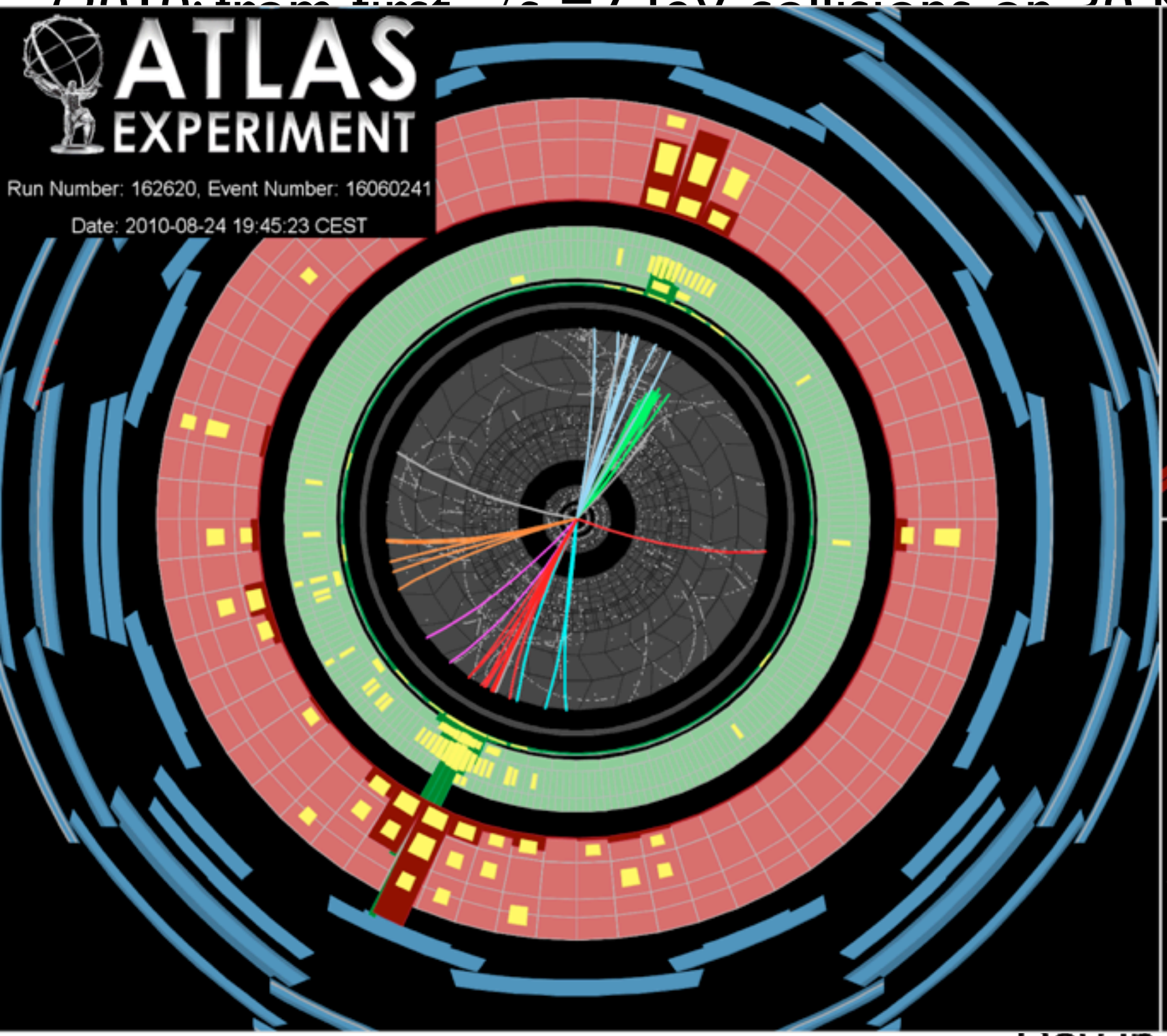

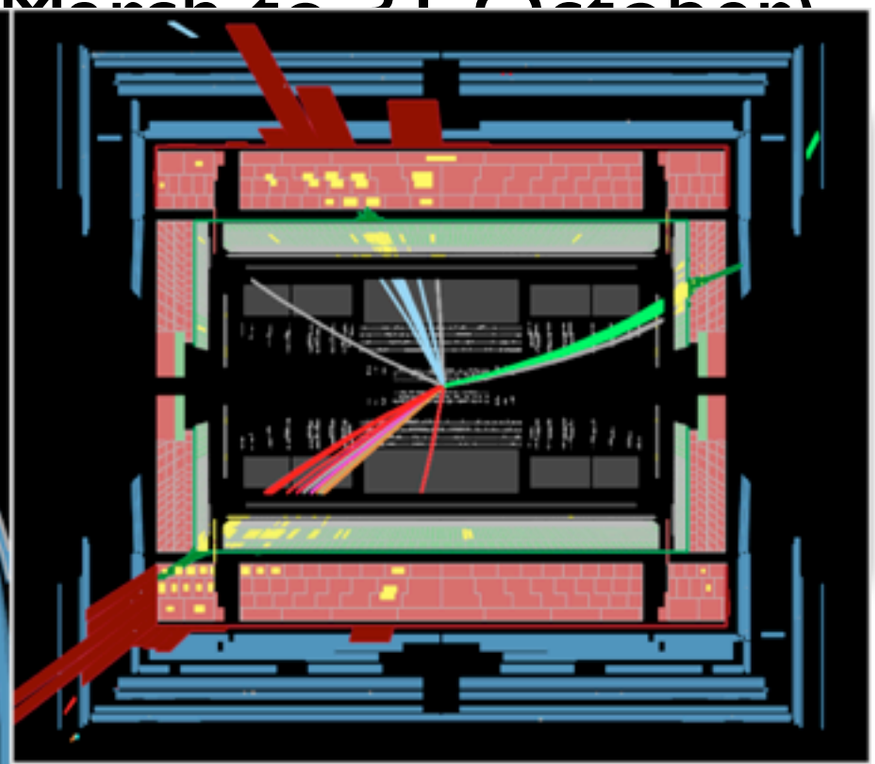

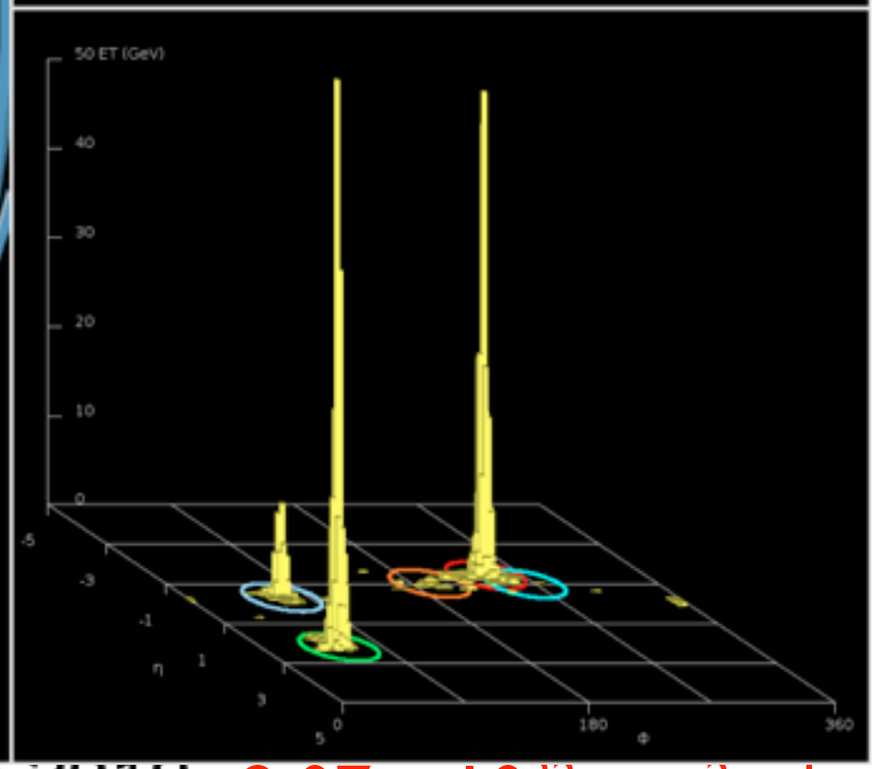

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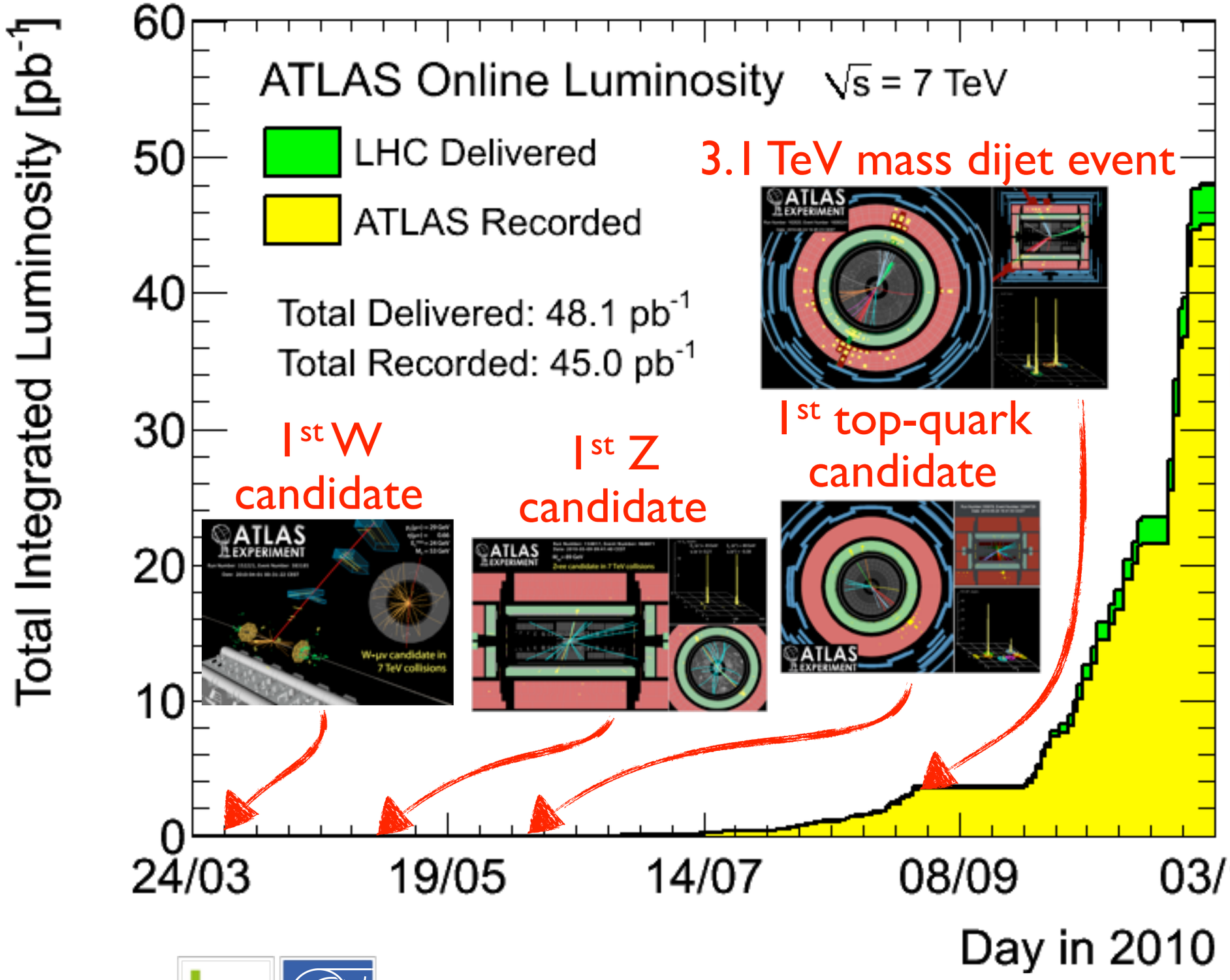

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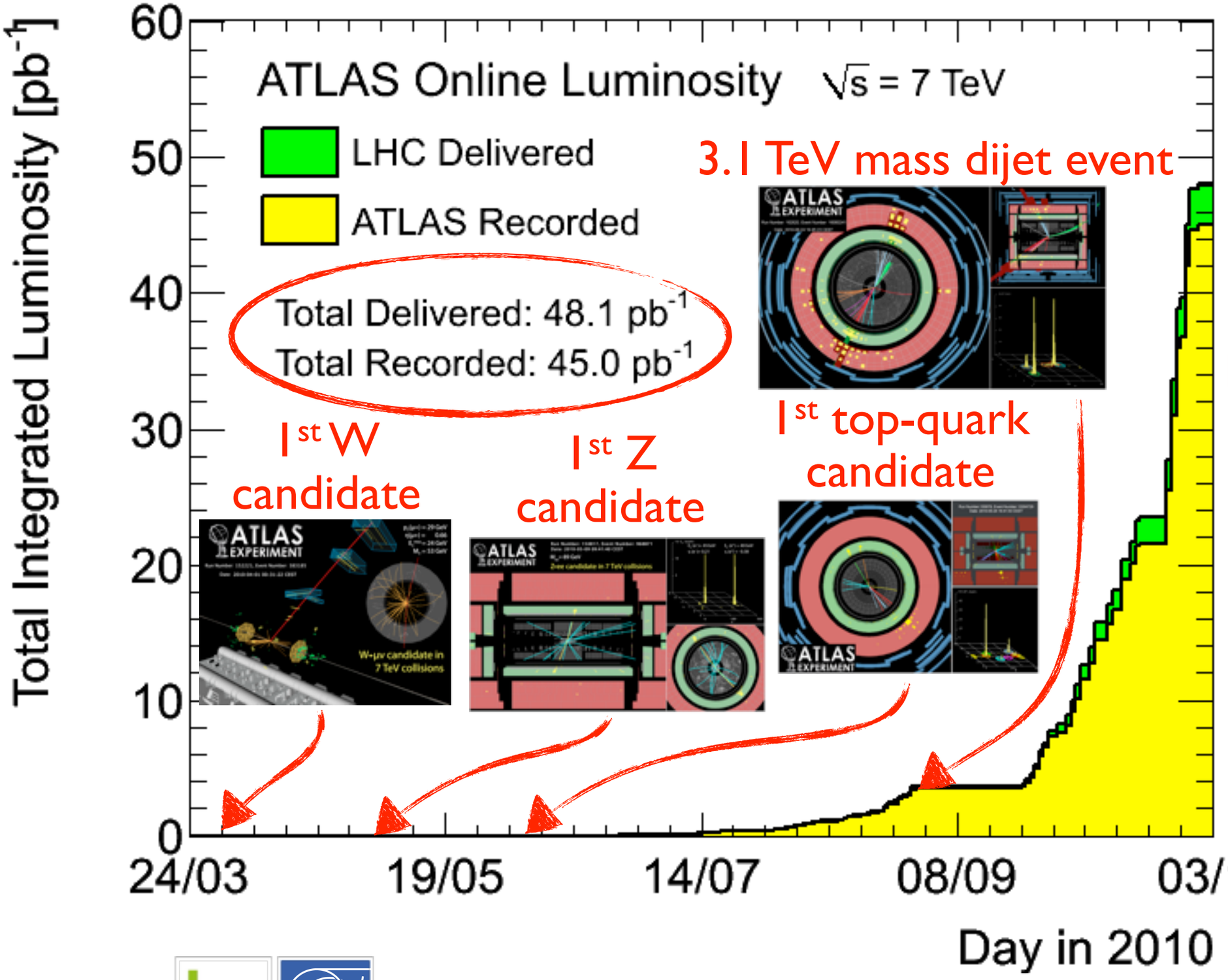

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ATLAS Detector Status

Subdetector	Number of Channels	Approximate Operational Fraction
Pixels	80 M	97.3%
SCT Silicon Strips	6.3 M	99.2%
TRT Transition Radiation Tracker	350 k	97.1%
LAr EM Calorimeter	170 k	97.9%
Tile calorimeter	9800	96.8%
Hadronic endcap LAr calorimeter	5600	99.9%
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Status of 88M data channels in ATLAS

Total fraction of good quality data (green "traffic light")

Inner Tracking Detectors			Calorimeters				Muon Detectors			
Pixel	SCT	TRT	LAr EM	LAr HAD	LAr FWD	Tile	MDT	RPC	CSC	TGC
99.0	99.9	100	90.5	96.6	97.8	94.3	99.9	99.8	96.2	99.8

Luminosity weighted relative detector uptime and good quality data delivery during 2010 stable beams in pp collisions at $\sqrt{s}$=7 TeV between March 30th and October 31st (in %). The ineffidencies in the calorimeters will largely be recovered in a future data reprocessing.

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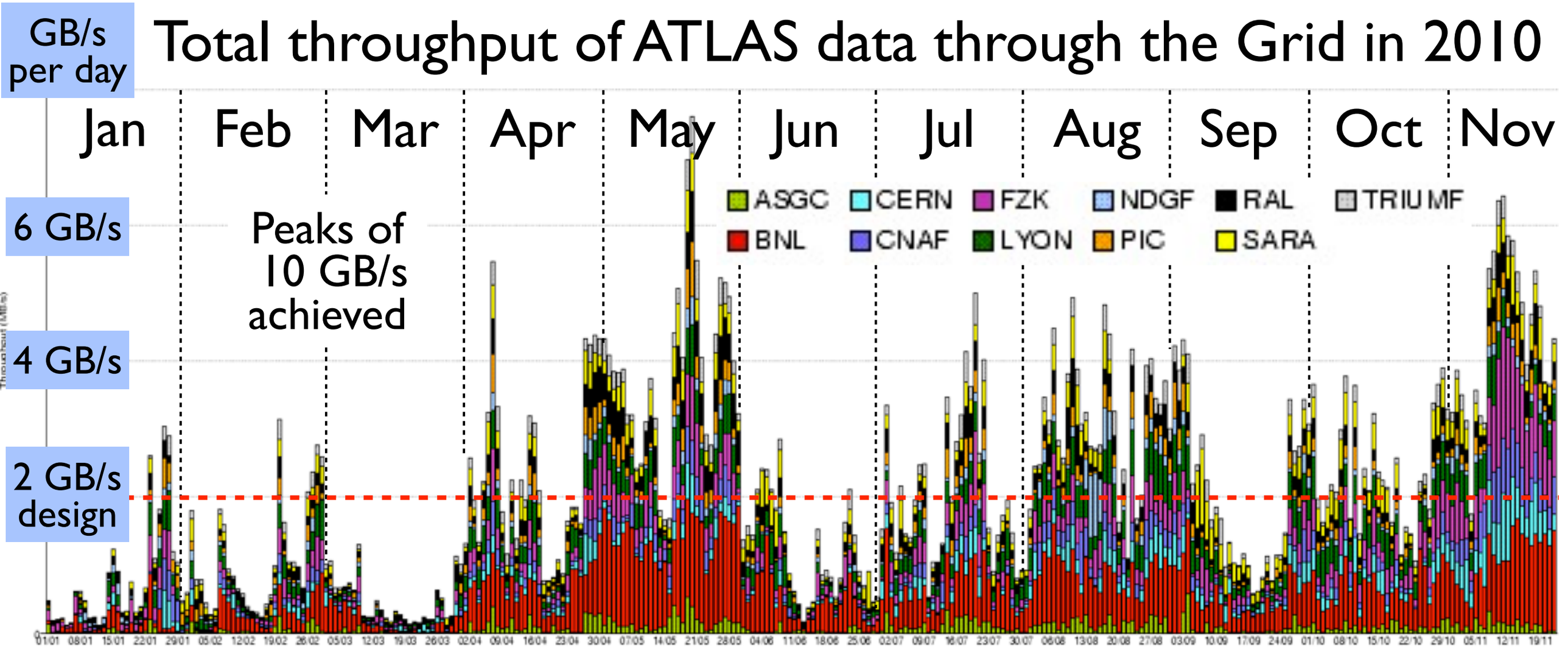
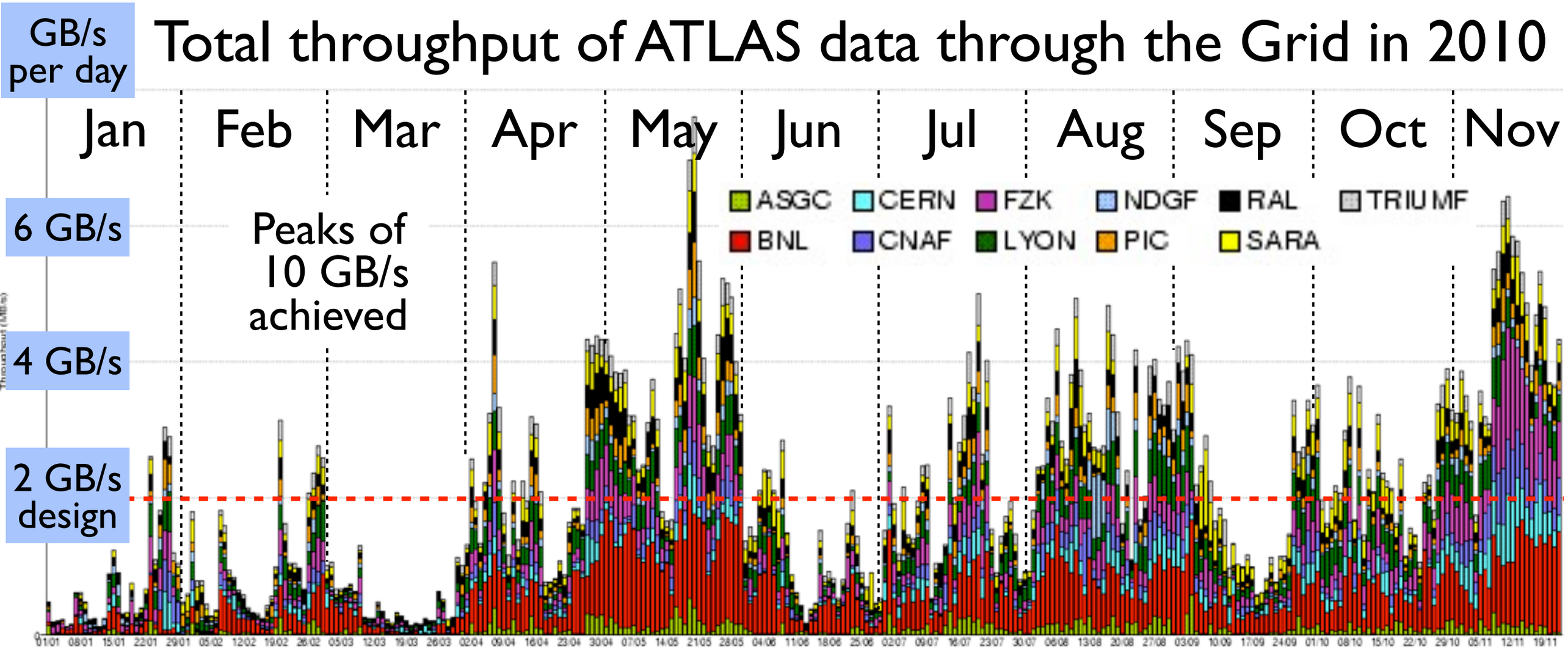
Worldwide Data Distribution and Analysis



Worldwide Data Distribution and Analysis



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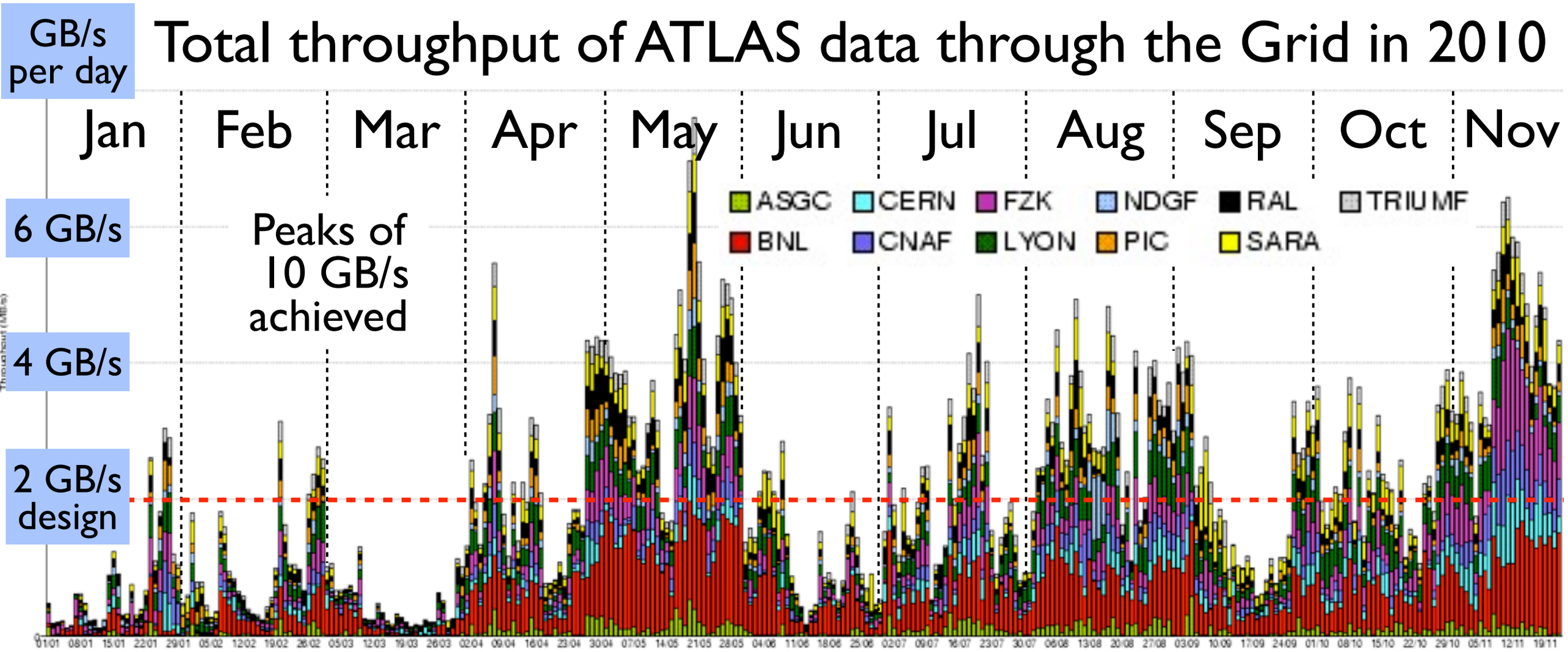

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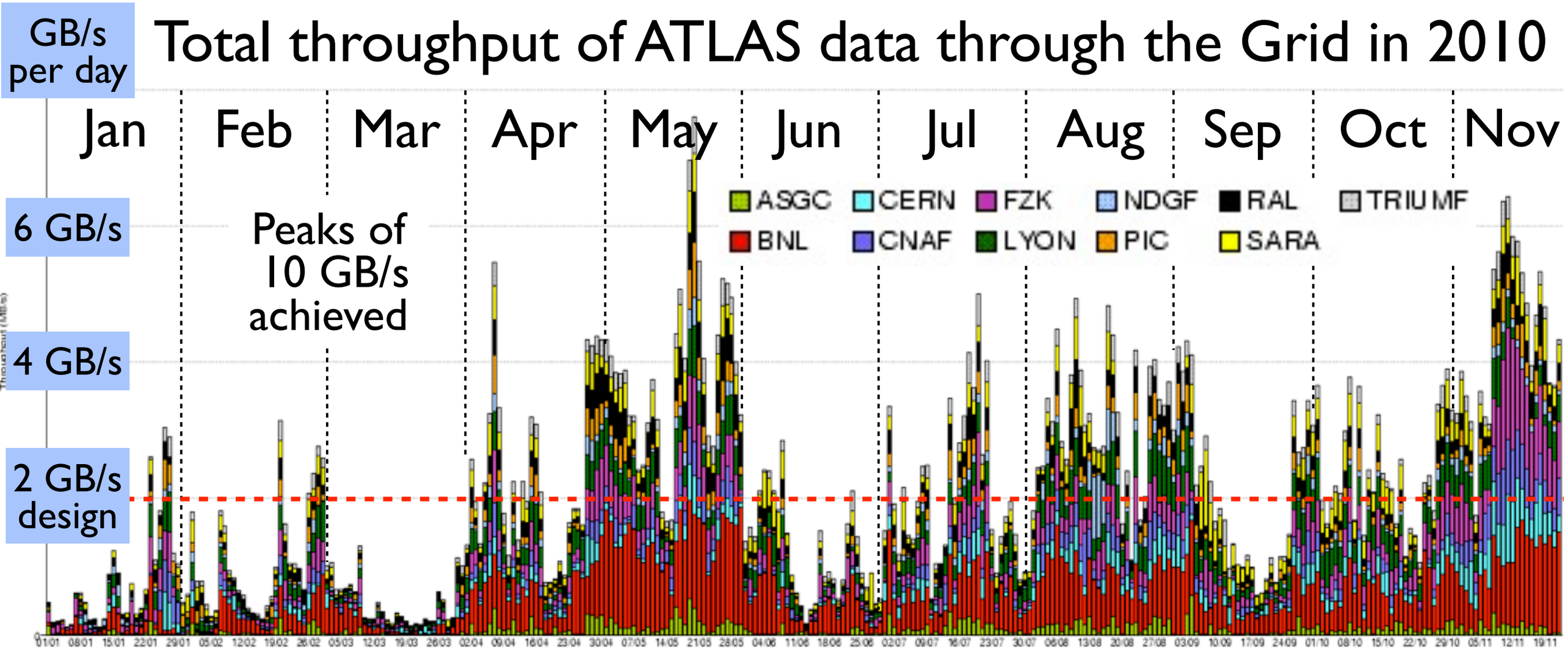
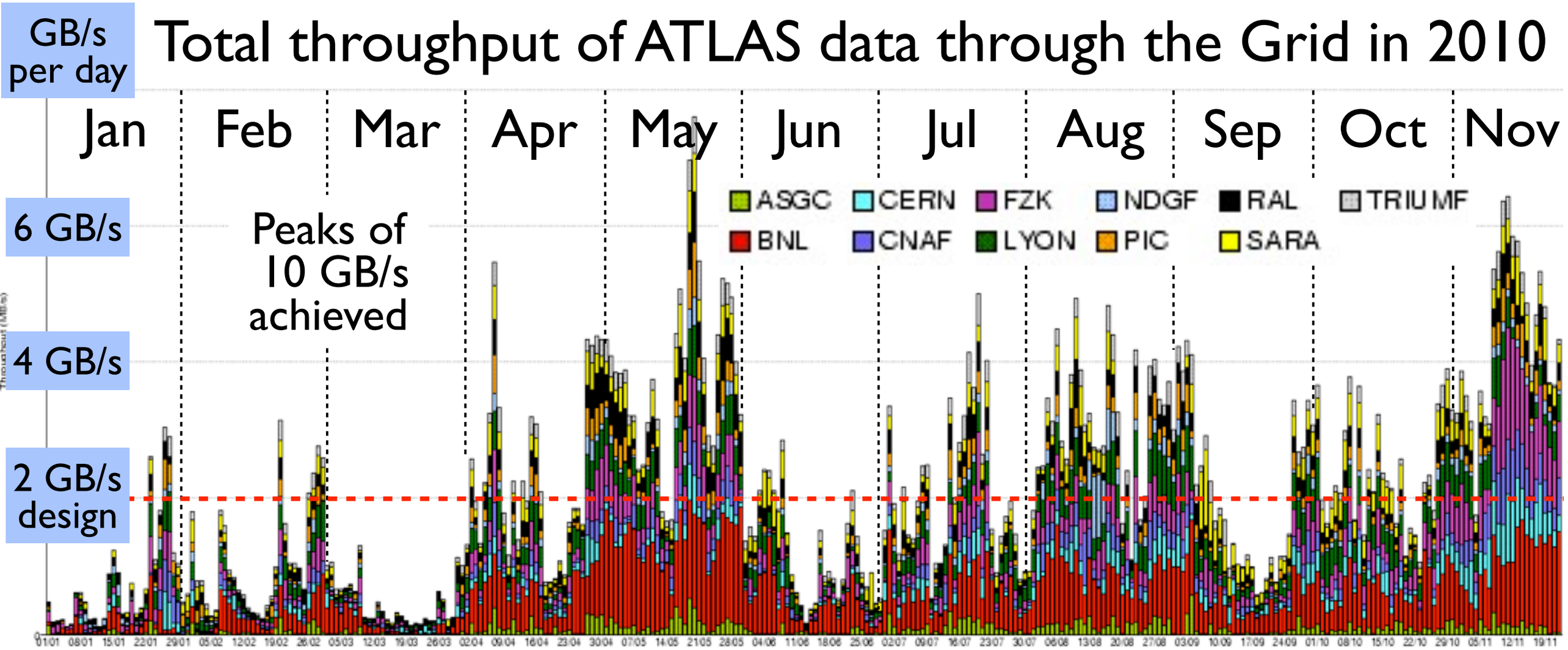
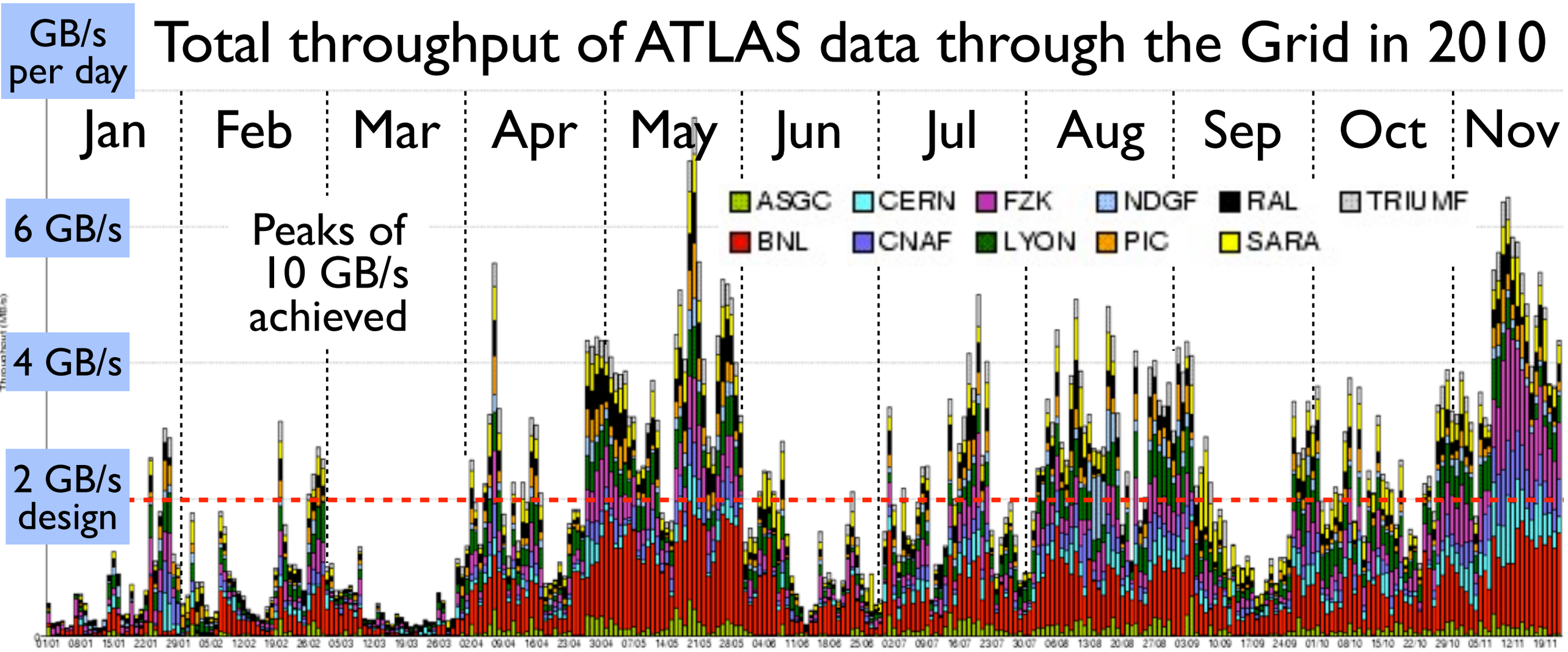


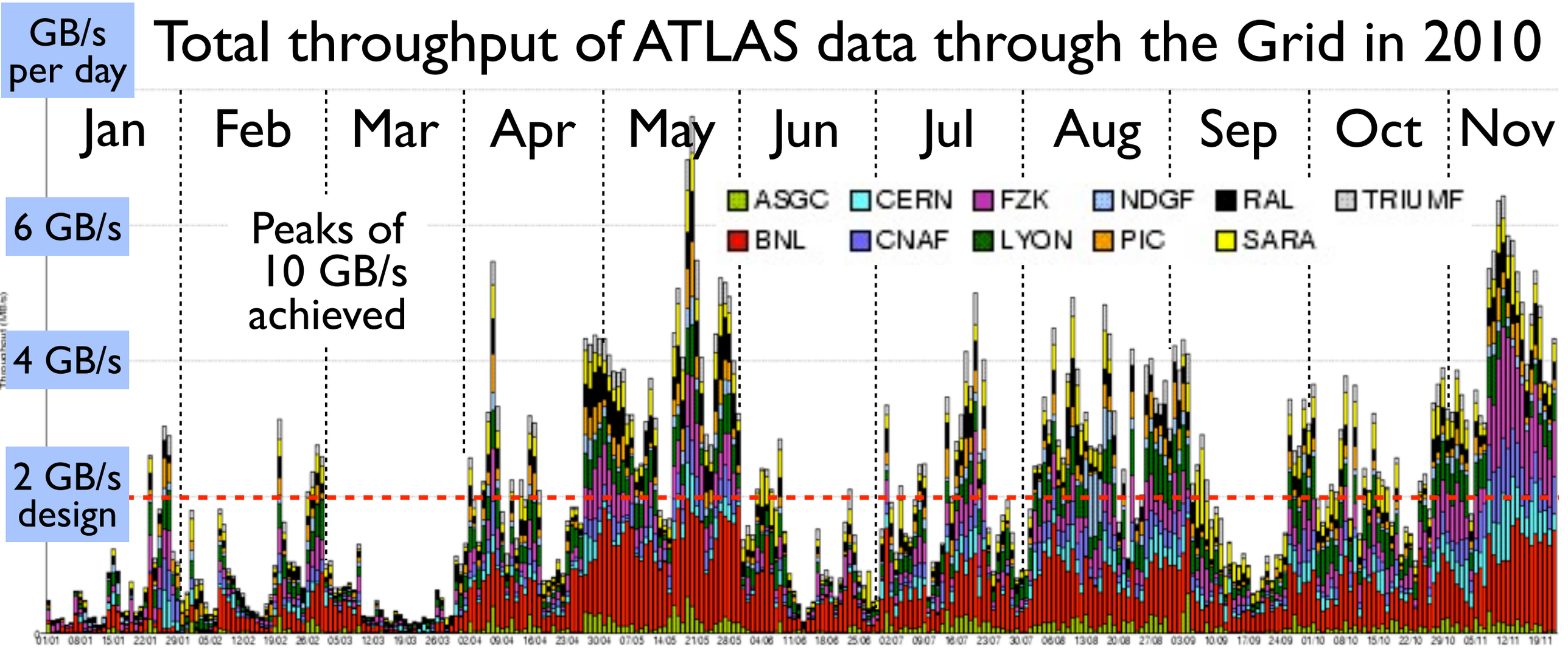
Worldwide Data Distribution and Analysis



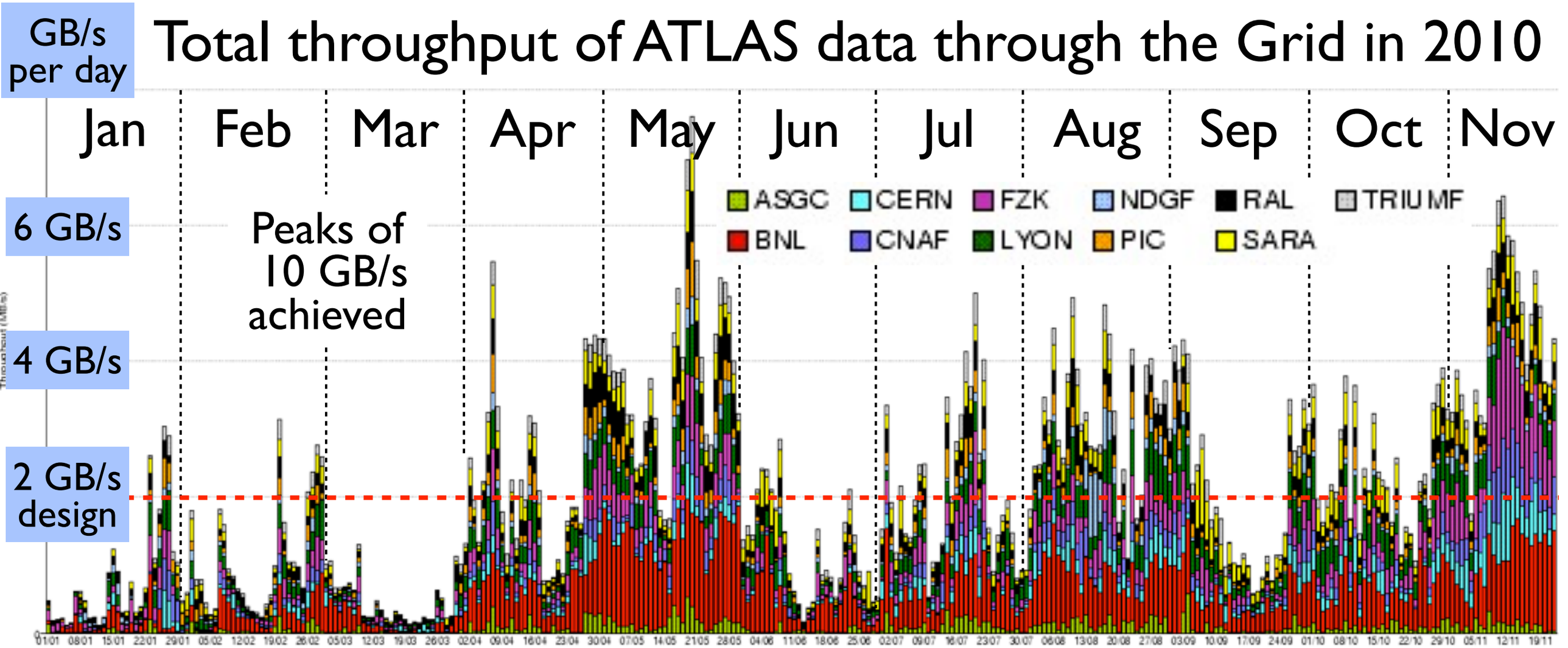
Worldwide Data Distribution and Analysis



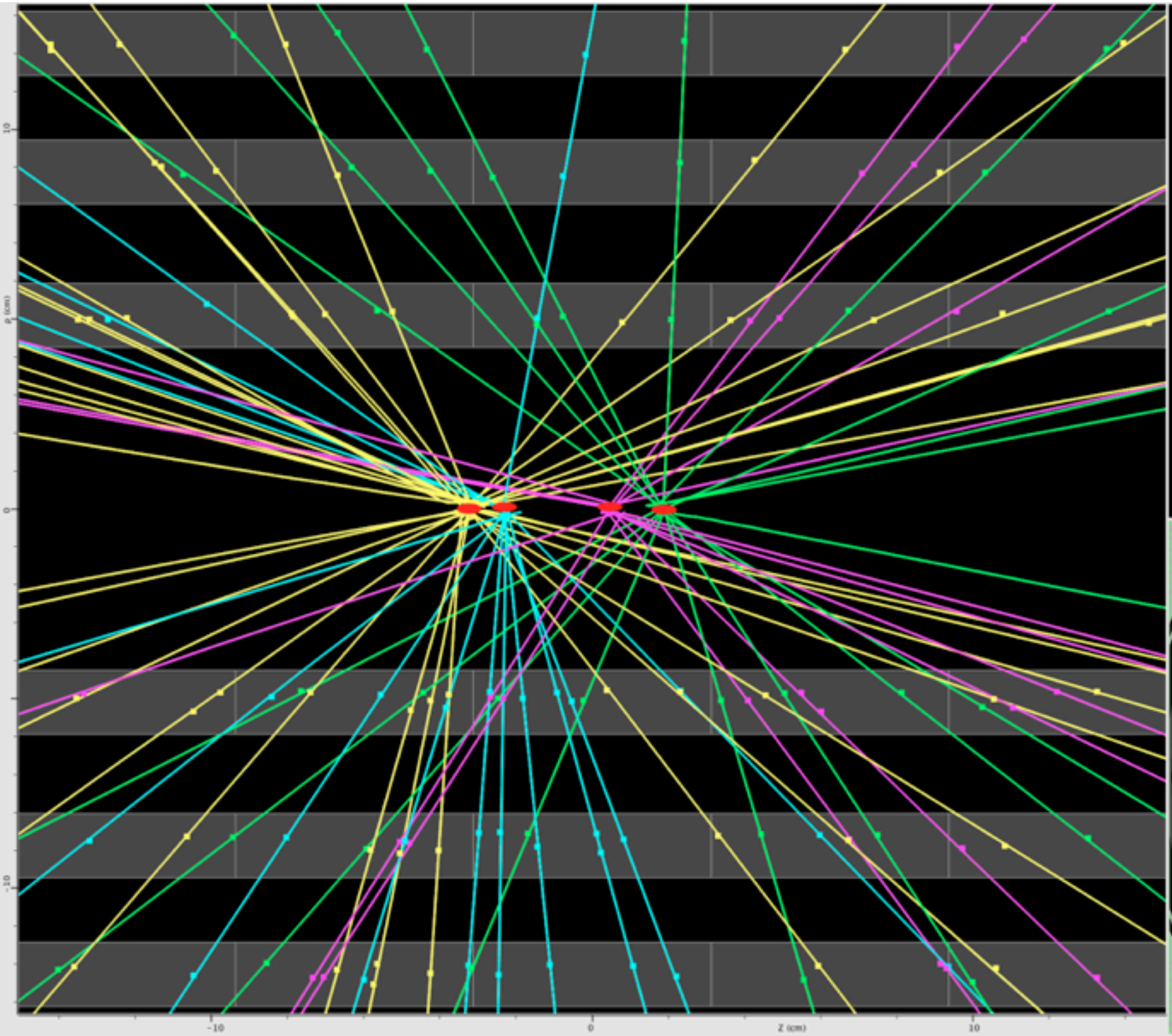
Worldwide Data Distribution and Analysis

