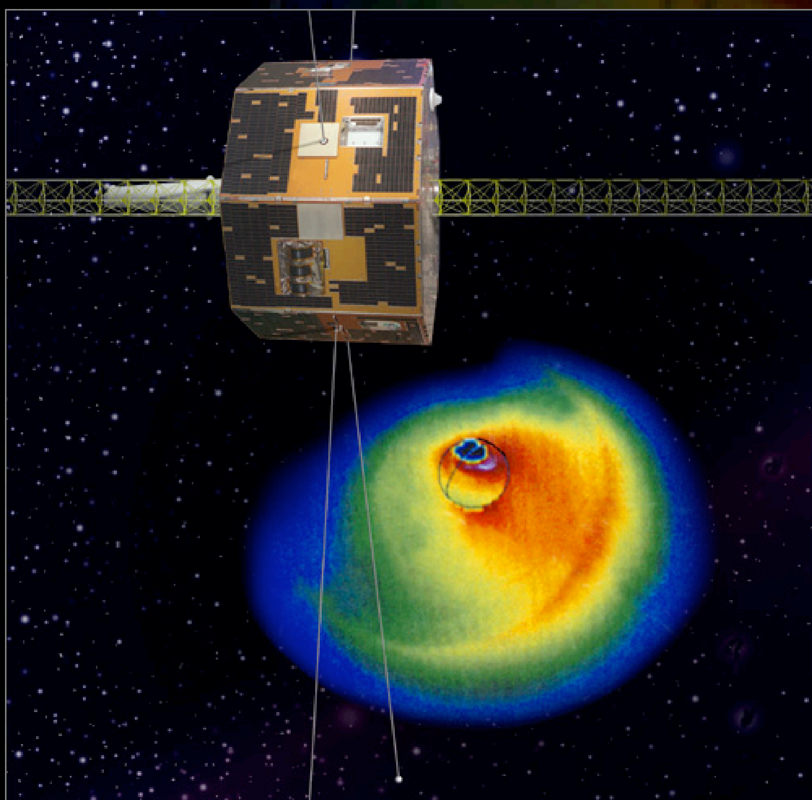
# Inferring Electric Fields From Multi-Point Energetic Neutral Atom and In Situ Measurements

Cluster and Double Star Symposium - 5th Anniversary of Cluster in Space
ESTEC, 19–23 September 2005



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# Outline

## Motivation

Macroscopic electric field effects in the magnetosphere;
state of electric field models.

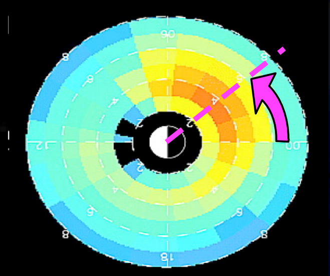
## Approach

UBK approach, challenges, examples, multiple datasets.

## Outlook

E- and B-inferrence, time dependence.

