
CERN

Konrad Jende

Exploring particles at scholl with LHC data - hands-on exercise(s)

outline

1. Search for W particles with ATLAS
2. Invariant mass searches for known and unknown particles
3. Search for the Higgs

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1. Search for W particles with ATLAS

physicsmasterclasses.org

username: teacherg password: Bohr1922

1. Search for W particles with ATLAS

HOMEPAGE | W-Path | Z-Path

LHC@InternationalMasterclasses

Join us on a journey to the smallest pieces of matter! Learn what is happening 100 meters below the ground at the European Organization for Nuclear Research (CERN). At the Large Hadron Collider, a circular collider with a circumference of 27 kilometres, the experiments ALICE, ATLAS, CMS, and LHCb are installed. The following short video gives an impression of the start of a fascinating journey looking for the origin of mass, Dark Matter, and new phenomena such as Supersymmetry or Extra Dimensions.

Links

Facebook-Seite

LHC Livescreen

http://atlas.physicsmasterclasses.org/en/index.htm

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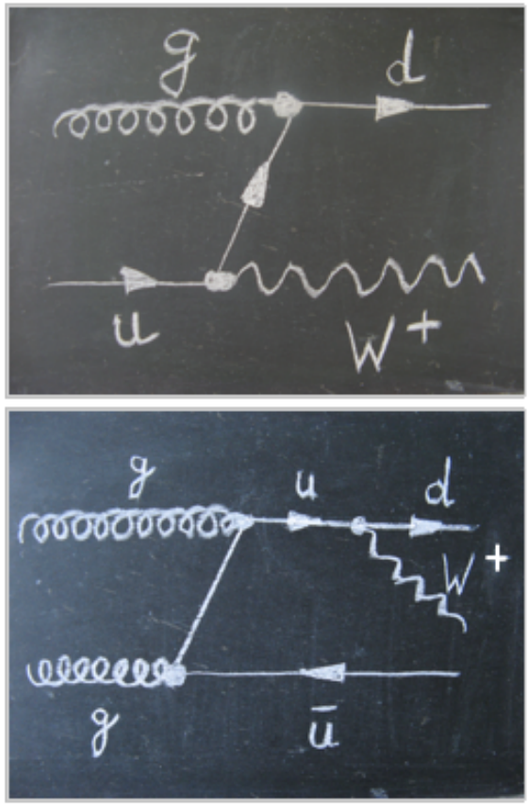
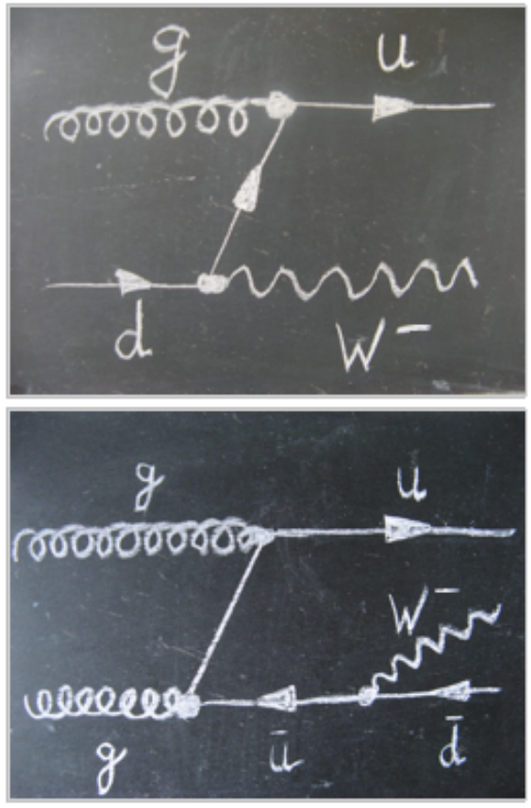
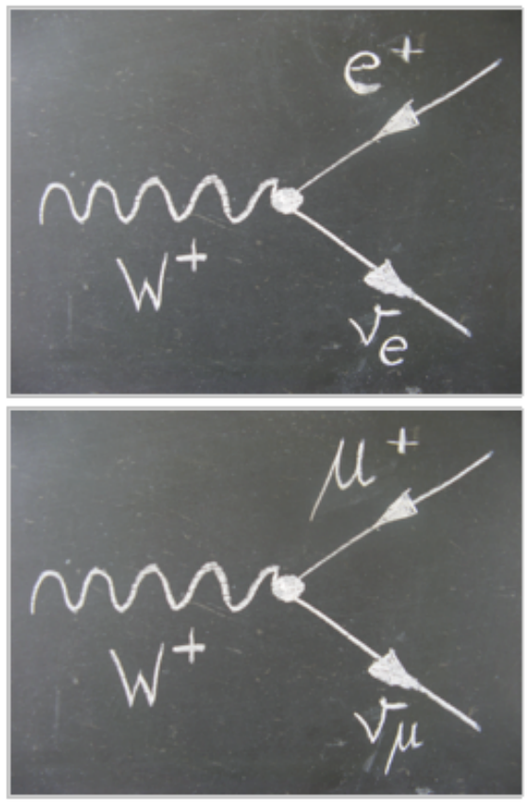
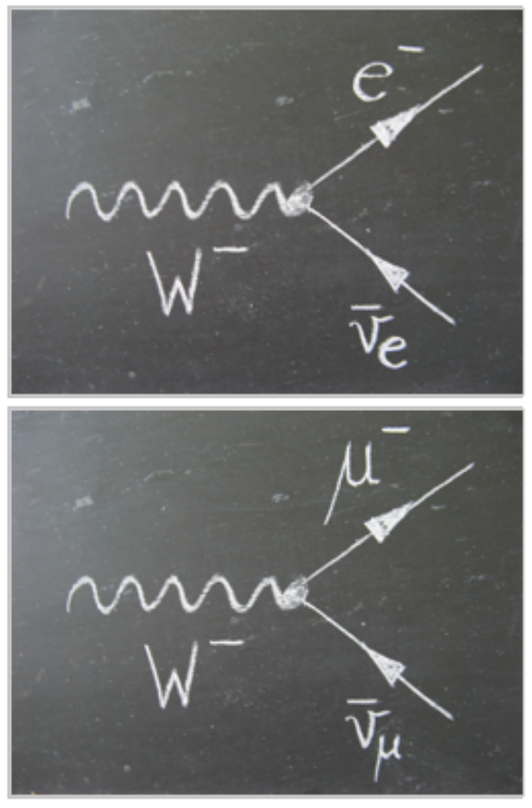
1. Search for W particles with ATLAS









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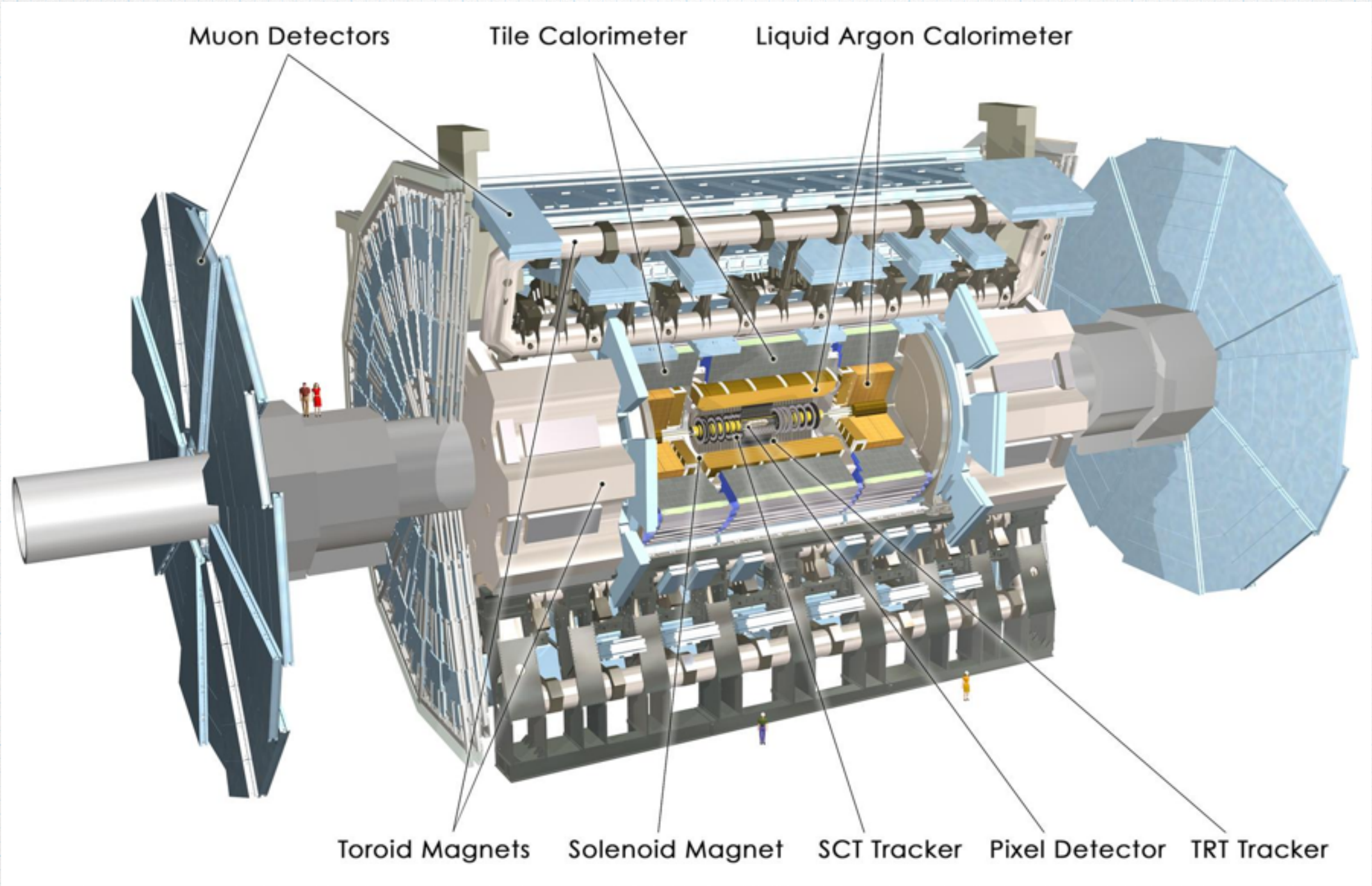

1. Search for W particles with ATLAS

1. to measure the momentum of electrically charged particles
2. to measure energy of electrically charged particles and photons
3. to measure energy of strongly charged particles
4. to measure momentum and unambiguously identify muons

several layers of detecting material with symmetry

1. at right angles to the beam pipe (cylindric - barrel)
2. in forward/backward region (linear - endcaps)

1. Search for W particles with ATLAS

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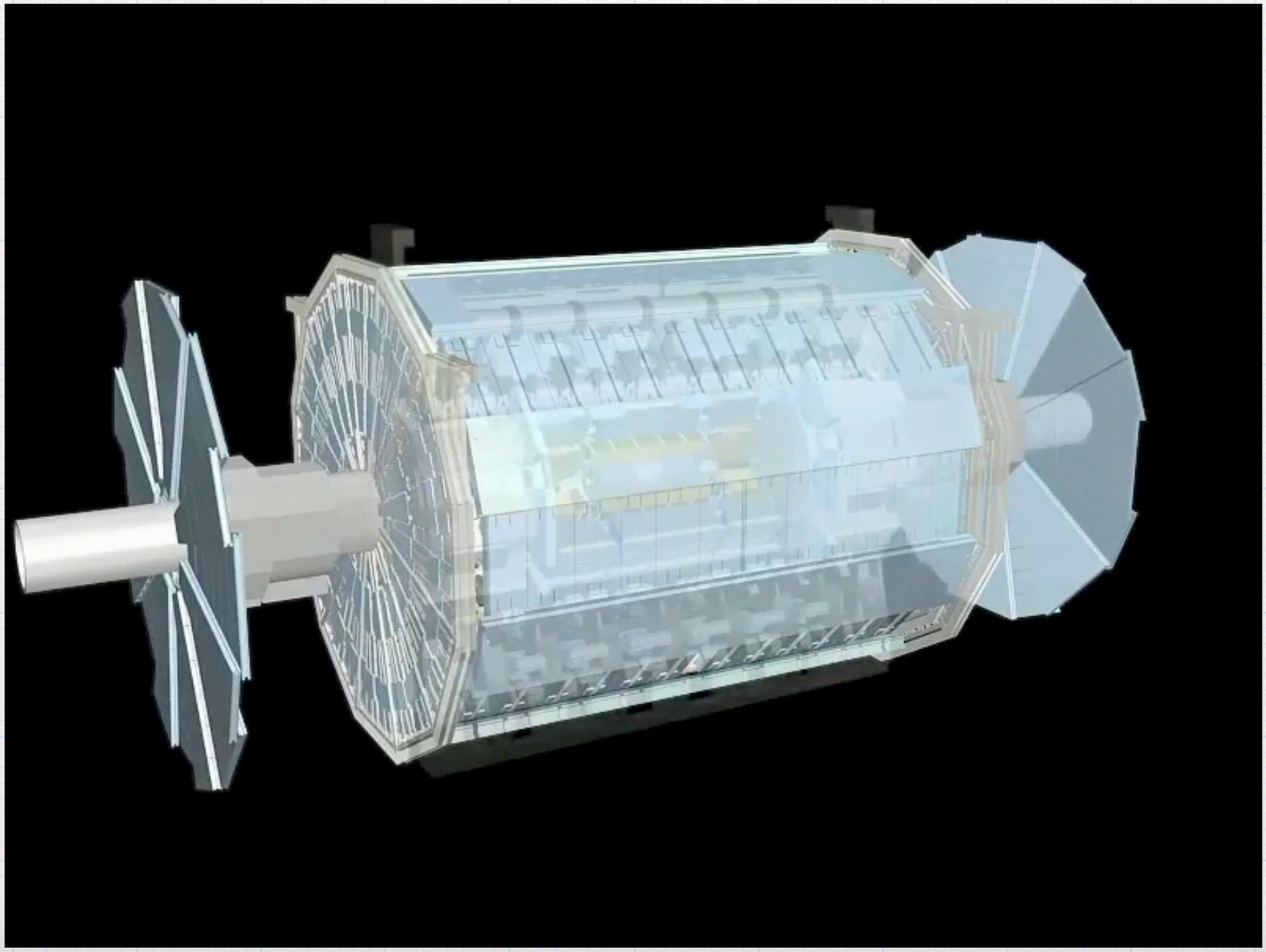

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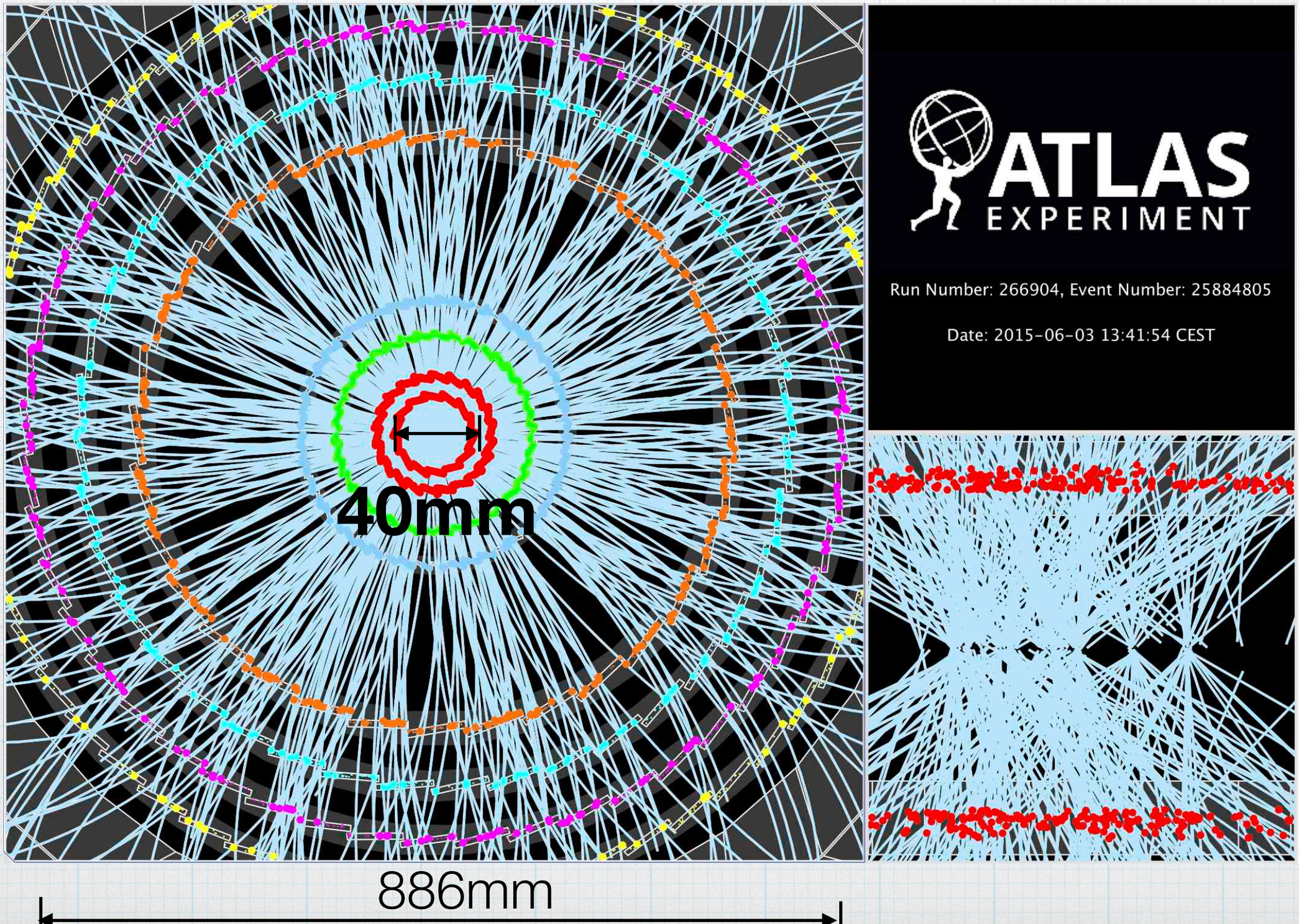

