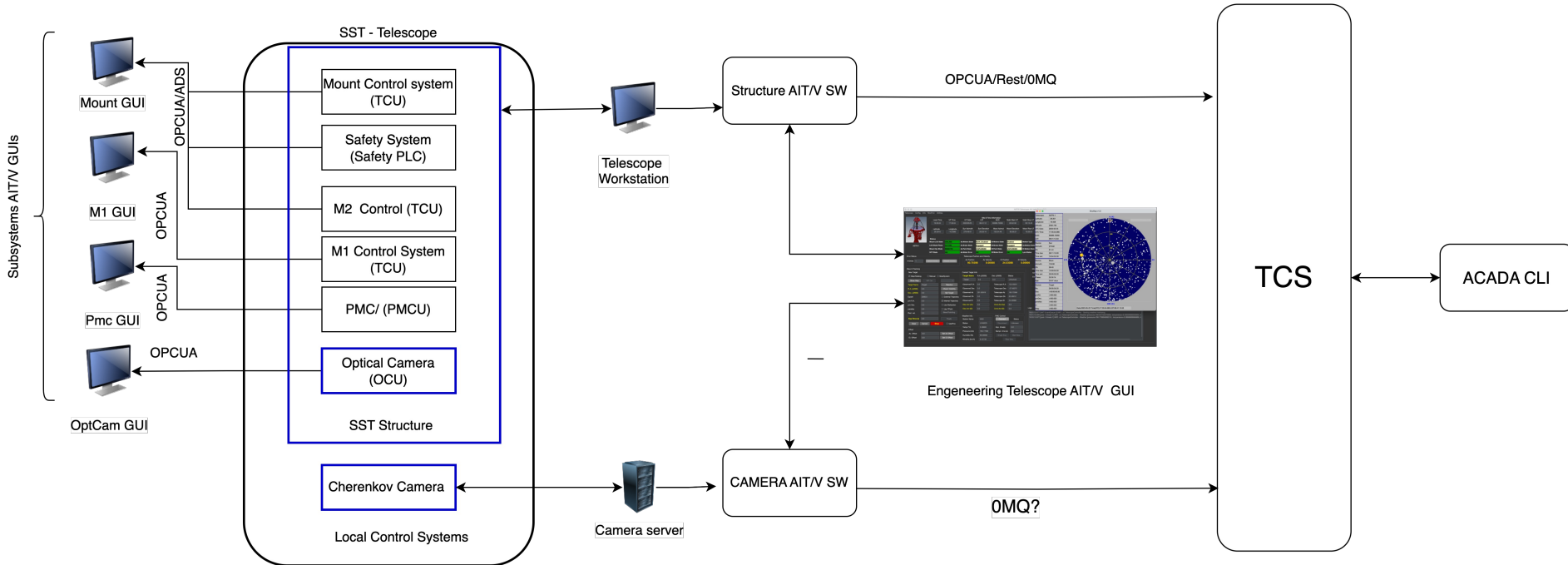


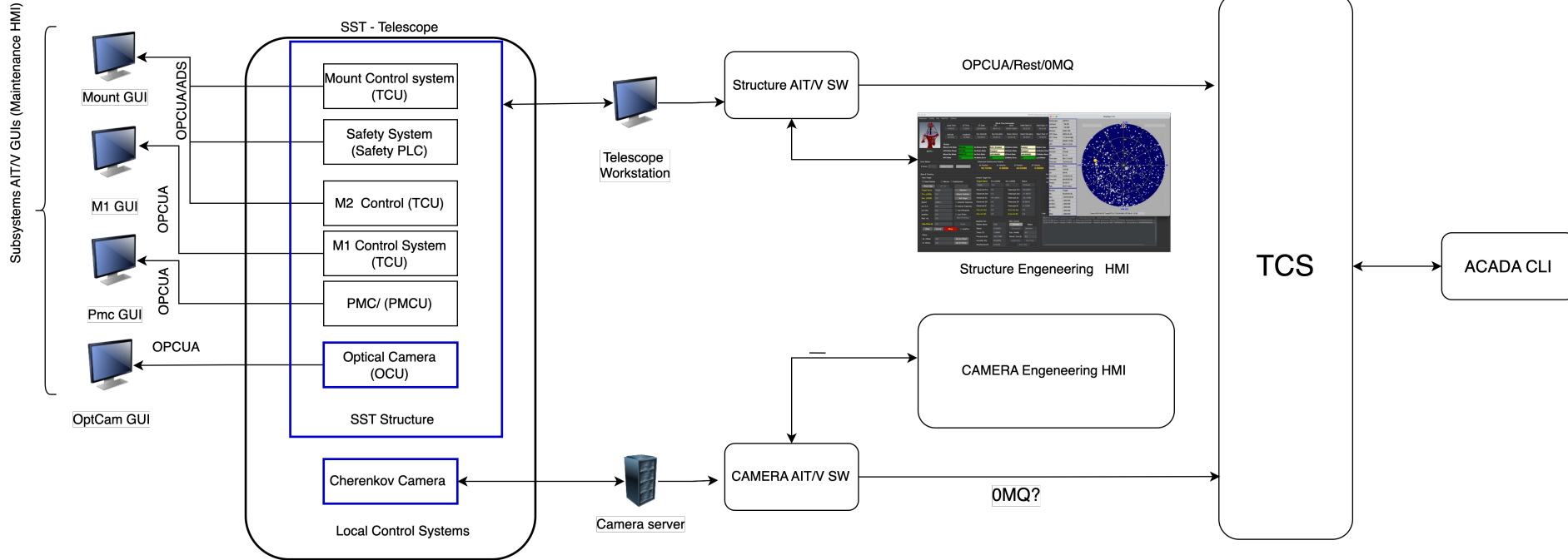
Structure Acceptance Tests and Support Sw.

G. Tosti 20/02/2024

SST: SST SW AIT/V Architecture version 1



SST: SST SW AIT/V Architecture version 2



Some Structure Technical UCs

CODE	DESCRIPTION	ACCESS MODE	PROTOCOL	
UC-SST-TECH-1	Telescope Structure Pointing Model includes: selection of the reference pointing grid, collection of the offsets based on the astrometry of images obtained with the Pointing monitoring Camera and the cherenkov Telescope Control Unit configuration changes. This is done by expert users using the Beckhoff Twincat environment running the main Program managing all the Hw and Sw components of the Mount Local Control System. A deep knowledge of the HW and SW components is required. This UC is executed in maintenance mode.	Remote	HMI - Telescope: OPCUA Remote user can run on any PC to run the HMI	
UC-SST-TECH-2	Telescope Structure TCU Local control software restart. This procedure is activate as extreme attempts to recover unpredictable crash of the PLC Local control software	Remote	HMI - Telescope: OPCUA Remote user can run on any PC to run the HMI	C
UC-SST-TECH-3	Telescope Structure TCU PC shutdown. This procedure is activate before to switch off the Telescope Power.	Remote	HMI - Telescope: OPCUA Remote user can run on any PC to run the HMI	
UC-SST-TECH-4	Telescope Axes control loop tuning. This is done by expert users using the Beckhoff Twincat environment running the main Program managing all the Hw and Sw components of the Mount Local Control System. A deep knowledge of the HW and SW components is required. This UC is executed in maintenance mode.	Remote	Connection to the Telescope PC-PLC via Remote Desktop/AnyDesk/TeamViewer	C
