

A bit closer to the stars:  
LINC-NIRVANA on its way to First Light

AstroTechTalk 28.04.2017

Thomas Bertram



1. Installation
2. Comissioning
3. Working at the LBT

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Previously...



Aug. 2015





Oct. 2015

# Installation Plan

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I2	Receipt & Bench Installation dry run	Nov. 15
I3	GWS Alignment / Computing Environment	Jan. 16
I4	Bench & Cryostat Integration	Feb. 16
I5	Warm Optics SX Alignment	Mar. 16
I6	HWS Sensor SX Alignment & loop SX	Apr. 16
I7	Warm Optics DX Alignment	May 16
I8	HWS Sensor DX Alignment & loop DX	May 16
I9	Annular Mirror Alignment	Jun. 16
I10	Cryostat + Instrument Verification	Jun. 16
I11	Installation at Instrument Platform	Jul. 16

# Installation Plan

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<del>I7</del>	<del>Warm Optics DX Alignment</del>	<del>May 16</del>
I8	HWS Sensor DX Alignment & loop DX	May 16
I9	Annular Mirror Alignment	May 16
I10	Cryostat + Instrument Verification	Jun. 16
I11	Installation at Instrument Platform	Sept. 16

# Team planning

	I1	I2	I3	I4	I5	I6	I7	I9	I8	I10	I11	
Arrival @ LBT	11. Jun. 15	08. Nov. 15	12. Jan. 16	23. Feb. 16	01. Mar. 16	12. Apr. 16	obsolete	04. May 16	26. May 16	10. Jun. 16	15. Sept. 16	
Start	11. Jun. 15	09. Nov. 15	12. Jan. 16	23. Feb. 16	01. Mar. 16	12. Apr. 16		04. May 16	26. May. 16	10. Jun. 16	15. Sept. 16	
Departure LBT	17. Jun. 15	25. Nov. 15	28. Jan. 16	04. Mar. 16	16. Mar. 16	26. Apr. 16		11. May 16	09. Jun. 16	21. Jun. 16	29. Sept. 16	
Breaks included	0	2	2	1	2	2	2	0	2	1	2	
Nights @ LBT	6	17	18	10	15	14	14	7	14	11	14	
Team size	2	8	4+4	5	3	4	0	5	4	5	9	
MPIA												# Trips
Tobias Adler		✓		✓							✓	3
Harald Baumeister	✓	✓		✓							✓	4
Thomas Bertram		✓		✓	( ✓ )	✓				✓	✓	5
Jürgen Berwein						✓			✓			2
Peter Bizenberger				( ✓ )	✓					✓	✓	3
Florian Briegel	✓			✓	✓					✓	✓	4
Tom Herbst		✓	✓					✓	✓		✓	5
Ralph Hofferbert		✓										1
Frank Kittmann			✓					✓				2
Kalyan K. R. S.						✓			✓			2
Werner Laun				✓						✓	✓	3
Ulrich Mall										✓		1
Tobias Maurer		✓									✓	2
Lars Mohr		✓		✓								2
Javier Moreno-Ventas				( ✓ )	✓	✓						2
Ralf-Rainer Rohloff		✓									✓	2
INAF												# Trips
Carmelo Arcidiacono									✓			1
Marco Dima			✓									1
Maria Bergomi			✓					✓				2
Jacopo Farinato			✓									1
Luca Marafatto			✓					✓				2
Valentina Viotto			✓					✓				2

630 person-days



LINC  
The LB  
Near-Inf  
Interfer

A collaborati  
Universität z  
http://www.

Doc. N  
Short  
Issue  
Date

Prepared

Approved

Released

LN-MPIA-TN-AIT-09

## 4 Cryostat

Friday, 16 Sept

Step

1

2

3

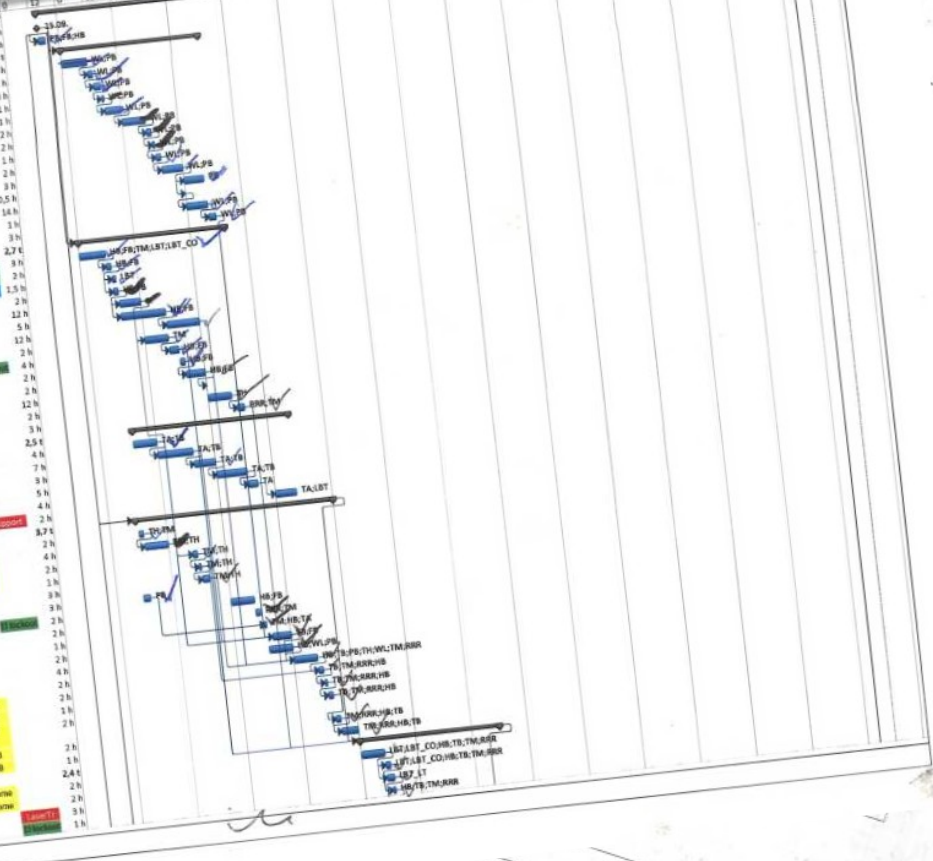
4

48  
54  
GWS rotator: cable chain all ins  
LN-MPIA-TN-AIT-058 - III P  
second try sheet 13:45  
peru

LN-MPIA-TN-AIT-058

## 8.2 Lifting onto the Instrument Platform

Step	Description	Time	Status
439	Installation at Instrument Platform	3.5 hr	
440	start of work	2.4 hr	
441	removal of tarpaulin	3 hr	
442	Cryostat leak test	2 hr	
443	setup for leak test	3 hr	
444	leak test	1 hr	
445	installation of the rails + cart	3 hr	
446	lowering of cryostat to reach top plate	3 hr	
447	leak test at top plate	2 hr	
448	removal of cryostat from bench	1 hr	
449	opening of the cryostat at leaving flange	3 hr	
450	inspection / cleaning / replacing o-ring	2 hr	
451	closing the cryostat	0.5 hr	
452	installation of cryostat on bench	14 hr	
453	adjustment of lateral support to the base frame	1 hr	
454	pump down	3 hr	
455	leak test (confirmation)	2.7 hr	
456	removal of cart and rails	4 hr	
457	Cover preparations	2 hr	
458	Dismounting of UAP + Cover	1.5 hr	
459	Dismounting of gallery cover parts	2 hr	
460	balancing of the telescope	12 hr	
461	modification of gallery cover parts	5 hr	
462	curing	12 hr	
463	installation of cover mount plates on GWS	2 hr	
464	curing	4 hr	
465	installation of shutter mechanisms	2 hr	
466	installation of cover parts at instrument gallery	2 hr	
467	inspection of main cover	12 hr	
468	fixing of the rubber seals	2 hr	
469	curing	3 hr	
470	installation and cabling of web cam	2.5 hr	
471	preparing UAP + Cover for sitting	4 hr	
472	Electronics	7 hr	
473	testing of shutter mechanisms	3 hr	
474	exchange and test of diodes	5 hr	
475	adjustment of temperature switch in B Cabinets	4 hr	
476	Test of CoCon SX	2 hr	
477	assemble connector for linking remote cable (L4)	8.7 hr	
478	connecting / testing power cables on telescope	2 hr	
479	Preparations prior to instrument installation	4 hr	
480	Cleaning of the Traverse access	2 hr	
481	weighing the traverse	3 hr	
482	installation of the empty traverse	3 hr	
483	Balancing of the empty traverse	3 hr	
484	Installation of 4x3 brackets for GWS mount	2 hr	
485	Covering of optics	2 hr	
486	prepare wooden floor plate for removal	1 hr	
487	inspect welded seams with brittle coating	2 hr	
488	Removal of the CoC bench access	4 hr	
489	Disconnecting the Bench	2 hr	
490	Clearing the way out of the lab	2 hr	
491	moving the bench to the high bay	1 hr	
492	Installation of the traverse	1 hr	
493	Installation of the instrument wheels	2 hr	
494	Removal of the instrument wheels	2 hr	
495	Installation of final Spacer Plates at Telescope interface	1 hr	
496	weighing instrument + traverse	2.4 hr	
497	Balancing the traverse to the full load	2 hr	
498	Installation on instrument Platform	2 hr	
499	Lifting IN to the rear of the telescope	3 hr	
500	Lifting onto the instrument platform	1 hr	
501	Laser Tracker Setup	1 hr	
502	Preparations for telescope IF adjustments	1 hr	



