

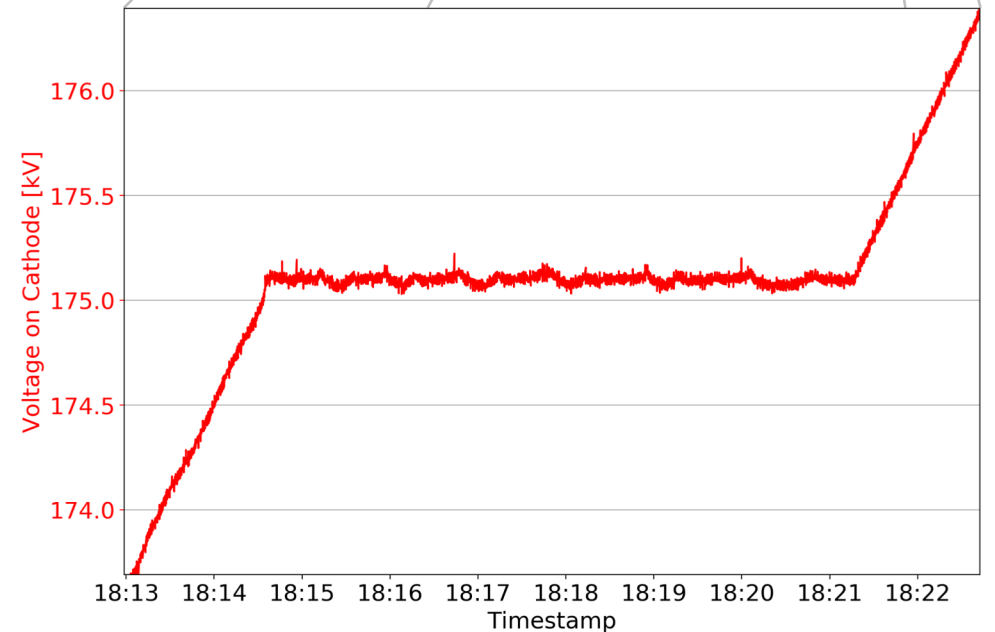
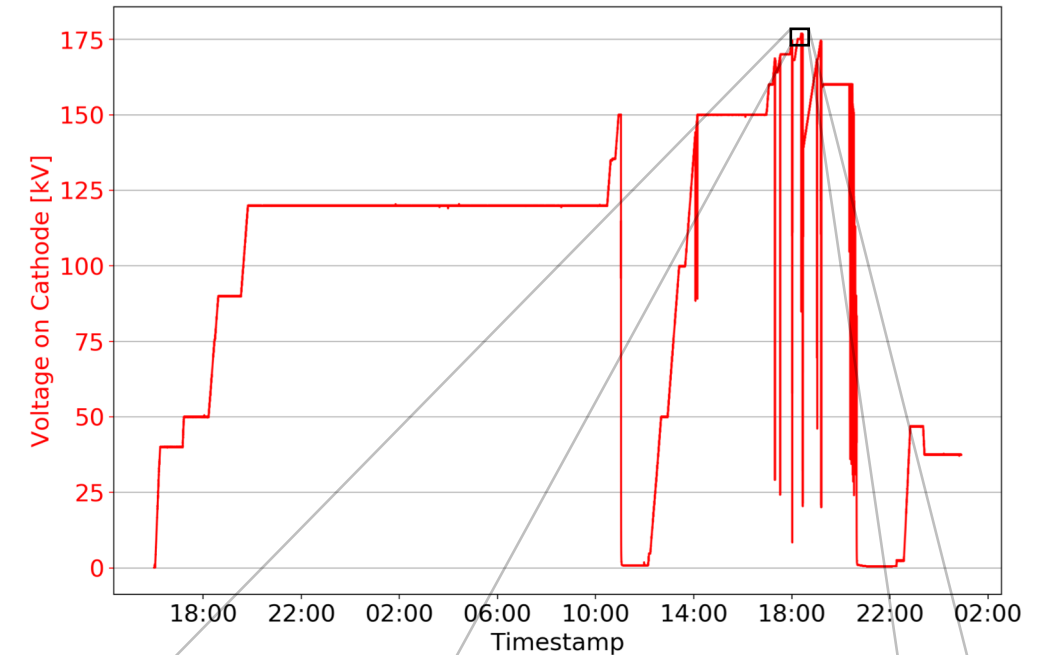
# High Voltage Activation

