

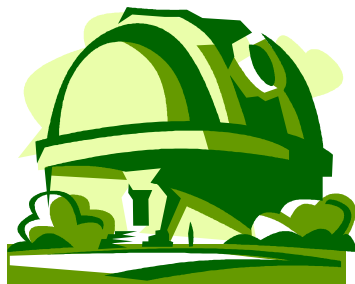
Orbit determination for GIOVE-A using SLR tracking data

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U. Hugentobler, M. Ploner

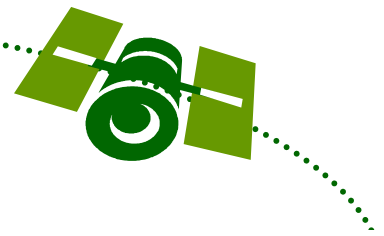
October 16, 2006

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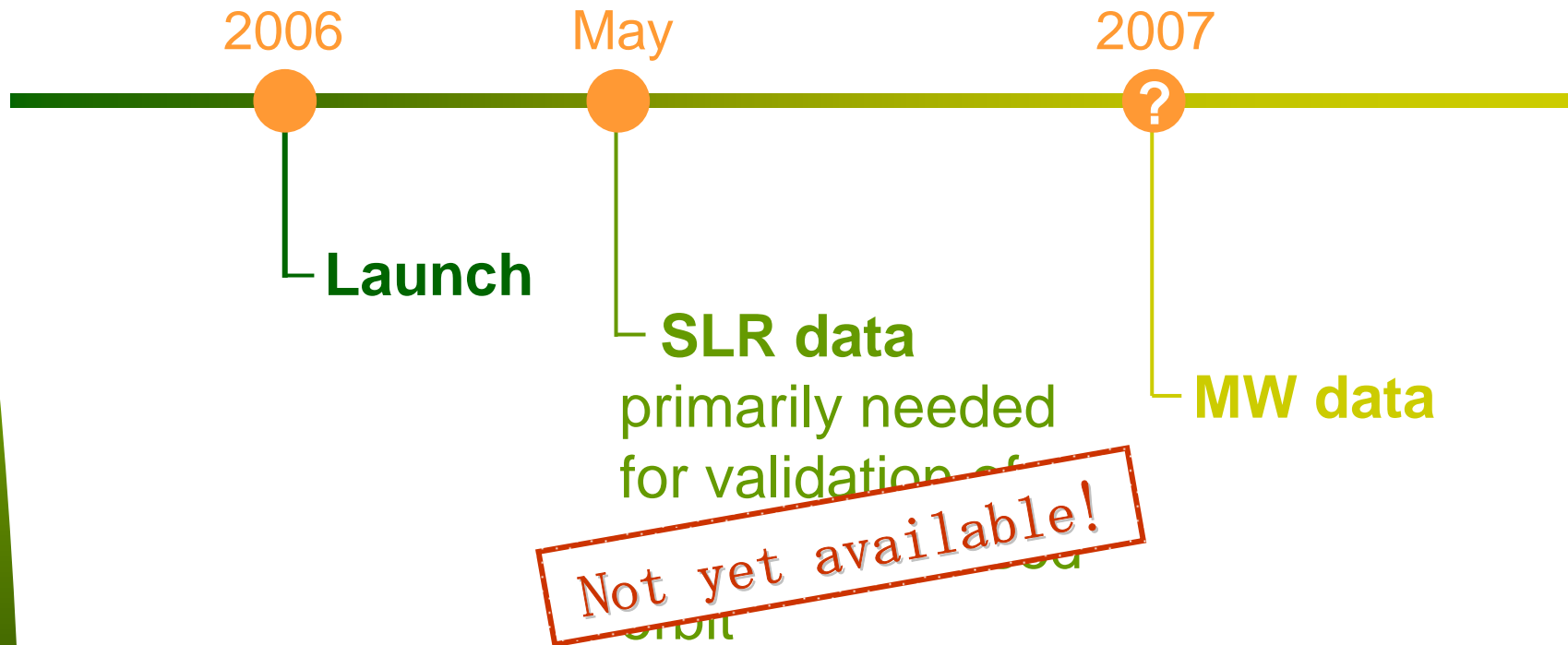


