



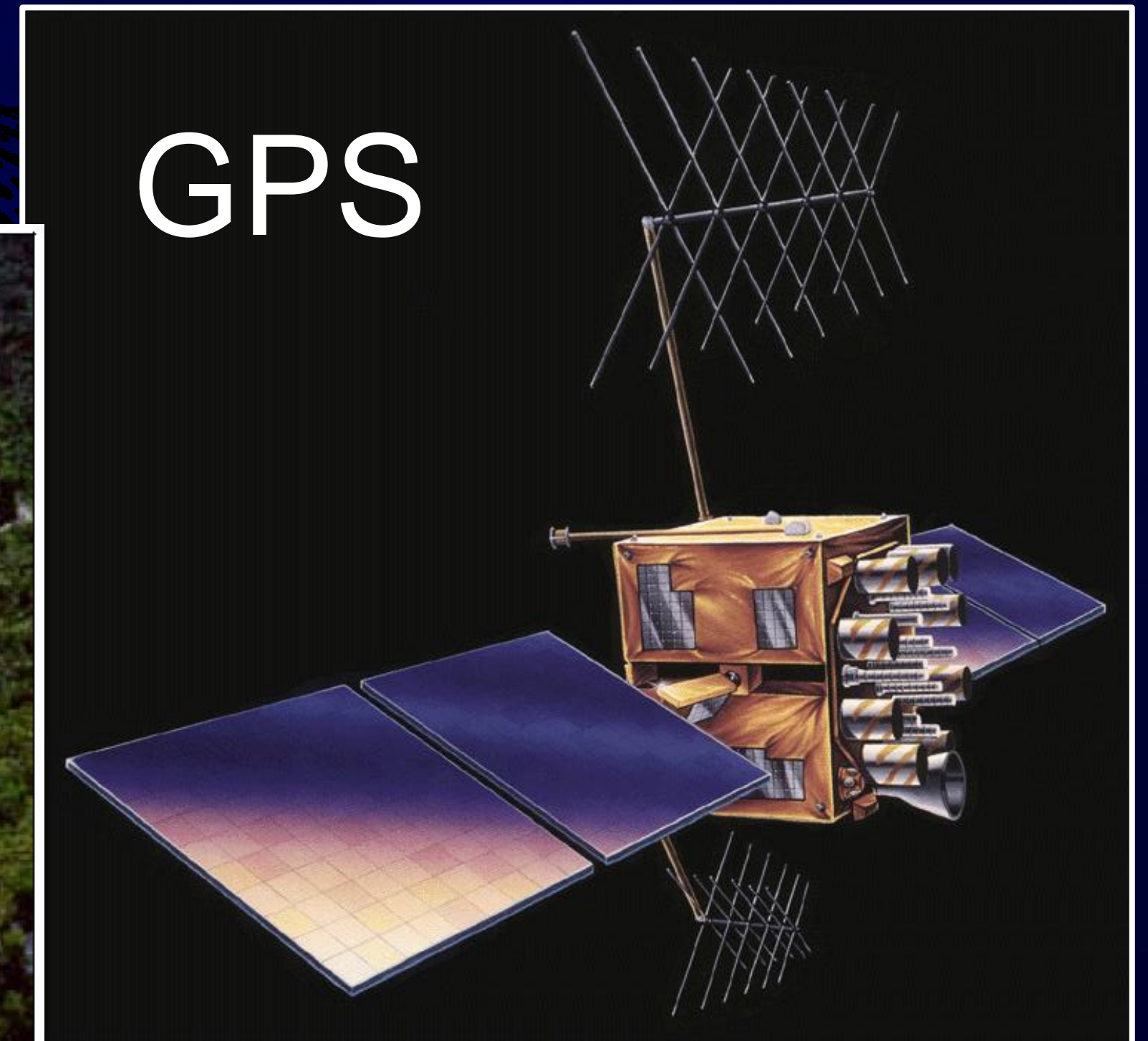
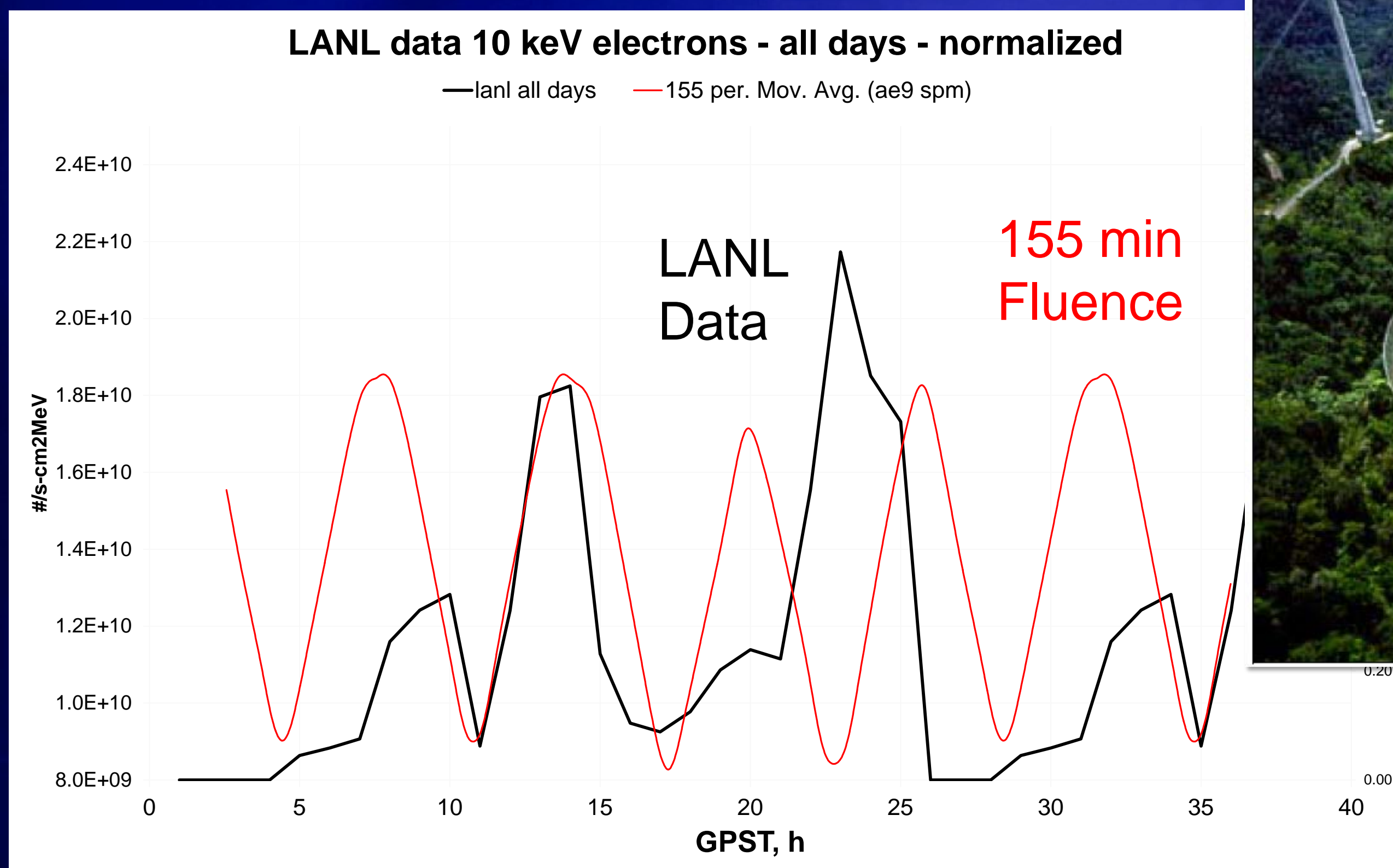
# A GROUND-BASED SURVEILLANCE CAMPAIGN TO DETECT GPS ARCING – FIRST PRELIMINARY POSITIVE RESULTS

