

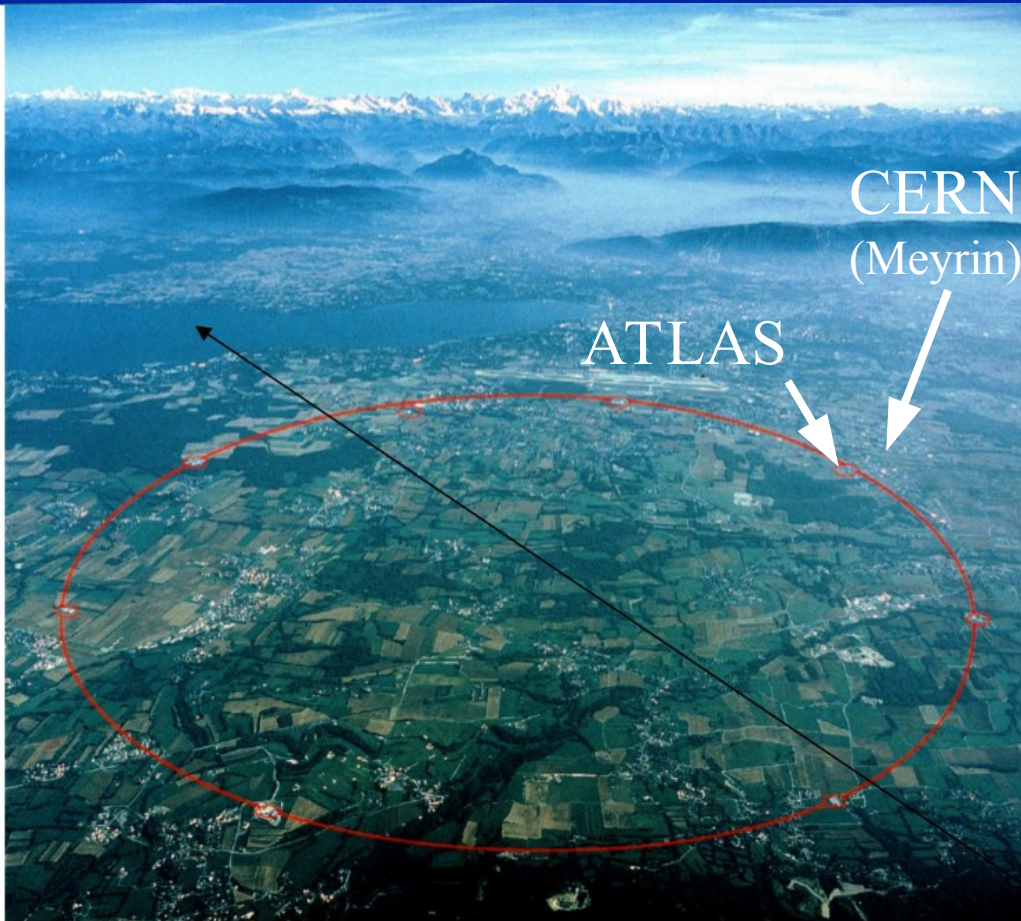


Collider physics with ATLAS at the LHC

Simone Pagan Griso
spagangriso@lbl.gov

Run: 303499
Event: 2810362531
2016-07-09 03:06:16 CEST

