Integral

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Integral Operations Coordination Meeting (25/3/2011)

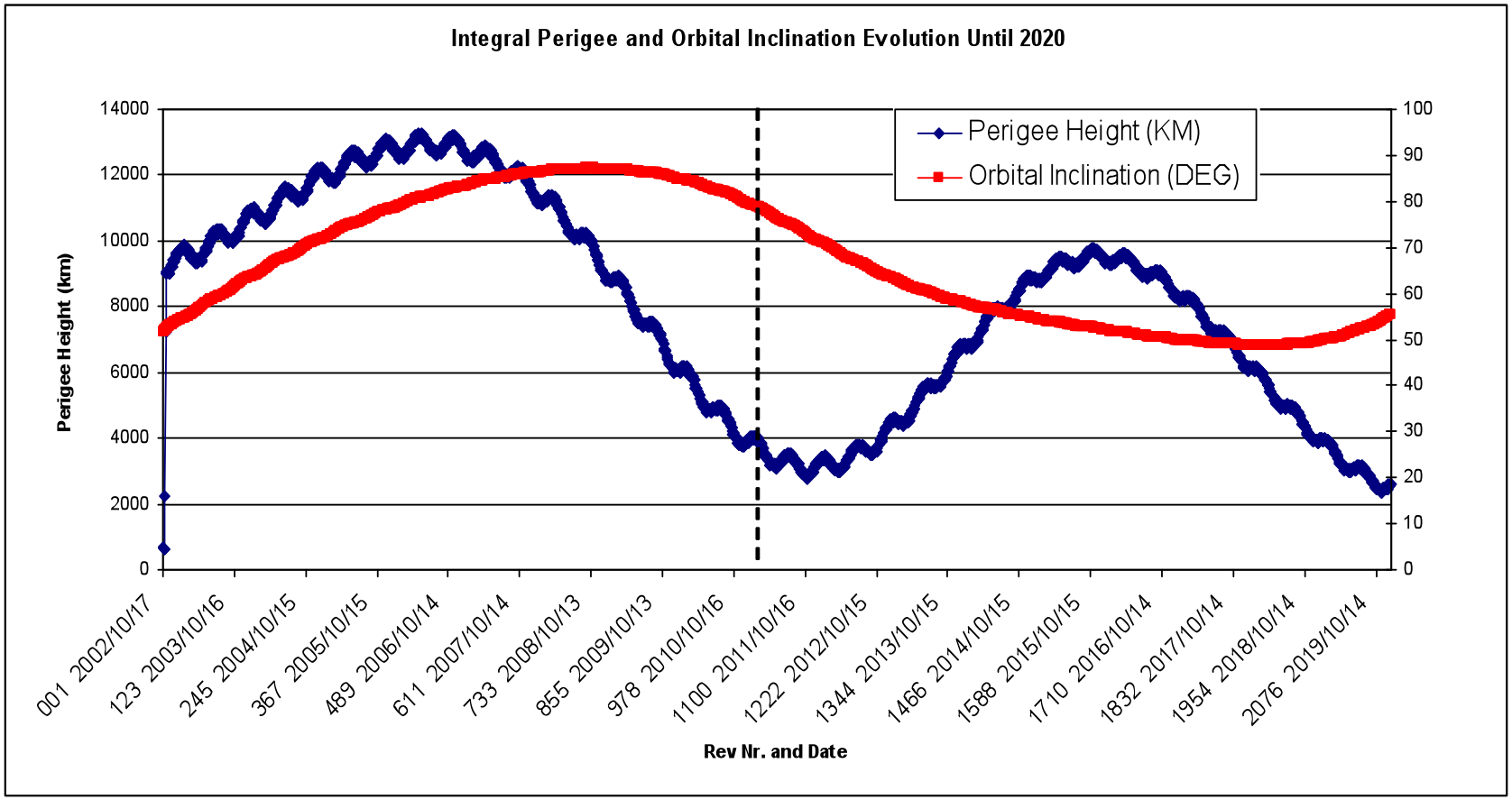
Orbital Evolution and Consequences

Integral Operations Status

- Orbit Evolution
- Belts history
- Belts Future
- Arrays
- Other effects
  - Number of eclipses /year
- Handling of Planned Belt entry / Exit Altitude Adjustment
- SPI Temperature at perigee
- Station Coverage

