Targeting to 2:15 pm to Maintain Recovery Time Margin for a Popup (AI# 24)

Dr. Dan

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REVIEW

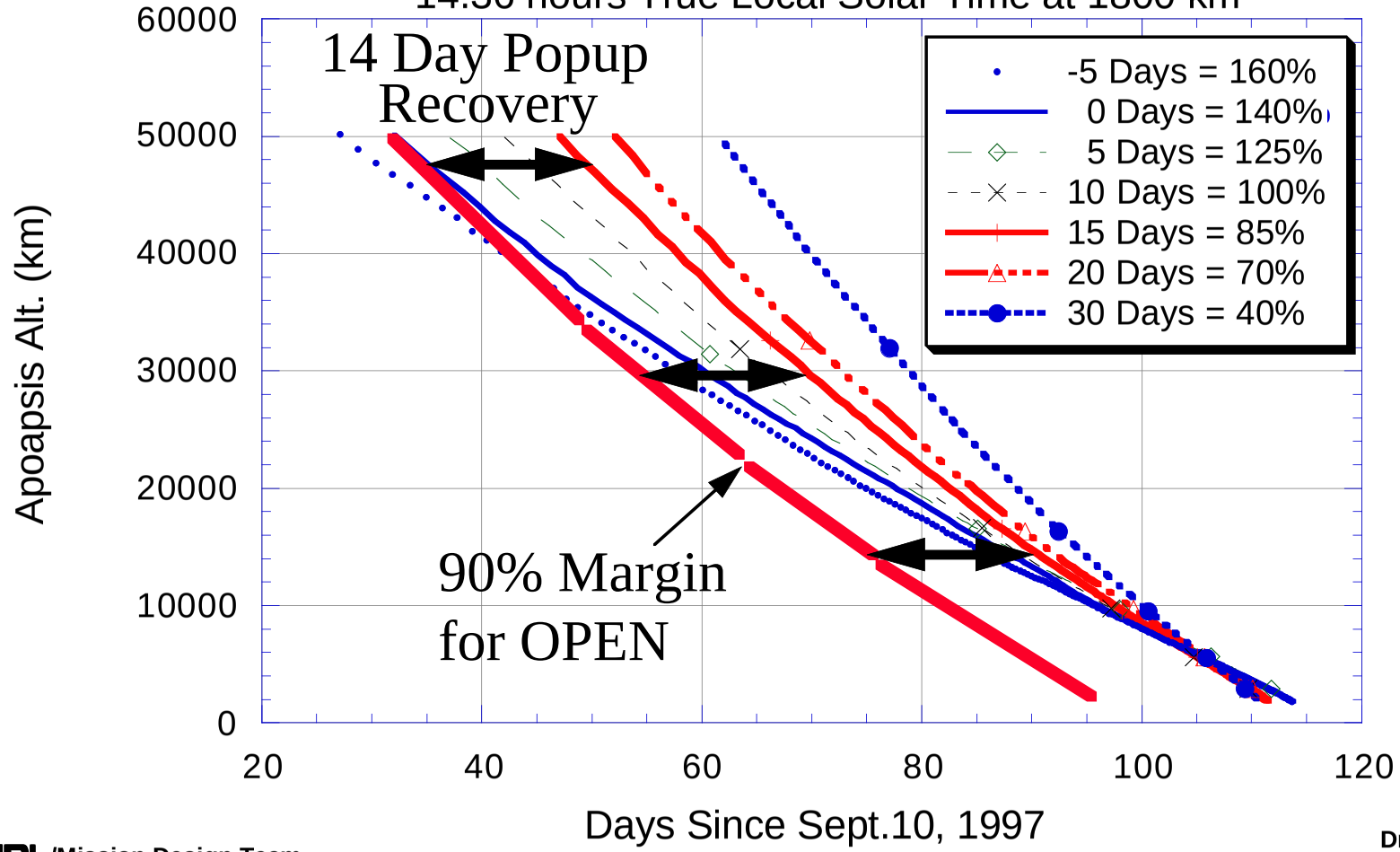
- Desire: Maximize the Time for Recovery from POPUP
- From Last Time:
  - Fly the 90% Margin Early in Main Phase
  - Maintains 14 Day Margin for Popup Recovery
  - Near End of Main Phase, “Coast” to 2 pm
  - Argument of Periapsis Moves too far during the Coast ...
  - NOT ENOUGH POWER
- Suggestion (AI# 24) ... Discussed Today
  - Aim for 2:15 pm ($\approx$ 7 Day Margin)
  - If no Popup, Either continue to 2:15 pm or Coast ?
  - If Popup > 14 Days, Local Solar Time will slip past 2 pm.,

Review: Maintain Time for Popup Recovery

Apoapsis Altitude Profiles

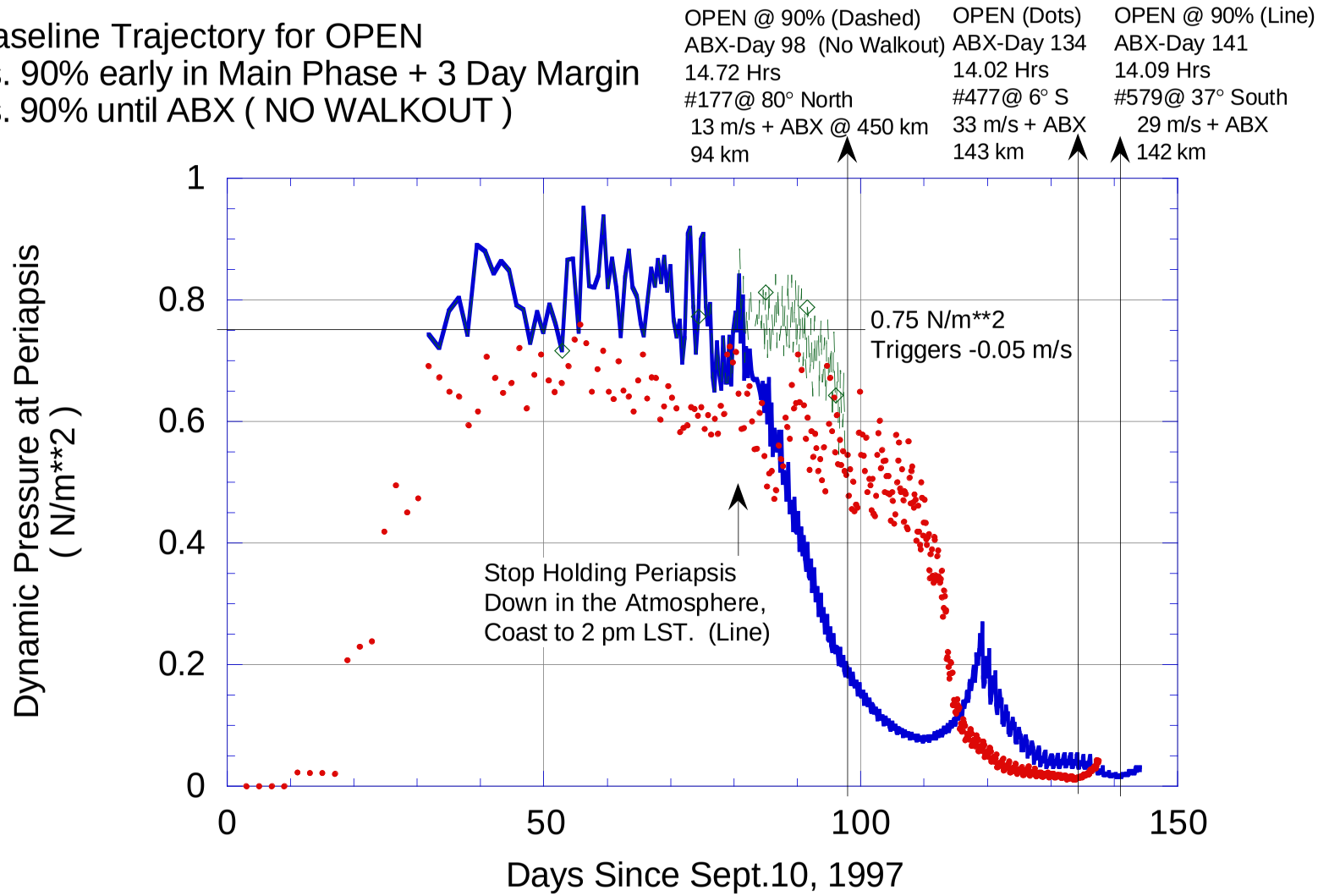
Days of Delay at AB4 related to % Qdot MARGINS

