CENTRE NATIONAL D'ÉTUDES SPATIALES

# CNES orbit solutions

OSTST Venice 2006 – POD & Geoid session

CNES POD Team (*) , with entries from Jason-1 POD Group

(*) F. Mercier, J.P. Berthias , P. Broca, L. Cerri,
C. Ferrier, A. Guitart, S. Houry

# Background (1)

Preparation of reprocessing :

-evolution of configurations

earth potential
parameterisation
Doris preprocessing
Doris along track biases
SAA frequency corrections, weightings
GPS antenna map
SLR (network, parameterisation, weighting)

-(re)processing of data sets

GPS orbits
GPS/SLR/Doris orbits

# Background (2)

- Jason and Envisat analyses

- important change of POE configurations

  New configuration applied since sept. 2005 on request of altimetry

  Jason cycle 136
  Envisat cycle 41

  Similar to the reprocessing configuration

  New models (earth potential…)
  GPS/Doris/SLR orbits for GDR Jason

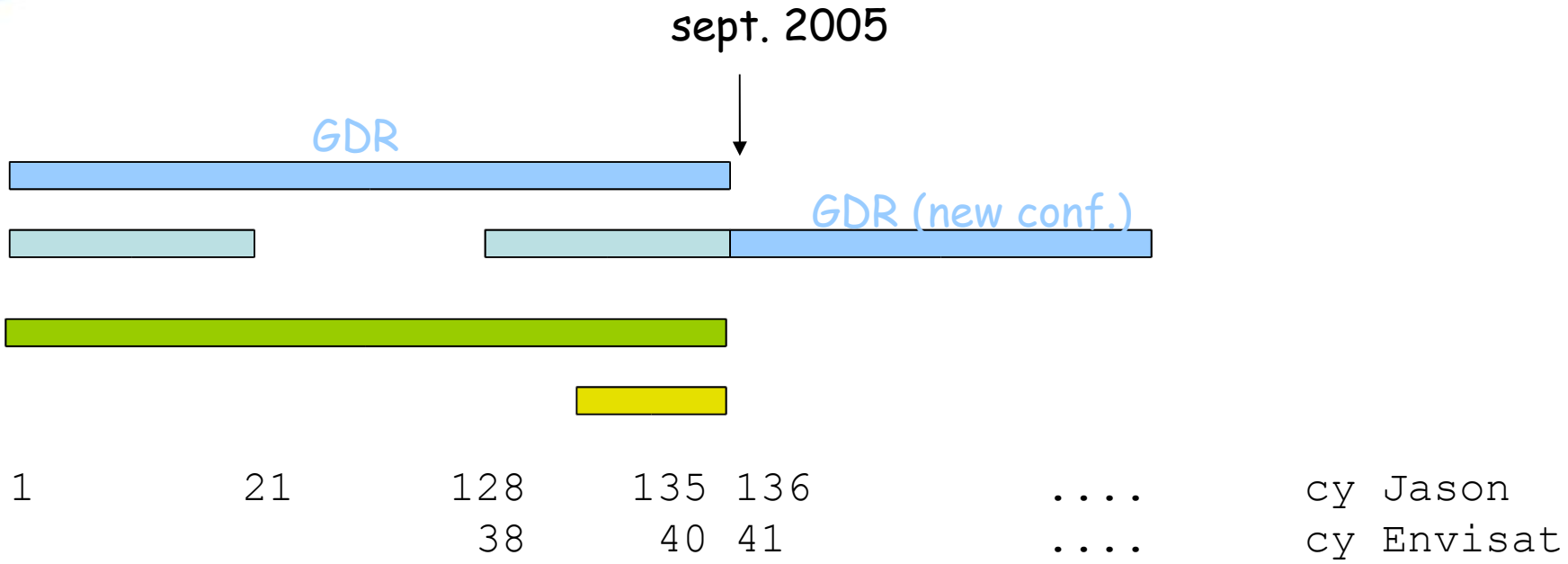
# Configurations (1)

| New configurations | Jason | Envisat |
|---|---|---|
| Earth potential | EIGEN3 | EIGEN3 |
| Tides | FES2004 | FES2004 |
| Atmosphere model | DTM94 | MSIS86 |
| Solar radiation pressure | modified (0.97) | reference |
| Satellite radiation | ref. Aviso model | |
| Parameterisation | | |
| attitude | quaternions | theoretical |
| 1/rev terms (T,N) | 12 hours | 24 hours |
| drag (every 2 orbits) | x | x |

# Configurations (2)

| New configurations | Jason | Envisat |
|---|---|---|
| Doris | | |
| preprocessing | x | x |
| along track bias | x | x |
| SAA weighting | x | |
| GPS | | |
| in GDR since cy 136 | x | |
| antenna map (phase) | new JPL model | |
| constellation | JPL (backup IGS) | |
| SLR | | |
| network definition | x | x |
| weighting, biases | x | x |

