

Update: European XFEL optics, diagnostics and operation schemes

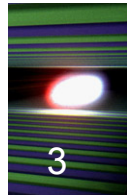
Harald Sinn

8th Hard X-ray FEL Collaboration Meeting
in Pohang

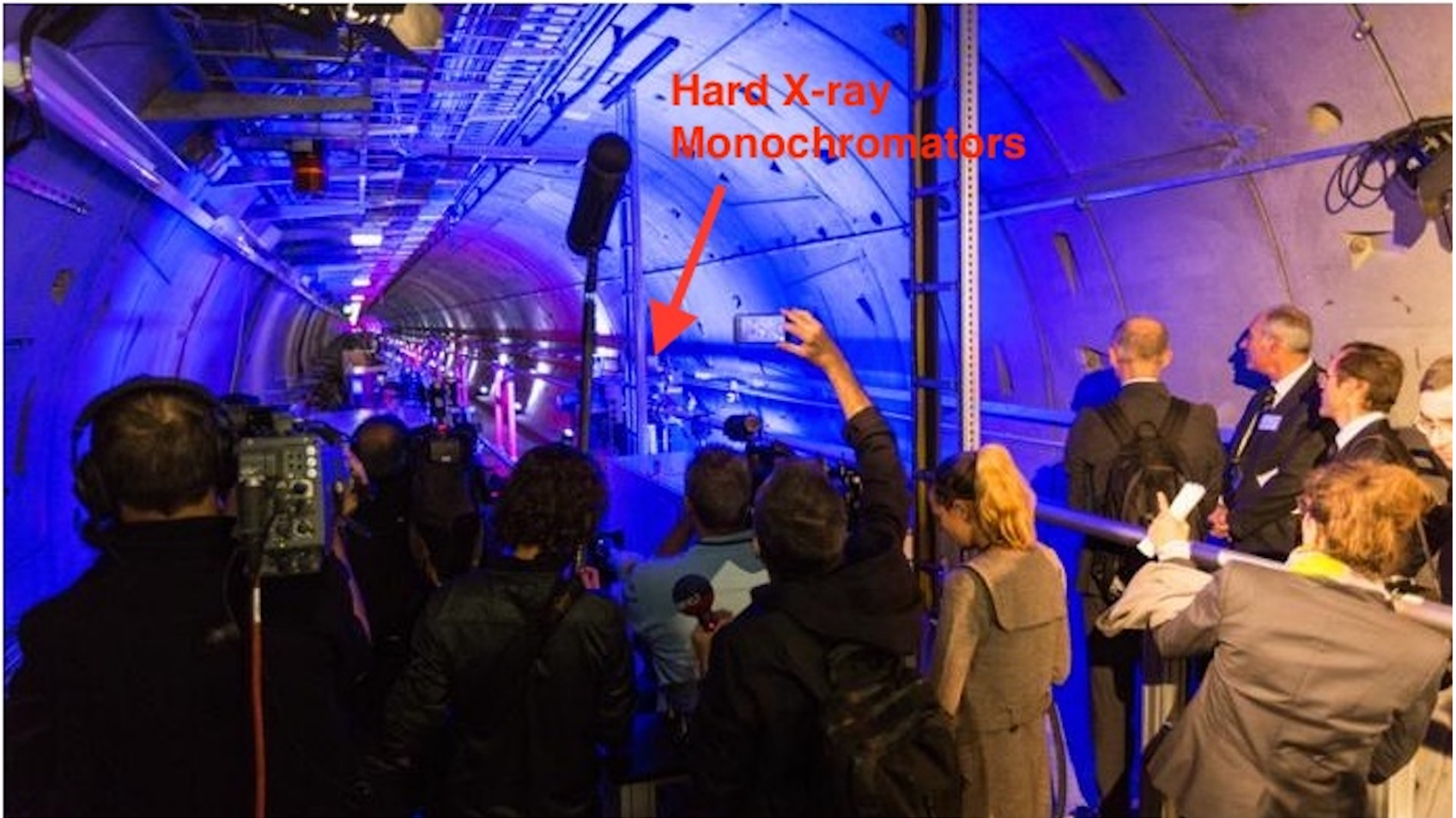
October 24, 2016

- Current installation activities
- Mirrors
- Diagnostics
- Photon beam commissioning
- User operation schemes

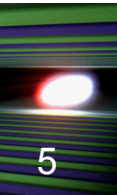
Oct. 6: Official start of technical commissioning



The 'really' last piece ..



Installation X-ray mono finished on October 5!



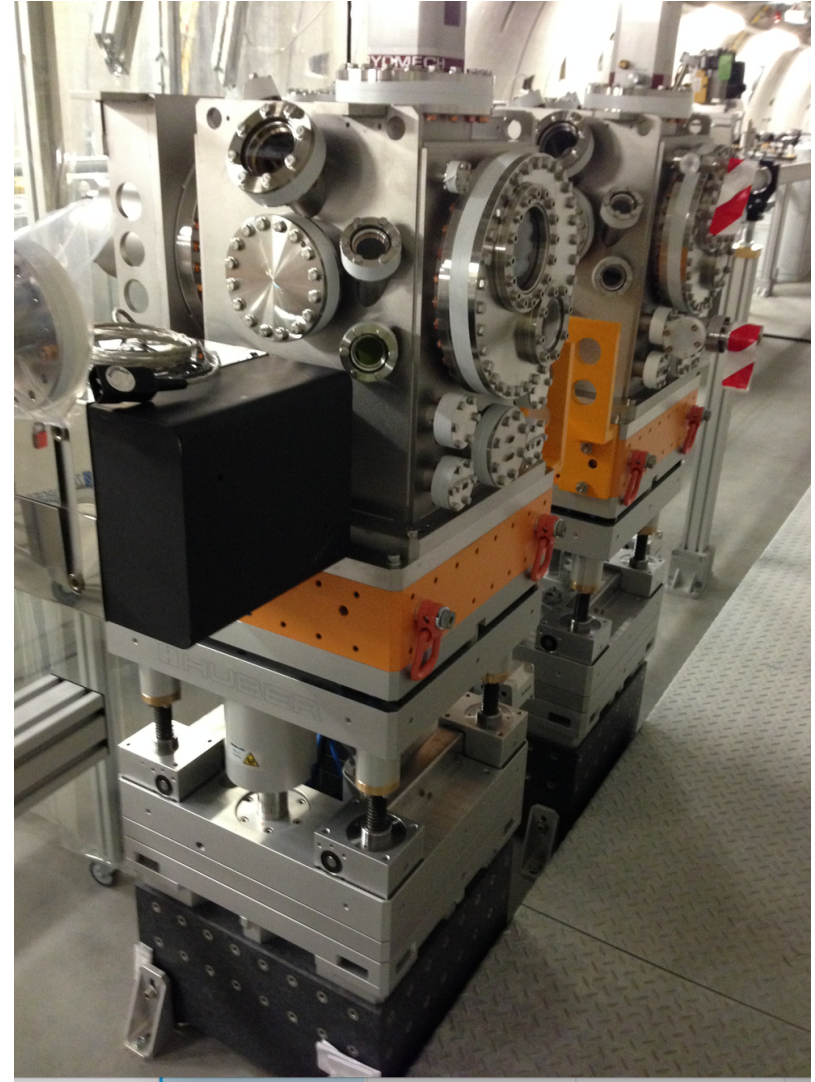
Transport into tunnel:
30 September 2016

