

GGTO :

1. Should we fix it or determine it?
2. How accurate should it be?
 - What is the impact of an error in the GGTO used ?

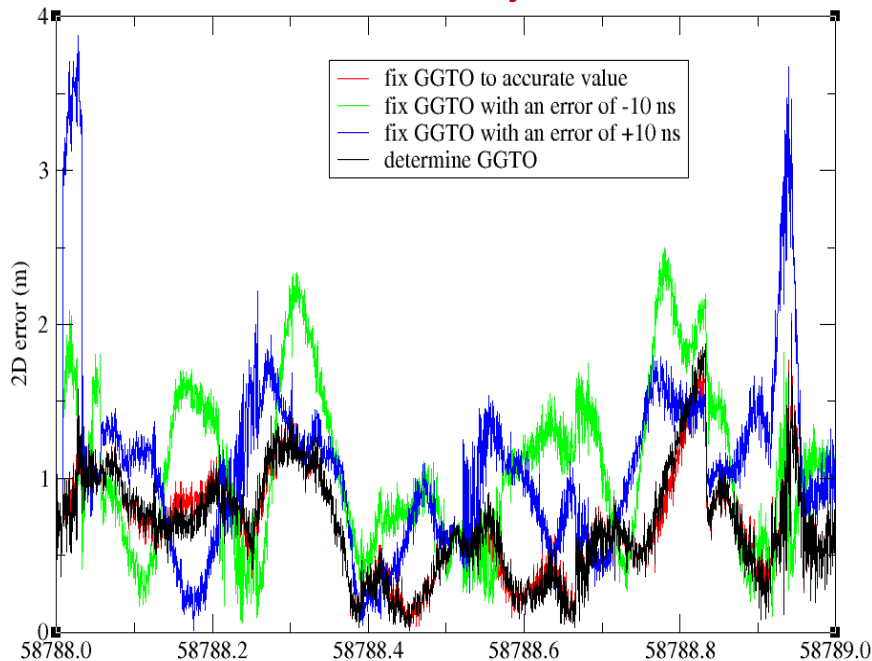
P. Defraigne
Royal Observatory of Belgium

Outline

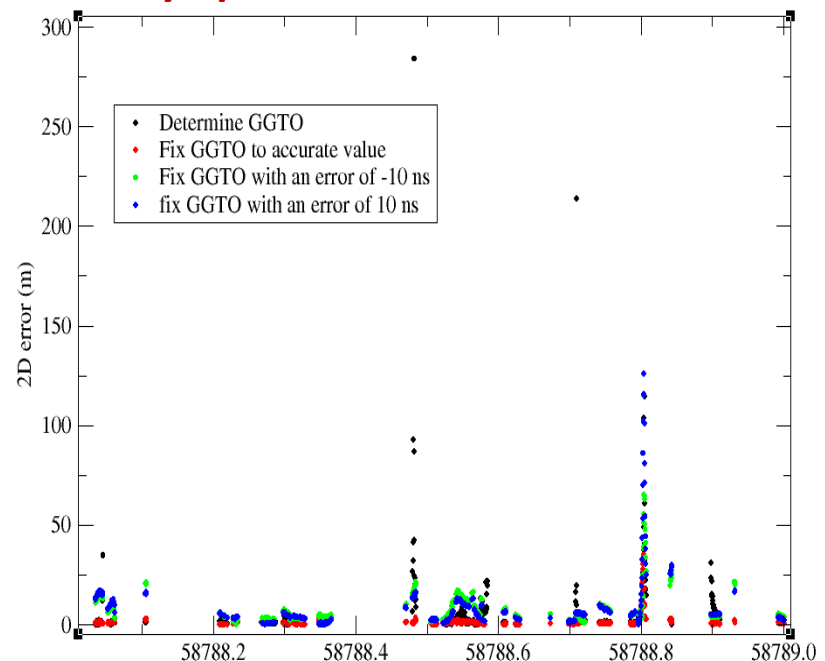
1. High precision receiver
 2. Smartphone in different situations
- Use GPS+Galileo data and GGTO
 - Single-Frequency user, Klobuchar for the iono correction
 - Each epoch, determine position, independent from the previous one, with available satellites
 - Define “accurate GGTO” as the GGTO corresponding to $GPST - GST + RCVR_HW_delays(GPS - Galileo)$