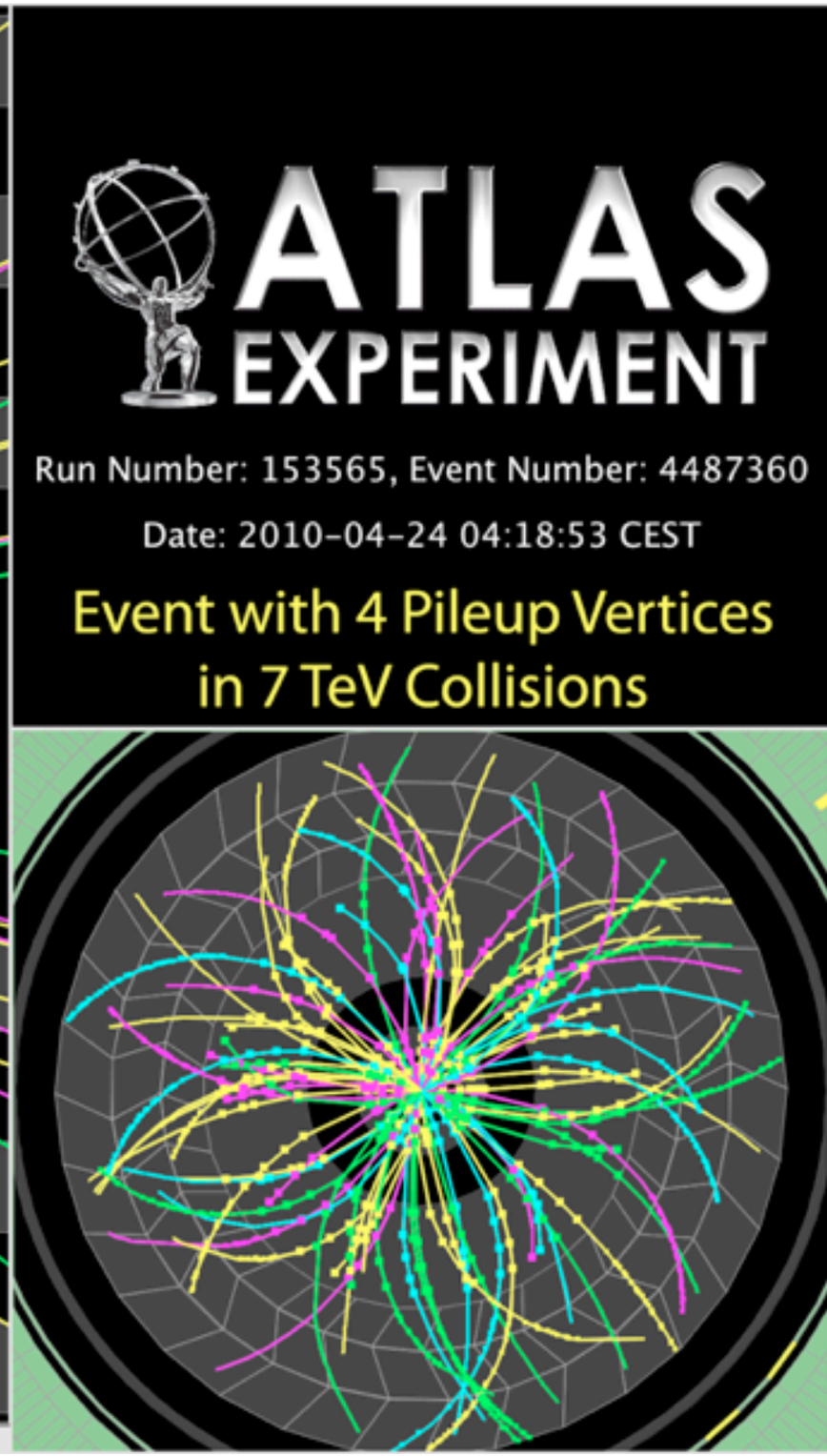


Worldwide Data Distribution and Analysis



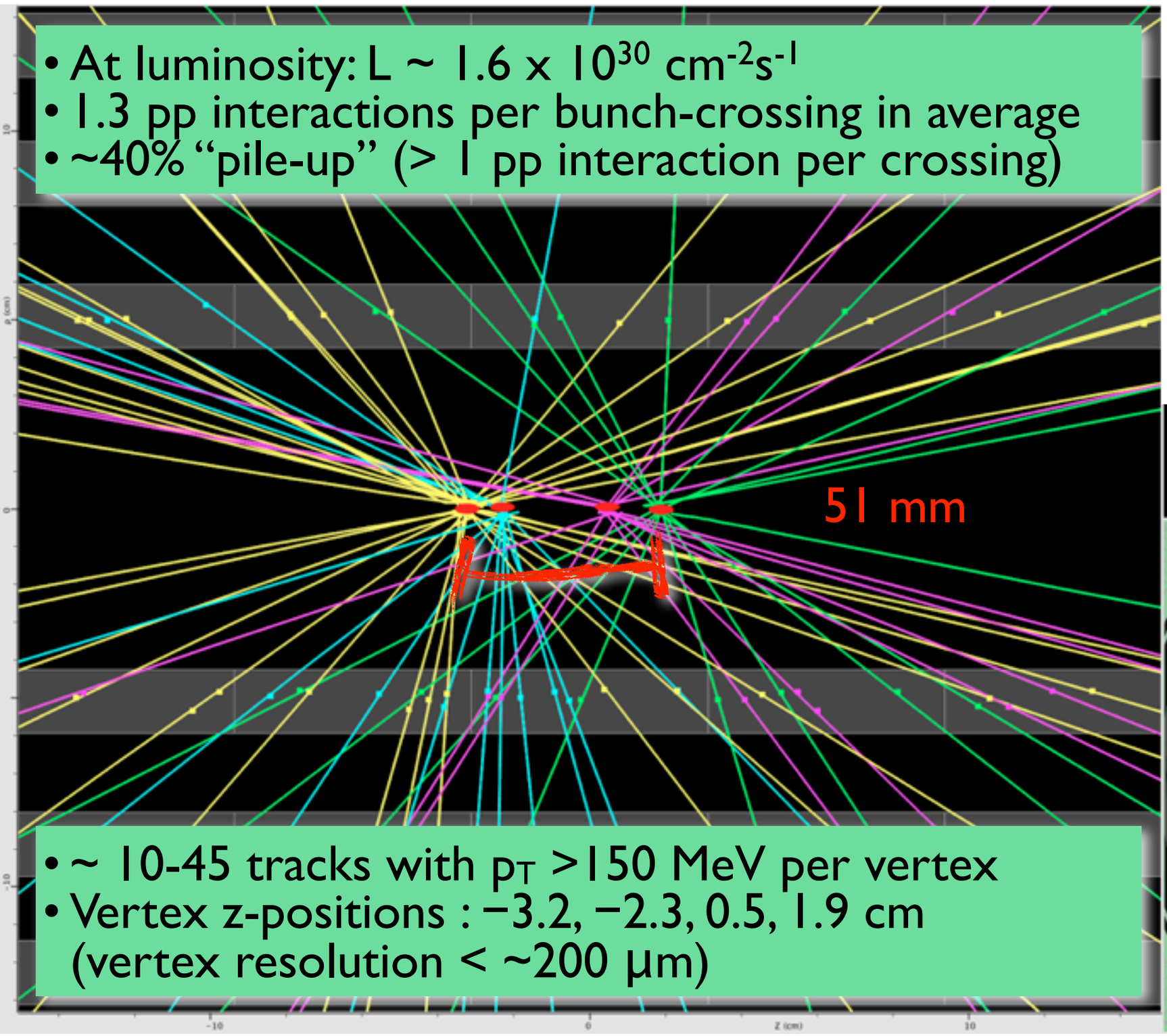
Pile-up Events



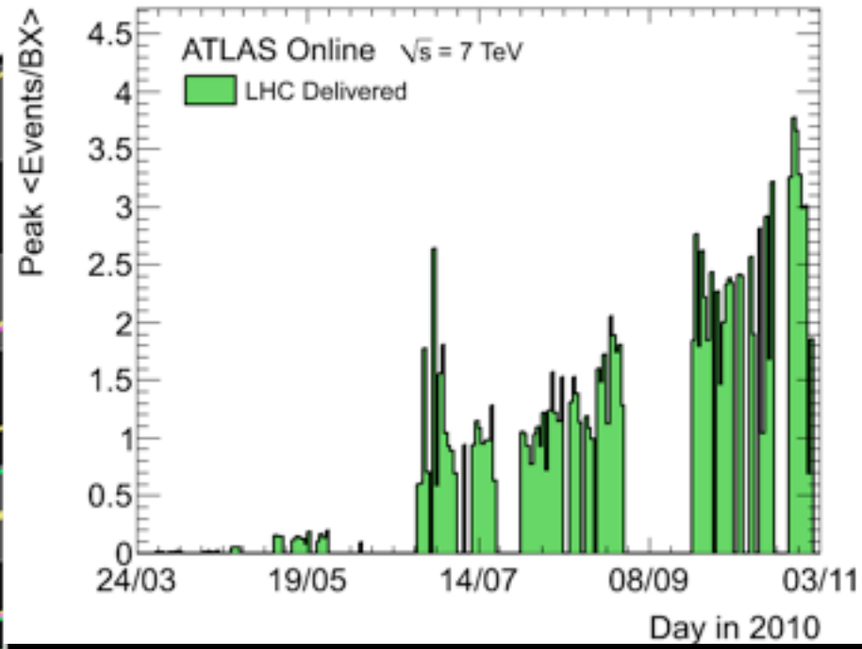


Pile-up Events

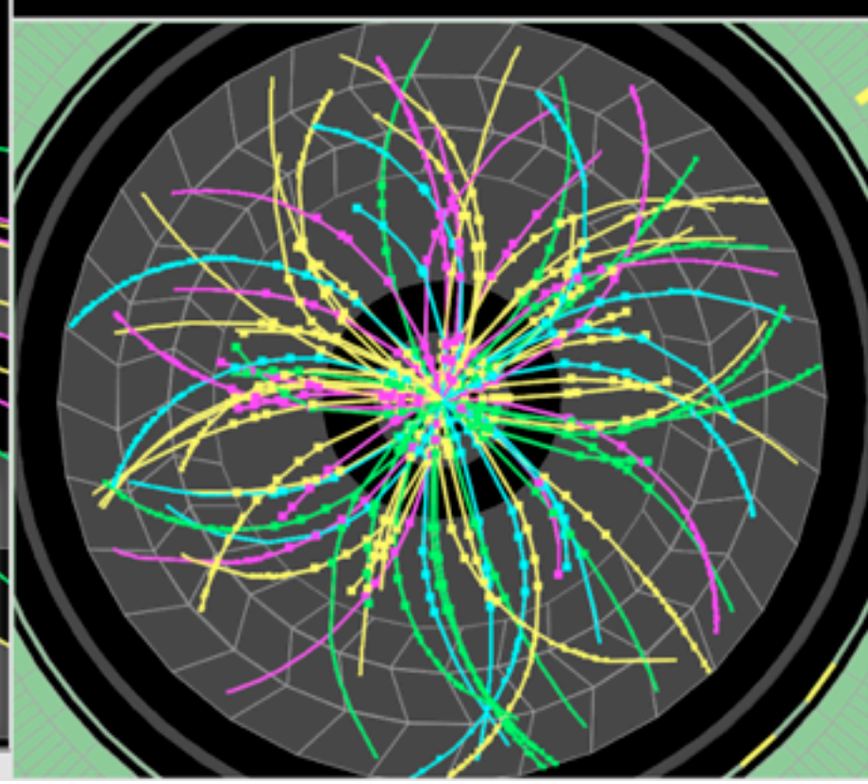
- At luminosity: L ~ 1.6 x 10^{30} $cm^{-2}s^{-1}$
- 1.3 pp interactions per bunch-crossing in average
- ~40% "pile-up" (> 1 pp interaction per crossing)



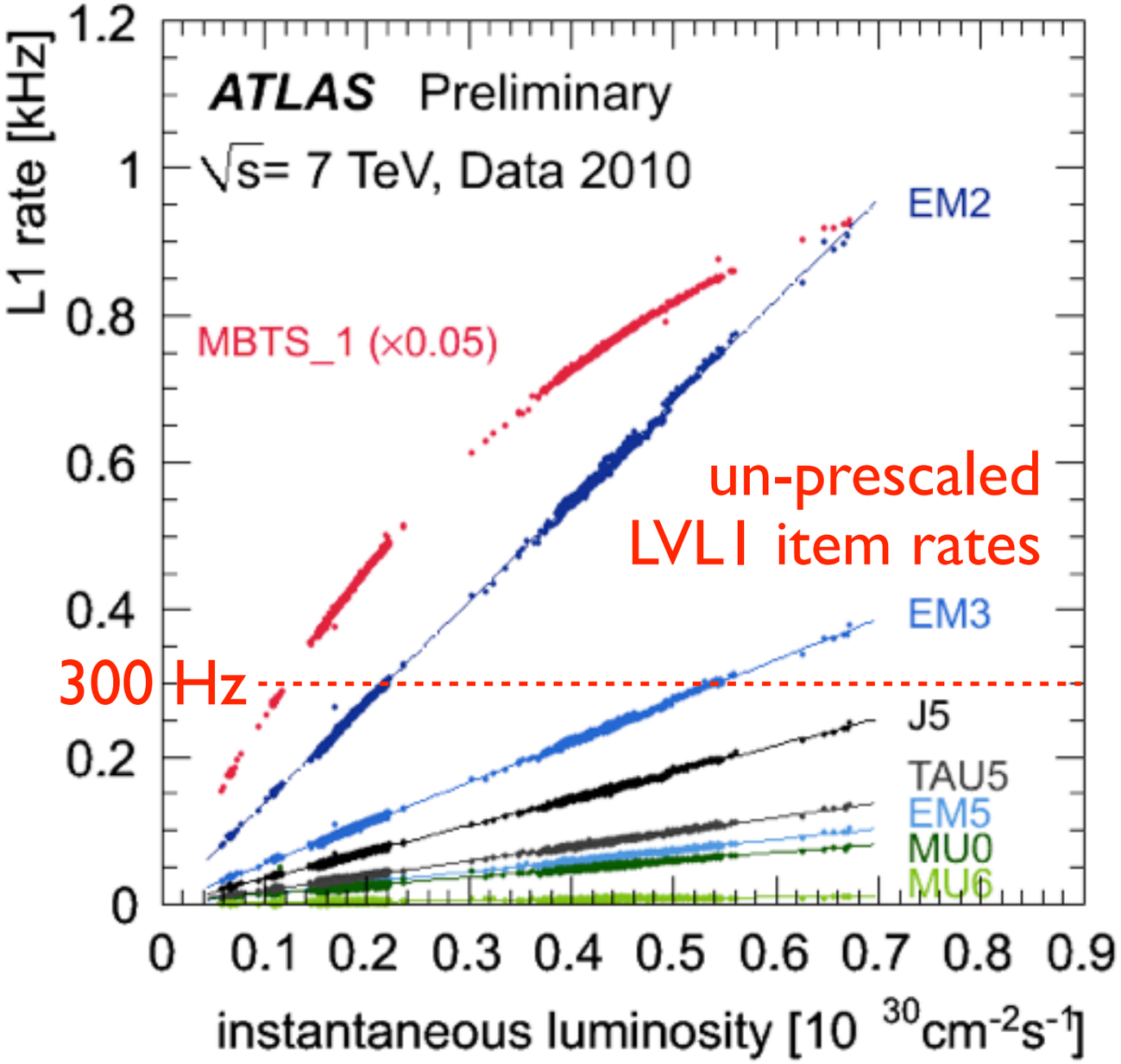
- ~ 10-45 tracks with p_T >150 MeV per vertex
- Vertex z-positions : −3.2, −2.3, 0.5, 1.9 cm (vertex resolution < ~200 μm)



Event with 4 Pileup Vertices in 7 TeV Collisions



Trigger

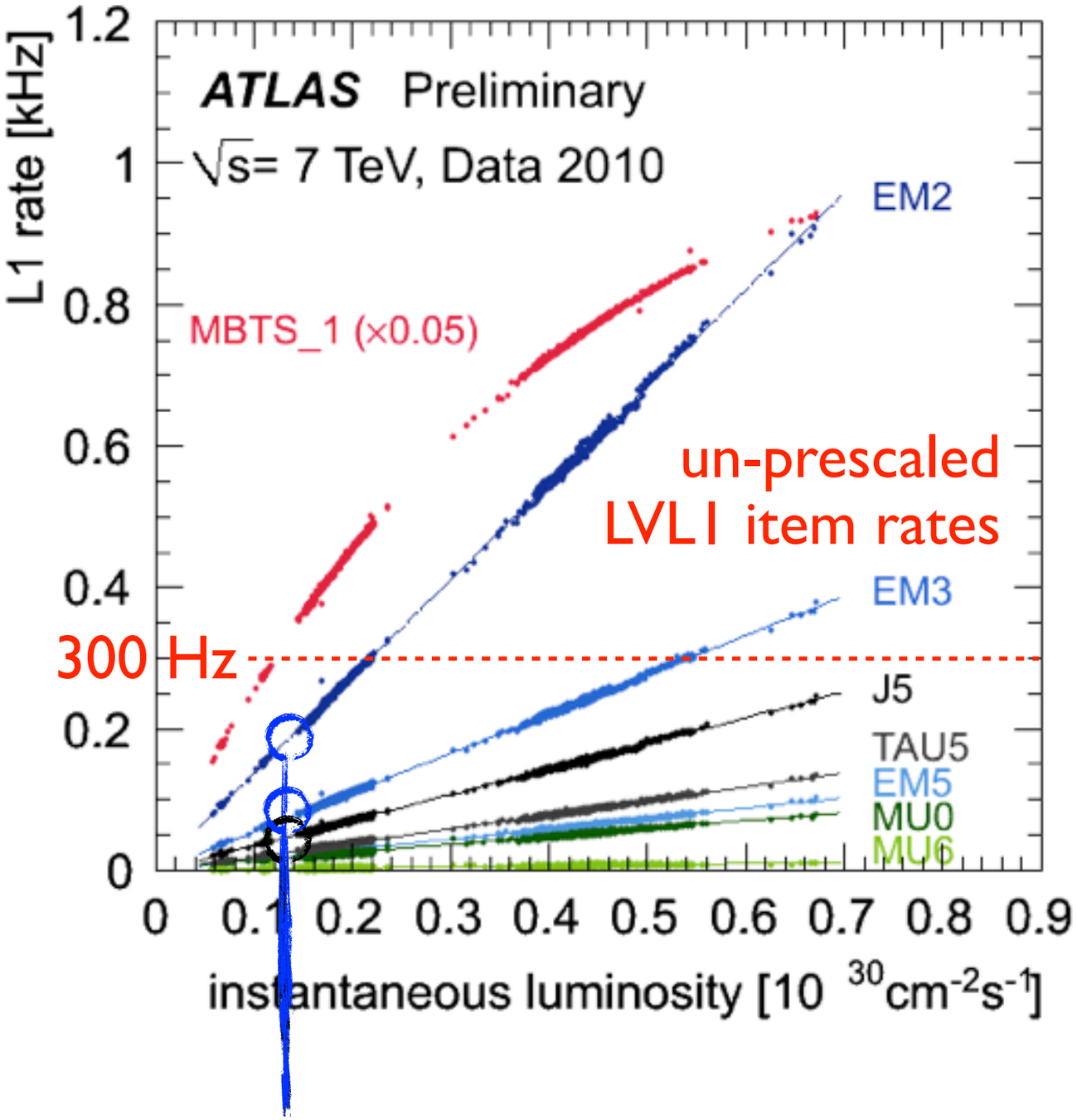


3 Trigger levels:
LVL1, LVL2, Event Filter (EF)
High Level Trigger (HLT) LVL2 & EF

Trigger output history: ~ 300 Hz

- $L < \text{few } 10^{27} cm^{-2}s^{-1}$: minimum-bias LVL1 trigger: hits in scintillator counters (MBTS) located at Z=± 3.5 m from collision centre; HLT running in transparent mode
- $L > 10^{27} cm^{-2}s^{-1}$: MBTS prescaled (only fraction of events recorded); Others items (EM2, J5, TAU5, MU0, ...): un-prescaled
- $L \sim 10^{29} cm^{-2}s^{-1}$: start to activate HLT chains to cope with increasing rate while running with low LVL1 thresholds. Jet items: lowest thresholds prescaled (HLT rejection small)

Trigger



HLT on (e/γ)
for EM2, EM3
J5 pre-scaled

3 Trigger levels:
LVL1, LVL2, Event Filter (EF)
High Level Trigger (HLT) LVL2 & EF

Trigger output history: ~ 300 Hz

- $L < \text{few } 10^{27} cm^{-2}s^{-1}$: minimum-bias LVL1 trigger: hits in scintillator counters (MBTS) located at Z=± 3.5 m from collision centre; HLT running in transparent mode
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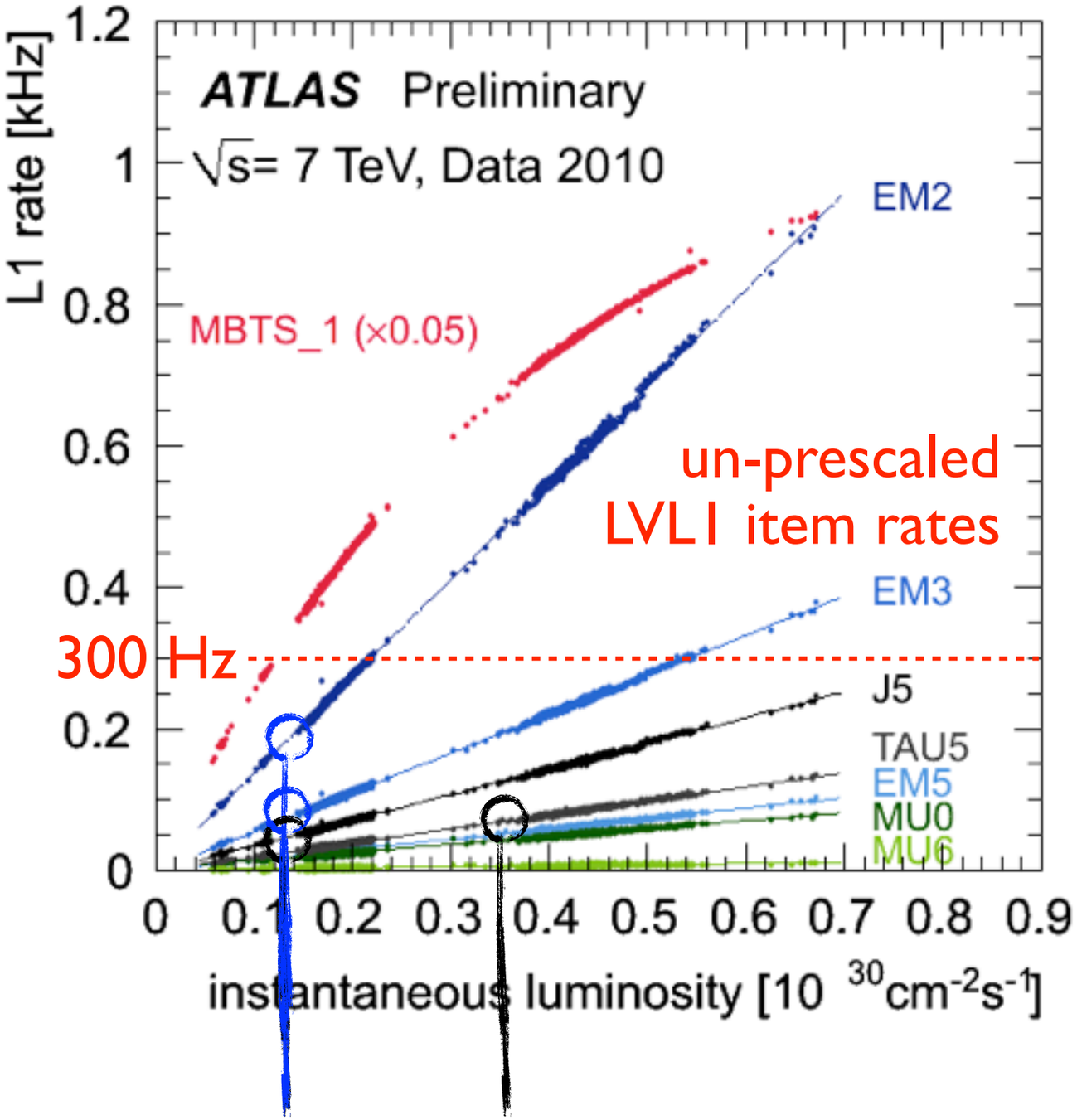
Trigger



HLT on (e/γ) for EM2, EM3 J5 pre-scaled

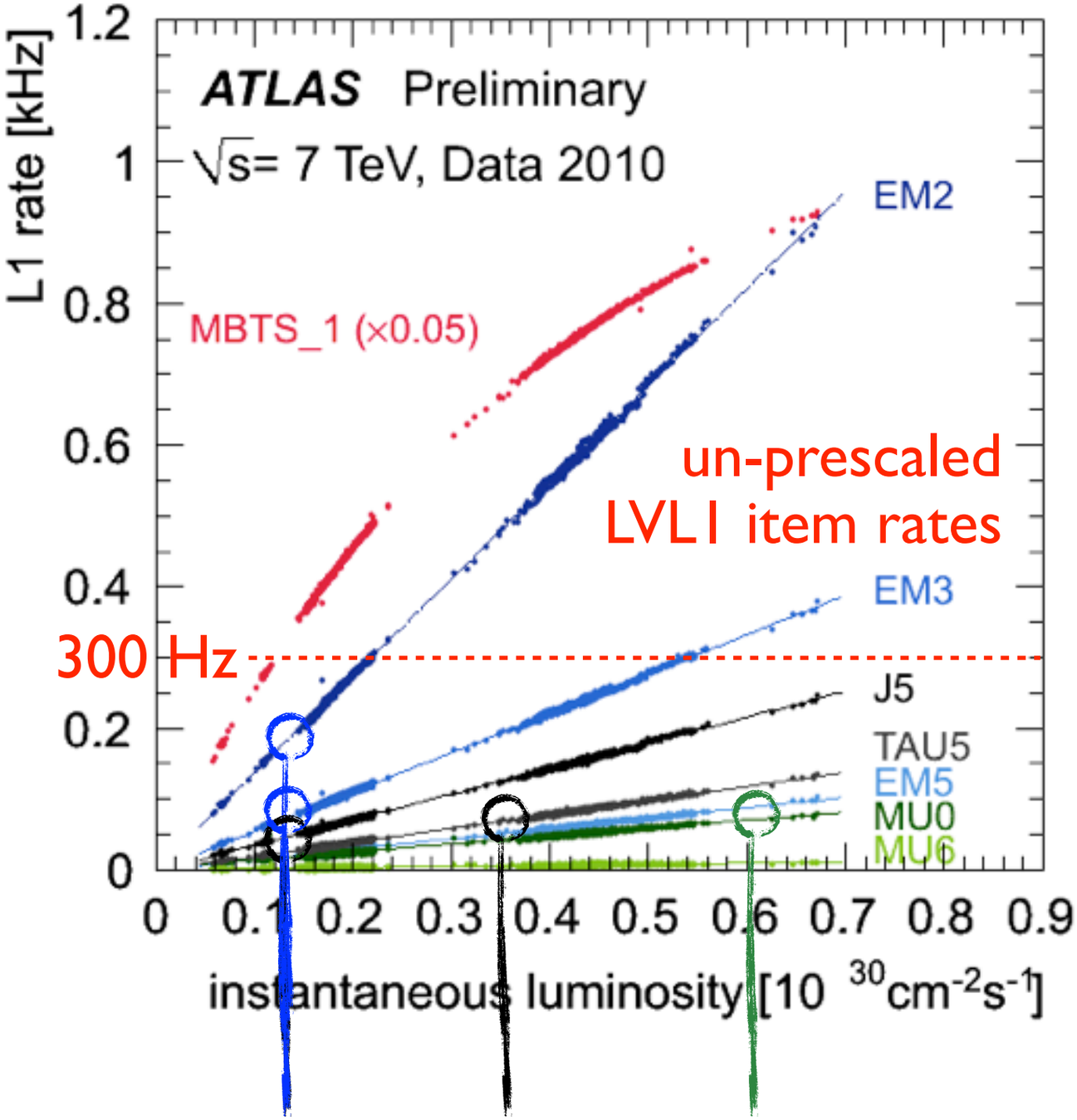
HLT on (τ) for TAU5

3 Trigger levels:
LVL1, LVL2, Event Filter (EF)
High Level Trigger (HLT) LVL2 & EF

Trigger output history: ~ 300 Hz

- $L < \text{few } 10^{27} cm^{-2}s^{-1}$: minimum-bias LVL1 trigger: hits in scintillator counters (MBTS) located at Z=± 3.5 m from collision centre; HLT running in transparent mode
- $L > 10^{27} cm^{-2}s^{-1}$: MBTS prescaled (only fraction of events recorded); Others items (EM2, J5, TAU5, MU0, ...): un-prescaled
- $L \sim 10^{29} cm^{-2}s^{-1}$: start to activate HLT chains to cope with increasing rate while running with low LVL1 thresholds. Jet items: lowest thresholds prescaled (HLT rejection small)

Trigger



HLT on (e/γ) for EM2, EM3 J5 pre-scaled

HLT on (τ) for TAU5

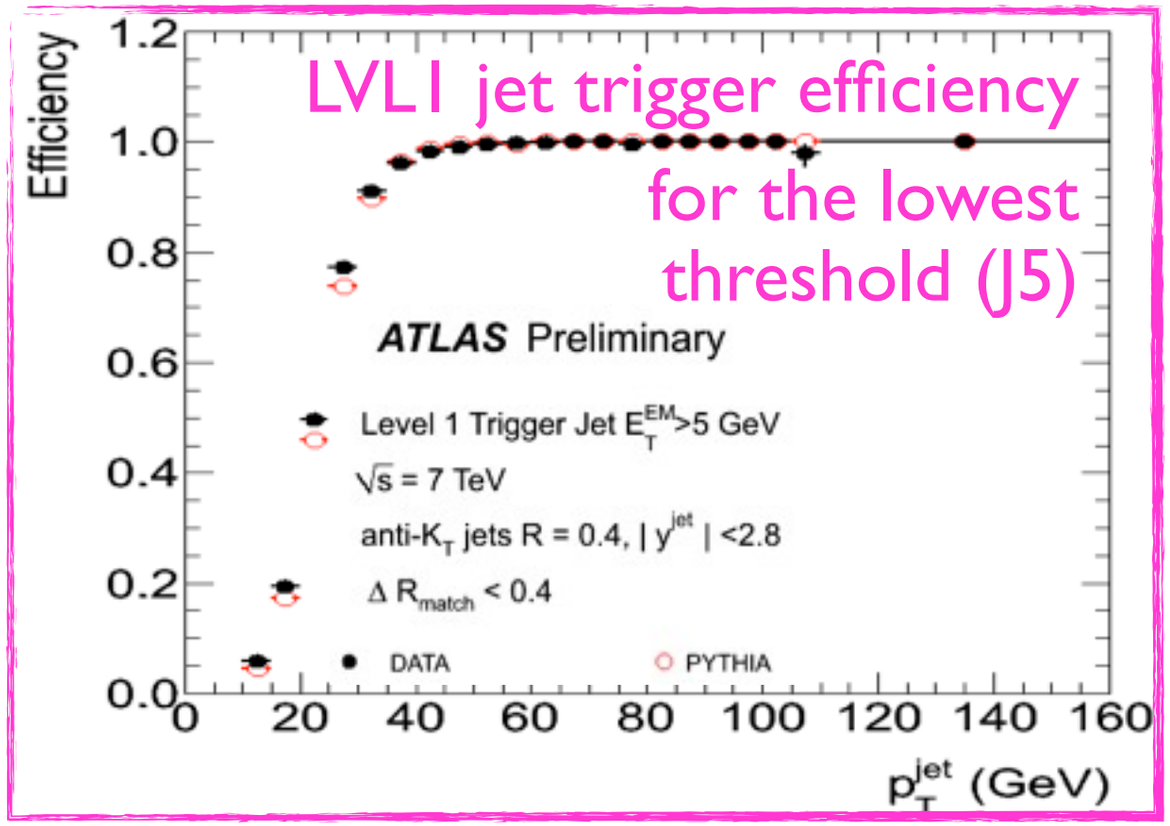
HLT on (μ) for MU0 fwd

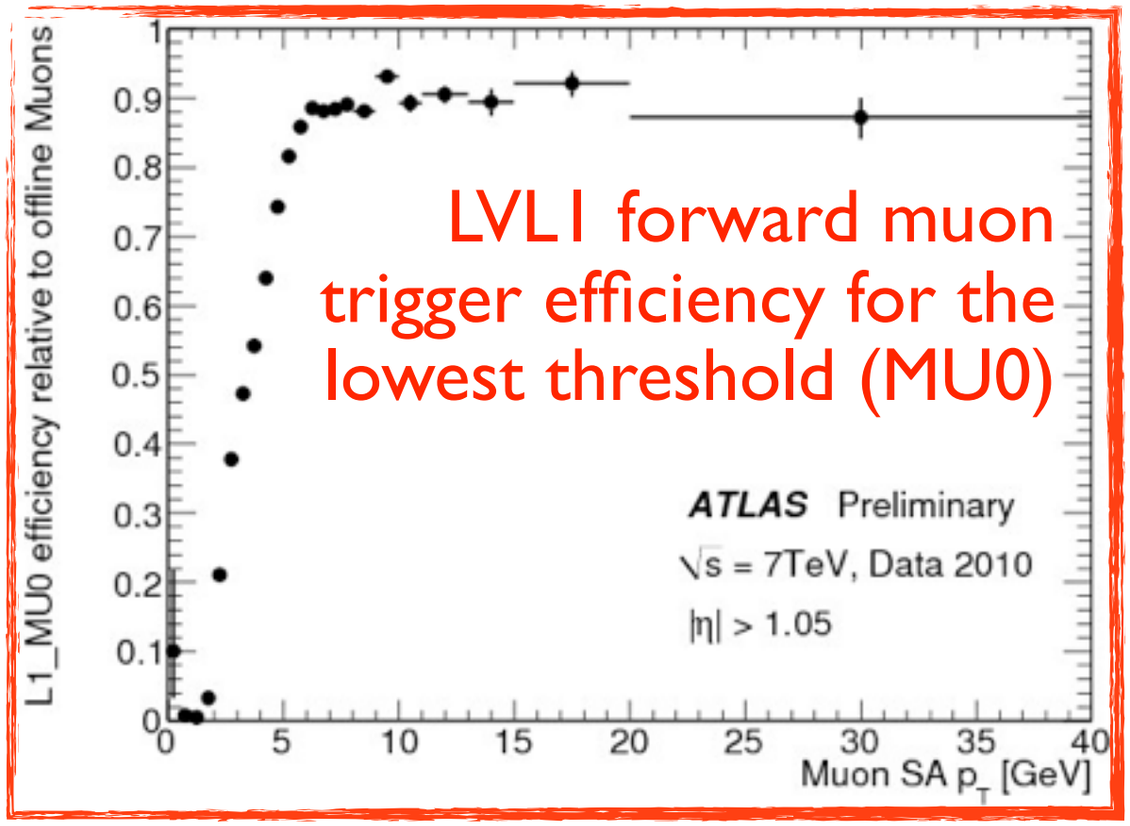
3 Trigger levels:
LVL1, LVL2, Event Filter (EF)
High Level Trigger (HLT) LVL2 & EF

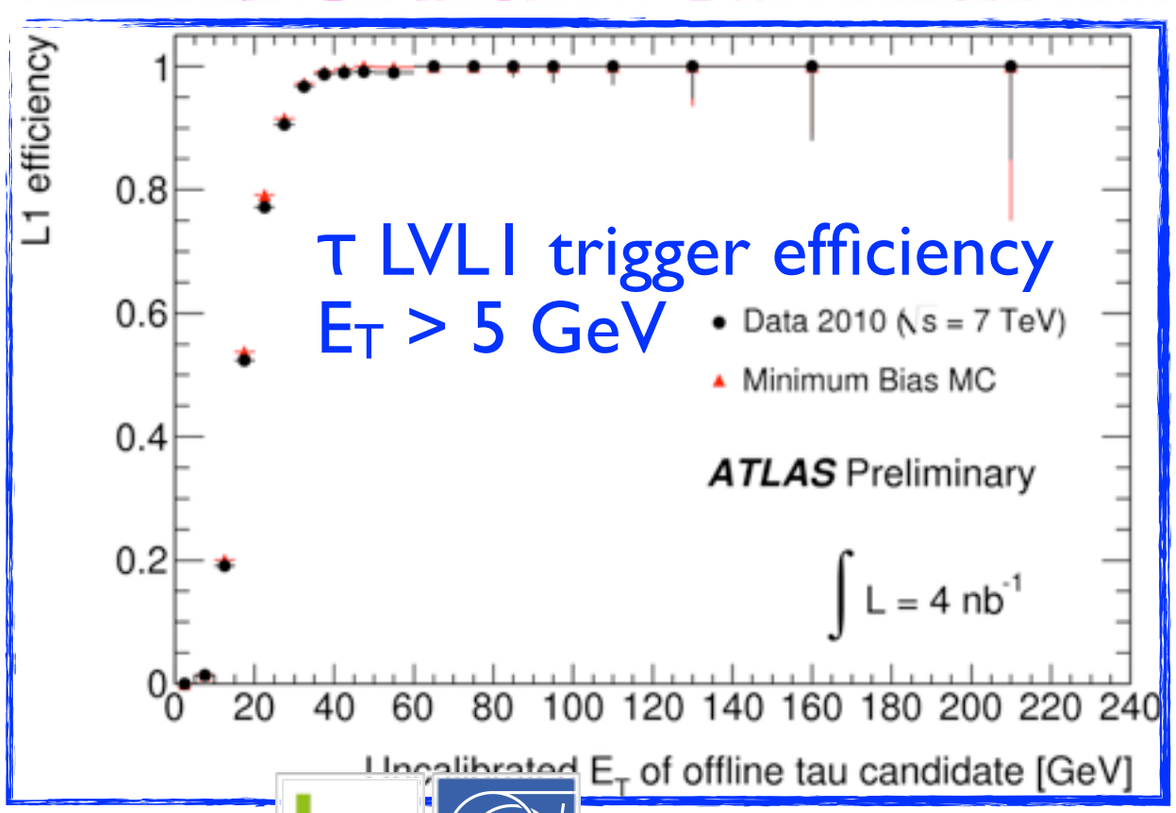
Trigger output history: ~ 300 Hz

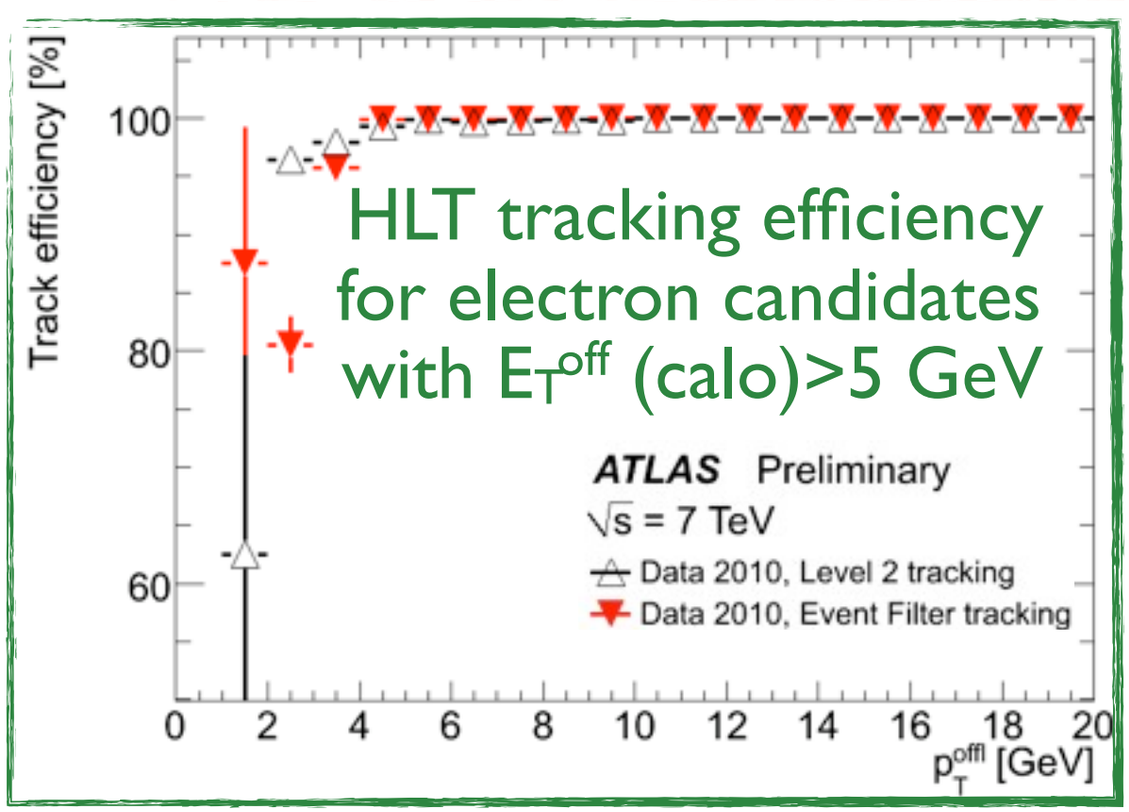
- $L <$ few $10^{27} cm^{-2}s^{-1}$: minimum-bias LVL1 trigger: hits in scintillator counters (MBTS) located at Z=± 3.5 m from collision centre; HLT running in transparent mode
- $L > 10^{27} cm^{-2}s^{-1}$: MBTS prescaled (only fraction of events recorded); Others items (EM2, J5, TAU5, MU0, ...): un-prescaled
- $L \sim 10^{29} cm^{-2}s^{-1}$: start to activate HLT chains to cope with increasing rate while running with low LVL1 thresholds. Jet items: lowest thresholds prescaled (HLT rejection small)

Trigger performance (examples)

