Update: Thermal Imaging

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ISU WEEKLY STAVE QA MEETING

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Motivation

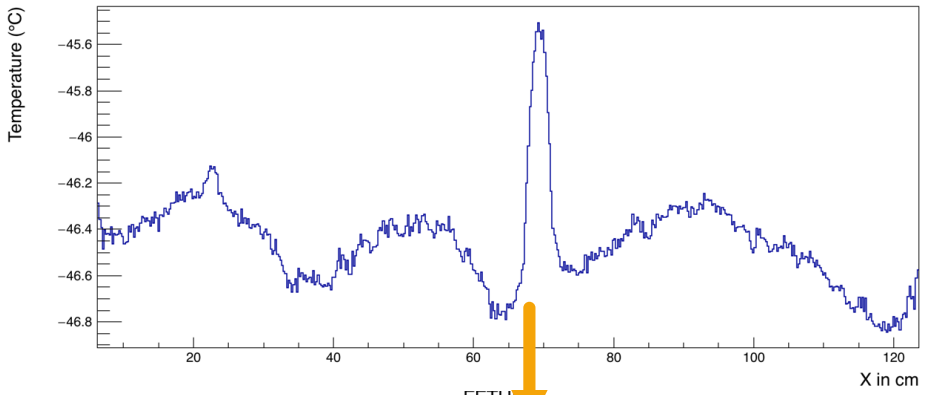
- The main goal of the thermal qc method is to create a system that identifies flaws by looking at a thermal image of a stave. The following code has been developed to find the flaws.
- Once a method of finding the flaws is well established, the goal is to improve the finding ability and characterization of flaws.

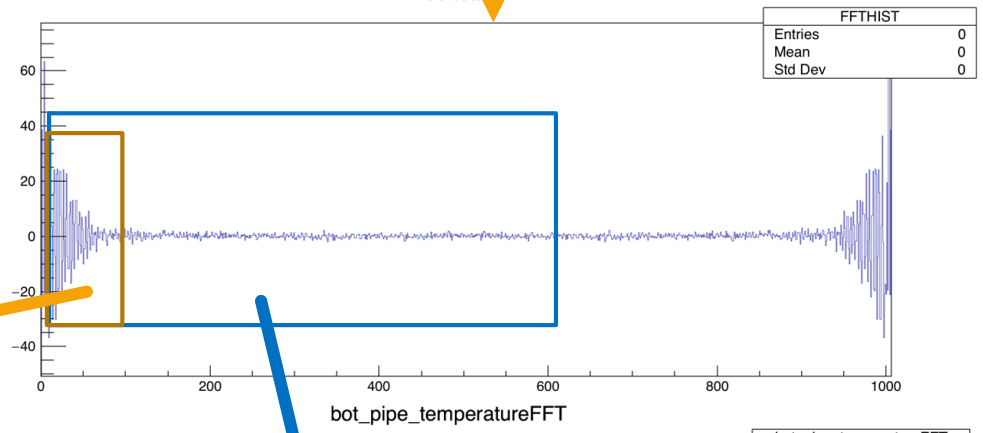
Flaw finding method

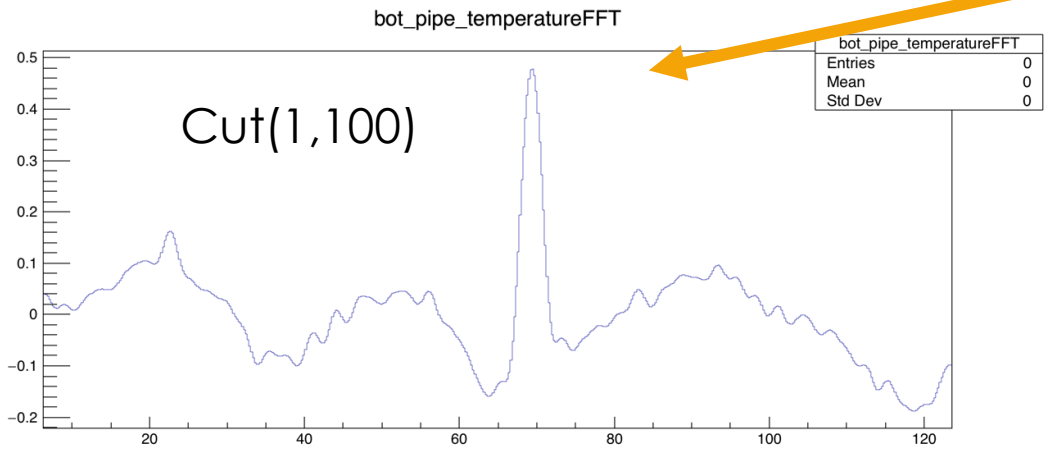
- Import results from frameanal.py
- Pass 1: Attempt to find all "Major" peaks
  - A band pass filter is used on the data. This removes all high and low frequency fluctuations in the data. This smooths tiny fluctuations in the data and removes some background.
    - BandPass(1,100)
  - TSpectrum is then used to find all peaks on the spectrum.
    - (npeaks = 20, sigma = 6, threshold = 0.15)
  - A Gaussian fit is attempted at each peak. If the fit falls within certain size criteria, it is noted as a flaw
    - Width: 2Sigma from fit with range(1-12cm)
    - Height: Height from fitbaseline > 0.1 C
- Pass 2: Attempt to find all "minor" peaks
  - Same approach is used as pass 1: Except…
    - BandPass(3,200)
    - TSpectrum Settings(npeaks = 20, sigma = 2, threshold = 0.01)
    - Ignore Areas with major flaws
    - Different Gaussian Criteria(Not really nailed down yet)