Kevin Wood, for the team

September 20, 2018

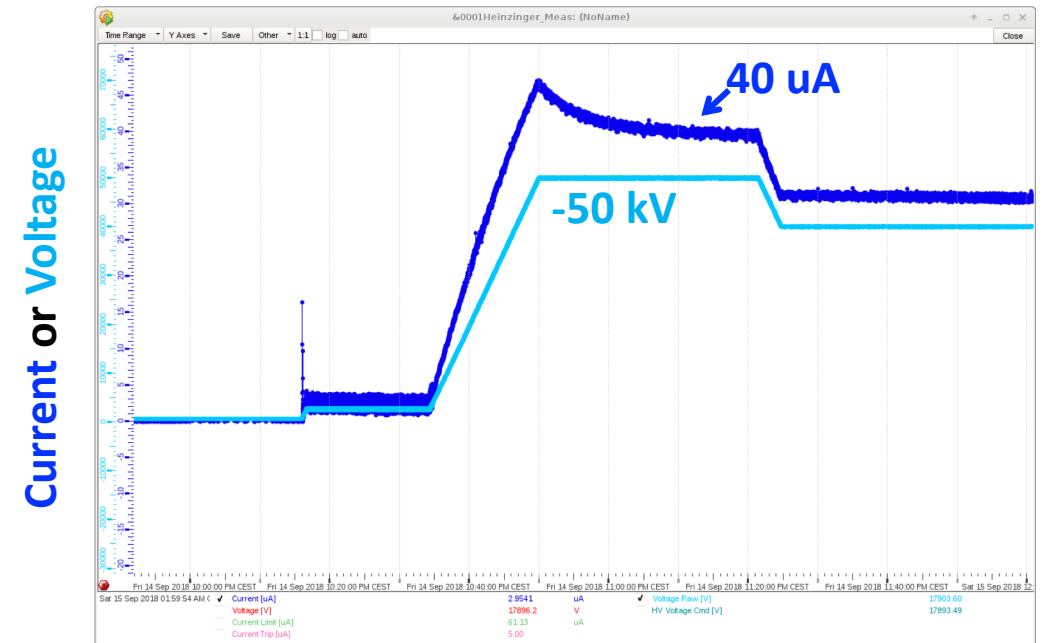
# The Ramp

- Top right: September 13, 4PM to September 15, 2AM
- Day 1:
  - The ramp to -120kV went very smoothly
  - Stable over ~14hrs.
- Day 2:
  - Ramped up to -150kV and tripped due to a relatively small and fast fluctuation
  - Hit a couple of current limits on the way back up to -150kV, but we made it and were stable for ~2hrs.
  - Increase to -160kV, no problem
  - Increase to -170kV, hit some current limits, but got there
  - Increase to -175kV, hit one current limit, but got there and held for several minutes
  - Push to -180kV was unsuccessful.
  - Decrease to -160kV with intention of sitting overnight, but it “tripped” ~45 minutes later

