ION GNSS 2015

NEW APPROACH FOR INTEGRITY BOUNDS COMPUTATION APPLIED TO ADVANCED PRECISE POSITIONING APPLICATIONS

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SESSION E2b: Advanced Technologies in High Precision GNSS Positioning 2

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INNOVATING SOLUTIONS

CONTENTS

- PPP Introduction
- PPP Integrity Bound
- Experimental Results
- Conclusions

PPP INTRODUCTION

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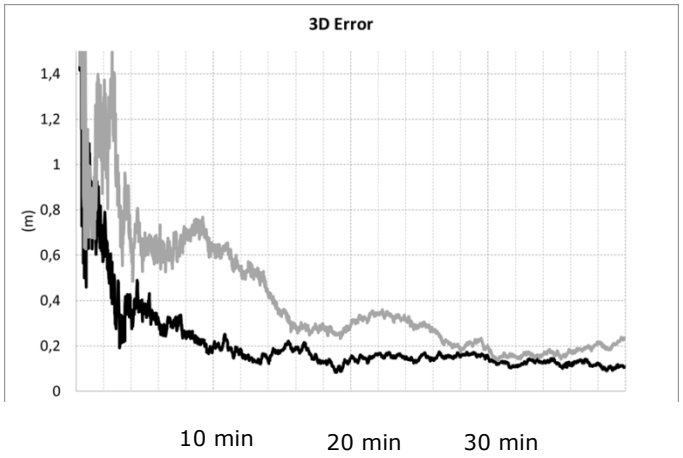
PPP INTRODUCTION

- Highly precise satellite ephemeris and clock models
- Detailed physical and correction models
- Use of very accurate carrier-phase measurements