14.36 hours True Local Solar Time at 1800 km



Review: Fly 90% Margin + LONG COAST

Baseline Trajectory for OPEN
vs. 90% early in Main Phase + 3 Day Margin
vs. 90% until ABX (NO WALKOUT)



90% Margin = NOT ENOUGH POWER

Baseline Trajectory for OPEN
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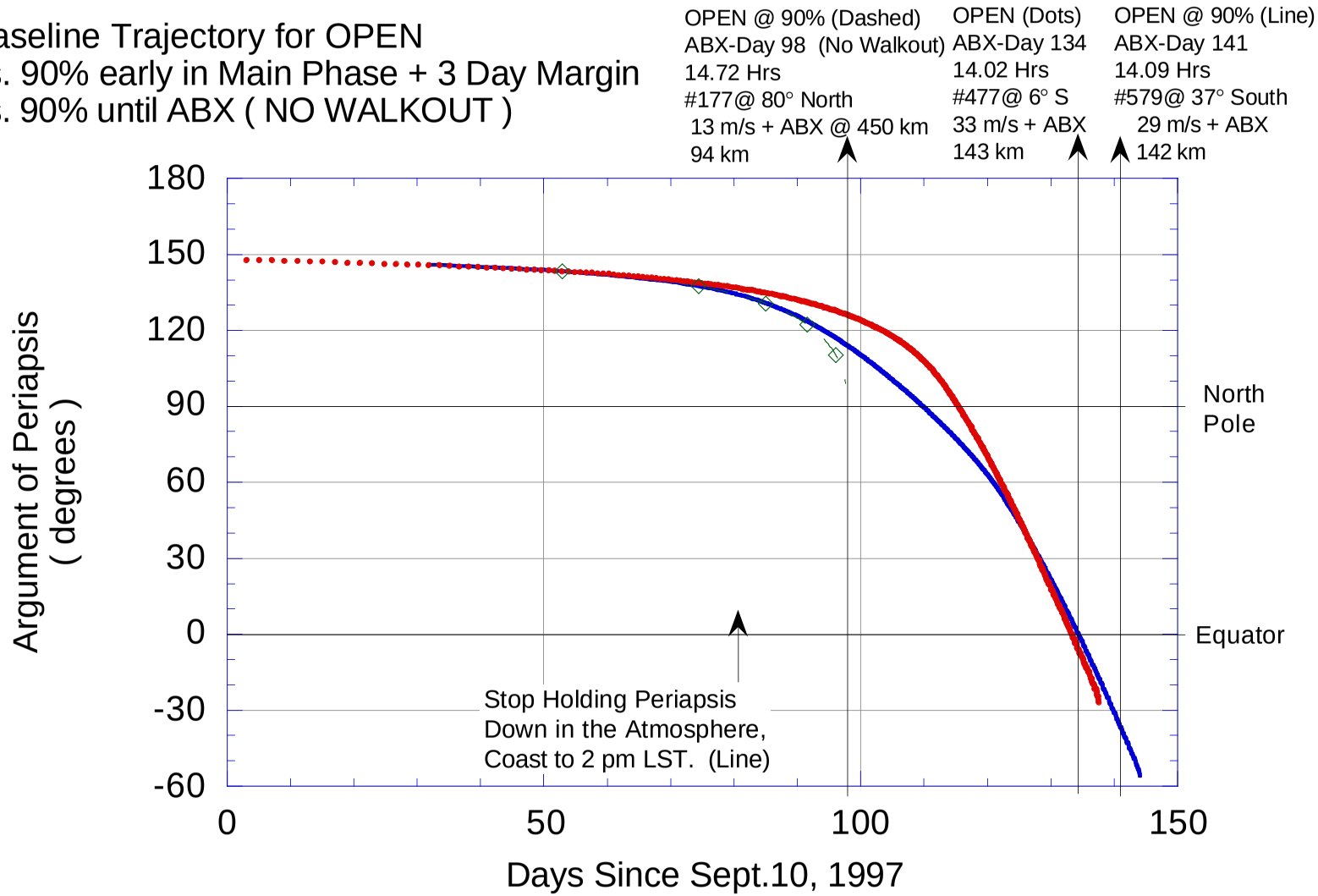
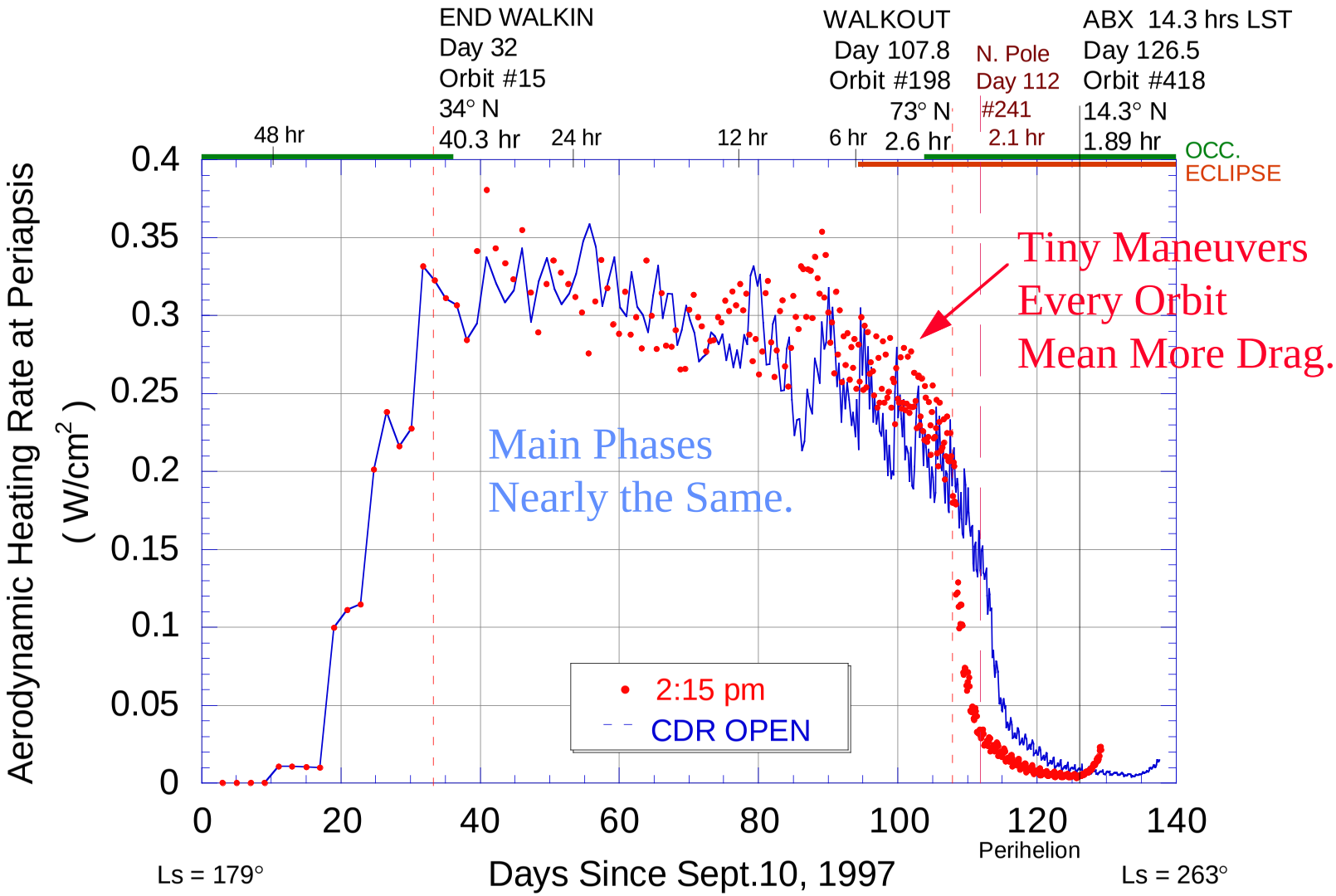


