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# Hardware Status and AIRS Calibration Activities

**Denis Elliott**

**October 16, 2015**



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# AIRS Status

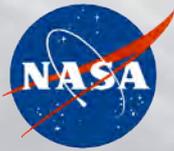


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# AIRS Operational Status

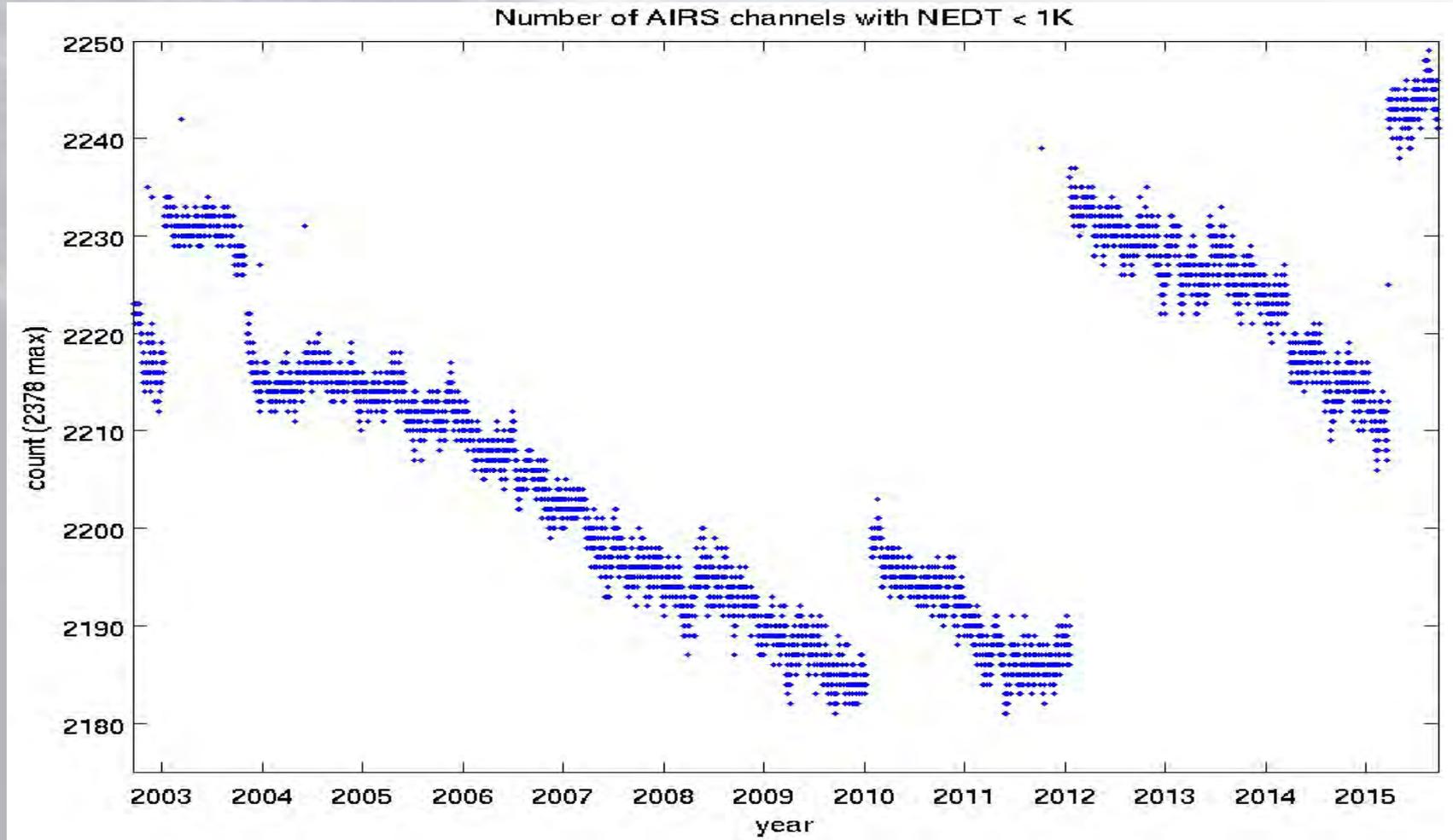
- **AIRS is in excellent health**
- **All available engineering parameter plots versus time are either flat or changing extremely slowly—no concerns**
- **Cooler A status remains unchanged since the anomaly of March 2014**
  - *Cooler does not update engineering telemetry or respond to commands*
  - *Compressor is running and focal plane temperature is as desired*
  - *Science data quality remains excellent*
- **A new detector gain table was uploaded on March 23, 2015**



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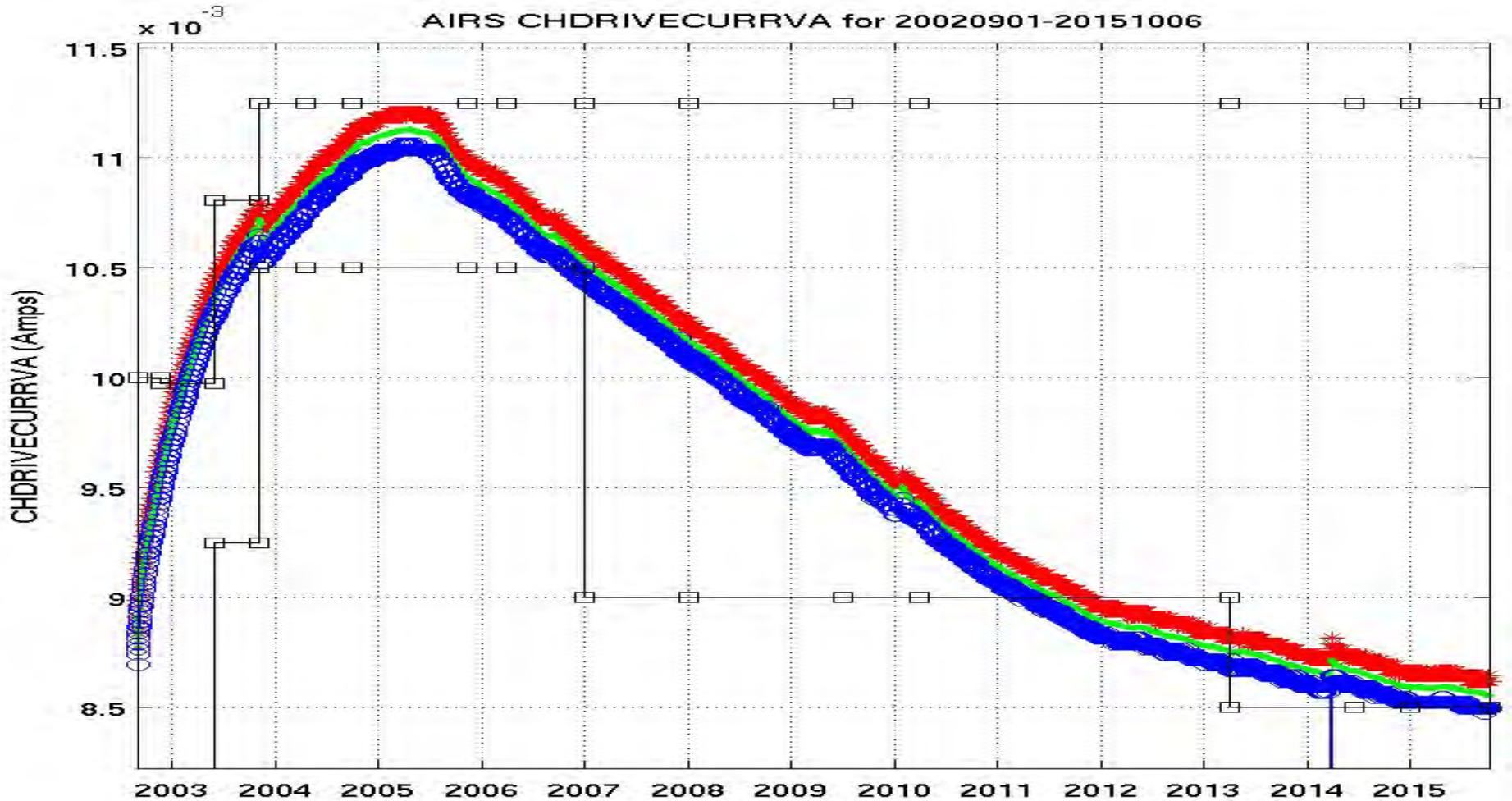
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# Number of AIRS channels with $NE\Delta T < 1K$





