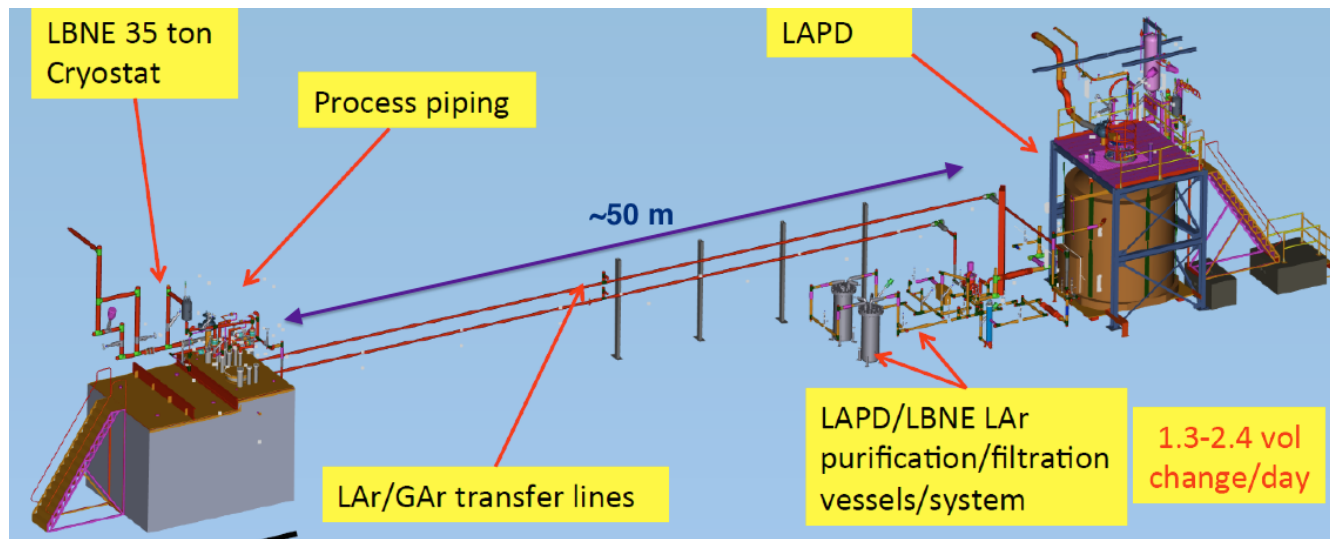


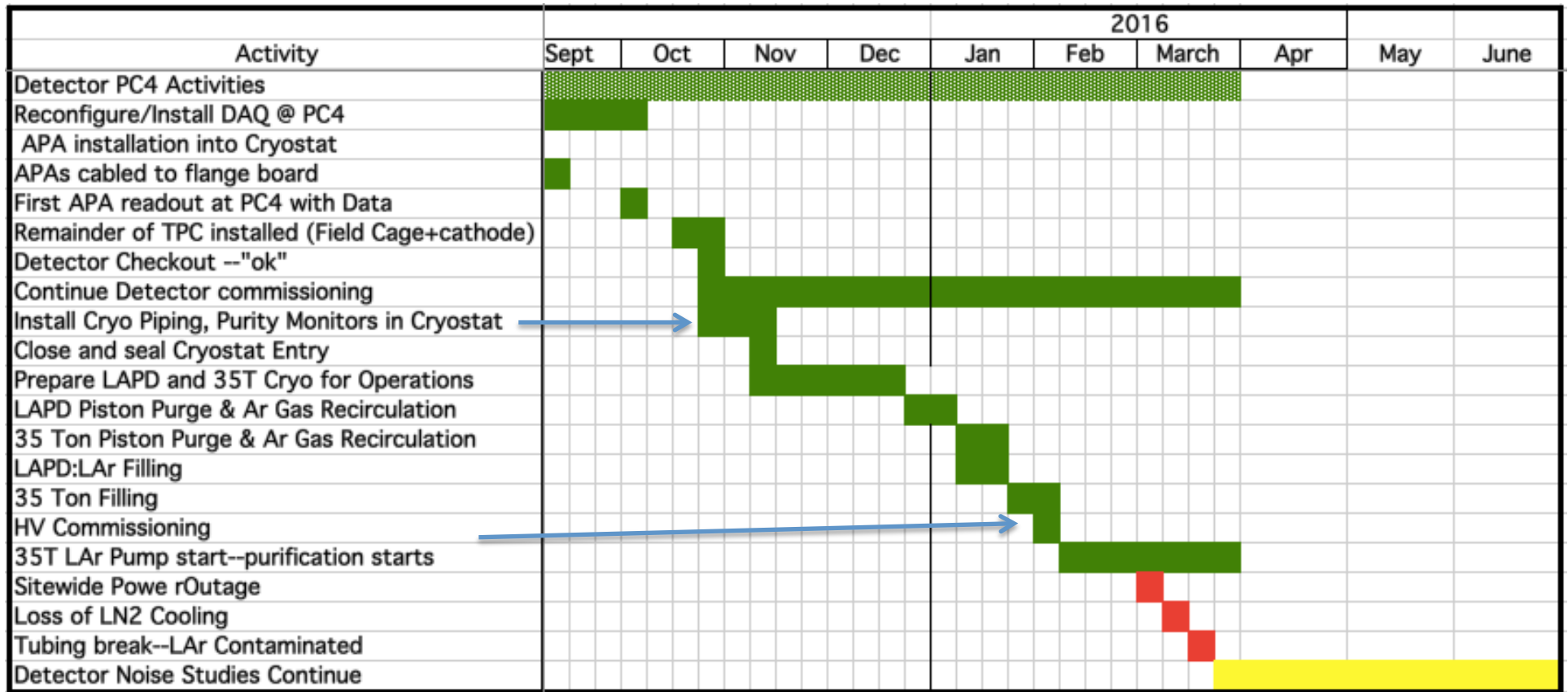
Cryo Operations

- Use LAPD Cryostat as a storage Dewar for LAr Deliveries from vendor
 - LAPD can supply 35T with ~70% of needed LAr
 - One last vendor delivery into LAr Trailer and then directly into 35 Ton.
- All LAr into 35T passes first through filtration system
 - Measurements with inline Purity Monitor during this fill show the filtered LAr to have e^- lifetimes in ~30 ms range—very pure)
- Normal 35 Ton operation circulates the LAr from 35T cryostat, to filtration and back to 35 Ton.
 - ~2.5 volumes/day (~10 gal/minute)