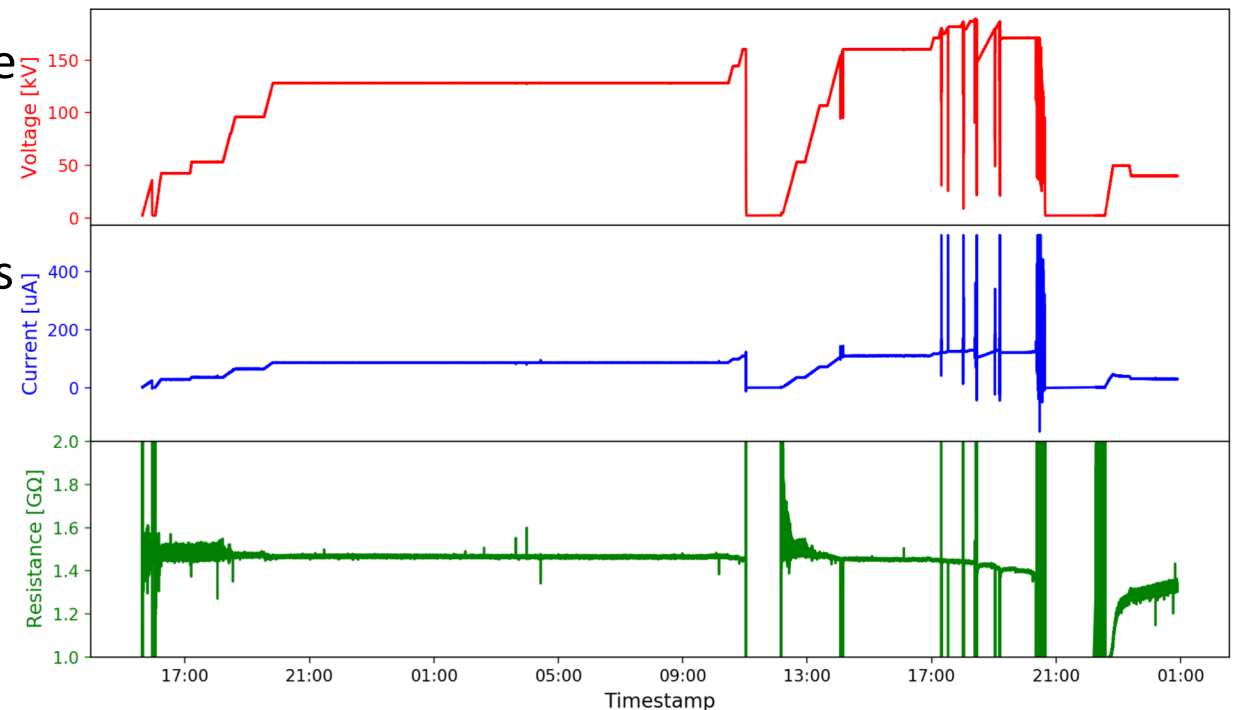


# Abnormal Current Draw

- When trying to ramp back up after the trip Friday night, we noticed an excessive current draw
- The shape of the current draw vs. time also indicated *something* was wrong

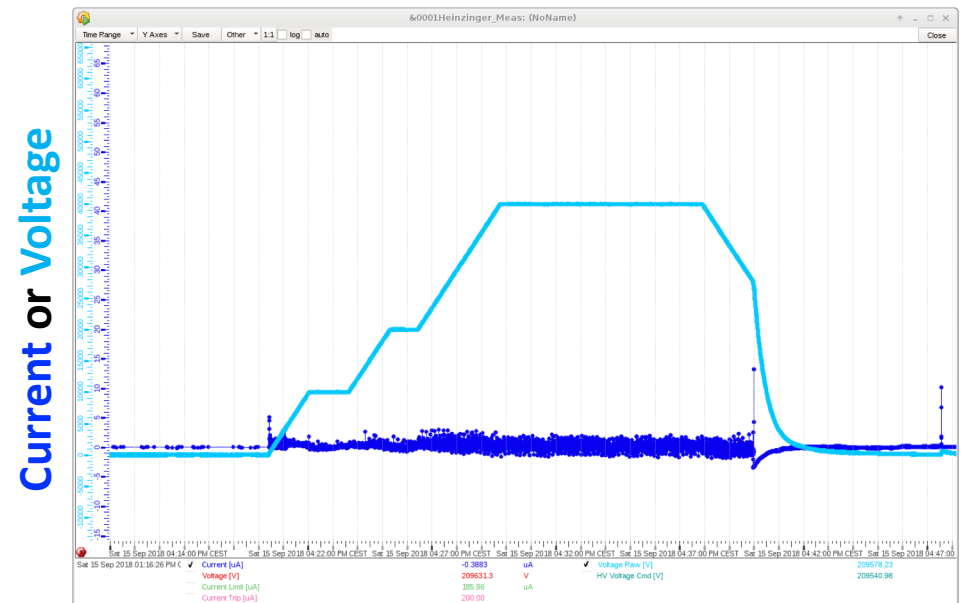
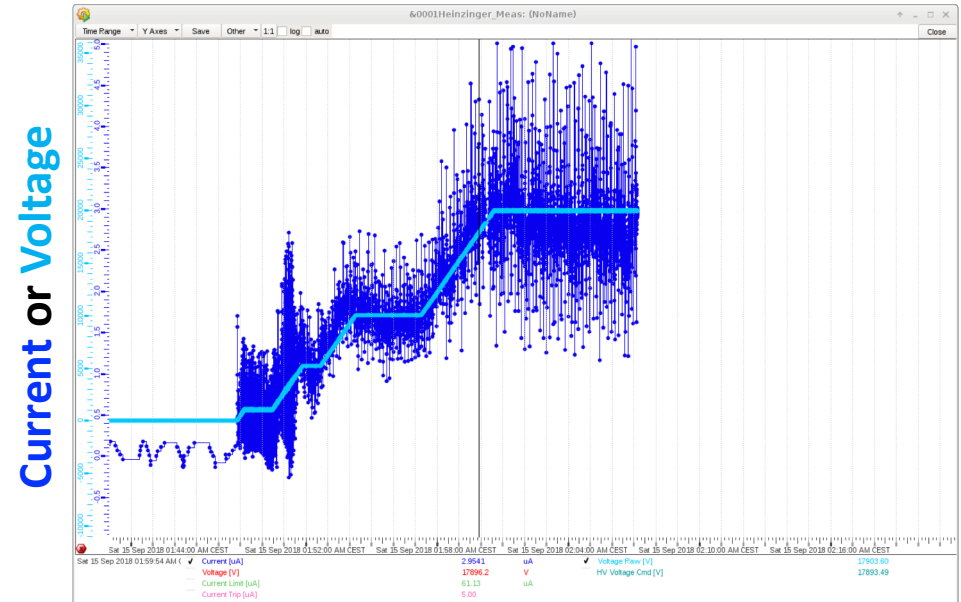