# AIRS Chopper Drive Current

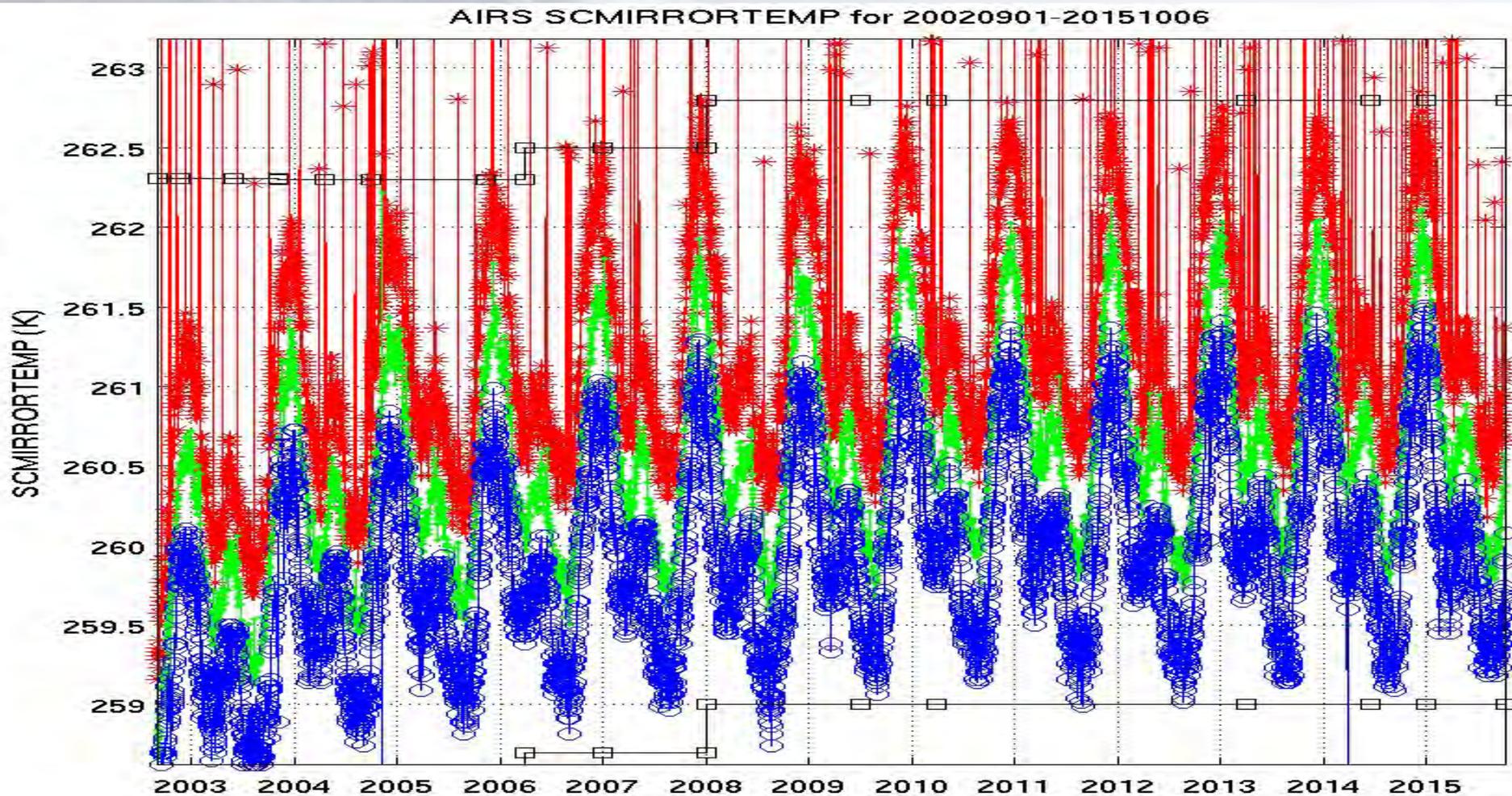




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# AIRS Scan Mirror Temperature



