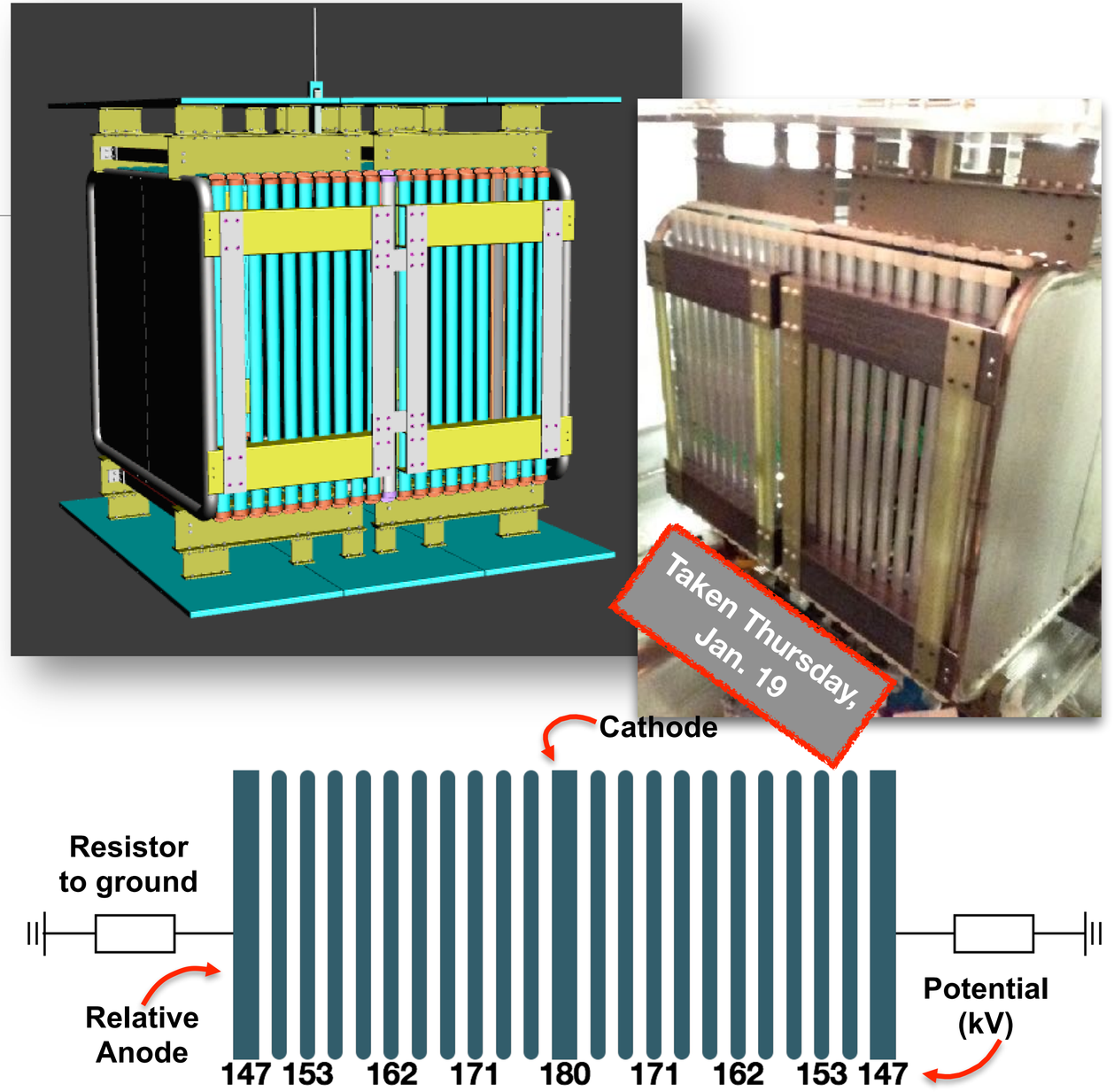
# 35T Test of the ProtoDUNE-SP Design

Sarah Lockwitz, FNAL
DUNE Collaboration Phone Meeting
October 6, 2017

# Context:  The Stage I 35T Test

- Goal was to perform an HV test of a full-scale, but reduced size version of the ProtoDUNE-SP field cage
  - Reduced size is about a (1.5 m)$^3$ cube
  - Full voltage would be 180 kV on the cathode, and 147 on a relative anode



