

# The NERC Space Geodesy Facility: QC possibilities using the routine Long-arc, Short-arc and Time bias processes

Philip Gibbs, Matthew Wilkinson (NERC SGF)

Ingrid Bayer (Degendorf TU)

ILRS workshop 14, San Fernando, Spain. June 2004.



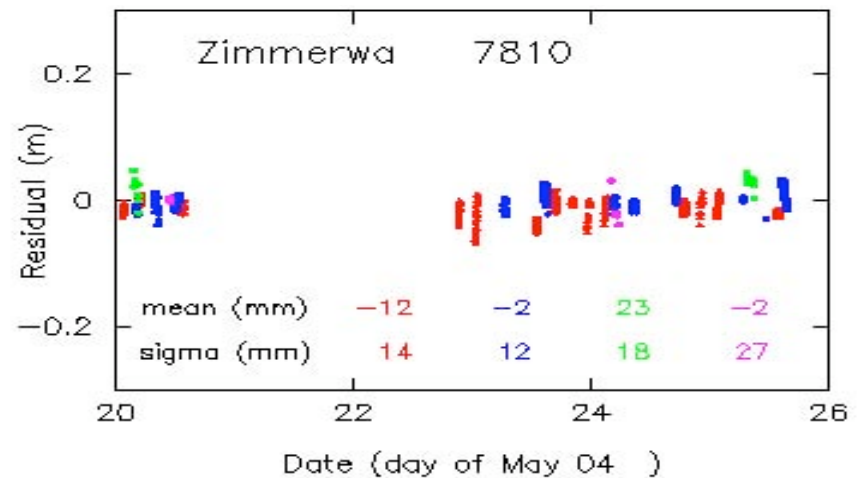
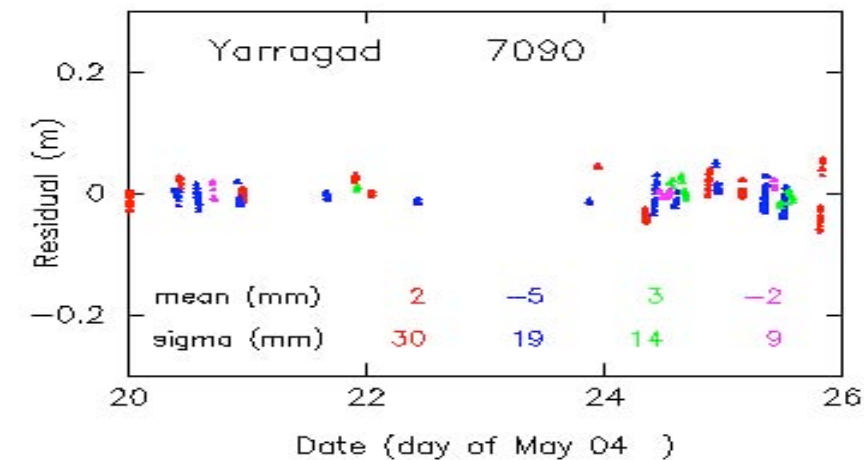
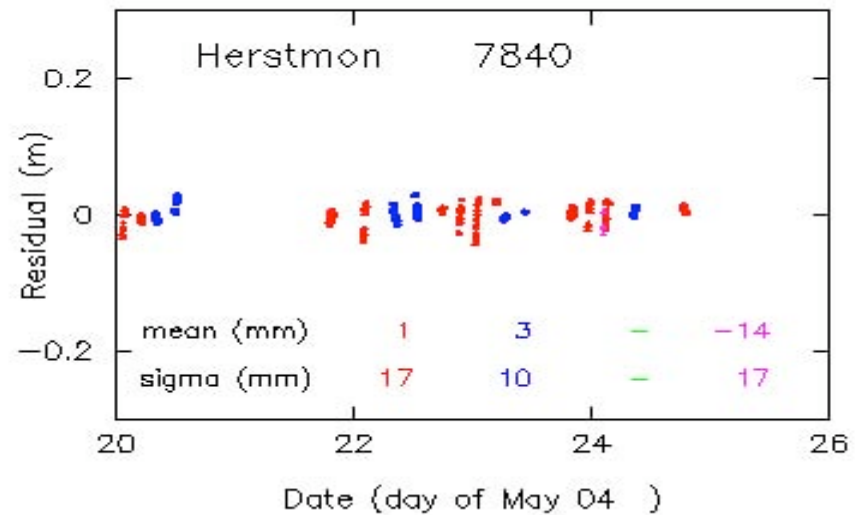
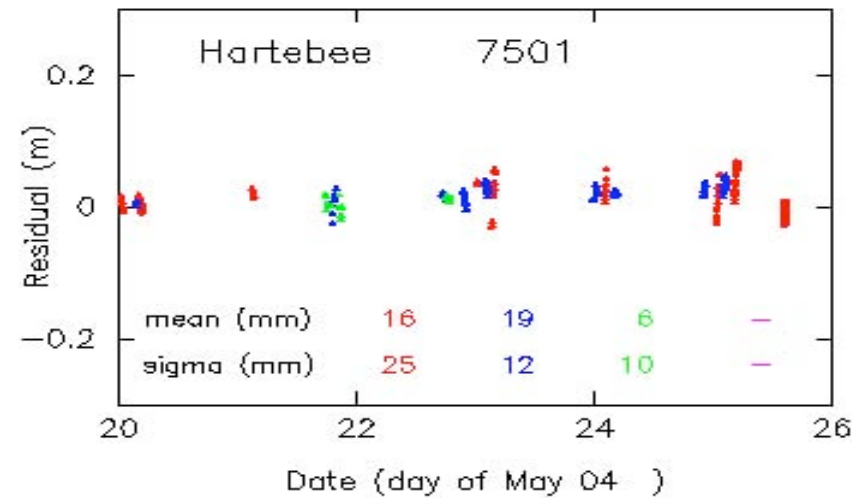
# Short-arc, Long-arc and Time Biases

- At Herstmonceux we have three automated processes that could be used to give some QC feedback to the stations on a daily or sub-daily timescale
  - Daily long-arc solutions
  - Daily short-arc solutions
  - Time biases

