

# Time dependence of SCE

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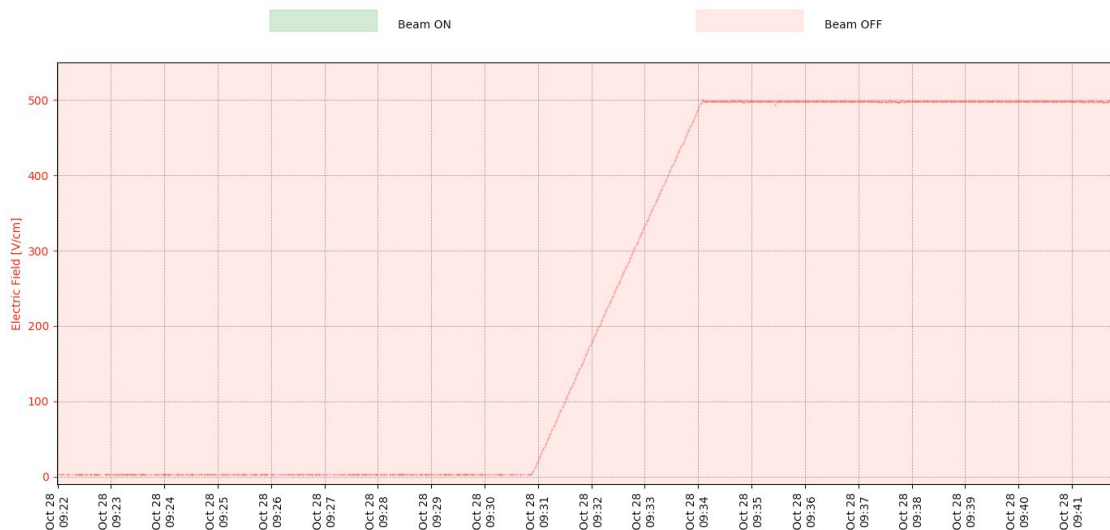
# Acknowledgements

A big thanks to:

- Kevin Wood for providing the HV data!
- The production team for reprocessing run 5661 to provide better statistics
- Tingjun Yang and Ajib Paudel, for their guidance

# Run 5661

- Run taken after HV turned off for long period of time
- Gradual ramping up of HV over the course of 20 min
- Goal: to study the buildup of space charge effect - does it stabilize?



# Procedure

- Only accept through-going,  $t_0$ -tagged cosmic rays
- Sort cosmic rays by time of arrival (1 min bins):  $evttime - t_0$
- Within each time bin, sort hit  $dQ/dx$  values into bins based on x-position
- Take median  $dQ/dx$  of each bin and graph  $dQ/dx$  vs x-position
- Fit plot with exponential  $f(x)=\exp(p_0+p_1*x)$  to get in form of  $dQ/dx = (dQ/dx)_0*\exp(-x/vd*\tau)$
- $vd$  = drift velocity =  $0.16 \text{ cm}/\mu\text{s}$ ,  $\tau$  = electron lifetime =  $1/[vd*p_1]$
- Plot fitted electron lifetimes vs time of arrival of cosmic rays

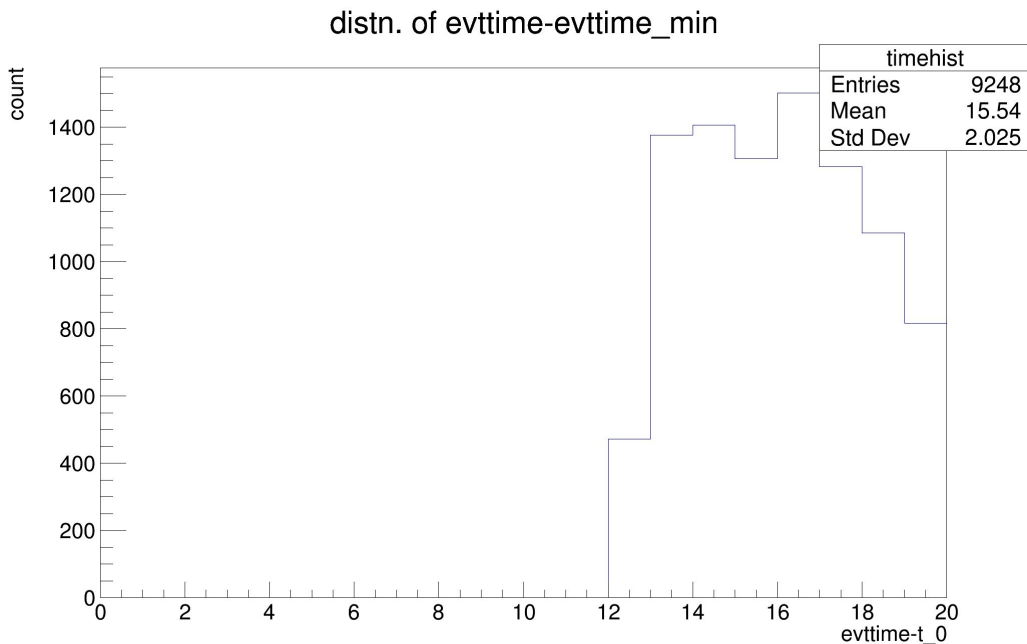
# Run information

Run start time t\_0: 1540718518 sec

Cuts:

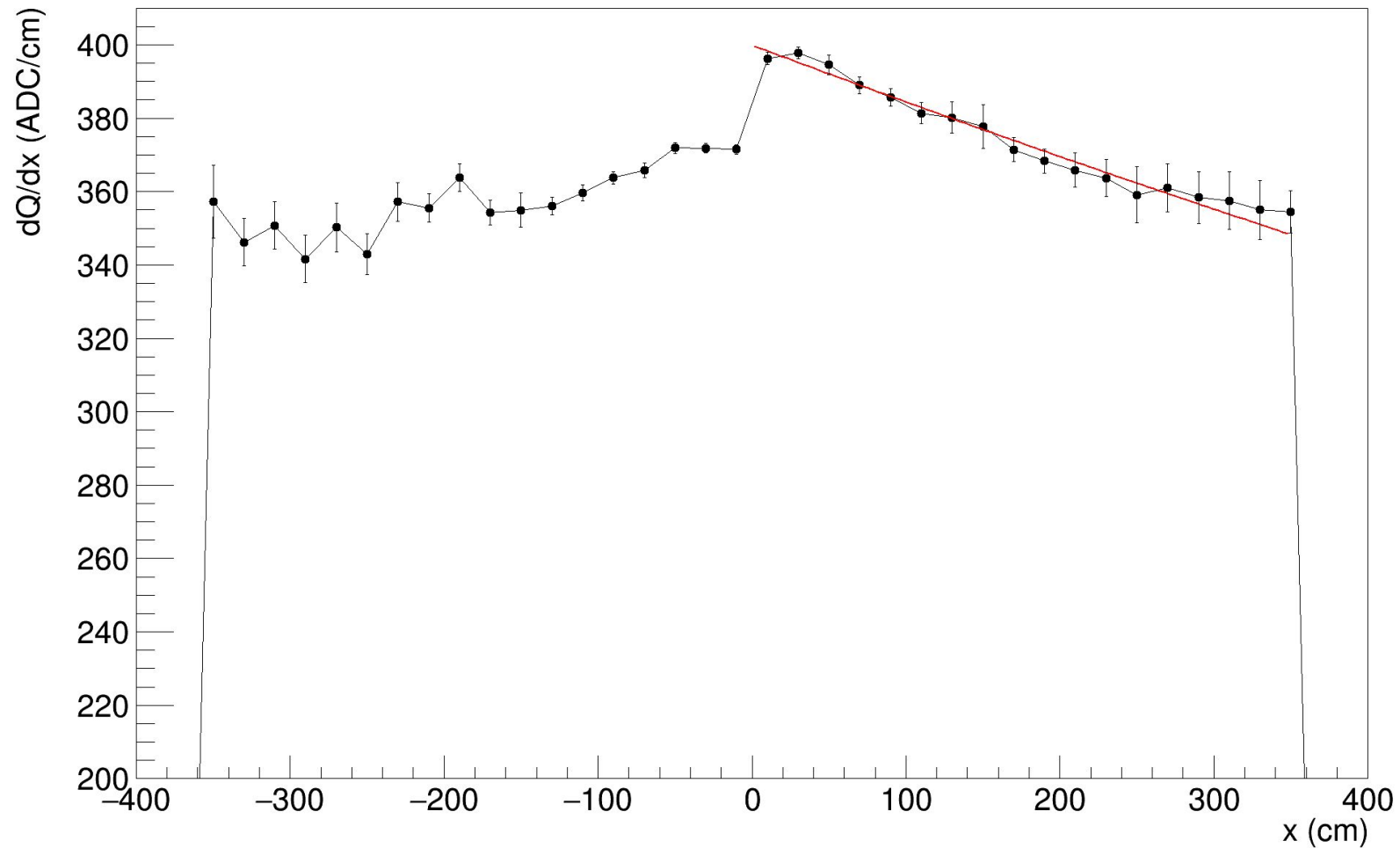
- Cosmic ray crossing tracks must start and end outside of the TPC
- Angular cuts: cutting out tracks parallel and perpendicular to the wire planes - see my previous talk