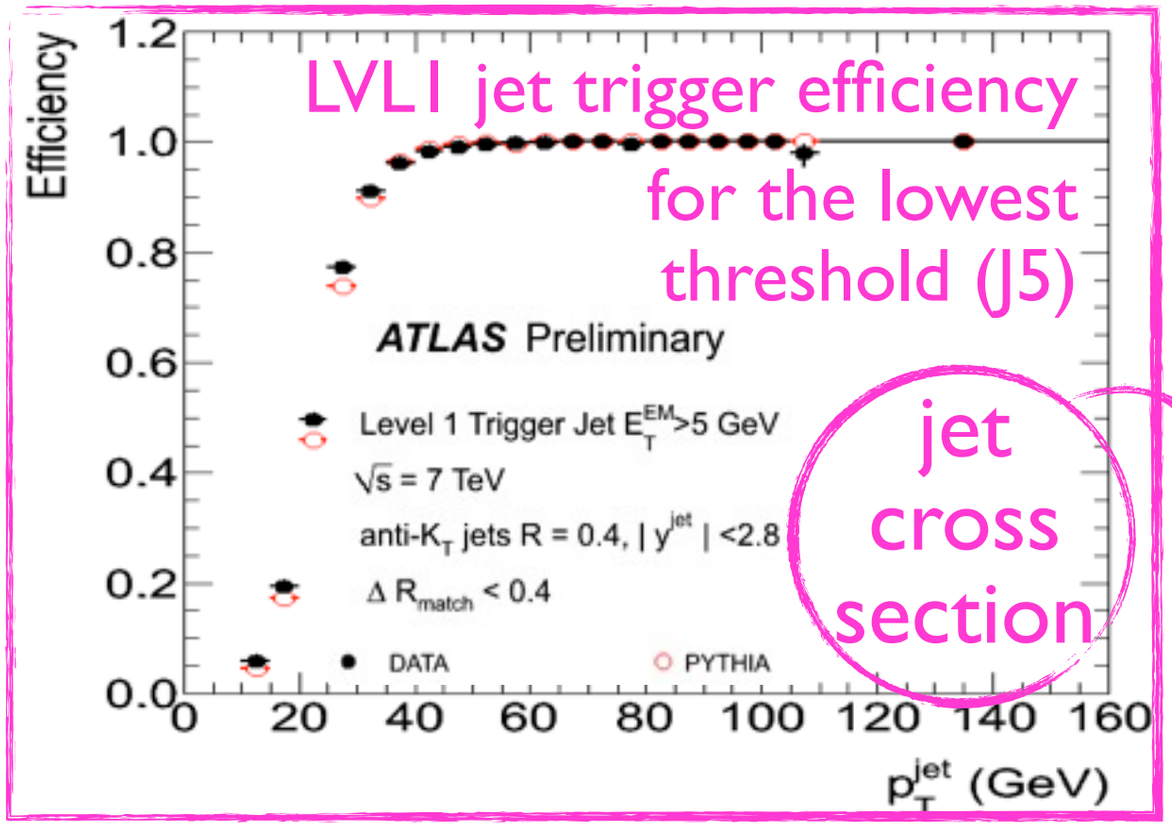


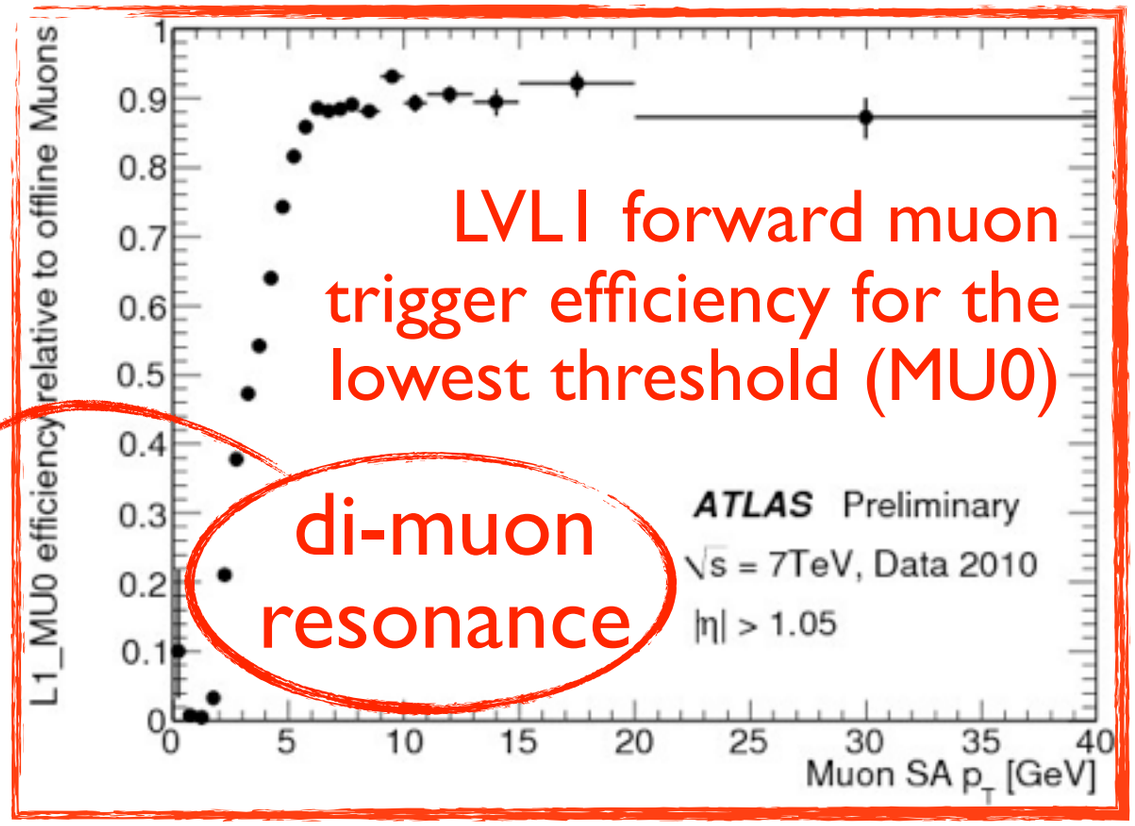




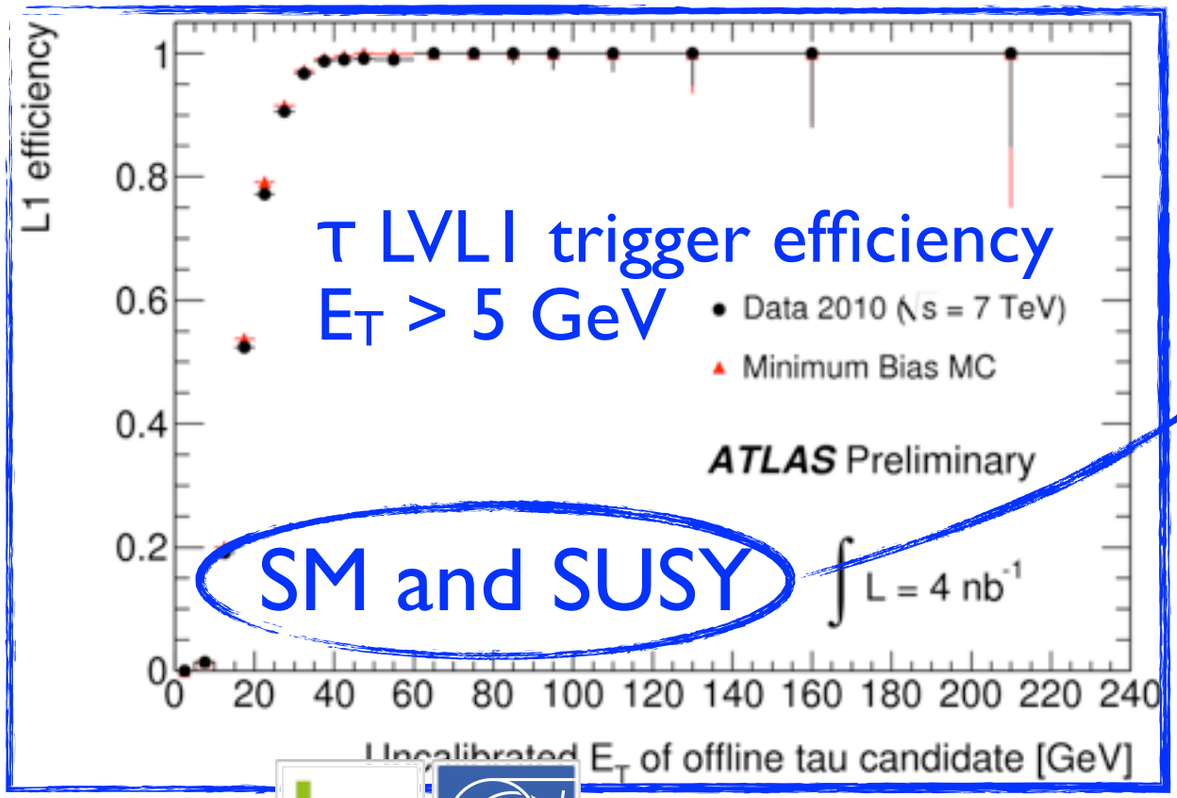


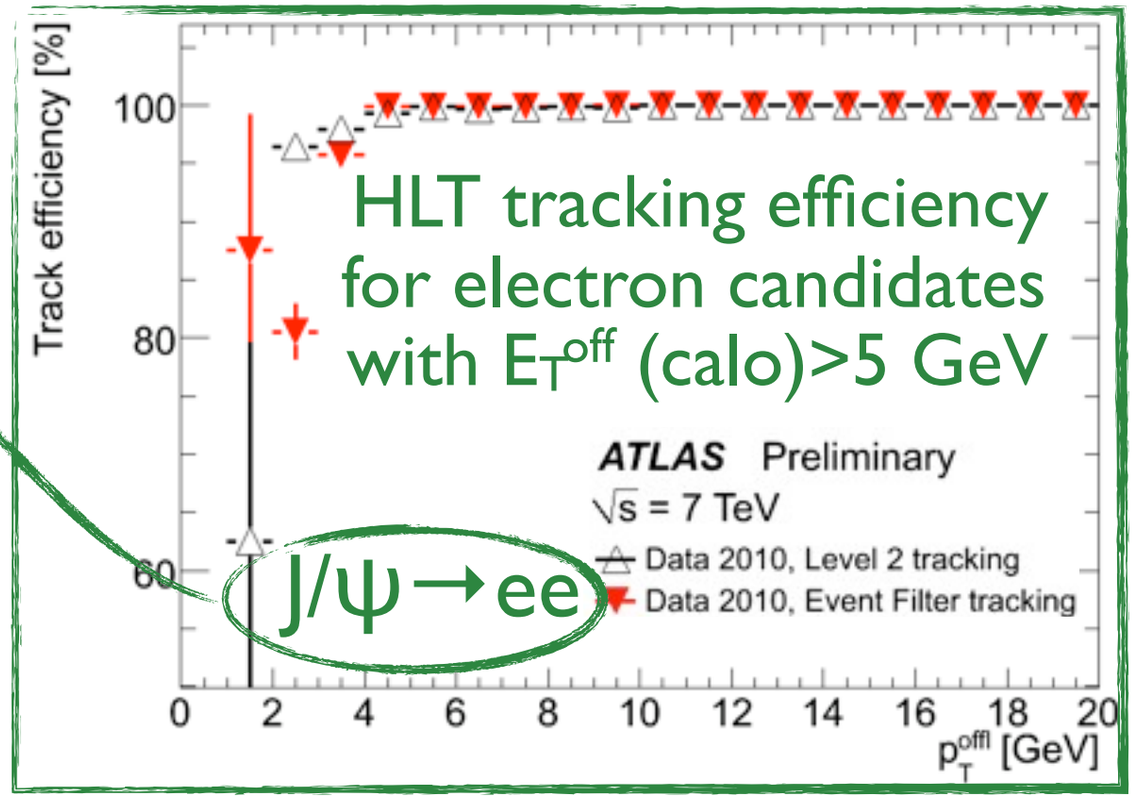
Trigger performance (examples)





Triggers are crucial for:





ATLAS Operation Issues

- LAr optical transmitters – 29 failures (rate ~1-2/month). Confined to units with a narrow-width pulse. Today = 2% of Front-End boards affected. Total energy read from trigger towers - replace dead TX in winter shutdown
- SCT/Pixel optical links – few failures per week (in counting room: can be replaced quickly). Spares on order.
- Magnet/Cryogenic – recent intervention to fix the filter clogging problem.

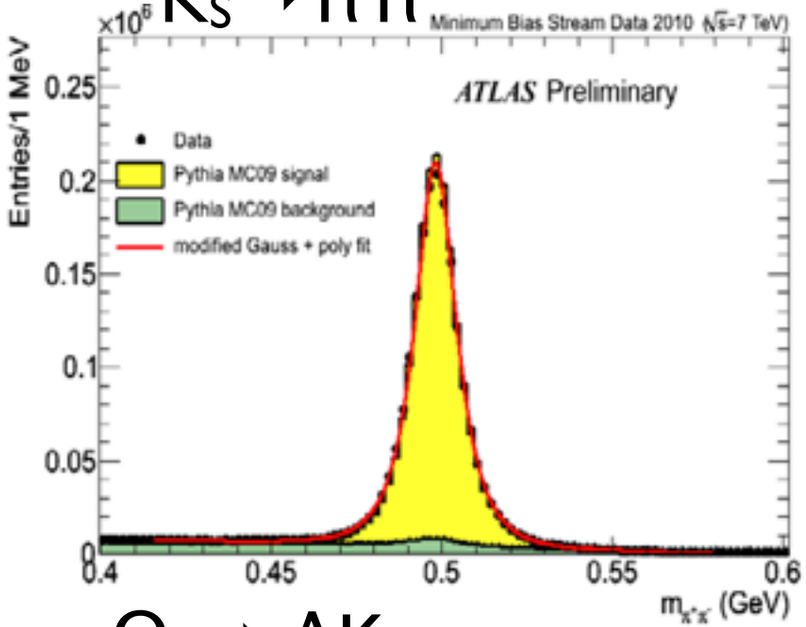
Plan for the winter shutdown:

- Open both sides of the detector for work on
- Liquid Argon Calorimeters (optical transmitters)
- Tile Calorimeters (power supplies)
- Preventative maintenance: cryogenics, vacuum & safety systems
- Access is not easy: only 2 of 9 weeks for real work on detector!

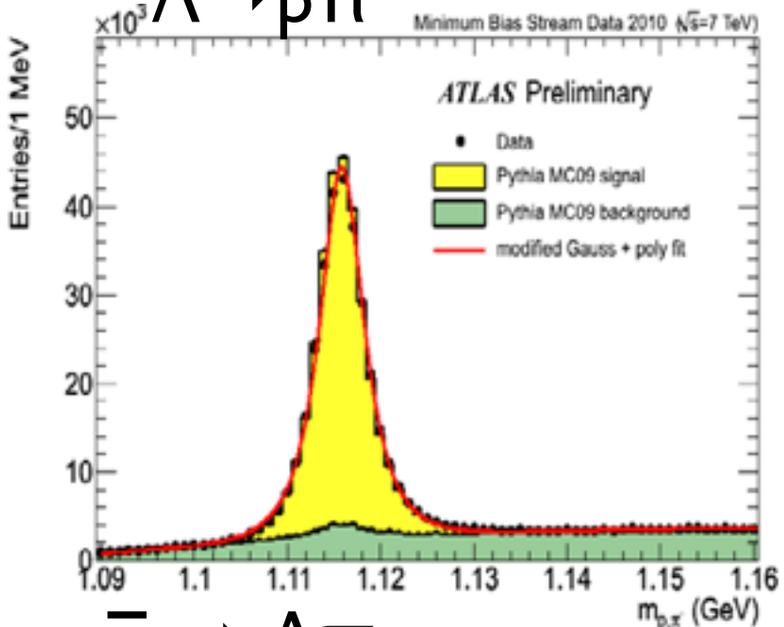
Tracking Performance: Peaks, Cascades & J/ψ→ee

Observed all most classic resonances:
Ks, K*, φ, Λ, Ω, Ξ, D, D* and J/Ψ
Momentum scale known to permil in this mass region.

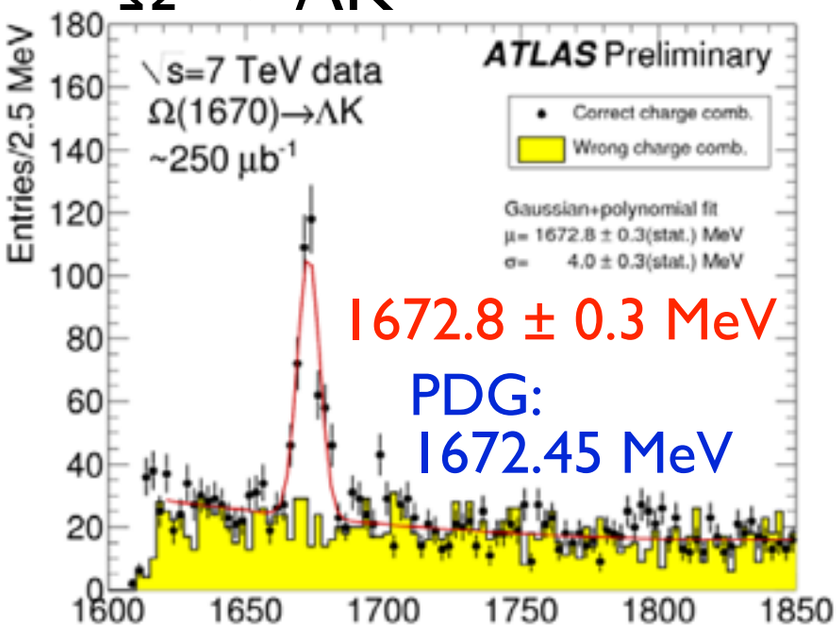
$K_S \to \pi\pi$



$\Lambda \to p\pi$



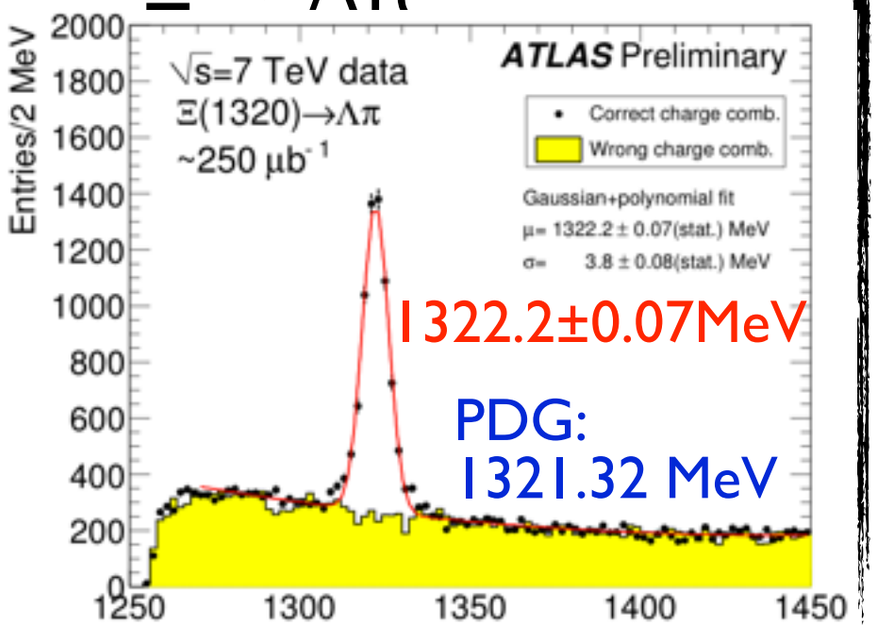
$\Omega \to \Lambda K$



1672.8 ± 0.3 MeV

PDG: 1672.45 MeV

$\Xi \to \Lambda\pi$

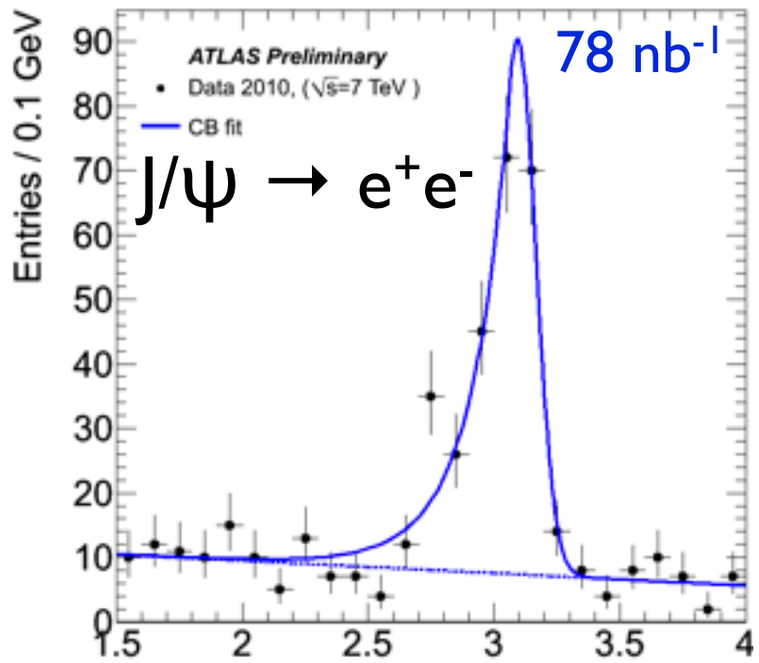


1322.2±0.07MeV

PDG: 1321.32 MeV

Extract signal from background:

- 2 EM clusters (track-match)
- p_T (e± tracks) > 4, 2 GeV
- track quality, calo shower shapes
- key handle: large transition radiation in TRT
- invariant mass from track parameters after
- Bremsstrahlung recovery (Gaussian Sum Filter)
- Signal: 222 ± 11 events
- Background: 28 ± 2 events
- Mass peak: 3.09 ± 0.01 GeV
- Mass resol.: 0.07 ± 0.01 GeV



Inner Detector Material Mapping: $\gamma \rightarrow e^+e^-$

Low threshold hits (with signs of bremsstrahlung losses)

e^-

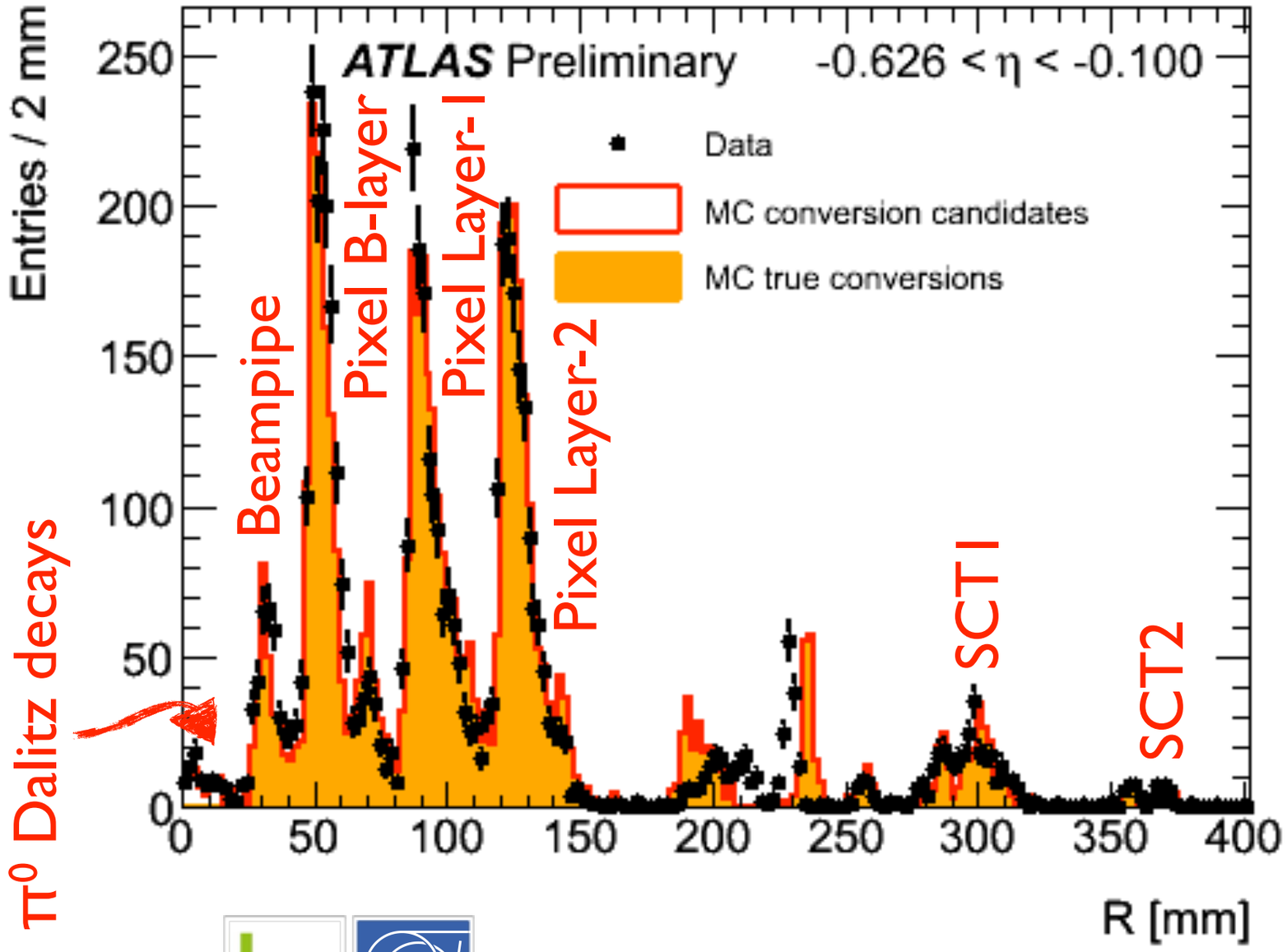
e^+

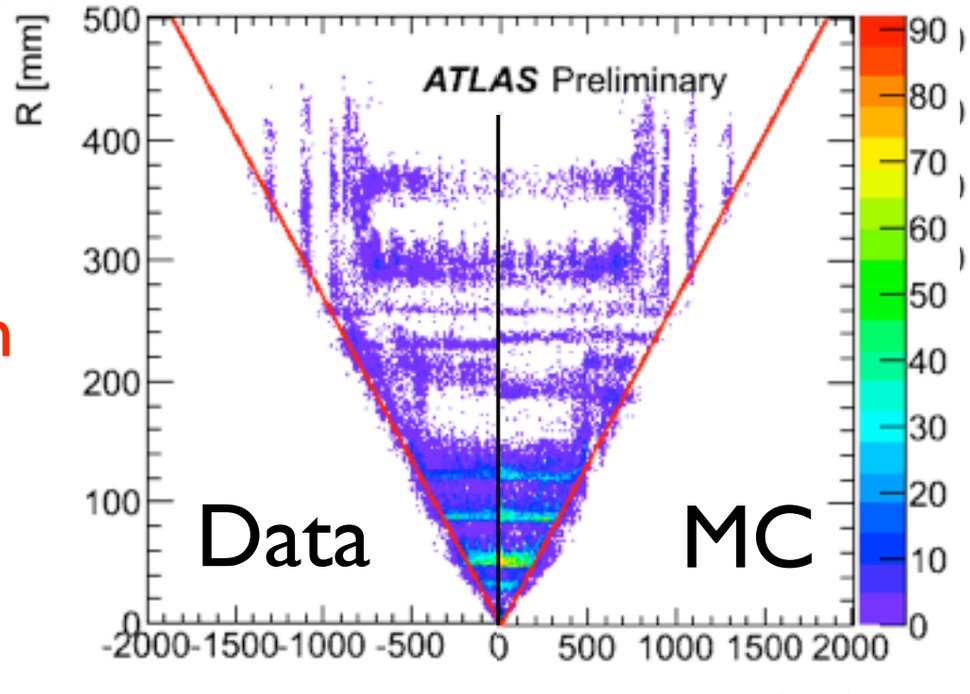
High threshold hit

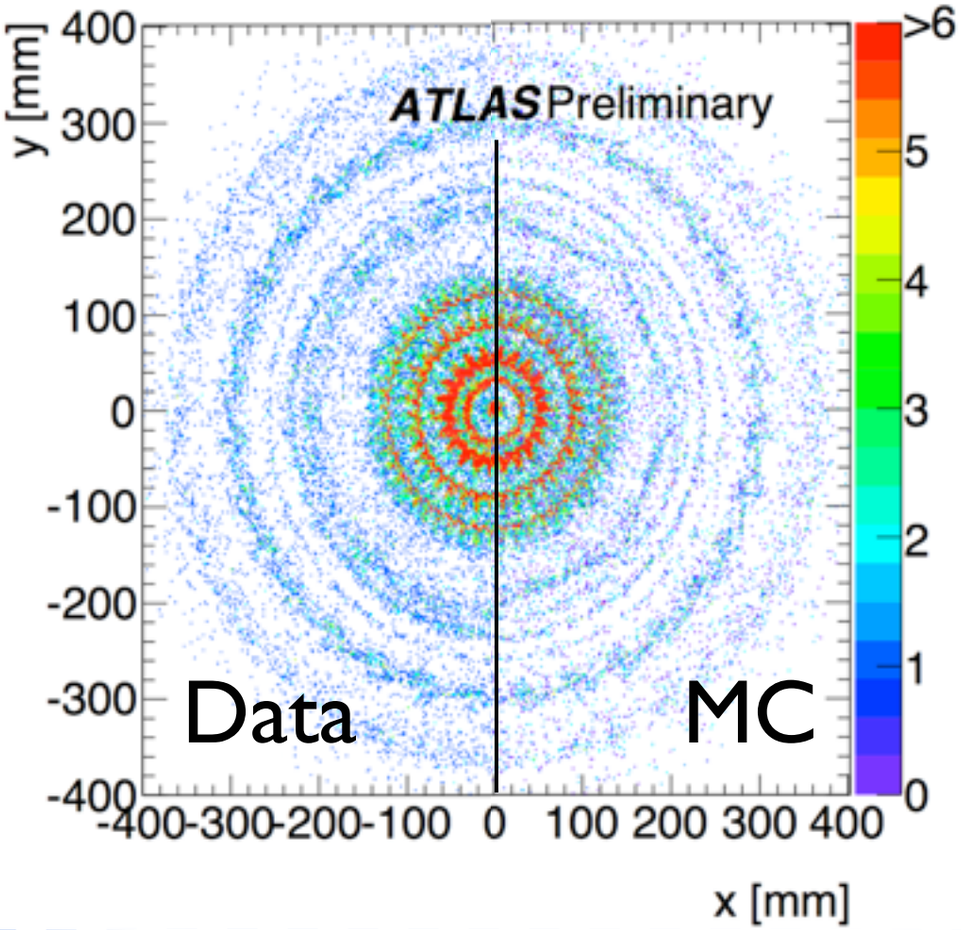
Inner Detector Material Mapping: $\gamma \rightarrow e^+e^-$

Goal: know material better than 5%
(over-constraining with several methods)
Present understanding: ~ 10%

- Reconstructed conversion point of $\gamma \rightarrow e^+e^-$ from minimum bias events (sensitive to X_0)







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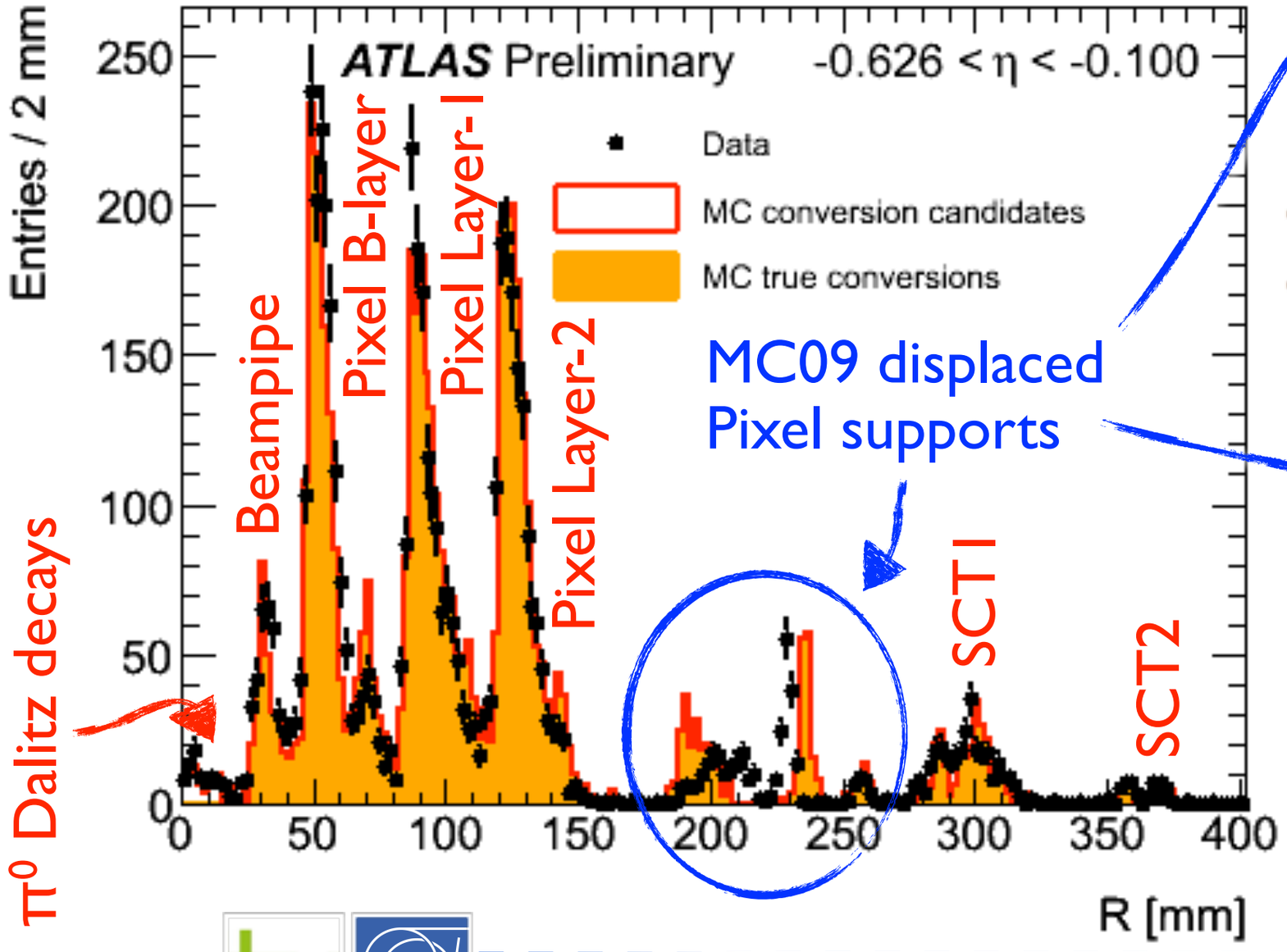
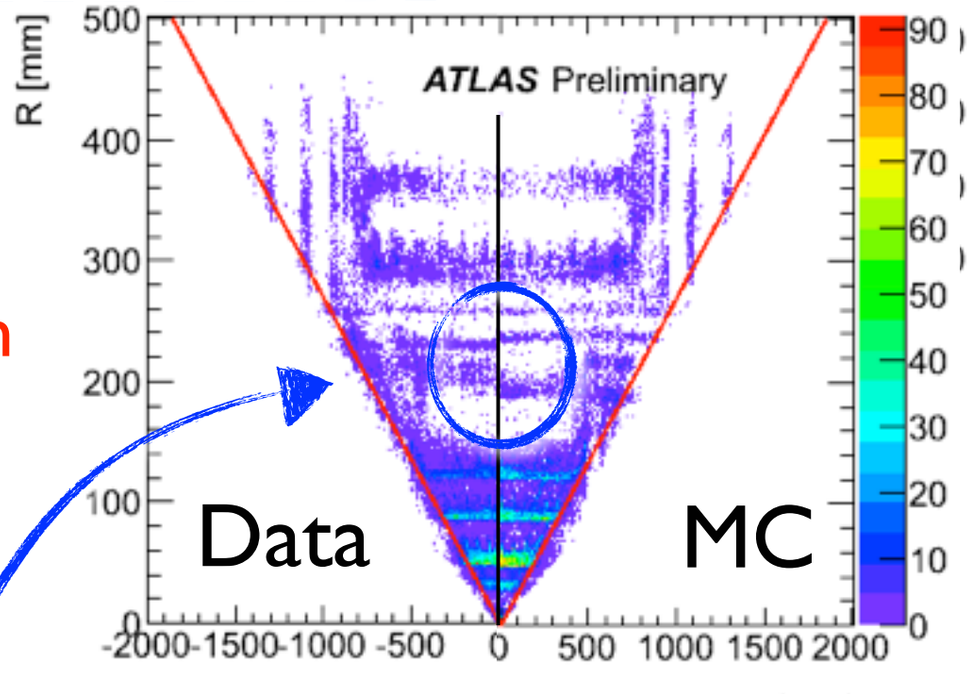
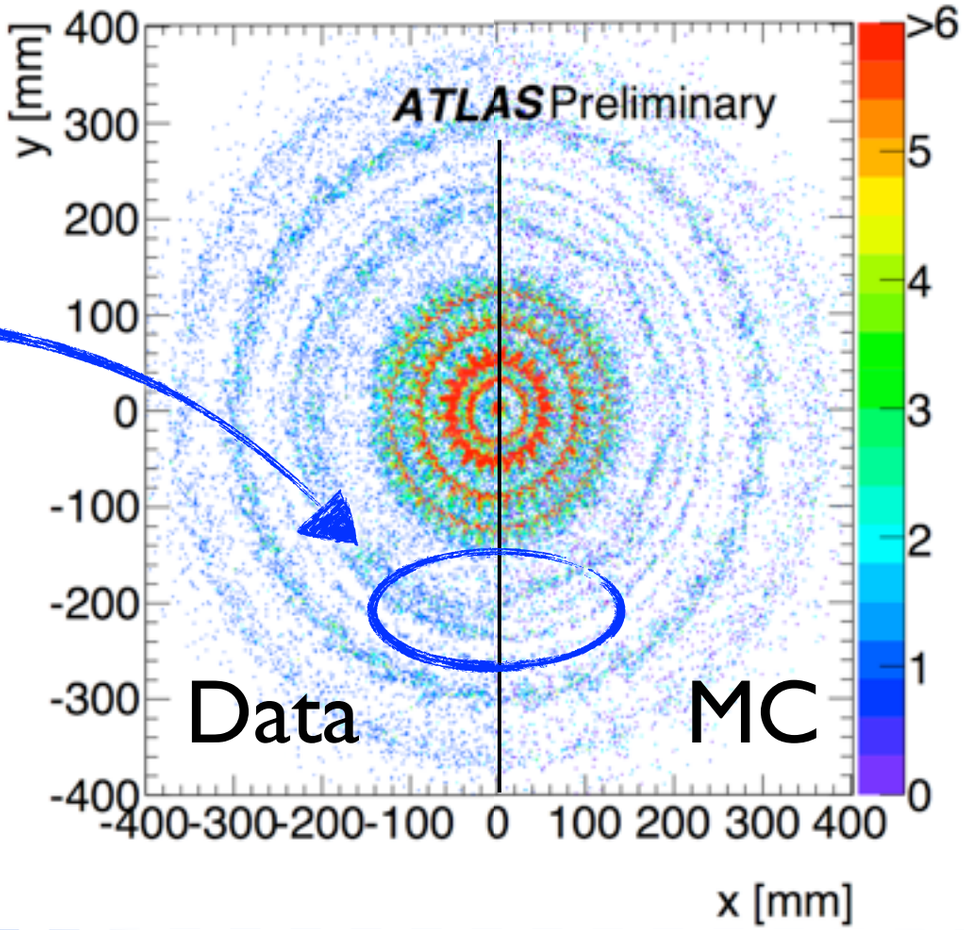
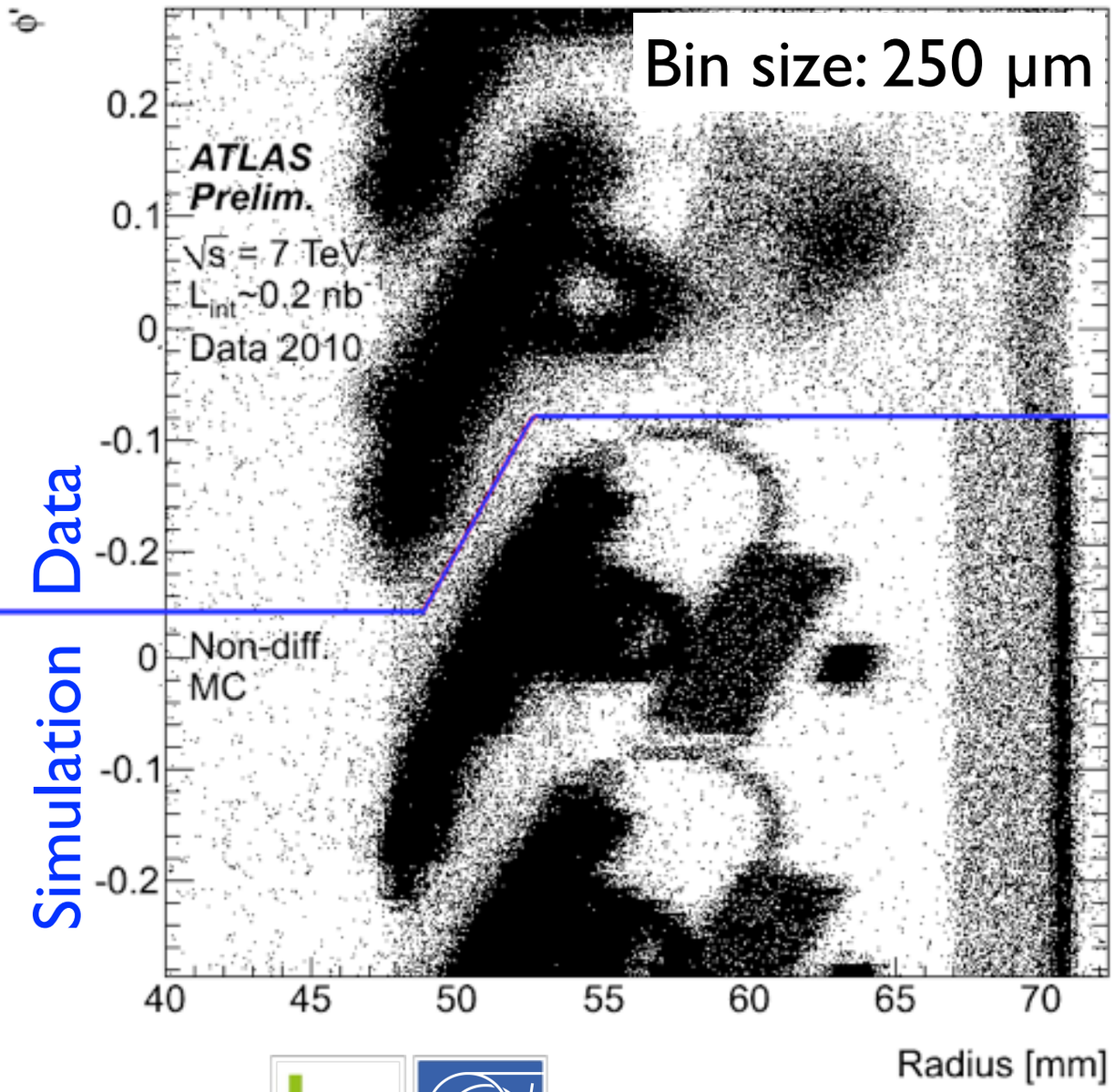


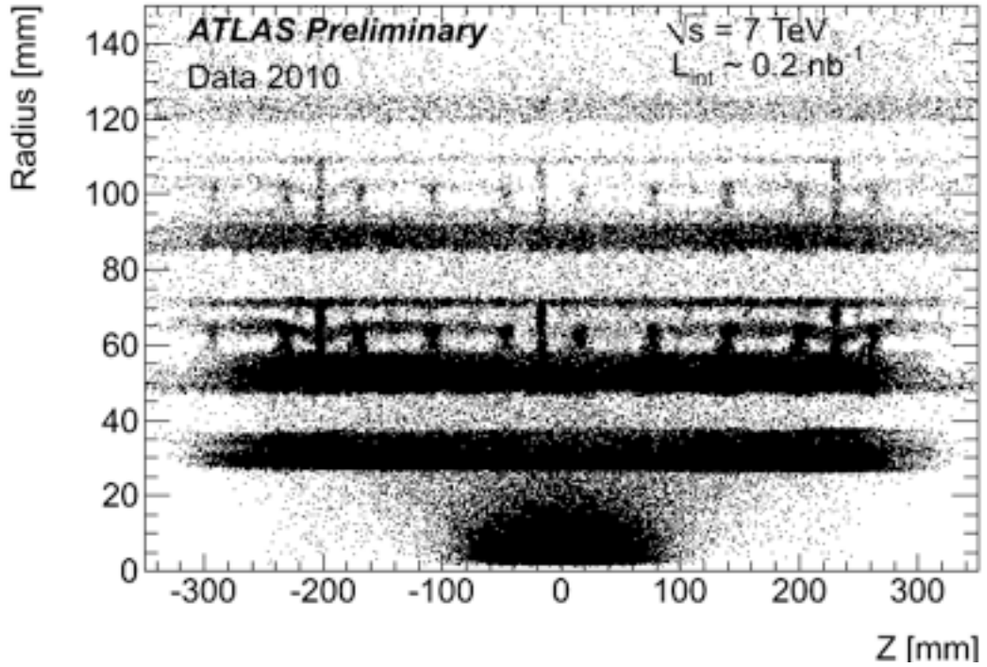


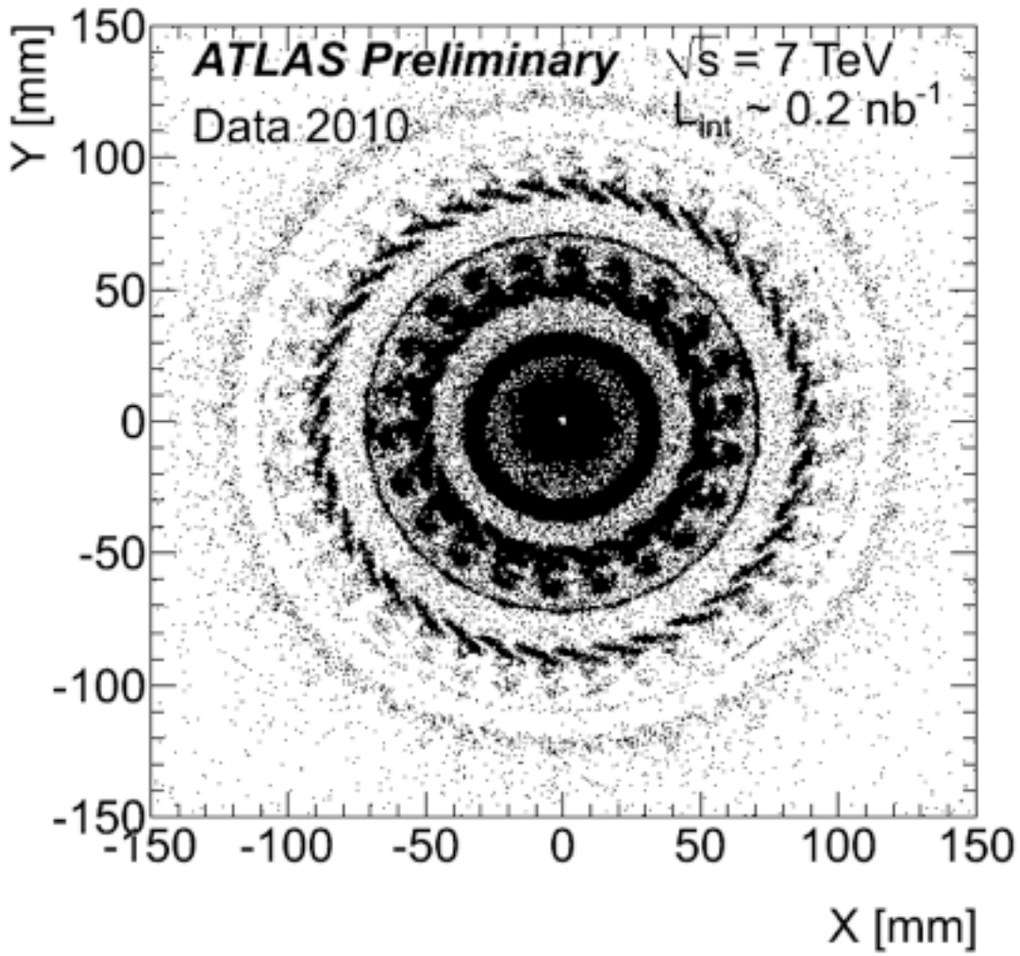


Inner Detector Material Mapping: hadron interactions

- Reconstructed secondary vertices due to hadronic interactions in minimum-bias events (sensitive to interaction length λ → complementary to γ conversion studies)
- Vertex mass veto against $\gamma \rightarrow e^+e^-$, K_S^0 and Λ