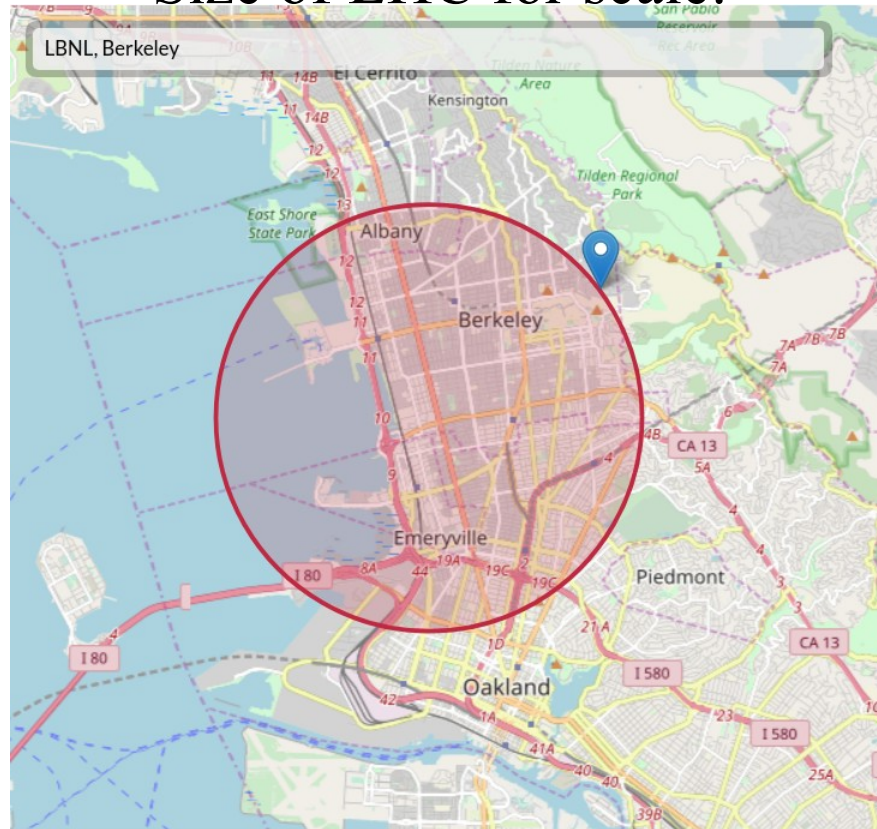
Where is ATLAS?



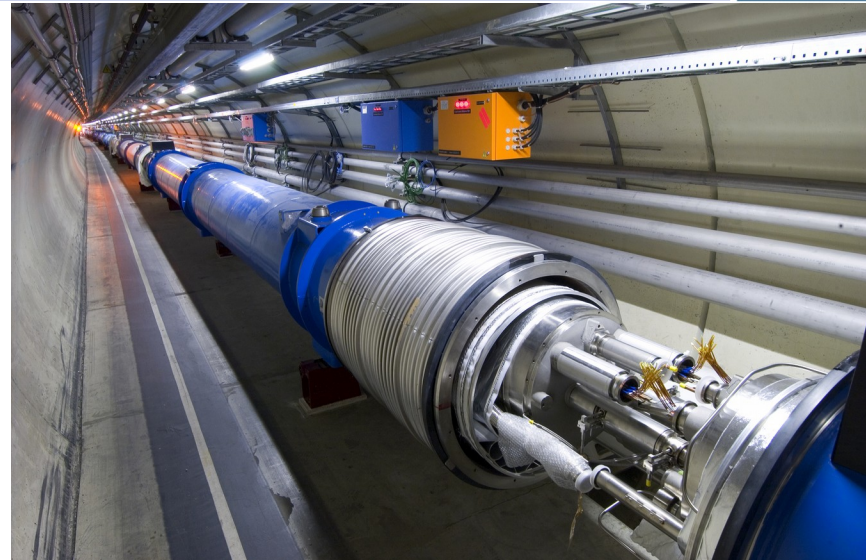
Geneva, Switzerland

The LHC Accelerator

Size of LHC for scale:



<https://natronics.github.io/science-hack-day-2014/lhc-map/>



27 km circumference

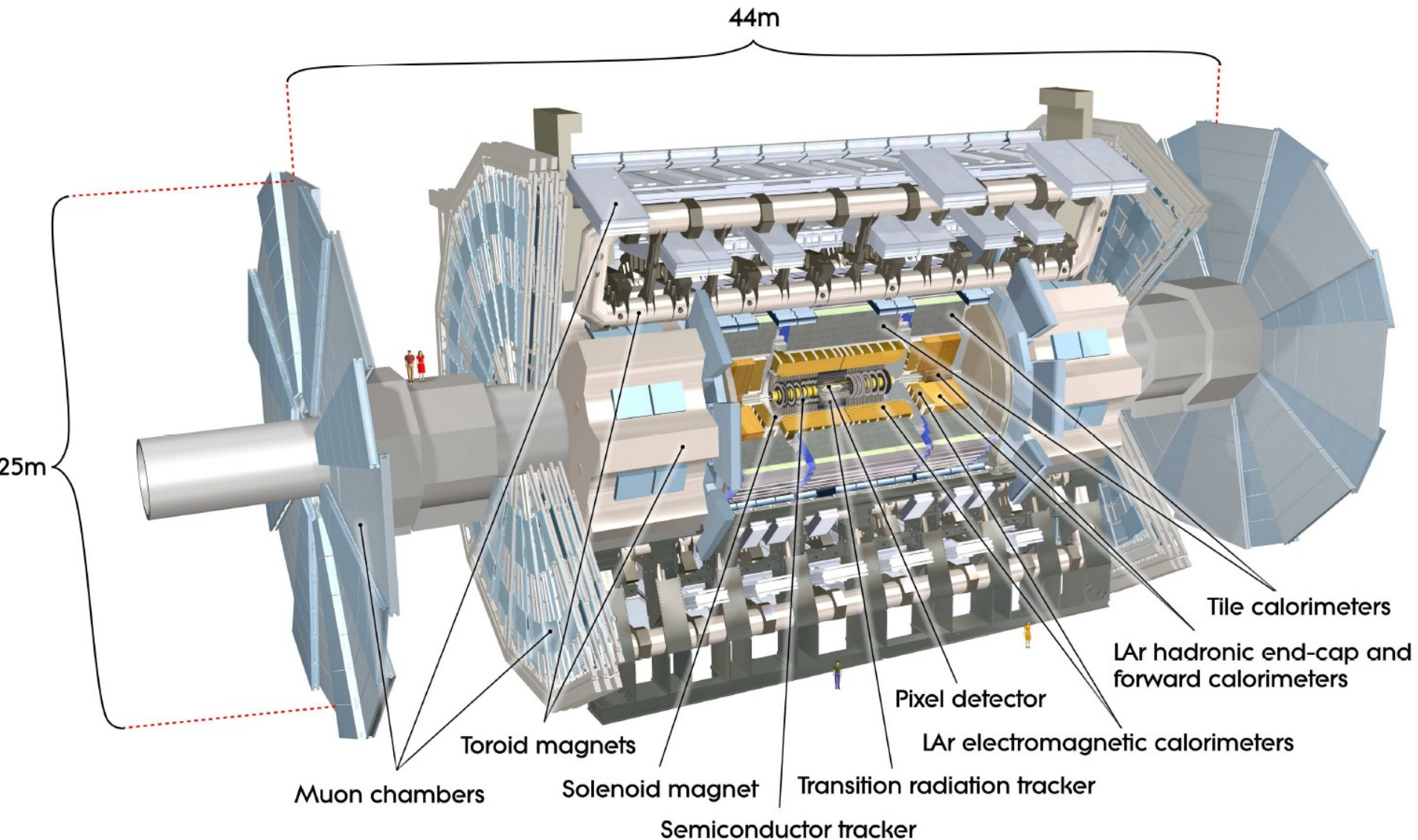
1200 dipole magnets (15m long)

8.3 Tesla

1.8 degrees K

Colliding protons at center-of-mass energies of 13 TeV

The ATLAS detector



Brief history



1990: first ideas

1994: full design

1997: construction start

2003: installation start

2008: first beam

2010: first collisions (7 TeV)