- Looking back at the current draw over time, we see the resistance decreasing ever since we tripped trying to go from -175kV to -180kV
  - Even a bit *leading up to the trip at -150kV*
- Even when the resistance was stable the value was less than we expected
- Immediately suspected the downstream filter, which has been leaking
- The value towards the end corresponds to about a 7.25G $\Omega$  resistor in parallel circuit



# Testing the Warm Side

- Removed the feedthrough cable insert to break connection from the detector and test the warm part of the HVS
- Ramped the voltage to -20kV, and sure enough there was a leakage current corresponding to about 7G $\Omega$
- The next morning we replaced the cable+filter line with a continuous HV cable which was attached to the feedthrough insert
- When changing the cable at the Heinzinger end, *water* was found inside
- The water was removed and the “warm side” held its voltage with no noticeable leakage current



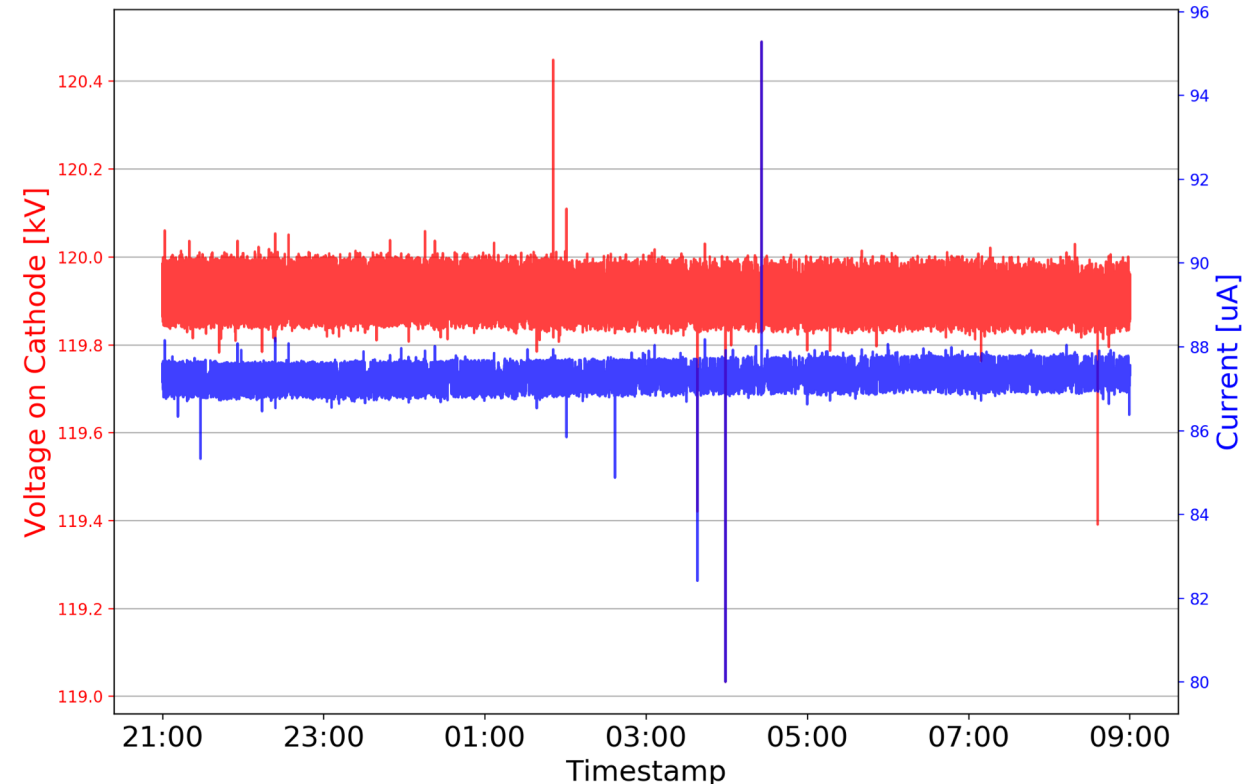
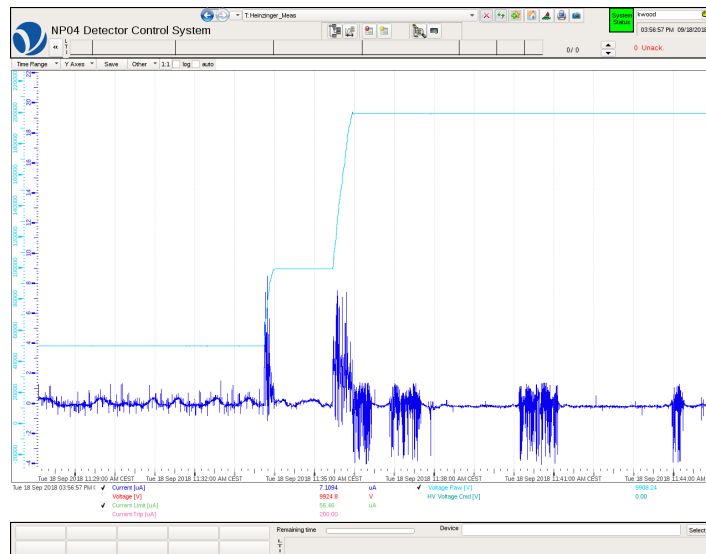
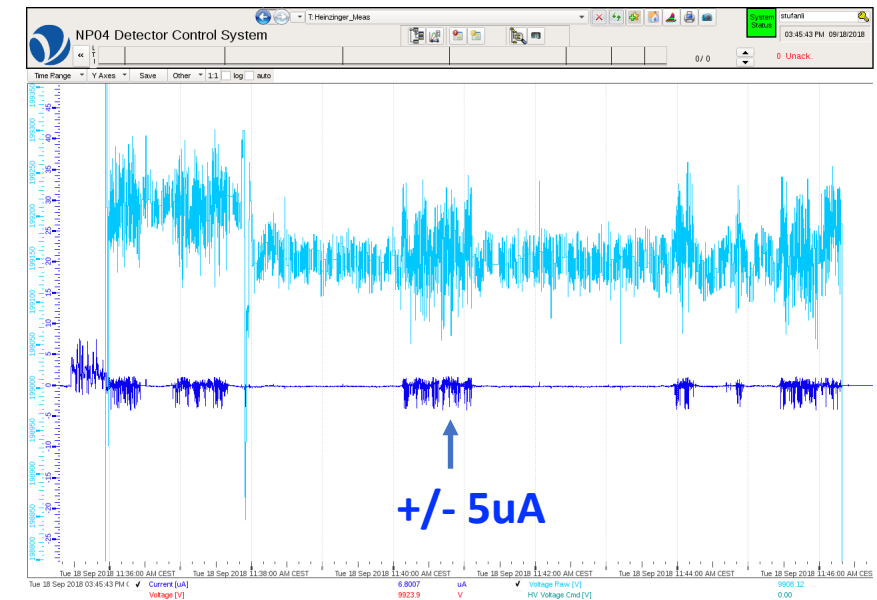
# Reconnecting with the detector

- Reconnected to the detector in the “dry Heinzinger + no filter” configuration and saw *a lot* of noise on the current draw (+/- 10uA)
- We found that the solder connection holding the cable onto the metallic tip of the insert came off. The cable was loose and could be pulled up away from electrical contact
- The insert was again removed, but the tip remained in the cavity...
- Machined a special tool and removed the piece



# Heinzinger

- We are a little concerned with the current fluctuations we see on the Heinzinger
  - e.g. with no load (no cable inserted) we see the activity shown at top right at -200kV
  - e.g. while connected to the detector after the first day of ramping, while sitting at -120kV overnight
  - etc...



# Back to the Ramp

- We tested the Heinzinger (with and without test loads), the filtered-cable, and the connectivity from the PS to the FC termination extensively
- Everything was shown to be in an acceptable condition, so we initiated a new ramp
  - -0kV to -30kV – check current draws and voltage stabilities of wire biasing PS's, FC termination PS's, and WIB/FEMB PS's
  - -30kV to -60kV – check current draws and voltage stabilities and run the DAQ
  - -60kV to -90kV – check current draws and voltage stabilities
  - -90kV to -120kV – check current draws and voltage stabilities, take a long DAQ run, and sit overnight
  - -120kV to -140kV – check current draws and voltage stabilities
  - -140kV to -160kV – check current draws and voltage stabilities, run the DAQ, and sit all day and overnight

