WLRS GNSS experience

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Geodetic Observatory Wettzell

System parameters (signal strength)

Consider Link-Budget-Equation

- Laser: 15mJ @ 20Hz (avg.: 0.3W), ca.120ps+
- Telescope: 0.75m diameter/monoaxial
- Transmit/receive efficiency: 0.5

2 different receive paths

Up to LAGEOS
MCP (Photec PMT210)
QE ca. 11%, Laser Divergency: 24arcsec (8arcsec LAGEOS)

High earth orbiters
APD (LASER COMP. SAP500)
QE > 90%, Laser Divergency: 8arcsec

System parameters (noise reduction)

Space-time filtering → limited by field of view (velocity aberration),
gate-on time (50ns) and
range-gate resolution (40ns)

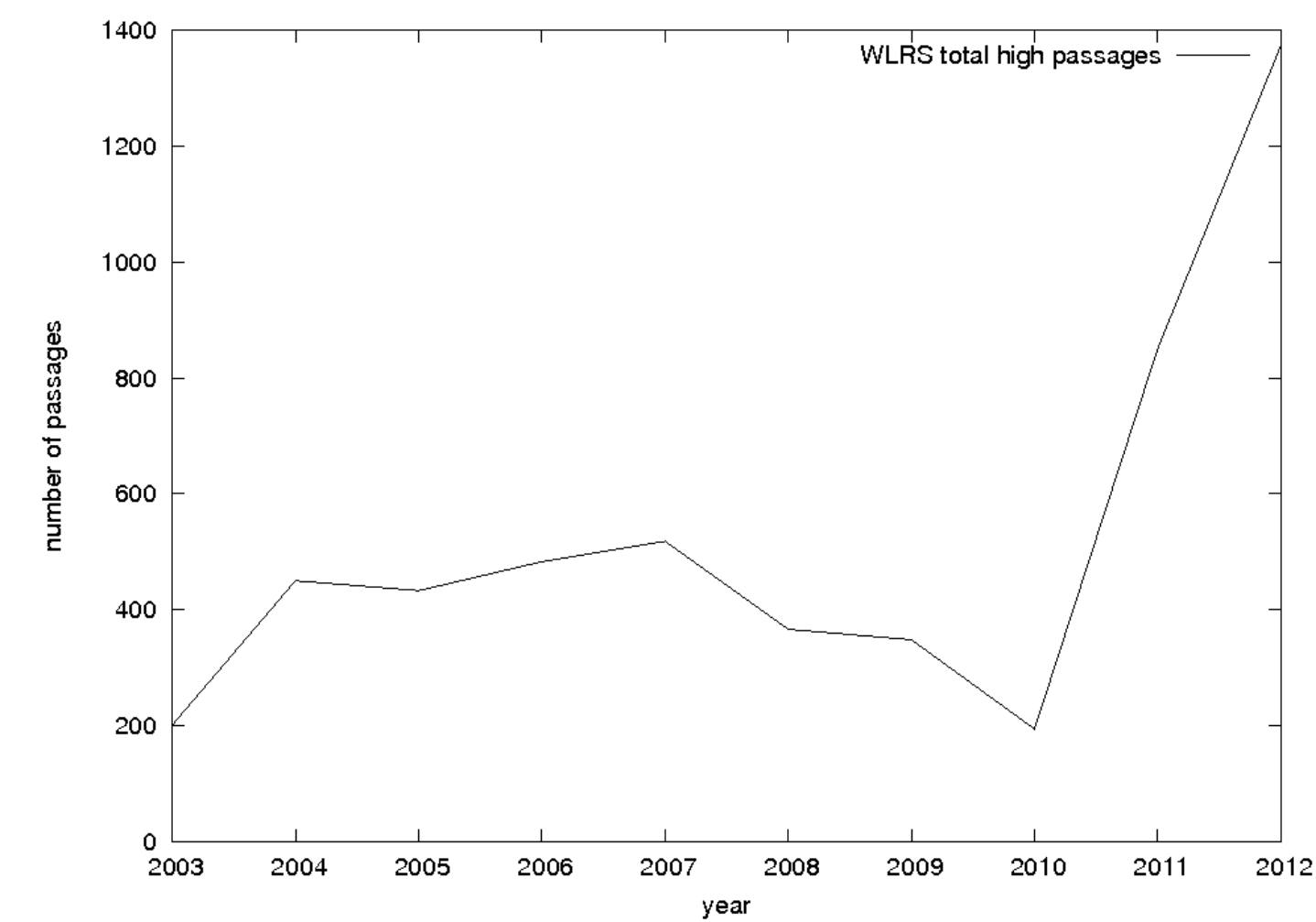
Spectral filtering → limited by laser bandwidth

