Alty Boys Talk

Laurie McClymont

CERN
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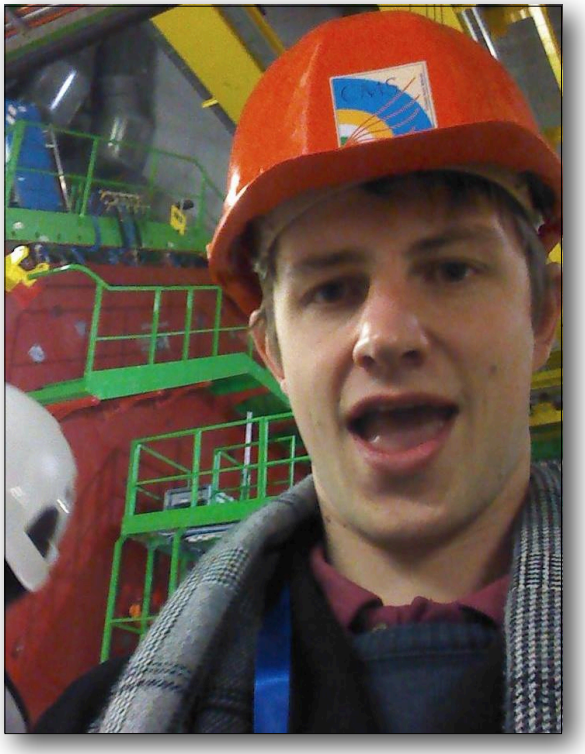
Who Am I?

- I was at AGSB (2003-2010)
  - Physics A-Level with Dr Squire.



- Now in my second year at UCL
  - PhD in Physics
  - Work on ATLAS
  - Spending 18 months at CERN

1) What I do.

2) What I actually do.

3) How I got into it.

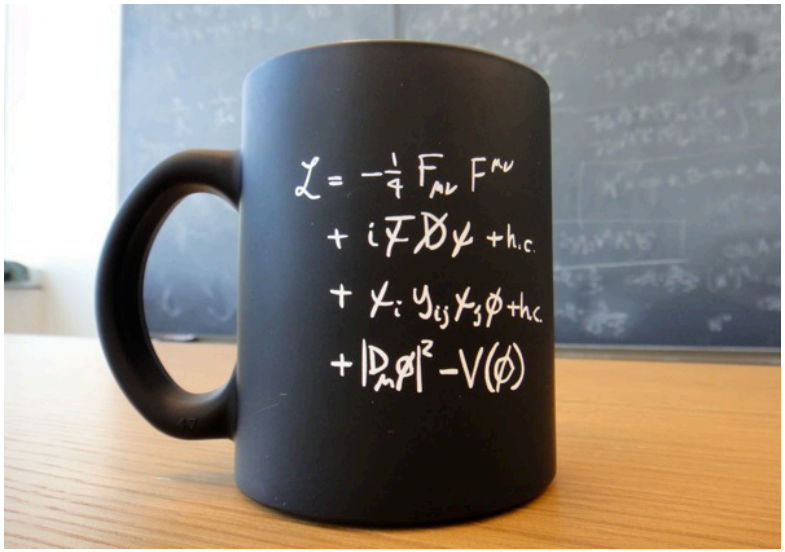
4) Questions?