UC-SST-TECH-5				


Some Structure Technical UCs

CODE	DESCRIPTION	ACCESS MODE	PROTOCOL
UC-SST-TECH-6	System Tests. Includes (partial list): Azimuth and Elevation axes speed and acceleration limits test Azimuth and Elevation Motion Modes (Absolute, Jog) test Azimuth and Elevation Parking procedure test Azimuth and Elevation State changes test Azimuth and Elevation Stow-Pin insertion/extraction test Azimuth and Elevation I/O states test Azimuth and Elevation Accelerometers acquisition test M2 positioning test Power consumption Test Internal device Power on/off test Interlocks chain test Motion limit switches Test Encoder only Tracking error test Encoder only Pointing error test	Remote	HMI - Telescope: OPCUA Remote user can run on any PC to run the HMI
UC-SST-TECH-7	M1 actuator system test. These are executed after the M1 Actuator and control box are mounted on the telescope and before to proceed to the M1 alignment.	Remote	HMI - Telescope: OPCUA Remote user can run on any PC to run the HMI
UC-SST-TECH-8	Optical Camera system Test. M1 actuator system test. These are executed after the Optical Camera is mounted on the telescope and before to proceed to the M1 alignment.	Remote	HMI - Telescope: OPCUA Remote user can run on any PC to run the HMI
UC-SST-TECH-9	M1 Alignment procedure. This is activated after detection of a degradation of the optical performance of the telescope and after dismounting of the Cherenkov camera and mounting of the Optical camera and M1 Actuator system.	Remote	HMI - Telescope: OPCUA Remote user can run on any PC to run the HMI
UC-SST-TECH-10	Pointing Monitor camera system test.	Remote	HMI - Telescope: OPCUA Remote user can run on any PC to run the HMI