# What we learned (or saw) in the Stage I Test

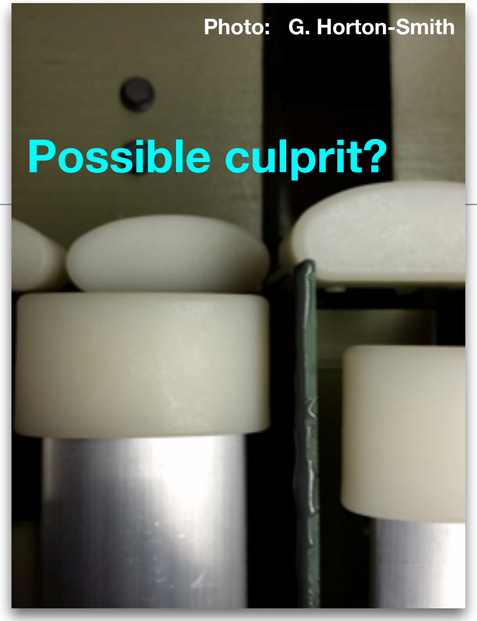
- We saw periods of elevated, noisy current on the power supply.  We called these “streamers”
  - The end of the resistor chain had less current implying ***an alternate path to ground***
  - Streamers were seen in 7 ppb argon (relatively impure) and increased in magnitude in purer argon
  - Observed streamers with voltages as low as 70 kV.
  - Streamer length in time (duration) could be controlled with a current-limit setting (lowers cathode voltage) on the power supply

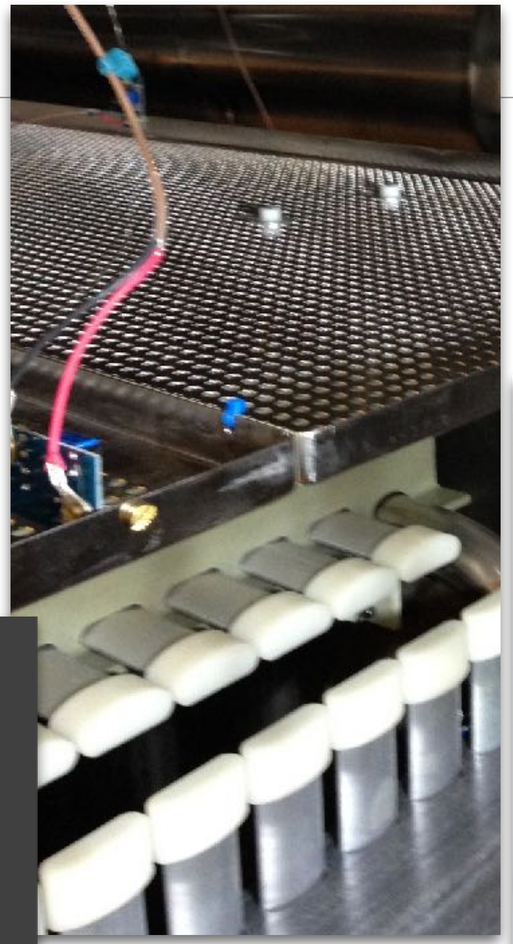
# What we learned (or saw) in the Stage I Test

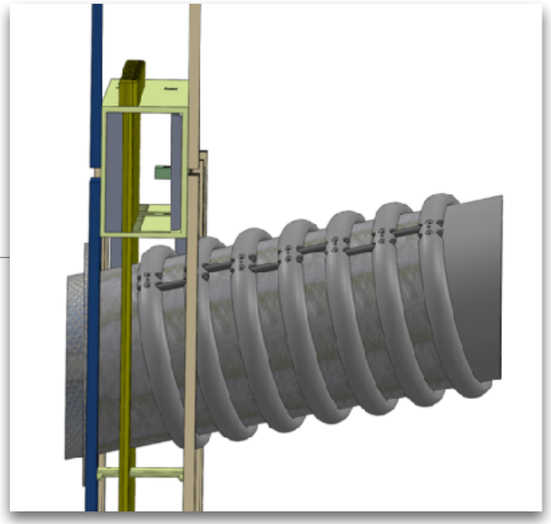
- We provoked many and major discharges at the end of the run.
  - One of the discharges interfered with a level probe, killed cameras, and tripped off instrumentation (meters, scopes, PMT HV)
- The TPC, filter resistors, and feedthrough all survived.
- For more details of this run, please see the talk at the May 2017 collaboration meeting.