Final assembly:
27 September 2016



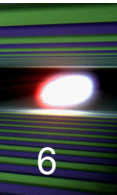
Vivien Sleziona

Xiaohao Dong



Cryo-version of ACCM, Deming Shu, APS

Some more (last) items (SASE3 soft X-ray mono)



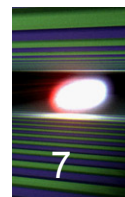
Arrival in Schenefeld
17 October 2016



Daniele La Civita

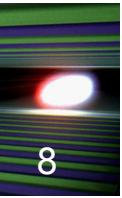
Installation 19 October 2016

Some more tunnel pictures (SASE1)



Differential pump + XGM in XTD9

Hutches in Experiment hall





X-ray Optics: Mirrors

For beam transport ordered

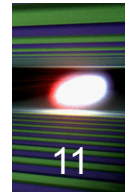
- 10 flat mirrors (2nm PV, 950-960 mm) JTEC (6 received, 2 in shipping)
- 2 curved (2 nm PV, 600 mm) JTEC, received
- 2 flat (3 nm PV, 960 mm) ZEISS (currently at 5 nm PV)

For experiments ordered

- 2 flat (MID, 5nm PV, cryocooled, 500 mm) ZEISS (arrived, in metrology)
- 11 flat + elliptical (KB systems 0.5-1 m) JTEC, in production

Next step: Coating at HZG, Gestacht and then again metrology
(and then.. the very last element to be installed)

17.3.2016: First superpolished mirror ready



FLAT super-polished mirrors TypeA #5264-1

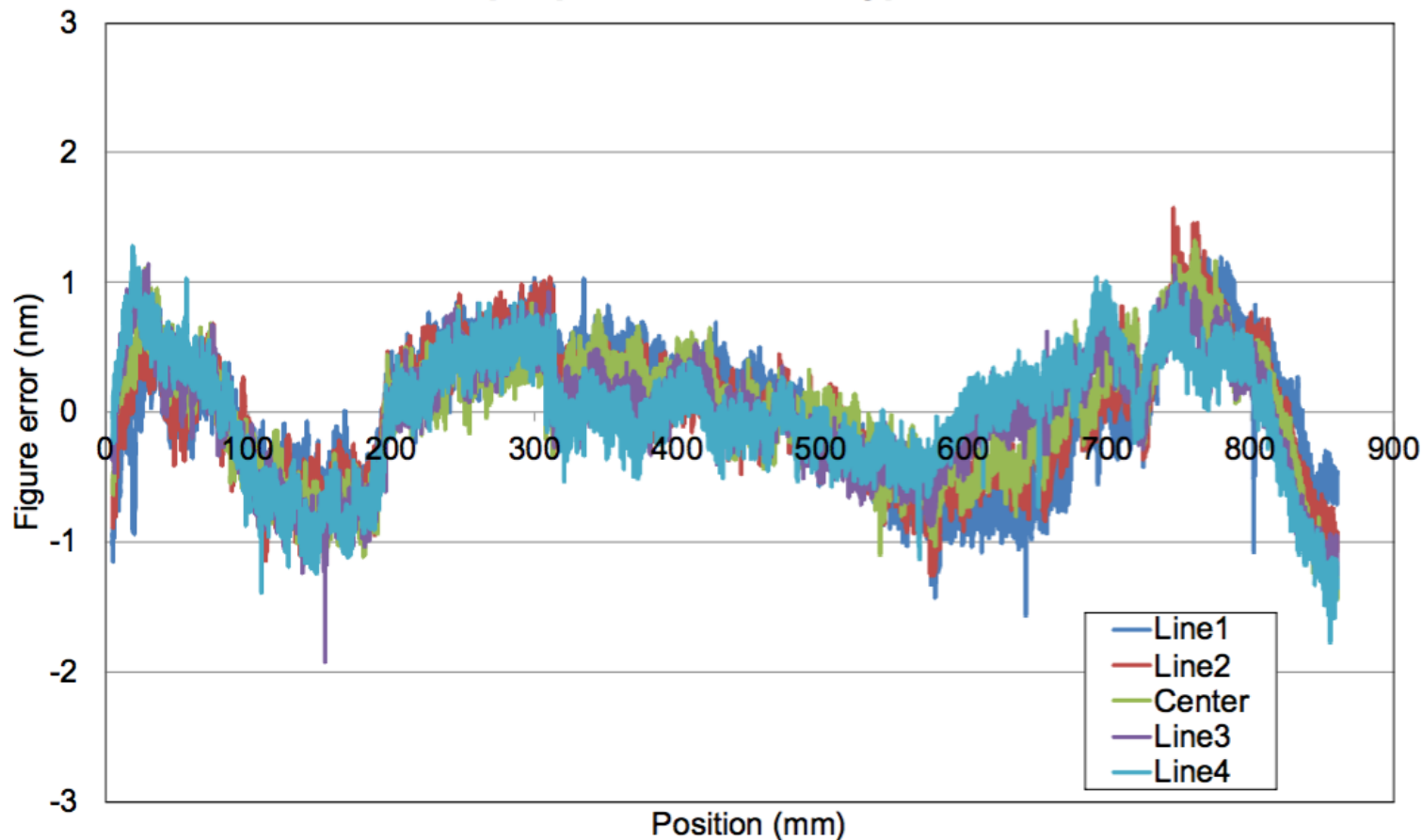
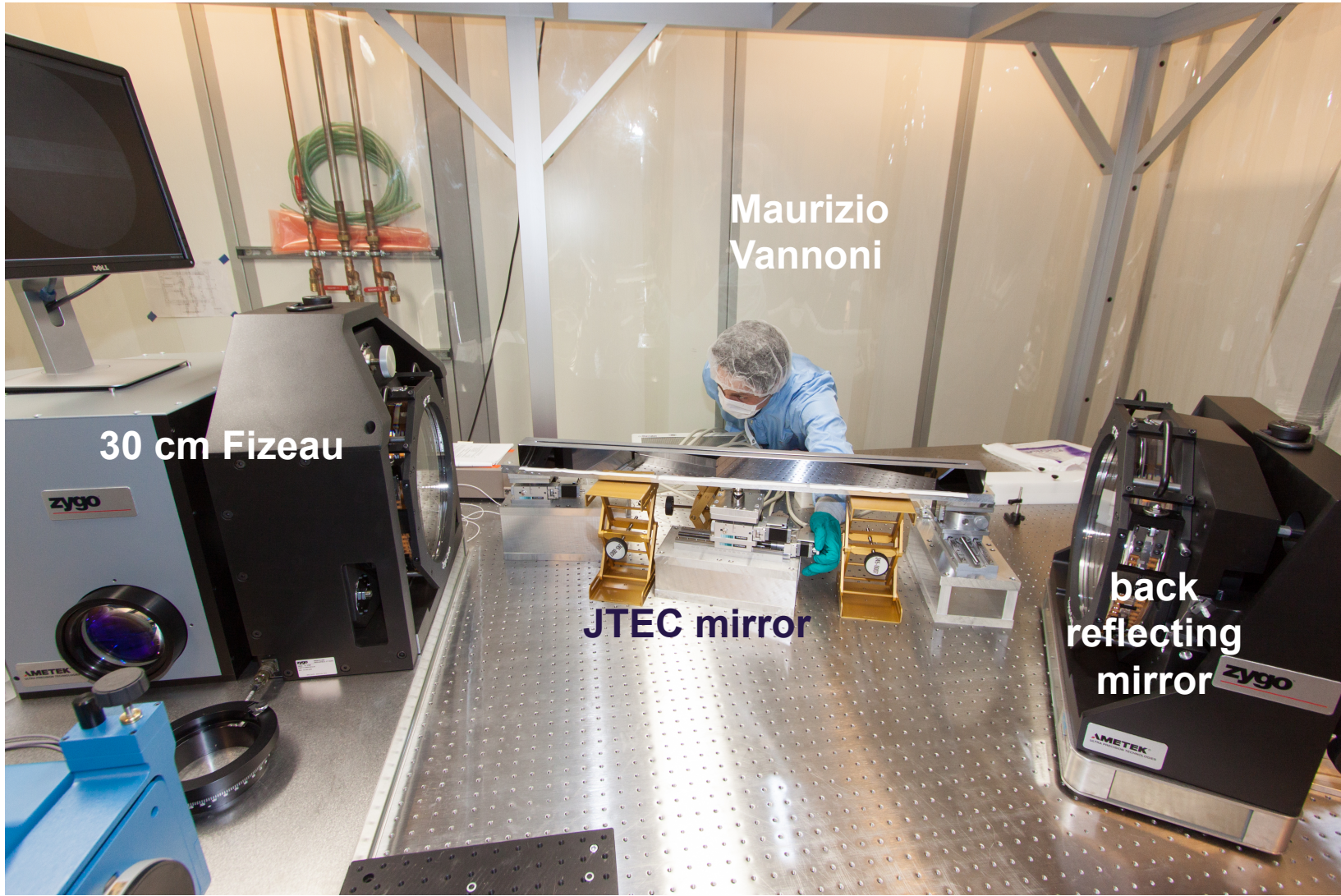
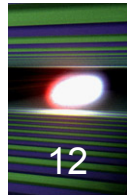


