



The status of WLRs system automation

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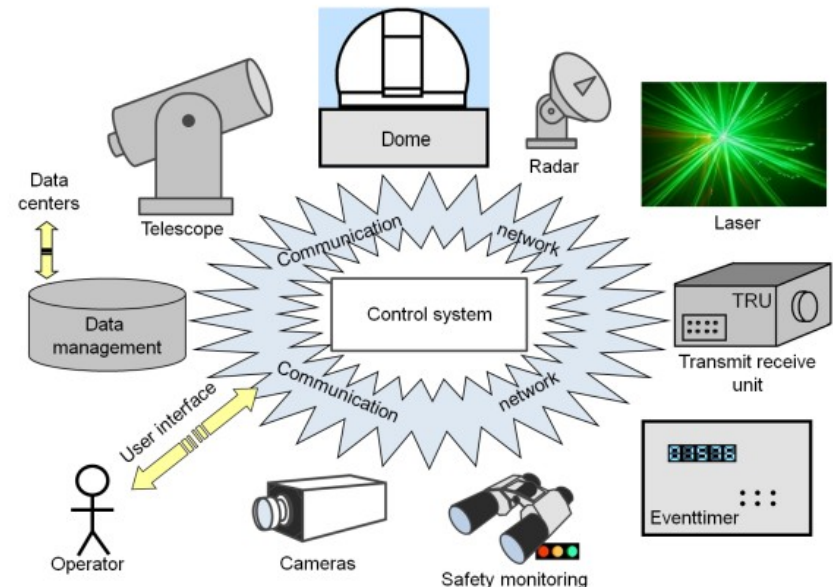
Geodetic Observatory Wettzell

Federal Agency for Cartography and Geodesy

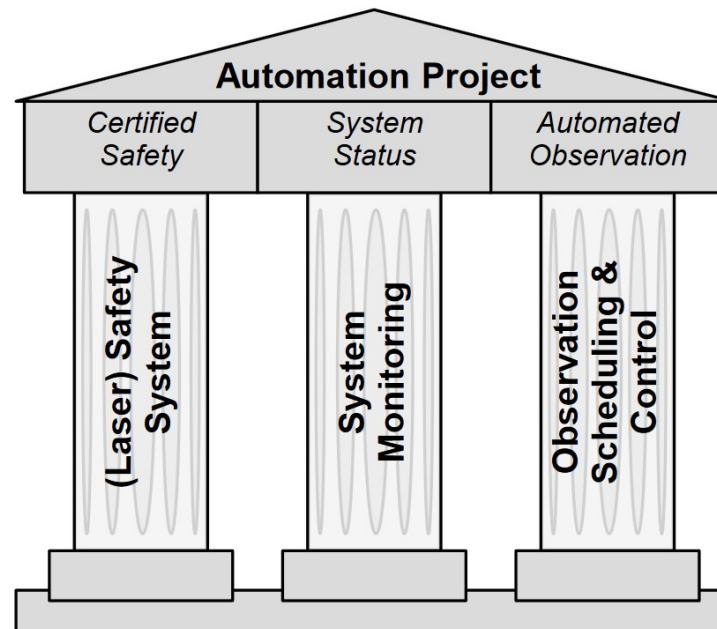
¹Technical University of Munich

Basic tools for sustainable software development and to ensure minimum requirements to functional safety:

- Version control: **Apache Subversion**
- Software documentation: **Doxygen**
- Software quality control: **Cppcheck**
- General documentation: **Dokuwiki**
- System-Monitoring:
Zabbix, Grafana & Wettzell SysMon
- Communication interface:
Idl2rpc.pl (A. Neidhardt),
Generator for client-server
architecture



The three pillars of the automation project



- Besides, Hardware:
 - Sensors for atmosphere
 - Increase repetition rate of WLRS (Session 9 presentation)

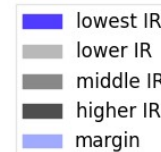
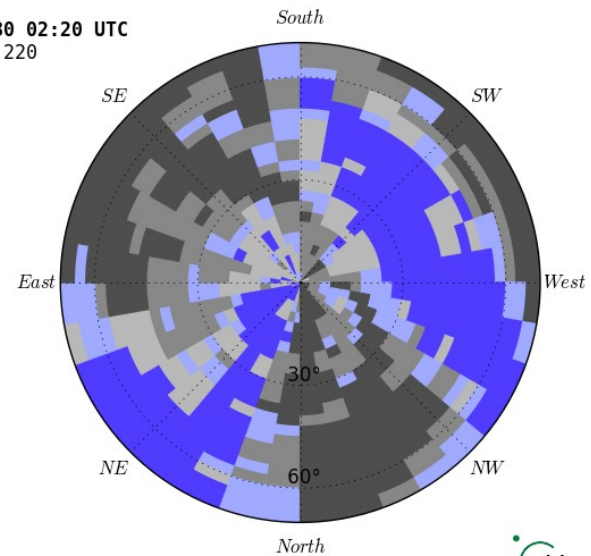
■ NubiScope:

- Skymap with IR-senor @ 10 min interval
- Resolution: 10 degree Azimuth, 3 degree elevation
- Precipitation indicator