check mark

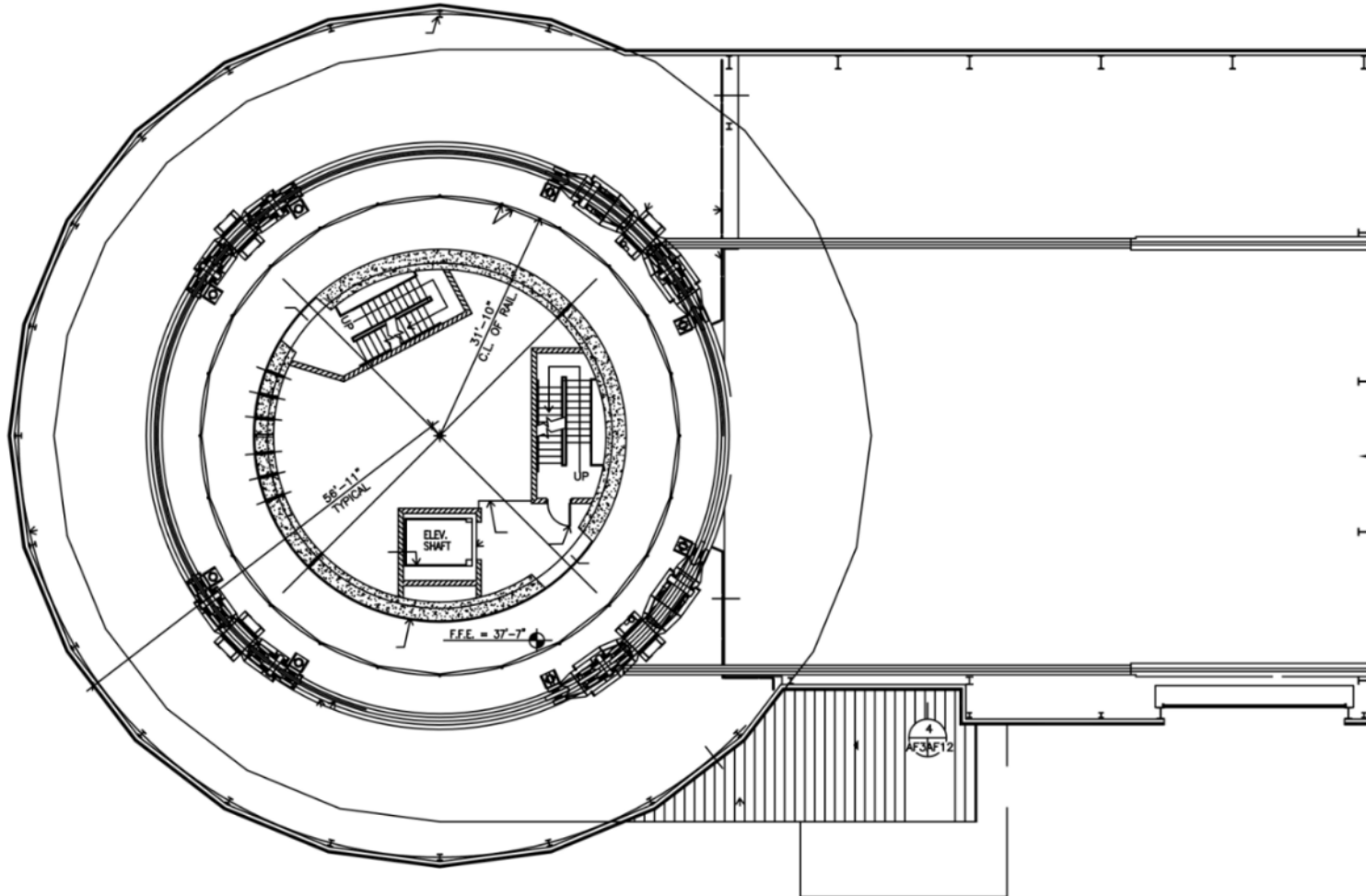
95

Fixing cables on the bench.

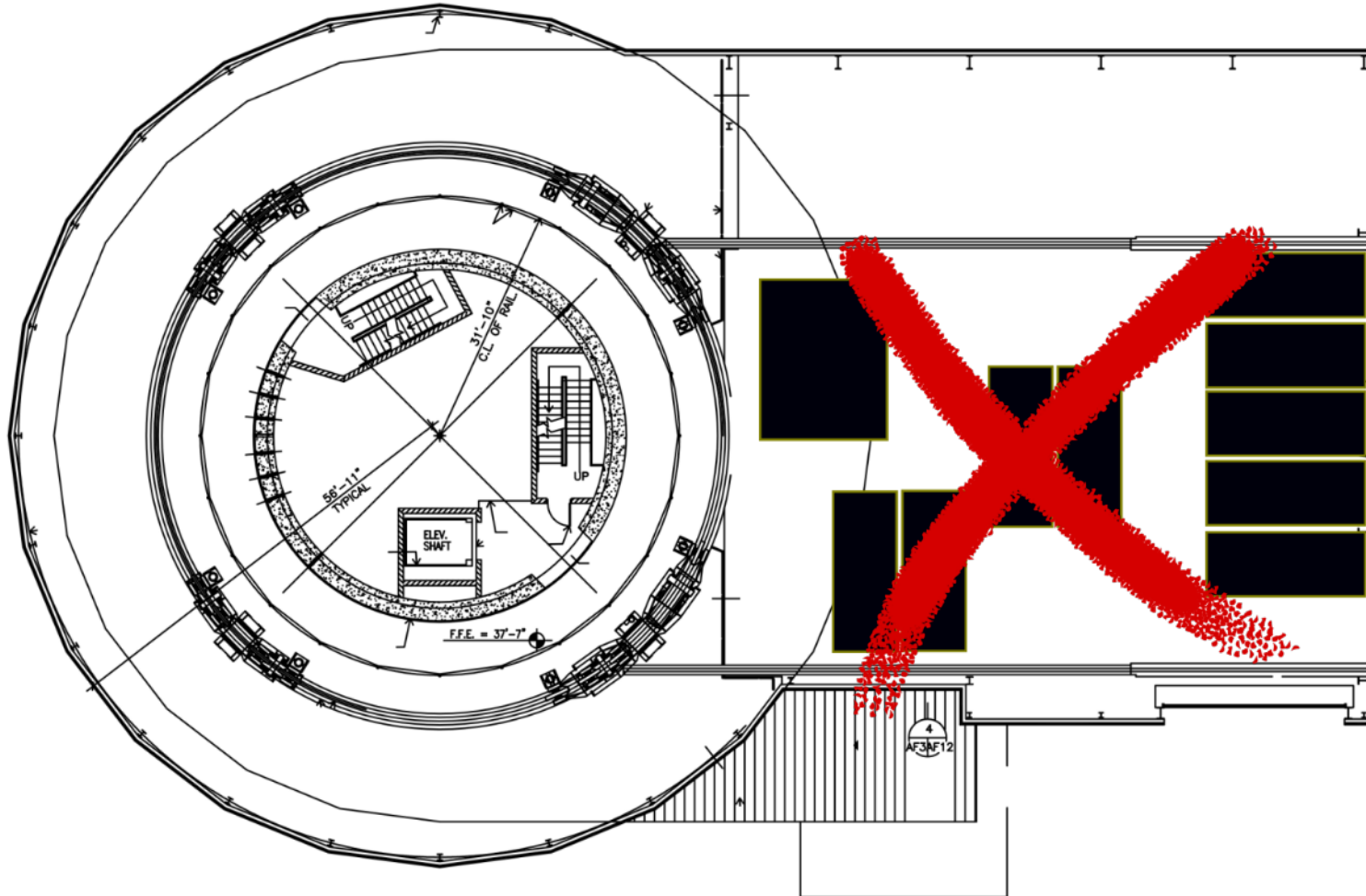
... mirror ... containers to the high bay ...  
... equipment units for the telescope ...  
... units for the telescope ...