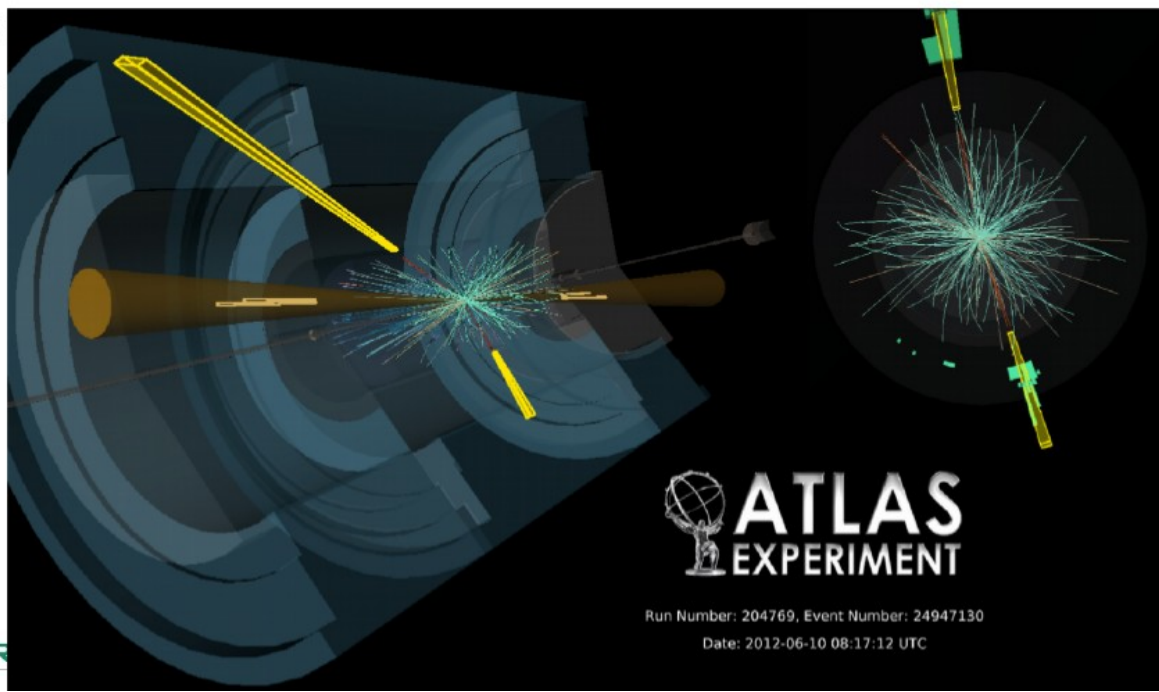
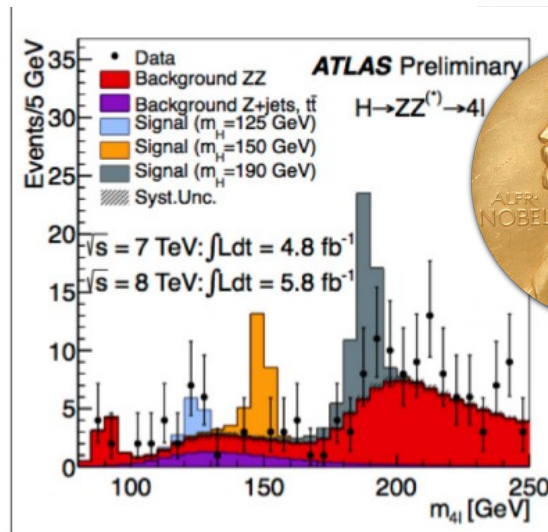
2012 Higgs discovered