# Event distribution

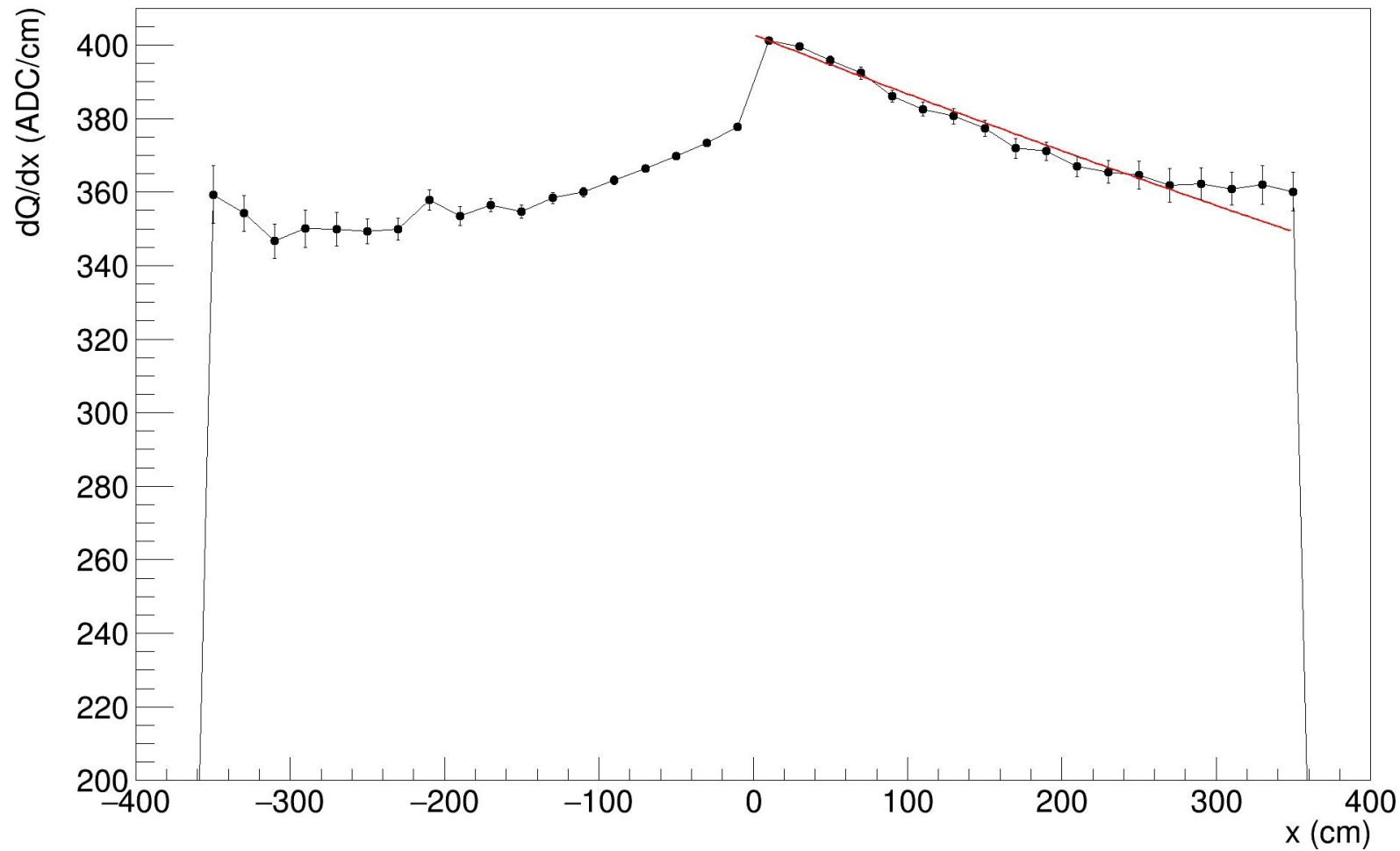


Bin #	# crossing tracks passing cuts
12	472
13	1376
14	1406
15	1307
16	1502
17	1283
18	1085
19	817

dQ/dx vs X-coord (12-13 min)

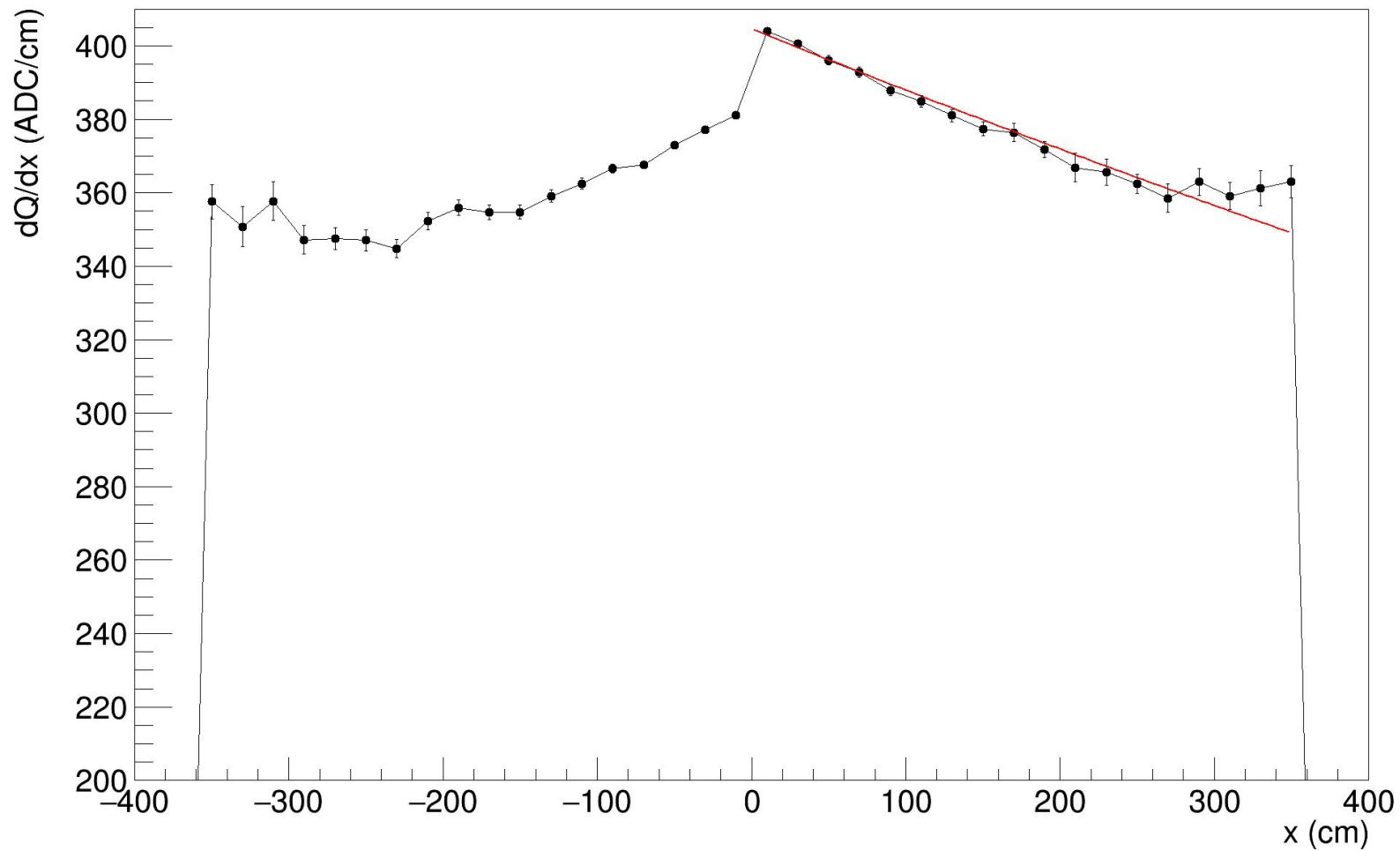


dQ/dx vs X-coord (13-14 min)

