Overview of ISU ATLAS Group

Outline

- Brief introduction of ISU group
  - ✓ Personal and experimental expertise
  - ✓ Previous analysis activities at ATLAS (Run I)
- Current activities at ATLAS (Run II)
  - ✓ Ongoing and future Analysis, Upgrade
  - ✓ Possible analysis ideas for new postdoc
- Future plan

ISU Group Overview

- Personal: all supported by DOE on ATLAS
  - ✓ 3 faculties (Jim Cochran, Soeren Prell & Chunhui Chen)
  - ✓ 1 permanent research scientist (Nils Krumnack)
    - Nils is one of leading ATLAS software developers/experts
  - ✓ 4 postdoc:
    - Jie Yu (Ames), Francesco De Lorenzi (CERN)
    - Fenfen An (joint with IHEP), Bo Liu (joint with IHEP)
  - ✓ 6 graduate students
  - ✓ 0.5 FTE engineer/technician support

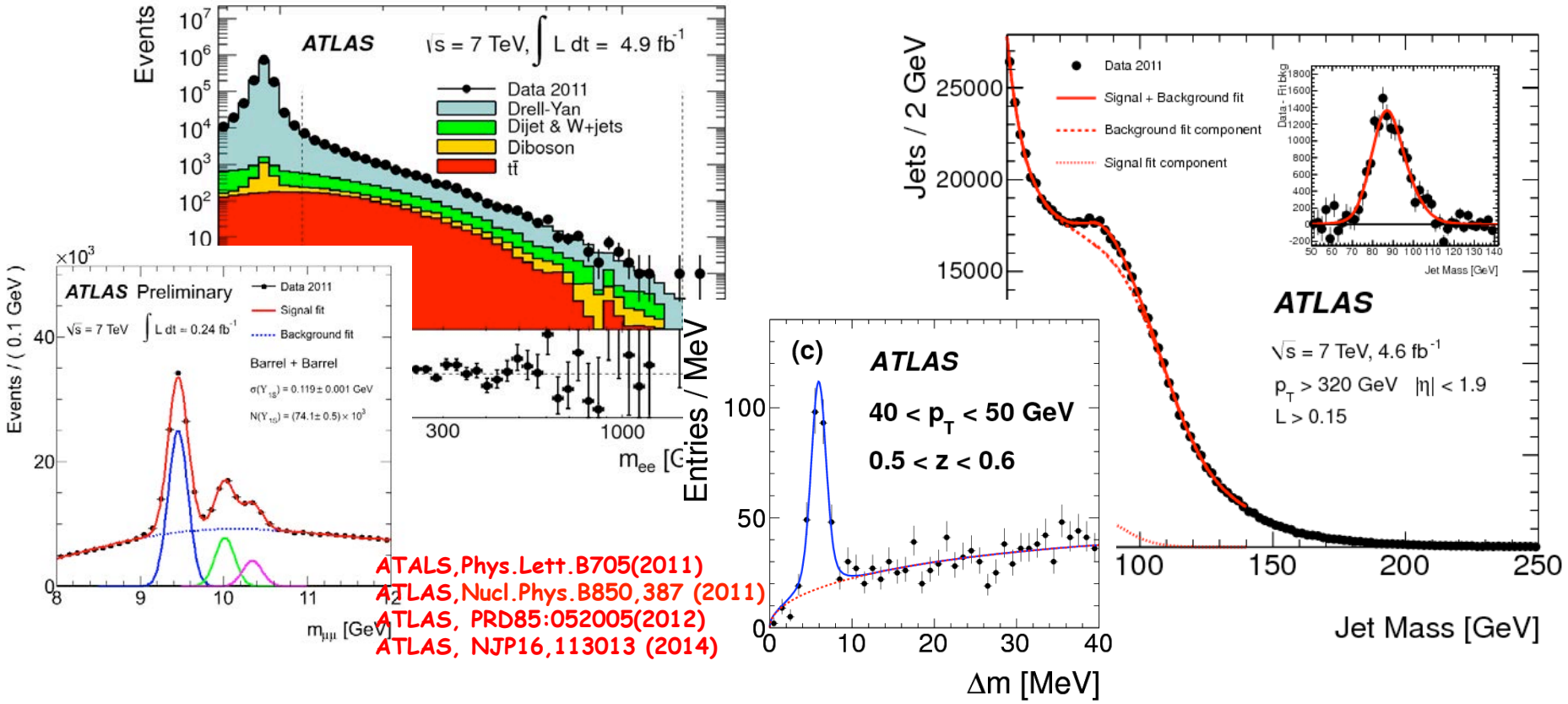
- Previously involved with DELPHI, D0, BaBar
  - ✓ Primarily focus on ATLAS at this time
  - ✓ Hardware group (DELPHI) -> Analysis oriented (BaBar) -> Analysis + ATLAS Phase II (QC for Phase II silicon strip)