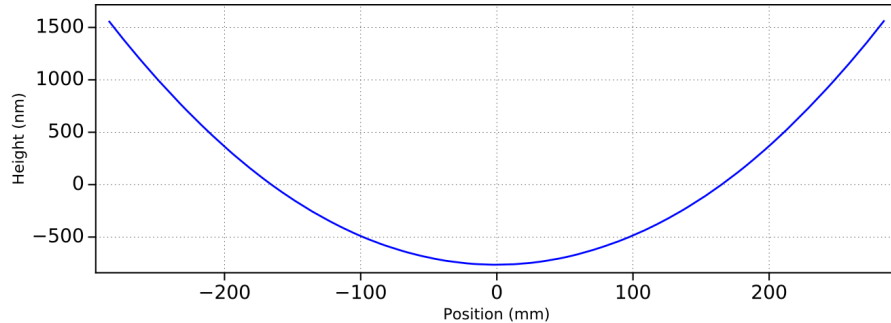
Figure 1-2: Tangential shape error profiles of Mirror #5264-1.

Measurements of first super polished mirror at XFEL (April 2016)



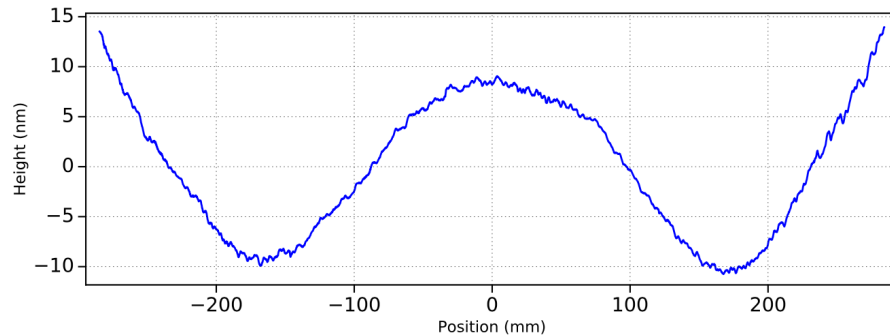
Recent metrology result: Pre-mirror soft mono

Height center profile of mirror: JX095002
(Radius: 17.46 Km; P-V: 2324.8 nm; rms: 691.42 nm)



