CREDANCE Observations onboard DSX Comparison to IRENE

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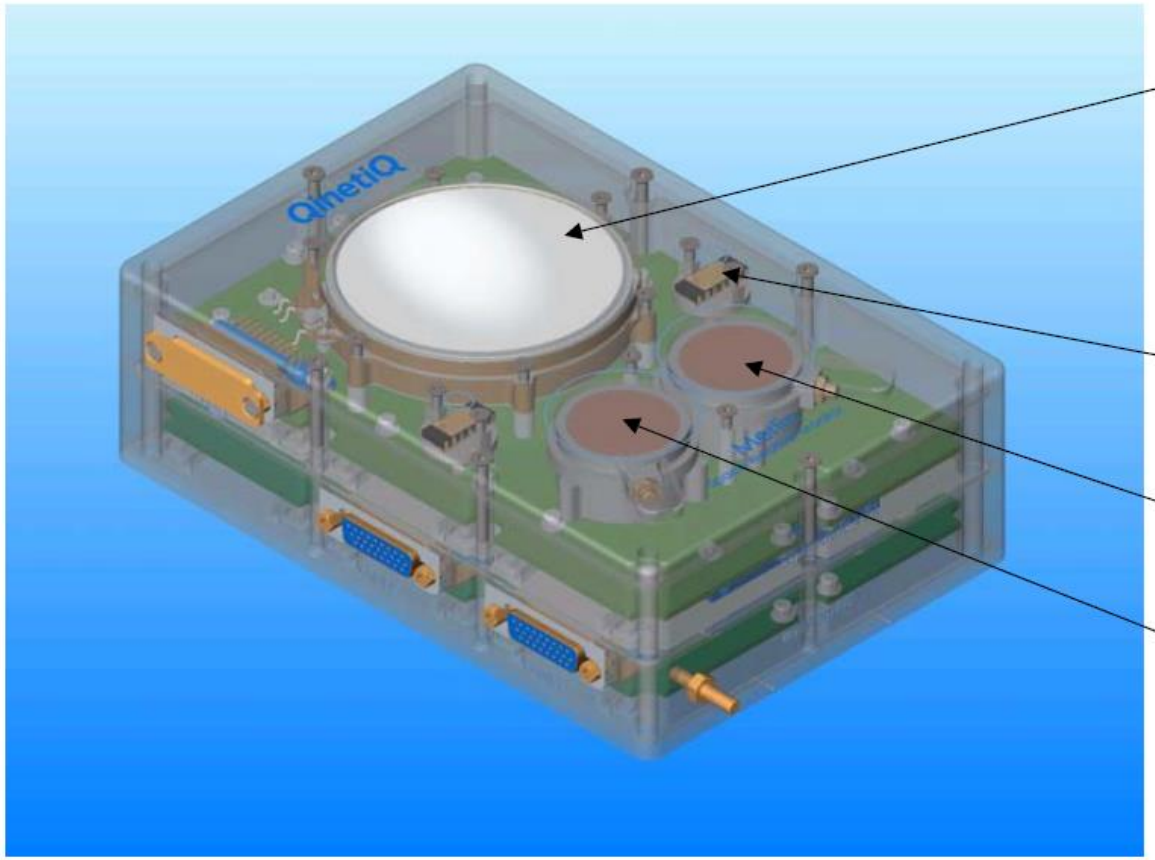
The CREDANCE Instrument Suite



Electrons & electrostatic charging

(three shielding depths)

Total dose

RADFET (x2)

Protons

(>40 MeV flux)

