Ambiguity fixing on geometry free like model using modernized GNSS signals

G. Tagliaferro[1]

[1] BIPM – Time Department

24/05/2022 EGU General Assembly 2022

Bureau International des Poids et Mesures

EGU General Assembly 2022

Definition

Normally in positioning:

$$y = F(X^r, X^s, \tau^r, \tau^s, ZTD, STEC, N, biases)$$

Geometry free like:

$$y = F(\rho, STEC, N, biases)$$

Adjustment done on undifferenced uncombined equations

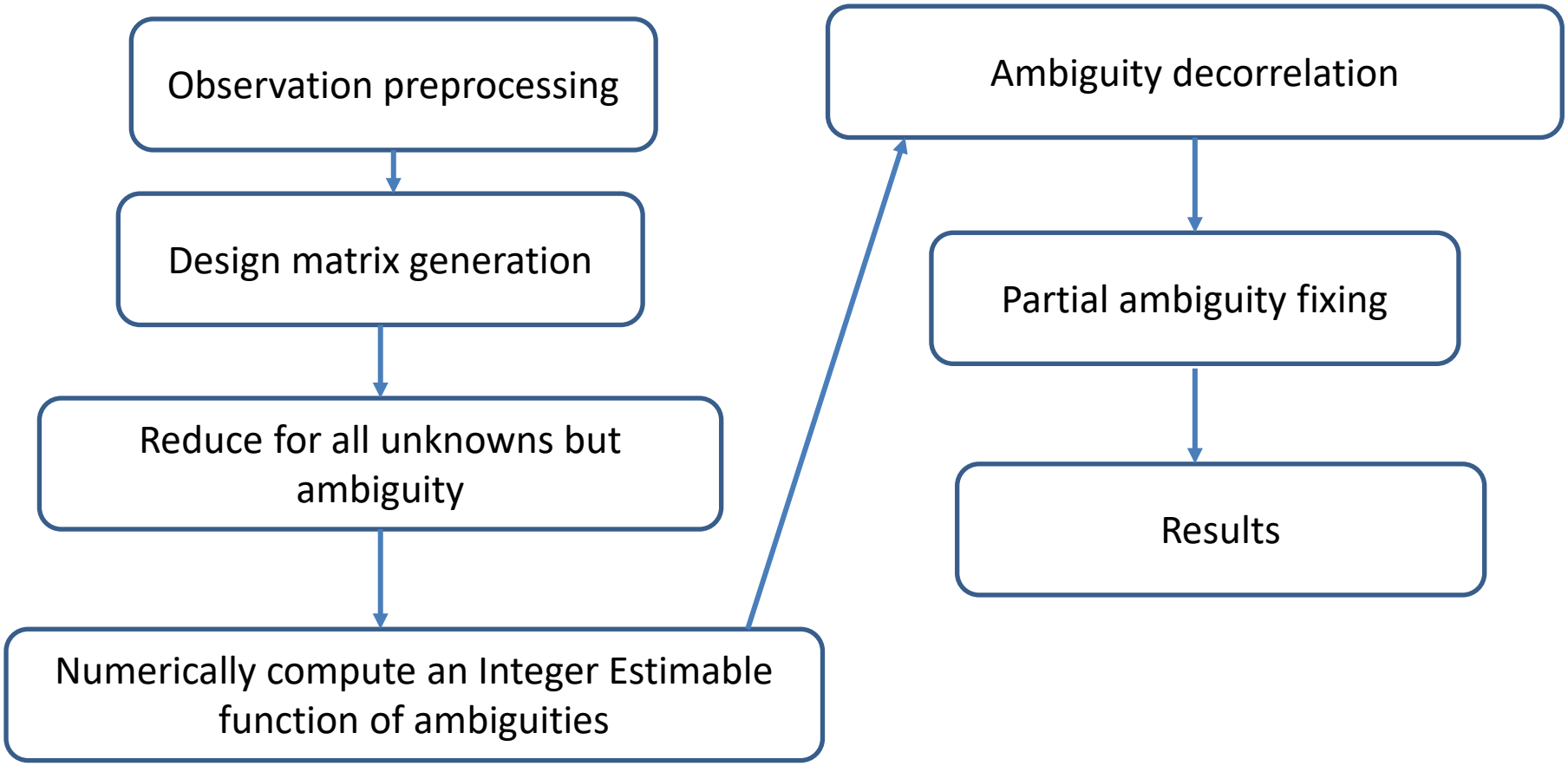
Motivation

No need for external corrections nor of models for the observations delay but the model is weaker.