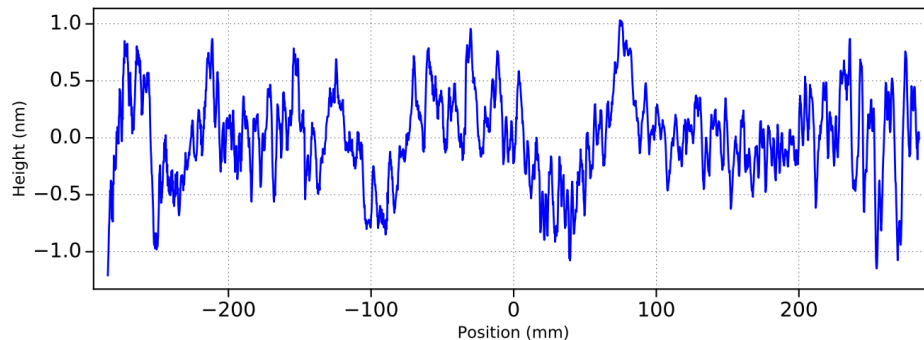
Absolute measured shape
(manual stitching)
R=17.46 km (specs 16.7 km)

Height center profile (best parabola removed) of mirror: JX095002
(Radius: 17.46 Km; P-V: 24.7 nm; rms: 6.75 nm)



Best parabola removed
(agrees with FEA PV24.6 nm)

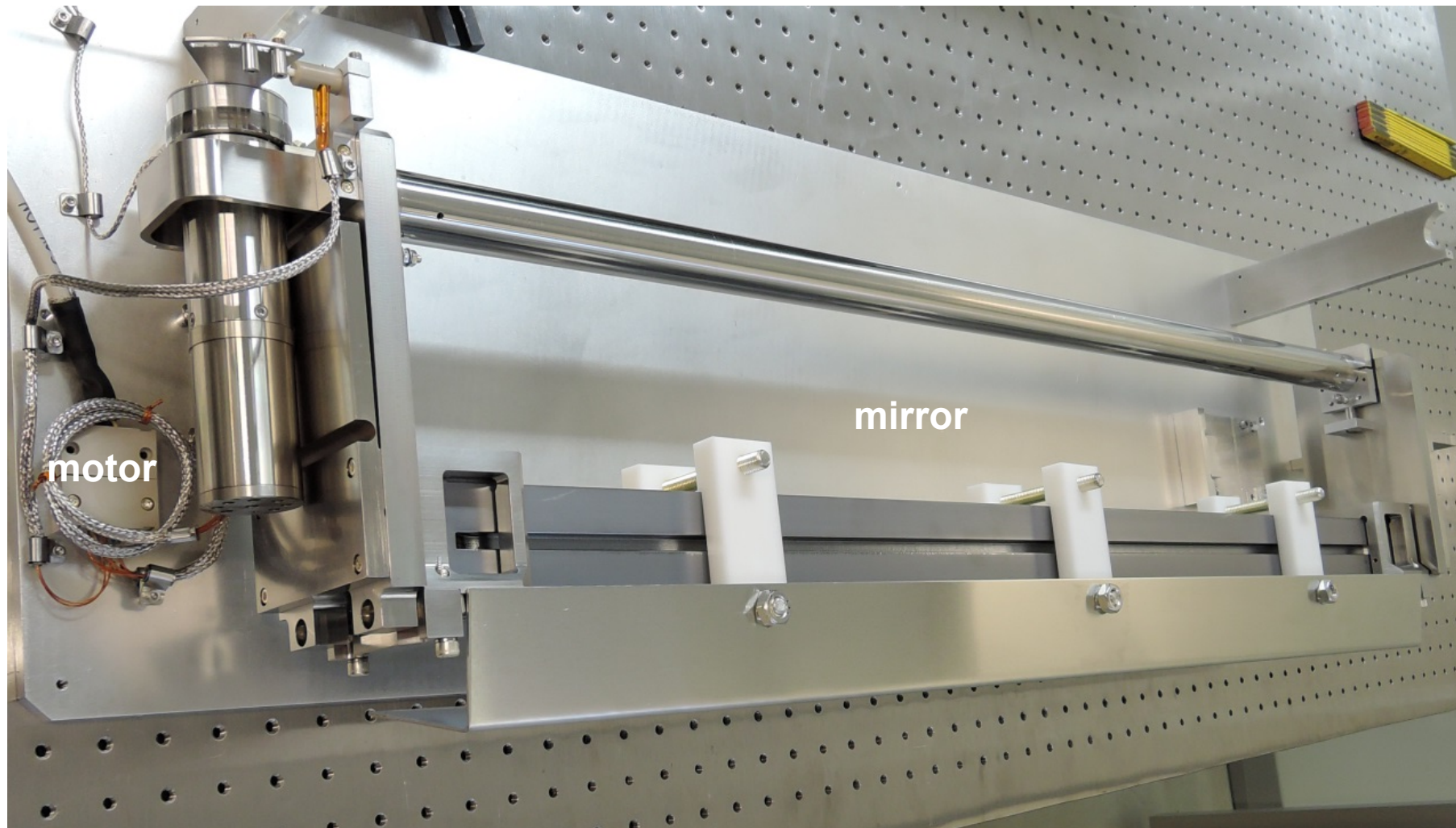
Height center profile (10th polynomial removed) of mirror: JX095002
(Radius: 17.46 Km; P-V: 2.2 nm; rms: 0.39 nm)