2015: first 13 TeV collisions

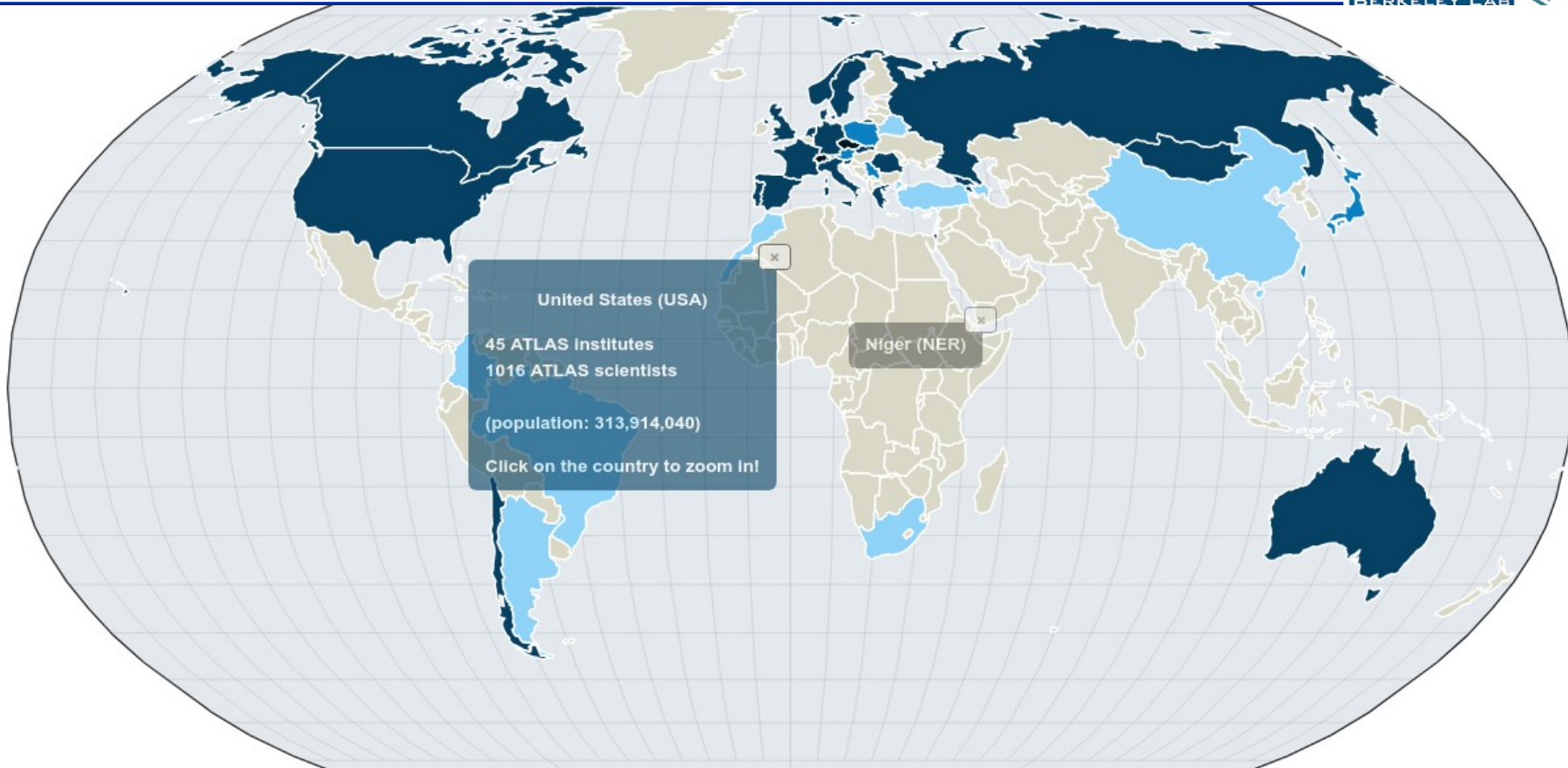
2017: new tracker designed

2022: new tracker built

2037(??): end of data-taking



The ATLAS Collaboration



ATLAS members per inhabitants



The ATLAS Experiment @ 2016 CERN

<https://atlas.cern/discover/collaboration>

~3000 scientific authors from 182 institutions (32 countries)

ATLAS group at Berkeley



**Largest US group with students.
We are based at LBNL not campus
(some of us based at CERN)**

January 2019, Berkeley

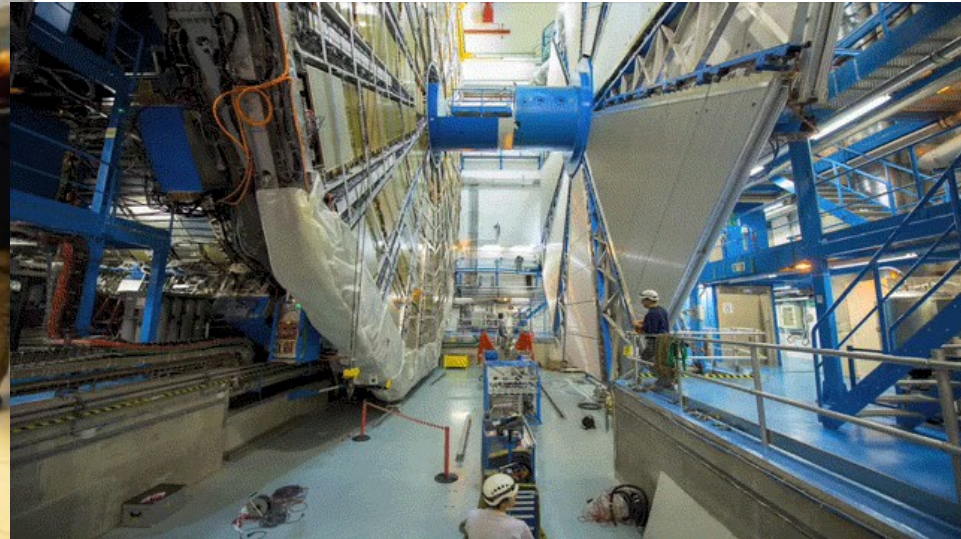
What is Berkeley doing in ATLAS?