High accuracy: < 10cm

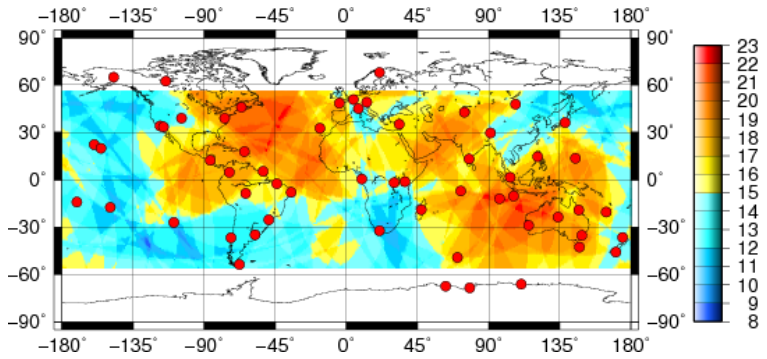
Global coverage

Absolute positioning

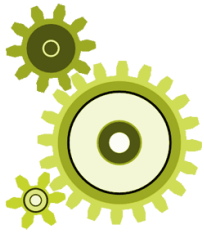


PPP ARCHITECTURE

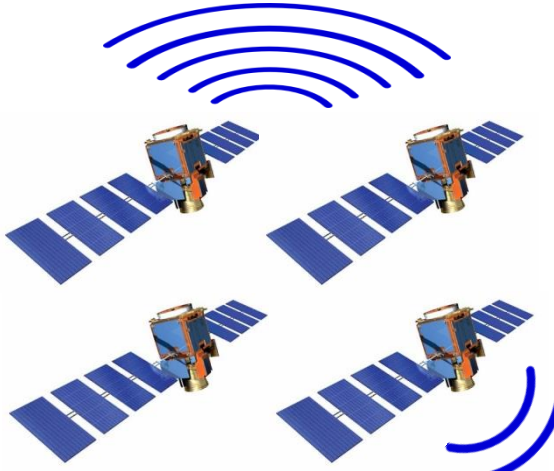
Precise Orbit & Clocks Determination

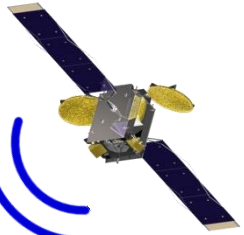


Raw measurements



Corrections

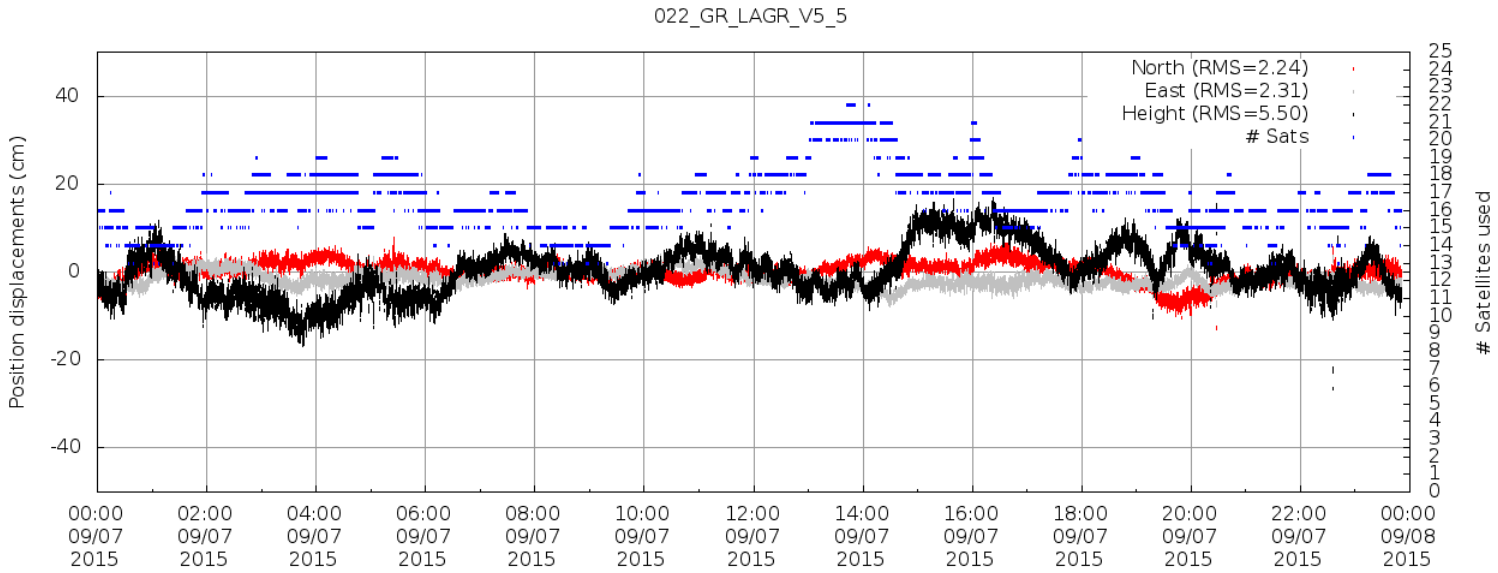




Raw measurements

magicGNSS RT PPP

- Multi-GNSS (GPS, GLO, GAL, BEI, QZSS)
- Dual/single-frequency PPP
- Gap bridging