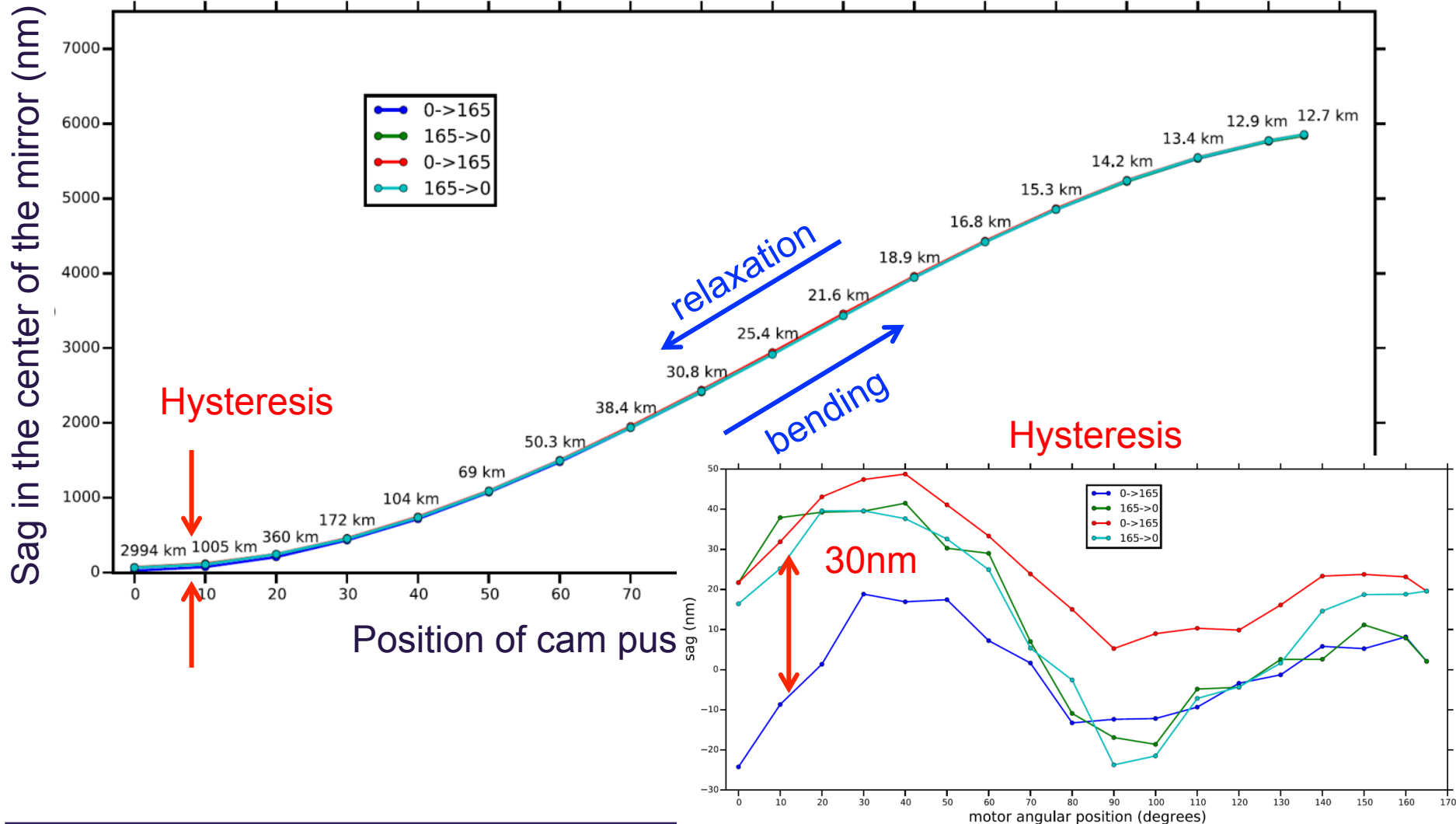
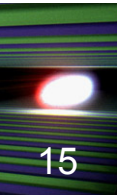
10th order polynomial removed
2 nm PV (specs: 3 nm PV)