MCP:
FoV = 30arcsec
Range Gate = 600ns
Spectral filtering: 0.35nm

APD:
FoV = 18arcsec
Range Gate = 200ns
Spectral filtering: 0.15nm

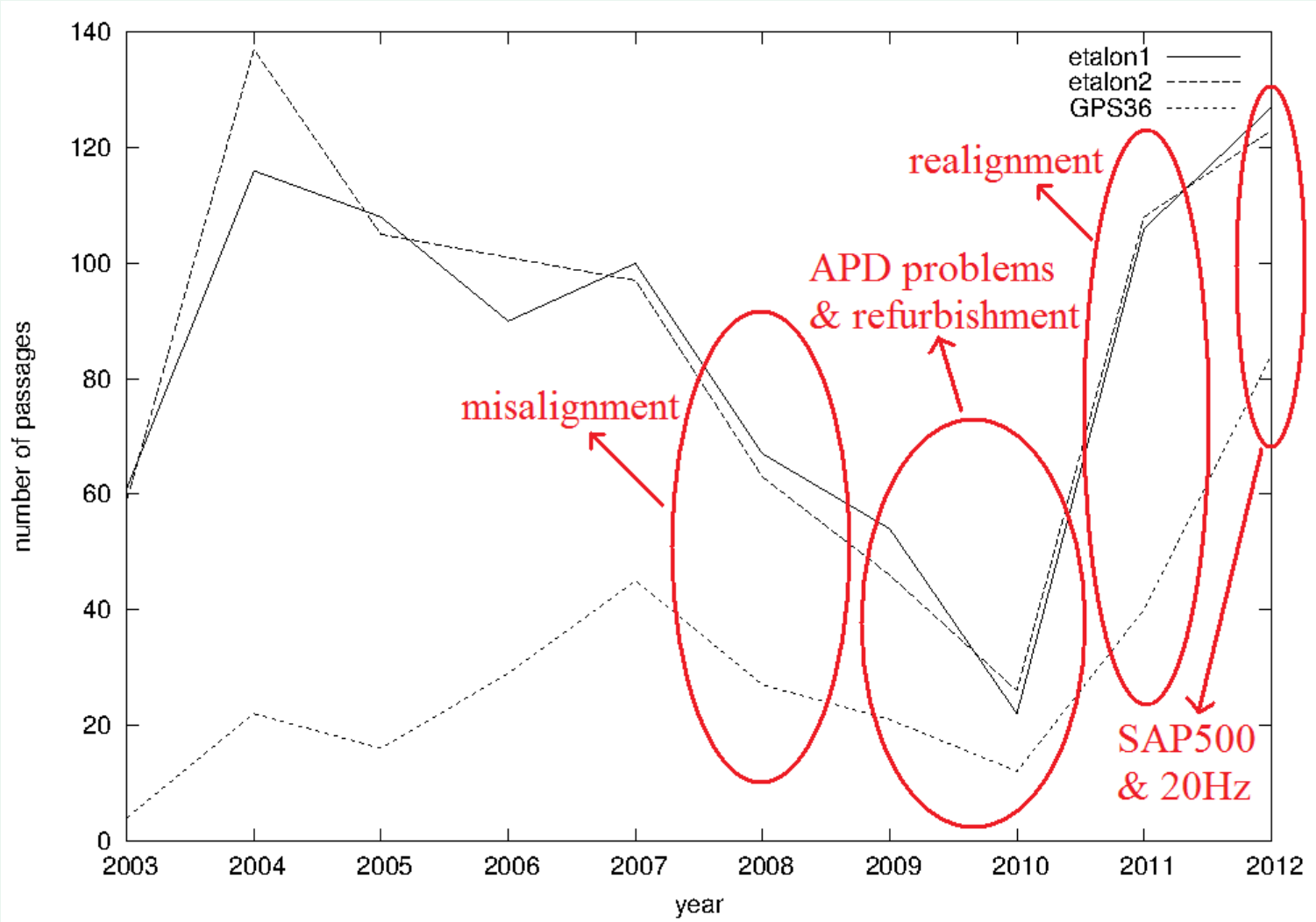
Passage statistics 1

WLRS total high passages (ILRS)