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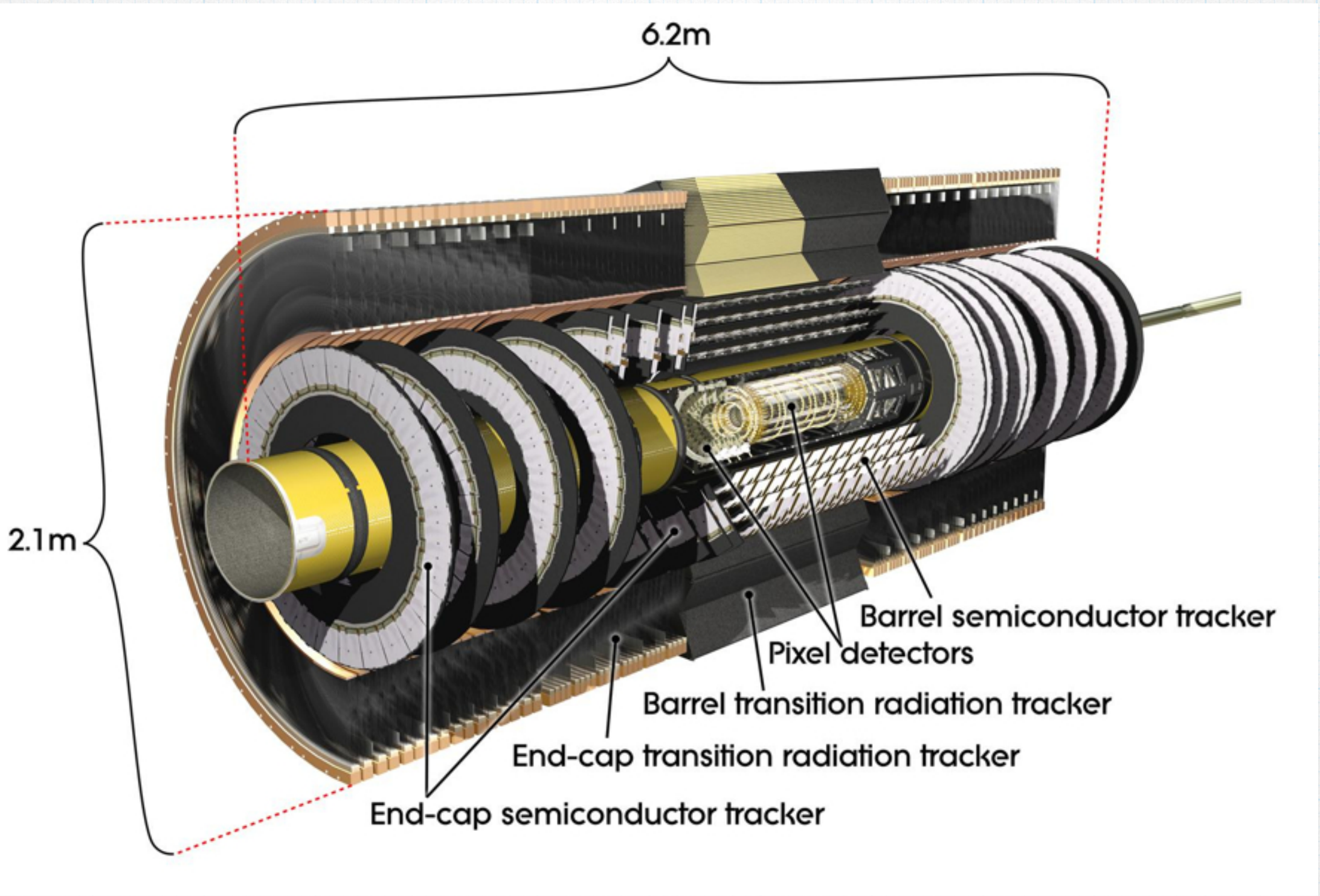

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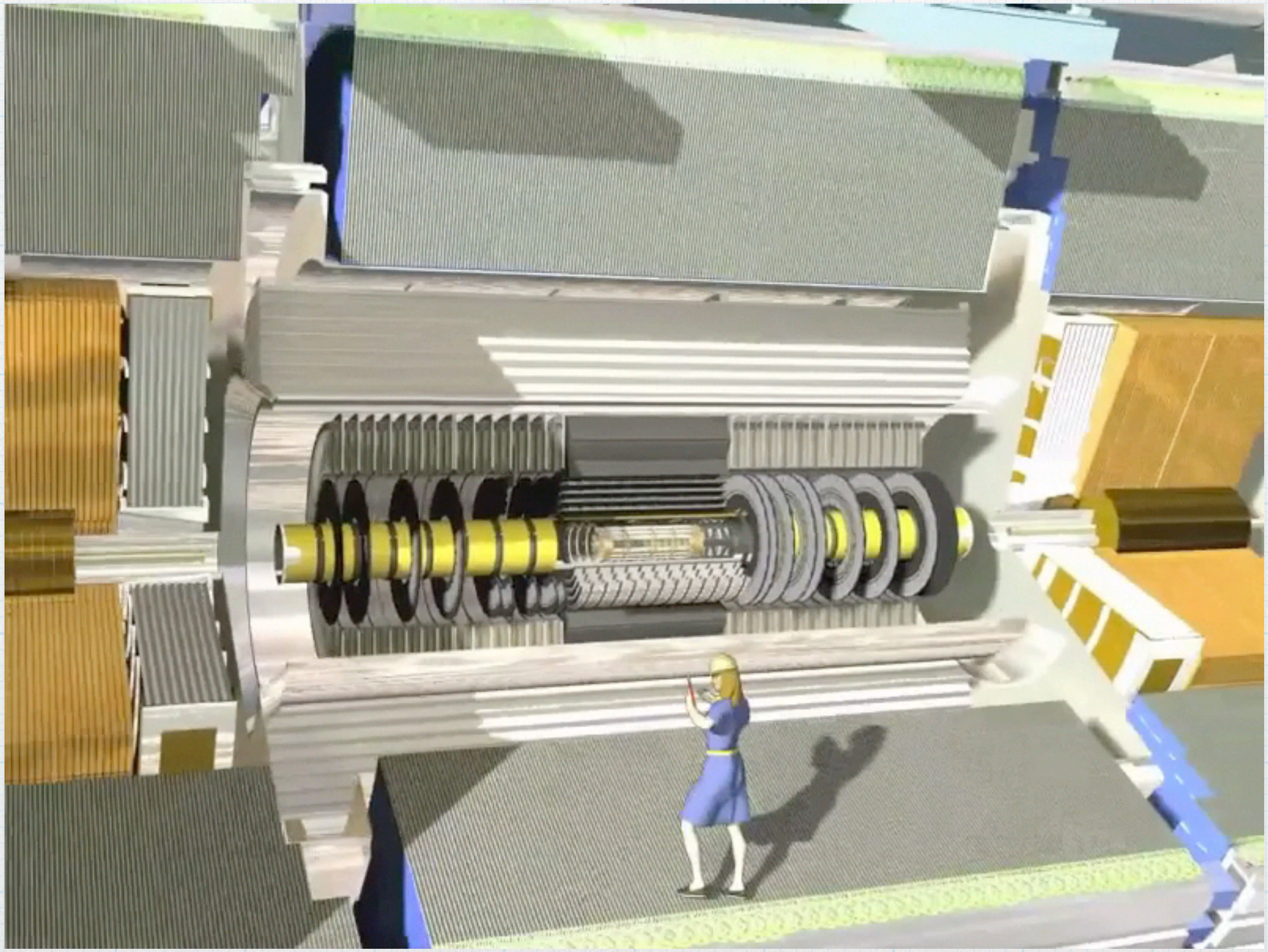

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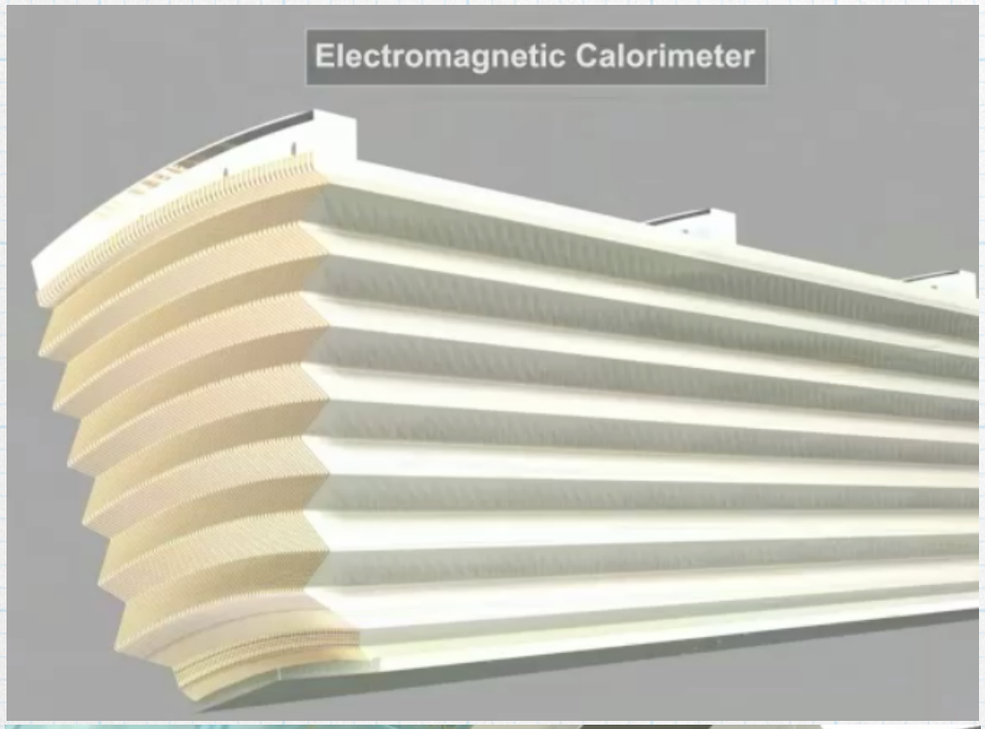
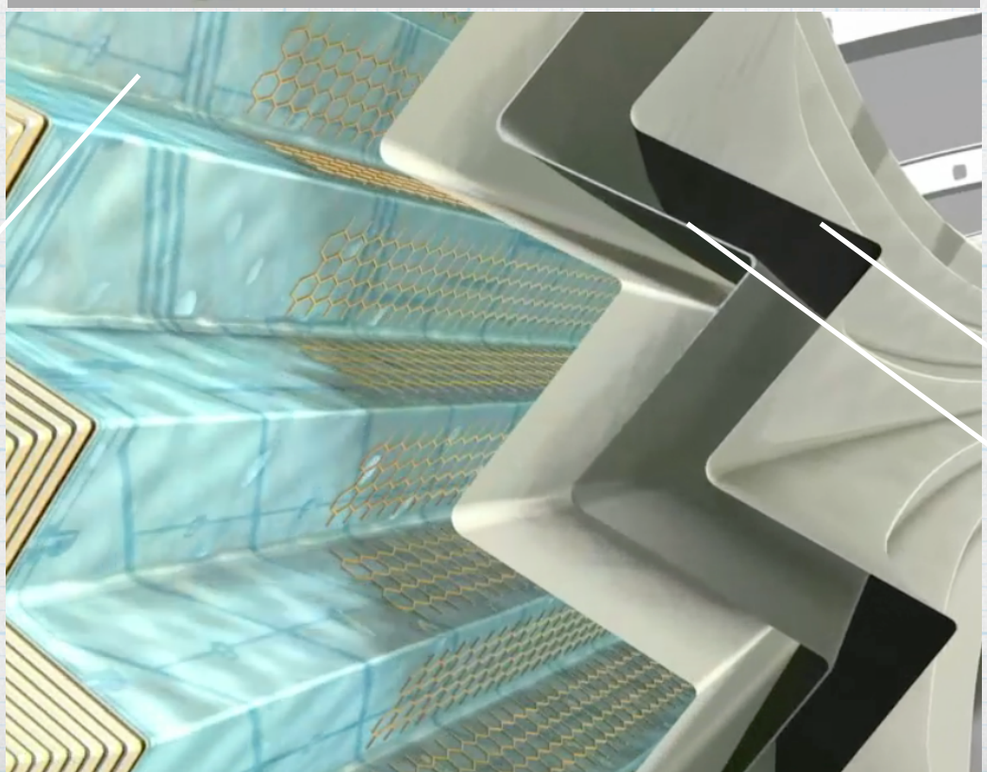
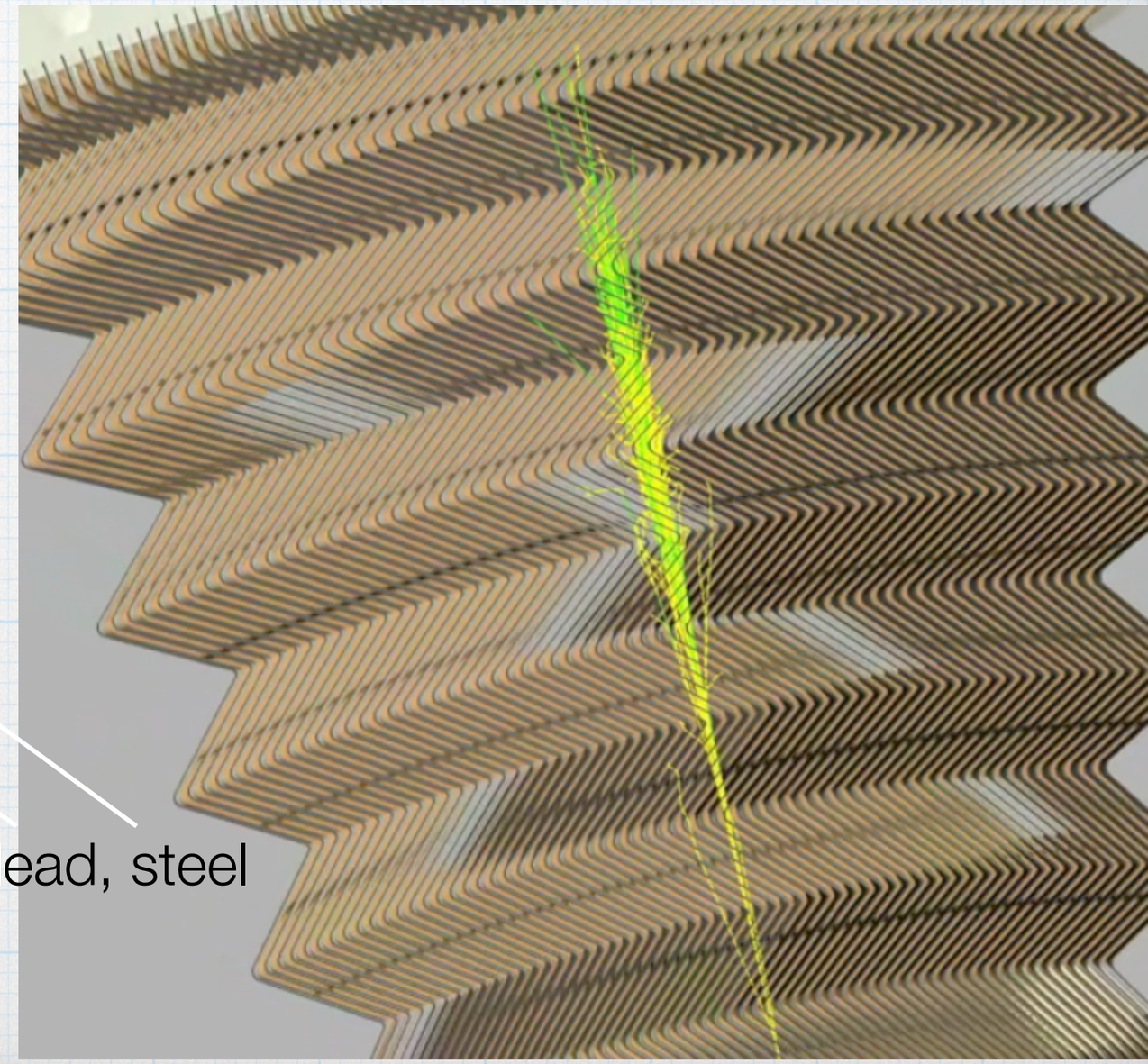