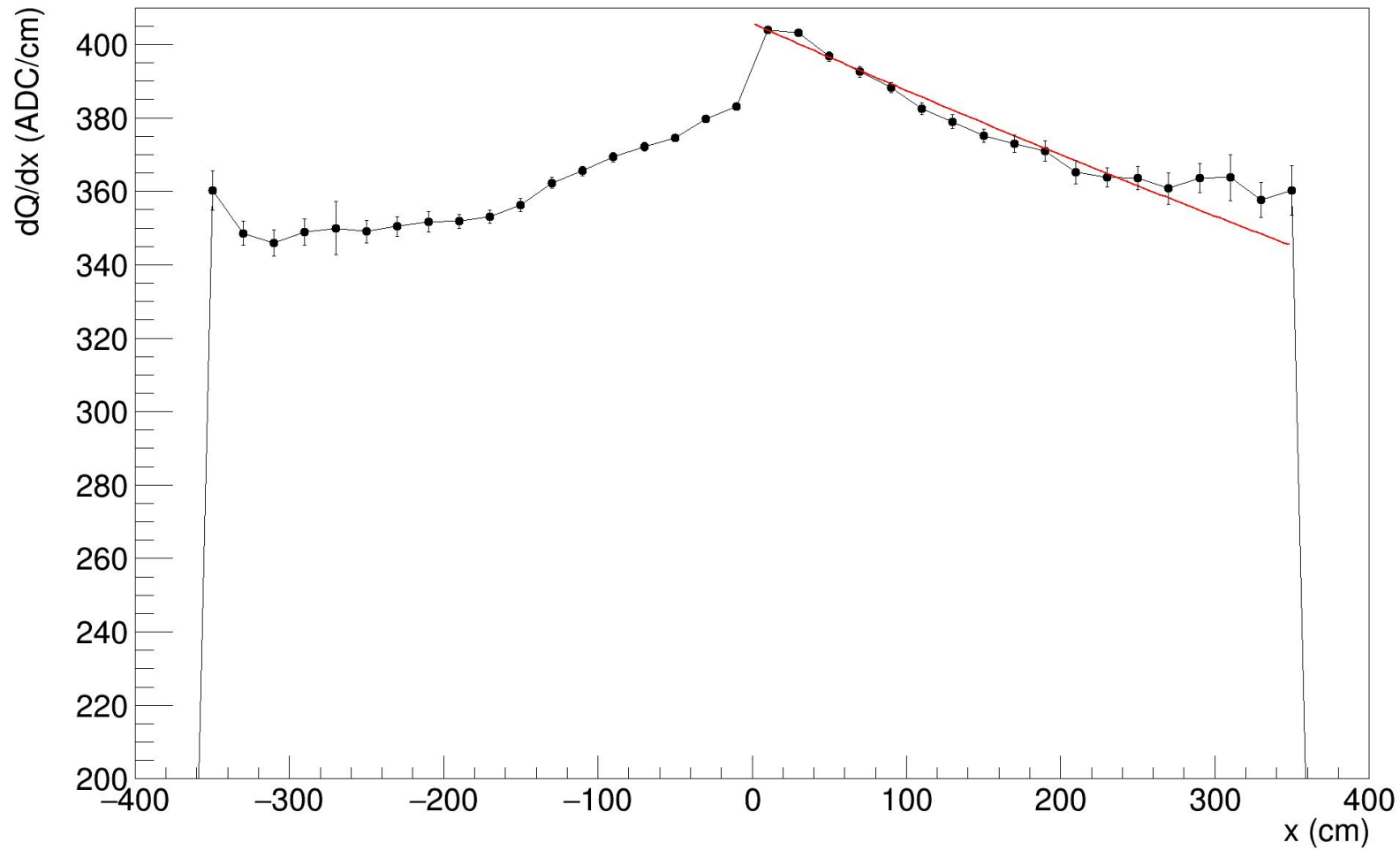




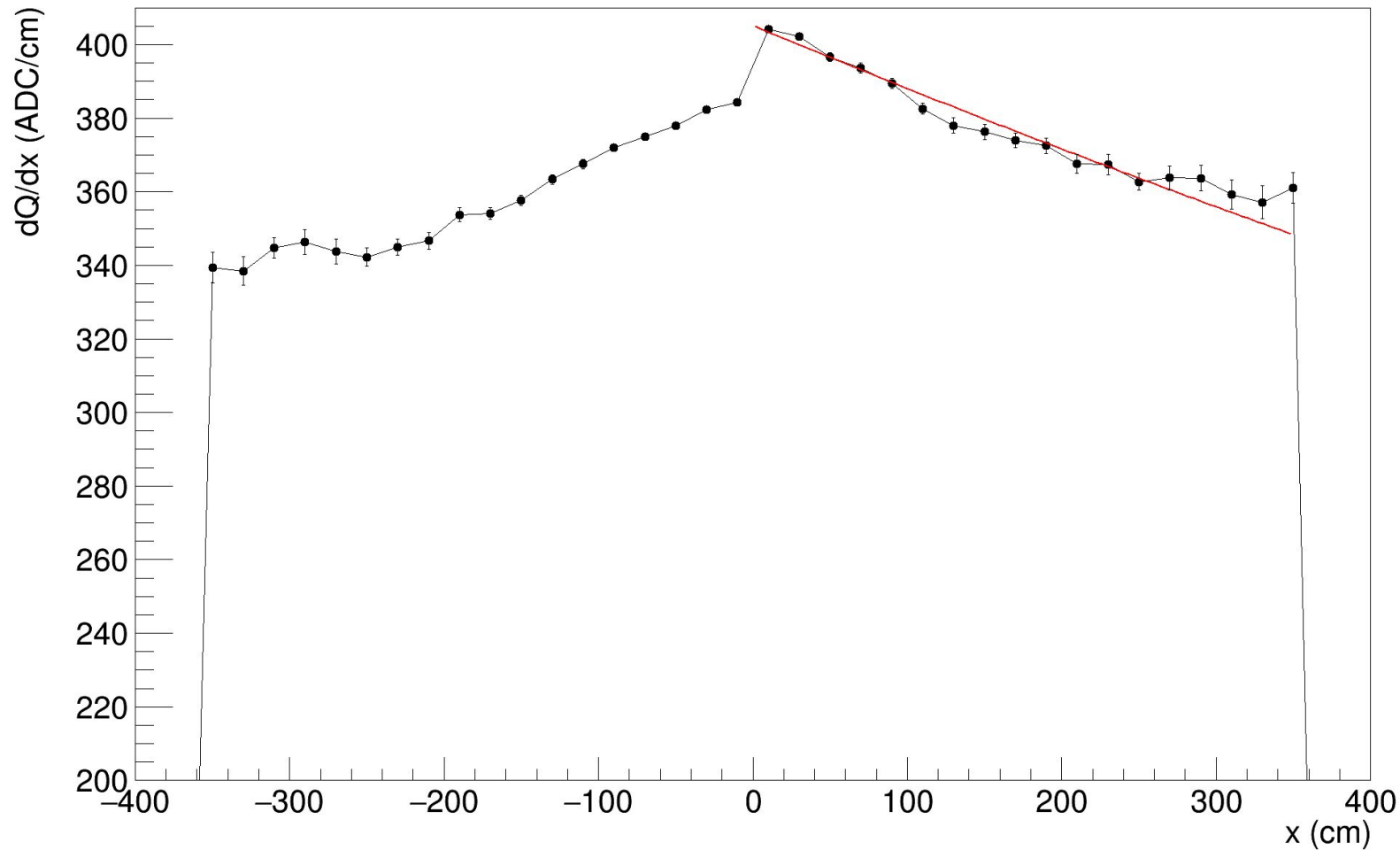
dQ/dx vs X-coord (14-15 min)