# Long-arc

- The long-arc solutions (six day orbits) are run once per day. We could run this more often.
- Although we run the long-arc solutions for all satellites, we currently only place the solutions for the Lageos and Etalon satellites on the web. We do have plans to expand this to all satellites in the future.
- It is down to the station to look at the long-arc solutions for problems. Errors can be seen at the 10-20cm level. We could automate feedback.
- Poor orbits can mislead

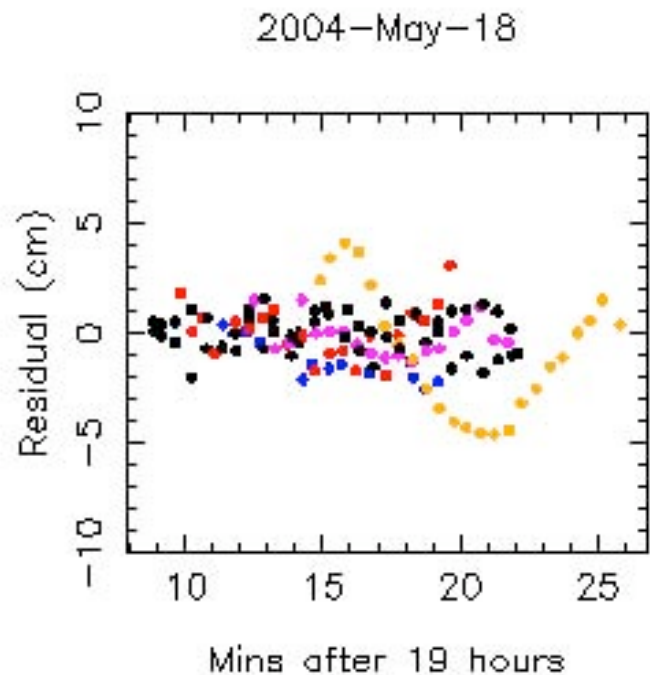
# Long-arc



# Short-arc

- The short-arc solutions are run once a day and require the long-arc orbit and simultaneous observing from at least two core stations.
- Currently there is no feed back – it is up to each station to check the short-arc on a daily basis. We could automate feedback.
- Poor orbits can mislead as can poor data from a core station.
- As simultaneous data is required the amount of passes checked is limited

# Short-arc



Station Herstmonceux  
Satellite Ajisai

7810 Zimmerwald  
7840 Herstmonceux  
8834 Wettzell  
7841 Potsdam  
1884 Riga

# Time bias

- To maintain an up-to-date time bias function for predictions, the automatic system at Herstmonceux generates an individual time bias, using a cut down version of the orbit fitting program SOLVE, for every observation as soon as it becomes available.
- Data becomes available in the following ways
  - Herstmonceux data is available immediately after a reduction.
  - Through E-mail – many stations send us data directly to speed up the TB process.
  - Hourly downloads from CDDIS
- Once a new data point is available a new function is calculated. These functions are made available through the Berne ftp system every 15 minutes.
- A poor time bias can easily corrupt the time bias function. Our system iterates, rejecting at a 3 sigma level to remove outlying data. It is this process that could be used as a QC tool

# Pros & Cons

- Pros
  - Once an hour all new data is downloaded from CDDIS. This means stations can be informed in near real-time of potential problems.
  - Being near real-time, it allows us to correct the data (remembering to increment version number) or withdraw it quickly (we really should be able to do this), hopefully before the users have downloaded the data they require, as users rarely go back and re-collect data.
  - Well tuned monthly IRVs allow us to see many potential errors clearly in the time bias data.