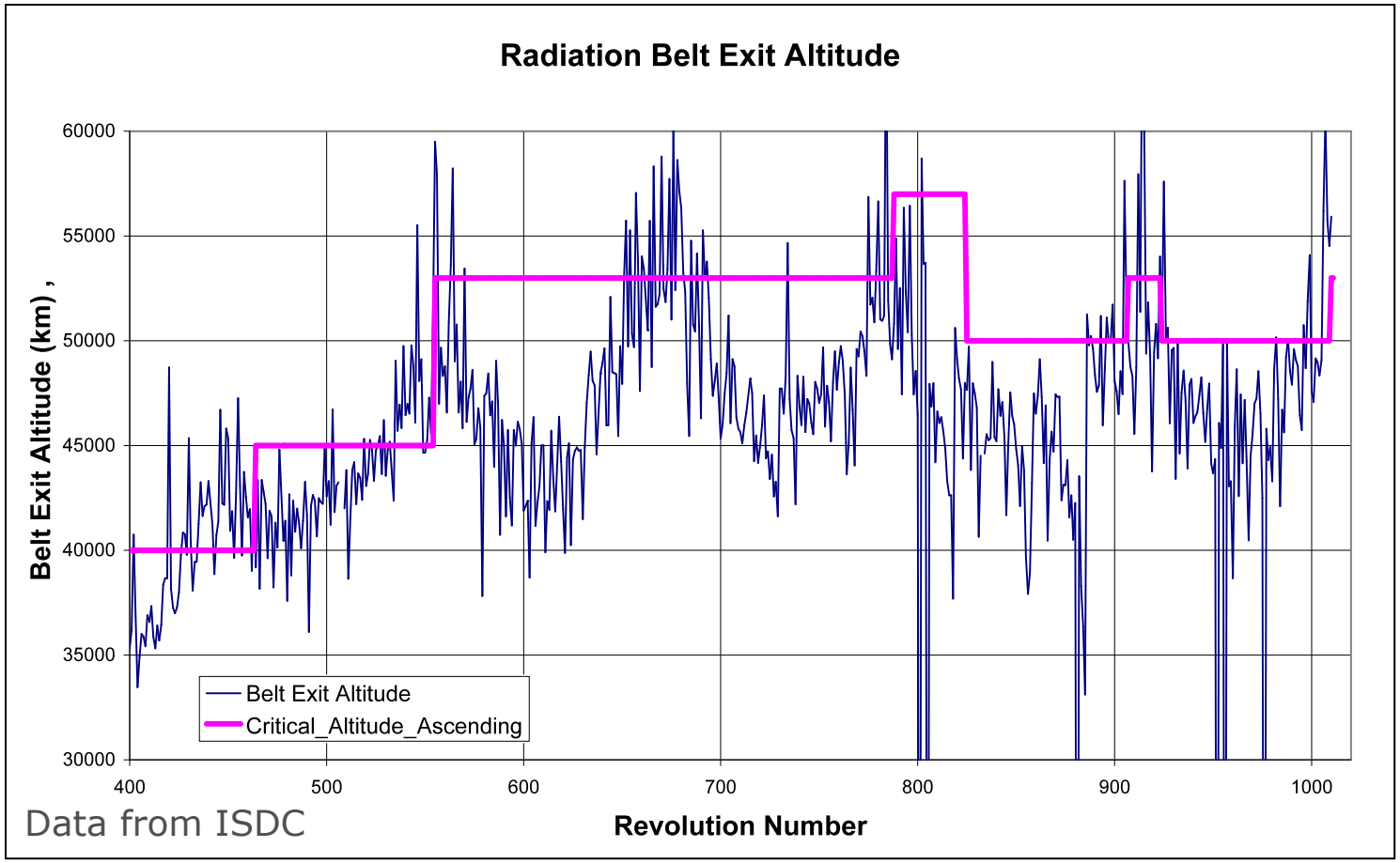
Orbital Evolution

- Significant changes in inclination and perigee height.



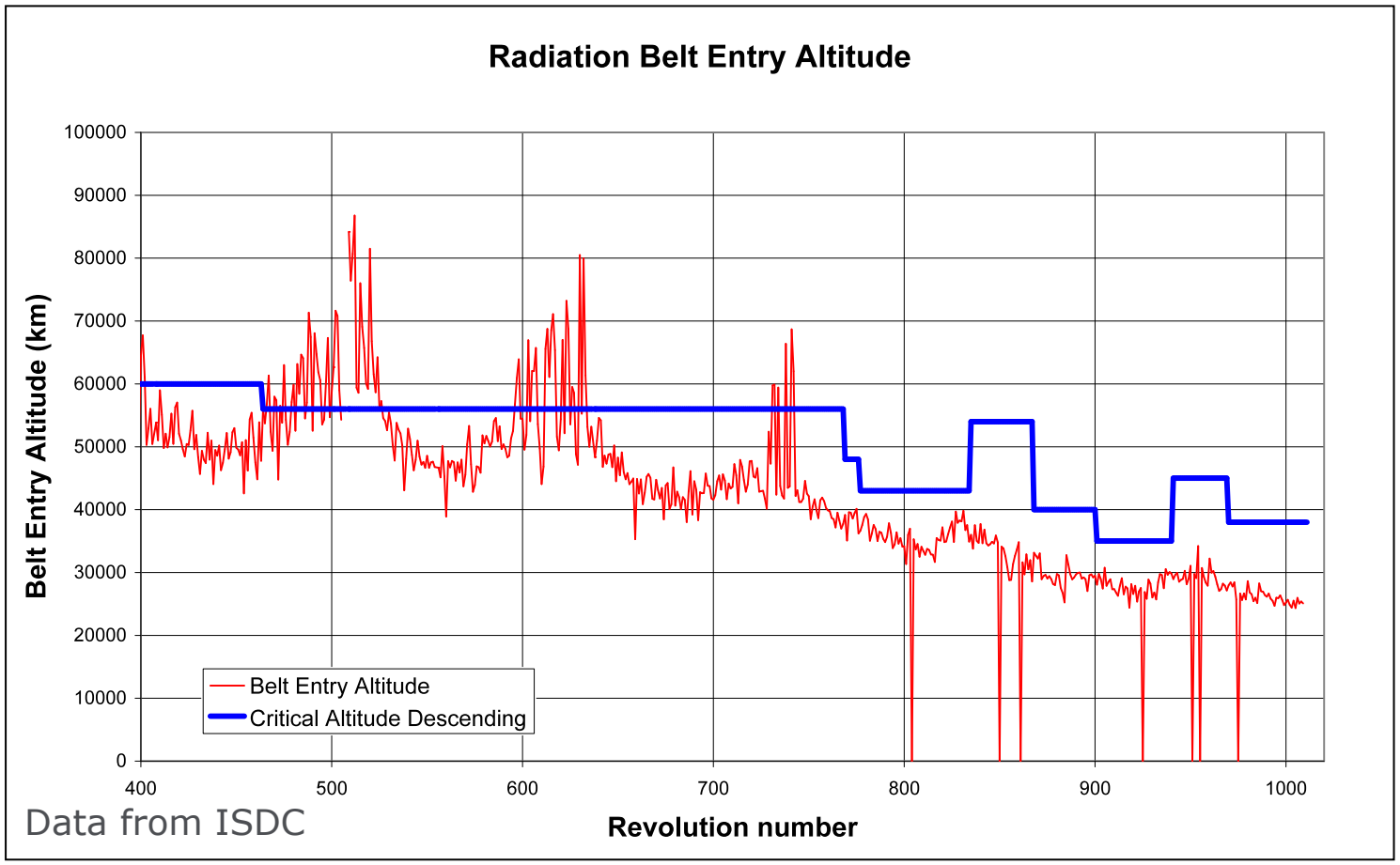
Belts History

- Seasonal and Long Term Evolution of Belts Exit Altitude.