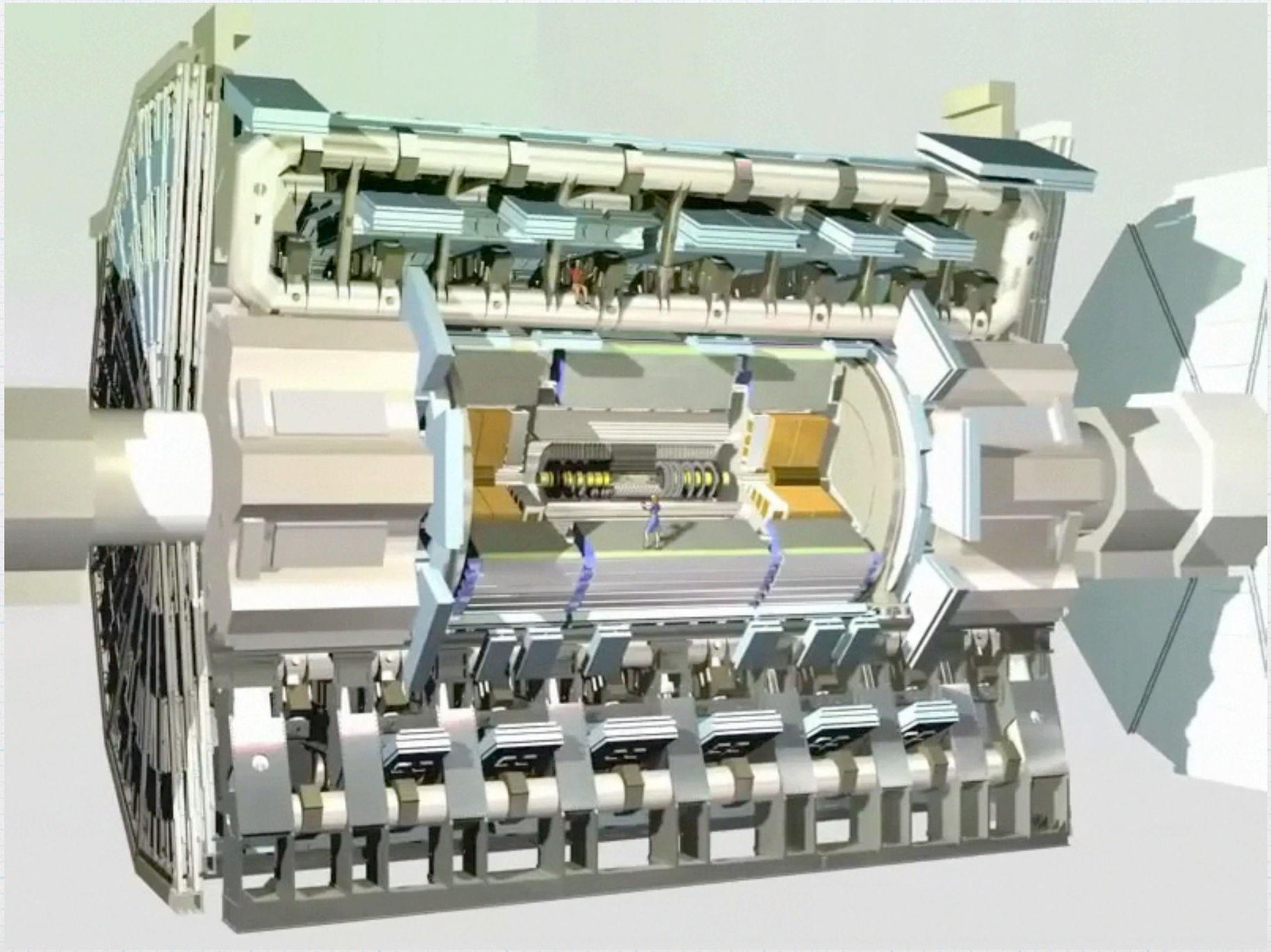


liquid argon (-185°)