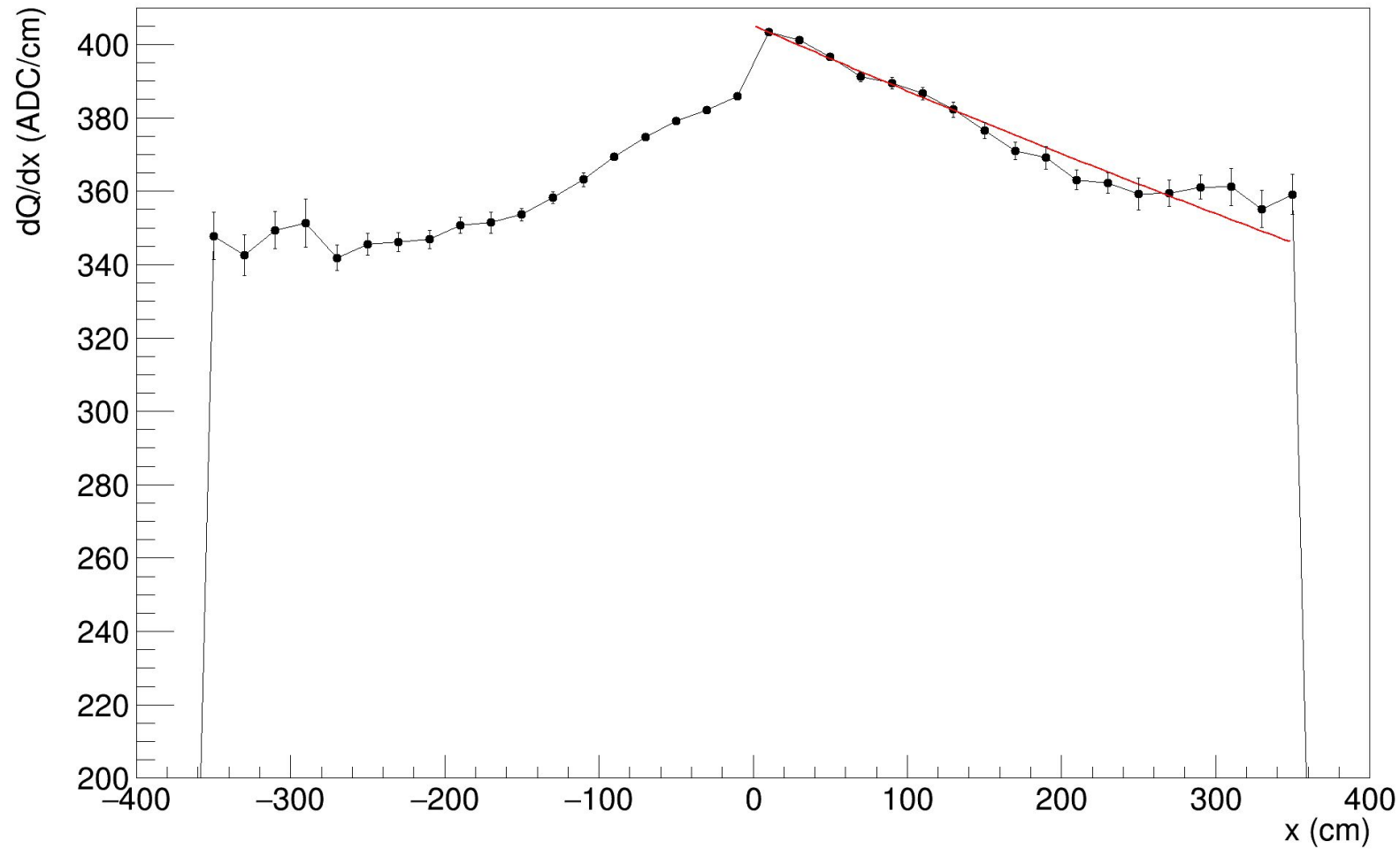
dQ/dx vs X-coord (15-16 min)