- ATLAS analysis: still primary focus of our group
  - ✓ Past: Leading contribution > 10 ATLAS papers:
  - ✓ Now: Exotic searches and Higgs physics, new Analysis method

- Excellent review by DOE in last 2 competitive review

Atlas Analysis Run I (7/8TeV)

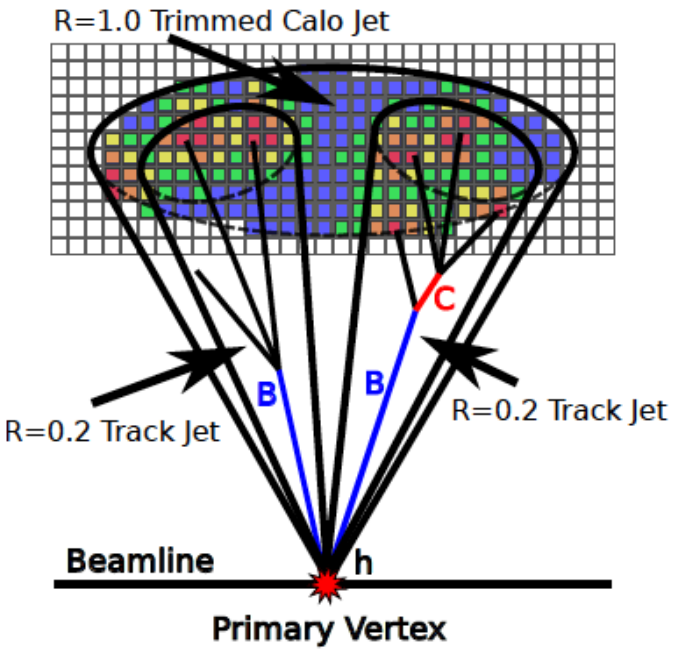
- Early data analysis focus on SM measurement (7 TeV)
  - ✓ Limited data sample
  - ✓ Help understand SM background & detector for NP
  - ✓ Publication: DY production (thesis), J/Psi production (thesis), D* jet, boosted W/Z

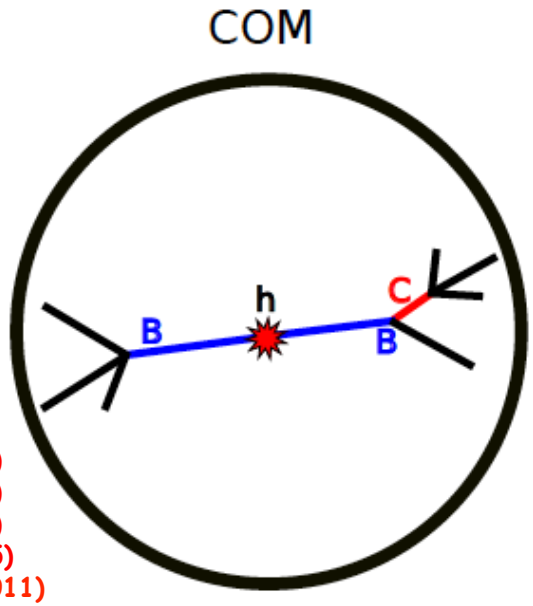


ATALS,Phys.Lett.B705(2011)
ATLAS,Nucl.Phys.B850,387 (2011)
ATLAS, PRD85:052005(2012)
ATLAS, NJP16,113013 (2014)