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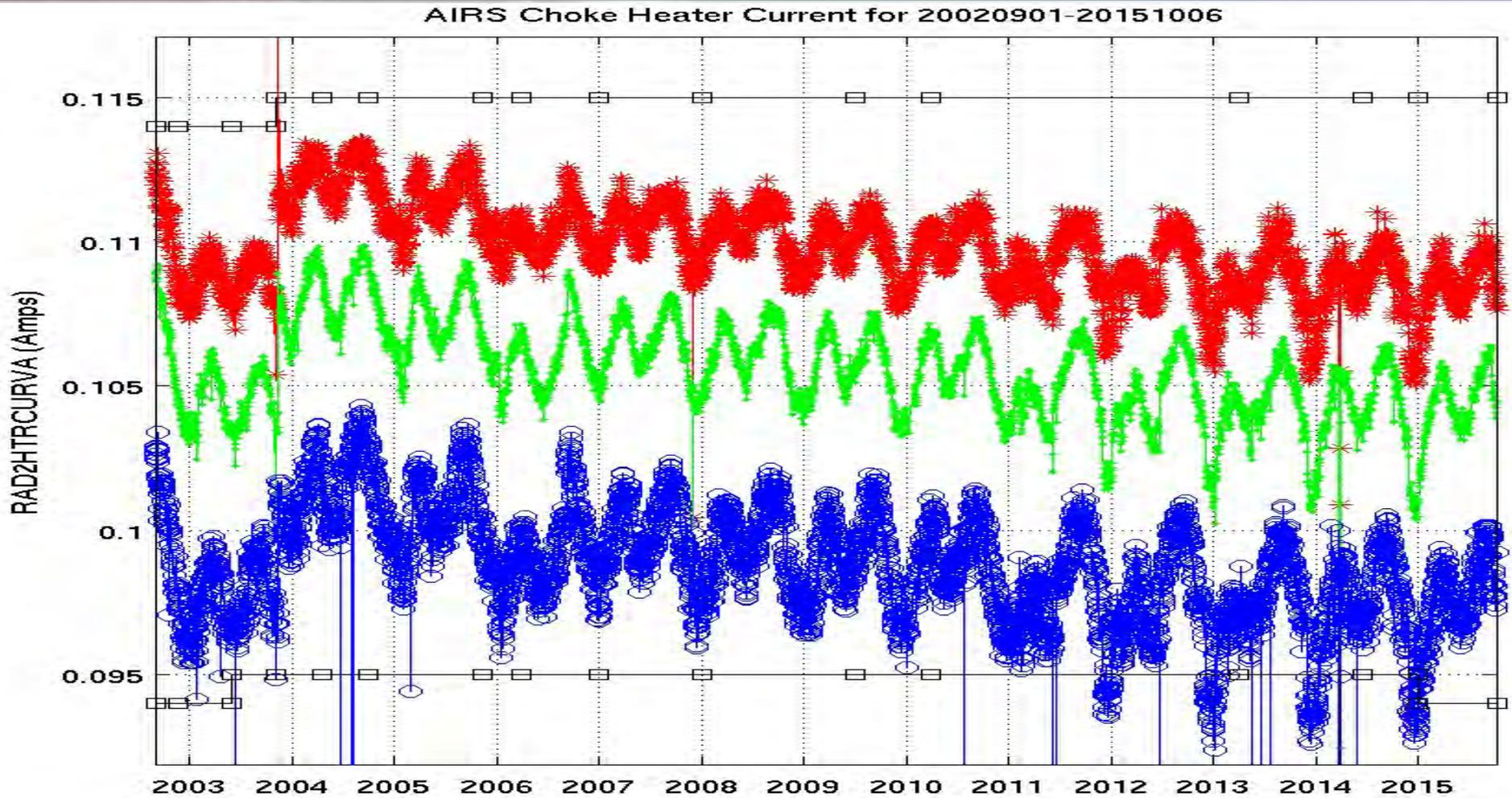
Operations and Calibration status  
AIRS Science Team Meeting  
October 13–16 2015 Greenbelt MD



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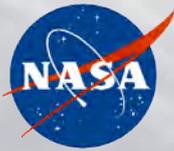
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# AIRS Choke Point Heater Current



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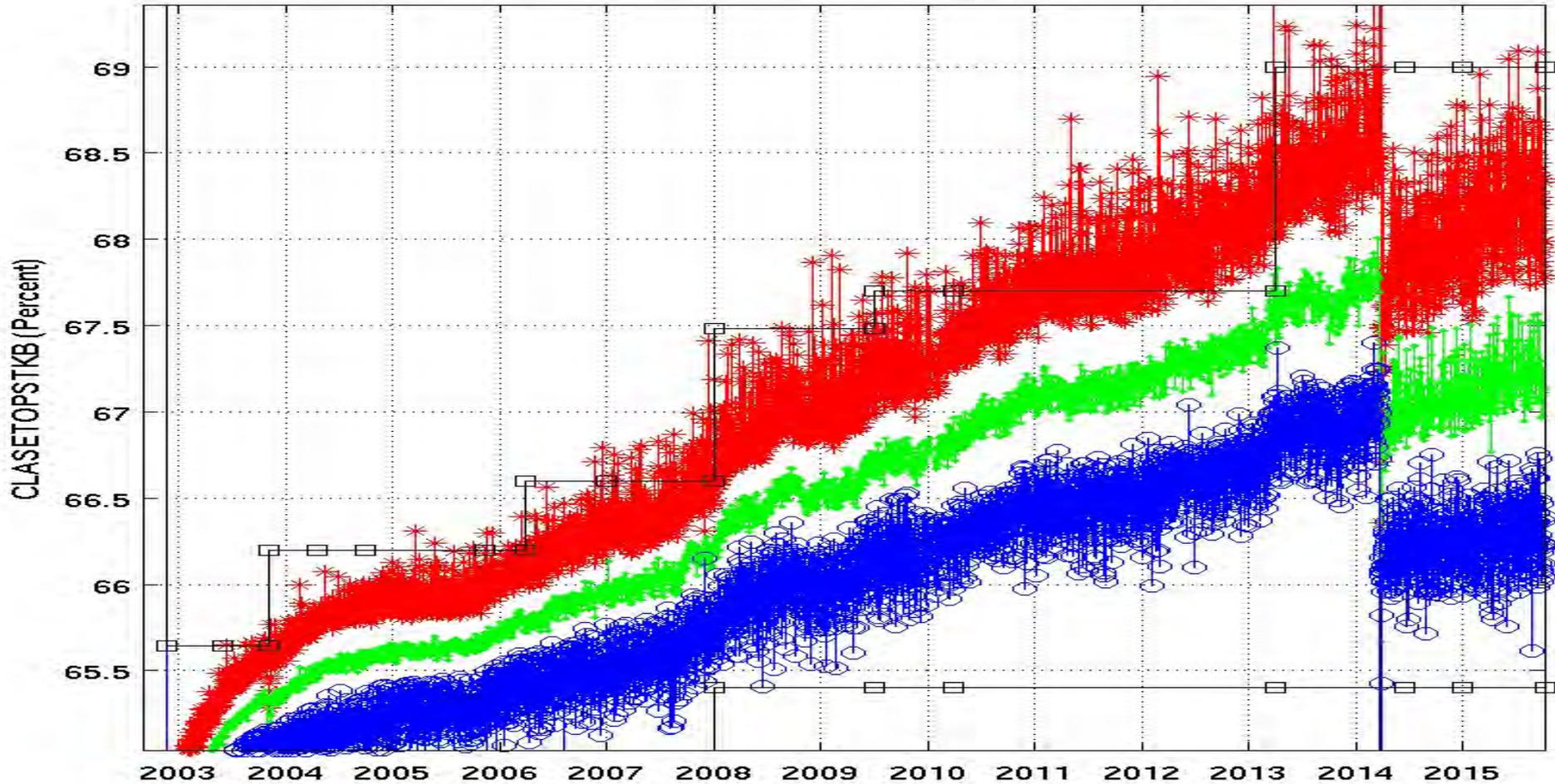


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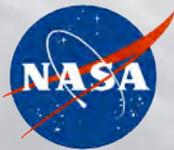
# AIRS Cooler B Drive Level