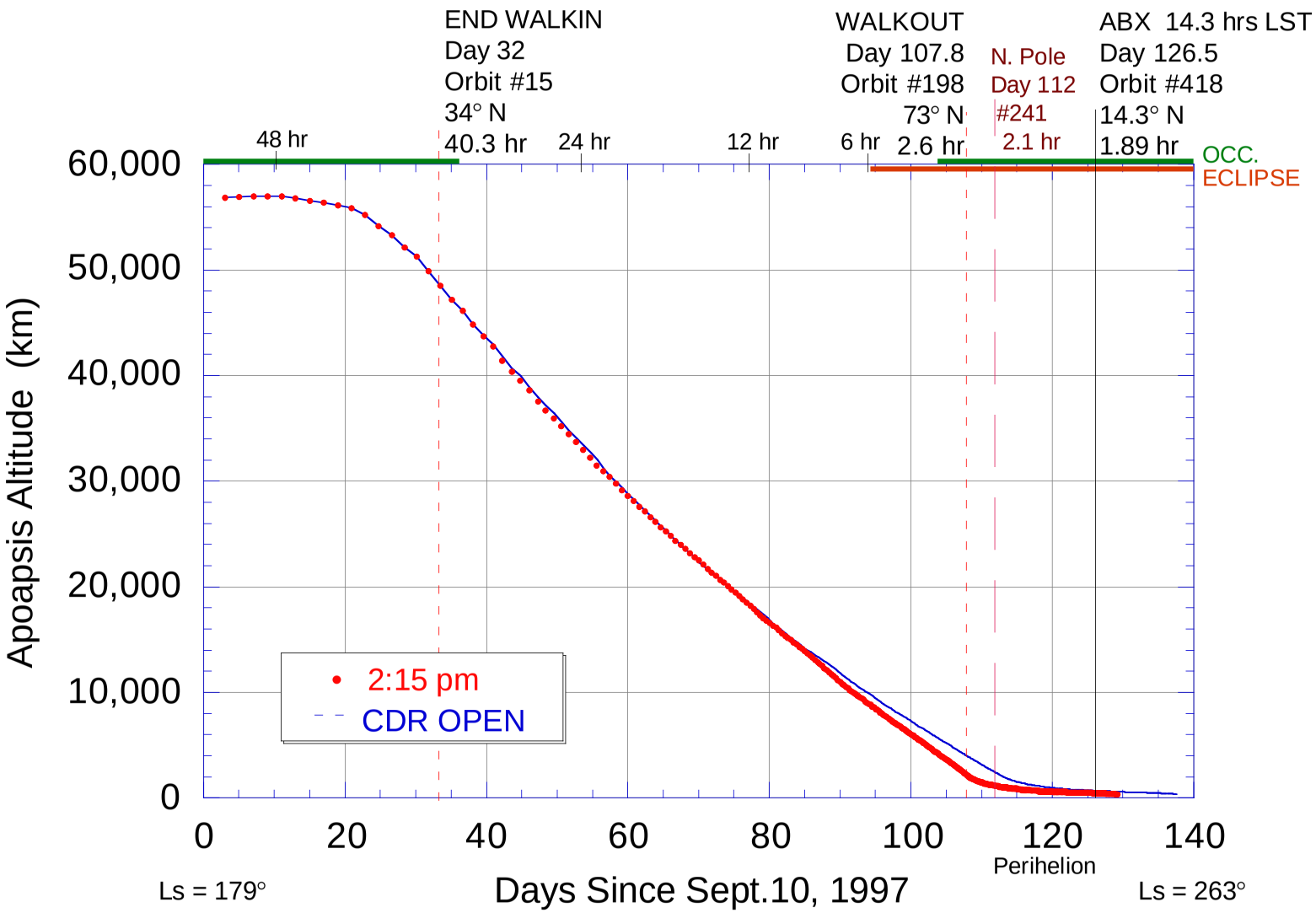
The NEW Trajectories

- Mission System CDR Baseline for Open (Blue dashes).
- Target 2:15 pm using Constant Dynamic Pressure Threshold with 0.05 m/s maneuvers (Red •).
- Target 2:15 pm for most of the Main Phase, but then Coast to Start of the Walkout phase to finish at 2:00 pm (Green x).
- Target 2:15 pm for the Main Phase, but include a 14 Day popup (Solid Black Line).
- All trajectories include a Walkout Phase with a 3 Day Orbit Lifetime.

