



# Multi-Dimensional Spectrogram Application

for Live Visualization and Manipulation of Large  
Waveforms

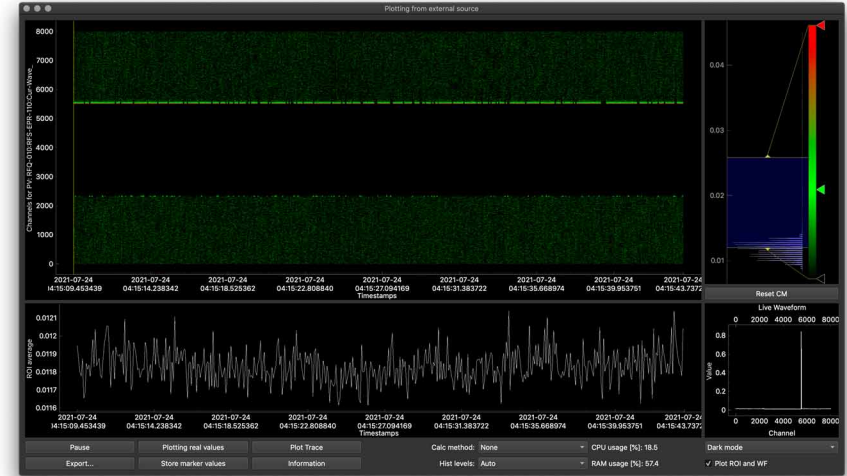
B. E. BOLLING, A. A. GORZAWSKI, J. PETERSSON

2023-10-10

# Challenge

Complex machinery and signals that are difficult to interpret

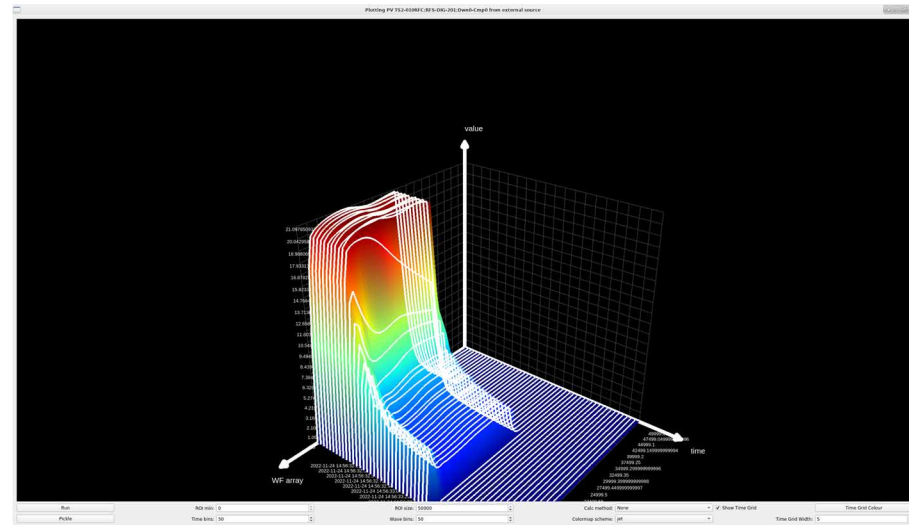
- Complex machinery
  - Many signals
  - How to make sense of the data?
- Early versions: 2D heatmap visualization



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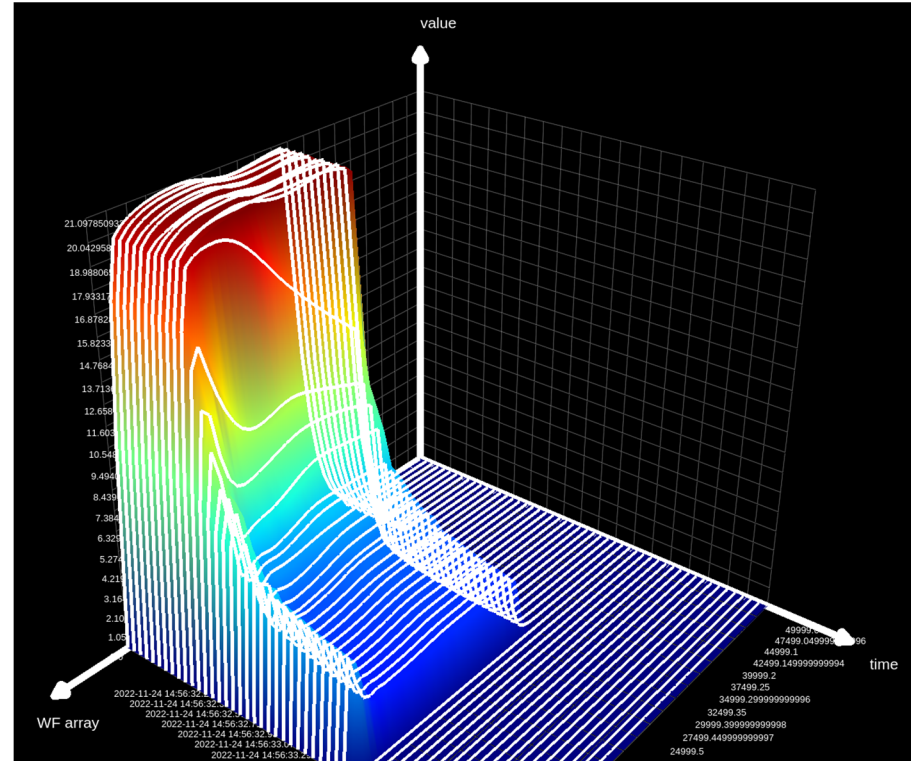
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  - Colleagues suggested: Why not try to use it to model a quench in a SRF cavity