AIRS Cooler B Drive Level for 20020901-20151006



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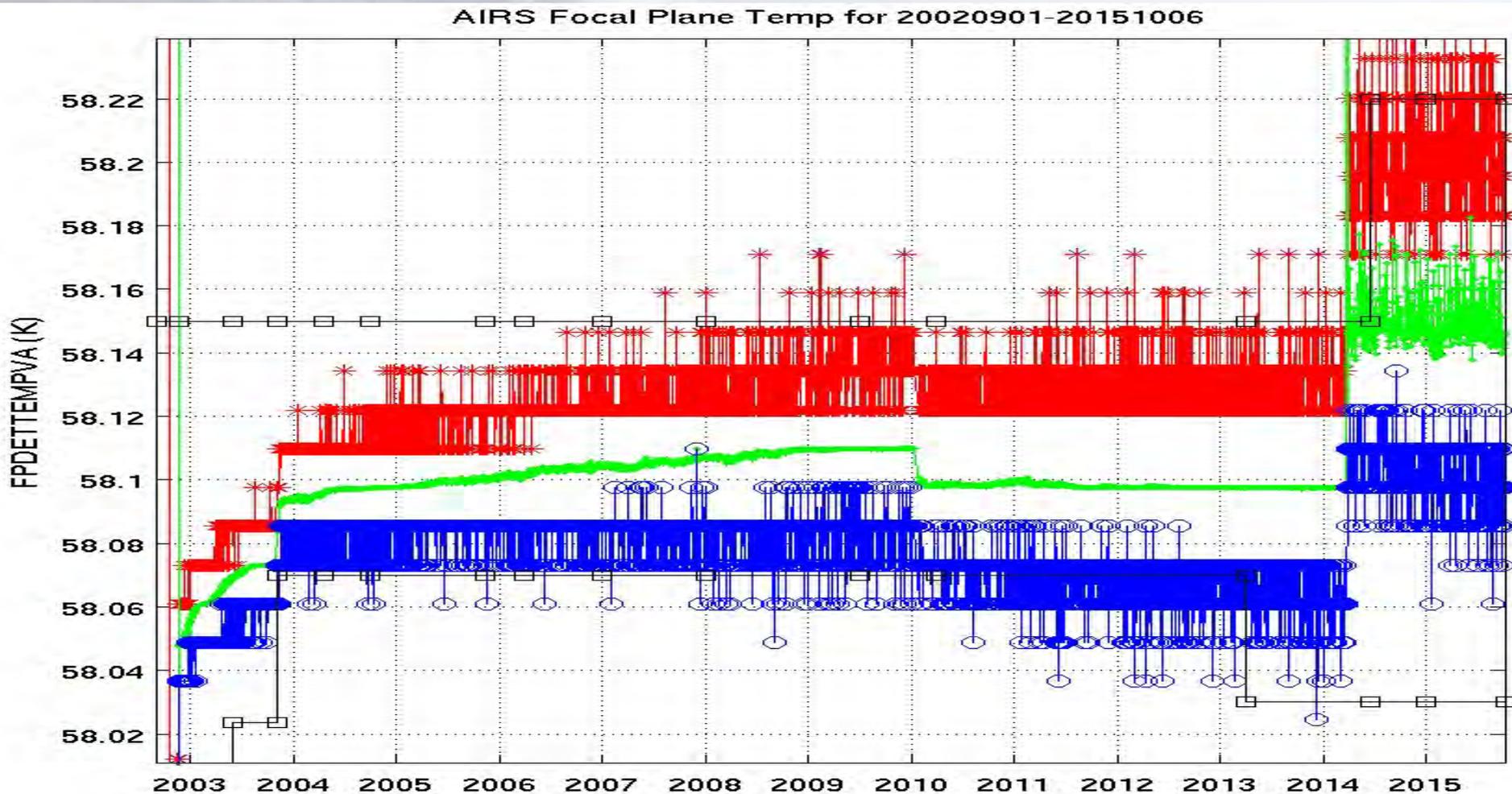
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# AIRS Focal Plane Temperature

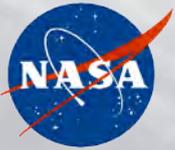




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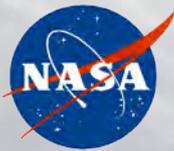
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# AMSU-A Status



## AMSU-A Operational Status

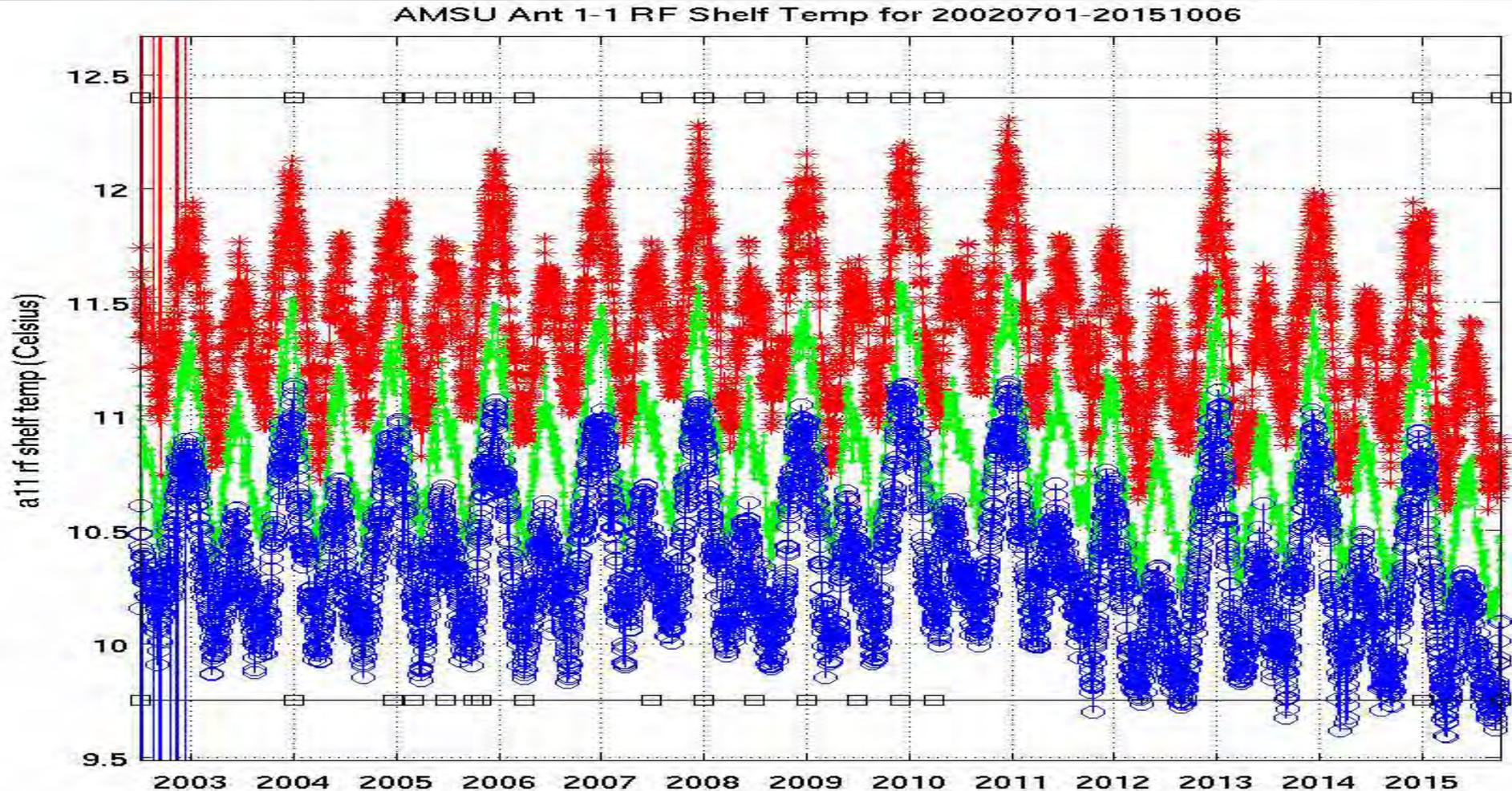
- **AMSU-A mechanical parts and most of the electronics are in good health**
- **All engineering parameter trends are slow**
- **The A1-1 and A1-2 scanner currents are rising, but very slowly and are not alarming**
- **9 of the 15 channels are healthy, but**
  - *Channel 4 failed in 2007 (declared non-operational on October 1 2007)*
  - *Channel 5 is now too noisy to contribute to Level 2*
  - *Channel 7 noise has exceeded specs since launch and has never been used for L2*
  - *Channel 6 has been degrading since 2008, but is still a good channel*
  - *Channel 1 began degrading in January 2012, seemed to recover, but is now degrading again*
  - *Channel 9 experienced occasional small bursts of noise early in the mission and is now experiencing them again*



