CODE Contributions to the IGS

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A. Sušnik[1], A. Villiger[1], A. Jäggi[1]

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[2] *Swiss Federal Office of Topographie, swisstopo*

EUREF 2015 AC Workshop
14.–15. October 2015, Bern, Switzerland

The CODE Analysis Center

- CODE, Center for Orbit Determination in Europe, is one of at present ten Analysis Centers of the IGS. CODE is formed as a joint venture of
  - the Astronomical Institute of the University of Bern (AIUB),
  - the Swiss Federal Office of Topography (swisstopo),
  - the Institut für Kartographie und Geodäsie (BKG), and
  - the Institut für Astronomische und Physikalische Geodäsie of TU München (IAPG, TUM).

AIUB

Bundesamt für Kartographie und Geodäsie

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Technische Universität München

Overview

CODE Ultra–Rapid Solution

CODE Rapid Solution

CODE Final Solution

Reprocessing Solution (CODE and AIUB)

CODE MGEX Solution

CODE Ultra–Rapid Solution

CODE Ultra–Rapid Solution

Number of stations: 90

Satellite systems: GPS+GLONASS

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Schedule, latency: **07:00**, 10:00, **12:00**, 15:00, **18:00**, 21:00, **24:00** UTC
available about 1 to 2 hours after the launch of the job

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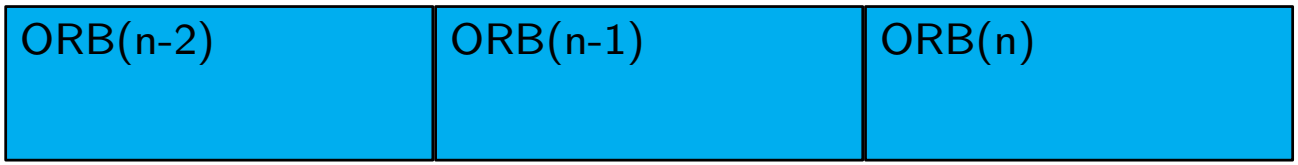
- The orbit and ERP files contain a prediction for 24 hours
  (with only reliably predictable satellites are included).
- Description in Lutz et al. (2014):
  "CODE's new ultra-rapid orbit and ERP products for the IGS" .

CODE Ultra–Rapid Solution

How the solution is generated?

Old procedure (until 2013, based on fitting orbit files):



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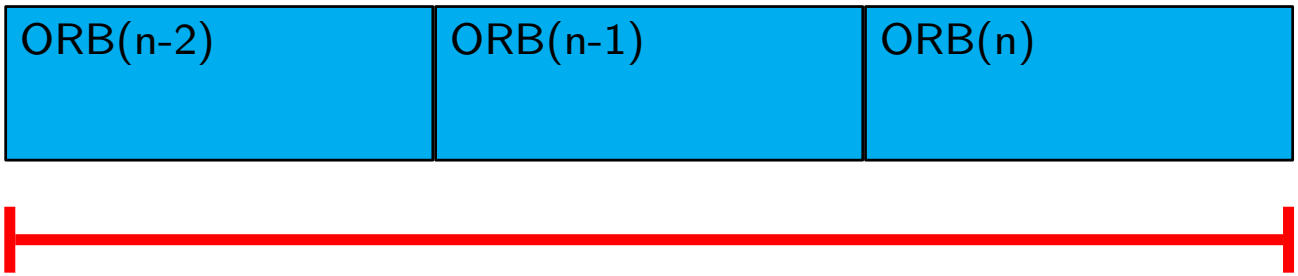

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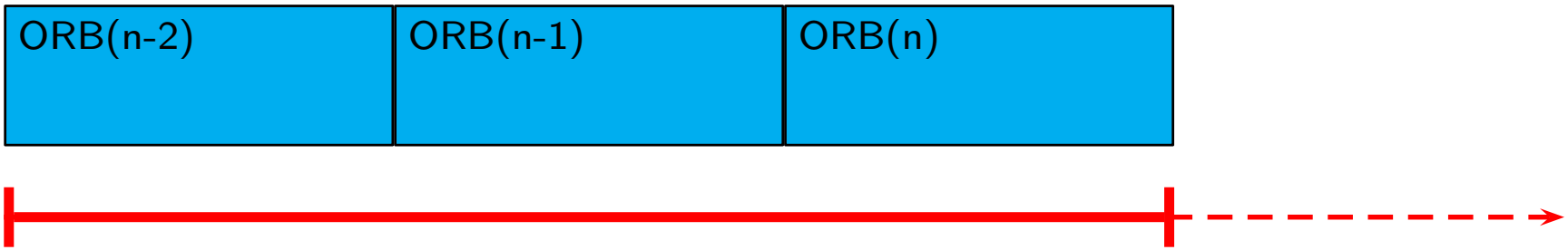

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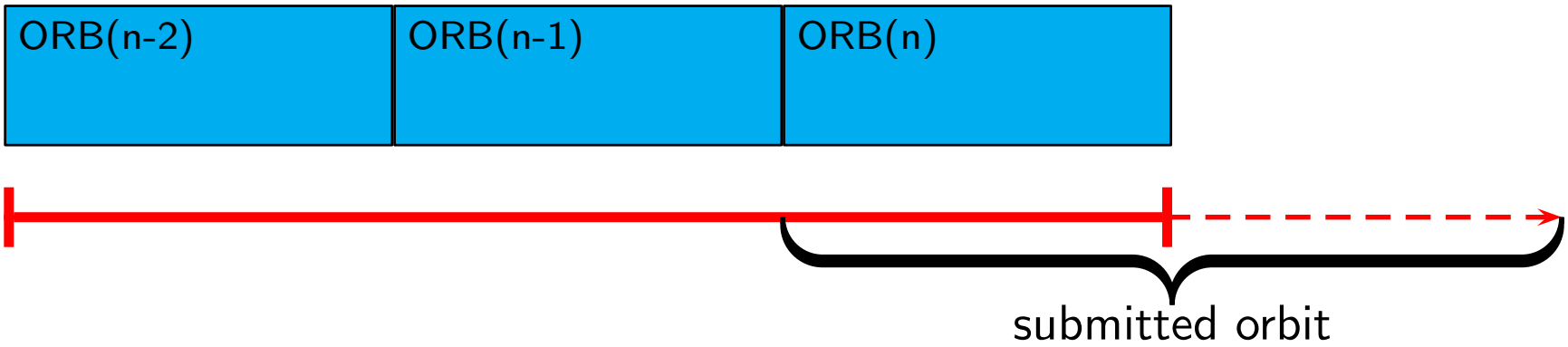

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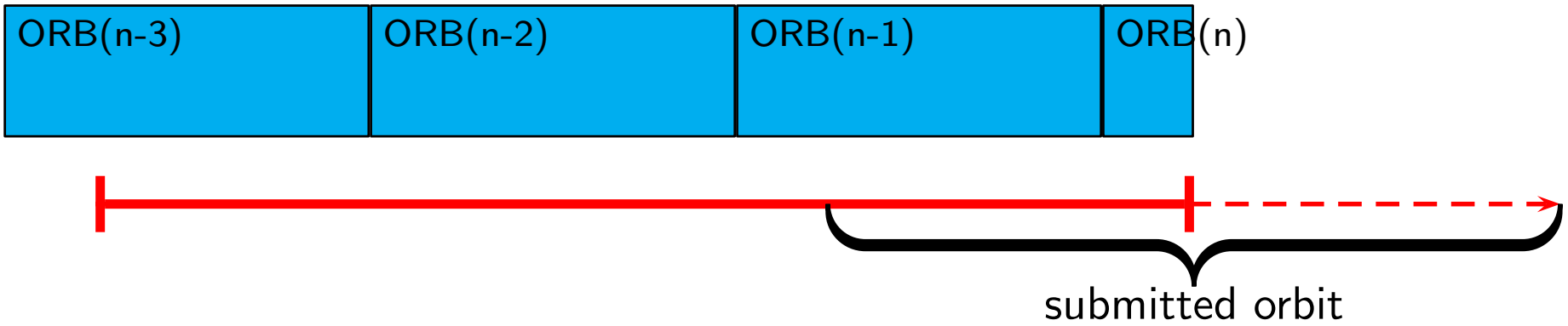