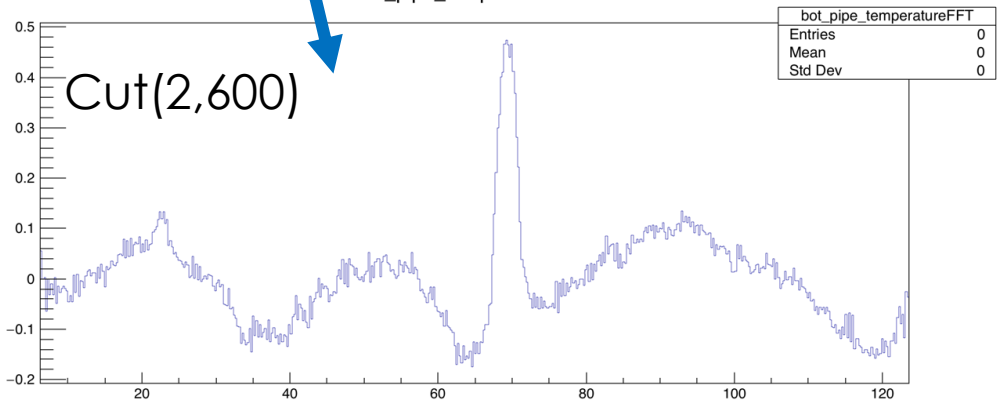
Band Pass Filter

- This Filter takes the raw data(it needs to be inverted for TSpectrum) and transforms it into frequency space.
- A cut is applied removing both low and high frequency values



