

WLRS GNSS experience

J. Eckl, et al.

Geodetic Observatory Wettzell

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)

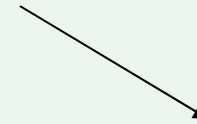
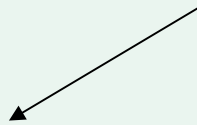
High earth orbiters

APD (LASER COMP. SAP500)

QE > 90%, Laser Divergency:
8arcsec

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

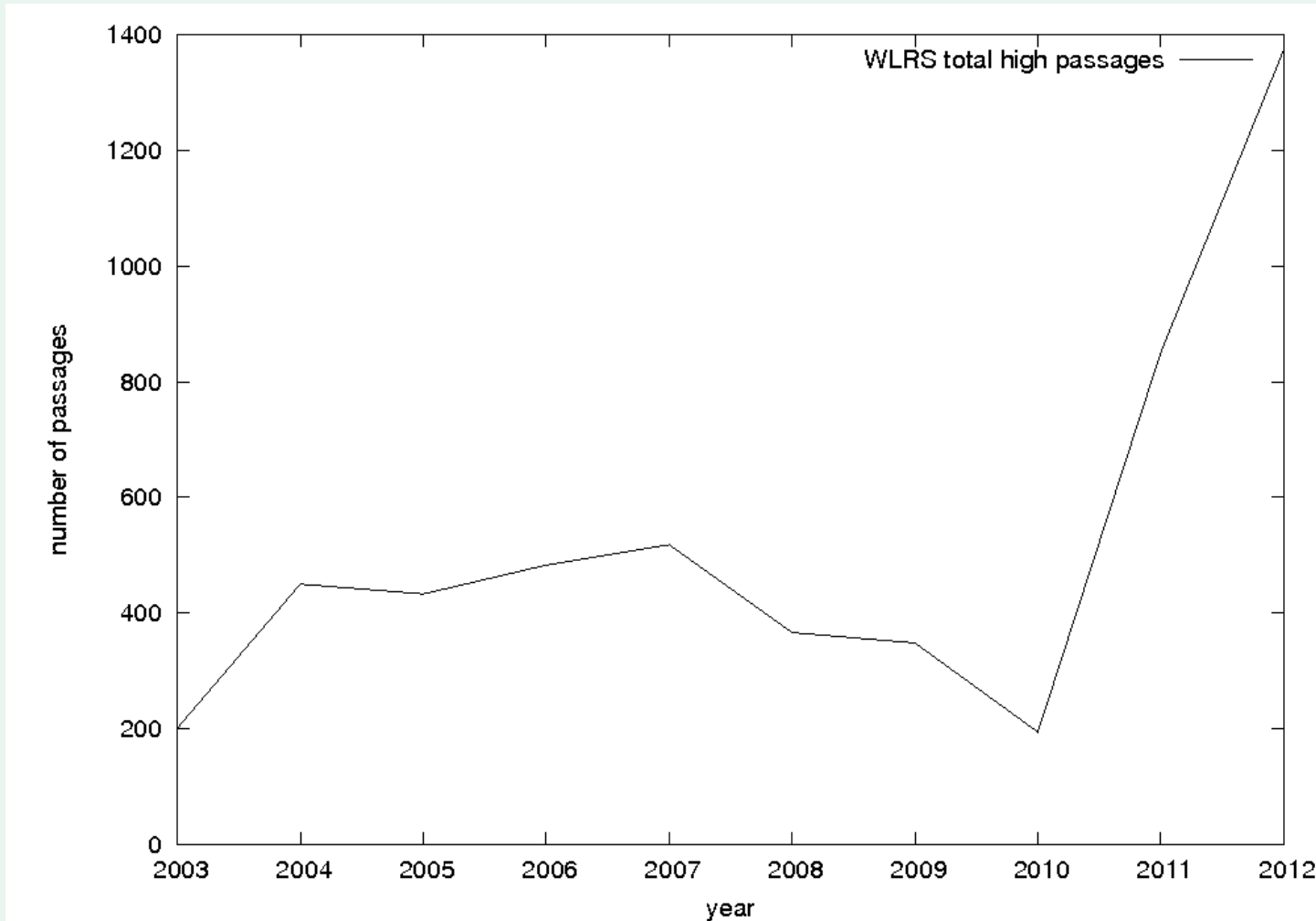
APD:

FoV = 18arcsec

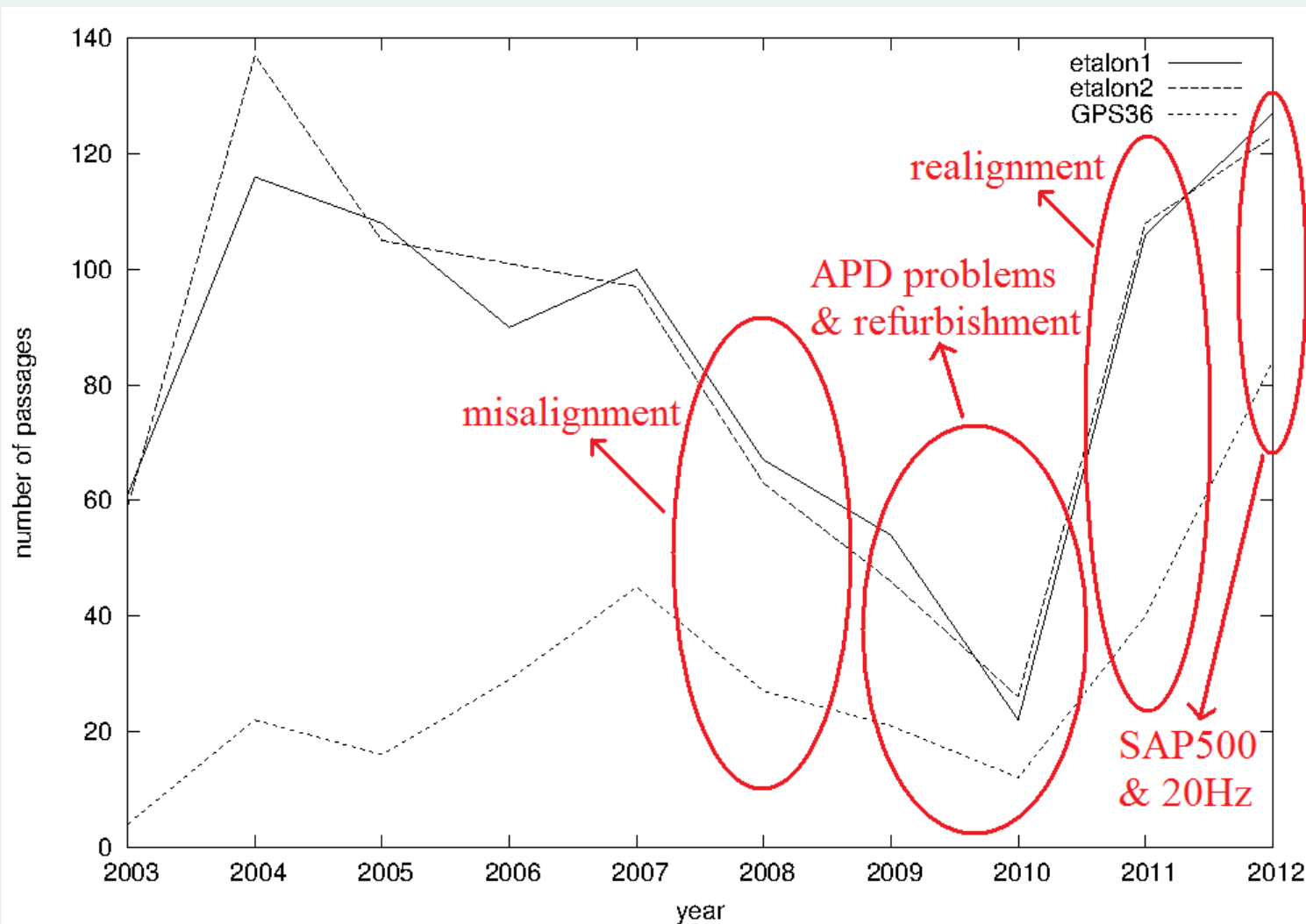
Range Gate = 200ns

Spectral filtering: 0.15nm