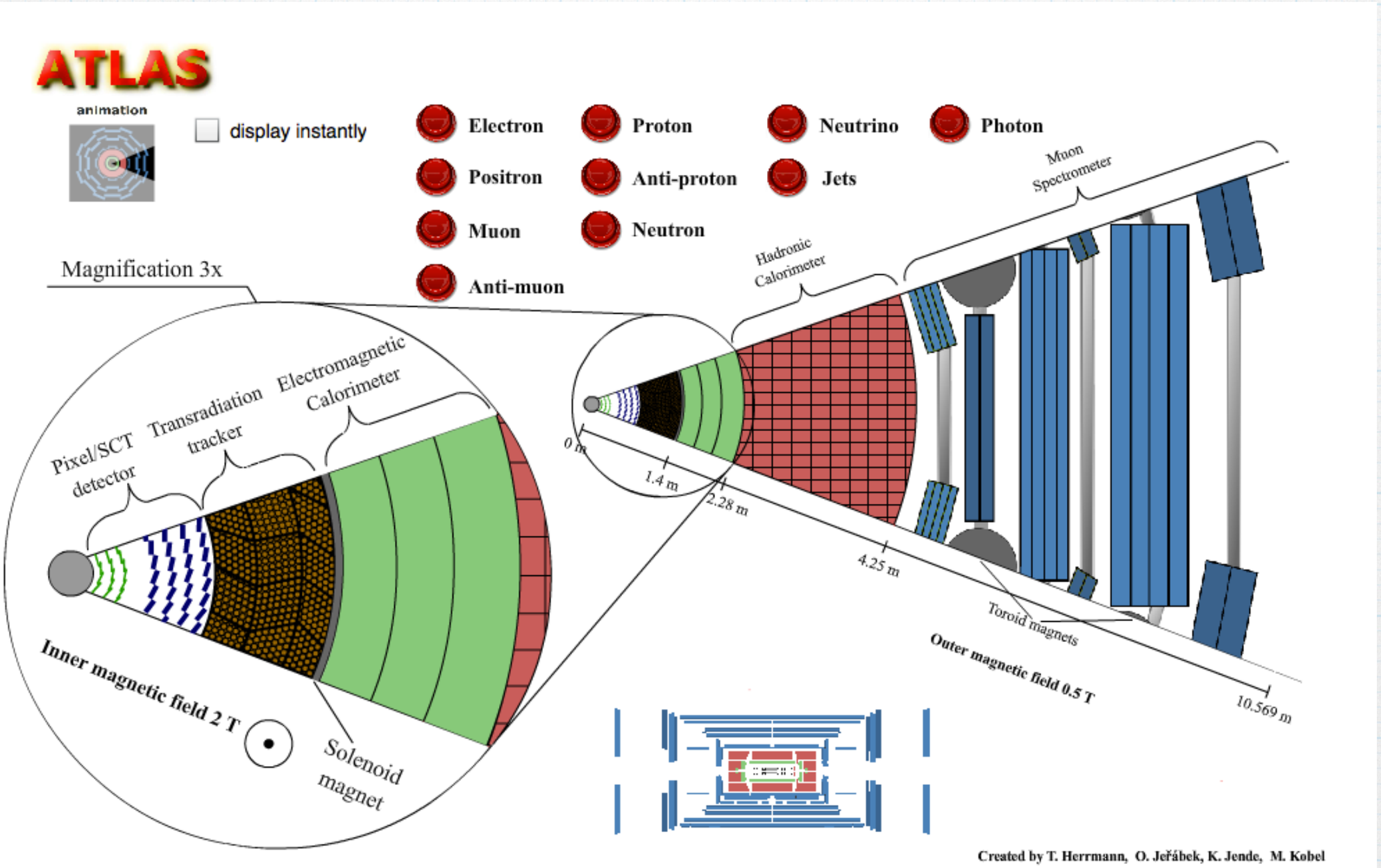


lead, steel

1. Search for W particles with ATLAS

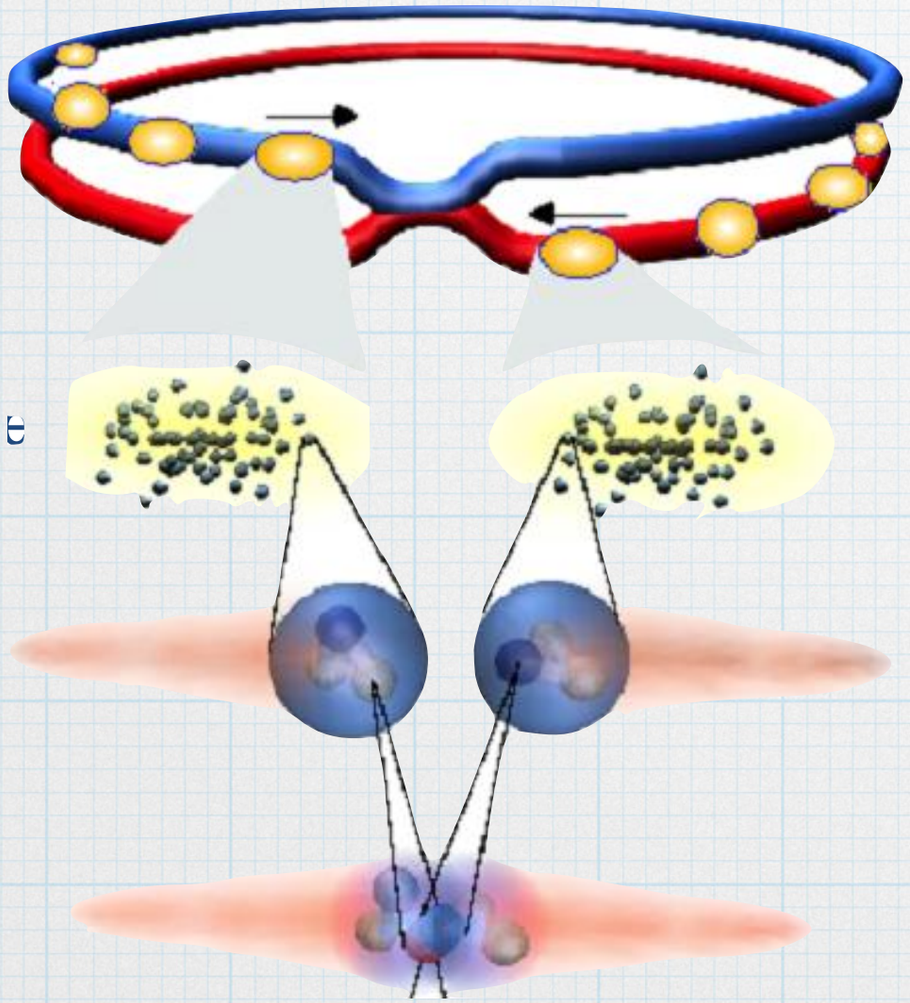


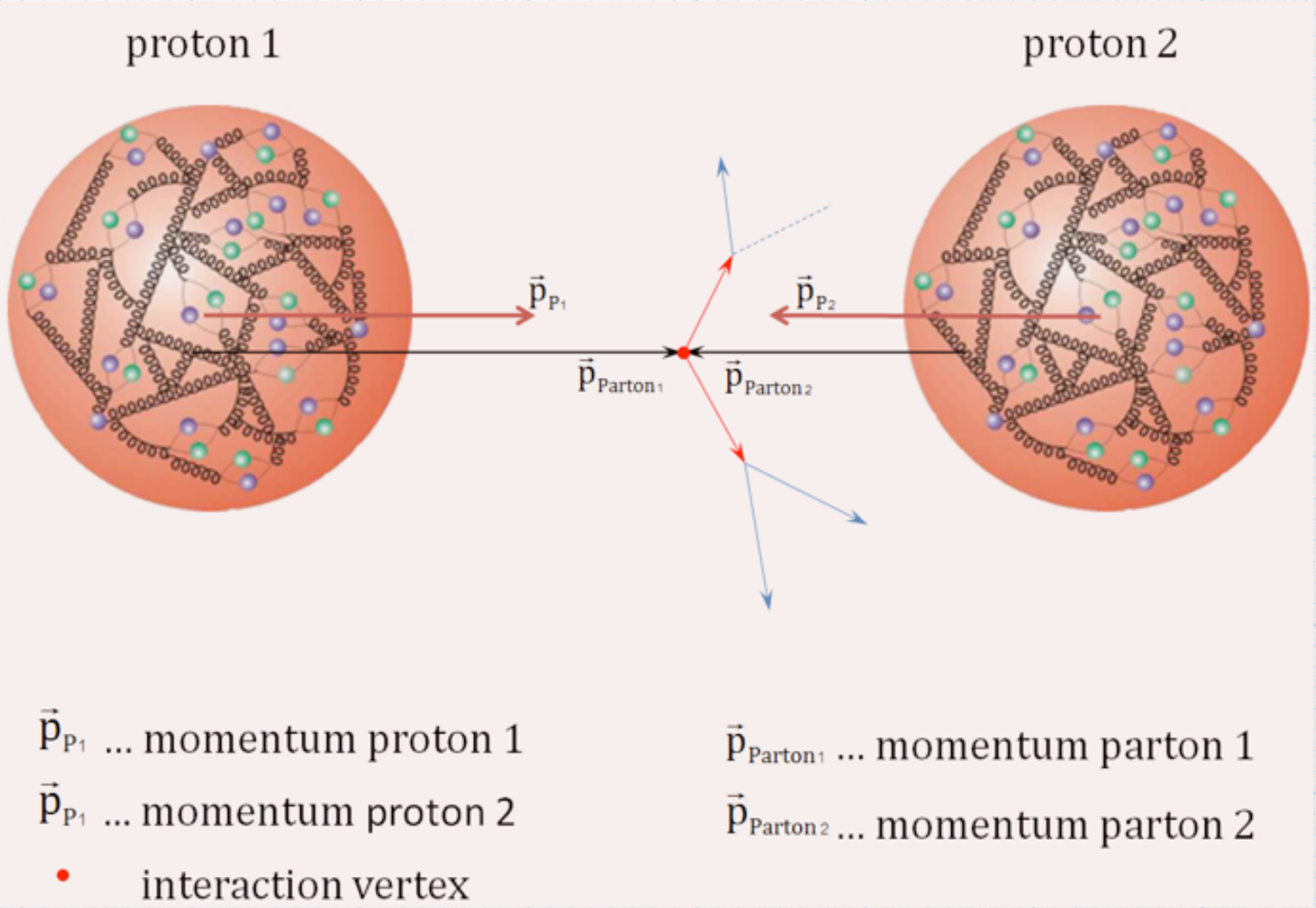
6. Detektorkonzepte



1. Search for W particles with ATLAS

Neutrinos





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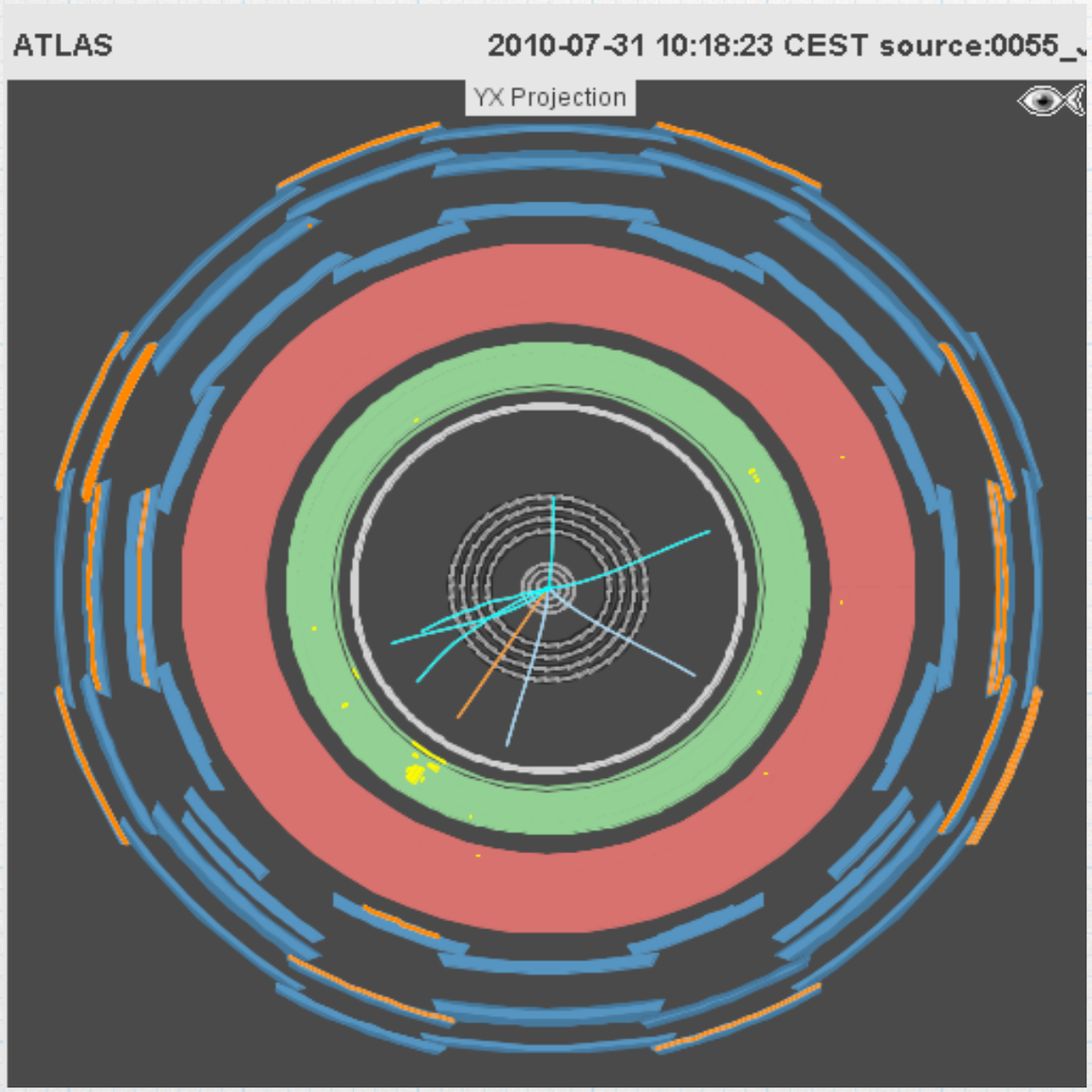
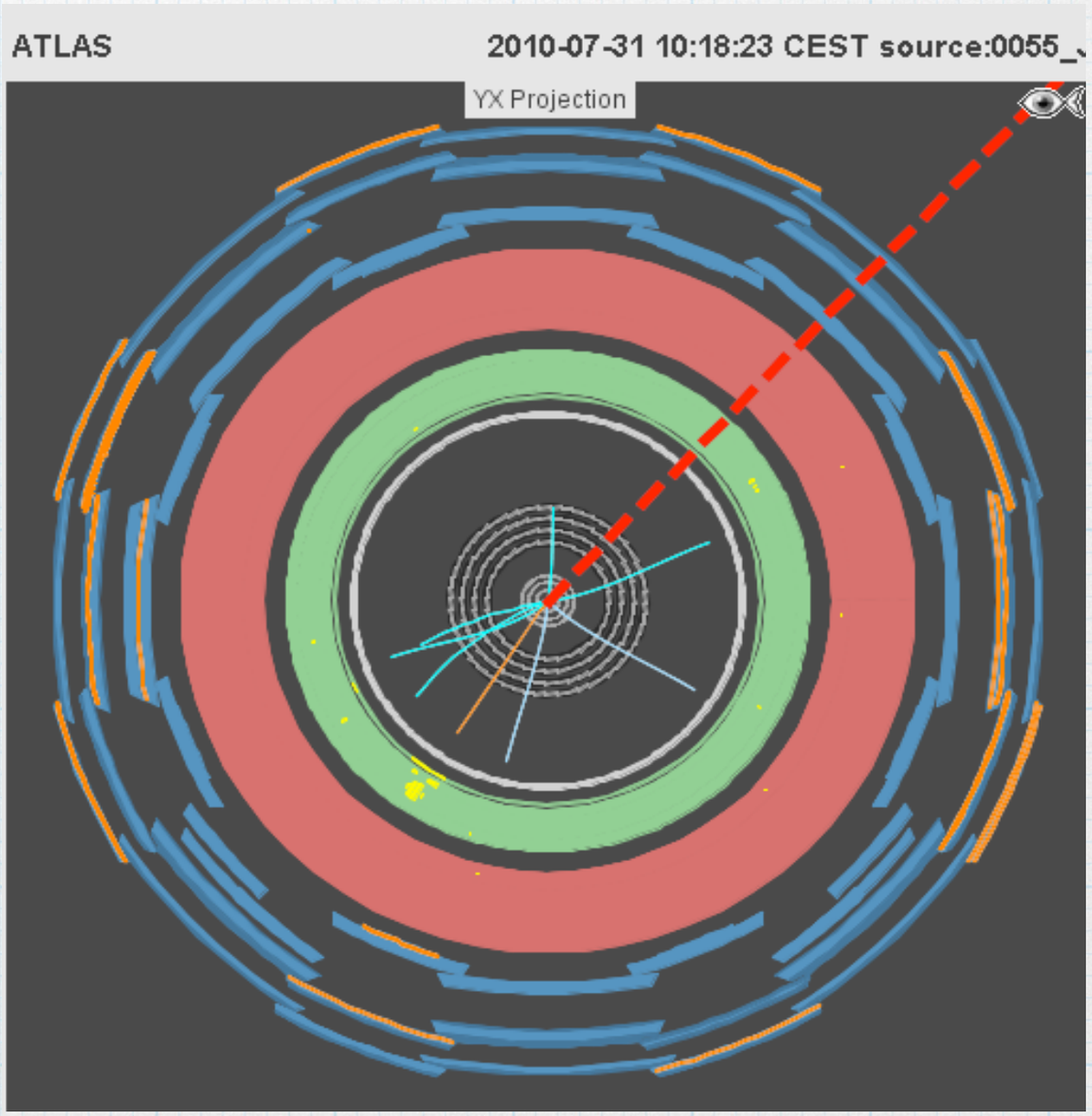
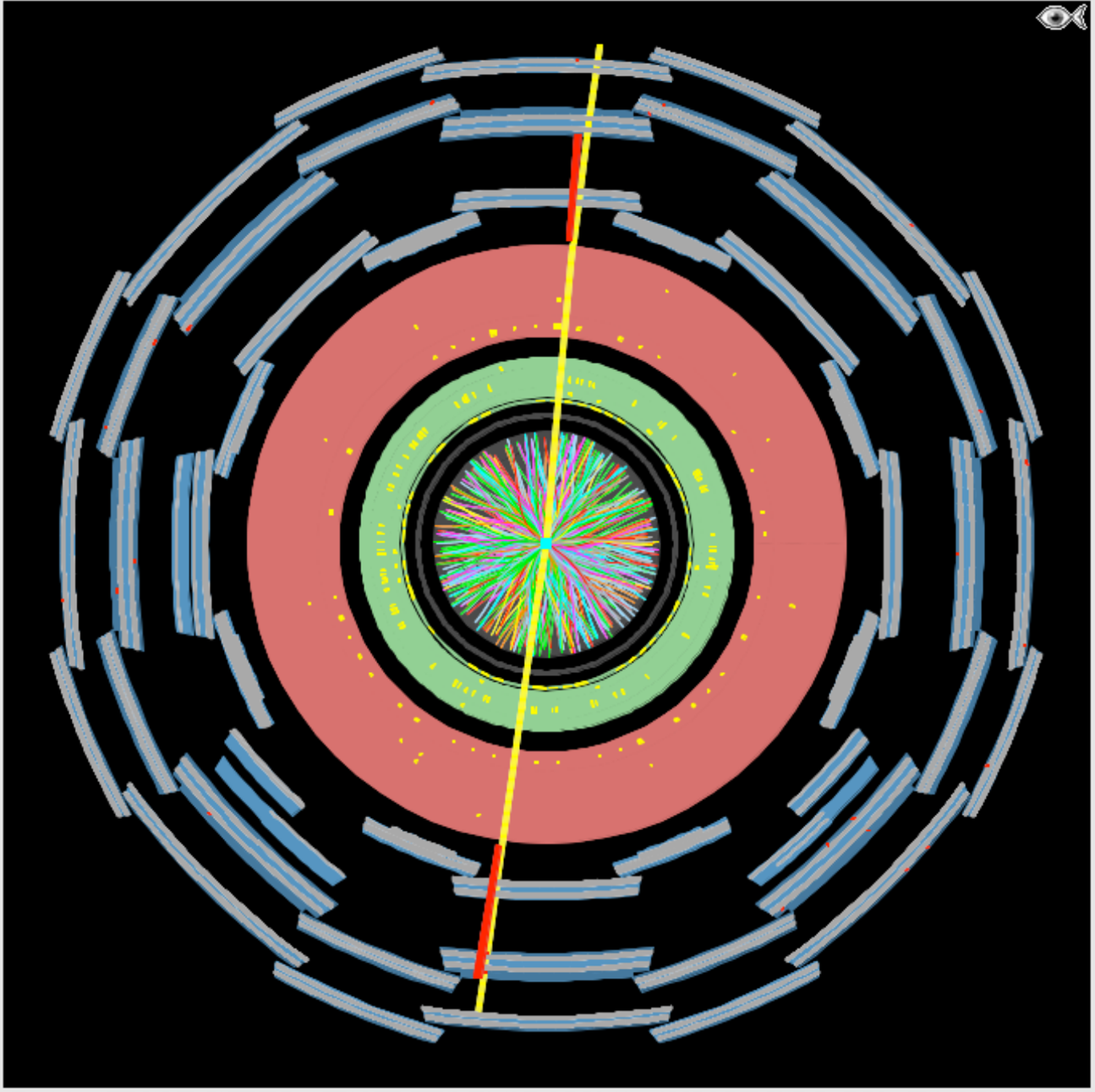
Neutrinos








ATLAS
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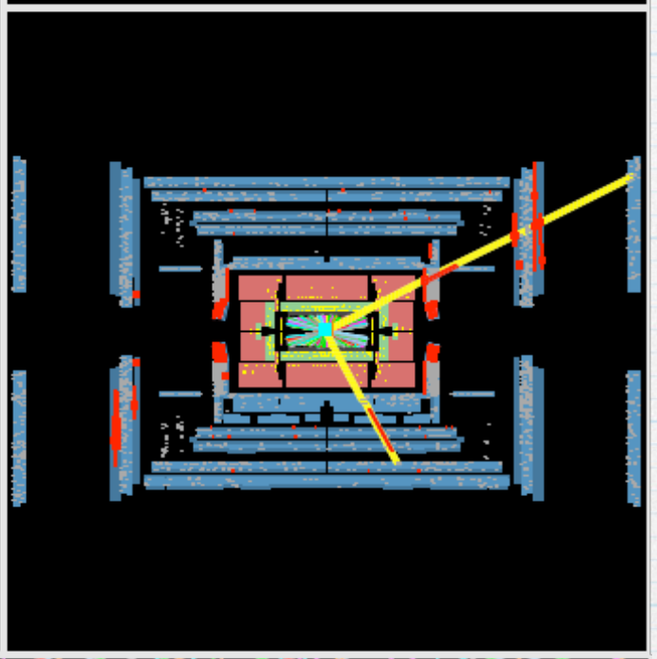
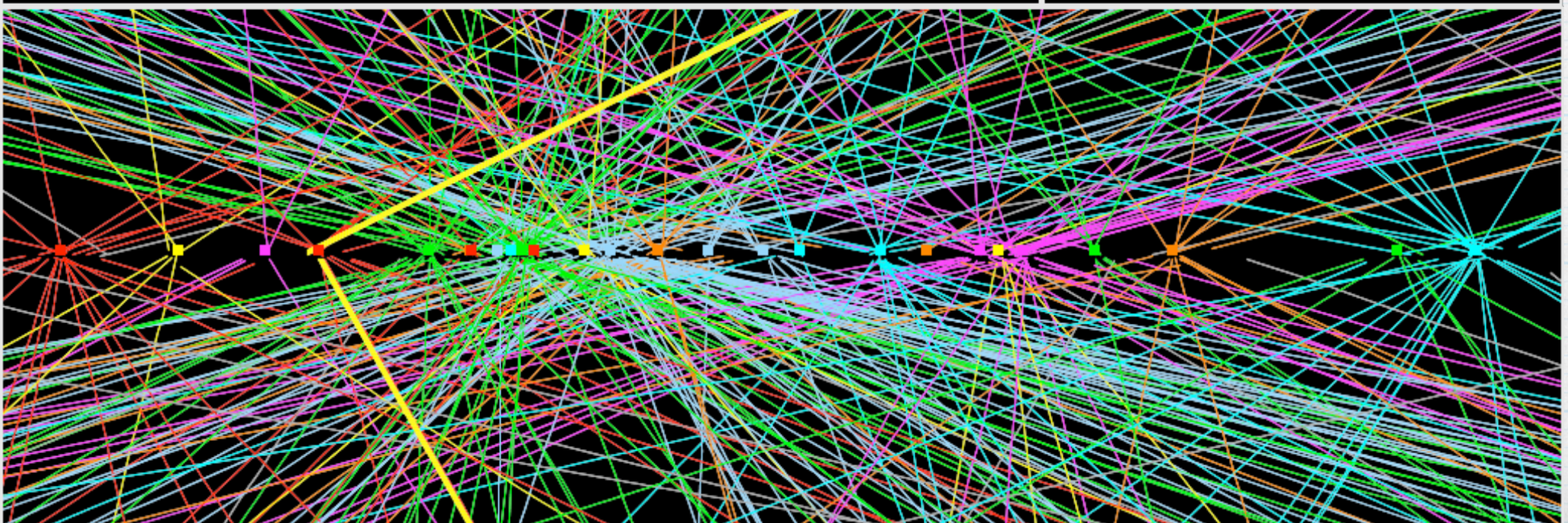
Date: 2012-04-15 16:52:58 CEST





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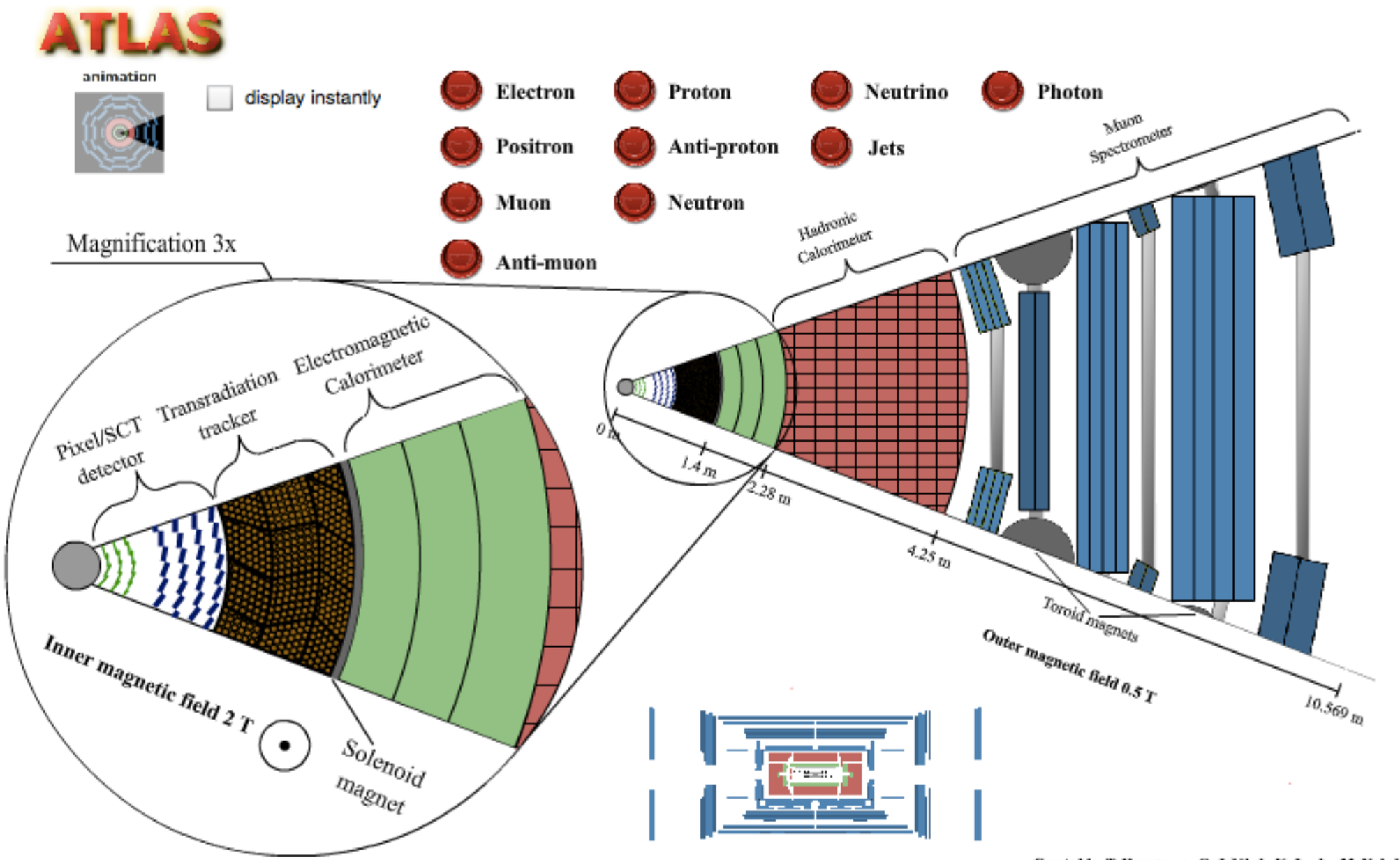
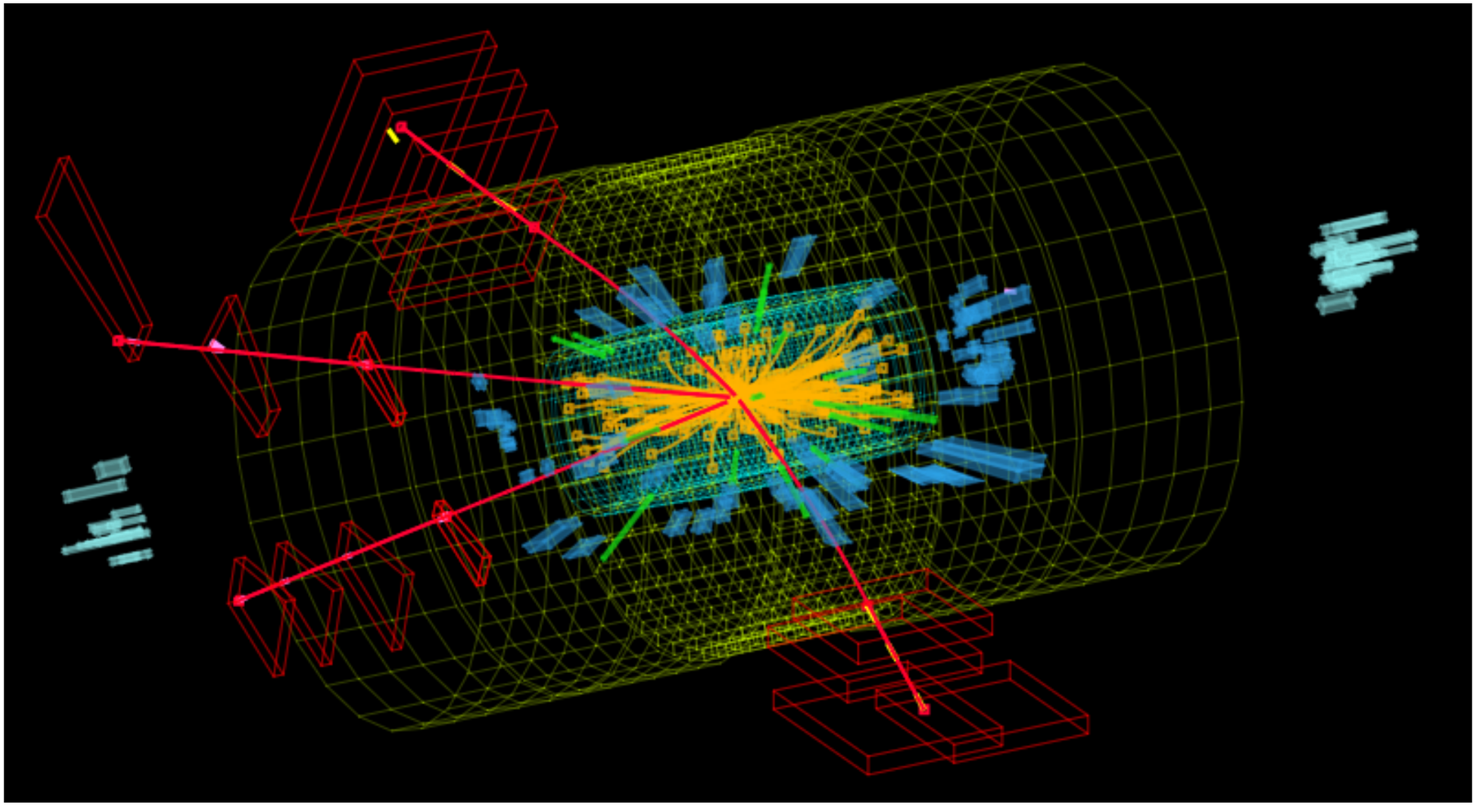


