

The Search for Vector-like Leptons

Brynn's Project, REU 2019

What are vector-like leptons (VLL)?

- Simpler extension to the Standard Model (SM)
- Proposes a new 4th family of leptons
- Small mixing with SM leptons, mainly taus

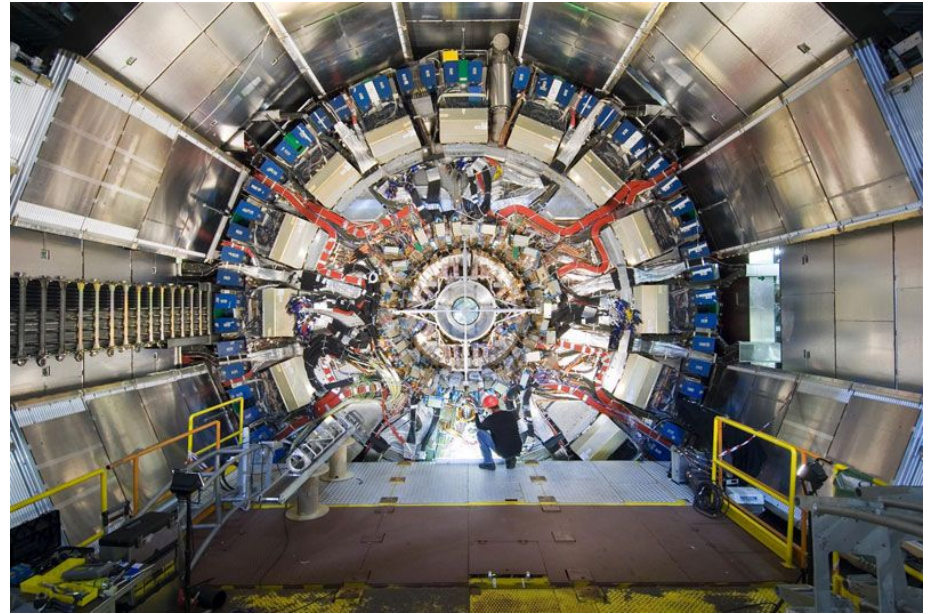
Doublet VLL

$$\begin{pmatrix} \nu' \\ \tau' \end{pmatrix} + \begin{pmatrix} \bar{\nu}' \\ \bar{\tau}' \end{pmatrix}$$