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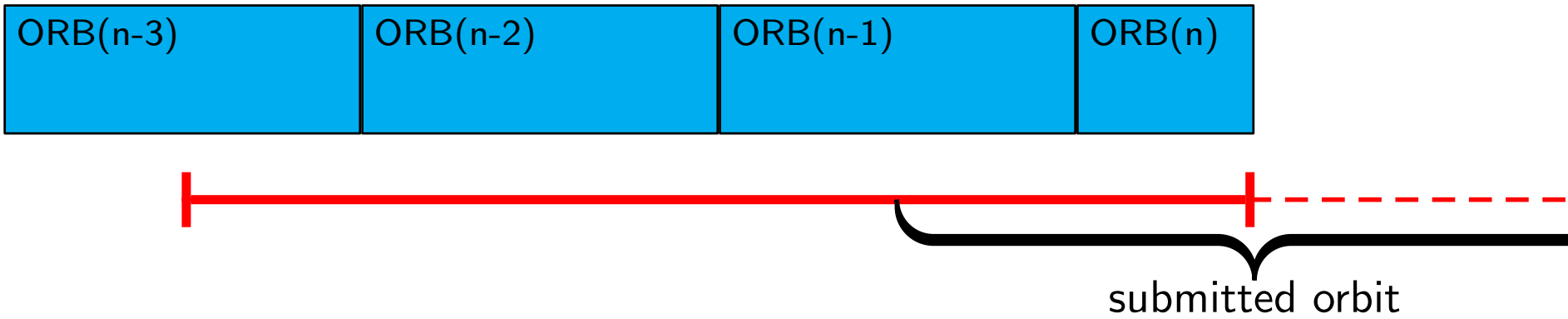

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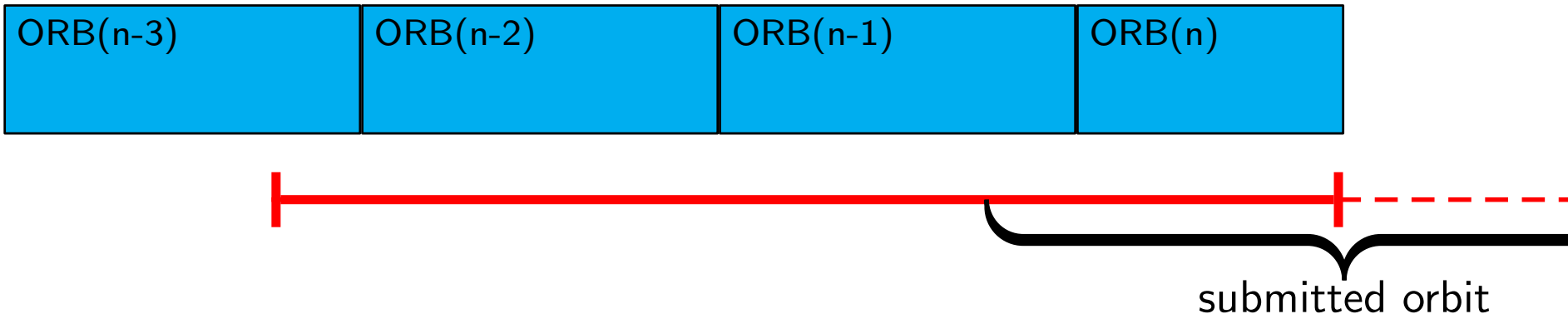

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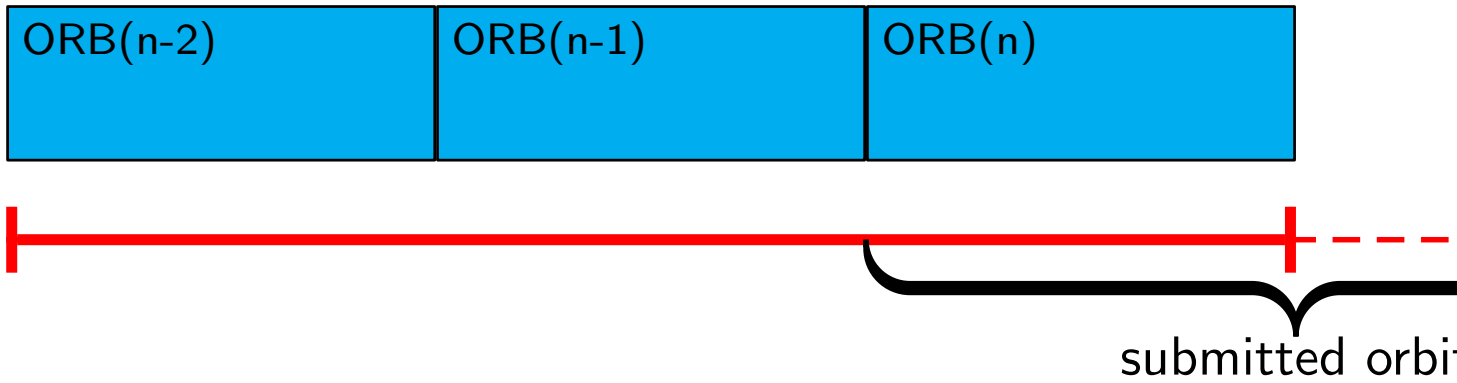

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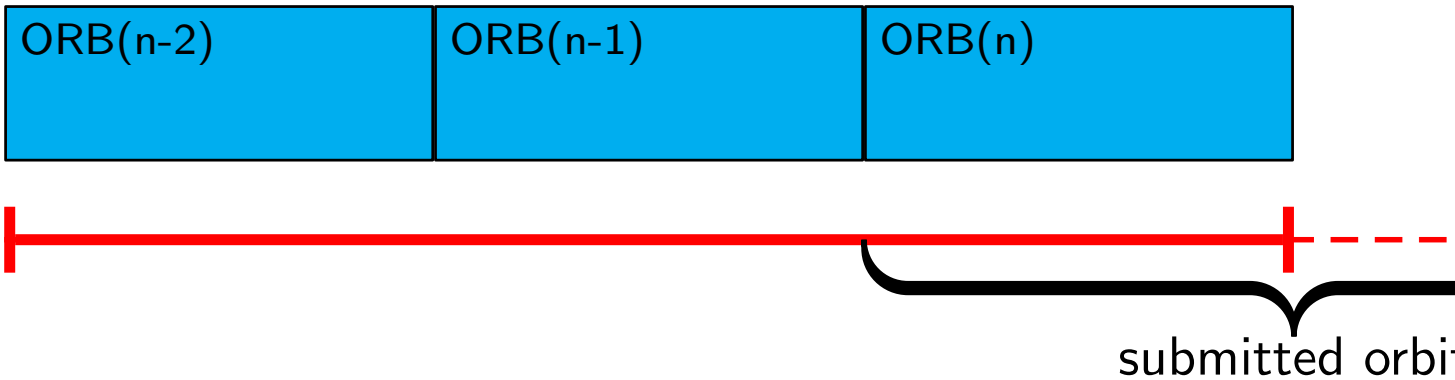

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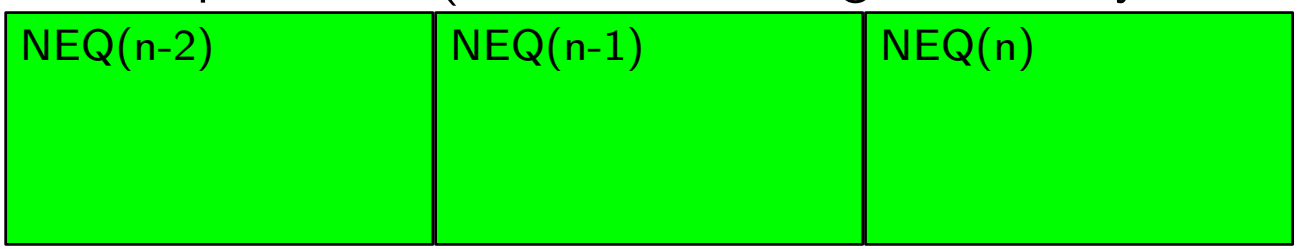