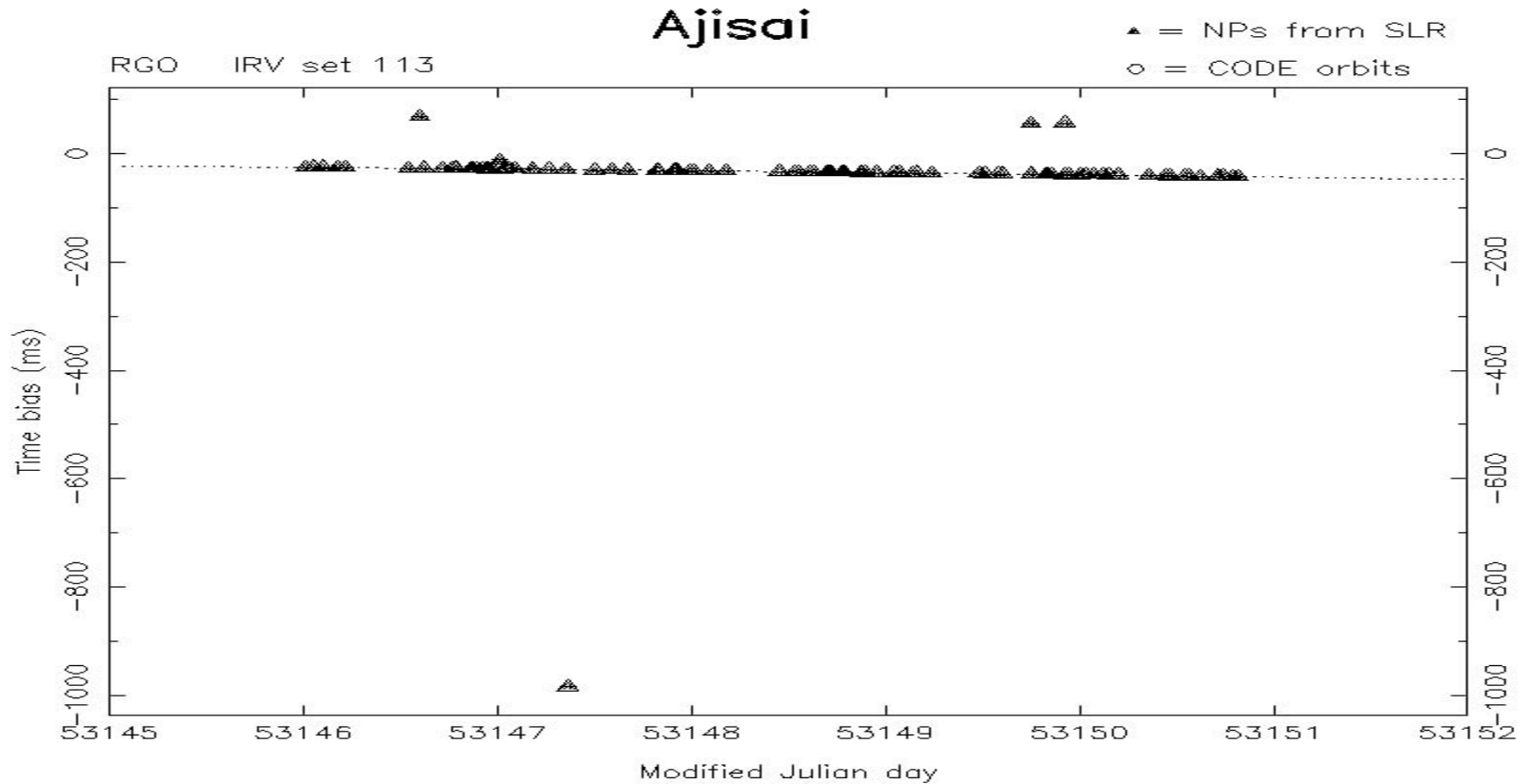


# Time bias

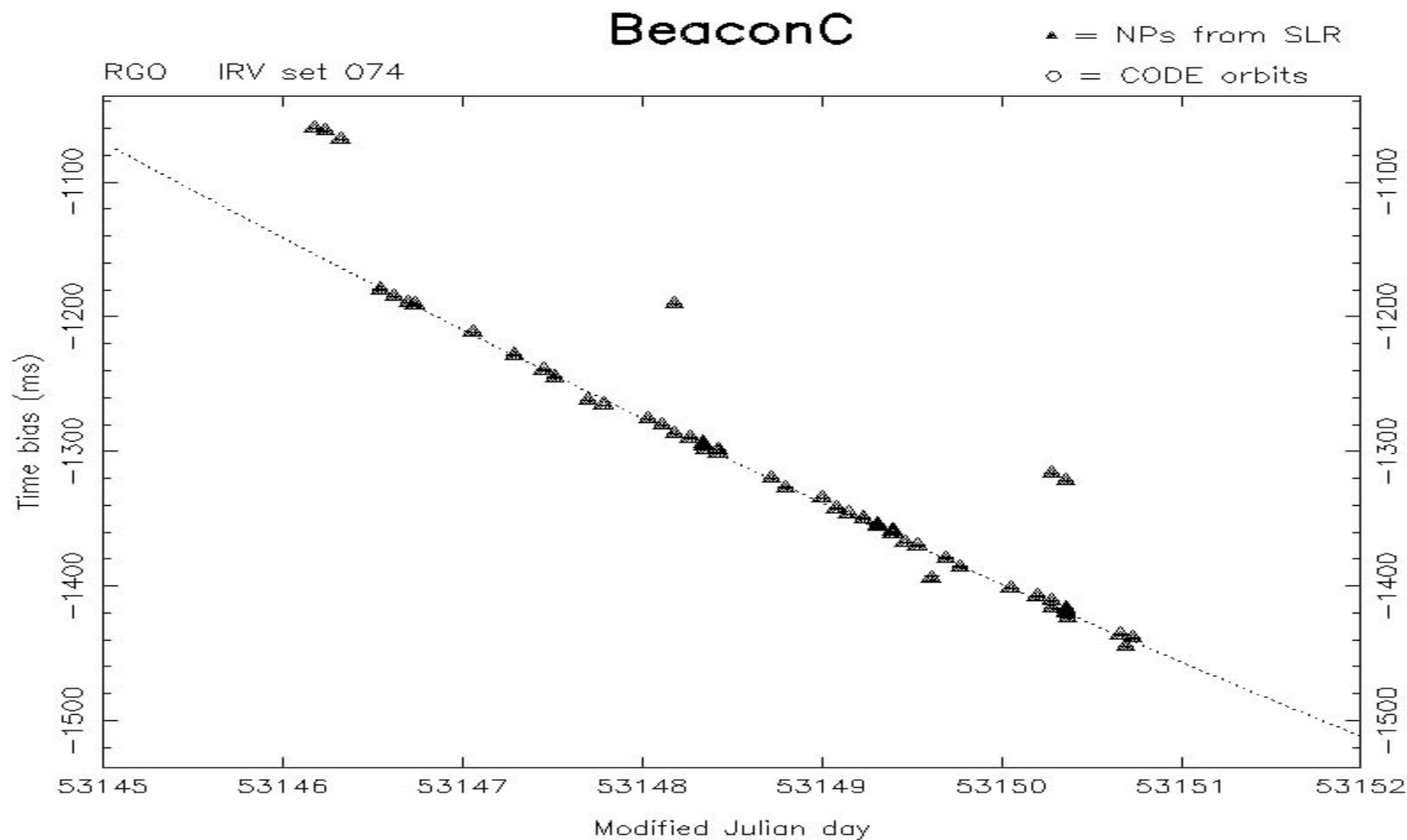
## Cons

- As the system only solves for two orbital parameters (along, across track) it can have trouble separating the two, thus giving spurious tb values. This is particularly true when a pass contains only a few NPs or has very little change in Az/EI.
- The system has problems around manoeuvres.

