F.PIETROPAOLO, F. CAVANNA, S. BORDONI, F.STOCKER, S. TUFANLI

E FIELD ESTIMATION DURING BEAM TIME

PROTODUNE DRA MEETING - 4TH JUNE 2019

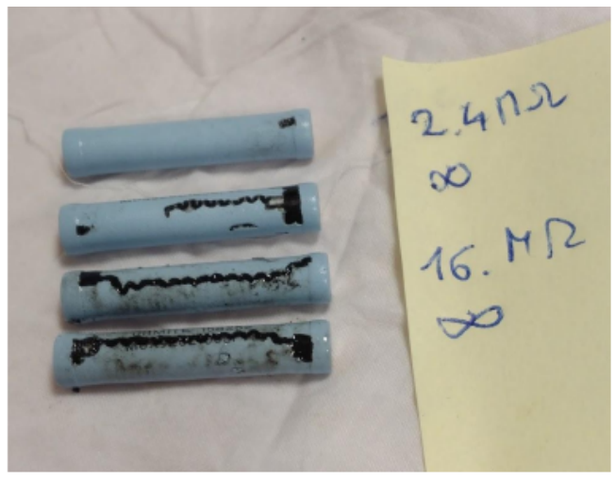
INTRODUCTION

- Instabilities on the cathode voltage due to HV noise filter problems
- Filter issue understood and a new design is under test: system much more stable even if some (others) instabilities remain

Hardware Performance: HV Ripple Noise Filters

- Low pass filter, reduce ~35kHz ripple noise from PS switching frequency
- ProtoDUNE used a “pipe-style” break in the cable to introduce the resistor
  - The resistor is submerged in mineral oil to prevent breakdown in air pockets
  - Containers leak and need often interventions to refill with mineral oil
  - When dry, the filter introduced current spikes and instabilities