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# AMSU-A1-1 RF Shelf Temperature



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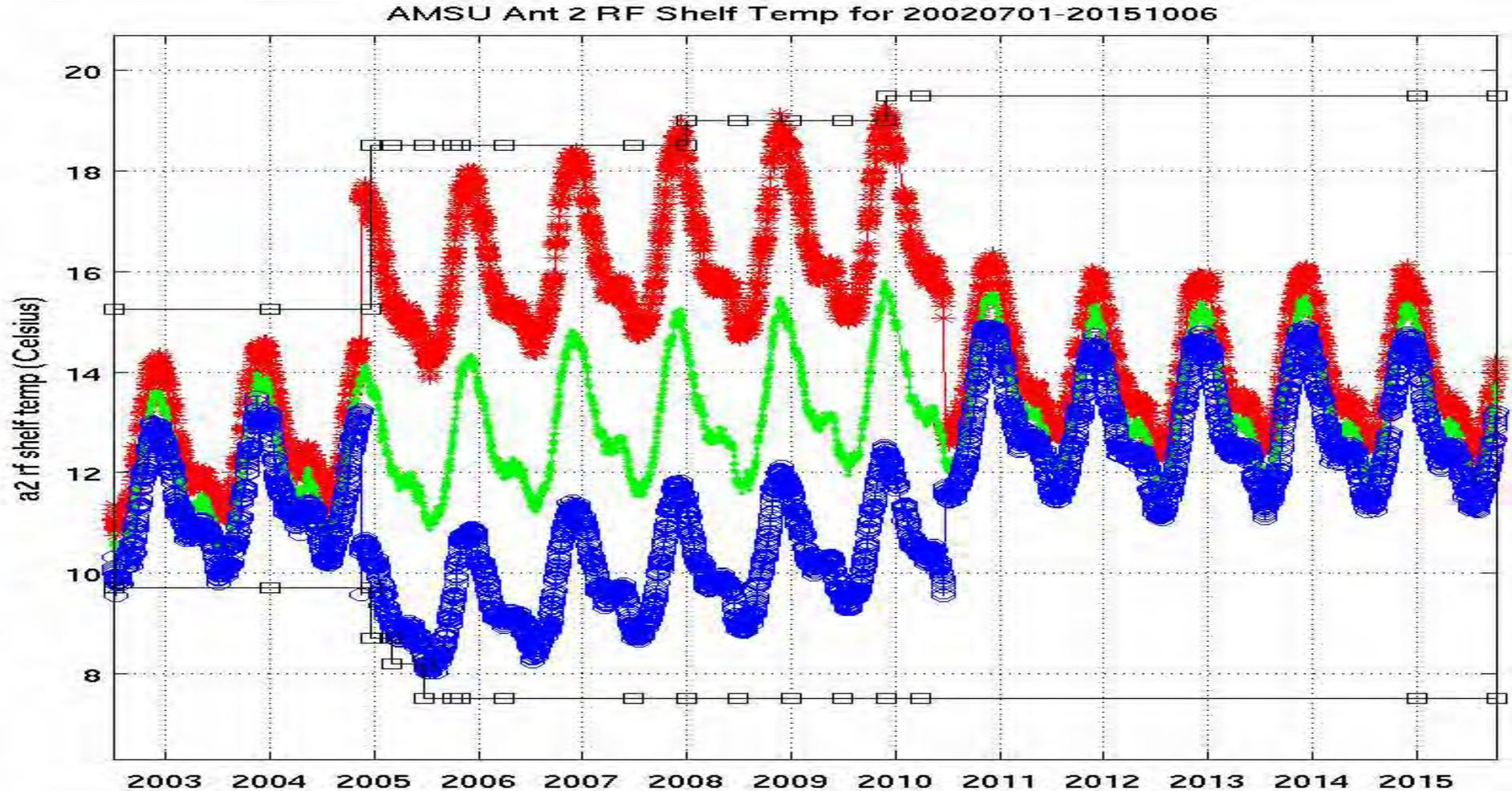
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# AMSU-A2 RF Shelf Temperature



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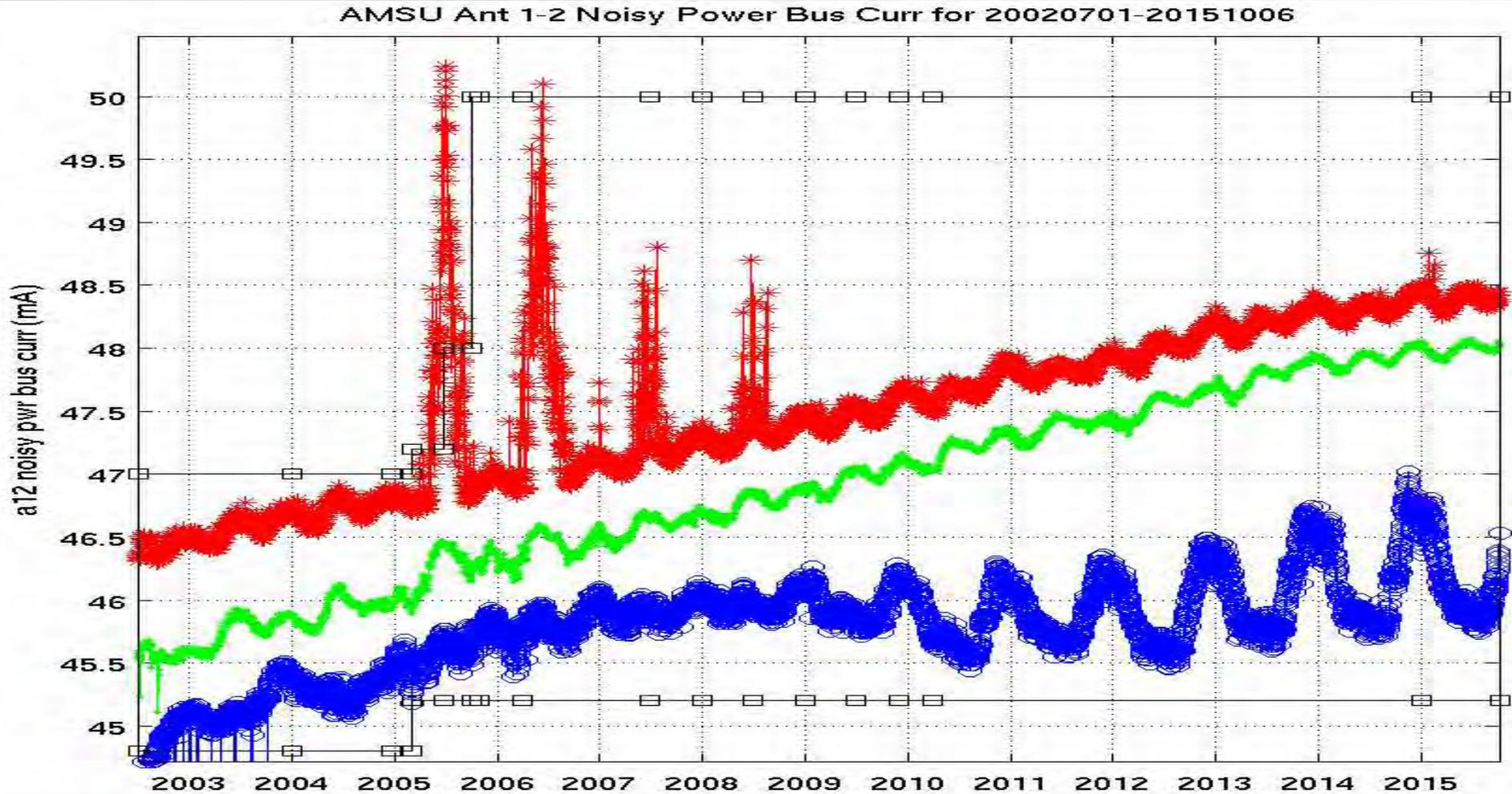
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# AMSU-A1-2 Noisy Bus Current