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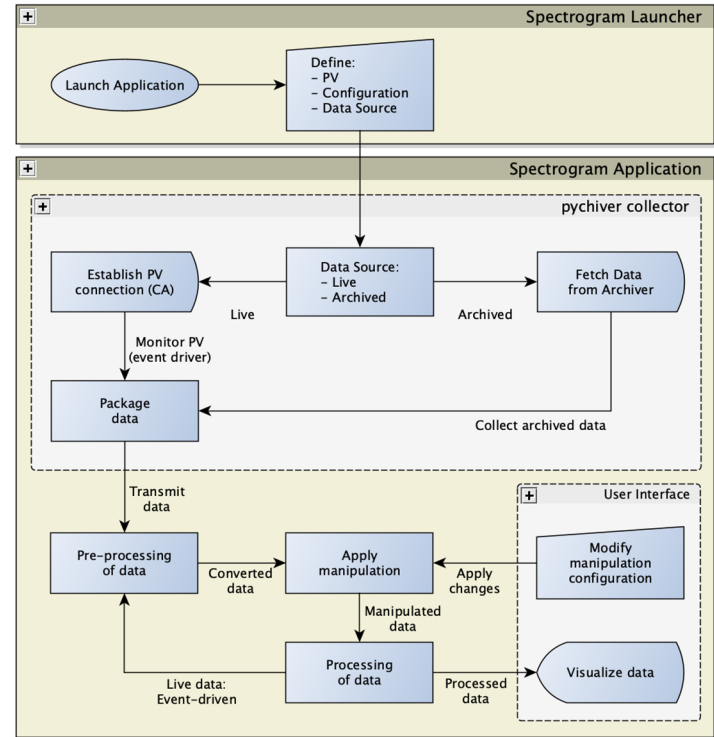
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  - Colleagues suggested: Why not try to use it to model a quench in a SRF cavity
  - Quick (bug-filled) yet successful test-version to capture a provoked quench



# Our work

There is a lot of work left to do and ideas to implement

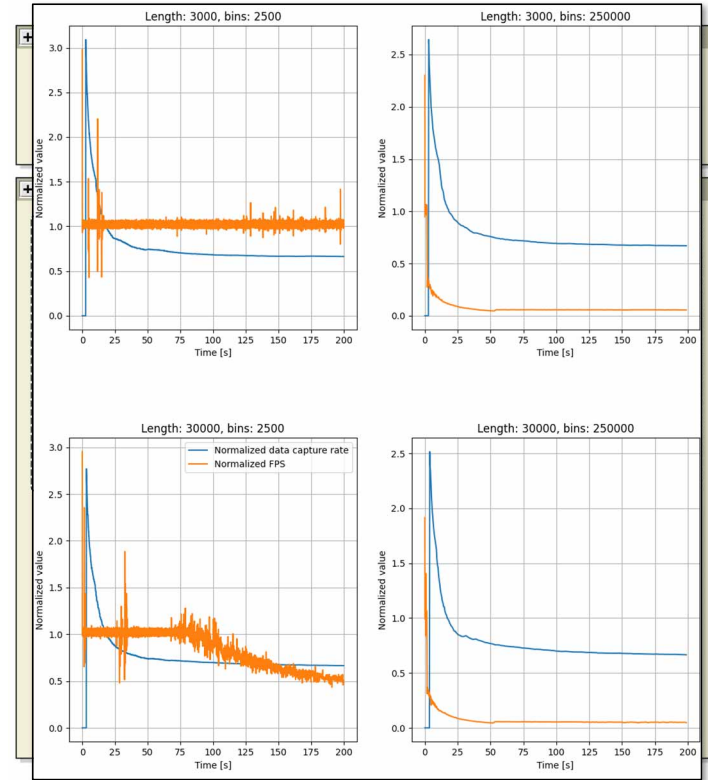
- Launcher
- pychiver
- Data manipulation and processing
- User interface
  - Visualization
  - Configuration of manipulation



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- User interface
  - Visualization
  - Configuration of manipulation
- Benchmarking
  - Found a bug: Some incorrect data buffer handling





# Conclusions

## Features include

## Samples

## Future

- Live manipulation of the data, including applying following to the data array:
  - Discrete Fourier Transformation (including inverse and custom-tailored ones)
  - Power Spectral Density
  - Data Filters
- Colormap setup
- Time grid with modifiable separator
- Exporting and Importing data
- Time and Wave bins
- Region of Interest for the waveform