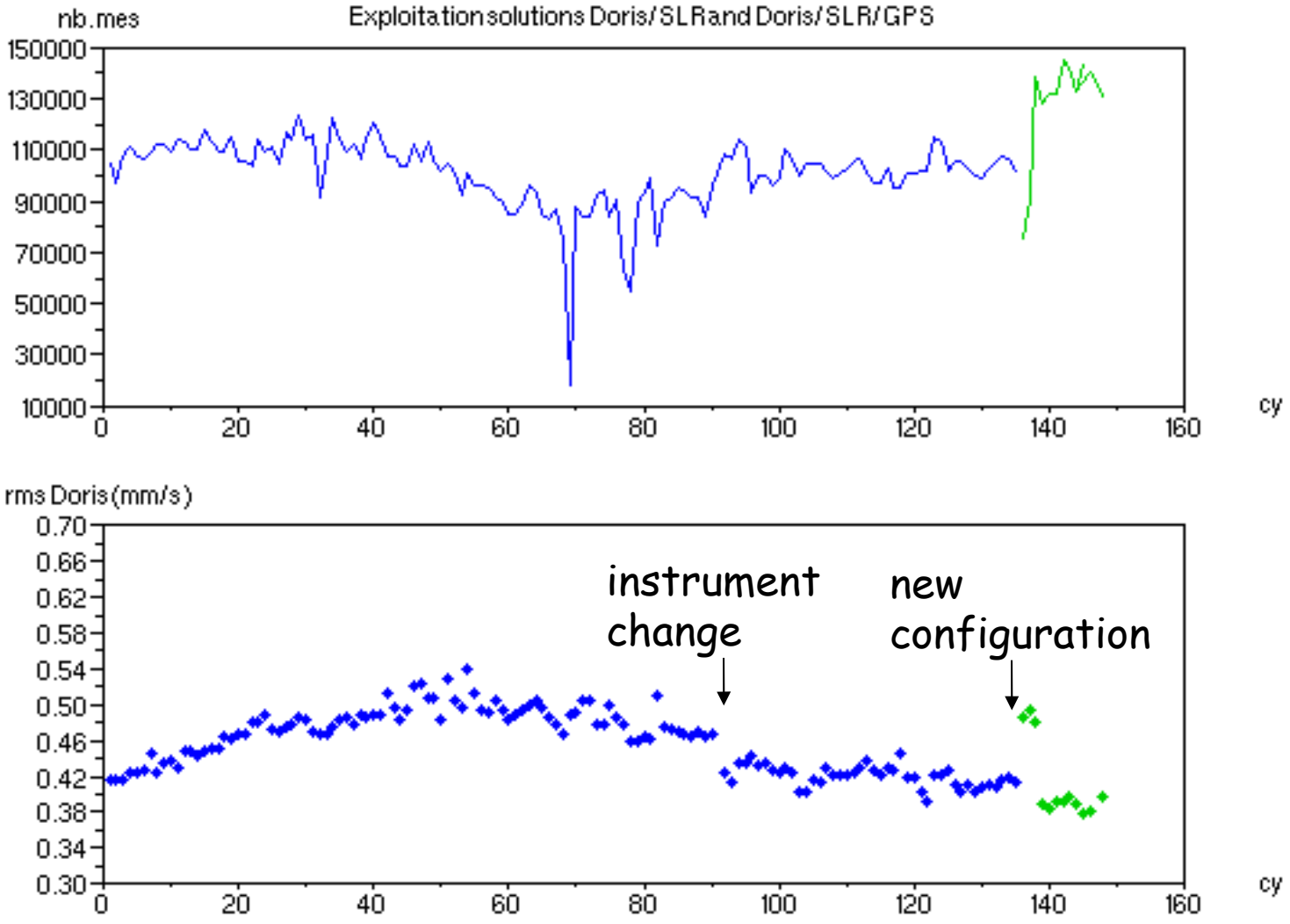
# Solutions



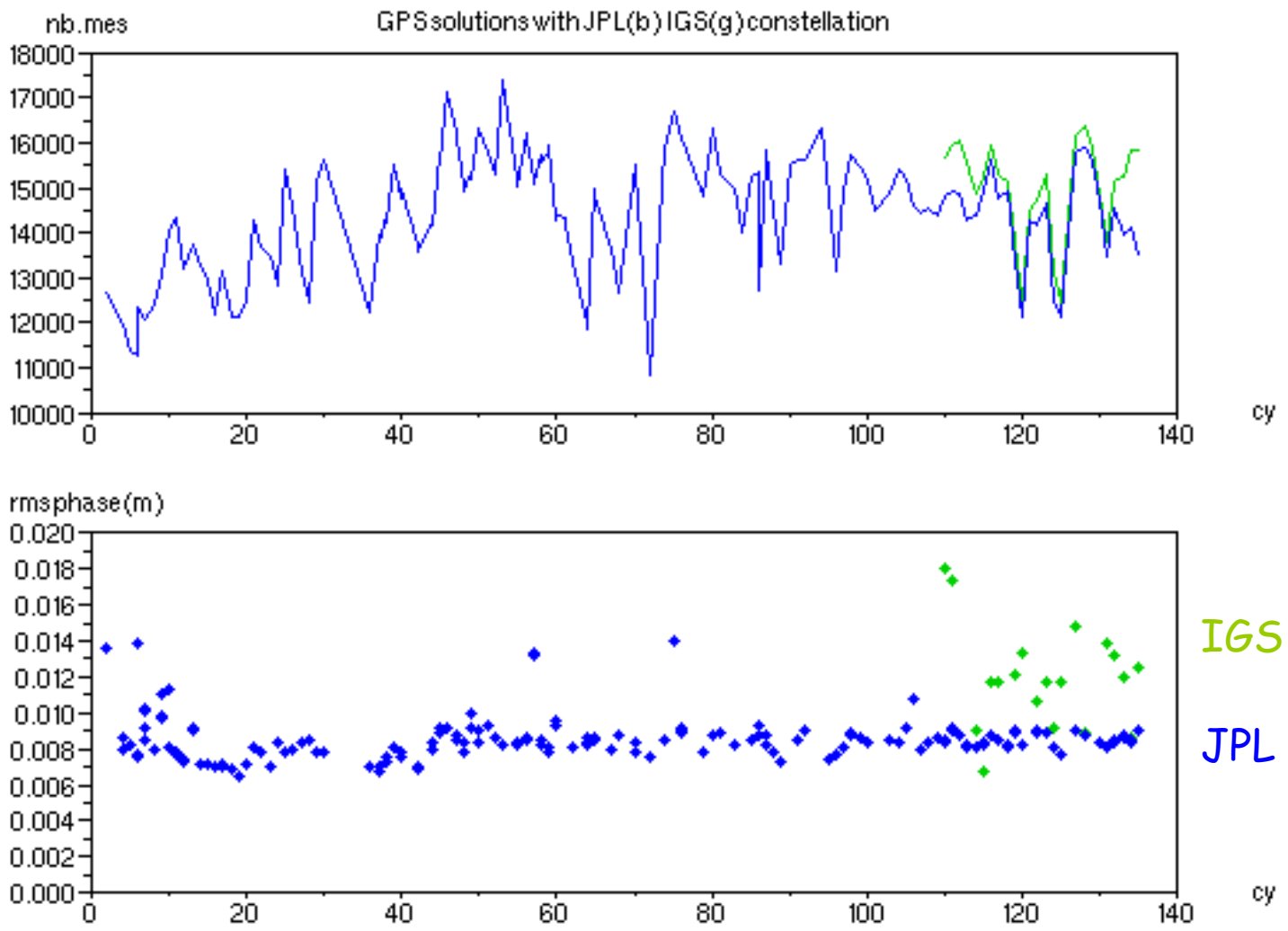

reprocessing : new configurations and GPS/Doris/Laser for Jason
GPS only : jpl constellation solution (some gaps)
GPS only : igs constellation solution (110 – 135)

Doris only solutions (Jason, Envisat) for Doris along track bias estimation

# Doris residuals



# GPS phase residuals (JPL or IGS constellation)



# GPS centre of phase variations

GPS antenna position adjusted (cy 110 – 135) :

