Introduction to NMT team and Research Areas

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New Mexico Tech

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Budapest, Hungary, February 14-15, 2011

Overview

- New Mexico Tech
- Research group/Laboratory space
- Projects
- Students

New Mexico Tech

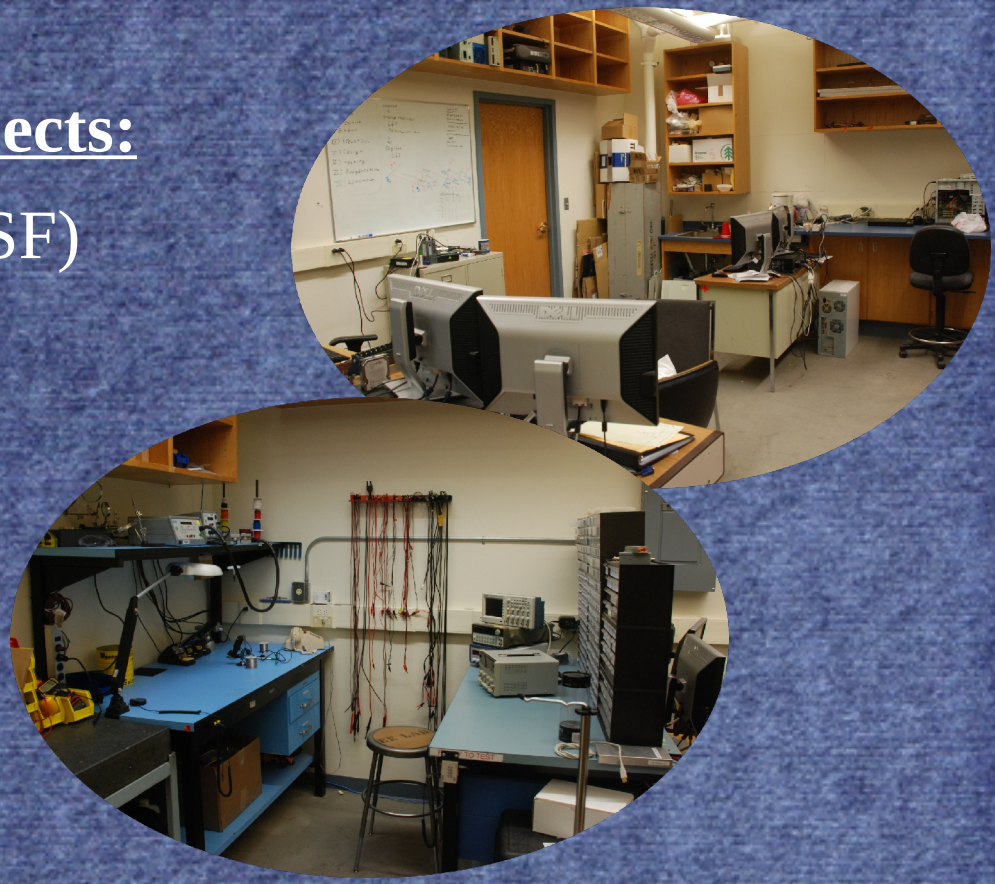
- 2000 students
- 150 faculty
- Technical University
- EE department:

  120 students
- 10% PhD rate

Research Group/Laboratory Space

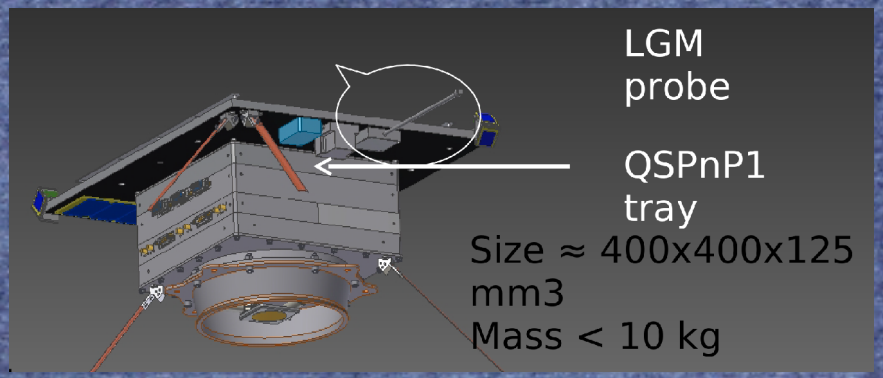
Projects:

