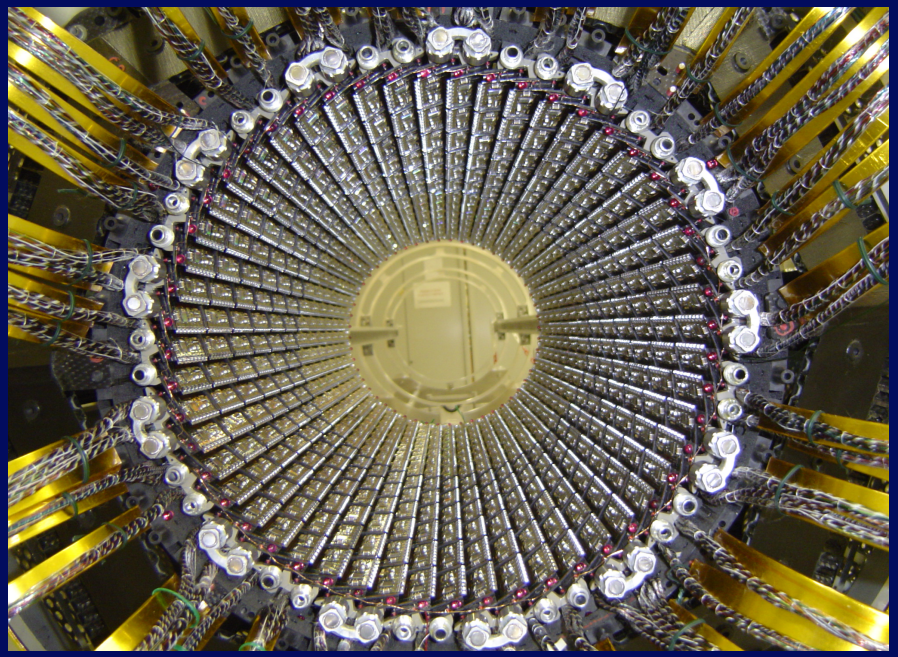
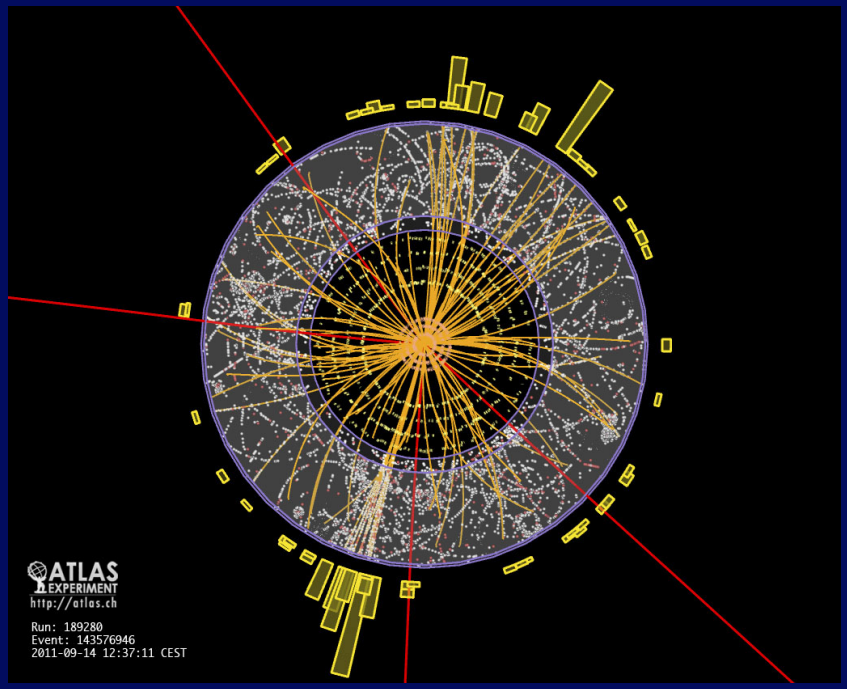
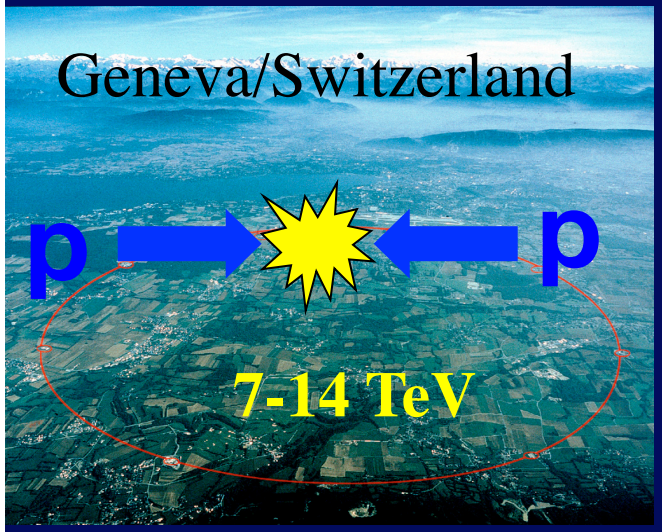
The ATLAS Experiment at the Large Hadron Collider