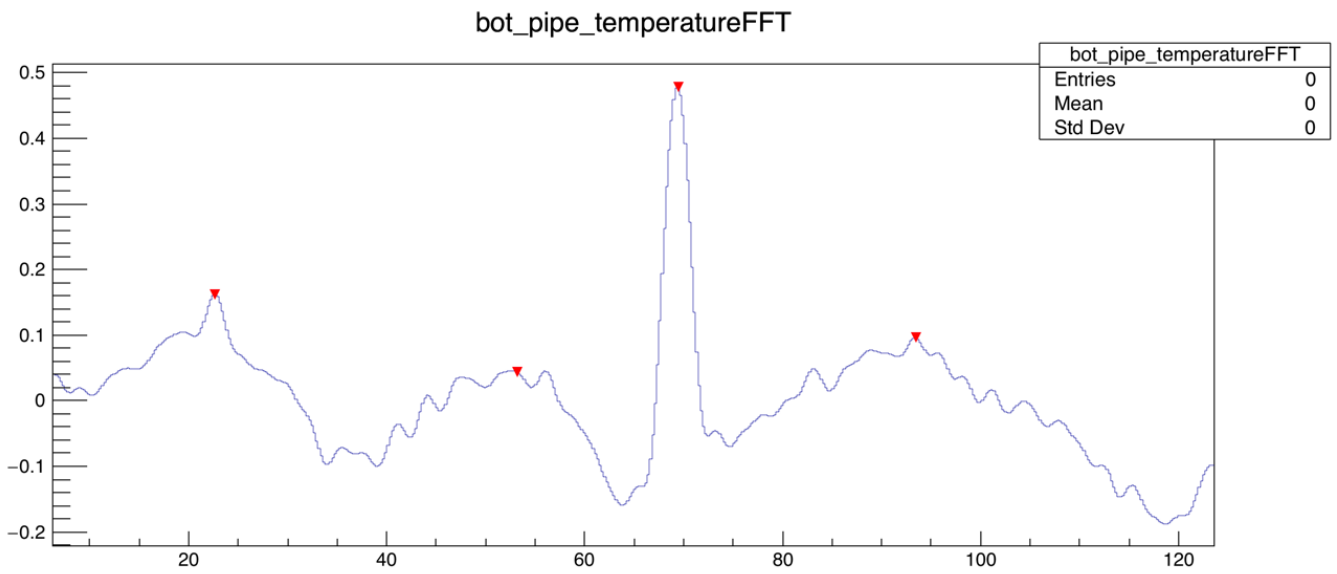






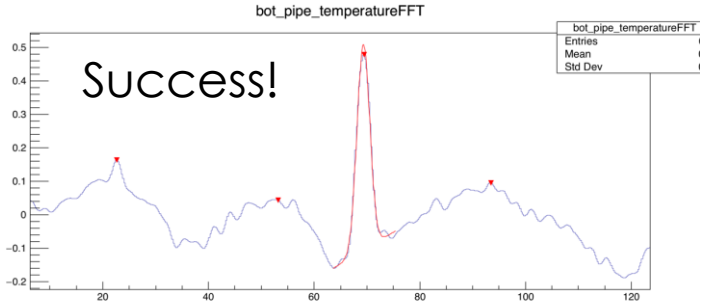
Using TSpectrum to Find Peaks

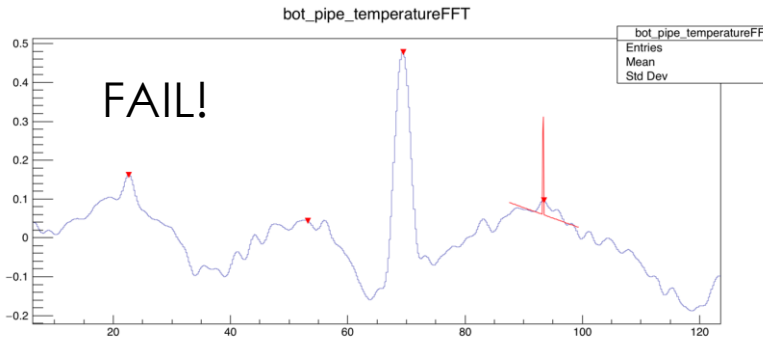
- TSpectrum.Search() is used to find peaks with two input search parameters
  - Sigma: sigma of searched peaks
    - Pass 1: 6
    - Pass 2: 2
  - Threshold: peaks with amplitude less than threshold*highest peak are discarded
    - Pass1: 0.15
    - Pass 2: 0.01

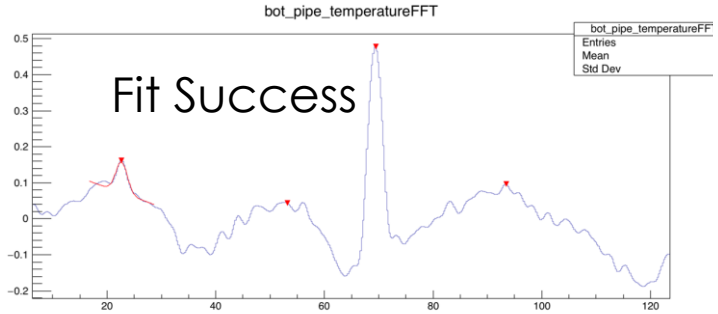


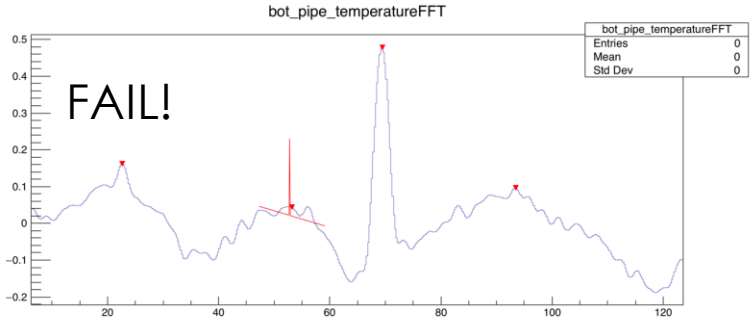
Fitting Each Peak

- Each Peak is fit with an Offset Gaussian Function
  - $C_0 + C_1 x + height * e^{-\frac{1}{2}\left(\frac{x-center}{sigma}\right)^2}$
  - The fitter requires good starting values and strict parameter limits to be successful. Center is taken directly from TSpectrum
  - Fits that match the criteria(Pass 1) below are kept and called defects
    - Center from fit is +/- 2 cm from TSpectrum values
    - 1 cm < 4*sigma < 12cm
    - height > 0.1 C