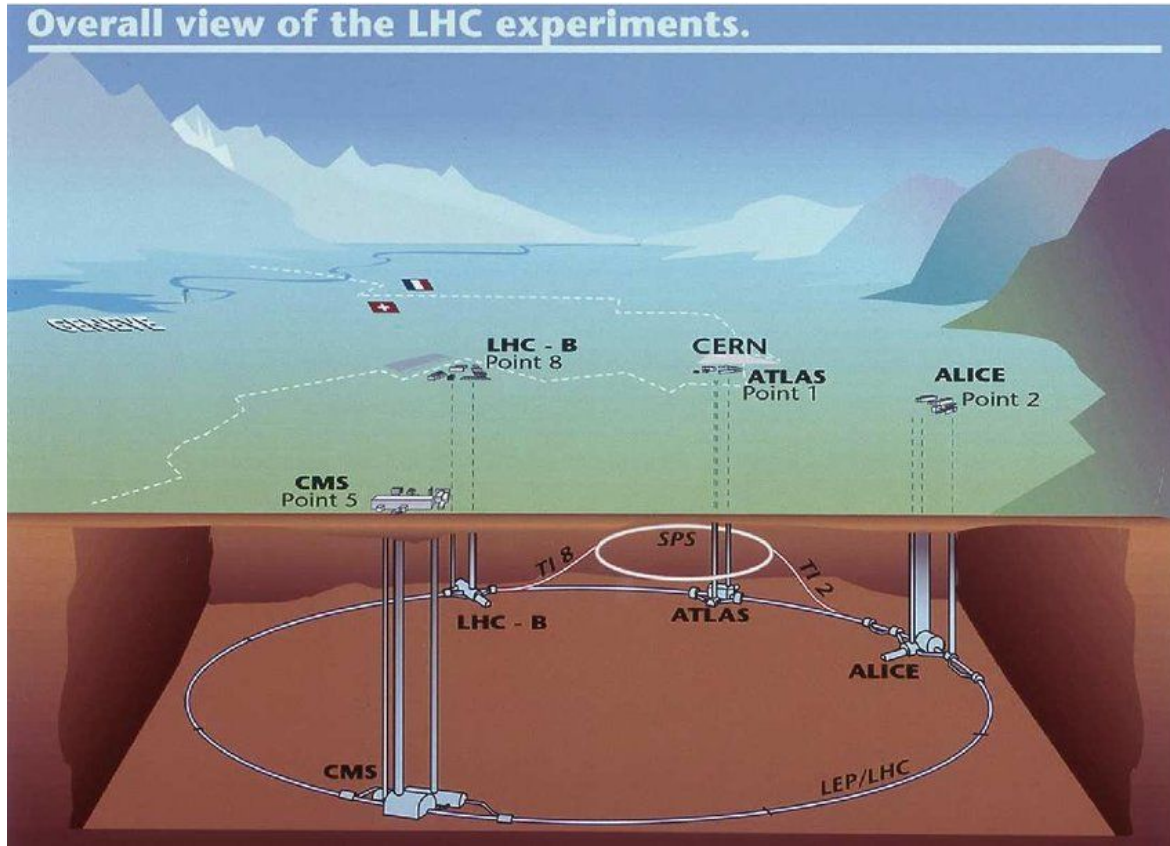


How do we find VLLs?

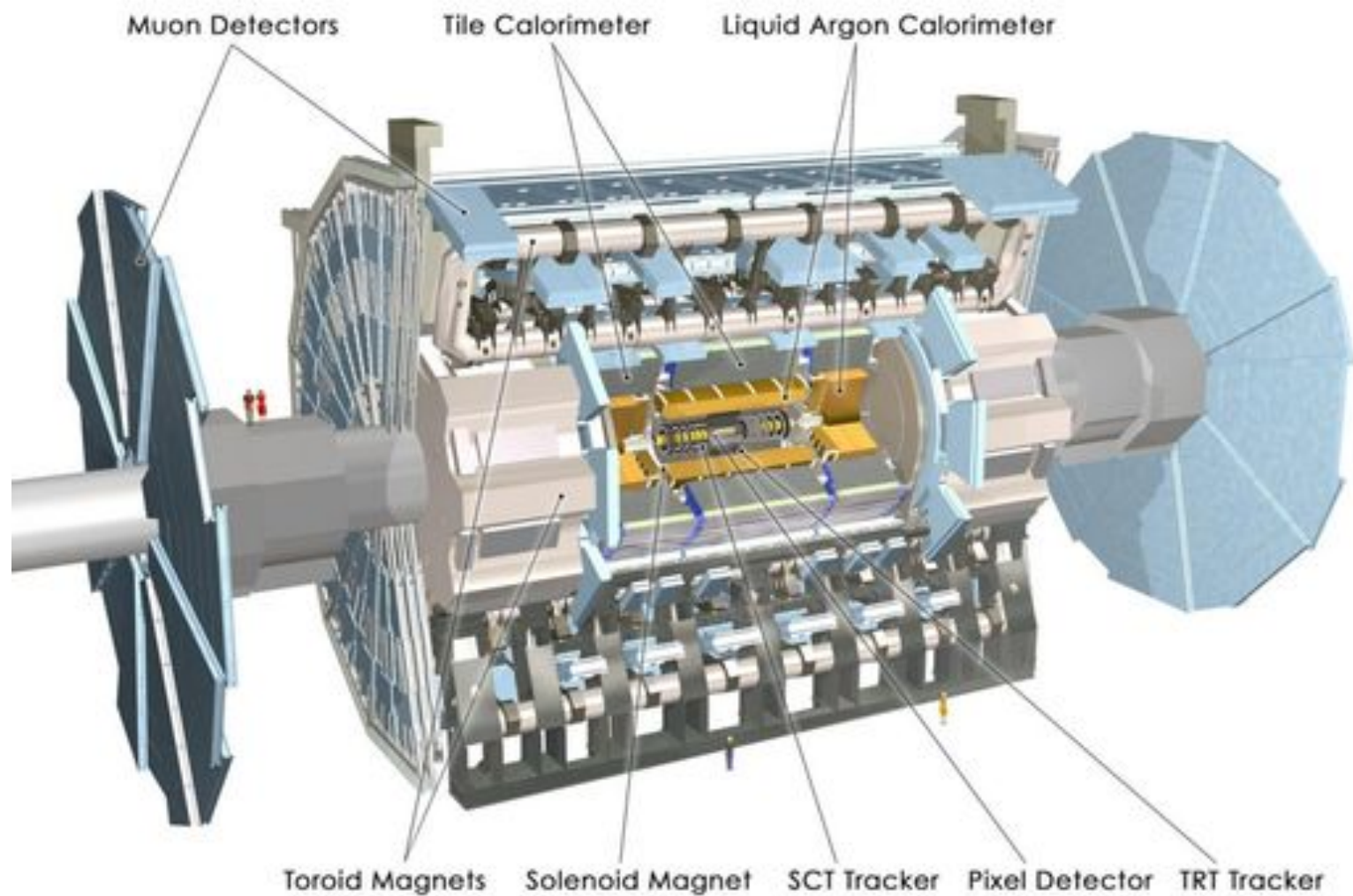
- ATLAS uses proton-proton (pp) collision events to produce the particle
- Have predicted decay patterns for the VLL and see if those expected particles are found by detector (many, many times)