- **Detector operations at CERN**
 - most students reside at CERN for ~1 year
 - you get to **SEE** atlas! and contribute to its successful data-taking



ATLAS Control Room

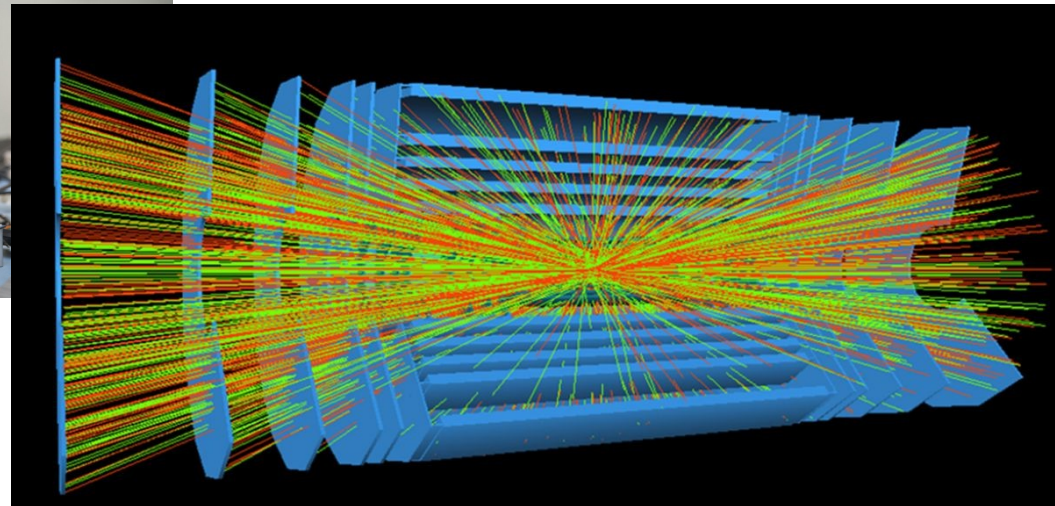
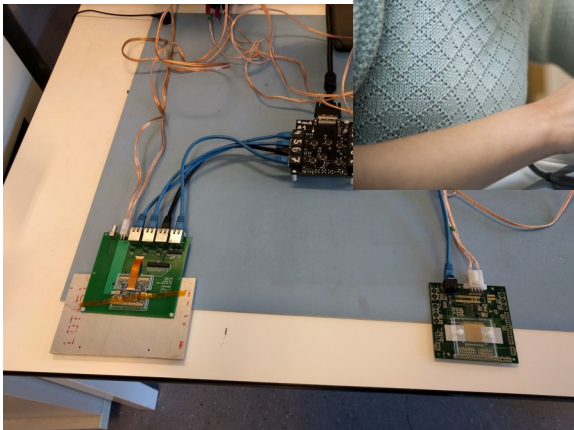
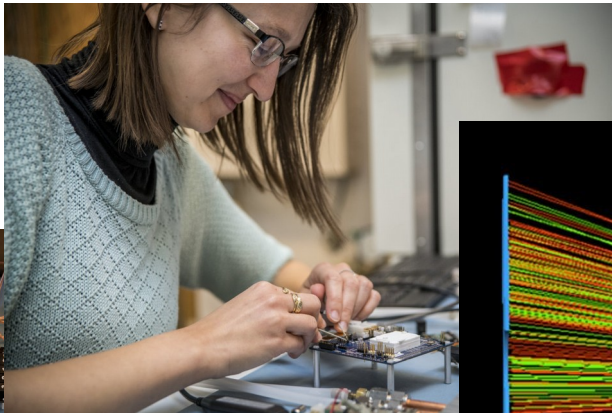


ATLAS Cavern

What is Berkeley doing in ATLAS?