outline

1. Search for W particles with ATLAS
2. Invariant mass searches for known and unknown particles
3. Search for the Higgs

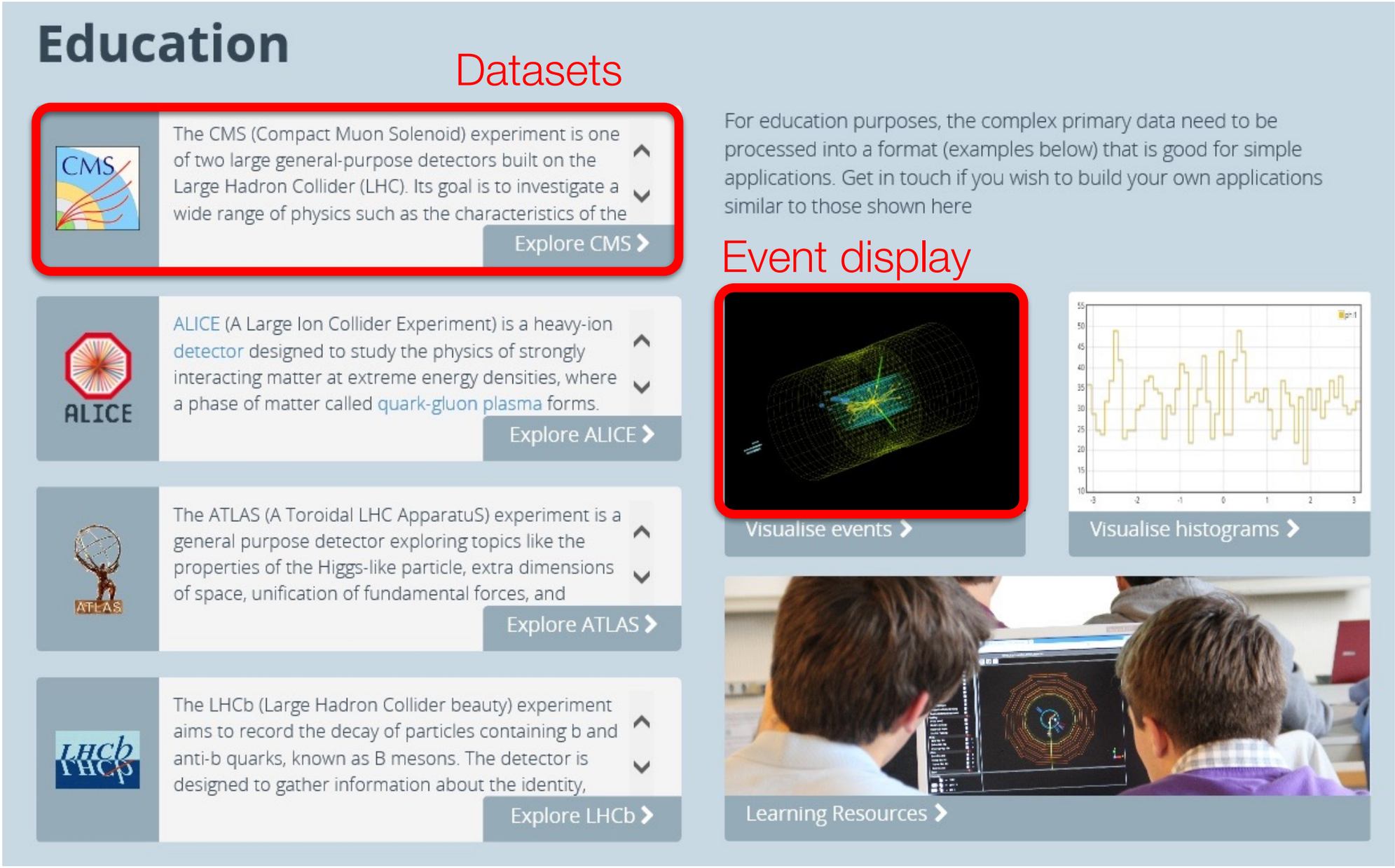
2. Invariant mass searches

Open Data Portal: http://opendata.cern.ch/education



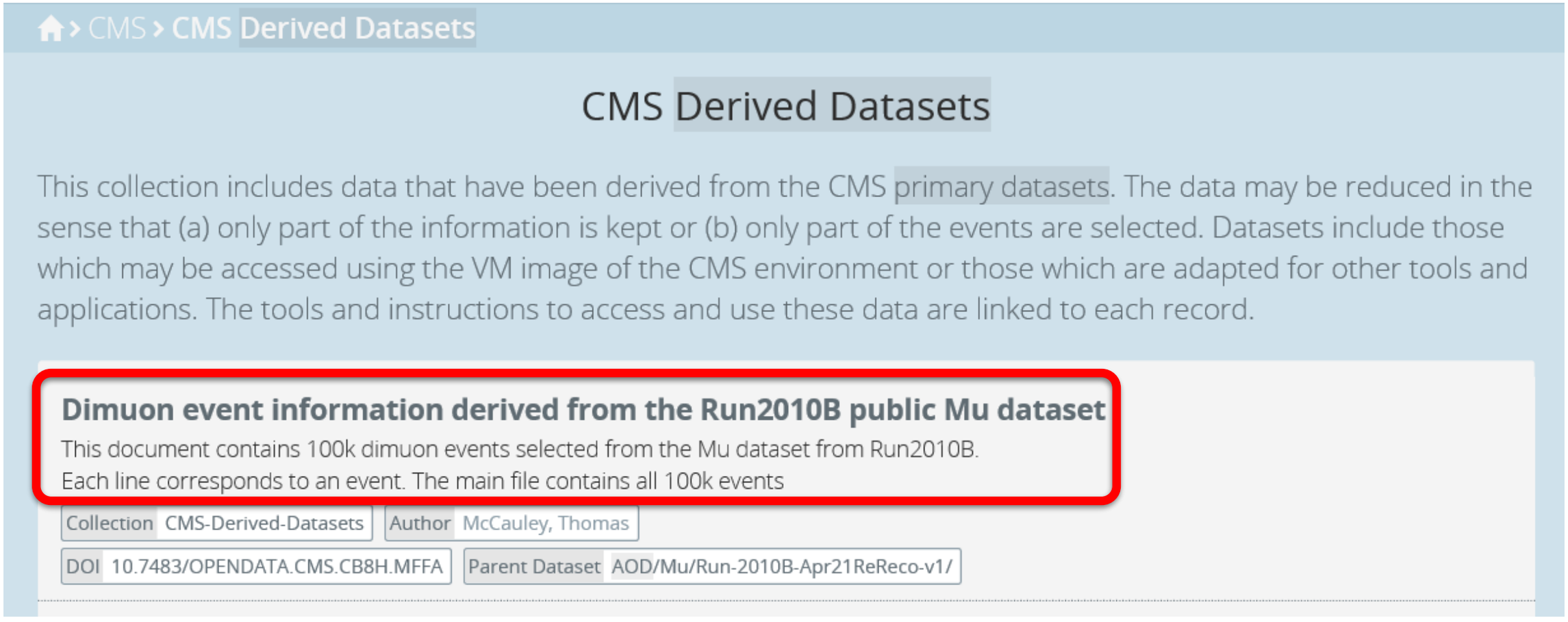
2. Invariant mass searches

Open Data Portal



2. Invariant mass searches

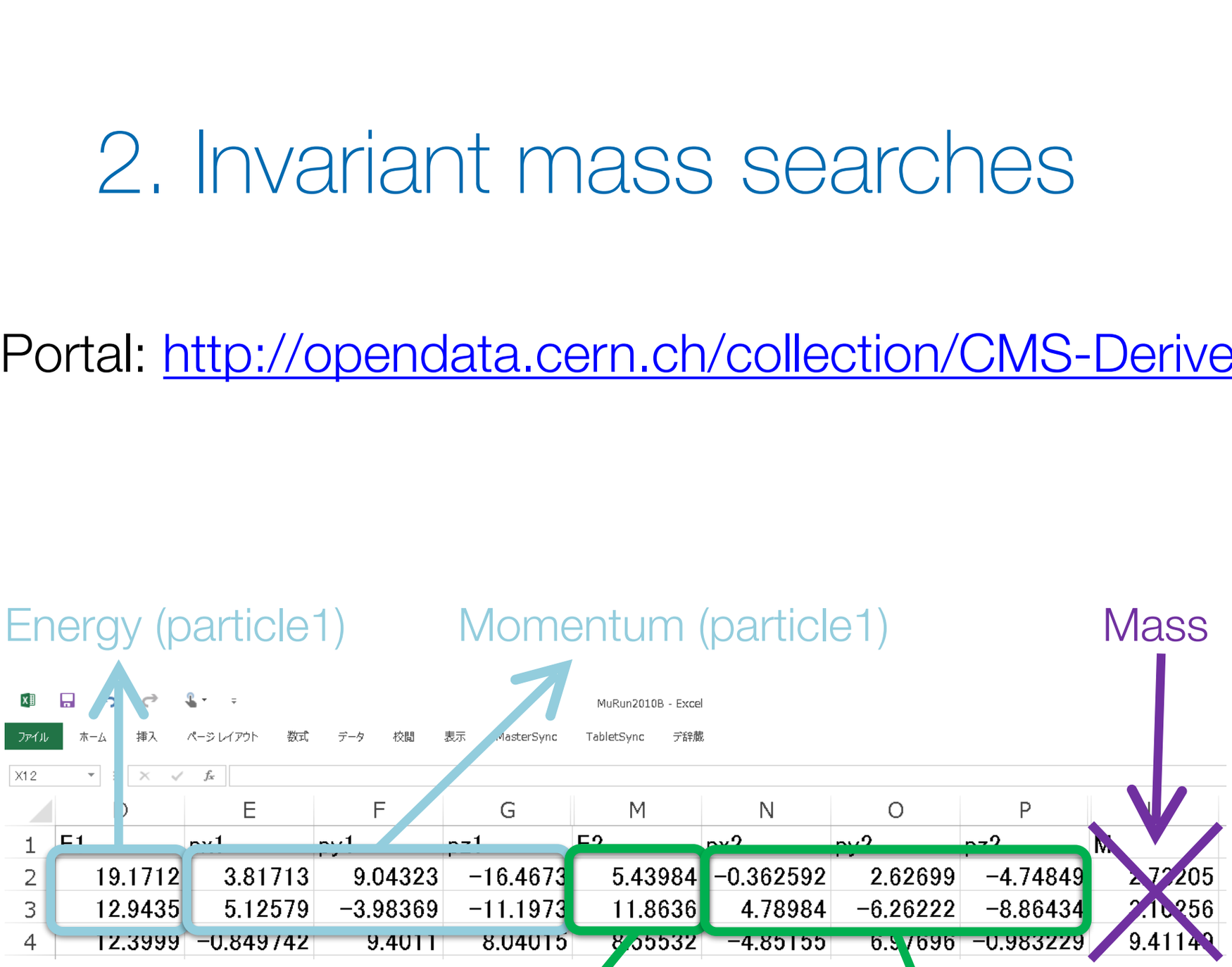
Open Data Portal: http://opendata.cern.ch/collection/CMS-Derived-Datasets



2. Invariant mass searches

Open Data Portal: http://opendata.cern.ch/collection/CMS-Derived-Datasets

Energy (particle1)　　Momentum (particle1)　　Mass



Energy (particle2)　　Momentum (particle2)

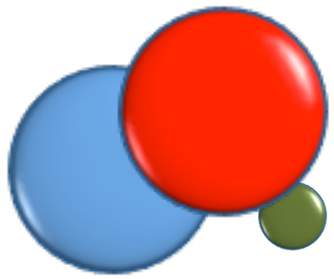
2. Invariant mass searches

Open Data Portal: http://opendata.cern.ch/collection/CMS-Derived-Datasets

E_0, m_0, $p_{0,x}$, $p_{0,y}$, $p_{0,z}$

$E_0^2 = m_0^2c^4+\mathbf{p_0}^2c^2$

$m_0 = (E_0^2/c^4-\mathbf{p_0}^2/c^2)^{1/2}$



E_1, m_1, $p_{1,x}$, $p_{1,y}$, $p_{1,z}$

$E_1^2 =m_1^2c^4+\mathbf{p_1}^2c^2$

E_2, m_2, $p_{2,x}$, $p_{2,y}$, $p_{2,z}$

$E_2^2 =m_2^2c^4+\mathbf{p_2}^2c^2$

$m_0 =((E_1+E_2)^2/c^4-(\mathbf{p_1+p_2})^2/c^2)^{1/2}$

to measure energy and momentum

$m_0 =(((m_1^2c^4+\mathbf{p_1}^2c^2)^{1/2}+E_2)^2/c^4-(\mathbf{p_1+p_2})^2/c^2)^{1/2}$

to measure momentum and identify the particle unambiguously

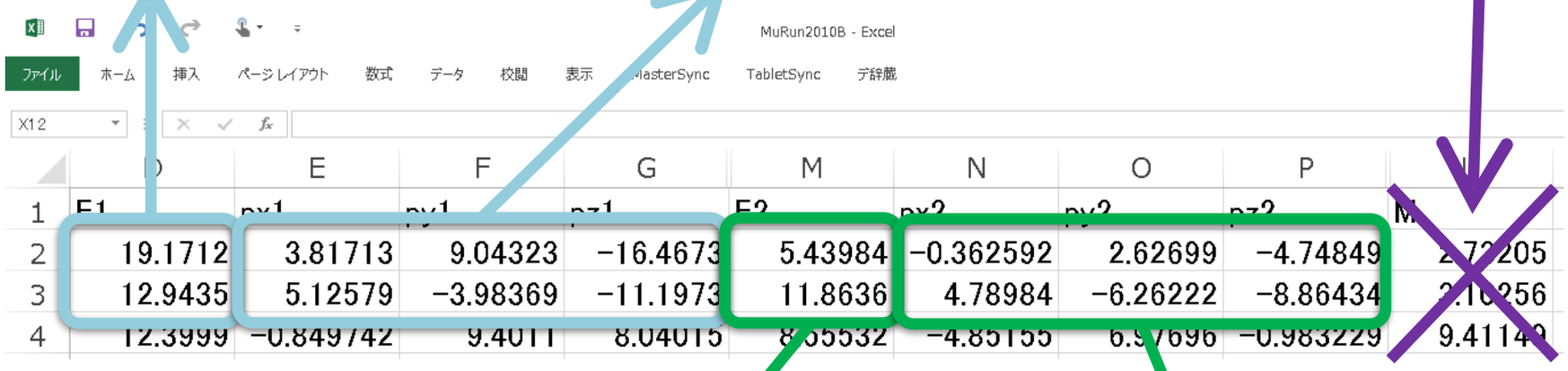
2. Invariant mass searches

Open Data Portal: http://opendata.cern.ch/collection/CMS-Derived-Datasets

Energy (particle1)

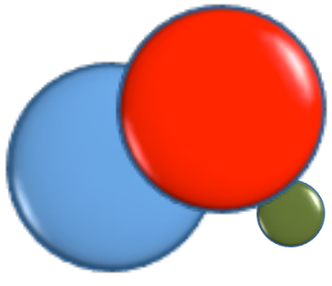
Momentum (particle1)

Mass



Energy (particle2)

Momentum (particle2)



$m_0 = ((E_1+E_2)^2/c^4-(\mathbf{p_1}+\mathbf{p_2})^2/c^2)^{1/2}$

$m_0 = (((m_1^2c^4+\mathbf{p_1}^2c^2)^{1/2}+E_2)^2/c^4-(\mathbf{p_1}+\mathbf{p_2})^2/c^2)^{1/2}$