- Astronomical Interferometry (NSF)
- Sensor Networks
- Field Line Resonance (AFOSR)
- Langmuir Probe (AFRL)
- Data assimilation



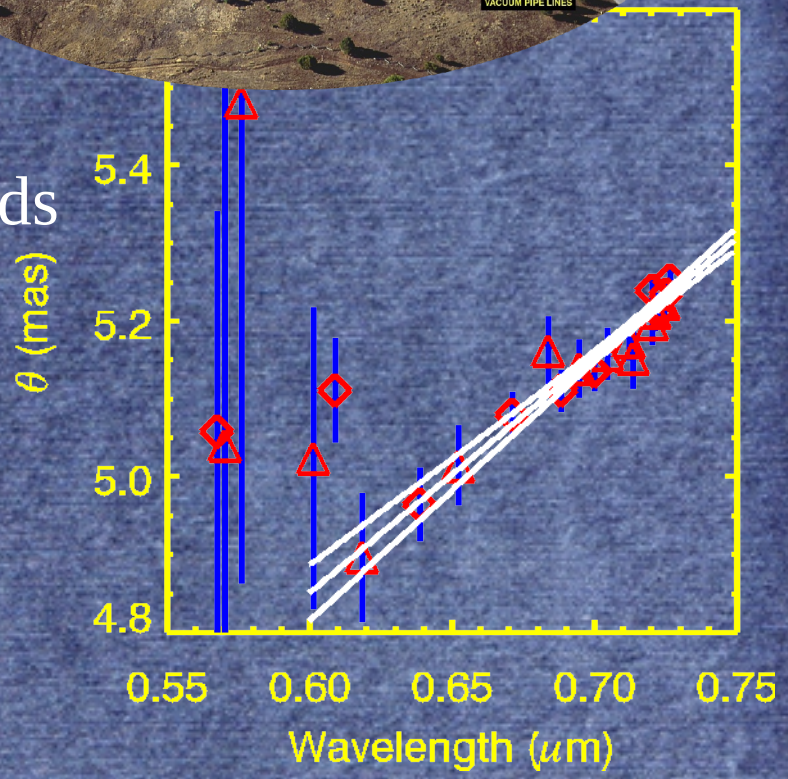
Students:

- 3 Undergraduate students
- 2 Graduate students
- “Spacecraft Instrumentation” class



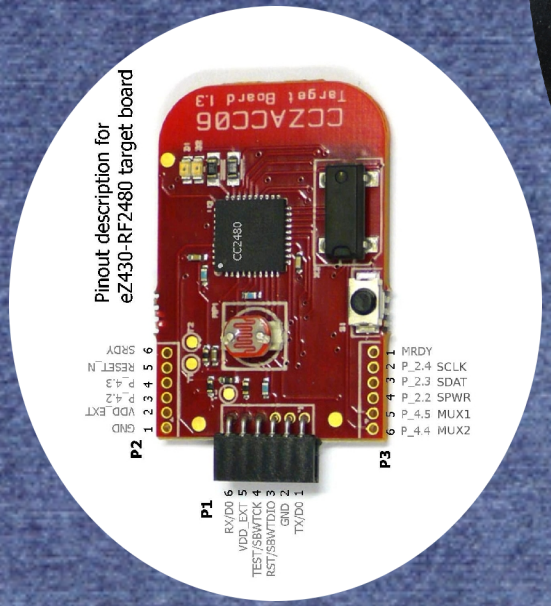
Astronomical Interferometry

- I work with the Navy Prototype
- Optical Interferometer (NPOI)
- \theta=\lambda/D to image stars
- Using new technique to get 0.1% accuracy in measuring stellar diameters.
- One graduate student and three undergrads
- Building data archive, building new data acquisition instrument, working on calibration and analysis.