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## GPS Power Degradation in Excess of Radiation Damage:

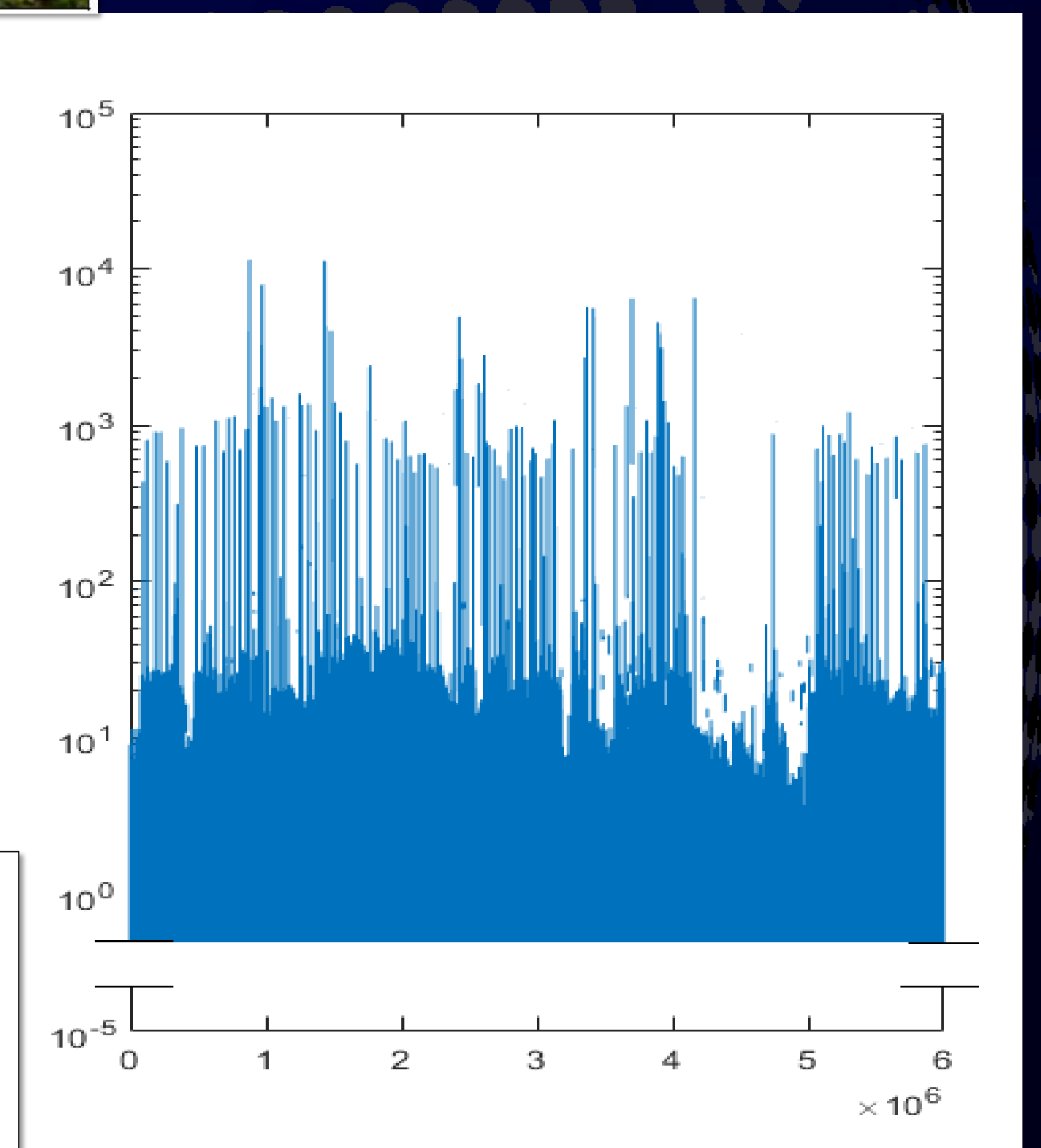
- Contamination from Solar Array Arcing hypothesized as cause of excess GPS power degradation over time [1,2]
- Coordinated LANL GPS radiofrequency detection system, radio (Arecibo, LWA1) and optical (Starfire Optical Range) observations undertaken in October and November (2015) to confirm arcing on GPS solar arrays [3]
- Arecibo and LANL data from Oct. 17-23, 2015 preliminary analysis reported here