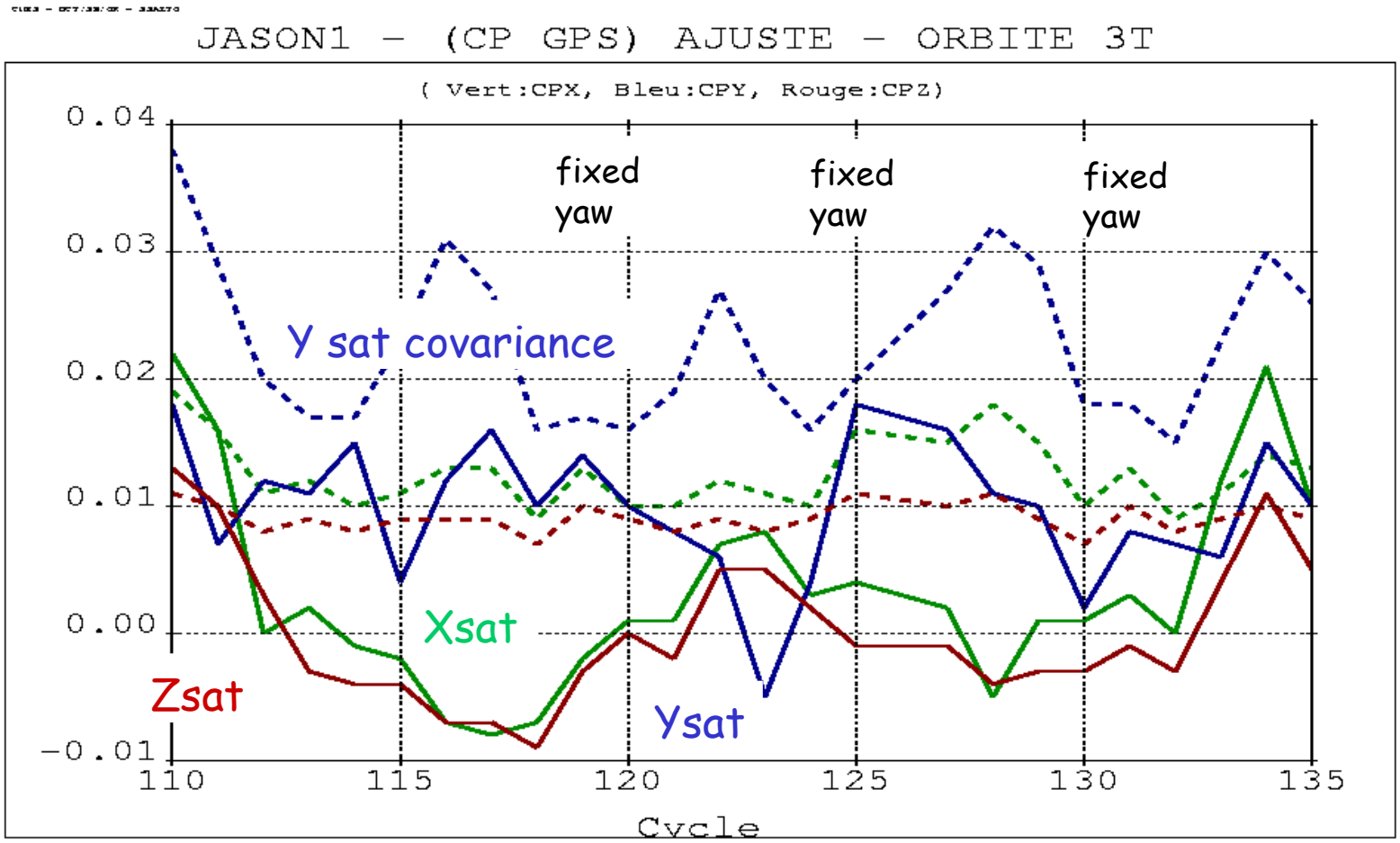
GPS/Doris/SLR solutions

1 cm bias in Y (direction of solar array axis)

6 month periodic term in X and Z

No important radial effect observed on the orbits

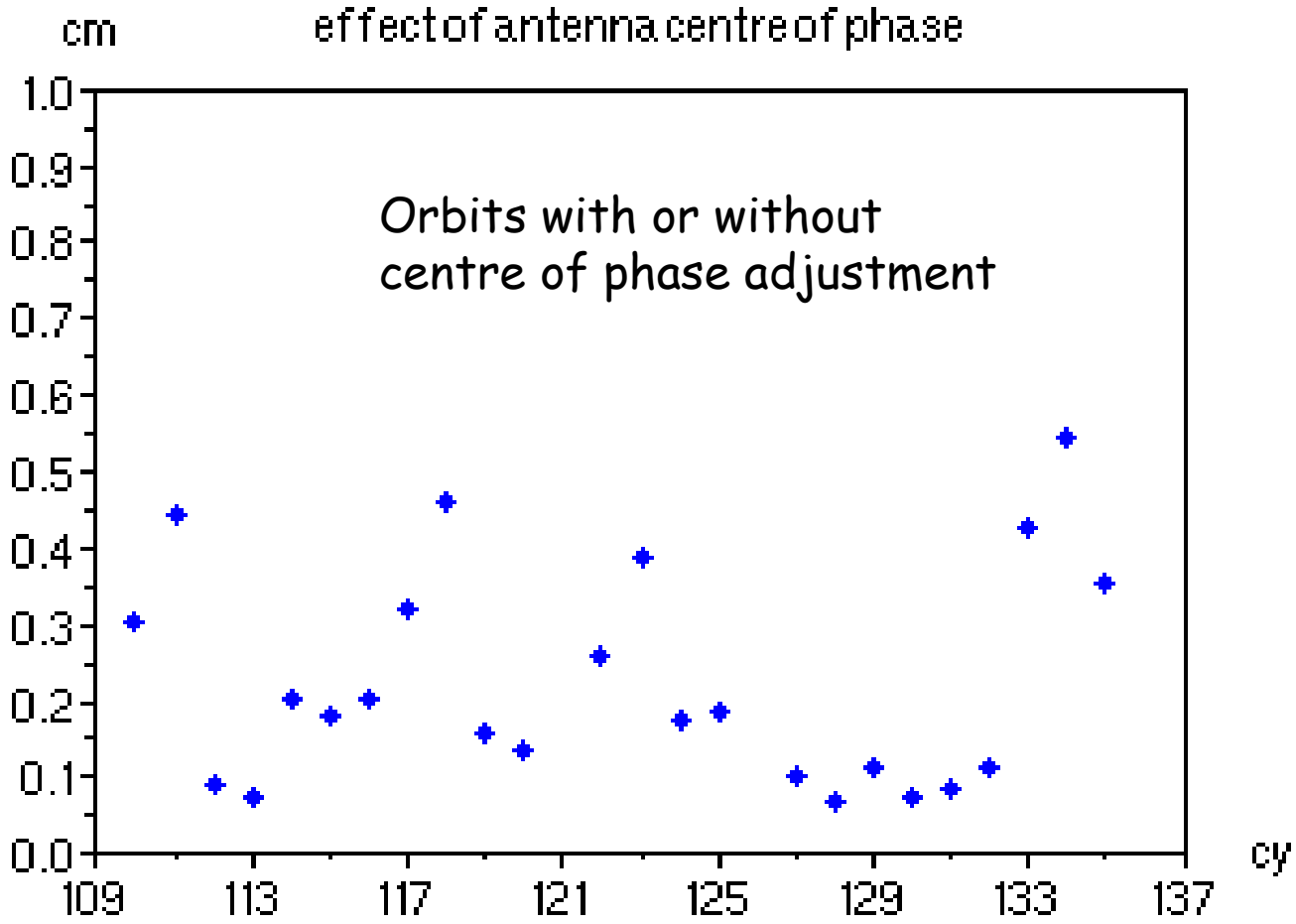
# GPS centre of phase adjustment (1)