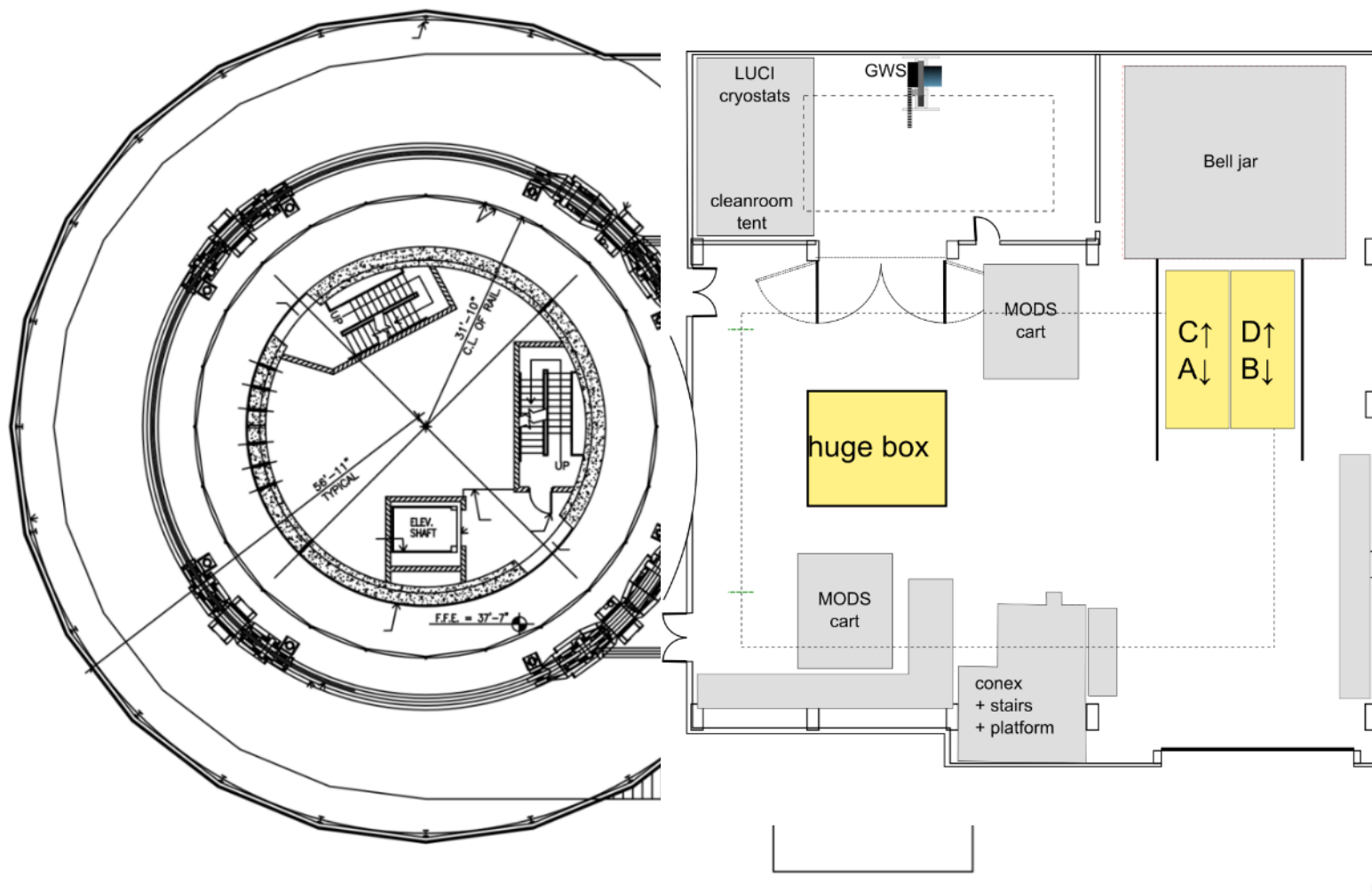






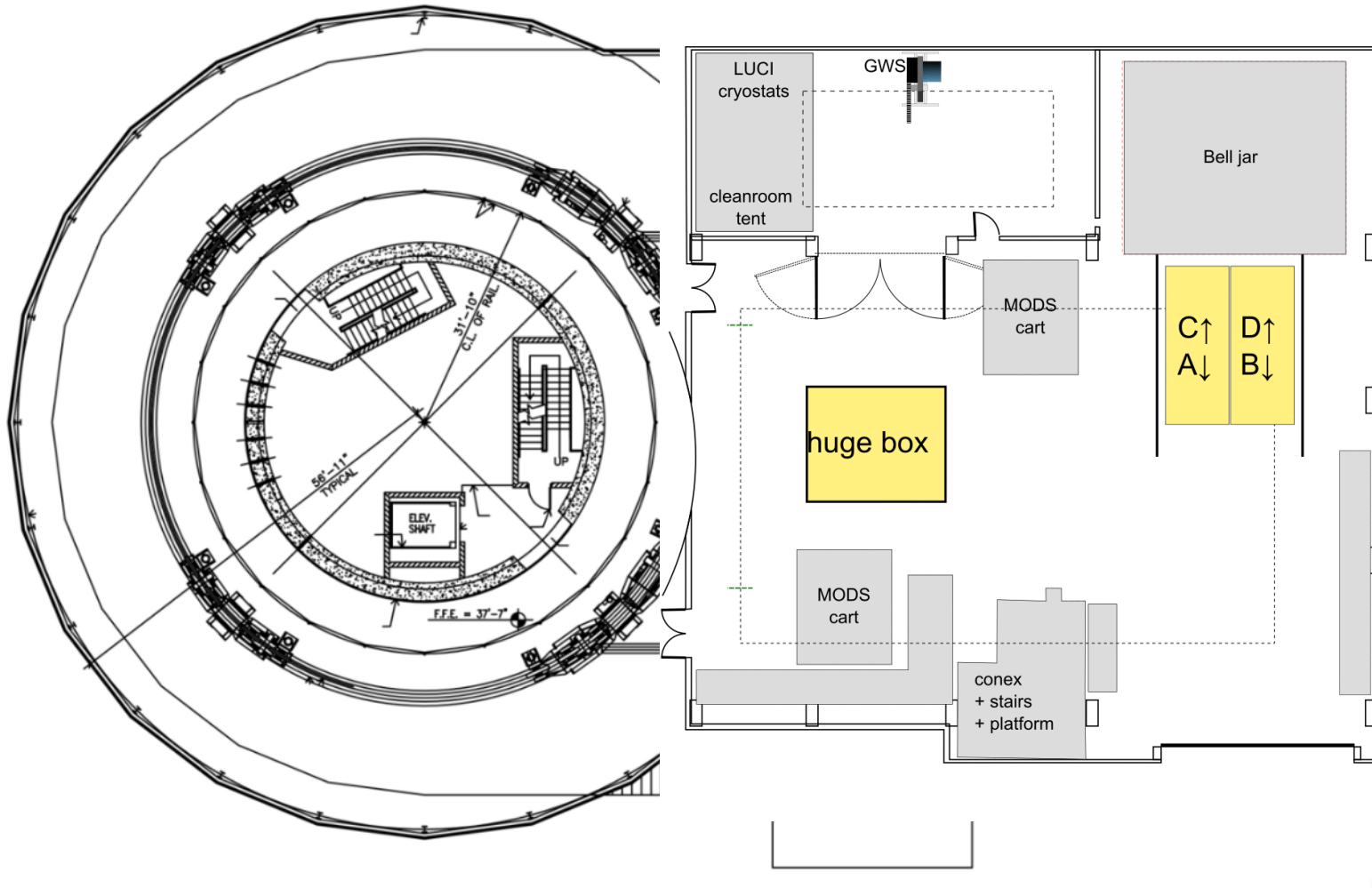
# Space

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# Space

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# Space

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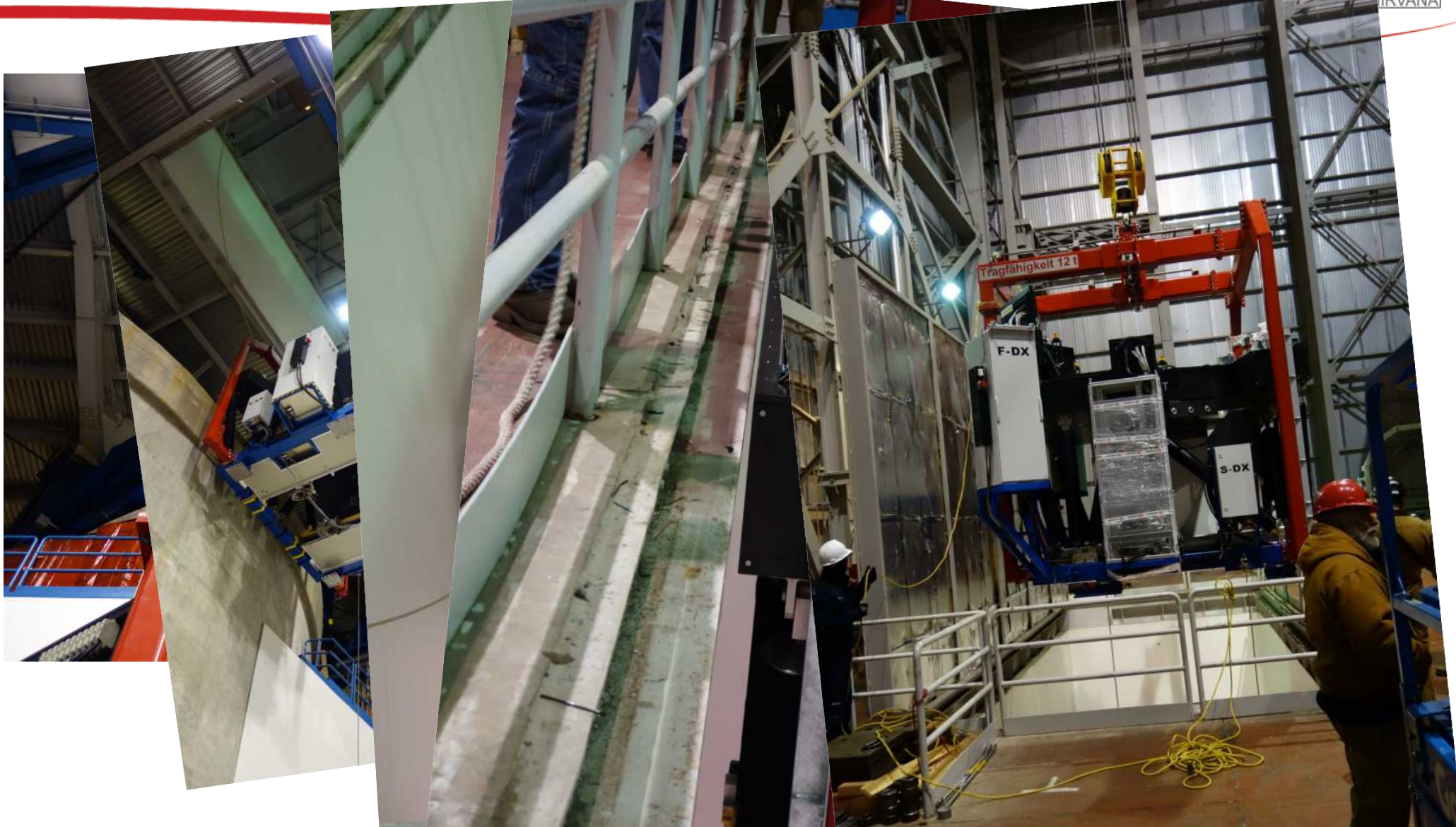