Atlas Analysis Run I (7/8TeV)

- Early data analysis focus on NP searches (7/8 TeV)
  - ✓ Final state with boosted W/Z jet: diboson resonance
    - Identify single jets containing multiple quarks
    - Develop new jet substructure methods: jet rest frame
  - ✓ Other complementary NP searches: Z'(thesis), Heavy neutrino, LFV Z decay, Vector-like top (thesis)

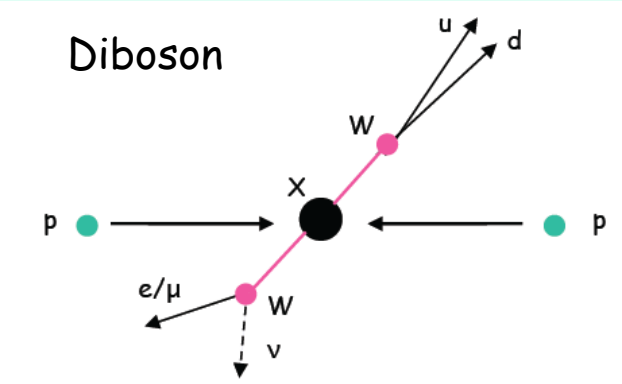




C. Chen, PRD85,034007(2012)
C. Chen, PRD87,074007(2013)
C. Chen, PRD88,074009(2013)
C. Chen, PRD92, 093010(2015)
ATLAS, Phys.Lett.B705,28(2011)
ATLAS, PRD90,072010(2014)
ATLAS, EPJC 75:209 (2015)
ATLAS, PRD92,032001 (2015)
ATLAS, PRD 92, 112007 (2015)
ATLAS, PLB755, 285-305 (2016)

Current Atlas Analysis Run II (13TeV)

- Six ongoing ATLAS analysis (leading or major contributions)



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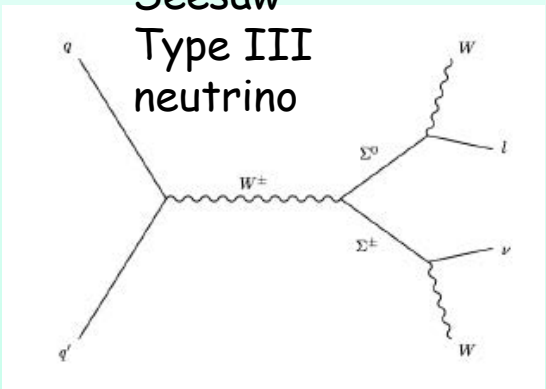
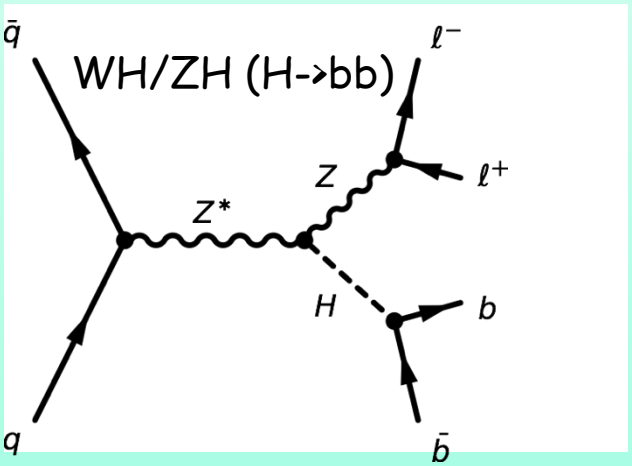
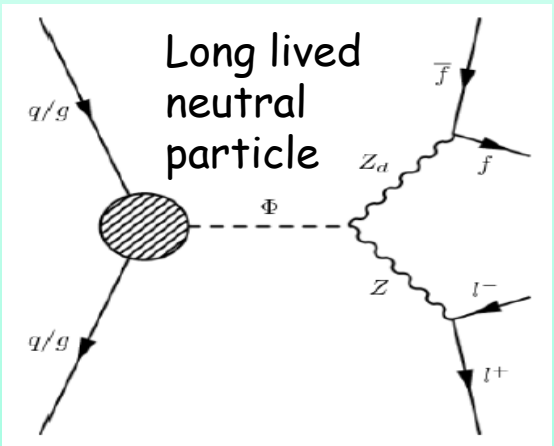