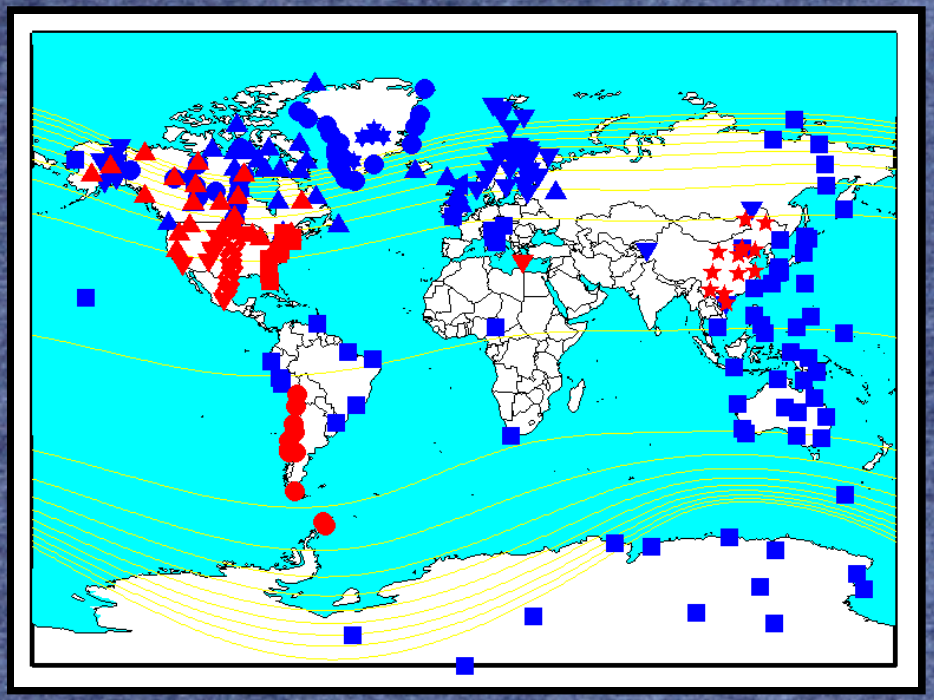
Sensor Networks

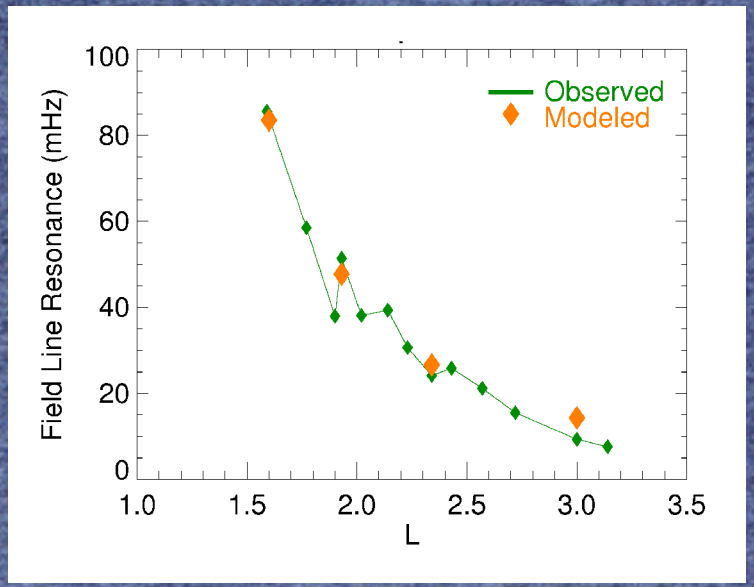
- Low-power, autonomous, self-organizing miniaturized and inexpensive sensors.
- Military, surveillance, industrial applications.
- Environmental monitoring.
- Cave environment research.