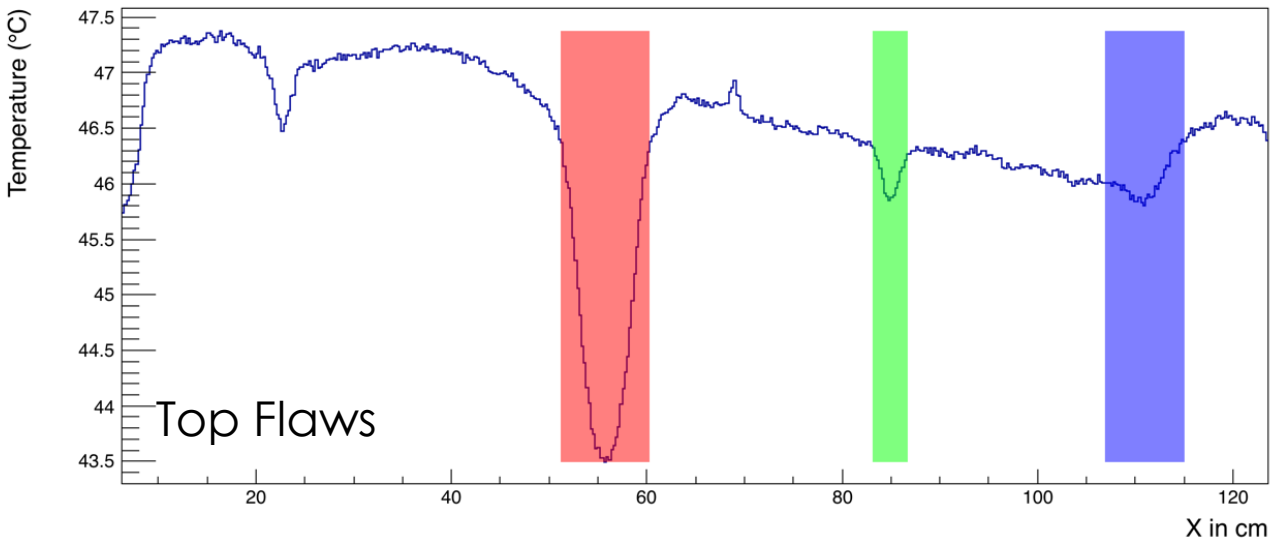


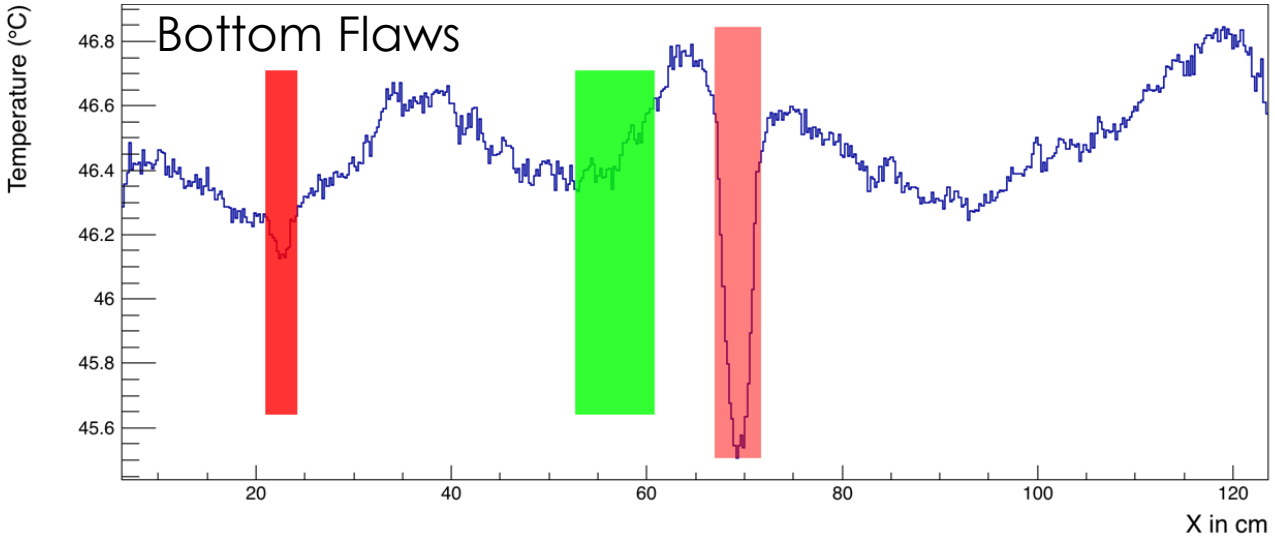




Current Output

- The plots to the right show the output of the flaw finder on stave2R JSide.
- Each box is calculated from the center and sigma values
- Long areas are major flaws and short areas are minor flaws
- It is still a work in progress





Future

- Background- Going to try and use TSpectrum's background generator and see what that gives in improvements in the defects
- Improve fitting- This should happen if backgrounds are better found
- Characterize flaws that are found from all flaws currently in our record

Backup Slides