22 June 4, 2019 ProtoDUNE: Lessons Learnt From Beam and Stability Runs

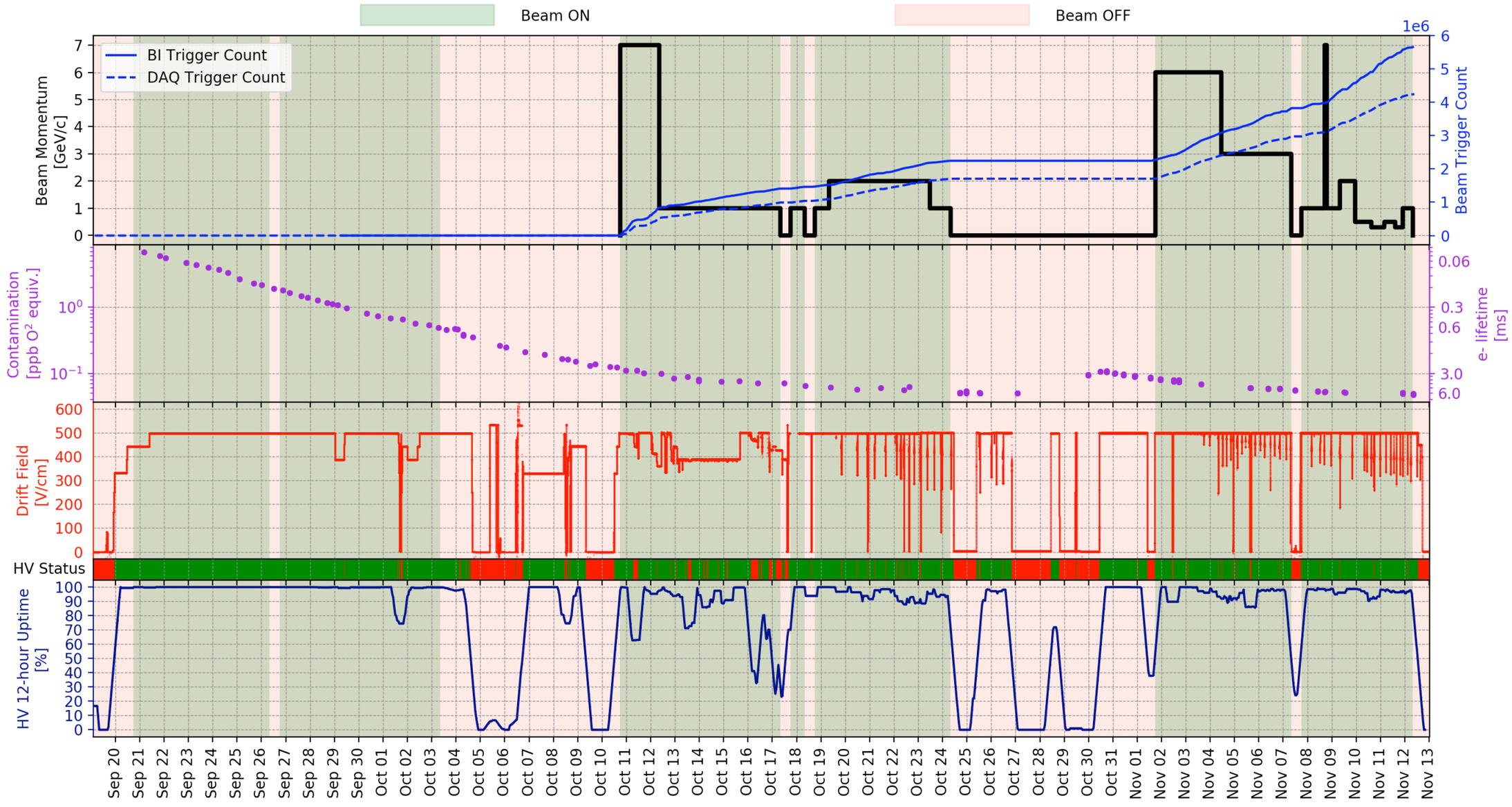


Main focus of today’s talk: **Impact of HV instabilities on the E-filed**?

- Especially important during beam time
- E field value needs to be defined for the next MCC production

INTRODUCTION

Beam summary plot



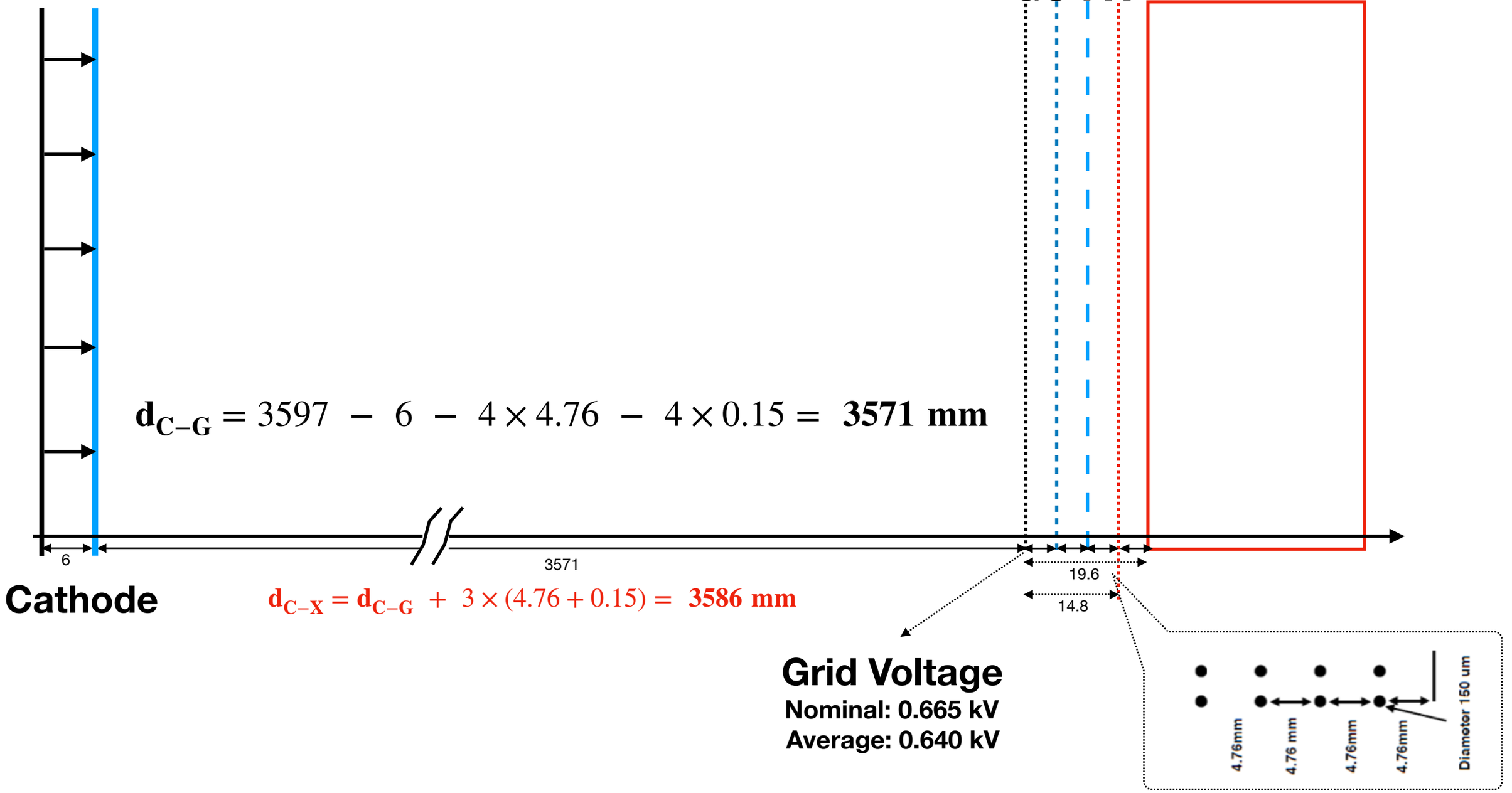
- Drift Efield plot clearly show the instabilities encountered during the beam period
- Efield calculation is wrong : assuming a wrong value for the full circuite resistance