High precision receiver

Full visibility



Cutoff at 45 degrees Only epochs with 5 visible satellites



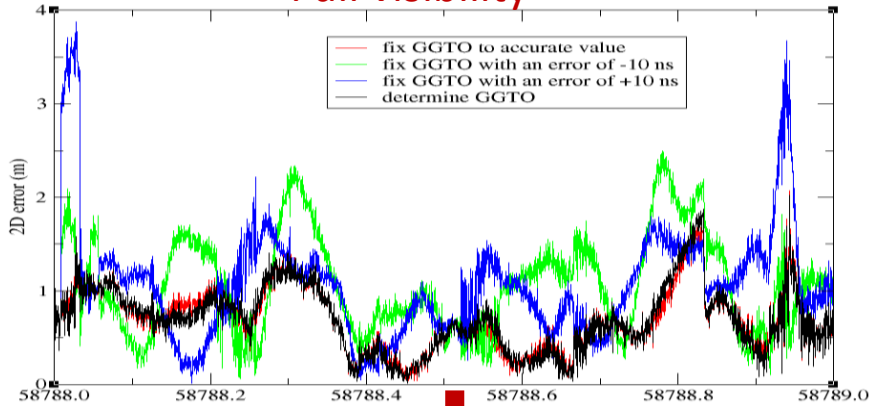
- Fix GGTO to accurate value or determine GGTO provides similar performances
- Any error in the fixed GGTO degrades the PVT solution

Not clear → in what follows, we look at the differences

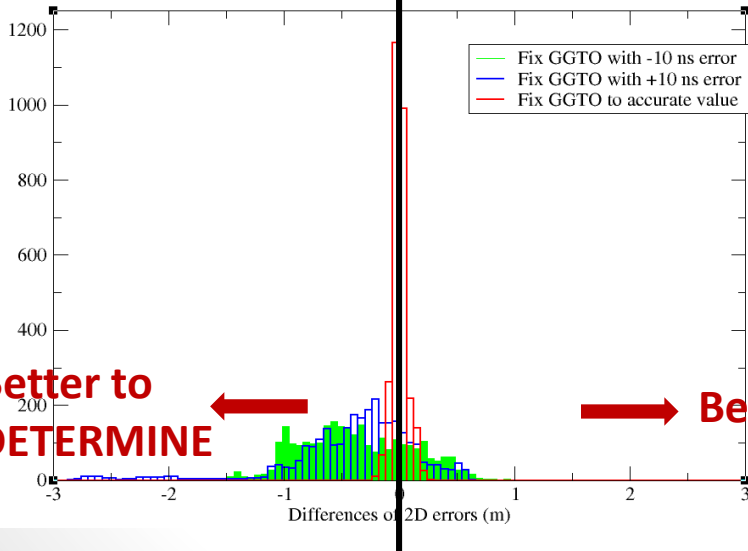
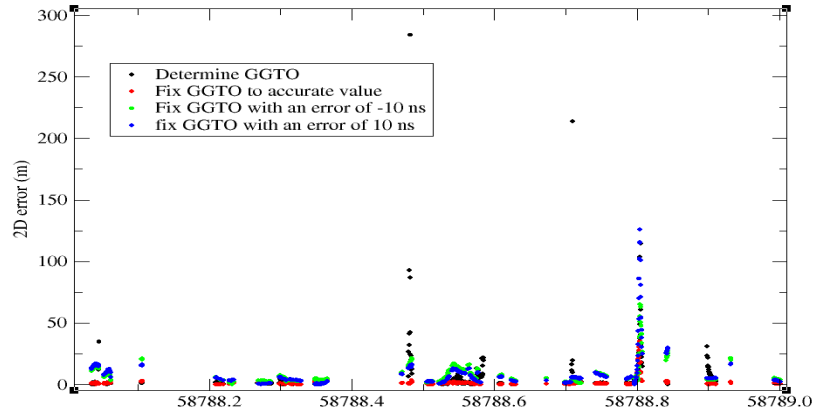
$$[2Derror_determine - 2Derror_fix]$$

