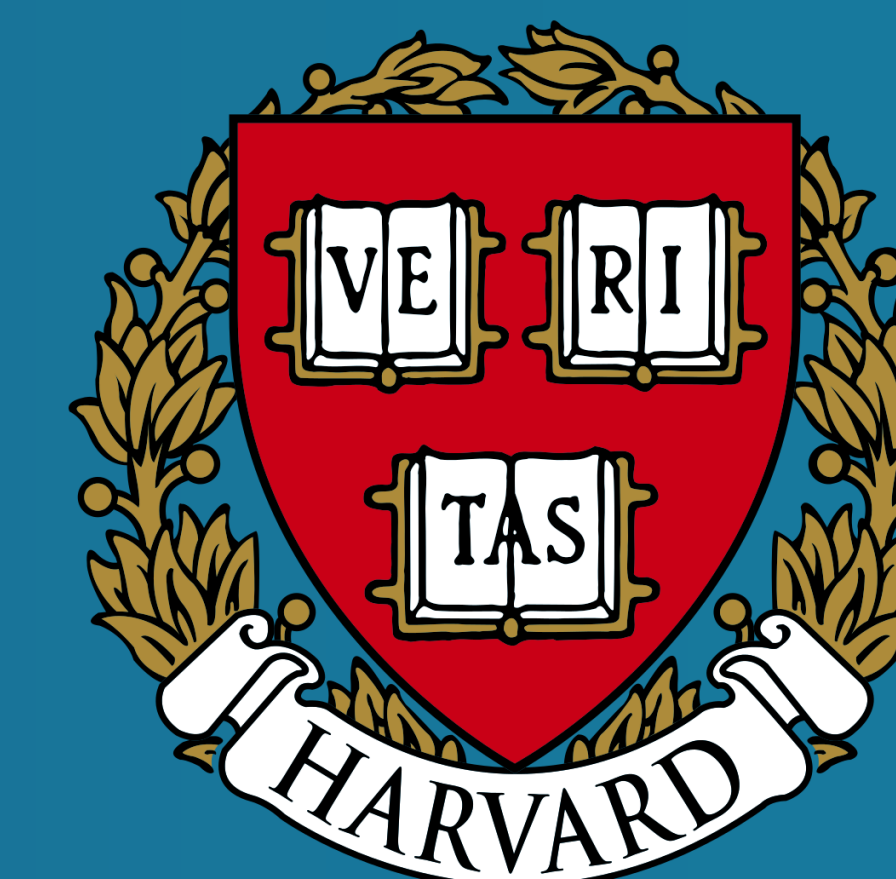


# The Digital Wire Analyzer



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Include University or Department Names if Needed

## Abstract

The Digital Wire Analyzer (DWA) is an instrument that measures the properties of wire planes in a particle physics detector, such as the Anode Plane Assemblies (APAs) used in DUNE.

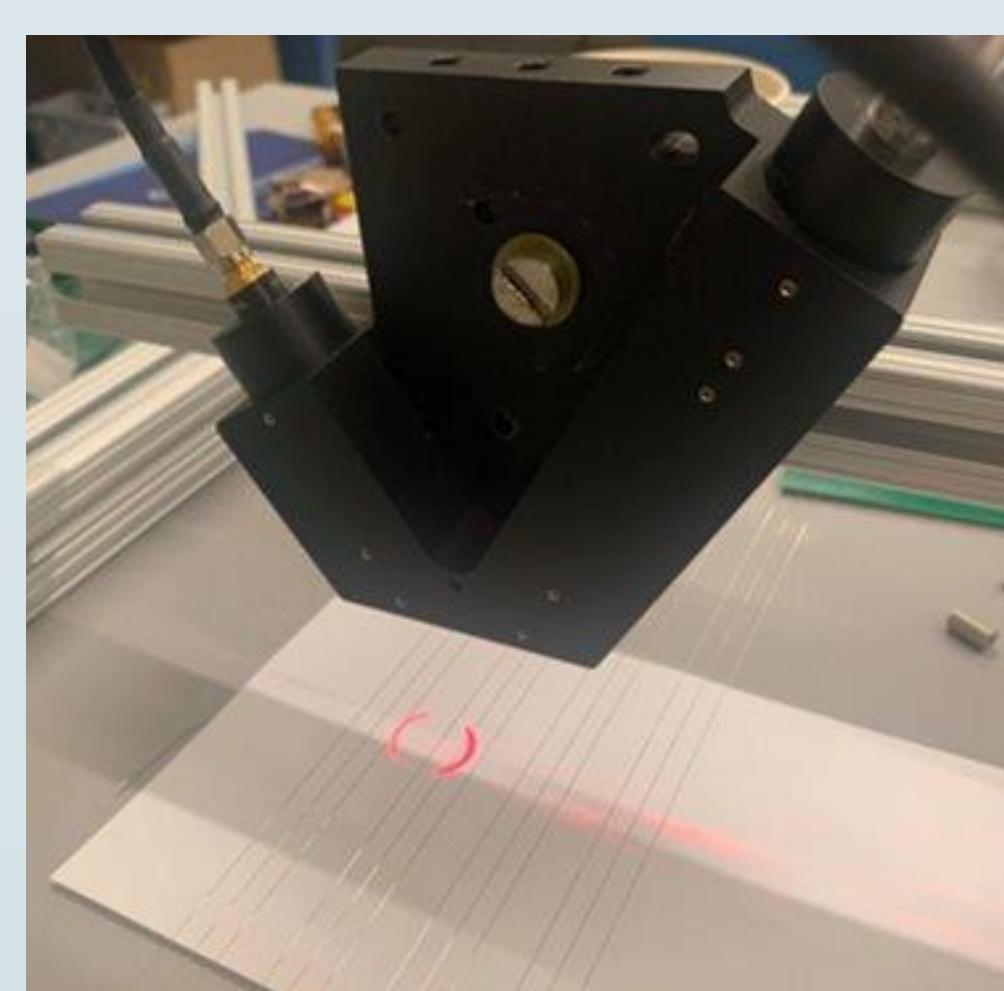
By sending AC current along neighboring wires in a plane and observing their resonance frequency, the tension of the wires can be calculated.