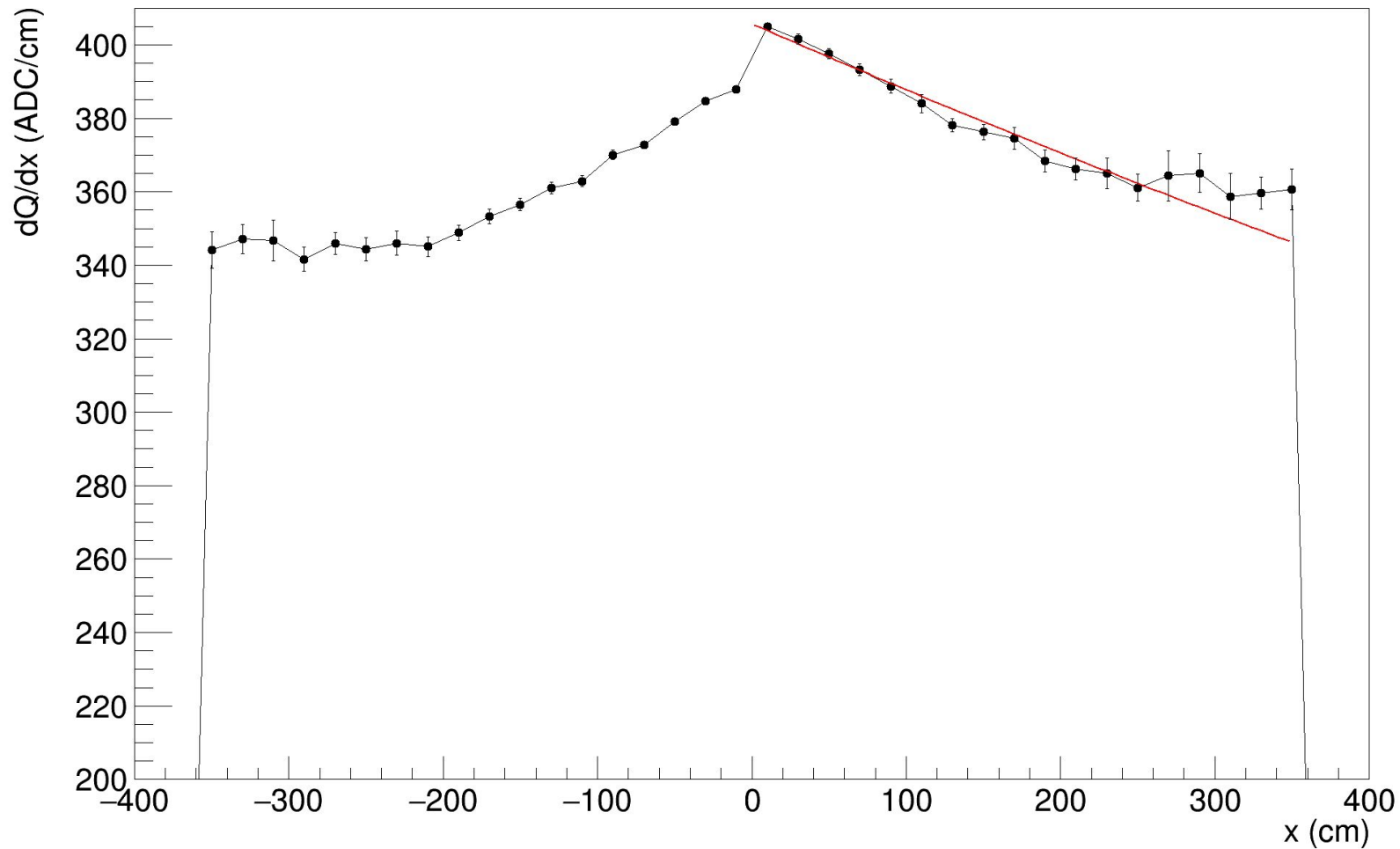
dQ/dx vs X-coord (16-17 min)



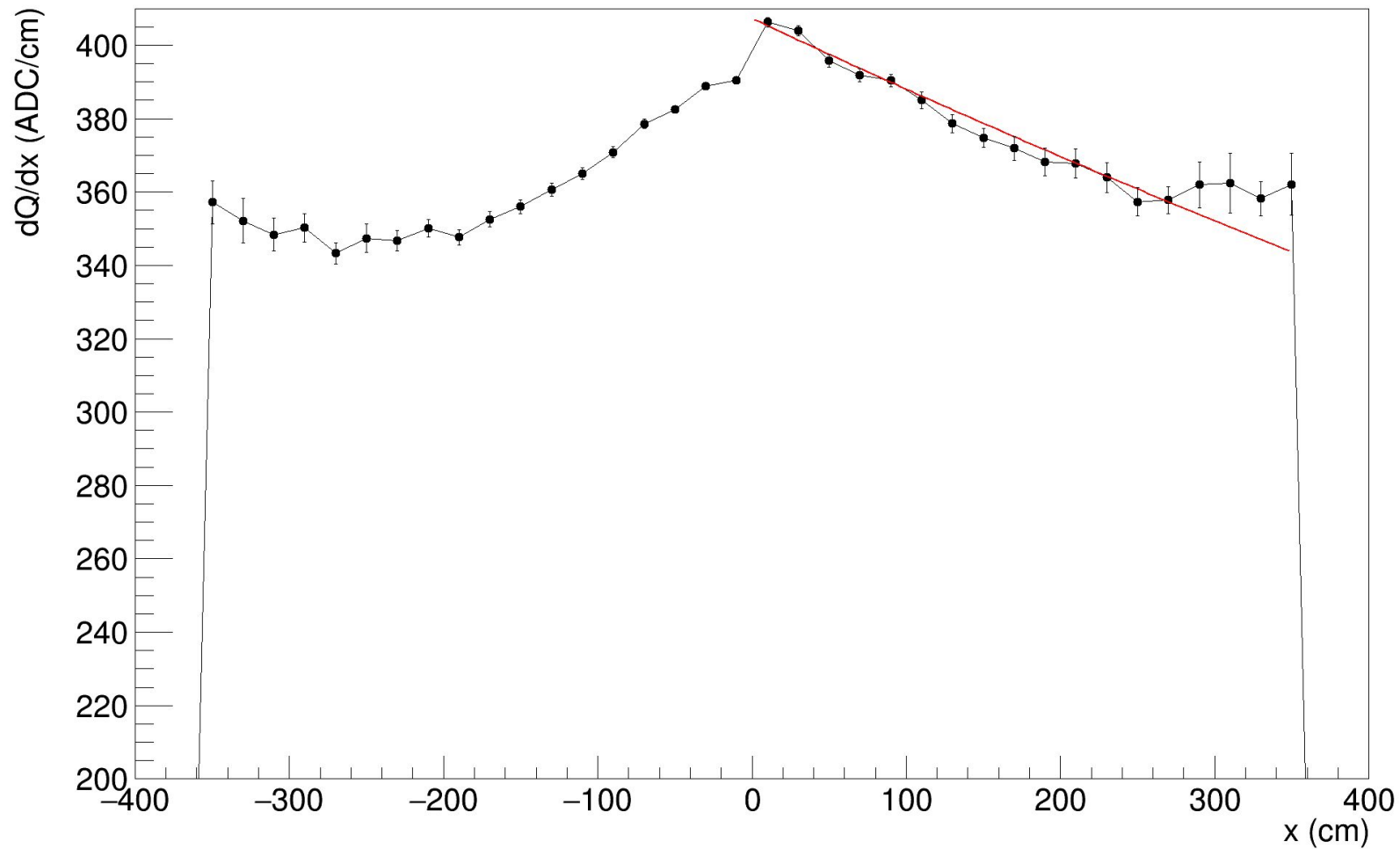
dQ/dx vs X-coord (17-18 min)