# GPS centre of phase adjustment (2)

small effect

more important during high β'



# Crossover

New solutions :

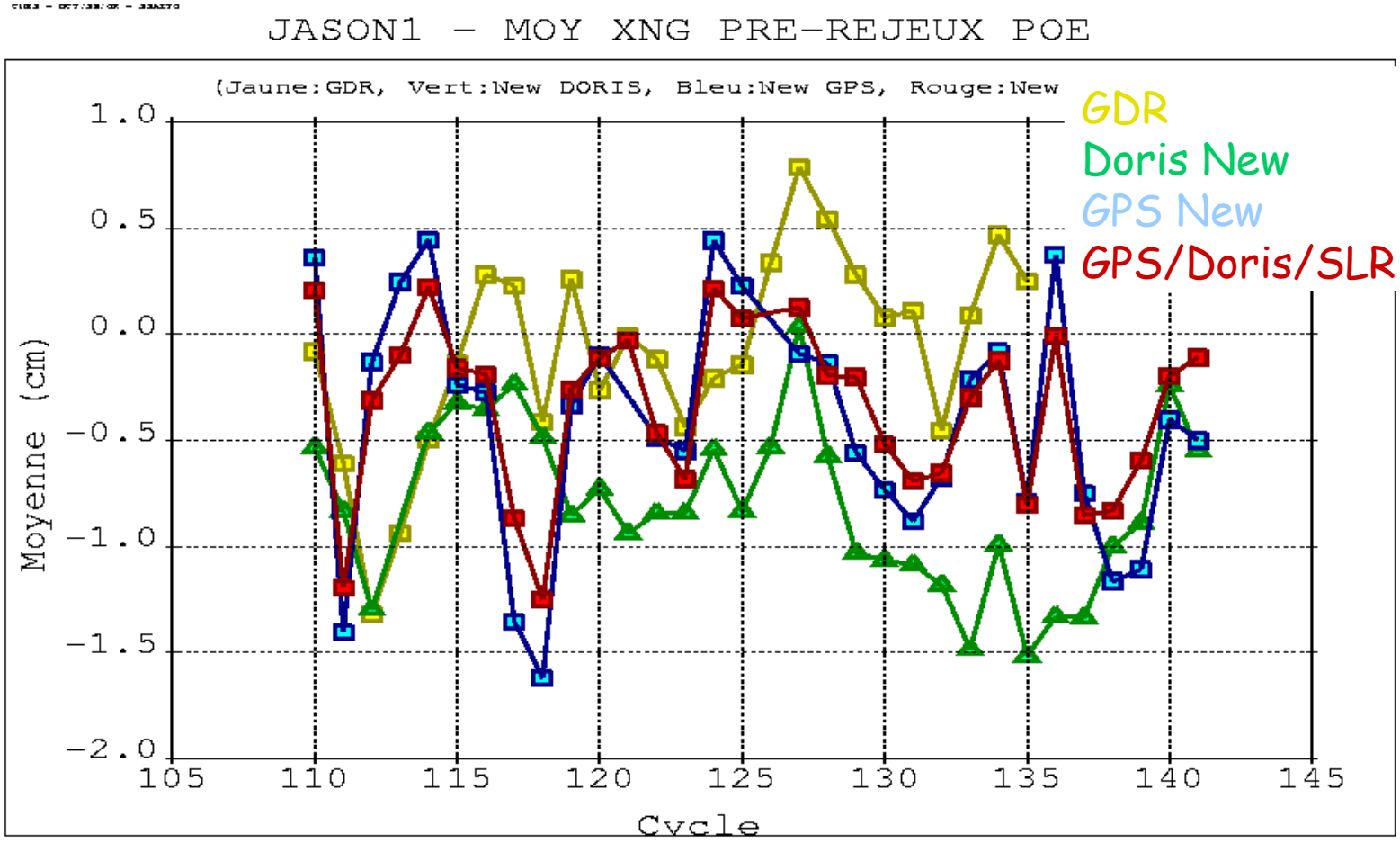
**crossover rms**

improvement versus GDR
GPS and GPS/Doris/SLR solutions are very close

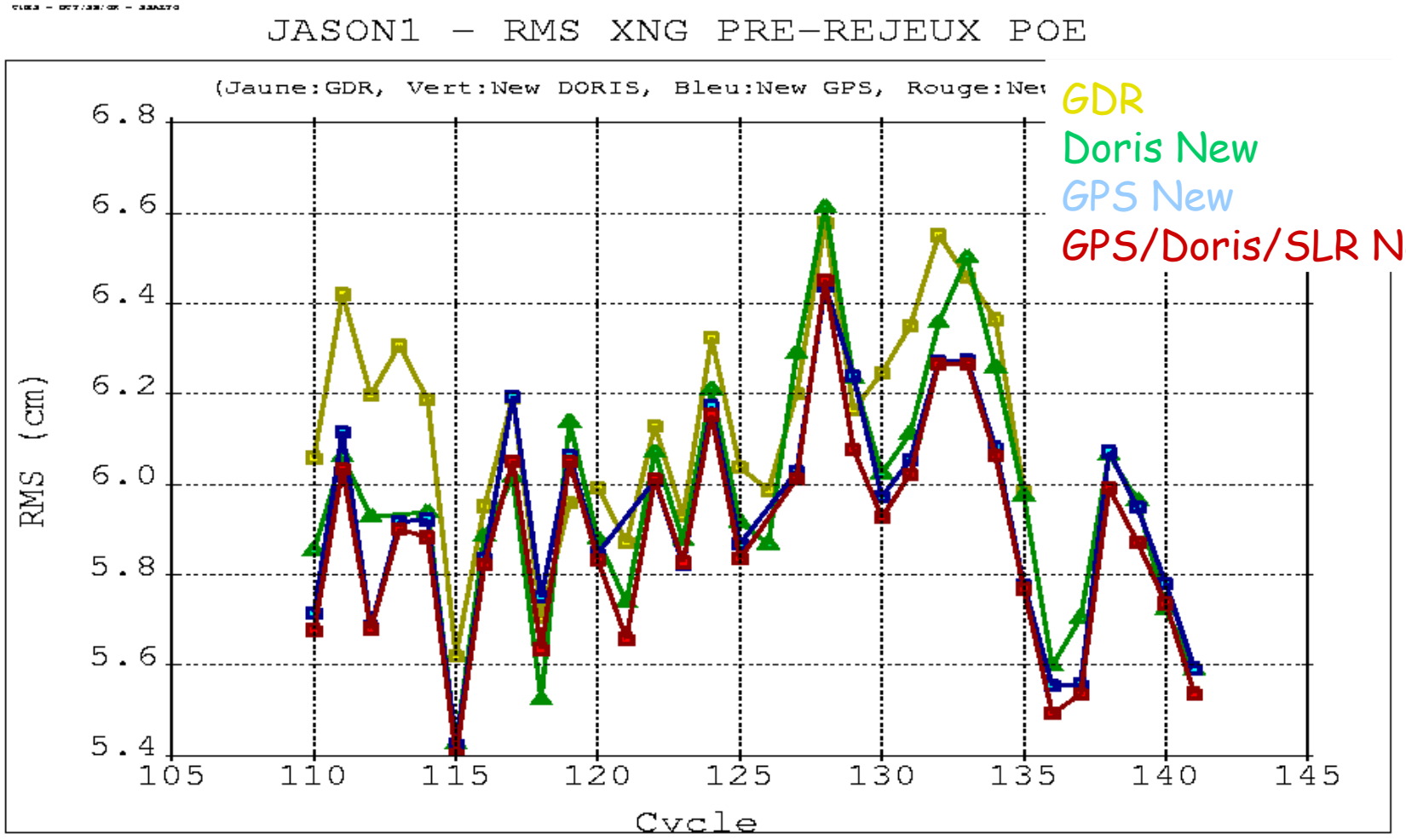
**crossover mean**

bias 0.5 cm
periodic 60 days
    important on GPS solutions : 0.5 cm

# Crossover mean



# Crossover rms



# Satellite direct radiation model

Aviso model (satellite radiation) :

