SGF Herstmonceux ILRS Tracking Activities on GNSS

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GNSS Tracking

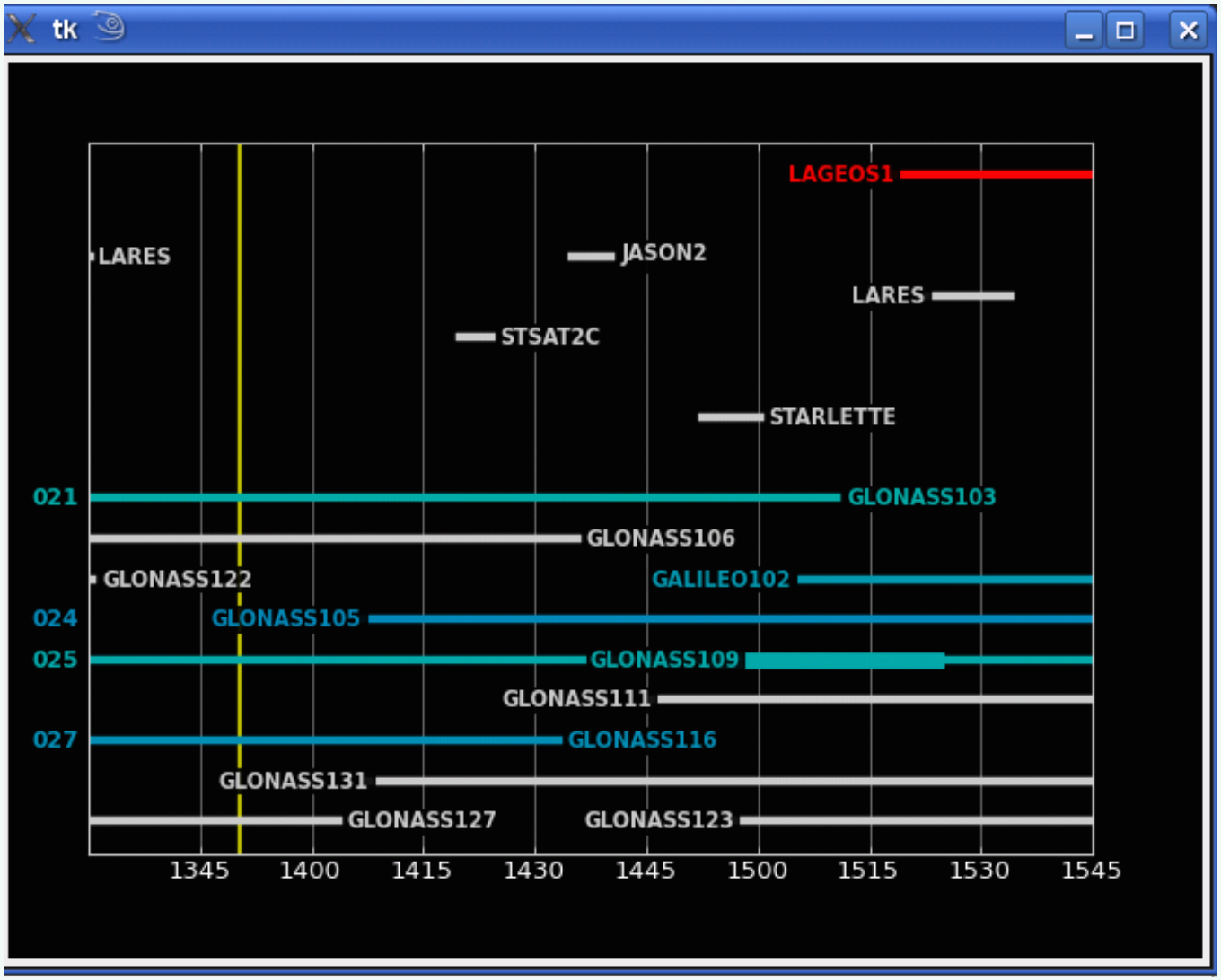
- Herstmonceux tracks all ILRS GNSS and the two Etalon missions, including **all** GLONASS.