The DWA is also capable of measuring the capacitance of the wires in the plane which is important for the eventual calibration of the experimental data.

## Introduction

The prevailing current method of measuring wire tension involves plucking the wires one by one and using a laser to measure the natural vibration frequency of the wire.

This method is time-intensive, and can only be performed during initial construction. The DWA is not only automatic and much faster, it can measure the tensions at any point during production or commissioning, or even in operation.



The Laser Method

## Methodology

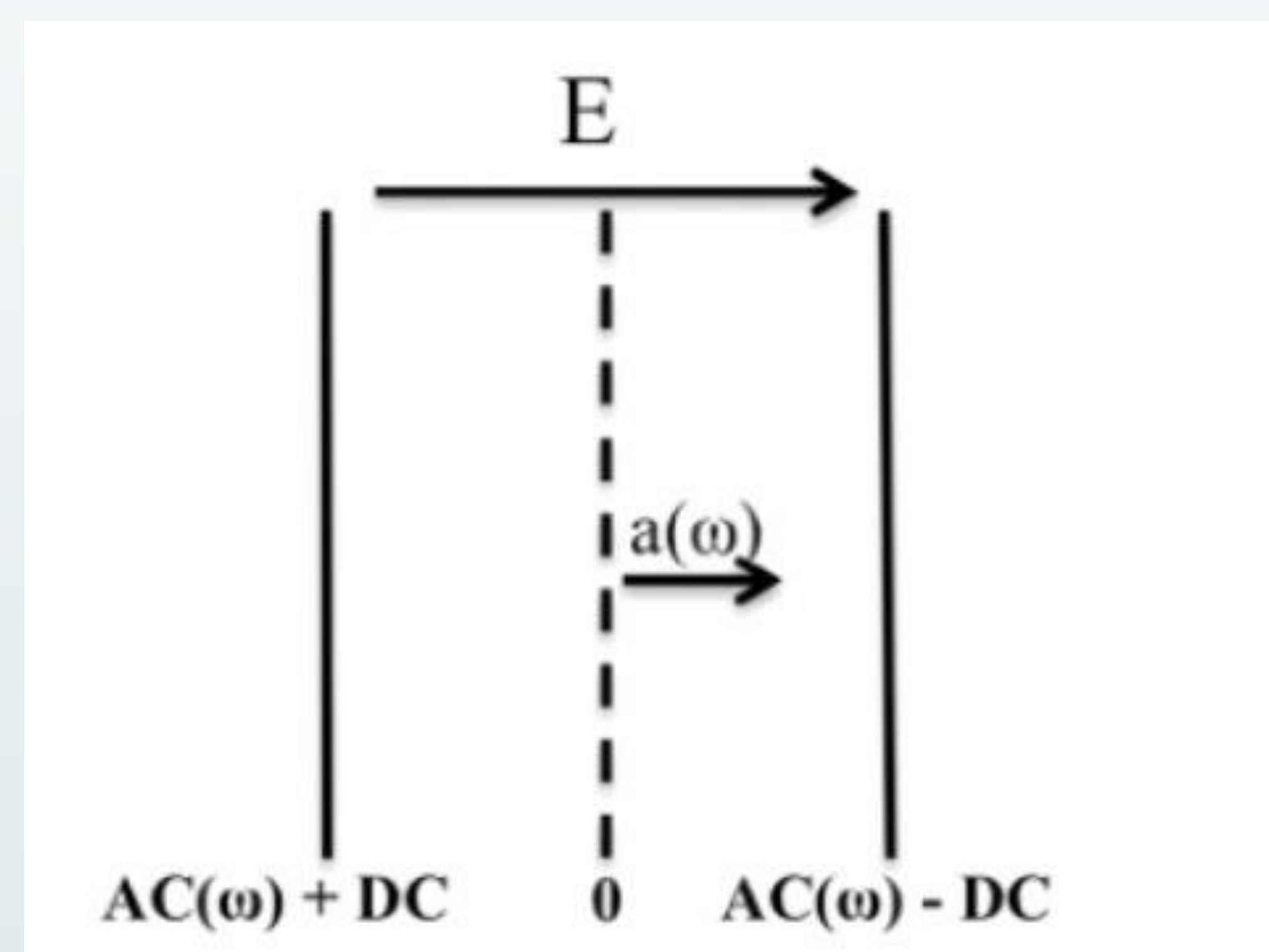


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### A novel electrical method to measure wire tensions for time projection chambers