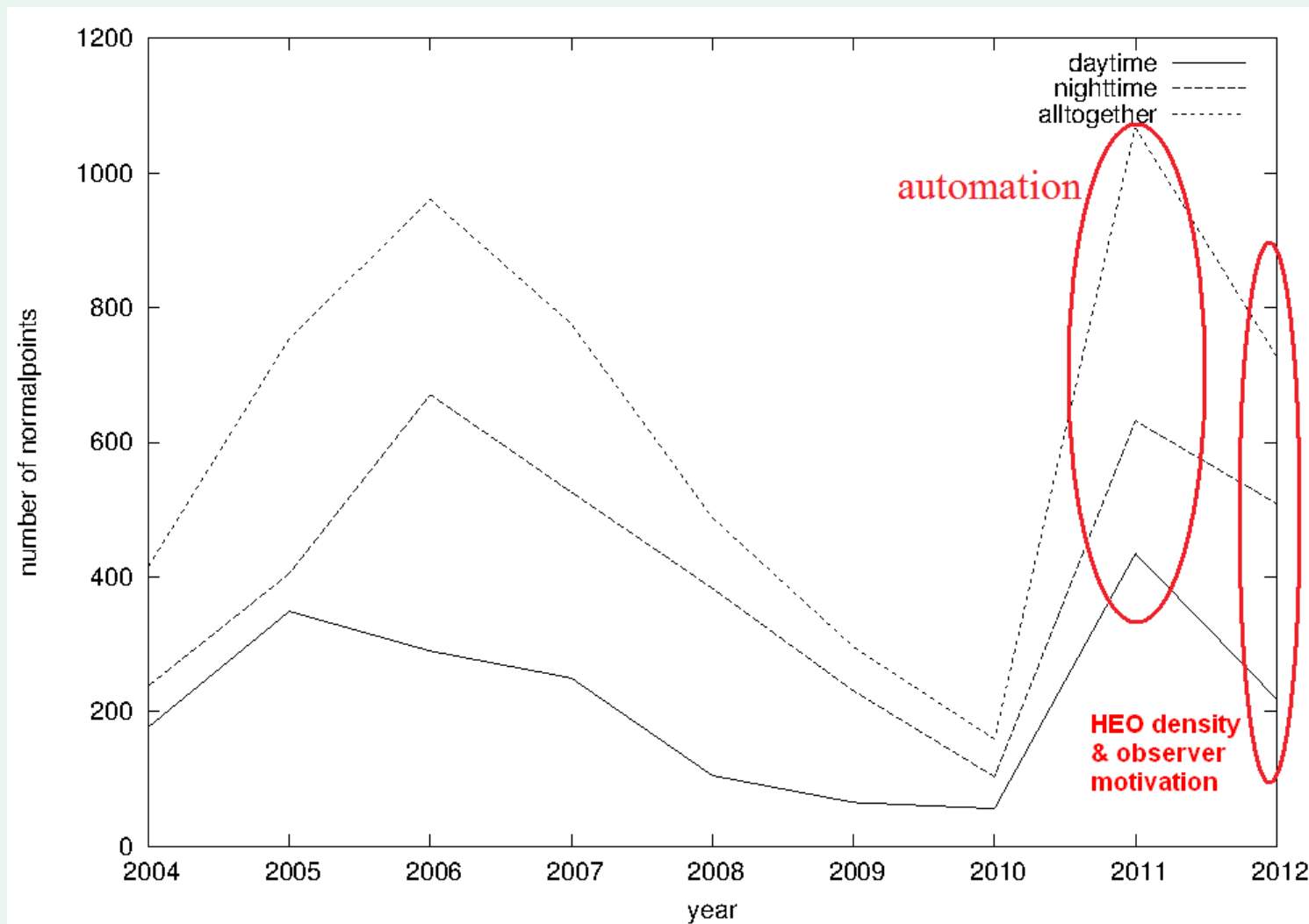
WLRS total high passages (ILRS)



Choose Etalon & GPS36 for further details (availability)