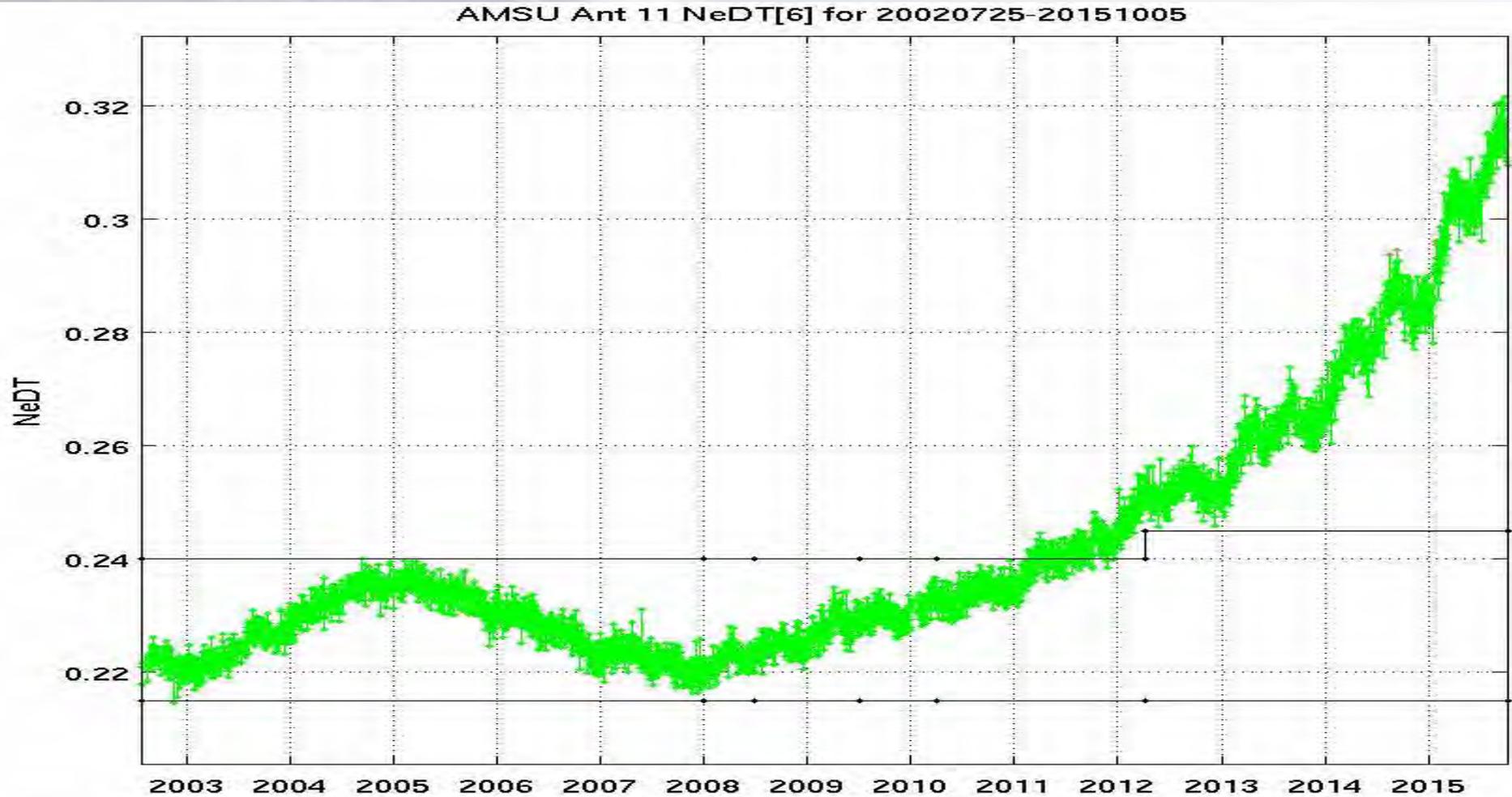




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# AMSU-A Channel 6 NE $\Delta$ T