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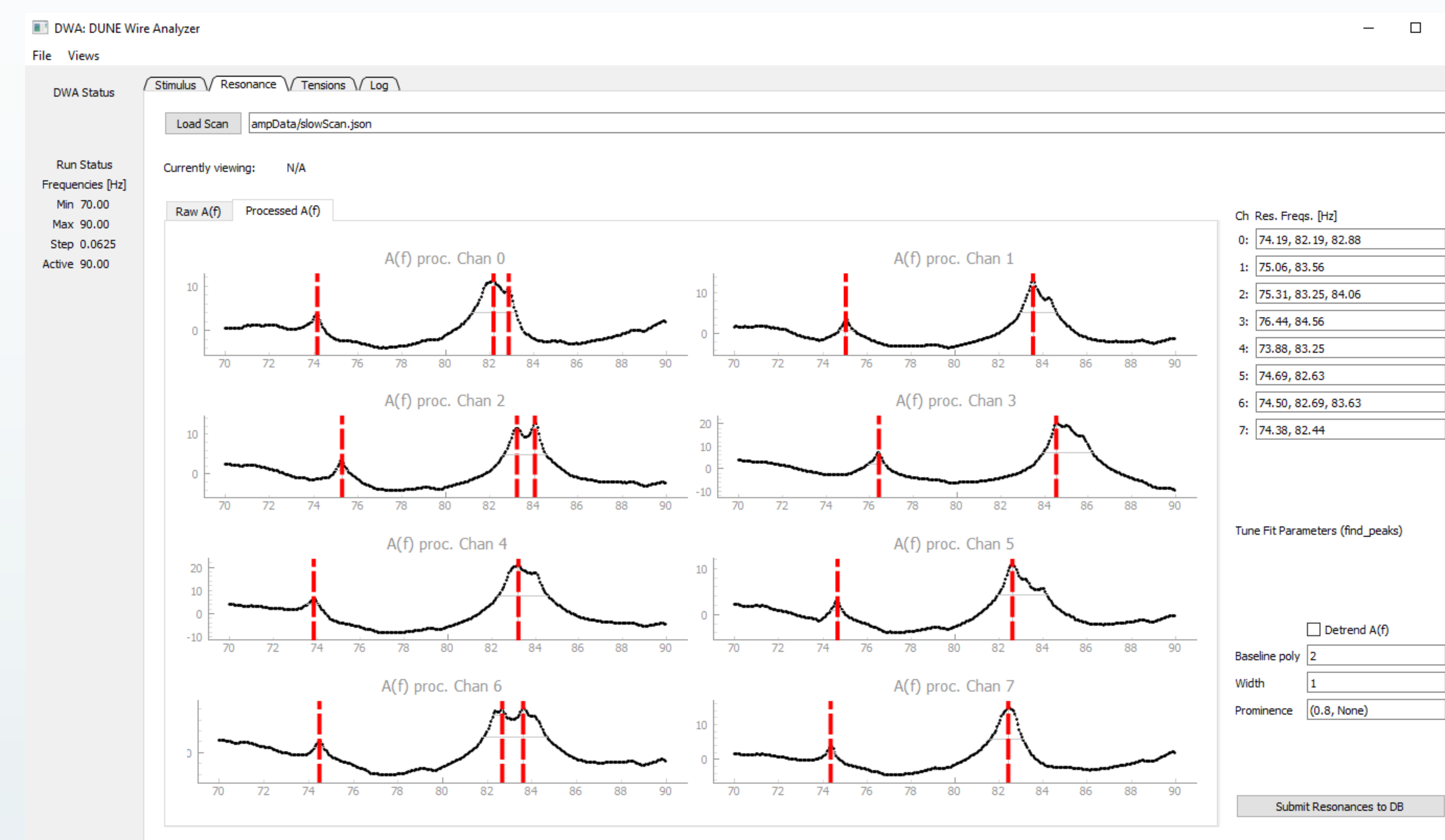


The resonance frequencies are obtained by sending a combination of DC and AC signals along 2 neighboring wires and reading out the amplitude of the sine wave returned on the central wire.

DUNE Anode Plane Assembly



## Results



DWA GUI

Custom-built software instructs the DWA to begin a scan and provides it with the necessary setup parameters. After a frequency scan is complete, it analyzes the data and identifies the resonances, which then get converted to wire tensions.