AIUB

Astronomical Institute University of Bern



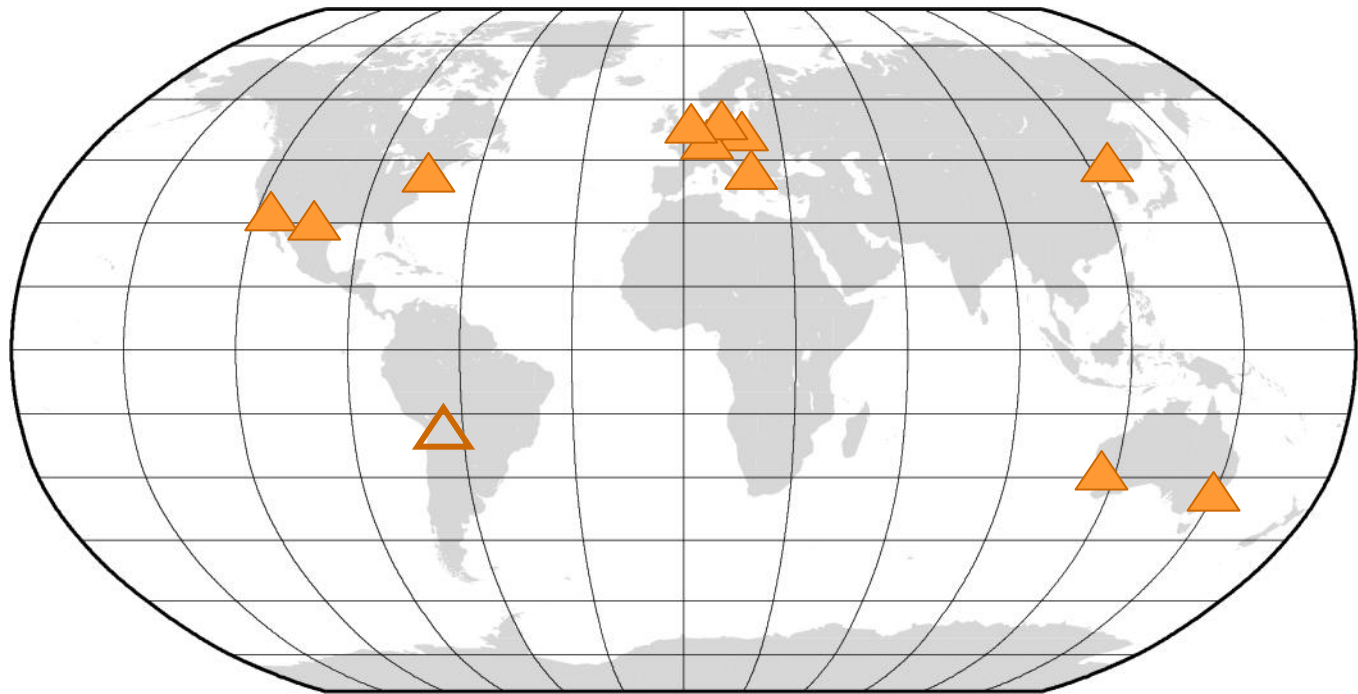
GIOVE-A



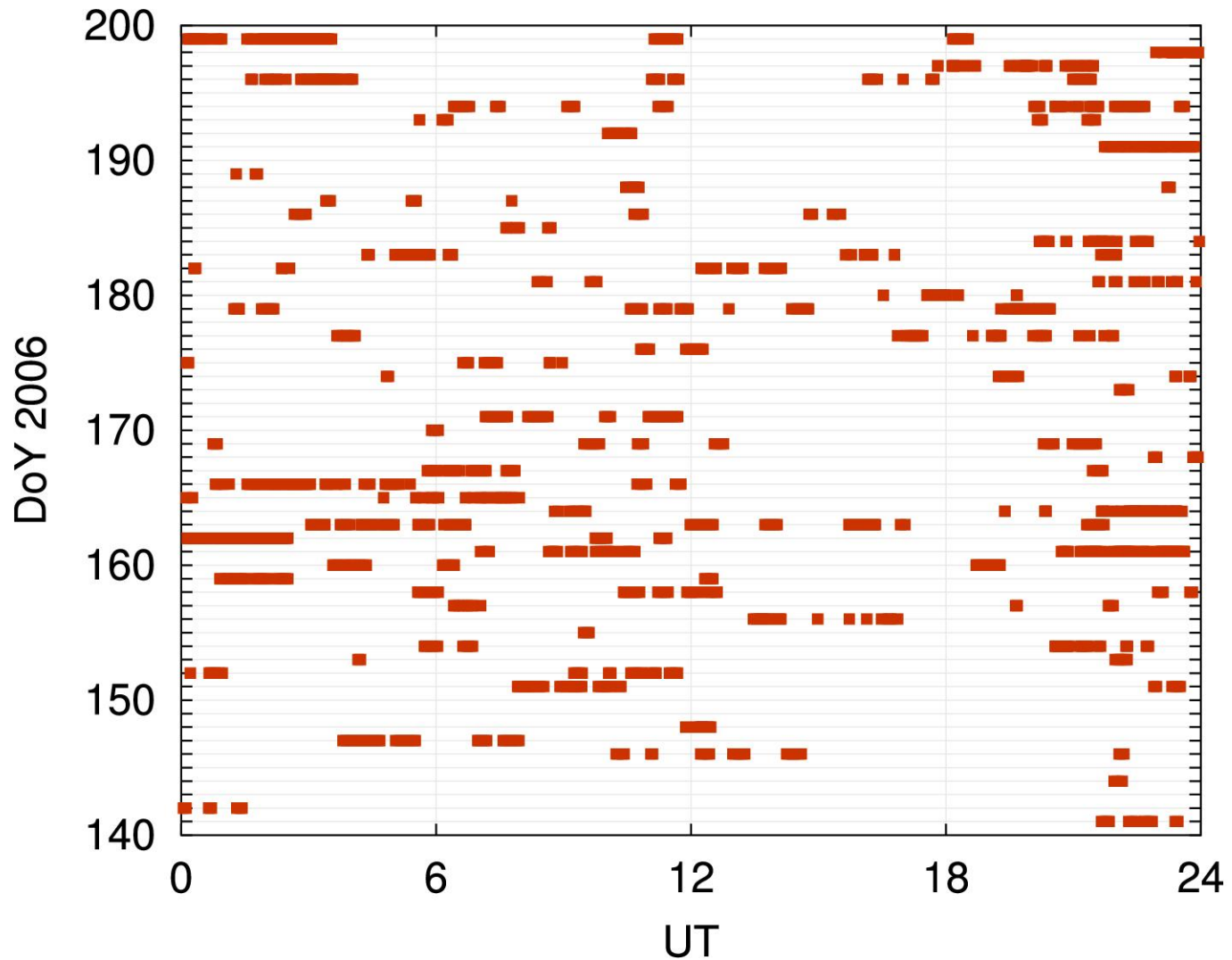
SLR orbit determination

SLR tracking network


11 SLR stations



SLR tracking data

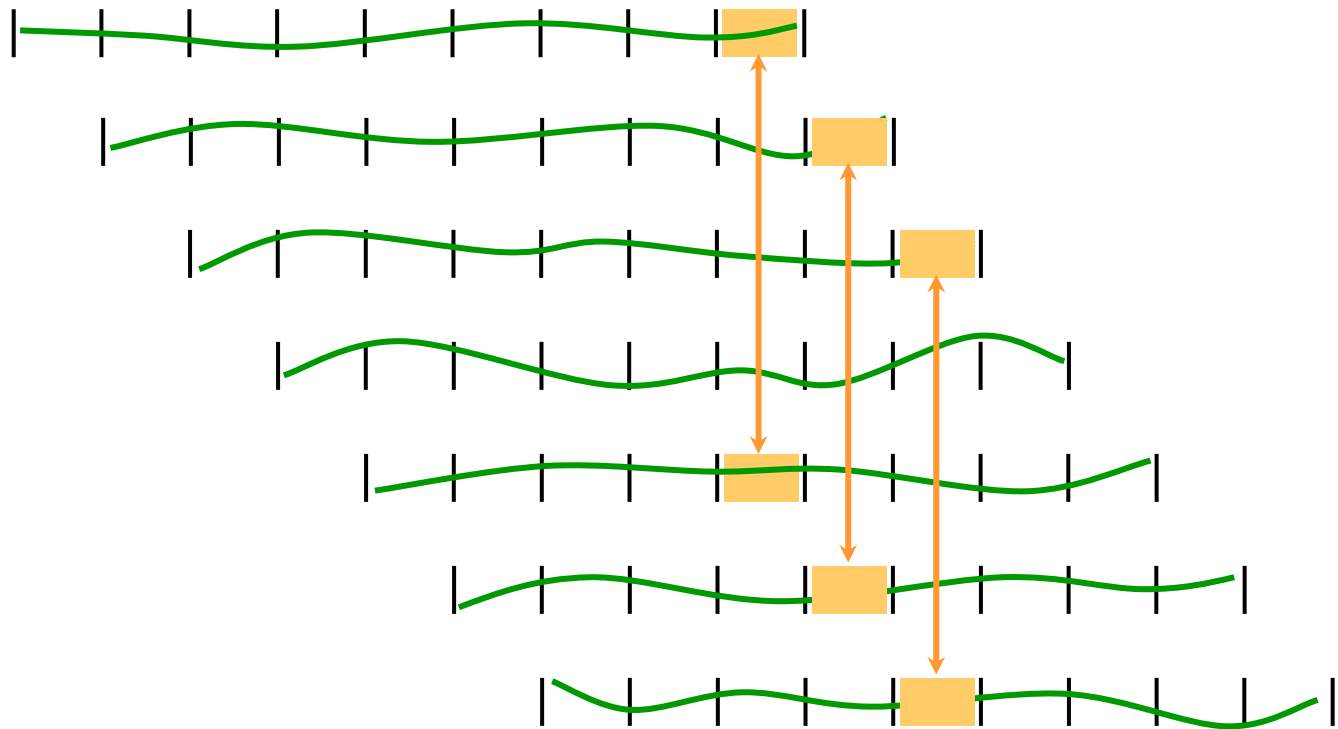


SLR-based orbit determination

- Bernese GPS Software
 - Computation of **n-day** arcs
 - 6 osculating elements
 - 9 dynamical orbit parameters
 - Arc-length **$n = 5, 7, 9, 11, 14$**
 - Analysis of orbit overlaps
- 