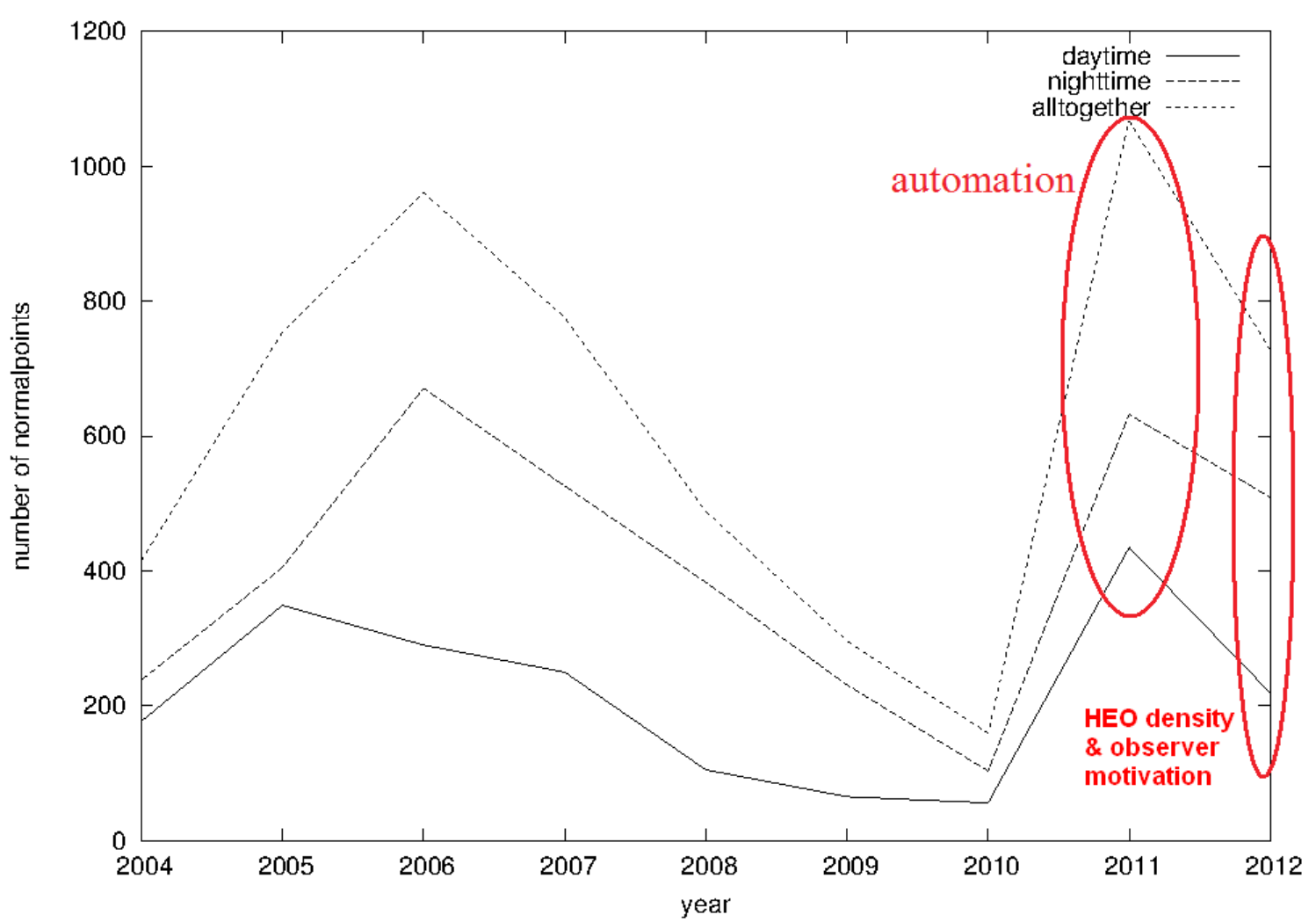
Passage statistics 2

Choose Etalon & GPS36 for further details (availability)



Normal Point statistics

Etalon for number of day- and nighttime