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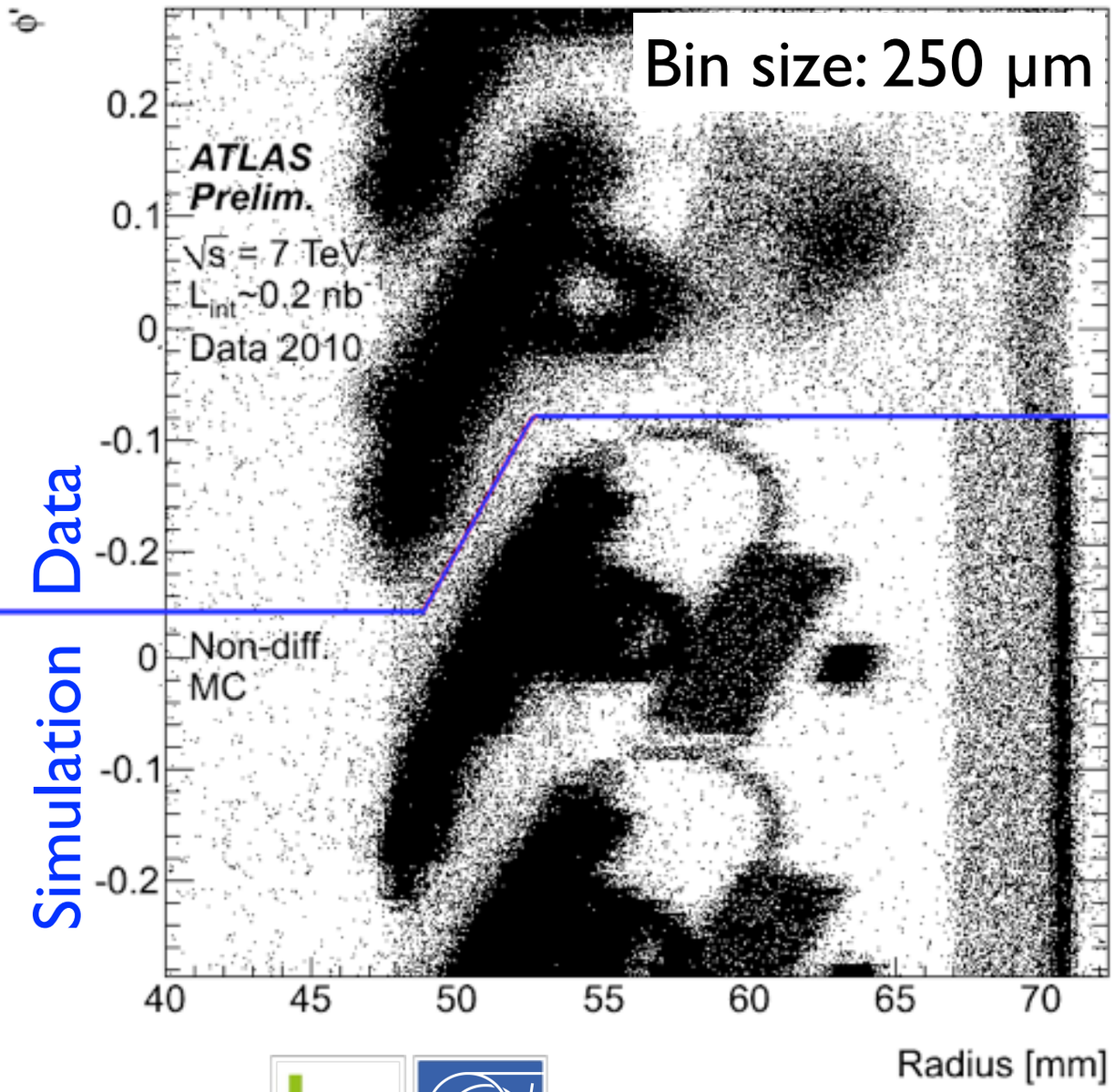
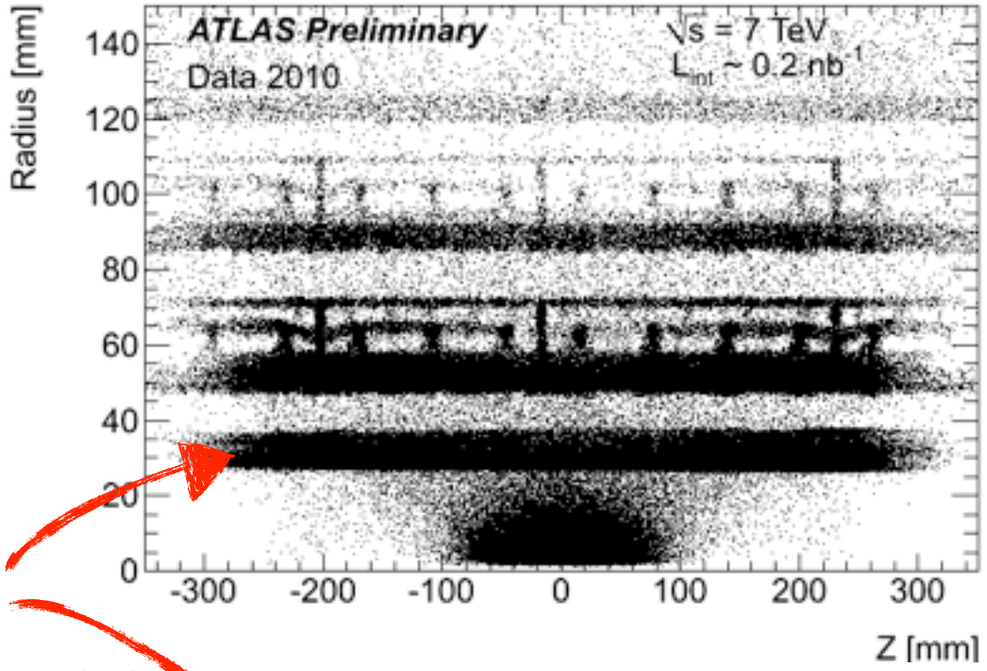
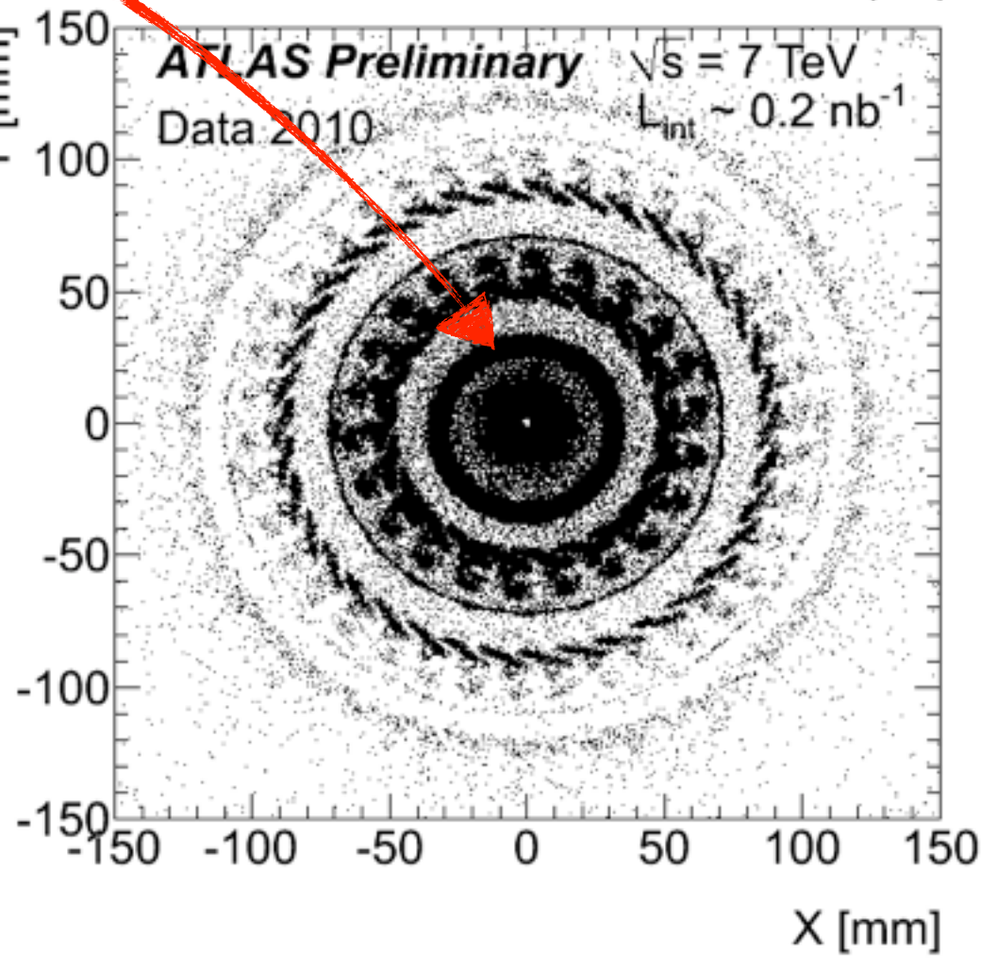


Beam Pipe





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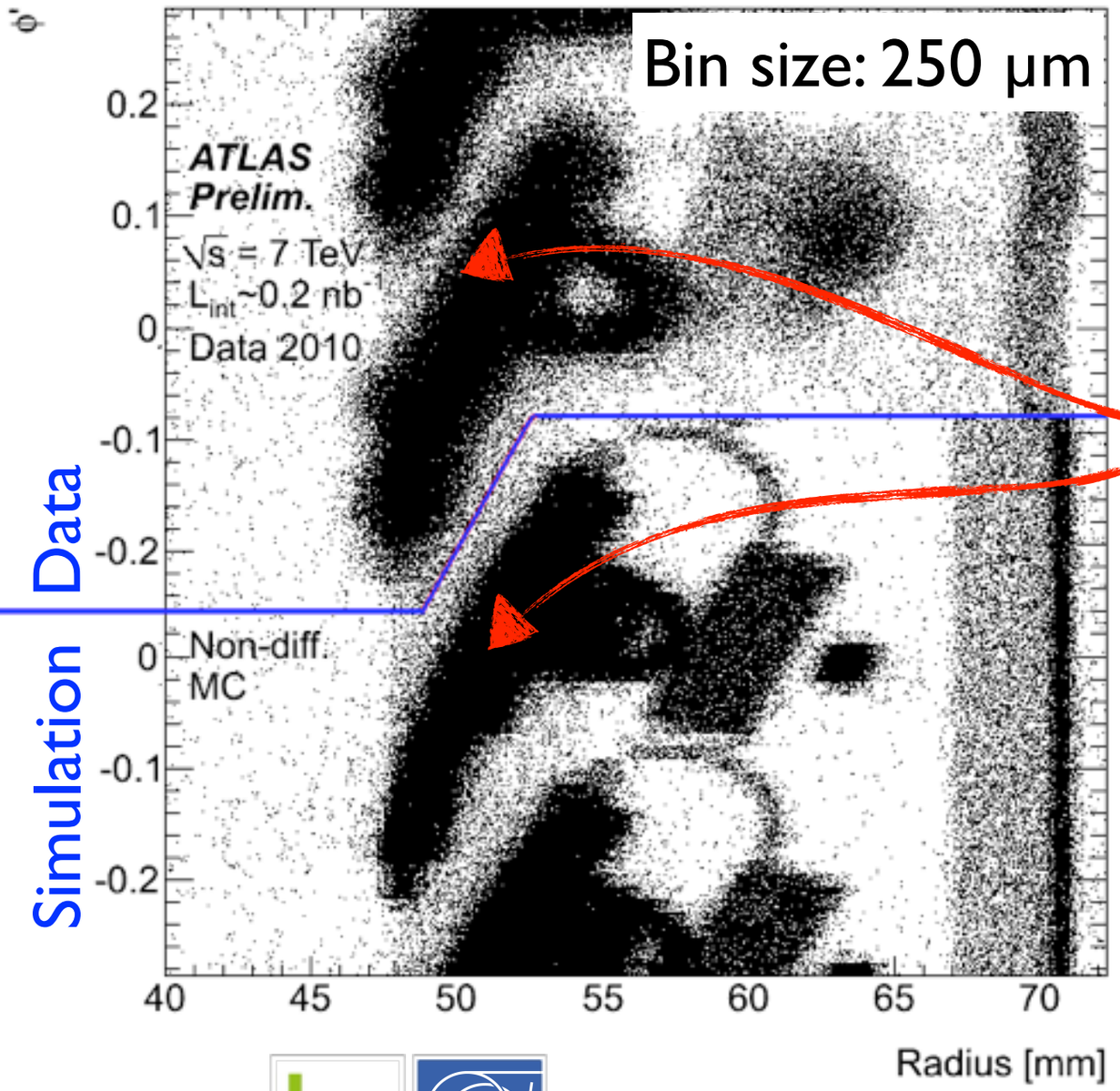
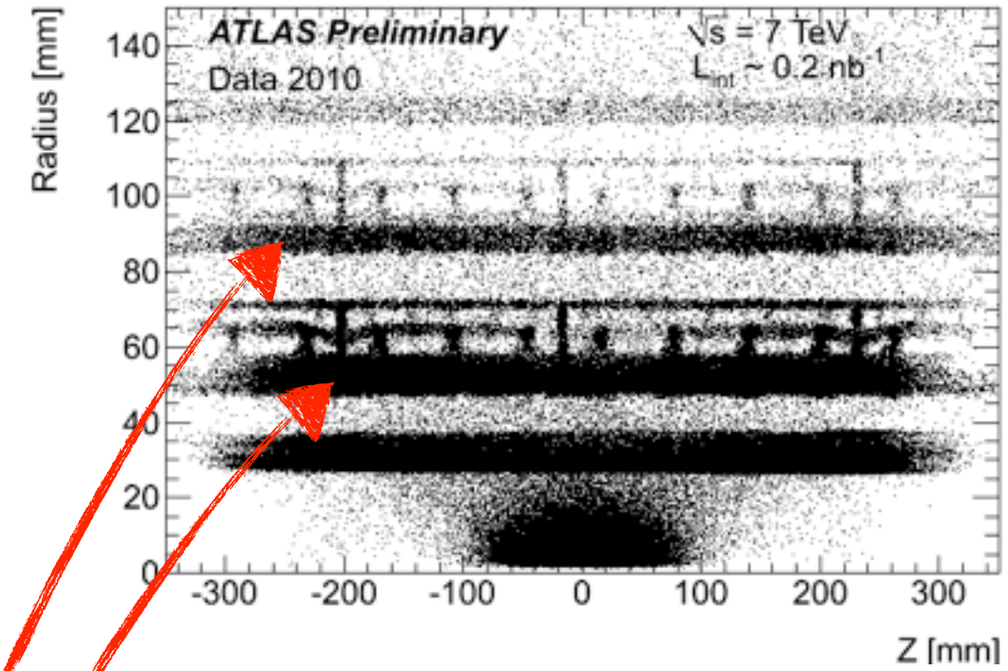
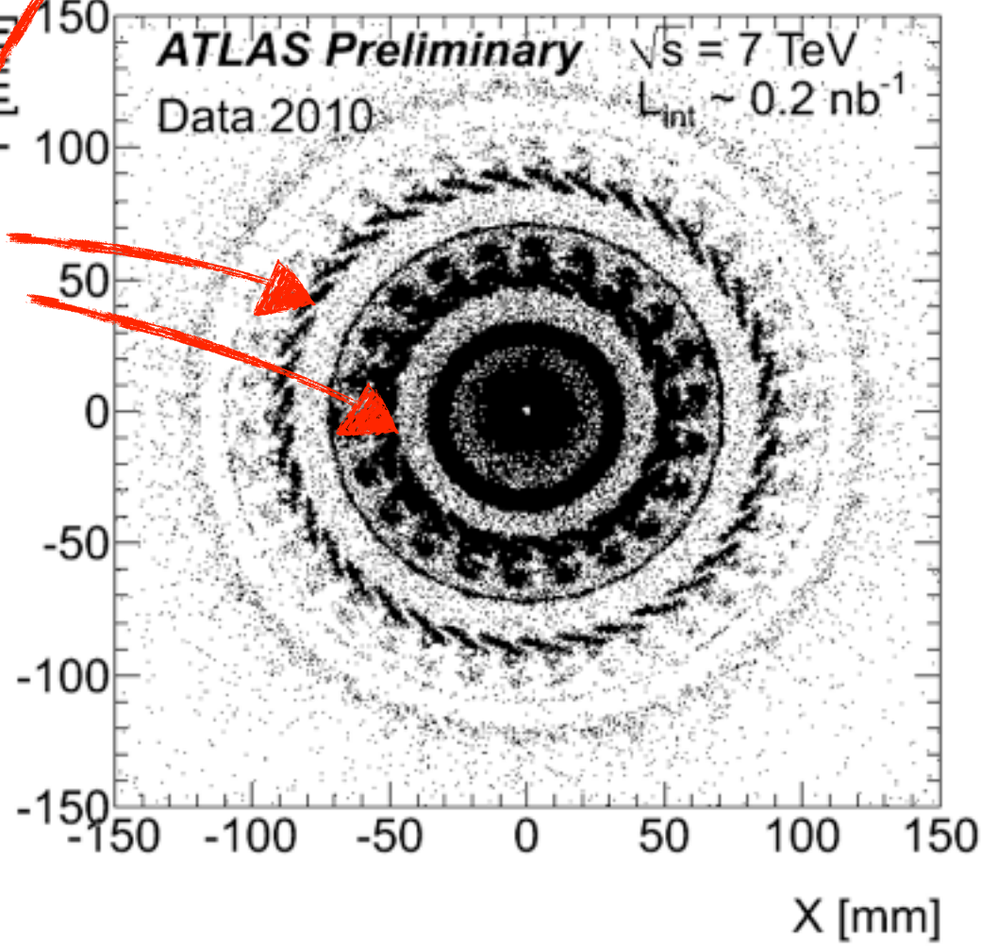




Pixel Modules



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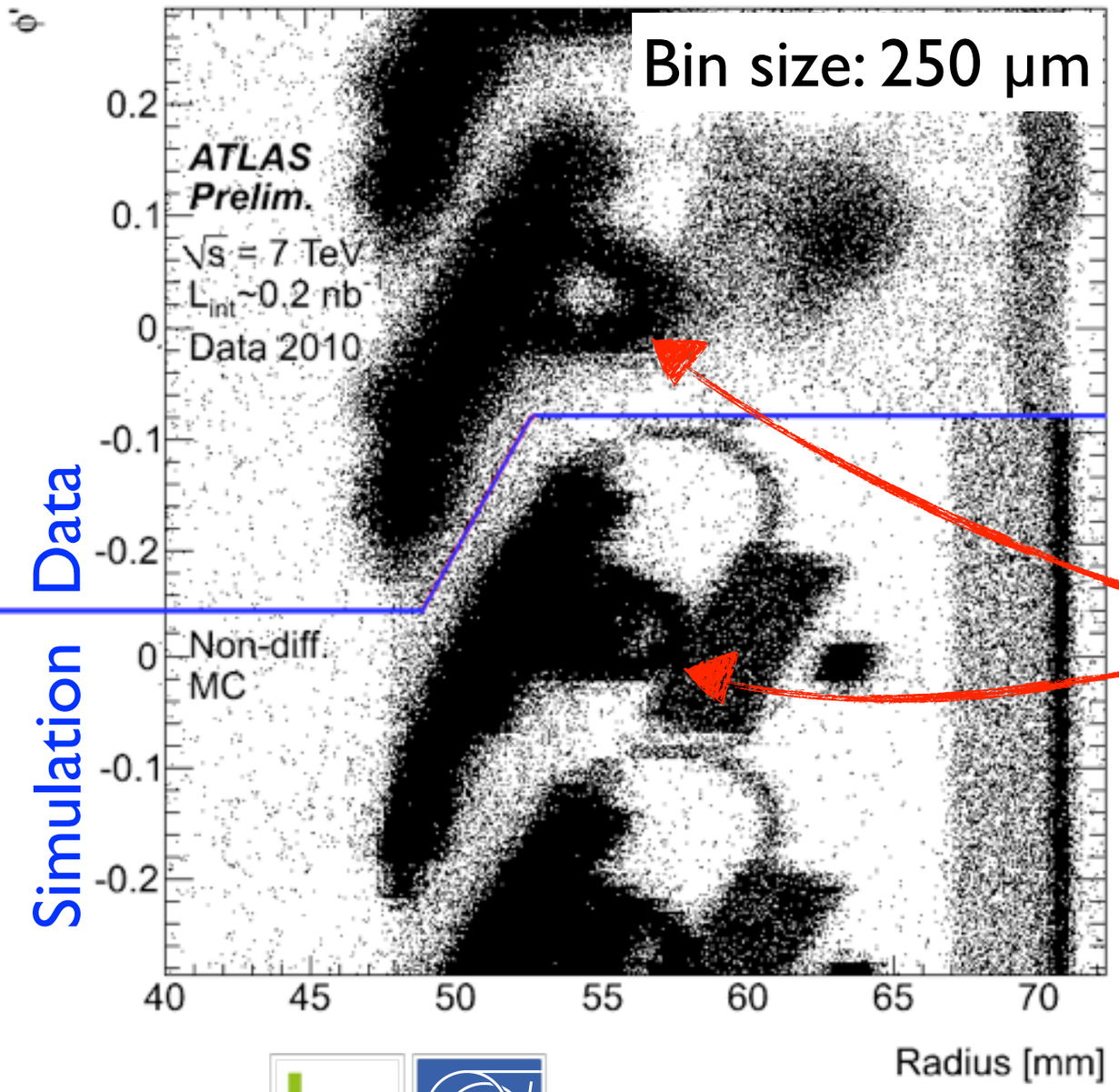

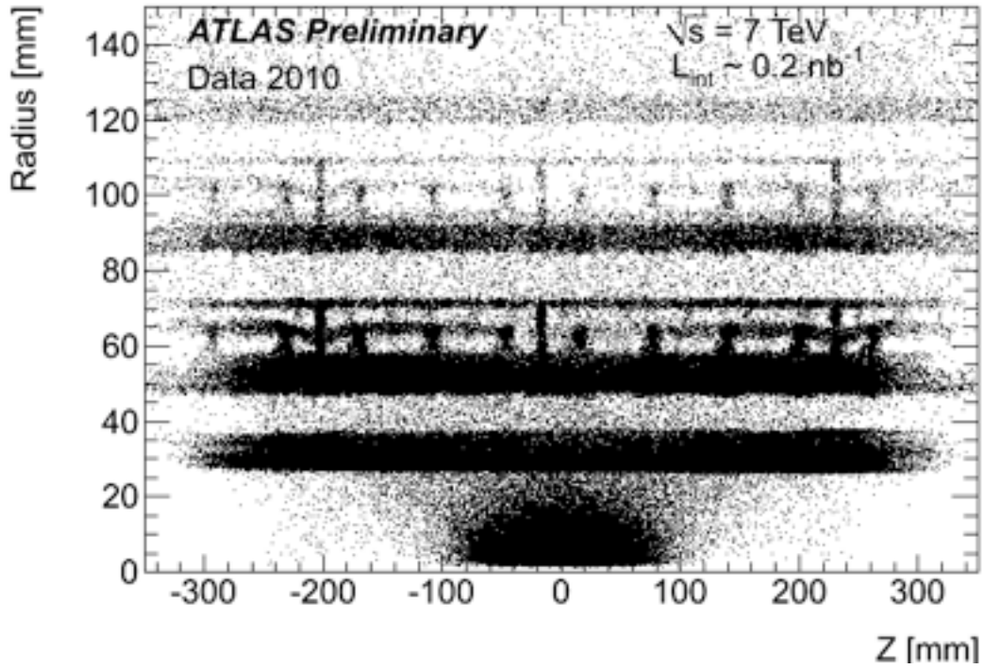

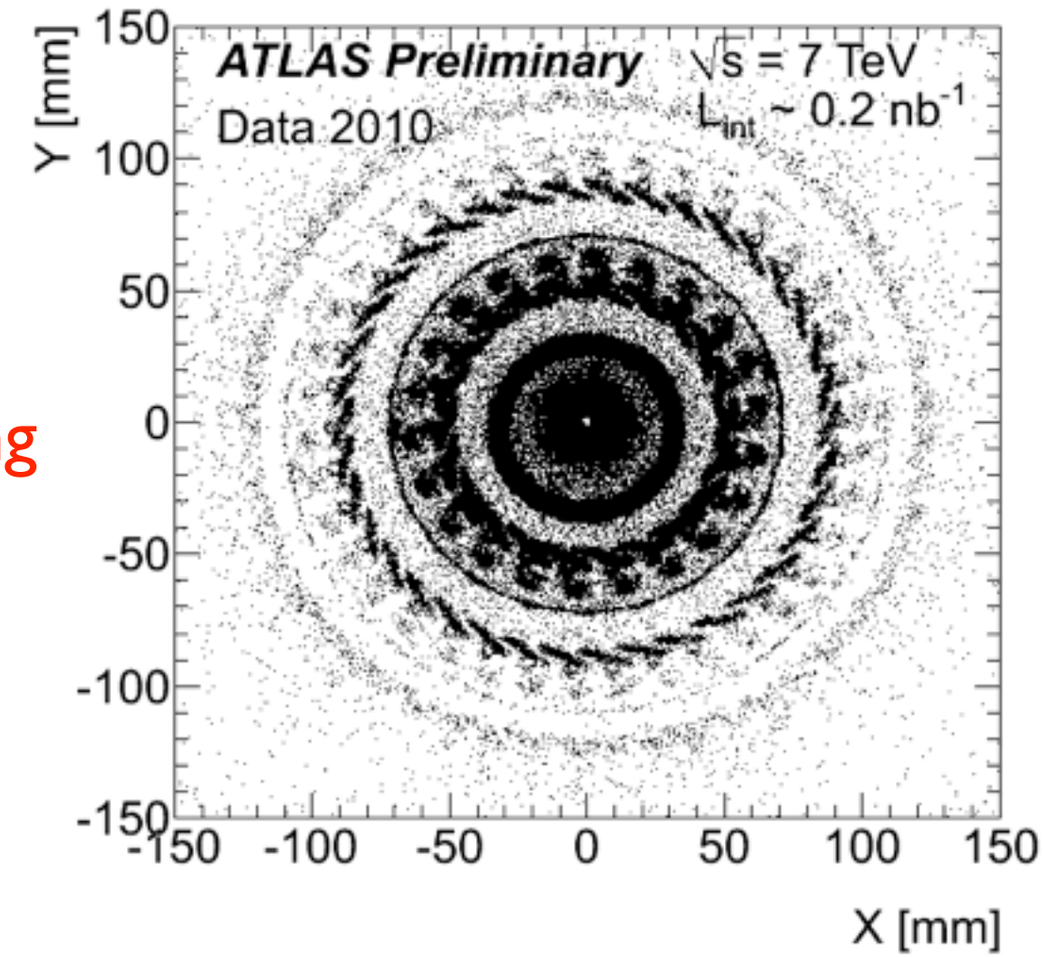

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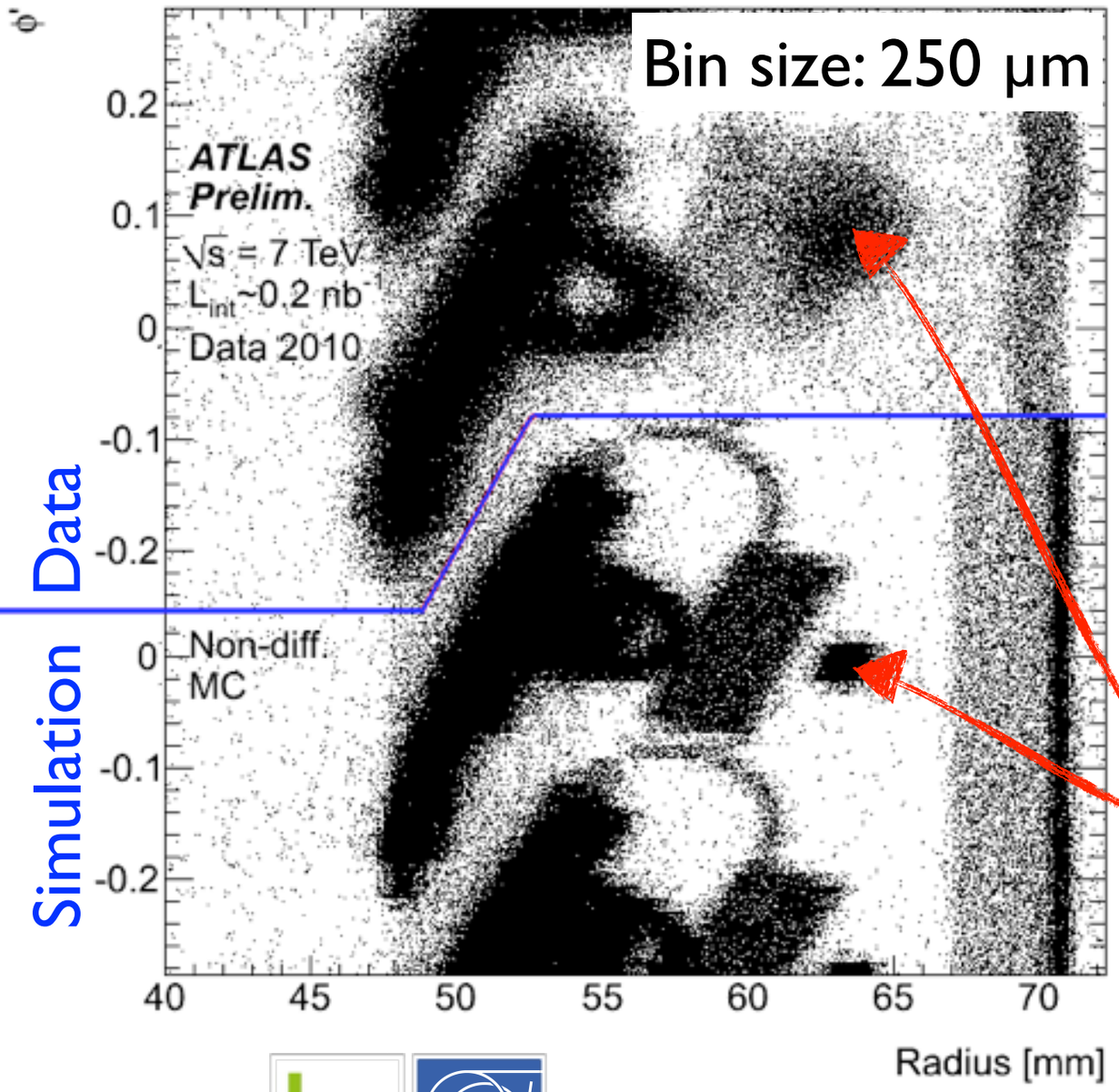
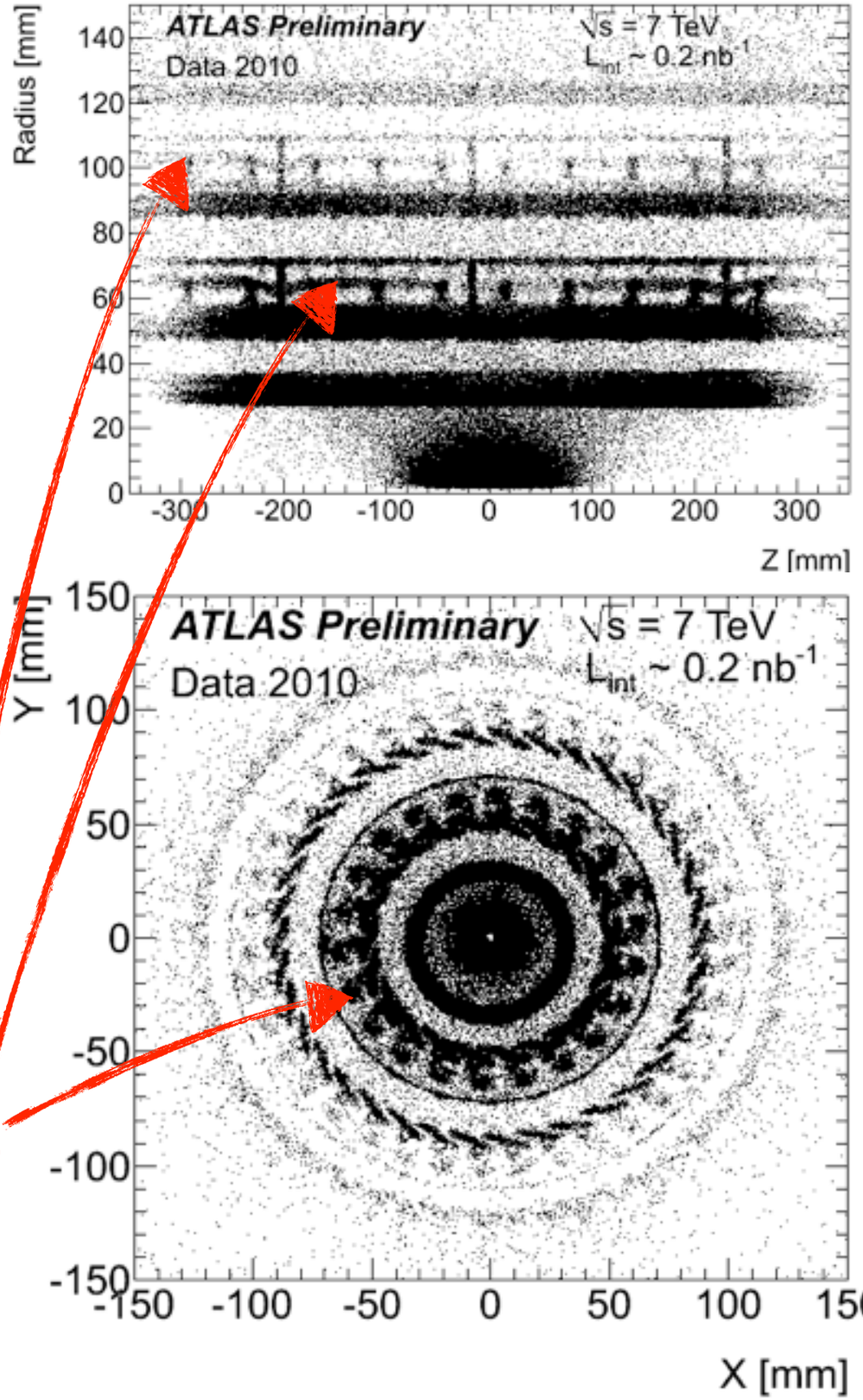
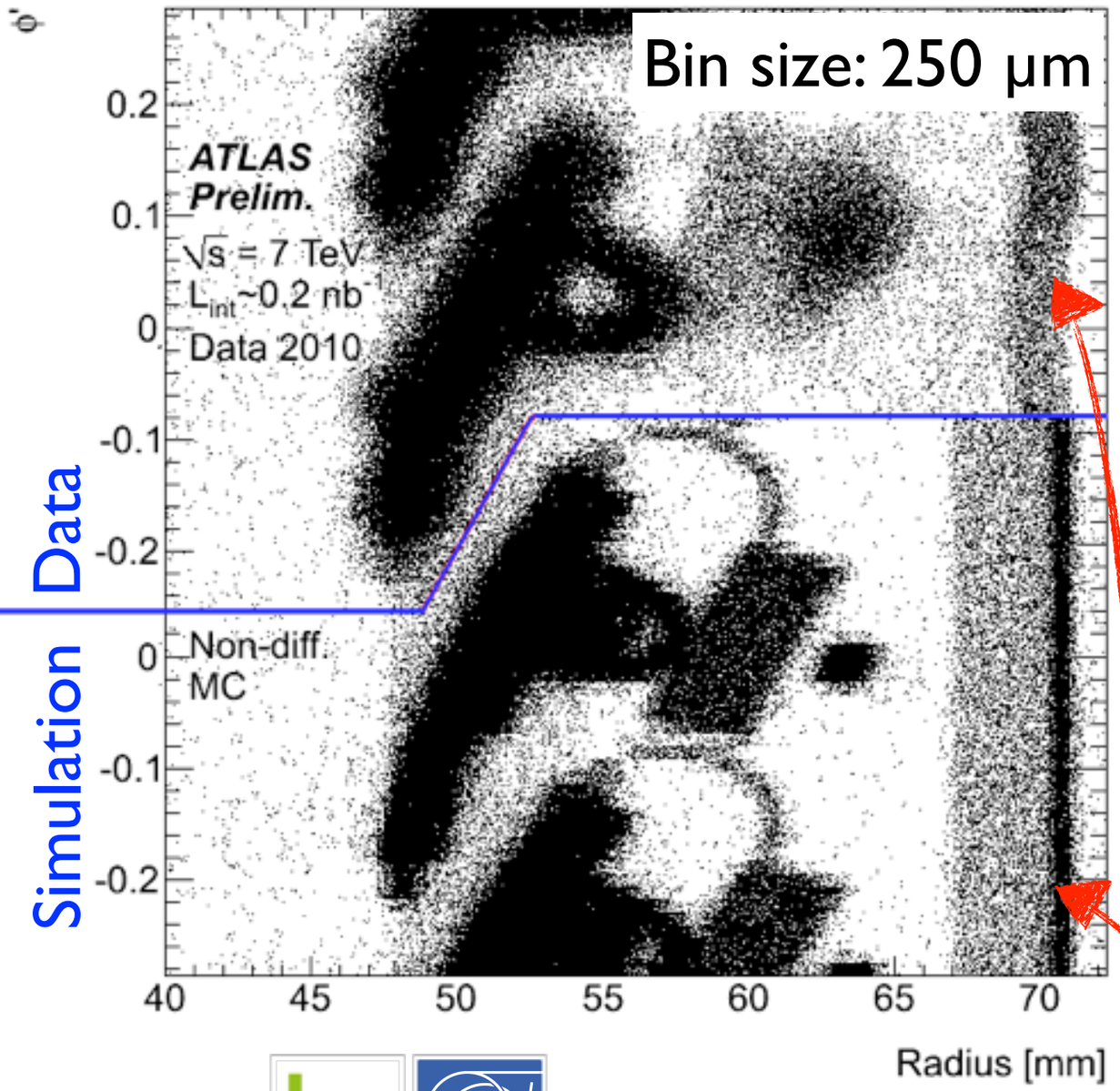
- Vertex mass veto against $\gamma \rightarrow e^+e^-$, K_S^0 and Λ

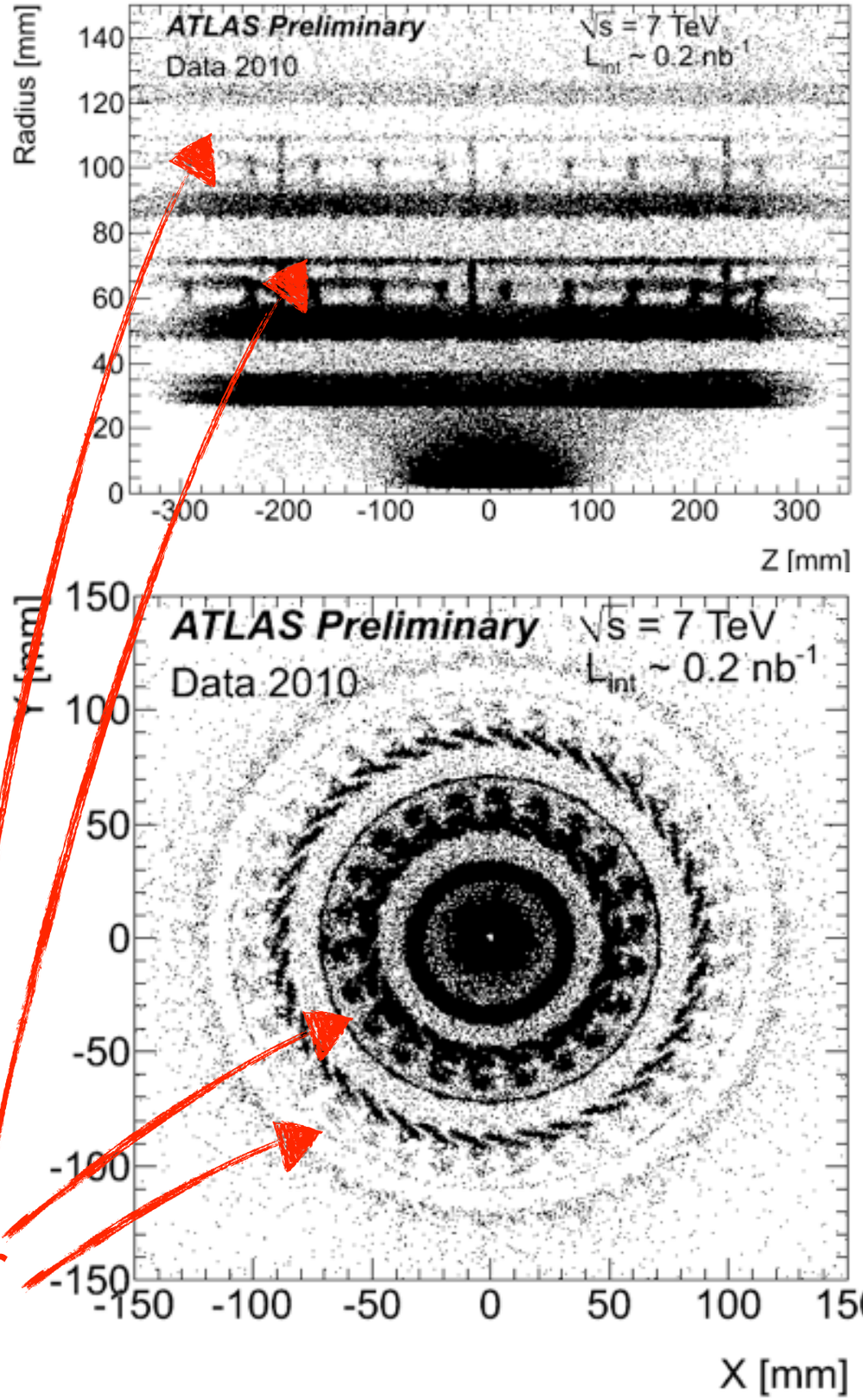




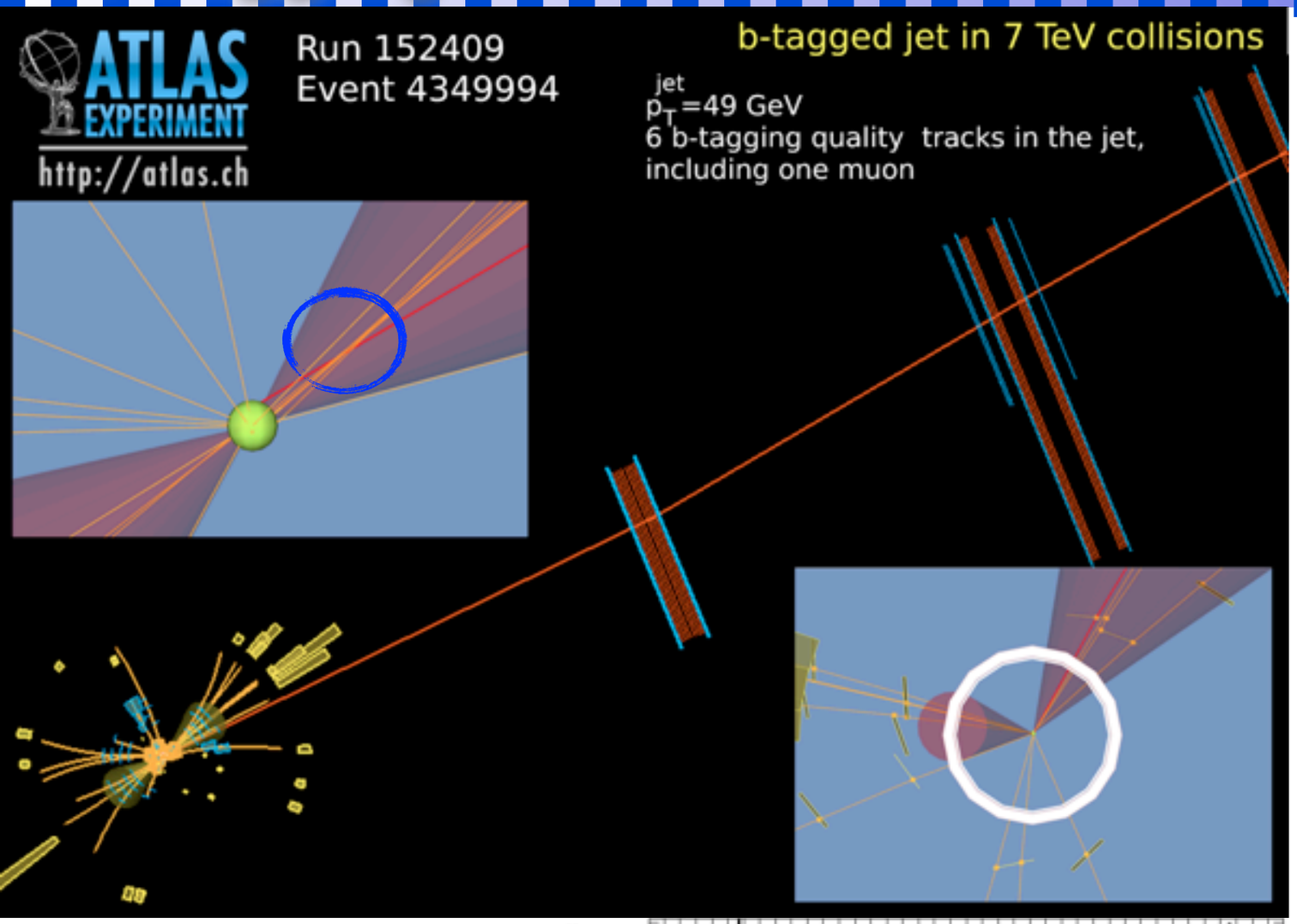
Inner Detector Material Mapping: hadron interactions

