

Preliminary Analysis of Proto-DUNE CFD Simulation

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TF Calibration Meeting

Tue 11 Sep 2018

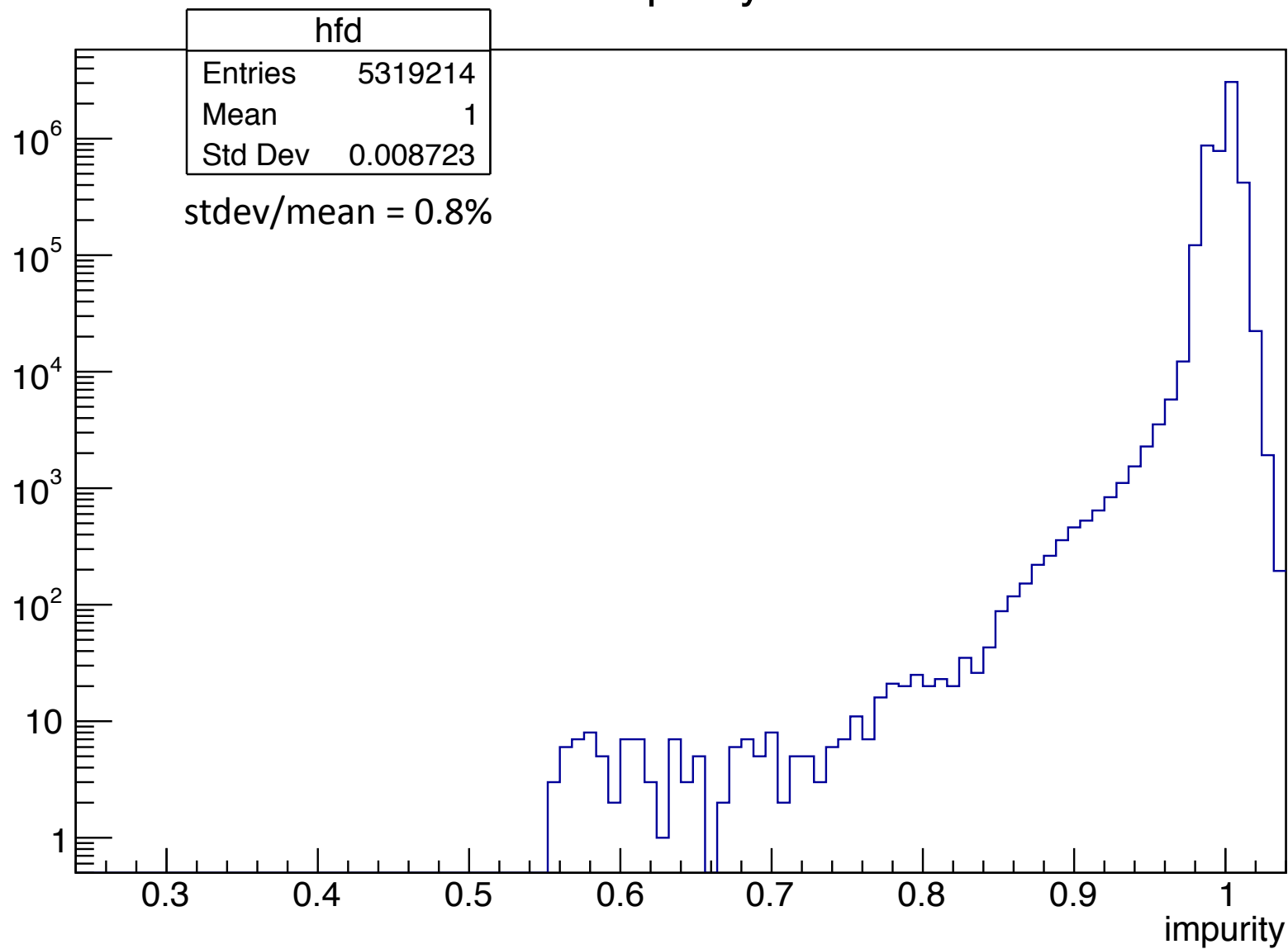
Outline

1. Disclaimers
2. Impurity
3. Temperature
4. 250V Mobility
5. 500V Mobility
6. 250V Drift Velocity
7. 500V Drift Velocity
8. Conclusion