| | |
|---|---|
| 40 w in +X direction | $-1.83\ 10^{-10}$ m/s$^2$ |
| 80 w in +Y direction | $-3.67\ 10^{-10}$ m/s$^2$ |

Some differences observed on fixed yaw periods :

- asymmetry in the adjusted drag (X satellite is along track)
- can be improved by applying a positive value on X acceleration (see J. Ries remarks)

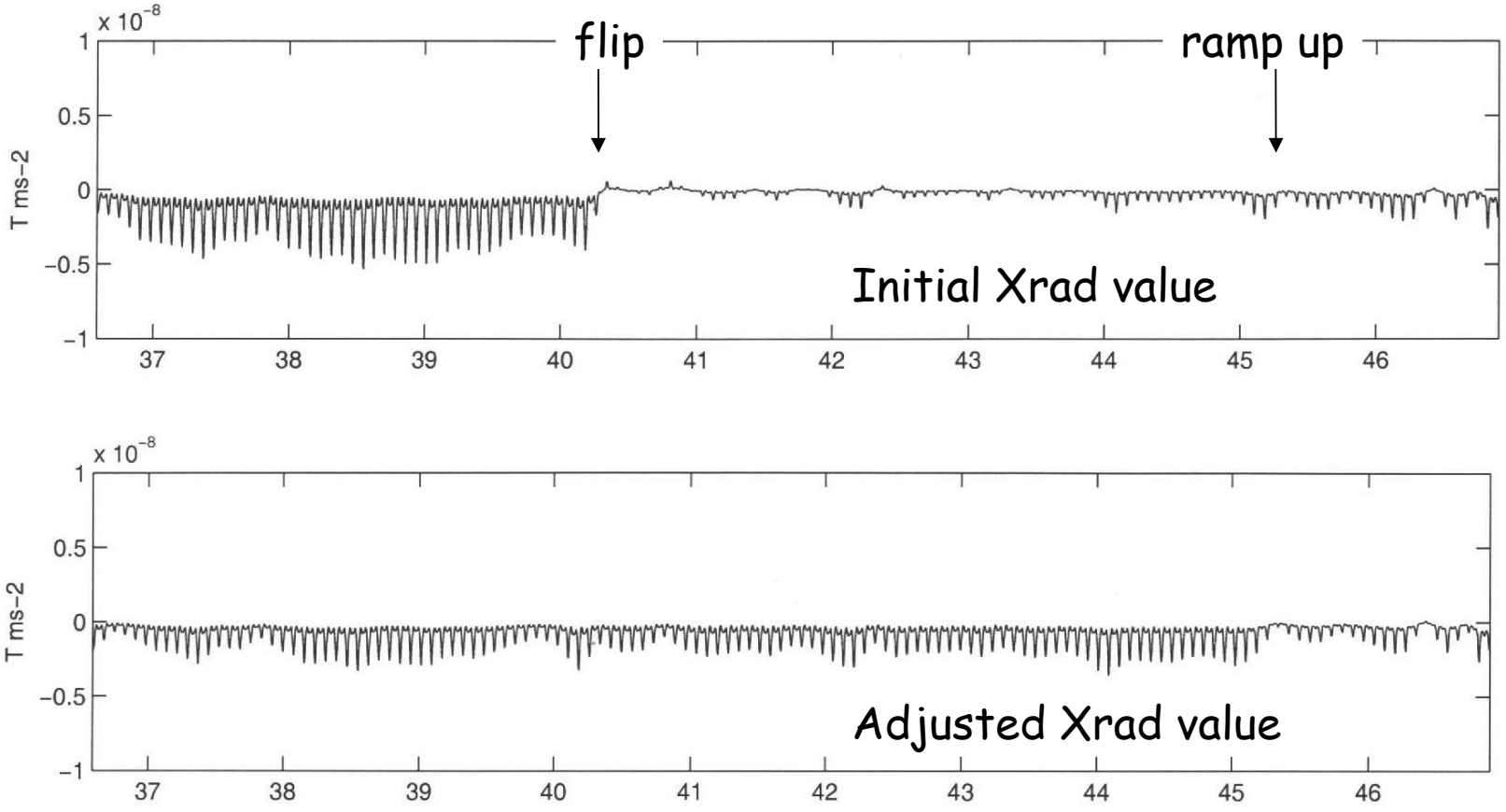
Adjusting the X value gives better results (remark the + sign)