- Unboxing of the bench
- Installation of the Bench Traverse
- Container logistics
- Assembly of the Cover
- Fit-Check Test of Bench and Cover
- Laser Tracker Measurements
- Preparation of the Laboratory



# I2 – Unpacking and Installation Dry Run

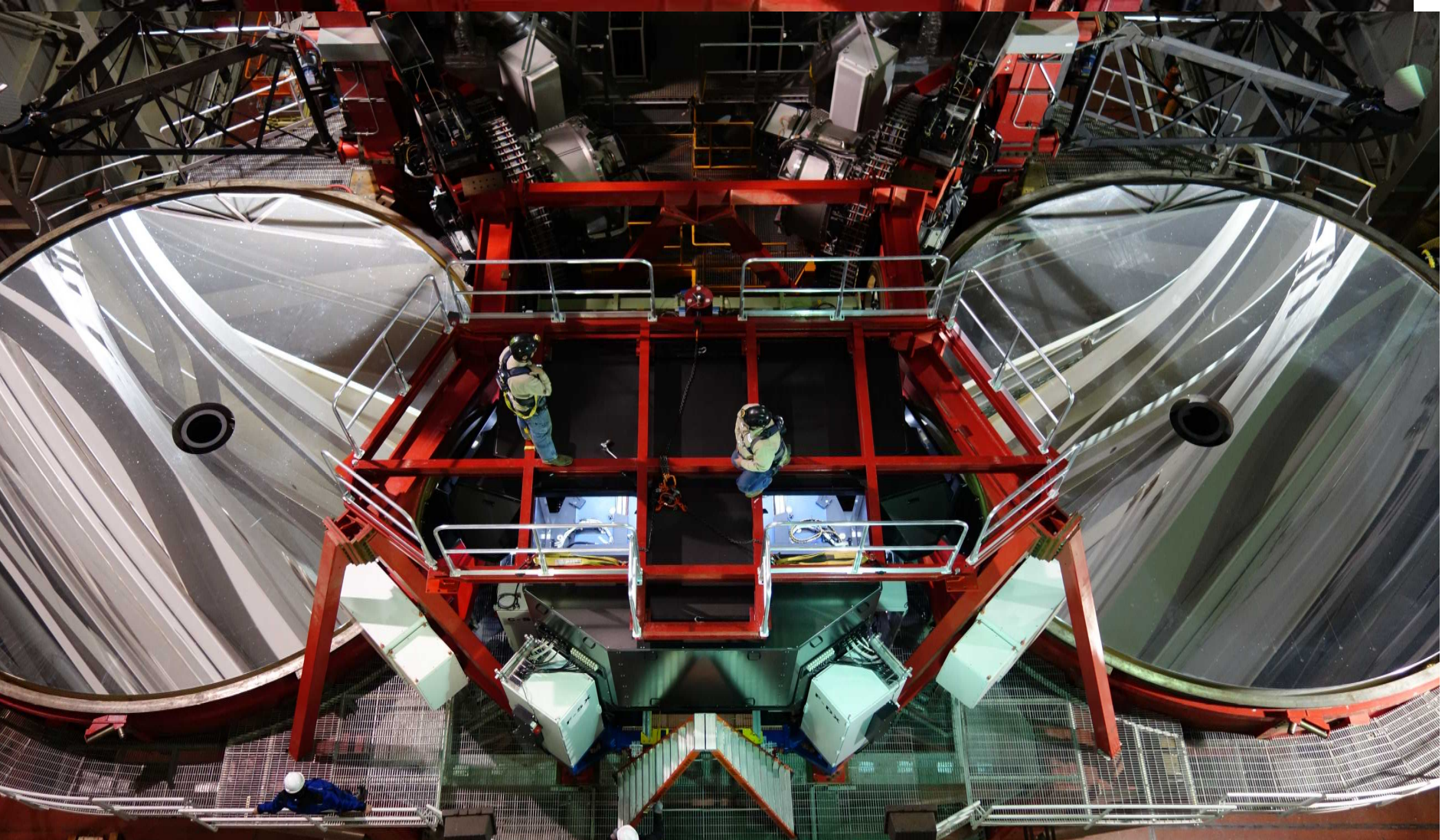
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# I2 – Unpacking and Installation Dry Run

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# I2 – Unpacking and Installation Dry Run

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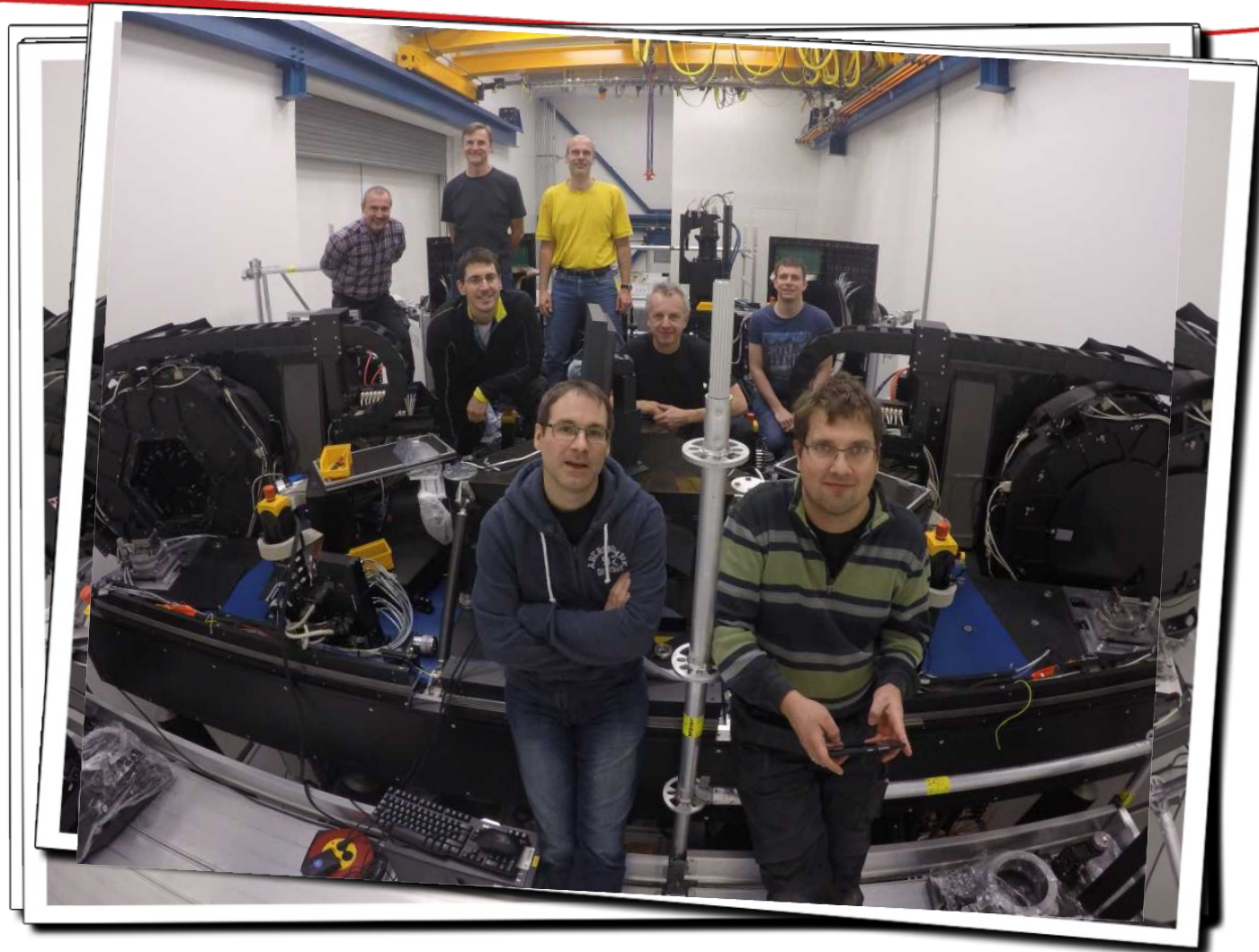


# I3 – GWS alignment / Computing Environment

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- Container logistics
- Stirling Cooler Test and Setup
- Installation of Groundlayer Wavefront Sensors
- Electronics
- Integration of the Cryostat
- Tests