1 m long mirrors: About 5 nm PV
uncertainty on long range shape

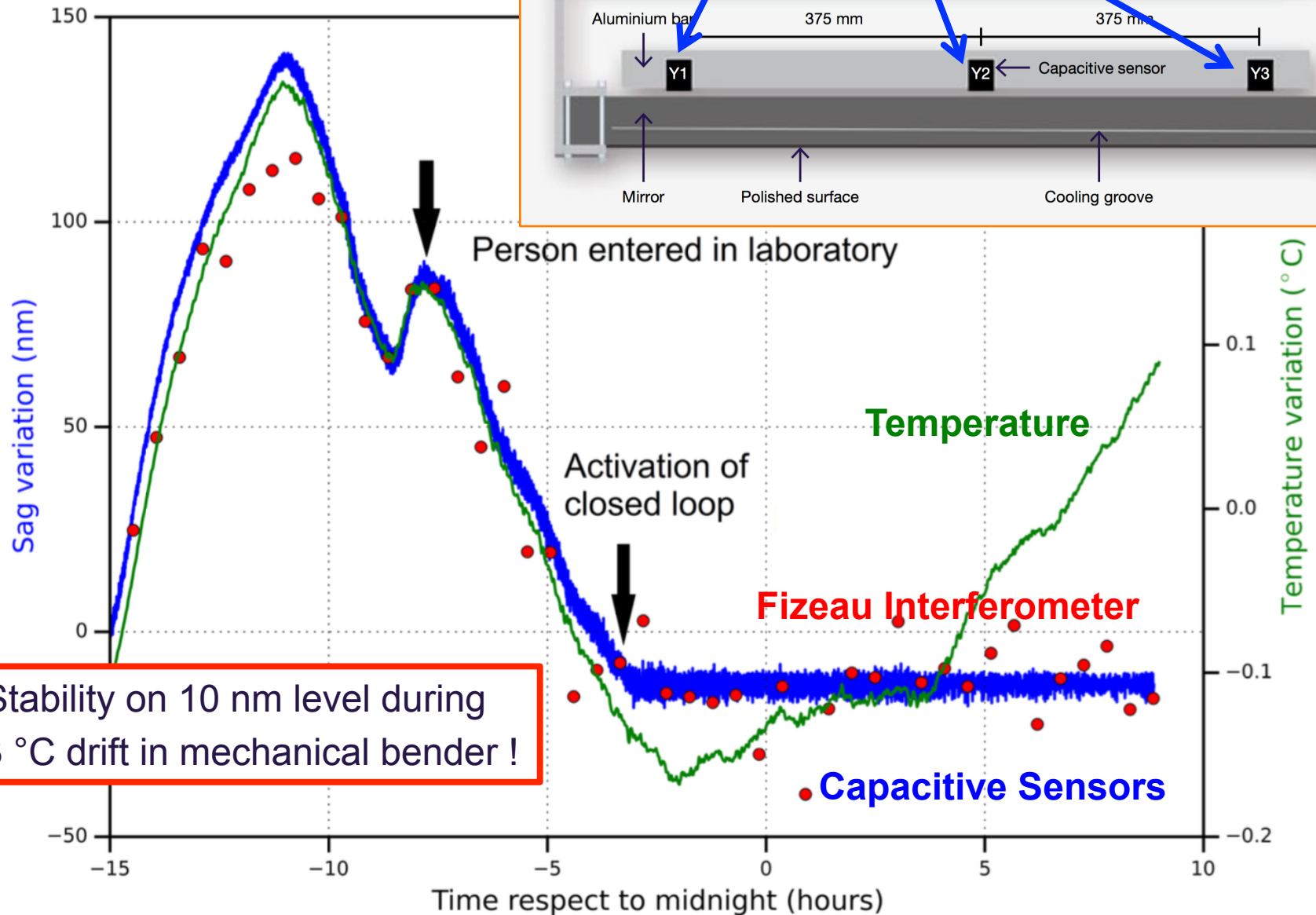
Mechanical bender for 'M2' mirrors



Mechanical bender results



Temperature drift

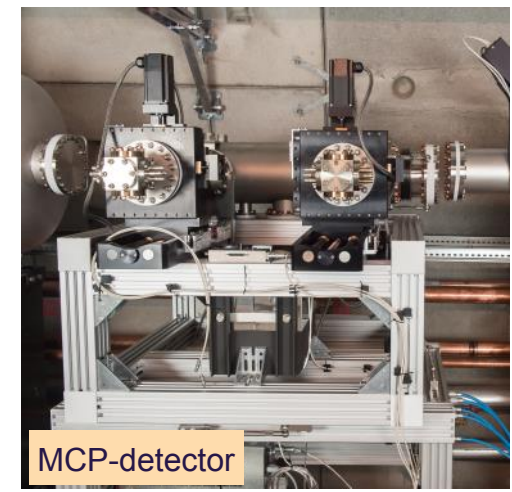
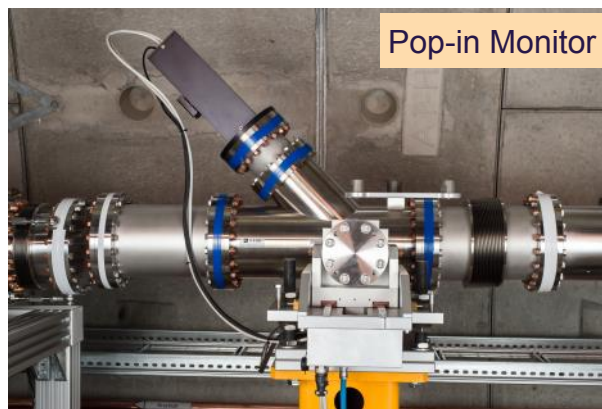


X-ray Diagnostics

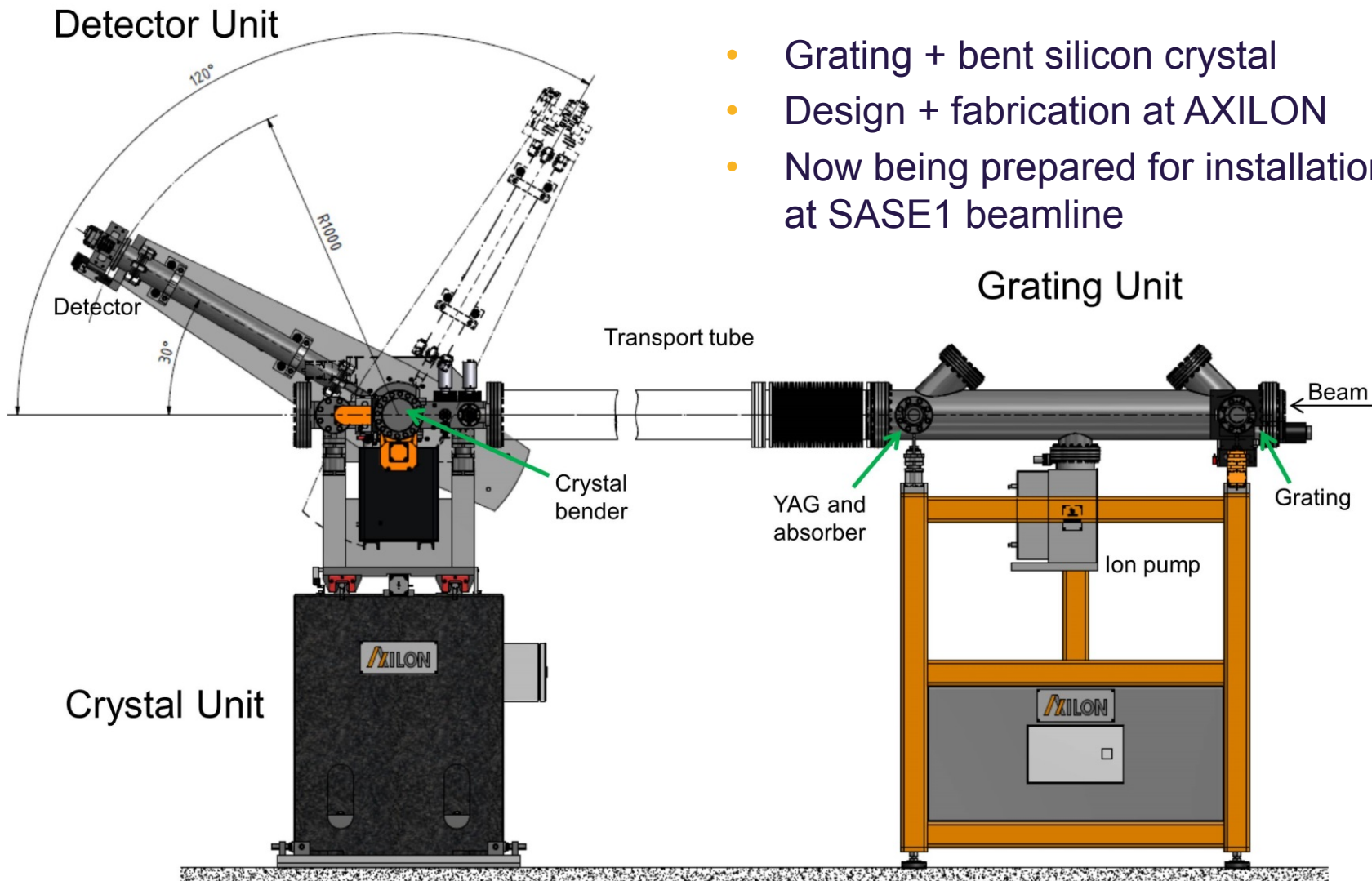
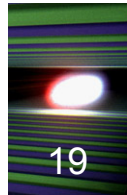


SASE1 installation status

- Vacuum systems XTD2: all planned WP74 vacuum systems are installed in the tunnel (except HIREX spectrometer)