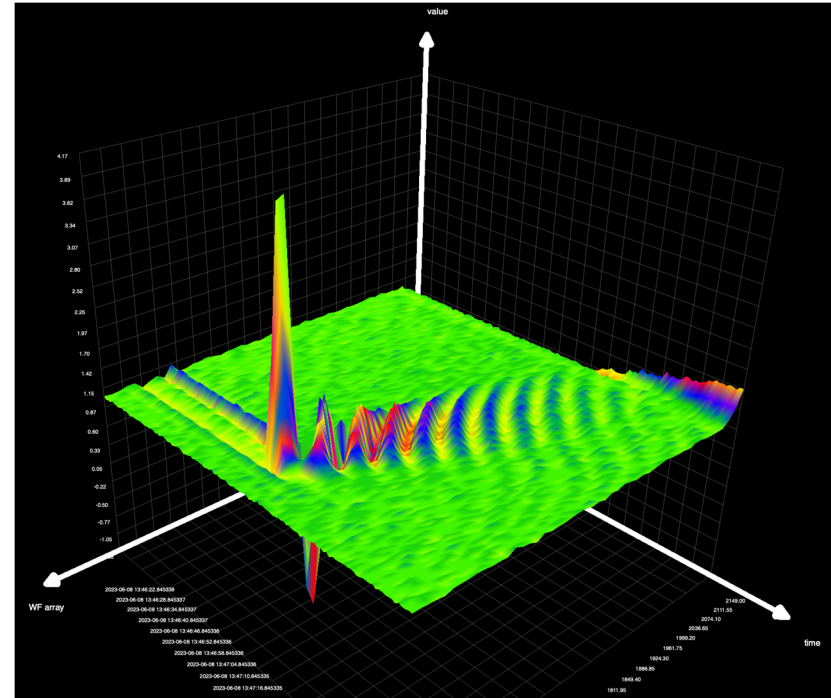
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  - Buncher cavity field phase with adaptive ffw before, during and after a beamloss event







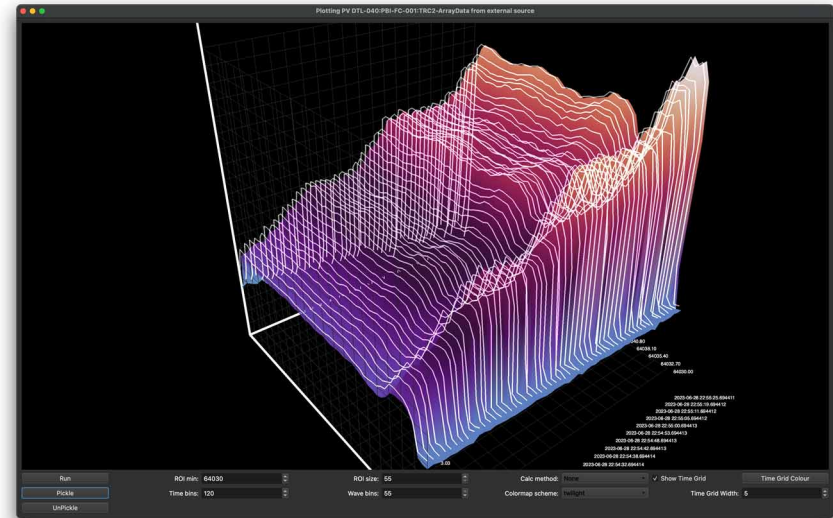
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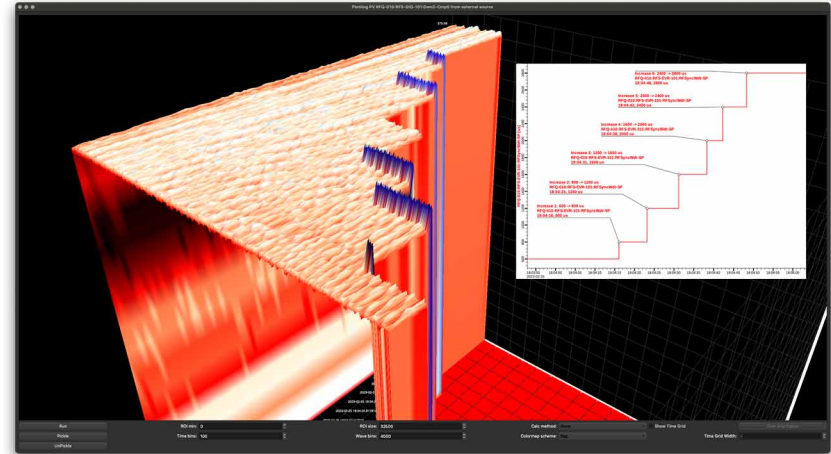
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- Pulse Length Increment
  - Radio Frequency Quadrupole pulse length increase resulting in an initial slight increase of power for some incremented regions



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- More stable implementation on axis labels
- Axis calibrations
- Improve data buffer functions
- Snapshot
- 1D and 2D mode switching compatibilities
- Markers with various tools (all 3 planes?)