PPP INTEGRITY BOUND

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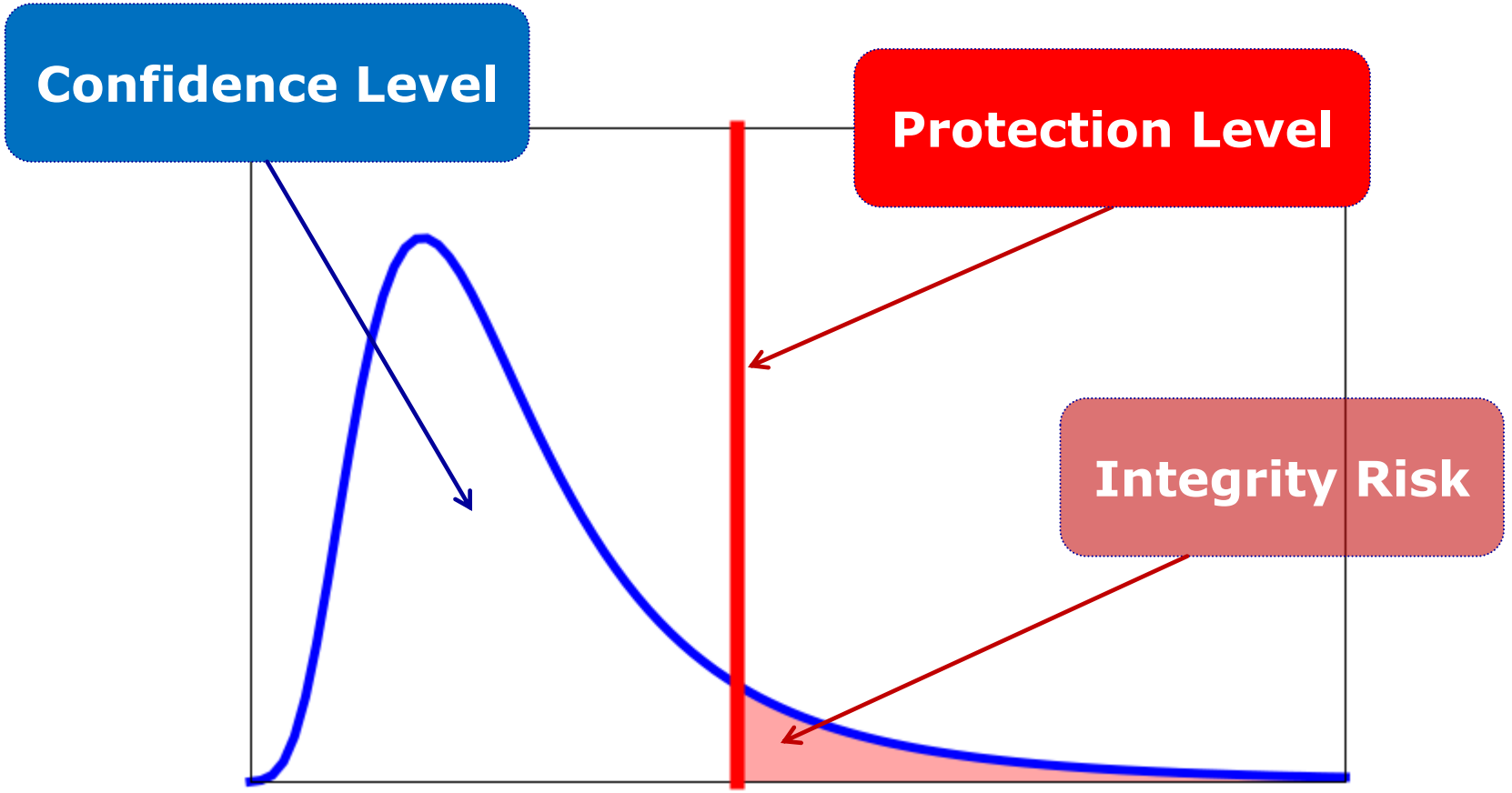
INTEGRITY BOUND (PROTECTION LEVEL)



$$P(Error > PL) \leq IR = 1 - CL$$

PREVIOUS WORK

Experimental PPP Bounding Algorithm

PPP Reliability Indicators

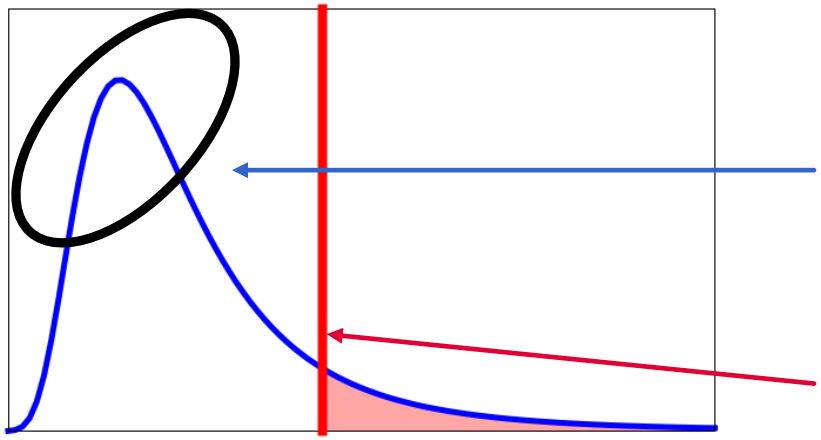
- Residuals
- Quality of Products
- Convergence time
- …