High precision receiver

Full visibility

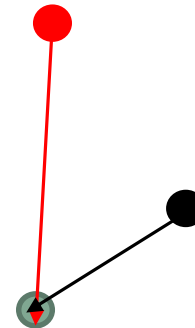


Cutoff at 45 degrees
Only epochs with 5 visible satellites



Differences :

2D error (determine GGTO)
- 2D error (fix GGTO)

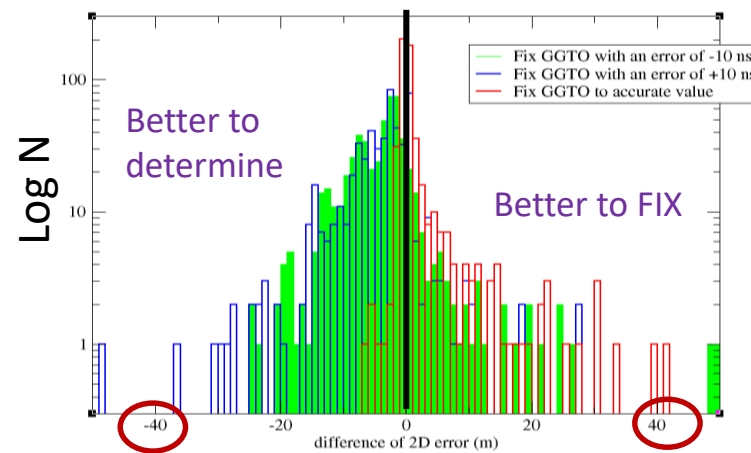
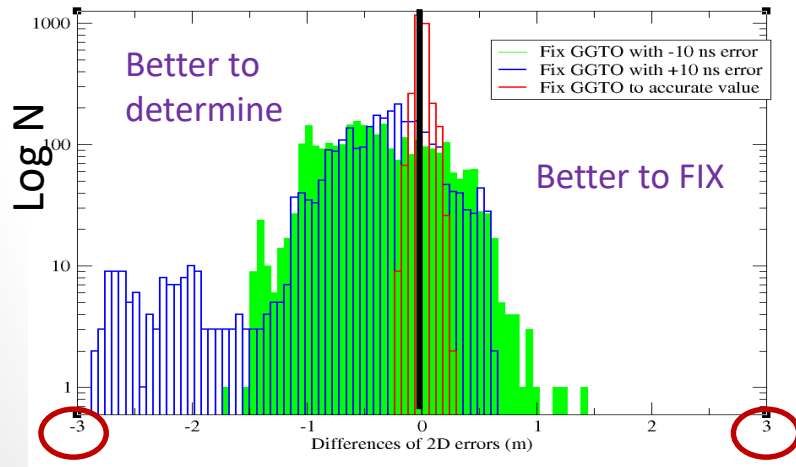
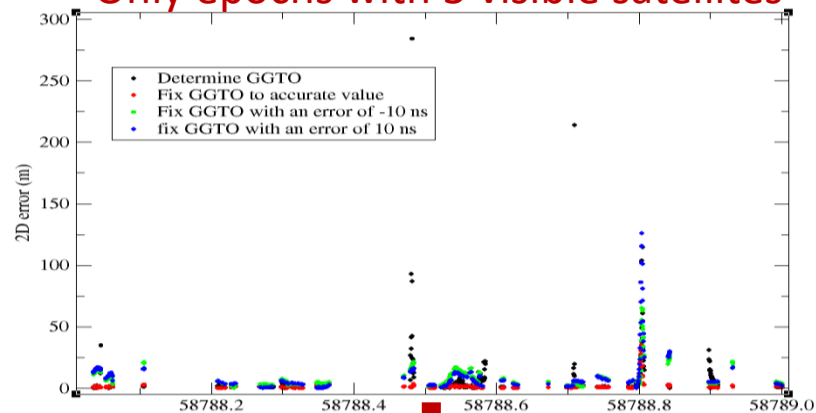
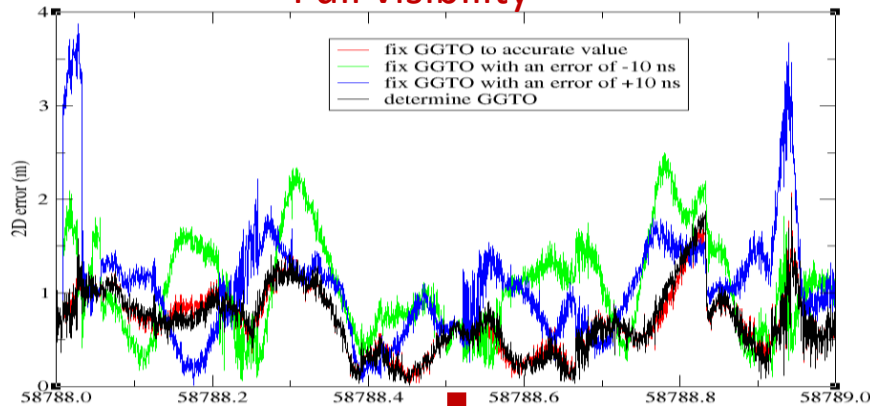