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- **R&D for next inner tracker for charged-particle reconstruction**
 - (Some of) You will visit the labs after this session
 - Upgrade needed to keep collect more data (faster) after 2026



What is Berkeley doing in ATLAS?

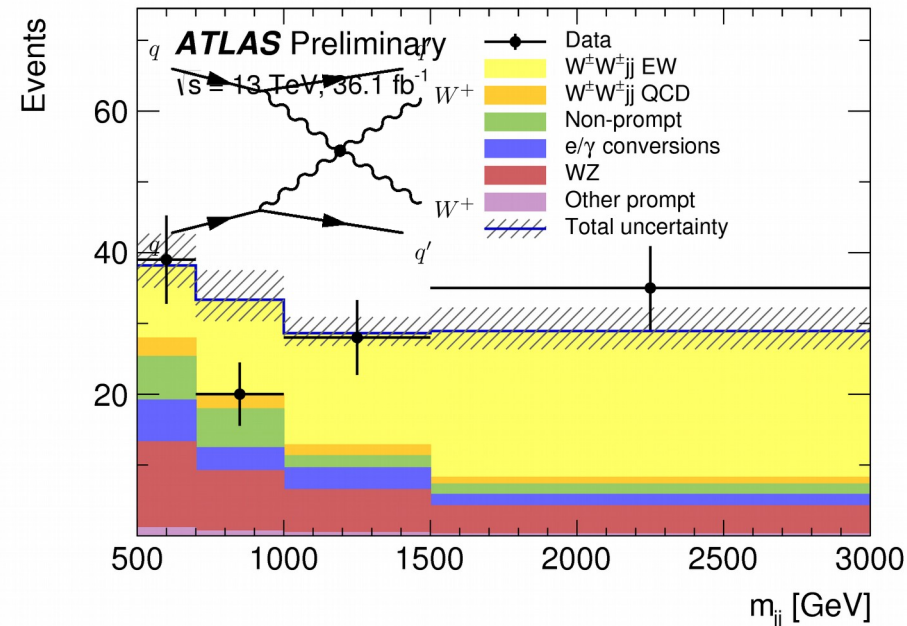
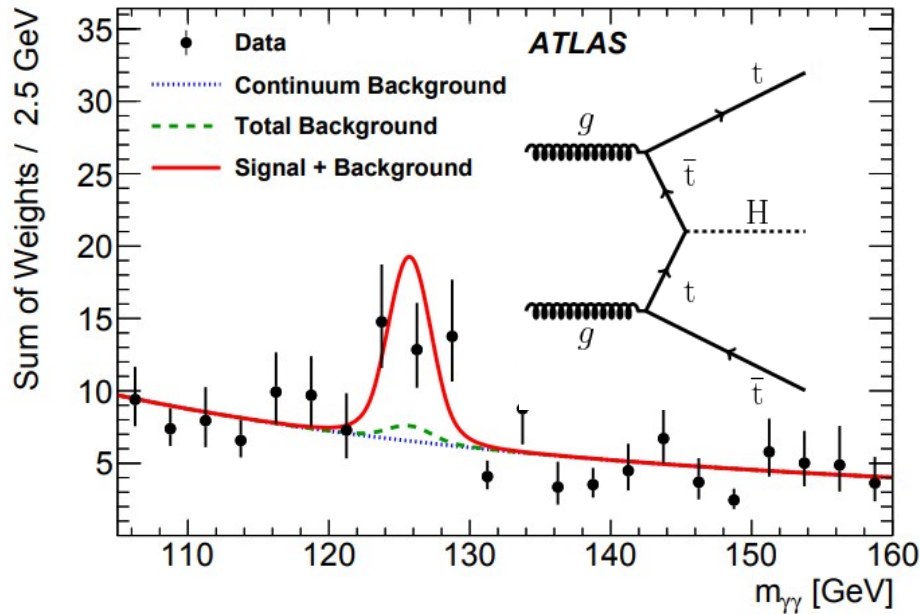


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 - Upgrade needed to keep collect more data (faster) after 2026
- **New software and framework to fully exploit detector and modern computing architectures**



Cori super-computer
@ NERSC

What is Berkeley doing in ATLAS?