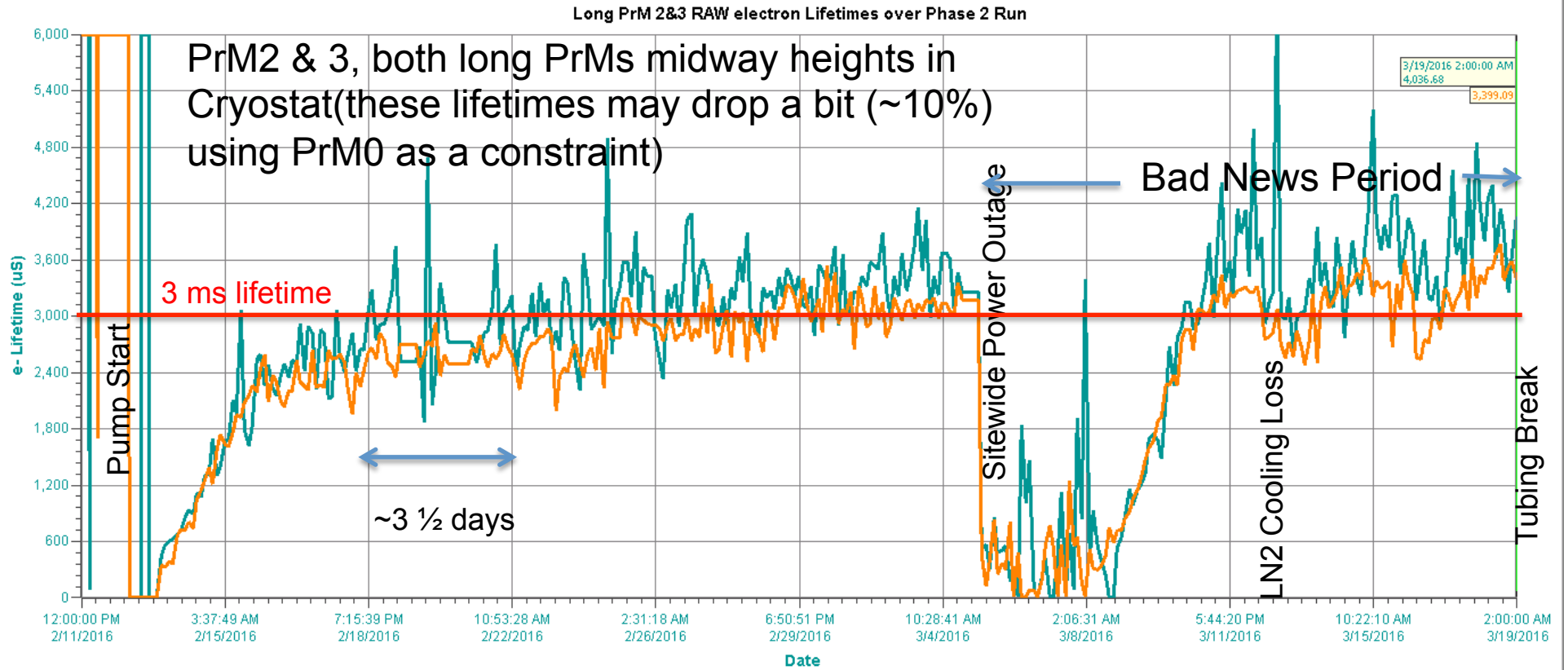
35Ton and LAPD at PC4



35 T Phase 2 Cryo Time Line



e⁻ Lifetime over Phase 2 Run



Pen Name	Description	Value	Eng Units	High Over Range	Low Over Range
35T.PRM_Lifetime_2_F_CV	Lifetime calculated from AnodeTrue Cathode...	4,036.7	us	1,000,000.0	0.0
35T.PRM_Lifetime_3_F_CV	Lifetime calculated from AnodeTrue Cathode...	3,399.1	us	50,000.0	0.0

