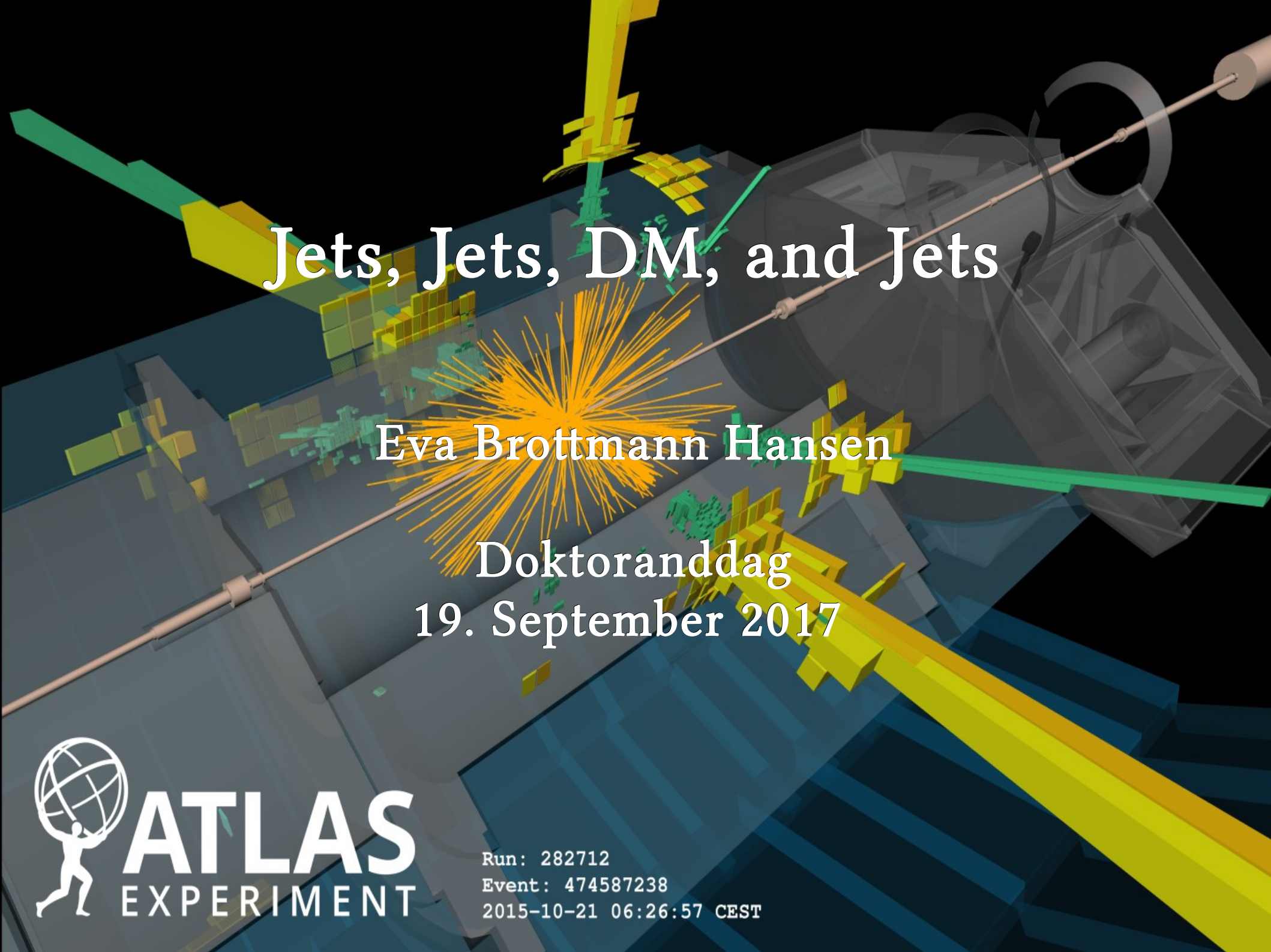



# Jets, Jets, DM, and Jets

Eva Brottmann Hansen

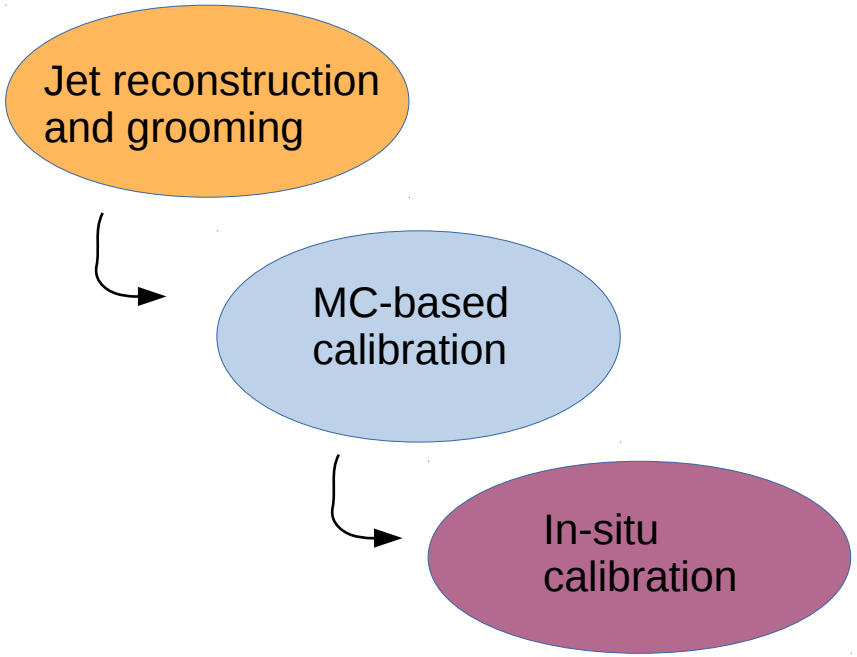
Doktoranddag
19. September 2017

# So far, so good

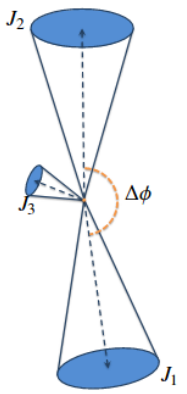
- Supervisor: Caterina the First
- One year and one week in to my PhD
- Dark matter searches with jet final states in ATLAS
- Until ~now: Mostly authorship qualification task
- From ~now: Mostly new analysis and upgrade work

# So far: Qualification task

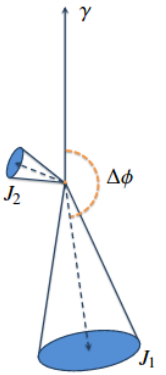
- Constrain large-R jet response (JES,JER,JMS,JMR) with in-situ measurements
- Example: Balance jet against a well calibrated object in data and MC
- Last step of the calibration chain
- Done for the first time in 2016 data for large-R jets
- My job: Combine the measurements to cover more phase space