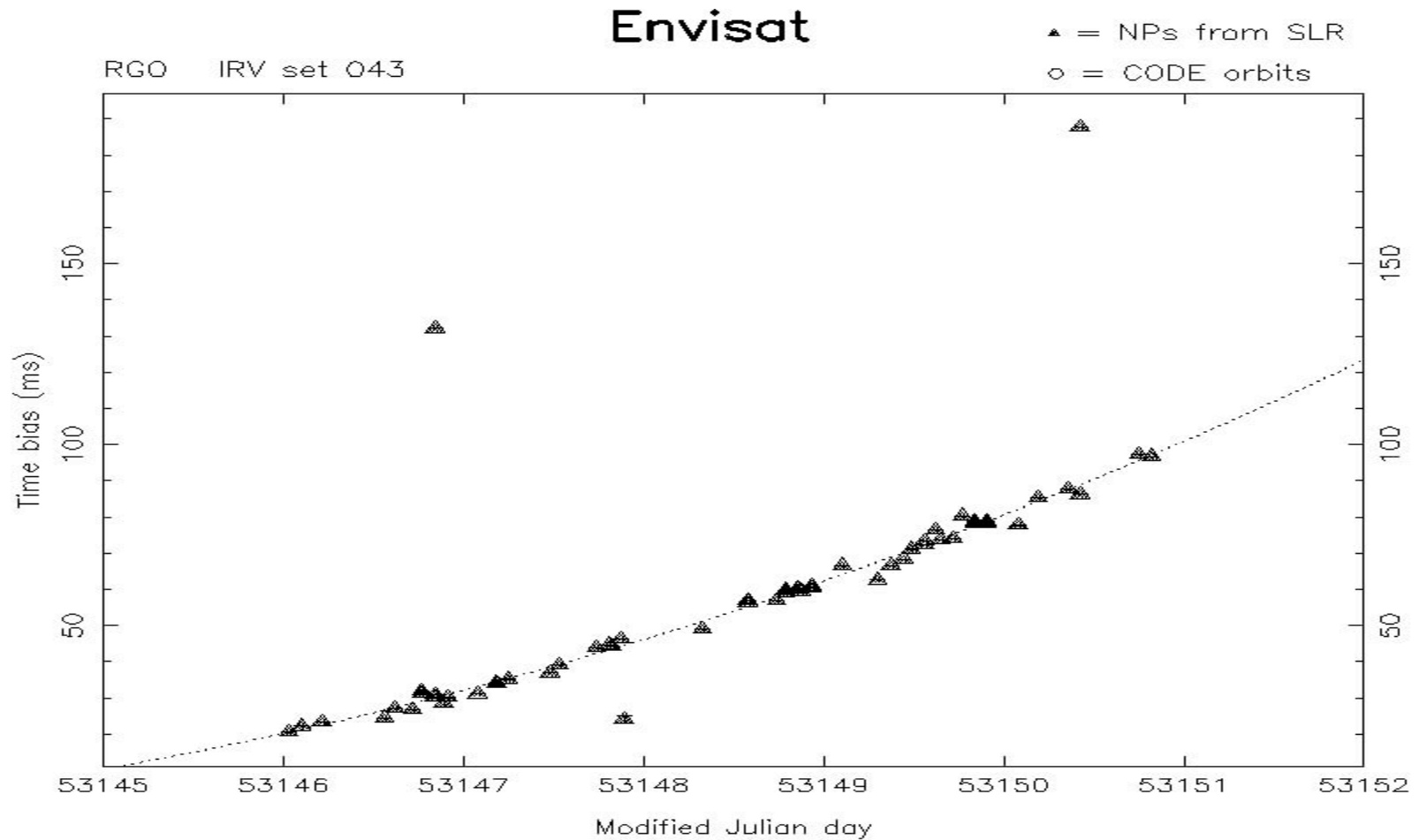
# Typical Time bias plot



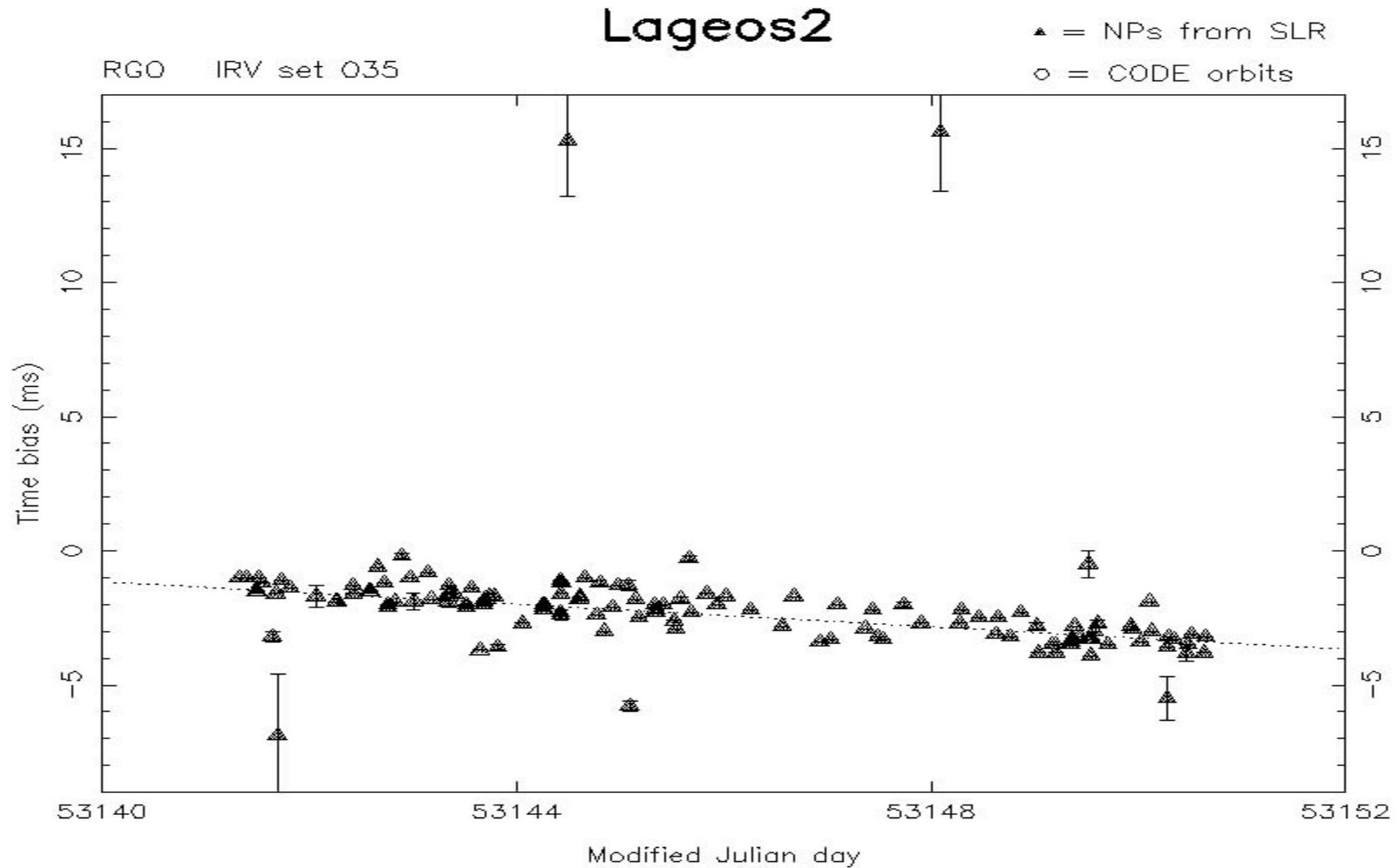
Typical Time bias plot (note that even at TBs  $\gg$  1second the system can still see outliers easily)