# Modeling Electric Fields

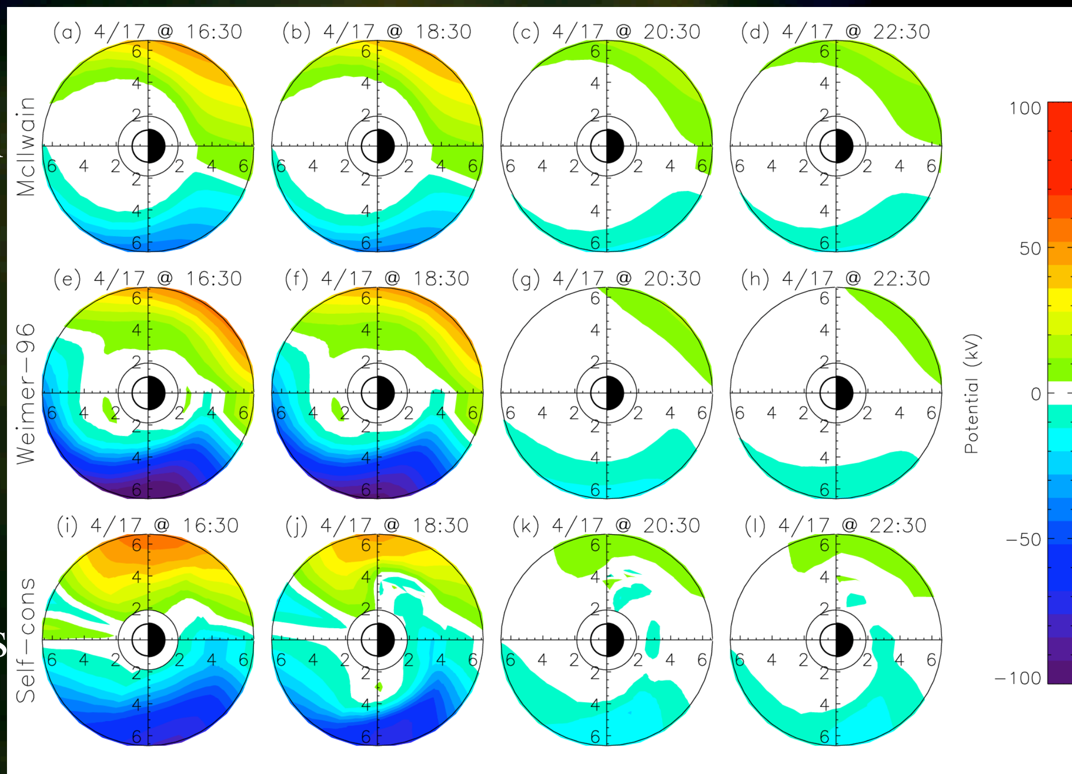


16:30 18:30 20:30 22:30

McIlwain

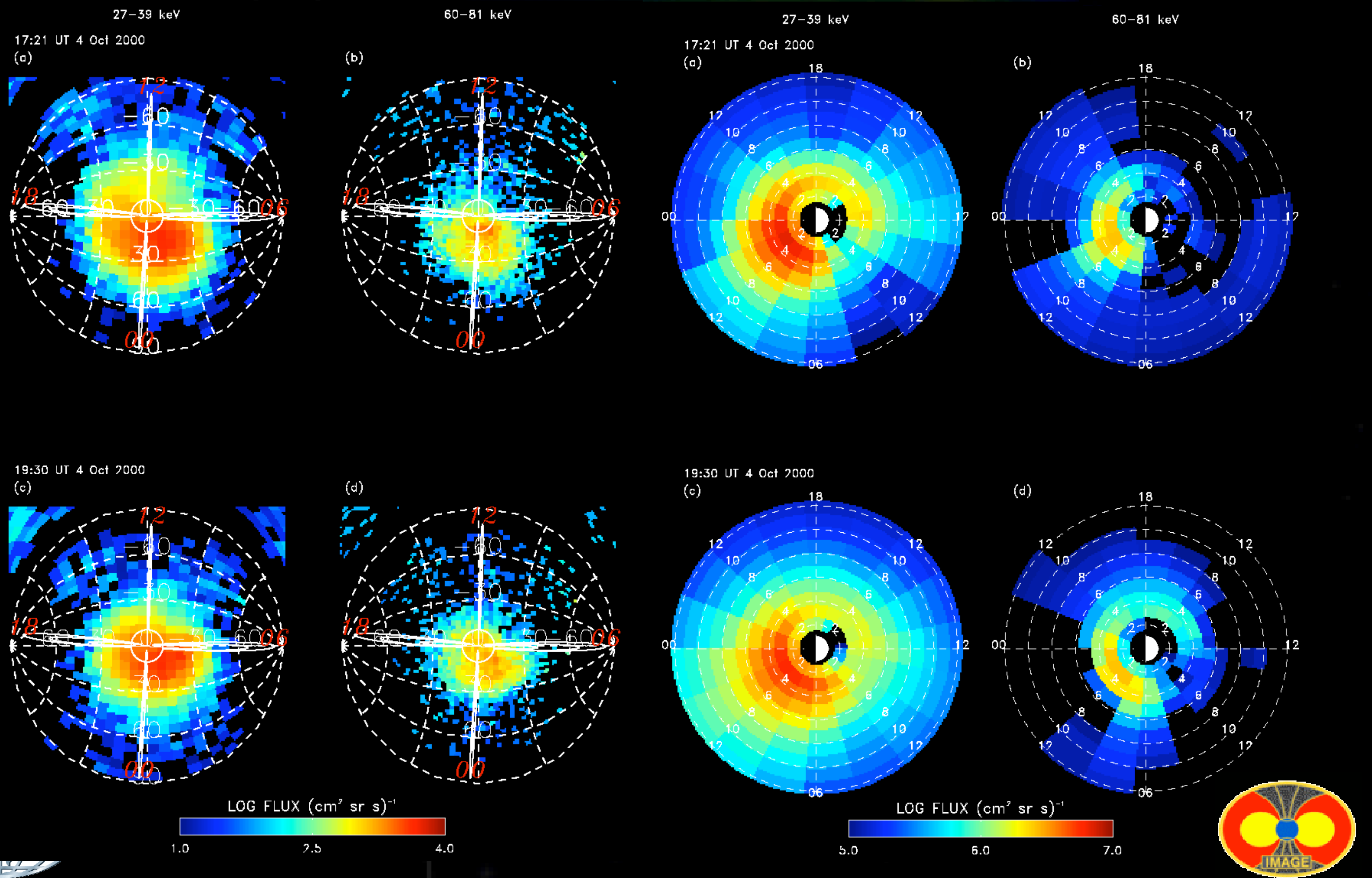
Weimer-96

Self-Cons

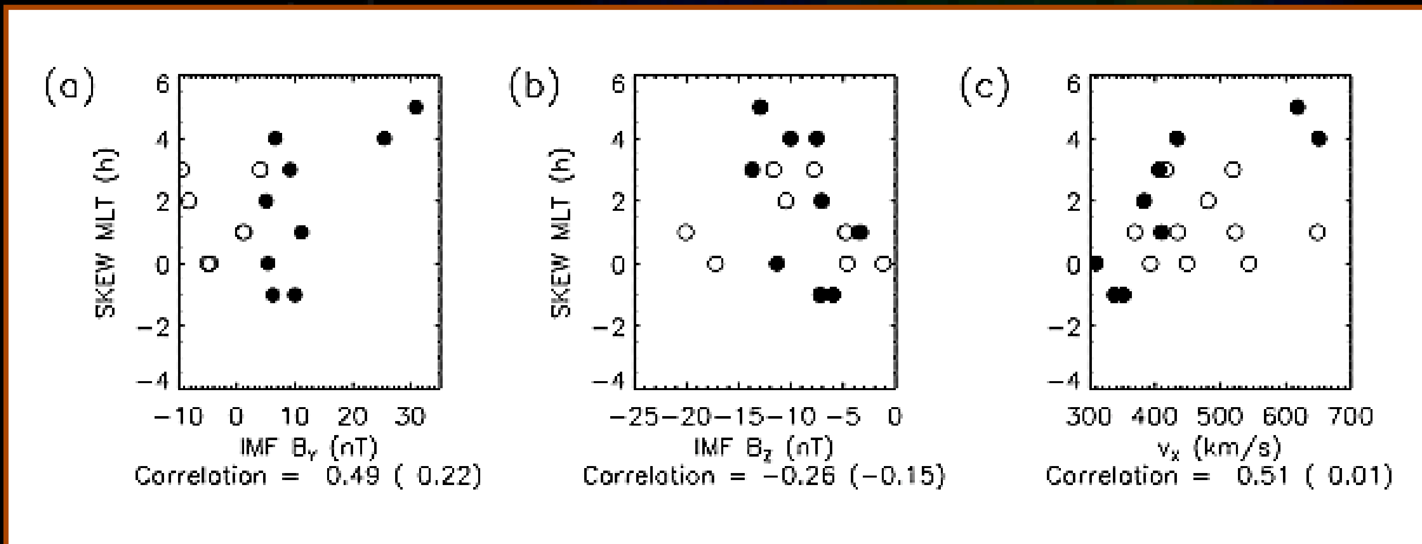



- Major difference:
  - McIlwain field always has the same pattern, only intensity varies
  - W-96 field has more complex features, strong driving on duskside
  - Self-consistent field has even more complex features, many local peaks/wells

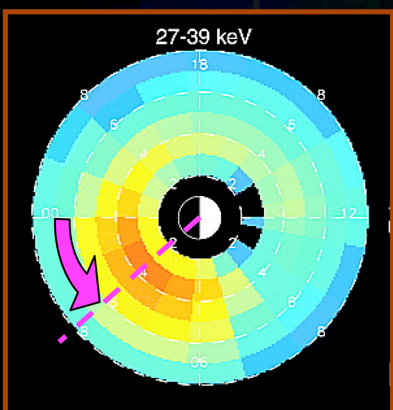
# Dawn-Side Ring Current "Slant"



# Correlation With Solar Wind



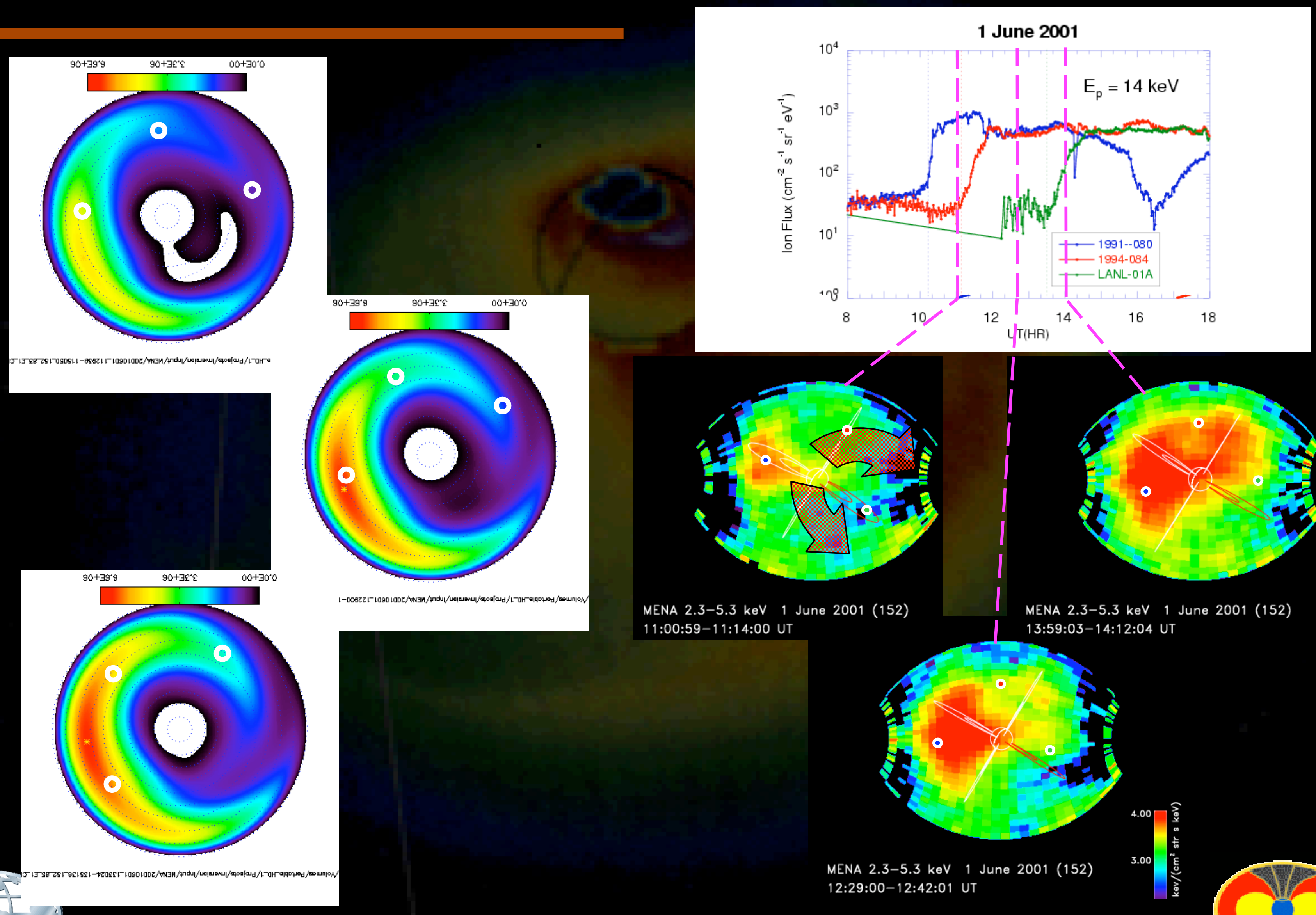

[Brandt et al., 2002]