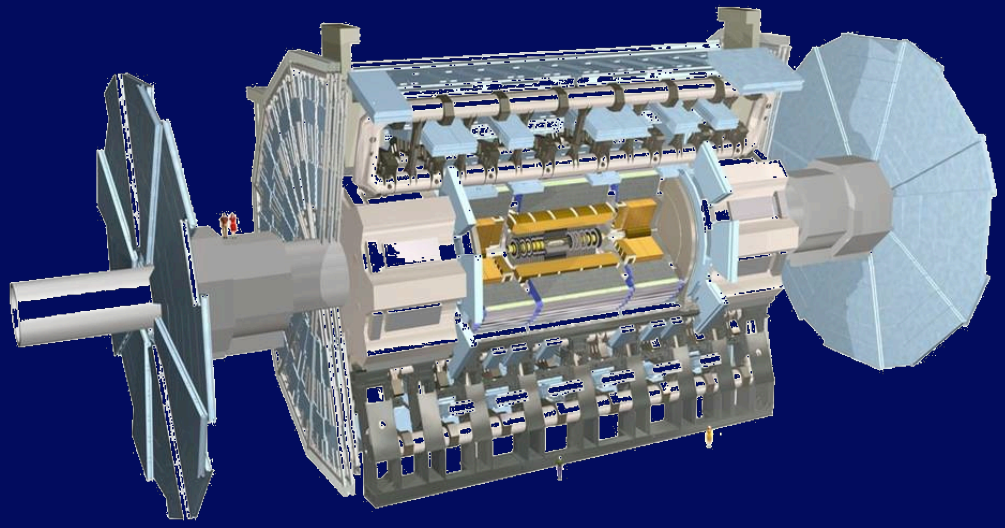
Beate Heinemann and Marjorie Shapiro





ATLAS at the LHC

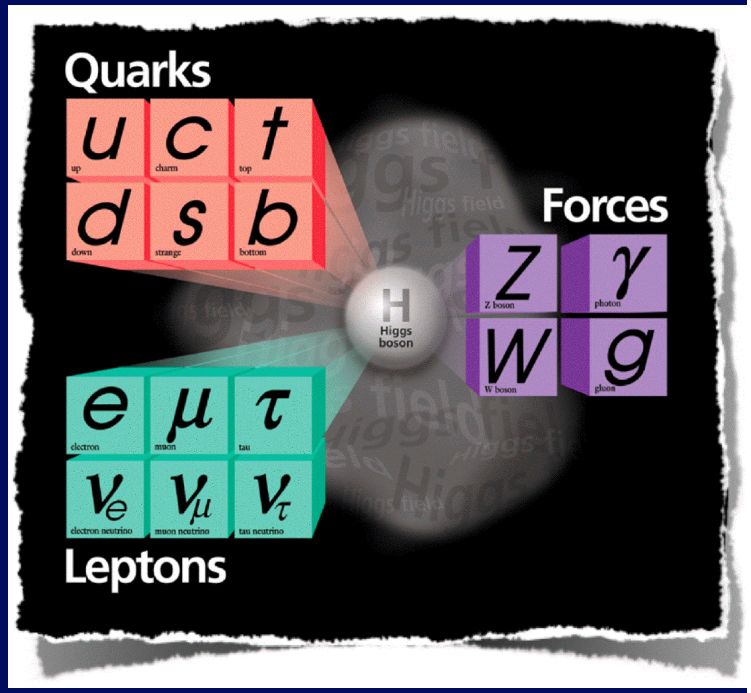


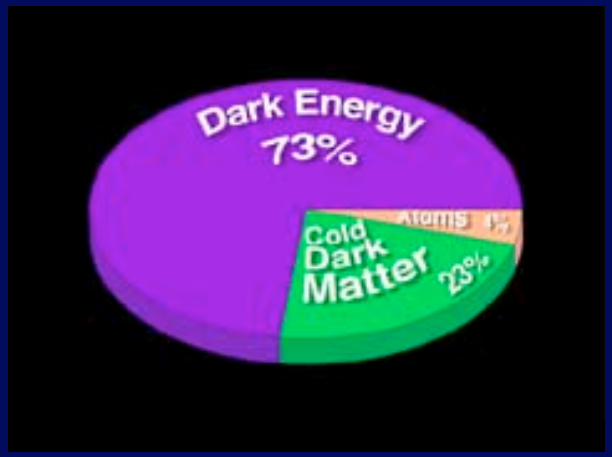


- LHC started high energy running (7 TeV) in 2010
  - ATLAS has published ~100 papers already
    - Testing the Standard Model at a new energy
    - Testing (and excluding) models of new physics
    - Searching for the Higgs boson (and seeing first hints!?)
  - Berkeley group members directly involved in 20 of them
- In the near future
  - LHC will upgrade to full energy (~14 TeV) by 2015

LHC Physics Goals

- **4% of energy in Universe arises from Standard Model particles**
  - **How do particles obtain mass?**
    - **The Higgs boson (?)**
  - **3 generations with very different masses**
    - **why 3, why mass hierarchy?**
  - **4 forces mediated by gauge bosons**
    - **Why do they have different strengths + were they the same at the Big Bang?**
  - **Where did all the anti-matter go?**
    - **Are neutrinos the clue?**
- **96% of the energy comes from unknown sources**
  - **Dark matter ?**
  - **Dark Energy ?**