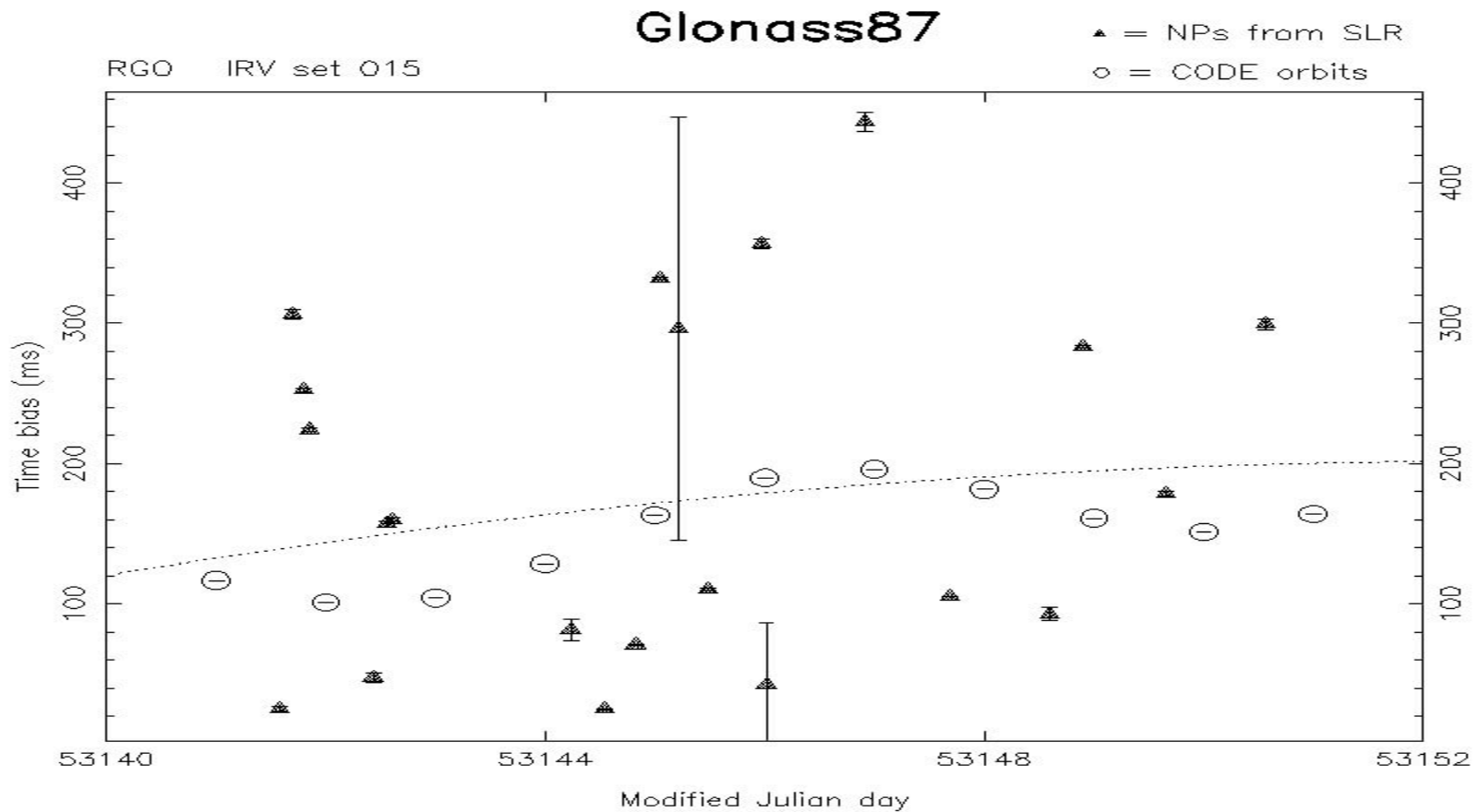
# Typical Time bias plot



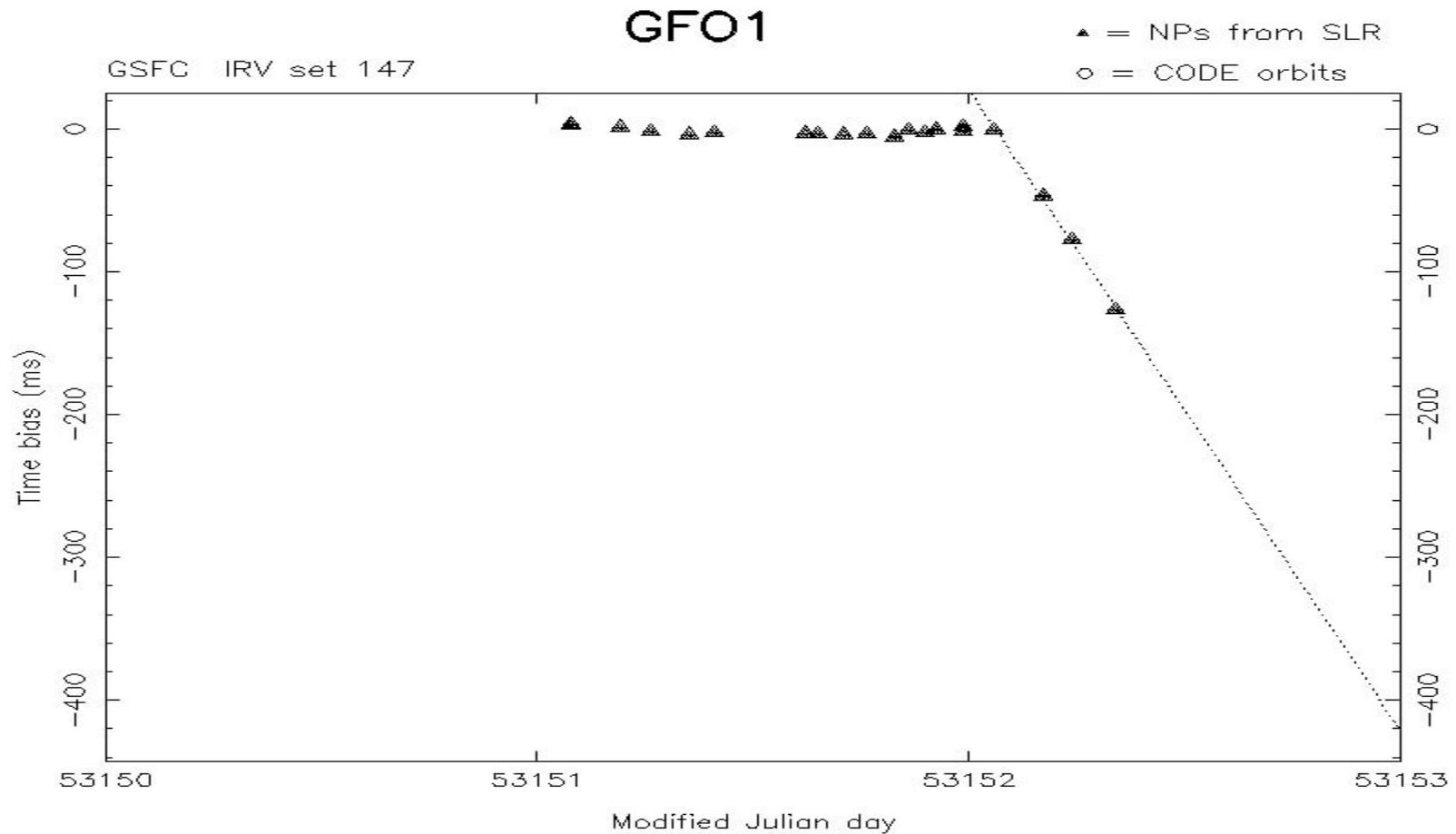