- This results in
  - **4 Galileo IOV vehicles + GIOVE-A**
  - **2 COMPASS (M3, I5)**
  - **24 GLONASS**
  - **1 IRNSS**

Operations

- One of the key factors is that the observer has full control of the ranging process and thus decides on which satellites to track and when
- Attempt to range all GNSS satellites 2-3 times when above horizon
- Has access to legacy YAG 10Hz laser and modern 2kHz VAN laser
  - But - currently 2kHz off-air to allow upgrade

Real-time availability display



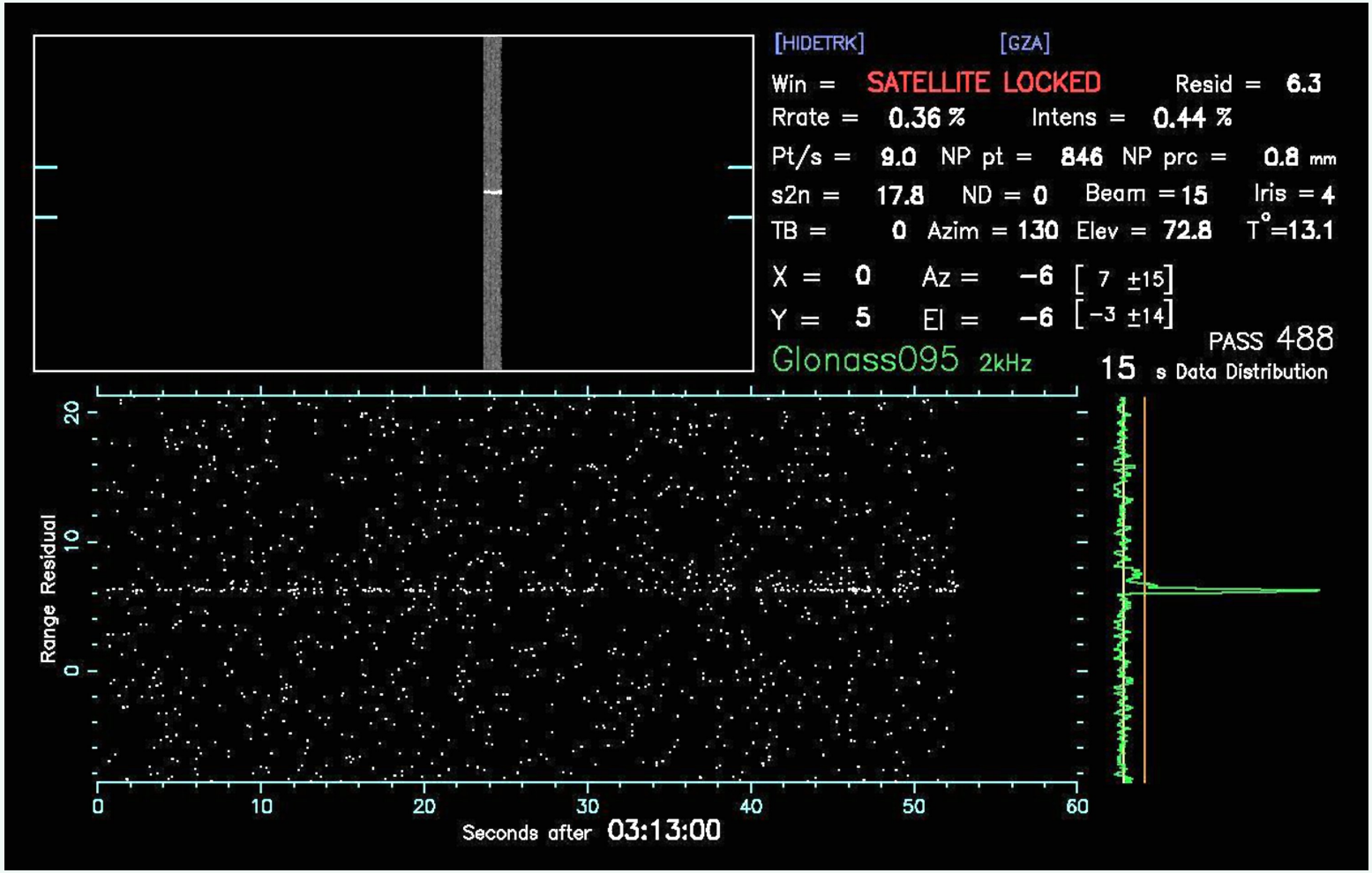
Precision in Real time

- Also key to maximising SLR tracking efficiency on many GNSS satellites is the availability of real-time estimates of precision.