Field Line Resonance

- Using SAMBA and MEASURE to map plasma density at L<3.
- Solve FLR equation directly using FLIP model.
- Good agreement during quiet time, not so during active time.
- We think active time disagreement is due to not including convection and depletion.
- That is the next step.



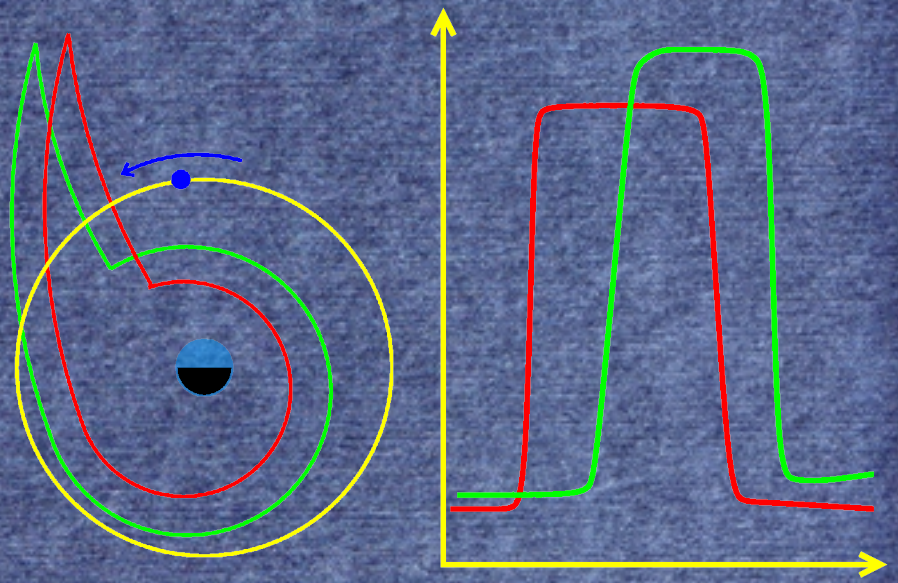


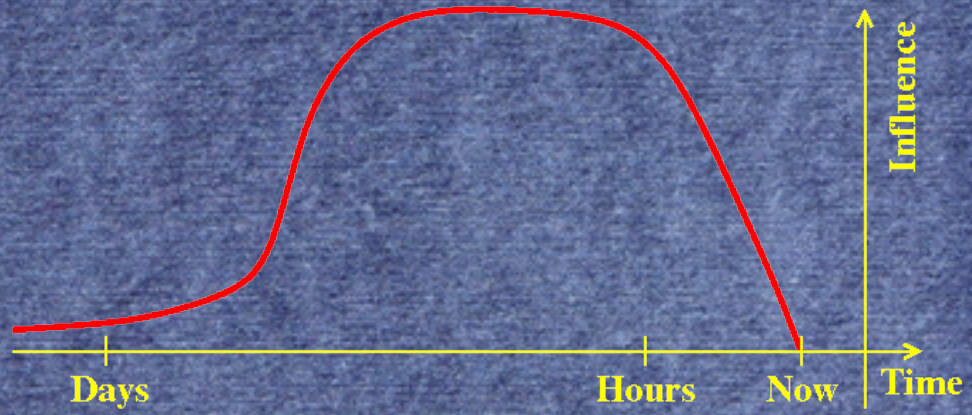
Langmuir Probe

- 20 cm probe, 5 cm x 5 cm x 1.25 cm electronics
- “Spacecraft Instrumentation” class with 8 students
- To be included on Swedish Plug-and-Play satellite to be launched later this year.

Plasmasphere Data Assimilation

- Plasmasphere dynamics consists (largely) of inflow and outflow, and a convective electric field.
- Assume DGCPM (Ober et al. 1997) is approximately correct.
- But we don't know the electric field.
- Data assimilation: determine electric field.
- Kalman filter or..?
- Particle filter can work with time-history.