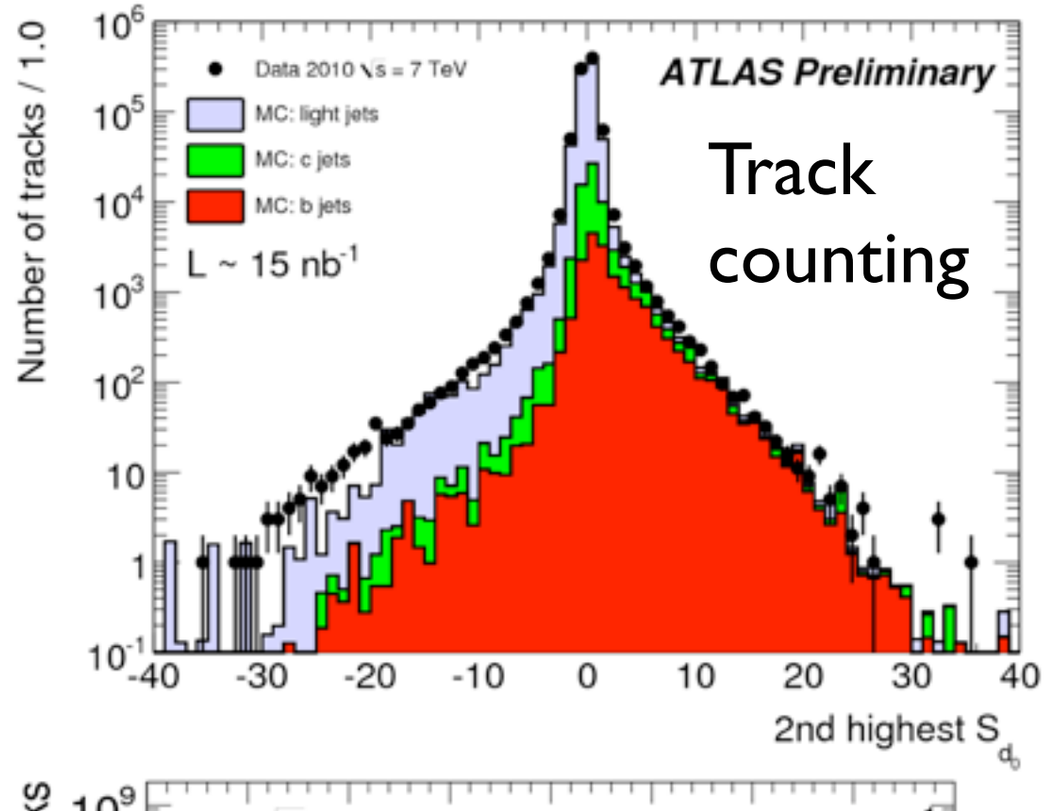
- Reconstructed secondary vertices due to hadronic interactions in minimum-bias events (sensitive to interaction length λ → complementary to γ conversion studies)
- Vertex mass veto against $\gamma \rightarrow e^+e^-$, K_S^0 and Λ

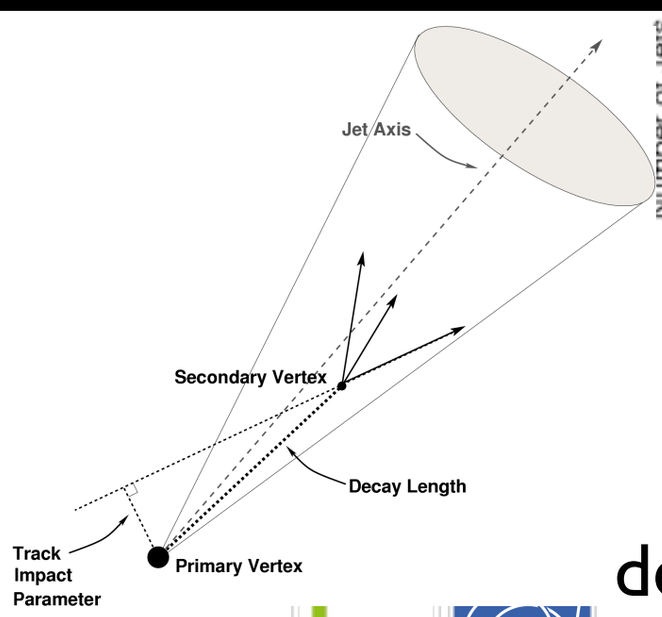


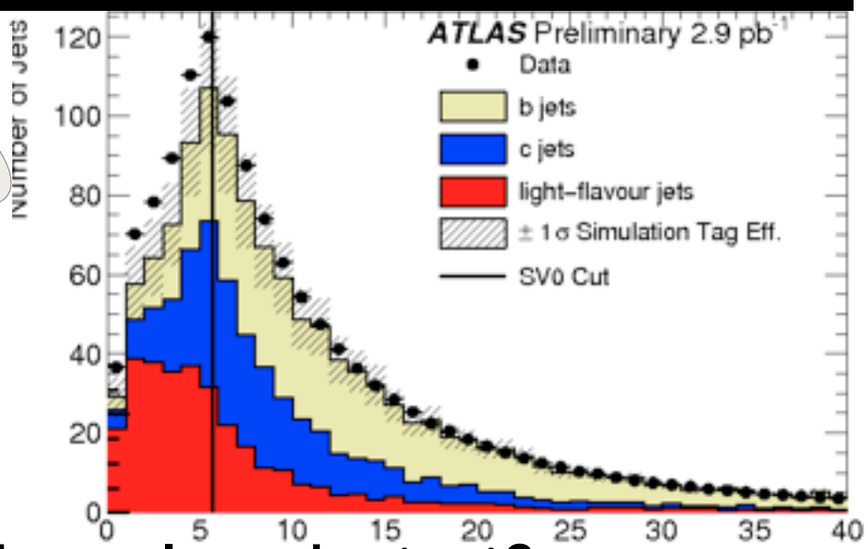


B-Tagging

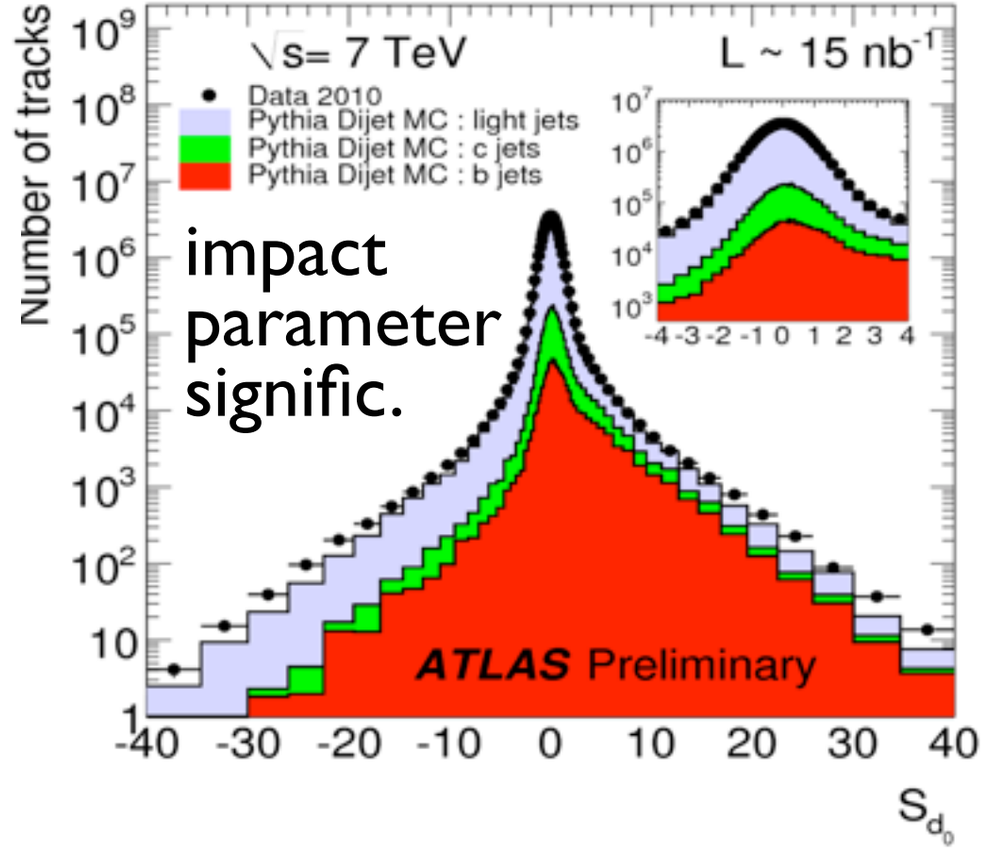








decay length significance

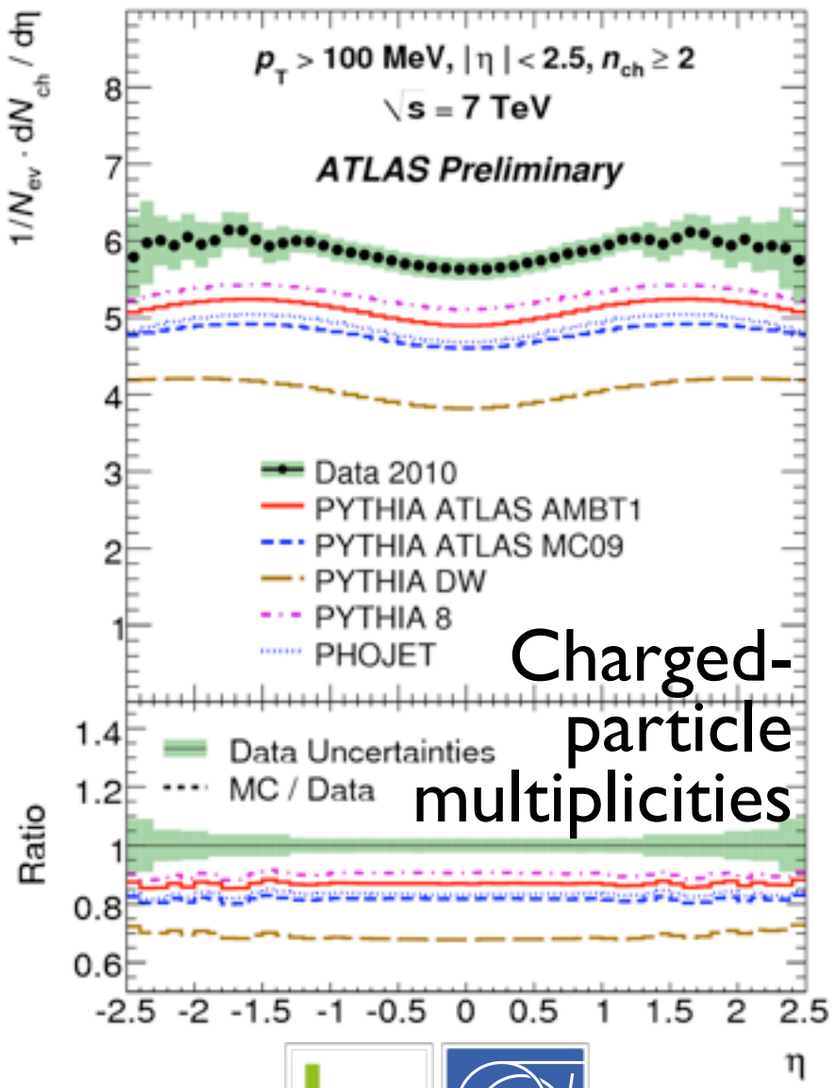


Soft QCD

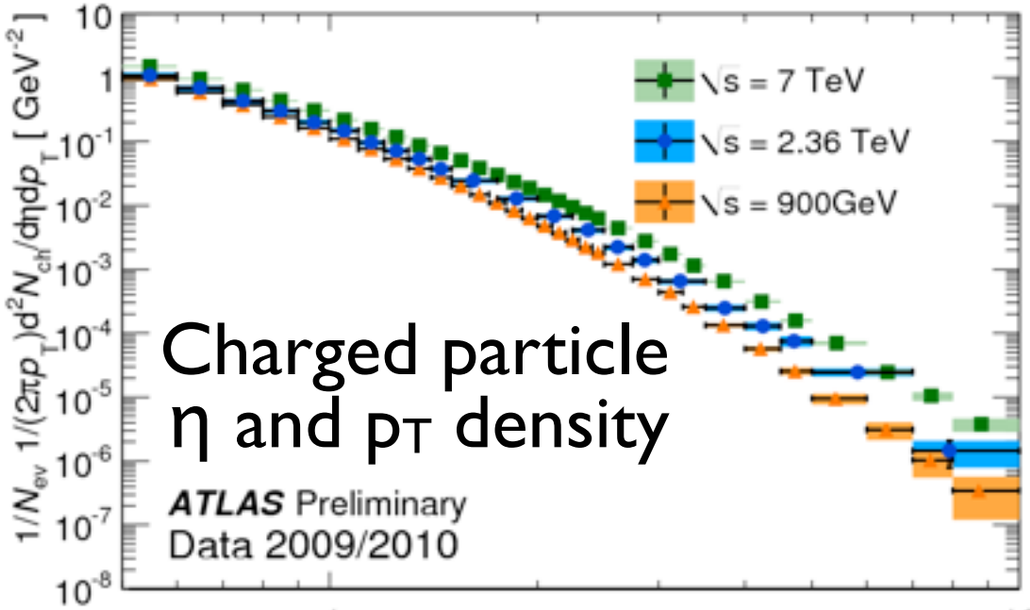
Particle multiplicities and momentum spectra in pp minimum-bias events

Measured over a well-defined kinematic region:
≥2 charged particle with p_T>100 MeV, |η|<2.5

- No subtraction for single/double diffractive components
- Distributions corrected back to hadron level
- High-precision minimally model-dependent measurements
- Provide strong constraints on MC models
- Experimental error: < 3 %



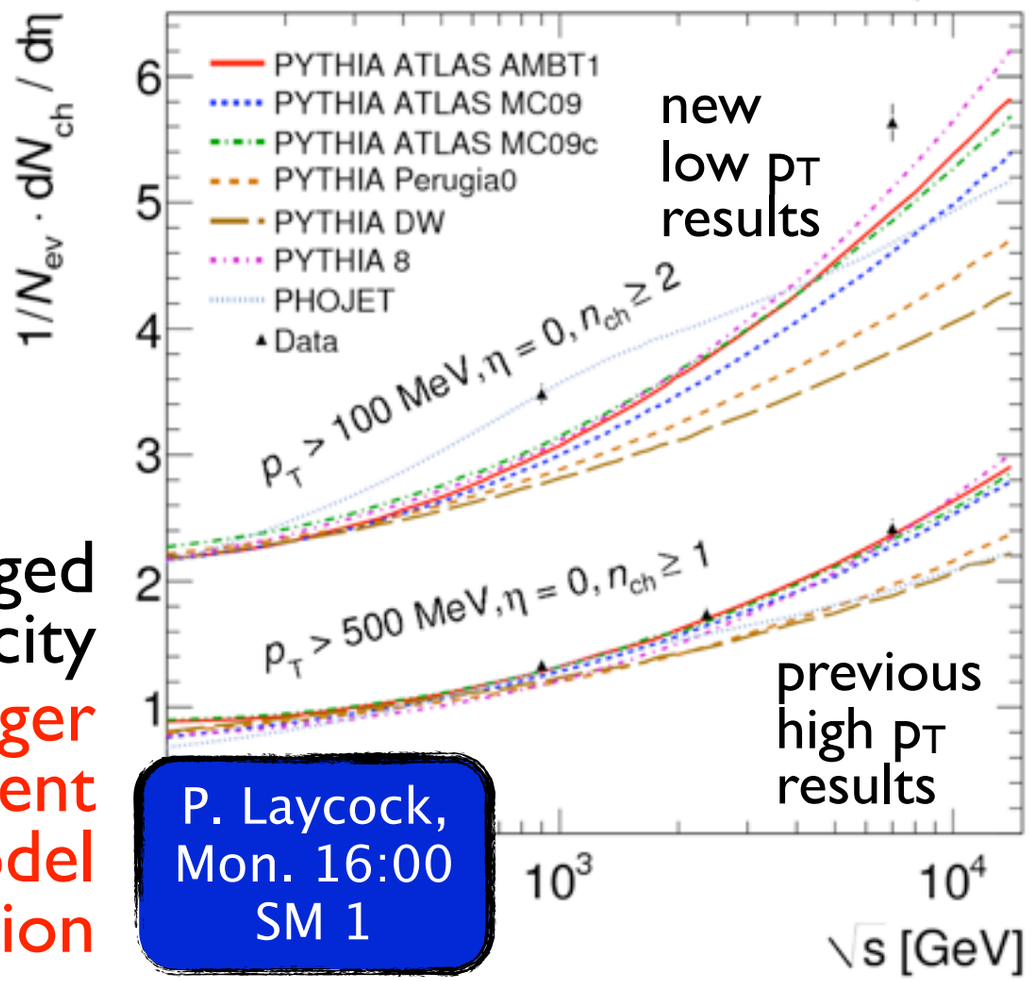
Charged-particle multiplicities



Charged particle η and p_T density

average charged particle multiplicity

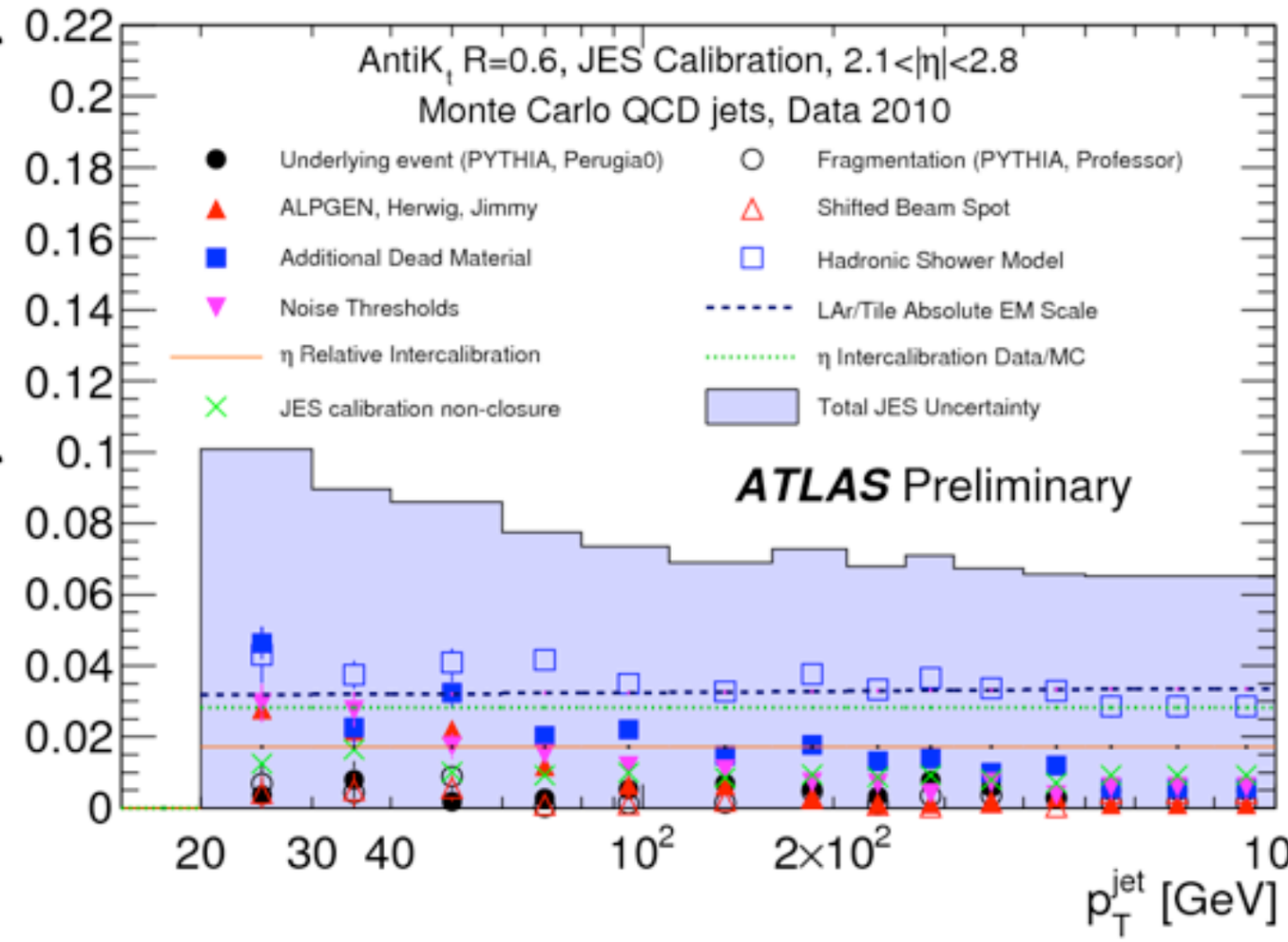
lower p_T → larger diffractive component → poorer model description



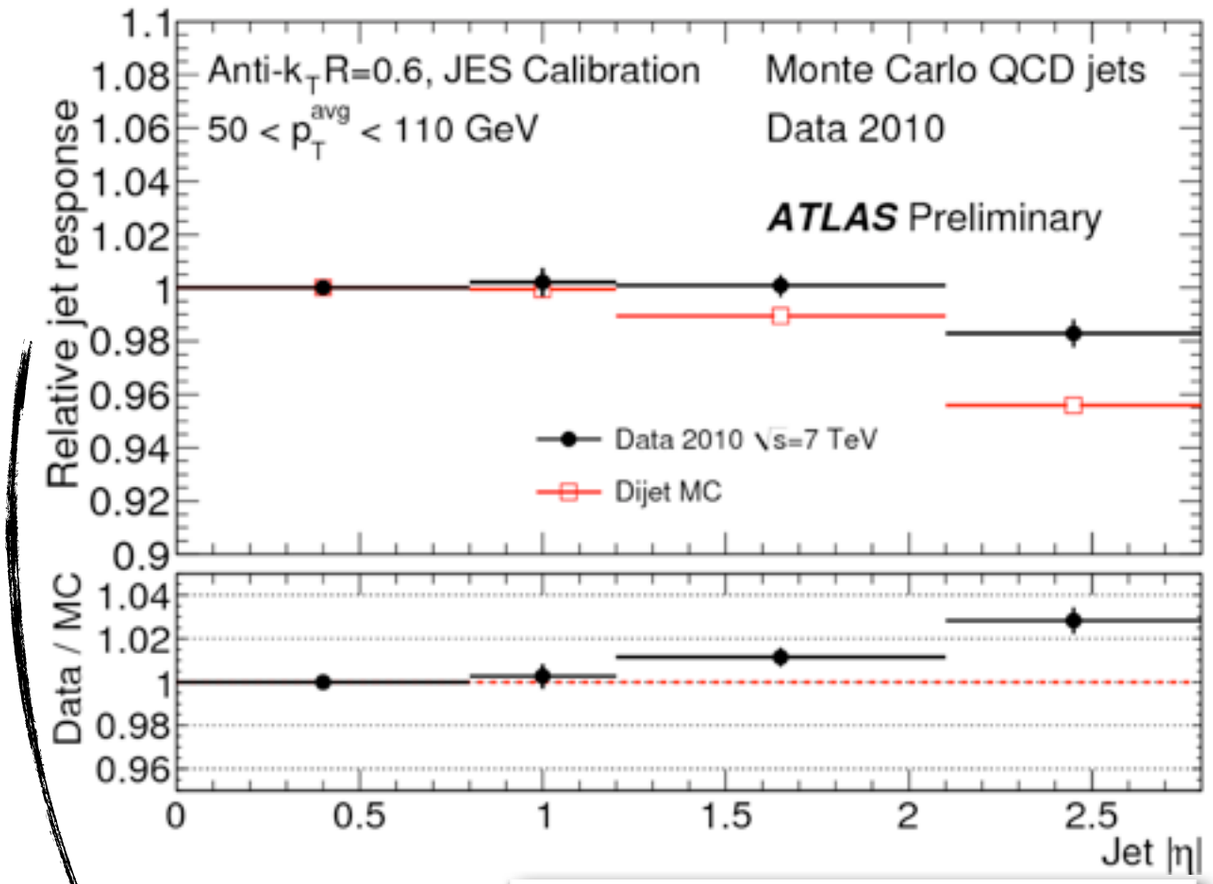
P. Laycock, Mon. 16:00 SM 1

Jet Energy Scale

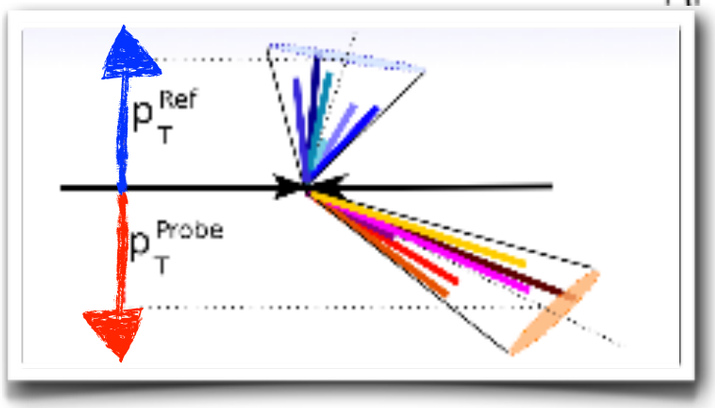
- "Topological clusters" reconstructed jets
- Jet momenta corrected for:
  - calorimeter non-compensation
  - dead material, etc.
- using η/p_T-dependent calibration factors
- derived from MC (tuned with 'combined testbeam' data)
- Checked with single particles / Min bias



using jet p_T-balance for central-forward Inter-calibration check



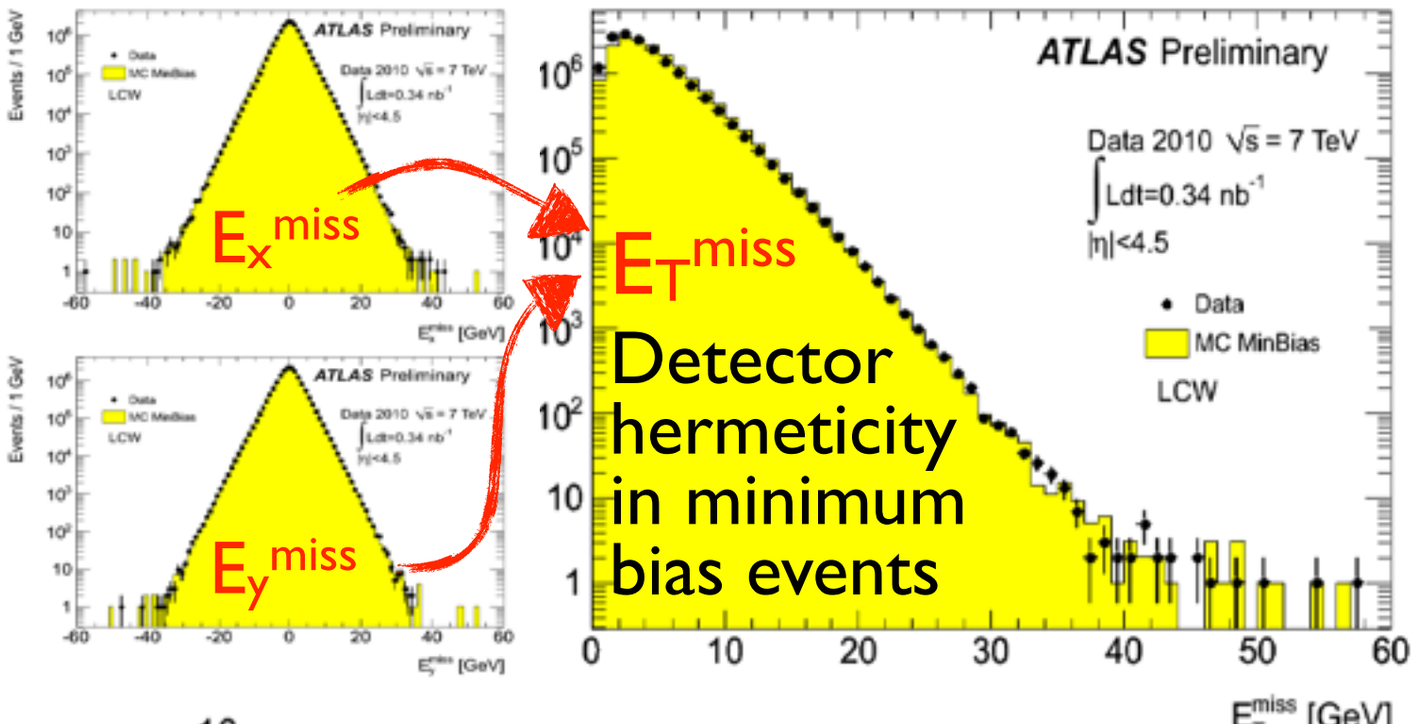
$$\frac{p_T^{Probe}}{p_T^{Ref}(|\eta|<0.8)}$$



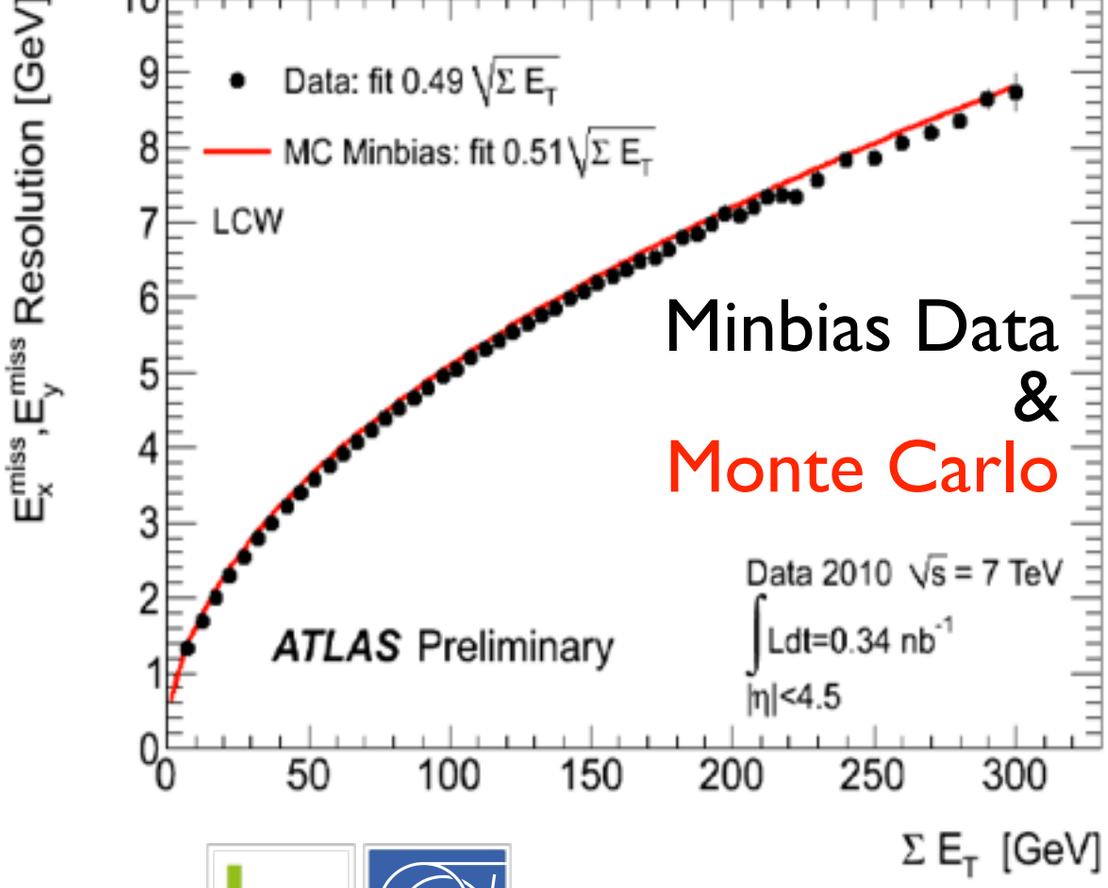
M. Petteni, Mon. 16:30 Detector 1

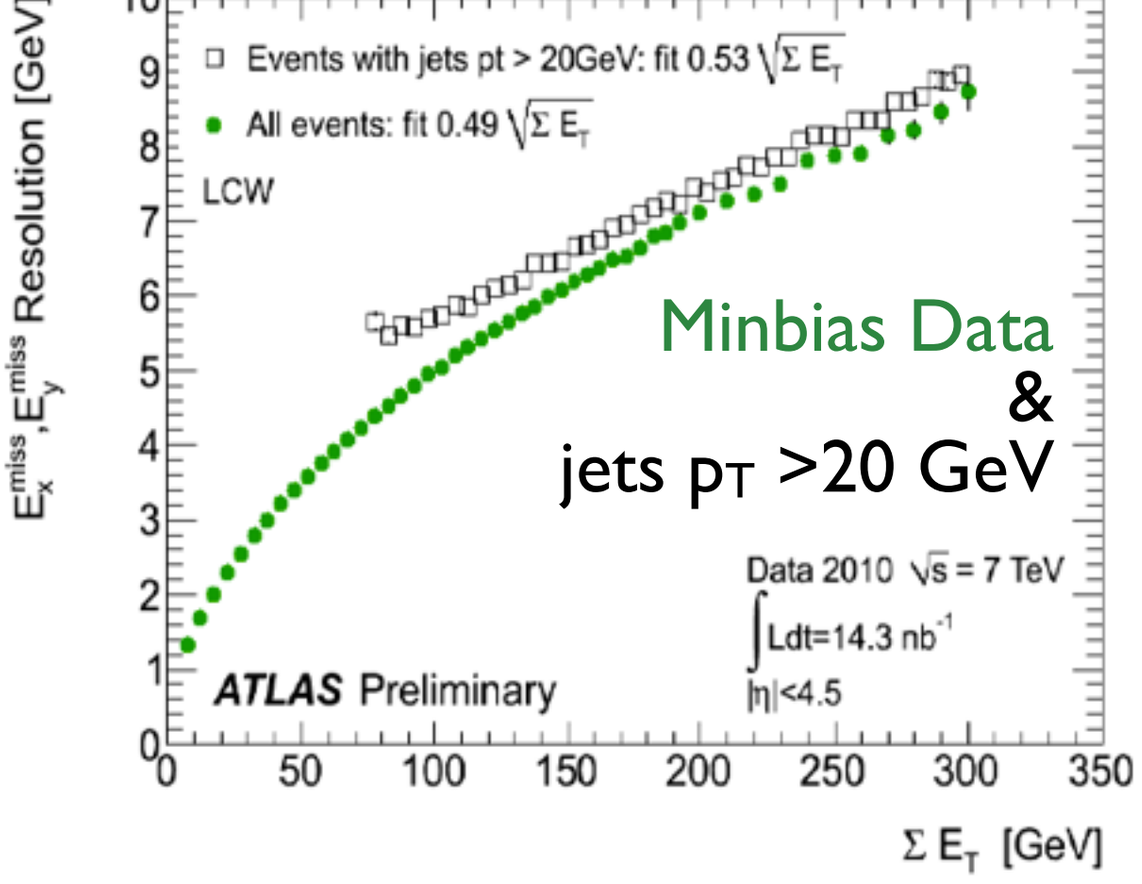
JES uncertainty: 7%
JES goal: 1%

Missing Transverse Energy

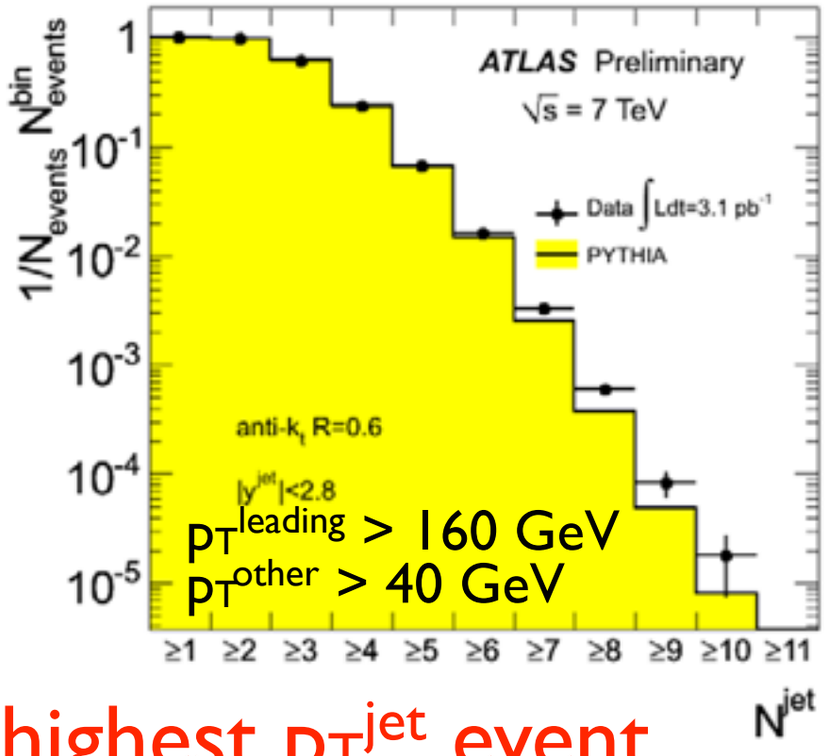


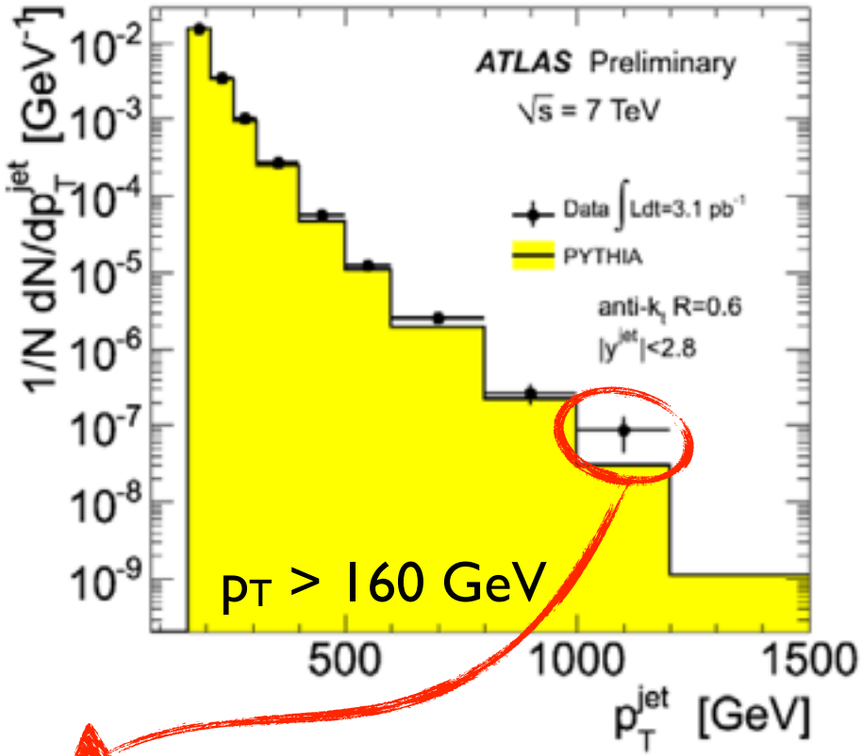
- Sensitive to calorimeter performance (noise, coherent noise, dead cells, mis-calibrations, cracks, etc.), and cosmics and beam-related backgrounds
- Calibrated E_T^{miss} from minimum-bias events
- Measured over ~ full calorimeter coverage (360° in φ, |η| < 4.5, ~ 200k cells)

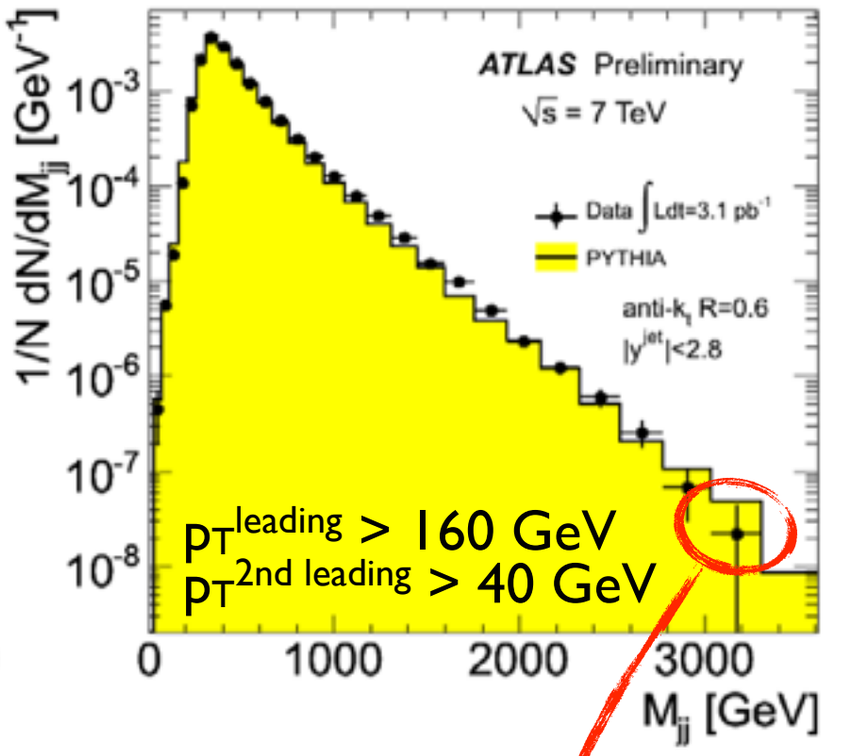




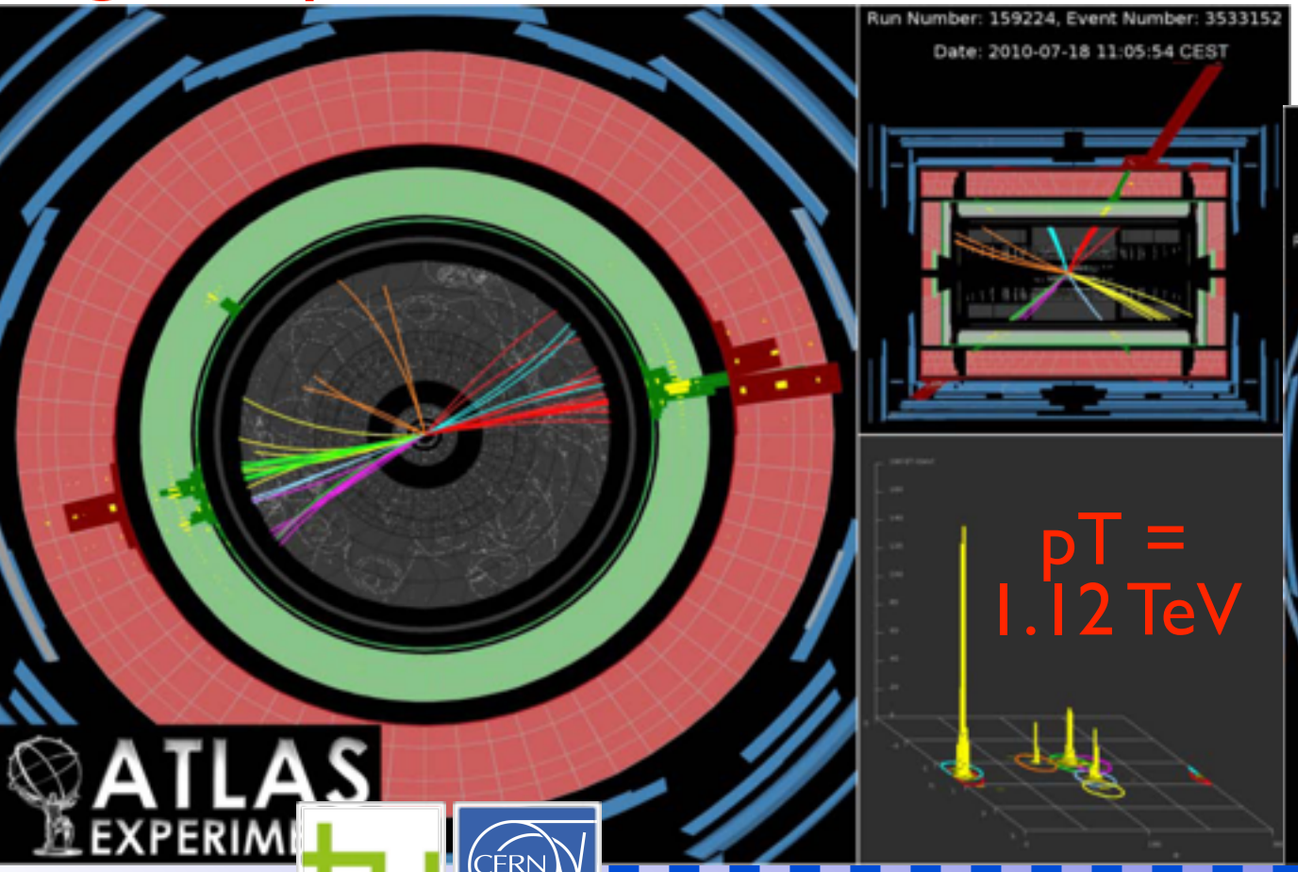
Jet Physics - Shape comparisons between data & parton-shower MC