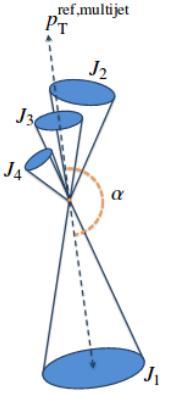

$$Response = p_T^{J1} / p_T^{ref}$$



(a) Di-jet



(b) $\gamma$–jet

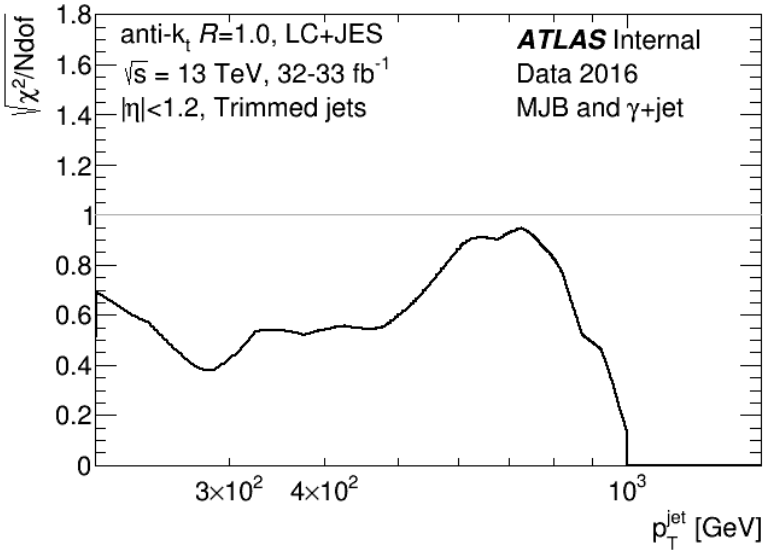


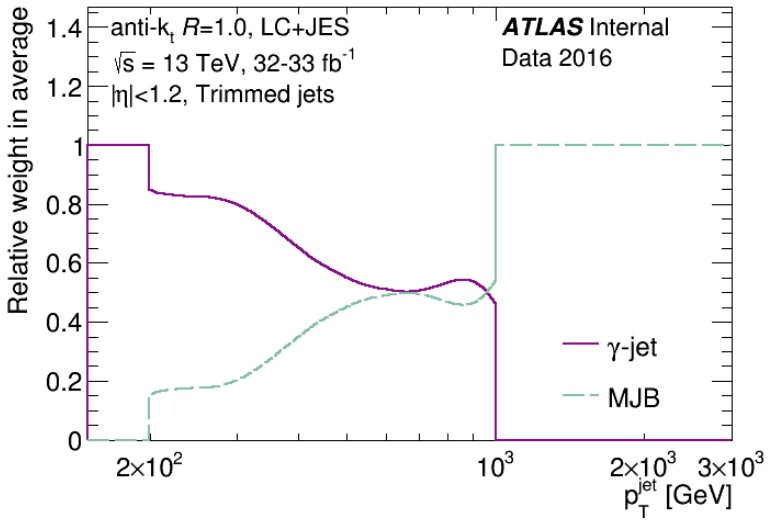
(c) Multi-jet

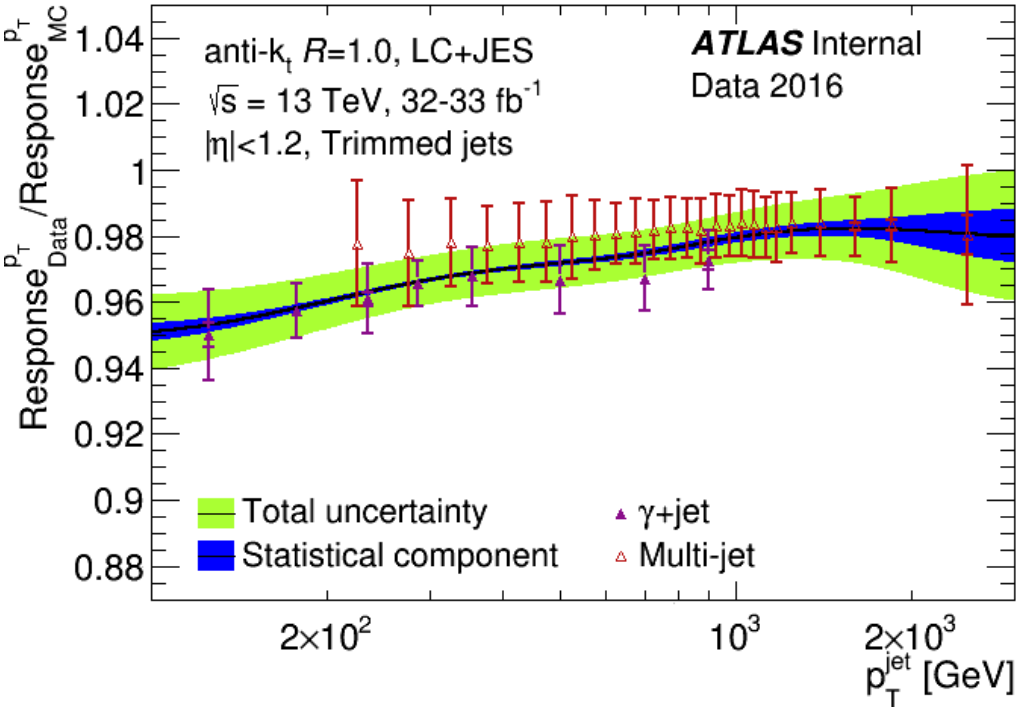
[1]

# In-situ Combination

- Measurements interpolated with cubic splines
- Weighted average based on $\chi^2$-minimization
- Weights account for systematics, correlations and different bin sizes
- Uncertainties scaled by the sqrt($\chi^2/N_{dof}$)
- Response ratio and uncertainties smoothed with a Gaussian kernel