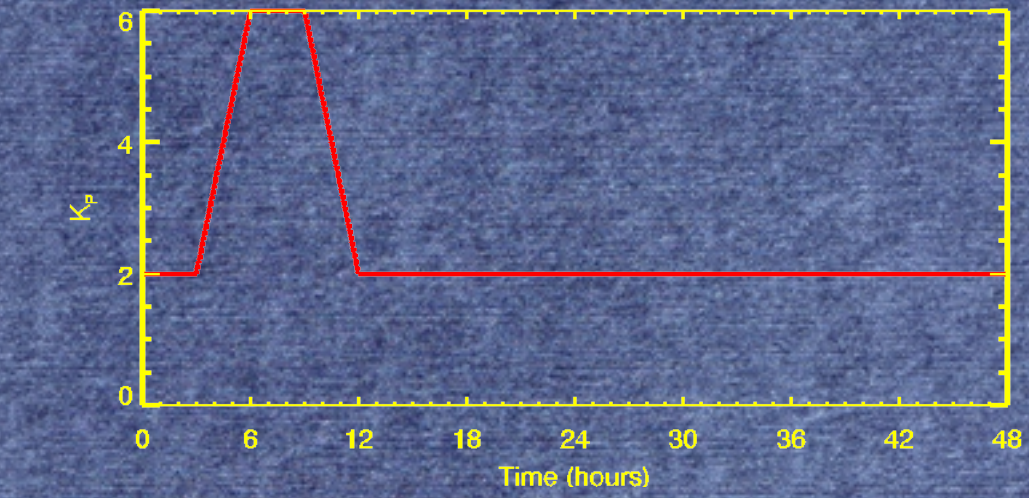


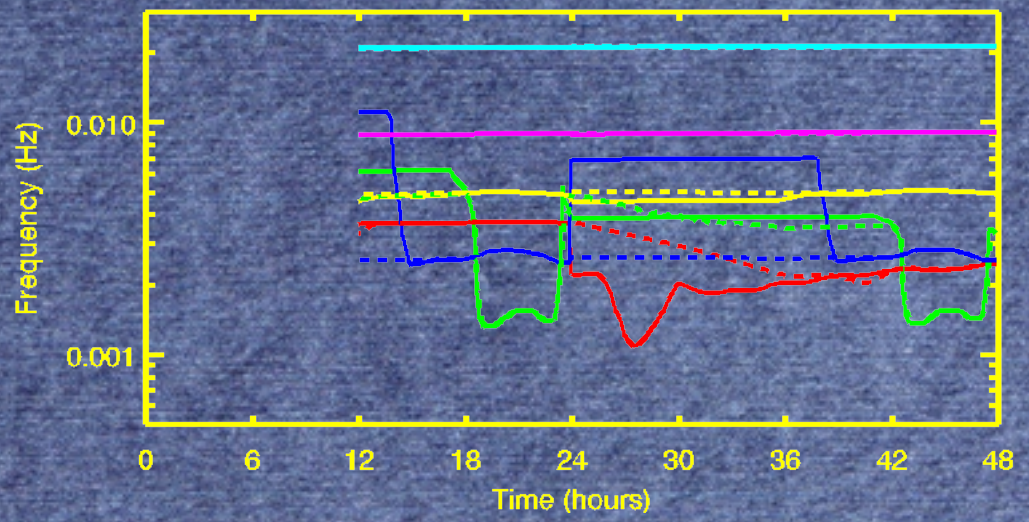


Particle Filter

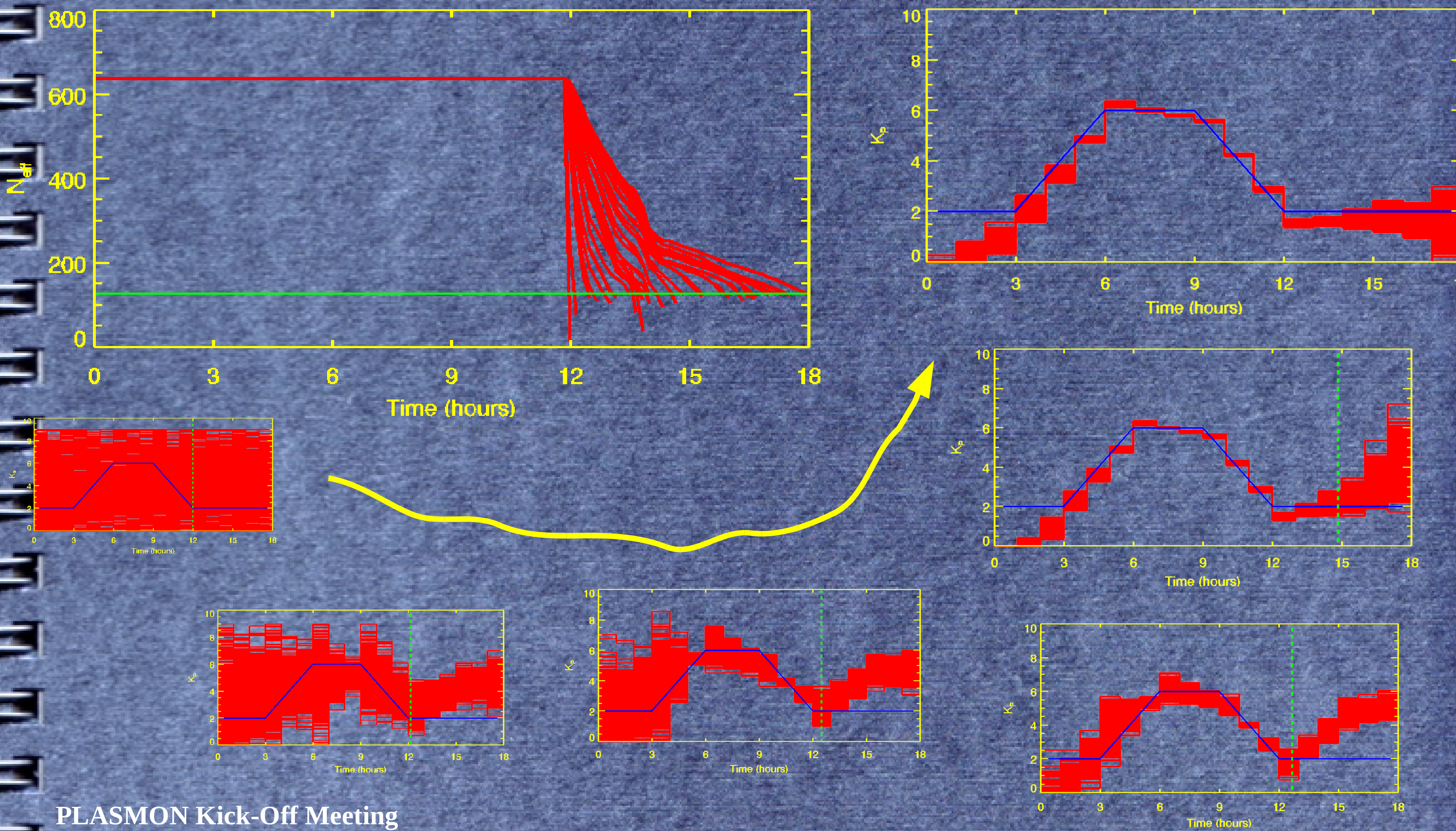
- In the particle filter a "particle" represents the time-history of the drivers.
- Example: Using Sojka (1986) electric field parametrized by Kp