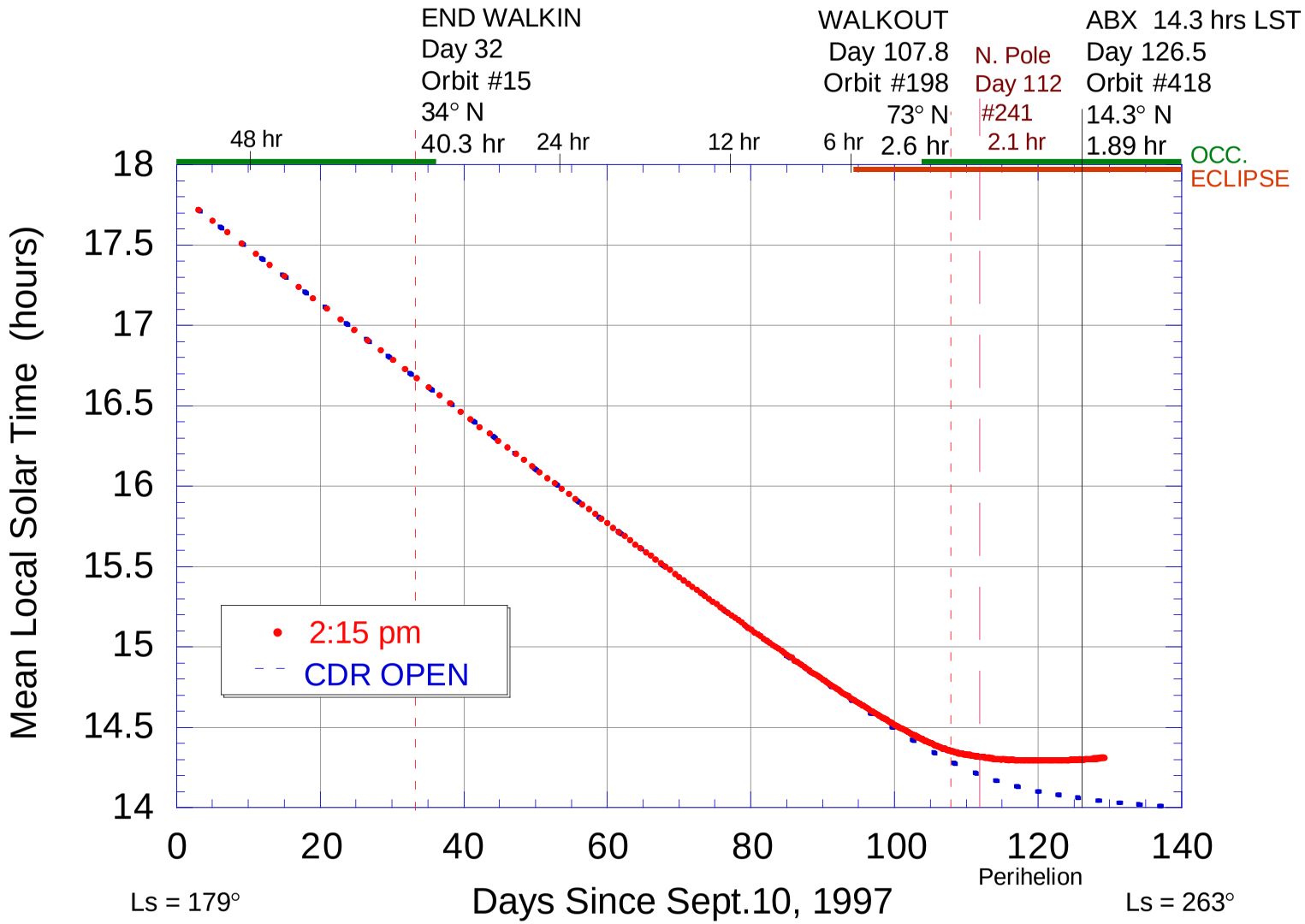
CDR BASELINE vs Target to 2:15 pm



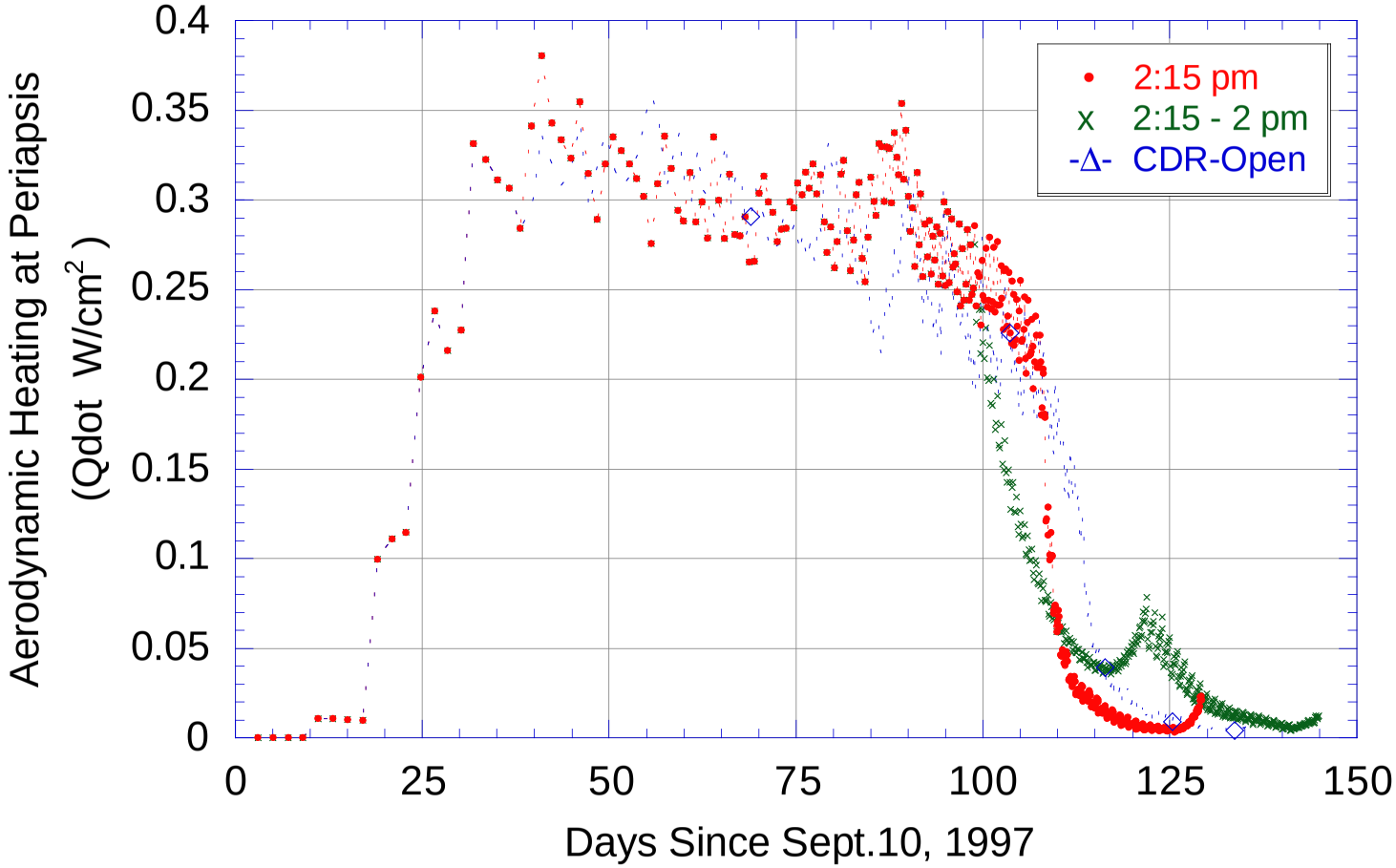
BASELINE ≈ 2:15 pm