normalpoints (availability)



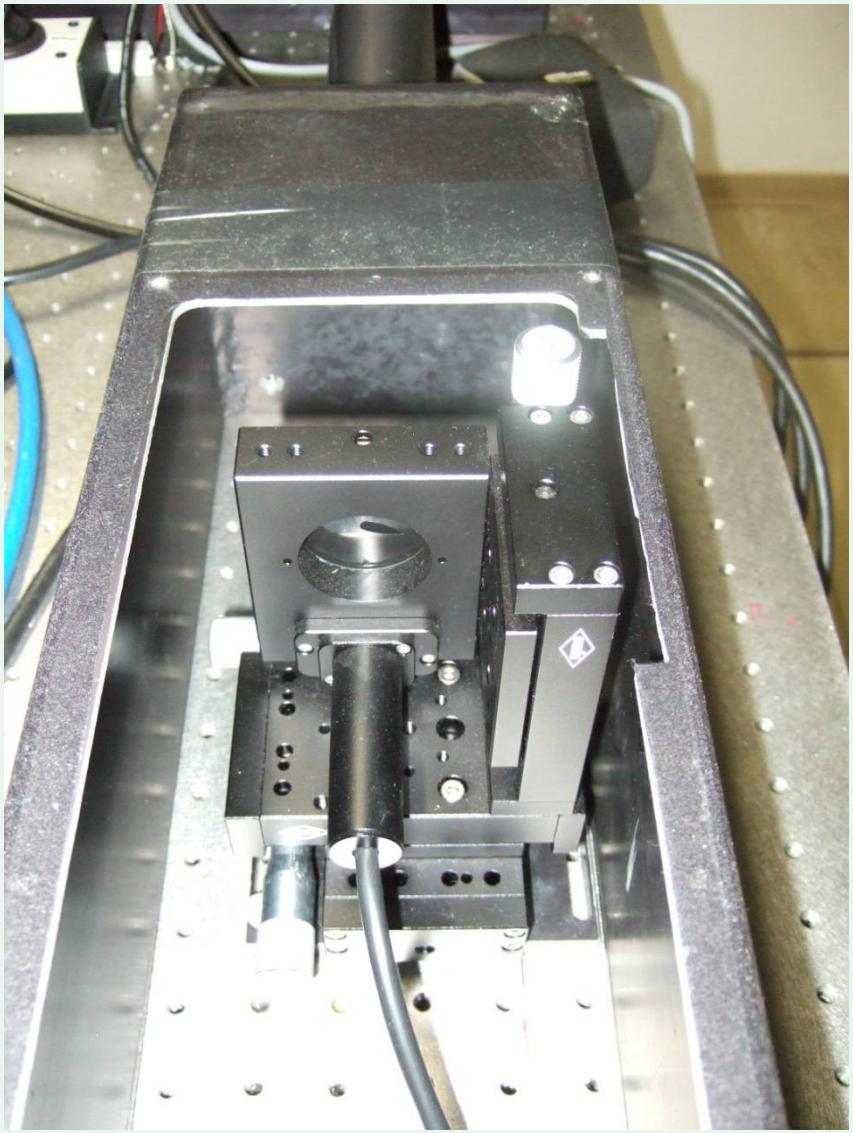
Improvements (alignment)

Few clicks on GUI
=> Easy verification of the optical axis of telescope, detector and laser