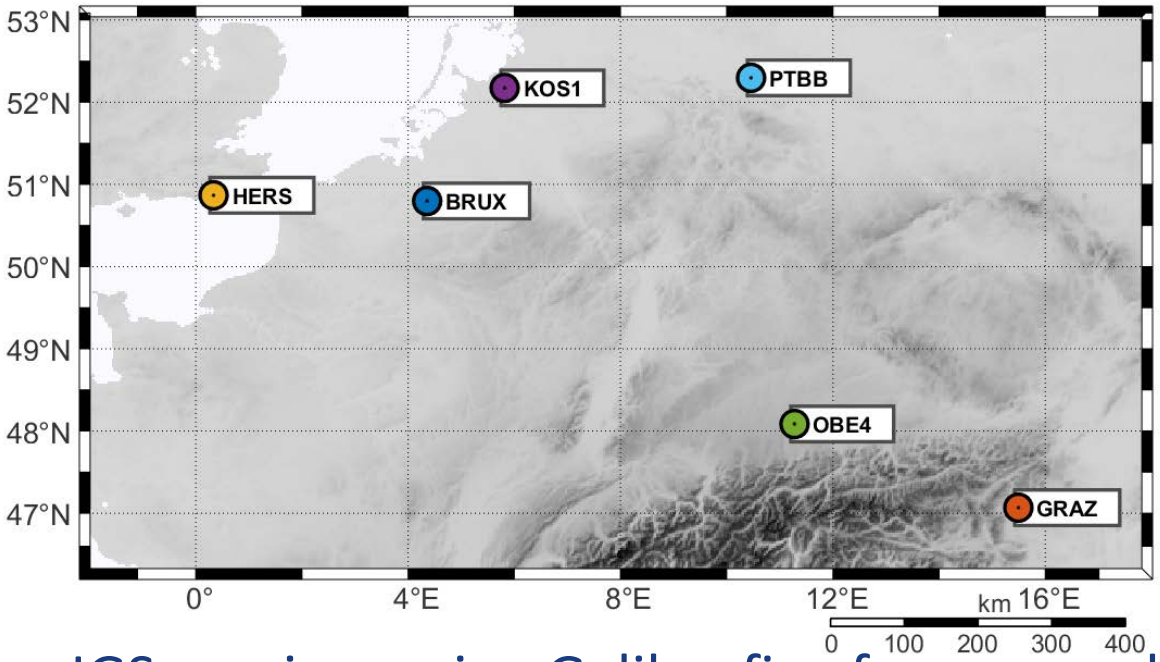
Using only 2 or 3 frequency ambiguity resolution needs long time spans.

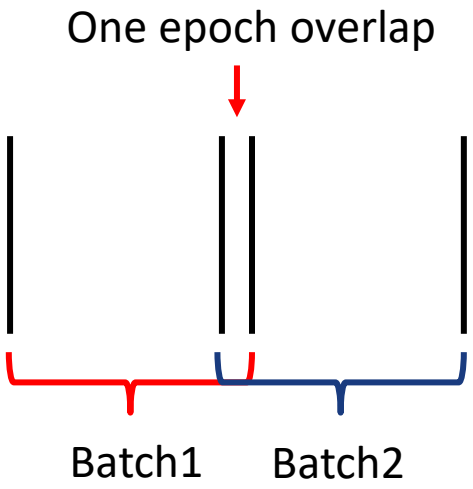
This presentation will evaluate the performance of ambiguity resolution using 5 frequency data.