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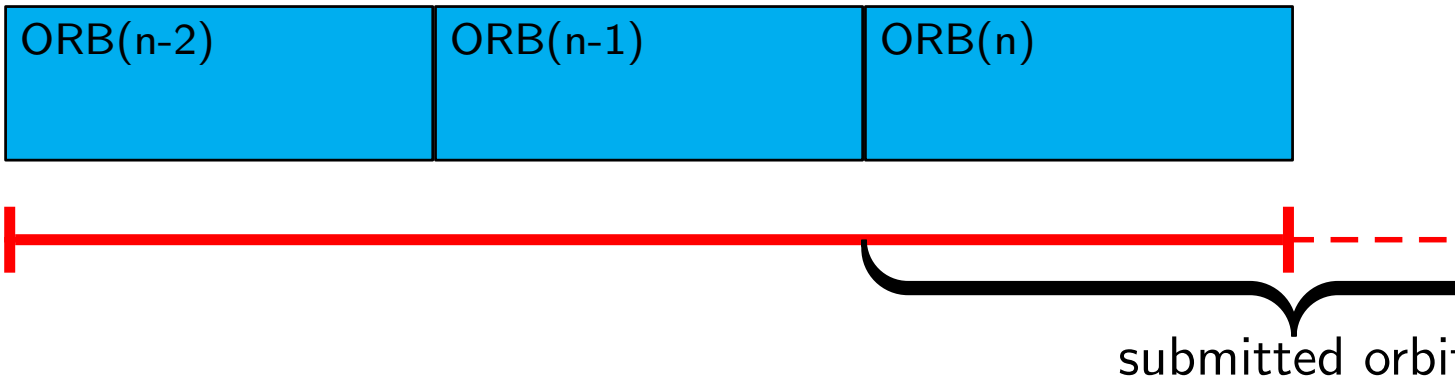

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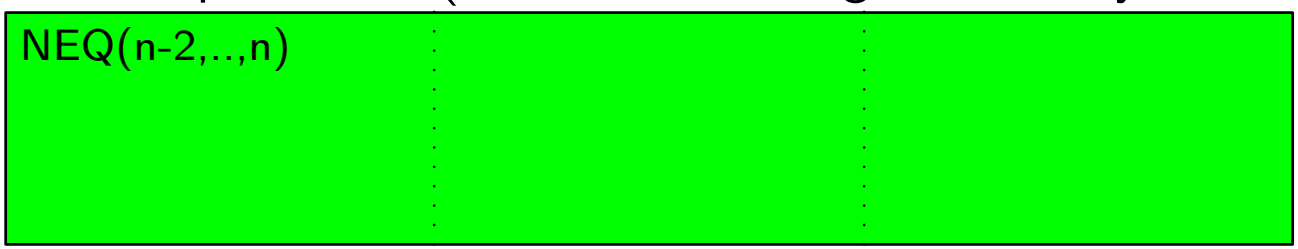

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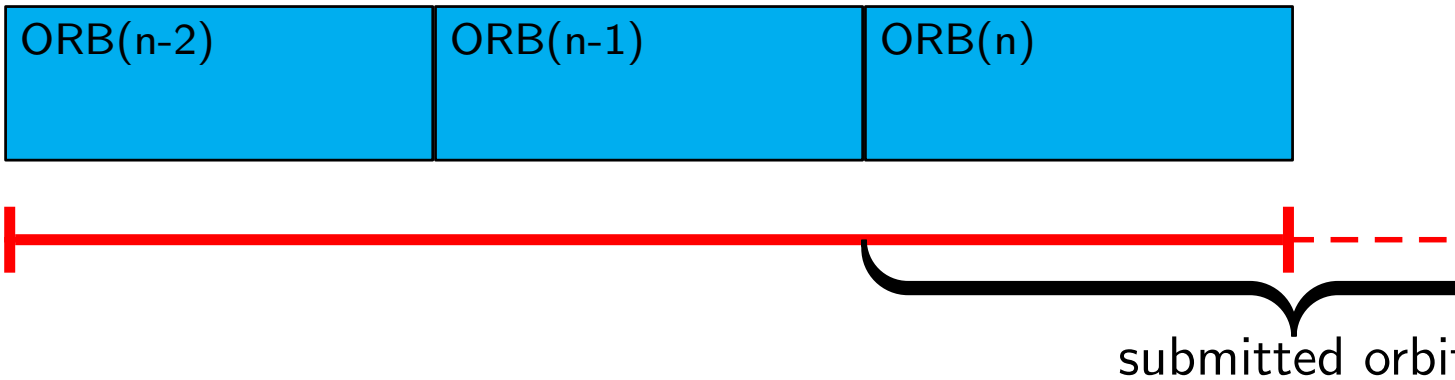

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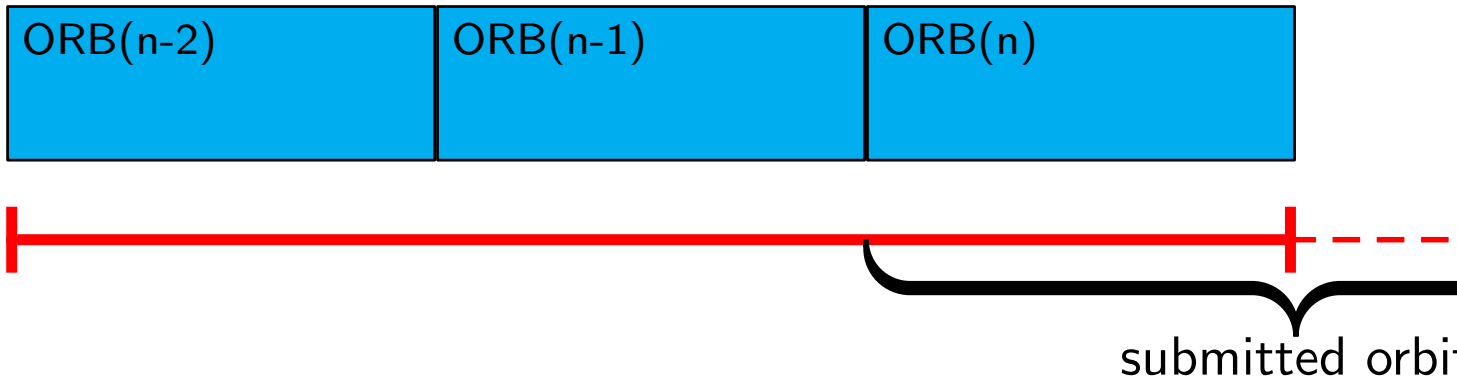

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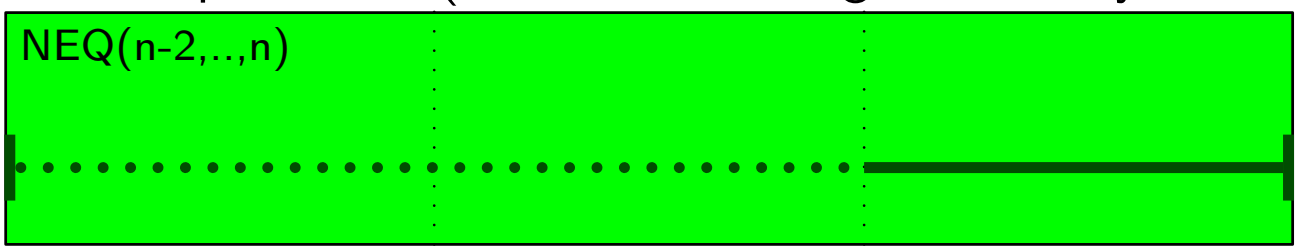