Improvements (automation)

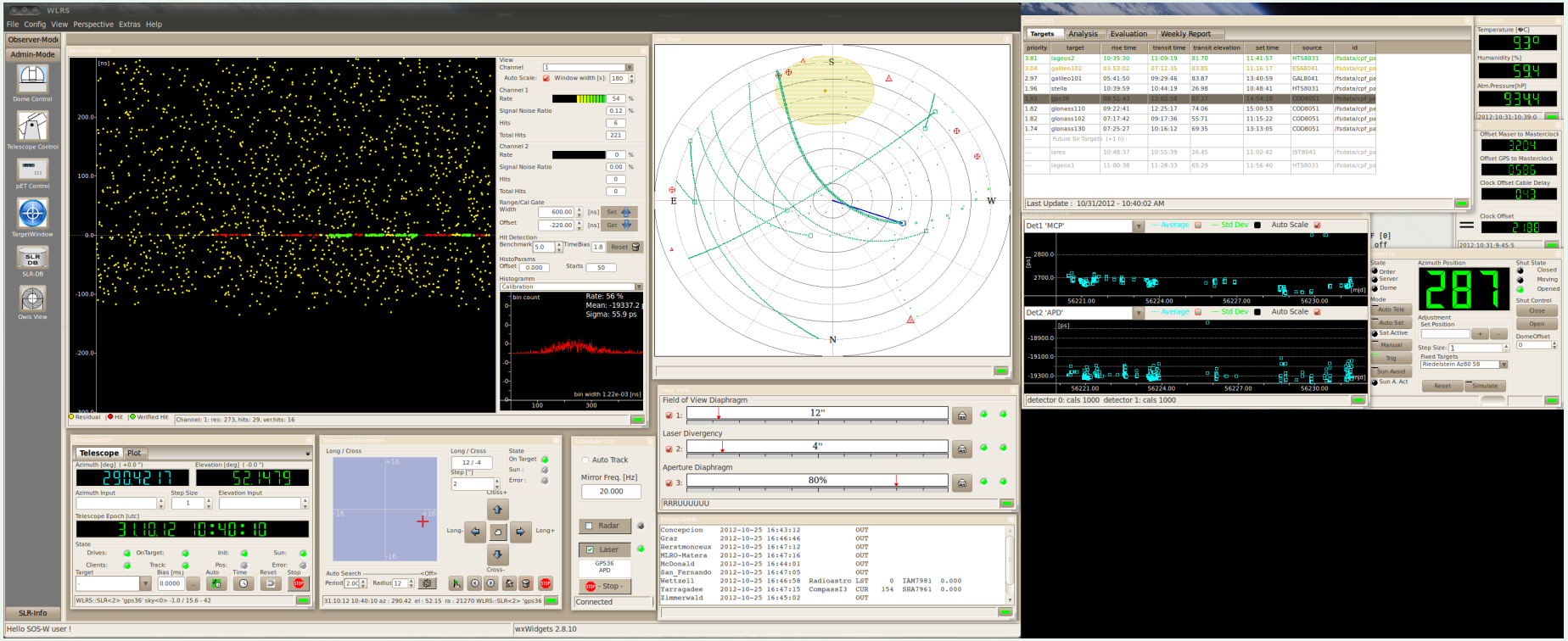
- Clear observer of unnecessary charges
  => automated control of system parameters

- introduce industry qualified equipment (reliability, accuracy, repeatability)
  (OWIS GmbH)