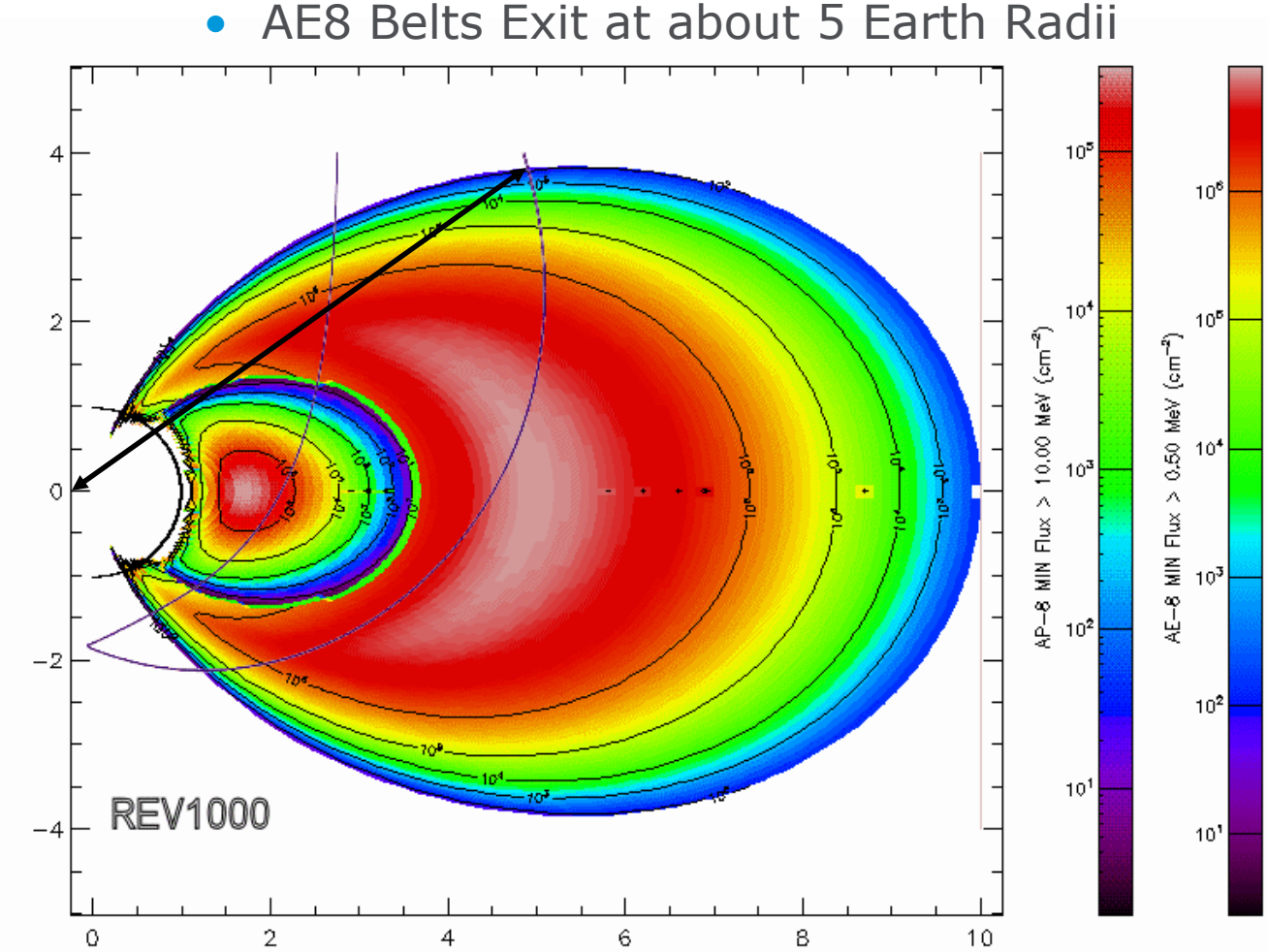
Belts History II

- Seasonal and Long Term Evolution of Belts Entry Altitude.