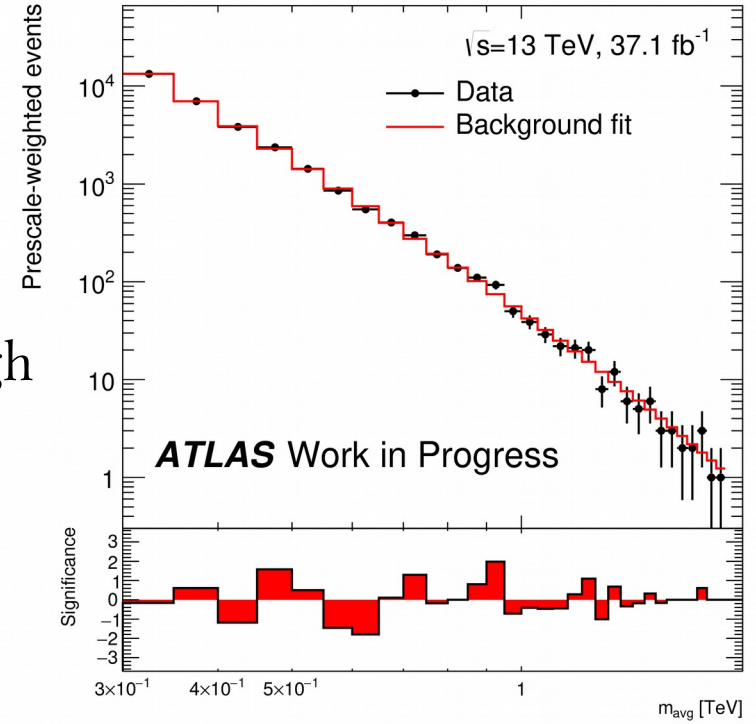


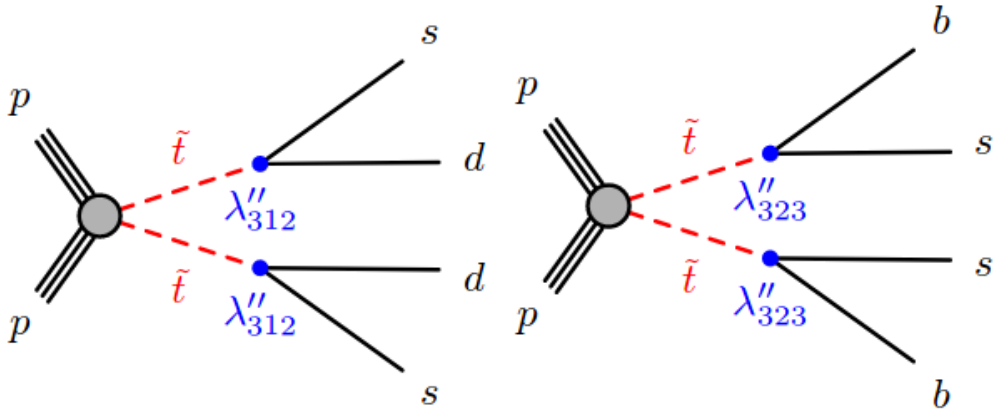



# So far: 4-jet analysis

- Search for pair produced, massive resonances decaying to two jets each – No missing $E_T$
- Interpreted in a SUSY simplified model where lightest particle is a Stop decaying to jets through R-Parity violating coupling
- My contribution: Fit background in 'validation region' to provide systematic uncertainty on background estimate

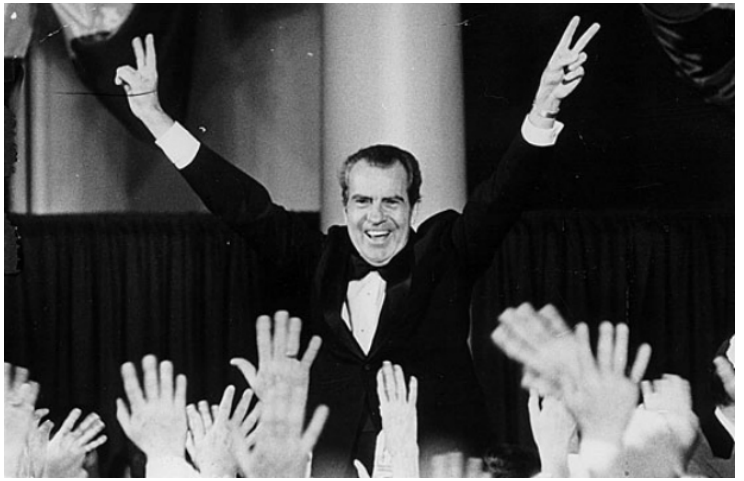


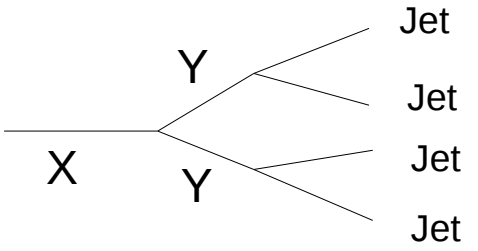

(a) $\tilde{t}\tilde{t}^* \to (\bar{d}\bar{s})(ds)$ (b) $\tilde{t}\tilde{t}^* \to (\bar{b}\bar{s})(bs)$