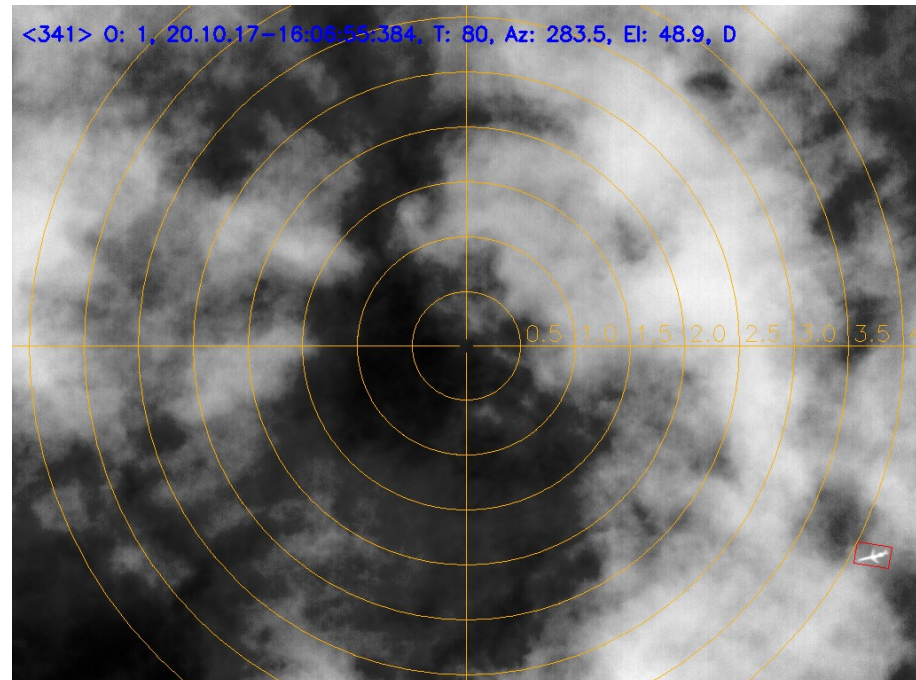
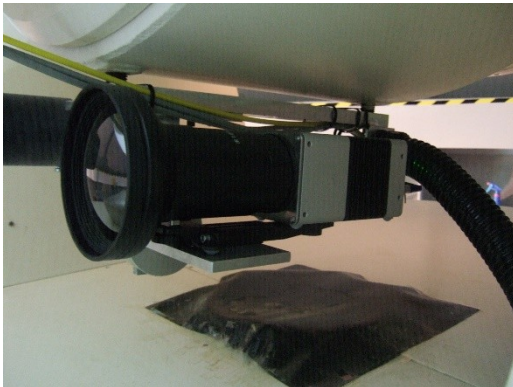
Nubigramm - Geodätisches Observatorium Wettzell

Date: 2018-10-30 02:20 UTC
Filename: M1810300.220
Horizon: 69.0°
Transp. Clouds
 ClCov: 60.3 %
 HighLCL: 0.0 %
 MidLCL: 0.0 %
 LowLCL: 60.3 %
 Precip: N
 Tzero: 15.9 °C
 Tblue: -45.6 °C
MainCloudBase:
 Cov: 0.0 %
 Temp: -7.0 °C
 Height: 2600 m
LowestCloud:
 Temp: -4.9 °C
 Height: 2240 m