- This is best suited to the 2kHz laser which can reach better than 1mm normal point precision quickly.

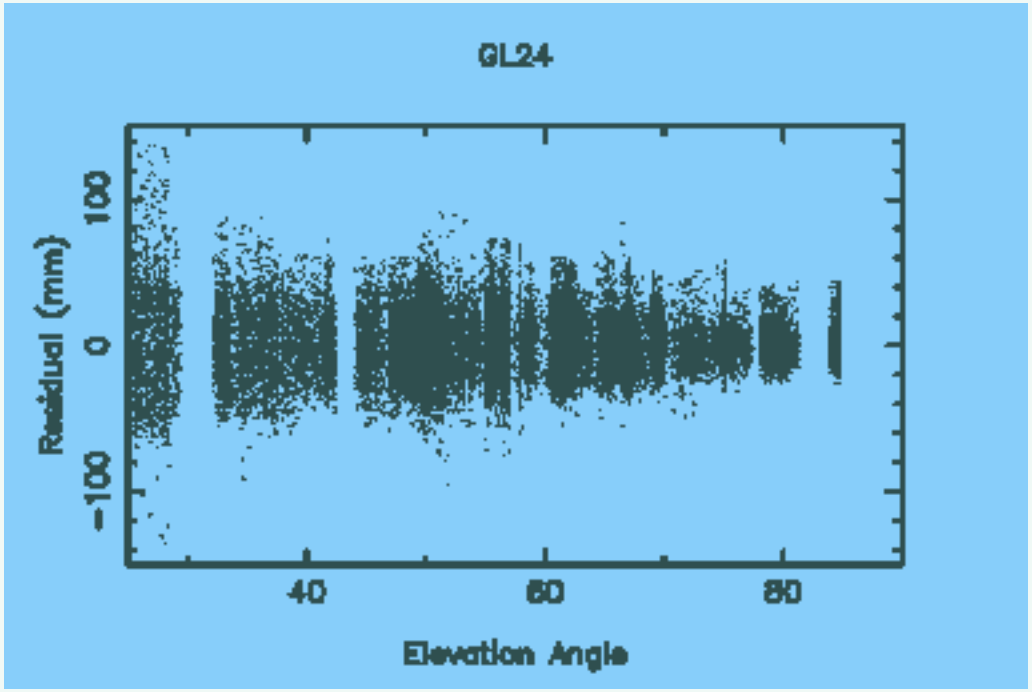
- Need reliable track detection in order to estimate precision:

Track detection

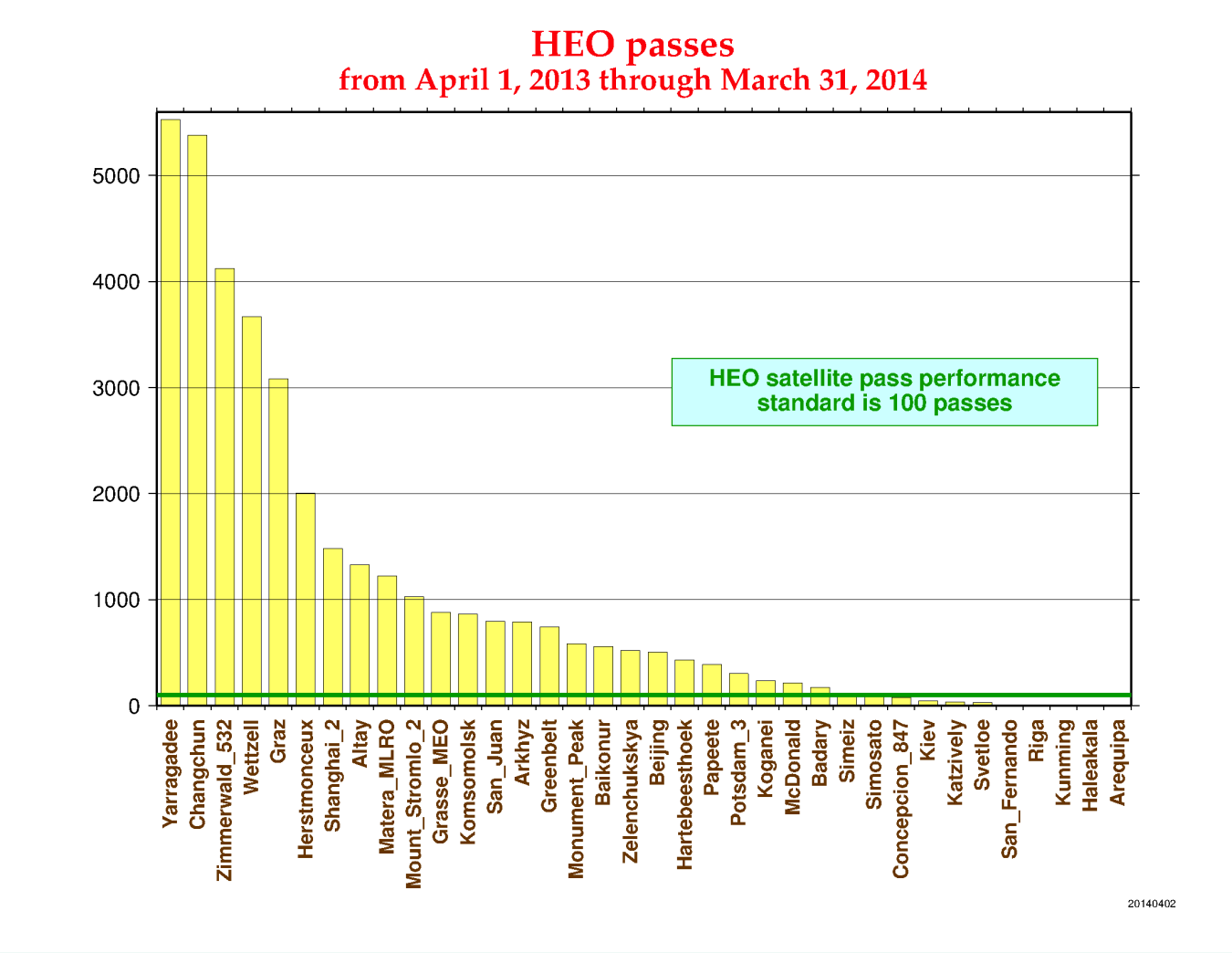


Normal point precision

- Number of single-shot measurements required to reach 1mm NP *precision* varies with satellite elevation – apparent array-size effect on the SGF single-photon system
- Not a problem – the accuracy of NP **mean** range is NOT compromised



