Phase 2 data-taking

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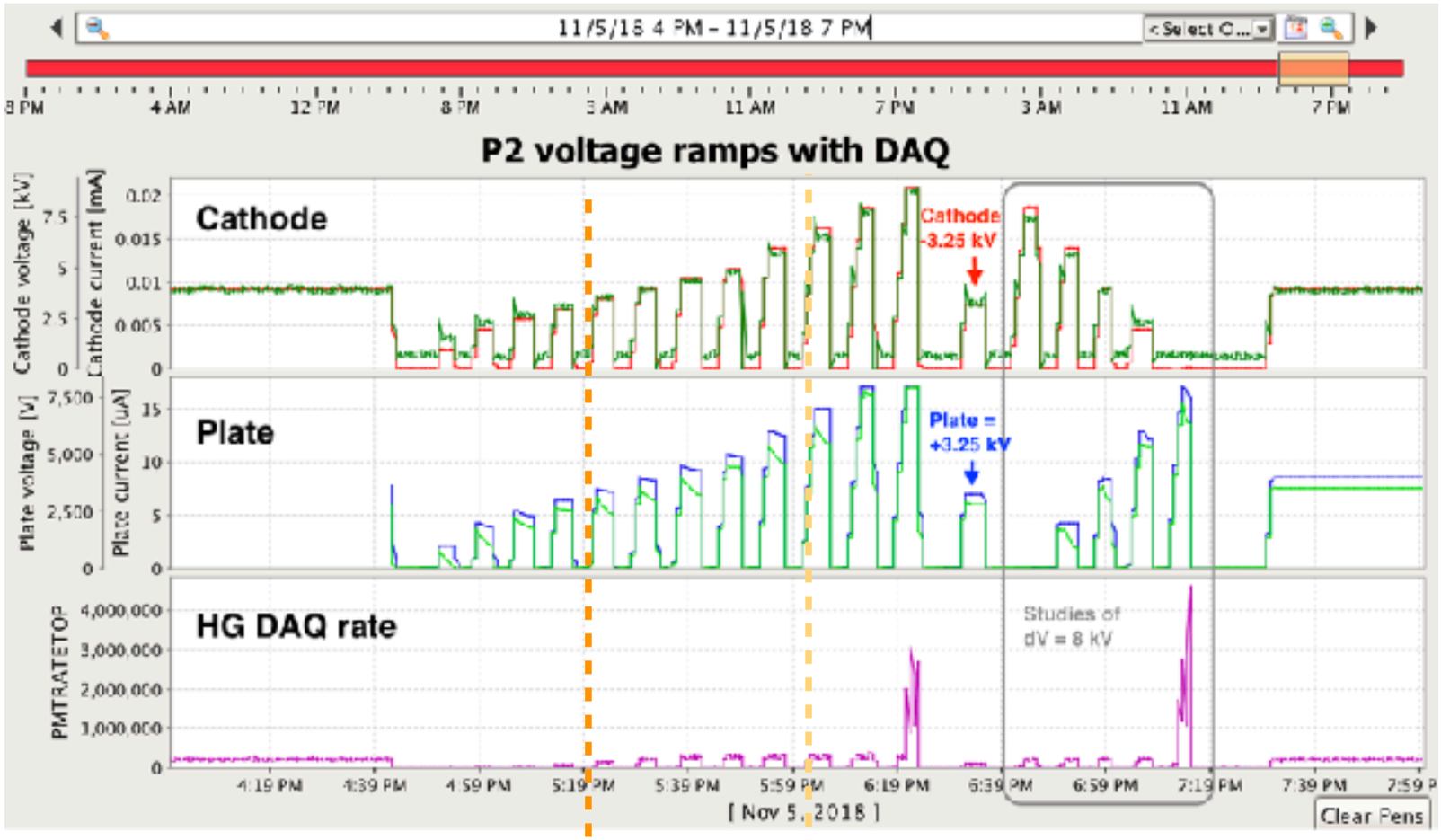
- The cathode needs electric fields that are high enough to drift electrons across the fiducial volume.
- The reverse field region (RFR) below the cathode is a high-field region. The cathode cannot have electron emission problems at our planned electric fields to operate the detector properly.
  - If we have -100 kV on the cathode, this is a field of 5.9 kV/cm which translates to a ΔV = 13.57 kV in Phase 2.
  - Phase 2 tests ~20% over the required LZ fields, ie., a field of 7.08 kV/cm and ΔV = 16.3 kV.
    - This is why we ramp the voltages to a ΔV = 17 kV.