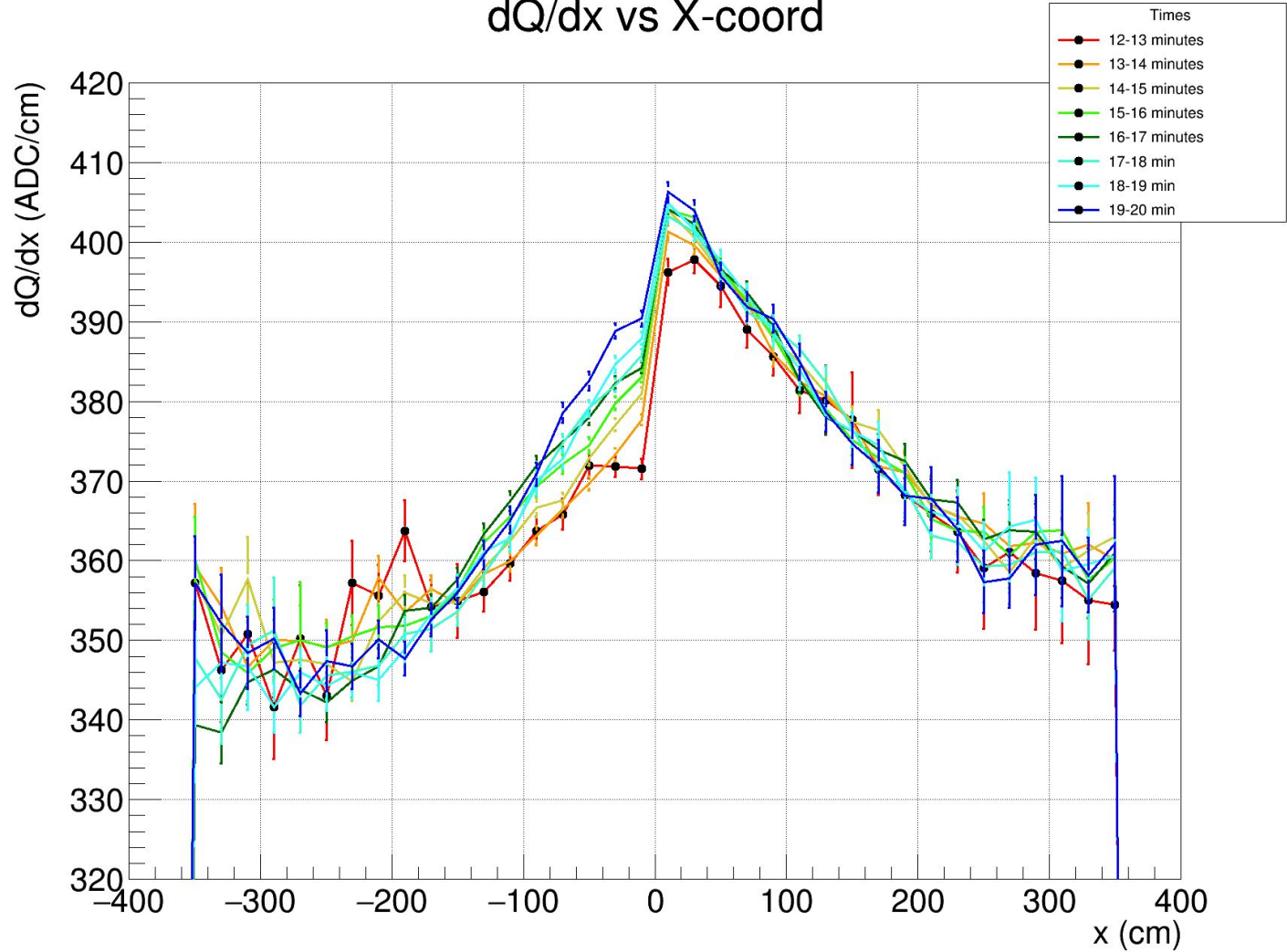
dQ/dx vs X-coord (18-19 min)



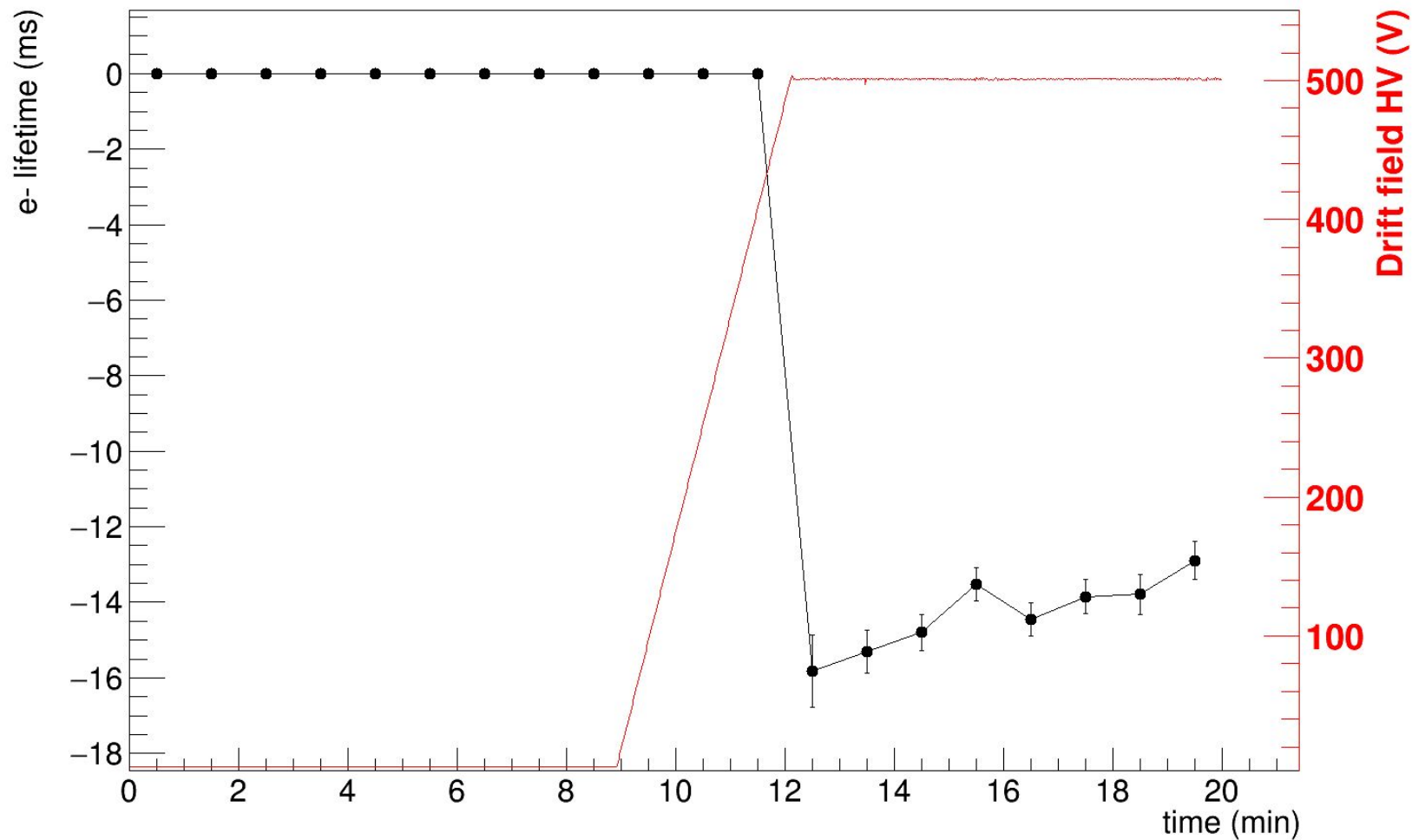
dQ/dx vs X-coord (19-20 min)