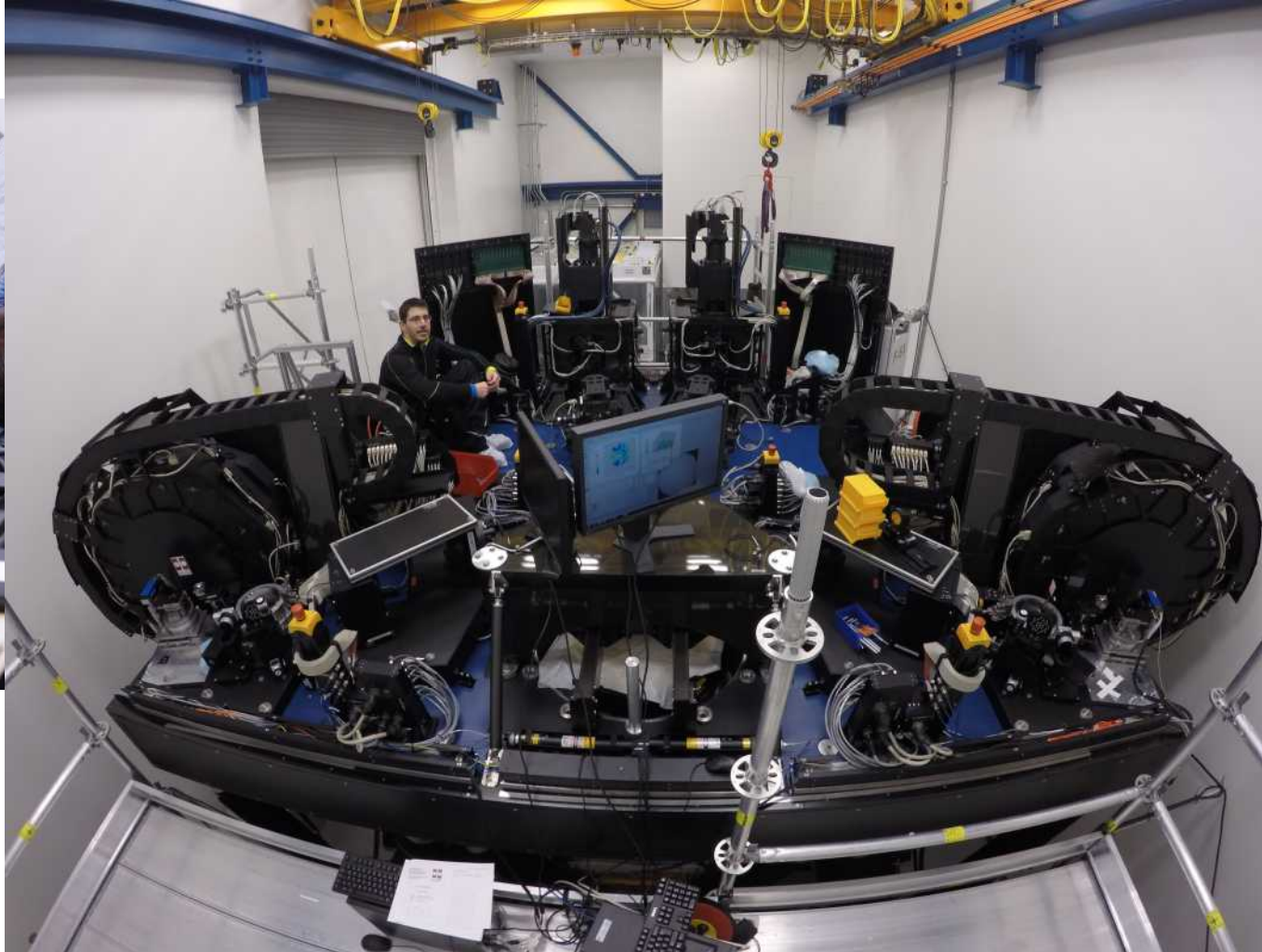
# I4 – Bench and Cryostat Integration

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# 15 – Optics Alignment

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For Help, press F1.



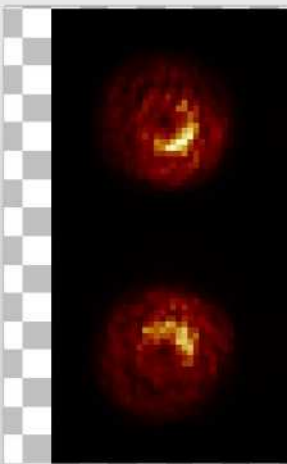
# I6+I8 – High Layer Wavefront Sensors

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CameraCtrl\_1 connection LC SVC SE

Camera View



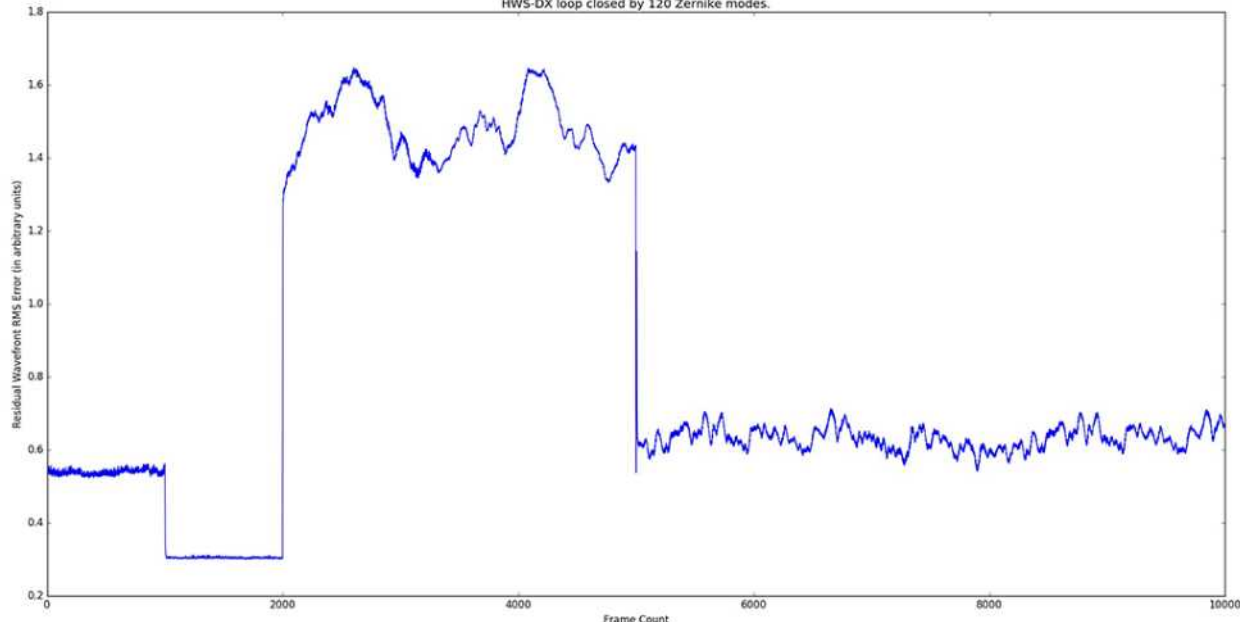
0.002 Set  
1 Set  
100 Set  
0.0000 0.0005  
Infinite Auto /tmp  
0 %

Camera State Select

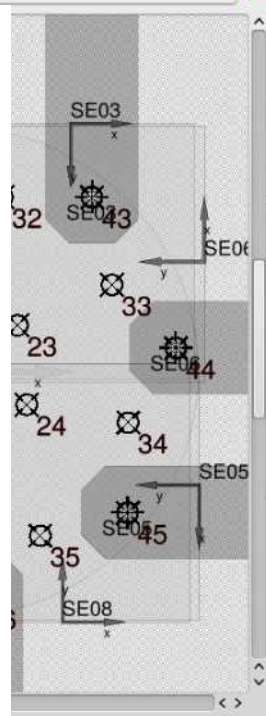
Switch On  
Switch Off

2016-04-24 00:16:02.331991932 INFO:SE07 [SE07 is already at the target position.]  
2016-04-24 00:16:02.357285054 INFO:SE08 [SE08 is already at the target position.]  
2016-04-24 00:16:04.090777416 INFO:SE [move to [SE01 = [-35055.3,27249.4], SE02 = [43625.4,4751.4], SE07 = [-27861.8,-34759.2], SE08 = [4533,-44271]] UM in coordin

HWS-DX loop closed by 120 Zernike modes.

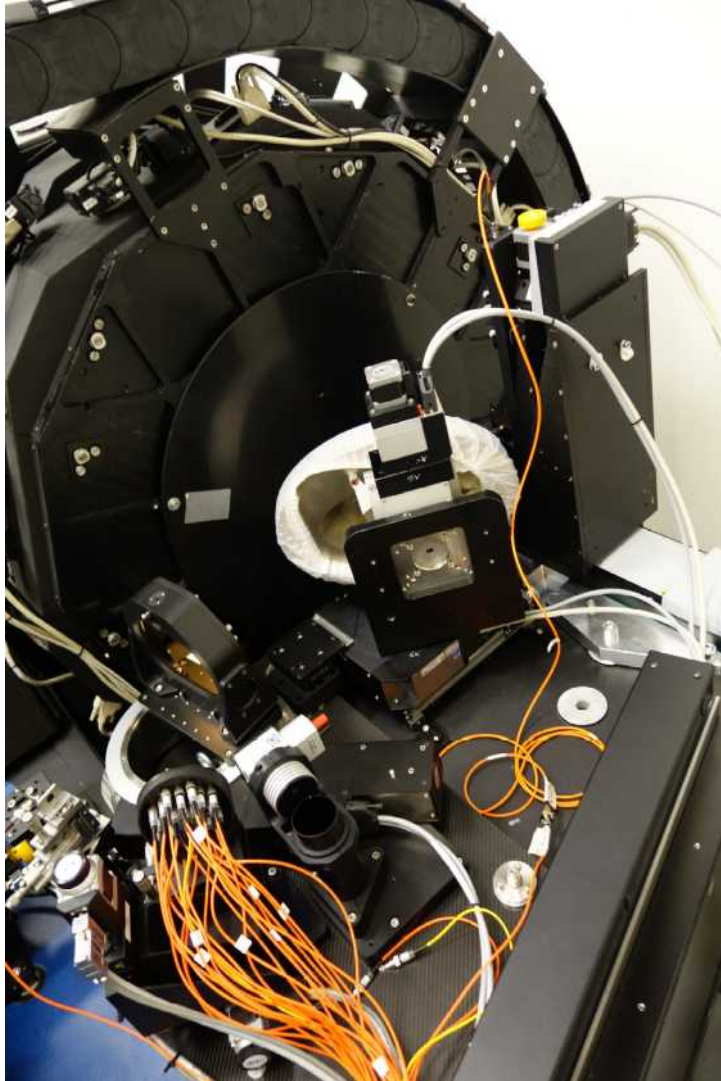


Frame Count	Residual Wavefront RMS Error (arbitrary units)
0	0.55
1500	0.30
2000	1.30
3000	1.60
4000	1.40
5000	0.60
6000	0.65
7000	0.60
8000	0.65
9000	0.60
10000	0.65