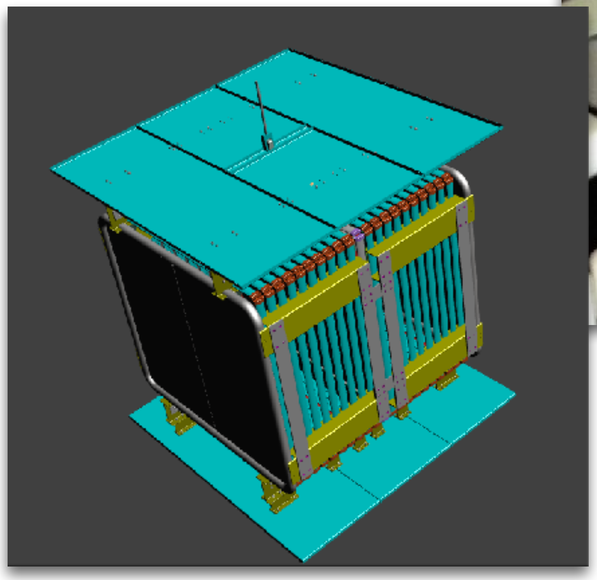
# Changes for Stage II

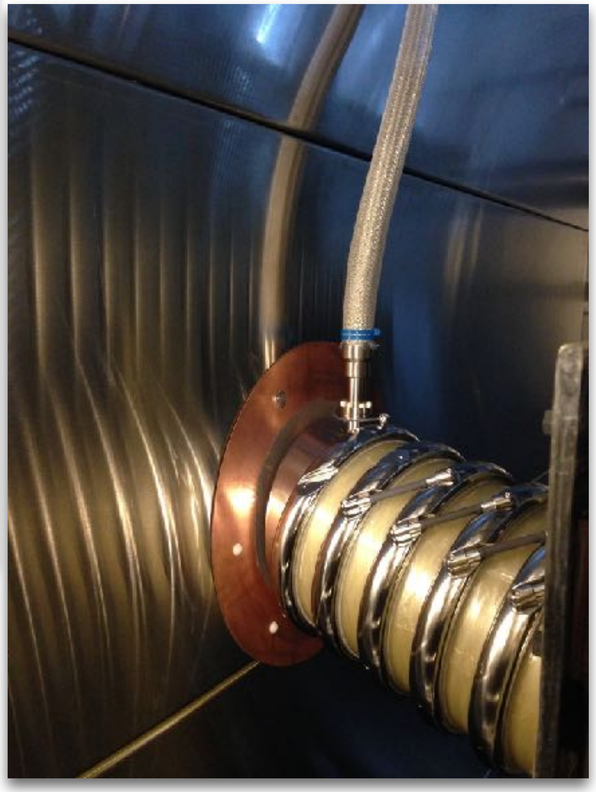
- Two major changes
  - Beam plug
  - Cathode frame field shaping strips
- Instrumentation:  the ground planes are now instrumented.