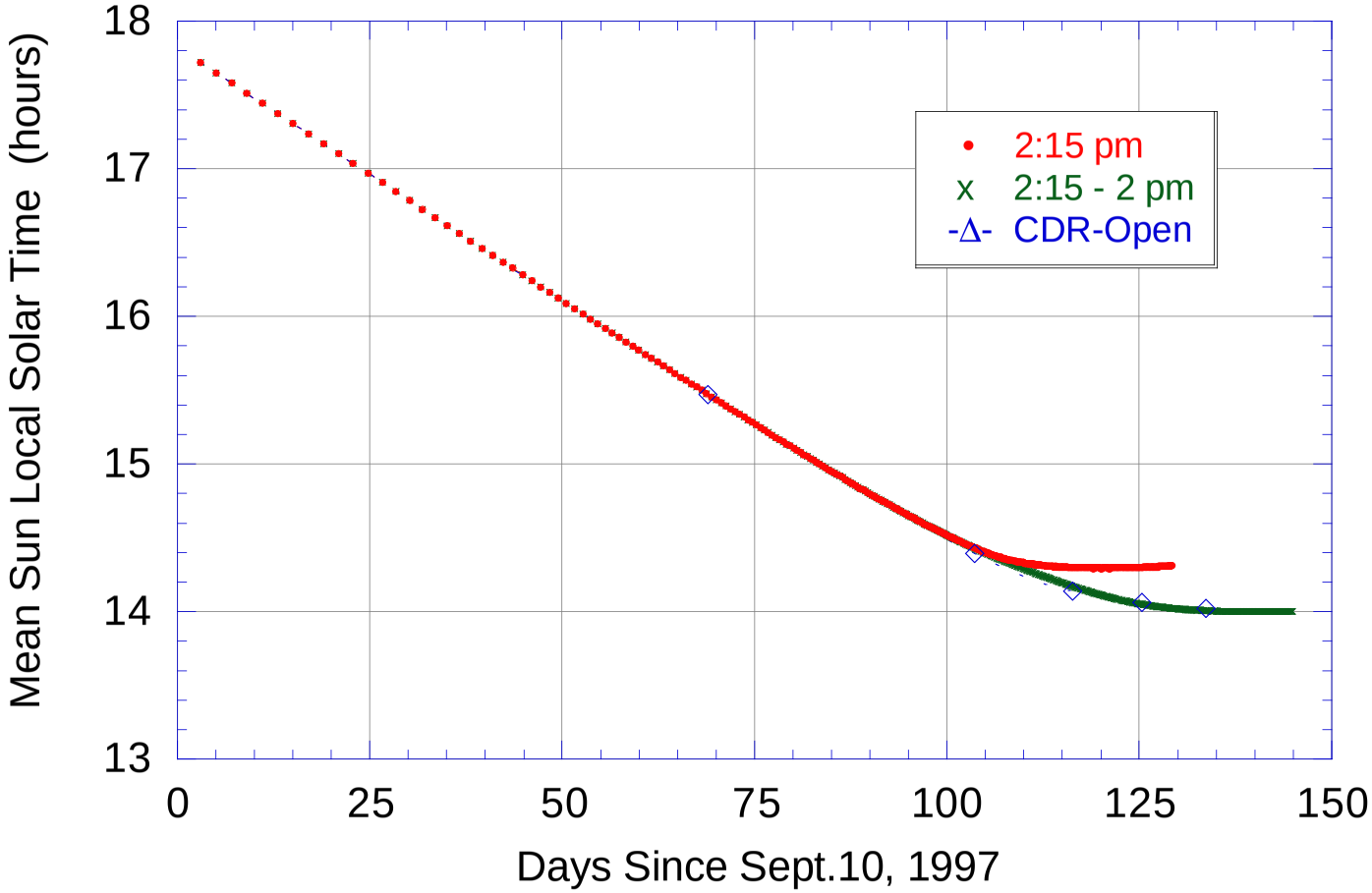
Extra Drag for Days 85 - 110 = 2:15 pm



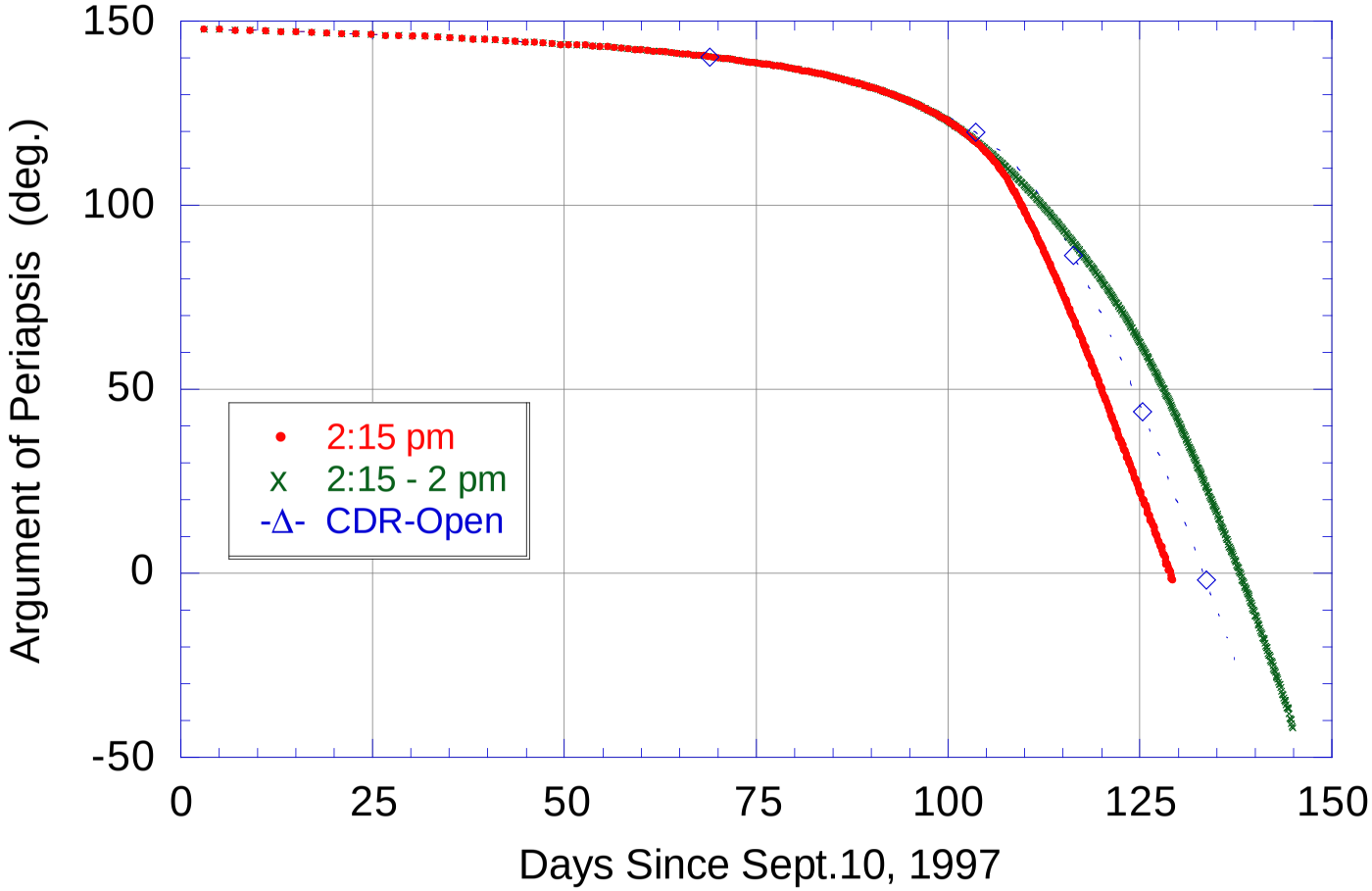
Coast from 2:15 to 2:00 pm