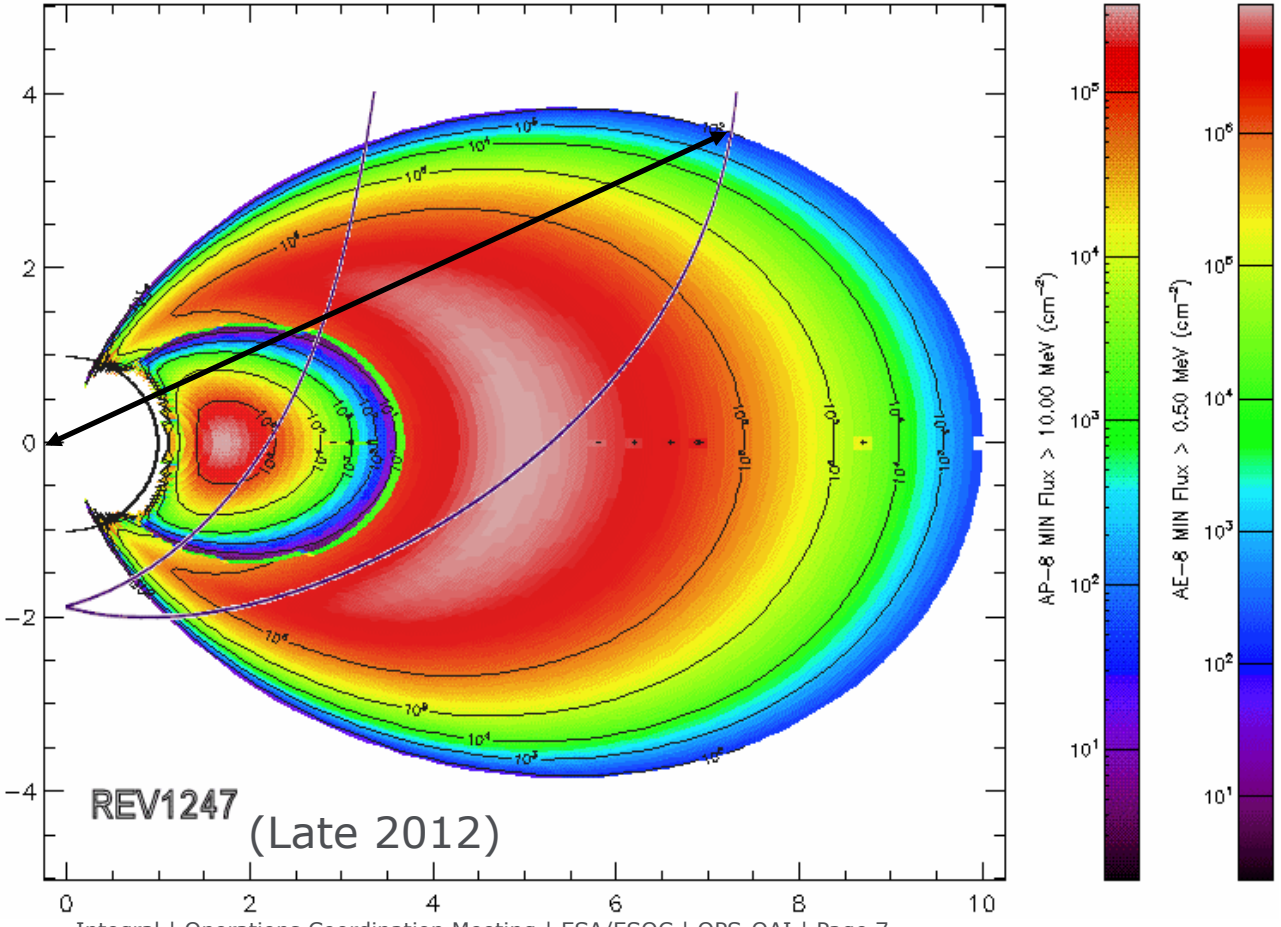
Belts Future

- Integral Passage through Belts revolution 1000.
  - AE8 Belts Exit at about 5 Earth Radii



Belts FutureII

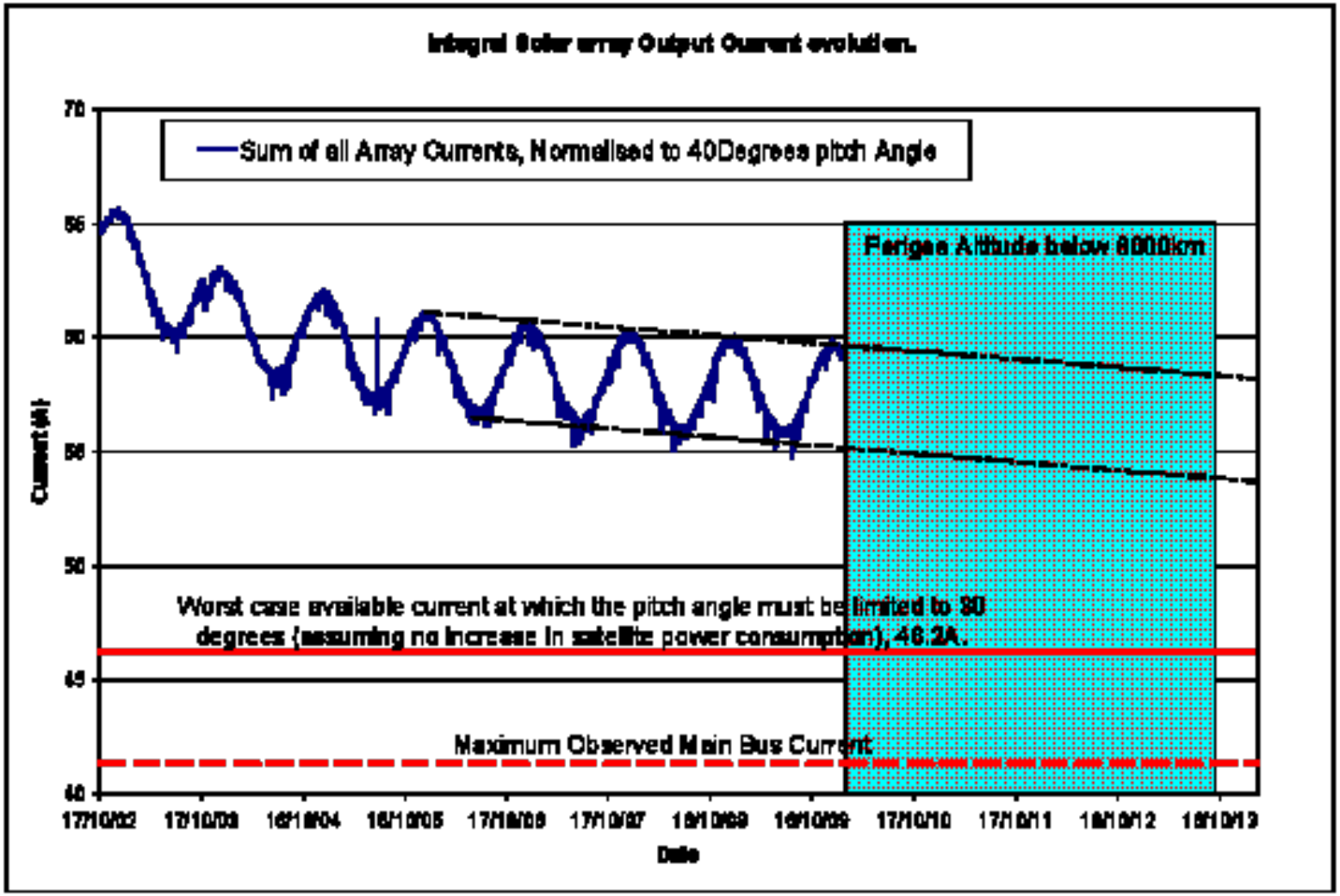
- Integral Passage through Belts revolution 1247.
  - AE8 Belts Exit at about 6.7 Earth Radii



Belts FutureIII

- In the next 2 years
  - Belts exit Altitude will increase (with a seasonal evolution superimposed on it)
  - This will lead initially to a later instrument activation
  - Belts Entry altitude will increase only slightly
  - Currently the belts entry is well below the Instrument switch off time.
- Long term as the Perigee altitude increases the belts exit will time will become earlier again.