SST: ASTRI Mini Array Structure Engineering HMI

ASTRI Telescope AIV Interface v.0.2

Telescope Config Info MscPLC Mirrors Control Utilities Msc Plots PMC



ASTRI1

Local Time 00:44:09 UT Time 23:44:09 UT Date 2024/02/19 Site & Time Information LST 08:35:47 MJD 60359.98899 Night Start UT 19:50:34 Night Stop UT 06:49:33 Time to Twilight 07:05:24

Latitude 28.3010 Longitude -16.5080 Sun Azimuth 302:36:11 Sun Elevation -61:49:36 Moon Azimuth 276:00:19 Moon Elevation 65:54:14 Moon Rise UT 14:29:04 Moon Set UT 04:20:45

Status

Mount LCS State	LOADED	Az Motors State	Disabled	EI Motors State	Disabled	Motion Type	ABSOLUTE
LCS State Phase	ACTIVE	Az Brake State	Engaged	EI Brake State	Engaged	Az Motion State	Stopped
Mount Op. Mode	REMOTE	Az Park State	UNPARKED	EI Park State	UNPARKED	EI Motion State	Stopped
NTP State	OK	Az Motor Error	E-OK - R:OK	EI Motor Error	OK	Lyra Status	On
Az Enc Status	INITIALIZED	Az STO Status	OK	EI STO Status	OK	Gate Status	OK

MCS LCS State Machine

LOADED

STANDBY

ONLINE

MAINTENANCE

Stop State Transition

Refresh

Telescope Subdevices Power Mgt.

PMC ☐ On ☒ Off Status Off

PMCTh ☐ On ☒ Off Status Off

SQM ☐ On ☒ Off Status Off

CheCamera ☐ On ☒ Off Status Off

CheCamTh ☐ On ☒ Off Status Off

SI3 ☐ On ☒ Off Status Off

UVSIPM ☐ On ☒ Off Status Off

M2 ☐ On ☒ Off Status Off

Driver400V ☐ On ☒ Off Status Off

Error Status

Errors 1 Show Errors Reset Errors

Telescope Position and Velocity

Az Position	Az MotEnc Pos	Az Velocity	EI Position	EI Velocity
-86.00000	0.00000	0.00000	1.50000	0.00000

Commands Status

Cmd Name	Execution Status	Time to End
	IDLE	0

Stow-Pins Status

☒ Use Stow-Pins when Parked

Az Stow-Pin ☒ El Stow-Pin ☒

ENGAGED ENGAGED

Slew & Tracking

New Target

☒ Map/Catalog ☐ Manual ☐ SolarSystem

Show Map HIP Cat

Target Name Target Resolve

R.A. (J2000) 0.0 Check Visibility

Dec. (J2000) 0.0 Set Target

Epoch 2000.0 External Trajectory

pm R.A. 0.0 Internal Trajectory

pm Dec. 0.0 Use Refraction

parallax 0.0 Use TPoint

Rad. vel. 0.0 Slew/Pointing

Exp.Time (s) 0.0 Track

Clear Cancel UsePmc

Offset

Az. Offset 0.0 Set Az Offset

EI. Offset 0.0 Set EI Offset

Current Target Info

Target Name	R.A. (J2000)	Dec (J2000)	Status
Target	0.0	0.0	Unlocked
Observed R.A.	0.0	Telescope R.A.	300.13961
Observed Dec	0.0	Telescope Dec	62.92780
Observed Az	0.0	Telescope Az	4.00000
Observed ZA	0.0	Telescope ZA	88.50000
Observed EI	0.0	Telescope EI	1.50000
Obs-Act (Az)	0.0	Cmd-Act (Az)	0.0
Obs-Act (EI)	0.0	Cmd-Act (EI)	0.0

Weather Info

Station Name WS#

Status Unknown

Temp (°C) 0.0

Pressure (mb) 0.0

Humidity (%) 0.0

WindVel.(km/h) 0.0

PMC Control

Connect Status

Disconnect Unknown

Exp. time(s) 0.0

Sampl. time (s) 0.0

Single Exp. Start Seq.