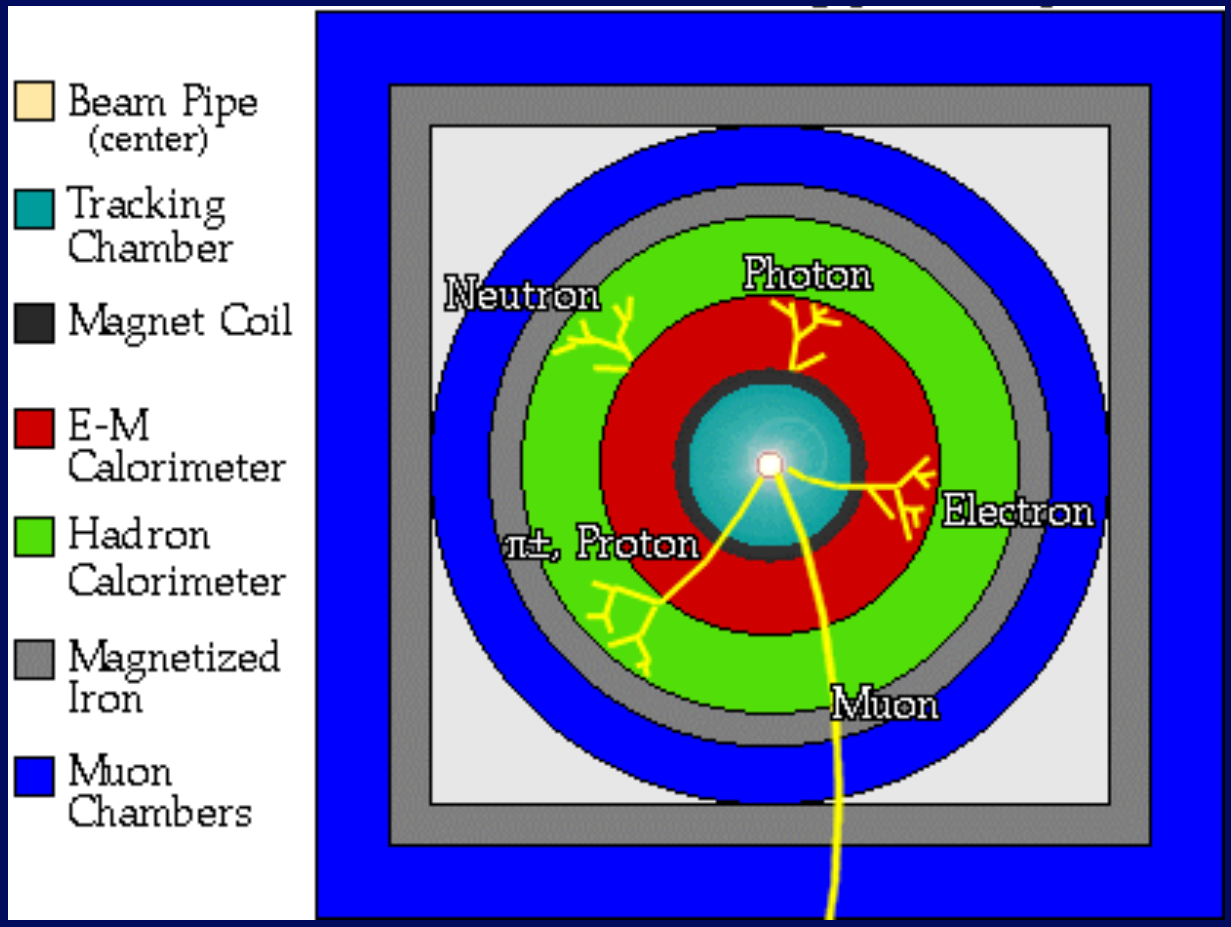