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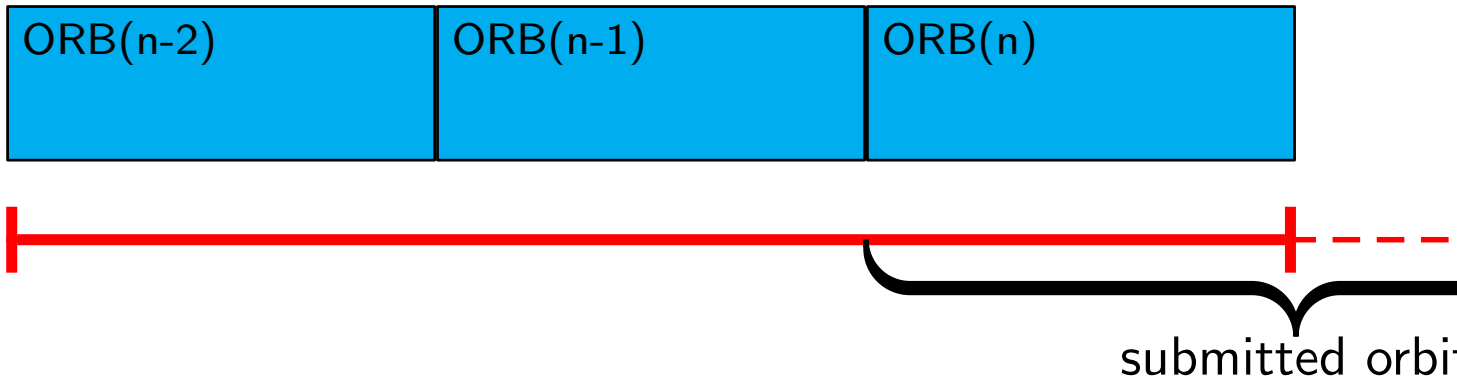

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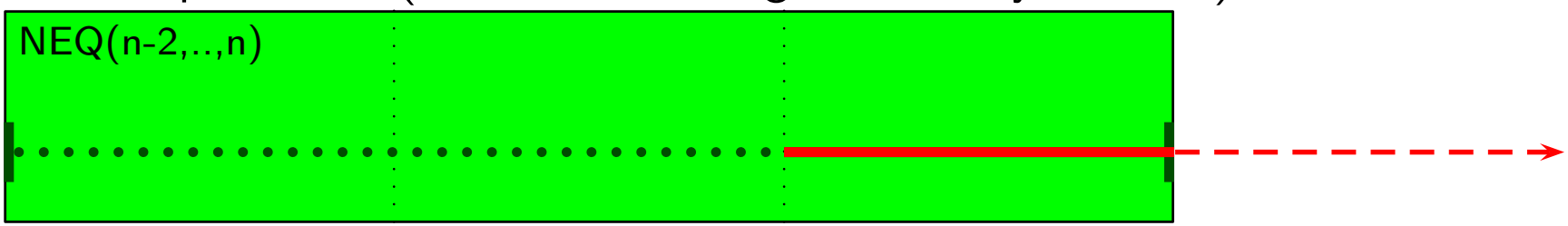

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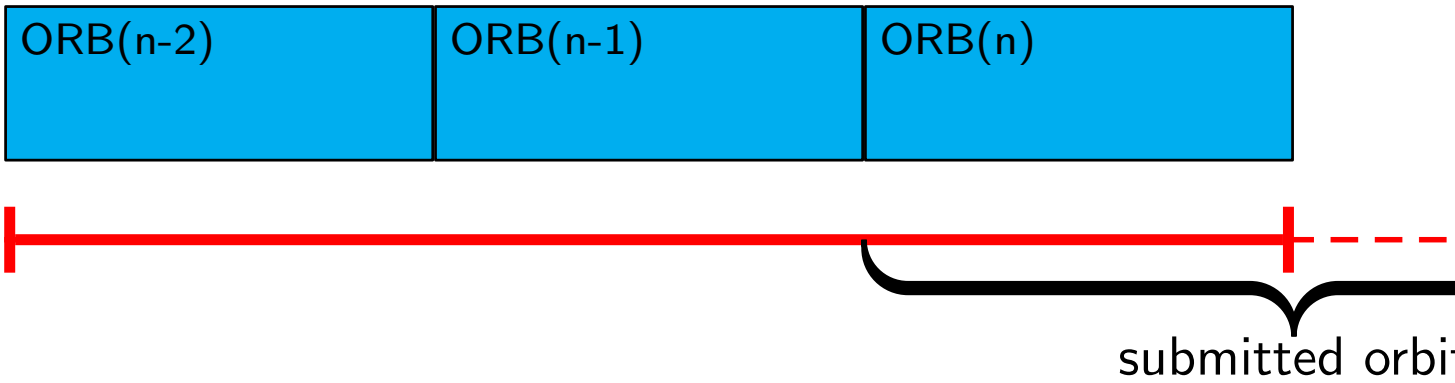

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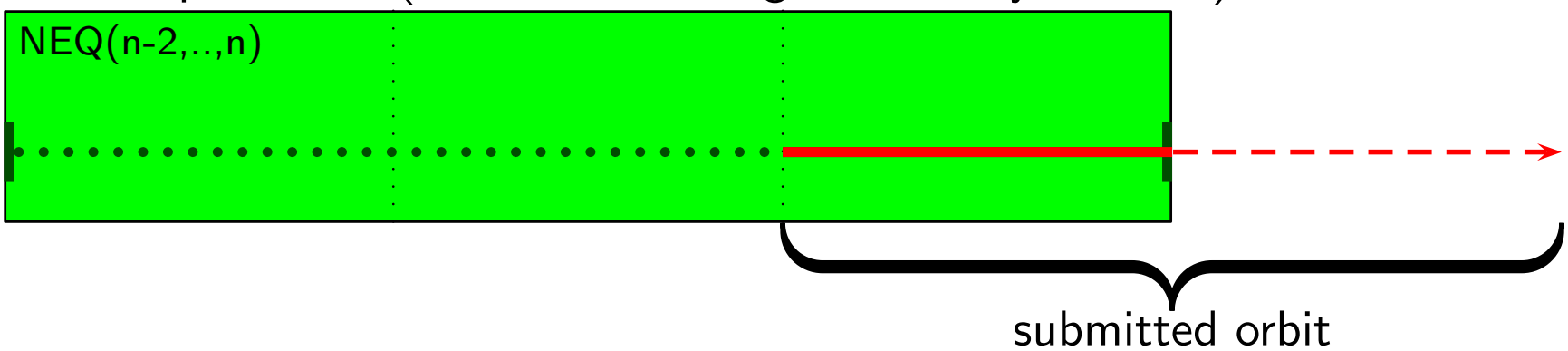

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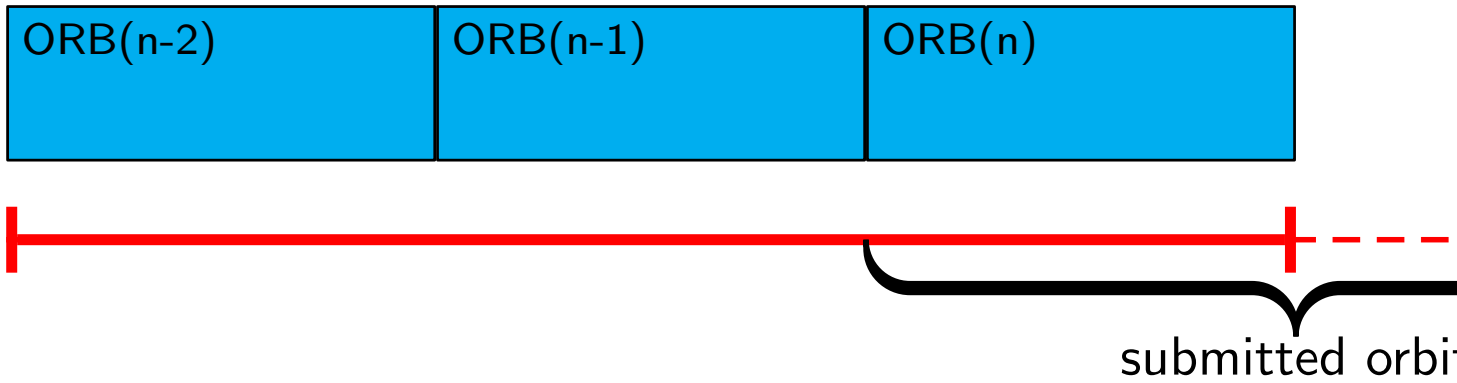