# Typical Time bias plot



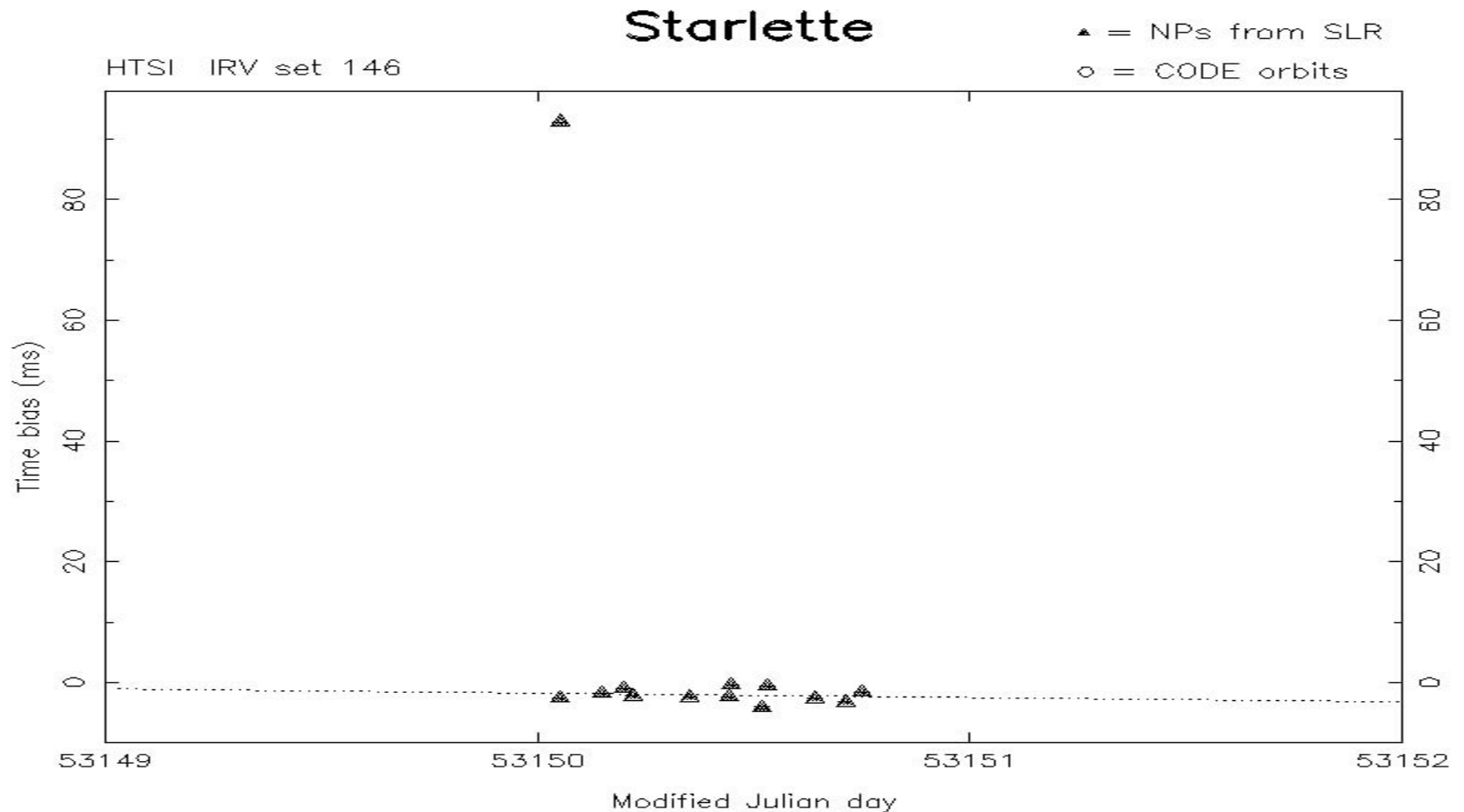
# What Satellites are difficult – poor TB determination