$4.5\ 10^{-10}$ m/s$^2$ to $5.0\ 10^{-10}$ m/s$^2$

- SLR residuals improved
- adjusted drag more realistic

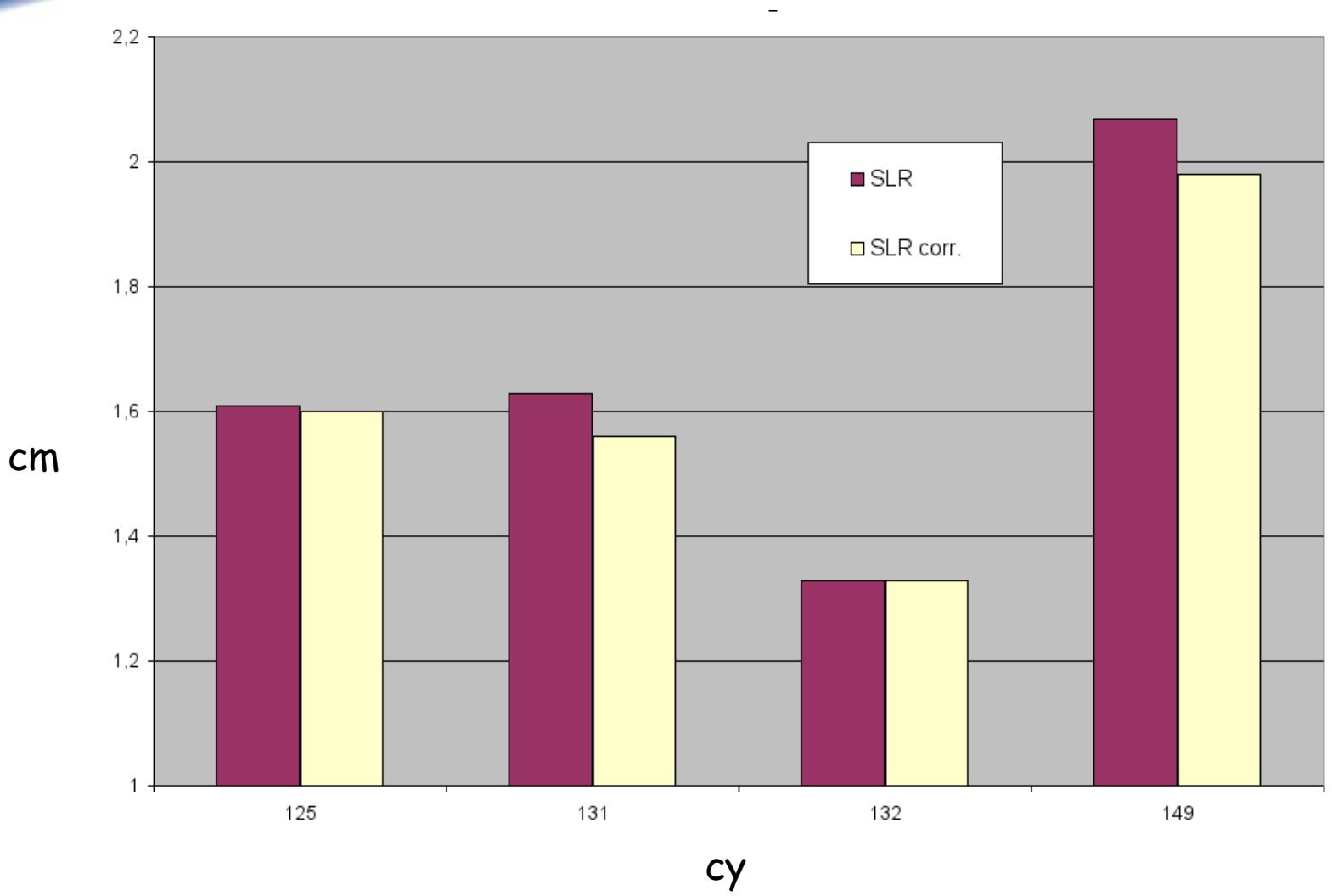
# Drag acceleration around flip (cy 125)