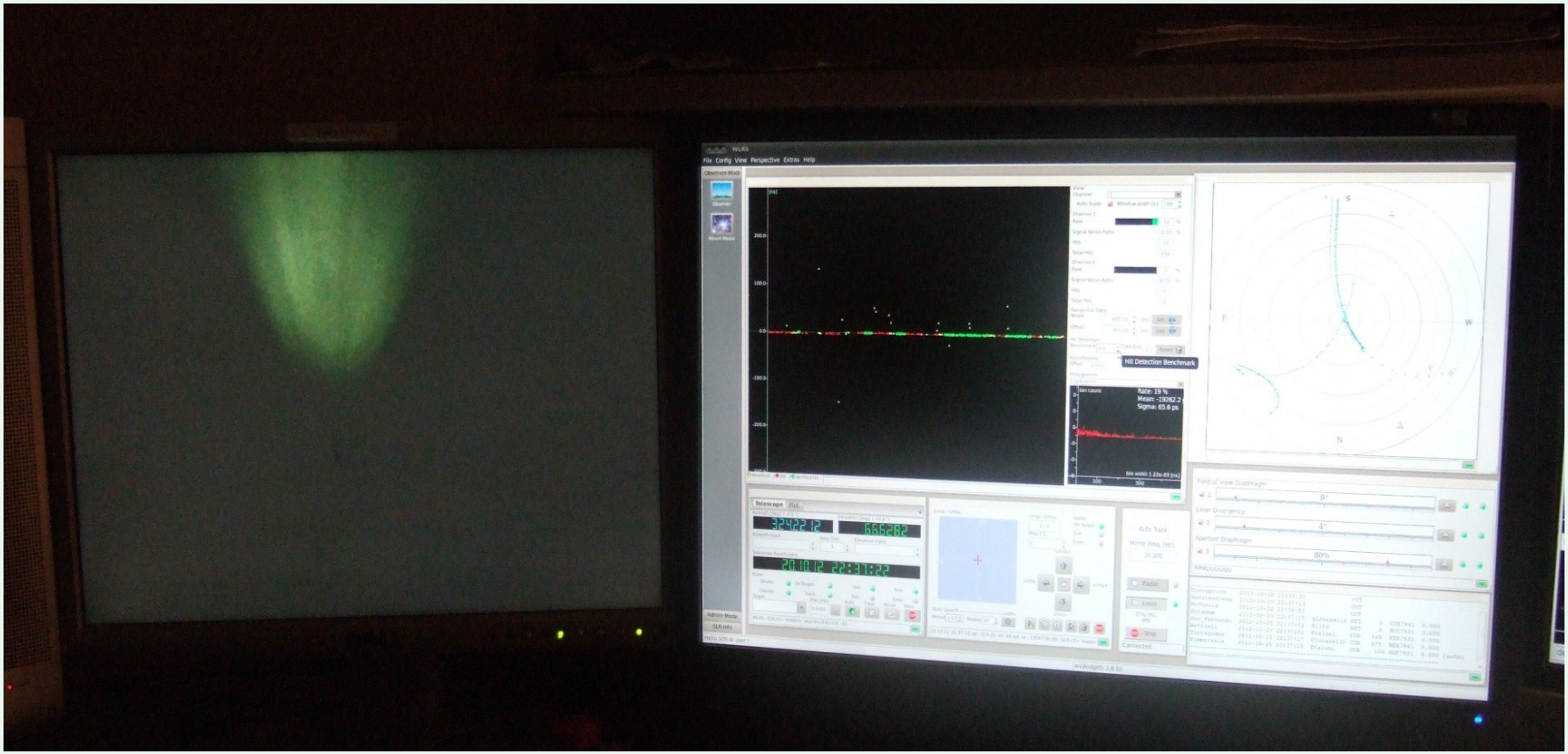
Improvements (automation)

Development of a modular software system for automation and remote control of geodetic observation systems. (finished in big parts)