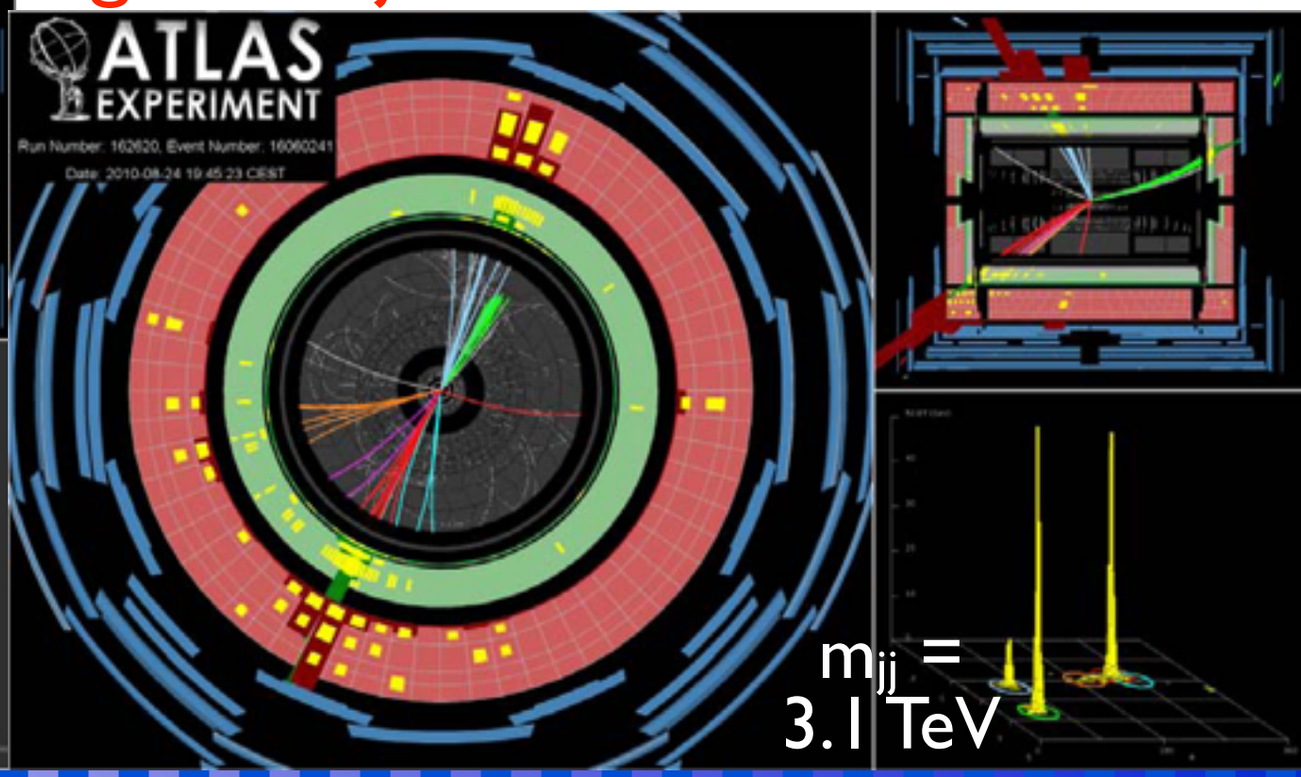




highest p_T^{jet} event

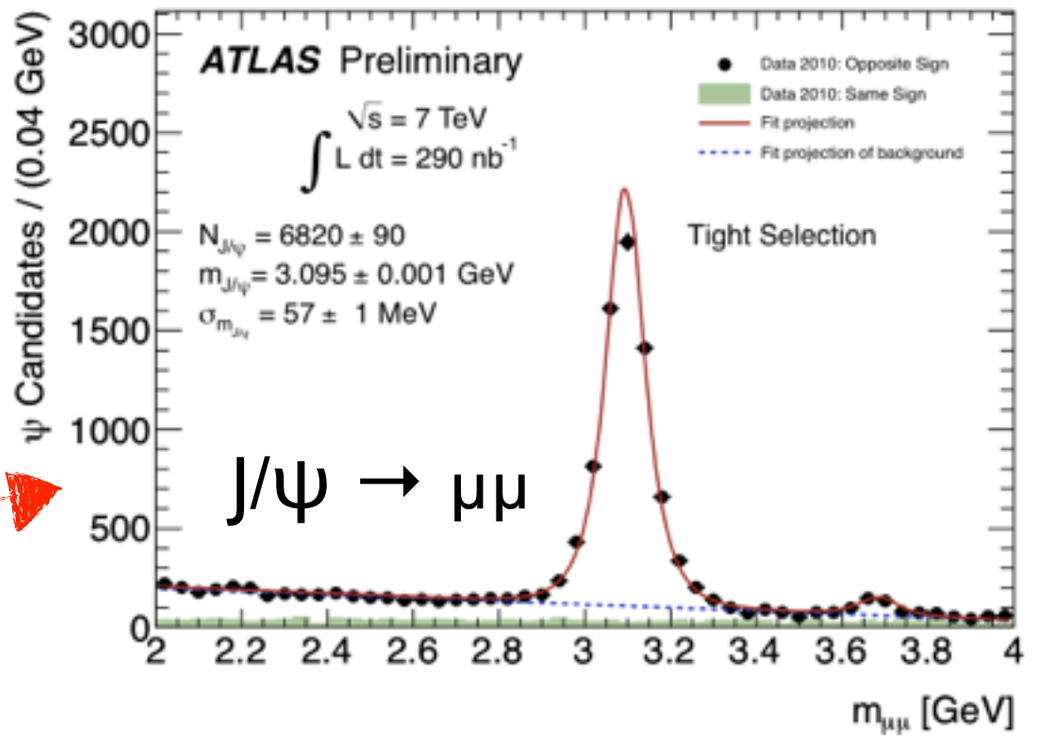


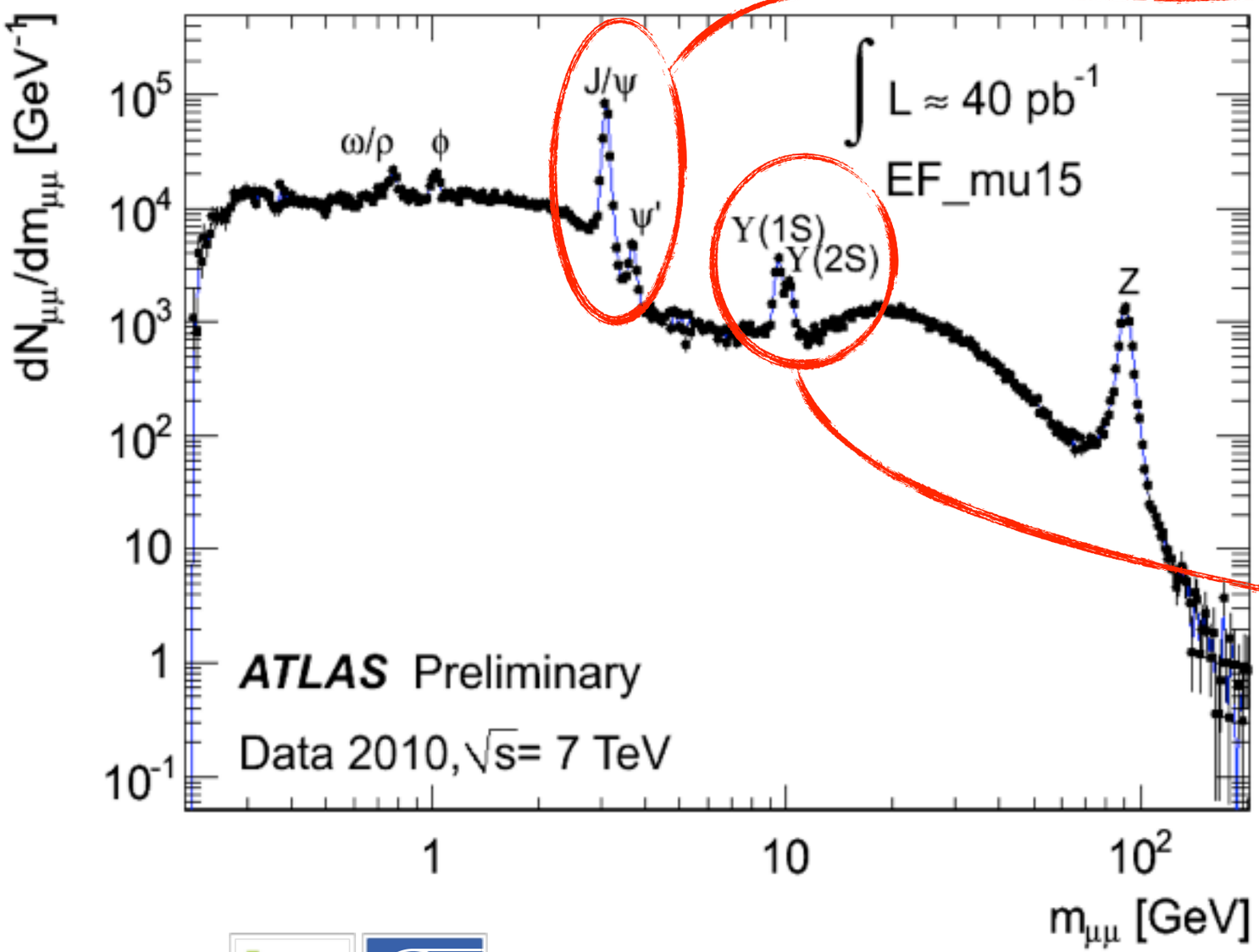
highest dijet mass event

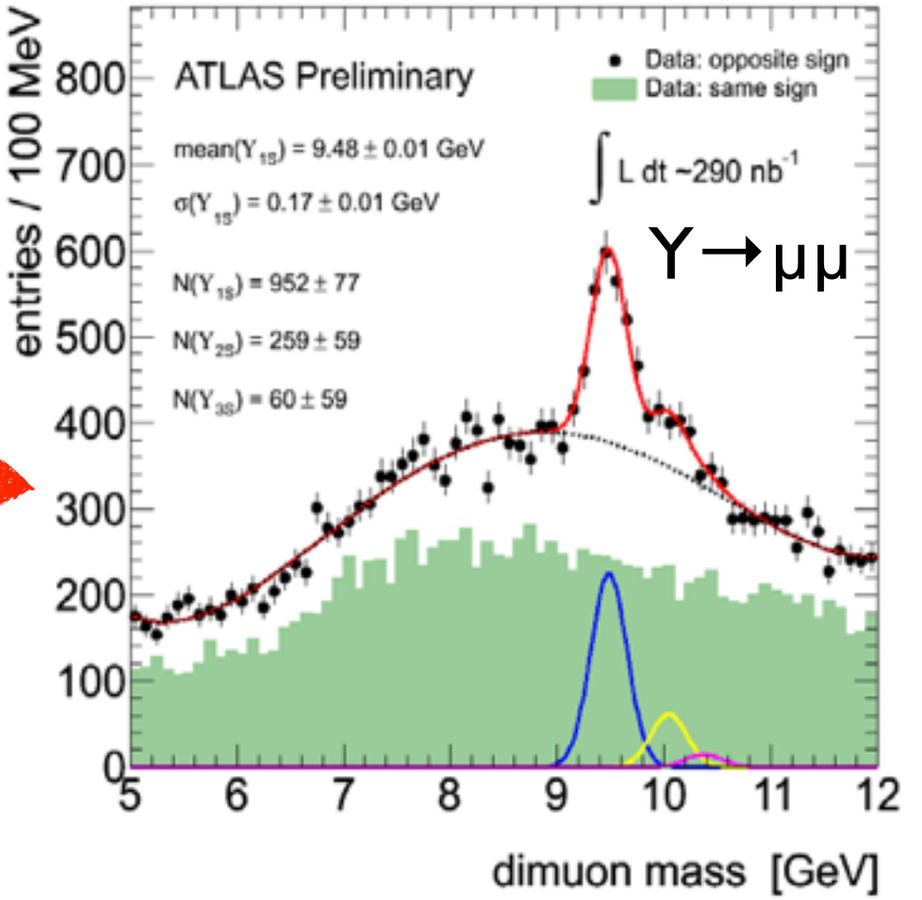


Di-Muon Spectrum

J/ψ is one of the first "candles" for detector commissioning & early physics (B-physics, QCD). Provides large samples of low-p_T muons to study μ trigger and identification efficiency, momentum resolution (~ 2%) and absolute momentum scale (~ 0.2%) in the few GeV range



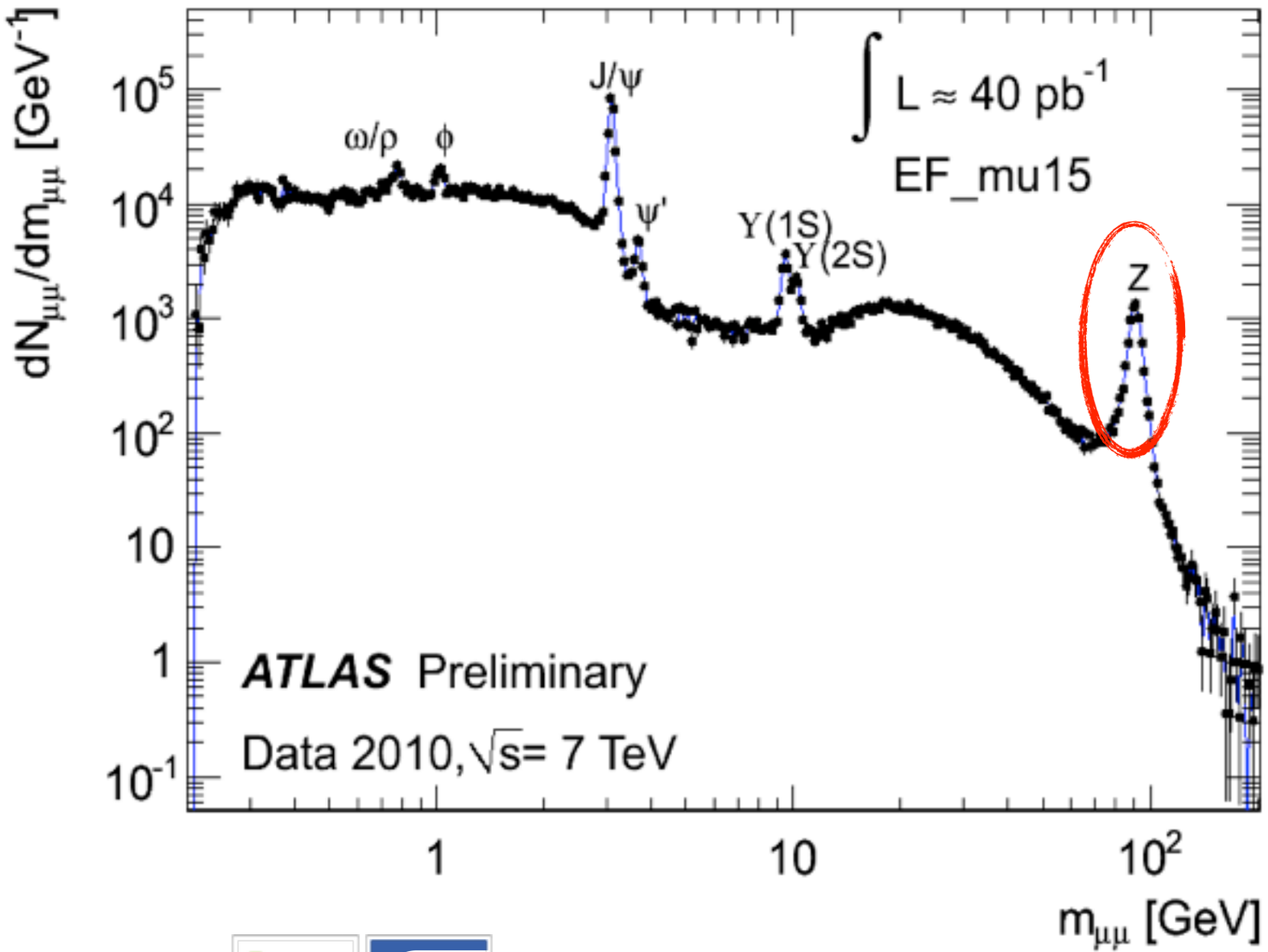


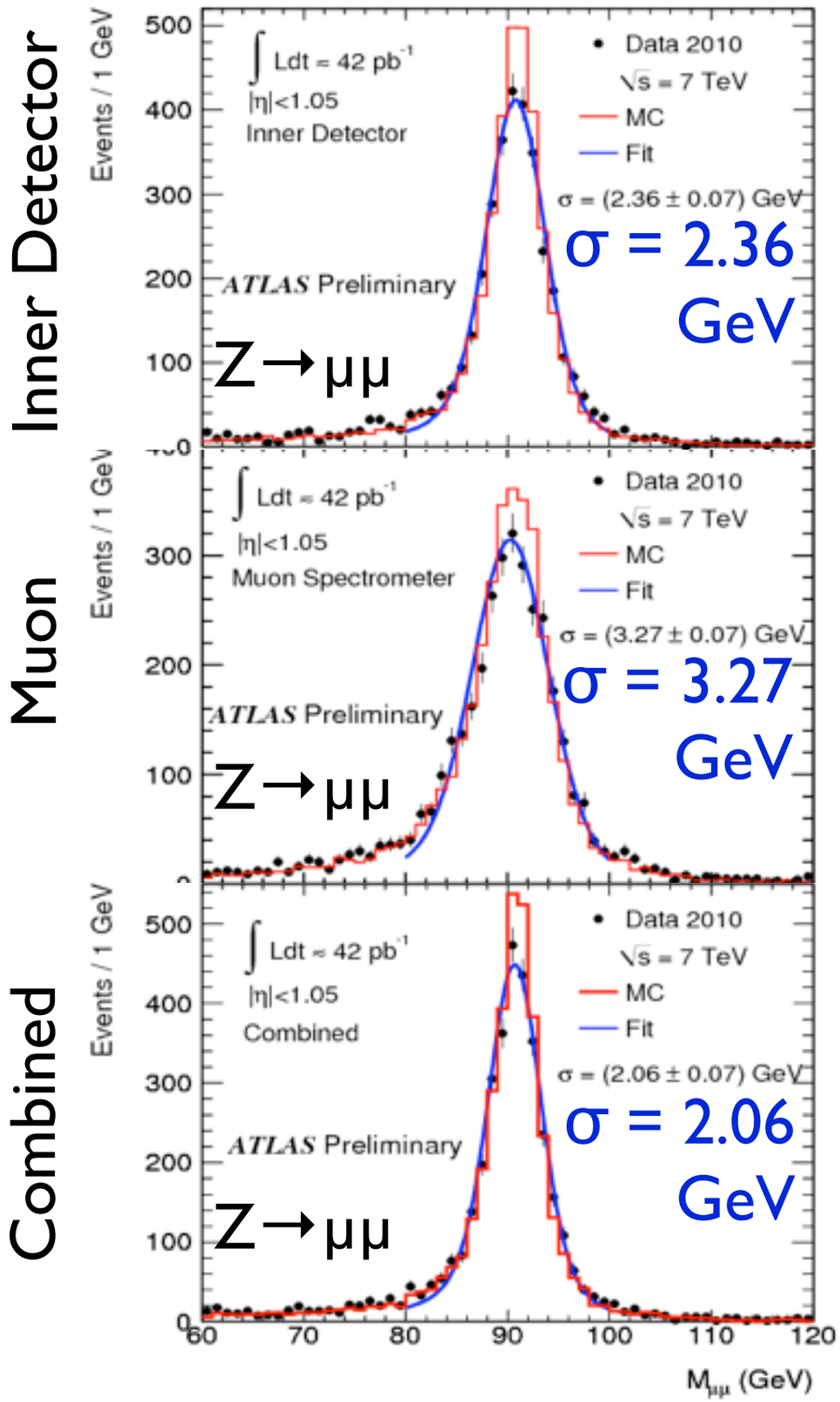


Di-Muon Spectrum

Simple analysis:

- LVL1 μ trigger with p_T ~ 6 GeV threshold
- 2 opposite-sign primary μs reconstructed by combining tracker and muon spectrometer
- muons with |z|<1 cm from primary vertex





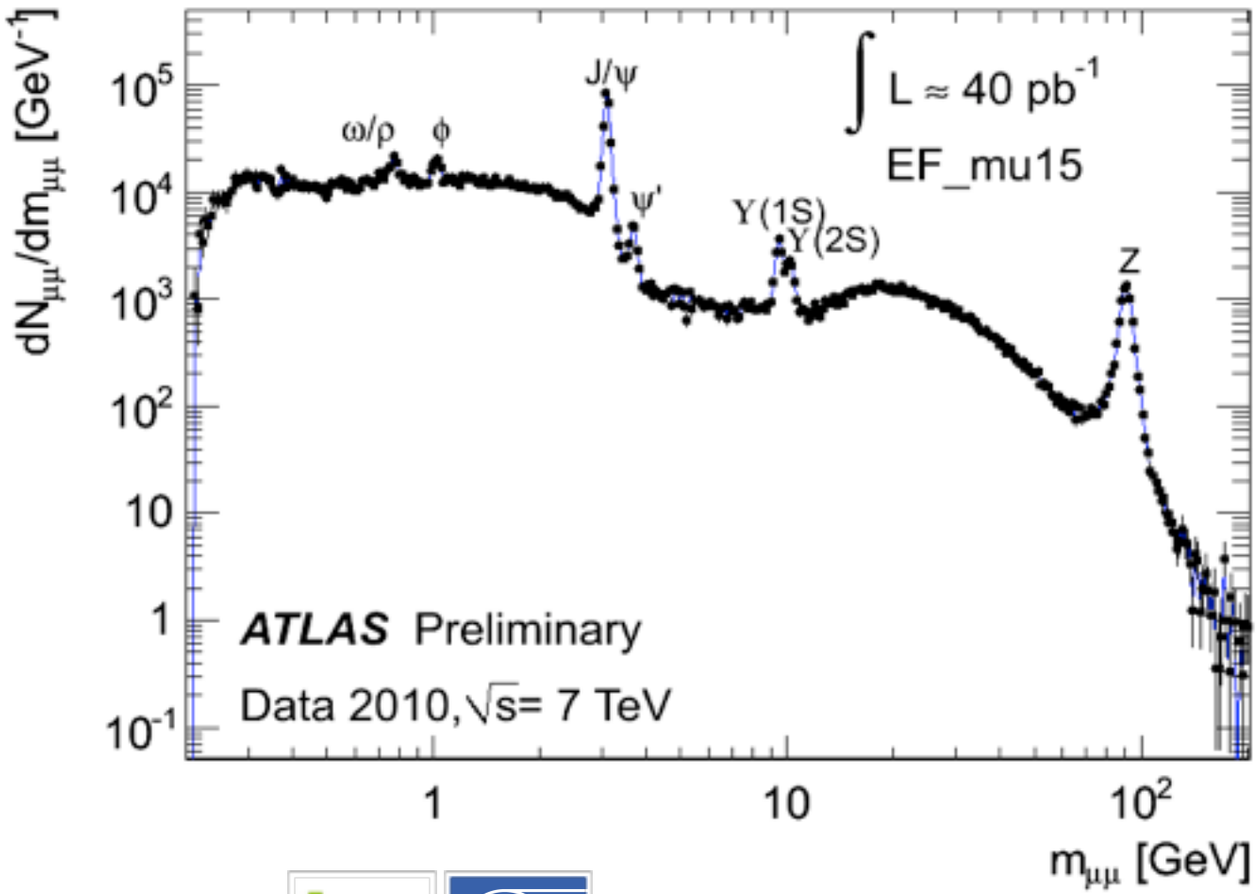
Di-Muon & Di-Electron Spectrum

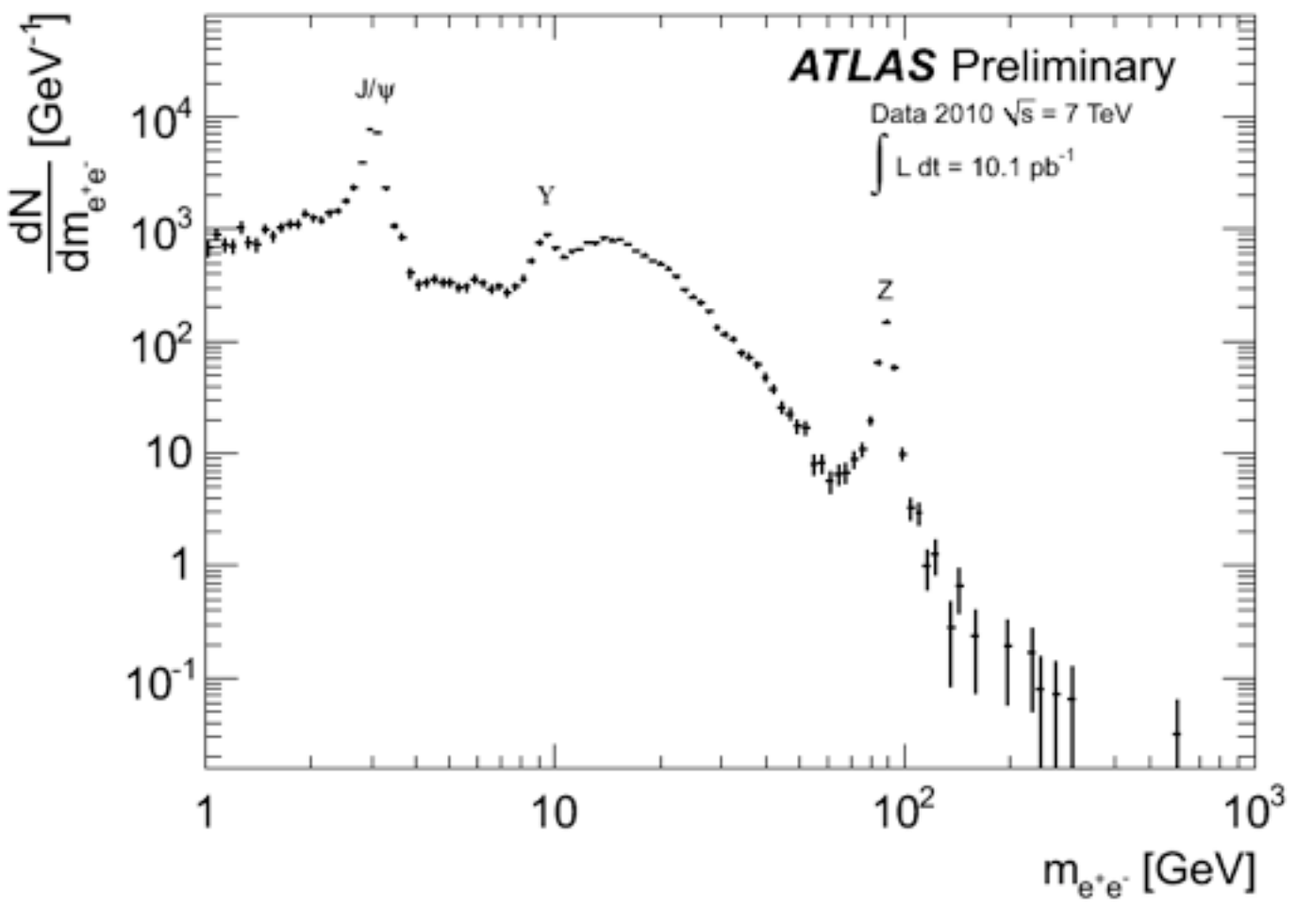
Di-Muon:

- Leading muon, p_T>15 GeV, second muon, p_T>2.5 GeV

Di-Electron:

- Data with 5 GeV E_T di-electron trigger (prescaled in later data)
- Trigger selection produces shoulder around 15 GeV

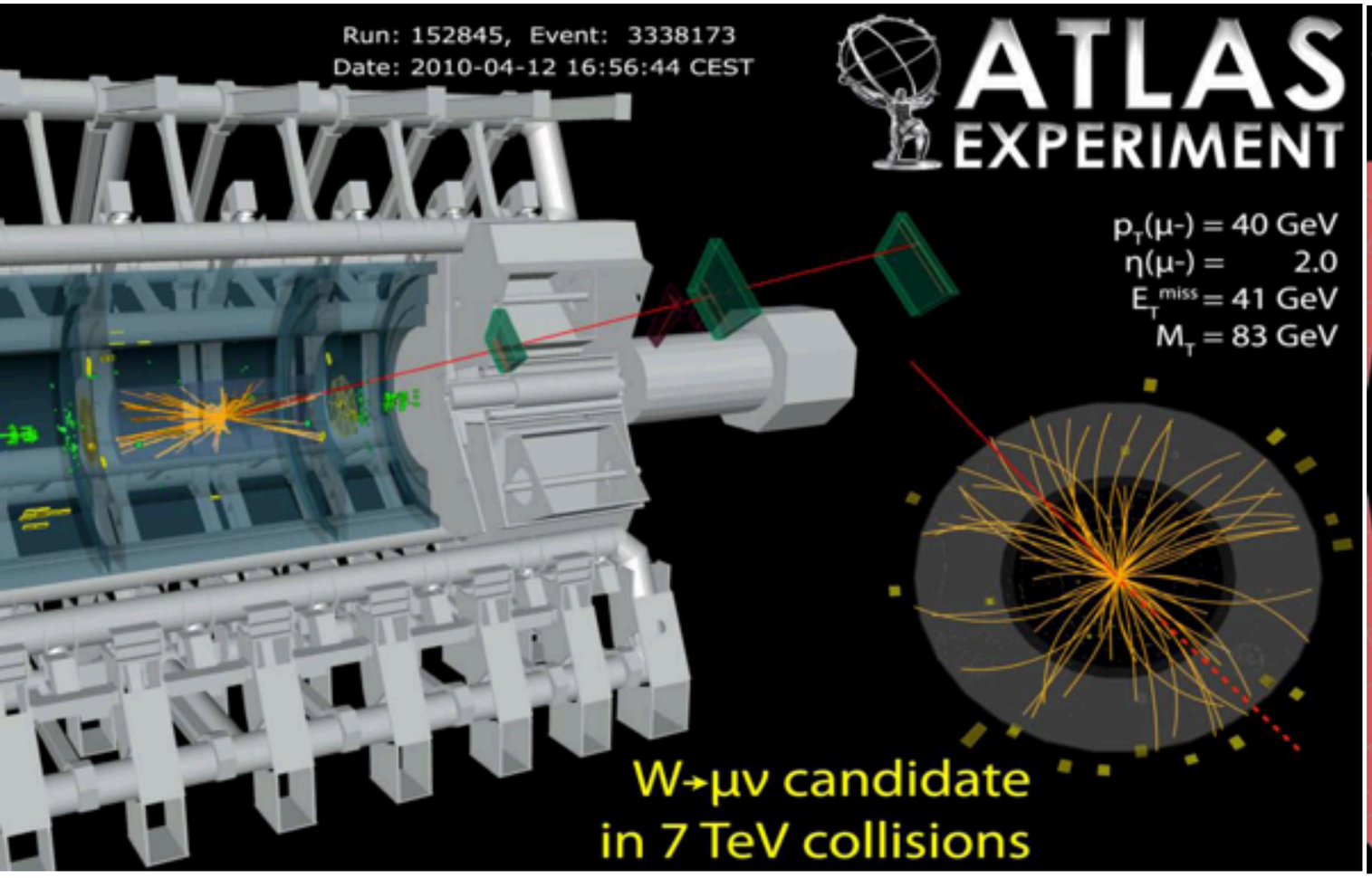




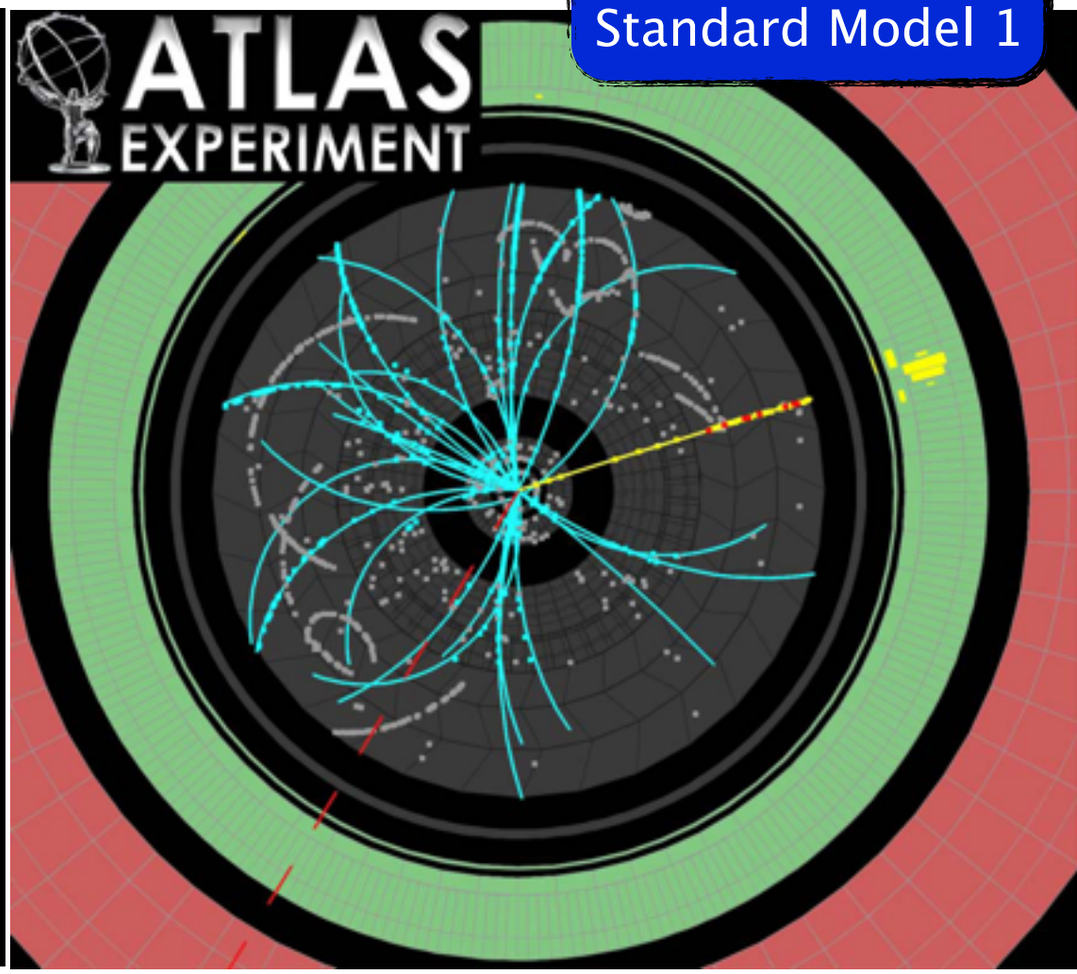
W and Z Physics

- Fundamental milestones in "rediscovery" of the Standard Model at $\sqrt{s}$ = 7 TeV
- Powerful tools to constrain q,g distributions inside proton (PDF)
- $Z \rightarrow ll$ is gold-plated process to calibrate detector to the ultimate precision
- (E & p scales and resolutions in EM calo, tracker, muon spectrometer; lepton identification, …)
- Among dominant backgrounds to searches for New Physics

Z. Czyczula, Mon. 14:00 Standard Model 1



Muon: 3 Pixel, 8 SCT, 17 TRT, 14 MDT hits
Z~0.1 mm from vertex, ID-MS matching within 1 GeV
E_T^{miss} (calorimeter only) ~ 3 GeV

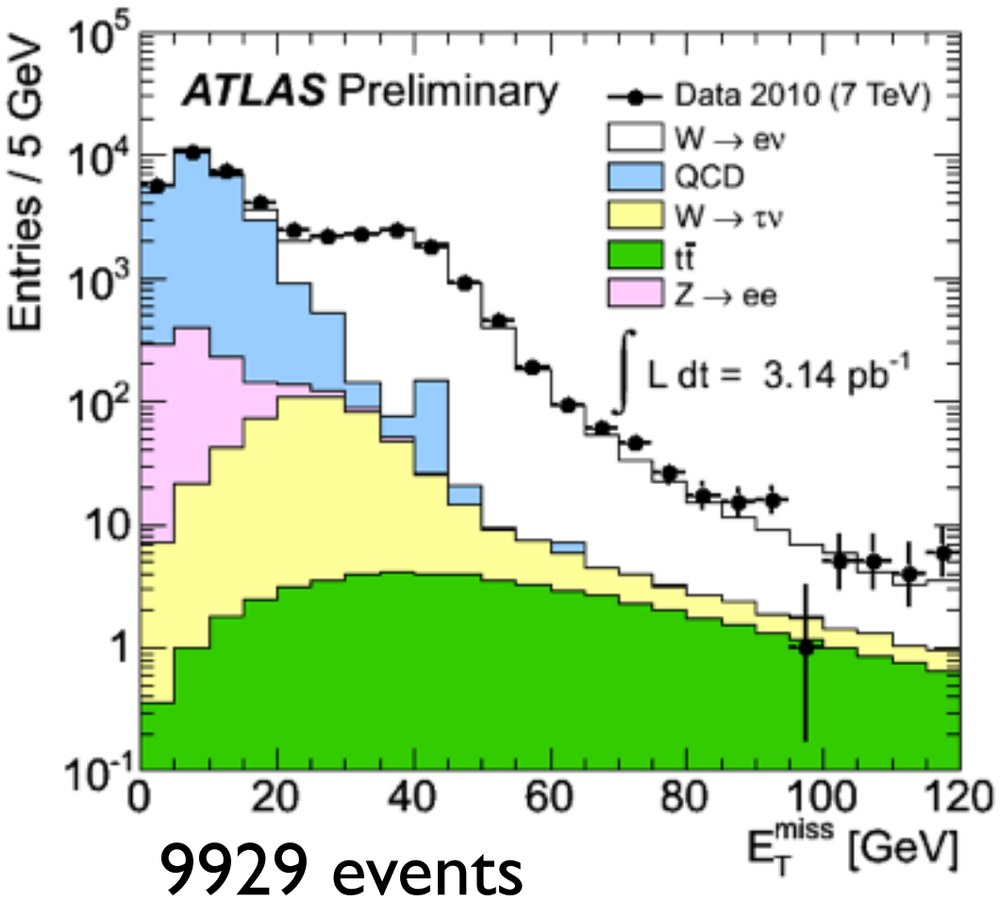


Electron: 3 Pixel, 9 SCT, 37 TRT
Z~4.5 mm from vertex
E_T^{miss} (calorimeter only) ~ 26 GeV

W → eν, μν measurements

W → eν selections:

- E_T(e)>20 GeV, |η|<1.37, 1.52<|η|<2.47
- tight electron identification criteria
- E_T^{miss} > 25 GeV
- transverse mass m_T > 40 GeV

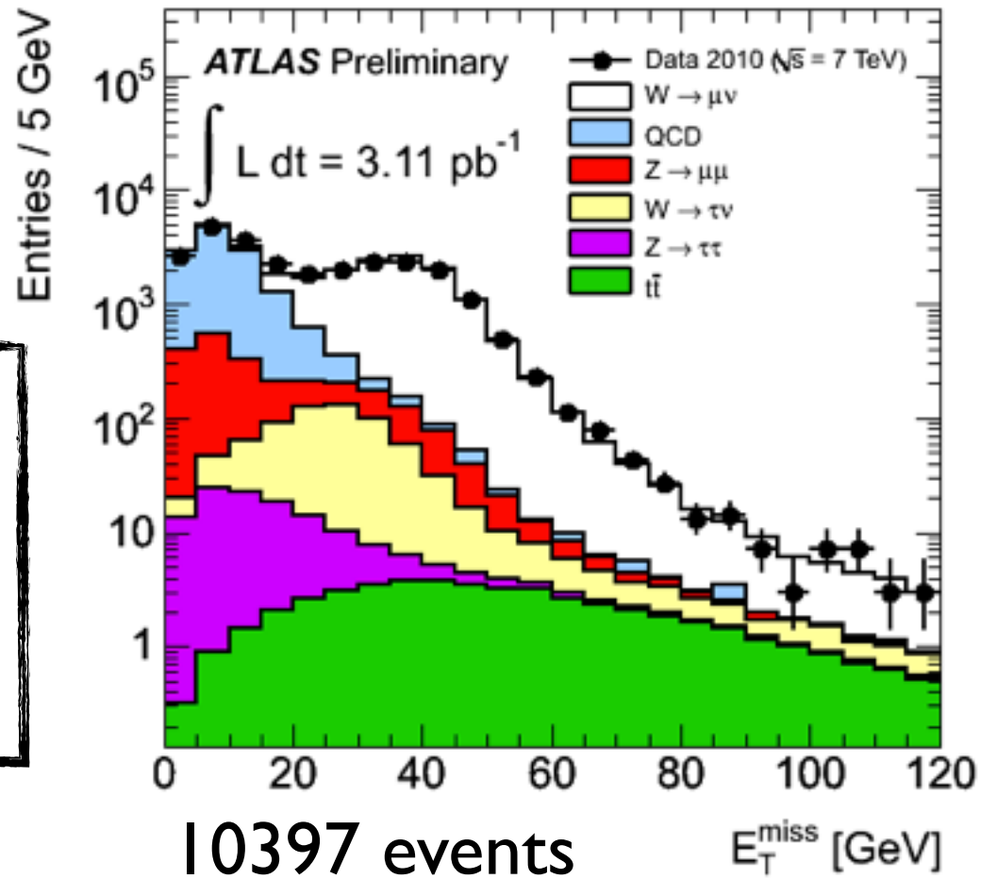


9929 events

Geometrical acceptance: 45-50%
Acceptance x efficiency : 30-35%
Main background: QCD jets
Expected S/B: ~ 20

W → μν selections:

- p_T(μ)>20 GeV, |η|<2.4
- track isolation
- E_T^{miss} > 25 GeV
- transverse mass m_T > 40 GeV

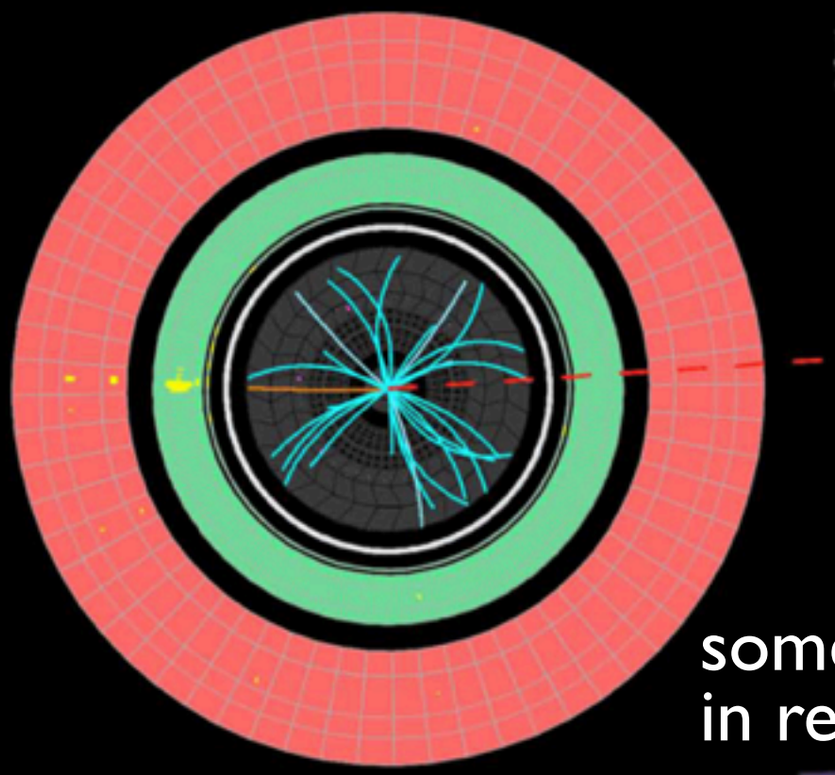


10397 events

Cross-section measured with int. lumi ~300 nb^{-1}:

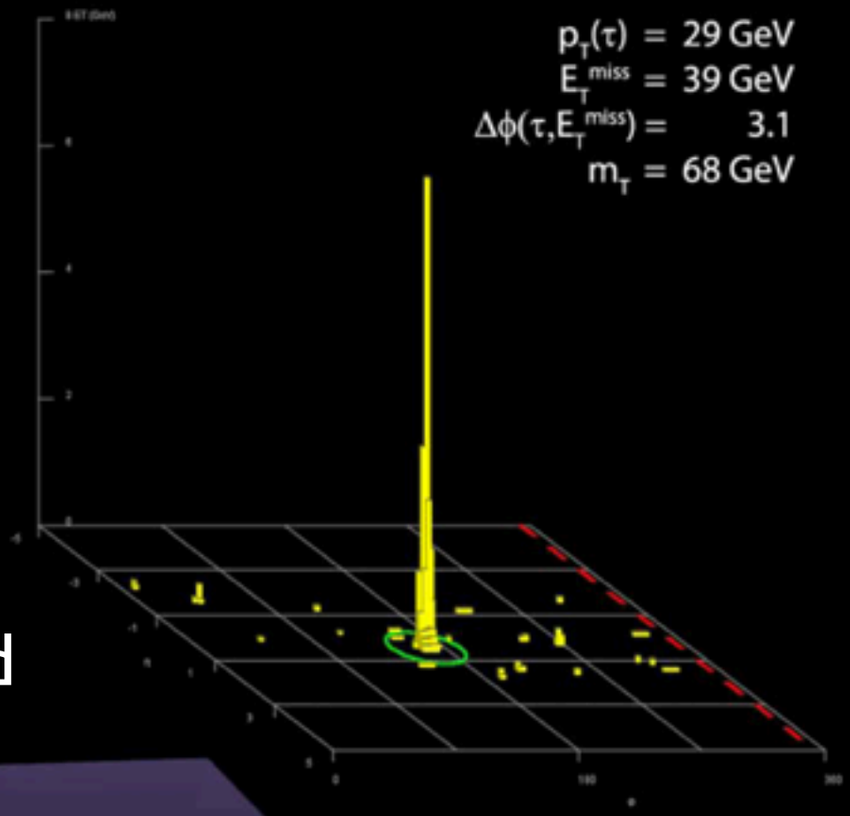
σ (W → lν) = 9.96 ±0.23(stat) ±0.50(syst) ±1.10(lumi) nb
σ (W → eν) = 10.51 ±0.34(stat)±0.81(syst) ±1.16(lumi) nb
σ (W → μν) = 9.58 ±0.30(stat) ±0.50(syst) ±1.05(lumi) nb
σ NNLO (W → lν) = 10.46 ± 0.52 nb per family