ΔV = 6.7 kV is equivalent to the LZ field in the RFR (below cathode) if we have C = -50 kV.

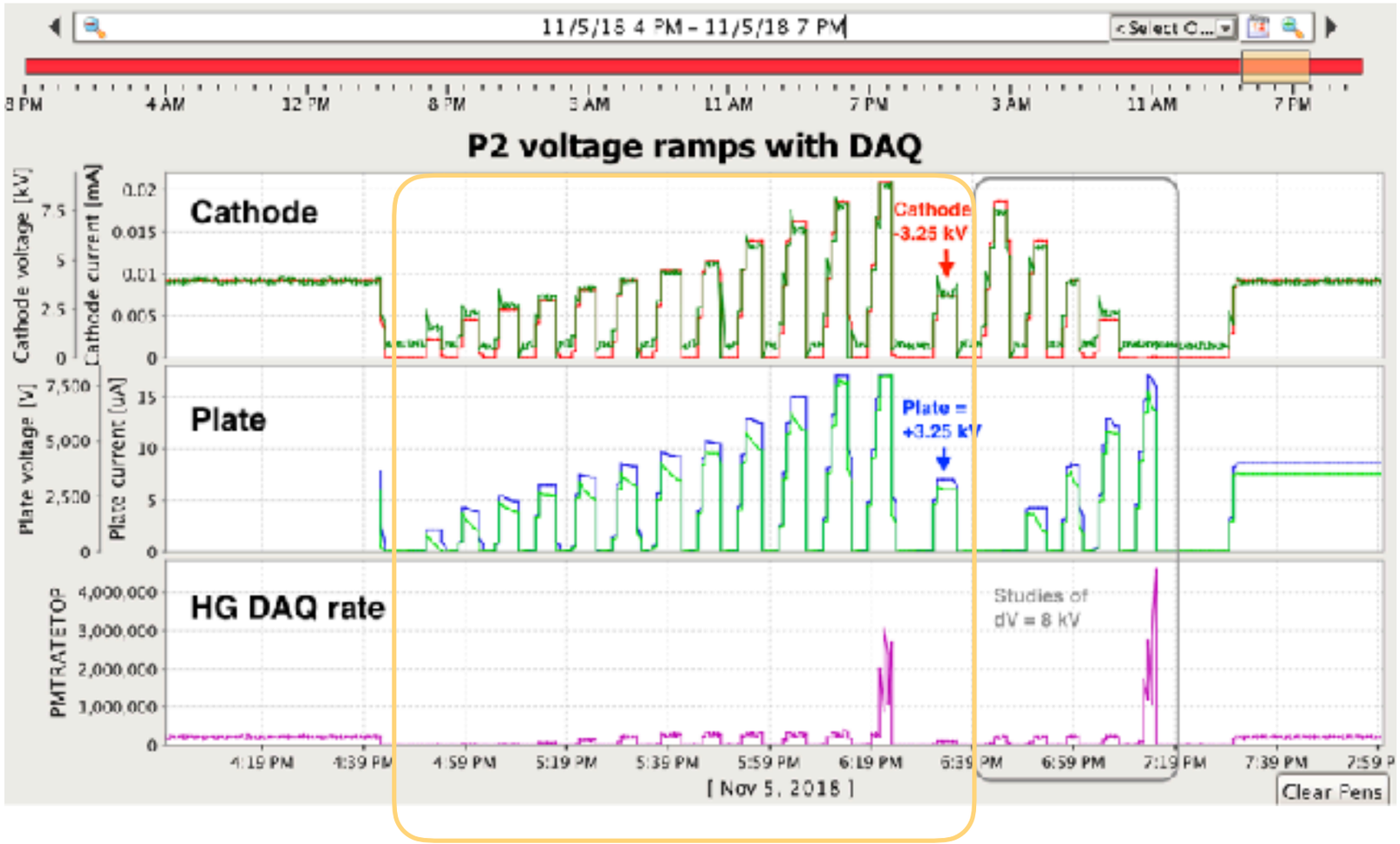
ΔV = 13.57 kV is equivalent to the LZ field in the RFR (below cathode) if we have C = -100 kV.

Normal voltage ramps

- The voltage ramps are copying the procedure from the gas test where both electrodes are set to 0V between subsequent voltage settings to “reset” the grid.

- The Gas Test saw more repeatable results when they followed this procedure.