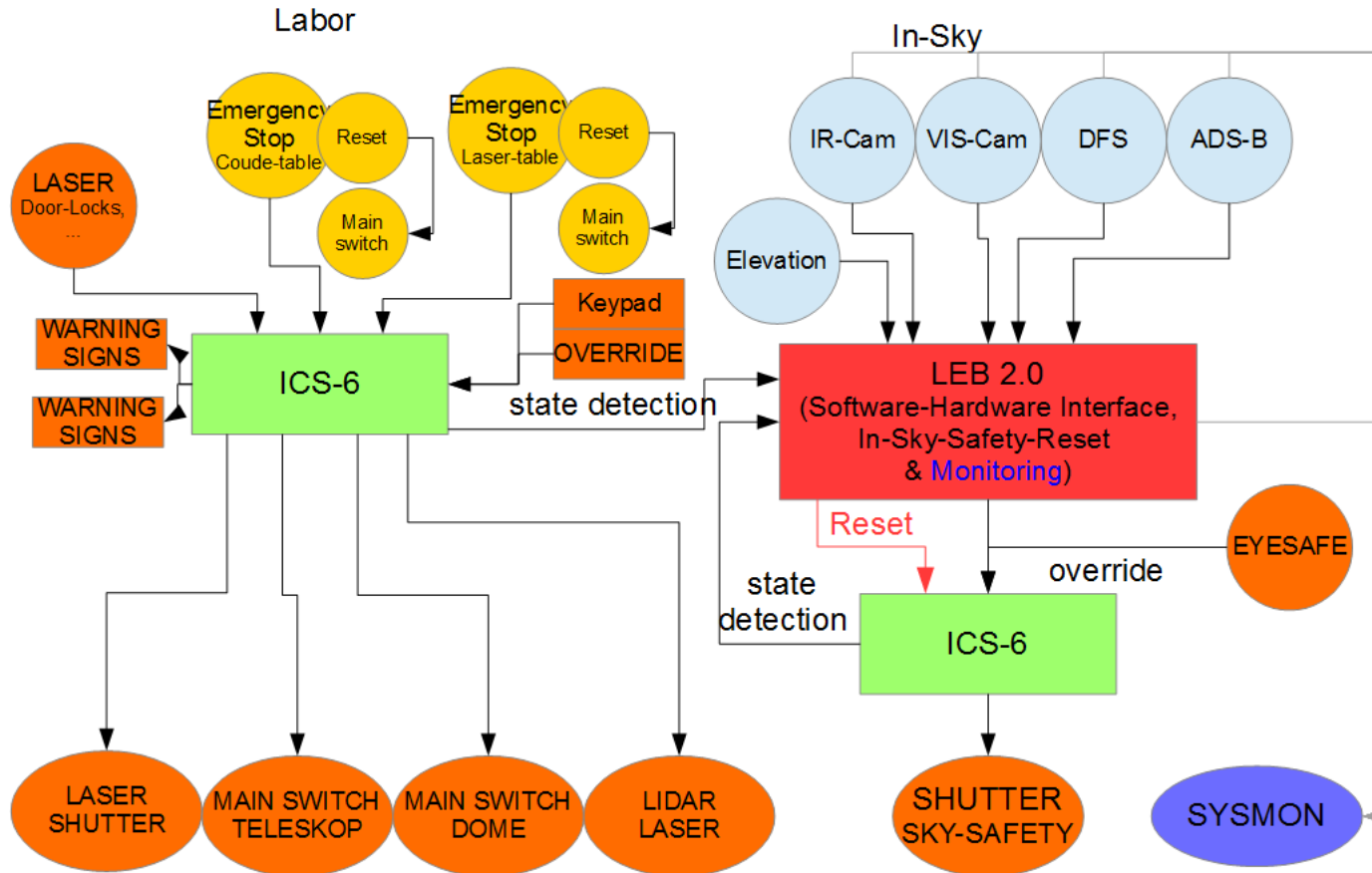


- **InfraTec:** Heat sensing camera for cloud detection during observation (part of In-Sky-Safety system → poster, board 23)
- **Thies:** Optical rain sensor to shut the system down





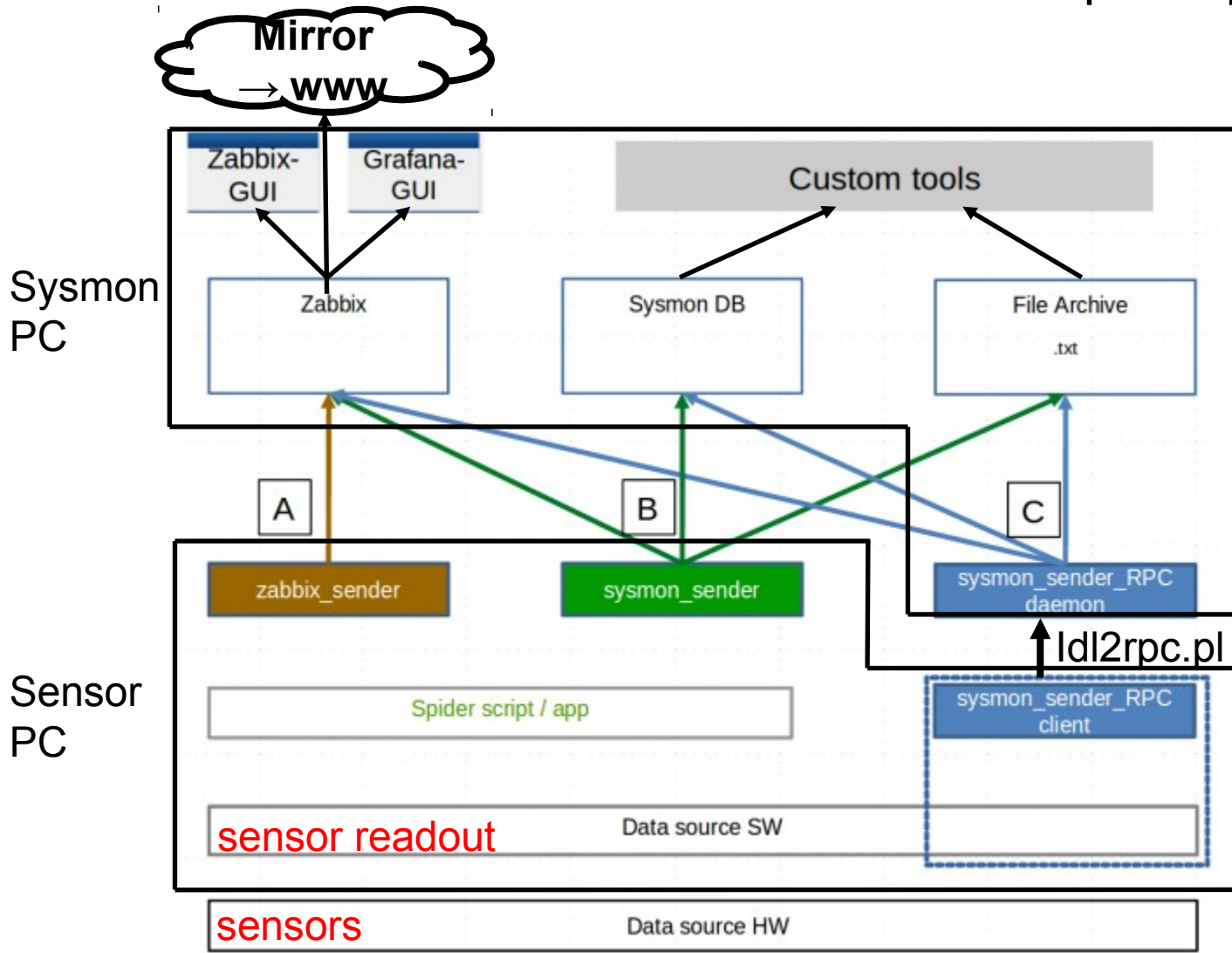
- Two independent circuits (Lab & In-Sky-Safety)