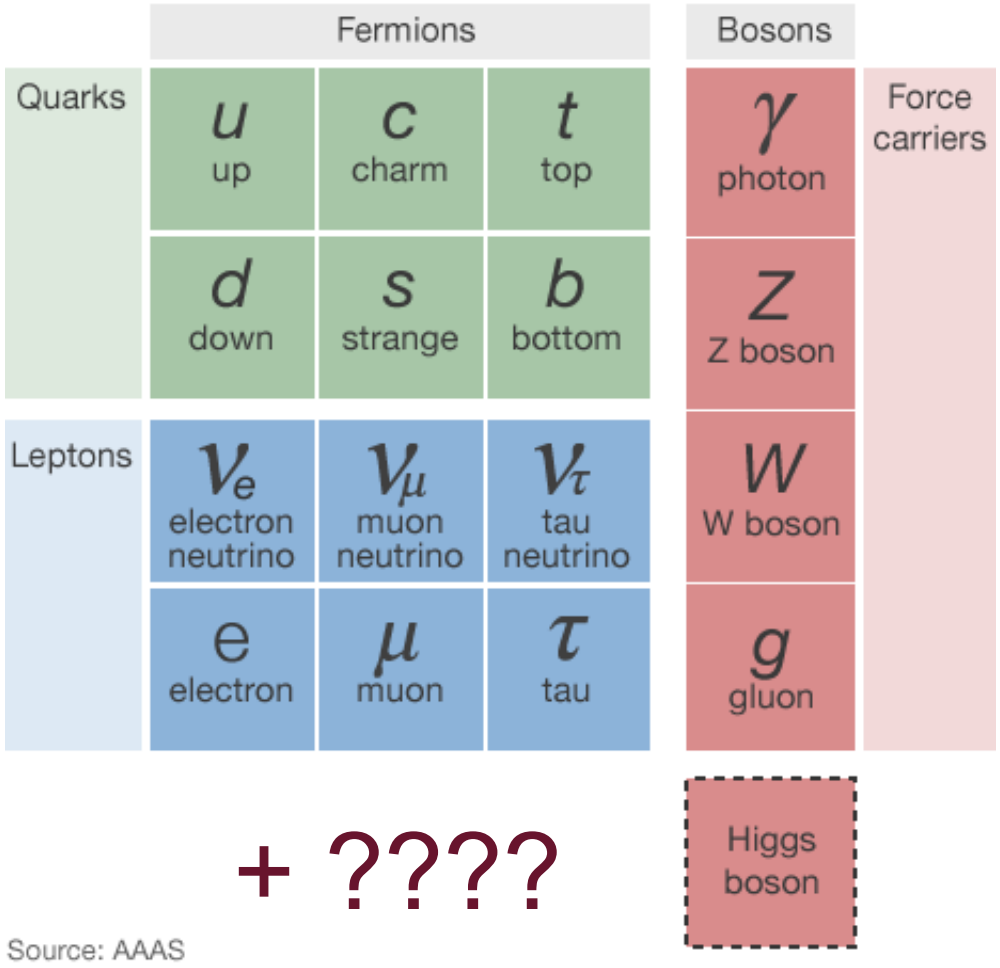
Standard Model

	Fermions			Bosons	
Quarks	u up	c charm	t top	γ photon	Force carriers
	d down	s strange	b bottom	Z Z boson	
Leptons	ν_e electron neutrino	ν_μ muon neutrino	ν_τ tau neutrino	W W boson	
	e electron	μ muon	τ tau	g gluon	
				Higgs boson	

Source: AAAS

- Good Theory!!
- Perfectly predicts all results from Particle Physics so far...