$E_0, m_0, p_{0,x}, p_{0,y}, p_{0,z}$

$E_1, m_1, p_{1,x}, p_{1,y}, p_{1,z}$

$E_2, m_2, p_{2,x}, p_{2,y}, p_{2,z}$

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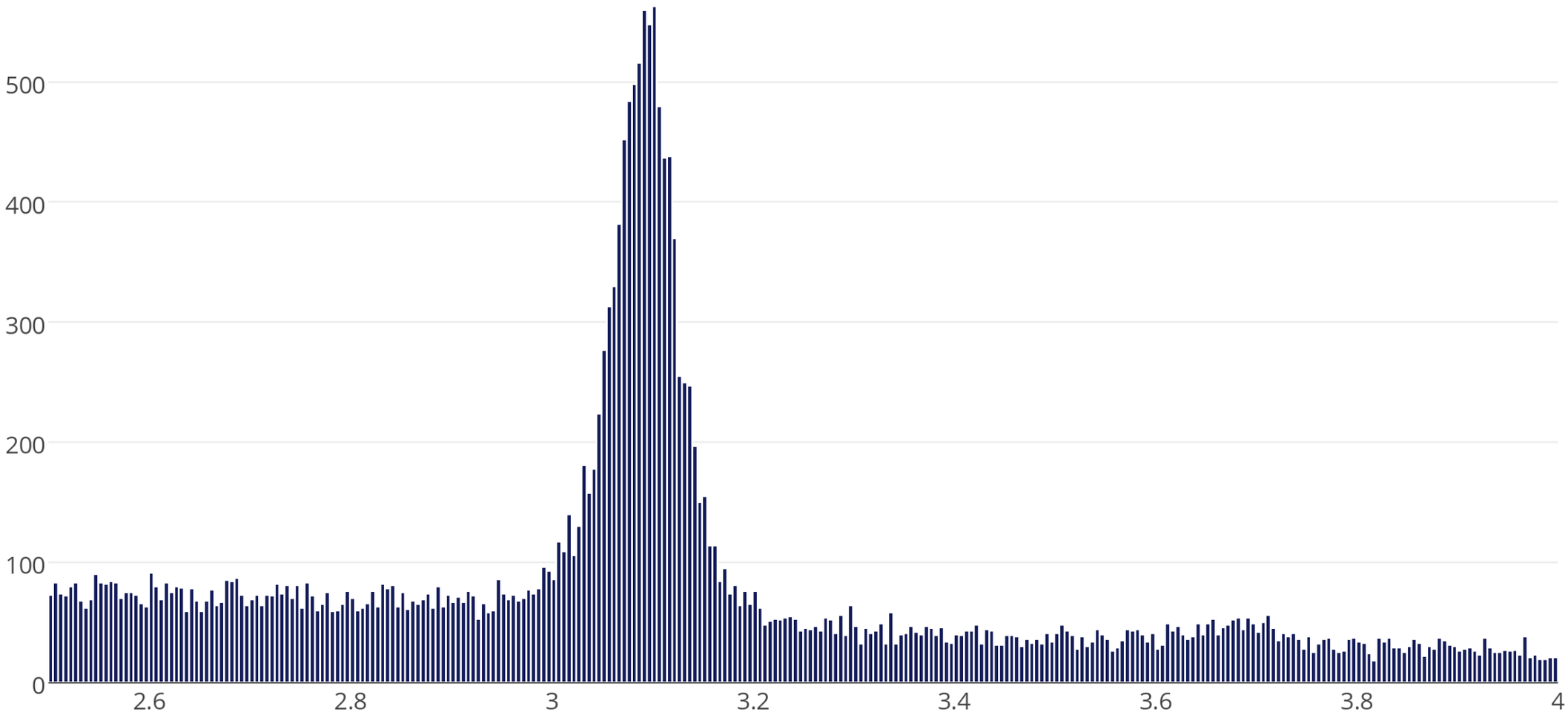

outline

1. Search for W particles with ATLAS
2. Invariant mass searches for known and unknown particles
3. Search for the Higgs

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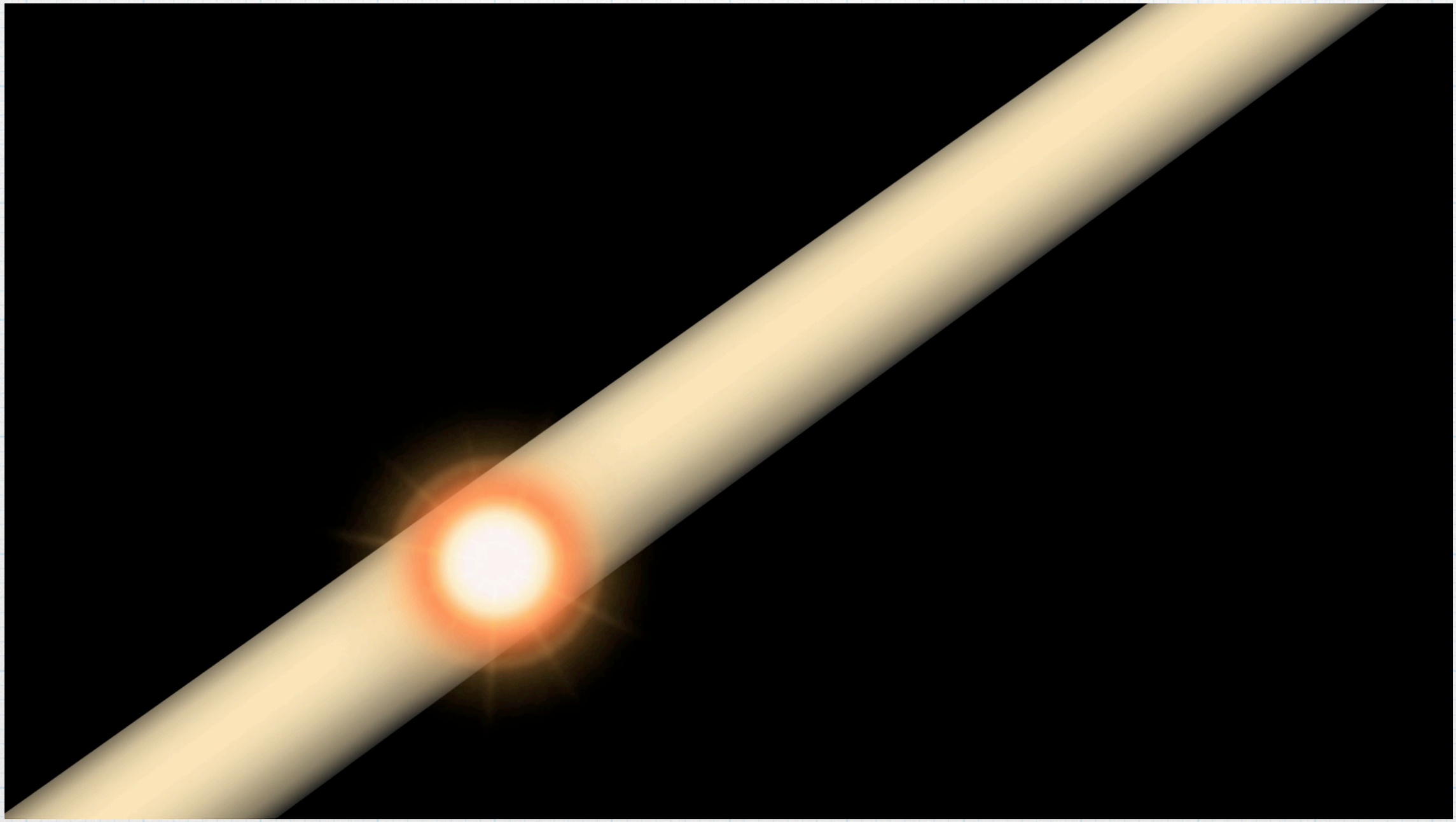

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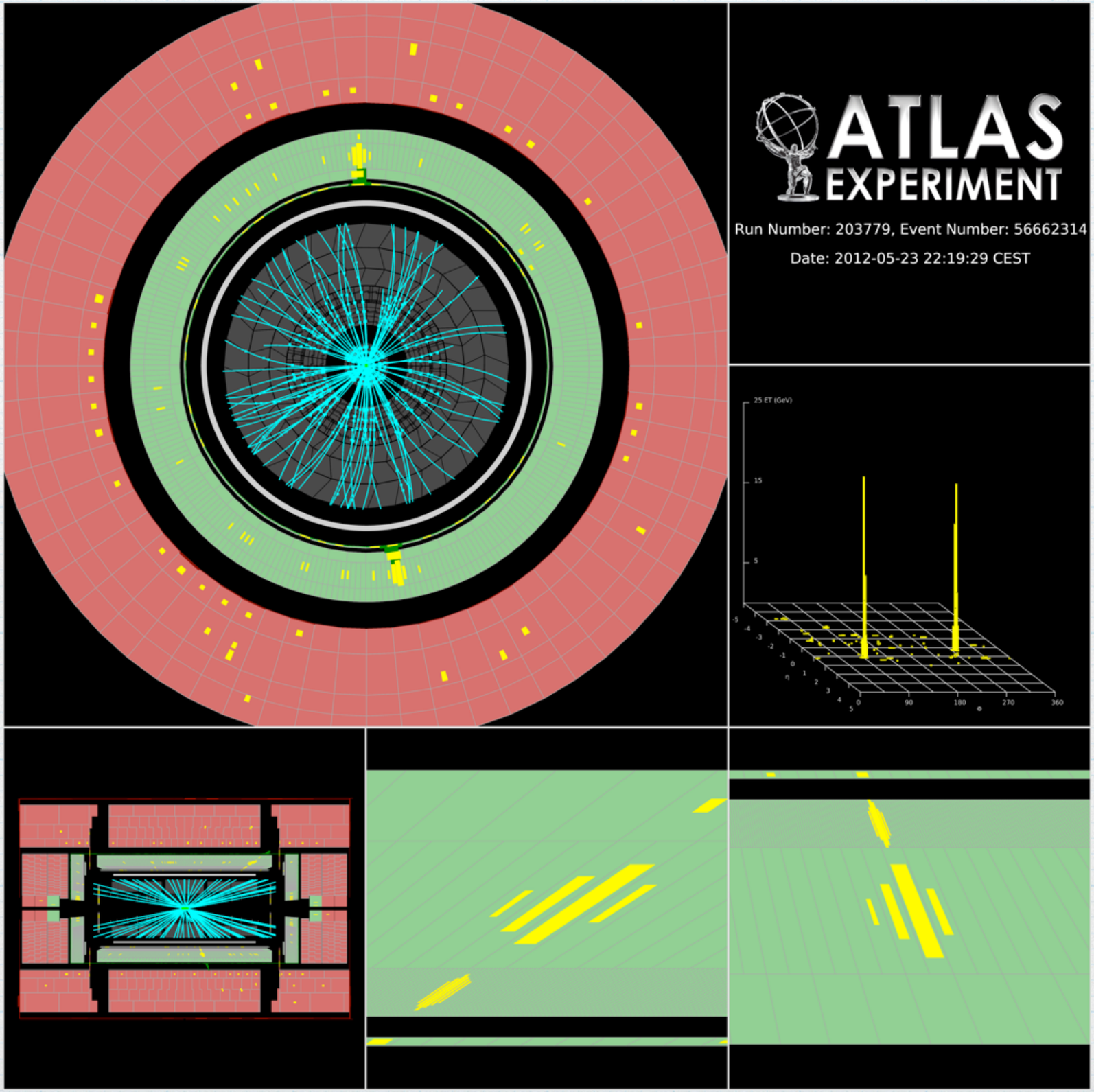

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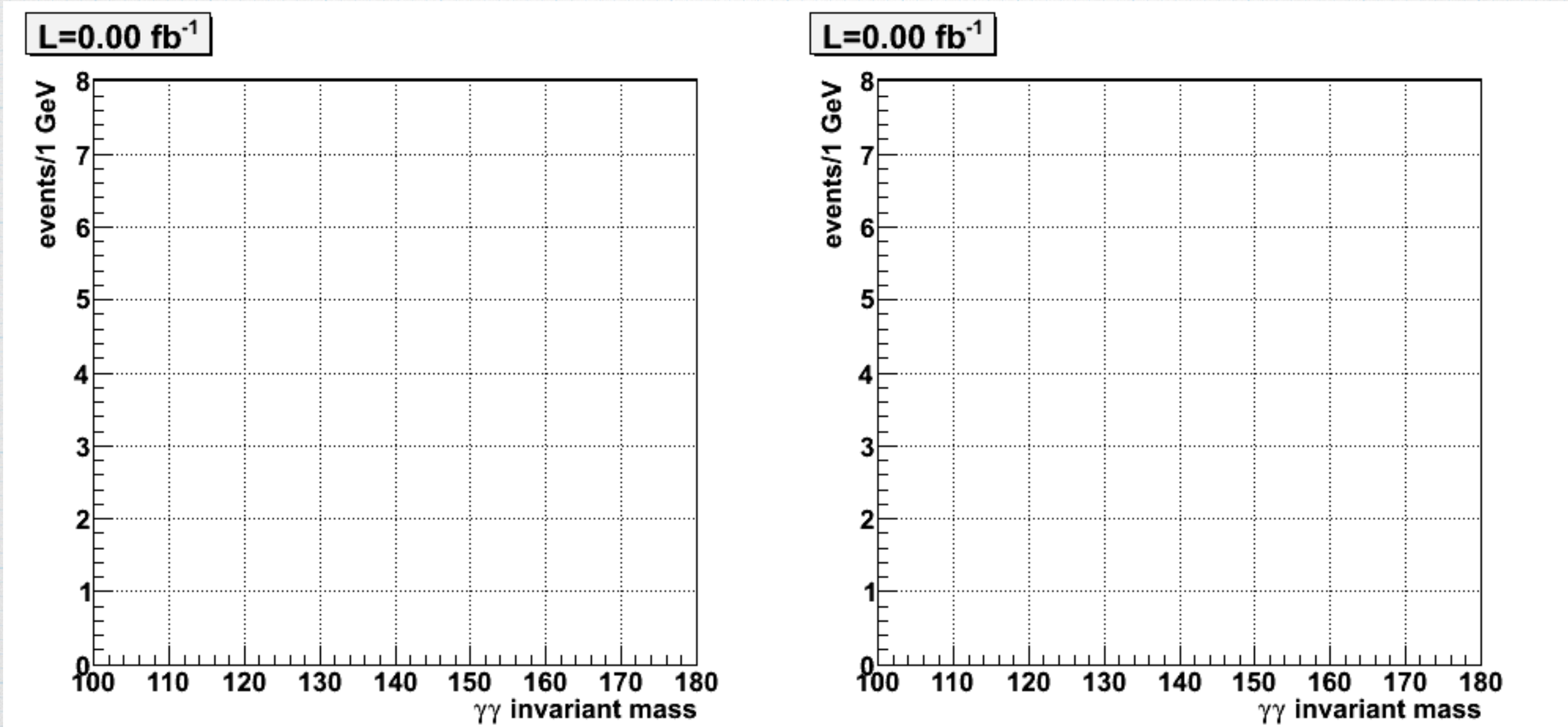
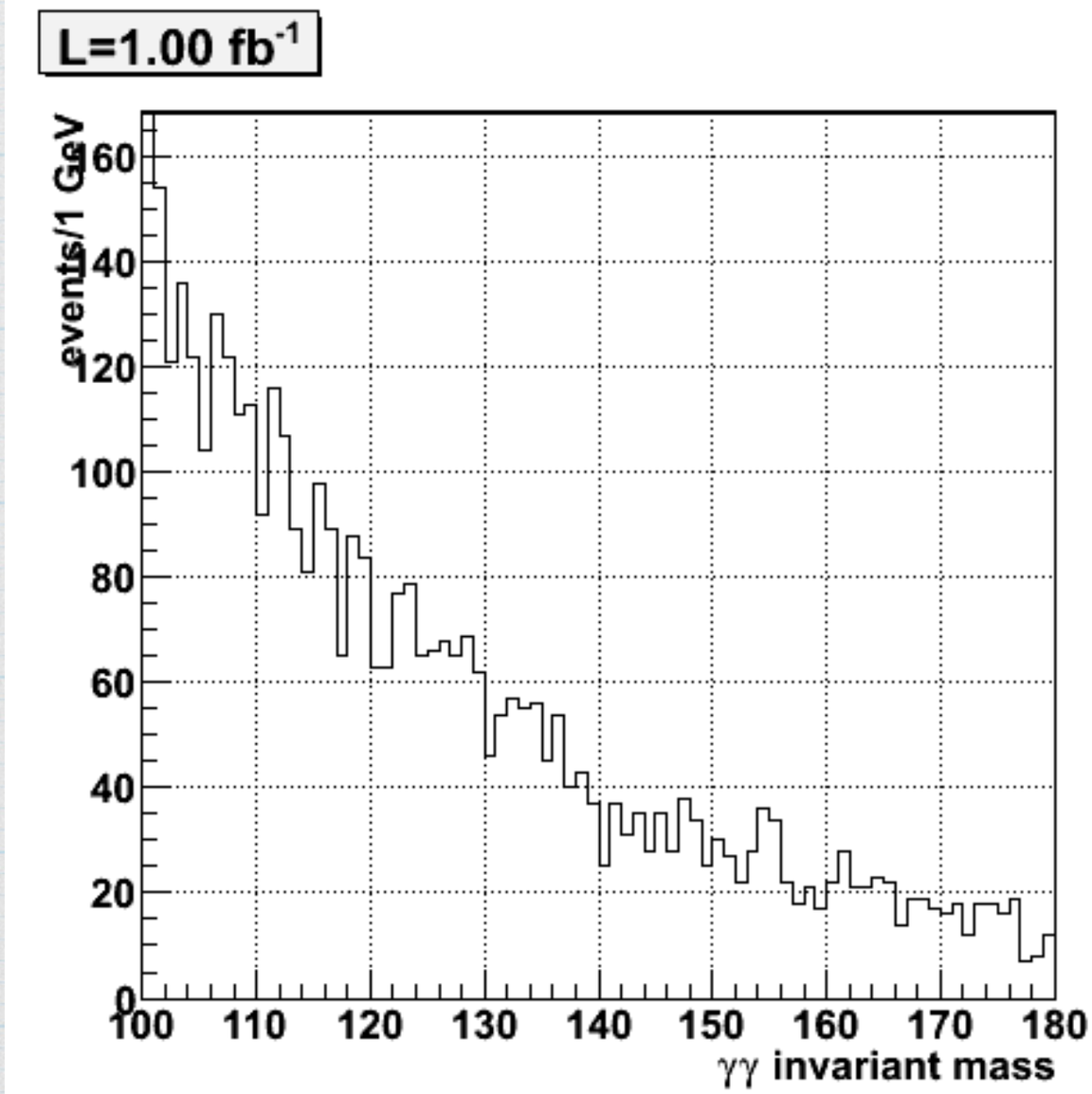
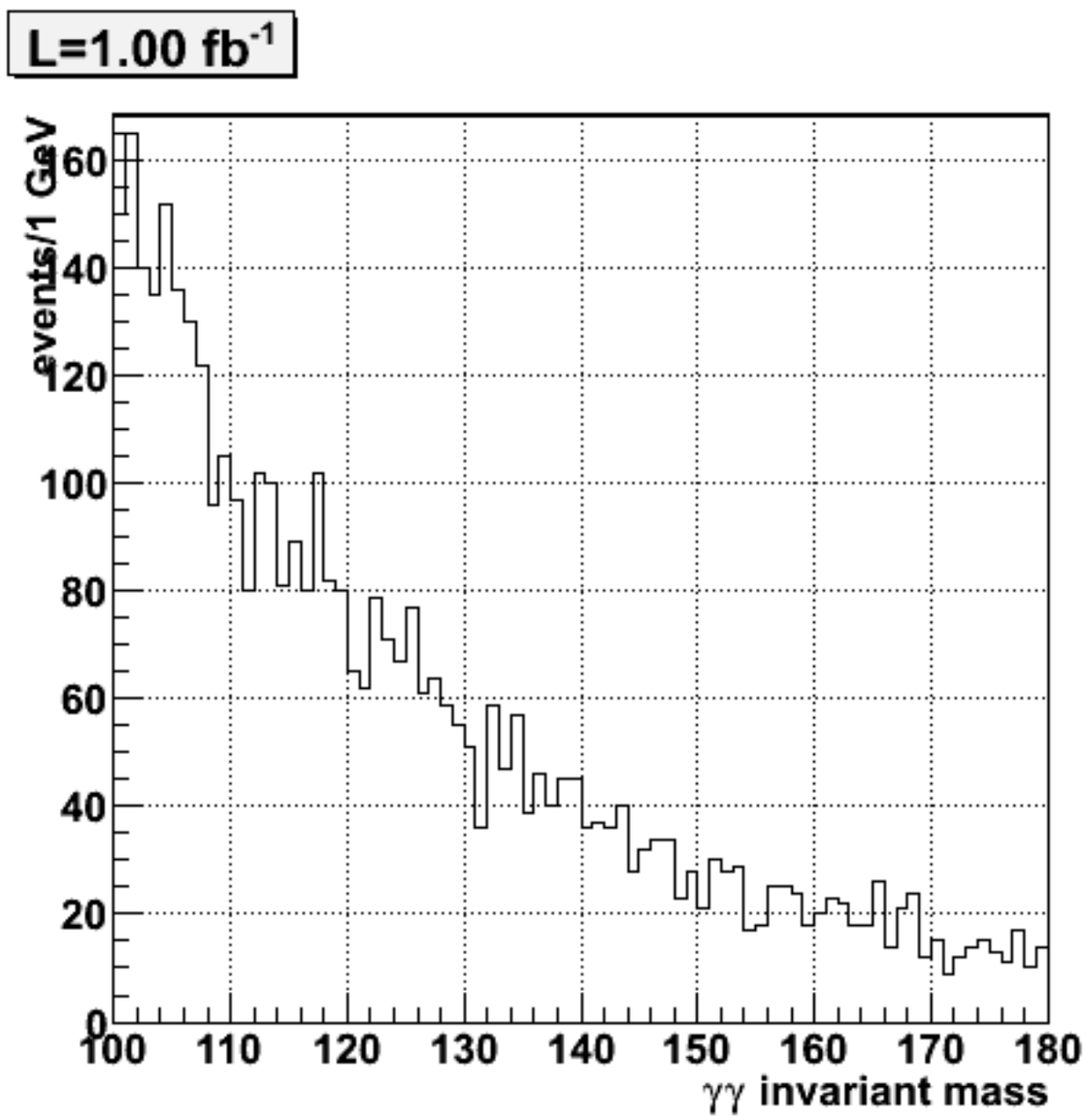