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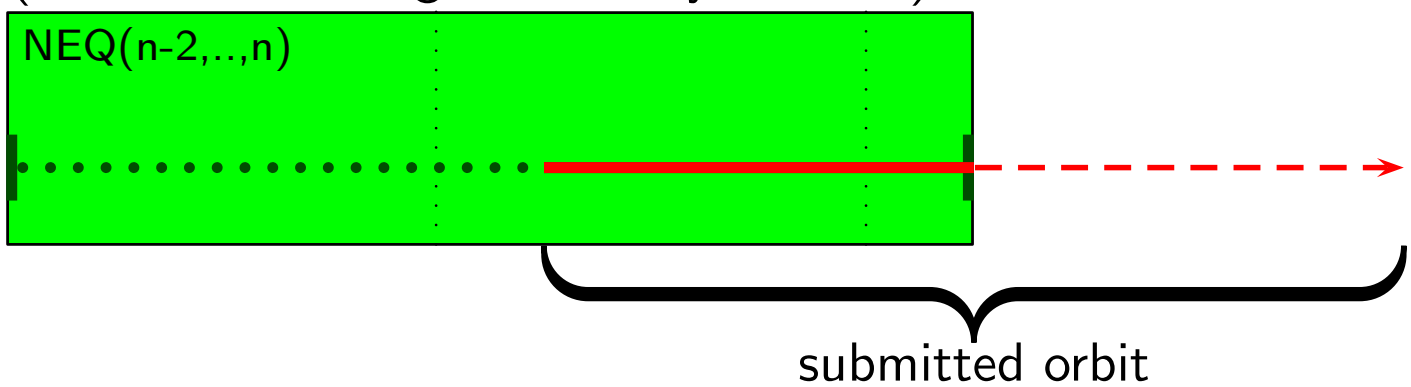

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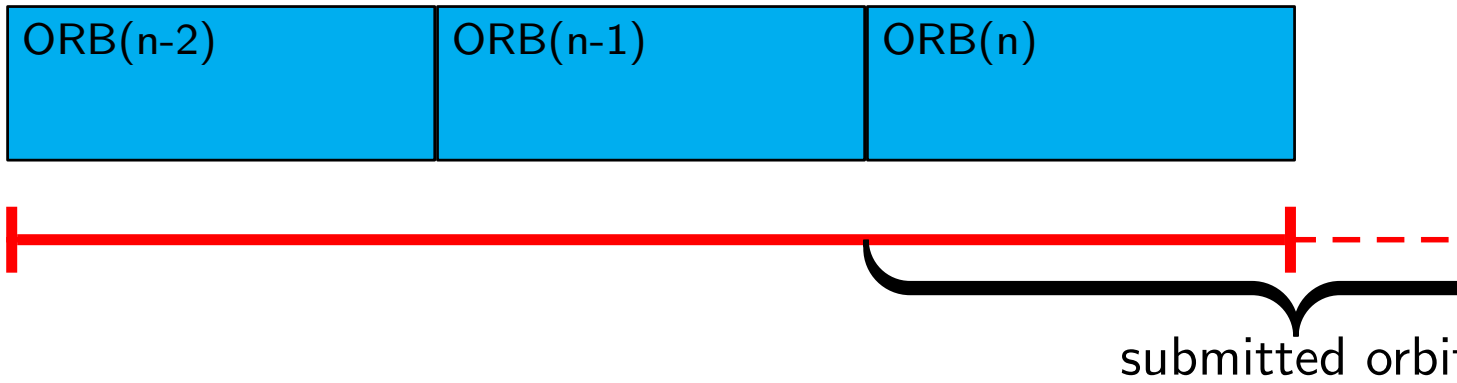

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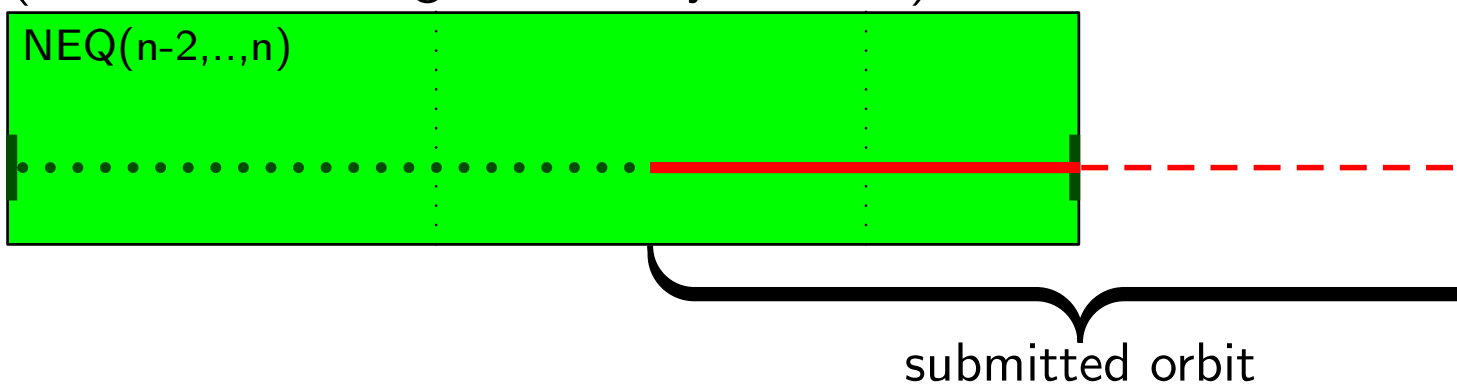

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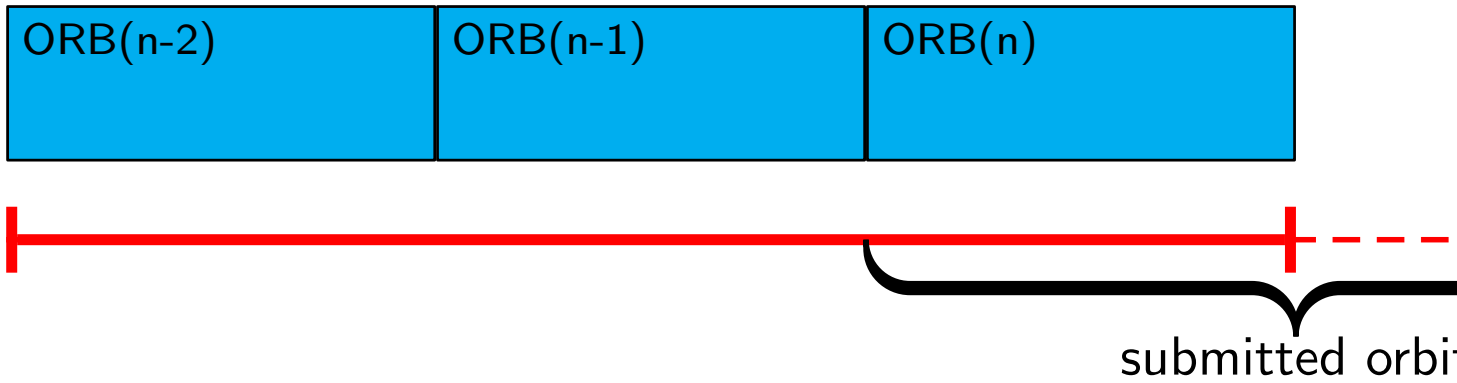