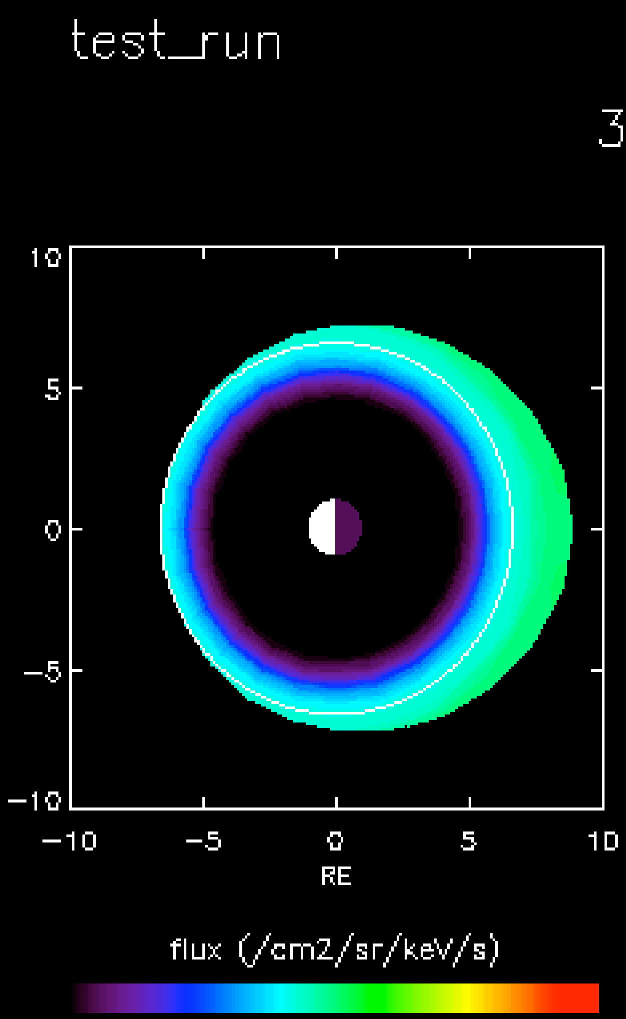

Sufficiently strong E-fields to compete with gradient-curvature drift.

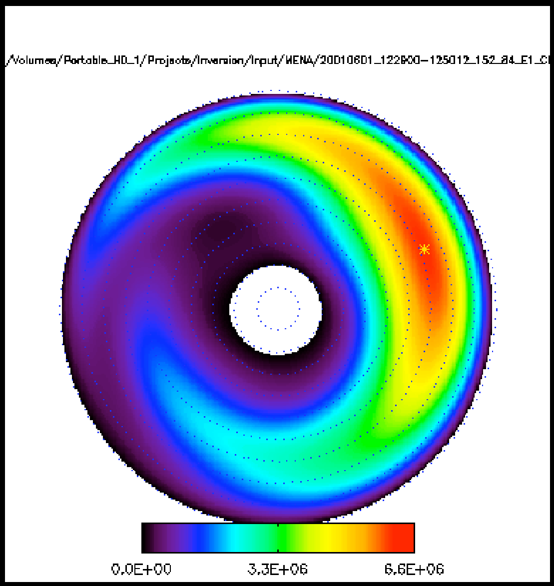
Correlation of offset angle with IMF and solar wind speed.