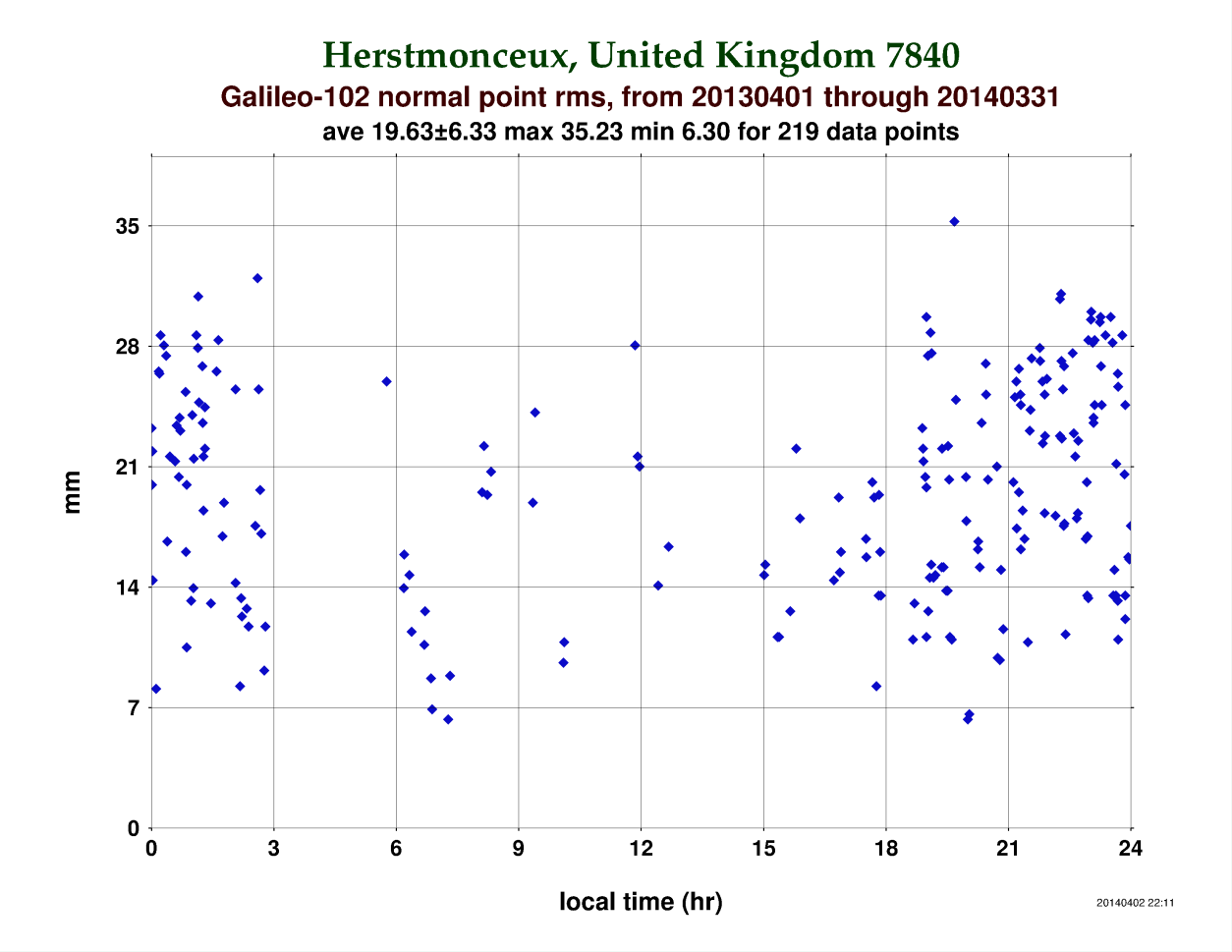
HEO yield (from ILRS web)
a number of stations doing well