2/11/2016 12:00:00 PM

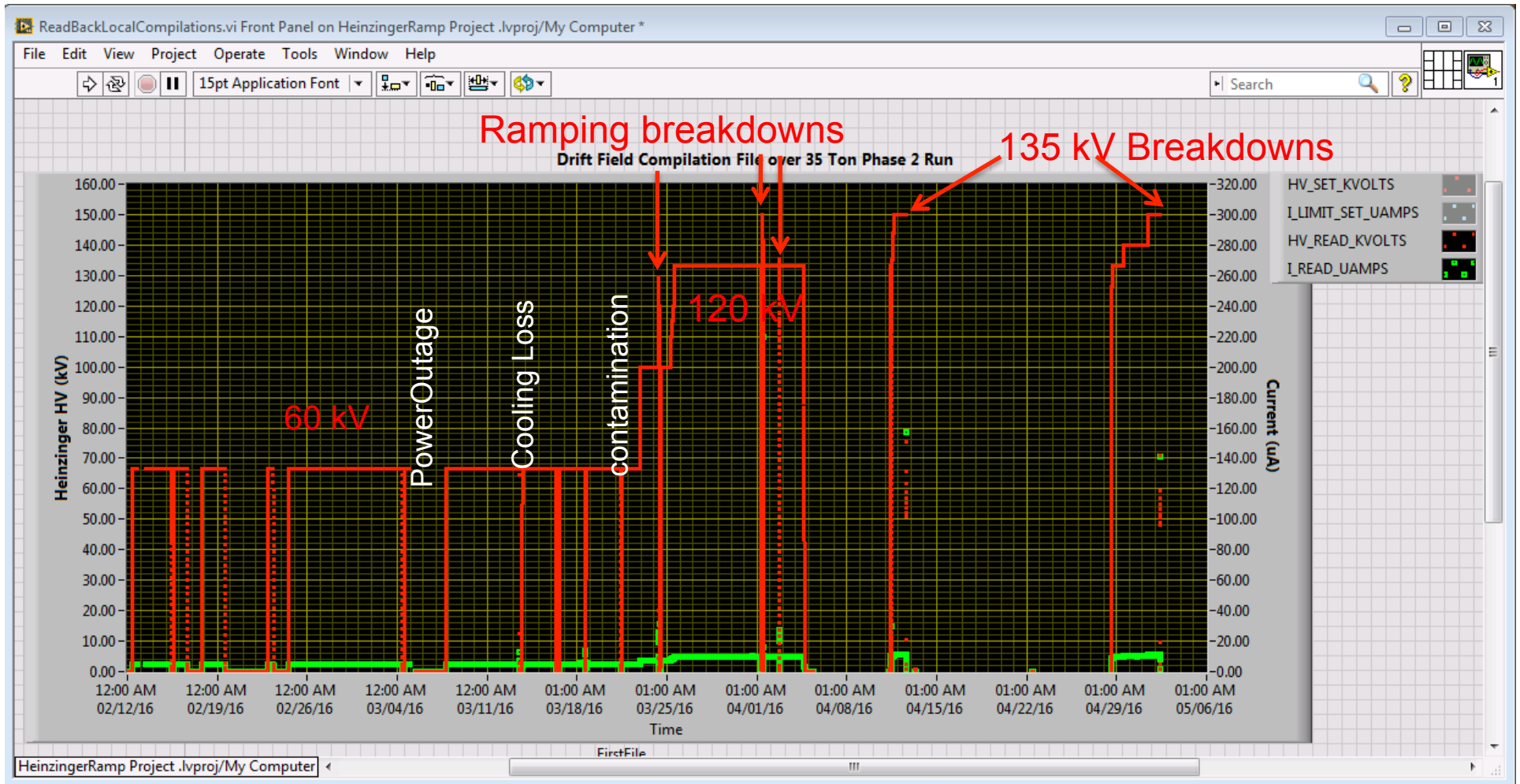
3/19/2016 2:00:00 AM

Drift Field HV

- Our experience here at FNAL is that HV breakdowns are sensitive to the purity of LAr.
- Phase 2 HV
 - 60 kV on Cathode, ~3 ms e⁻ lifetimes (100 ppt O₂)
 - No trips
 - 90 kV, 120 kV on Cathode, low purity (30 ppm O₂)
 - No trips—120 kV held for 1 week
 - 135 kV, low purity----(30 ppm O₂)
 - trips after ~24 hrs (2 times)
 - I am concerned that we may have had issues with 120 kV with purified LAr.
- Major disappointment that the LAr Contamination occurred before we had a chance to raise the HV to ~120kV (on Cathode) to achieve the design E Field of 500 V/cm.