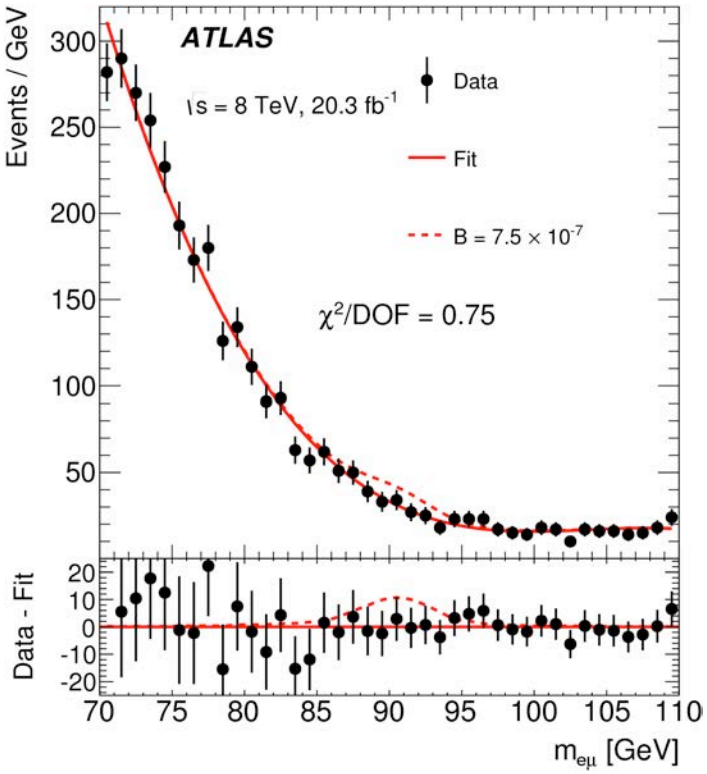


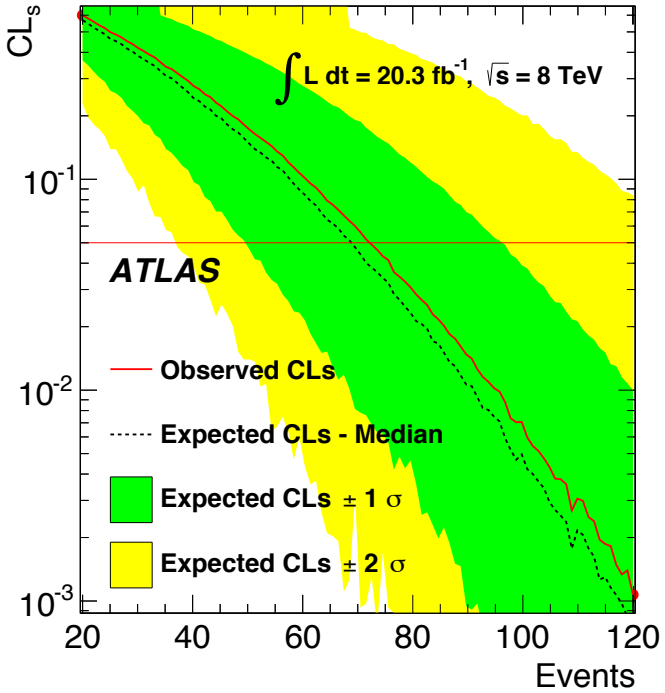


- Search for Lepton flavor violating Z decay (see later slides)
- New double b tagging for boosted Higgs (see later slides)