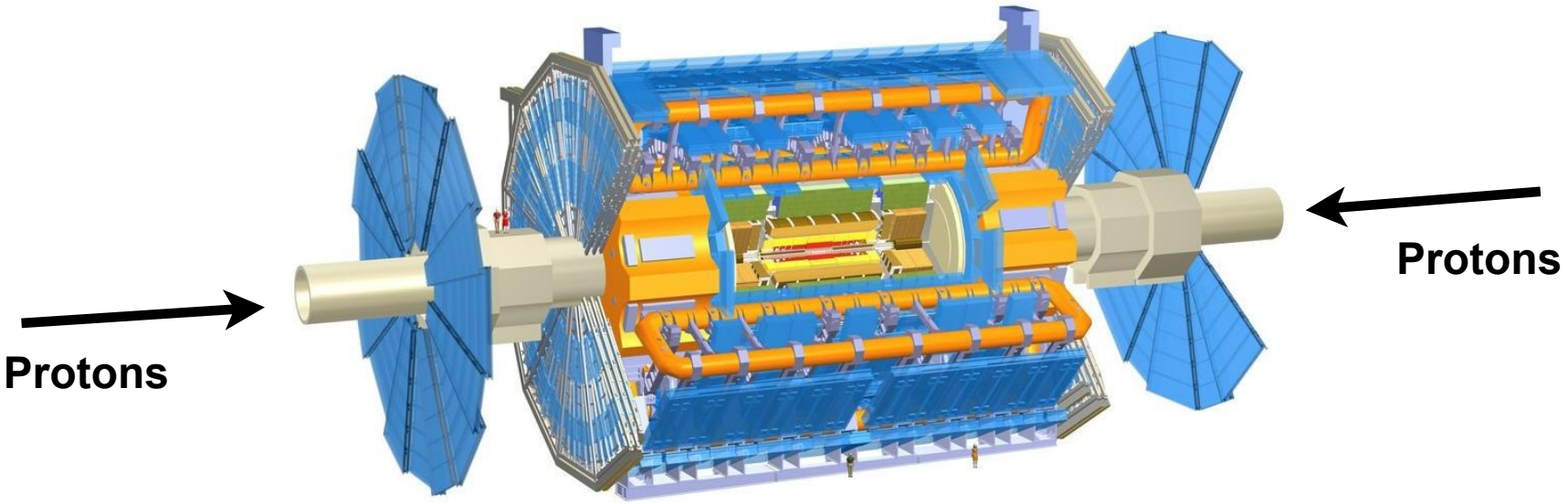


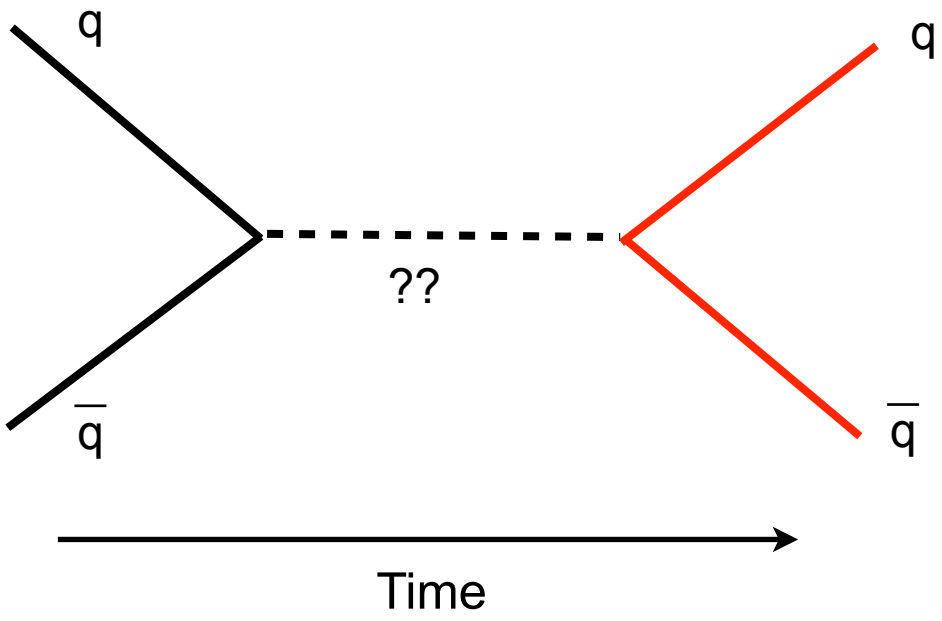


- But...
- There are things that SM doesn't explain
- E.g. Dark Matter
  - Astronomers tell us that there is more mass in the universe than is explained by SM
- There must be Beyond Standard Model Physics!! (BSM)

- LHC
  - Accelerate beam of protons in a 27 km ring.

- ATLAS
  - Smash protons at centre of massive detector
  - See what happens...