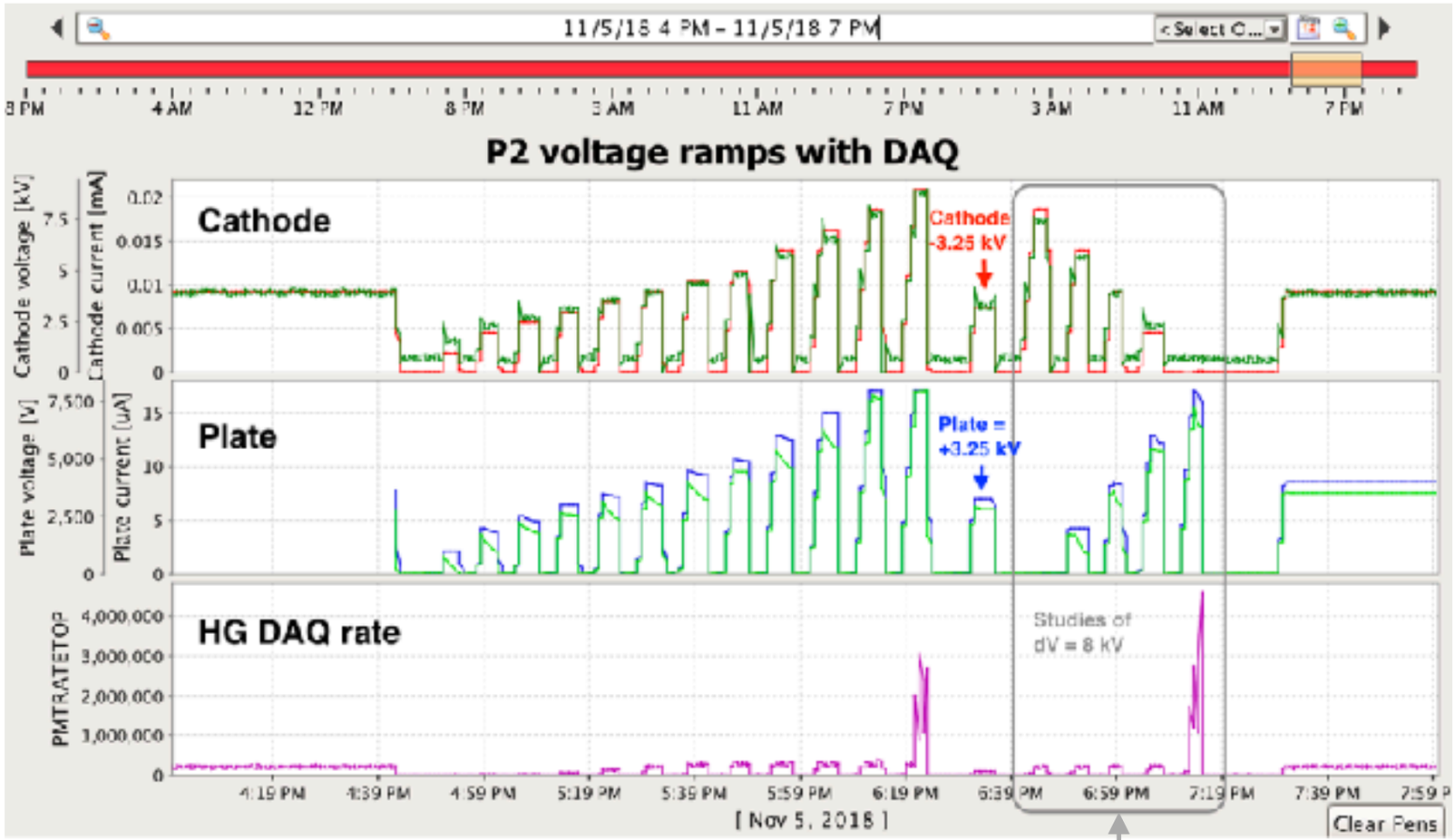
- We compare our results to the Gas Test, so it makes sense to replicate their procedures.



1. Voltages are ramped up to a target voltage on the cathode and on the plate. These are ramped to -[x] on the cathode and +[x] on the solid Al plate below the cathode.
2. Hold the grid and plate at voltage for 3 min while we take data.
3. Ramp down to 0V for 3 minutes.
4. Repeat steps 1-3 with the next voltage.