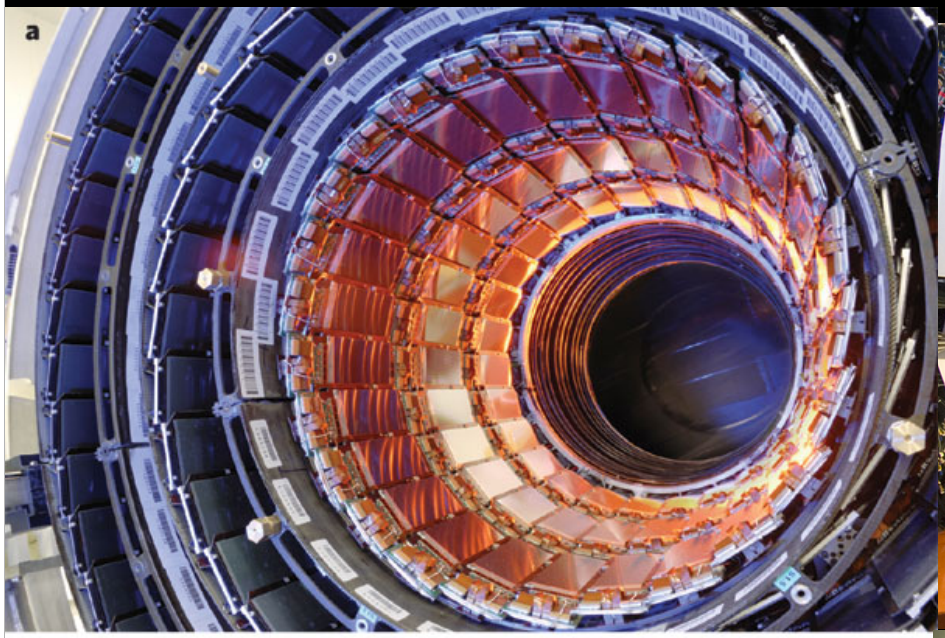
Confusion among Theorists?