# Plasma Sheet Motion

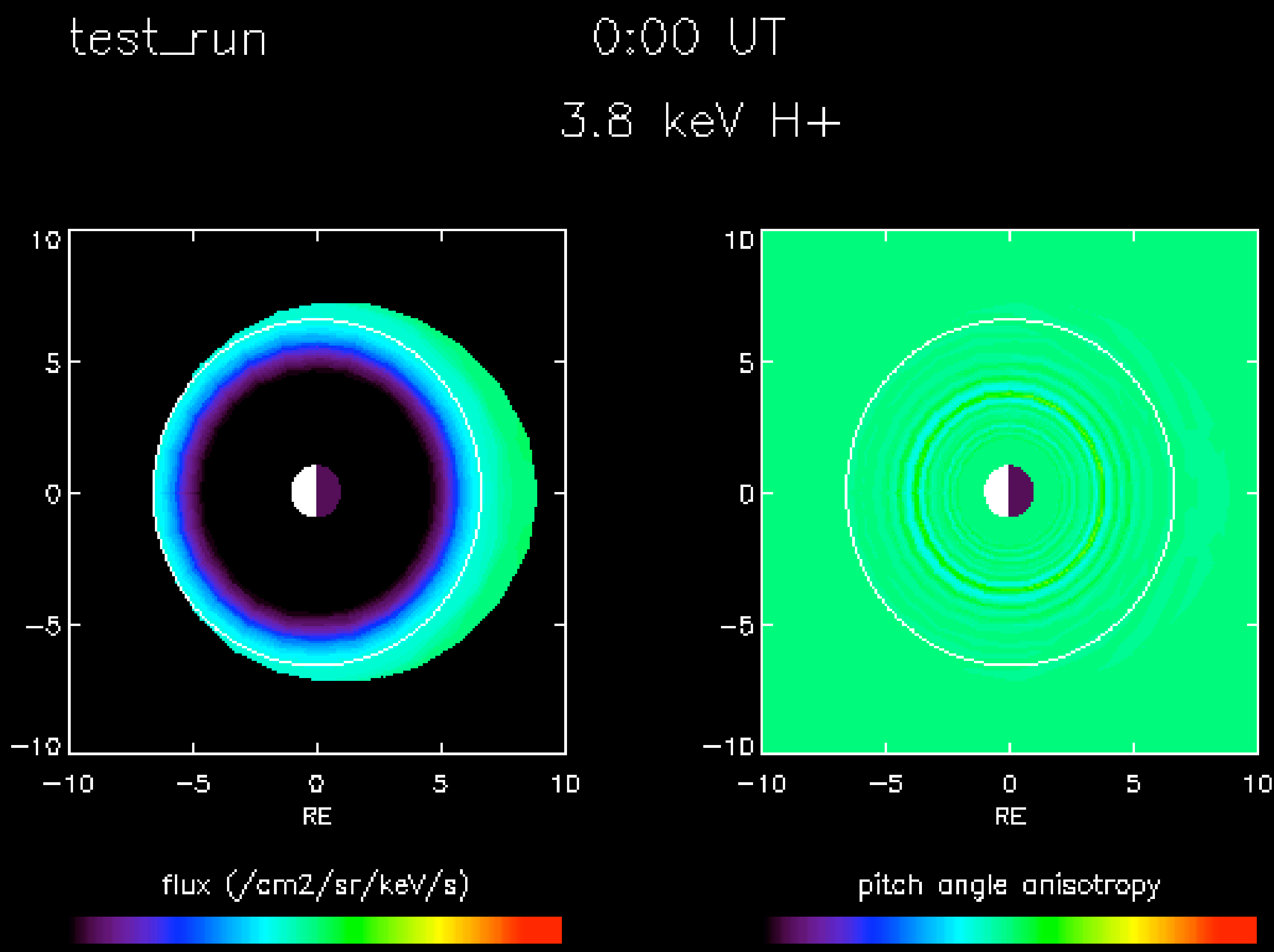


# Effect of $B_z$ Southward Turning (CRCM)

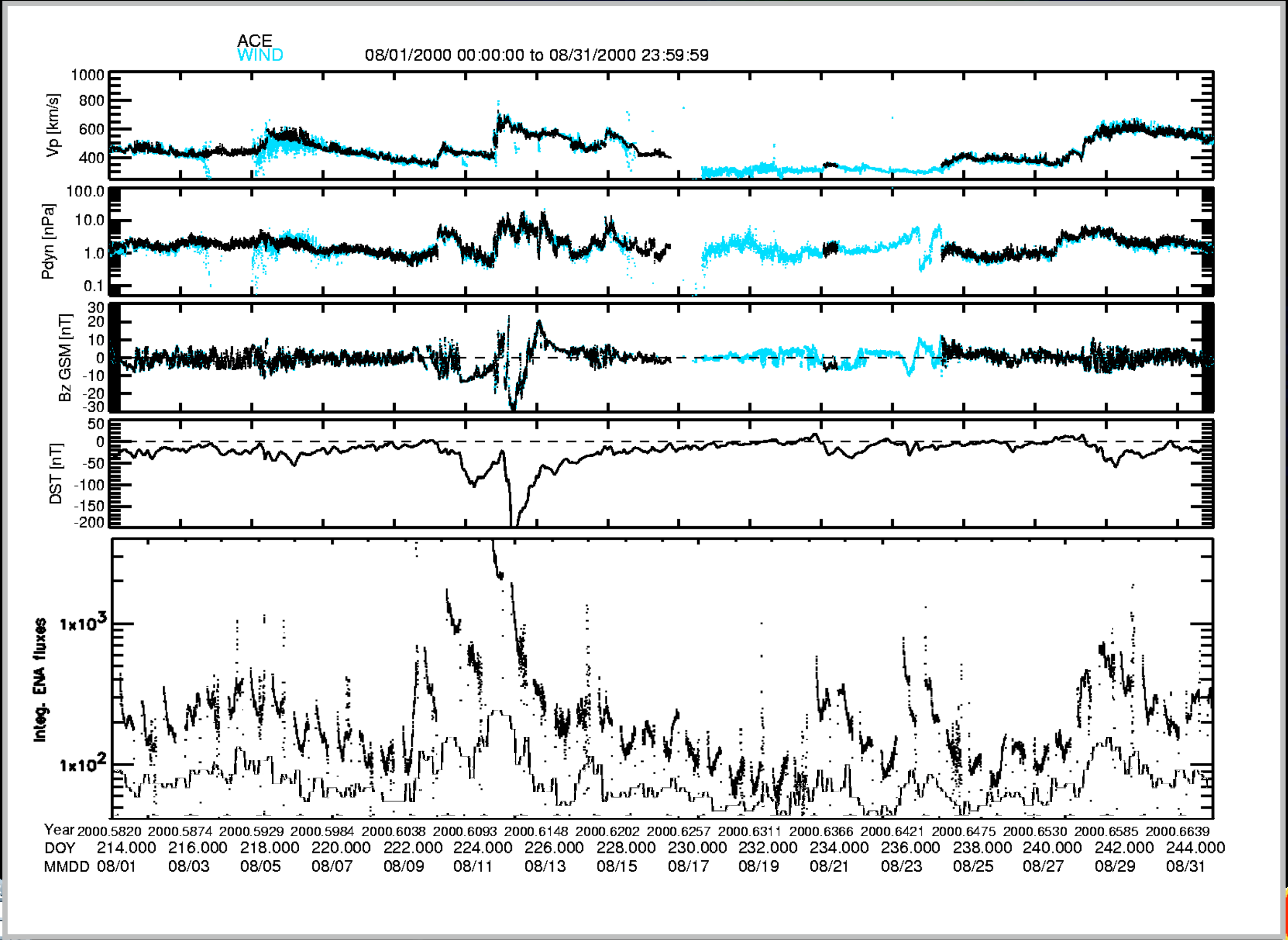


# Animation of $B_z$ Southward Turning (CRCM)



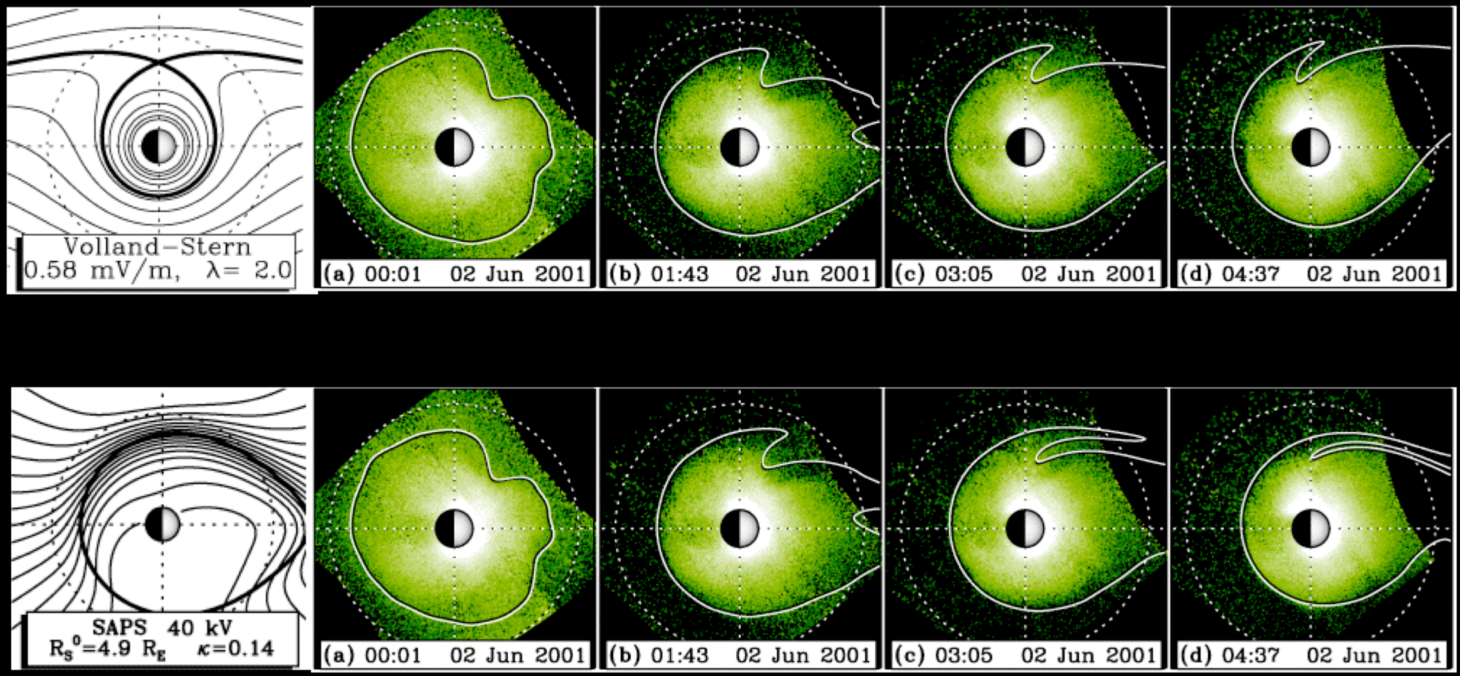
# August 2000 (< 20 keV ENAs)



# Motion of the Plasmasphere

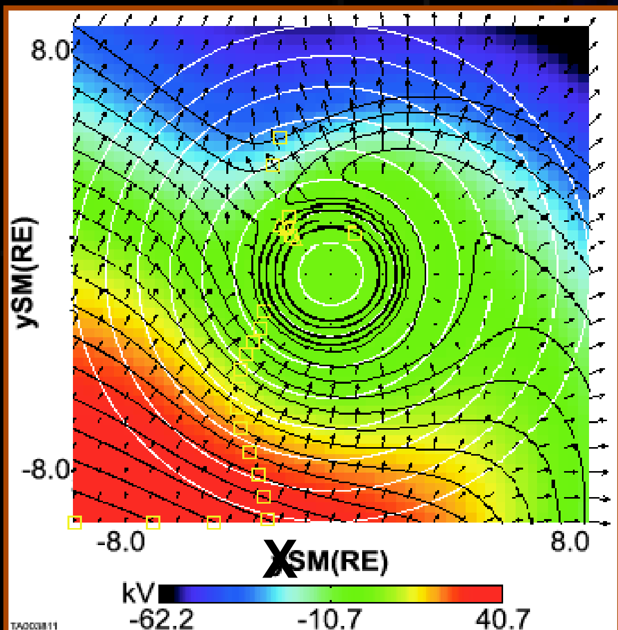
**Volland-Stern**
***0.12 $E_{SW}$* norm**