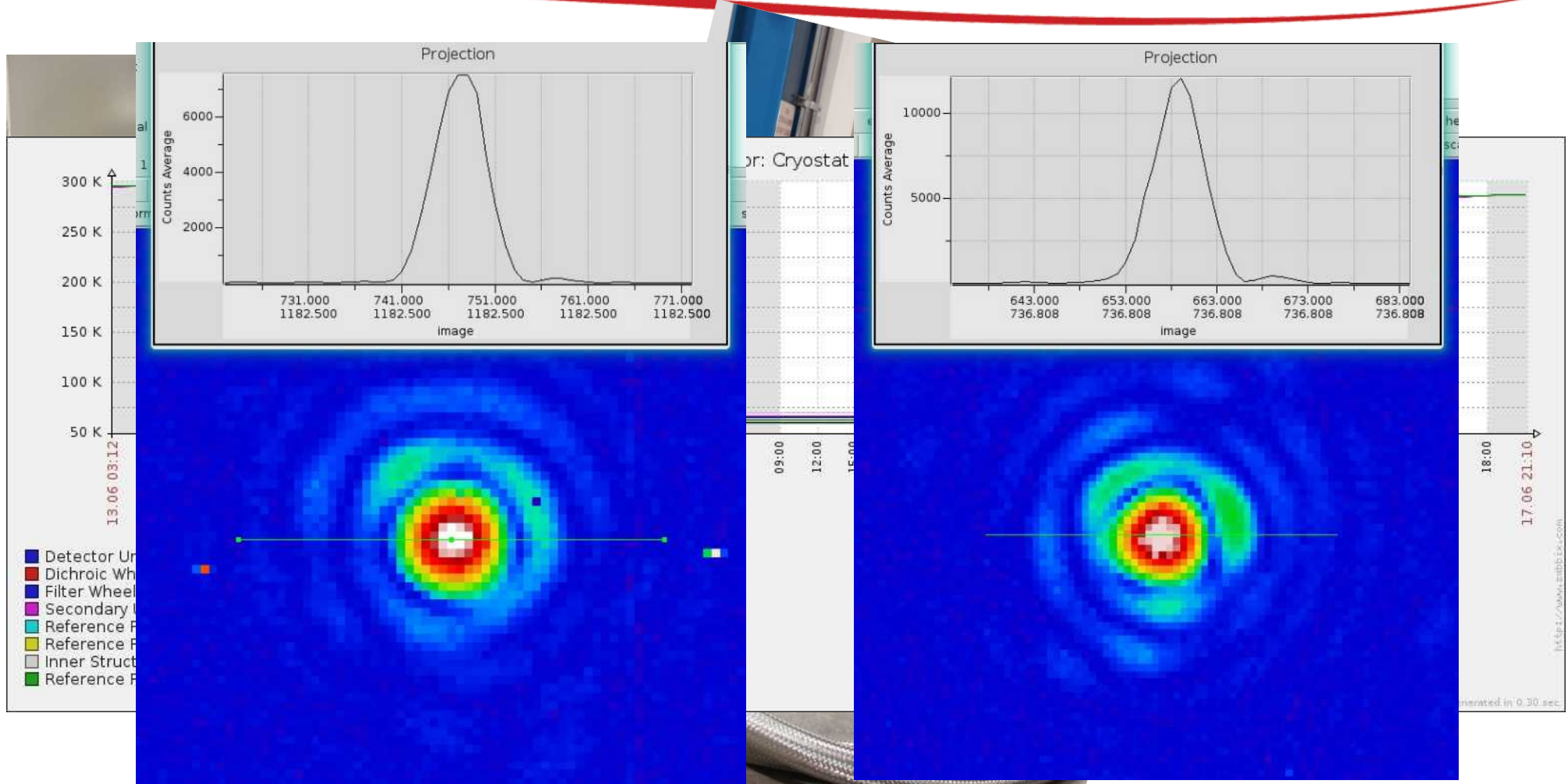
# I9 – Annular Mirror Alignment

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# I10 – Cryostat and Instrument Verification

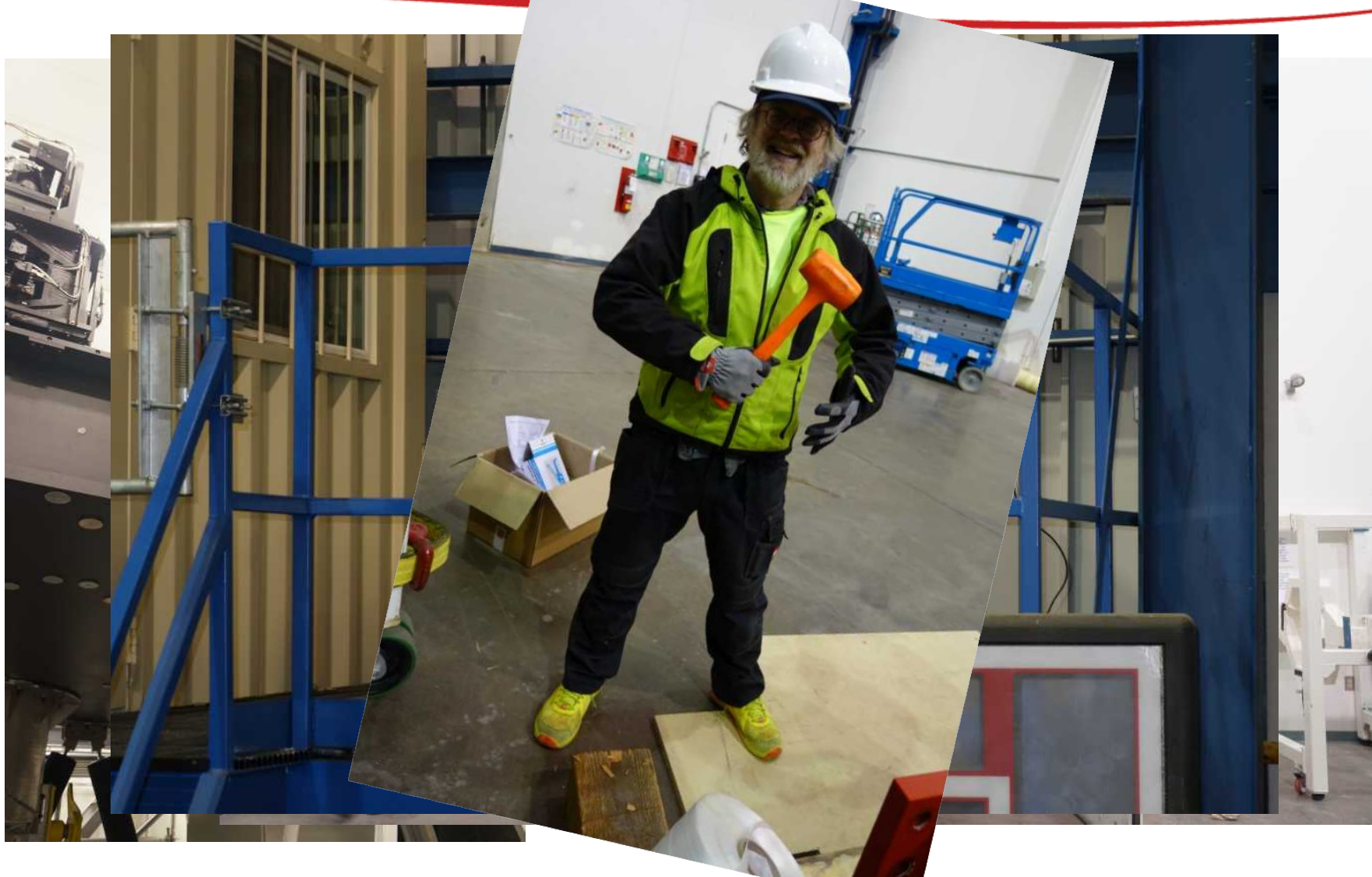
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# I11 – Installation on the Telescope

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# I11 – Installation on the Telescope

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# I11 – Installation on the Telescope

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# I11 – Installation on the Telescope