W → τν measurement



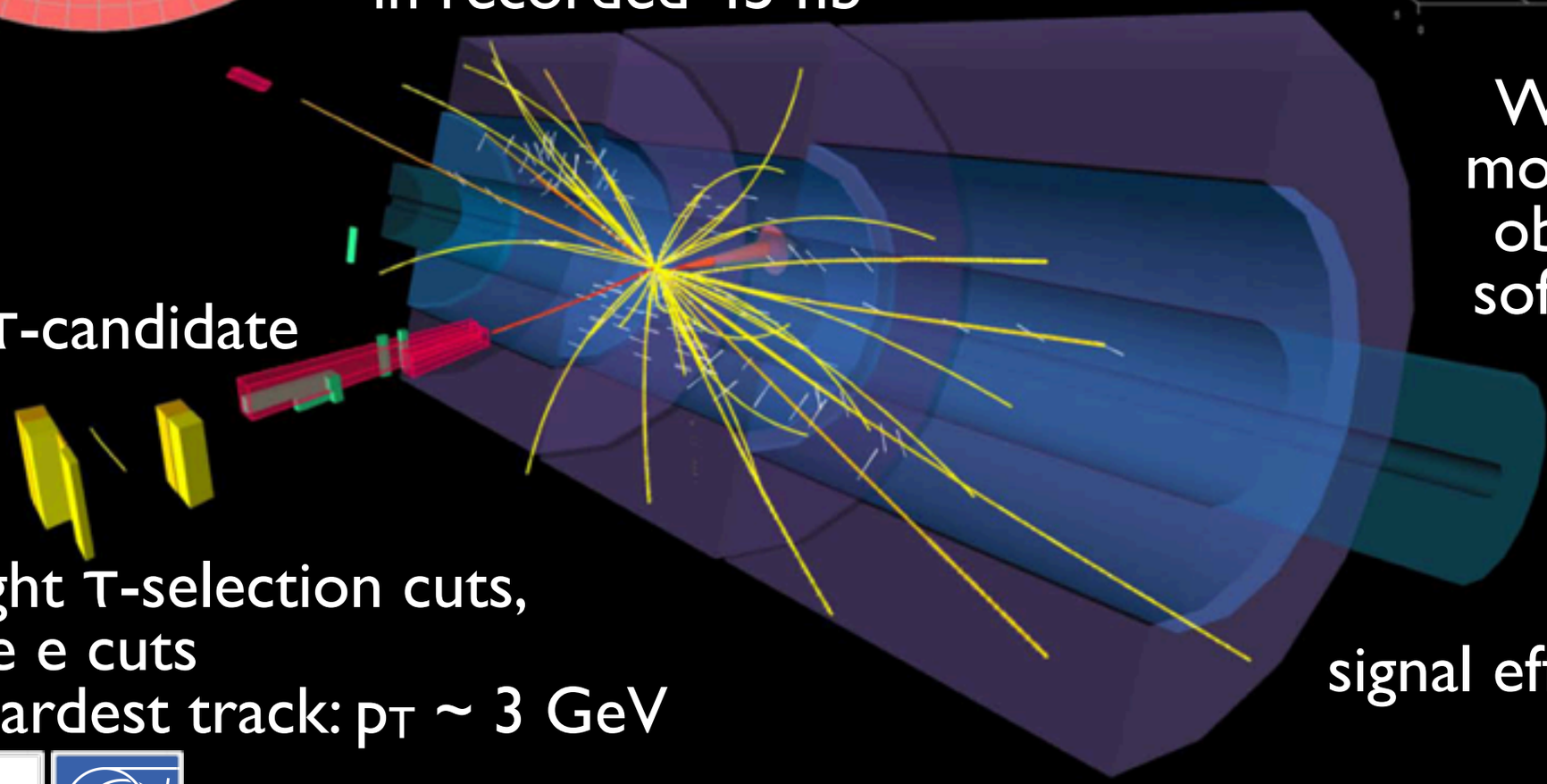
ATLAS EXPERIMENT

Run 155697, Event 6769403
Time 2010-05-24, 17:38 CEST



W→τν candidate in
7 TeV collisions

some 1000 events expected
in recorded 45 nb^{-1}



1-prong τ-candidate

Passes tight τ-selection cuts,
fails loose e cuts
Second hardest track: p_T ~ 3 GeV

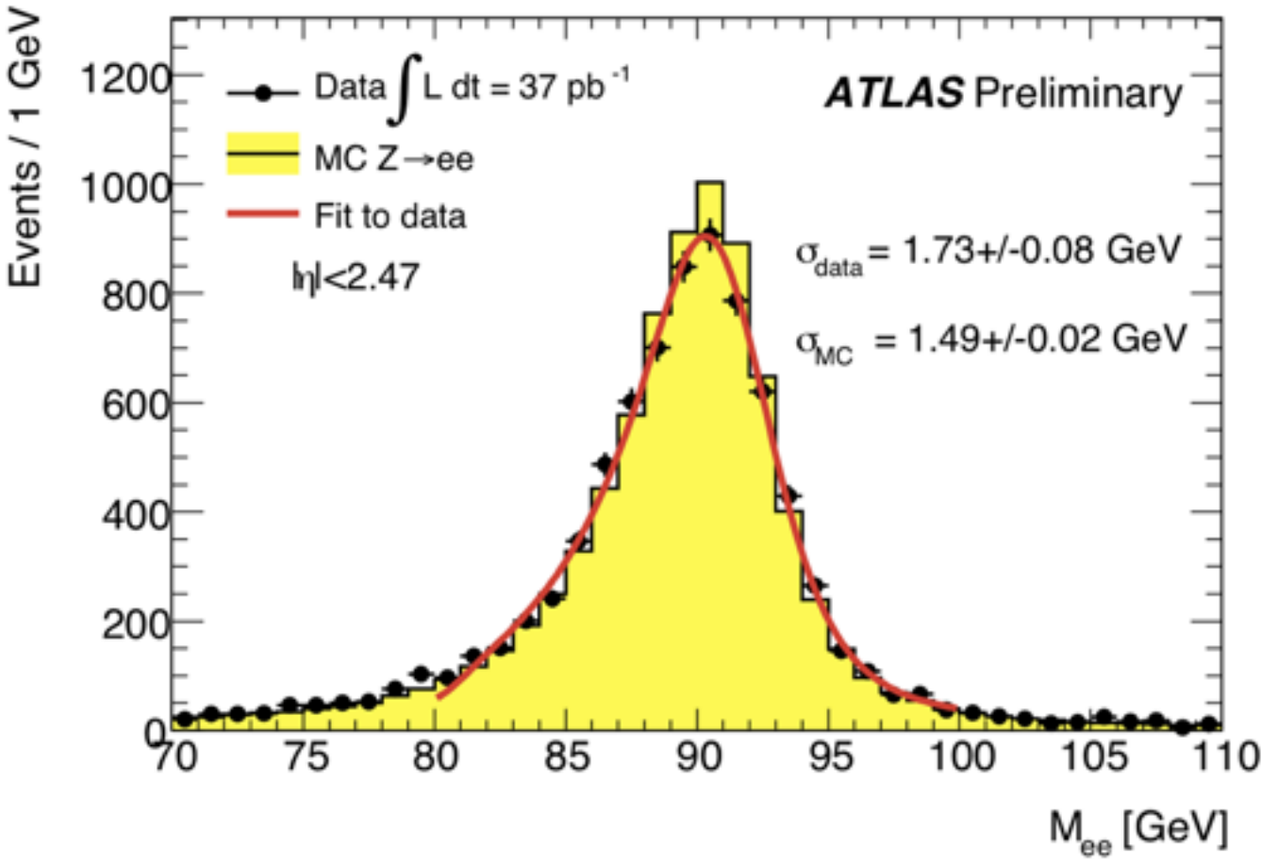
W → τν signal more difficult to observe due to softer spectrum and larger backgrounds (jets, W → eν, Z→ ττ):
signal efficiency < 1%,
S/B ~ 7

Z → ee, μμ measurements

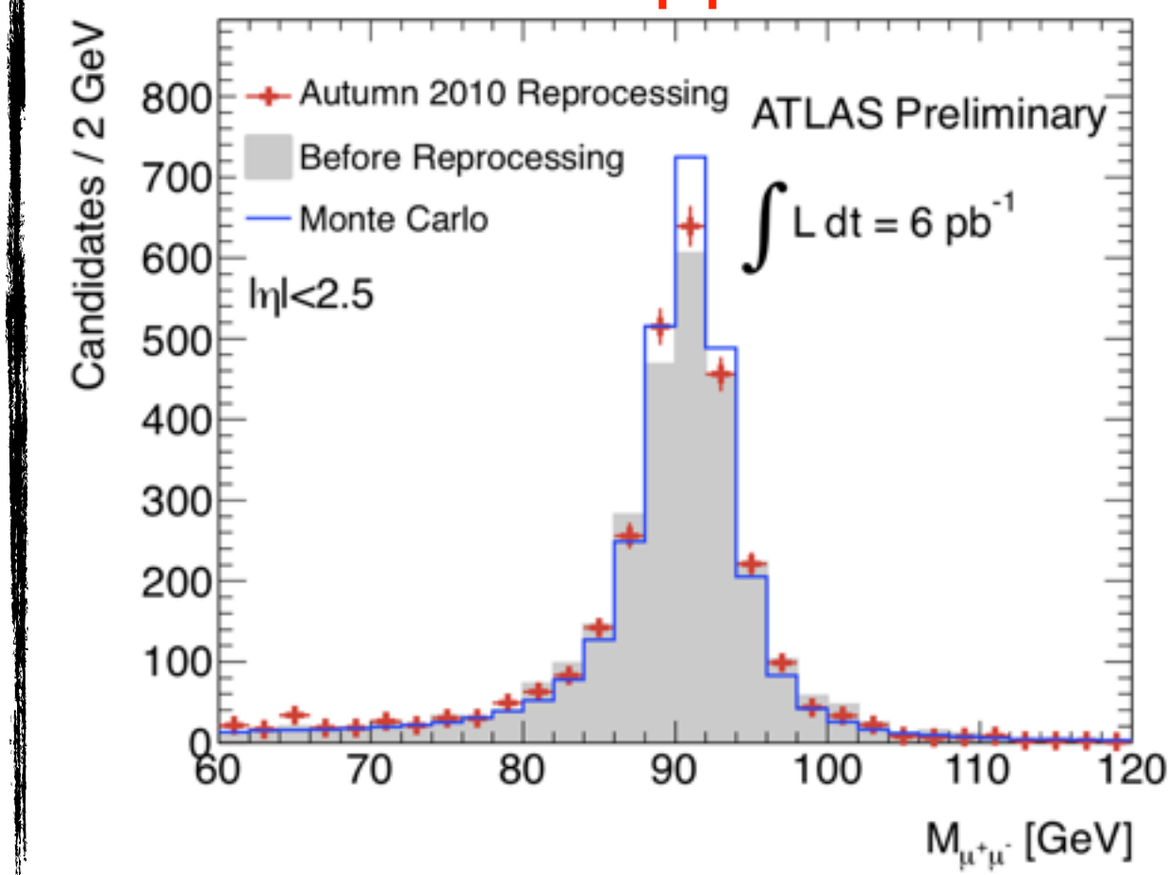
Event selection:

- e/μ selections - similar to W → lν
- Pair of opposite charge leptons
- 66 < m_{ll} < 116 GeV
- Background: QCD, ZZ->ττ, W->eν, tt, bb

Z → ee:



Z → μμ:



Cross-section measured with int. lumi ~300 nb^{-1}:

σ (Z → ll) = 0.82 ± 0.06 (stat) ± 0.05 (syst) ± 0.09 (lumi) nb
σ (Z → ee) = 0.75 ±0.09(stat) ±0.08(syst) ±0.08(lumi) nb
σ (Z → μμ) = 0.87 ±0.08 (stat) ±0.07(syst) ±0.10(lumi) nb
σ NNLO (γ*/Z → ll) = 0.96 ±0.05 nb per family

Top-quark Candidates

lepton + jets channel

$t\bar{t} \rightarrow bW\,bW \rightarrow bl\nu\,bjj$

$\sigma \sim 70$ pb

1 isolated lepton $p_T > 20$ GeV

$E_T^{miss} > 20$ GeV

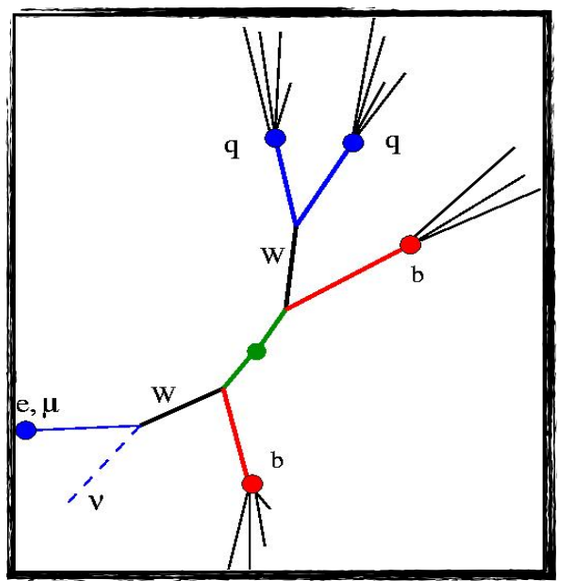
E_T^{miss} & $m_T > 60$ GeV

≥ 4 jets $p_T > 25$ GeV

≥ 1 b-tag jet

Acceptance x efficiency ~ 15%

Expect ~ 30 events in 3 pb^{-1}



2-lepton channel

$t\bar{t} \rightarrow bW\,bW \rightarrow bl\nu\,bl\nu$

$\sigma \sim 10$ pb

opposite-sign leptons ee/eμ/μμ with $p_T > 20$ GeV; ≥ 2 jets $p_T > 20$ GeV

ee: $E_T^{miss} > 40$ GeV

$|M(ee)-MZ| > 5$ GeV

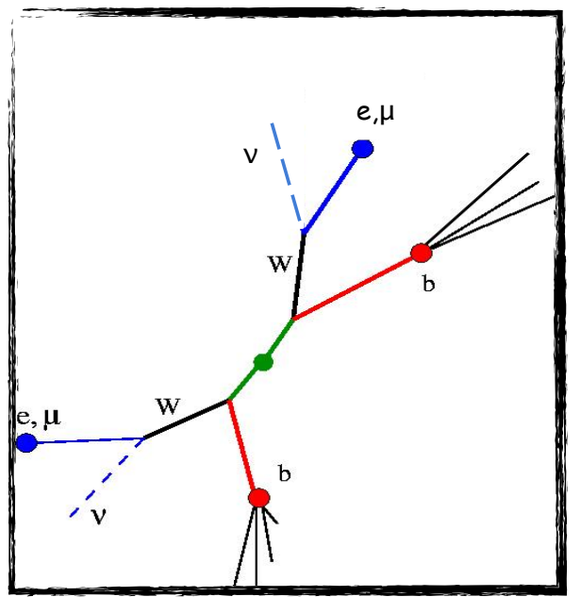
μμ: $E_T^{miss} > 30$ GeV

$|M(\mu\mu)-MZ| > 10$ GeV

eμ: $H_T = \Sigma E_T\,(l, j) > 150$ GeV

Acceptance x efficiency ~ 25%

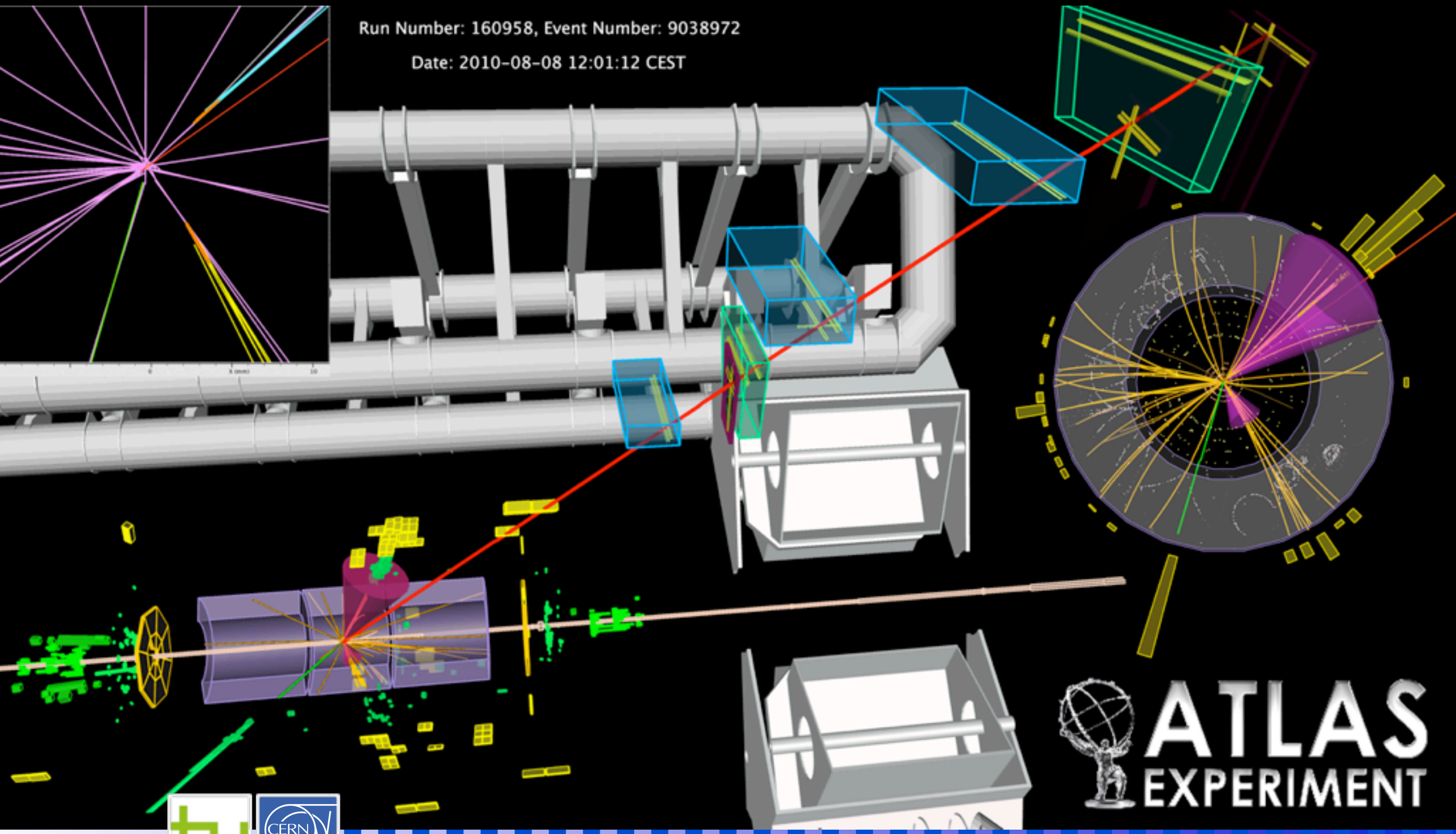
Expect ~ 7 events in 3 pb^{-1}



$\sigma(t\bar{t}) \cong 160$ pb

$\sqrt{s}$: 7 TeV

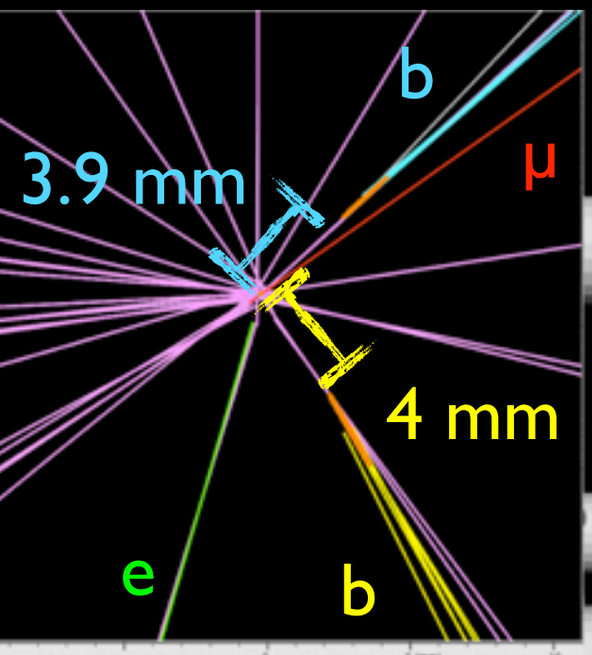
“Text Book“ Top Candidate: eμ Event with 2 b-jets

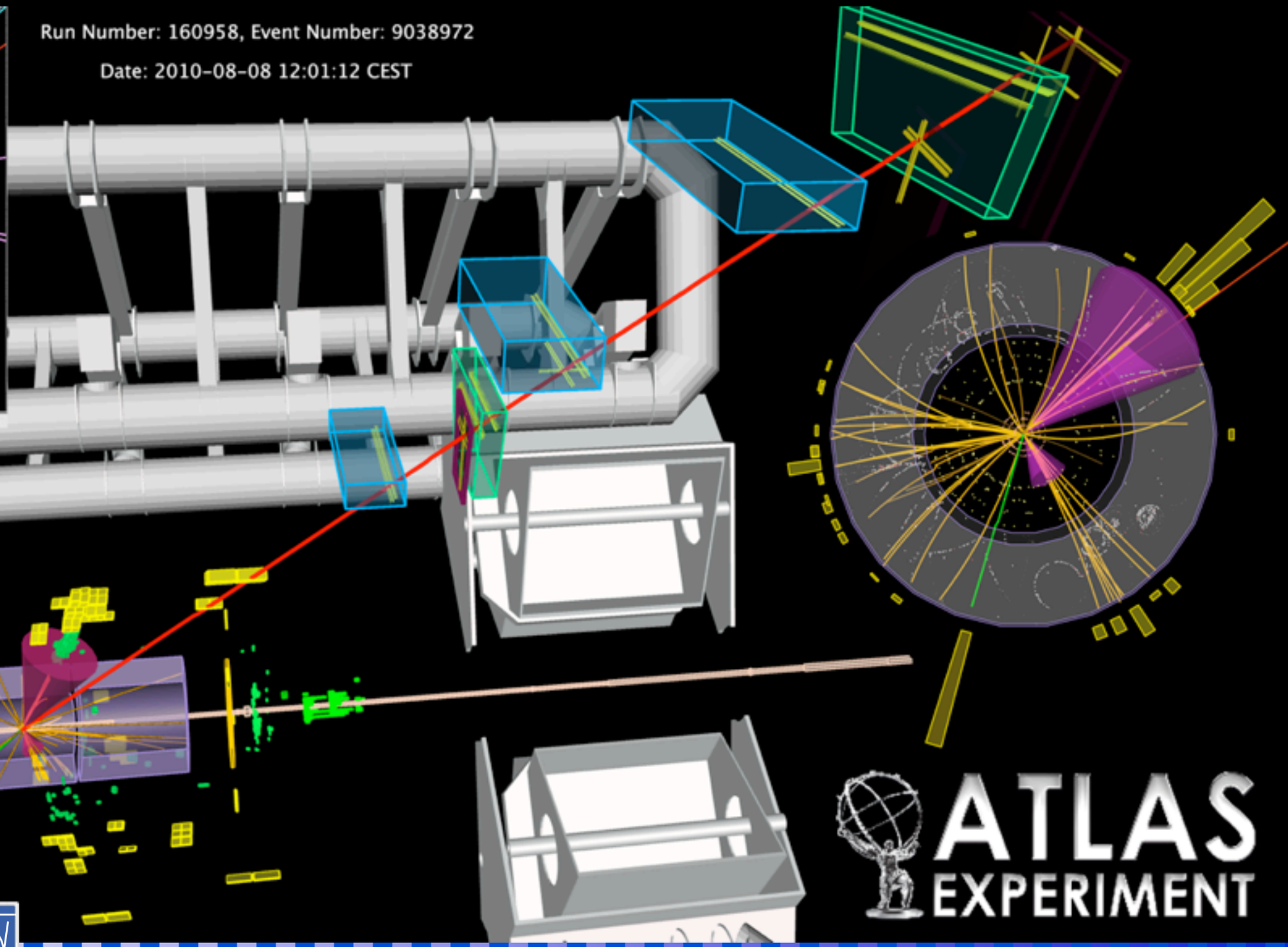


“Text Book“ Top Candidate: eμ Event with 2 b-jets

$p_T(\mu)$ = 51 GeV; $p_T(e)$ = 66 GeV; p_T (b-tag jets) = 174, 45 GeV; E_T^{miss} = 113 GeV

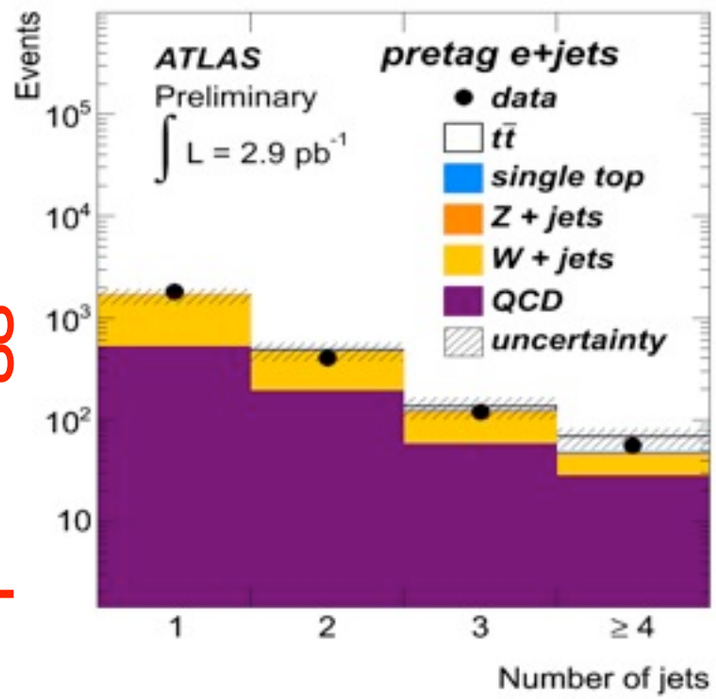
Secondary vertices vertex mass = ~ 2 GeV, ~ 4 GeV; Purity: > 96%

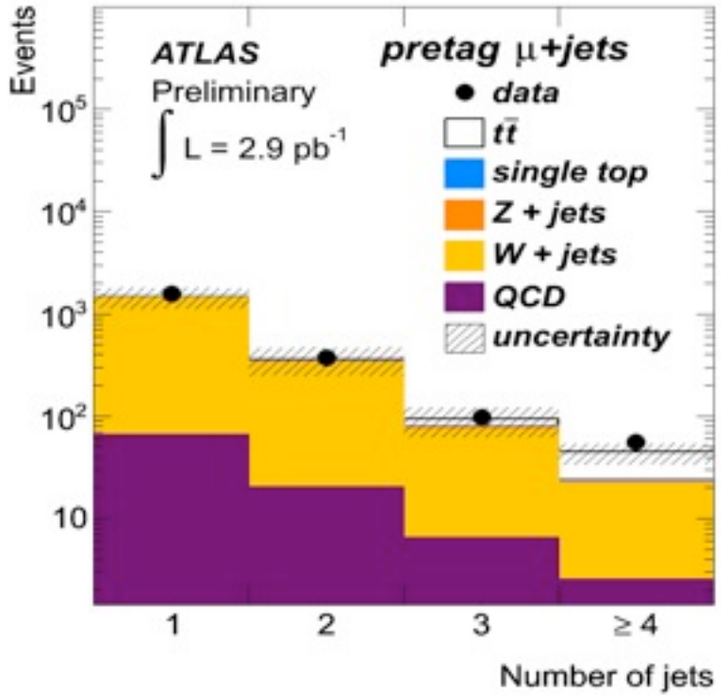




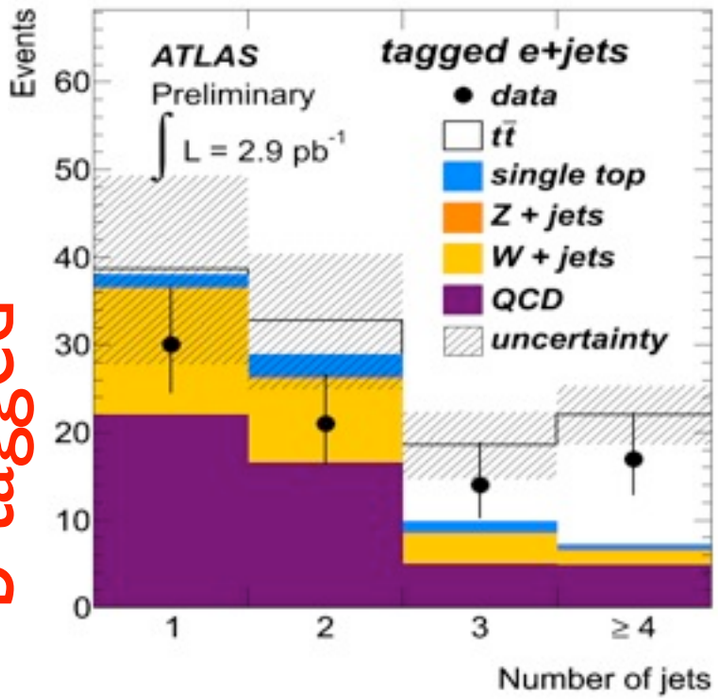
Top-quark Candidates Selection

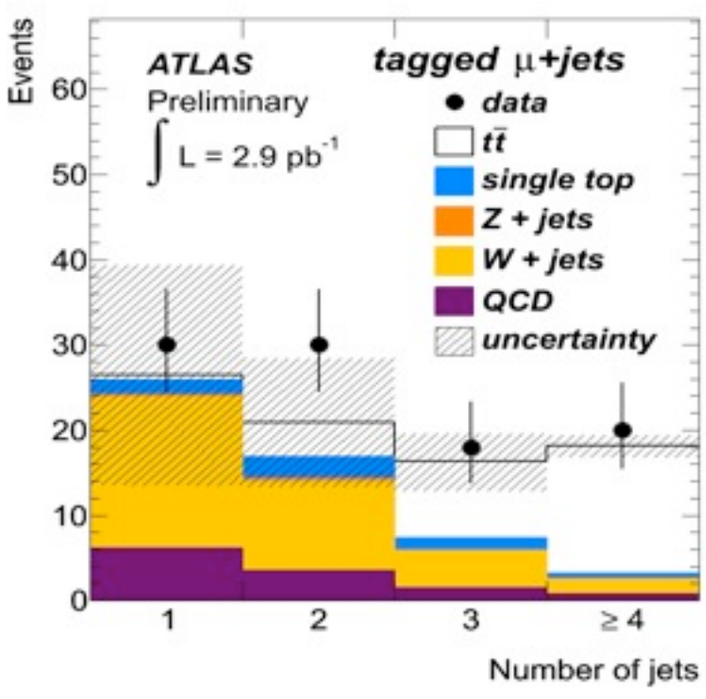
pre-tagged





b-tagged

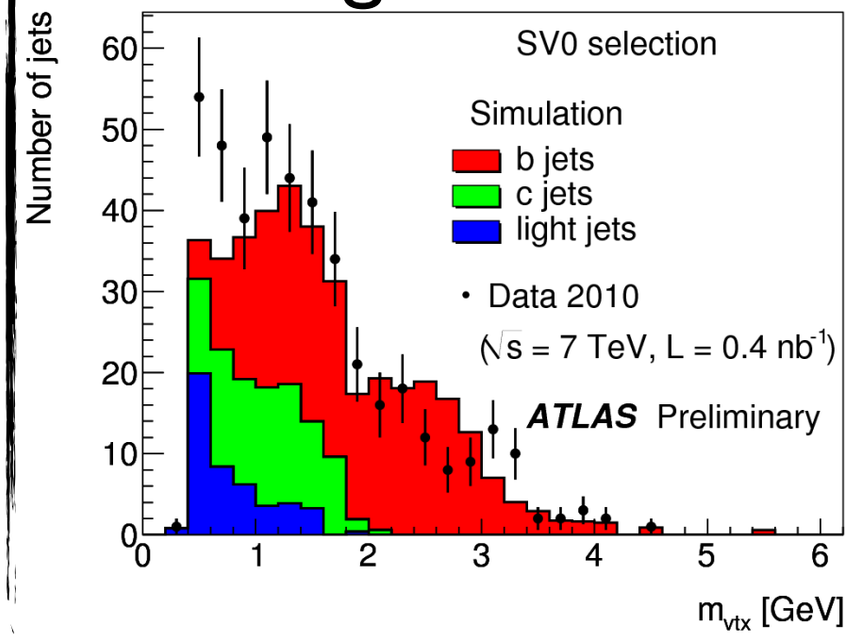




e+jets μ+jets

- Estimate of QCD background data-driven
- Single top and W/Z +jets backgrounds taken from Monte Carlo:
  - MC@NLO
  - ALPGEN

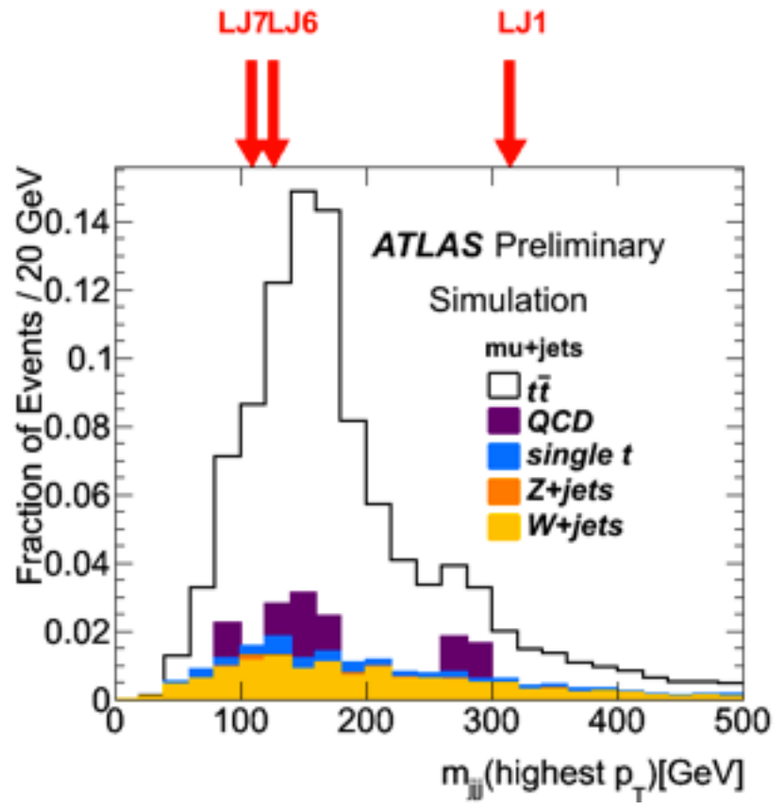
Jets b-tagged by secondary vertex algorithm



Nine Top-quark Candidates in first 280 nb^{-1}

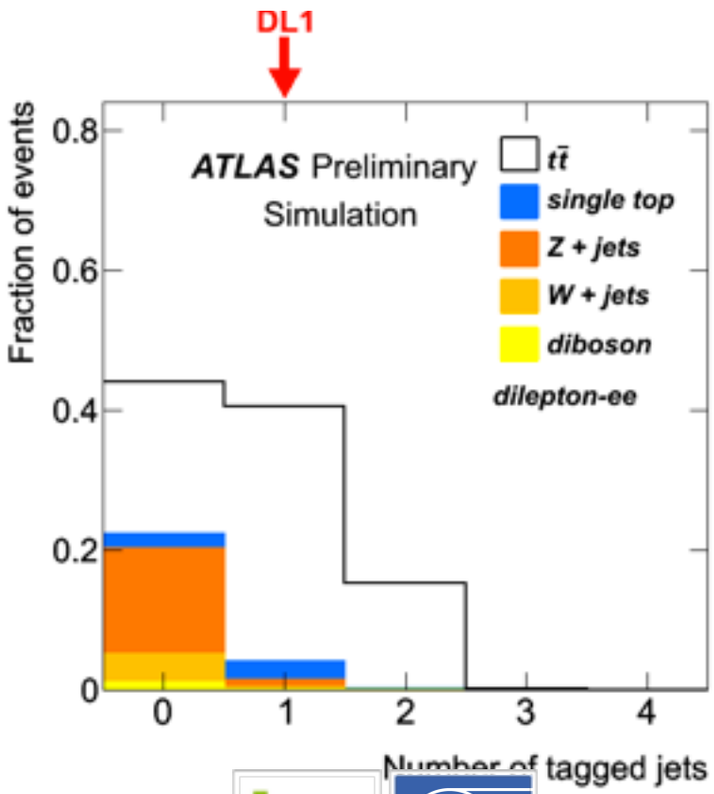
lepton + jets channel

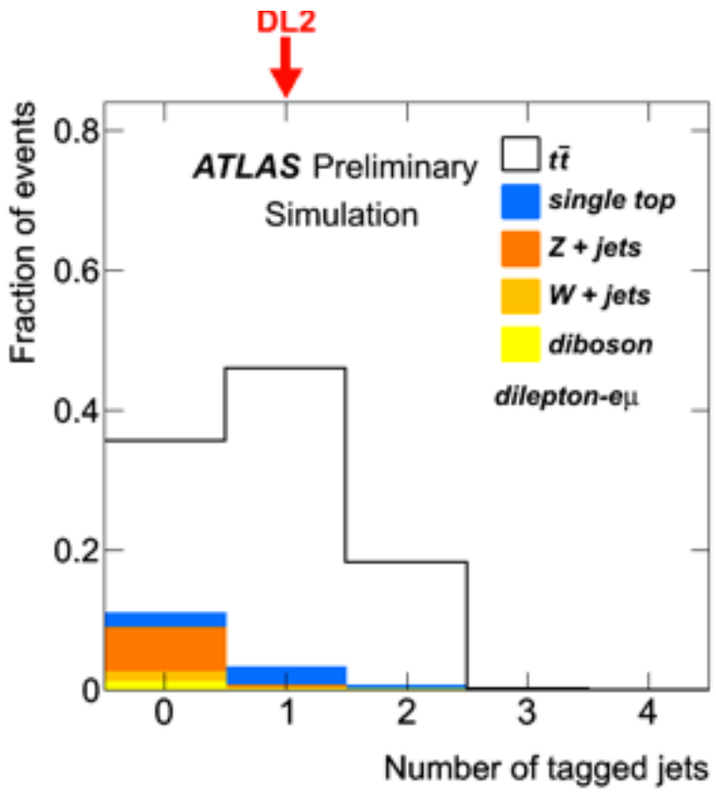
ID	Run number	Event number	Channel	p_T^{lep} (GeV)	E_T^{miss} (GeV)	m_T (GeV)	m_{jjj} (GeV)	#jets $p_T > 20$ GeV	#b-tagged jets
LJ1	158801	4645054	μ+jets	42.9	25.1	59.3	314	7	1
LJ2	158975	21437359	e+jets	41.4	89.3	68.7	106	4	1
LJ3	159086	12916278	e+jets	26.2	46.1	62.6	94	4	1
LJ4	159086	60469005	e+jets	39.1	66.7	102	231	4	1
LJ5	159086	64558586	e+jets	79.3	43.4	86.7	122	4	1
LJ6	159224	13396261	μ+jets	29.4	65.4	64.1	126	5	1
LJ7	159224	13560451	μ+jets	78.7	40.0	83.7	108	4	1

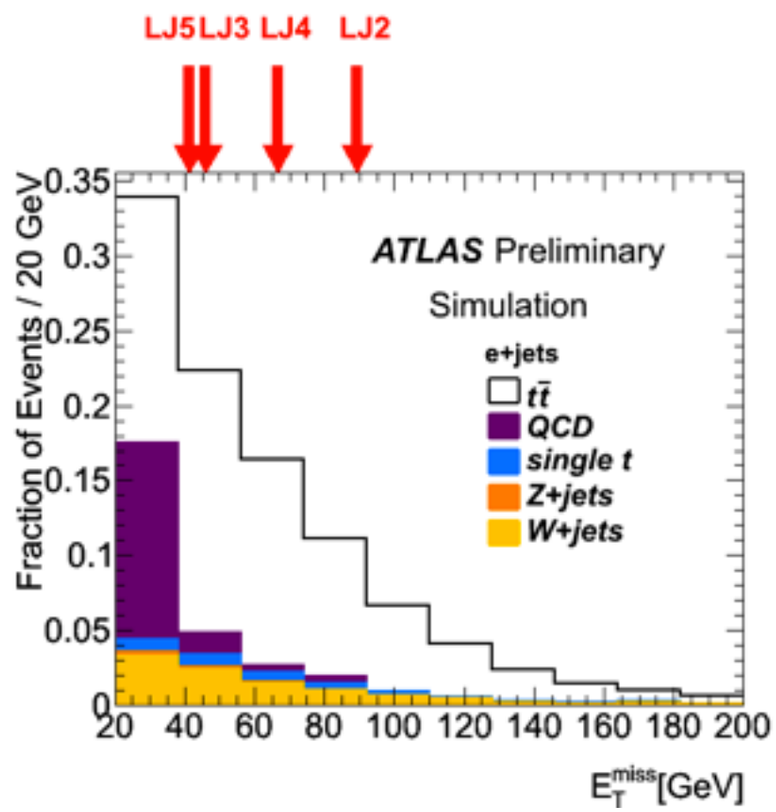


2-lepton channel

ID	Run number	Event number	Channel	p_T^{lep} (GeV)	E_T^{miss} (GeV)	H_T (GeV)	#jets $p_T > 20$ GeV	#b-tagged jets
DL1	155678	13304729	ee	55.2/40.6	42.4	271	3	1
DL2	158582	27400066	$e\mu$	22.7/47.8	76.9	196	3	1







Nine Top-quark Candidates in first 280 nb^{-1}

lepton + jets channel

ID	Run number	Event number	Channel	p_T^{lep} (GeV)	E ($\not$
LJ1	158801	4645054	μ+jets	42.9	2
LJ2	158975	21437359	e+jets	41.4	8
LJ3	159086	12916278	e+jets	26.2	4
LJ4	159086	60469005	e+jets	39.1	6
LJ5	159086	64558586	e+jets	79.3	4
LJ6	159224	13396261	μ+jets	29.4	6
LJ7	159224	13560451	μ+jets	78.7	4

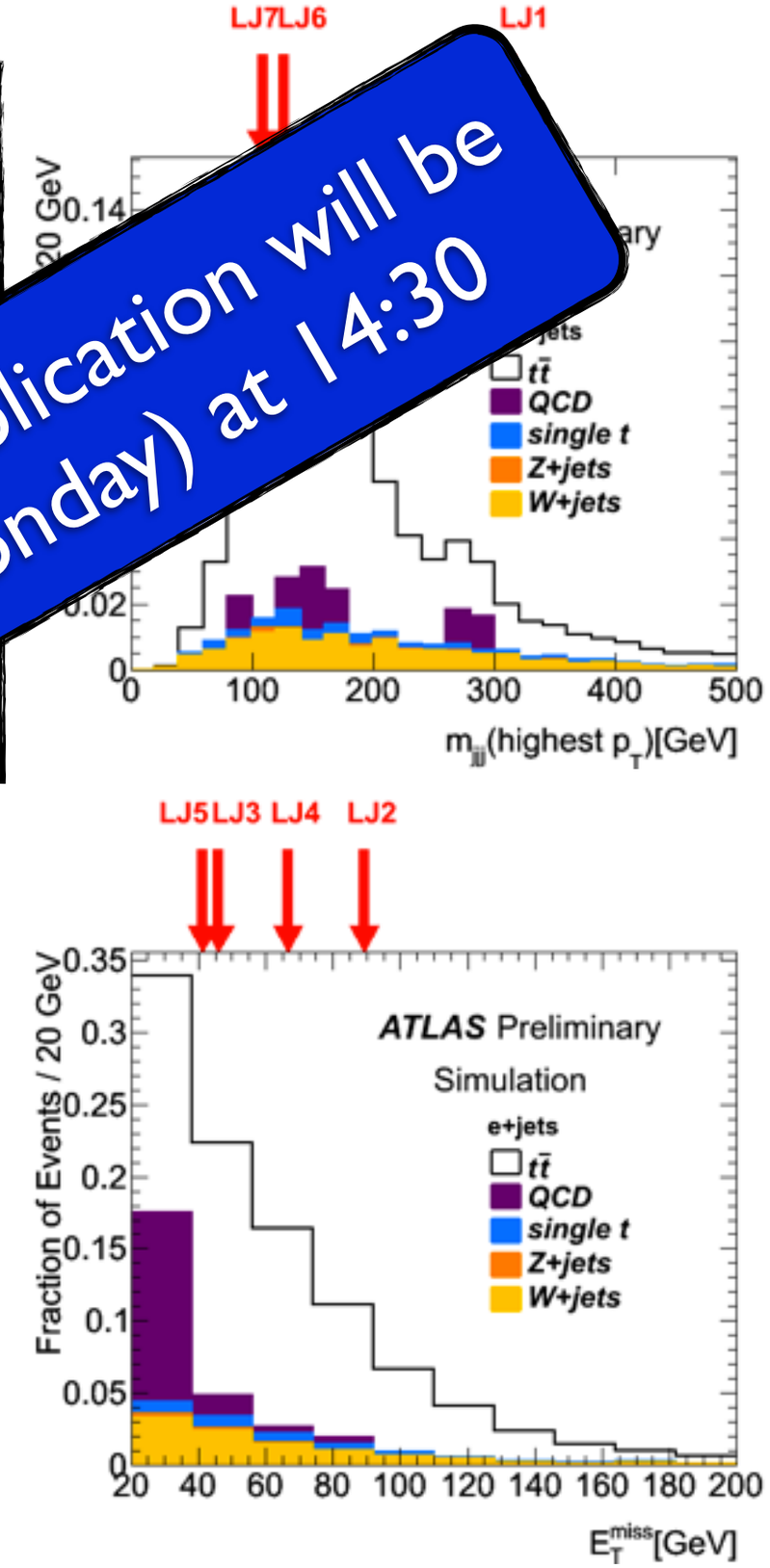
2-lepton channel

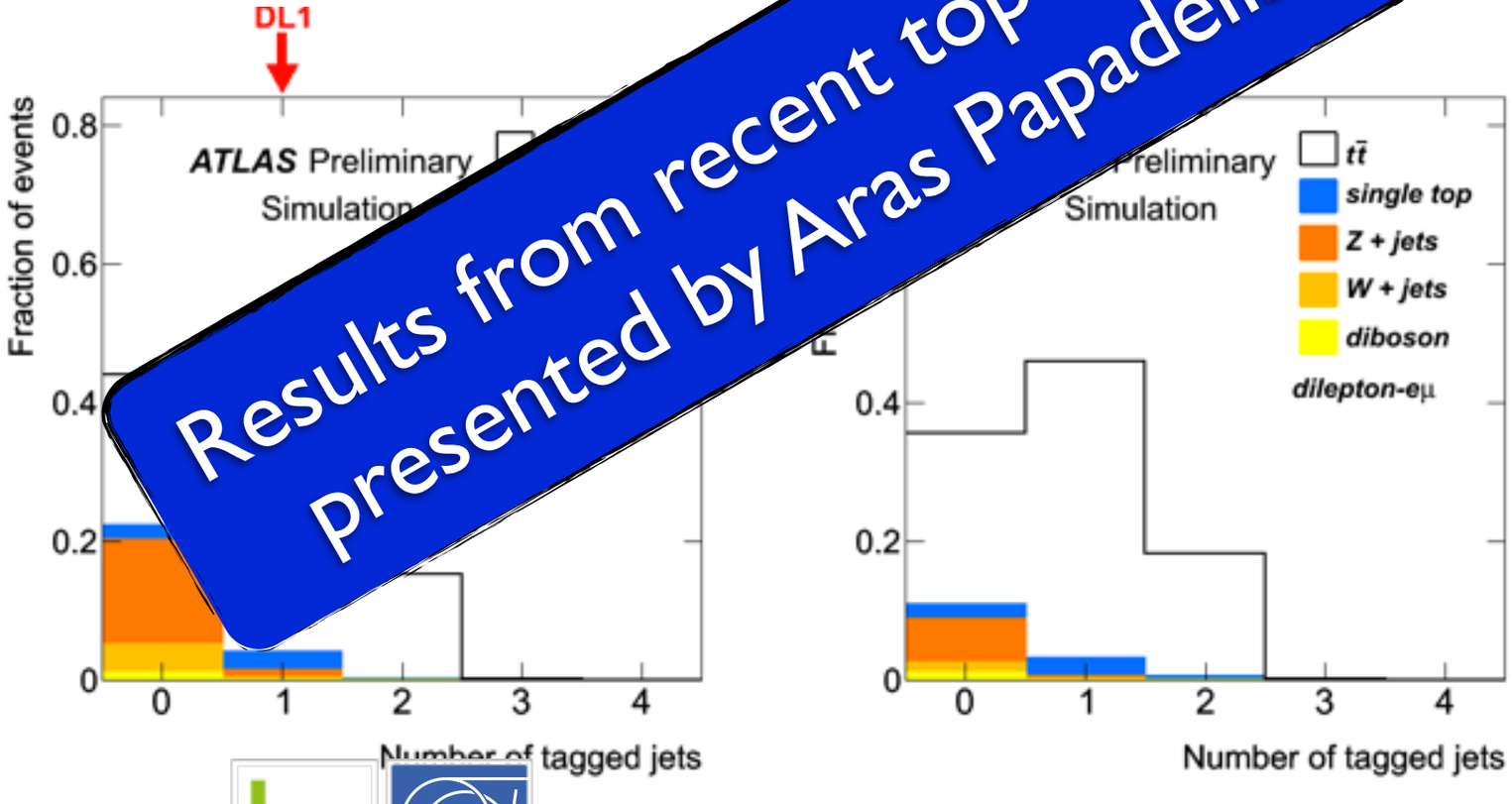
ID	Run number	Event number	Channel	p_T^{lep} (GeV)
DL1	155678	13304729	ee	55.2/40
DL2	158582	27400066	$e\mu$	22.7/47