# dQ/dx vs X-coord

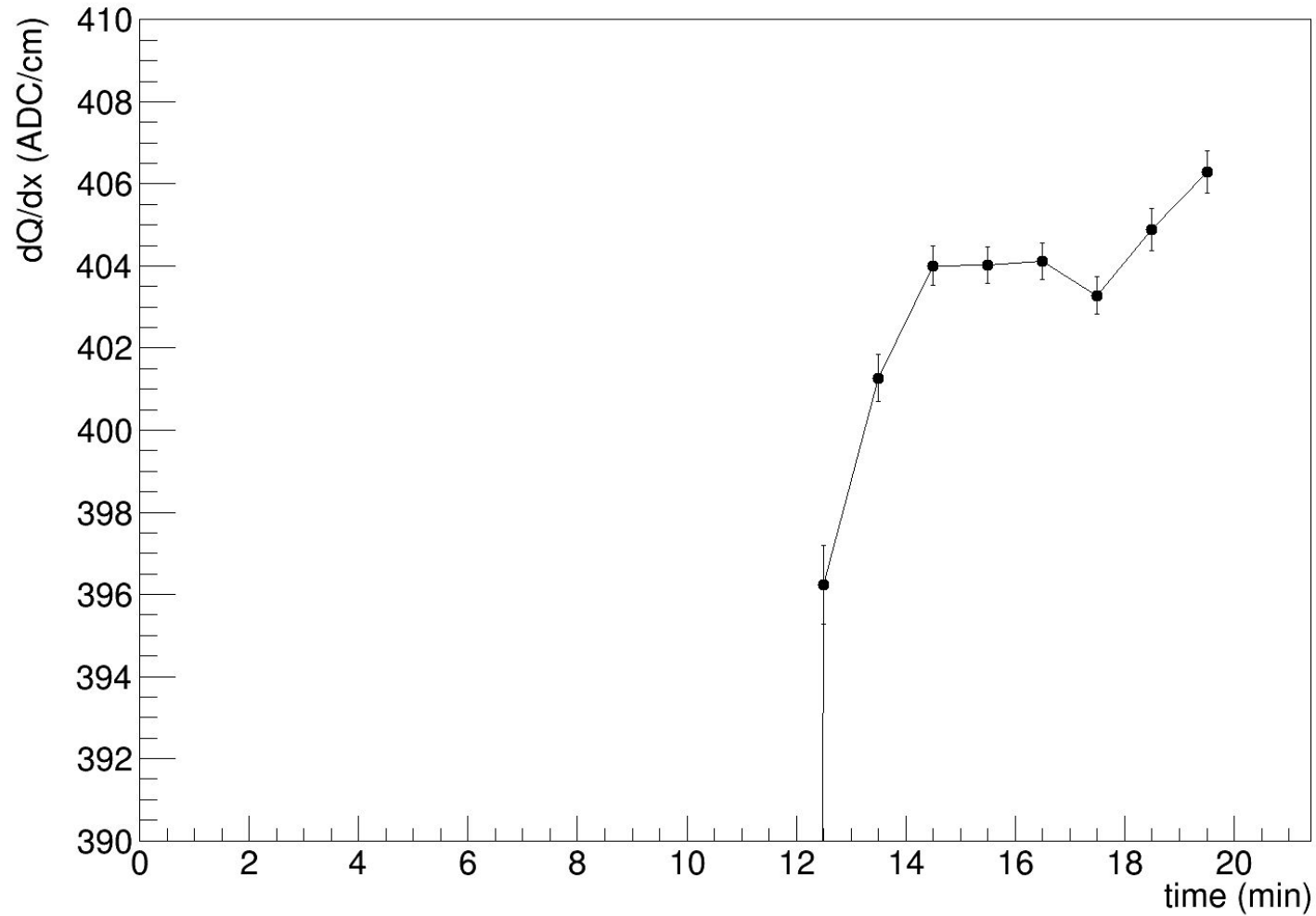


# e- Lifetimes





# Median dQ/dx values at x=0



# Conclusions

- The increase of  $dQ/dx$  at the cathode throughout the 20 minute period seems to indicate a buildup of space charge effect
- $dQ/dx$  is still increasing up until the end of the run, so it's hard to say whether space charge effect stabilizes with time. More data with longer run times are needed to better understand this effect