Orbit overlaps

SLR-based 9-day arcs

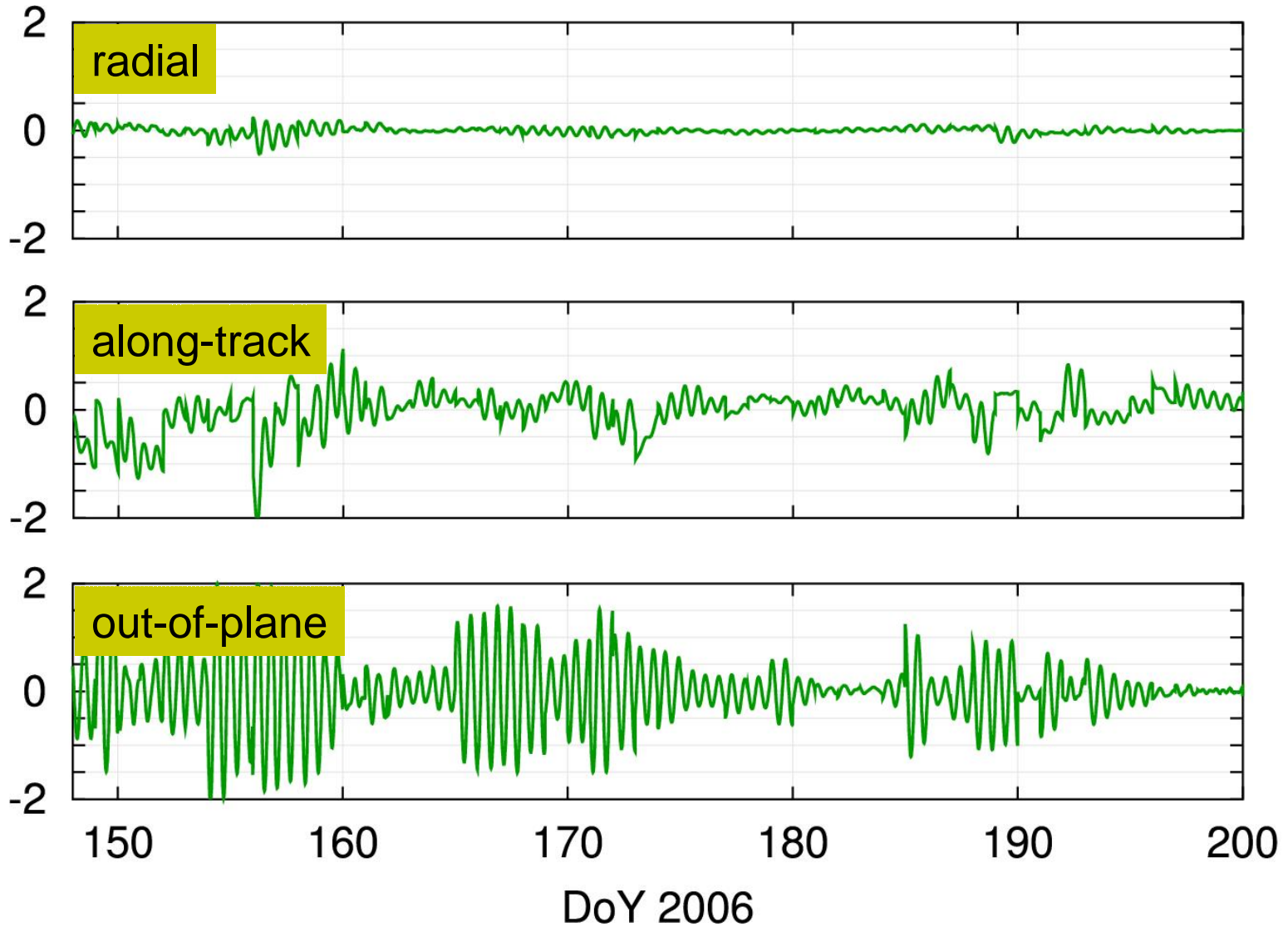


Orbit differences:
last day of arc – central day of arc

Orbit overlaps

SLR-based 9-day arcs

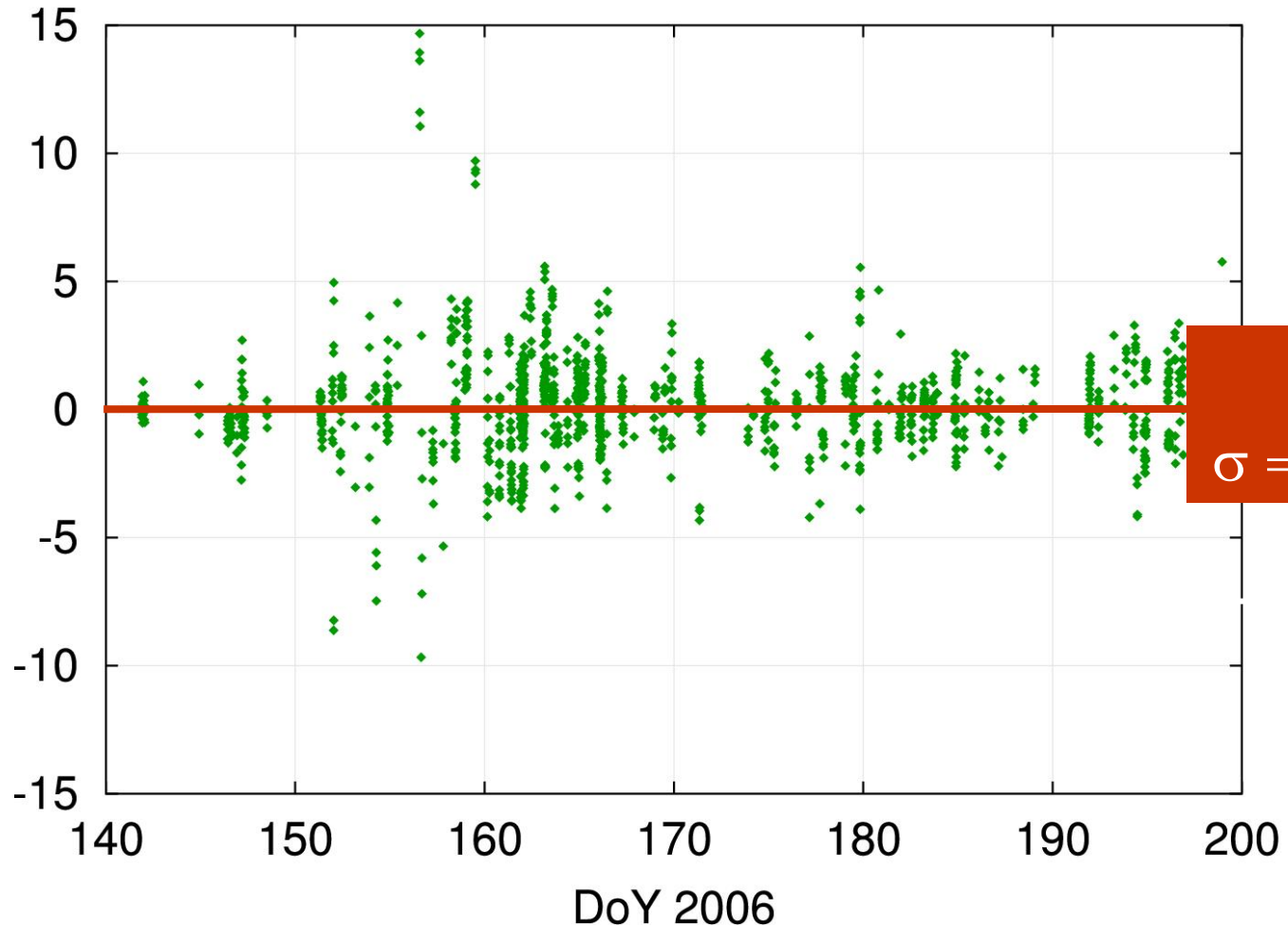
(m)