- Properties of candidates consistent with tt production
- Several candidates in bi… signal purity regio…
- Analysis of n… careful … and… …ng

Top cross-section publication will be presented by Aras Papadelis Today (Monday) at 14:30

Results from recent top …

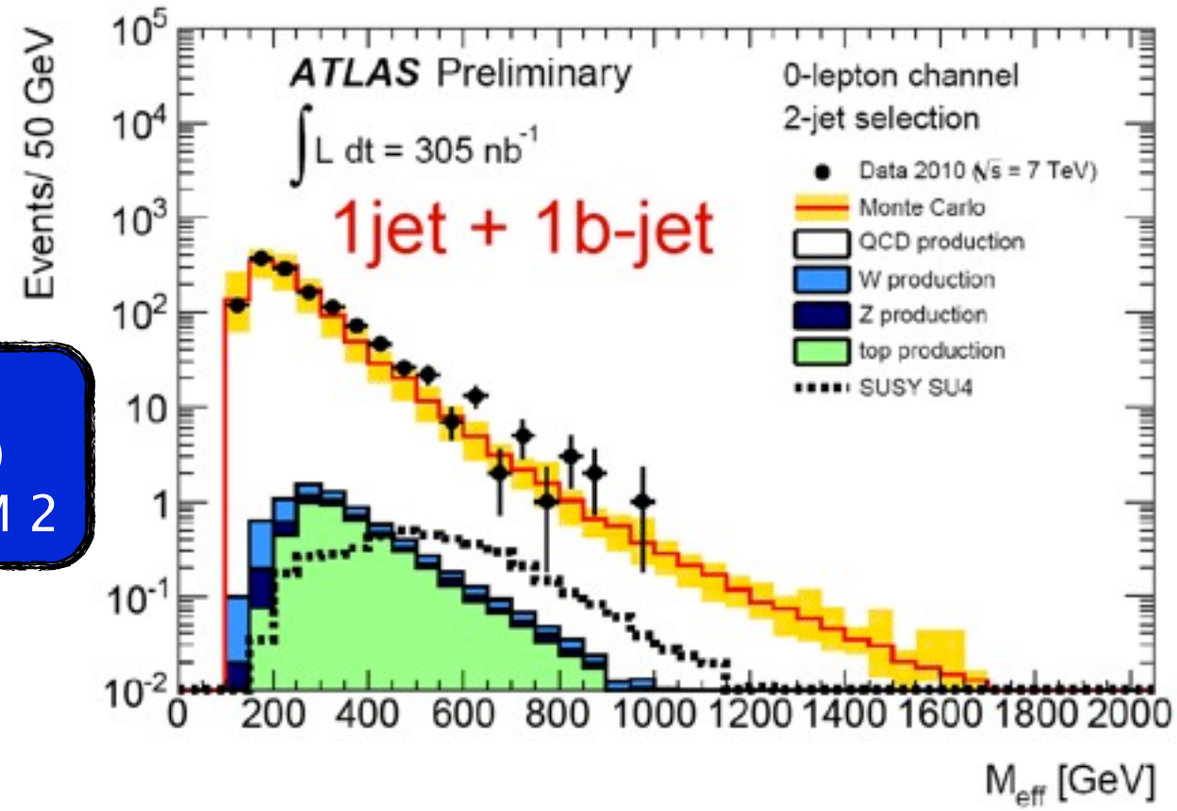


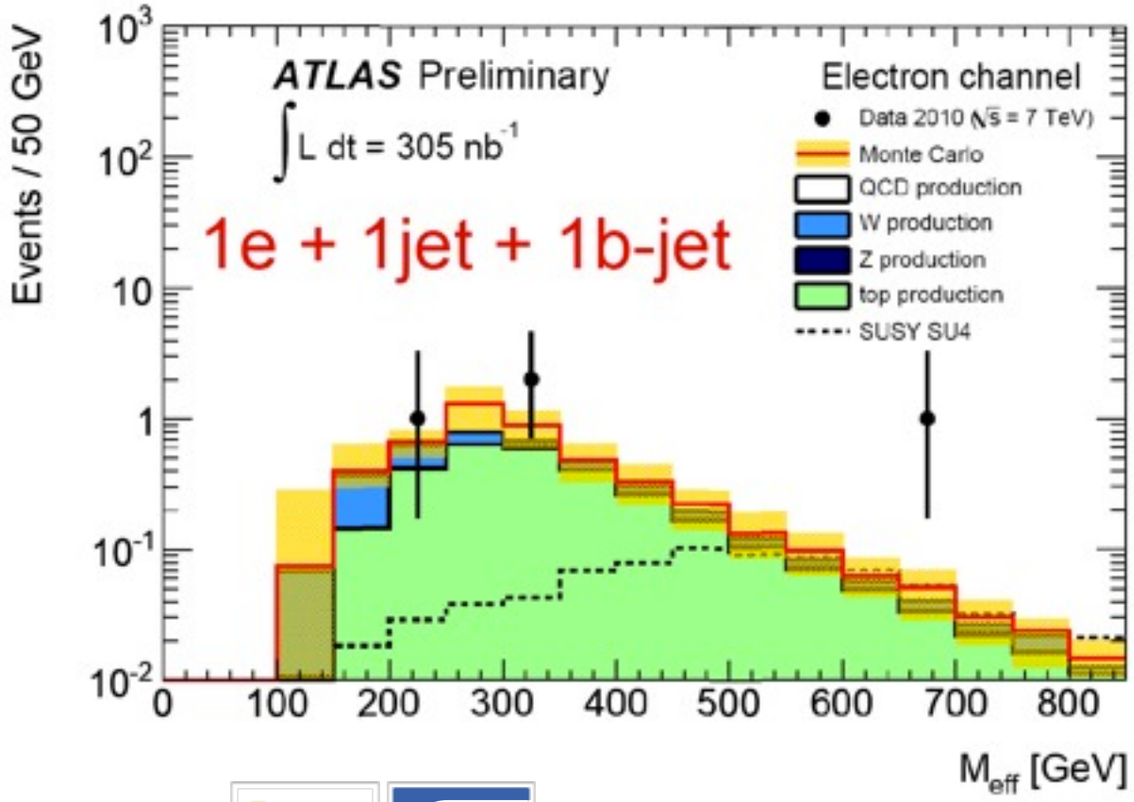


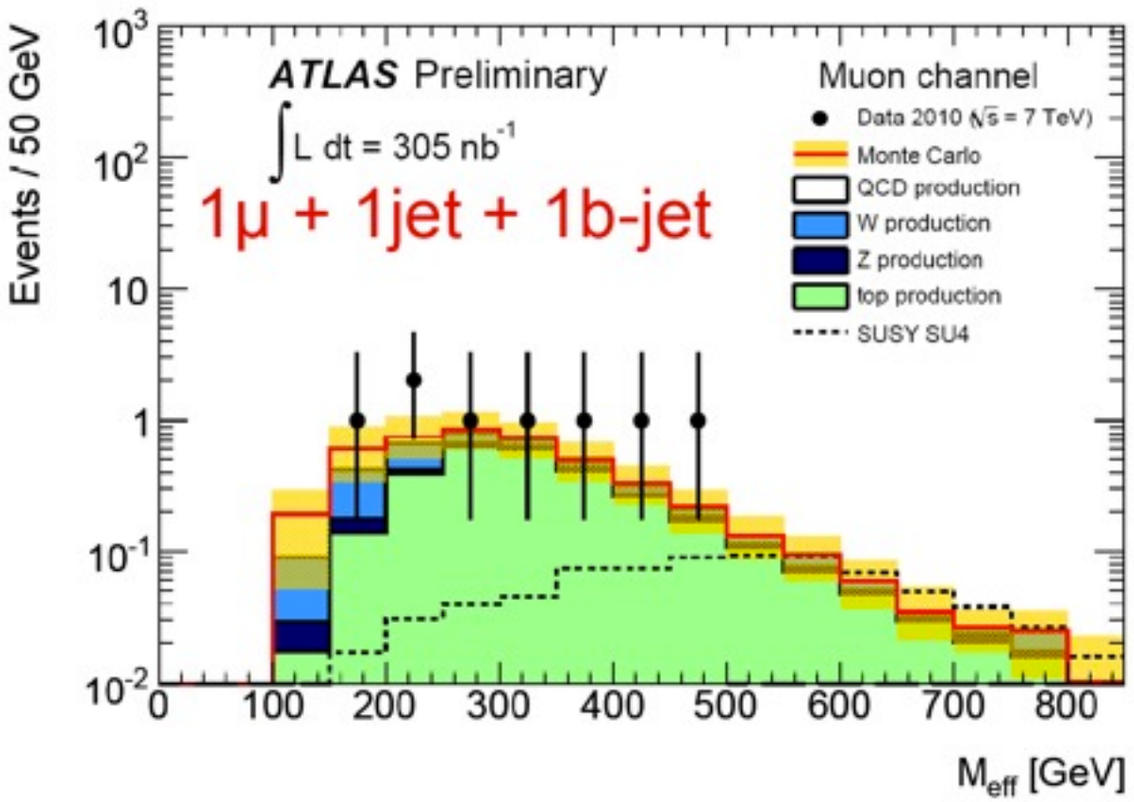
SUSY Searches

- dataset analyzed so far: no sensitivity to unexplored regions yet
- SUSY analyses rather background studies at this stage
- Many inclusive channels under investigation
- Examples: b-jets+missing E_T

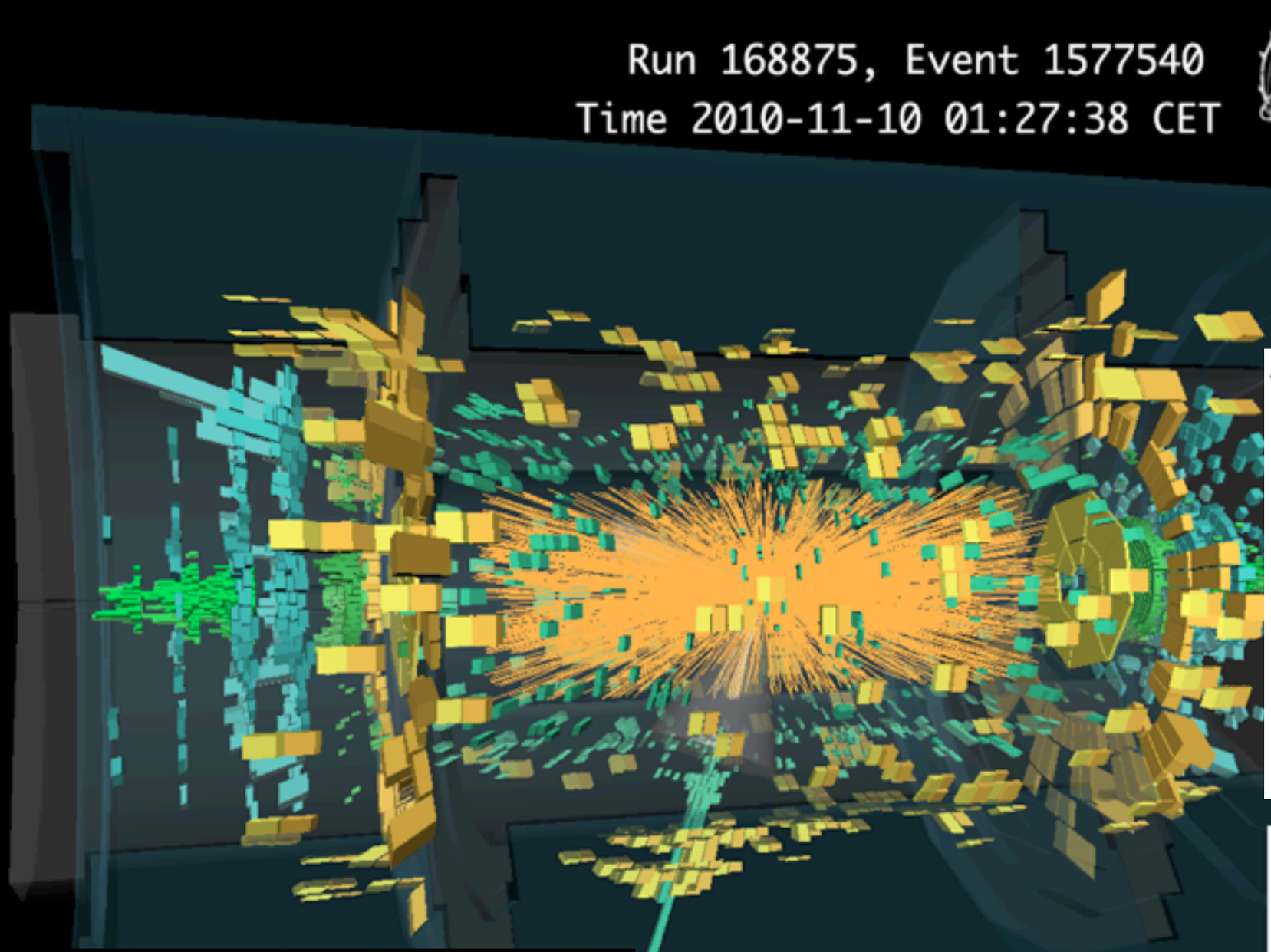
X. Zhuang,
Wed. 14:00
Exotics & BSM 2

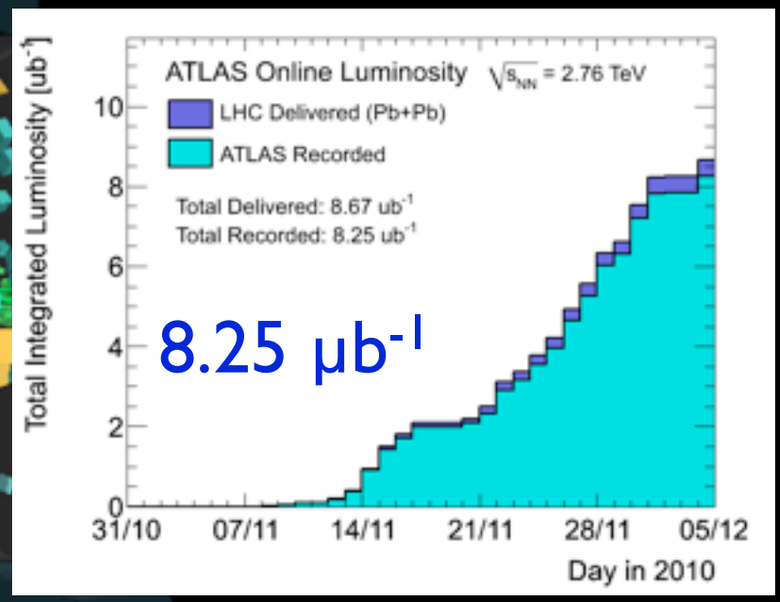


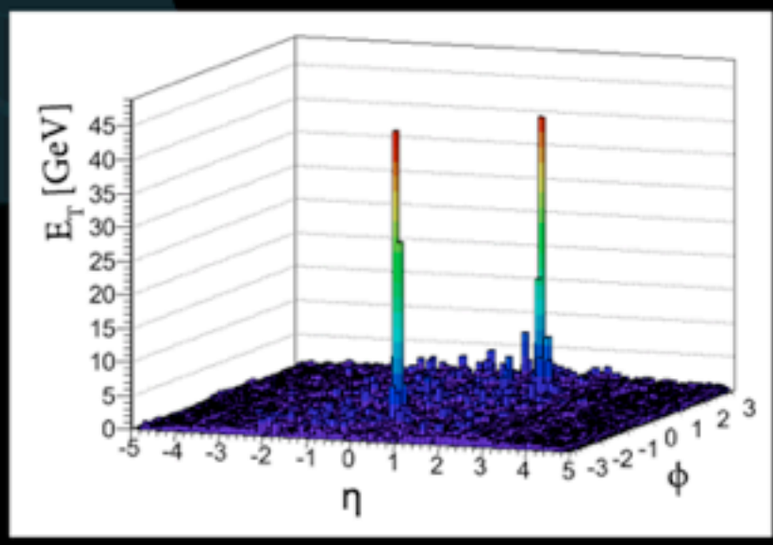


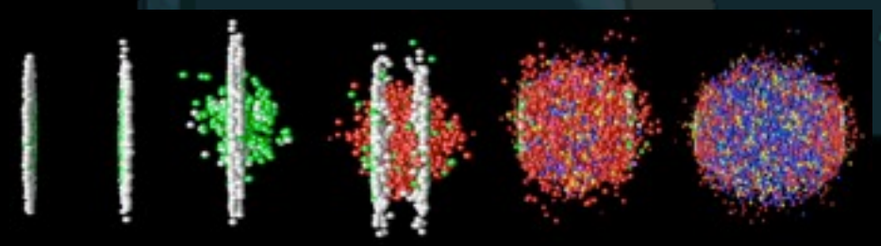


Heavy Ion Operation



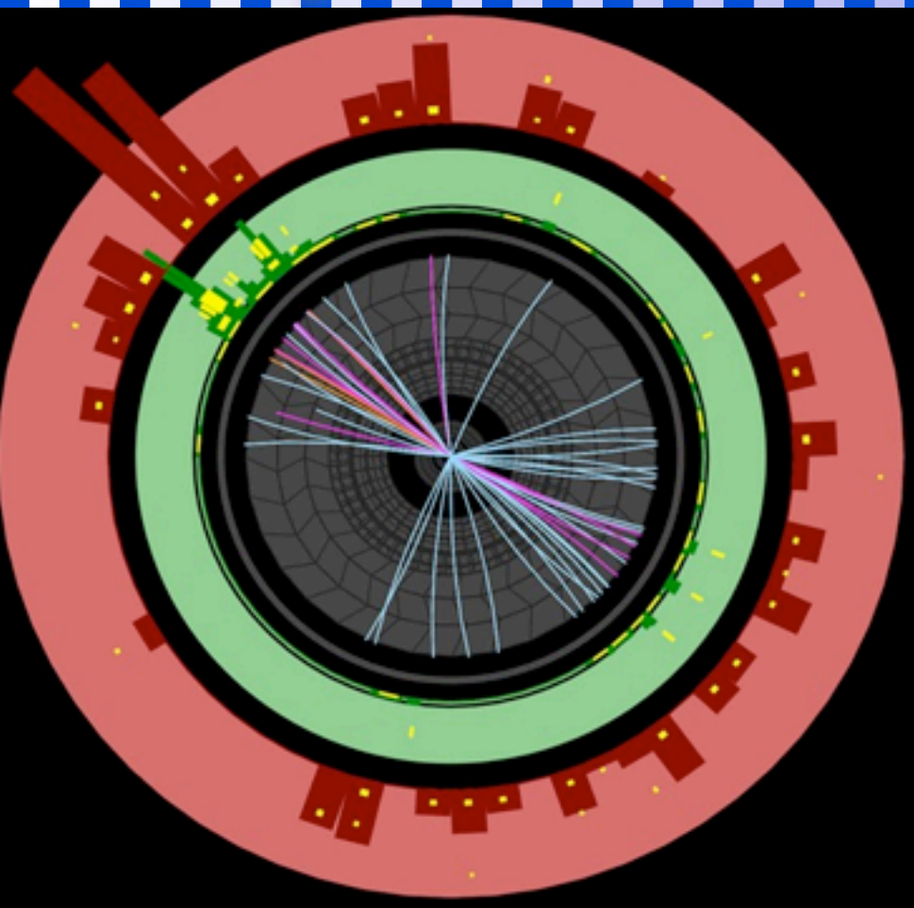


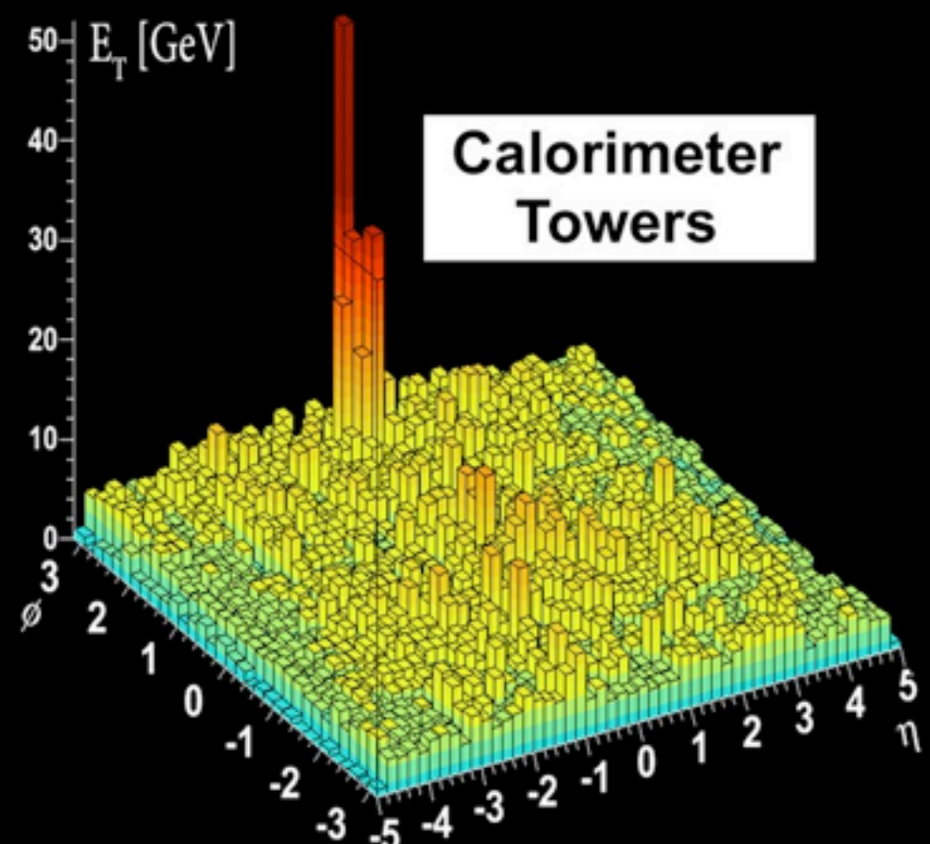


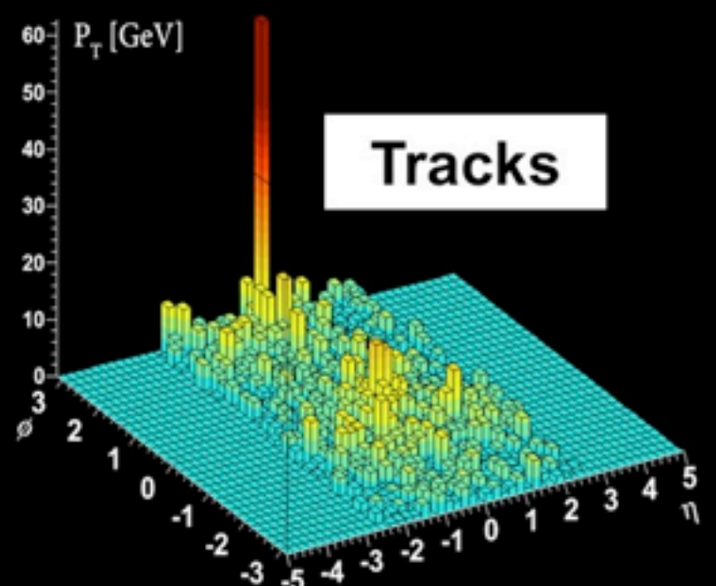


Heavy Ion Collision Event with 2 Jets

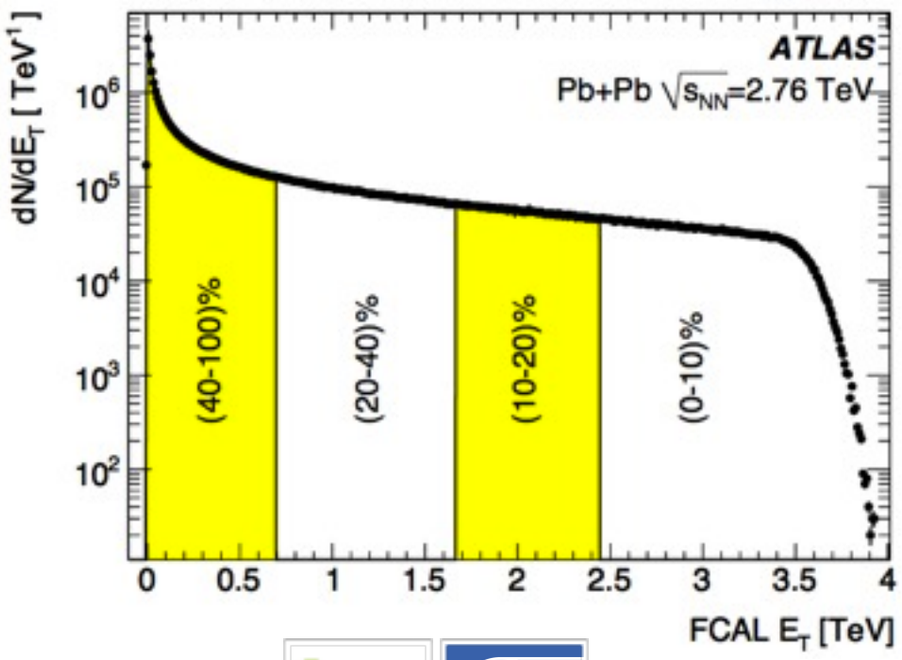
Heavy Ion - Centrality-Dependent Dijet Asymmetry



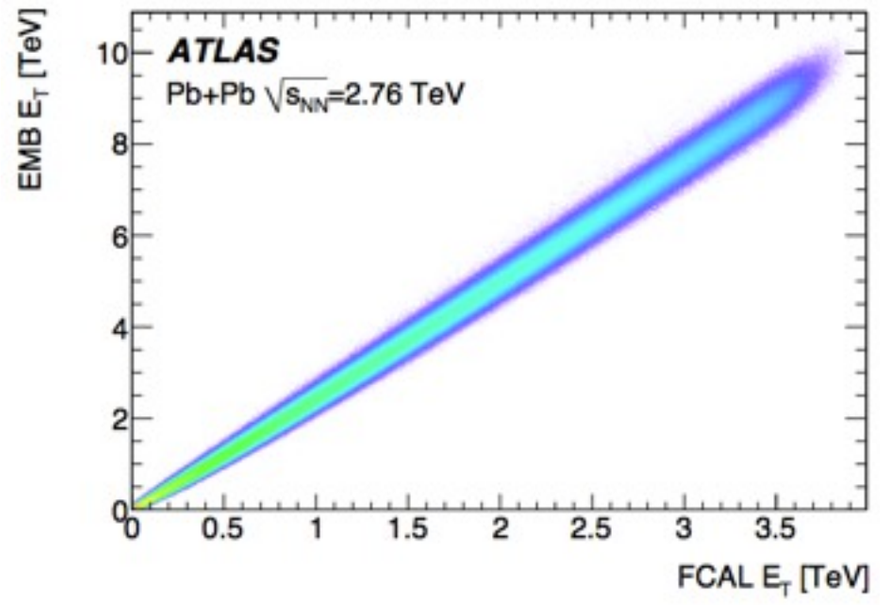




ATLAS
Run: 169045
Event: 1914004
Date: 2010-11-12
Time: 04:11:44 CET

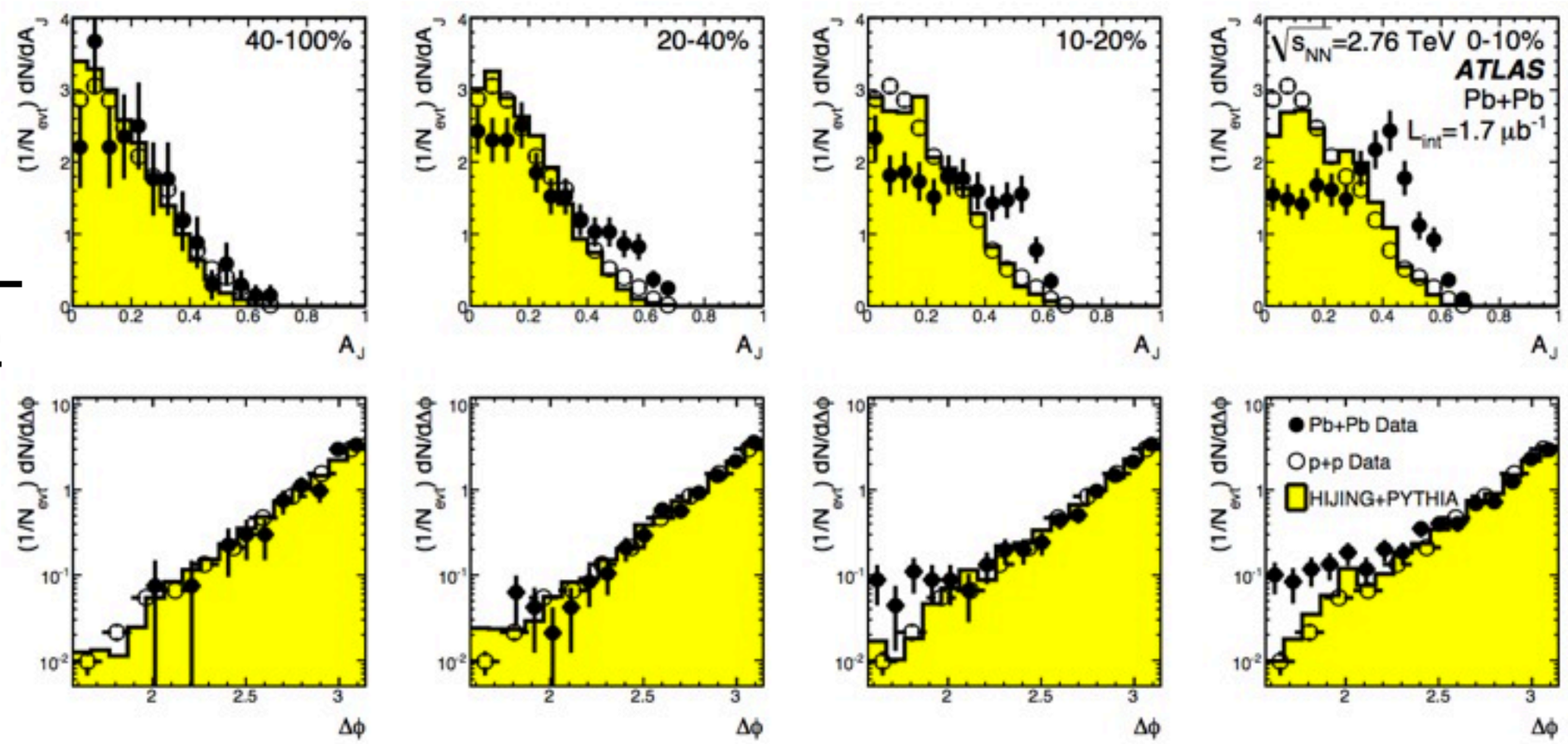


An asymmetry is observed between the transverse energies of the leading and second jets that increases with the centrality of the collisions

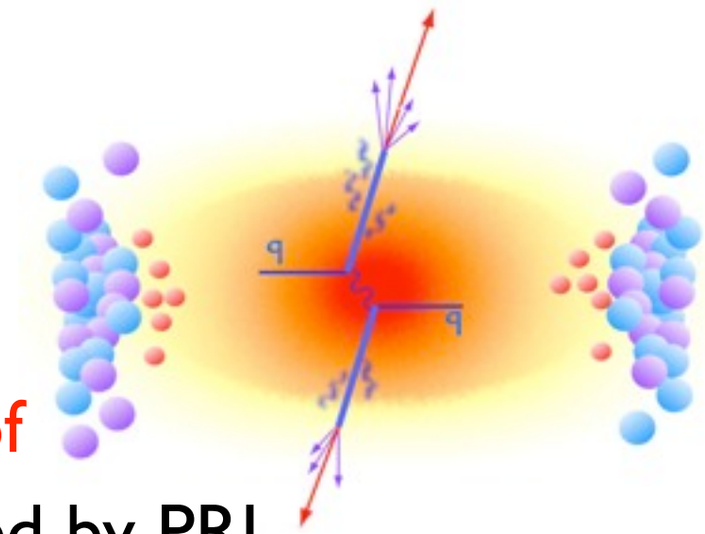


Heavy Ion - Centrality-Dependent Dijet Asymmetry

$$A_J = \frac{E_{T1} - E_{T2}}{E_{T1} + E_{T2}}$$

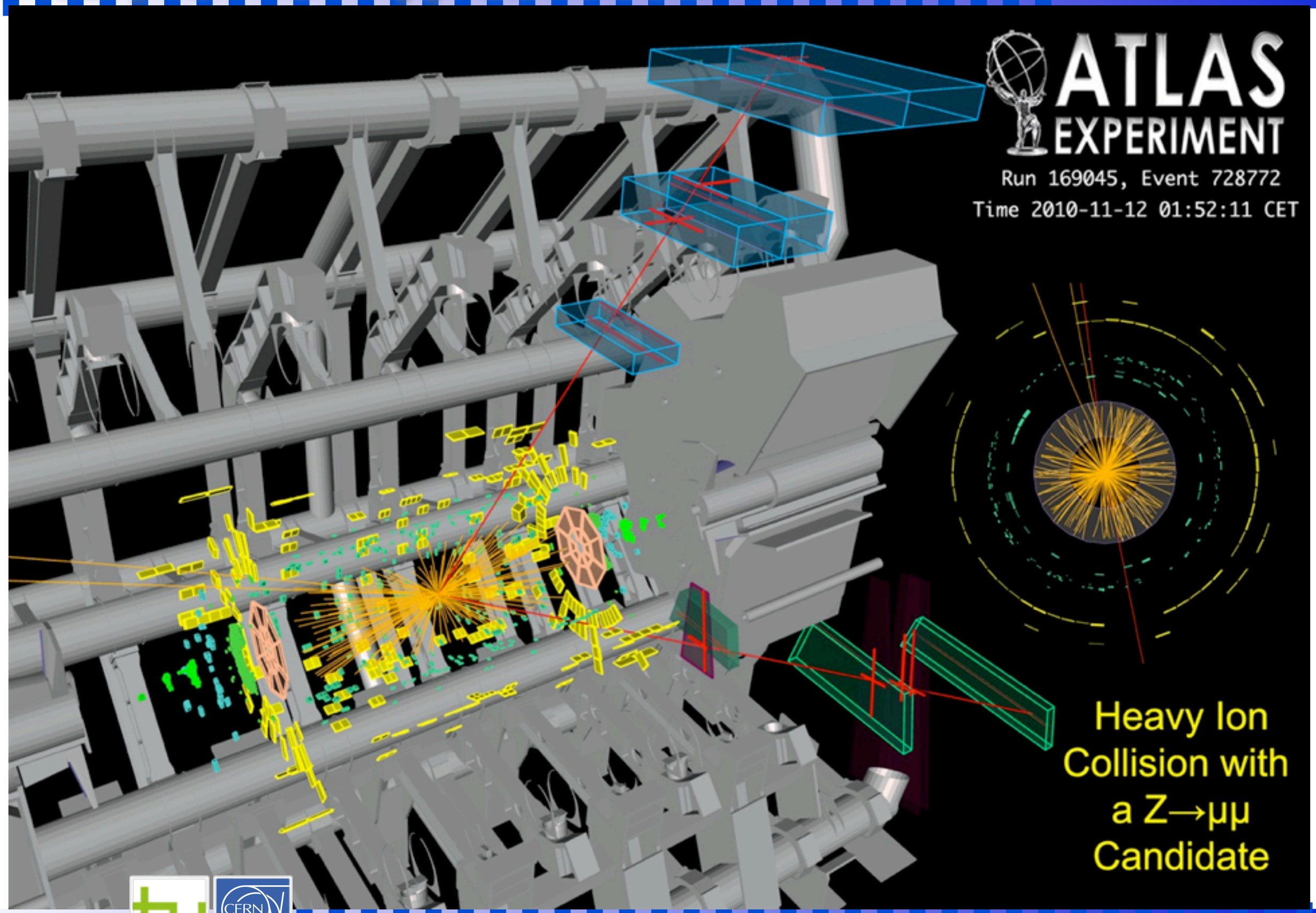


This has a natural interpretation in terms of QCD energy loss, where the second jet is attenuated, in some cases leading to striking highly-asymmetric dijet events. This observation is the first of an enhancement of such large dijet asymmetries, not observed in proton-proton collisions, which may point to an interpretation in terms of strong jet energy loss in a hot, dense medium.



Accepted by PRL

Heavy Ion - Z → μμ Candidate



ATLAS Results and Topics

- Salvador Marti i Garcia - Performance of the ATLAS Inner Tracker
- Claudio Santoni - Performance of the ATLAS Calorimeters
- Marcello Bindi - Performance of the ATLAS Muon Spectrometer

Performance

- Michele Petteni - Jet/E_T^{miss}: Setting the ATLAS jet energy scale
- Francesco Conventi - Heavy Flavour Production in ATLAS

B physics

- Aras Papadelis - Top Quark Studies in ATLAS

Top

- Paul Laycock - Soft QCD measurements in ATLAS
- Rainer Stamen - Hard QCD measurements in ATLAS
- Zofia Czyczula - Production of W, Z in ATLAS

SM & QCD

- Jana Novakova - Higgs sensitivity in ATLAS

Higgs

- Xuai Zhuang - Early searches for supersymmetry in ATLAS

SUSY

- Xin Chen - Searches for new physics with leptons in ATLAS
- Reyhaneh Rezvani - Exotic searches with dijet events in ATLAS
- Lorraine Courneyea - Searches for new physics with jets in ATLAS

Exotics

LHC and ATLAS reached the phase of a very exciting bouquet of Physics

Conclusions

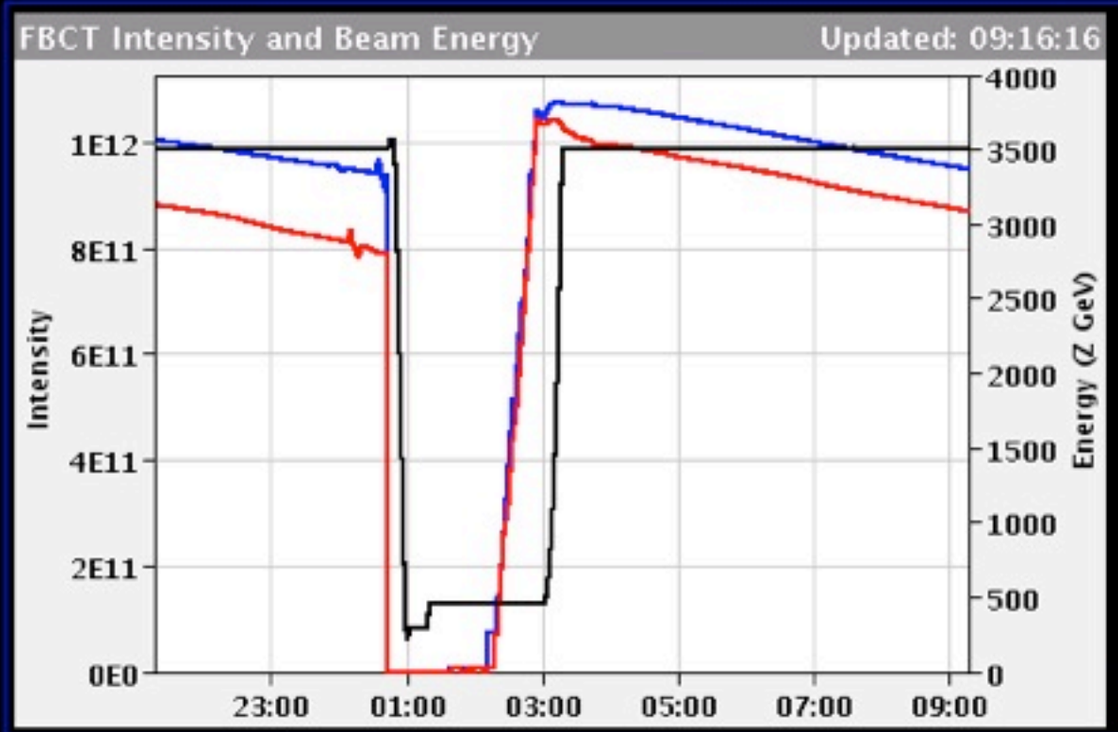
- From 30 March to 7 November, ATLAS successfully collected 45 pb^{-1} proton-proton collision data during the first LHC run at $\sqrt{s}$ = 7 TeV
- Entire experiment has worked efficiently and fast, from data taking at the pit (with efficiency ~ 94%), through data processing and transfer worldwide, to delivery of performance and physics results.
- 1st data demonstrate that detector performance (resolution, efficiencies) and the quality of the reconstruction and simulation software are better than expected and in agreement with detailed simulation. Years of test beam activities, increasingly realistic simulations, and commissioning with cosmics were fundamental for such a good turn-on year.
- First physics measurements of jet, W, Z, J/ψ cross-sections and properties have been produced, as well as observations of top candidates and tau candidates.
- Searches for new physics at TeV scale have begun!
- 1st Heavy Ion run successfully collected 8.25 μb^{-1} (with efficiency > 95%) - observations and results are very encouraging.
- ATLAS is ready (and has started) to exploit full physics potential of LHC.
- A big big thanks to our LHC colleagues!

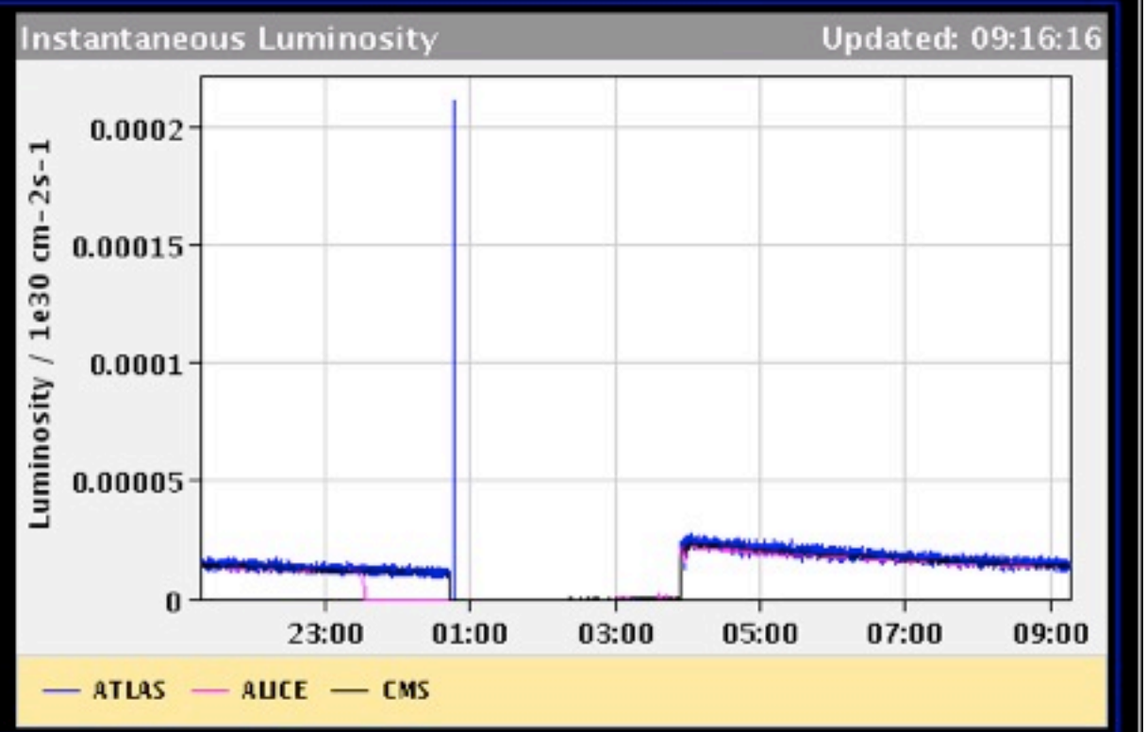
Still stable beams

LHC Page1 | Fill: 1540 | E: 3500 Z GeV | 06-12-2010 09:16:16

ION PHYSICS: STABLE BEAMS

Energy:	3500 Z GeV	I(B1):	9.56e+11	I(B2):	8.71e+11





Comments 06-12-2010 04:08:04 :

STABLE BEAMS

BIS status and SMP flags	B1	B2
Link Status of Beam Permits	true	true
Global Beam Permit	true	true
Setup Beam	false	false
Beam Presence	true	true
Moveable Devices Allowed In	true	true
Stable Beams	true	true

AFS: 5 …_130_0_8bpi18inj_IONS | PM Status B1: ENABLED | PM Status B2: ENABLED