**add SAPS**
***Ad-hoc parameterization***




Goldstein et al., (2003c), *Geophys. Res. Lett., 30, 2243*

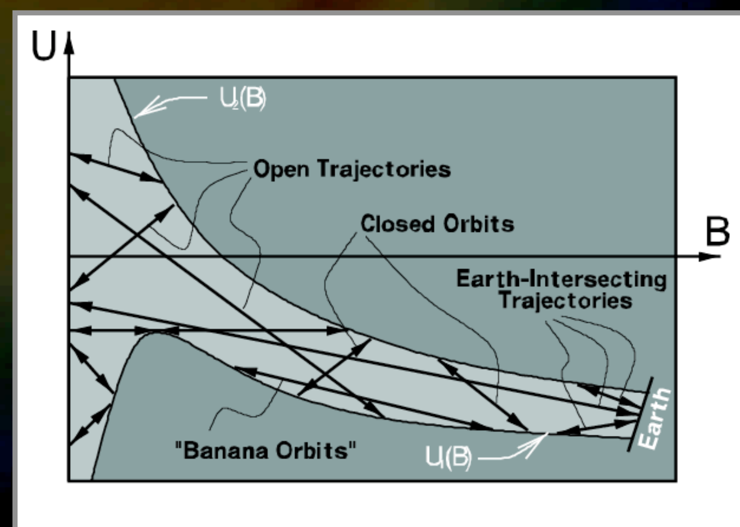
# Approach: UBK Drift Calculation




… incur the  the penalty of coordinate transformations and calculate particle drifts using UBK coordinate.

Gain: Simplify the forward modeling problem.

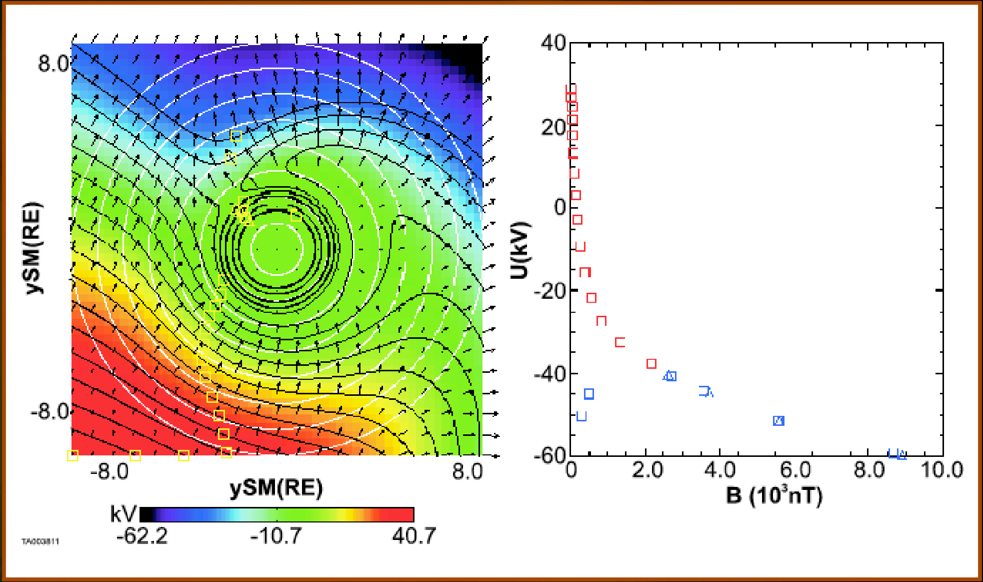
Instead of running regular particle drift codes in model magnetospheres …



# Consequences

Advantages

Simple drift trajectories; forward modeling becomes straightforward; easy to combine various datasets (ENA, in situ particle, UV imaging) and constraints (e.g. in situ E- and B-fields).



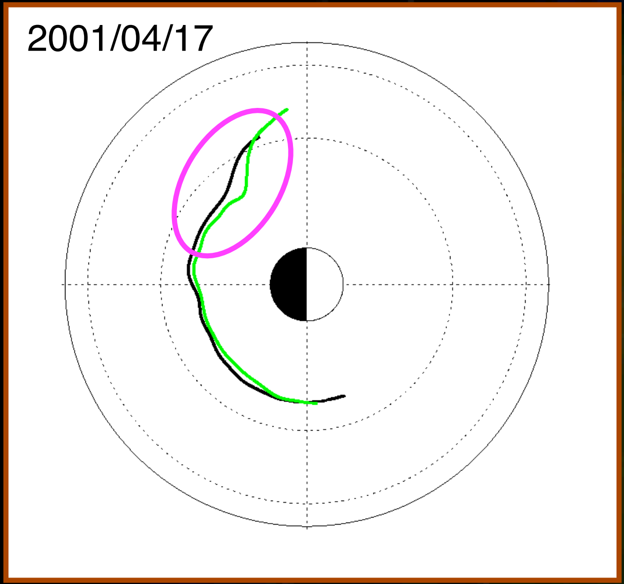

Penalties

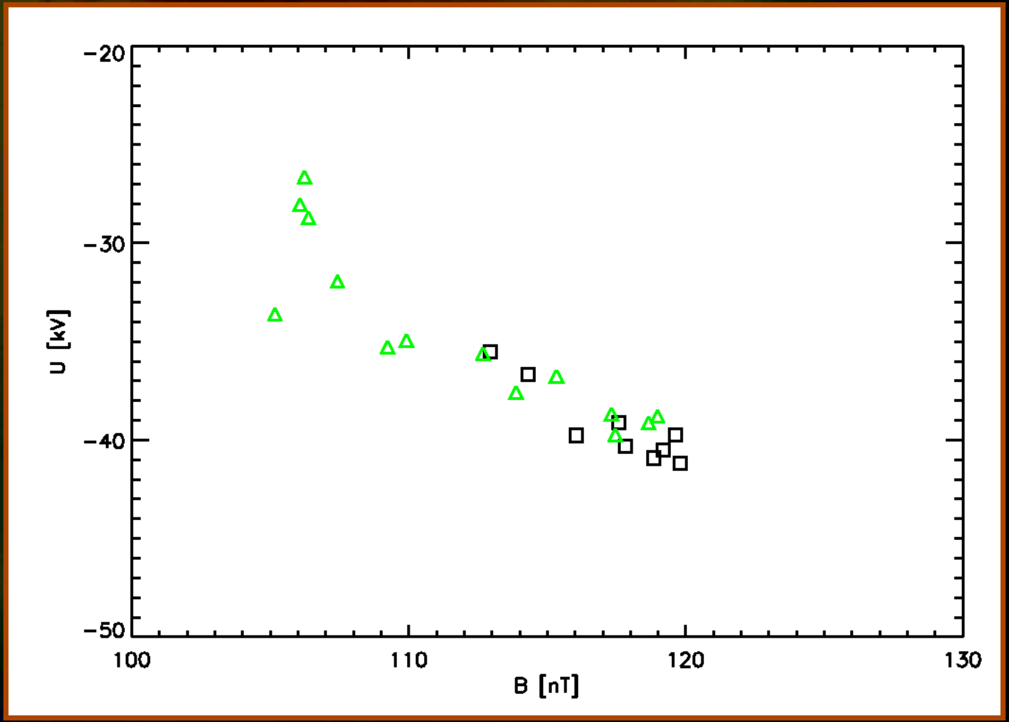
Time-independent fields; (back-)transformations needed; including particle losses may be awkward.