Voltage ramps at a constant ΔV

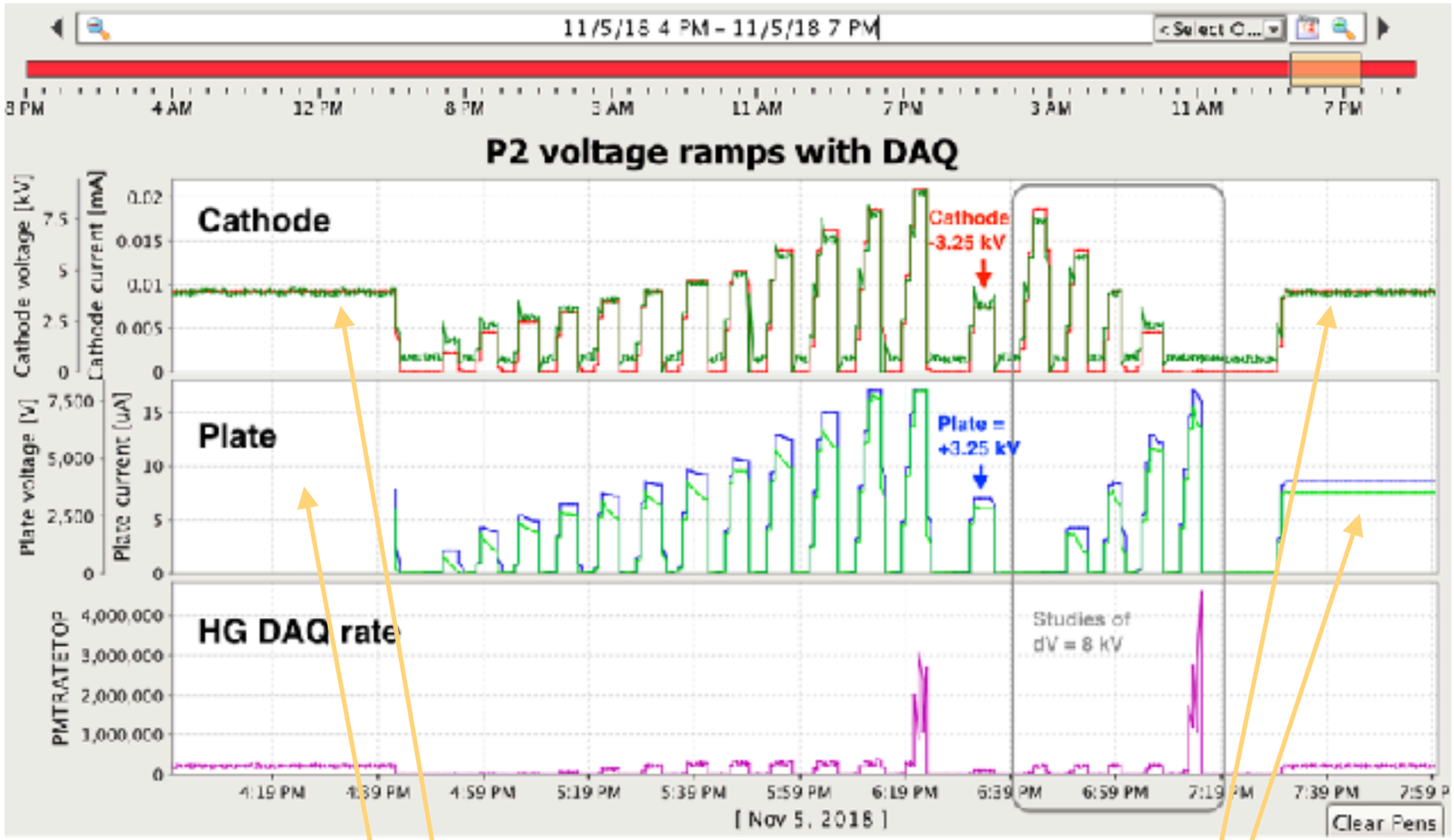
- The voltage ramps are usually ±[X] kV.
- We also take data with ΔV = 8 kV, but with different combinations of voltage set points.
- A really high rate is seen when the cathode is at 0V and the plate at +8 kV.
    - PMTs are negatively biased (~-1400 V), so this is likely contributing to a field in the detector without the cathode biased.



(Cathode, Plate) = (-8, 0) kV; (-6, +2) kV; (-4, +4) kV; (-2, +6) kV; (0, +8) kV

Training the grid

- Set the electrodes at ±4 kV over the weekend (~70 hours)
- Set the electrodes at ±8 kV (not pictured) on Tuesday for ~18 hours.
- The gas test saw evidence that training the grids correlated with more stable and repeatable performance at the training voltage and voltages lower than the training voltage.
    - This is similar to conditioning, but does NOT involve sparking the grid!
- We look at data taken at the beginning and end of training and at normal voltage ramps before and after training to determine effectiveness.



"Train" the electrodes by setting the plate and cathode at high voltage for long periods of time.