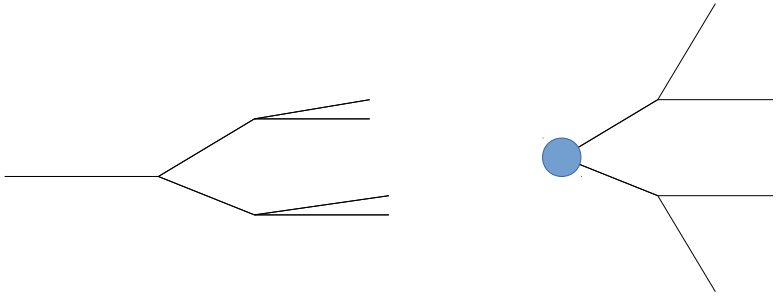
[2]

# Next 6 months: Nixon Analysis

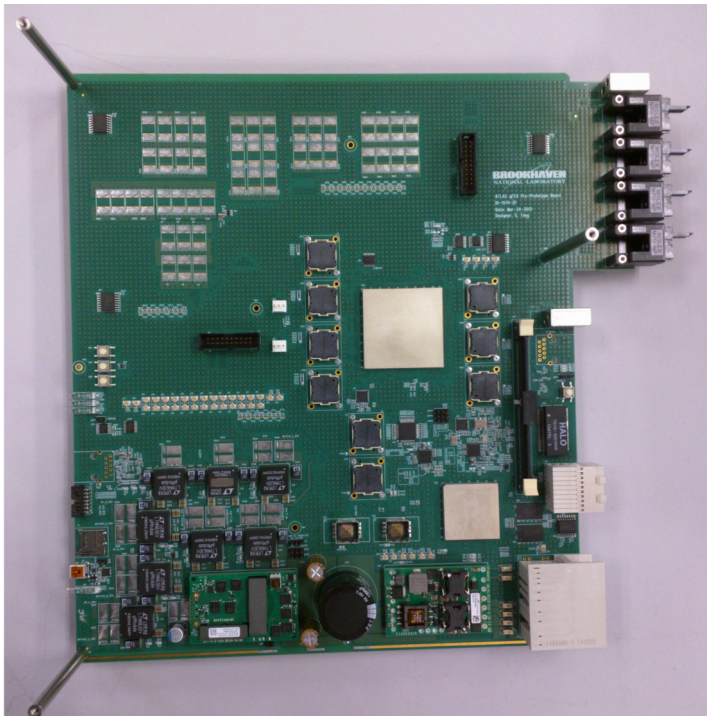


- Paired dijet final states
- Will cover a wide range of masses for pair produced resonances associated to Dark Matter or SUSY
- Near future:
  - Show that (or whether) a different technique than 'normal dijets' is necessary for this signature
  - Test/develop generic, scale invariant anti-QCD tagger



# Next 6 months: Global Feature Extractor (gFex)



[3]

- Module for Phase-1 upgrade of L1Calo
- Entire η range of calorimeter available in one module
- Enables identification of large radius jets and substructure in real time

  ⟶ Capture Lorentz boosted W/Z/Higgs/top
- Other global event variables:
  - Missing transverse energy
  - Centrality in heavy ion collision
  - Event-by-event pile-up energy density

    ⟶ Local pileup suppression using baseline subtraction techniques

- My task: Software that controls connections and communication with databases

# Useful Course

- CERN School of Computing (link)
  - Base technologies
    - Performance tuning
    - Parallelization
    - Security
    - Networking
  - Data technologies
    - Storage
    - Visualization
  - Physics computing
    - Multivariate classification
    - Data analysis

# Useful Course

- CERN School of Computing (link)

# References


- [1] ATLAS Collaboration: “In-situ measurements of the ATLAS large-radius jet response in 13 TeV pp collisions”
- [2] ATLAS Collaboration: “A search for pair-produced resonances in four-jet final states at s√ = 13 TeV with the ATLAS detector”
- [3] ATLAS Collaboration: “gFex Phase-1 TDAQ Upgrade: Final Design Report”