IBPL

Isotropy Based PL

- LSQ solutions
- Highly reliable in all kinds of environments

INTEGRITY BOUND (PROTECTION LEVEL)

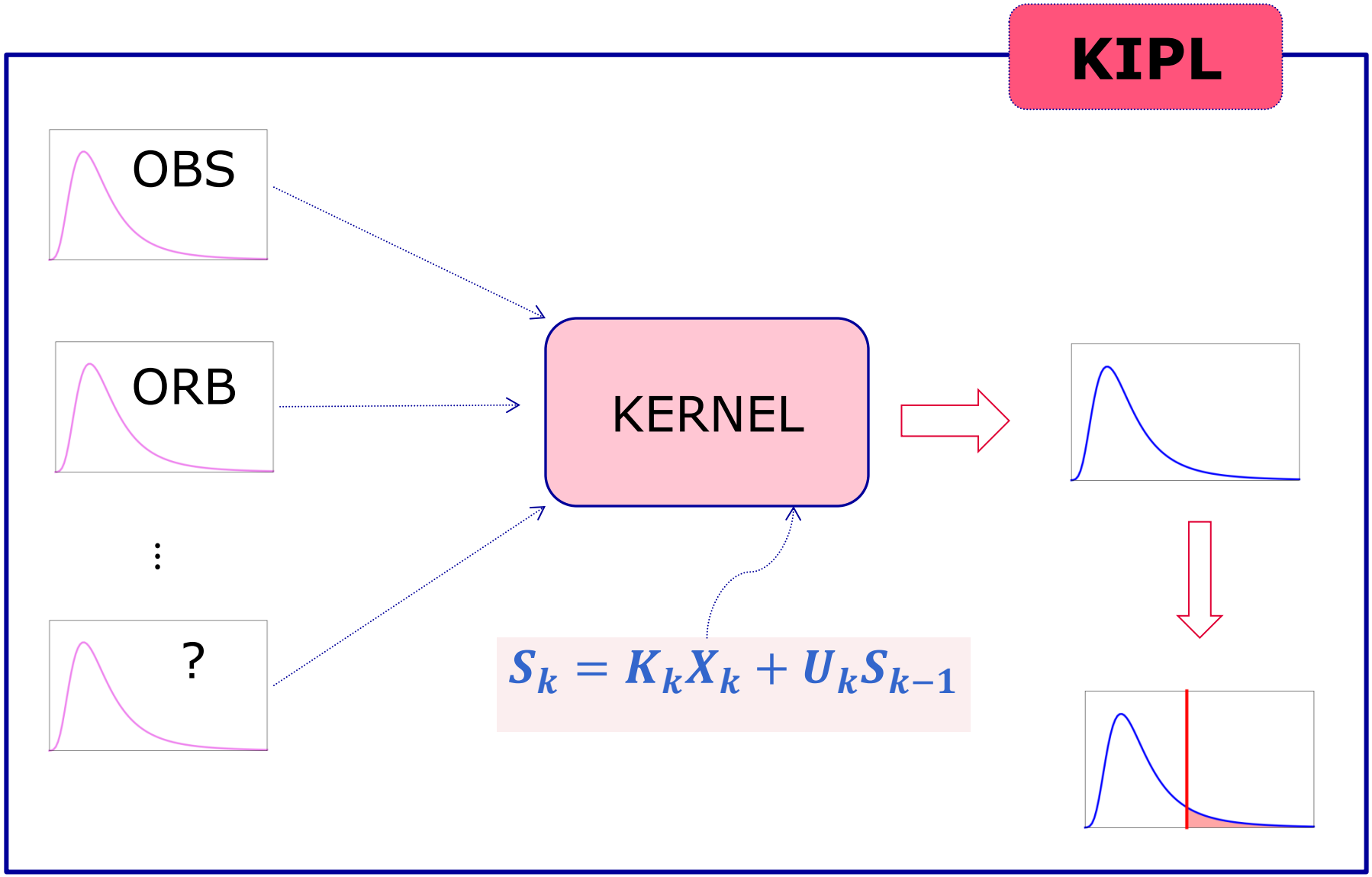


1- Compute error distribution

2- Derive PL

- Real distribution not known ➔ use statistical model
- Dependent on the conditions