Future promises

E- and B-modeling/modifications are “equivalent”.

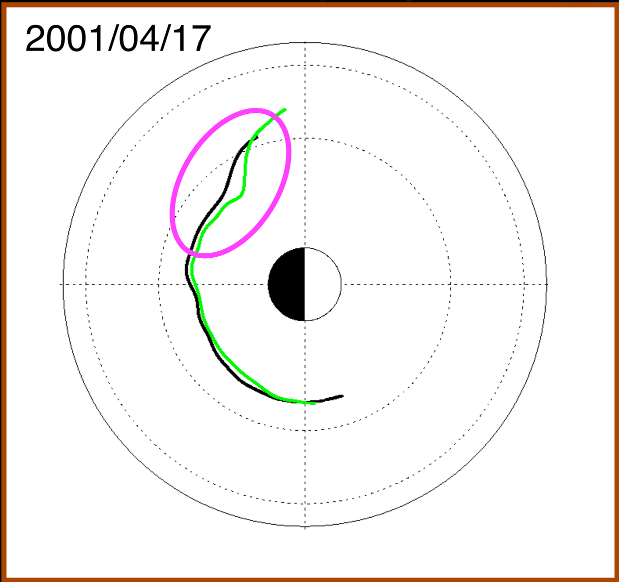
# Plasmasphere Boundary Motion



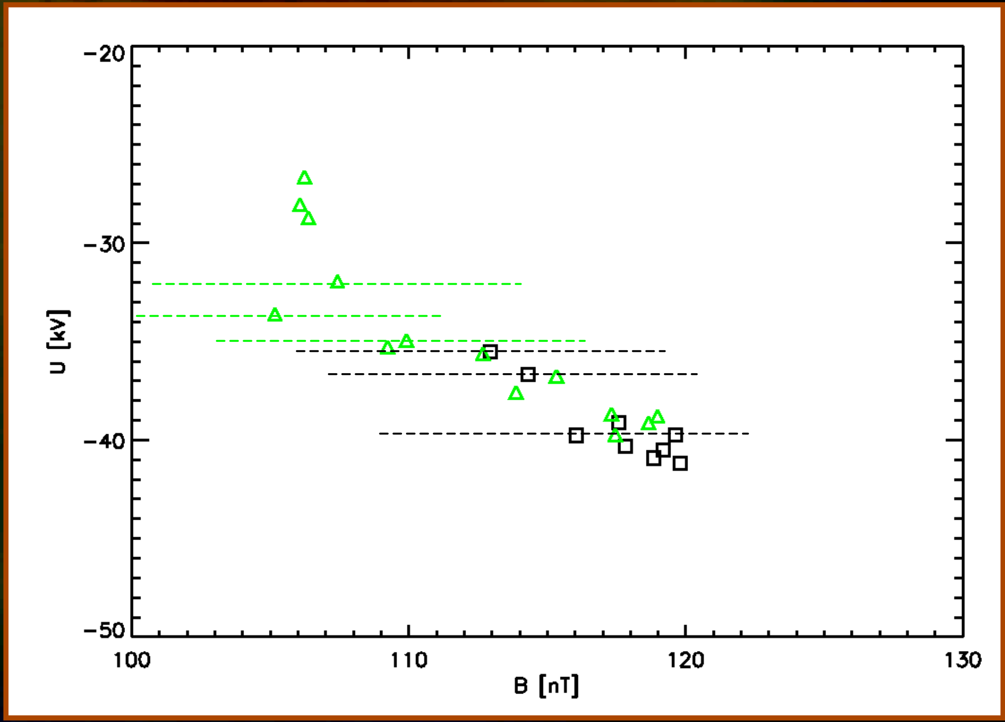

Inward motion due to enhanced **E.**

# Plasmasphere Boundary Motion (E = 0 eV)




Inward motion due to enhanced **E.**

- Investigate drift of “zero-energy” particles.



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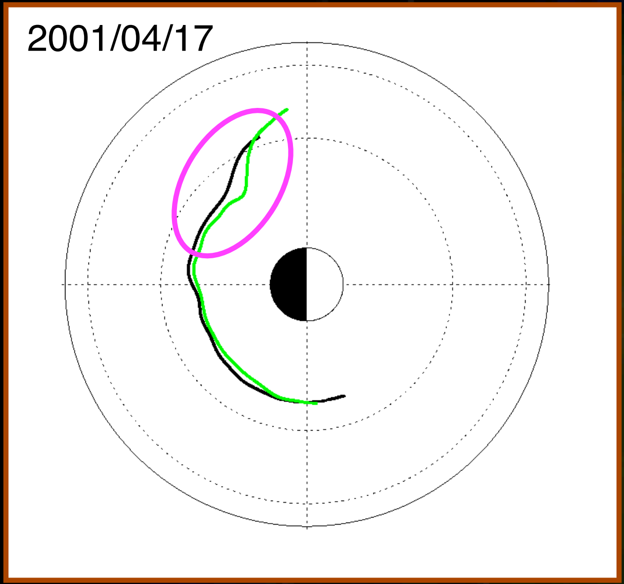


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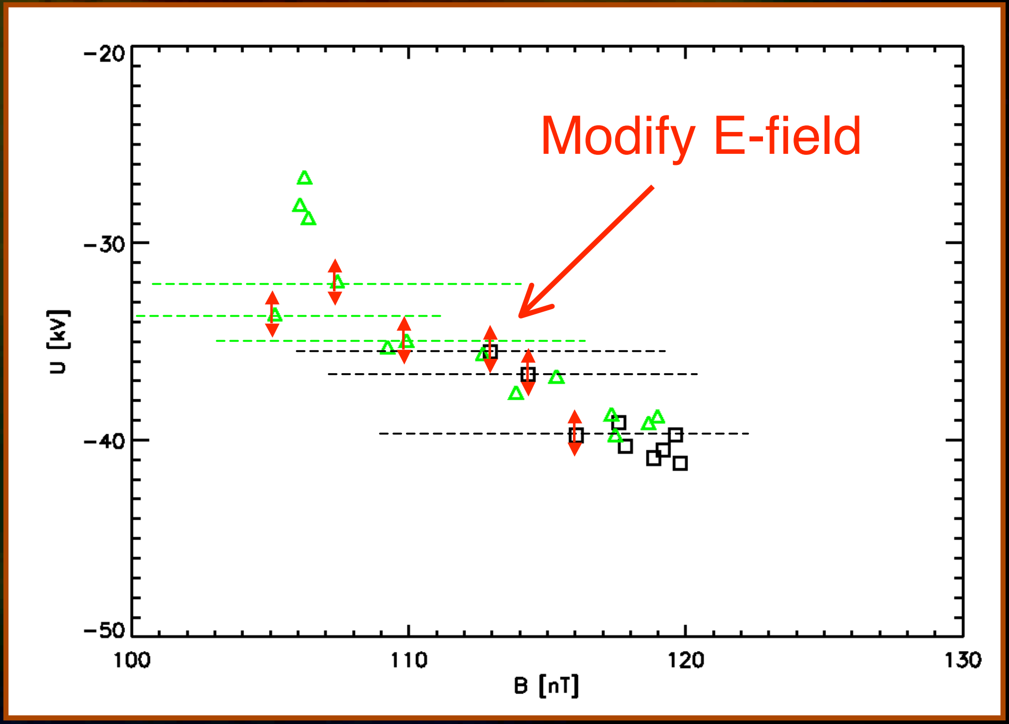