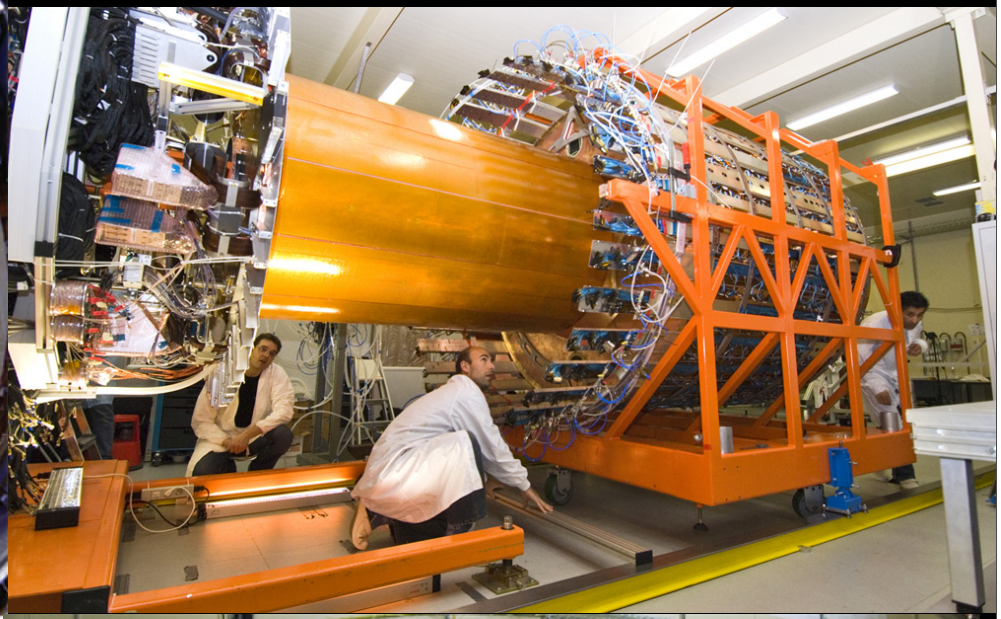
Particle Identification

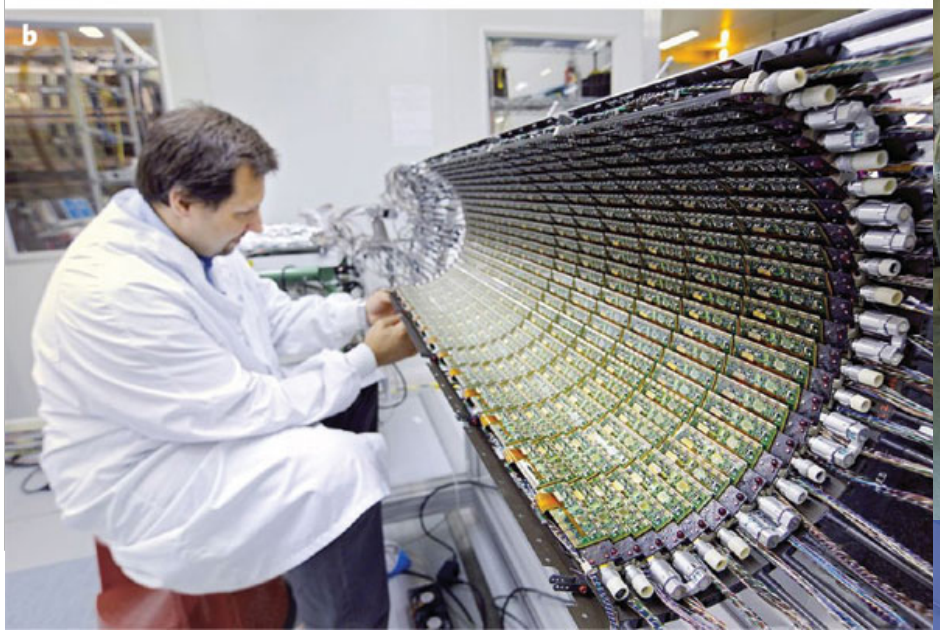
- Collisions enclosed by layers of different detectors (like an onion):
  - separate particle types
  - measure their energies