INTEGRITY FOR KALMAN SOLUTIONS



EXPERIMENTAL RESULTS

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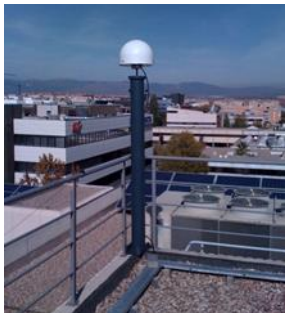
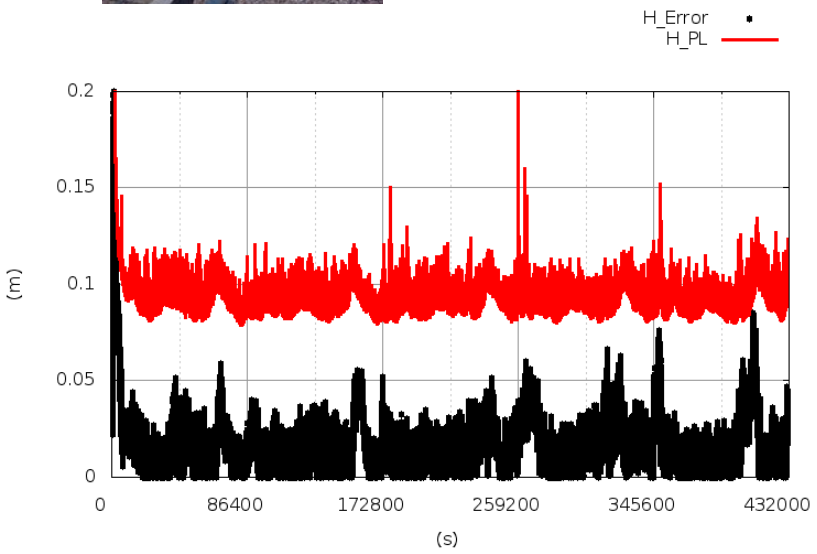
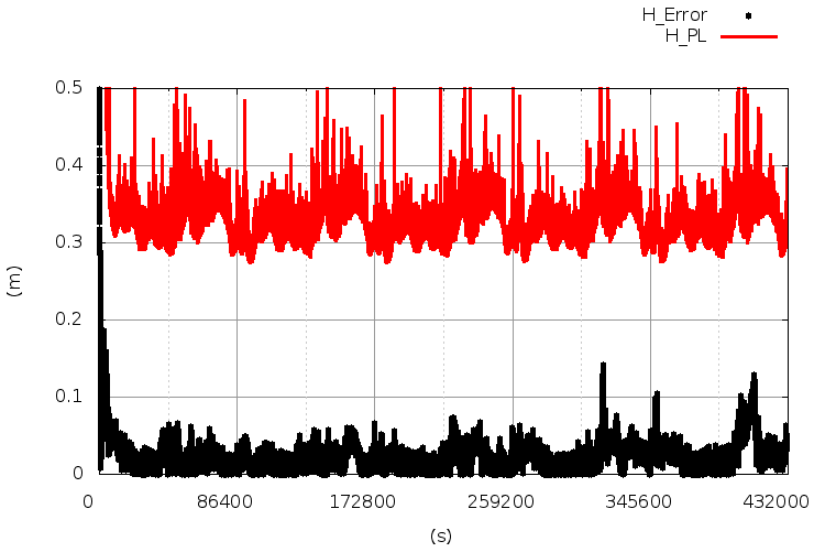
STATIC SCENARIOS (5 DAYS)