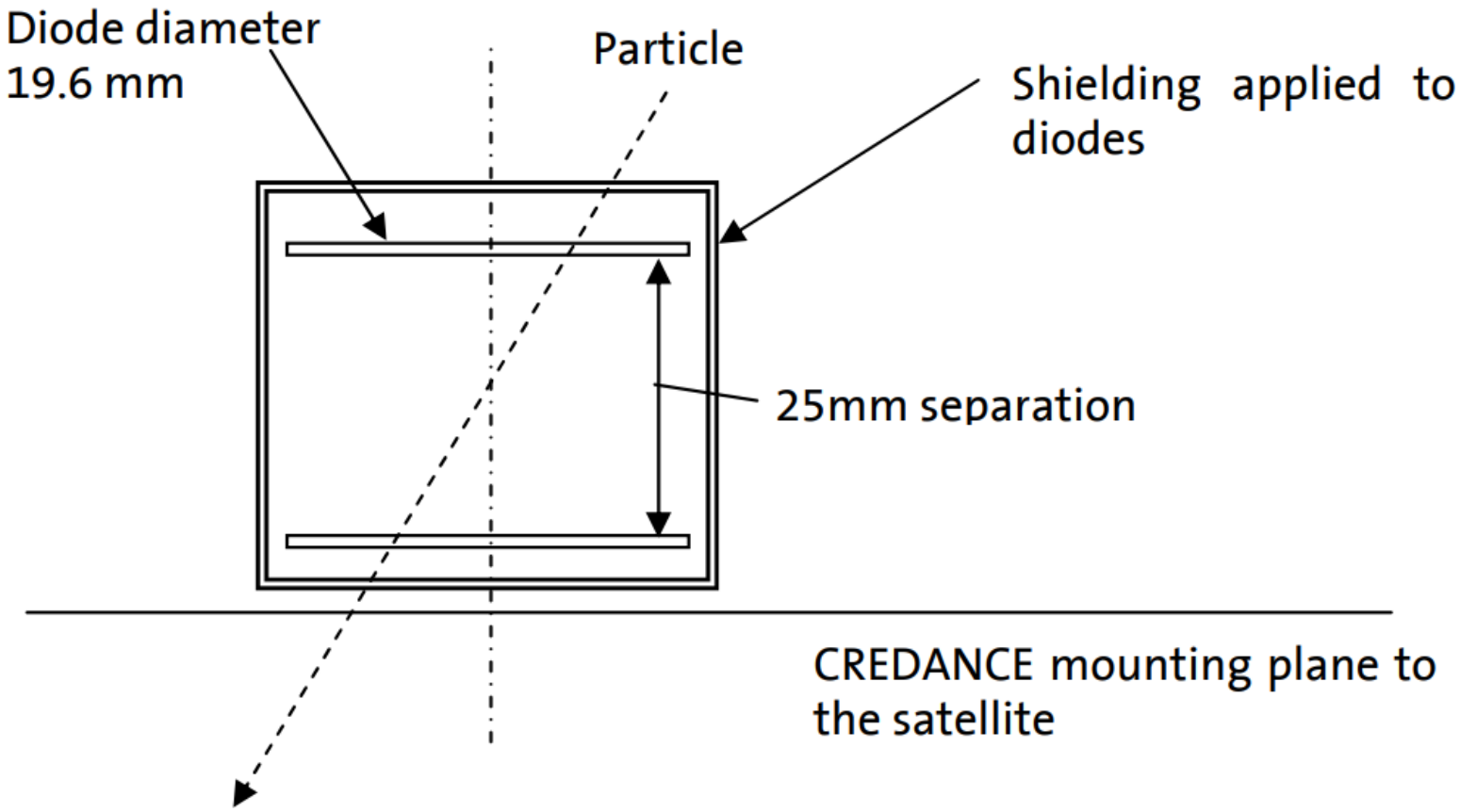
Ions

(Linear energy transfer telescope)

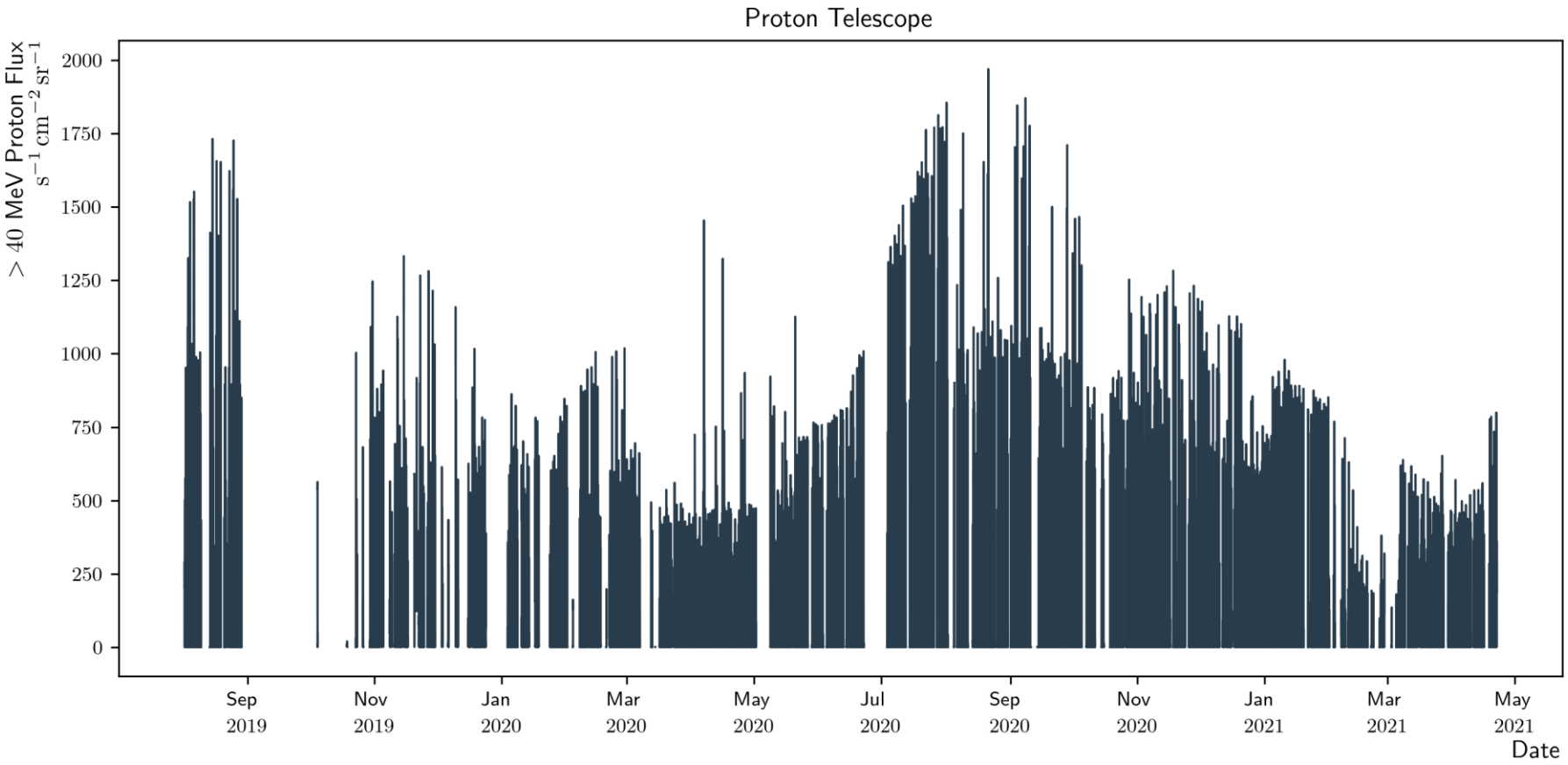
DSX Mission

- AFRL Satellite
- Aug 2019 - May 2021
- MEO (6000km – 12000km)
- Inclination ~45 degrees
- CREDANCE part of NASA Space Environment Testbed payload