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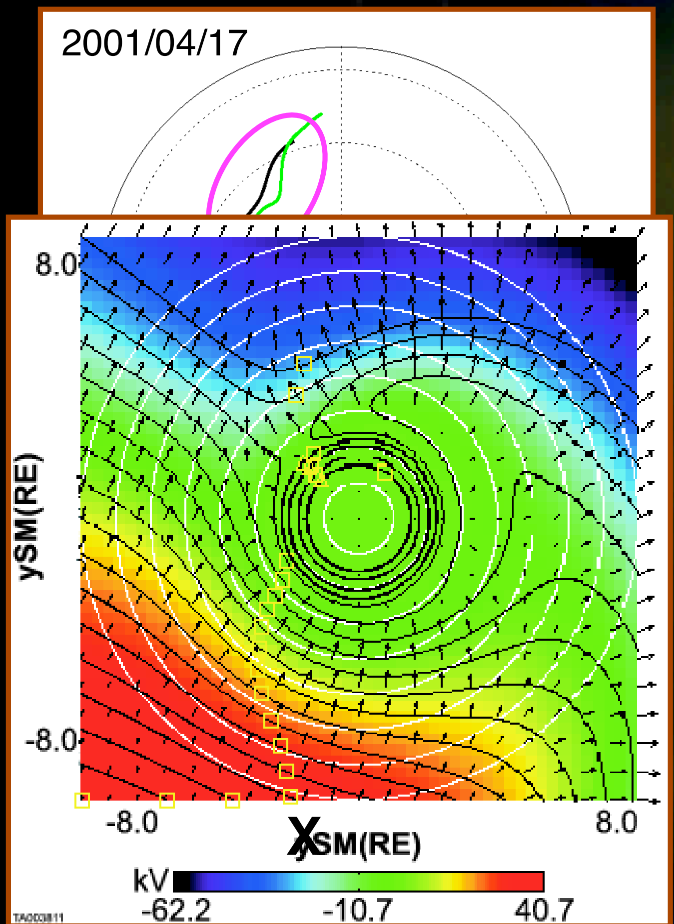


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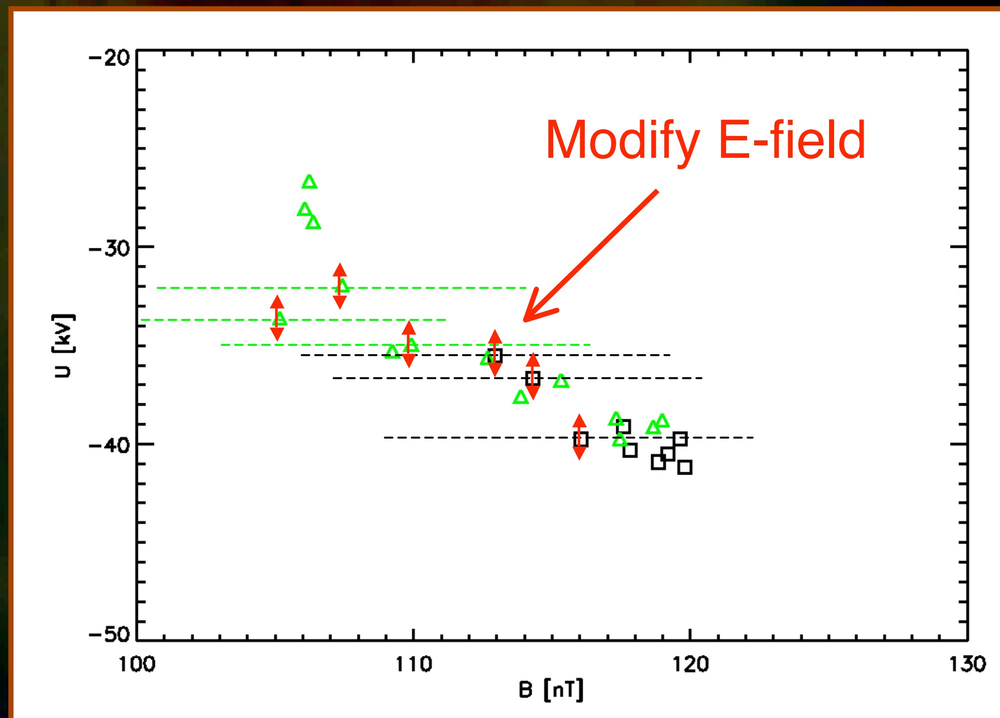
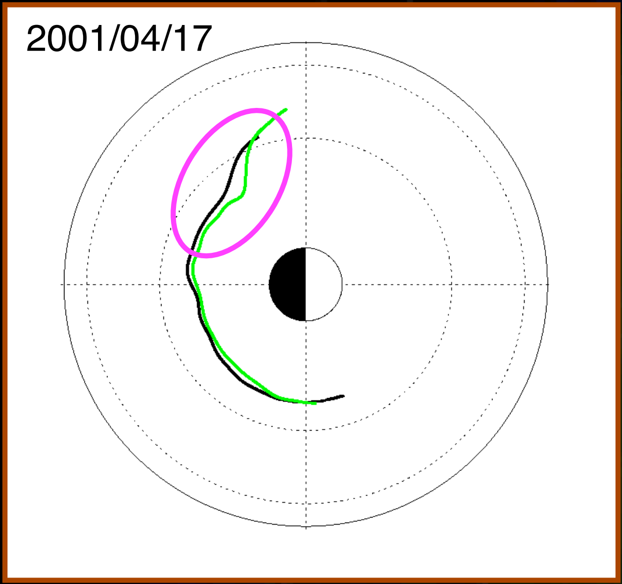
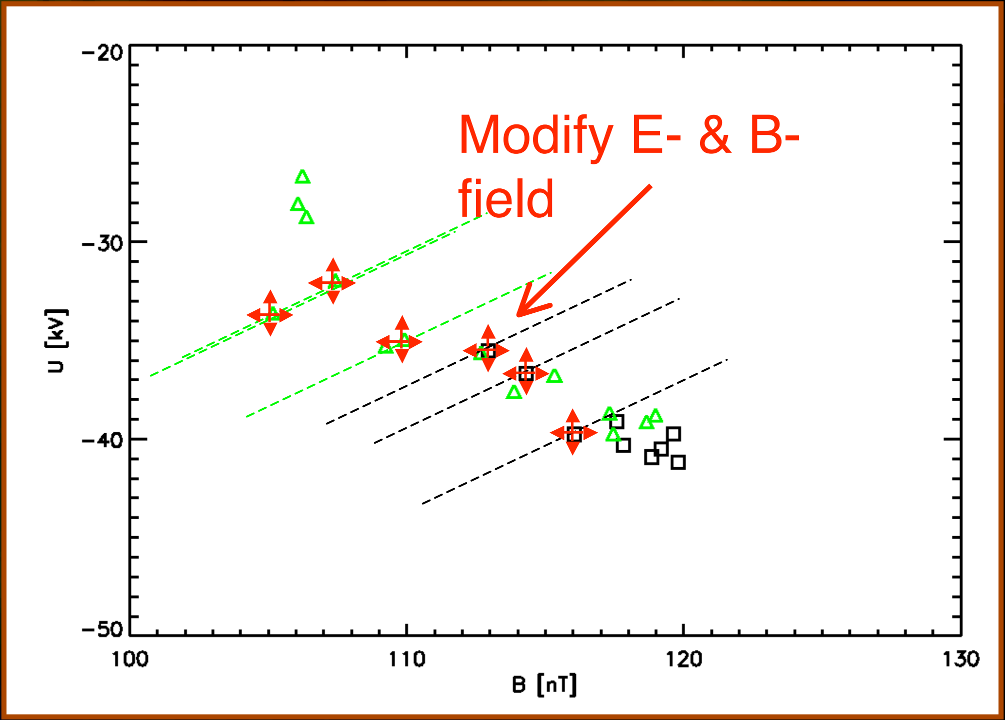


# Modifying Fields (E > 0 eV)




Investigate drift of non-zero energy particles.