Lepton flavour violating decay Z/H->eμ

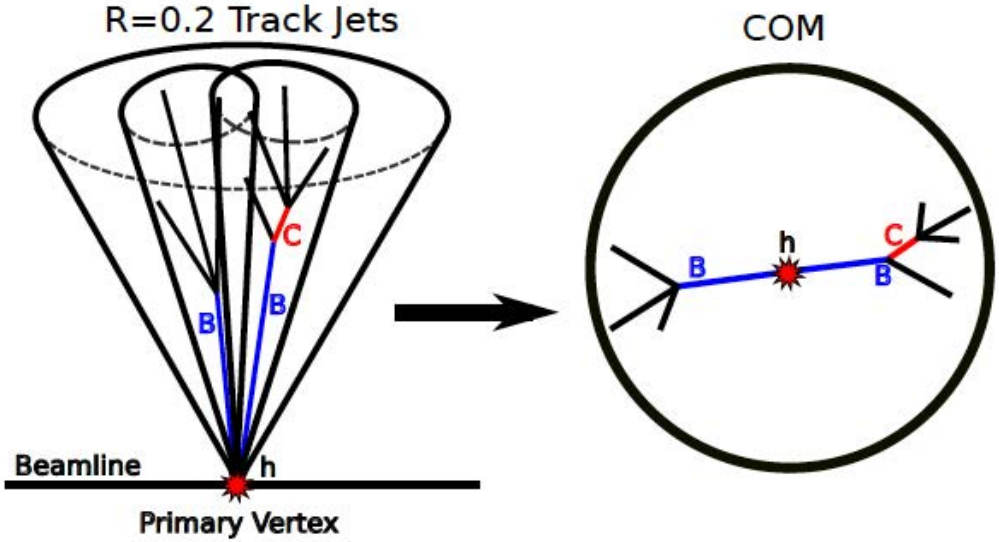
- Z->emu search done by ISU & OSU group with Run I 8TeV data: PRD
- Update analysis with 13TeV data (2016+2017)
  - ✓ Thesis topic for Hai Jiang (ISU student),
  - ✓ Expect to done by early 2018
  - ✓ Simple analysis strategy: A peak over smooth background