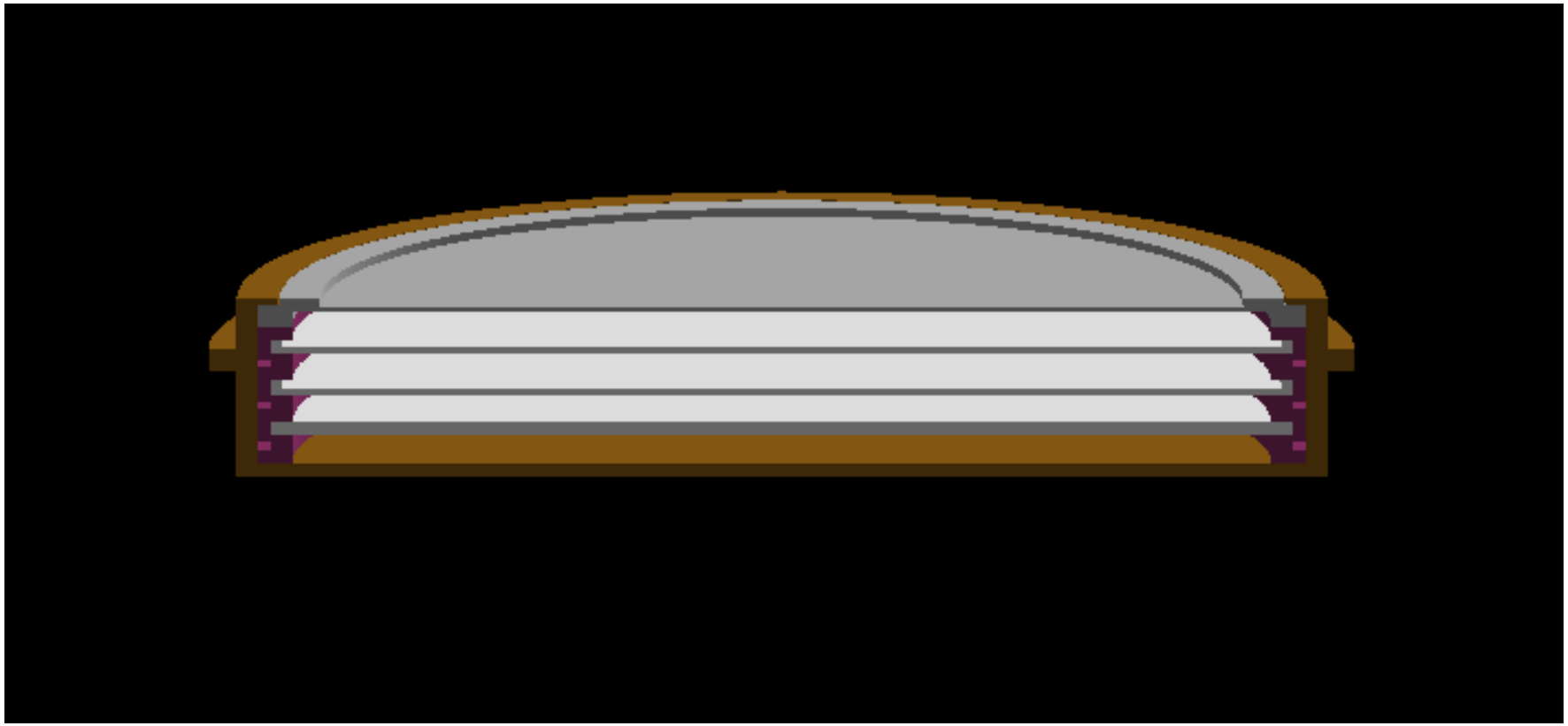
Proton Telescope



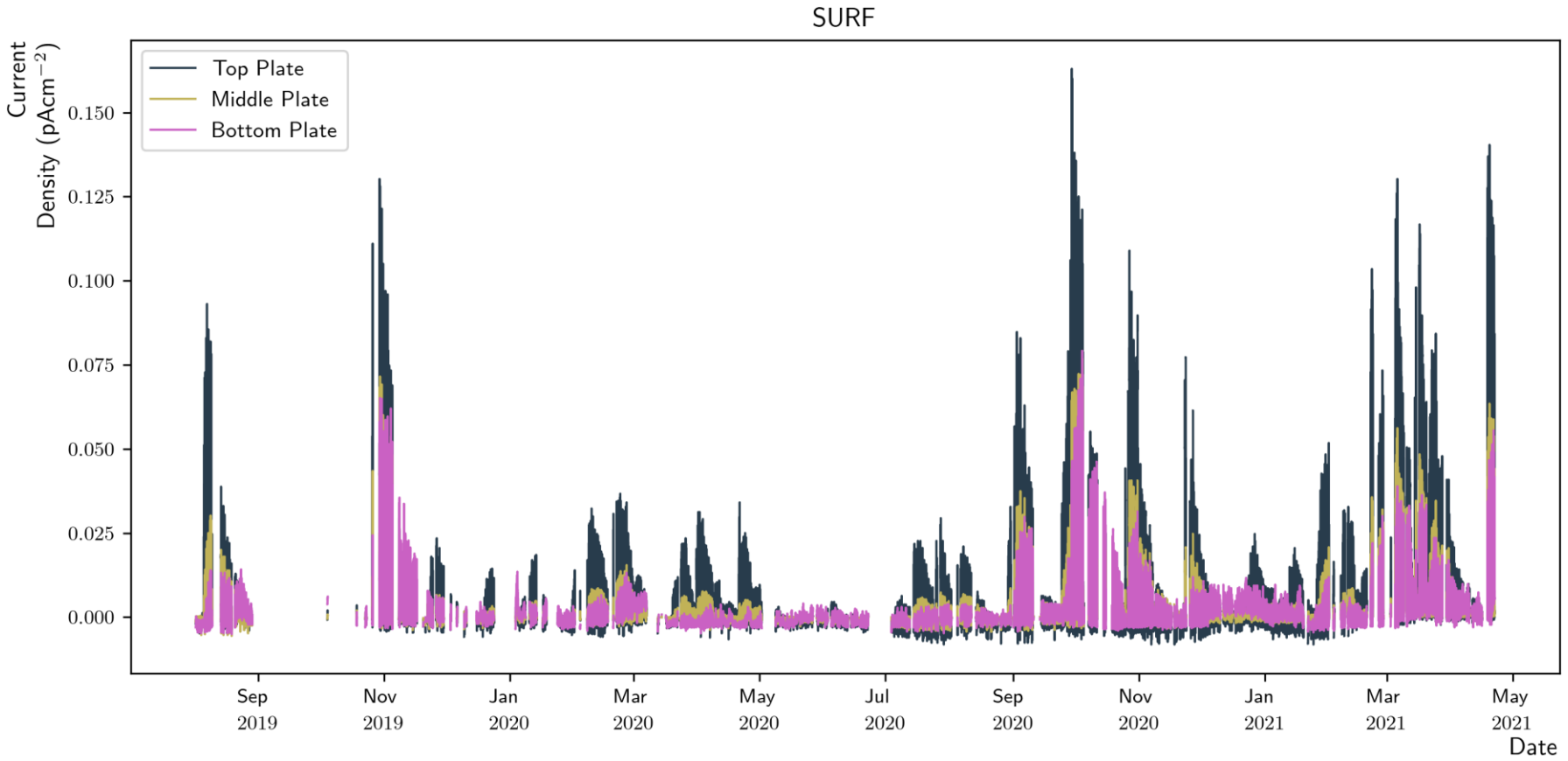
Proton Telescope Time Series



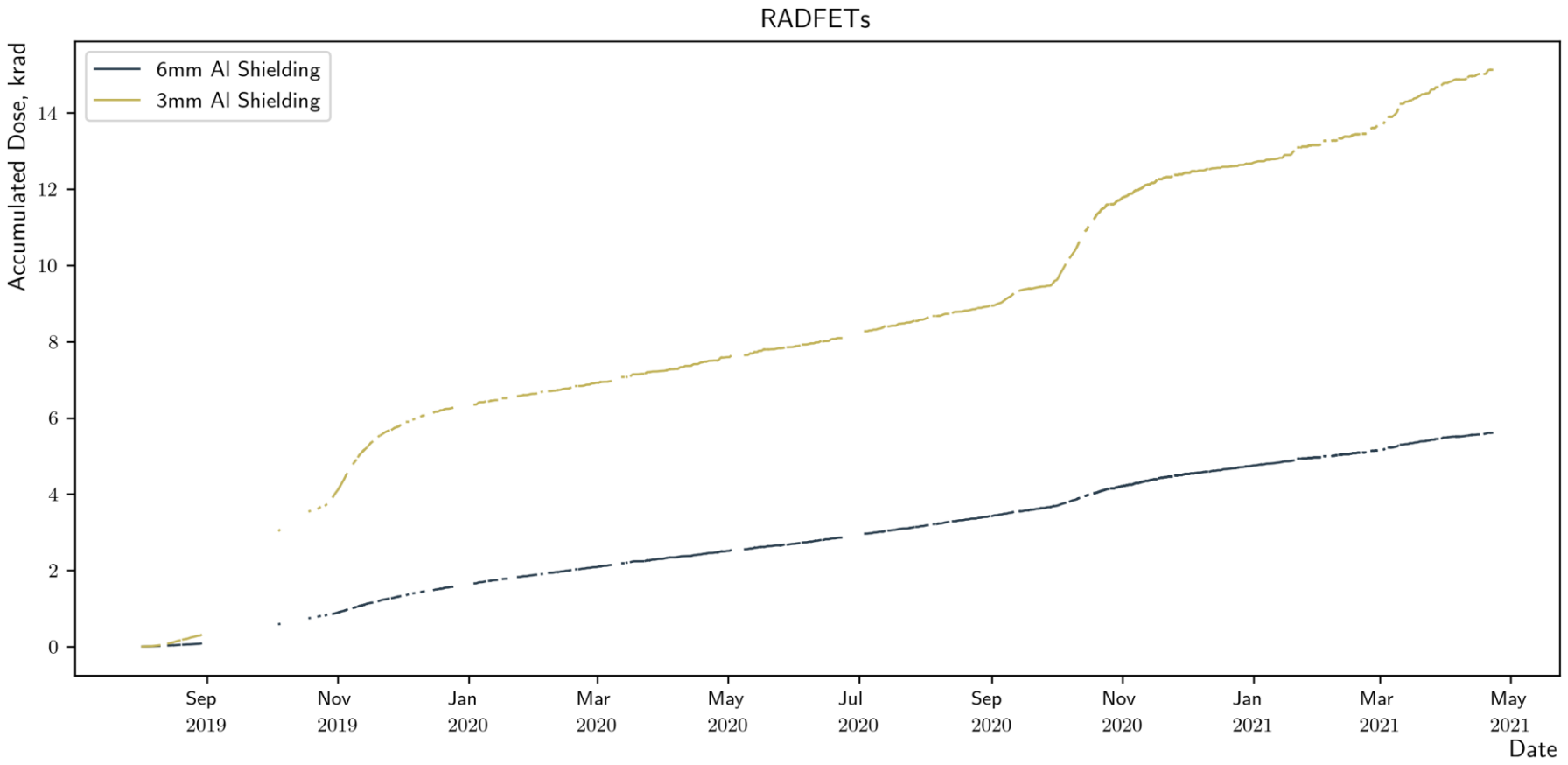
SURF



SURF Time Series



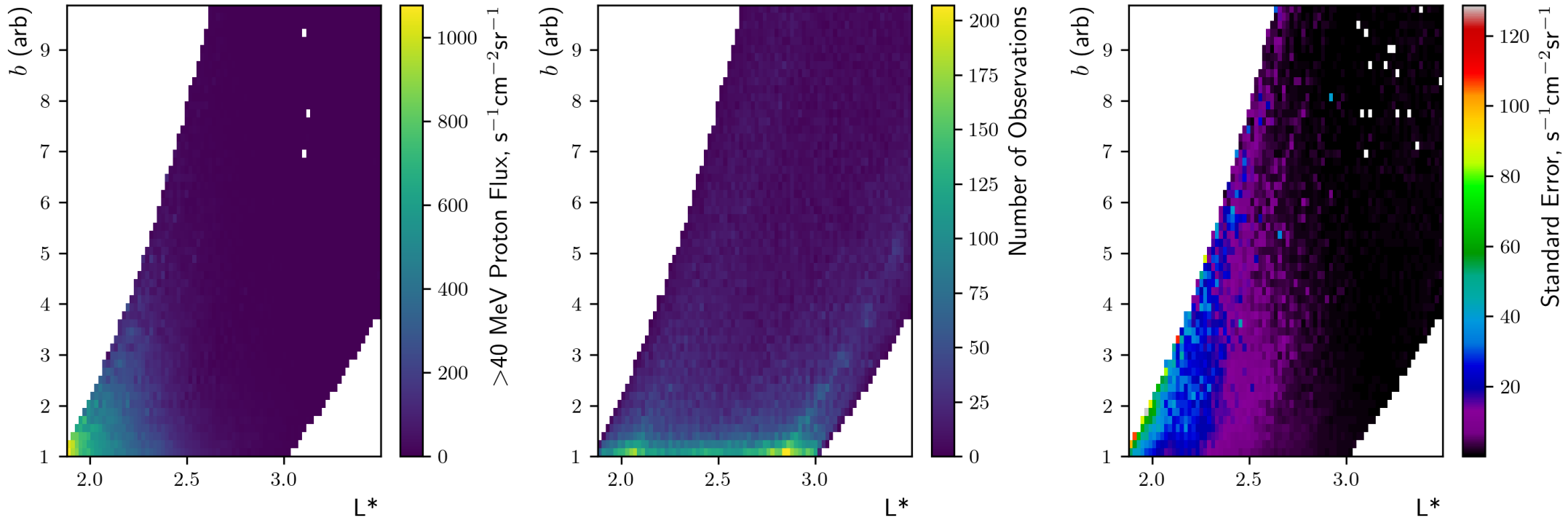
RADFET Time Series