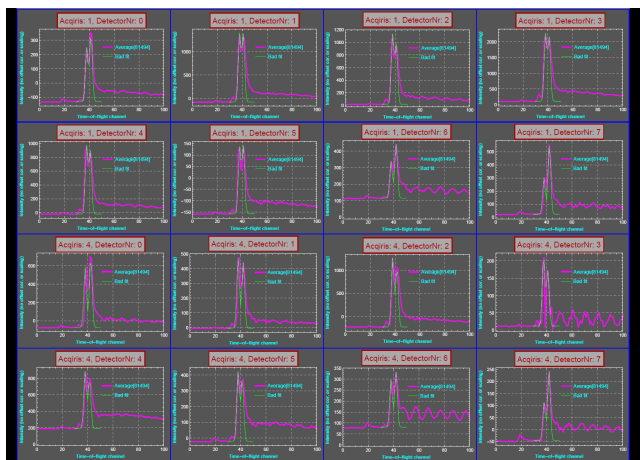
HiREX spectrometer



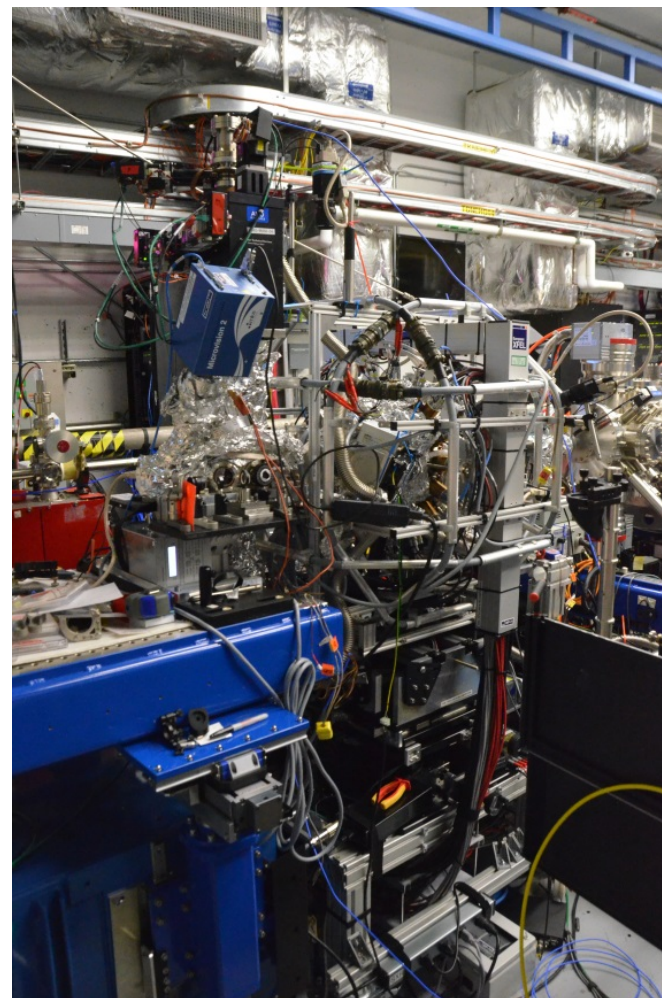
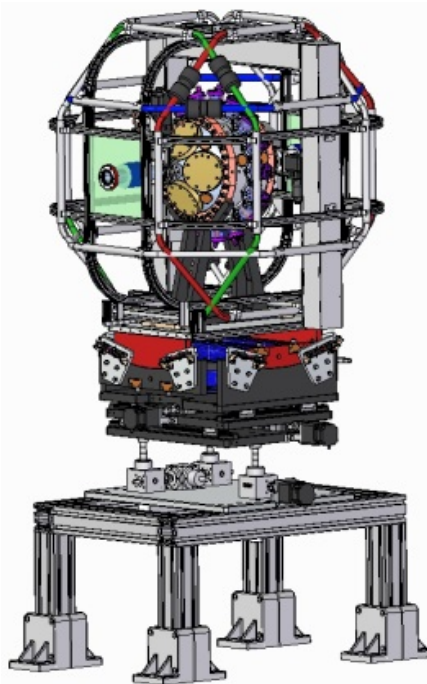
- Grating + bent silicon crystal
- Design + fabrication at AXILON
- Now being prepared for installation at SASE1 beamline

SASE3: Photoelectron Spectrometer (PES)

- Beamtimes with “our own” PES at LCLS/AMO in 2015:
 - DELTA undulator commissioning
 - user beamtime (W. Helml, LH-52)
 - inhouse beamtime (R. Coffee)
 - ➔ proof that the device is very **reliable, robust and performant** (currently up to 2kV retardation voltage is possible)



Signals from 16 radially distributed ToF-detectors → spectra and polarization

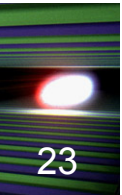


Photon beam commissioning and early user experiment phase



- When photons will be generated, 2 people from the photon commissioning team will join the DESY control room team
- Overall 16 members from 9 different XFEL groups
- Work in parallel to DESY control room shifts
- Start on 25 March (+ delay from He-pipe incident)
- Will commission all beam transports (SASE1,2,3) plus 1-2 weeks for each instrument (together with instrument teams)
- First early user experiment 18 May (+ Δt)
- PCT activity phases out end of Nov 2016 (+ Δt)

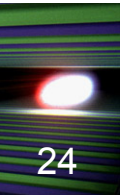
Shift plan for photon com. team (preliminary)



Date	Program	Accelerator	Photon Commissic	Public Holiday	Type of Shift	Participant 1	Participant 2	Participant 3	Participant 4	Participant 5	Participant 6	Participant 7	Participant 8	Participant 9	Participant 10	Participant 11	Participant 12	Participant 13	Participant 14	Participant 15	Participant 16	
Thursday, 23 March 17	Acc. Studies	1			swing																	
Thursday, 23 March 17	Acc. Studies	1			owl																	
Friday, 24 March 17	Und. Closed	1			day																	
Friday, 24 March 17	Und. Closed	1			swing																	
Friday, 24 March 17	Und. Closed	1			owl																	
Saturday, 25 March 17	Photon Comm.	0			day																	
Saturday, 25 March 17	Photon Comm.	0			swing																	
Saturday, 25 March 17	Photon Comm.	0			owl																	
Sunday, 26 March 17	Photon Comm.	0			day																	
Sunday, 26 March 17	Photon Comm.	0			swing																	
Sunday, 26 March 17	Photon Comm.	0			owl																	
Monday, 27 March 17	Photon Comm.	0			day																	
Monday, 27 March 17	Photon Comm.	0			swing																	
Monday, 27 March 17	Photon Comm.	0			owl																	
Tuesday, 28 March 17		0			day																	
Tuesday, 28 March 17	Acc. Studies	1			swing																	
Tuesday, 28 March 17	Acc. Studies	1			owl																	
Wednesday, 29 March 17	SASE	1			day																	
Wednesday, 29 March 17	SASE	1			swing																	
Wednesday, 29 March 17	SASE	1			owl																	