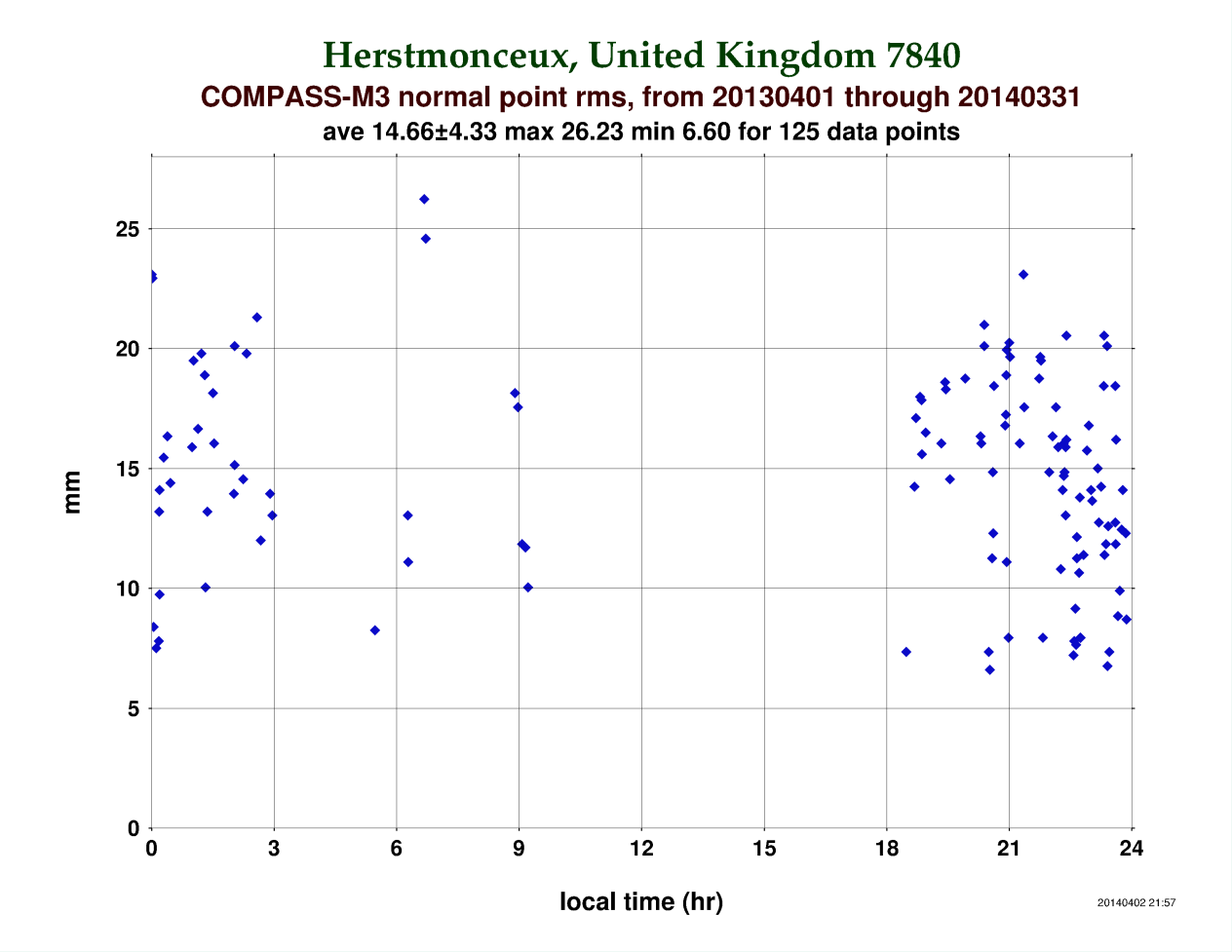
Some examples of GNSS tracking from Herstmonceux

- Plots show data yield and NP precision in last 12 months as function of local time
- Some suggestion of higher precision in daytime:
  - Higher elevation preferred, so array effect reduced
- NOTE GLONASS difficult in daytime
- Plots taken from ILRS website