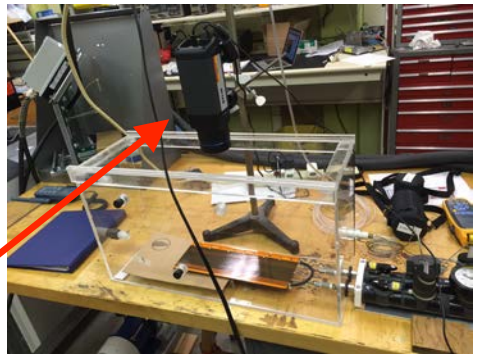


Boosted H->bb tagging in jet CM frame

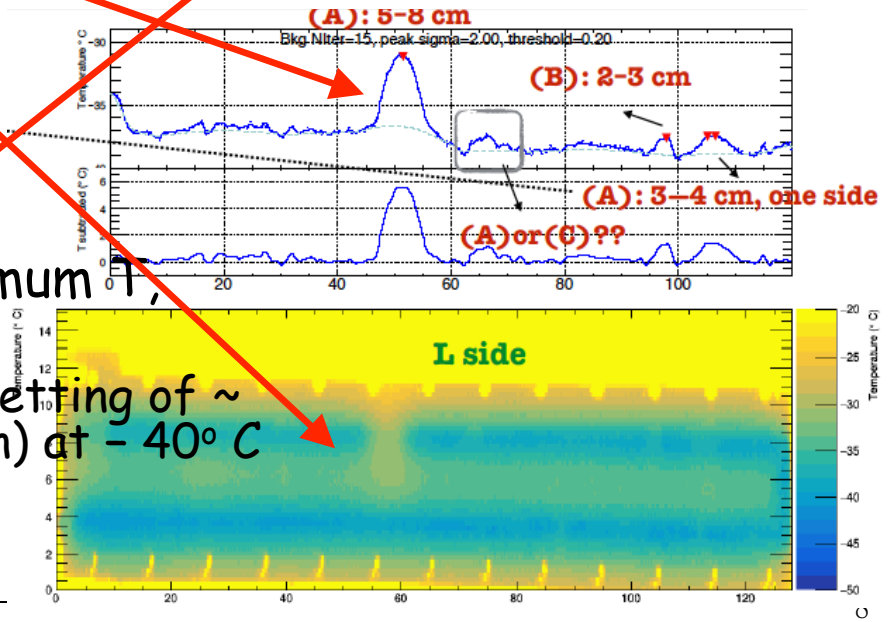
- Boosted H->bb reconstructed in a single jet
- Identify both b quarks inside the single jet
  - ✓ Many different approaches: fixed R=0.2 cone track jet (default)
  - ✓ Variable R track jet, Exclusive Kt subjet, CM subjet
- CM subjet method has best performance
  - ✓ 30% - one order of magnitude improvement vs. default ATLAS method
  - ✓ PUB note is under review, working on calibration and performance paper
  - ✓ Make it official tool for future analyses in ATLAS
  - ✓ ISU student thesis