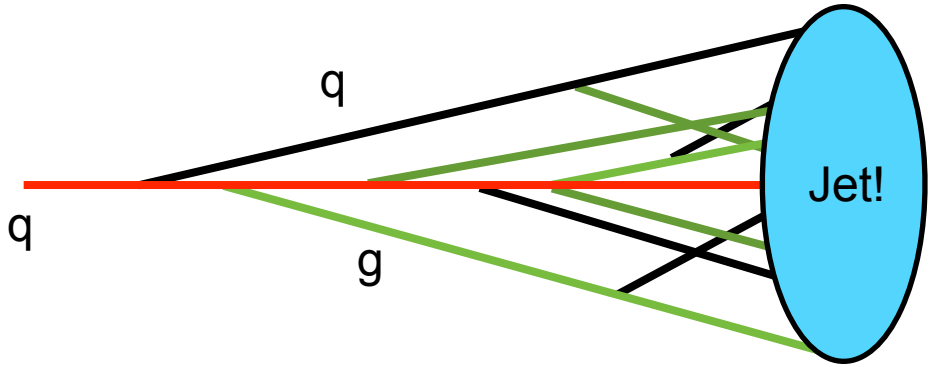




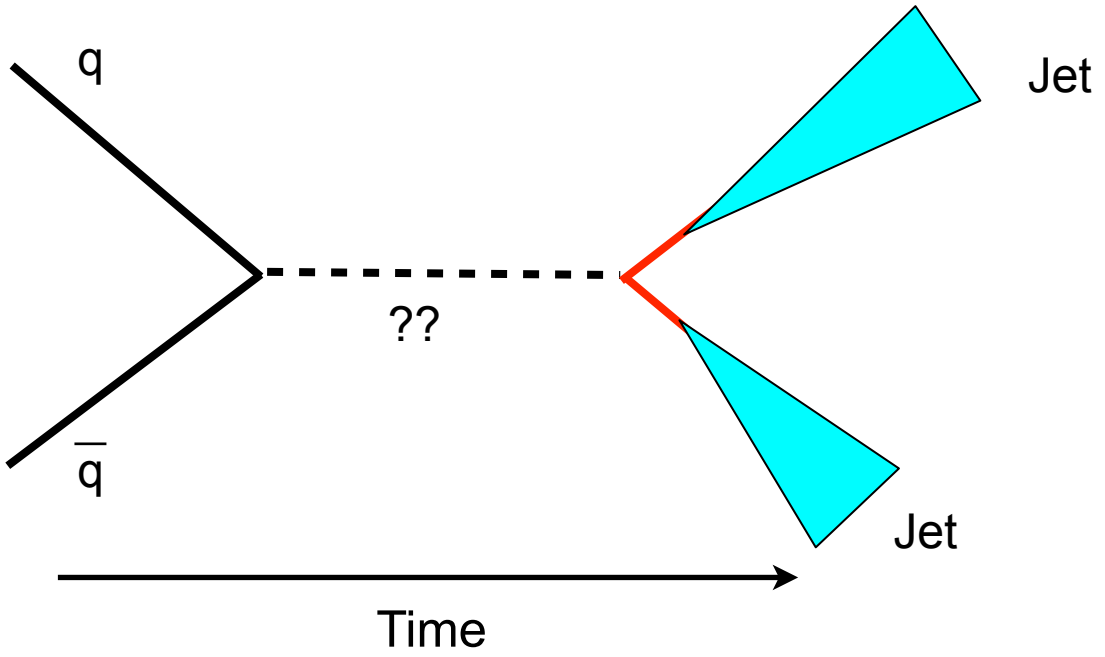
- New exotic particles can decay into two quarks
- We can look for this as a signature.

Jets

- Quarks don't like being on their own.
- They will find other quarks and gluons to join with.
- They form a beam of hadronic material
- These are called jets