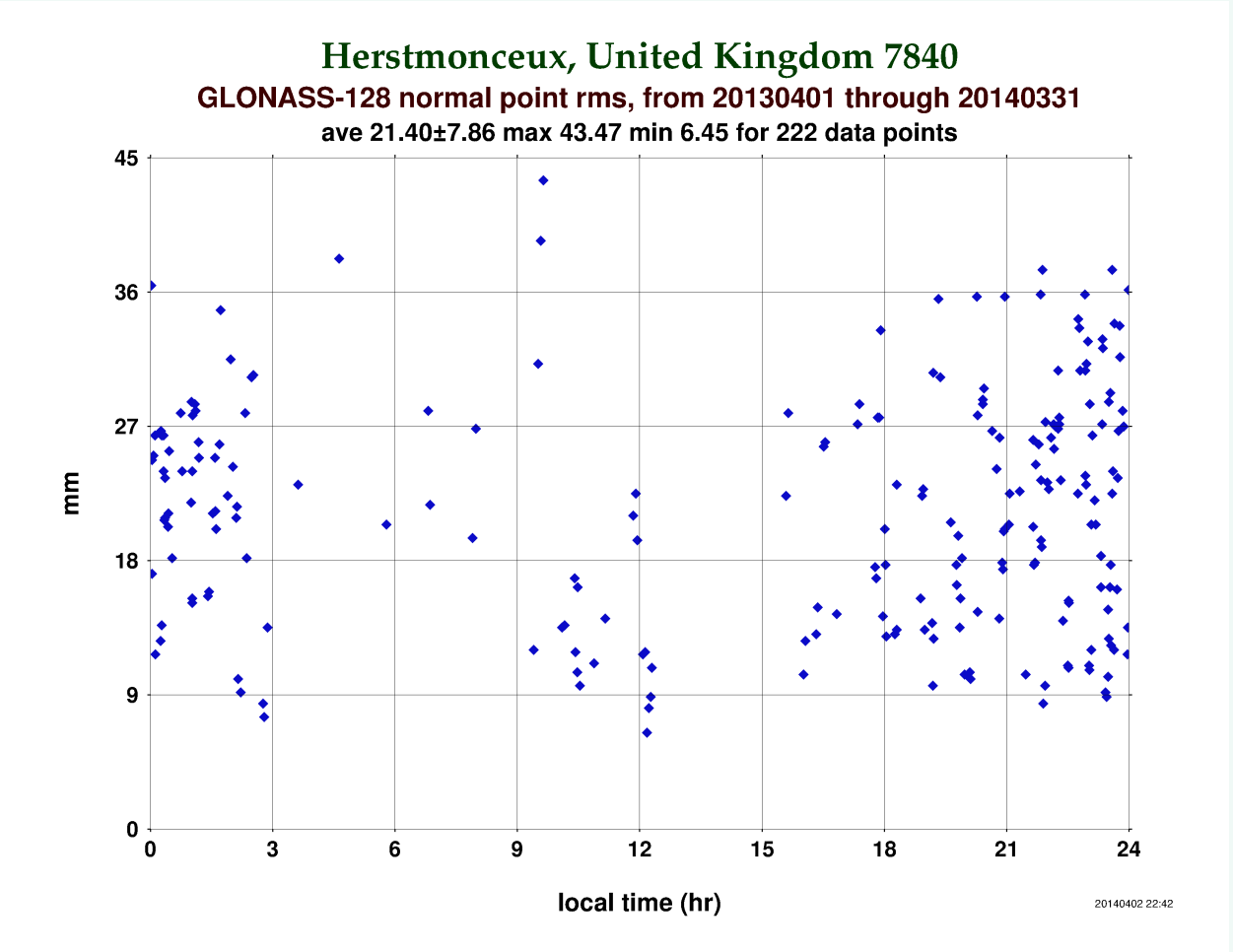
Galileo-102


Herstmonceux, United Kingdom 7840
Galileo-102 normal point rms, from 20130401 through 20140331
ave 19.63±6.33 max 35.23 min 6.30 for 219 data points
mm
35
28
21
14
7
0
0
3
6
9
12
15
18
21
24
local time (hr)
20140402 22:11