Solar Arrays

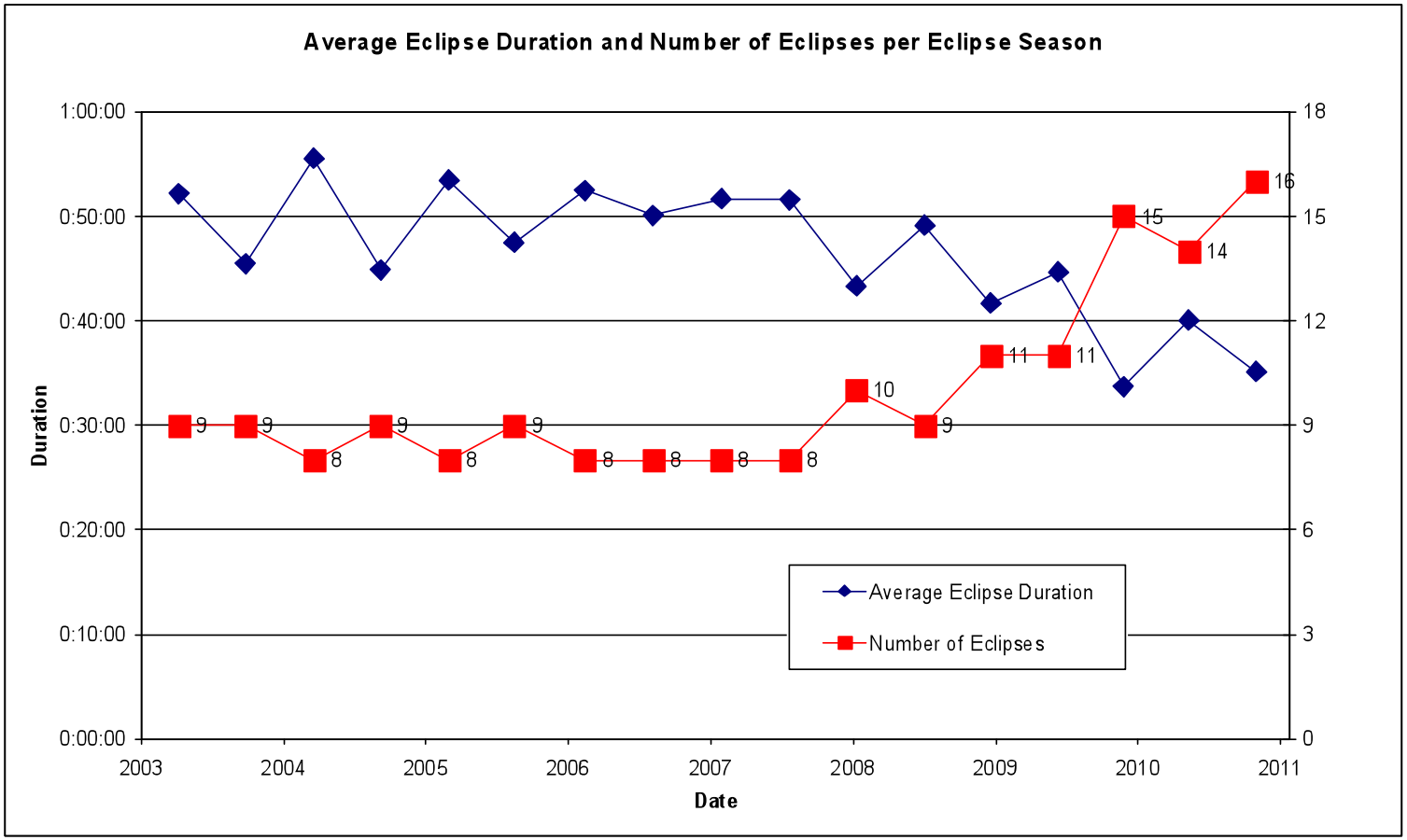


Solar Arrays

- Currently Sufficient Margin to Operate without Constraints.
- TBD margin Available in 3 years time
  - TEC-EPG study ongoing (with XMM) to try to determine the future Evolution and margin
- In case the low power margin is reached:
  - ALENIA recommend more stringent pitch angle constraint (40degrees to 30degrees). How “hard” is this recommendation?, we only need to accommodate relatively short duration peak demands in power.
  - Initially the constraint may need to be valid in eclipse season only (extra power needed for battery recharge).
  - Use of lower battery charge rate could also “buy” us more time.