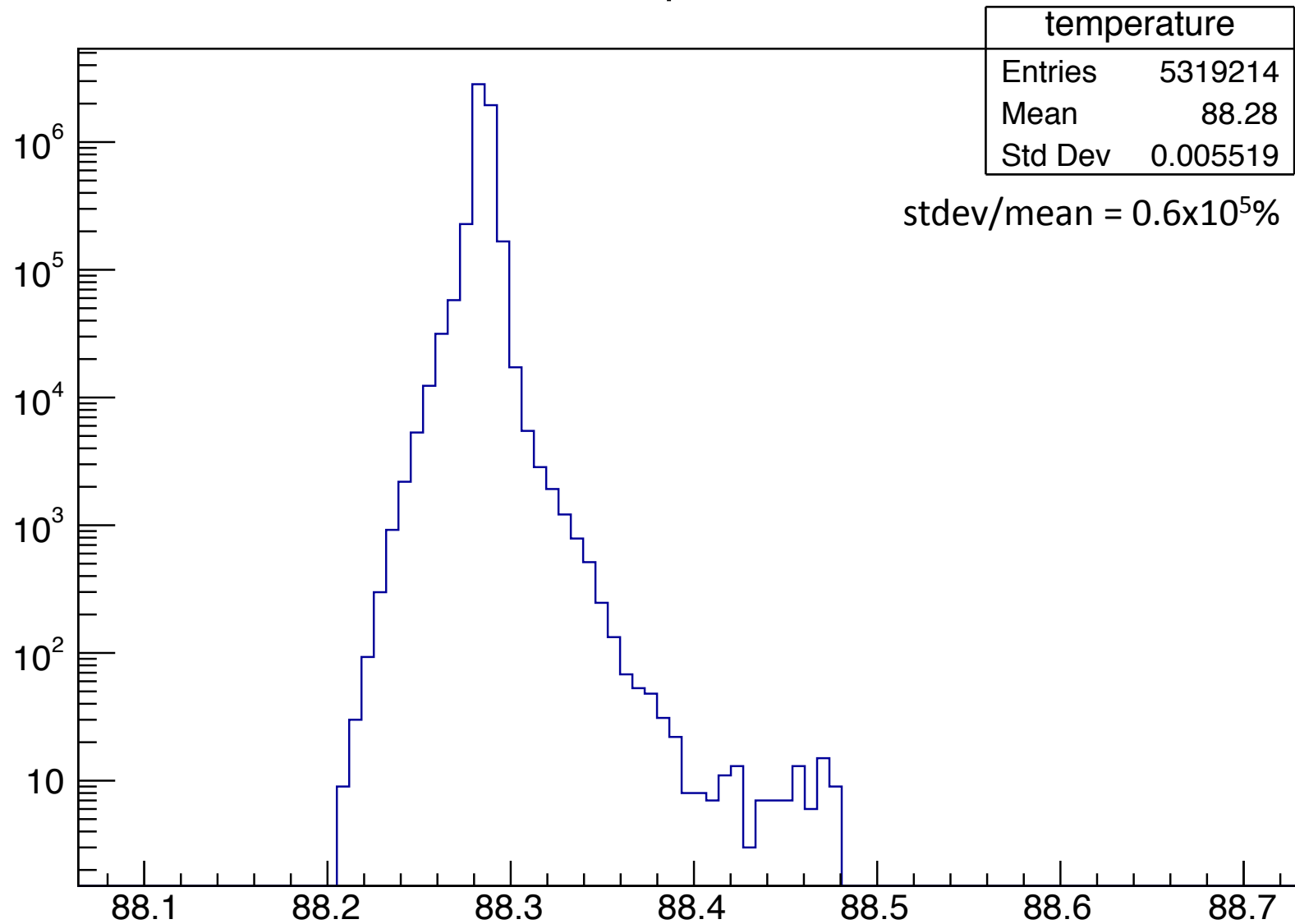
Disclaimers

- This analysis was performed on a simulation run by Erik A Voirner at Fermilab on a simplified model of Proto-DUNE—I have no idea how simplified the model is or in what ways it is simplified.
- Erik’s normalized impurity data has numbers greater than 1.0, and I don’t understand what this means.
- I used the formula for electron mobility and drift velocity at: <https://lar.bnl.gov/properties/trans.html> and the units seem hinky to me—electron mobility evidently has units of cm^2/sec which doesn’t seem right. The drift velocity is given as $v = \mu E$ which doesn’t seem to have the right units given the units of μ .