High precision receiver

Cutoff at 45 degrees

Only epochs with 5 visible satellites

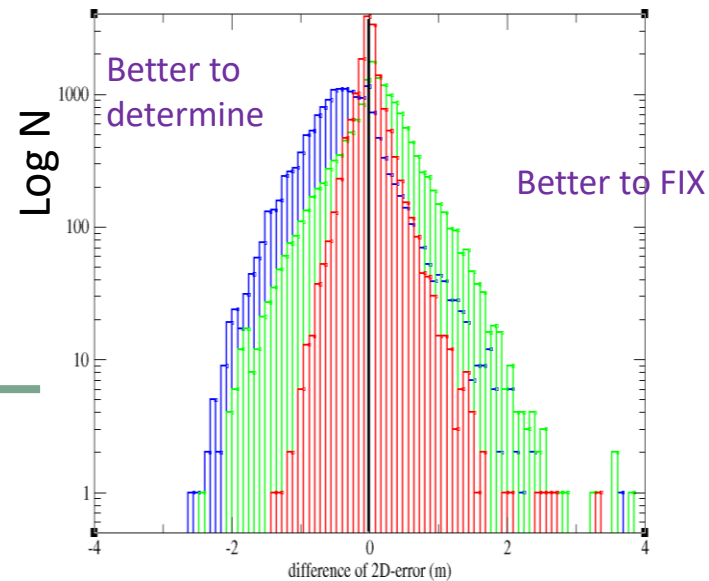
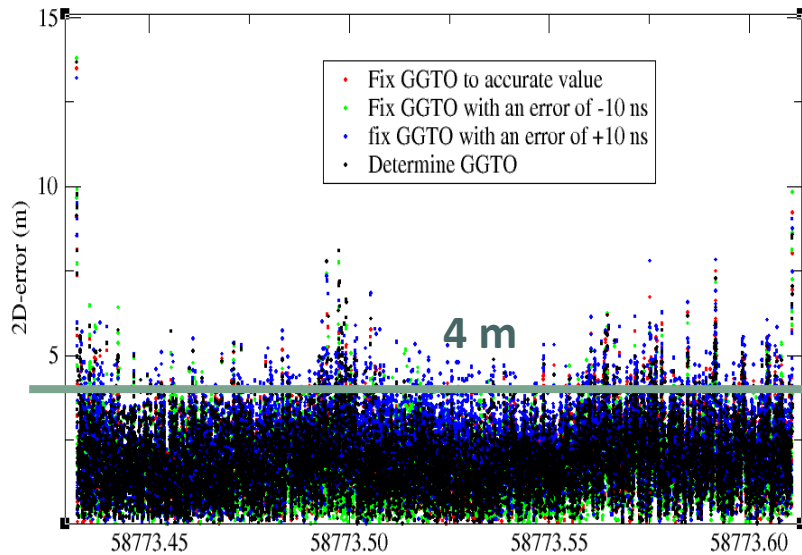
Full visibility