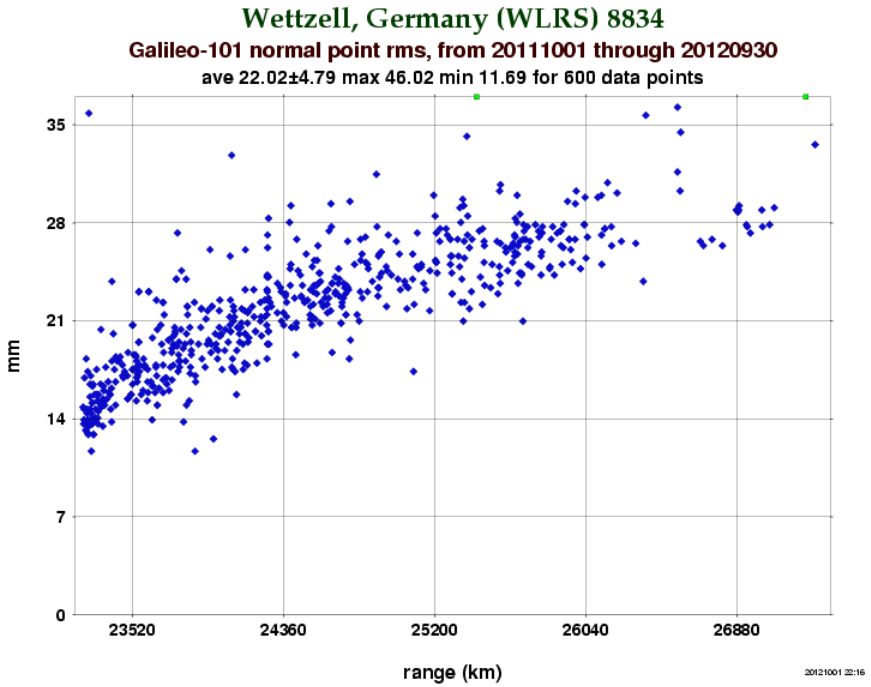
Improvements (detector)

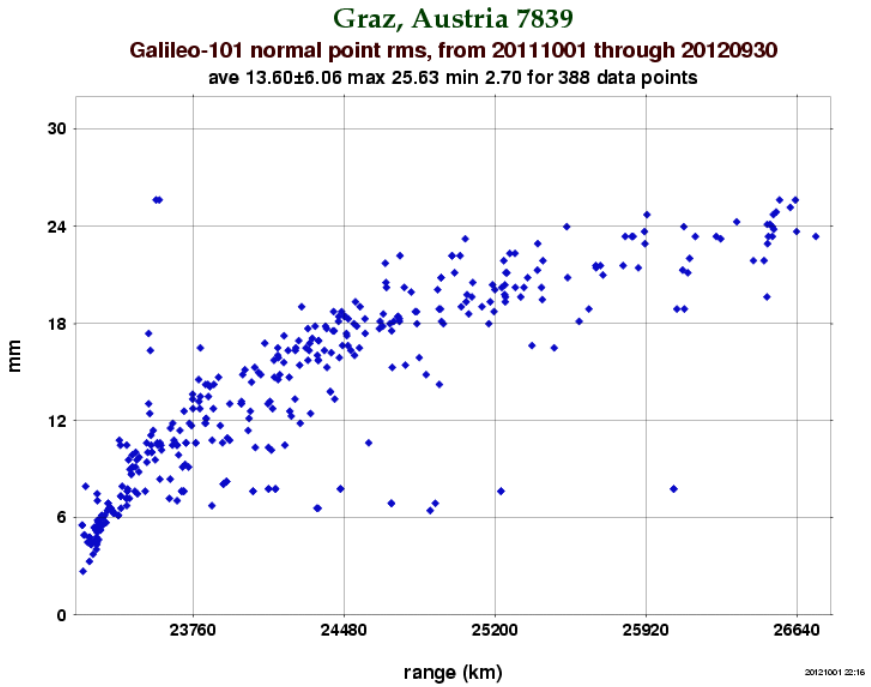
Implementation of a high quantum efficiency and low dark noise Detector (Laser Components SAP500)



Problems (detector)

Just reasonable accuracy
(better when satellite signature becomes worse)





Problems (general)

- WLRS is just a 20Hz system (max 600 hits@10% & 300sec np window)

  => no passage interleaving during NP window
- Hitdetection during daytime tracking

  (5 ns Binwidth)

  => not evaluable passages
- Some occasional offset error in mount model (up to 30“)

  => long search times

Conclusion

Now:
WLRS is a high efficient SLR-System
=> RadioAstron, LLR efforts in progress

But:
Improvements in accuracy and range bias issues inevitable

Future:
WLRS should become a high accurate SLR-system with the capability of ranging from LEOs up to the moon
& support of all scientific programs