1 fb^{-1}(inverse femtobarn) corresponds to about 100 trillion (100 times 10^{12}) proton-proton collisions

3. Search for the Higgs





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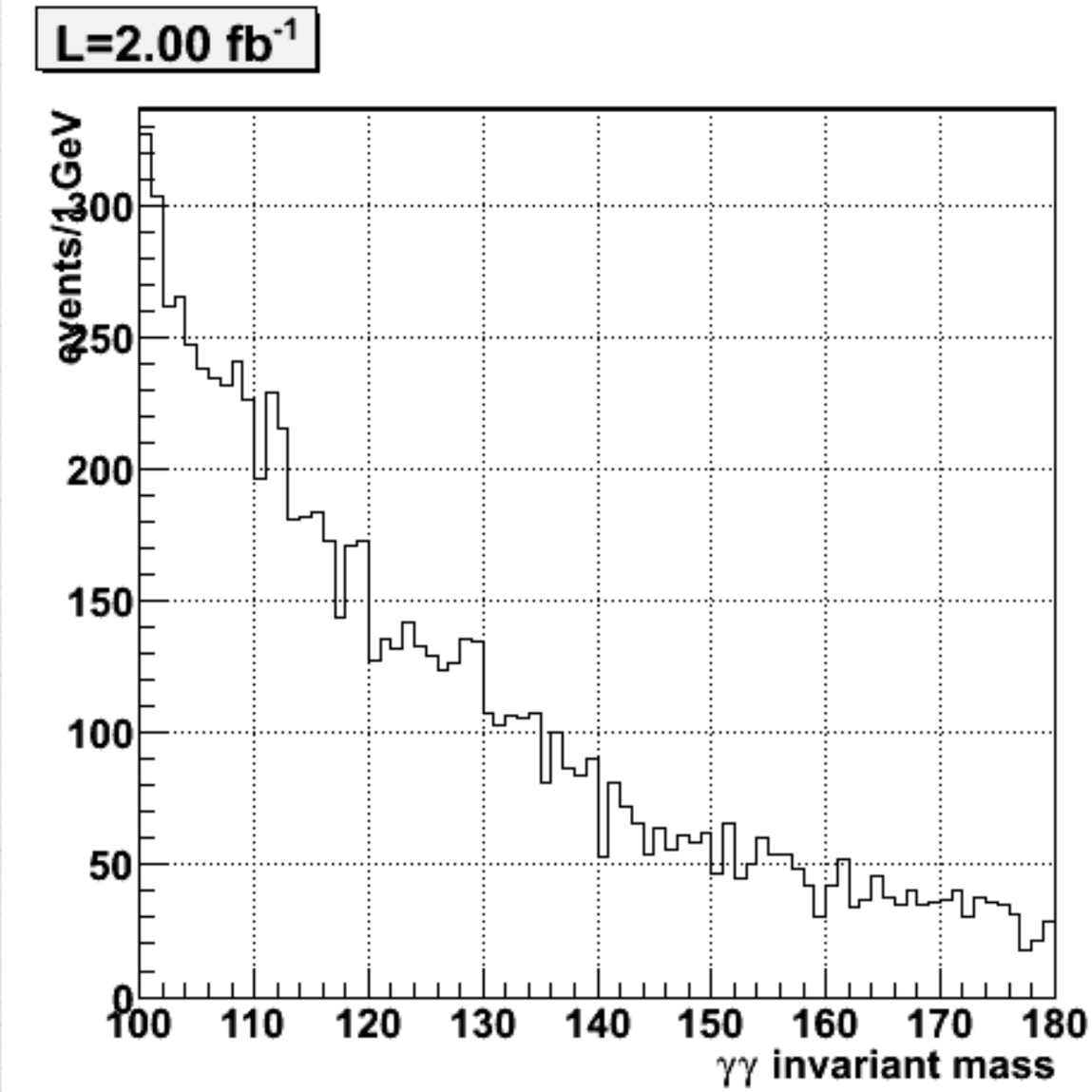

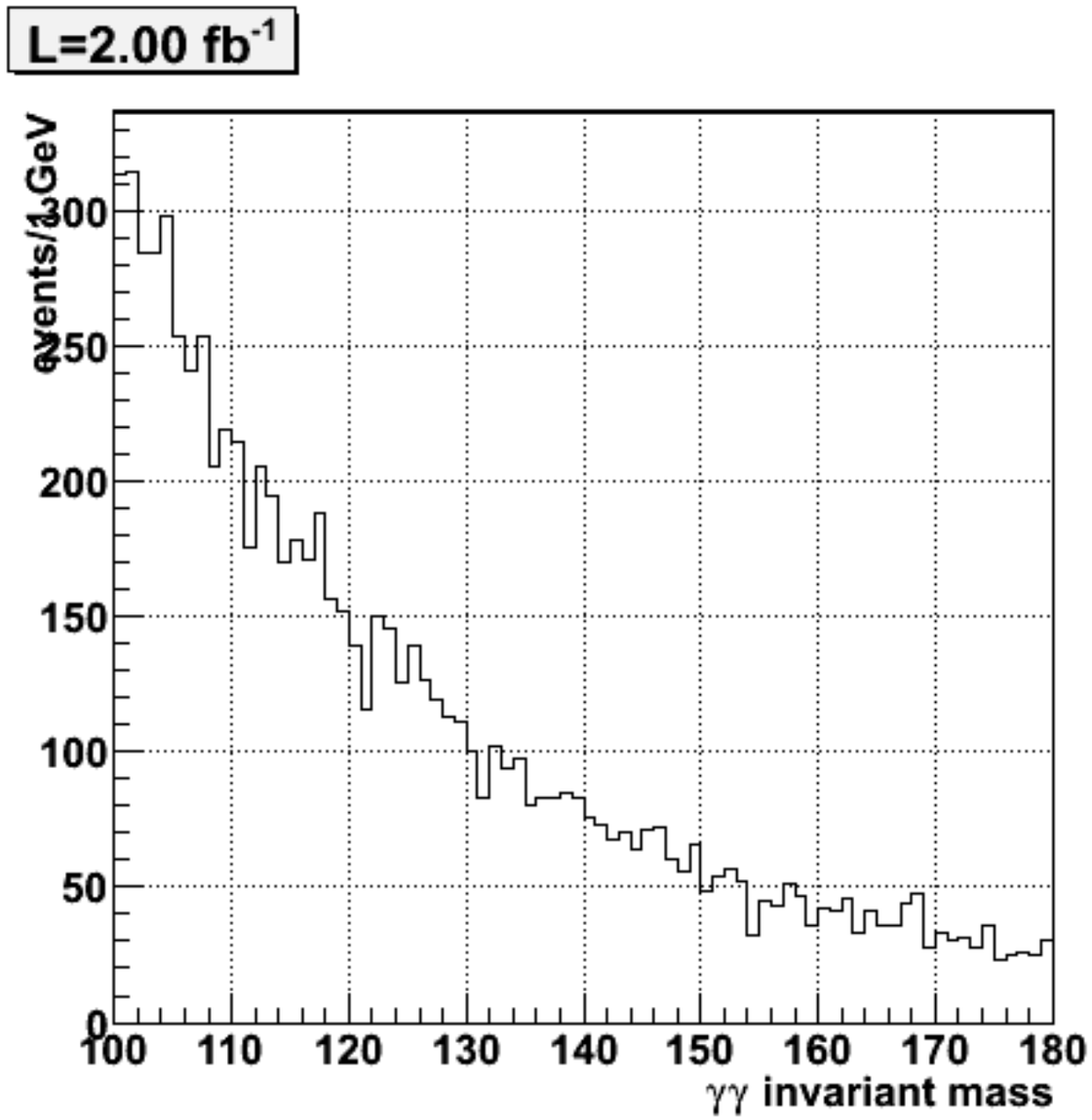

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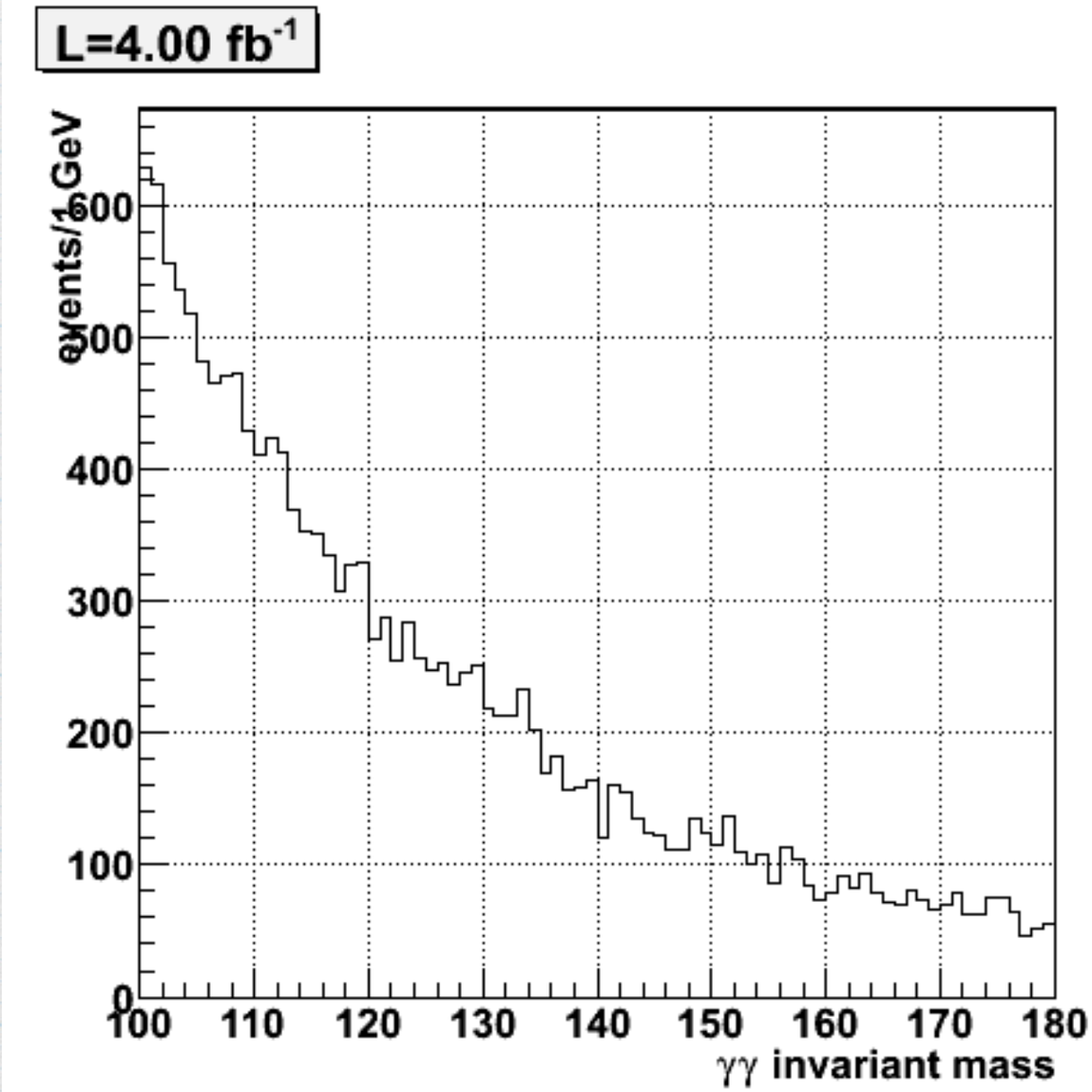