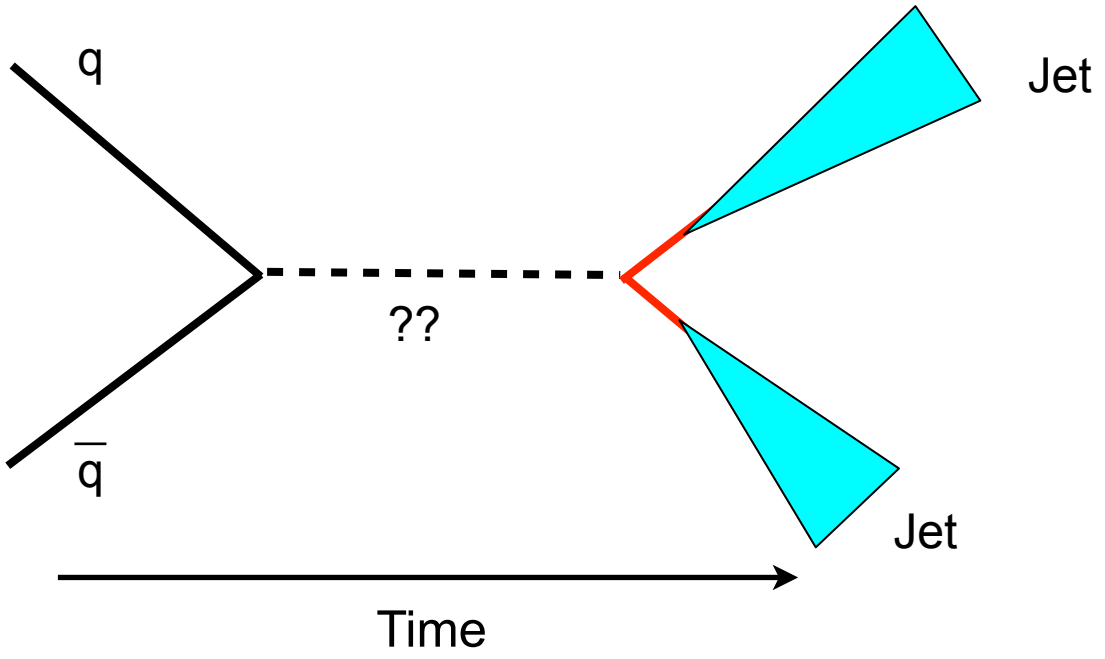


Looking for exotics at ATLAS using Jets



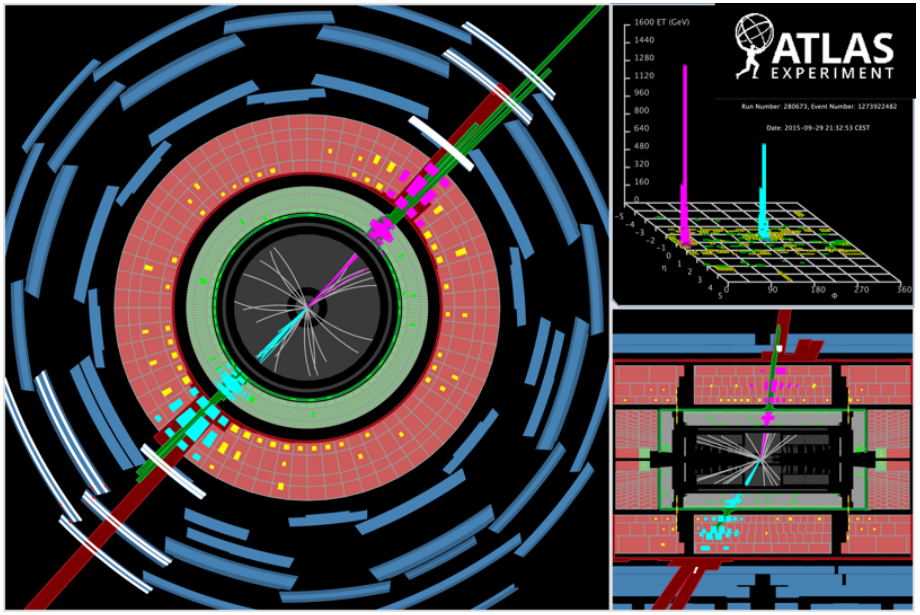
Signature is two jets

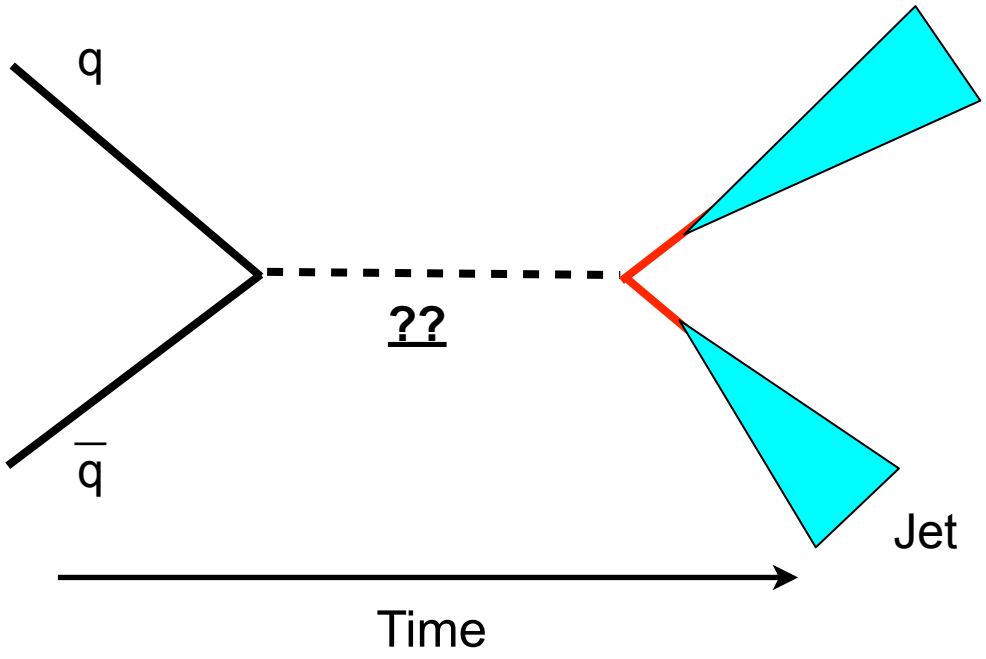