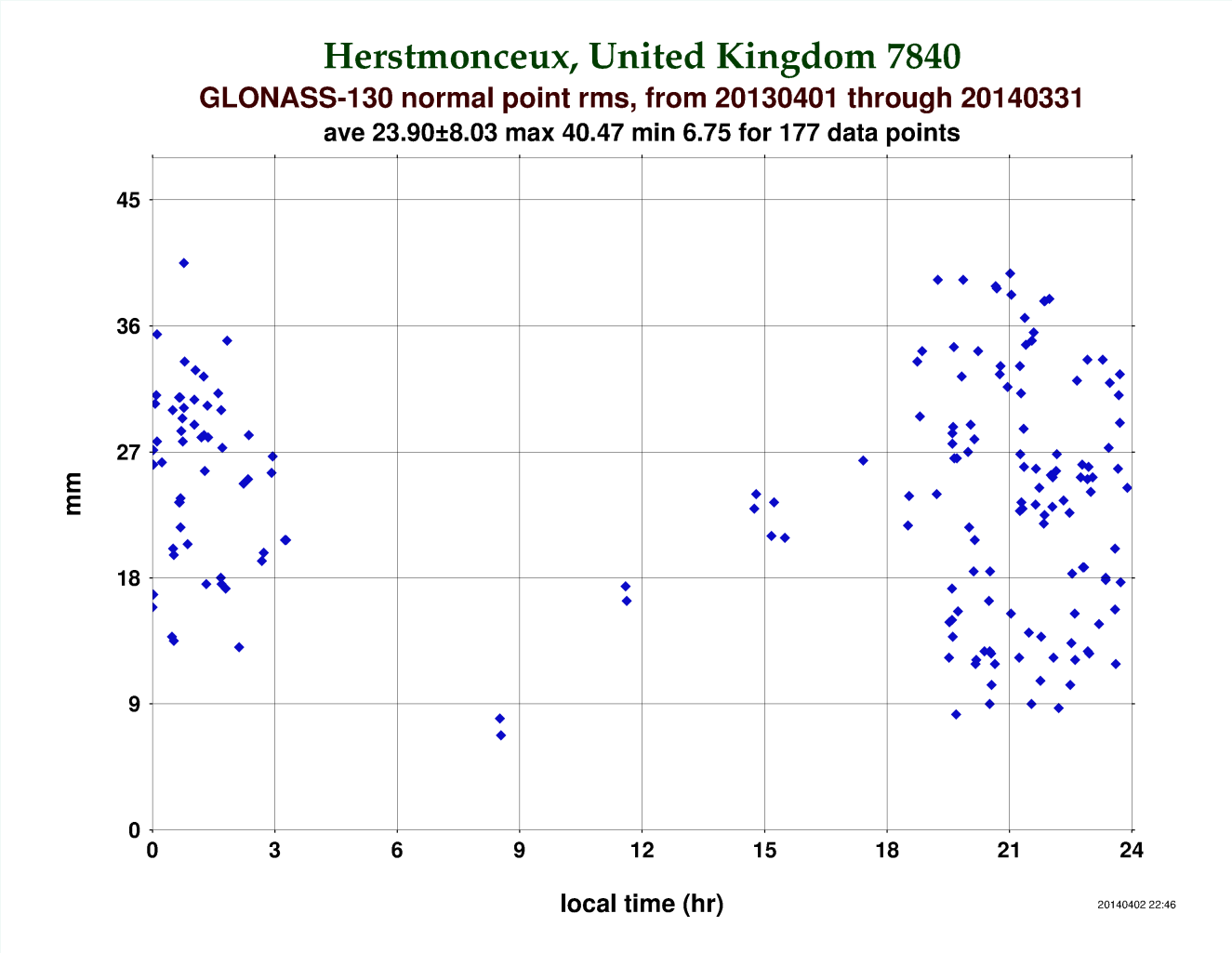
COMPASS-M3


Herstmonceux, United Kingdom 7840
COMPASS-M3 normal point rms, from 20130401 through 20140331
ave 14.66±4.33 max 26.23 min 6.60 for 125 data points
mm
0
5
10
15
20
25
0
3
6
9
12
15
18
21
24
local time (hr)
20140402 21:57

GLONASS-128


Herstmonceux, United Kingdom 7840
GLONASS-128 normal point rms, from 20130401 through 20140331
ave 21.40±7.86 max 43.47 min 6.45 for 222 data points
mm
45
36
27
18
9
0
0
3
6
9
12
15
18
21
24
local time (hr)
20140402 22:42

GLONASS-130


Herstmonceux, United Kingdom 7840
GLONASS-130 normal point rms, from 20130401 through 20140331
ave 23.90±8.03 max 40.47 min 6.75 for 177 data points
mm
0
9
18
27
36
45
0
3
6
9
12
15
18
21
24
local time (hr)
20140402 22:46

Conclusion

- SGF Herstmonceux attempts to track all the GNSS vehicles when available
- Effort appears not to impact the tracking on LAGEOS, etc.
- GLONASS remain difficult during daytime
  - Need good sky conditions, observer experience, etc.