Example





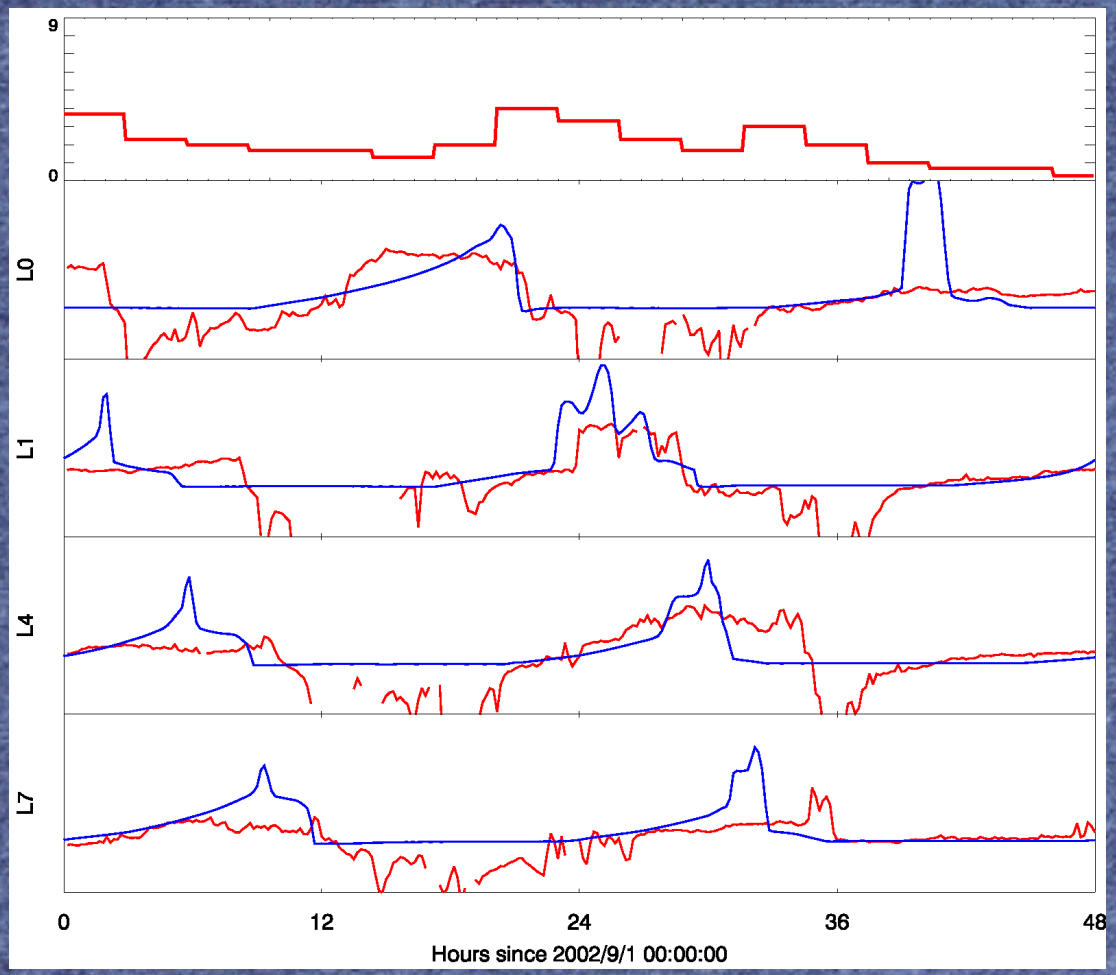
Example



Time (hours)
Time (hours)
Time (hours)
Time (hours)
Time (hours)
Time (hours)

LANL data comparison

- Density measurements from MPA on four LANL spacecraft, compare with DGCPM run.
- Sojka et al. (1986)
- Some similarities
- A lot of differences
- **Observations**
- **DGCPM**



How Does the Electric Field Map?

- The electric field is the primary driver of the low-energy plasma, and the low-energy plasma is important for losses and acceleration in the high-energy plasma.
- How do the magnetospheric and ionospheric electric fields compare?
- Answer: sometimes they agree, sometimes they don't [e.g. Boonsiriseth, 2001].
- Perhaps we can say more if we can obtain a global magnetospheric electric field from data assimilation.