- **Lasernet:** Laser Safety System
 - EN ISO → 13849-1 performance level e
 - EN61508 → SIL 3
 - Dual blade shutter



- Installation planned during major system overhaul 2019



Choose either A, B or C to insert data to Sysmon



ZABBIX Monitoring Inventory Reports

Dashboard Problems Overview Web Latest data Triggers Graphs Screens Maps Services

Dashboard

All dashboards / Dashboard

SLR Systems

Updated: 23:56:46

LEB Status

Items	WLRs_LEB
WLRs_LEB_ADSB	Free Sky (No Detection) (1)
WLRs_LEB_Building	1
WLRs_LEB_DFS	Free Sky (No Detection) (1)
WLRs_LEB_IRCAM	1
WLRs_LEB_Laser	1
WLRs_LEB_Observer	1
WLRs_LEB_Radar	1
WLRs_LEB_SECURITY	1
WLRs_LEB_SkySafe	1
WLRs_LEB_SLR2	1
WLRs_LEB_Vision	1

Updated: 23:56:38

Nubi

Nubigramm - Geodätisches Observatorium Wettzell

Date: 2018-10-30 22:40 UTC
 Filename: M1810302.240
 Horizon: 69.0°

Transp. Clouds
 CLCov: 0.0 %
 HighLCL: 0.0 %
 MidLCL: 0.0 %
 LowLCL: 0.0 %
 Precip: N
 Tzzero: 4.3 °C
 Tblue: -53.1 °C

MainCloudBase:
 Cov: 0.0 %
 Temp: - °C
 Height: - m

LowestCloud:
 Temp: - °C
 Height: - m

Updated: 23:56:38

WLRs Computers

Updated: 23:56:35

Problems

Time	Recovery time	Status	Info	Host	Problem - Severity	Duration	Ack	Actions
23:49:28	23:52:51	RESOLVED	SOSW_Dome	SOSW_Dome	External Calibration	3m 23s	No	
23:44:46	23:44:50	RESOLVED	WLRs_Dome	WLRs_Dome	Dome error	4s	No	
23:35:01		PROBLEM	WLRs_Combined_Items	WLRs_Combined_Items	Obs_running	21m 37s	No	
23:34:48	23:34:48	RESOLVED	WLRs_Dome	WLRs_Dome	Dome not aligned	0	No	
23:34:31	23:35:01	RESOLVED	WLRs_Combined_Items	WLRs_Combined_Items	No Observation	30s	No	
23:28:25	23:28:54	RESOLVED	SOSW_Dome	SOSW_Dome	Dome not aligned	29s	No	
23:00								
22:59:01	23:34:31	RESOLVED	WLRs_Combined_Items	WLRs_Combined_Items	Obs_running	35m 30s	No	

7 of 7 problems are shown Updated: 23:56:39

Status of Zabbix

Parameter	Value	Details
Zabbix server is running	Yes	
Number of hosts (enabled/disabled/templates)	90	15 / 0 / 75
Number of items (enabled/disabled/not supported)	454	447 / 1 / 6
Number of triggers (enabled/disabled [problem/ok])	204	184 / 20 [2 / 182]
Number of users (online)	4	1

Updated: 23:51:35

Host status

Host group	Without problems	With problems	Total
WLRs Rechner	6		6

Updated: 23:56:35



System-Monitoring - example Grafana -





Features:

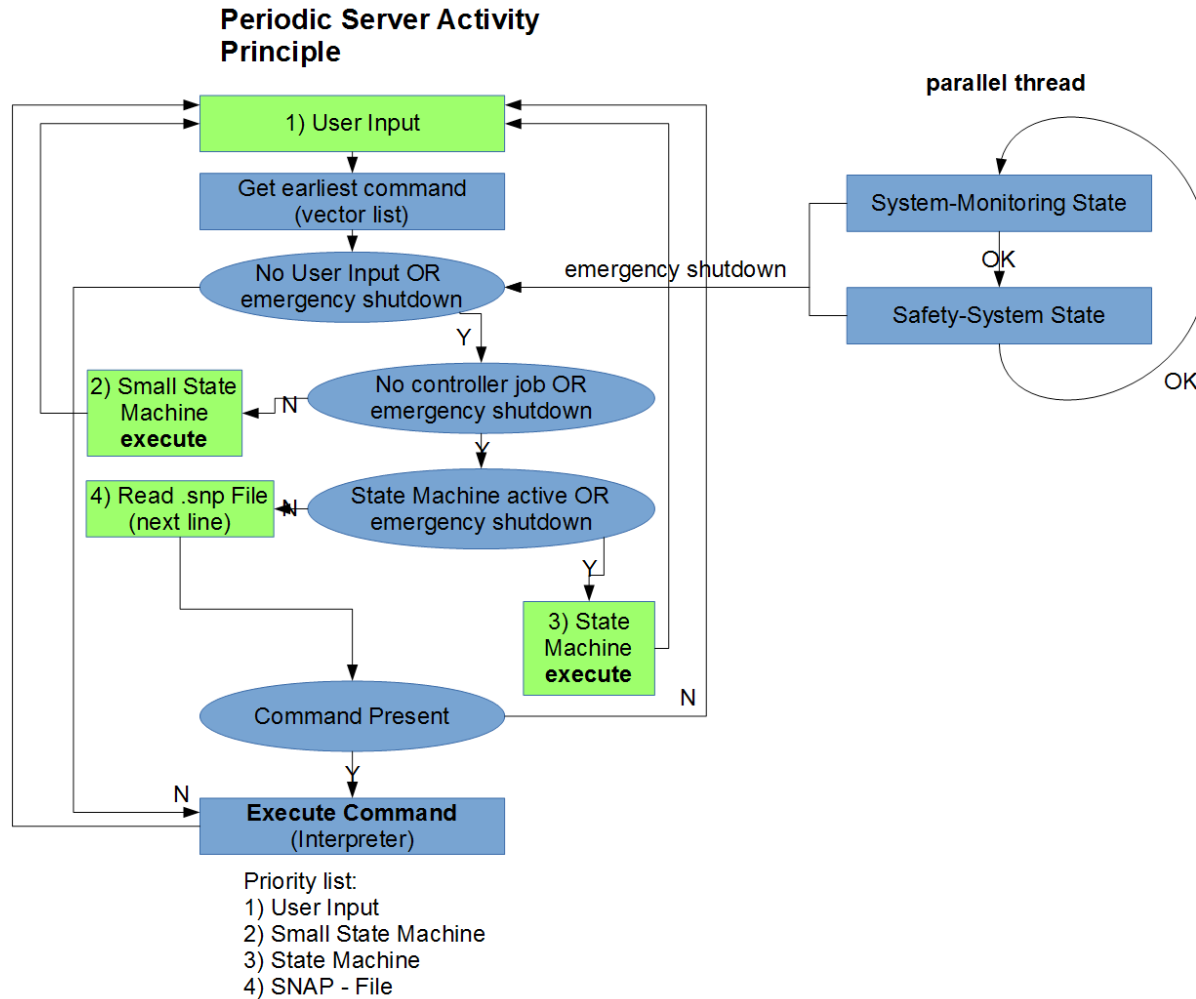
- Central configuration file distributed to each device
- System control based on SNAP commands (VLBI)
- Mission dependent SNAP-files possible
- State Machine for optimization during observation (pending)

CALIBRATION

1. **EUROLAS**=usSet?=CAL
2. **SLRET**=usSetCalibration=... #PPS & channeloffset
3. **SLRET**=usStartMeasurement
4. **TRU_OWIS**=usSet??? #divergence, fov, aperture, nd wheels
5. **TRU_OWIS**=usMove2Reference
6. **CONTROLLER**=usSetAzEl=... #moves telescope & waits until coordinates reached
7. **CONTROLLER**=usSetAzEl=... #moves telescope once more (if required)
8. **CONTROLLER**=usCheckCalFinished #reads SLRET usisvalid until != 0
9. **CONTROLLER**=usCheckTRU_OWIS #reads TRU_OWIS parameters until position reached
10. **SLRET**=usSetCalibration=... #set calparameters
11. **SLRET**=usSetLaserDelay=100000
12. **SLRET**=usStartMeasurement
13. **CONTROLLER**=usAdjustSignalLevel=%RR #moves TRU_OWIS until signal level is proper
14. **CONTROLLER**=usCheckCalFinished
15. **SLRET**=usSetLaserDelay=0
16. **CONTROLLER**=usSetAzEl=... #move the telescope, if required
17. **SLRET**=usSendCal2DB
18. **Scheduler**=usGetJob