Integrity performances within target in all scenarios

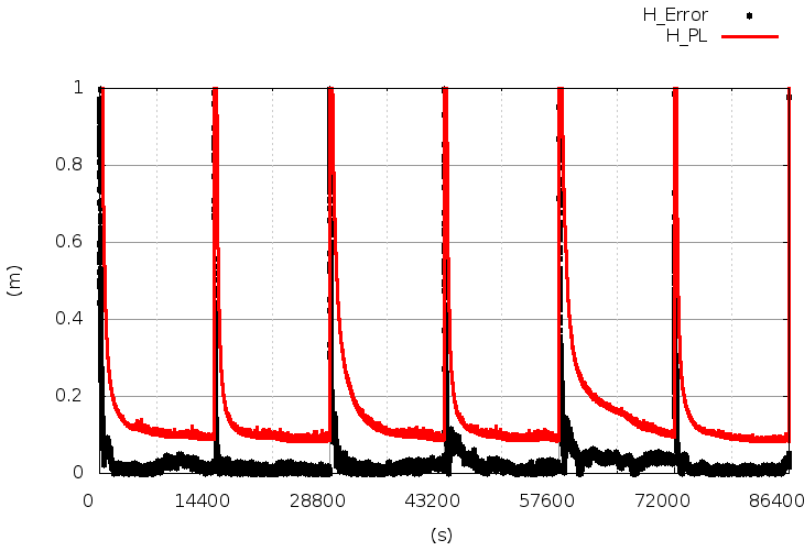


Horizontal, 99.9%

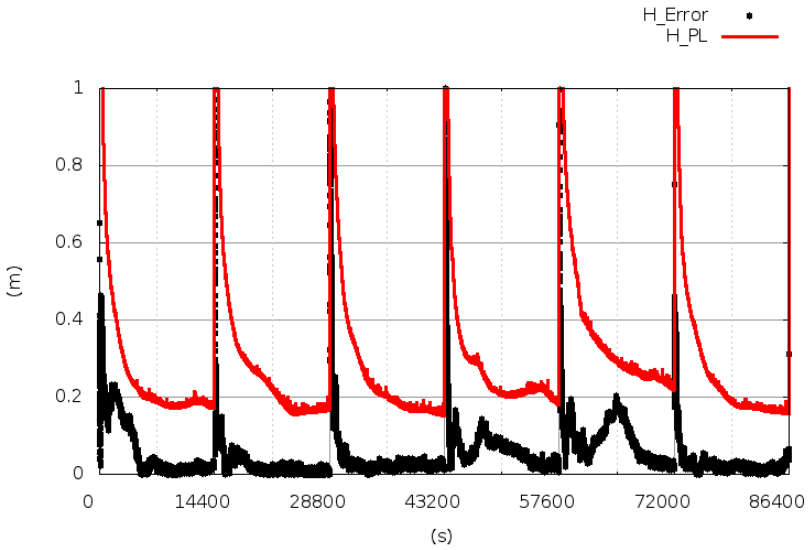


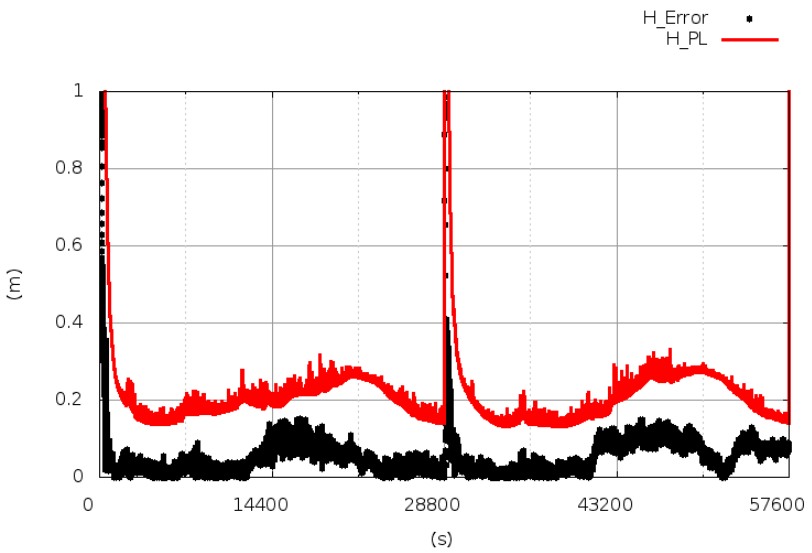
Horizontal, 99.99999%

STATIC SCENARIOS: CONVERGENCE