Looking for exotics at ATLAS using Jets



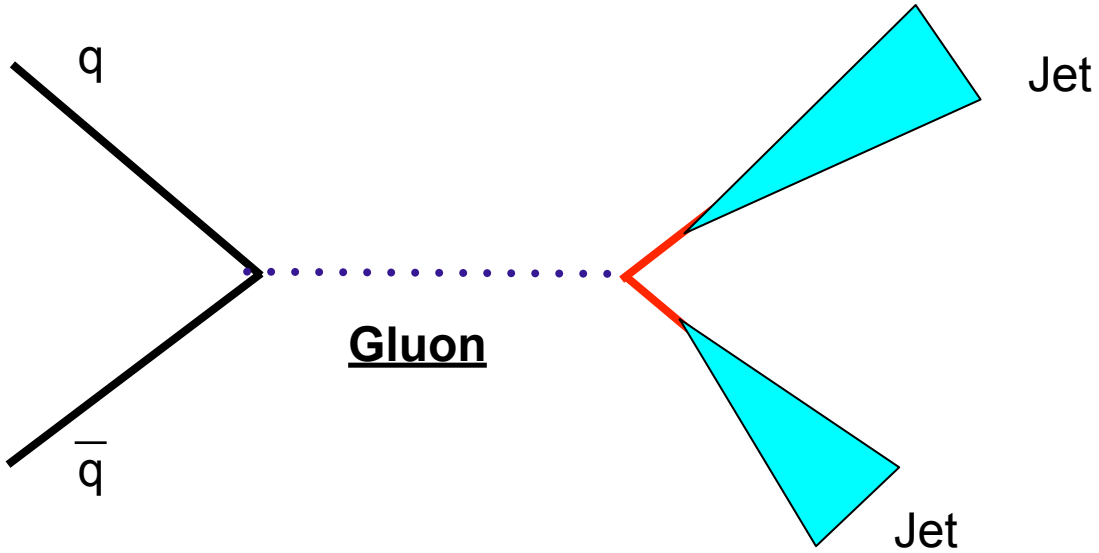
Signature is two jets

Here is a real example =>





What we are looking for!