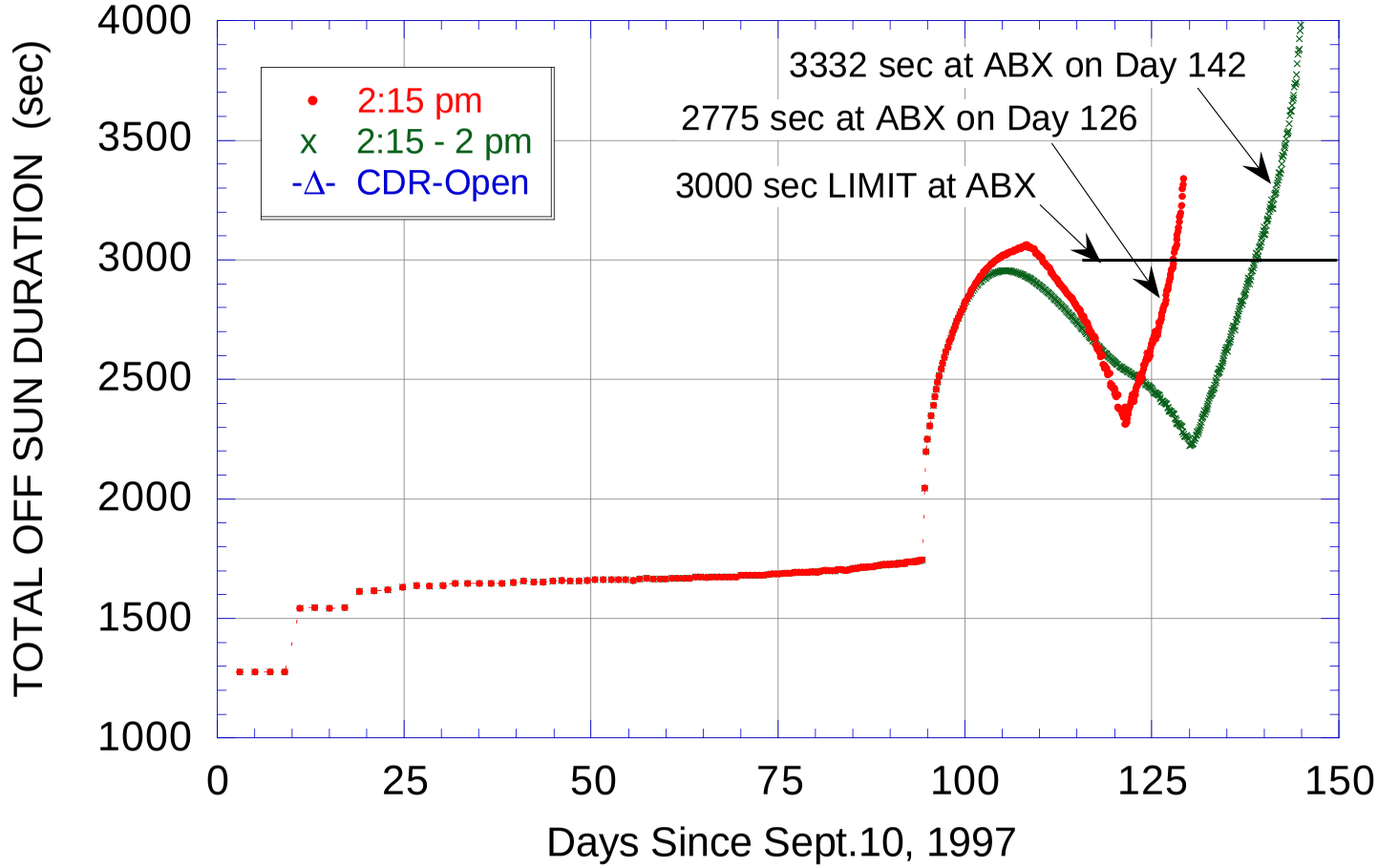
Mean LST: Coast ≈ Baseline



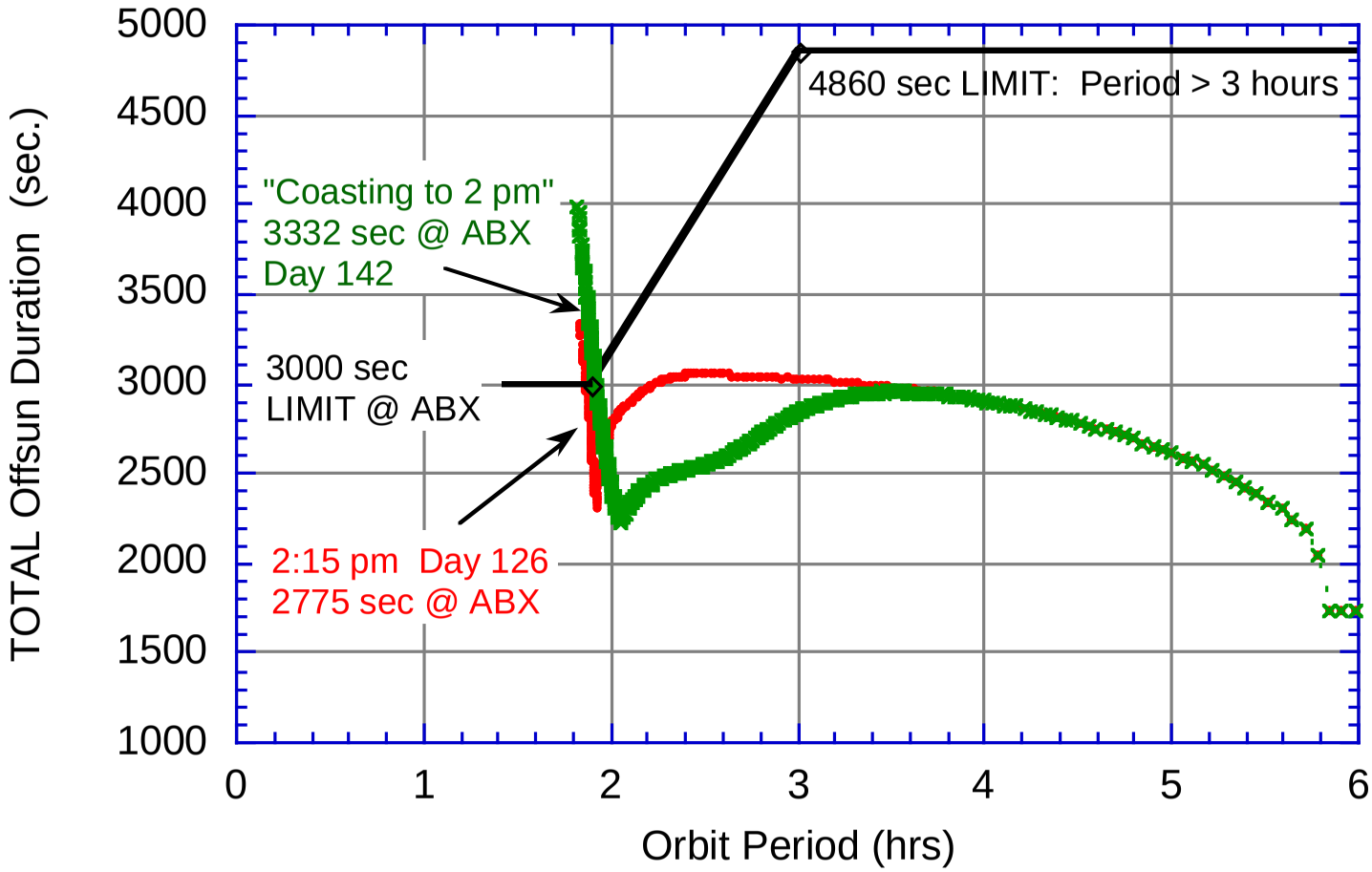
Argument of Periapsis at ABX is DIFFERENT