- **Physics analysis**
 - Detailed measurement of Higgs boson properties
 - Measurement of rare Standard Model processes
 - Supersymmetry, new physics searches
 - Find dark matter at colliders!
 - your new IDEA!

ATLAS Ph.D thesis at Berkeley (≥ 2011)



Lauren Tompkins : A Measurement of the proton-proton inelastic scattering cross-section at $\sqrt{s} = 7$ TeV with the ATLAS detector at the LHC

Michael Leyton: Minimum Bias Measurements with the ATLAS Detector at the CERN Large Hadron Collider

Maxwell Scherzer: Measurement of the $Y(1S)$ Production Cross Section in Proton-Proton Collisions at Center of Mass Energy 7 TeV

Seth Zenz: Properties of Jets Measured with Charged Particles with the ATLAS Detector at the Large Hadron Collider

Andre Bach: Search for Pair Production of a New b' Quark that Decays into a Z Boson and a Bottom Quark with the ATLAS Detector at the LHC

Joe Virzi A Measurement of the Underlying Event Distributions in Proton-Proton Collisions at $\sqrt{s} = 7$ TeV in Charged-Particle Jet Events using the ATLAS Detector at the Large Hadron Collider

Louise Skinnari: A Search for Physics Beyond the Standard Model using Like-Sign Muon Pairs in pp Collisions at $\sqrt{s} = 7$ TeV with the ATLAS Detector

Peter Loscutoff: Search for resonant WZ to $lvll$ production using 13 fb^{-1} in $\sqrt{s} = 8$ TeV p-p collisions with the ATLAS detector

Alexander Sood: First Observation of WW scattering at LHC

Anna Ovcharova: Measurement of top quark production at high transverse momentum at 8 TeV

David Yu: Searches for new phenomena using events with three or more charged leptons in pp collisions at $\sqrt{s} = 8$ TeV with the ATLAS detector at the LHC

Jackie Brosamer: Properties of jets in events with top quarks

Robert Clarke: Search for Higgs decay to $\mu\tau$

Tova Holmes: A Search for Supersymmetry in Events with a Z Boson, Jets, and Missing Transverse Energy in pp Collisions with $\sqrt{s} = 13$ TeV with the ATLAS Detector

Brad Axen: A Search for Long-Lived, Charged, Supersymmetric Particles using Ionization with the ATLAS Detector A Search for Long-Lived, Charged, Supersymmetric Particles using Ionization with the ATLAS Detector

Brian Amadio: Searches for new phenomena with LHC Run-2

... and the current PhD students



- **Emily Duffield** – Vector boson scattering with $W^\pm W^\pm jj$
- **Jennet Dickinson** – Higgs boson production in association with $t\text{-}\bar{t}$
- **Sai Neha Santpur** – New physics search using non-pointing photons
- **William Patrick McCormack** – Exclusive WW production
- **Cesar Gonzalez Renteria** – Qual. task on pixel det. readout chip simulation
- **Gregory Ottino** – Qual. task on strip detector power-board
- **Some of you?**

- **Typical PhD cycle at LBL-ATLAS:**
 - Warm-up project (while still busy with classes)
 - At least two among
 - detector R&D
 - detector performance studies
 - ATLAS operations
 - Physics analysis
 - Get a great job (in academia or outside)

... and the current PhD students



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- Both UCB Faculty and senior LBL members can be thesis advisors
- We function as a single group
 - normal for a student to work with several postdocs/senior members during their PhD

- detector performance studies
- ATLAS operations

- Physics analysis
- Get a great job (in academia or outside)

Interested in spending the summer working on ATLAS at LBL?
Summer funding for incoming graduate students!

Further questions? curiosity?
we're here all the day,
come talk to us if you haven't done so yet

spagangriso@lbl.gov