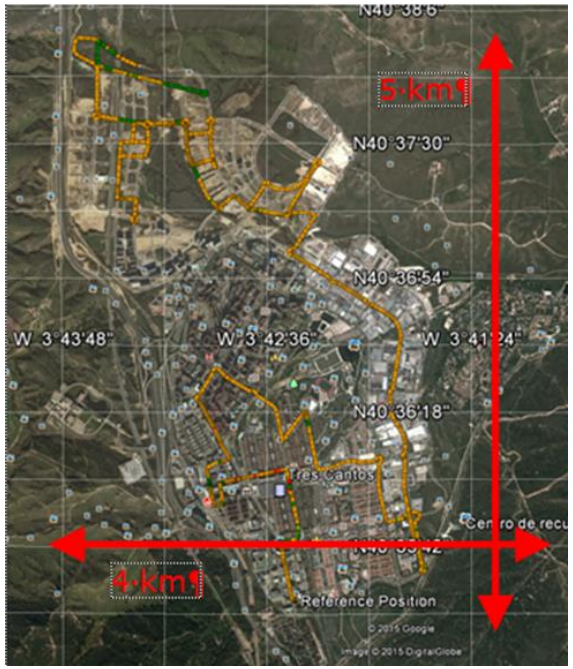
- Horizontal, 99.9%
- GPS+GLONASS
- GPS-only
- GLONASS-only

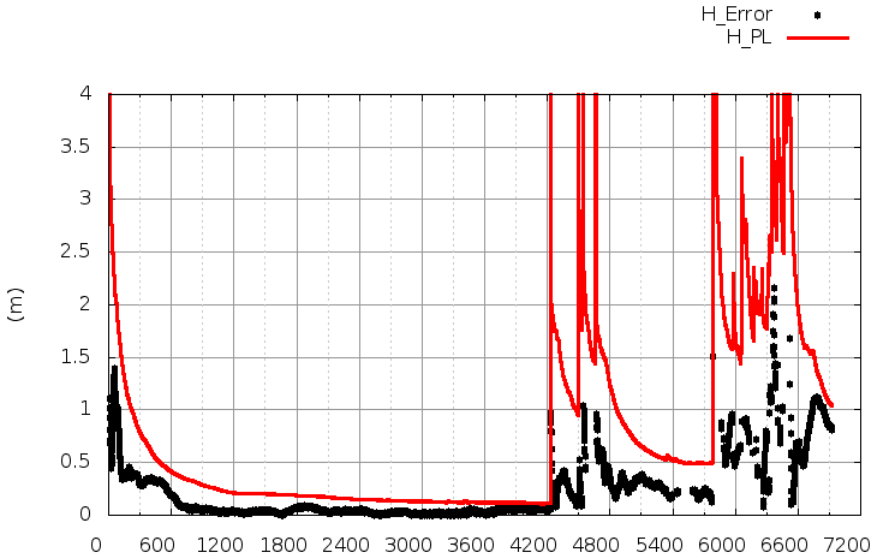


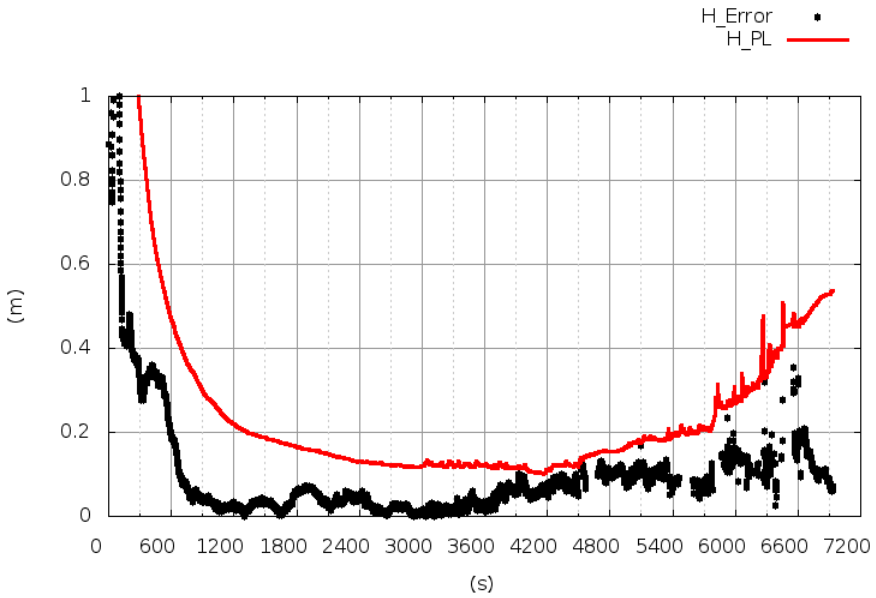


KINEMATIC SCENARIO 1

Tres Cantos (2h)