→ With 5 sat, if the GGTO is accurate, it is better to fix it, but if there is an error on the fixed GGTO it is better to determine it.

Smartphone (Xiaomi MI 8)

Open sky

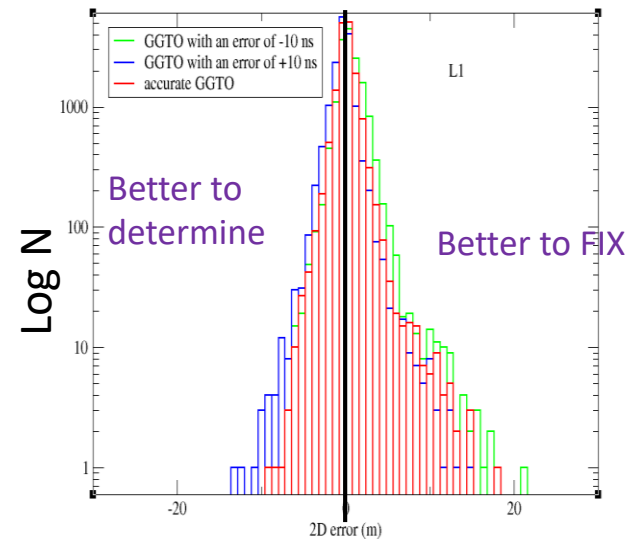
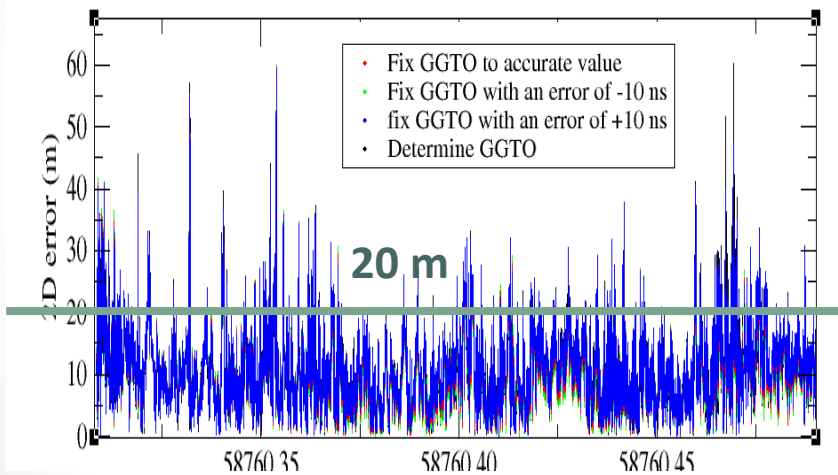


Open sky

- PNT solution is statistically a bit better when fixing the GGTO,
- and an error of 10 ns has limited impact on the position error

Smartphone (Xiaomi MI 8)