Methods


Observation preprocessing
Design matrix generation
Reduce for all unknowns but ambiguity
Numerically compute an Integer Estimable function of ambiguities
Ambiguity decorrelation
Partial ambiguity fixing
Results

Dataset

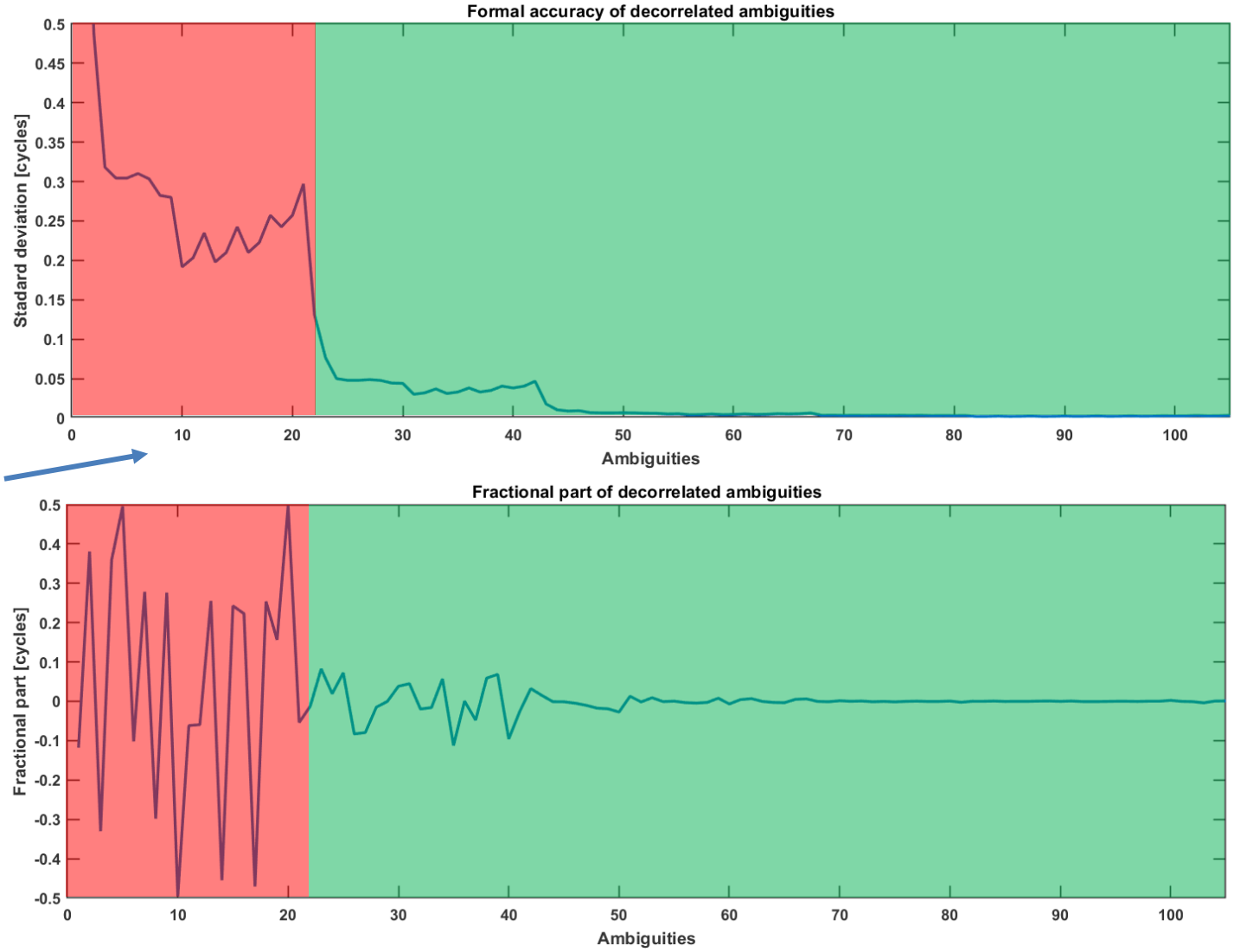




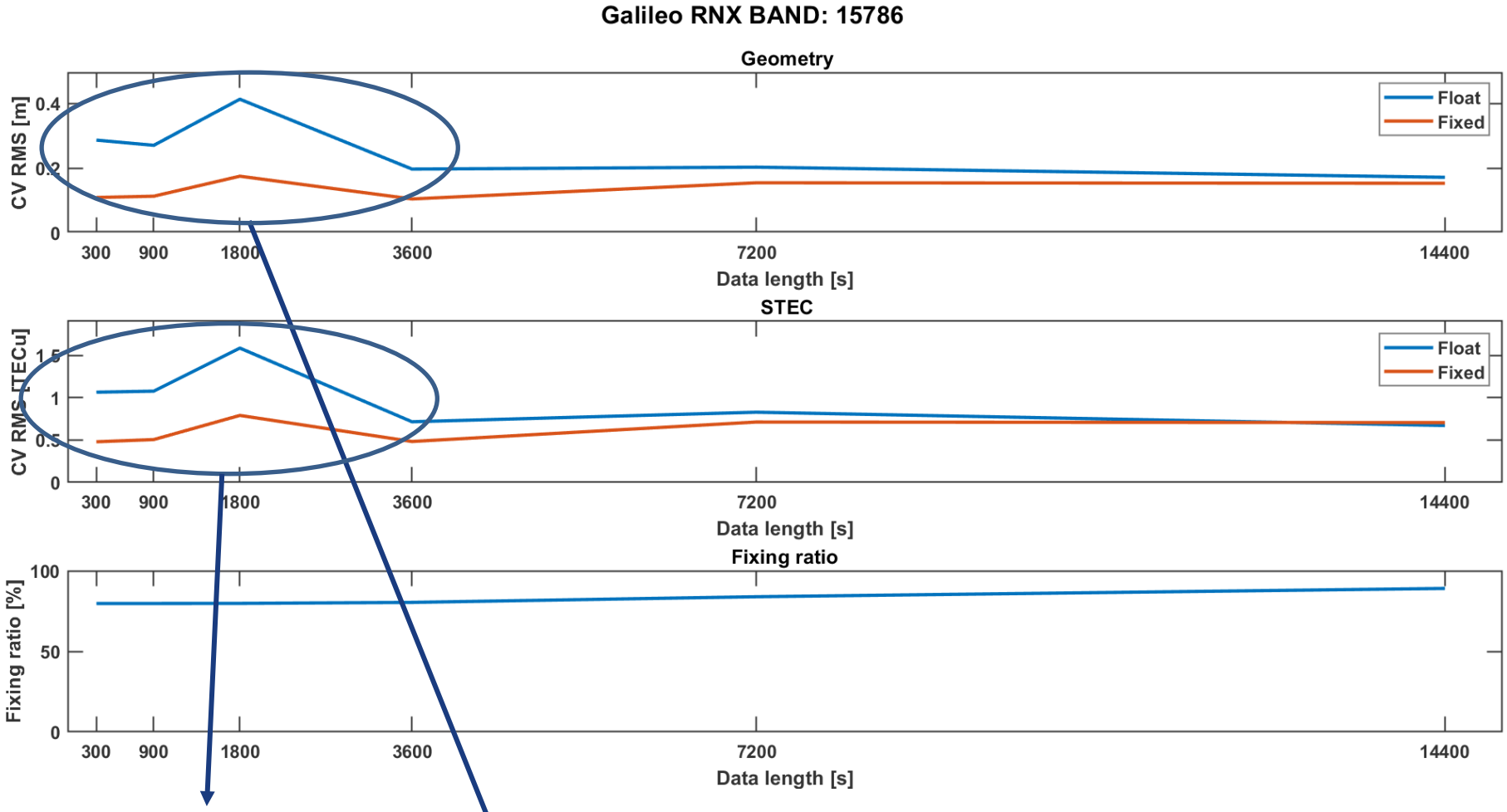
- IGS receiver using Galileo five frequency data.
- One day of data: 2th Jan 2022
- Cross validation using one common epoch between different adjustement.