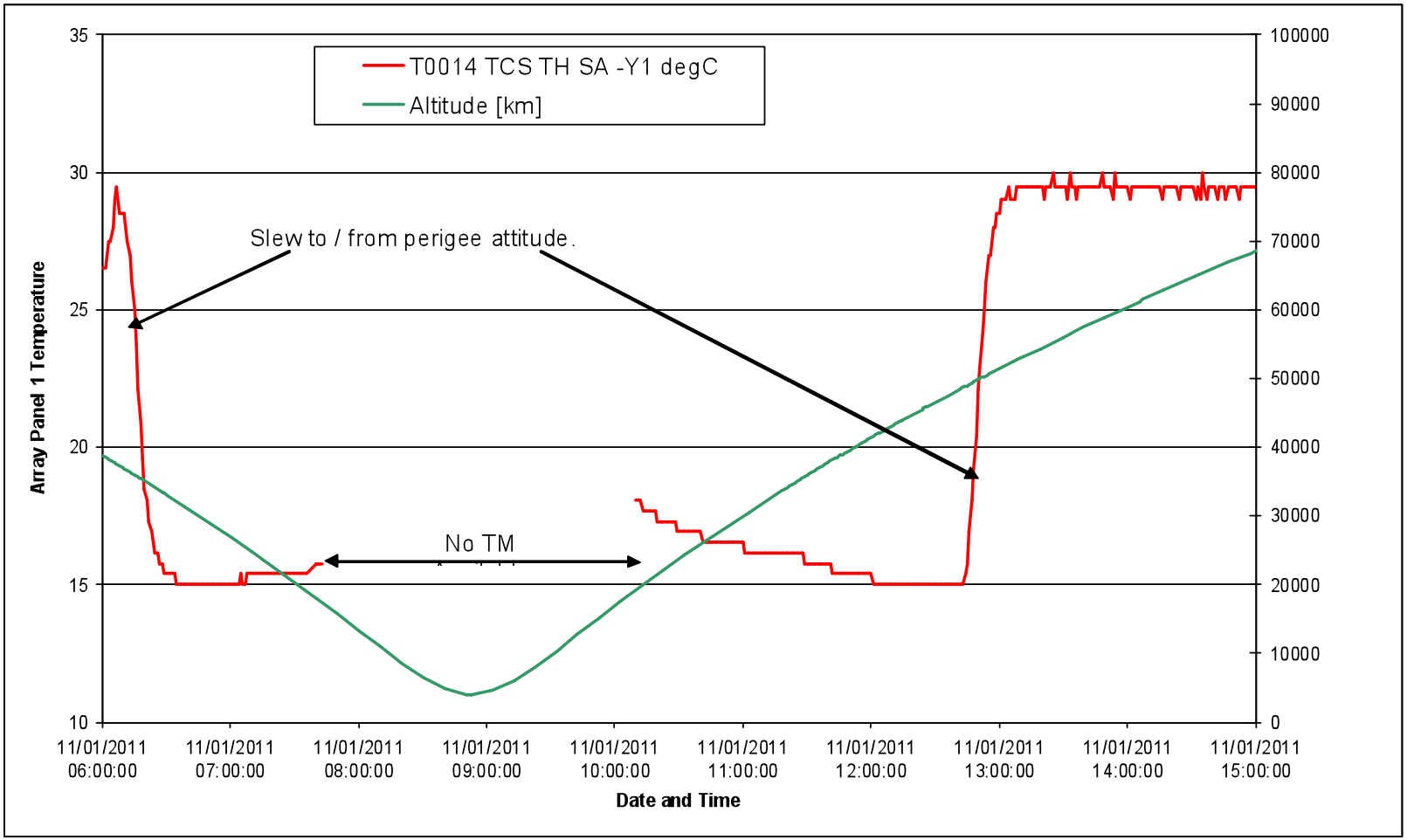
Other Effects

- Eclipses



Other Effects

- Earth Albedo effect on Arrays



Handling of Belt / Entry / Exit Adjustment

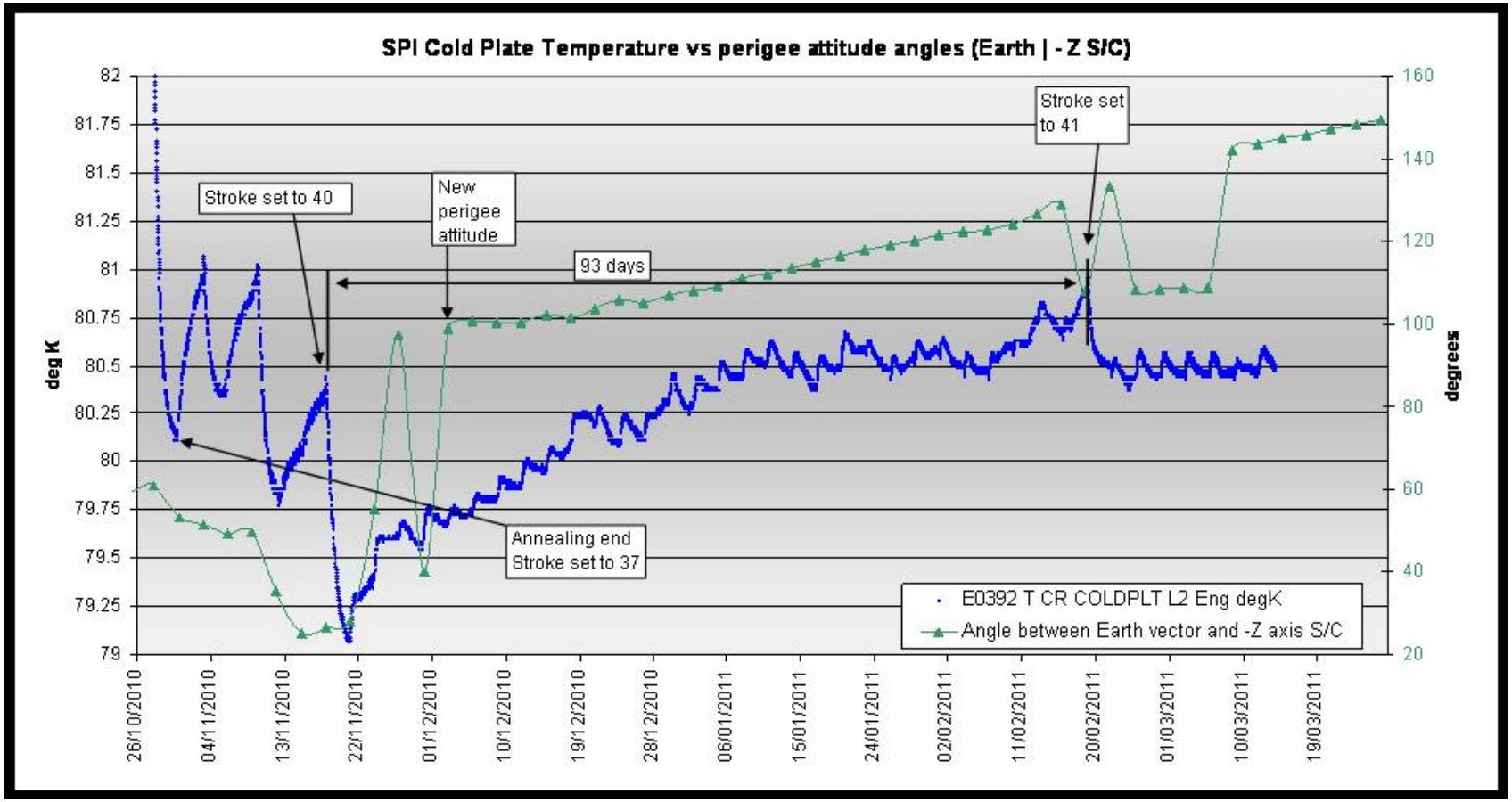
- MOC have tried (on a low effort basis) to predict the belts evolution in order to optimise science time.
  - Based on historic behaviour
- MOC lack Expertise, Manpower, Visibility of Science Data (VC-7)
- Input required from PIs / ISDC
  - As done by IBIS in January
- Co-ordination by ISOC?
- Notification via OCR?.
  - Emergency case, contact SOM.