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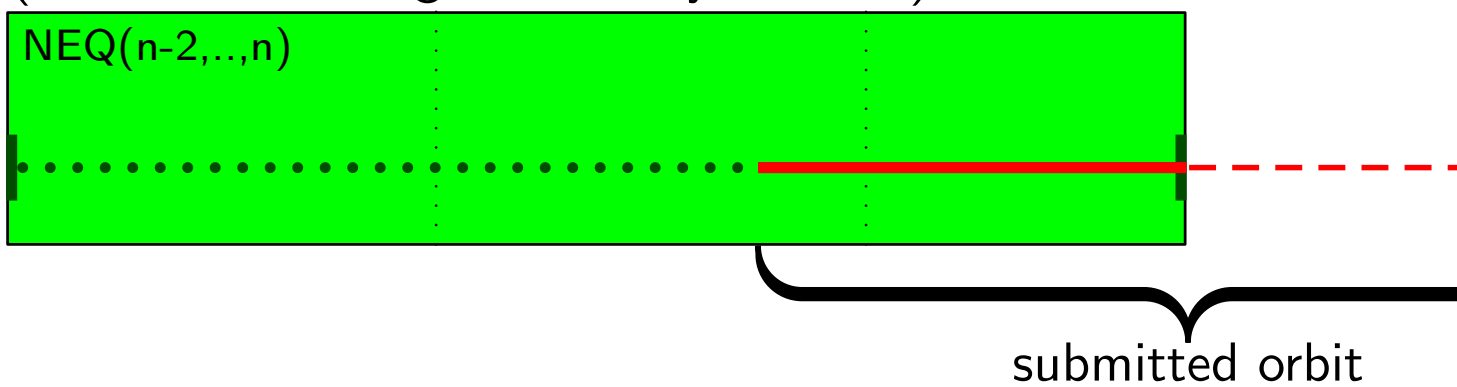

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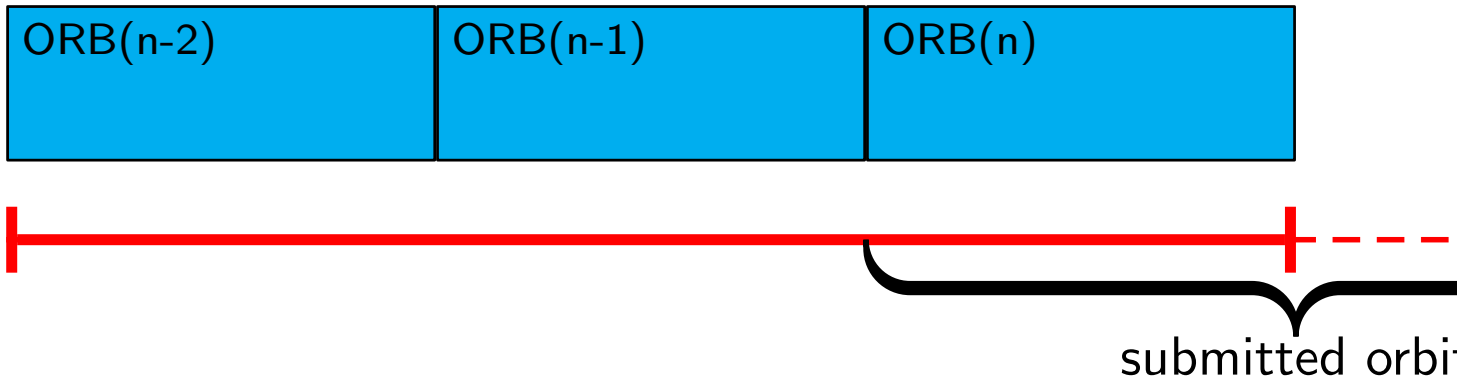

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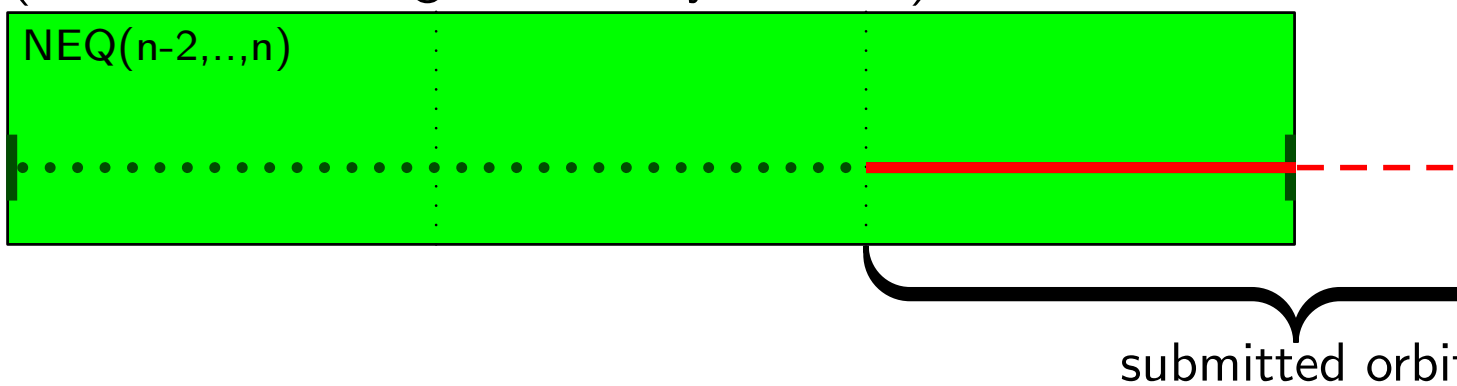

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Number of stations: 120

Satellite systems: GPS+GLONASS

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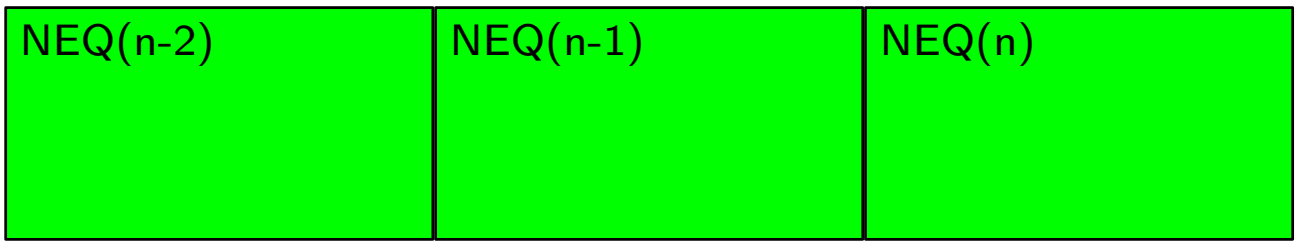
Remarks:

- Two versions of the rapid solution are made available:
  `ftp://ftp.unibe.ch/aiub/CODE/COD{wwwwd}.???_R` and
  `ftp://ftp.unibe.ch/aiub/CODE/COD{wwwwd}.???_M`.
  `_R` "early rapid solution"
  `_M` "final rapid solution"
- The rapid solutions are removed from the FTP server if the final solution is published.

CODE Rapid Solution

Why CODE is providing two rapid solutions?



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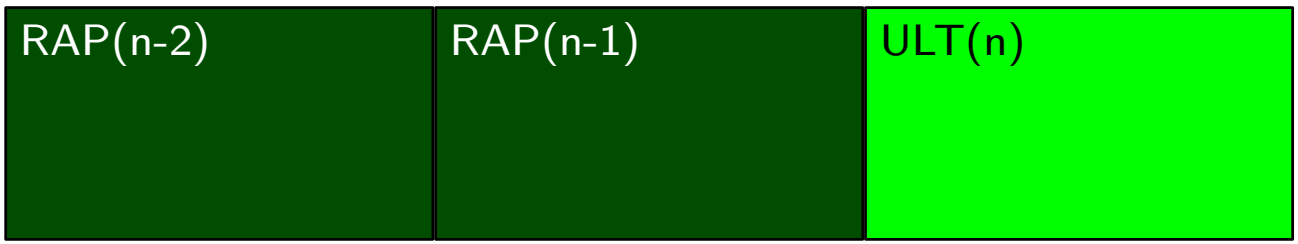