SLR range residuals

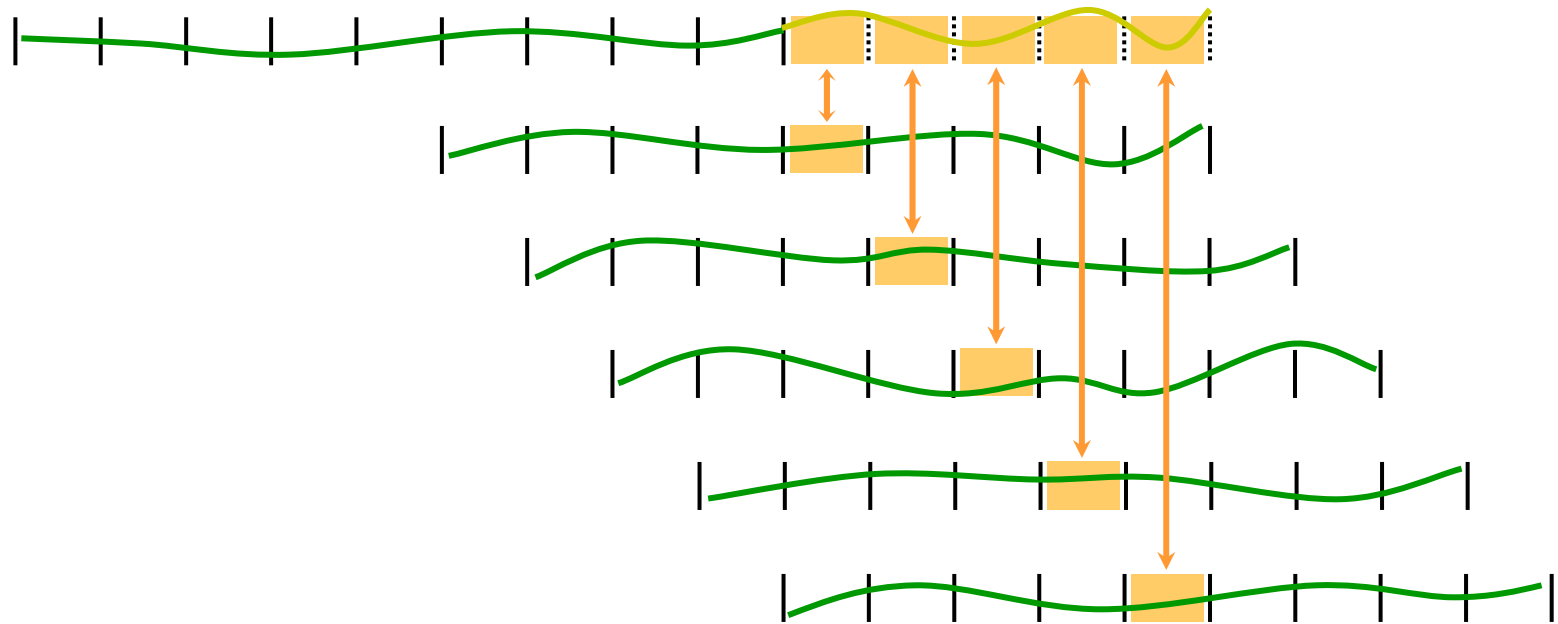
SLR-based 9-day arcs

(cm)