# What Satellites are difficult – around a manoeuvre



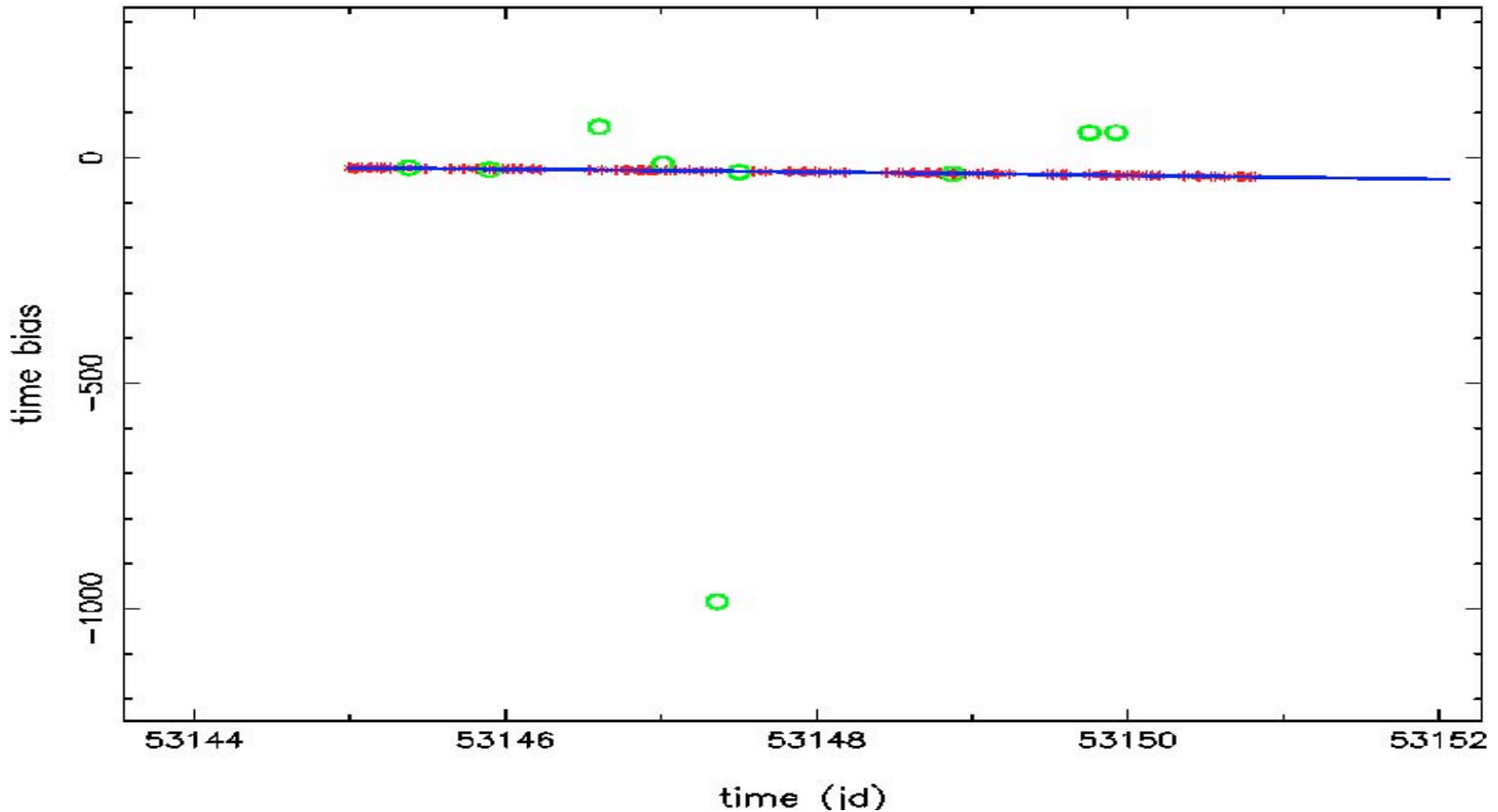
# Why we do not use daily IRVs





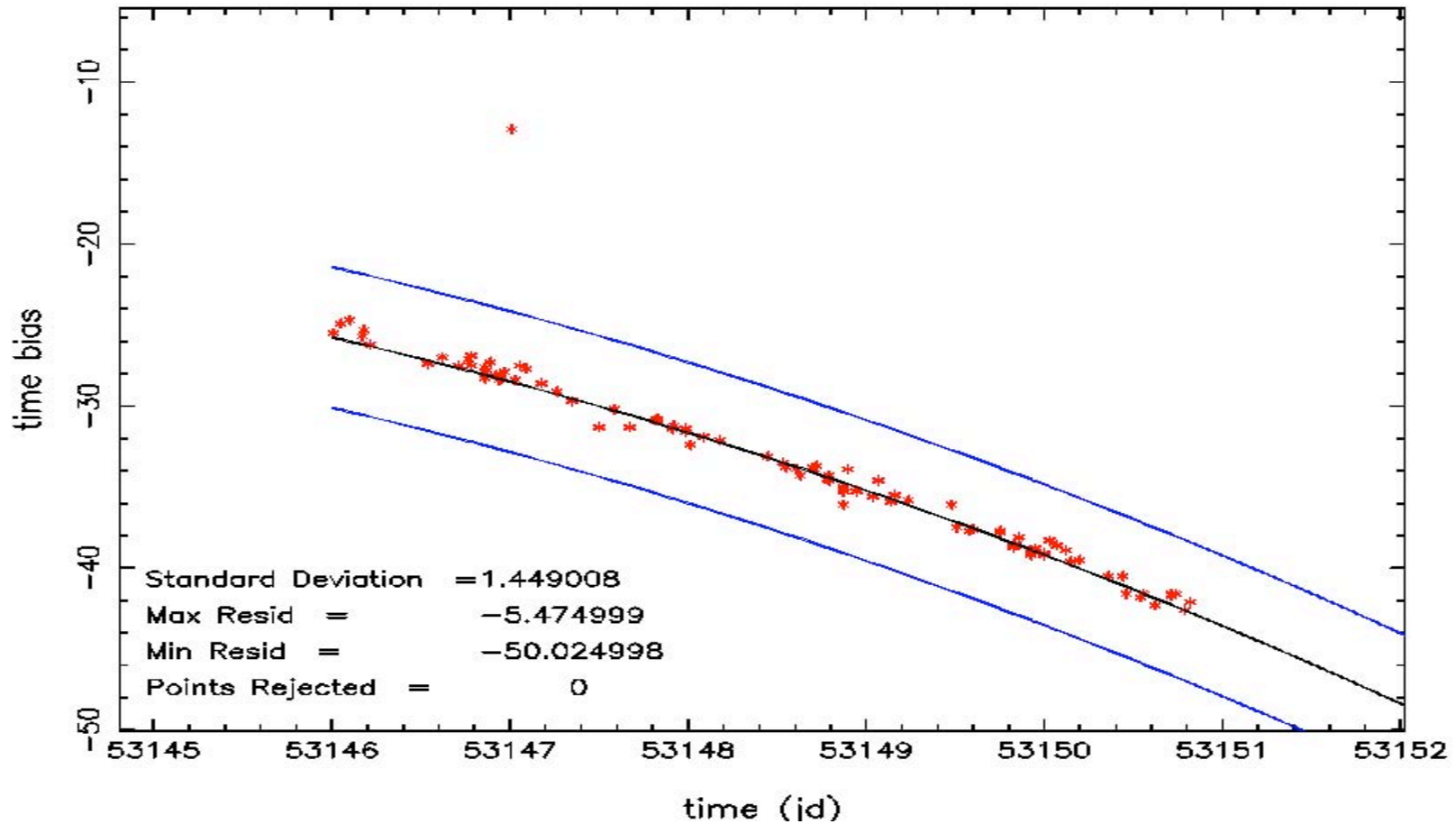
# Finding the outliers – the easy ones

Ajisai



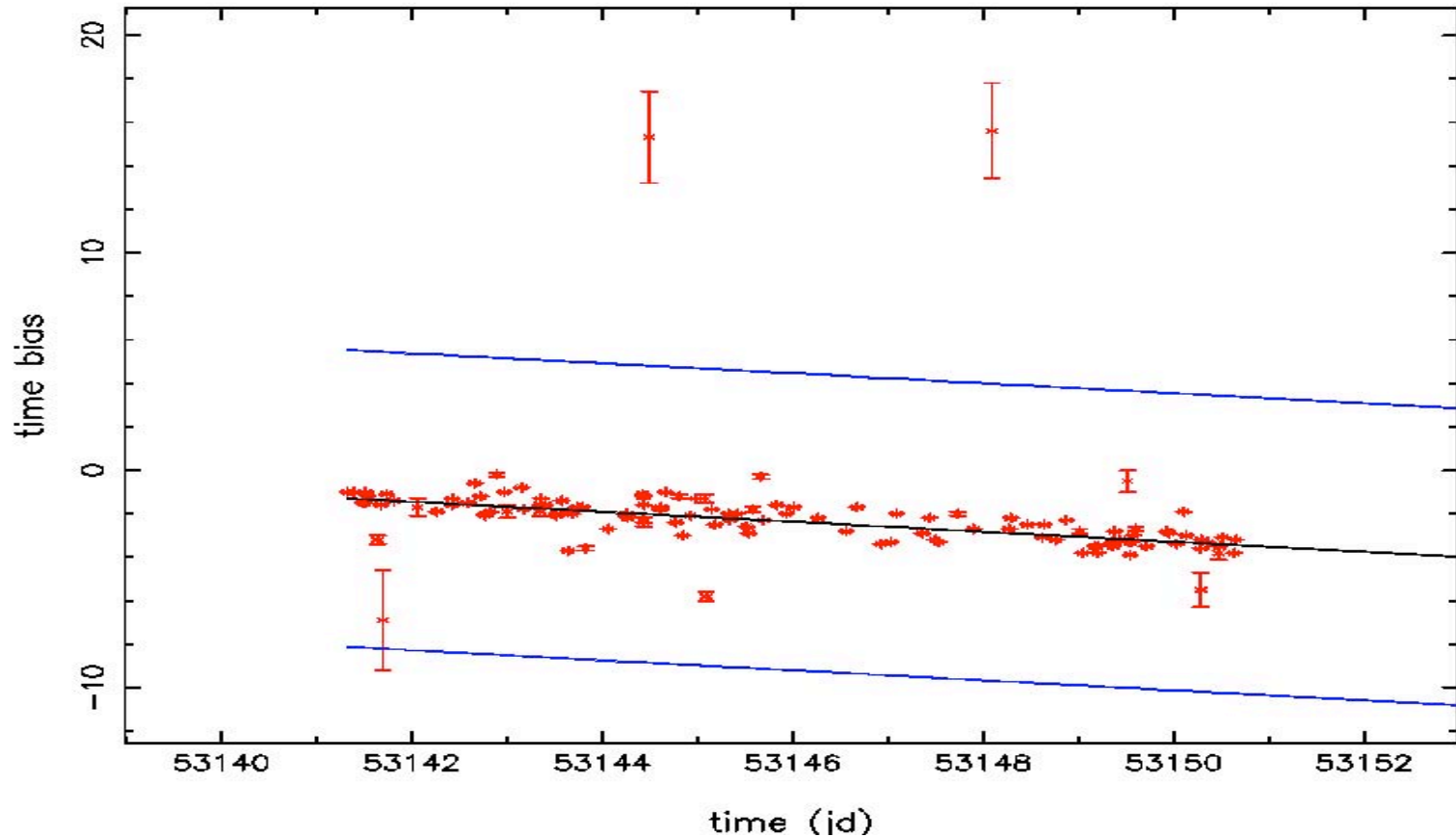
# Finding the outliers – the not quite so easy ones

Ajisai



# Finding the outliers – the tricky ones

Lageos2



# Summary

- If we implement any of these systems as QC checks we would like feedback – hopefully we will be able to improve the detection criteria from the feedback.
- Stations should make every effort to stop bad data from being released – not rely on QC to detect problems.

# Summary

- To implement any of these systems we need an e-mail address for each station to send the information to – we would also inform EDC/CDDIS
- We are happy to offer this service (for TBs) to any station even if it is not used as an official ILRS QC check – just let us know the e-mail address to send the feedback to.