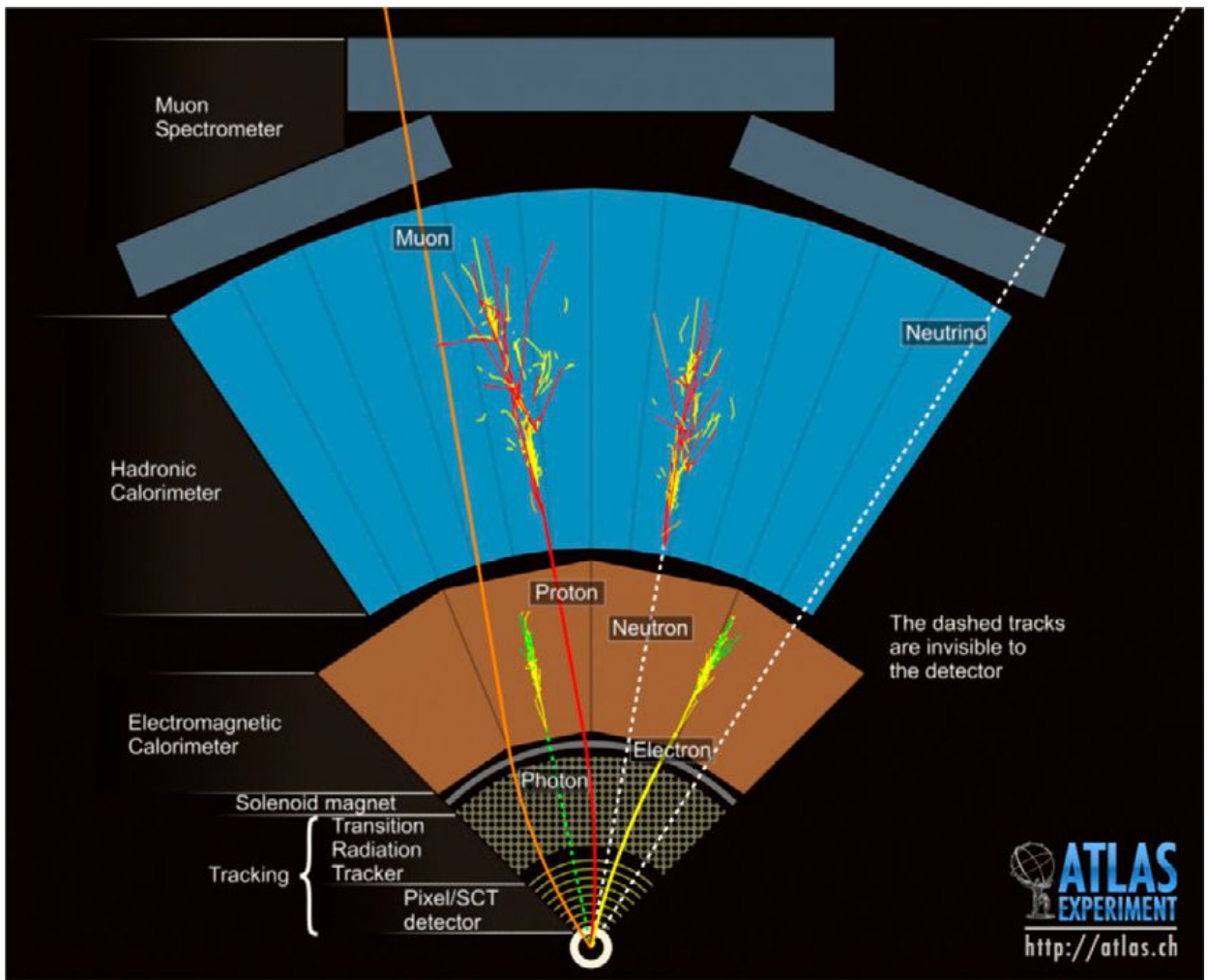


ATLAS detector, courtesy of the ATLAS website.

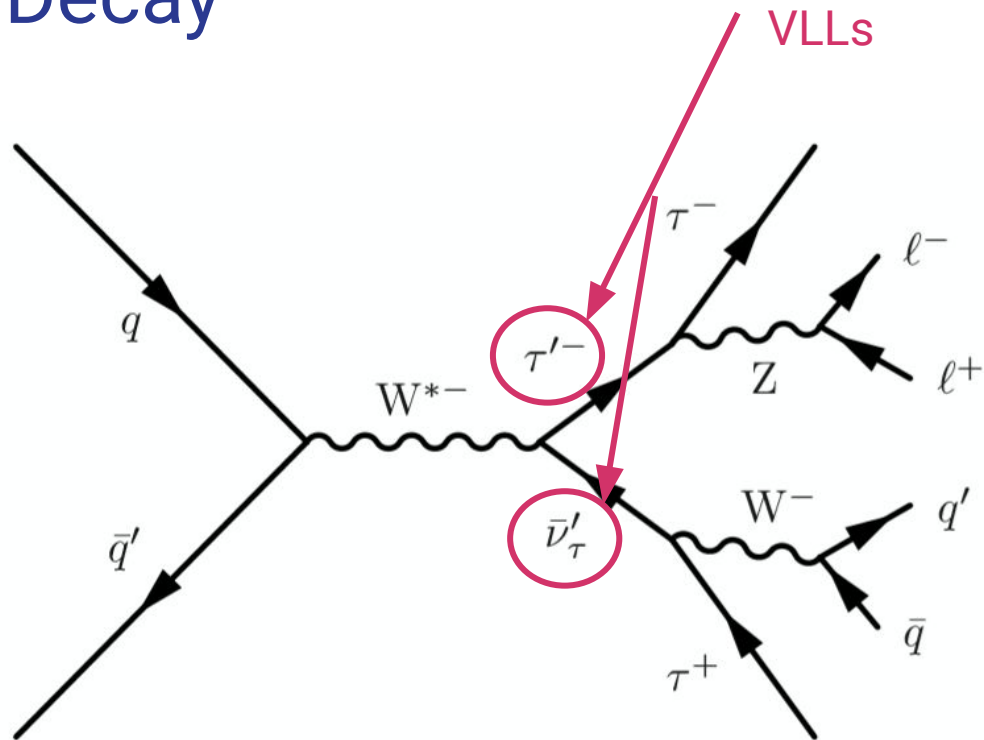


The Detector:





The Decay

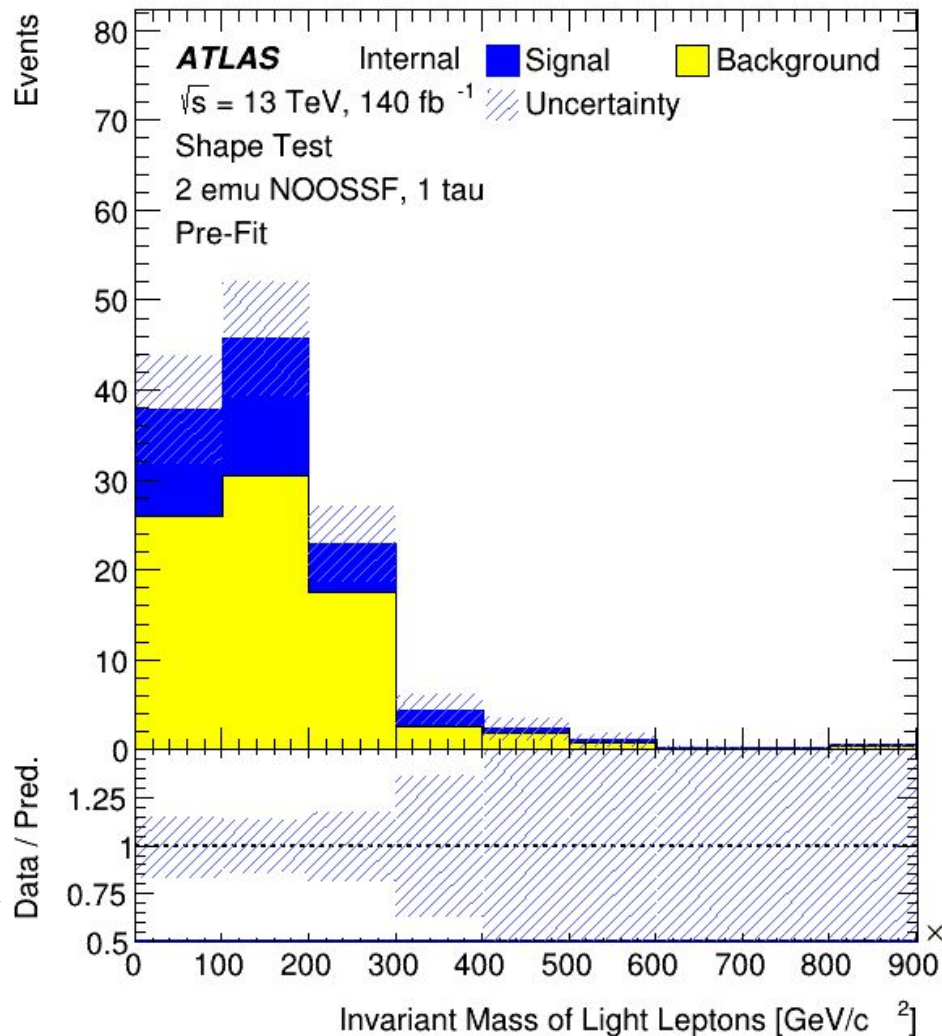


One example
of VLL
decay

My Work

- Use the HEP Server to run analyses
- Need to understand the background and signal in order to optimize the signal and parameters

An example



The background is a solid pink color. In the top right corner, there are several overlapping geometric shapes: a dark pink square, a medium pink square, and a light pink square, all partially cut off by the edge of the frame.

Thanks! Questions?