Power Balance: 2:15 pm OK, Coasting NOT OK



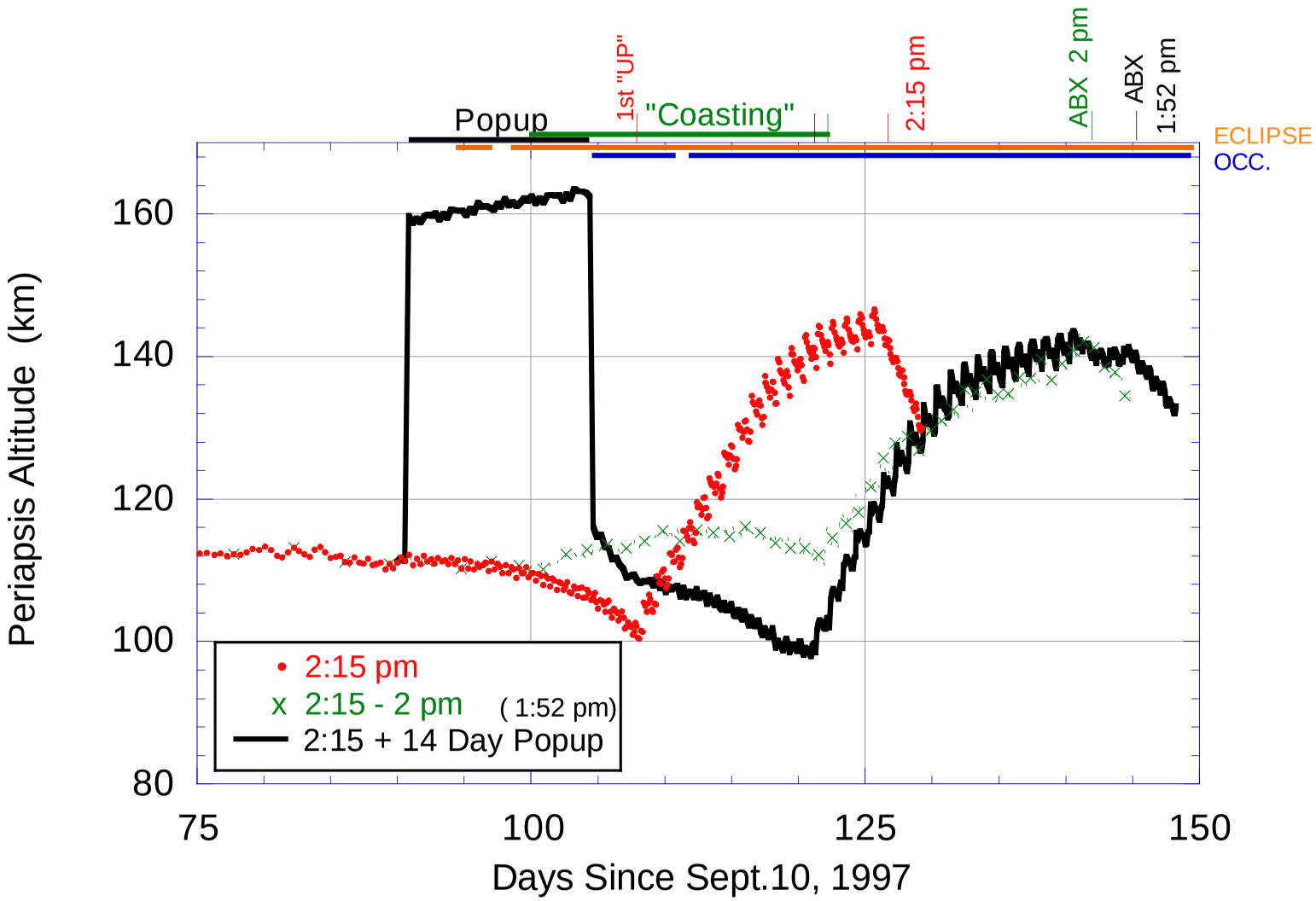
Power Constraint versus PERIOD



OPTIONS FOR IMPROVING POWER BALANCE

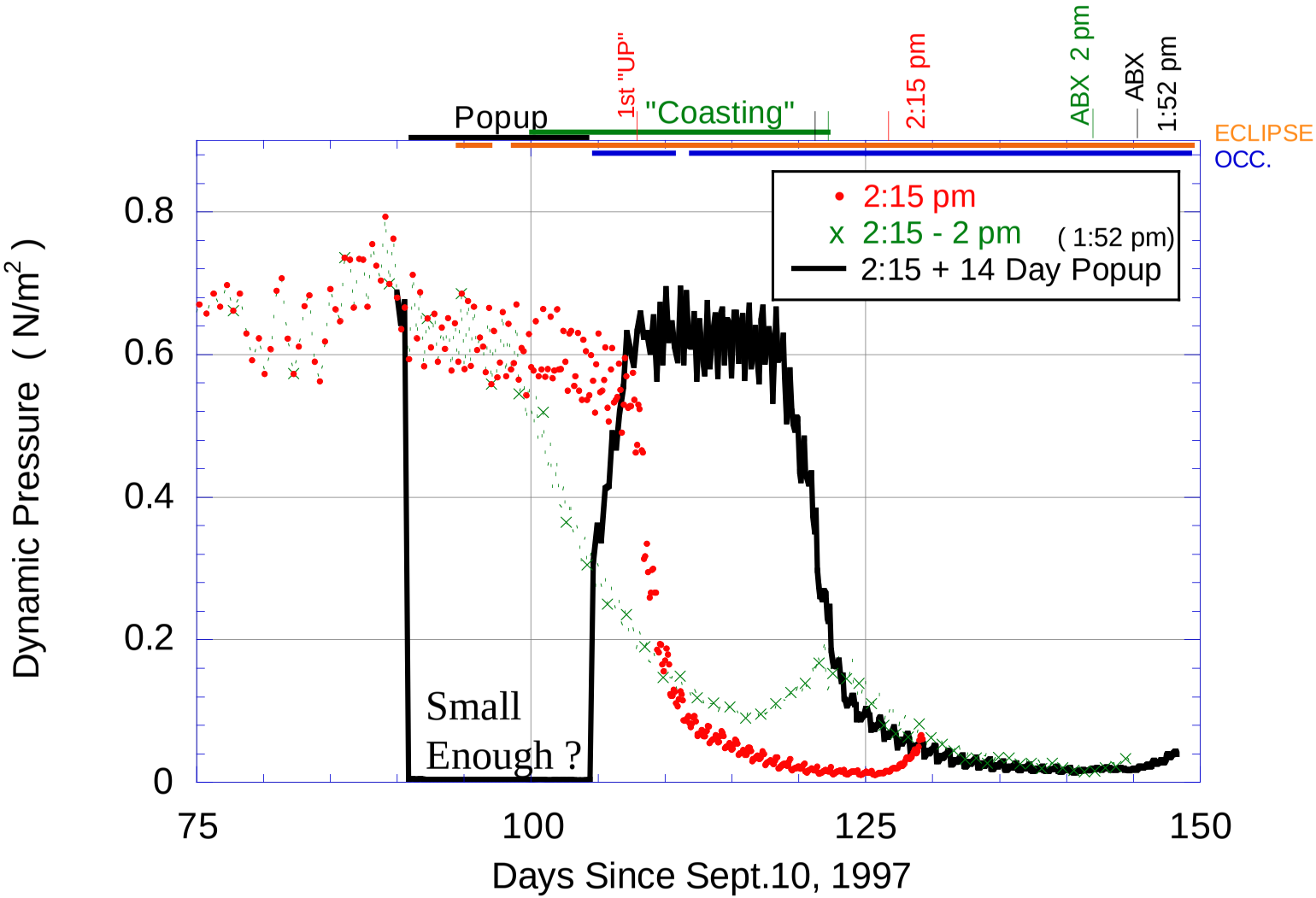
- Coasting Trajectory with 3 Day Orbit Lifetime “Takes Too Long”
  - Argument of Periapsis is changing Rapidly,
  - Not Enough Overlap between Drag Zone and Eclipse Region.
  - Not Enough Time to Recharge the Batteries.
- Increase the Power Collected:
  - Change the Outer Gimbal Angle to Reduce Solar Panel Sweep from 30° to 10°. (Torque not an issue for Walkout Phase.)
  - Point the HGA at the Sun rather than the Earth. (Every other orbit ?)
  - Reduce or Eliminate the 5 minute Timing Margins (10 min. Savings).
    - What Uplink Frequency would be Required ?
    - Would Additional AACS Propellant be Required ?
- Speed Up the Walkout Phase
  - Means Reducing the Orbit Lifetime.
  - Shorter Walkout means Less Time for Periapsis to Move