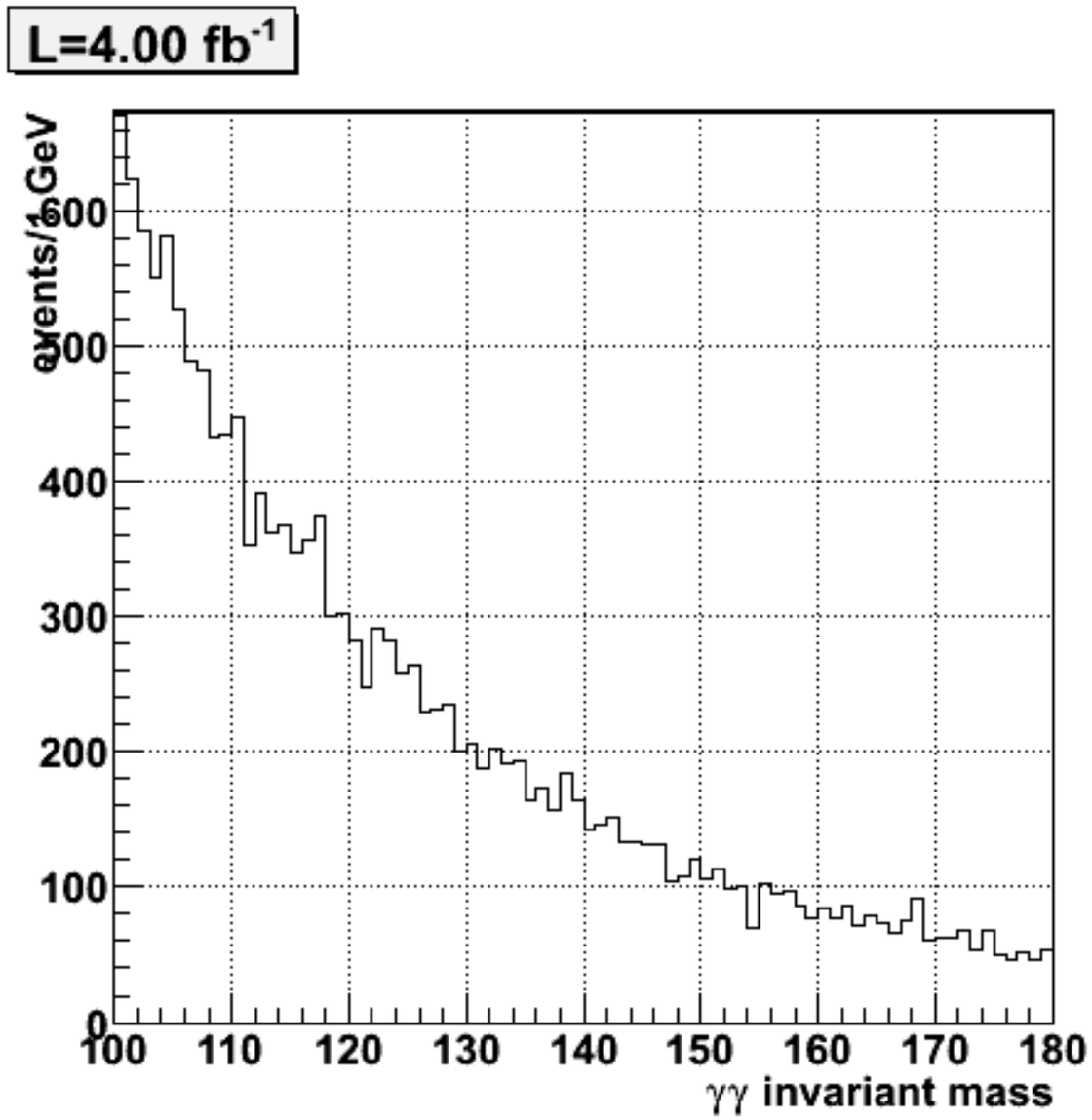

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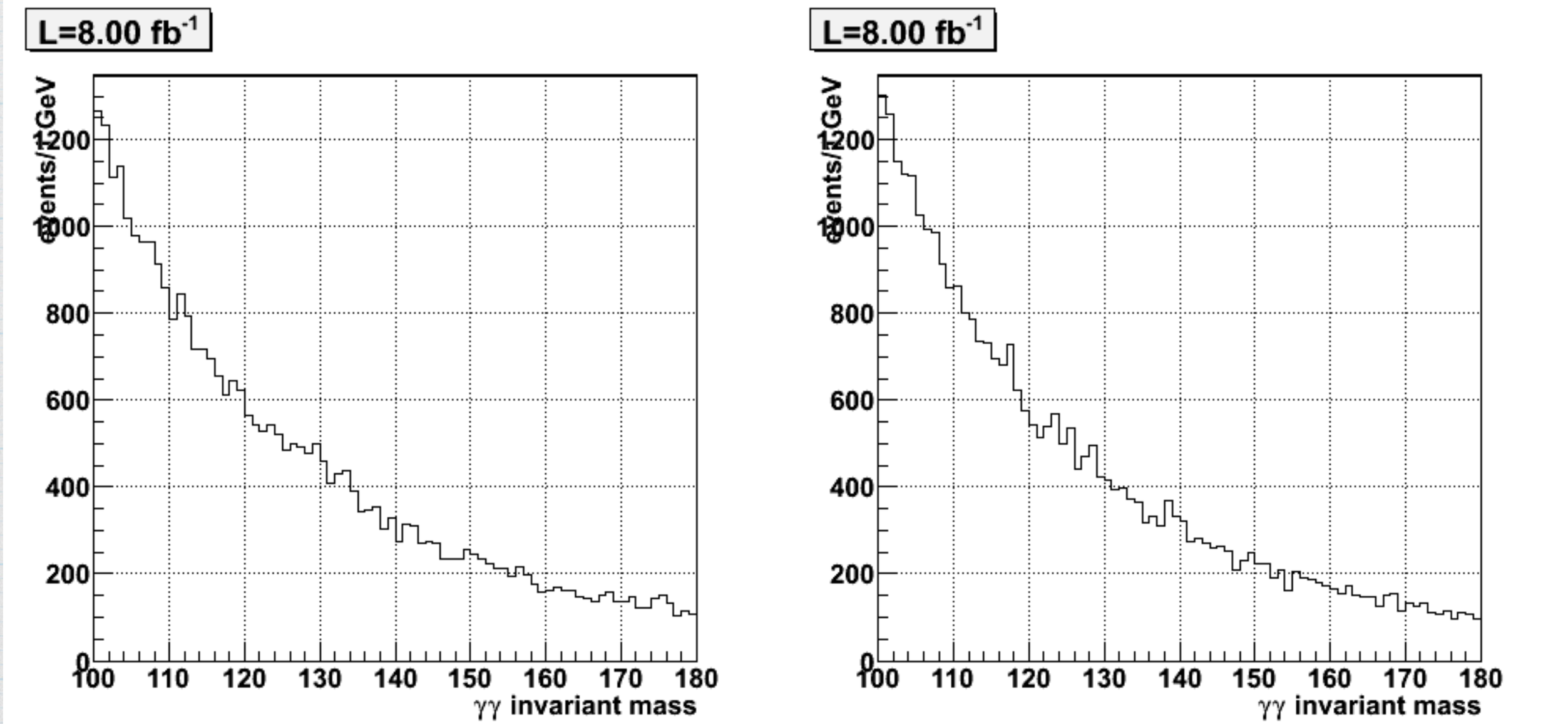

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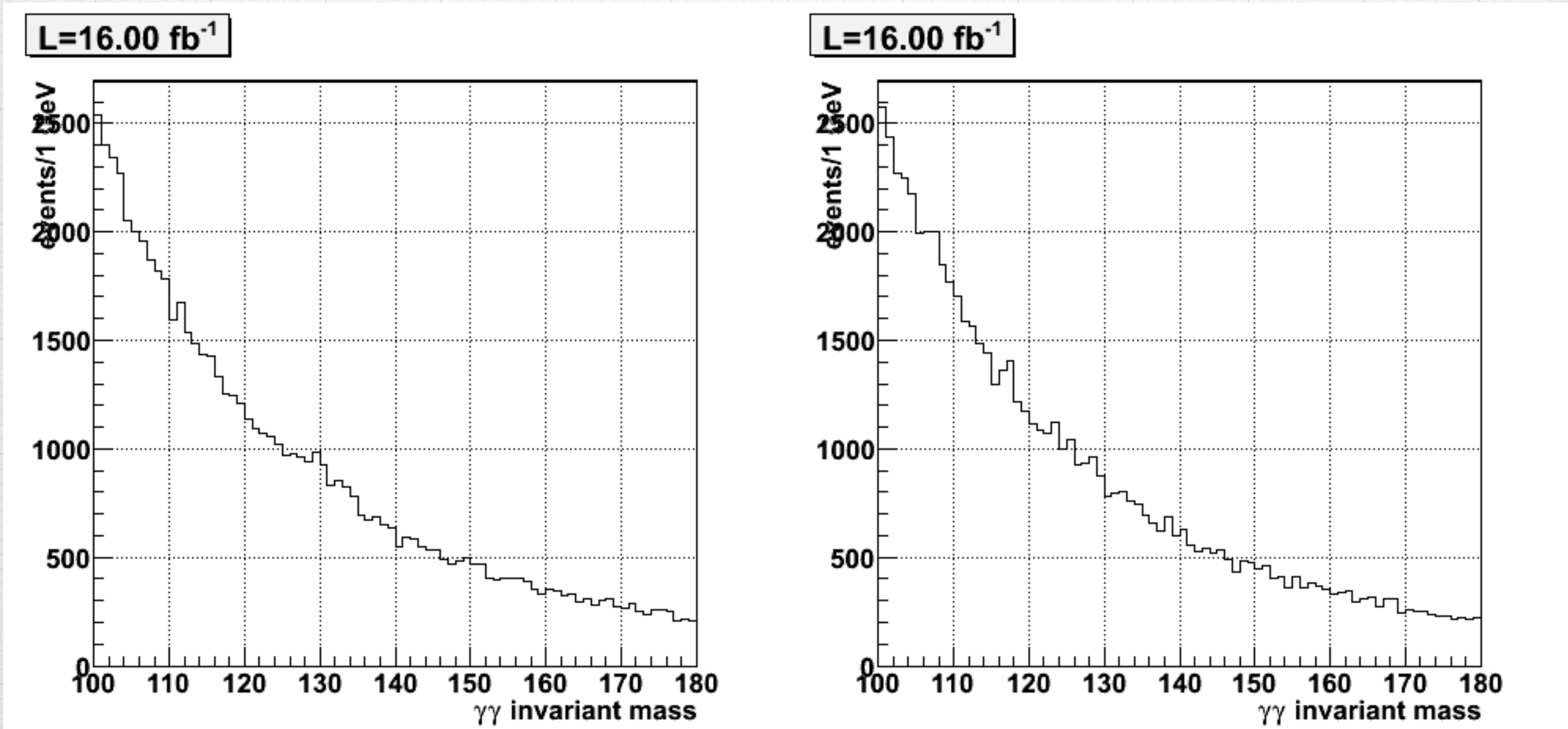

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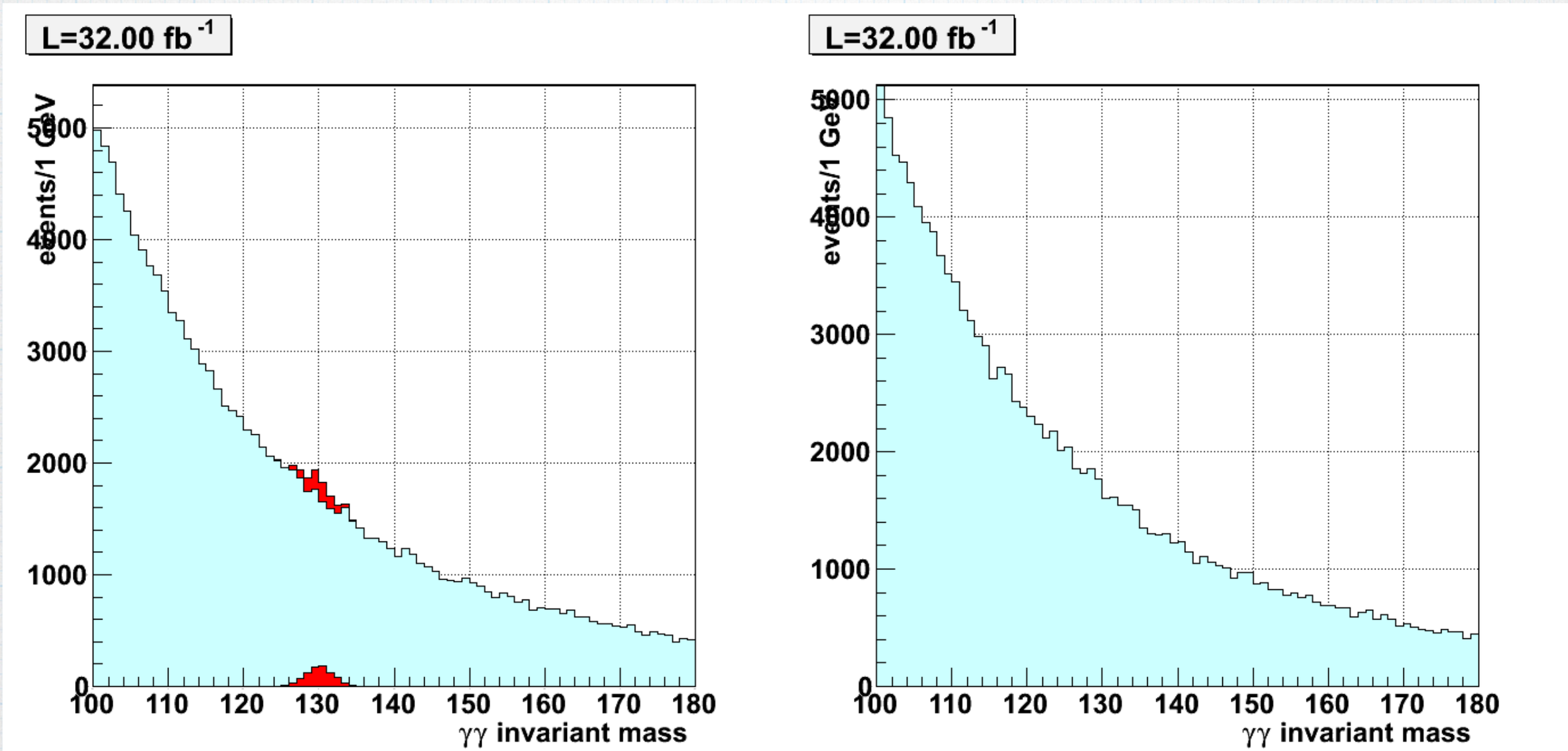

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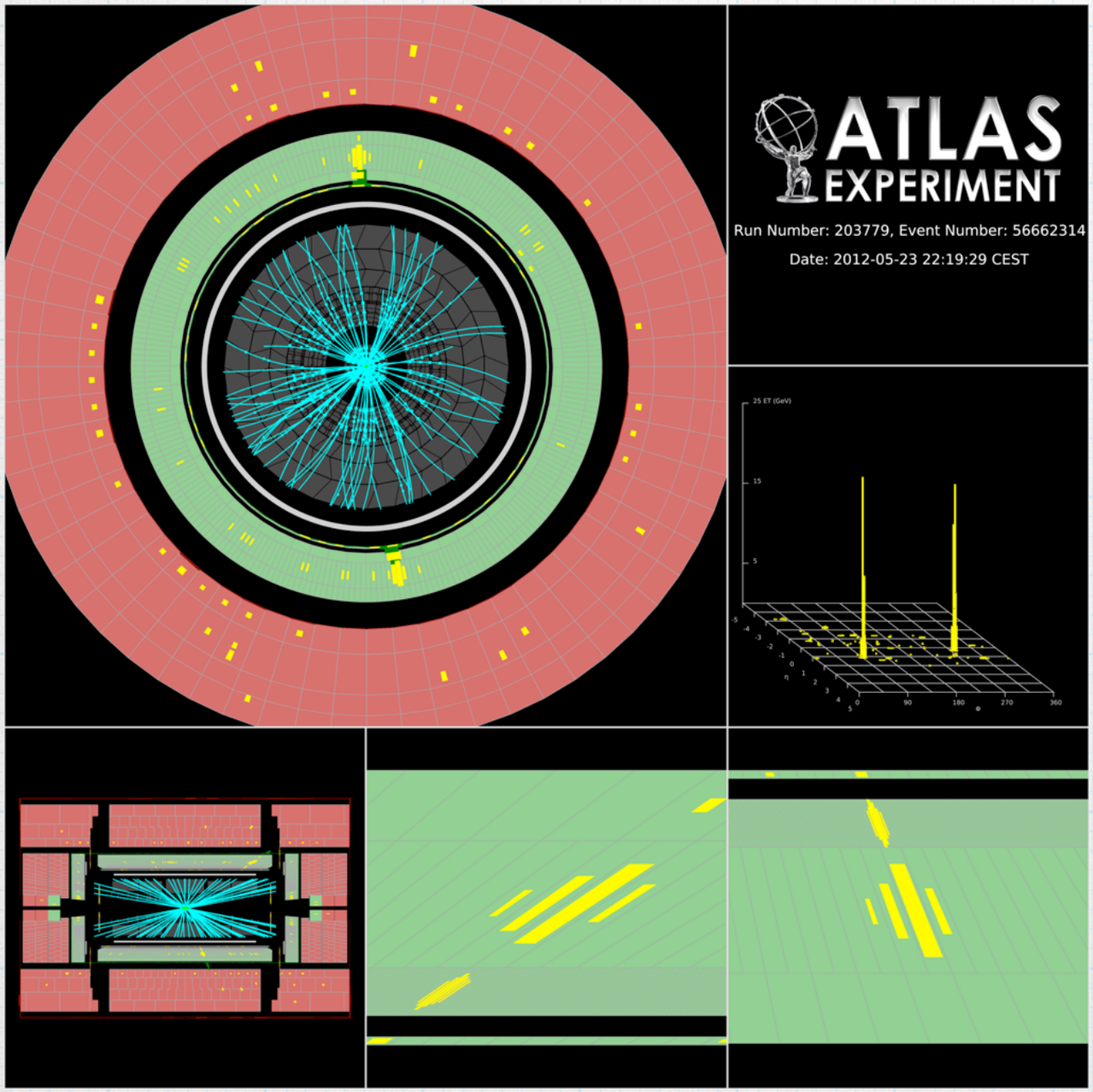

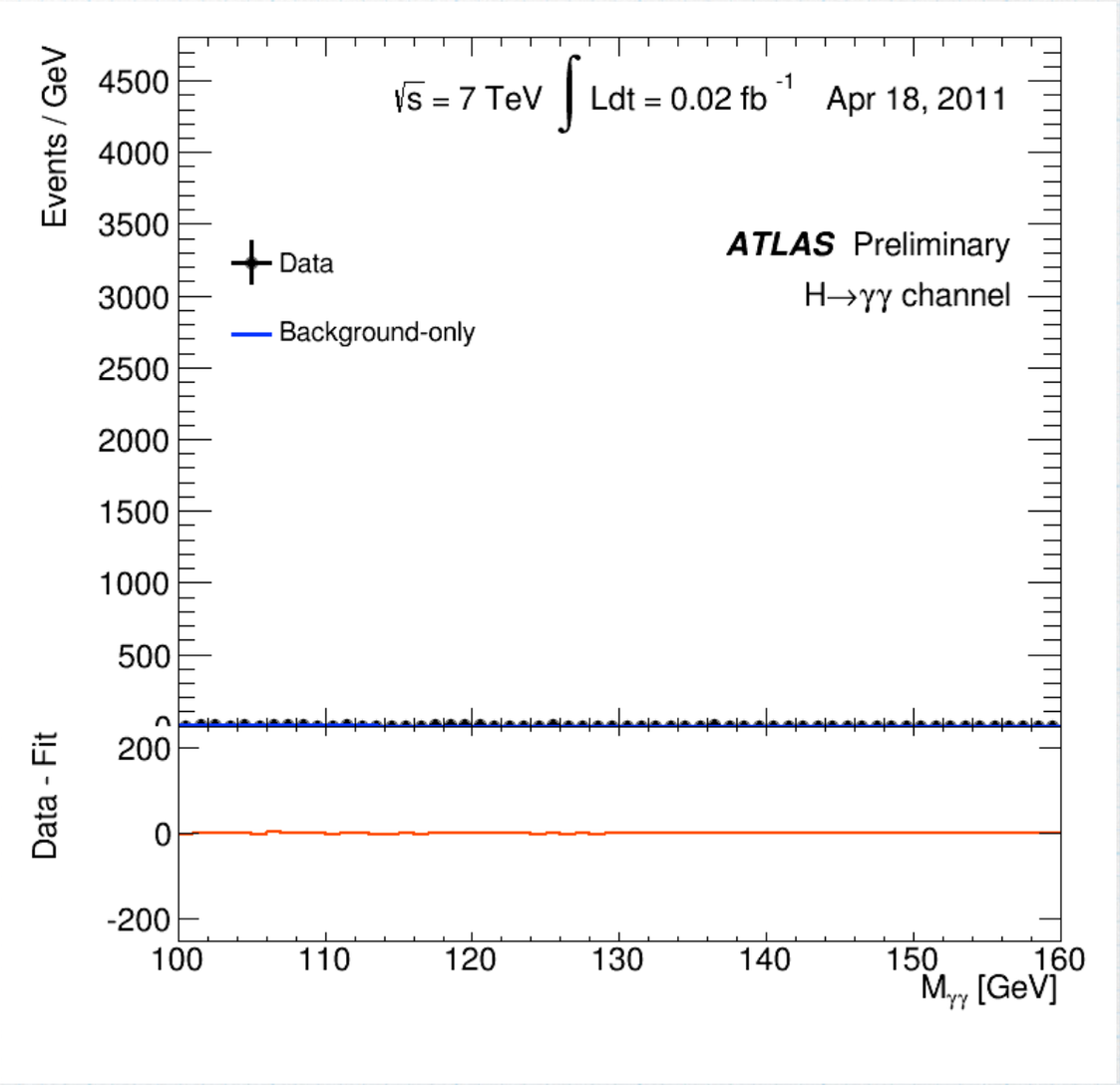

Thanks very much!