Mild Urban

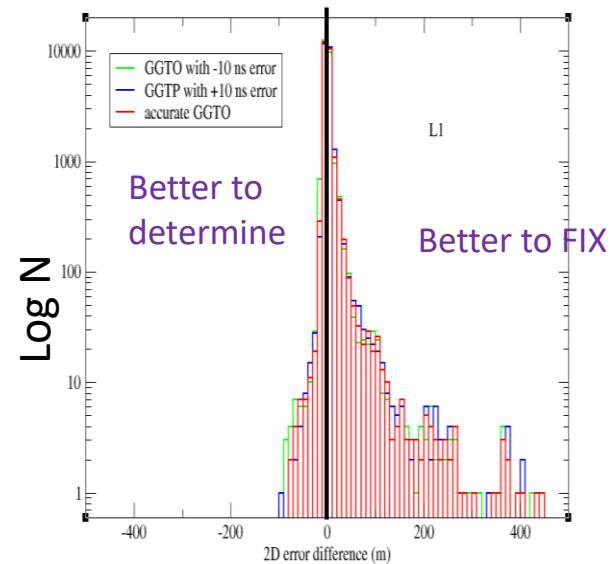
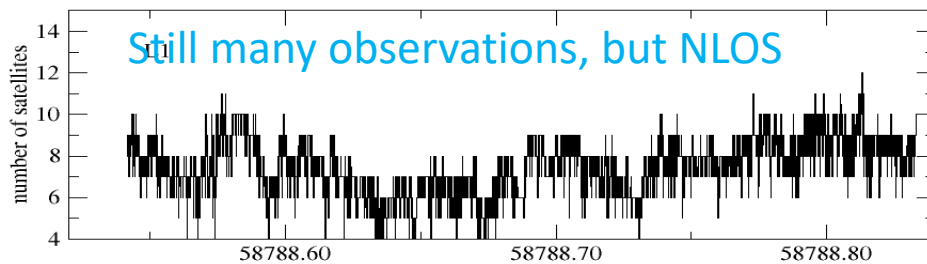
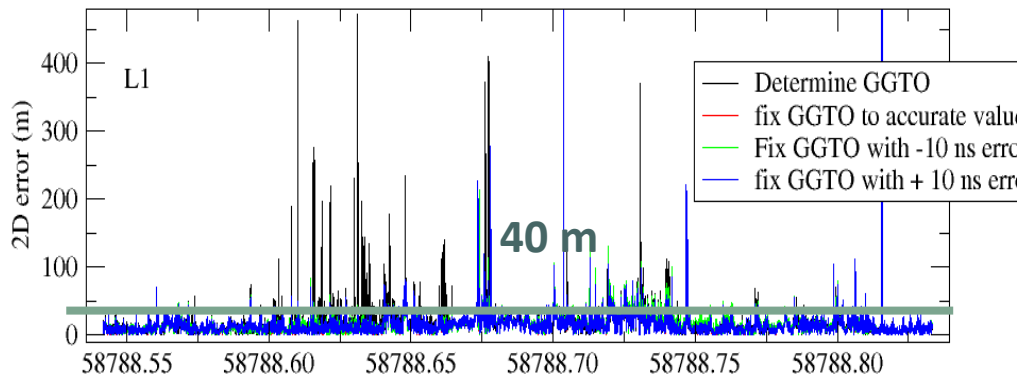


Mild Urban

- PNT solution is statistically better when fixing the GGTO,
- and an error of 10 ns has a very limited impact on the position error

Smartphone (Xiaomi MI 8)

Deep urban
canyon



Deep urban canyon

- PNT solution is statistically much better when fixing the GGTO,
- and an error of 10 ns has NO impact on the position error

Conclusion

- With a smartphone as the one tested,
 - fixing the GGTO provides equivalent or better PNT results than determine it
 - An error of 10 ns on the GGTO fixed has a limited impact on the PNT solution only in open sky situation; otherwise it has no impact.
- With a high precision receiver, it is always better to determine the GGTO except if
 - There is a very poor visibility (5 satellites)

AND

 - The broadcast GGTO is very accurate (error less than 5? ns)