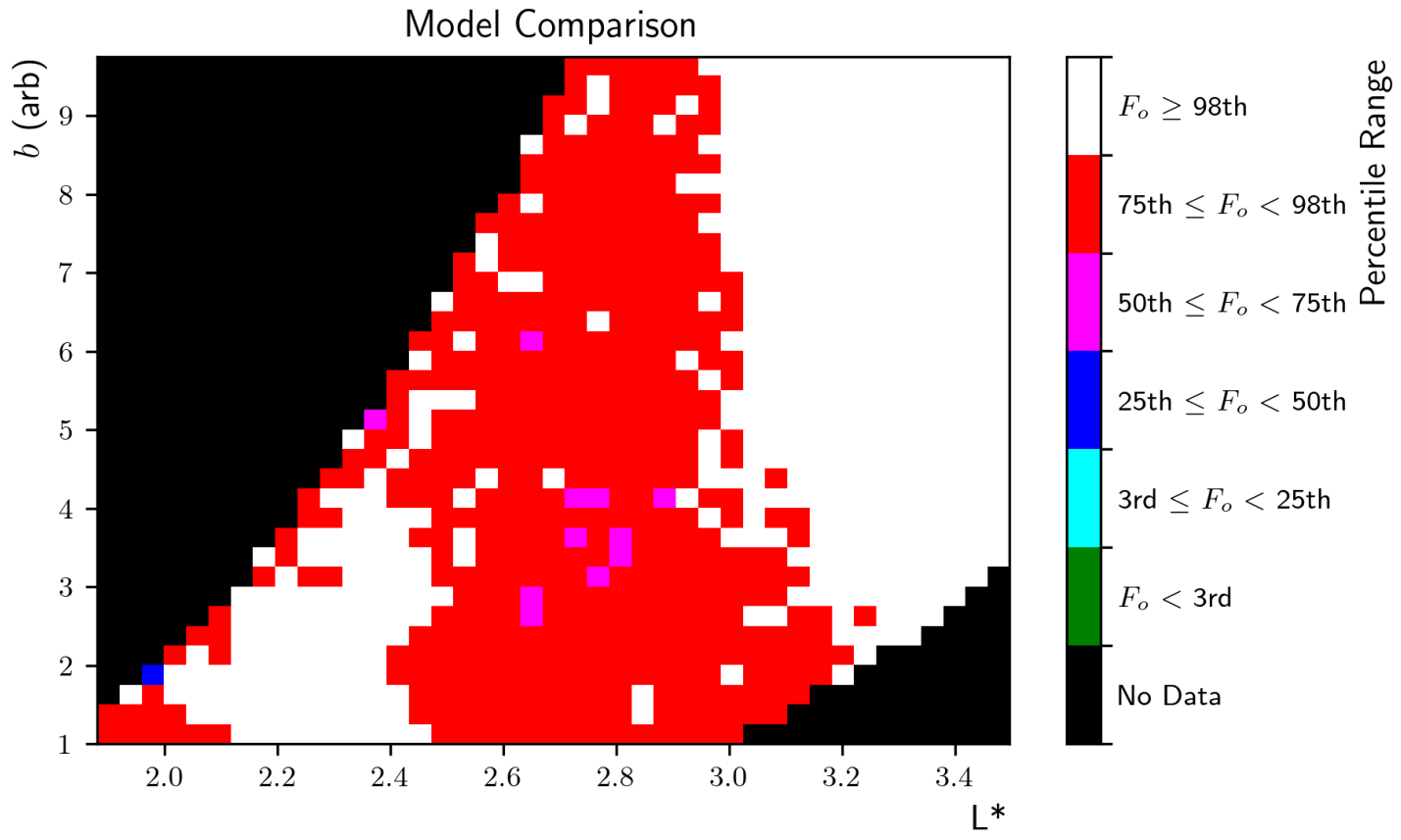
Comparison Framework (SURF & Protons) I

- How do observations compare to IRENE's climatological predictions?
- Run AE9 and AP9 using spacecraft ephemeris
- Retrieve **omnidirectional fluxes**
- Models in **percentile mode**
  - 3^{rd}, 25^{th}, 50^{th}, 75^{th}, 98^{th}, 99^{th} percentiles used
- Combine fluxes with electron and proton response functions for SURF
- Assume ideal response >40 MeV for protons
- Map the average of observations and simulations