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

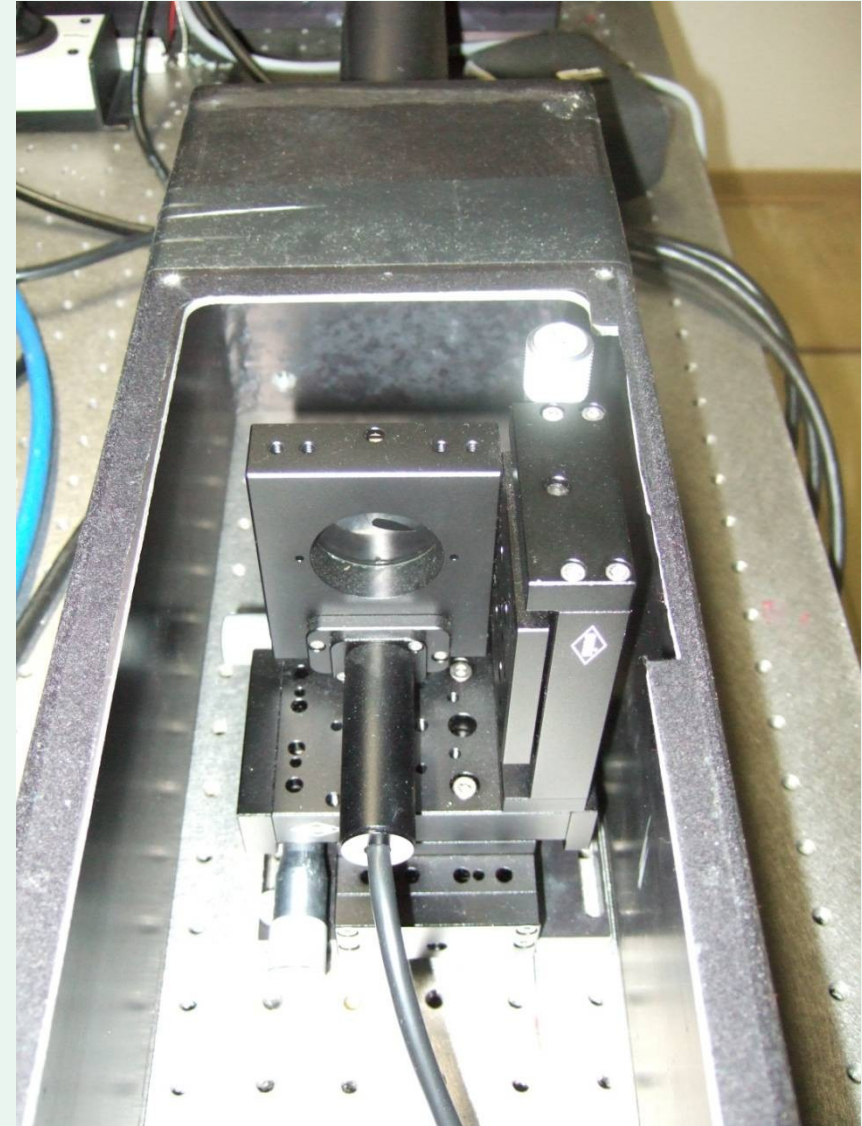


Few clicks on GUI

=> Easy verification of the optical axis of telescope, detector and laser



- Clear observer of unnecessary charges
=> automated control of system parameters
- introduce industry qualified equipment (reliability, accuracy, repeatability)
(OWIS GmbH)