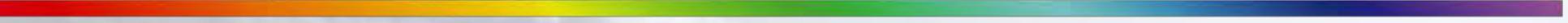




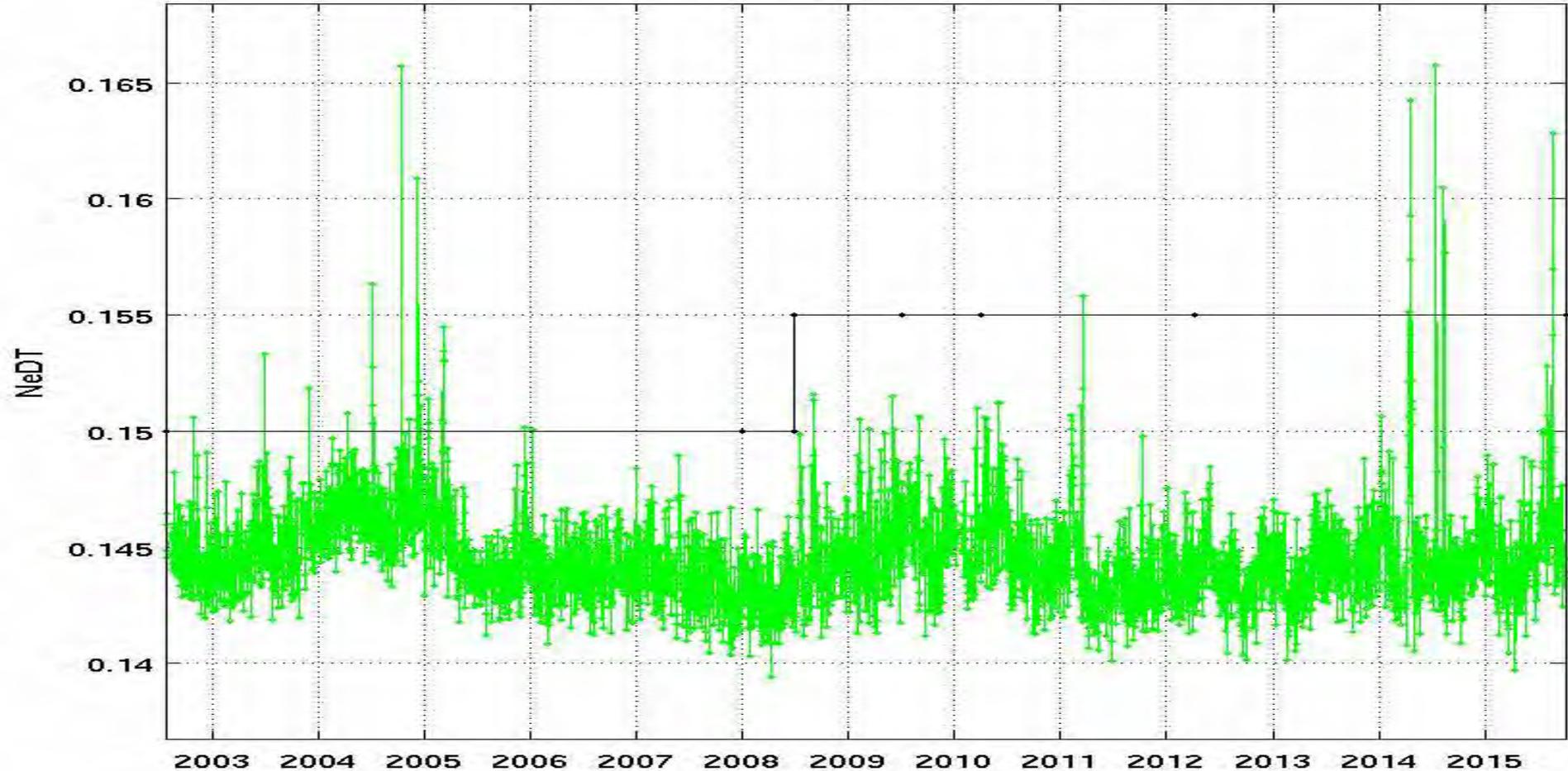
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# AMSU-A Channel 9 NE $\Delta$ T



AMSU Ant 11 NeDT[9] for 20020725-20151005

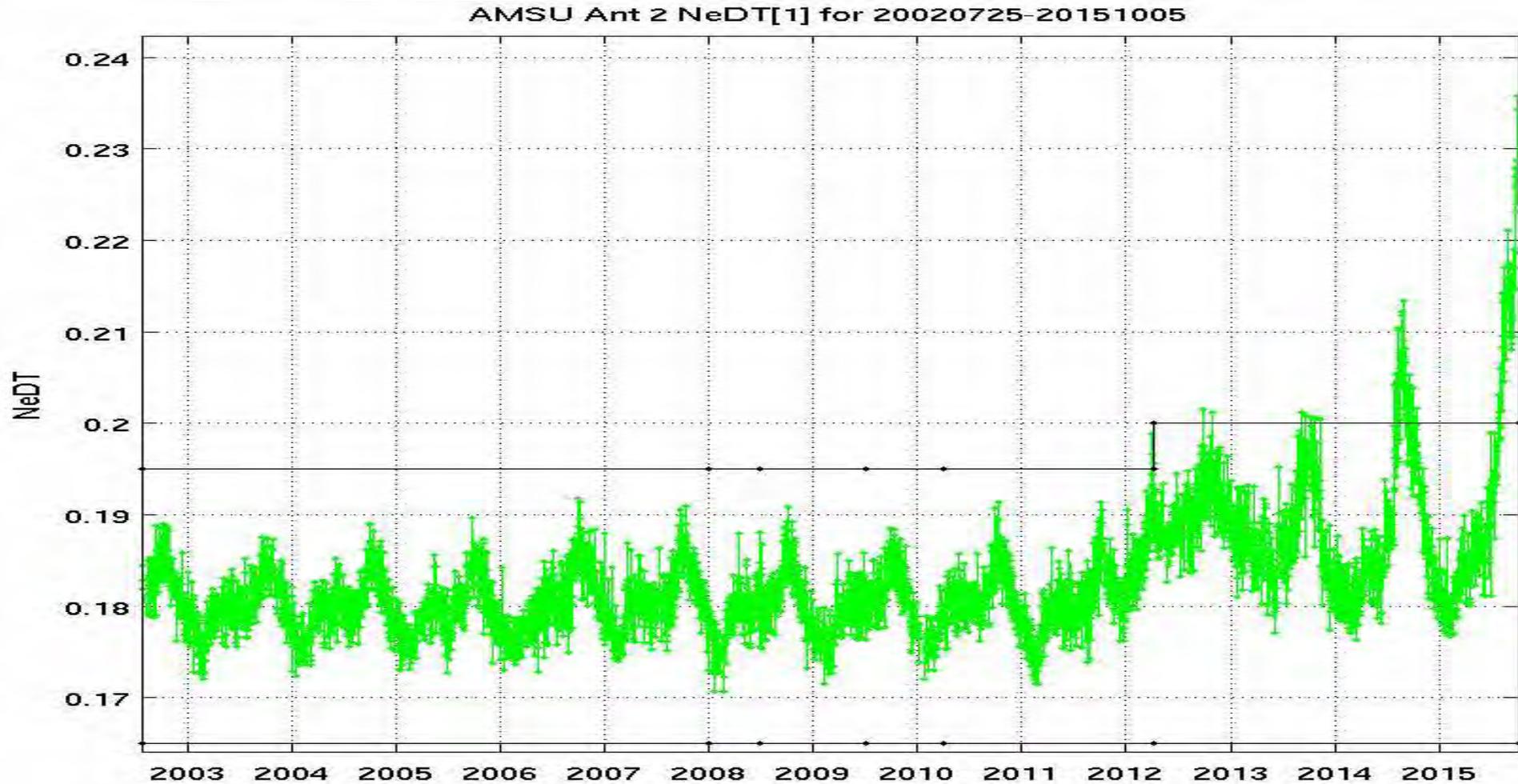




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# AMSU-A Channel 1 NE $\Delta$ T

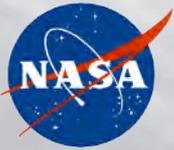




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# Aqua Status And Anomalies



# Aqua Spacecraft Health Status

- Aqua is in very good health
- Several anomalies have occurred over the years, but none have impacted operations yet
  - **Solar array**
    - Potentiometers used for orientation are noisy
    - Thermistor failure on one panel
    - Solar cell arrays
      - *have lost 11 strings of solar cells (out of 132 on the spacecraft)*
      - *there is no impact to mission operations at this time*
  - **FMU/SSR hardware timeouts**
  - **Battery**
    - Pressure too high early in mission but now in control
    - Power from one cell behaved erratically for several years but now seems OK
    - Temperature of one cell was high for part of a day
  - **Computer memory bit errors**