Orbit overlaps for predictions

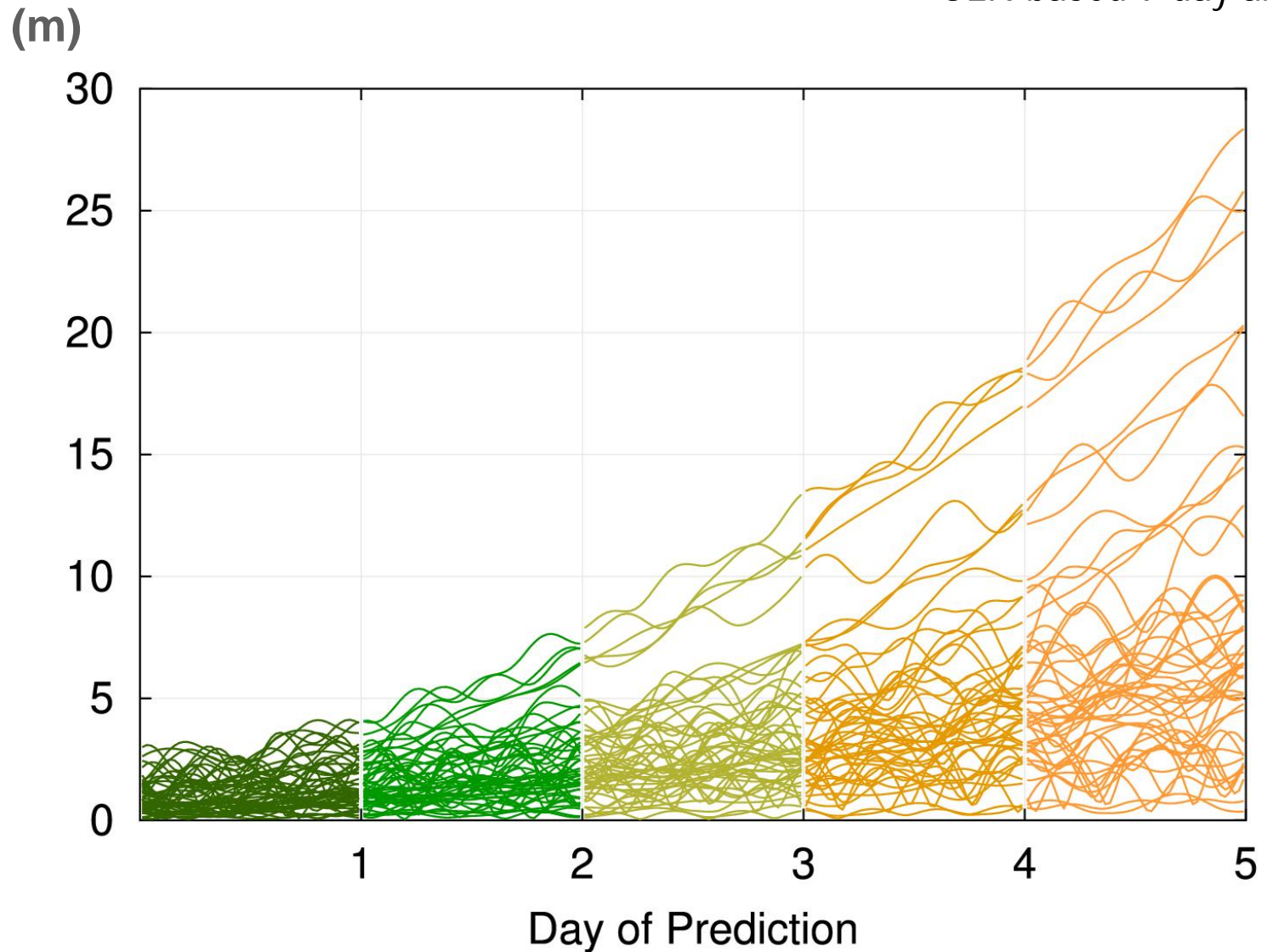
SLR-based 9-day arcs + 5-day prediction



Orbit differences:
prediction day of arc – central day of arc

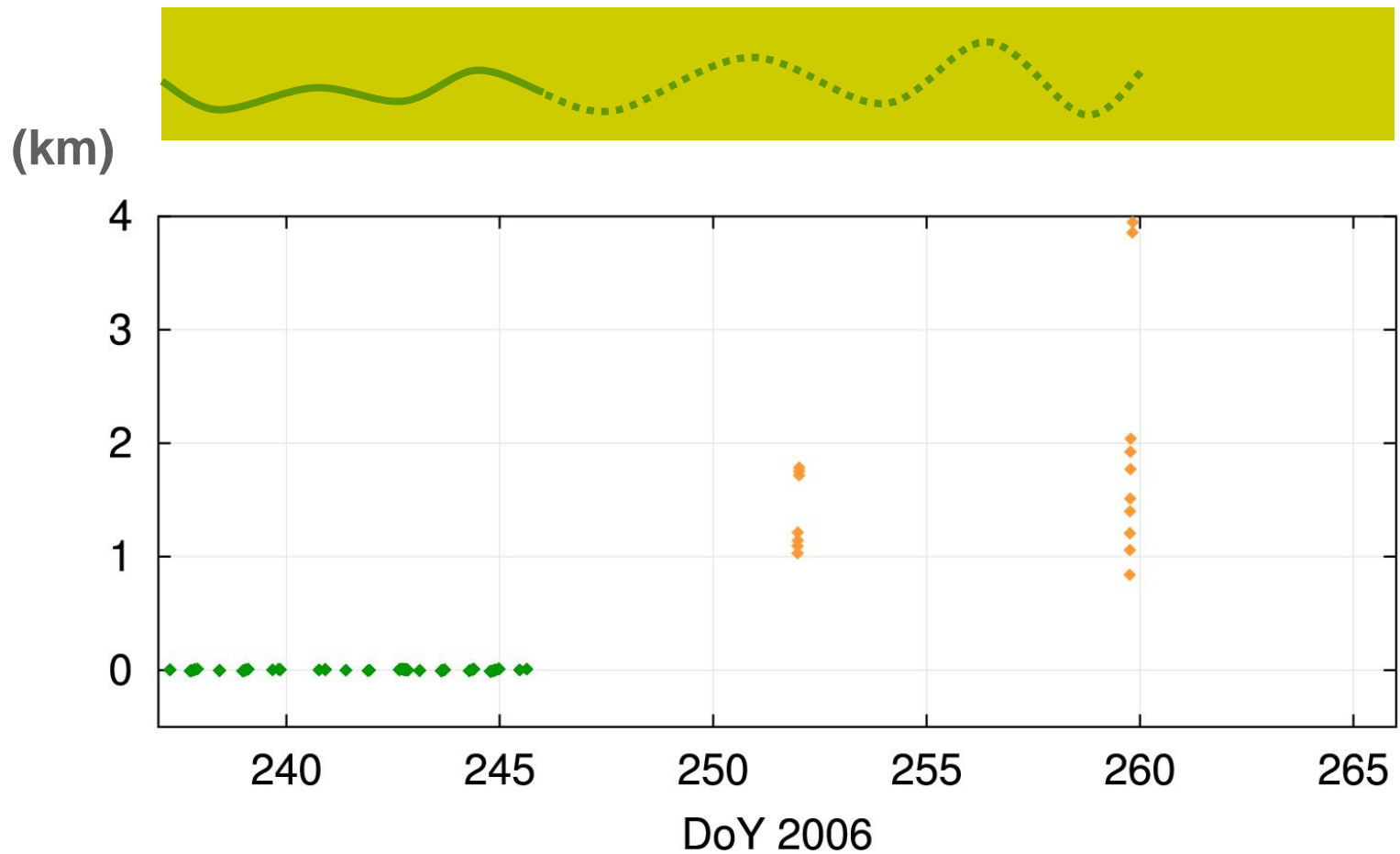
Orbit overlaps: 5-day predictions

SLR-based 9-day arcs