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# Commissioning

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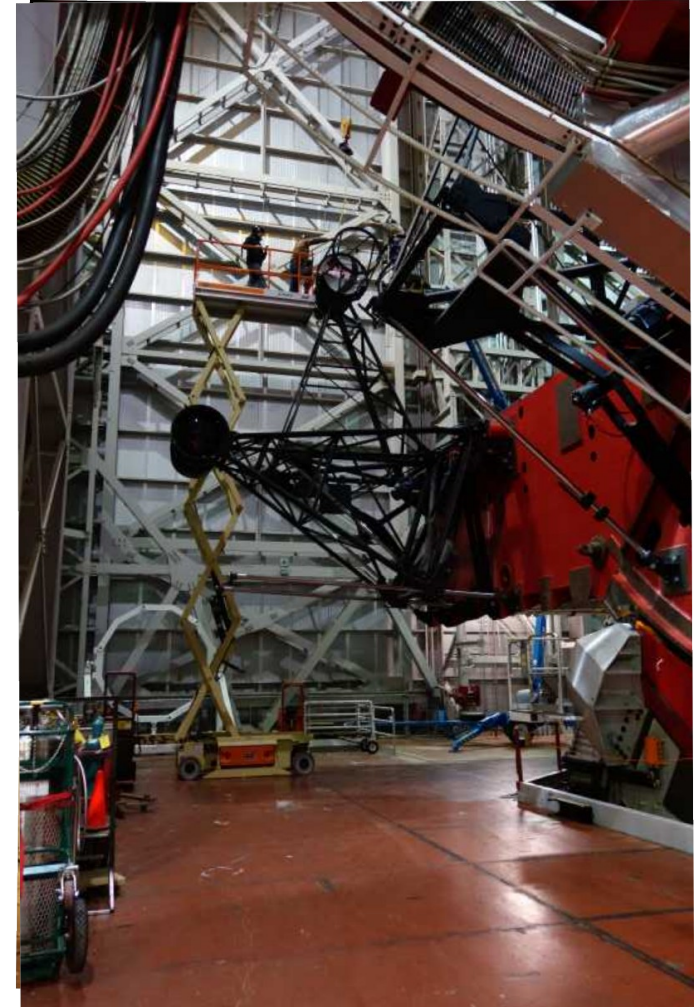


PC-1	Telescope Alignment / GWS Calibration	Nov. 16
PC-2	GWS SX Calibration	Feb. 17
COM-1	GWS SX on Sky, Autoguiding	Mar. 17
COM-2	HWS on Sky	Jun. 17
COM-3	Attempt MCAO	Fall 17
COM-4	MCAO	Fall 17

Same for 2018...



- Alignment of secondary and tertiary mirror to LINC-NIRVANA focal station
- Attempt GWS calibration with adaptive secondary mirrors



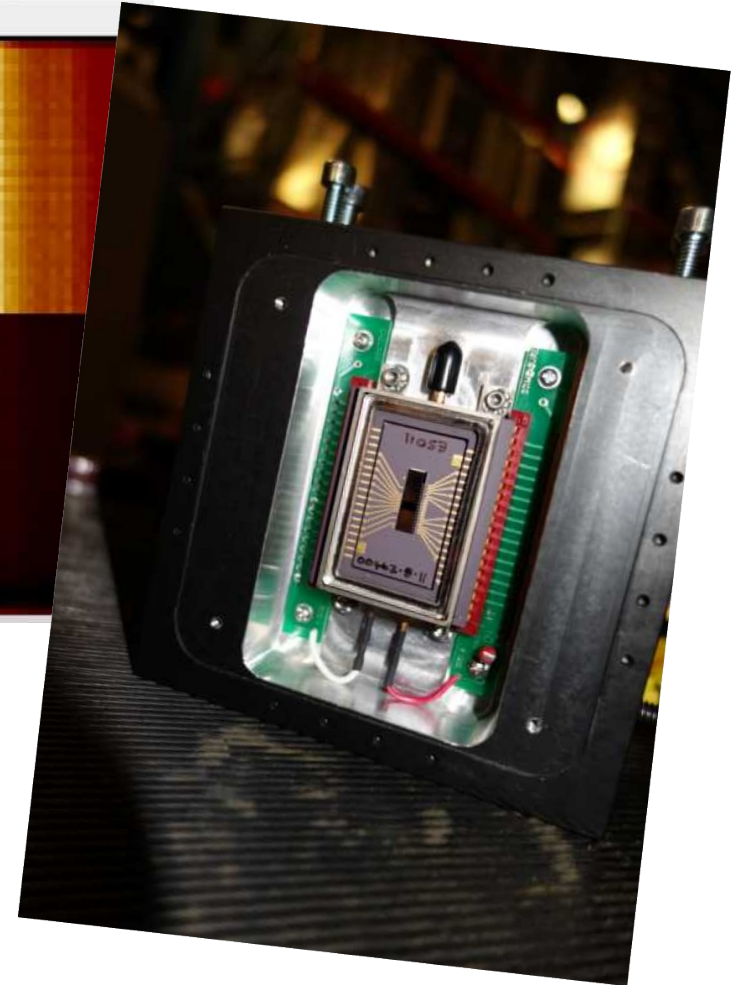
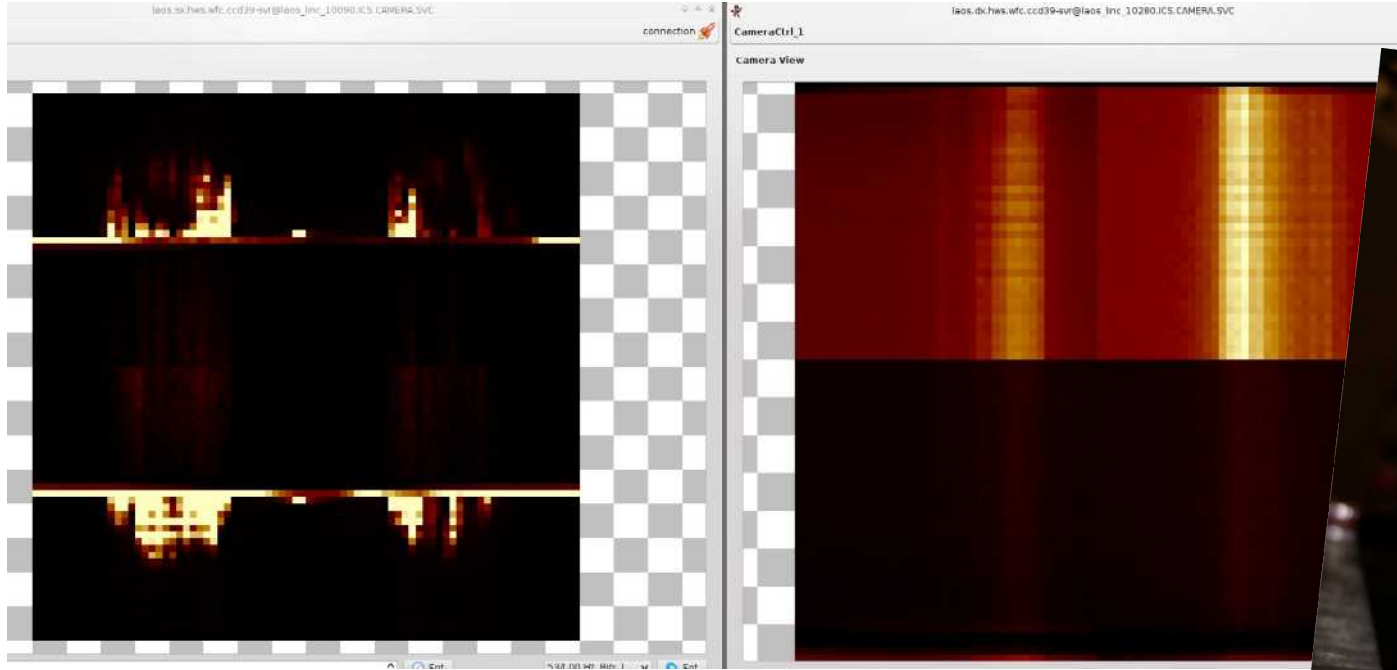
# Pre-Commissioning

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# Pre-Commissioning

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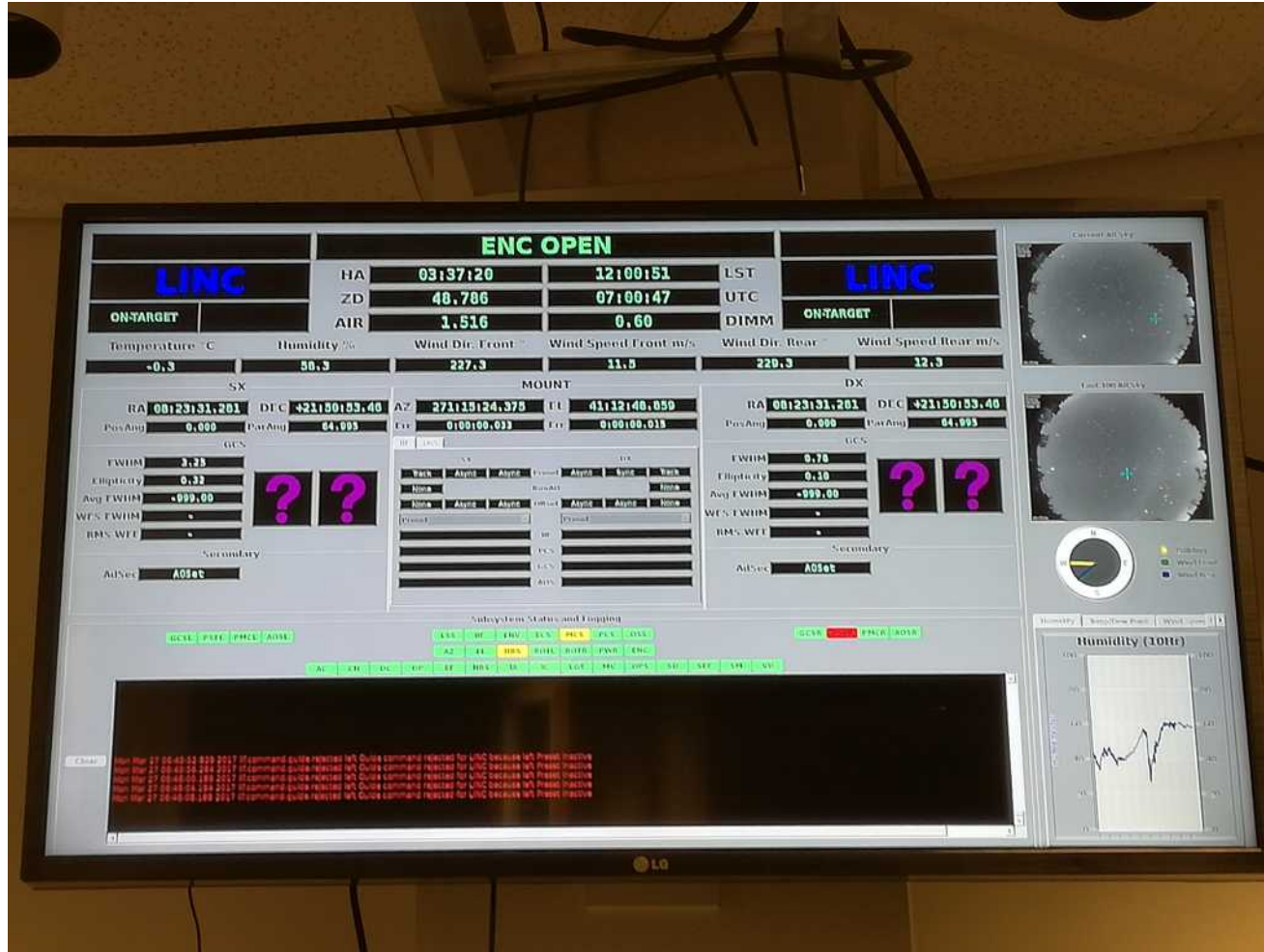