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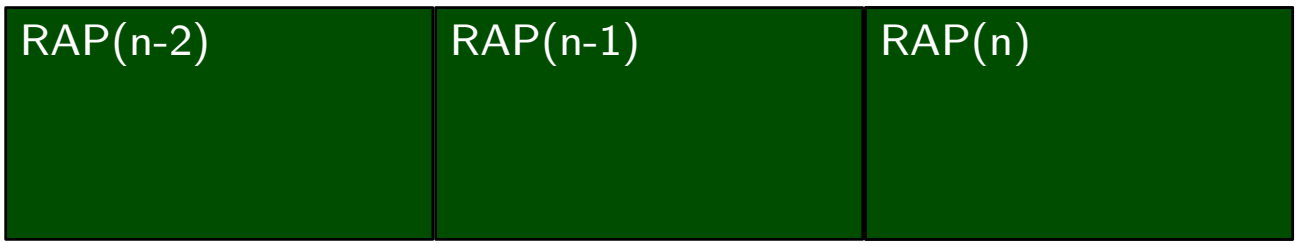

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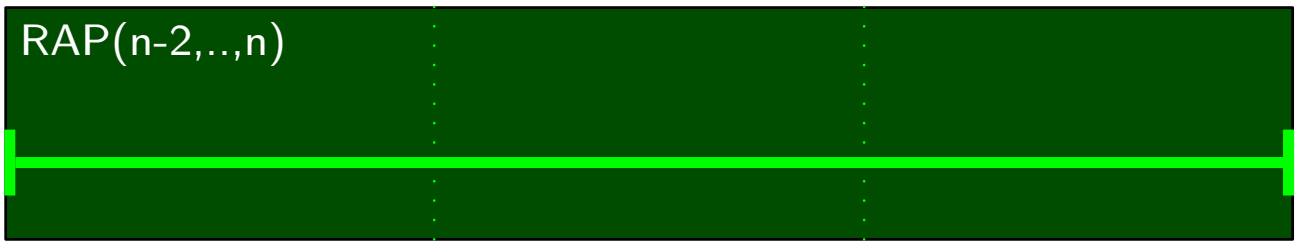

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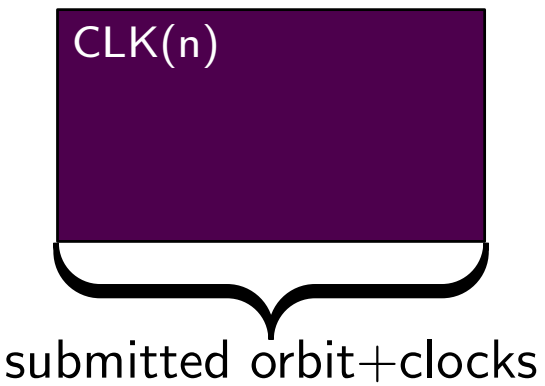
Early rapid solution (ID: _R)
end of a long-arc solution



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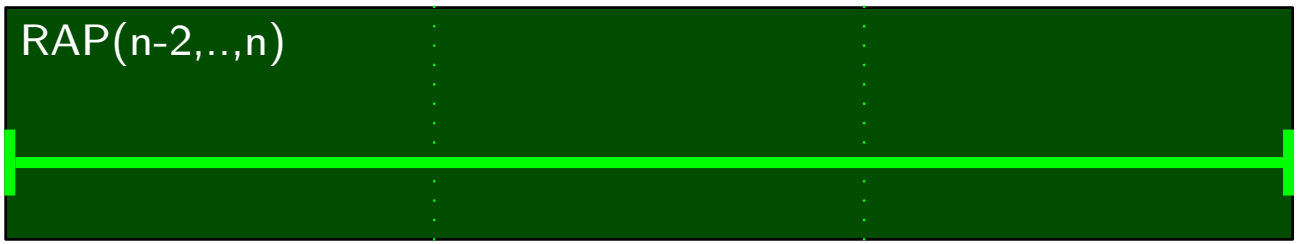

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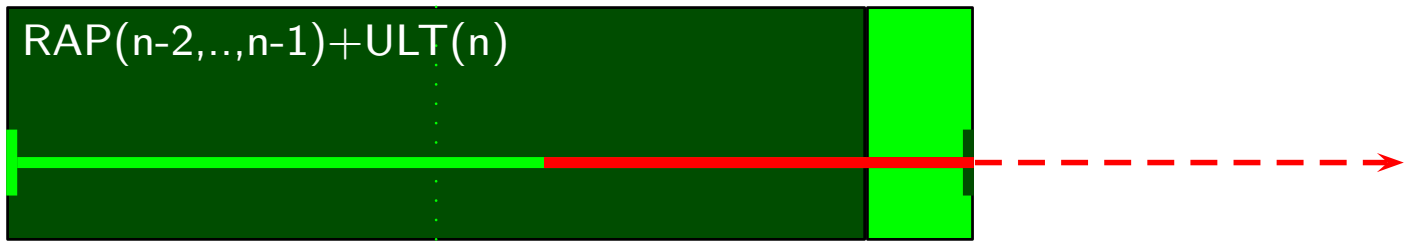

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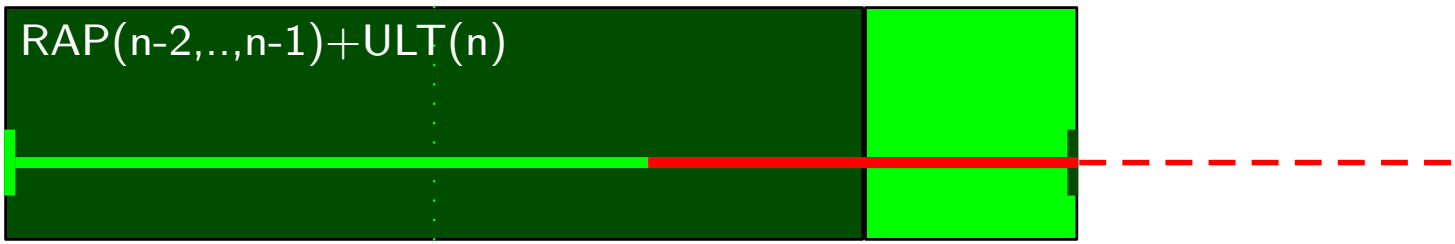

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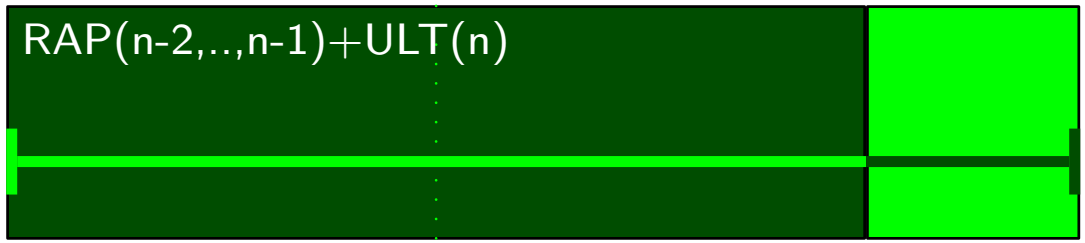

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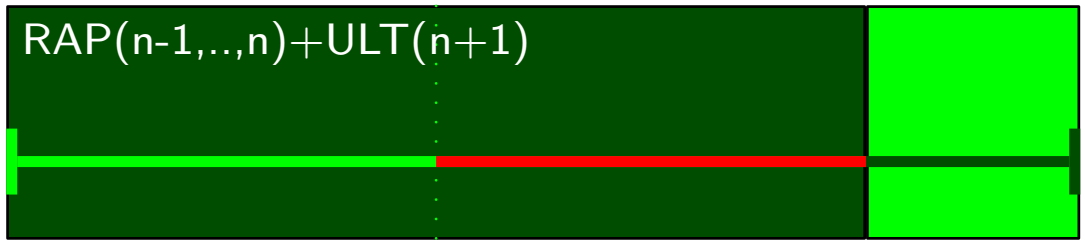