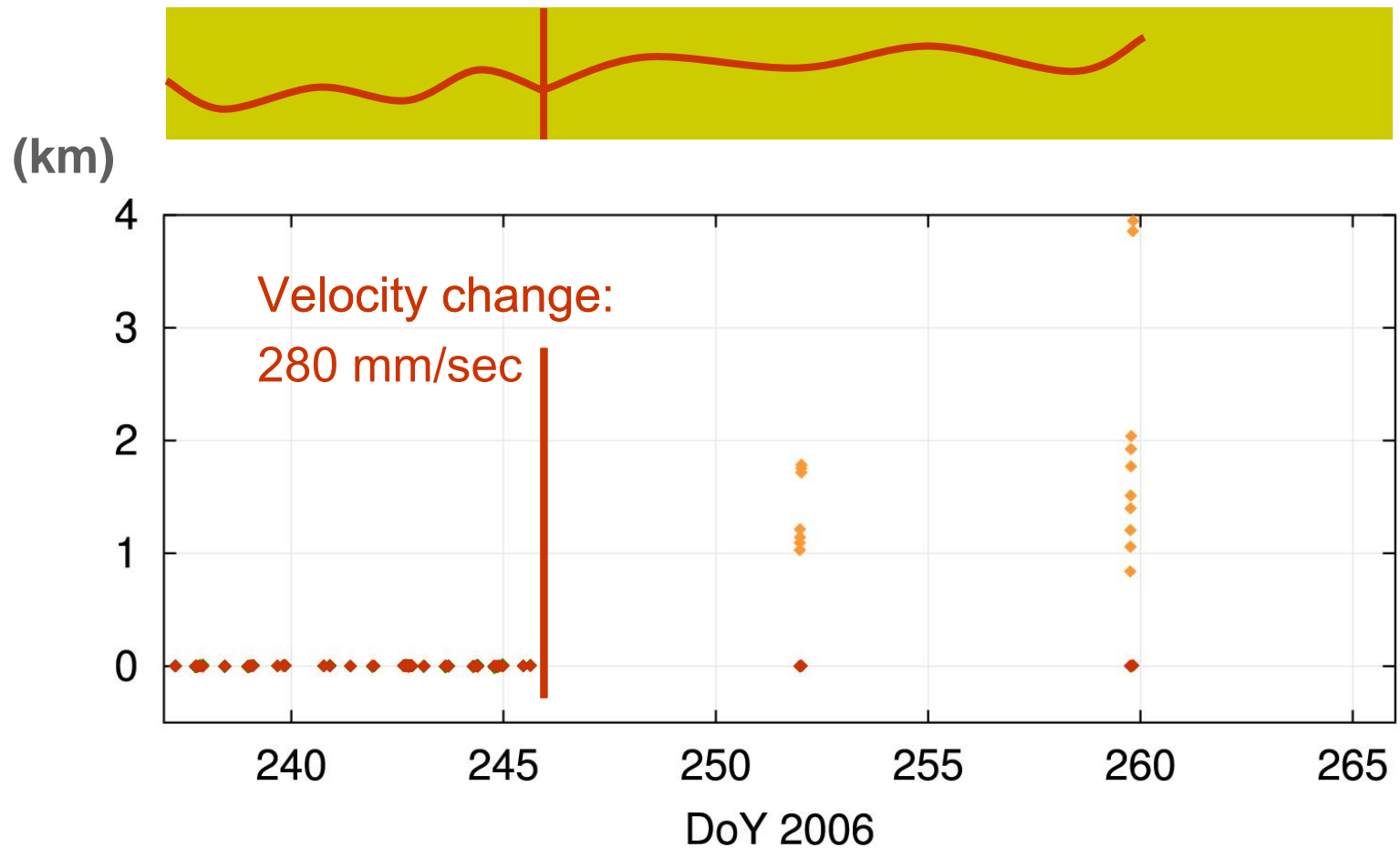
Orbit maneuver – SLR range residuals

SLR-based arc



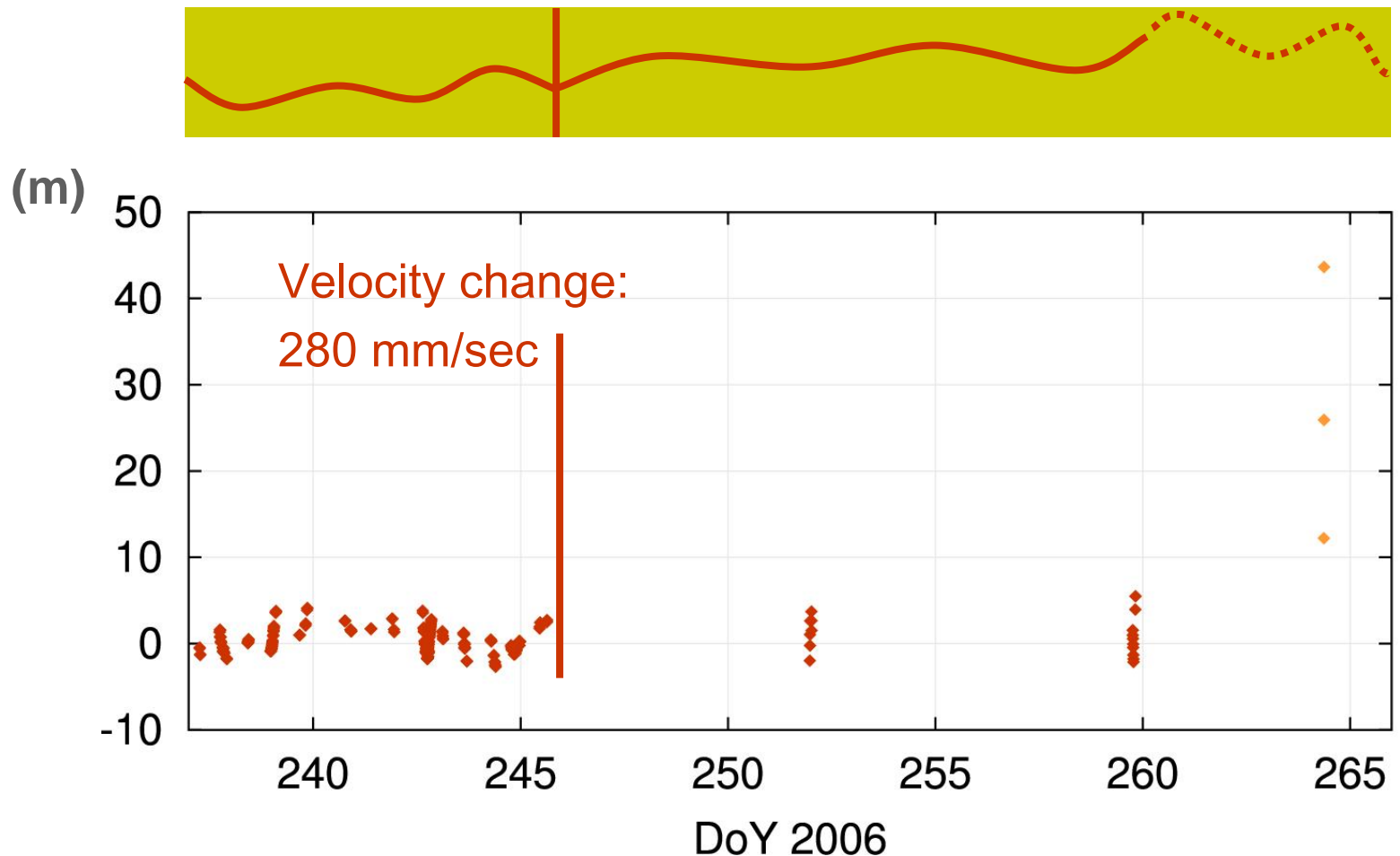
Orbit maneuver – SLR range residuals

SLR-based arc with 1 stochastic pulse



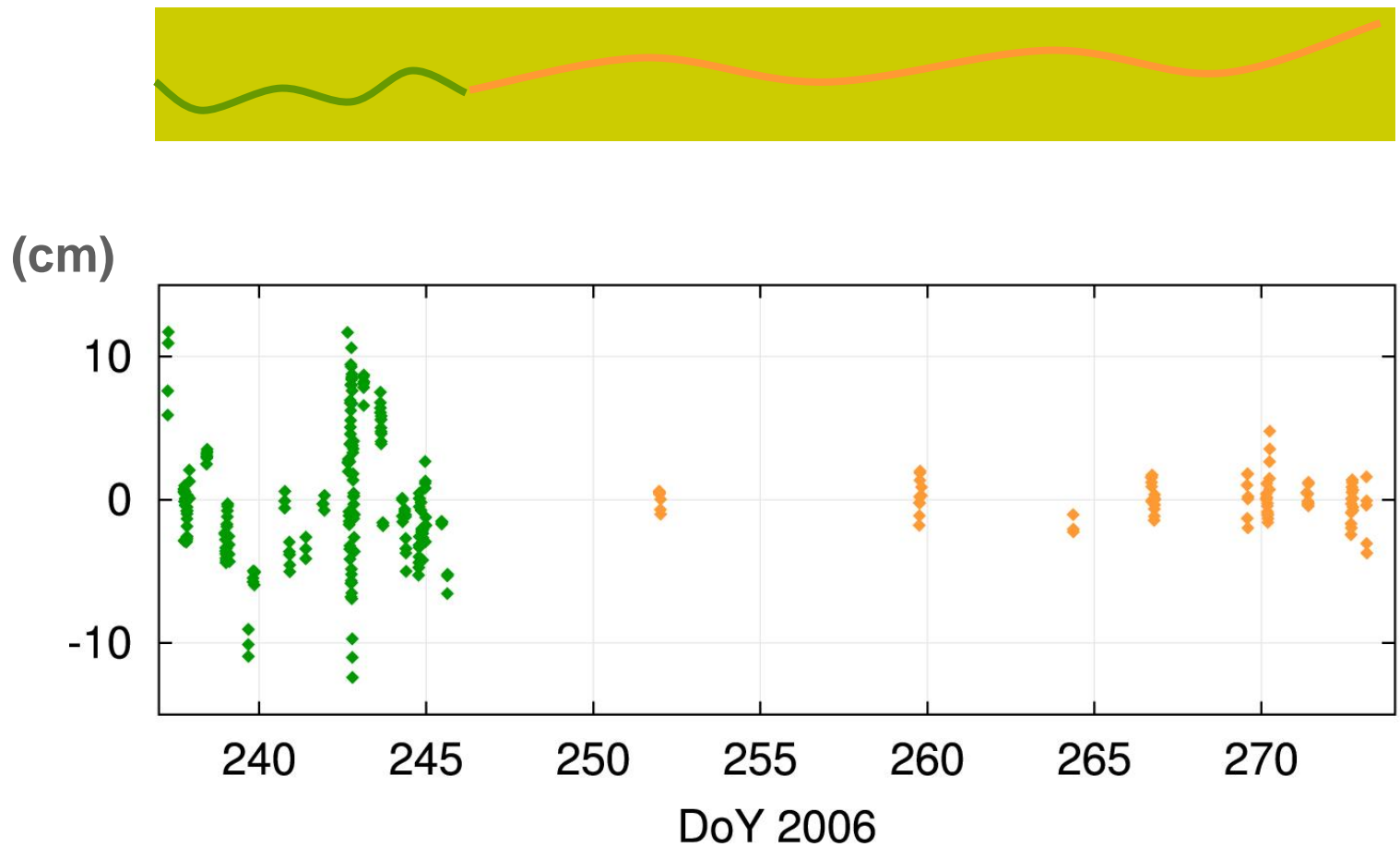
Orbit maneuver – SLR range residuals

SLR-based arc with 1 stochastic pulse



Orbit maneuver – SLR range residuals

2 separated SLR-based arcs



Combined analysis

Microwave + SLR data for POD

What is the possible contribution of SLR to GIOVE-A orbit determination in a combined analysis of microwave and SLR data?