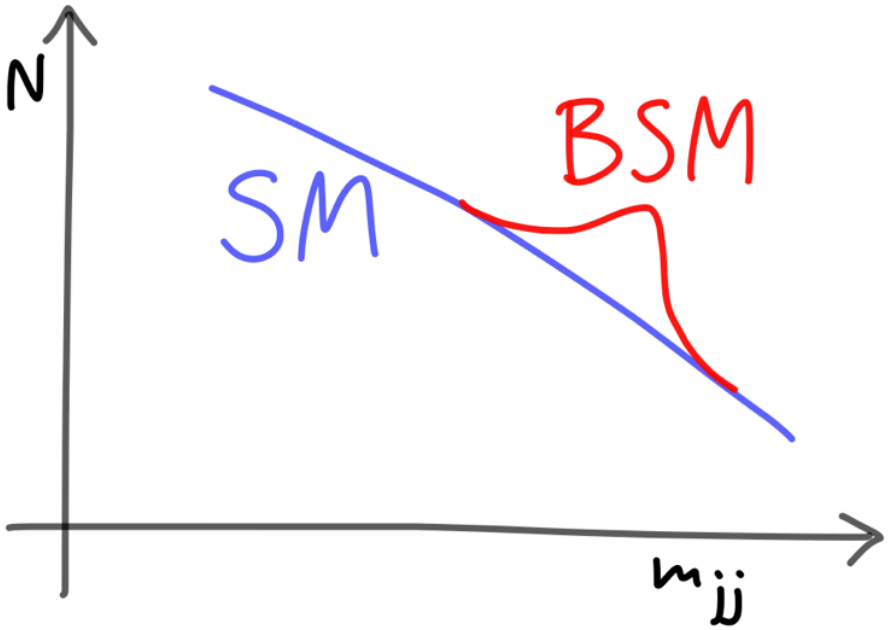


SM Physics

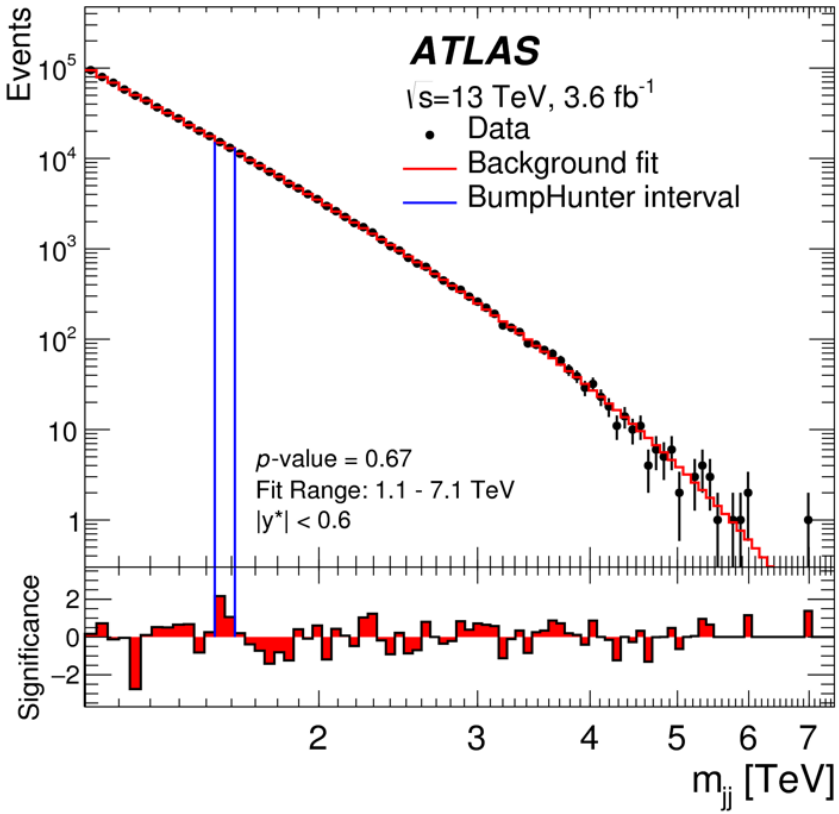
Looks very similar

- Count number of events that you see.
- Make a plot agains the energy of the two jets added together (mjj)
- Look for any deviations from Standard Model (SM) prediction

In Theory



In Practice



1) What I do.

2) What I actually do.

3) How I got into it.

4) Questions?

Physics Analysis

Understand the data that is coming from ATLAS

- Are there any deviations from the SM prediction?
- What are the errors of the measurement?
- Calibration, are the detectors reliable?
- How can we remove backgrounds to our signal?