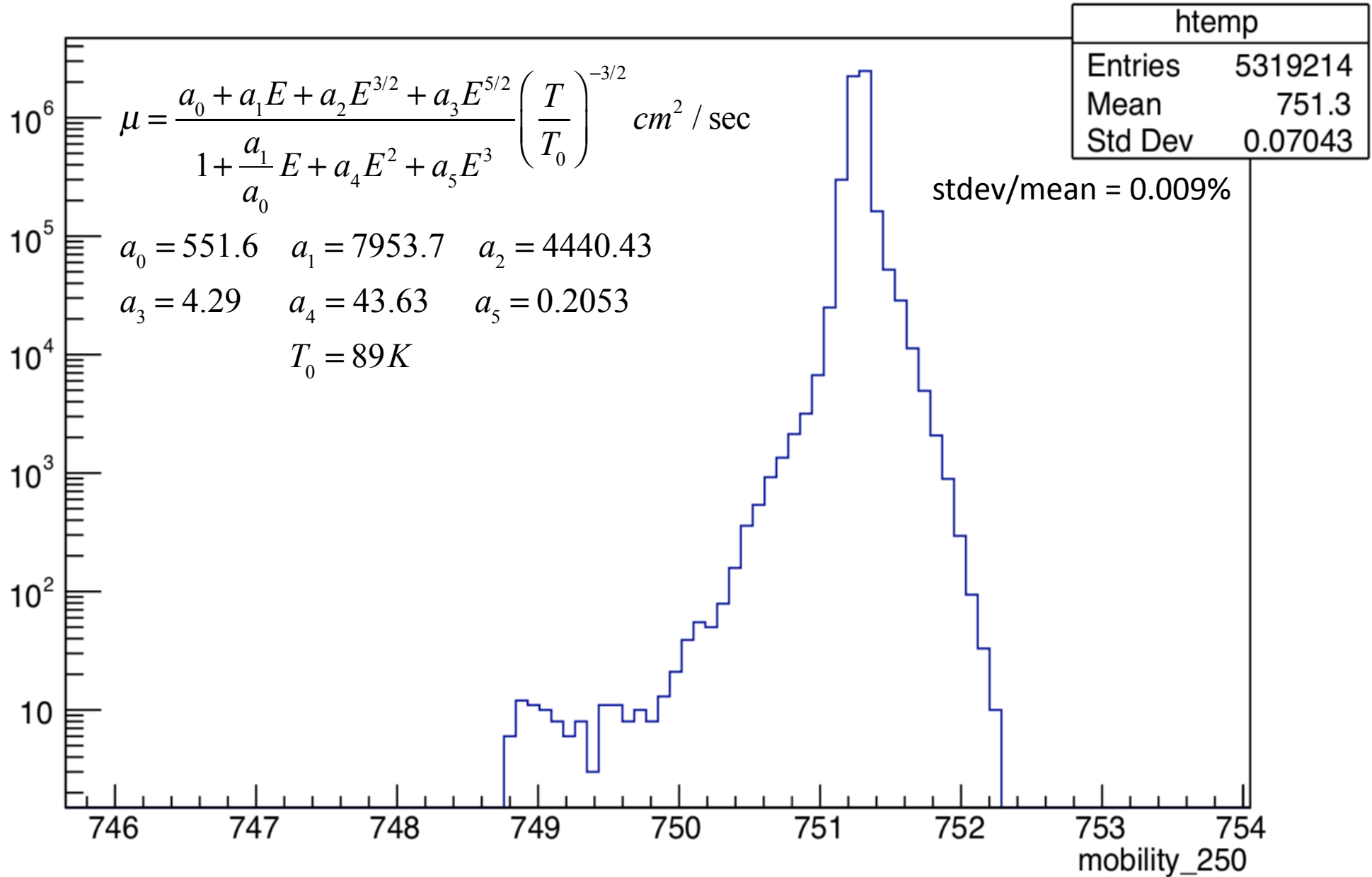
impurity



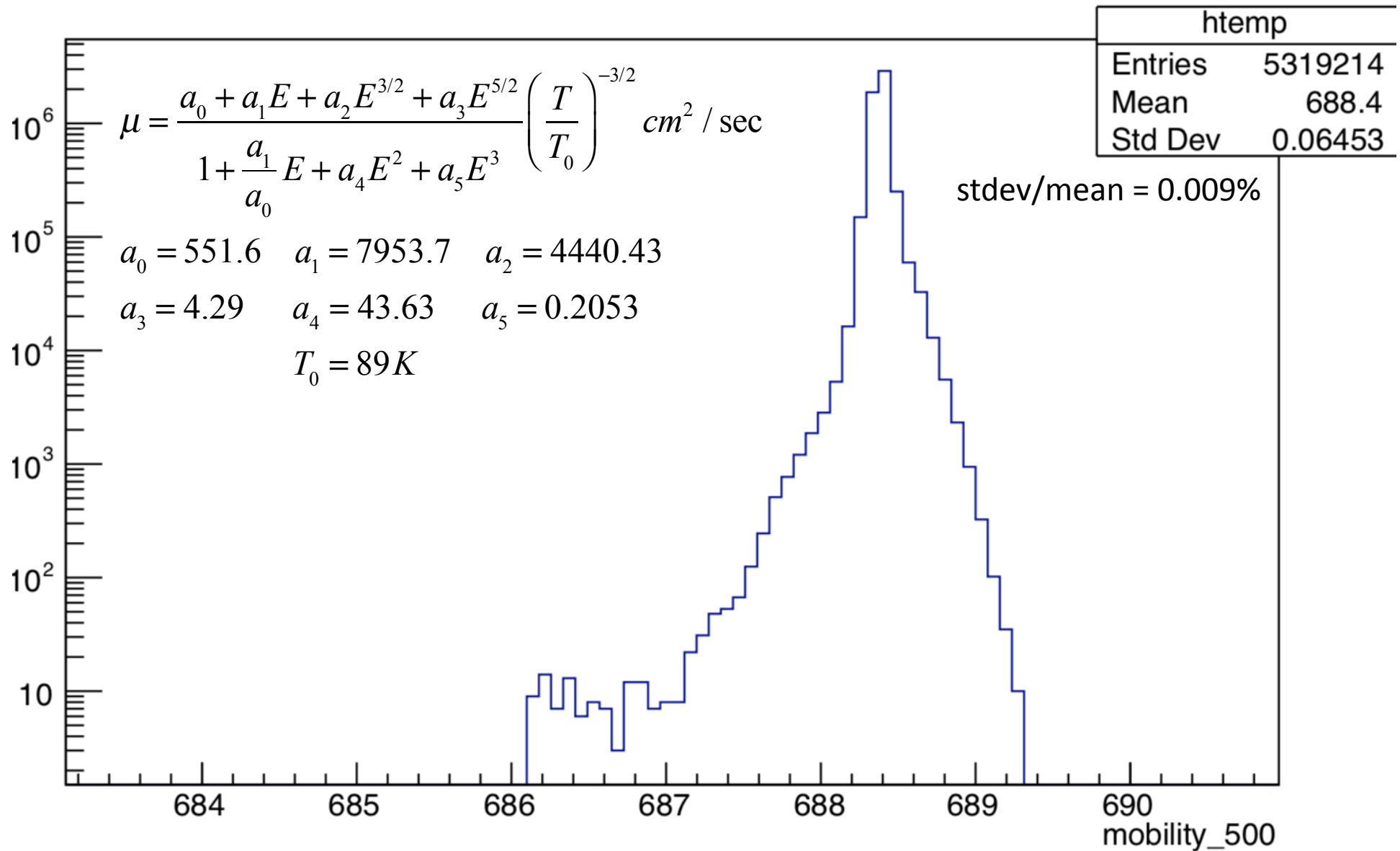
temperature



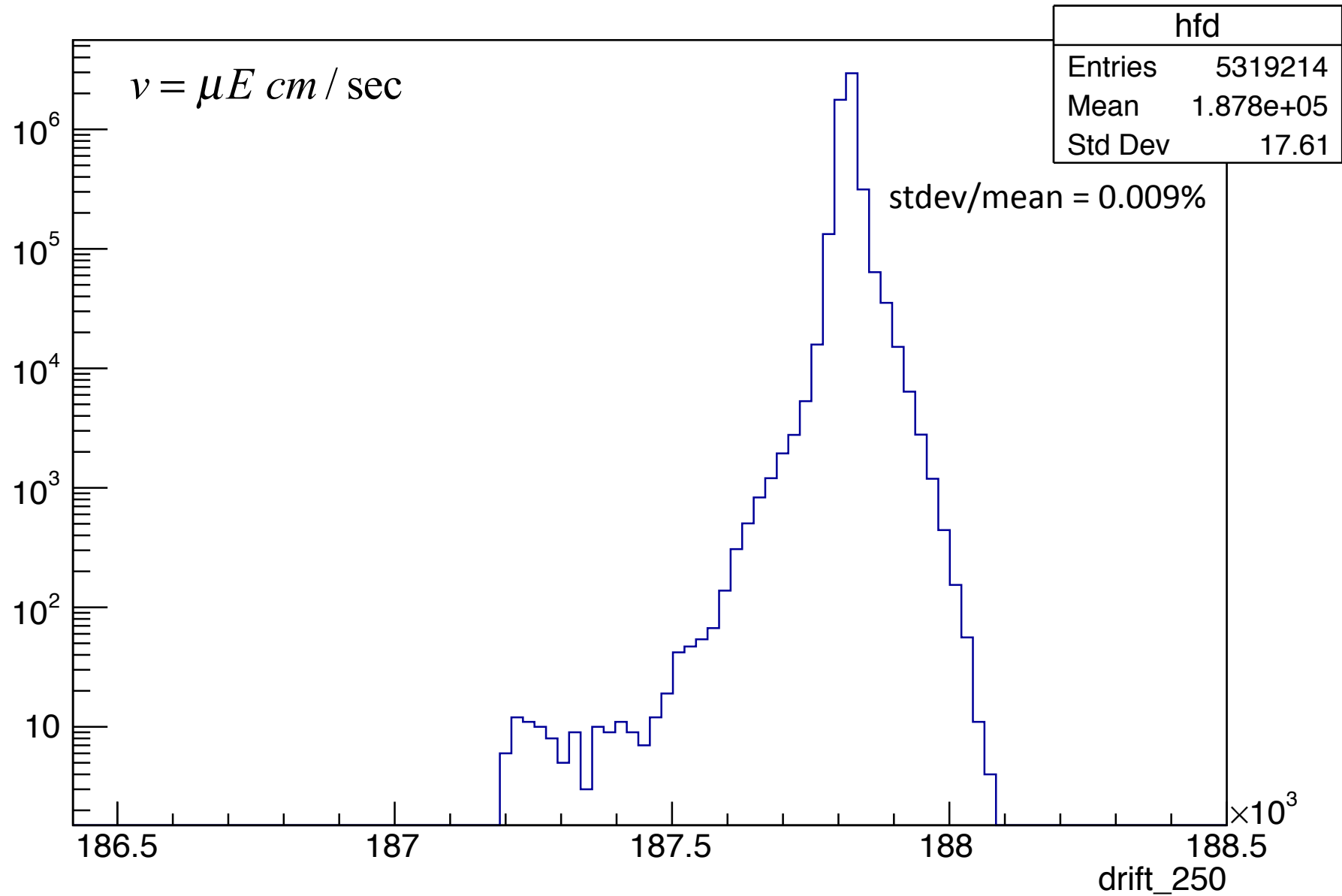
mobility_250