Partial ambiguity fixing

- 8 satellites
- 5 receivers
- 1 amb per arc



Results



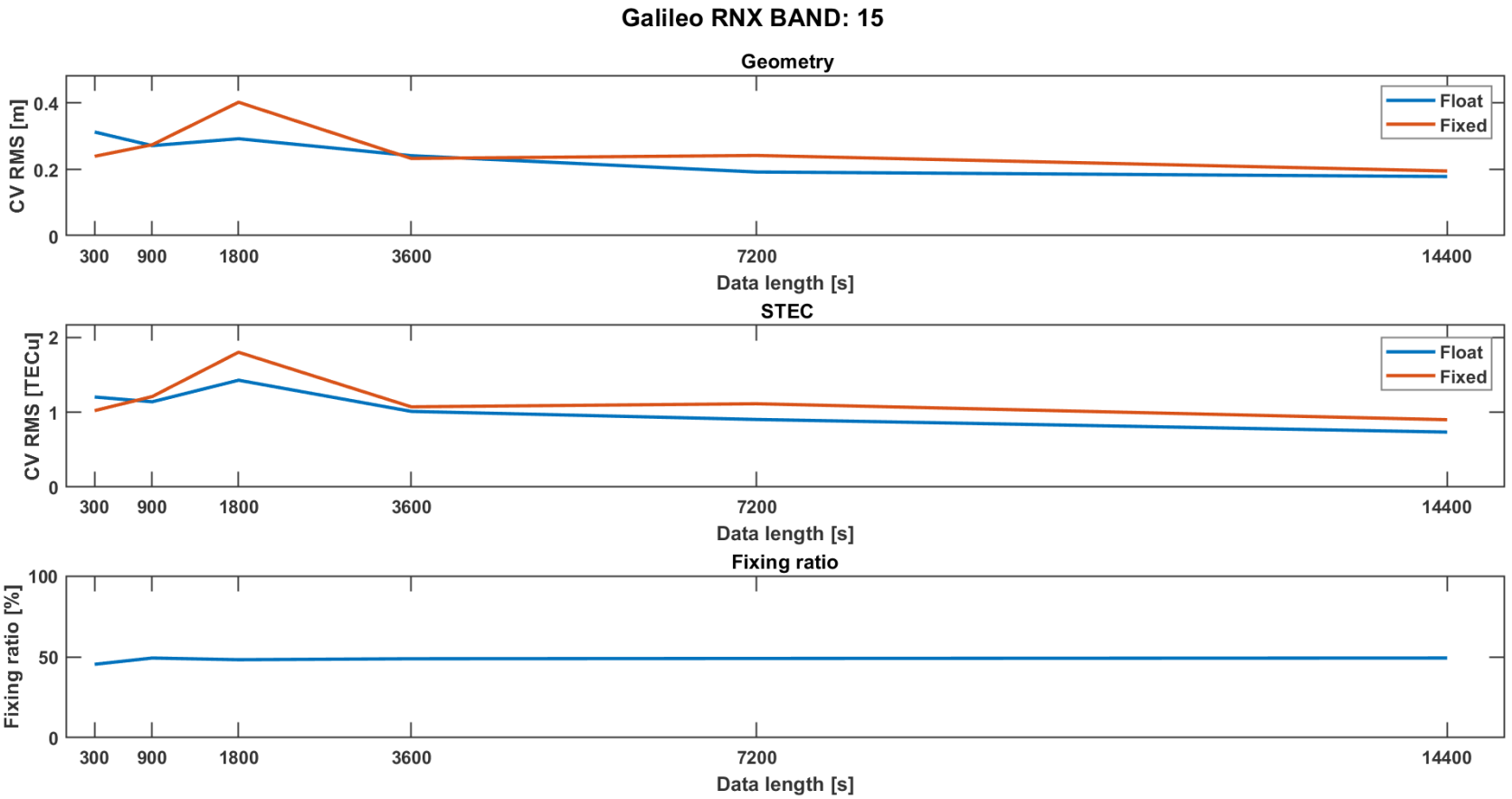
Reduction of RMS by factor 2 for short arcs

Reduction of RMS by factor 3 for short arcs

Conclusion

- Partial ambiguity resolution on Galileo five frequency data has been evaluated.
- Full ambiguity resolution could not be achieved.
- Partial ambiguity resolution improved the estimation of “range” and STEC values reducing the RMS **approx. 3 and 2 times for short arcs.**
- Possible application in real time PVT and ionospheric estimation.

Additional


Galileo RNX BAND: 15
Geometry
CV RMS [m]
0.4
0.2
0
Float
Fixed
300
900
1800
3600
7200
14400
Data length [s]
STEC
CV RMS [TECu]
2
1
0
Float
Fixed
300
900
1800
3600
7200
14400
Data length [s]
Fixing ratio
Fixing ratio [%]
100
50
0
300
900
1800
3600
7200
14400
Data length [s]