DRIFT DISTANCE DEFINITION

$$d_{C-APA_{Frame}} = 3597\ mm$$ **at Room T, from CERN-NP/Benoit's 3D model and PSL/Dan's drawings**

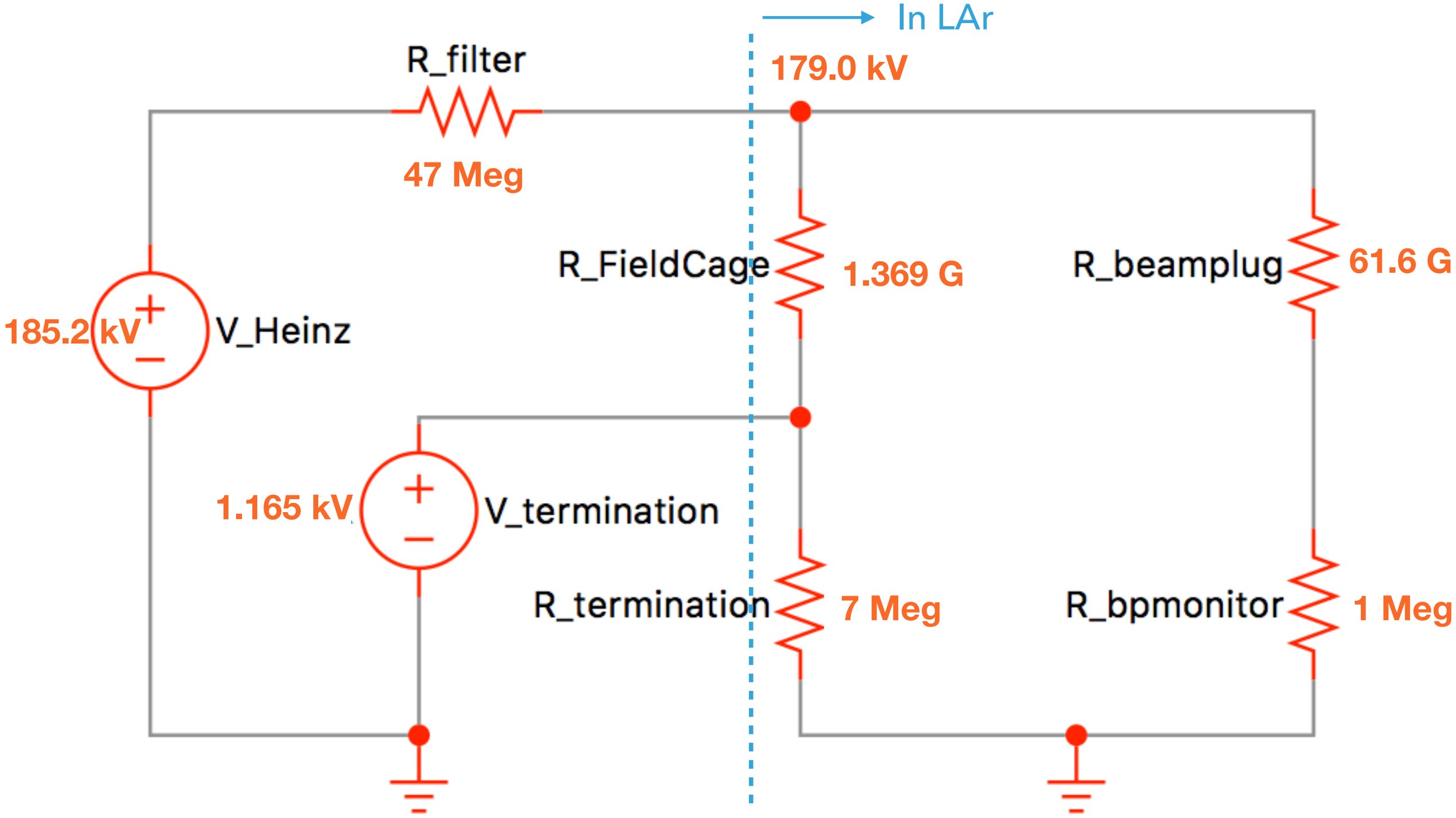
1.65 mm/m shrinkage at LAr T:

Room T→LAr T



THE PROTODUNE CIRCUIT

Values are from the precise measurements performed recently (AFTER the beam)

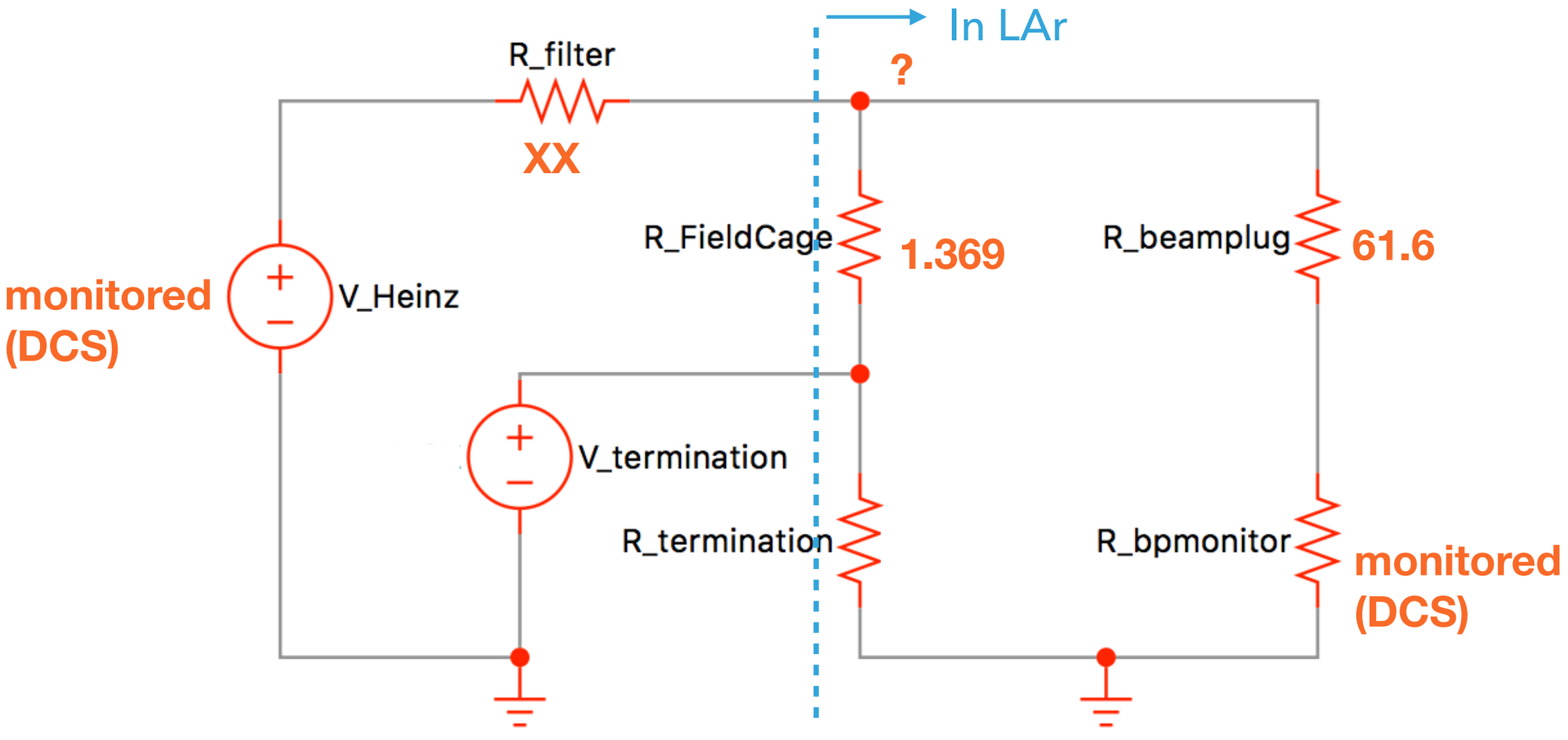


DEDUCE THE CIRCUIT AT THE TIME OF THE BEAM

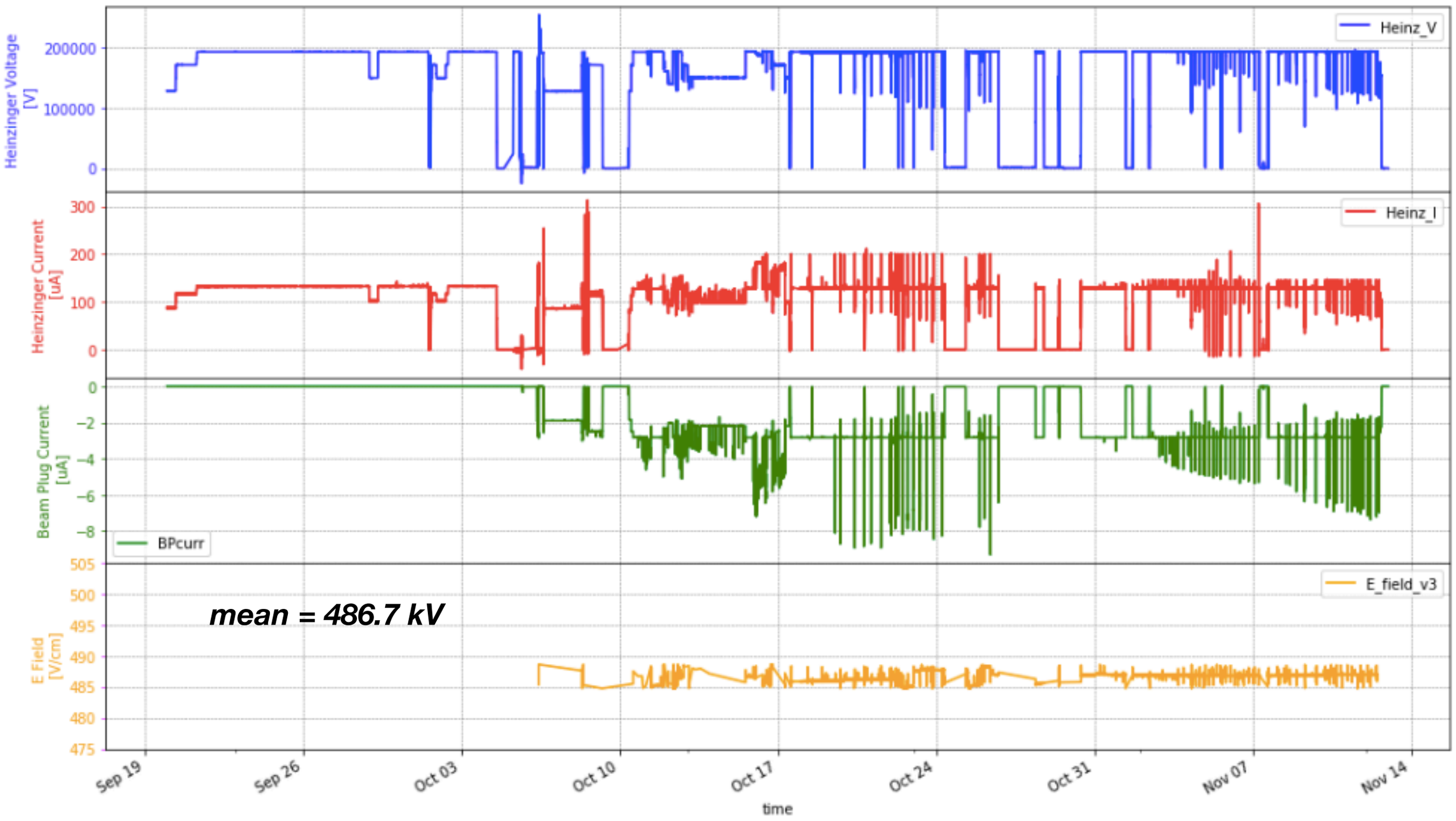
- What we need to determine is the Voltage at the cathode (?) at the time of the beam runs

$$V^{cath}_{now} / I^{BP}_{now} = V^{cath}(t_{beam}) / I^{BP}(t_{beam})$$

measured ***monitored in DCS***



E FIELD ESTIMATION DURING BEAM PERIOD



SOME CONSIDERATIONS

- Damage to the HV filters cannot be attributed to a unique event. A degradation in time is the most plausible assumption
- The E field should then be estimated at the time of the runs. Degradation due to the filters damage is expected
- The Power Supply currently in use is NOT the one used at the time of the beam. The difference in stability from the two PS can be added as a systematic uncertainty to the Efield estimation