Stop Seq.

Move Point-to-Point

Azimuth (deg) 0.0 Move Az Stop Az

Elevation (deg) 0.0 Move EI Stop EI

Slew Stop

Log

2024-02-20 00:43:35 INFO a.t.TelescopeController - Starting Position Monitor

2024-02-20 00:43:37 INFO a.t.TelescopeController - Adding subscription to:AZ_STOWPIN_STATUS

2024-02-20 00:43:38 INFO a.t.TelescopeController - Adding subscription to:EI_STOWPIN_STATUS

2024-02-20 00:43:38 INFO a.t.g.m.MainMotionPanel - Status Panel monitor started

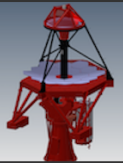
Jogging Motion

Az Velocity 0.0 El Velocity 0.0

North (UP)

West(CCW) Stop East(CW)

South (D)



ASTRI1

Local Time 00:49:47

UT Time 23:49:47

UT Date 2024/02/19

Latitude 28.3010

Longitude -16.5080

Sun Azimuth 304:34:57

Sun Elevation -62:51:31

Moon Azimuth 278:21:20

Moon Elevation 64:41:52

Moon Rise UT 14:29:04

Moon Set UT 04:20:45

Site & Time Information

LST 08:41:27

MJD 60359.99292

Night Start UT 19:50:34

Night Stop UT 06:49:33

Time to Twil 06:59:45

Status

Mount LCS State **ONLINE**

LCS State Phase **ACTIVE**

Mount Op. Mode **REMOTE**

NTP State **OK**

Az Enc Status **INITIALIZED**

Az Motors State

Az Brake State

Az Park State

Az Motor Error

Az STO Status

Both_Enabled

El Motors State

Enabled

Motion Type

ABSOLUTE

Engaged

El Brake State

Engaged

Az Motion State

Stopped

UNPARKED

El Motion State

Stopped

Un

Telescope: ASTRI1

Latitude: 28.301

Longitude: -16.508

Altitude: 2362.730

UTC Date: 2024-02-19

UTC Time: 23:49:48.158

MJD: 60359.99291

LST: 08:41:28.01

Source: Sun

Azimuth: 304.56

28.85

7:40: 5.00

3:59: 7.00

moon

76.35

5.29

4:29: 4.00

4:20:45.00

1.71 %

0.65 days

target

0:00:00.00

00:00:00.00

000.000

000.000

000.000

000.000

000.000

000.000

Date:2024-02-19 Time(UTC):23:49:48.158 LST:08:41:28.01

AmcAivGui v.0.1

Connect

M1 Status LOADED

M1 StatusPhase ACTIVE

Disconnect

M2 Status LOADED

M2 StatusPhase ACTIVE

Mirrors control

M1 M2

M1 Command & Monitor Panel

Motion Control

Mirror Seg. id M1SEG1

Piston (mm) 0.0

Tilt X (arcsec) 0.0

Tilt Y (arcsec) 0.0

Home

Move

Stop

State Machine

Go Loaded

Go Standby

Go Online

Go Maint.

Abort Cmd

Reset

Error Status

Errors

0

Slew & Tracking

New Target

☒ Map/Catalog ☐ Manual ☐ SolarSystem

Show Map

HIP Cat

Target Name

Target

Resolve

R.A. (J2000) 0.0

Check Visibility

Dec. (J2000) 0.0

Set Target

Epoch 2000.0

External Trajectory

pm R.A. 0.0

Internal Trajectory

pm Dec. 0.0

Use Refraction

parallax 0.0

Use TPoint

Rad. vel. 0.0

Slew/Pointing

Exp.Time (s) 0.0

Stop

Track

Update Trajectory

Clear

Cancel

UsePmc

Offset

Az. Offset 0.0

Set Az Offset

El. Offset 0.0

Set El Offset

Current Target Info

Target Name

Target

Observed R.A.

Observed Dec

Observed Az

Observed ZA

Observed El

Obs-Act (Az)

Obs-Act (El)

Weather Info

Station Name

Status

Temp (°C)

Pressure (mb)

Humidity (%)

WindVel (km/h) 0.0

Stop Seq.