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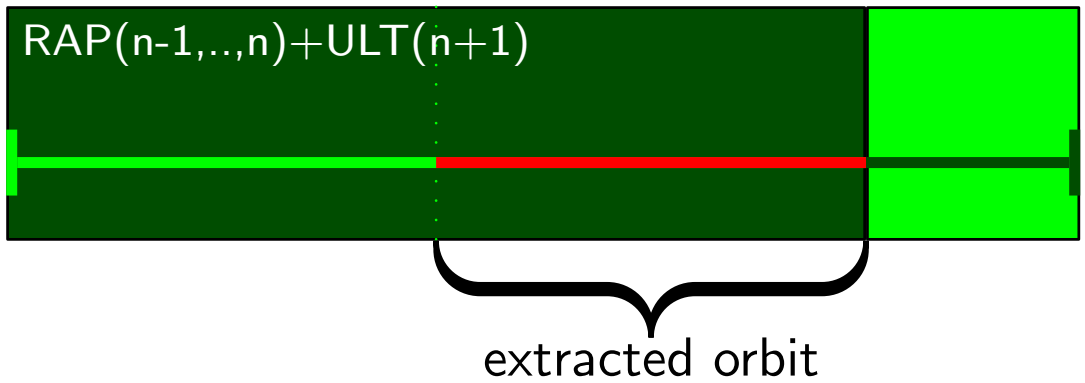

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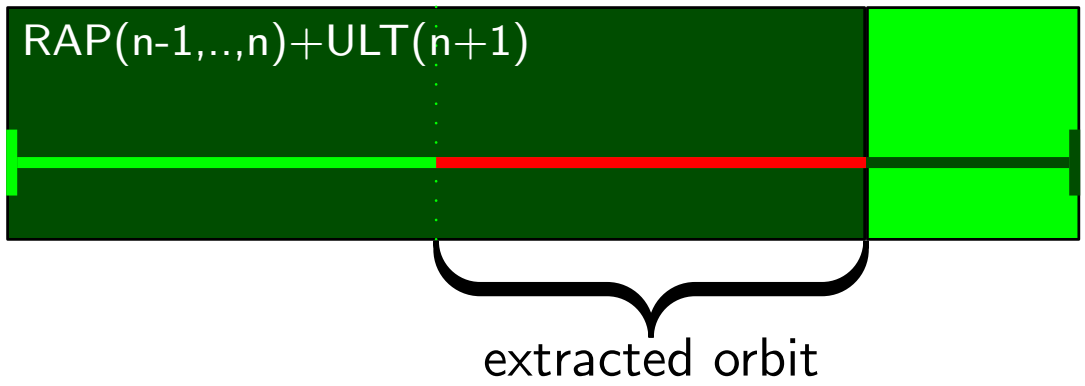

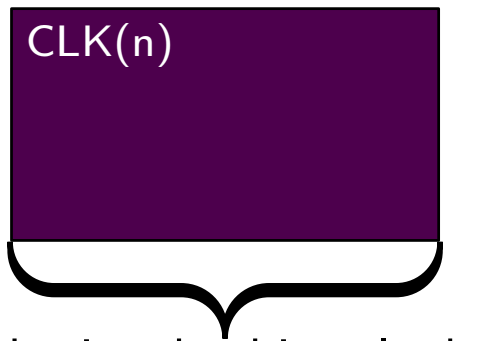

Early rapid solution (ID: _R)
end of a long-arc solution

Final rapid solution (ID: _M)
middle of a long-arc solution

CODE Final Solution

1

2

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Number of stations: 250

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Schedule, latency: published on Thursday after the end of the week

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Available products: orbit, ERP, tropo, SINEX(crd), clock (only GPS)
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`ftp://ftp.unibe.ch/aiub/CODE/{yyyy}/COD{wwwwd}.???`[1]

[1] The "final rapid solution" with the GLONASS clocks is copied to `ftp://ftp.unibe.ch/aiub/CODE/{yyyy}_M/COD{wwwwd}.???`
[2]

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Remarks:

- Two versions of the final solution are computed:
  - `cof` "clean one-day final solution"[2]
  - `cod` "three-day long-arc solution"
- The "three-day long-arc solution" is strongly recommended if you are interested in the orbits!!!

[1] The "final rapid solution" with the GLONASS clocks is copied to `ftp://ftp.unibe.ch/aiub/CODE/{yyyy}_M/COD{wwwwd}.???`

[2] only submitted to the CDDIS server

CODE Final Solution

Clock densification in the CODE final solution:

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300 s sampling: (processing by GPSEST, combination by CCRNXC)

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5 s sampling: (processing by CLKEST)
further interpolation based on phase (epoch-difference) observations using the high-rate RINEX files generated from real-time streams

This product is suited for high-rate applications up to 1 Hz.

Reprocessing Solution (CODE and AIUB)

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Remarks:

- processing strategy from Summer 2013 used
- a new series is currently under generation (including clocks)
  publication planned for the beginning of 2016
  either still in IGb08 or ITRF2014 reference frame

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The current reprocessing effort is done
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Internal validation procedure:

- GPS orbits and satellite clock corrections
  (done by Andreja Sušnik)
- GRACE orbits based on a PPP-based kinematic solution
  (done by Daniel Arnold)
- monthly gravity field based on GRACE orbits and K-band
  (done by Ulrich Meyer)

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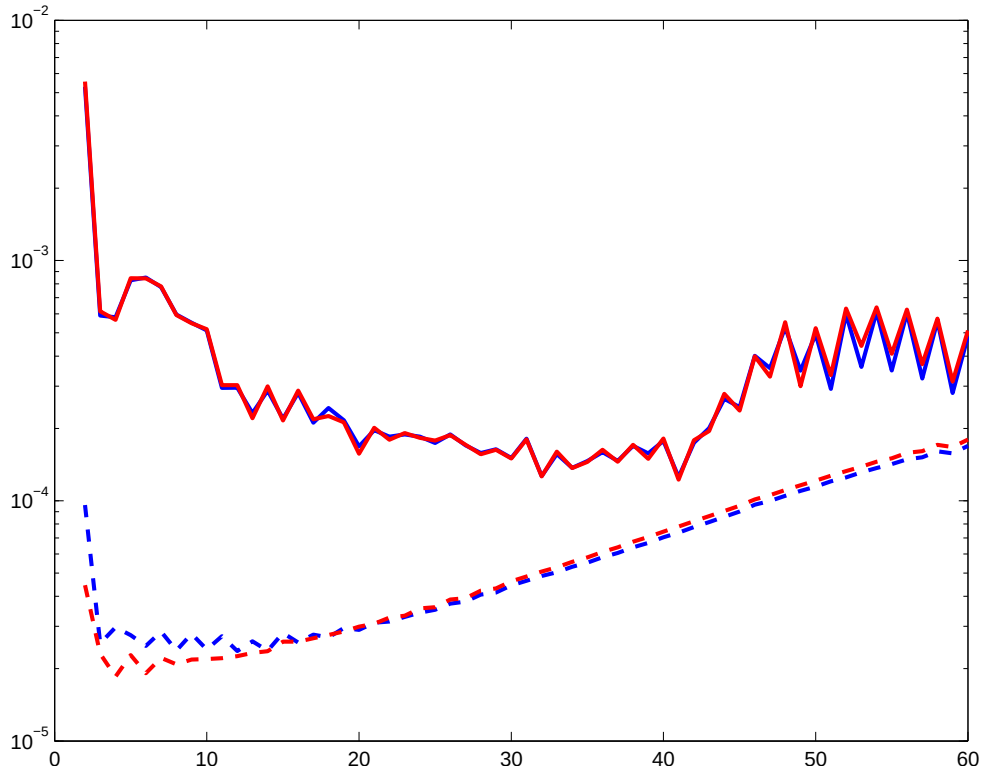
Degree variances of a monthly GPS + K-Band solution (Jan. 2012):

Solution AIUB-RL02 (60)
Solution based on the recent repro
(dashed lines: formal errors)

Differences to the static part of the a priori gravity model AIUB_GRACE03S, scaled to geoid heights in meters.



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- extracted from a three-day long-arc solution
- more details on this solution:
  Dach et al. (2015): "Updating the CODE GNSS Orbit Model"

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Experimental solutions going behind GPS/GLONASS:
MGEX solution (also for PPP)

THANK YOU
for your attention

Publications of the satellite geodesy research group:

`http://www.bernese.unibe.ch/publist`