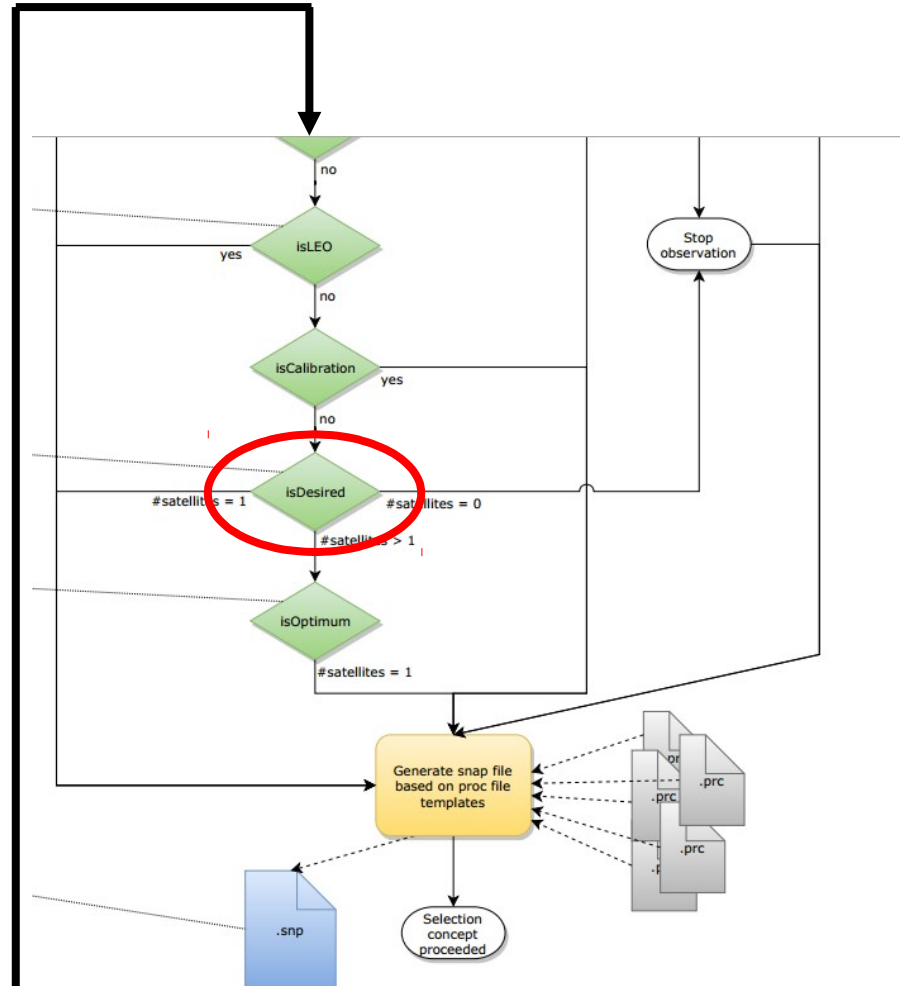
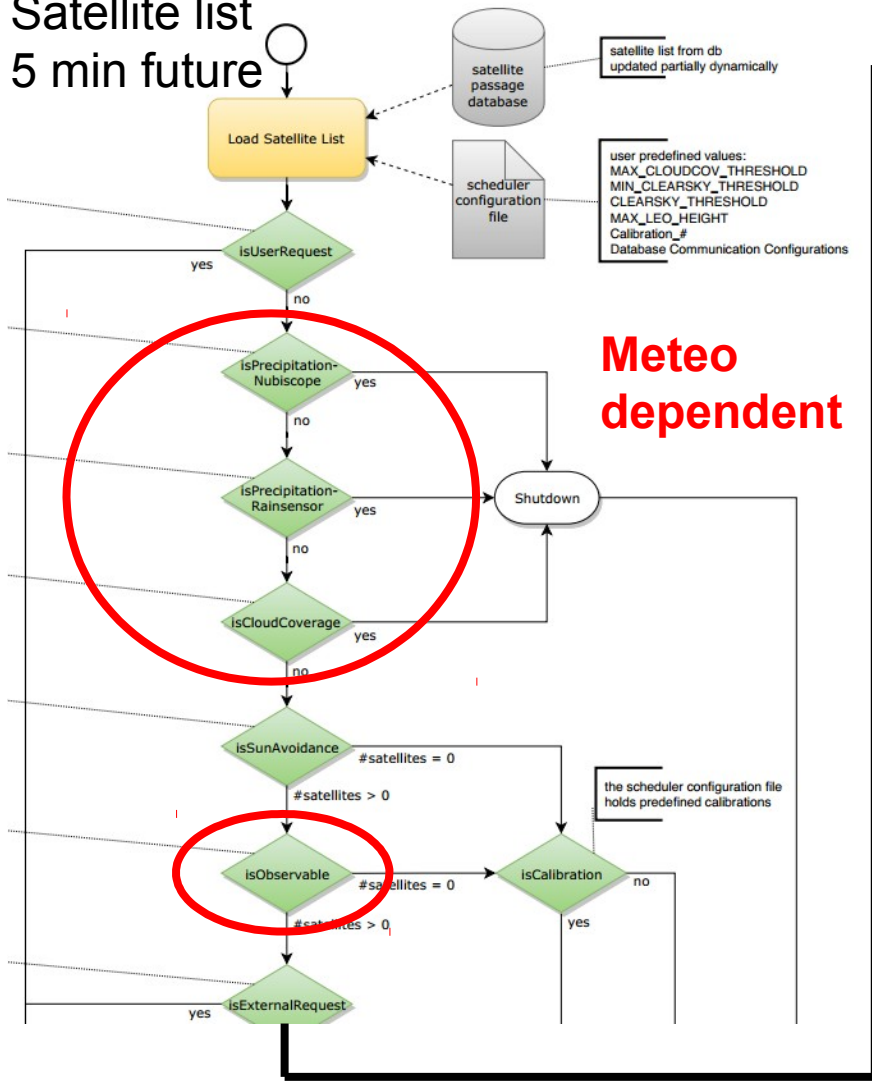
Scheduling & Control - Controller main loop -





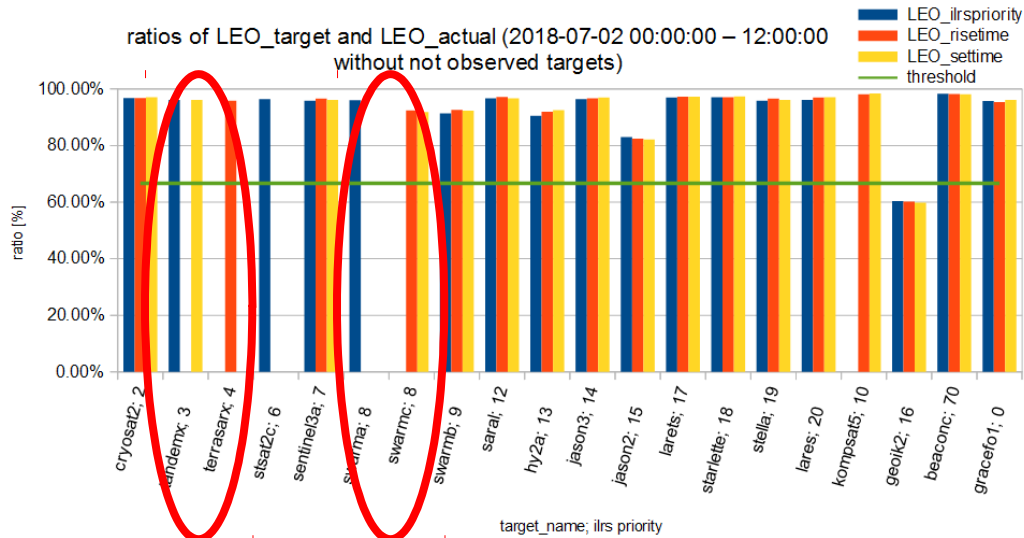
Scheduling & Control - Scheduler selection plan -