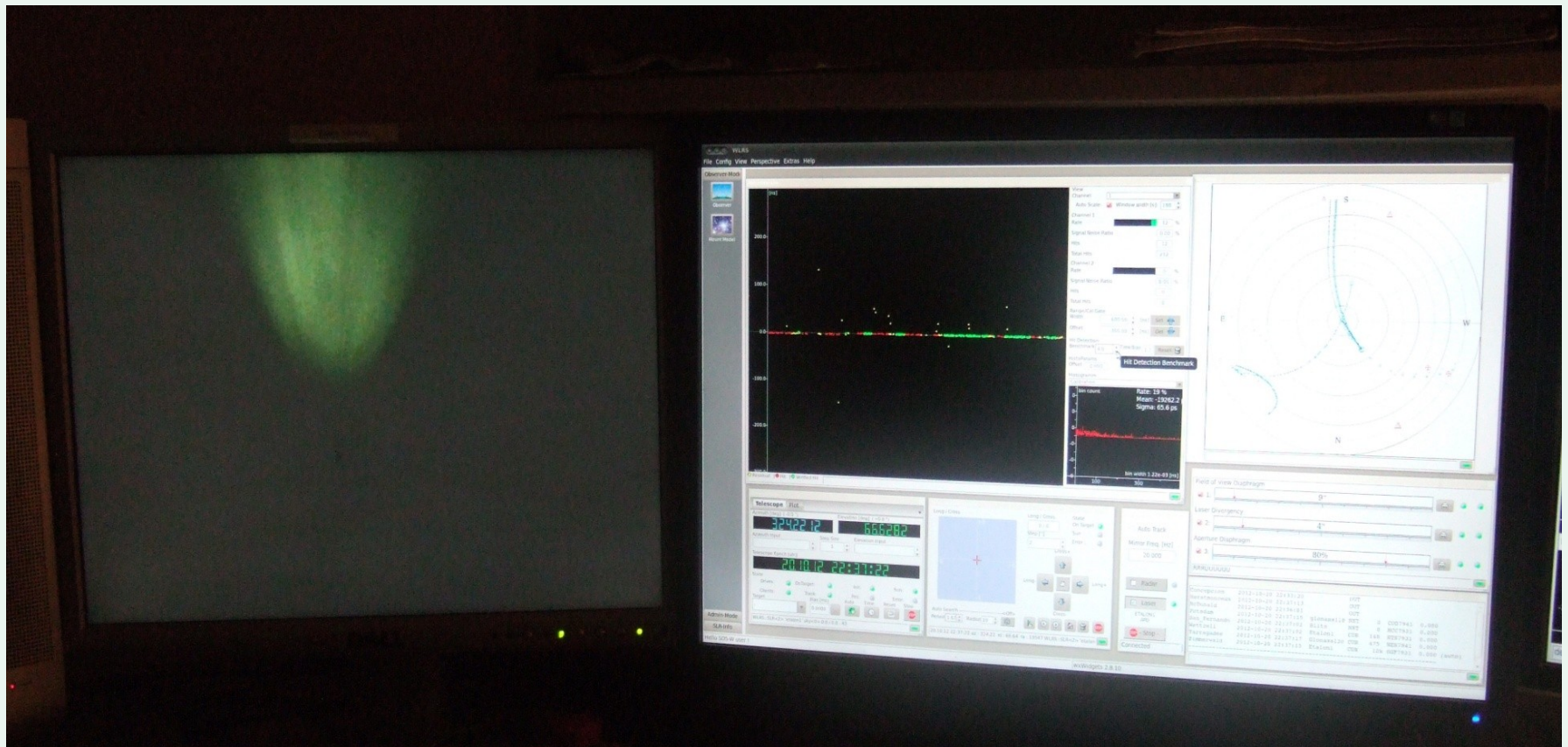
Development of a modular software system for automation and remote control of geodetic observation systems. (finished in big parts)

The screenshot displays a complex software interface for geodetic observation. It is divided into several functional areas:

- Observer-Mode / Admin-Mode:** Located on the left, it contains control buttons for Dome, Telescope, pET, TargetWindow, SLR DB, and Oculi View.
- Main Plot Area:** The central-left part shows a scatter plot of observation data points (yellow and green) with a red horizontal line. To its right is a circular plot with a grid and colored regions (yellow, green, blue).
- Control Panels:**
 - Telescope Plot:** Shows Azimuth (290.4217) and Elevation (52.1479) with a step size of 1.0. It also displays a date and time (31.10.12 10:40:10).
 - Long / Cross:** A grid-based control panel for telescope movement with various buttons and a state indicator.
 - Field of View Diagram:** Shows parameters like 12" and 4" with a laser divergency indicator.
 - Conception Log:** A table listing observation events with columns for date, time, location, and status.
- Targets Table:** A table in the top right corner listing observation targets with columns for priority, target, rise time, transit time, transit elevation, set time, source, and id.

priority	target	rise time	transit time	transit elevation	set time	source	id
3.81	lagos2	10:35:30	11:09:19	81.70	11:41:57	HT58031	/f/odata/cpf_pa
3.04	galileo102	03:53:02	07:12:35	83.85	11:16:17	ES48041	/f/odata/cpf_pa
2.97	galileo101	05:41:50	09:29:46	83.87	13:40:59	GAL8041	/f/odata/cpf_pa
1.96	irelia	10:39:59	10:44:19	26.98	10:48:41	HT58031	/f/odata/cpf_pa
0.93	gps3	05:51:52	10:55:55	81.17	14:55:15	GPS0002	/f/odata/cpf_pa
1.82	glmass110	09:22:41	12:25:17	74.06	15:00:53	CO08051	/f/odata/cpf_pa
1.82	glmass102	07:17:42	09:17:36	55.71	11:15:22	CO08051	/f/odata/cpf_pa
1.74	glmass120	07:25:27	10:16:12	69.35	13:13:45	CO08051	/f/odata/cpf_pa
	Future SIF Targets: (+1 h)						
	lores	10:48:37	10:55:39	26.45	11:02:42	HT8041	/f/odata/cpf_pa
	lagos1	11:00:38	11:28:33	65.29	11:56:40	HT58031	/f/odata/cpf_pa
- Environmental Data:** On the far right, there are digital readouts for Temperature (9.30), Humidity (5.94), and Air Pressure (934.4).
- Detector Status:** At the bottom right, there are indicators for Det1 MCP and Det2 APD, showing their current states and positions.