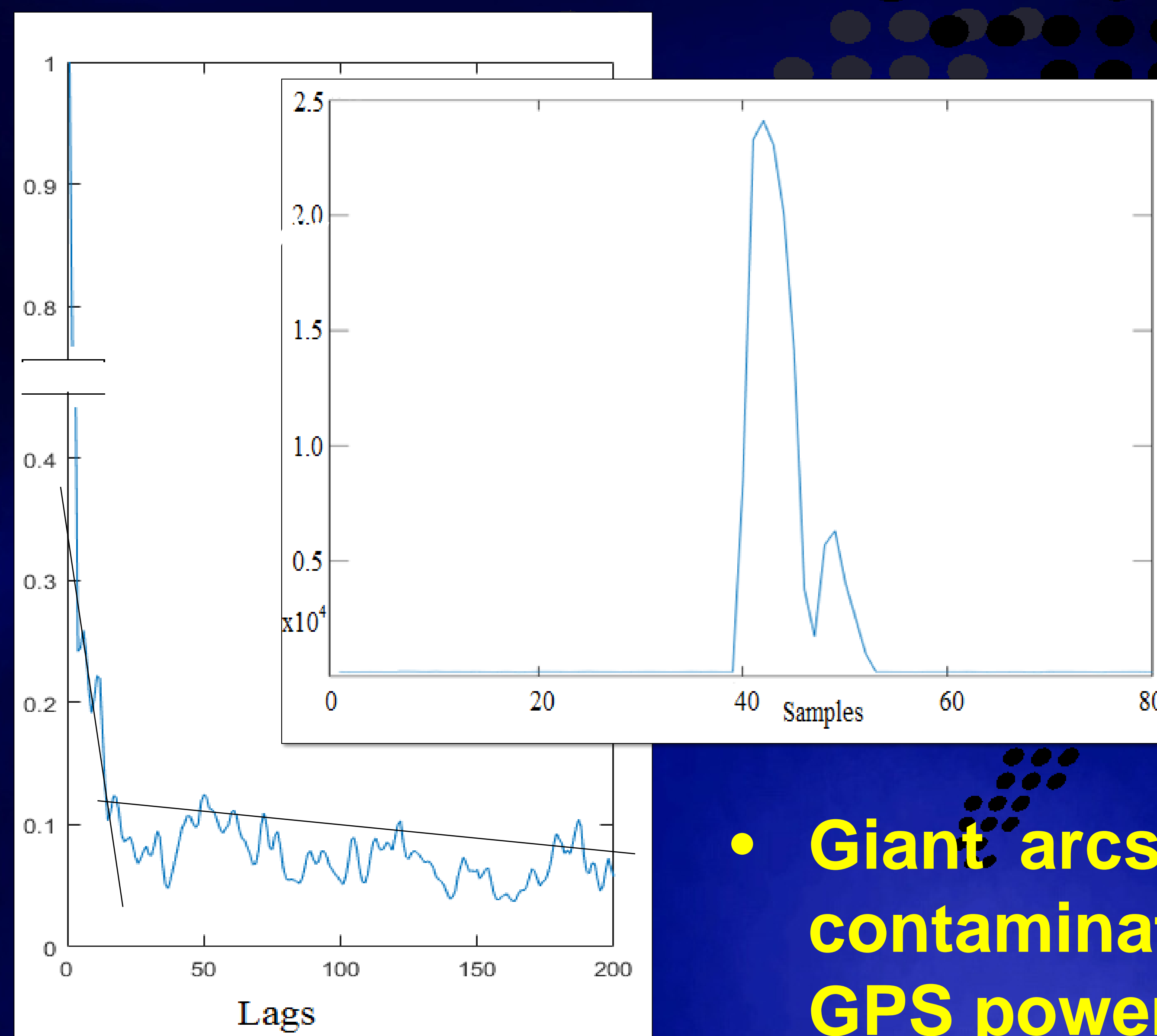
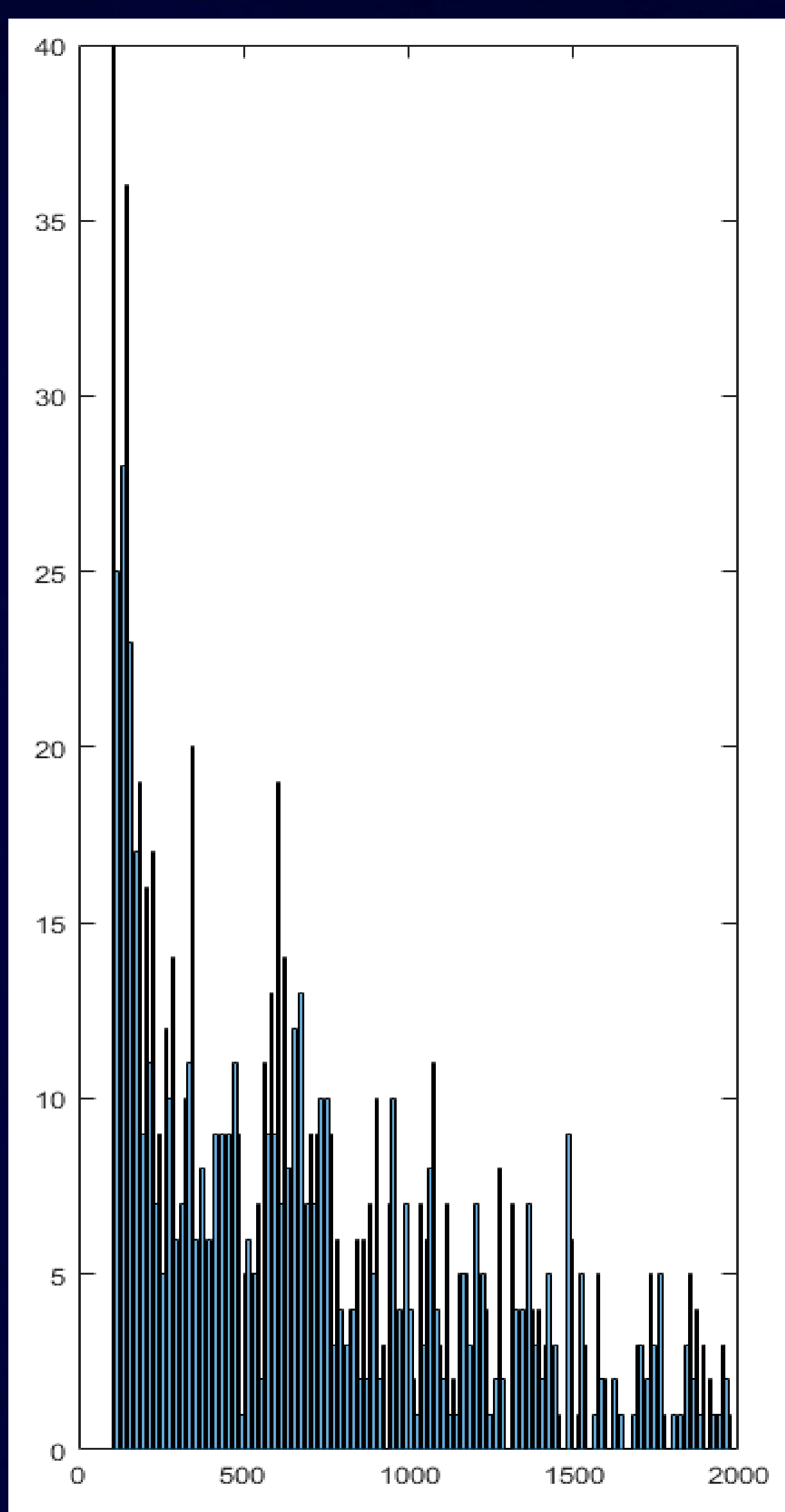
Arecibo 305 m dish