14 Daily Basis

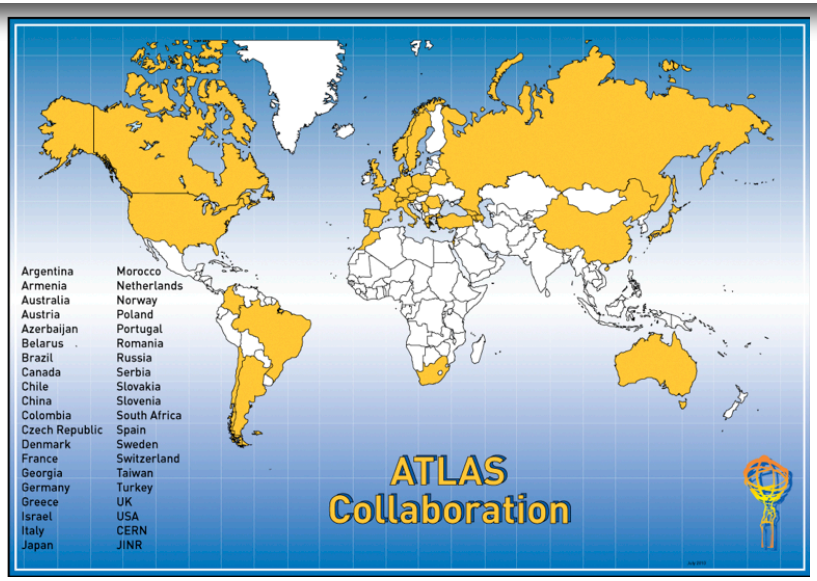
1) Computing / Coding

- Write a set of commands that computers can follow.
- This allows us to consider huge amounts of data in short periods of time.

```
    //default:
    }
  } // If sv1

  //If jf vertex exists
  if ( jet_jf_m_lead_jet > 0 ) {

    h_jf_m_r20->Fill(jet_jf_m_lead_jet, weight);
    h_jf_sig3d_r20->Fill(jet_jf_sig3d_lead_jet, weight);
    h_jf_nvtx_r20->Fill(jet_jf_nvtx_lead_jet, weight);
    h_jf_nvtx1t_r20->Fill(jet_jf_nvtx1t_lead_jet, weight);
    h_jf_ntrkAtVx_r20->Fill(jet_jf_ntrkAtVx_lead_jet, weight);
    h_jf_efc_r20->Fill(jet_jf_efc_lead_jet, weight);

    switch(truthflav_lead_jet){
```

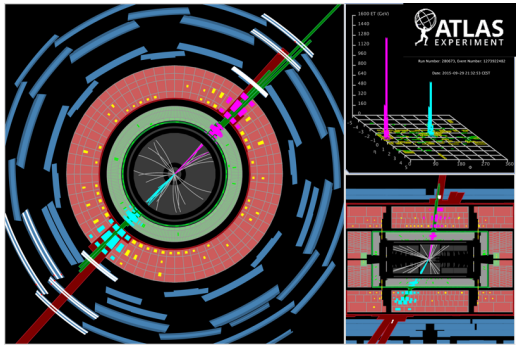
2) Meetings

- ATLAS collaboration is huge.
- A lot of data to analyse, people work in groups to get things done.
- Co-ordination is important to actually get things done



3) Service work

- ATLAS is a large and complicated detector.
- Everyone needs to help to get it work
- I help keep the event display running.



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4) Questions?

- **AGSB** (2003-2010)

- **Undergraduate Physics, Oxford** (2010-2014)
  - Degree is a little different to school.
  - More self reliant and independent.
    - Lectures, Problems Sheets, Tutorials, Practicals, Exams.
  - Time to go into much more detail!

- **Summer Research Internships**
  - Institute of Astronomy, Cambridge 2nd year
  - Project working with CMS, Rutherford-Appleton Lab, Oxfordshire, 3rd year.

  - These are a great opportunity to find out what research is like
  - Where I learnt a lot of research (computing) skills that I now need.

- **Postgraduate Physics, UCL** (2014-2017)

- **Afterwards...** Not sure.

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