Drift HV History over Run

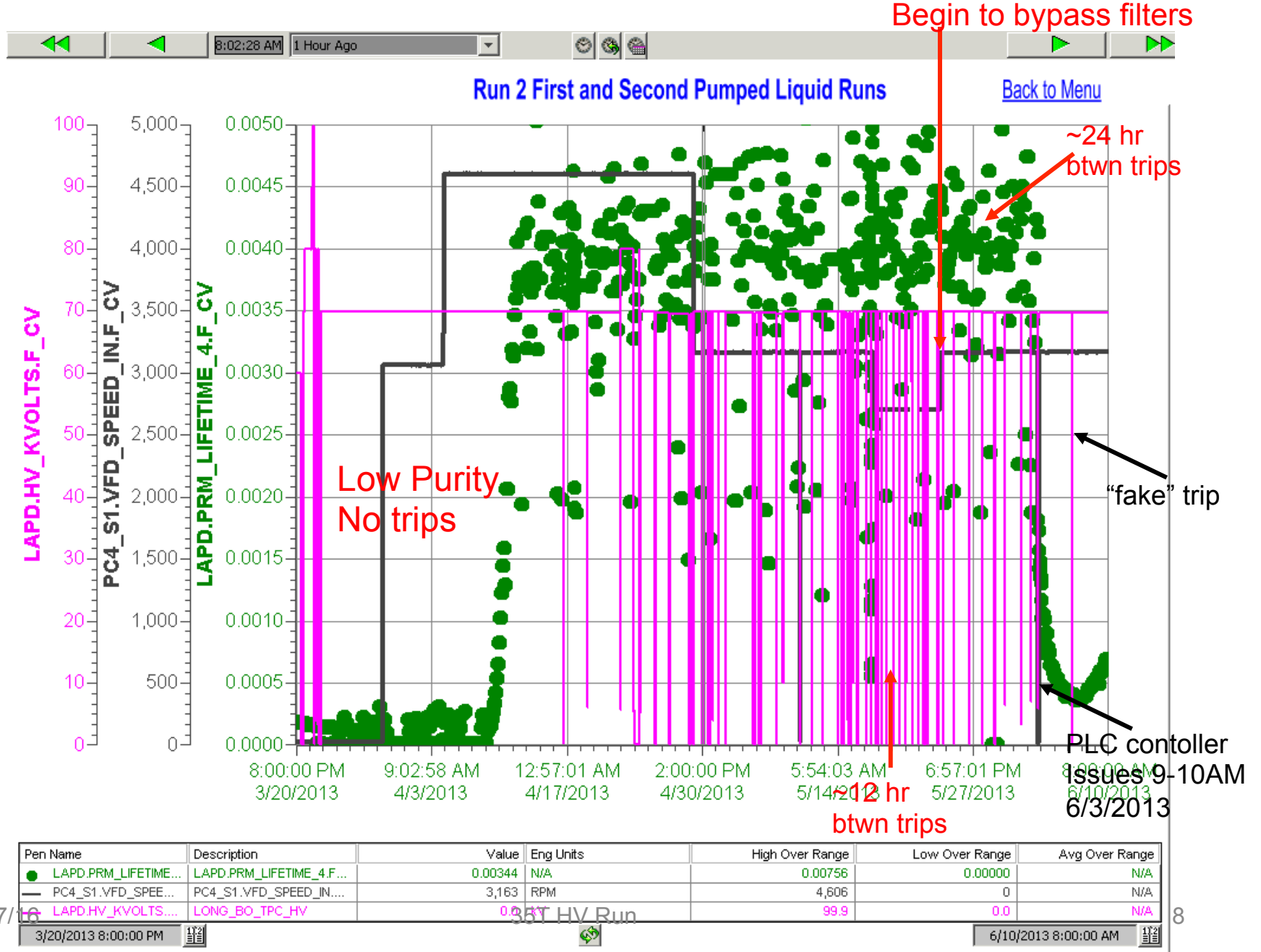
120 kV at Cathode $\sim 500\text{V/cm}$



Why didn't we raise the HV sooner?

- Gun shy
 - At least a few of us had experienced LAPD where the Long Bo field cage was damaged immediately after filling when HV was being raised to full design value (also ~120kV)
 - Caveats—LAPD suffered an accident where a ribbon cable floated into the field cage, shorting out the cage and damaging the resistor chain
 - So perhaps unfair comparison.
- We had decided to initially run at $\frac{1}{2}$ design field (250 V/cm or 60 kV on 35T cathode) until we acquired enough data to do some of our desired measurements.
 - Then we would raise the HV.
 - However due to the very high noise in the TPC, good runs were not plentiful, and even these runs were noisy, preventing any reasonable (future) zero suppression
 - Result was a DAQ max sustained rate of ~ 1Hz
 - Word from Analysis people was that enough data was in hand by 3/16 to consider a higher voltage.
- We desired that the SS Membrane Cryostat “corrugation” be covered by ~1 “ LAr just to keep the stray fields between the Cathode and the grounded membrane “reasonable”.
- Due to loss of LAr during the cooling loss the previous weekend 3/12, we needed to makeup some of the LAr Level (~1 “).
 - Hence the LAPD-35T gas transfer that failed on 3/17 and contaminated the LAr.
 - We were expecting to have a sufficient LAr level by 3/19-20, and intended to raise the HV at that point.

LAPD Experience—HV breakdowns increase in Frequency as Purity improves



6/27/16

8

STATUS

- In process of scheduling the removal of 35T Phase 2 Detector from Cryostat
- In process of finding cryo manpower resources for this test.