ADD 14 DAY POPUP

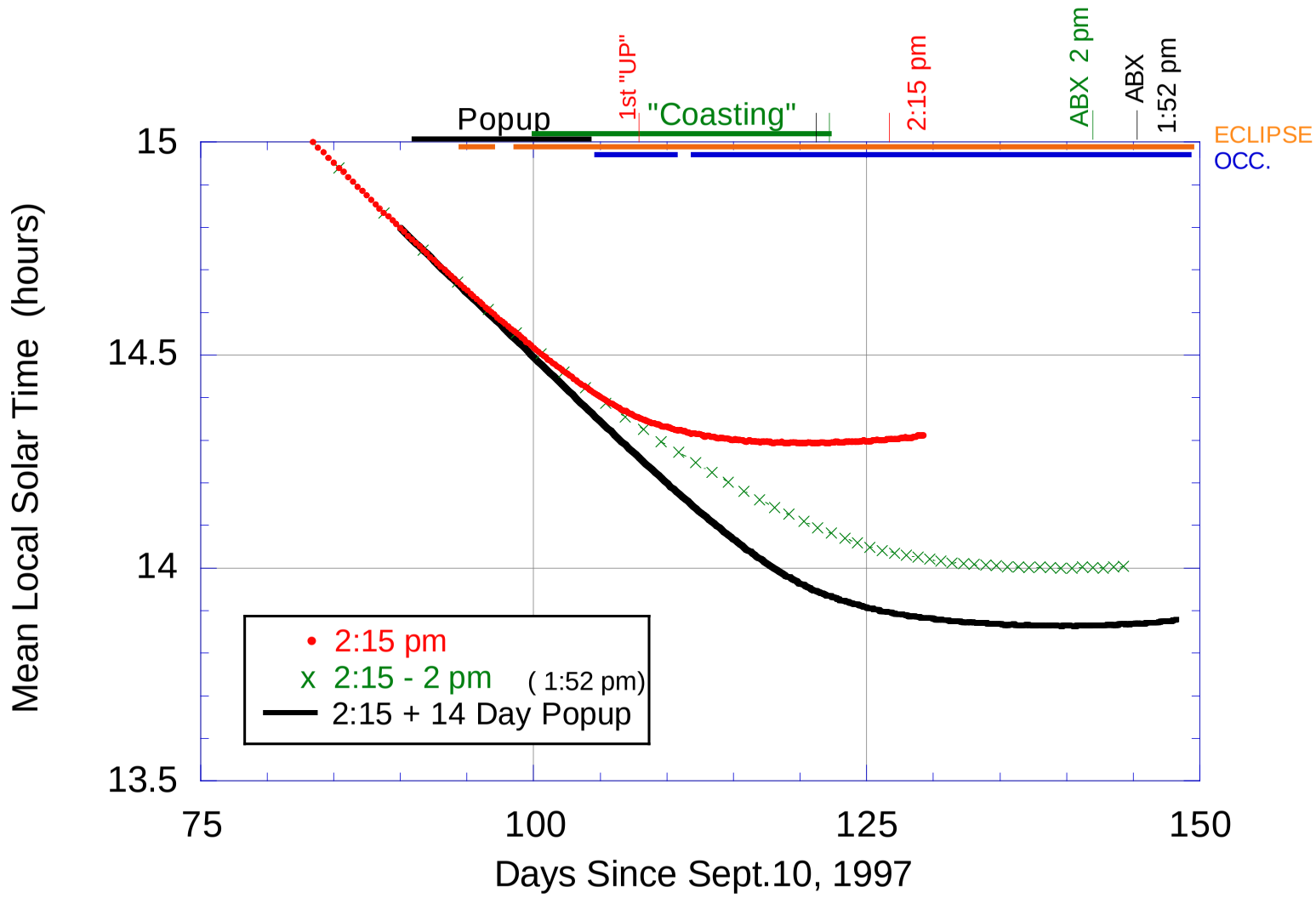


Mars Global Surveyor

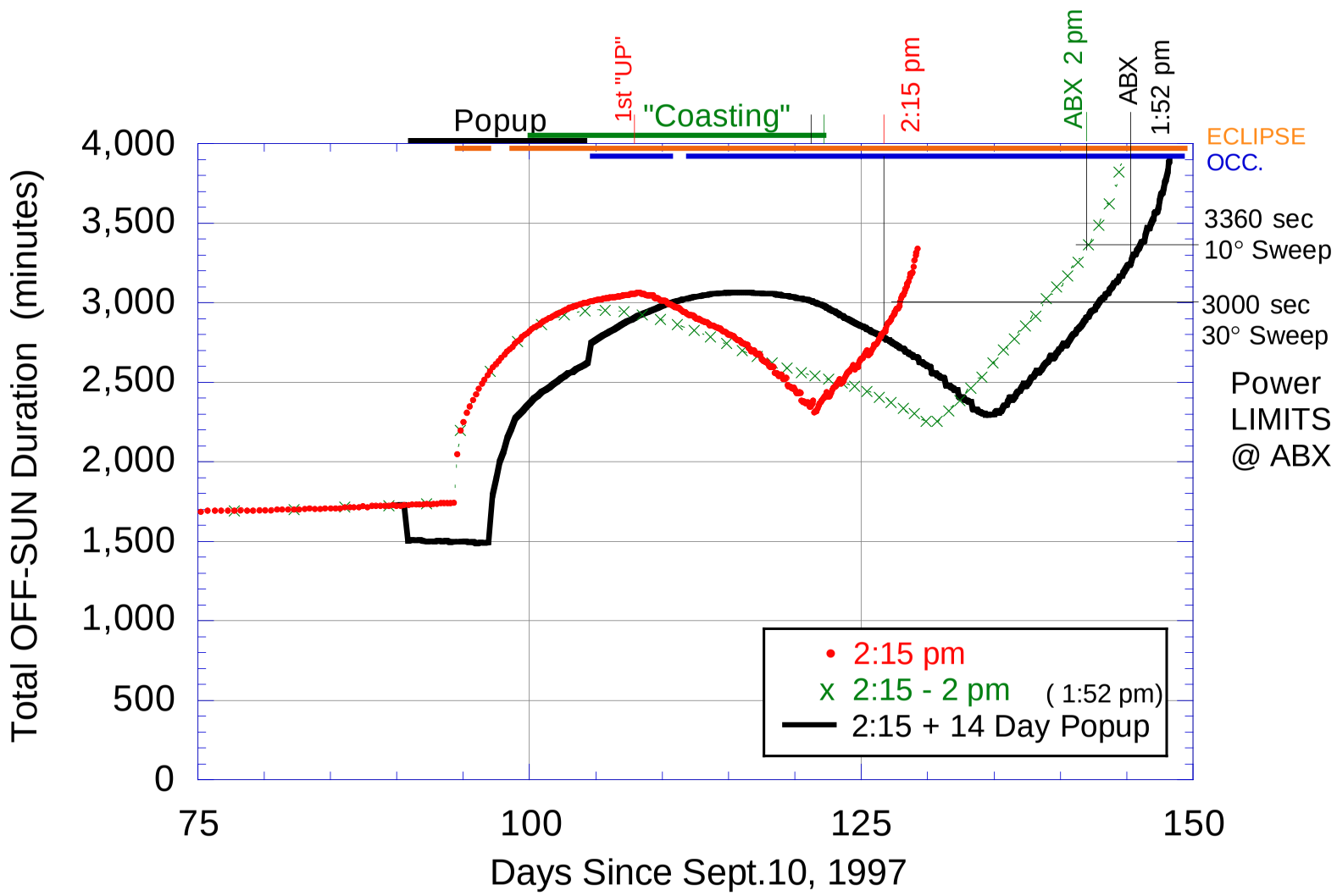
DYNAMIC PRESSURE



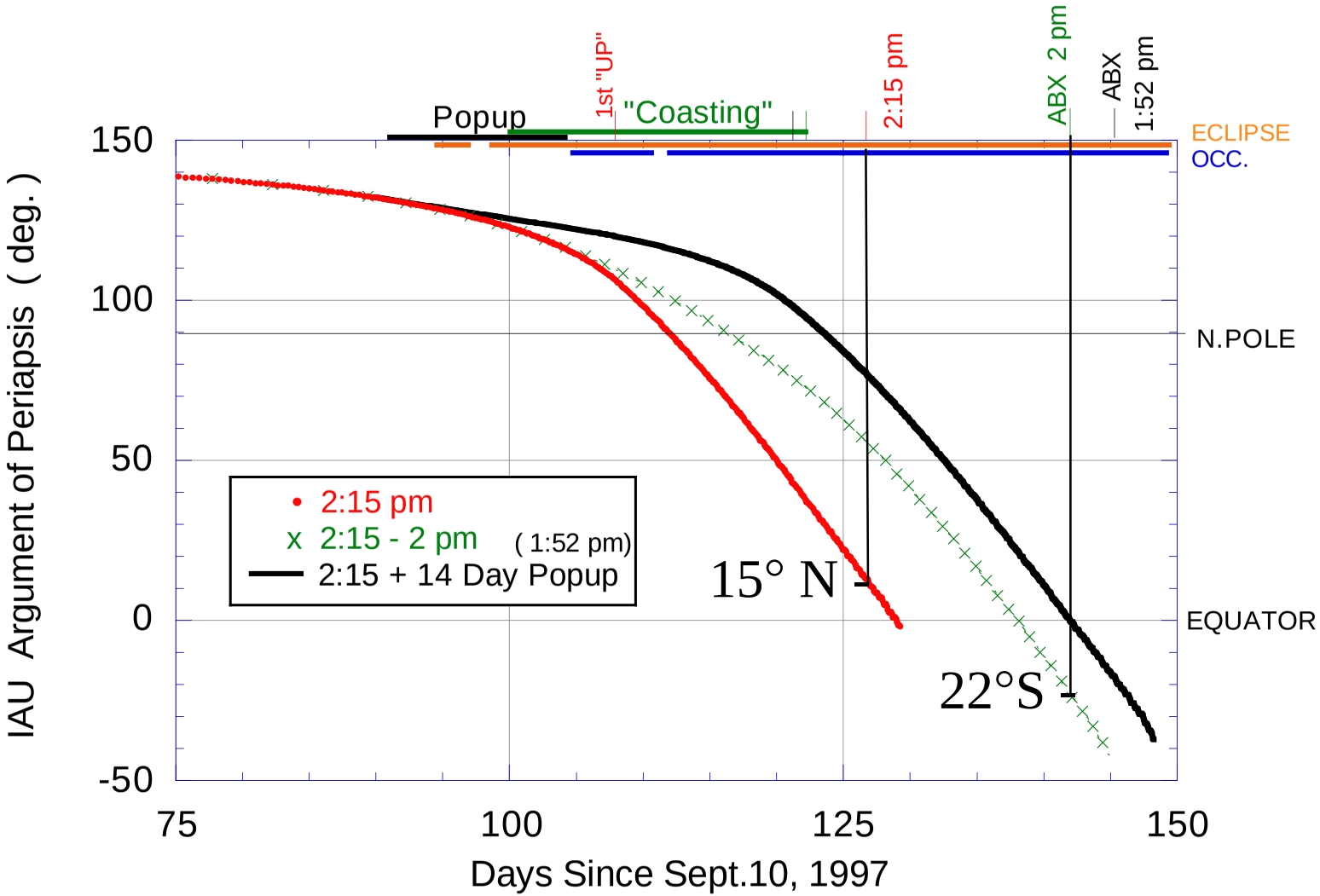
1:52 pm Mean LST of POPUP "Not Bad"



POPUP has a POWER PROBLEM TOO



Periapsis is TOO FAR SOUTH



CONCLUSIONS

- Targeting for and achieving 2:15 pm was OK for POWER.
  - (15° N)
- Targeting for 2:15 pm and COASTING to 2 pm
  - Still has a power Problem, (ABX at 22° South)
  - Power Problem is not as bad as for 90% + Coasting. (ABX at 37° South)
- Targeting for 2:15 pm was the same as the CDR BASELINE for most of the Main Phase.
  - The CDR Baseline was OK for POWER. (ABX at 6° South)
  - Continued “Relaxed” Aerobraking better than “Coasting”
- Recommendation: Stick to the Baseline.

OPEN ISSUES

- WHAT IF POPUP OCCURS DURING WALKOUT (POWER ??)
- WHAT OPTIONS WILL WE IMPLEMENT FOR POWER ?
  - Changing the Outer Gimbal Angle ?
  - Giving up Telecom for Power (HGA to Sun) ? How often ?
  - Reducing Orbit Lifetime Margin to Shorten Walkout ?
- HOW OFTEN DO WE CHANGE THE POPUP ΔV ?