Handling of Belt / Entry / Exit Adjustment

- Constraints:
  - MOC require at least 1hour 30 minutes hours to ensure safe Instrument deactivation at perigee entry before LOS – particularly critical with current proton Belts passage
  - MOC require at least 2hours 7minutes after AOS at perigee exit to activate Instruments etc. (45 minutes extra in eclipse season after latest of AOS and Eclipse exit).
- In emergency case activation can be stopped and executed manually later
- Urgent case – the PSF can be regenerated and forwarded to SOC (a few revolutions in advance?) to trigger a replanning – "few" TBC by FD
- Planned non urgent case require about 1 months notice (PSF generation)

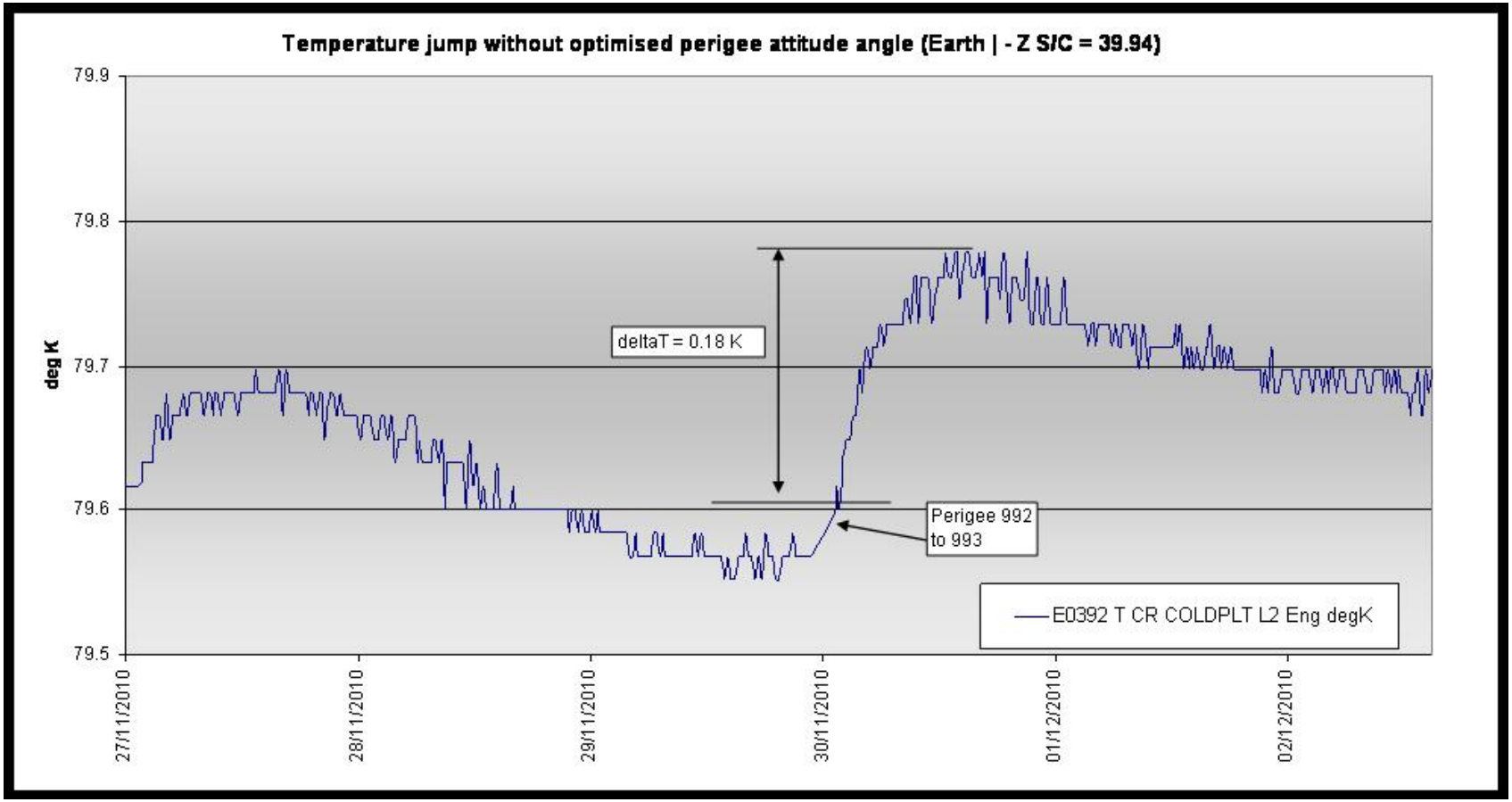
SPI Temperature Evolution at Perigee I

- **Compressor Temperature evolution:**



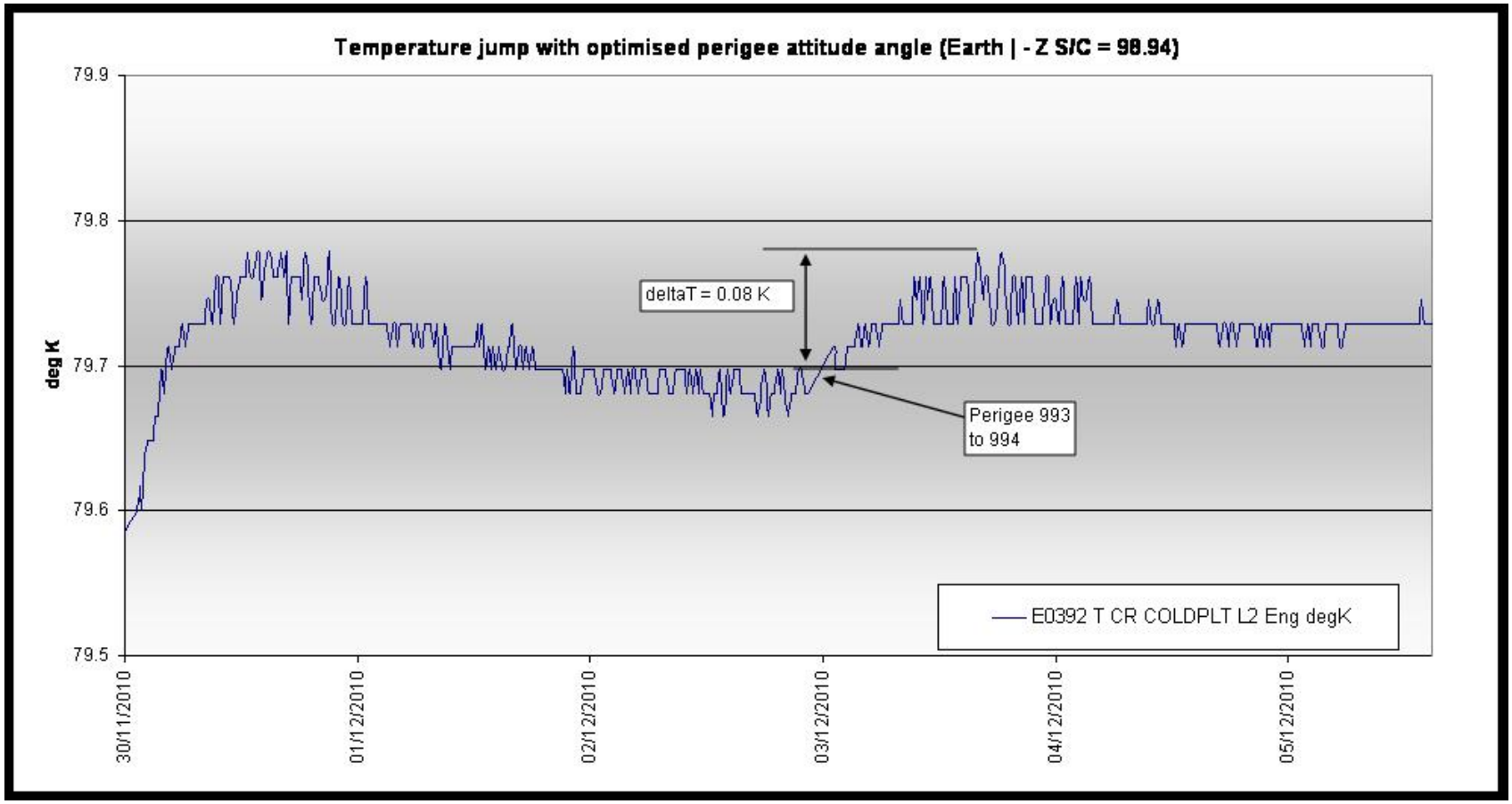
SPI Temperature Evolution at Perigee II

- **Compressor Temperature evolution:**



SPI Temperature Evolution at Perigee III

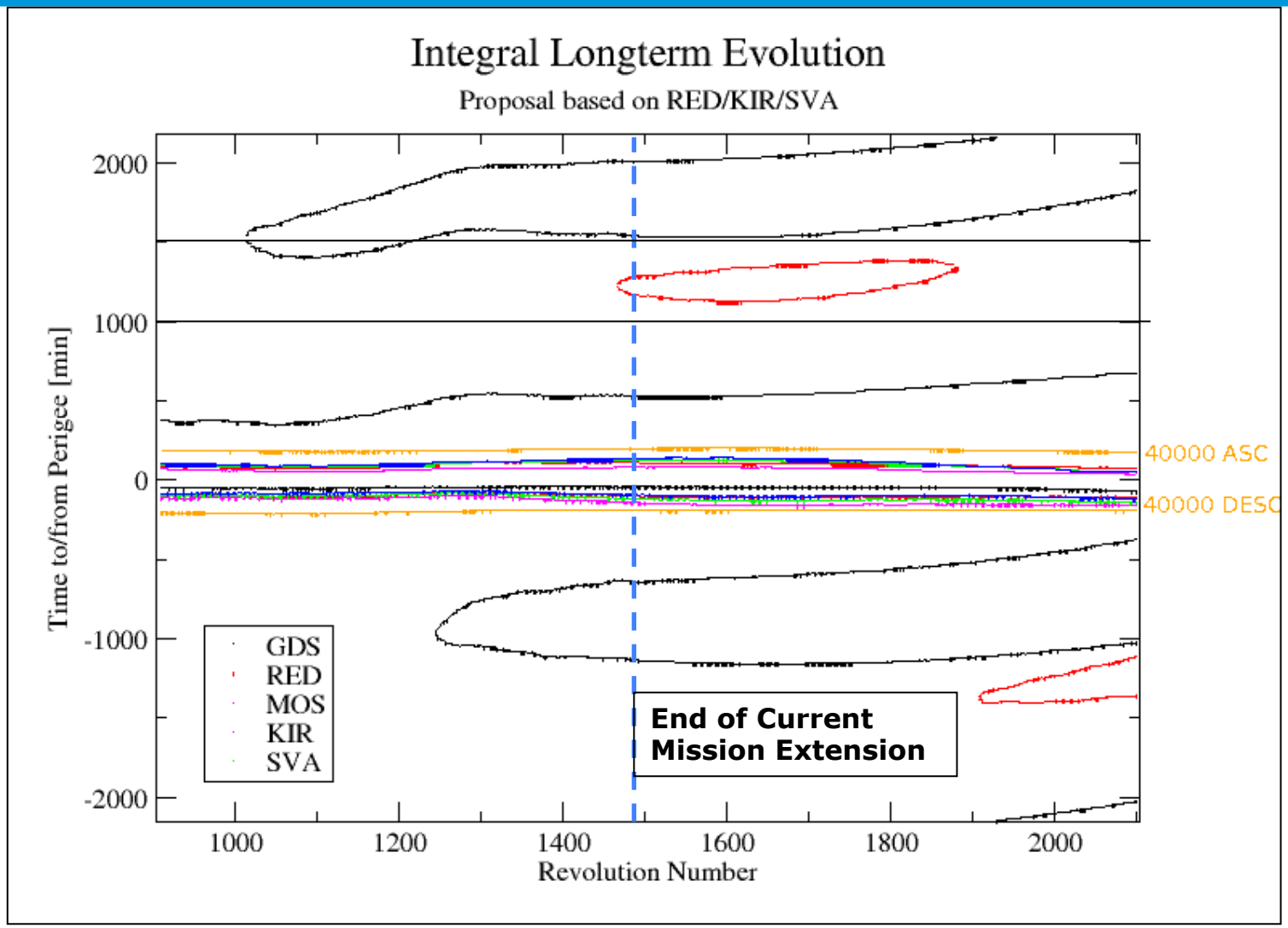
- **Compressor Temperature evolution:**



SPI Temperature Evolution at Perigee IV

- FD supply recommended perigee attitude in PSF
  - Attitude at which the angle between S/C –Z axis and earth limb is maximised, as far as allowed by other constraints
- Occasionally implies large slews to / from perigee attitude
  - Takes some time
  - Negligible effect on fuel consumption
- Do we need to use this optimised perigee attitude all year?
  - Illumination of Antarctica changes
  - Test now and at Summer solstice with non optimised attitude?

REDU visibility Gap



REDU visibility Gap II

- Dates (very approximate):
  - Starts in September 2014 (revolution 1460)
  - Ends in March 2018 (Revolution 1880)
- Duration (very approximate):
  - At end of 2014 about 2 hours
  - Maximum about 4 hours in 2015/ 2016
- Cannot be closed by Orbit control
- High latitude Station Needed:
  - Kiruna (ESA) - feasibility study ongoing:
    - Probably technically possible
    - Station availability unknown (many competing users)
  - Svalbard
  - DSN
  - Moscow