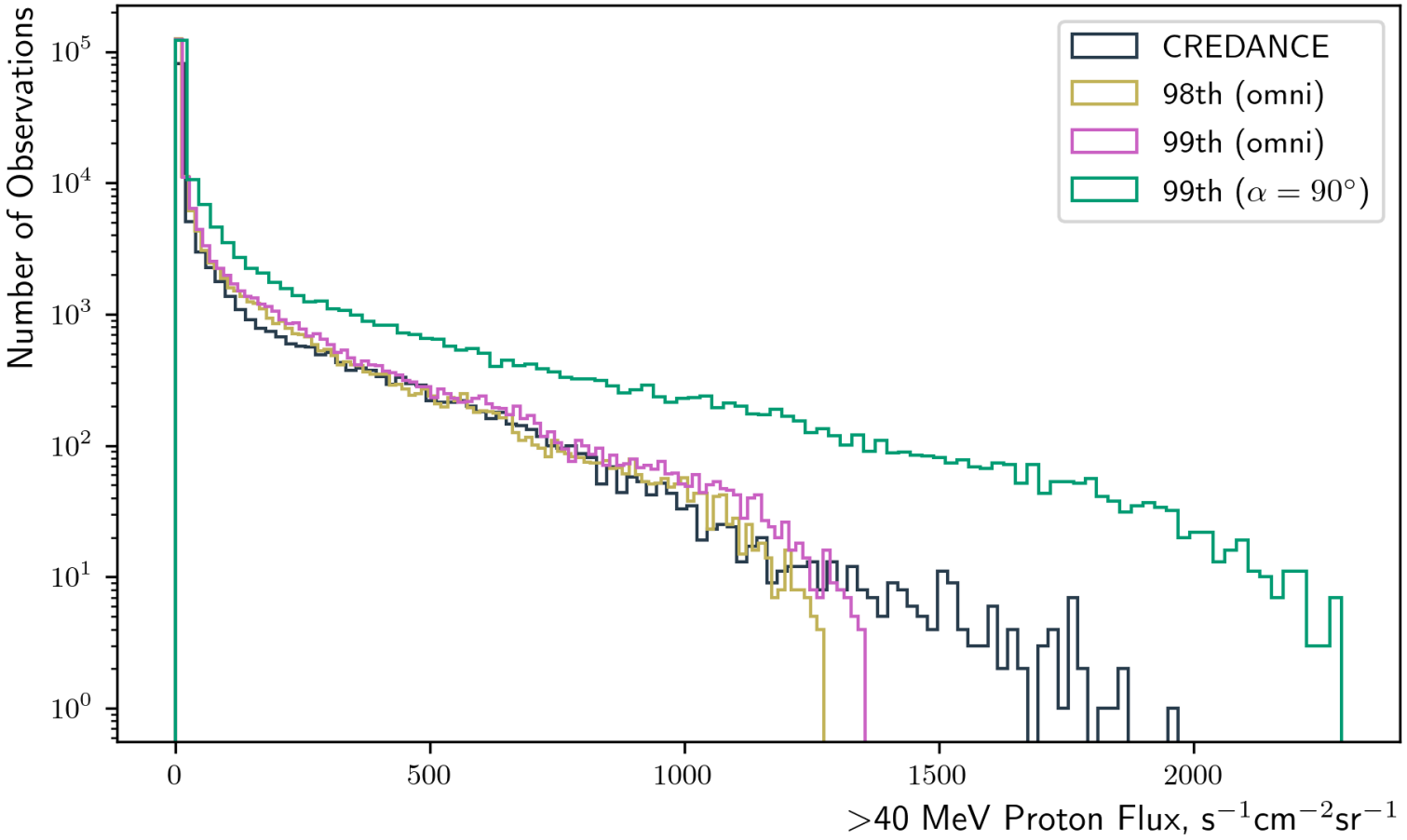
Proton Maps


b (arb)
L*
>40 MeV Proton Flux, s^{-1}cm^{-2}sr^{-1}
Number of Observations
Standard Error, s^{-1}cm^{-2}sr^{-1}