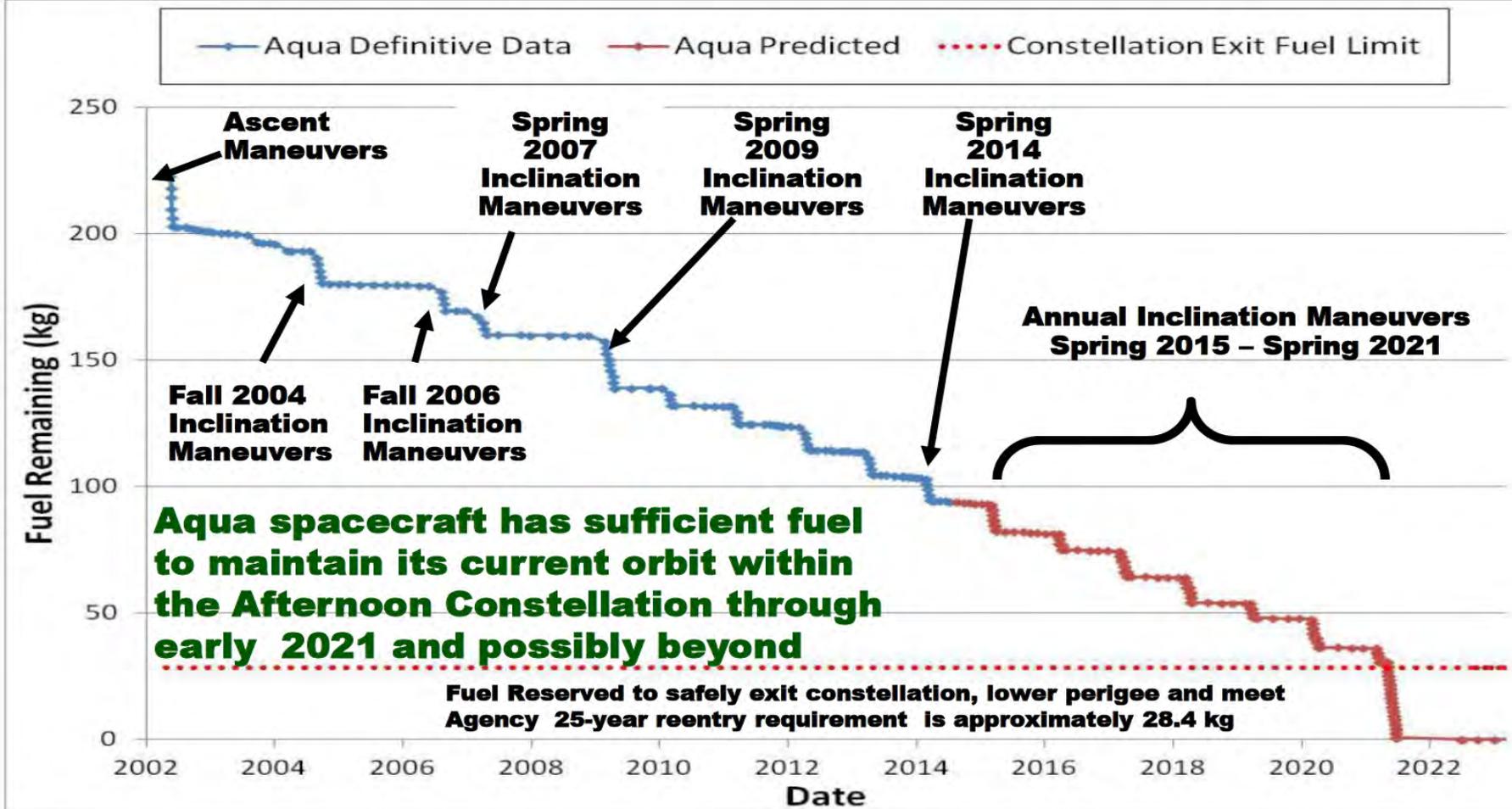


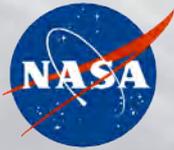
## Aqua Fuel Supply

- Occasional drag make up burns use only a very small amount of fuel
- Most fuel usage takes place in orbital inclination adjustment maneuvers, needed to keep Aqua properly aligned with other A-train instruments and to tightly control our 1:30 pm crossing time
  - *Three or four such maneuvers are planned every year, near the vernal equinox*
  - *The most recent estimate of future fuel usage indicates that the hydrazine should last at least until 2021, and possibly longer*
  - *The plot on the next page was made before the Spring 2015 inclination adjustments, but it is the most recent available*



# Projected Aqua Fuel Usage

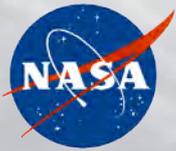




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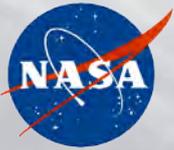
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# AIRS Calibration Status



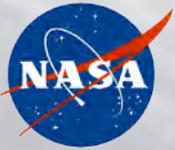
## Calibration overview

- **The AIRS radiances exceed the pre-launch requirements in both accuracy and stability**
- **We would like to push both accuracy and stability as far as we can, to improve the utility of AIRS for climate studies, cloud properties, and atmospheric dynamics studies**
- **A number of easy-to-implement improvements are being made for V7**
- **There are several bigger-ticket items that will be listed in the next two slides**
  - *(Probably interrelated) issues that are being actively worked*
  - *Issues that remain on the back burner because of resource limitations*



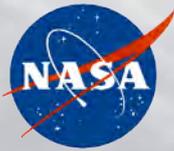
## Issues being actively worked

- **IR radiance trends**
  - *Trends have been observed in the short-wave channels for warm scenes*
  - *Trends in window channels differ from channel-to-channel, day vs night, and with latitude*
- **Systematic differences between A detectors and B detectors seen in modules 5–10 with by far the largest effects in M8**
- **$C_{ij}$  problems and possible ways to reduce their impact**
- **Spectral calibration changes with time**
- **Detailed comparisons with IASI and CrIS**
- **Vis/NIR calibration changes—old Gaiser correction to Vis channel 1 is clearly no longer valid as degradation has slowed**
  - *Mirror surface—effects are largest for the blue channel*
  - *Lamp illumination and stability—based on Aumann's comparisons with DCCs, it looks like lamps are surprisingly stable*
  - *Detector changes—still under investigation*



## Issues on the back burner

- **Pagano and Overoye have shown that intrinsic uncertainty in AIRS radiances should be on the order of 50 to 100 mK, but L2 optimal estimation results imply much larger errors**
  - *Knowledge of the spectral calibration?*
  - *RTA?*
  - *Cloud clearing issue?*
- **Mirror polarization characterization**
  - *Witness samples were sent for measurement, but the results were disappointing and this effort is on hold*
- **Disagreements among overlap channels (channels at similar frequencies but in different detector modules)**
  - *L1C is being used to reduce the effects*
- **Handling of space views in the L1B software**
  - *Spaceview #3 (closest to Earth's limb) may not be a reliable sample of cold space*



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## Reminder

- **The various calibration issues described are dealing with effects below the specification levels to which the instrument was designed and built.**
- **That is, we are pushing hard to make the instrument not just meet its requirements but beat them**