Phase II Upgrade: Thermal Imaging Stave QA

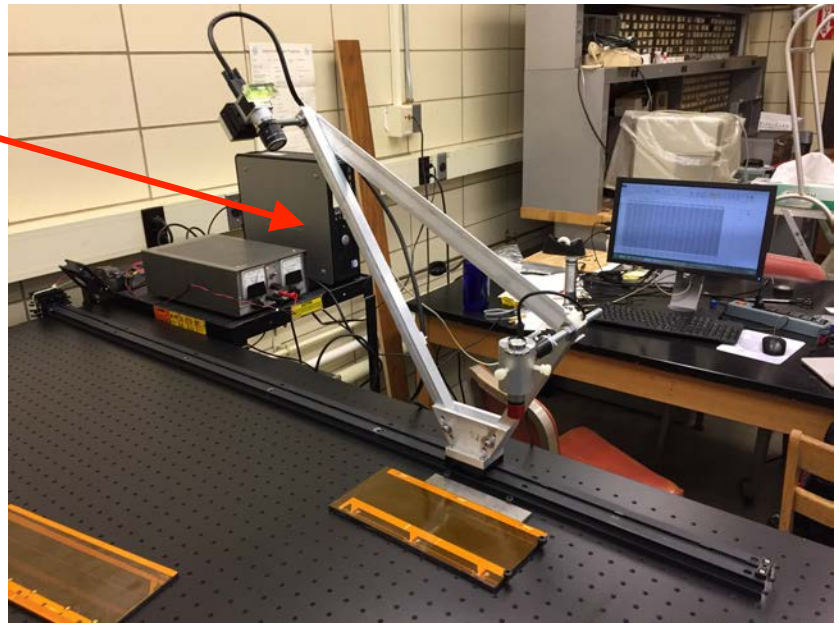


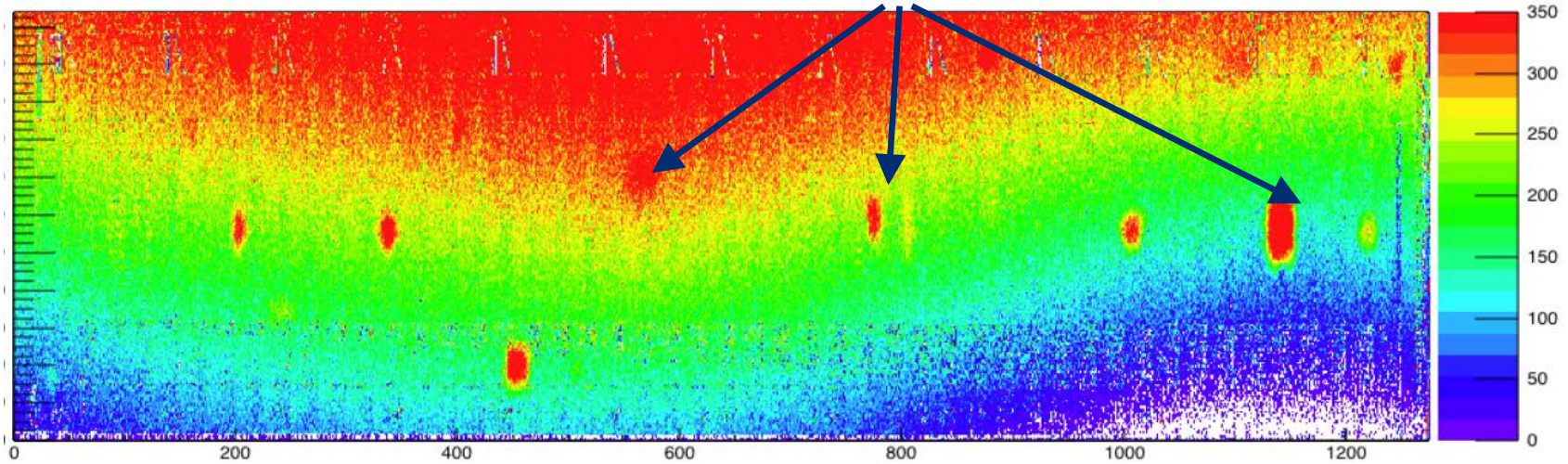
- Principle
  - Stave coolant circulates at – 40° C, ambient at room temperature (in dry air atmosphere to avoid ice build up)
  - Thermal image of stave visualizes cooling path
  - Interruptions in cooling path (due to delaminations) from pipe to foam to facing show up as hot spots
- Recirculating chiller (SP Scientific RC211B0)
  - T range –80 °C → + 75 °C
  - Booster pump (180 psi @ –60 °C)
  - Currently operating above –35 °C (limited by pressure gauge)
- FLIR A655sc thermal camera (minimum T, resolution, noise)
  - Total noise of ~ 0.1° C and max. vignetting of ~ 1.0° C (can be reduced by calibration) at – 40° C



Laser Scanning Stave QC

- Scan stave surface with laser array and CCD camera triangulation
- Labview software reads out camera, performs center-of-line finding and in-situ height calibration
- Subtract image of non-pressurized stave from image of pressurized stave (at 3-5 psi) to make delaminations between honeycomb and facing visible
- Also used for bending/flatness tests





Future Plan

- ATLAS analysis focus on NP searches using Higgs boson
  - ✓ Some complimentary analyses
  - ✓ Developing new analysis methods
  - ✓ Ramp up phase II upgrade involvements
- ATLAS will remain as major research focus
  - ✓ DOE funding tied to ATLAS
  - ✓ Student & postdoc support 100% by DOE
  - ✓ Faculties have their own freedom during semesters
- CEPC studies as priority for future direction
  - ✓ No specific preference at this time
  - ✓ Sensitive/feasibility studies of physics case
  - ✓ Jim, Soeren and Chunhui will work closely with coming postdocs