- PC-2 GWS SX Calibration  
(successful)



# Commissioning 1

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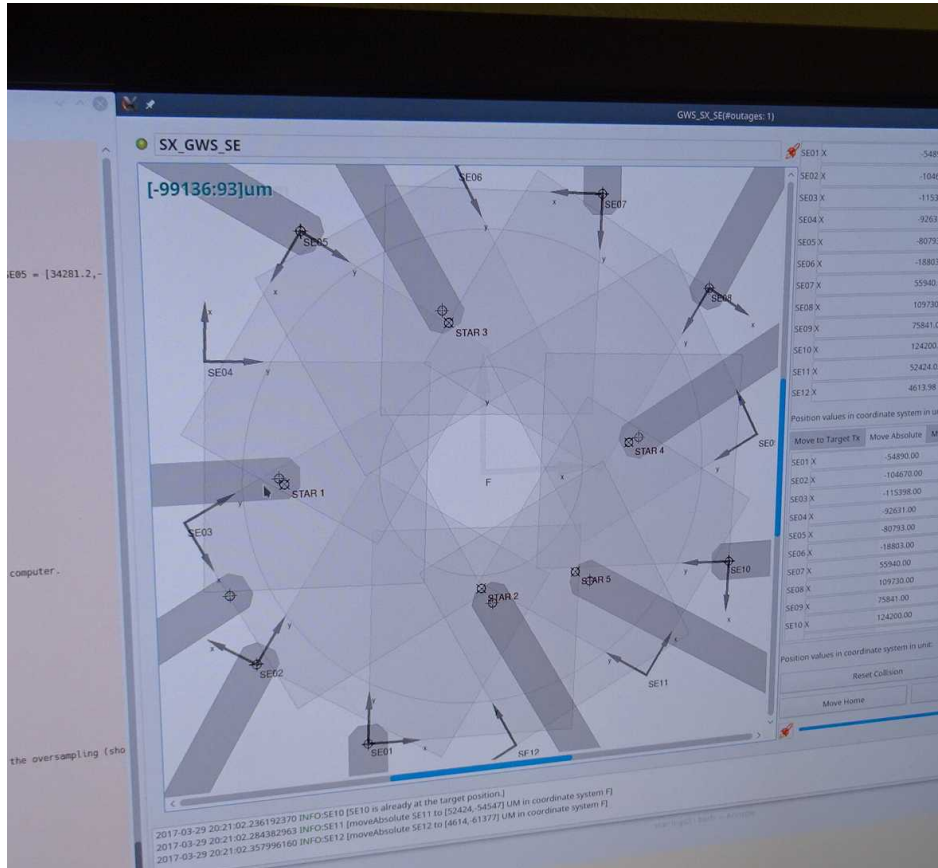
- 7 half-nights scheduled → 4 usable
- GWS SX on-sky tests
- Autoguiding tests
- CCD39 problem fixed!



# Commissioning 1

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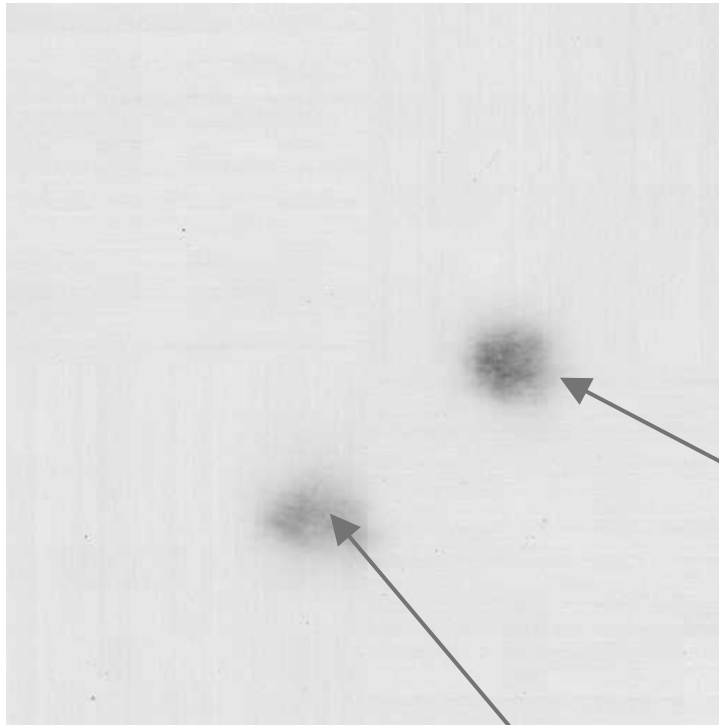
## Target 08.9+11.9

- 5 GWS reference stars
- stellar target



# Commissioning 1

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LN Science Channel  
2k Hawaii-2  
K' band

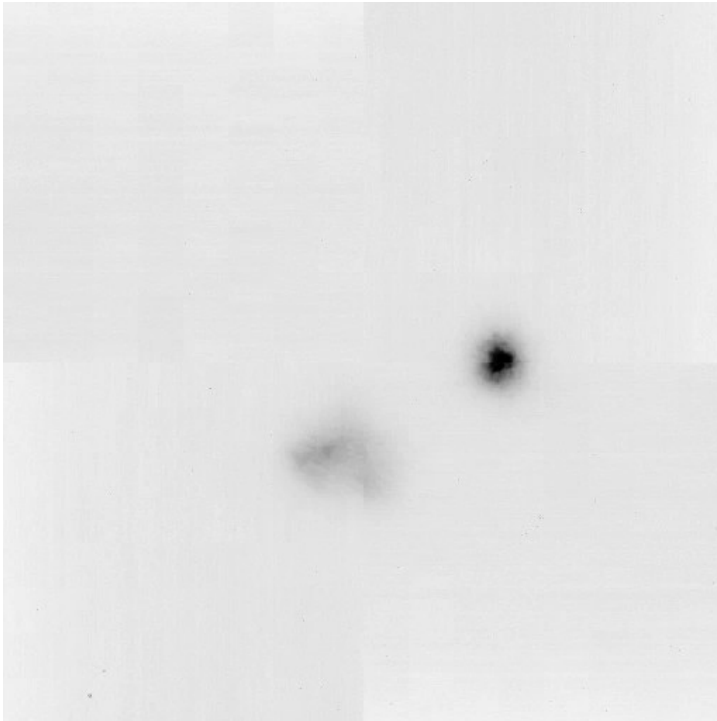
SX Target

DX Target (uncollimated)

29 March 2017  
K-band seeing  $\sim 1''$

# Commissioning 1

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LN Science Channel  
2k Hawaii-2  
K' band

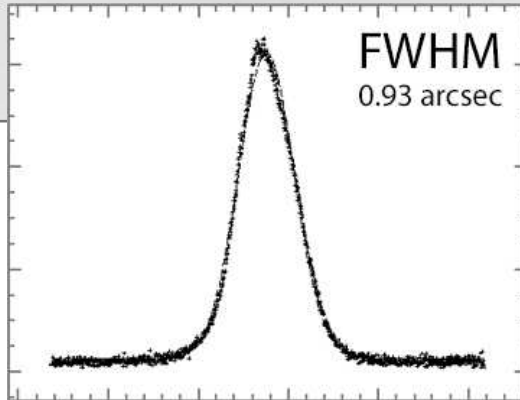
29 March 2017  
K-band seeing  $\sim 1''$

# Commissioning 1

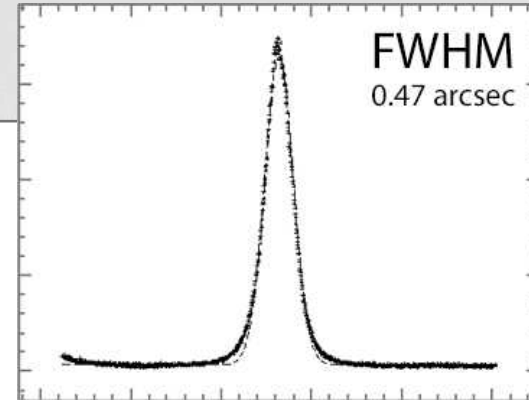
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Open Loop



GLAO - 20 modes 5 ref stars





# Commissioning 1

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