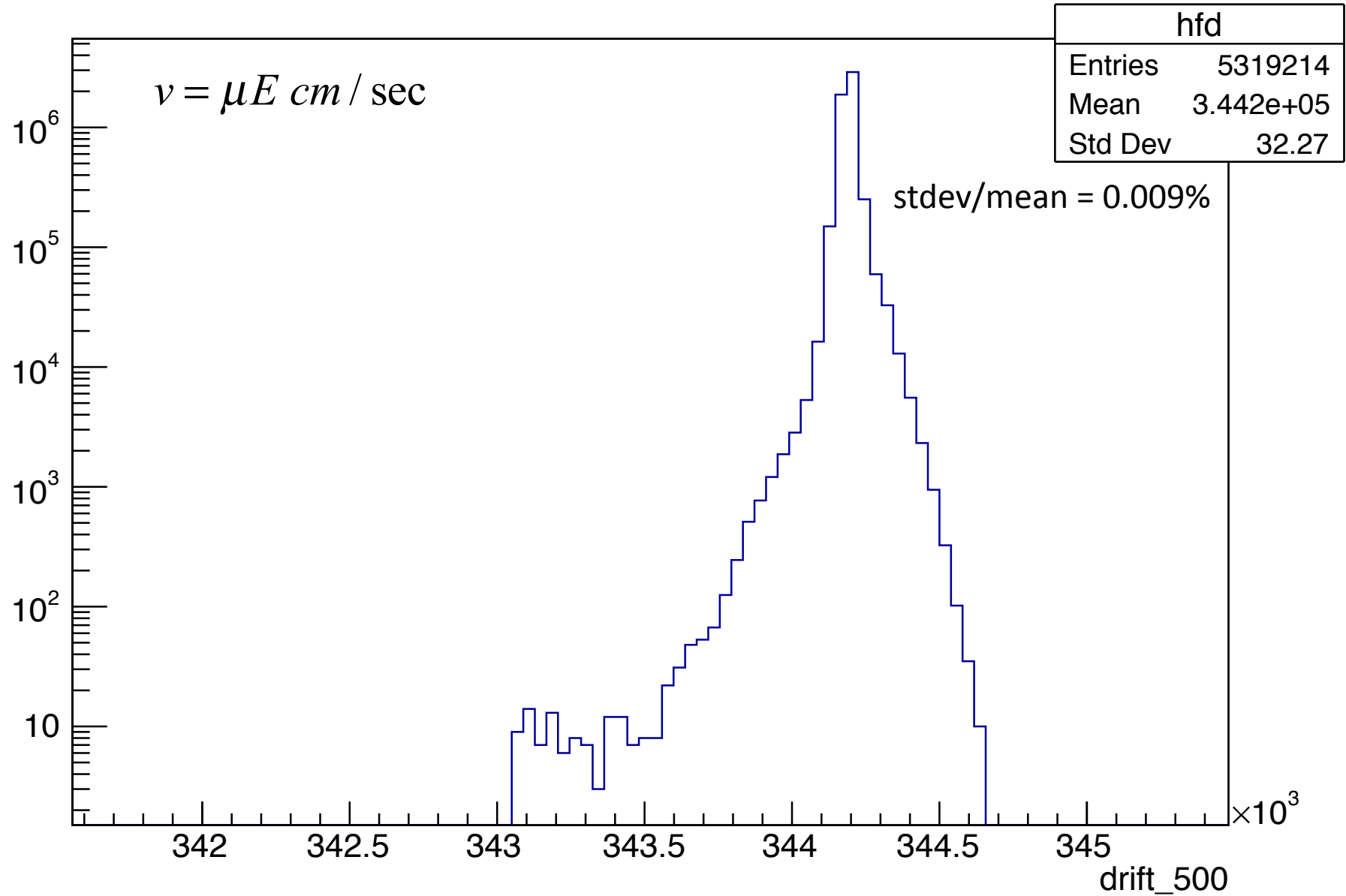
mobility_500



drift_250



drift_500



Conclusions

- The ratio of stdev/mean in all cases is less than .01%.
- From Prof Mooney:

*Even for charge originating near the cathode, this should result in $\sim 3600 * 0.0001 = 0.36$ mm variation in reconstructed charge location, which is less than a time tick even at half E field (a time tick is roughly 0.5 mm at 250 V/cm, 0.8 mm at 500 V/cm). This means the impact from temperature fluctuations, as predicted from the CFD model Erik ran, is truly negligible.*