SkyMap v1.0

Az:274.73 ZA:087.30

RA:040.01 Dec:005.38

0 (N)

60

30

180 (S)

270

TelescopeController - Current Mount State:LOADED

TelescopeController - Command GoStandby - started at: Mon Jan 01 01:00:00 CET 1601

TelescopeController - The Mount LCS state STANDBY

TelescopeController - Command GoStandby - completed at: Tue Feb 20 00:47:58 CET 2024

TelescopeController - Current Mount State:STANDBY

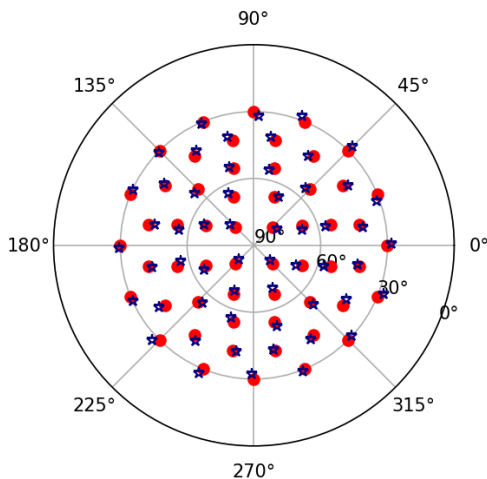
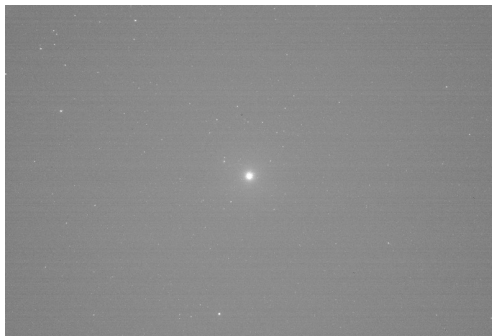
TelescopeController - Command GoOnline - started at: Mon Jan 01 01:00:00 CET 1601

TelescopeController - The Mount LCS state ONLINE

TelescopeController - Command GoOnline - completed at: Tue Feb 20 00:48:07 CET 2024

SST: Pointing Model and tracking verification tools

The **Pointing Monitoring Camera** (PMC) is an auxiliary optical camera equipped with the software for real-time astrometry analysis.

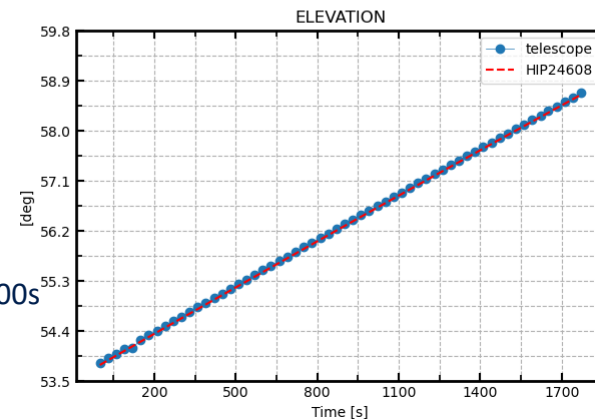
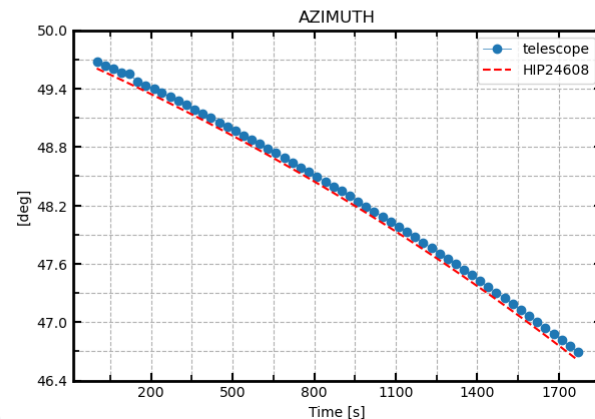


Result: the RMS pointing error projected on sky is 28''.

The **Pointing Model** is a 14-parameter function providing the pointing correction to the telescope for every sky position (Alt, Az).

Tracking:

- the tracking accuracy is $\sim 0.6'$ over 1800s
- the precision is $\sim 4.6'$ over 1800s
- the offset is constant (no drift)



SST: ASTRI Mini Array Optical System AIT/V