## effect of X radiation term



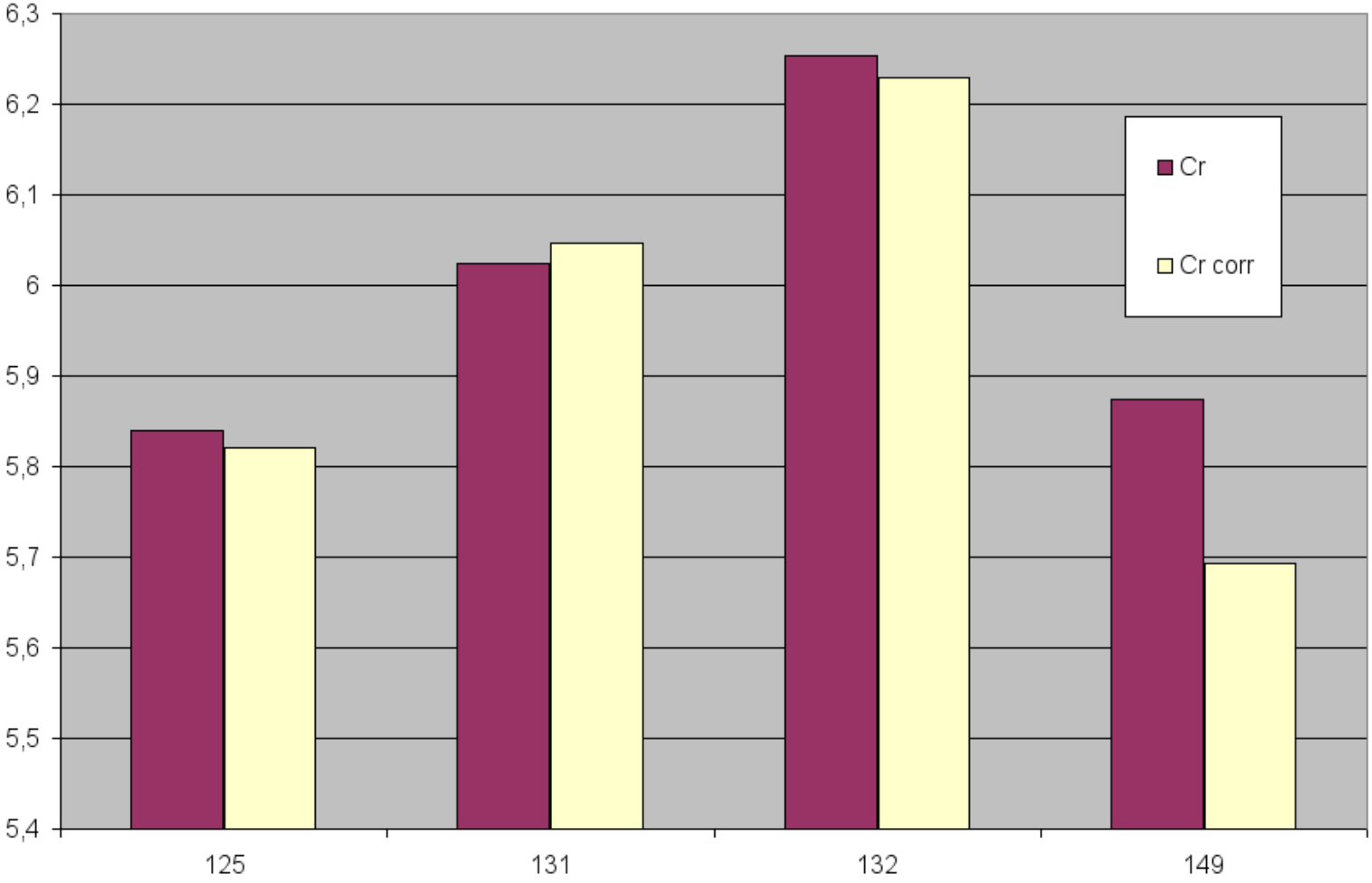
# SLR residuals

## effect of X radiation term



# Crossover rms

## effect of X radiation term



# Conclusion

The new configuration (since Jason cy 136) produces very good products
(GPS/Doris/SLR GDR orbits)
these products have been tested by altimetry

Some older Jason cycles have been reprocessed with the same configuration
in order to have longer solution series
(GPS only, GPS/Doris/SLR)

GPS and GPS/Doris/SLR orbits are very close. The tri-technique product
is more robust in cases of data gaps in GPS, or in Doris

The corresponding configuration (since Envisat cy 41) shows similar
performance improvements