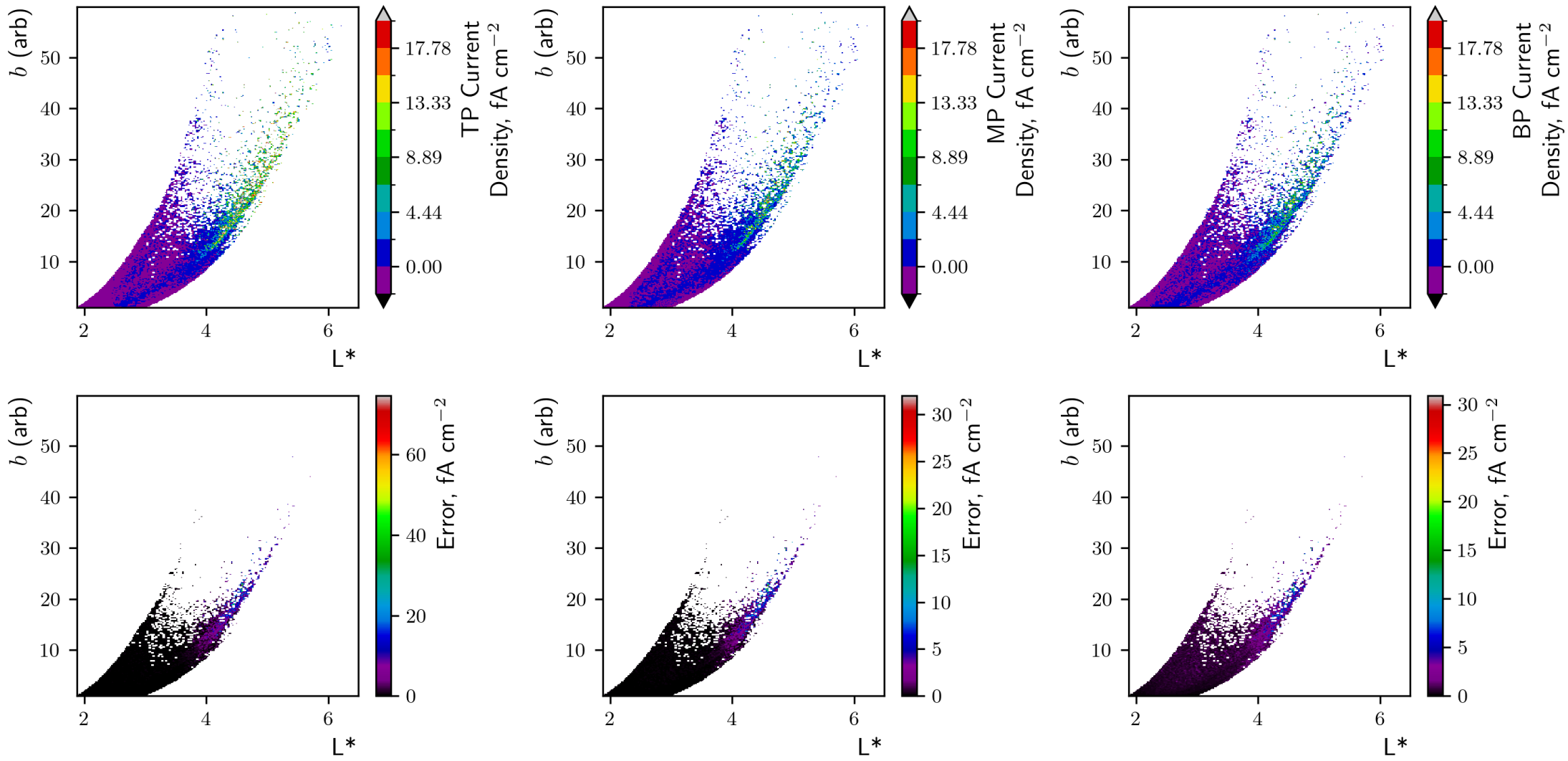
Proton Median Comparison



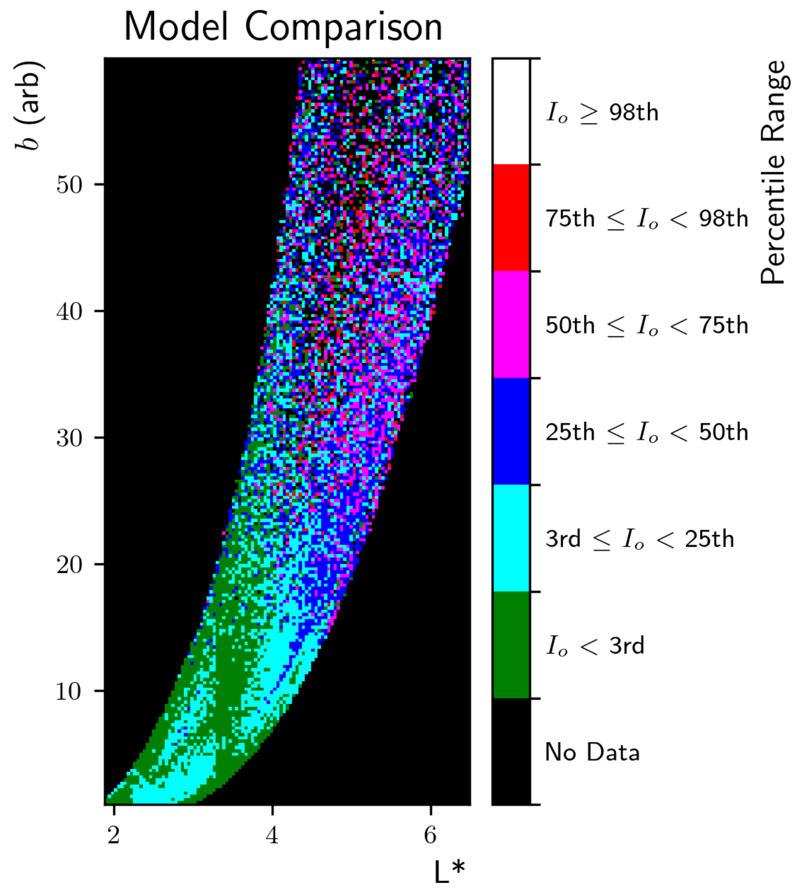
Proton Histogram Comparison

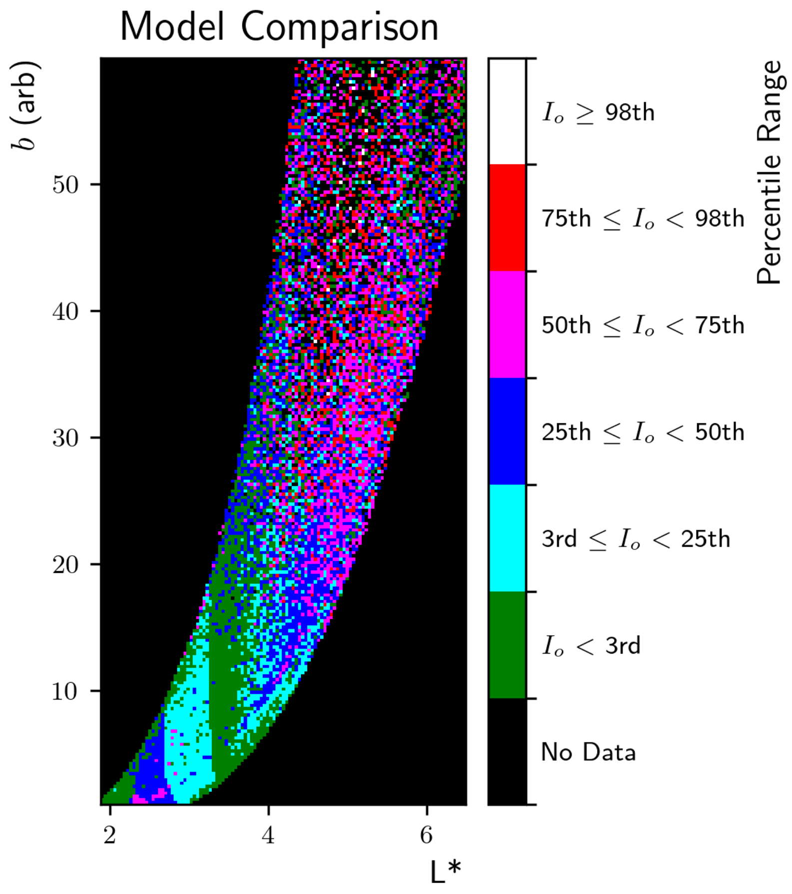


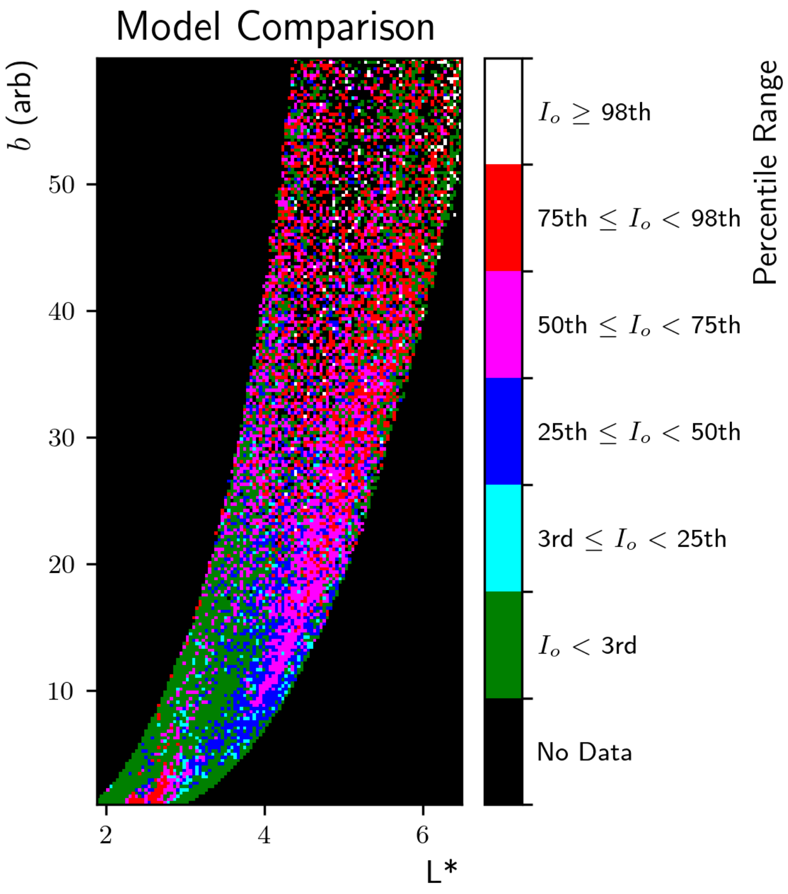
SURF Median Maps



SURF Median Comparison



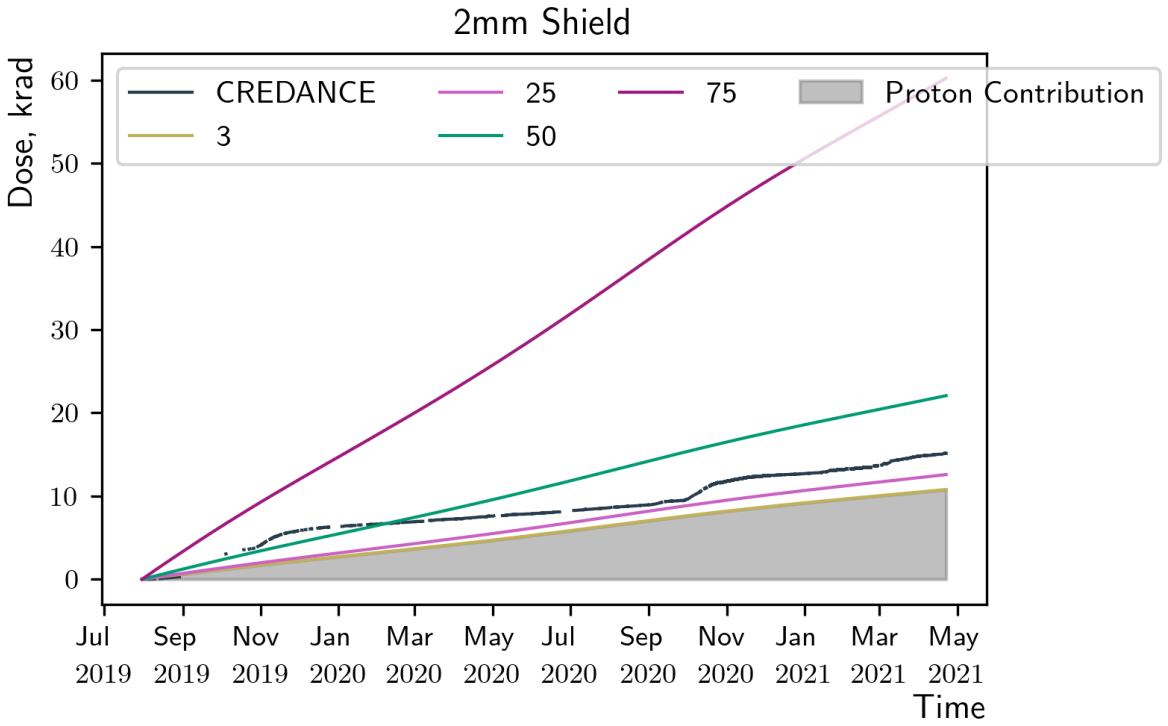


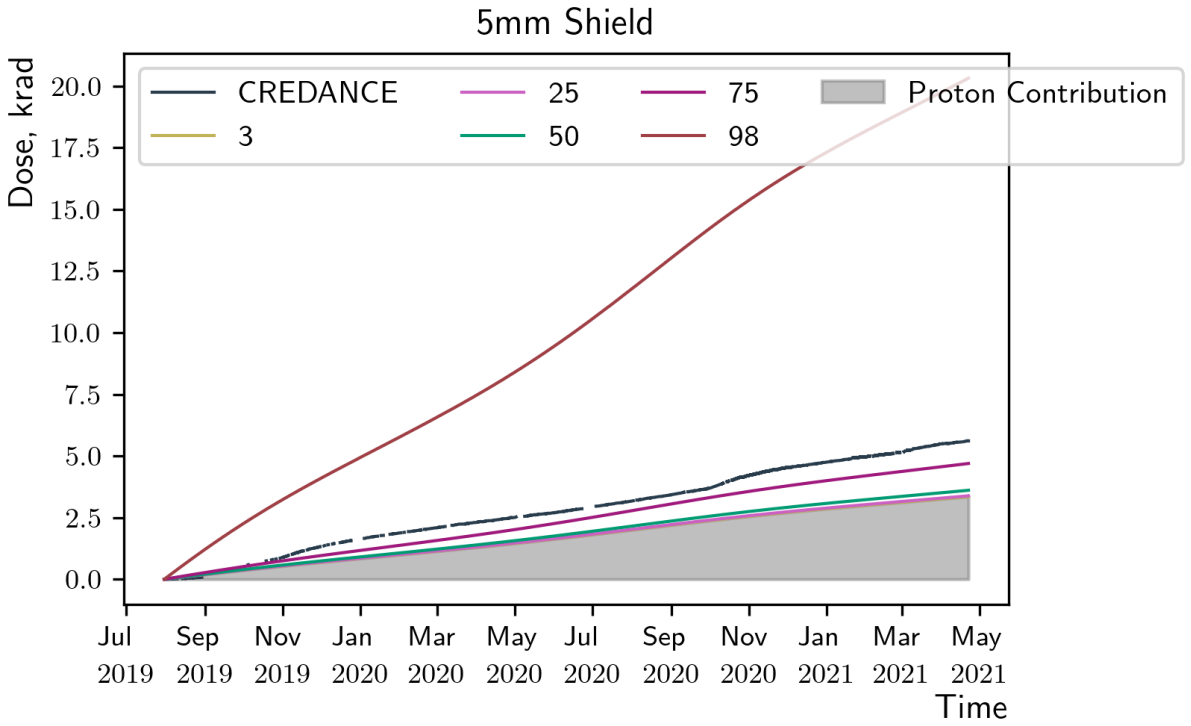


Comparison Framework (RADFETS)

- Fix proton flux at 98th percentile
- Vary electrons as before
- Use SHIELDOSE-2Q to calculate dose under 3mm and 6mm Al shielding
- Compare predicted and observed accumulation

RADFET Comparison





Some Conclusions

- Mission average proton flux looks to be close to climatological extremes
- Mission average internal charging is:
  - Very low in the inner belt (lower than slot) – consistent with protons
  - Closer to climate average in the outer belts
- RADFET below 2mm shielding received climatologically normal dose
- RADFET below 5mm shielding received higher than expected dose – not clear why