- Average LANL radiofrequency event data and 155 minute moving average of the 10 keV electron flux [2,4] from the AE9/AP9/SPM model. Peaks and valleys well represented.

First minute of data, noise subtracted



Giant arc signal, 144 microseconds wide, not seen in off-source



- Histogram (left) and autocorrelation function (ACL, right) of signal after noise subtraction. Peak at ~ 650 in histogram. ACL feature at 15 lags corresponds to about 144  $\mu$ s

- Giant arcs may be a source of contamination, causing excess GPS power degradation
- Arc mitigation may increase EOL power by 25%

[1] A. Bogorad, C. Bowman, P. Papa, S. Mucciacciaro, 1991, "Electrostatic Discharge Induced Degradation of Solar Arrays," Conference Record of the Twenty Second IEEE Photovoltaic Specialists Conference – 1991, IEEE CH2953-8/91/0000-1531-1534.

[2] D. Ferguson, P. Crabtree, S. White, and B. Vayner, 2016, "Anomalous GPS Power Degradation from Arc-Induced Contamination," Journal of Spacecraft and Rockets, accepted for publication.

[3] D. Ferguson and B. Vayner, 2014, "Anomalous GPS Power Degradation from Arc-Induced Contamination," XXIII Space Photovoltaic Research and Technology Conference, OAI, Brookpark, Ohio, October 29-30.

[4] D. C. Ferguson, R.V. Hilmer, and V. A. Davis, 2015, "The Best GEO Daytime Spacecraft Charging Index," Journal of Spacecraft and Rockets, Vol. 52, No. 2 (2015), pp. 526-543.