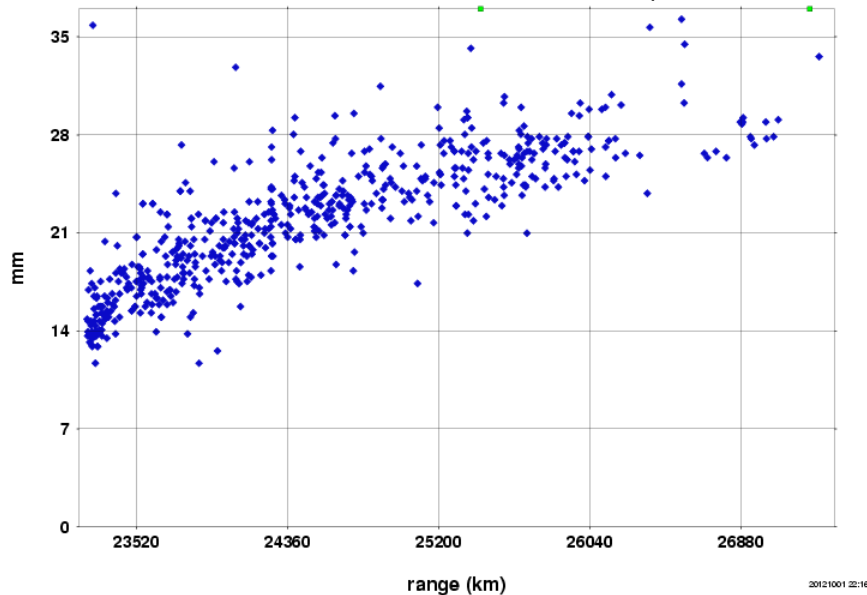
Implementation of a high quantum efficiency and low dark noise Detector (Laser Components SAP500)



Just reasonable accuracy
(better when satellite signature becomes worse)

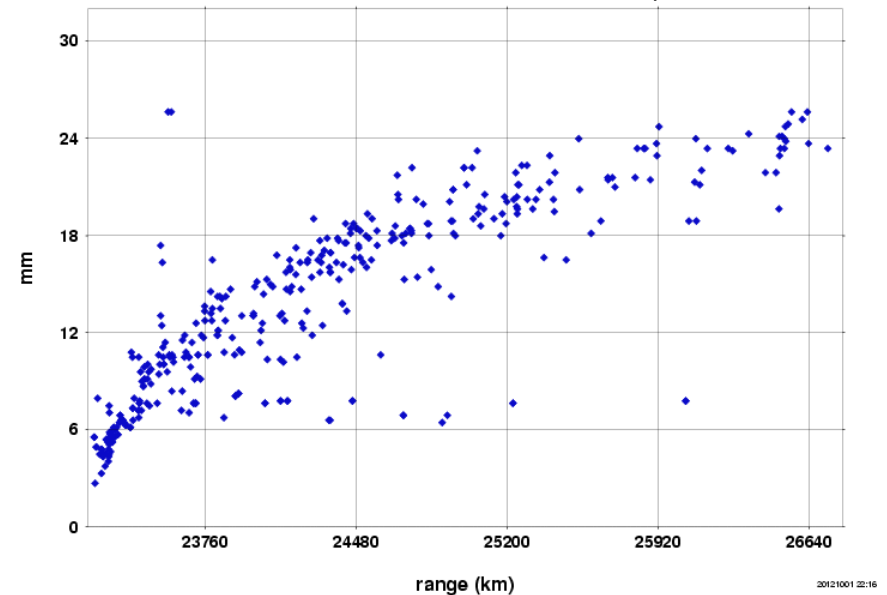
Wetzell, Germany (WLRS) 8834

Galileo-101 normal point rms, from 20111001 through 20120930
ave 22.02±4.79 max 46.02 min 11.69 for 600 data points



Graz, Austria 7839

Galileo-101 normal point rms, from 20111001 through 20120930
ave 13.60±6.06 max 25.63 min 2.70 for 388 data points



- 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

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