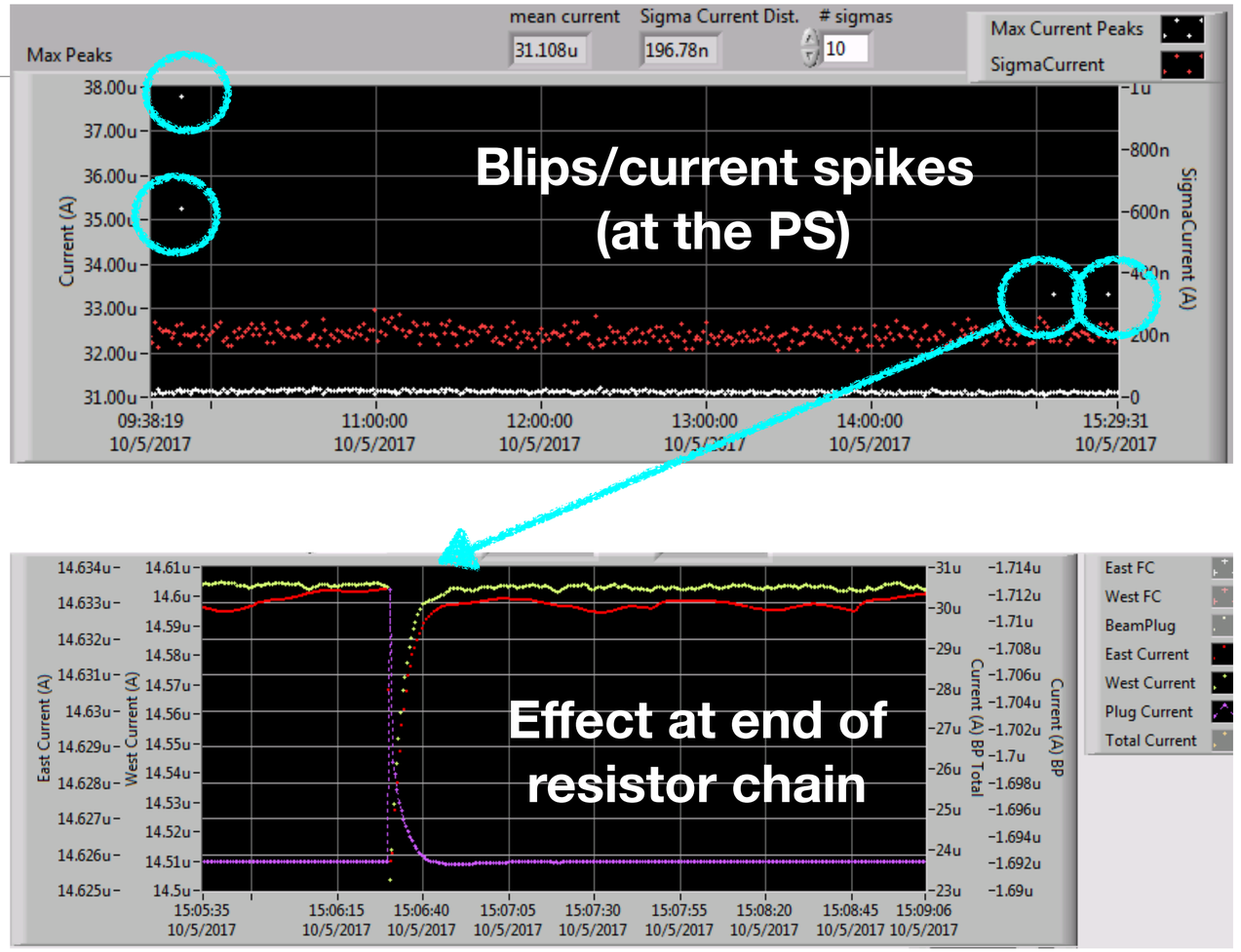






# What we see in Stage II

- Can hold 120 kV fairly reliably in 6 ms argon (good TPC-quality)
  - Some “blips” — about 1 every few hours
  - In lower purity argon (200-300 μs), there is not an obvious change in performance
- Long-term streamer activity
  - For the most part gone
  - Technically, we were able to produce one
    - Magnitude was low
    - Frequency is now rare… Definitively have seen one.



# What we see in Stage II

- We have difficulty stably running above 120 kV
  - Fast discharge-like events
  - No (detected) light associated with the events
  - Ground plane activity is not localized
    - We see activity on a number of planes.
    - In order of number of hits:  bottom (also the largest), beam plug plate, top south, …

# Outlook

- Digest the data
  - Attempting to record data that would better fit into a model of the system
- Likely changing the beam plug pressure next week to see how the behavior changes
- Plan to wrap up the testing in the next week or two
  - Ship the beam plug off to CERN & perform more testing.
- Then Stage III:  a run without the beam plug