a priori covariance analysis

GIOVE-A orbit determination based on
SLR + simulated microwave phase data

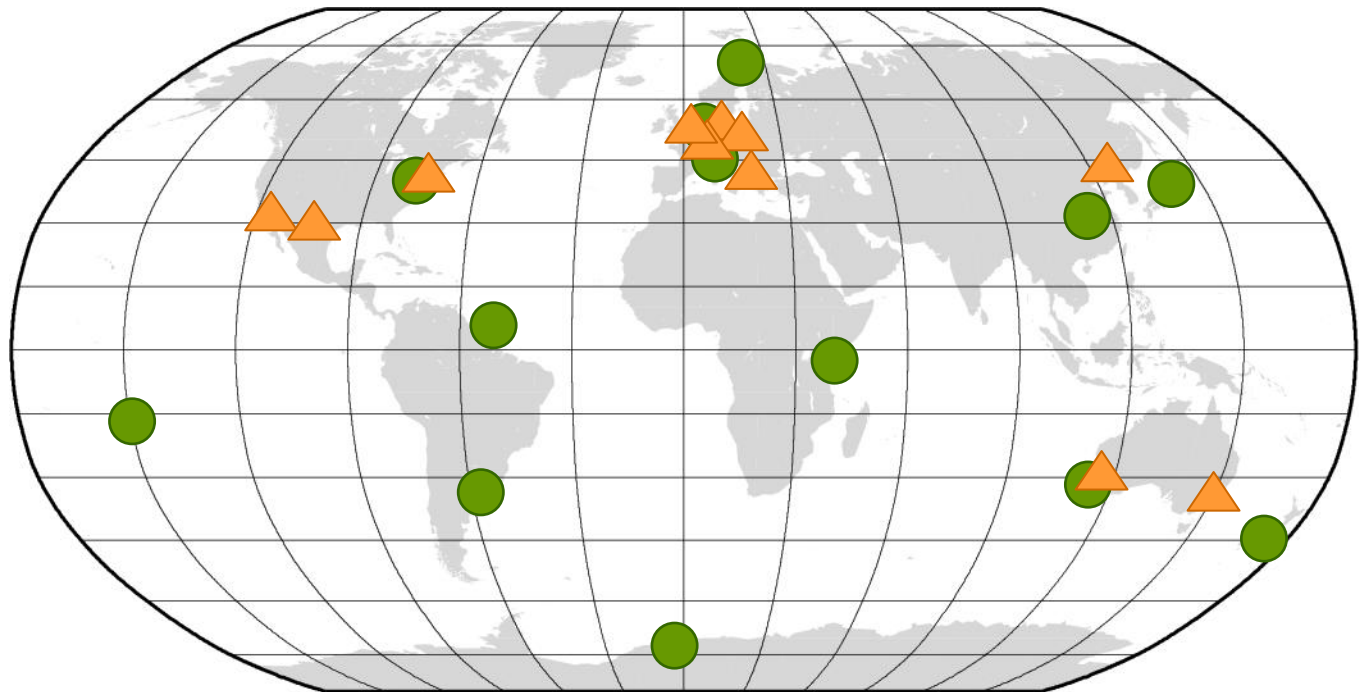
Sampling rate 30 sec

σ_{L1} phase 1 mm

Tracking network

Simulated observations of **13 GSTB/V2 stations**

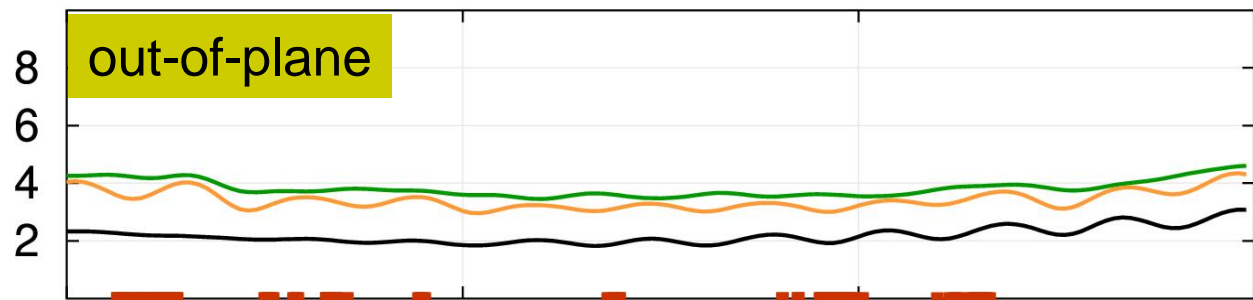
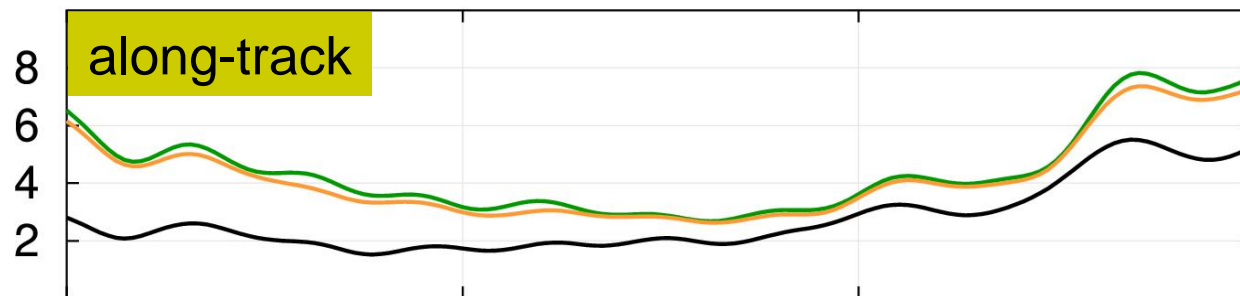
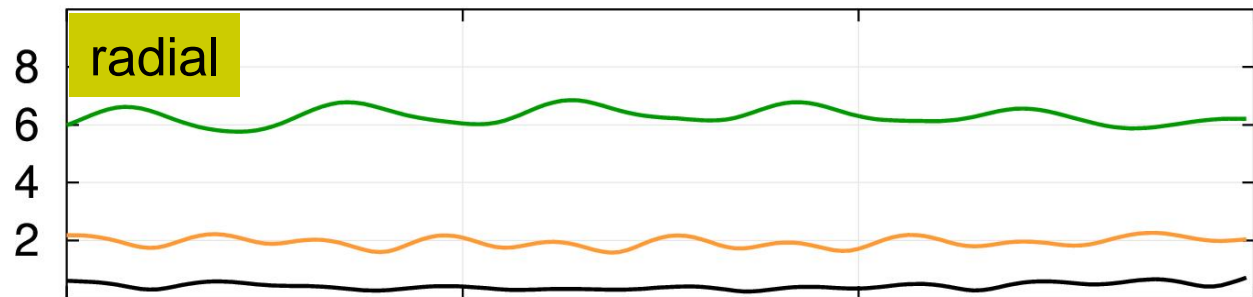
True observations of **11 SLR stations**



A priori formal orbit error

SLR + simulated microwave data, 3-day arc

(mm)



163 164 165 166

DoY 2006

$\sigma_{\text{SLR}} =$

∞

1 cm

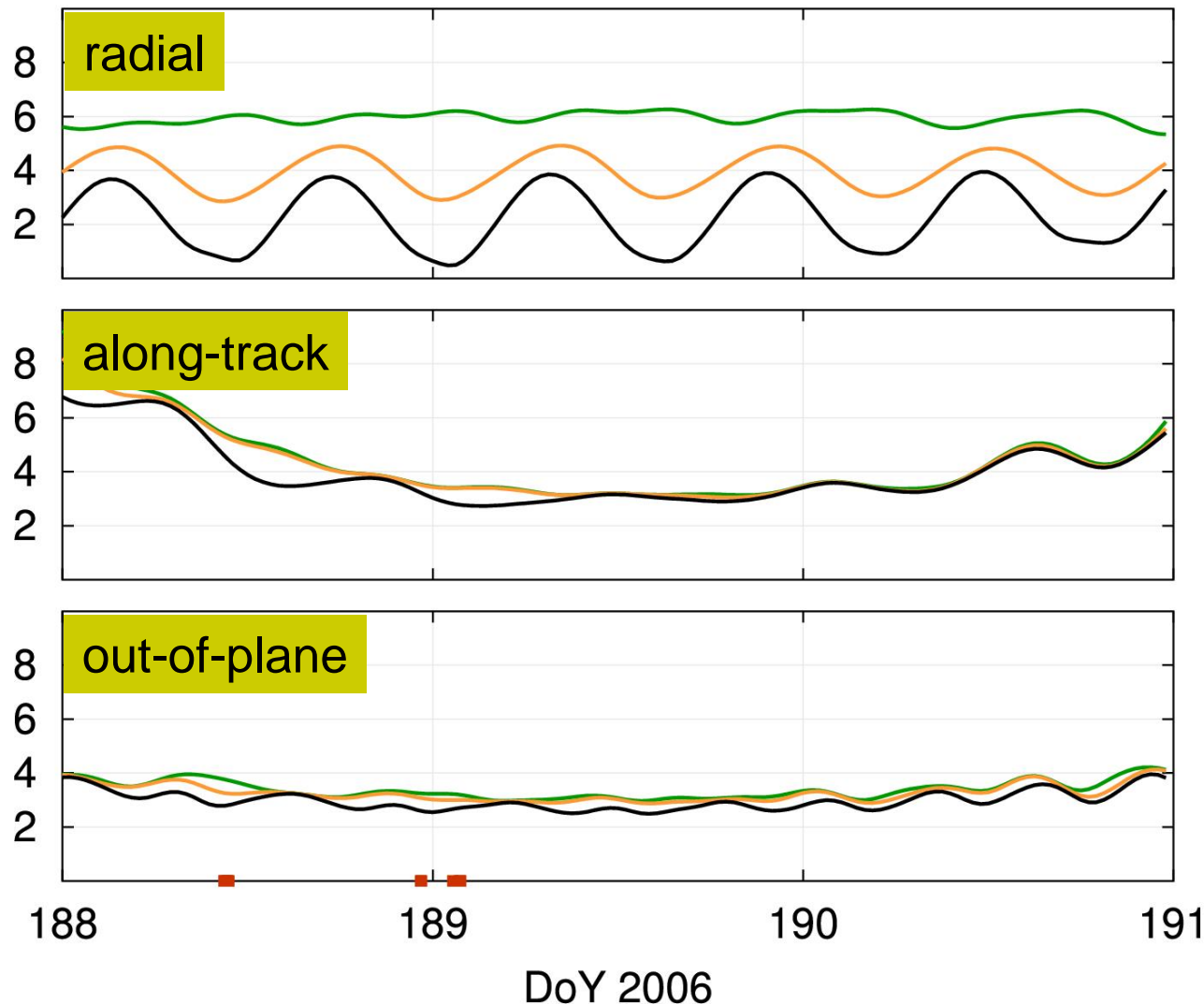
1 mm

SLR data

A priori formal orbit error

SLR + simulated microwave data, 3-day arc

(mm)



$\sigma_{\text{SLR}} =$

∞

1 cm

1 mm

SLR data

GIOVE-A orbit determination using

SLR

- Radial: < 10 cm
- Along-track: < 1 m
- Out-of-plane: < 2 m
- 5-day prediction: < 30 m
- Not announced maneuvers are a critical issue.

Microwave + SLR

- Radial: ~70% possible improvement, assuming
 - no model errors
 - evenly distributed SLR data