Inward motion due to enhanced **E.**

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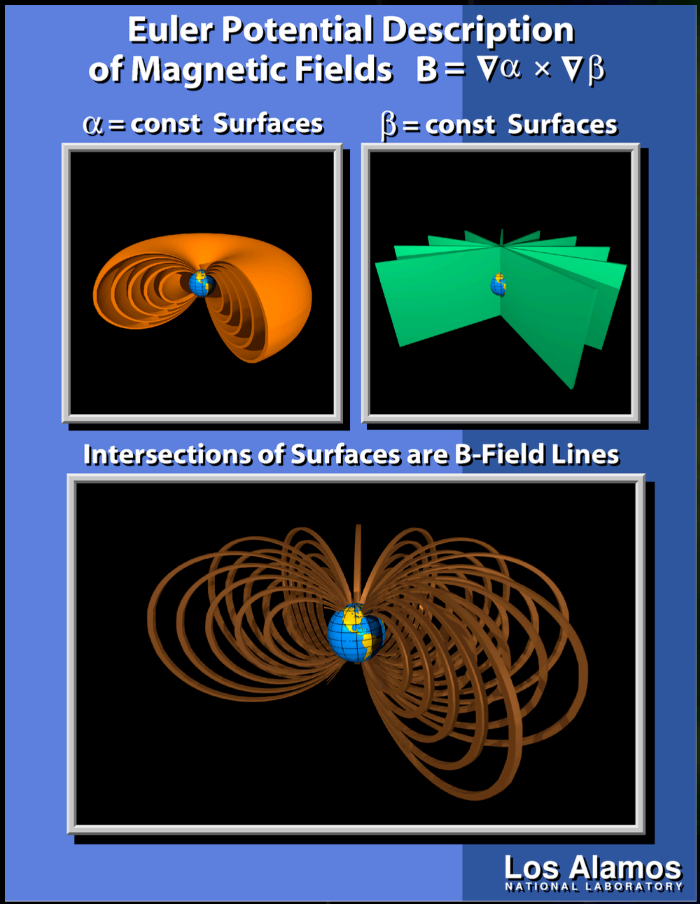


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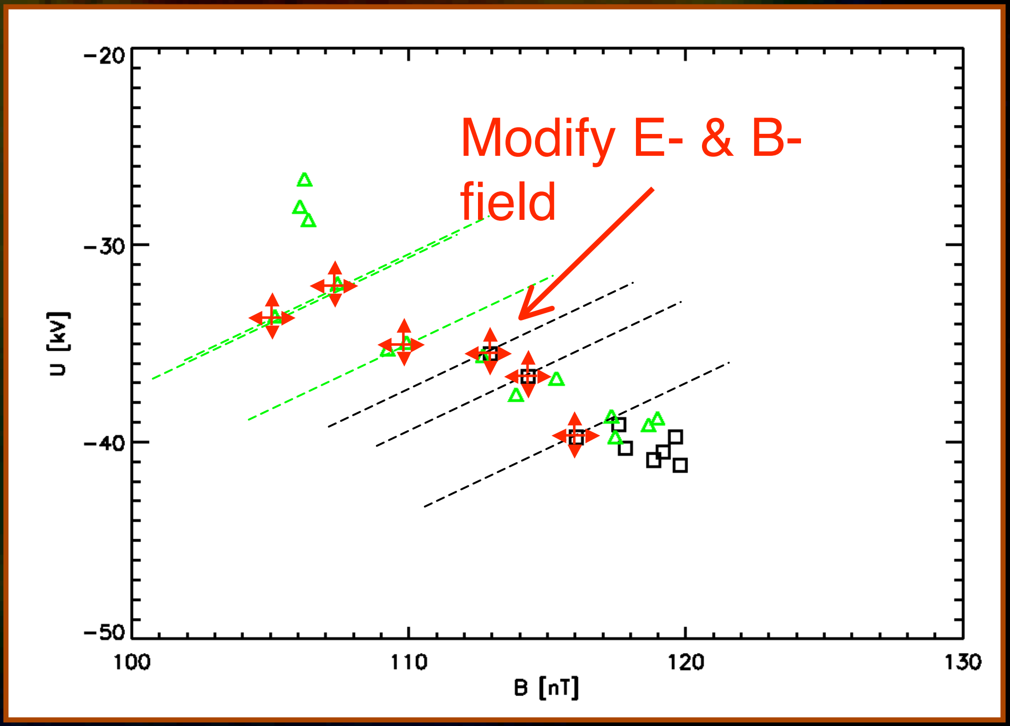


# Summary

UBK framework has been built

Currently testing particle drifts in UBK as well as backward transformation.

Working to develop field modification routines for E.

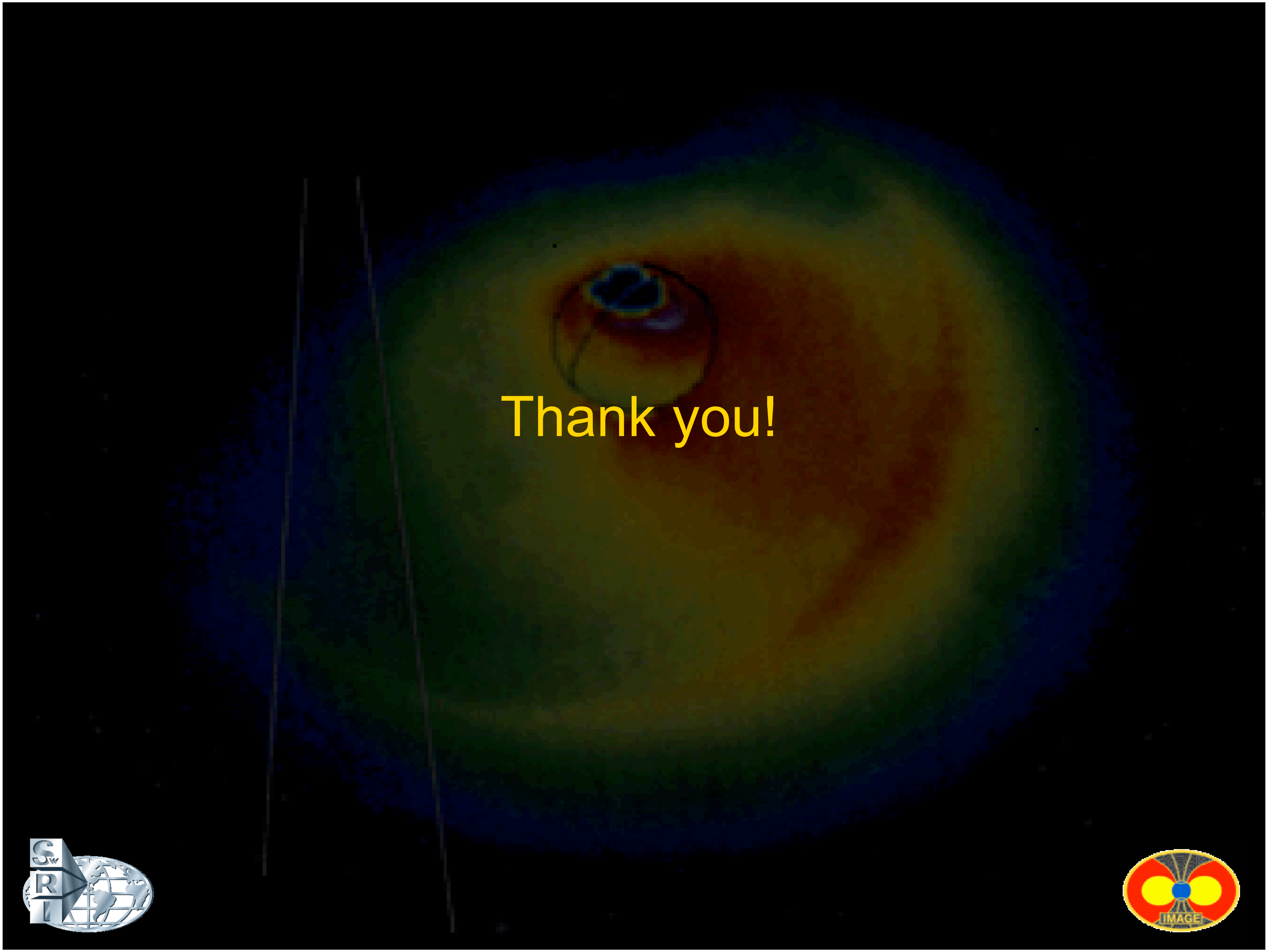
Test Data Sets

Starting with EUV plasmaspause motion; once we have particle losses included, move to ENA inversion results, bound by in situ data

Challenges:

Sensible field “deformation” algorithms.

Can be use features stationary in ENA?


Thank you!