Satellite list
5 min future

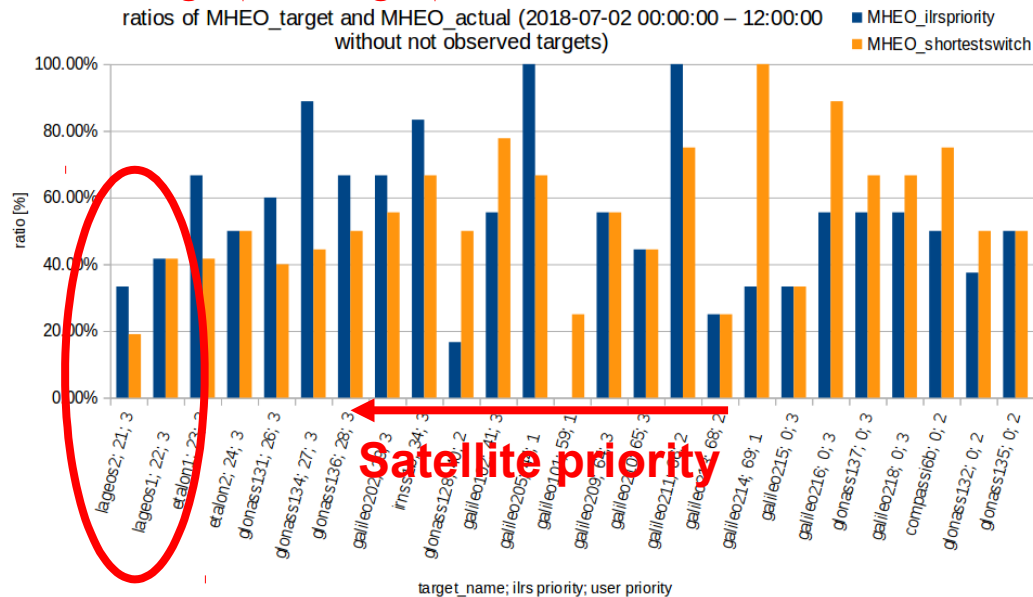




LEO:
No inter-
leaving



HEO:
Short
visibility

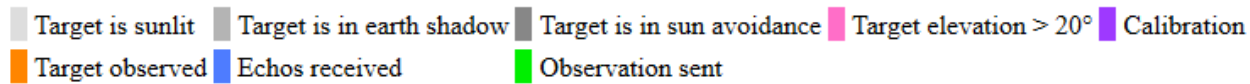


Satellite priority

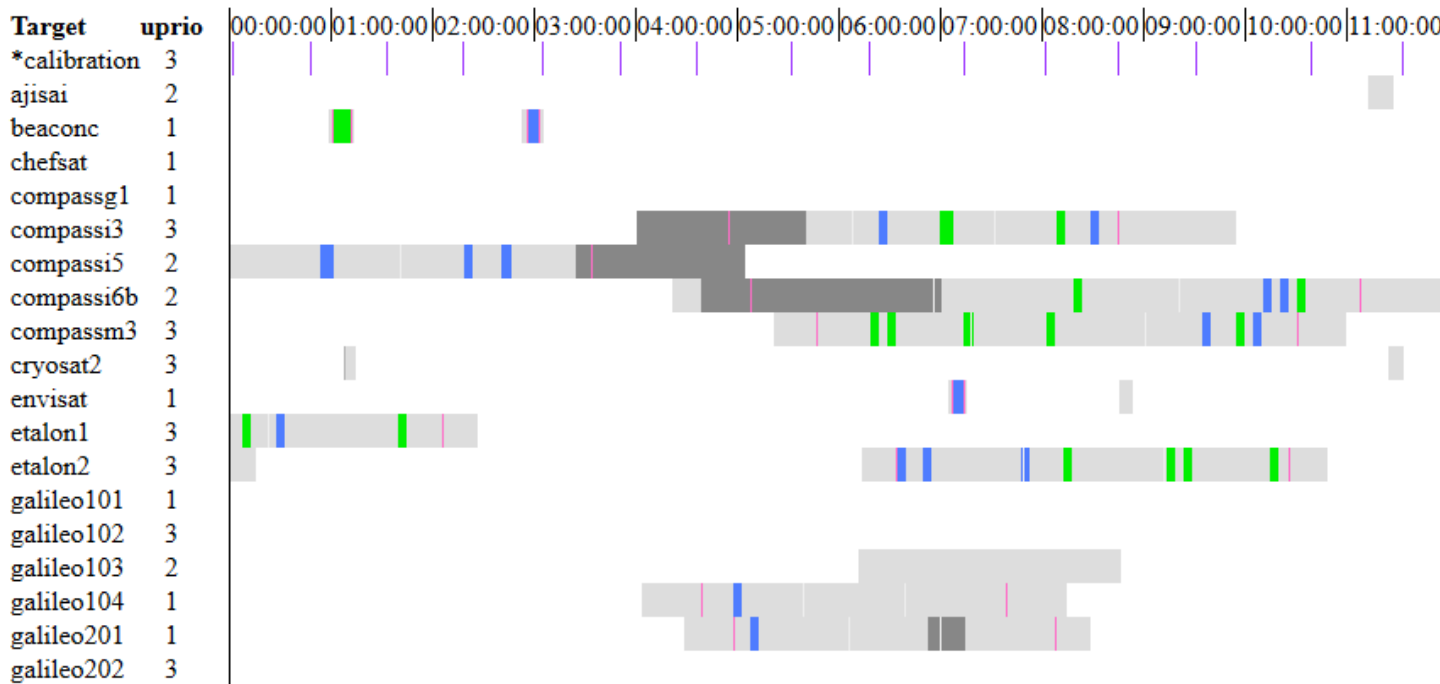


■ Scheduler & Controller in simulation-mode

Colour code:

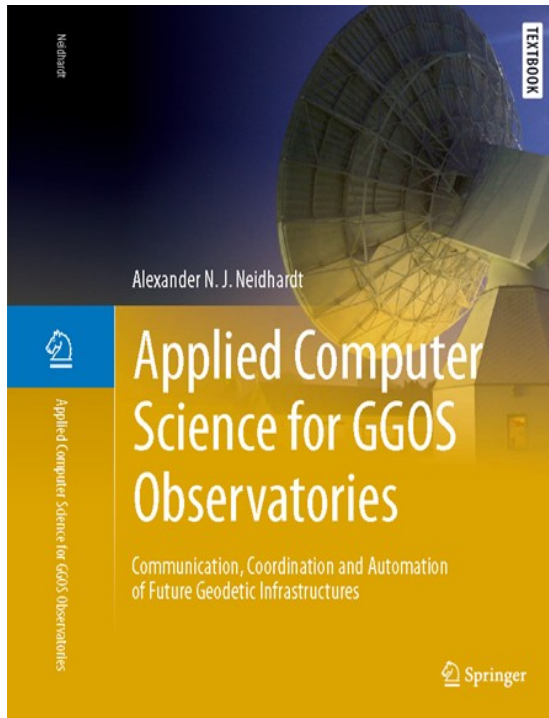


Satellite Table (2018-07-04 00:00:00 - 2018-07-04 12:00:00) (autonomous scheduling)



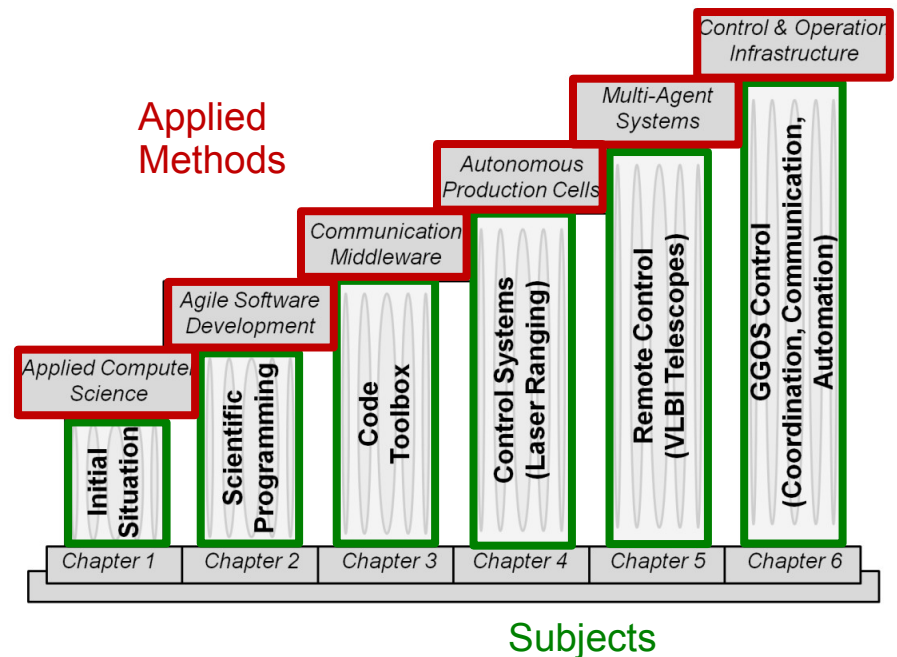


- System automation of WLRs is in advanced state
- System integration tests planned in early 2019
- Autonomous operation still challenging
- Major system upgrade planned for mid 2019 to gain CE conformity and to improve safety-standard and documentation



Type: eBook, Hardcover
Series: Springer Textbooks in Earth Sciences, Geography and Environment
Hardcover: 546 pages
Publisher: Springer; 1st ed. 2017 edition (August 29., 2017)
Language: English
ISBN-10: 3319401378
ISBN-13: 978-3319401379
<http://www.springer.com/us/book/9783319401379>

This book combines elementary theory from computer science with real-world challenges in global geodetic observation, based on examples from the Geodetic Observatory Wettzell, Germany. It is a guide for students, staff and development engineers.



2018, Oct. 31st

DOWNLOADS

5.24K

CITATIONS

1

Compared to Plag/Pearlman "Global Geodetic Observing System" (2009)

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8.58K

CITATIONS

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