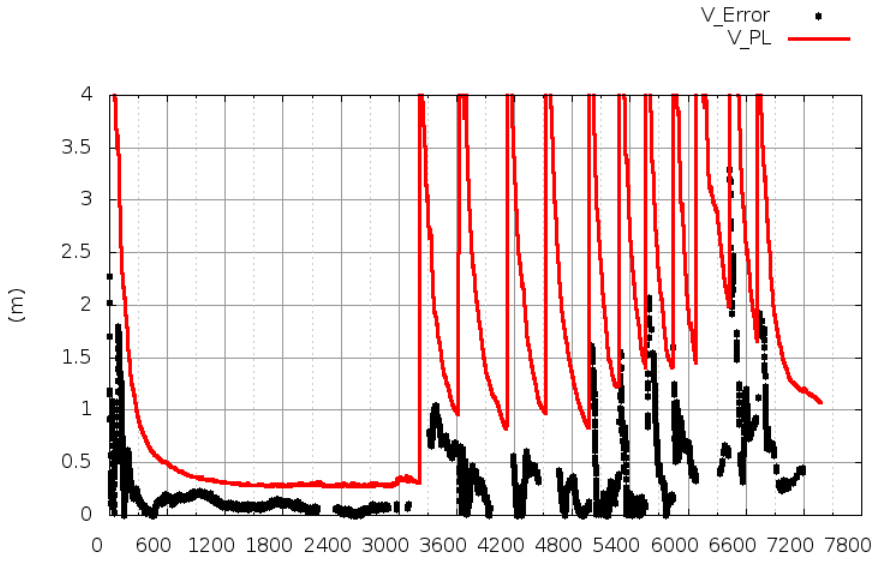


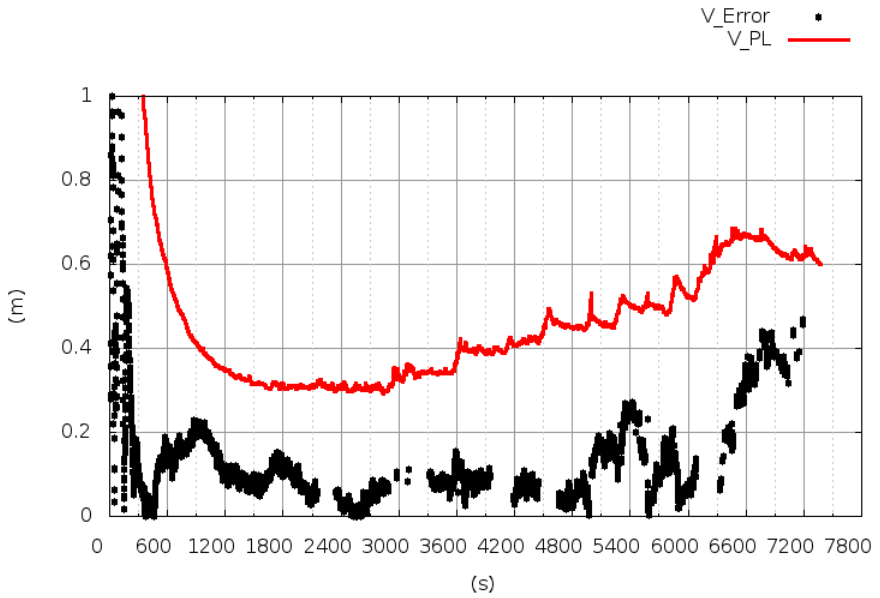




Horizontal, 99%

KINEMATIC SCENARIO 2





Vertical, 99%

CONCLUSIONS

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CONCLUSIONS

- Statistically sound method developed for an integrity bound for positioning based on Kalman filter
- In particular, applied to PPP solution
- Integrity bounds of a few decimeters, with integrity performances within target, for different confidence levels
- Very good results in different conditions / environments

Thank you

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118/120

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