Tracking Detectors





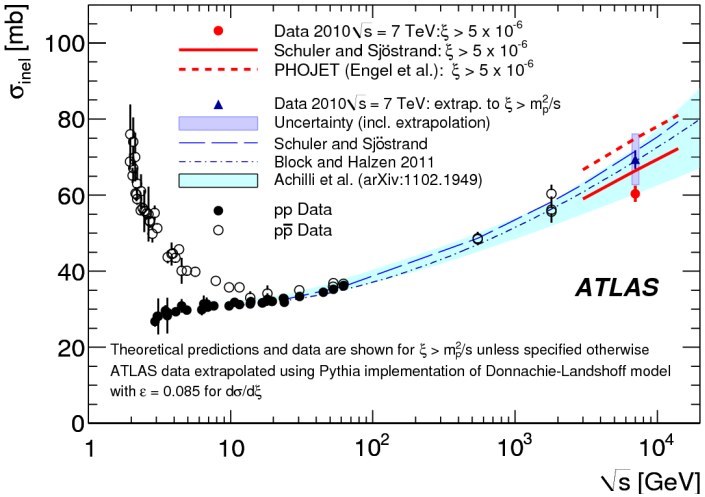


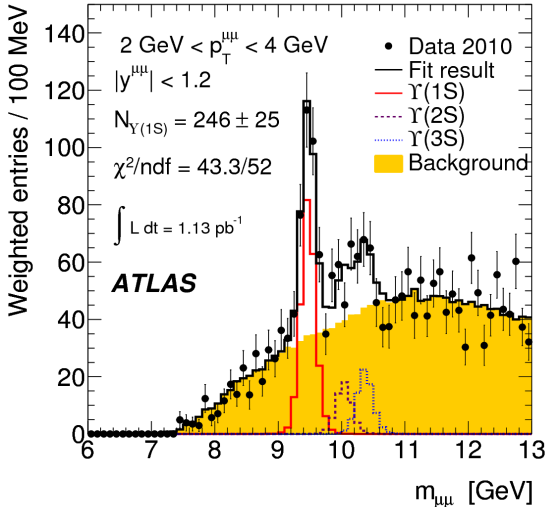
Berkeley's crew 2007

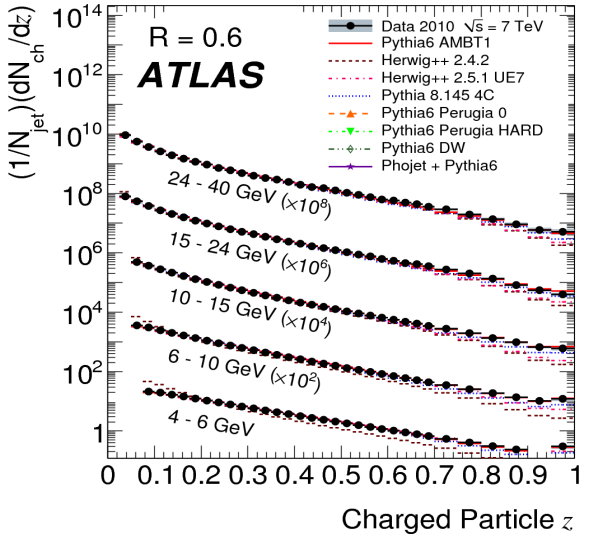
Berkeley ATLAS group

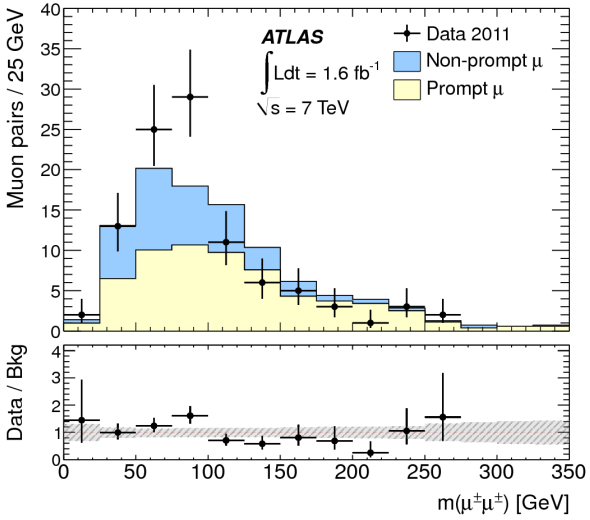
- **Largest US group on ATLAS: 42 scientists**
  - Strong and diverse expertise in hardware, software and physics analysis
- **Currently have 10 PhD students and 10 postdocs**
  - Expect most of current students to graduate on 2011/2012 data
  - Next generation of students will use data at full LHC energy
  - => significant discovery potential!
- **Supervisors from UCB and LBNL available**
  - Can take up to 15 graduate students

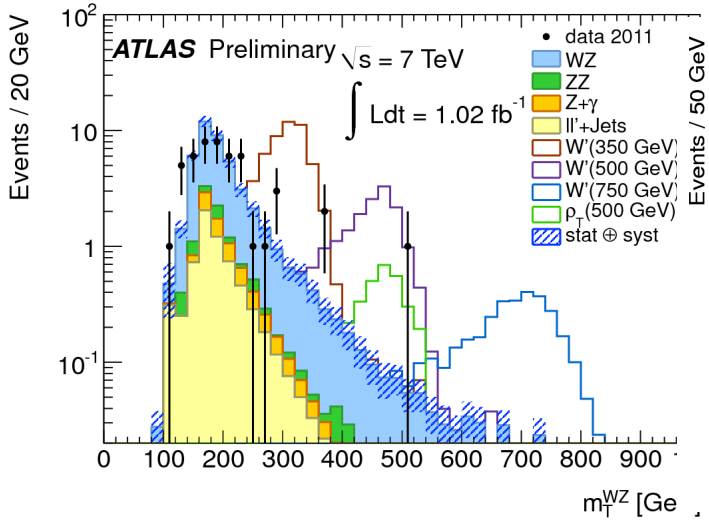
Some Measurements by Berkeley PhD Students

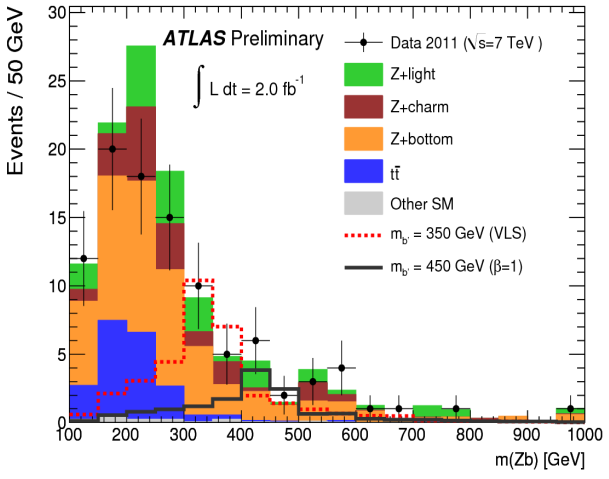












Conclusions

- **Berkeley has a very strong group on ATLAS**
  - Joint with LBNL (see tour tomorrow)
- **During your PhD you will typically do**
  - Detector hardware development
  - Detector operation
  - Physics analysis
    - Covering broad range of topics (including searches for dark matter and Higgs boson)
- **Typically PhD will take 5 years**
  - ~2 years you will spend at CERN
- **Students can make significant impact despite the experiment being so large**
  - Feel free to talk to current students
- **The high energy run (at twice the current energy) offers new discovery possibilities**
  - Starts in 2015 and your PhD will be on this
- **Experimentalists benefit from strong Berkeley theory group**
  - Joint seminars, monthly lunch meetings, hallway conversations,….