First 'early' user experiment:
June 2017 (+Δt)

December 2017: Change to parallel user operation mode



Date	Shift	Ferien	Shutdown / Maintenance PETRA	Shutdown / Maintenance FLASH	Program	Accelerator	Photon Systems	FXE	SPB	SQS	SCS	HED	MID	XTIN	XTL	North (T2,T4,T10)	North (T9)	South (T1,T3,T5,T7)	South (T6)	South (T8)
						3592	1776	348	348	348	348	348	348	348	6448	6448	5336	4928	2976	1840
Wed, 06/ Dec	F				SASE															
Wed, 06/ Dec	S				SASE															
Wed, 06/ Dec	N				SASE															
Thu, 07/ Dec	F				Early User															
Thu, 07/ Dec	S				Early User															
Thu, 07/ Dec	N				Early User															
Fri, 08/ Dec	F				Early User															
Fri, 08/ Dec	S				Early User															
Fri, 08/ Dec	N				Early User															

preliminary operation plan from Winni Decking (Sept. 2016)

- First call for proposals (SPB+FXE): 7.12.2016 (+ Δt , not before cooldown) UPEX: User Portal for the European XFEL
- First allocation period: 15.6.2017 (+ Δt) (only one experiment running)
- Two allocation cycles per year

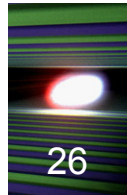


Silvia Bertini
Head of User Office

Parallel Experiments

- Starts in December (+ Δt)
- Default shift pattern: 12 hour shifts over 5 days (Thu-Mon) with two experiments sharing day/night
- Initially only one electron beamline (SASE1+3 parallel)
- 2018: User mode + Further commissioning
- 2019: Full user mode (4000h on 3 SASEs)

Meet us in Schenefeld during the test phase!



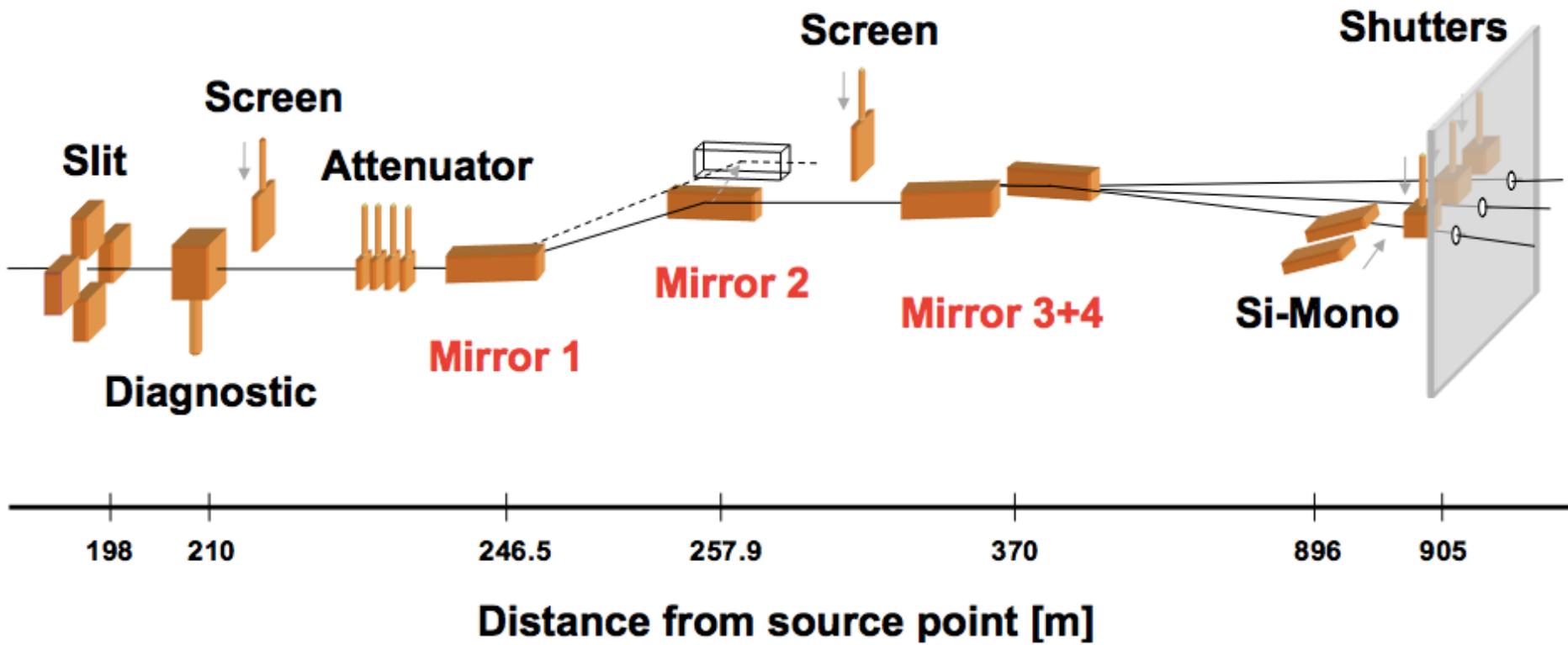
Thank you for your attention!



Mirrors in X-ray beam transport

large distances: 300 ... 1000 m!

SASE1 / SASE 2 Layout



Mirrors for European XFEL (in production)

Area	Type	Quantity	Length [m]	Bender	Cooling
Tunnels	1 st Offset	3	0.90	no	In-Ga/water
	2 nd Offset	3	0.95	yes	In-Ga/water
	Steering	3	0.90	no	In-Ga/water
	Soft Mono Pre-mirrors	2	0.6	no	In-Ga/water
	Soft Mono Gratings	3	0.55	no	In-Ga/water
SPB	KBs	6	1.0	no	In-Ga/water
SQS	KBs	2	1.0	yes	In-Ga/water
SCS	KBs	3	0.5-0.9	yes	In-Ga/water
MID	Steering	2	0.6	no	cryo-cooling
Total		27	0.5-1.0		all



Harald Sinn, (Wini Decking, DESY Thomas Tschentscher)

WP73: Liubov Samoylova

WP72: Sergey Tomin

WP74: Naresh Kujala

WP81: Peter Zalden

WP82: Zuzana Konopkova

WP83: Ulrike Boesenberg

WP84: Marcin Sikorski

WP85: Markus Ilchen

WP86: Manuel Izquiereo

Associates:

WP71: Yuhui Li (beam based alignment, undulator tuning)

WP72: Gianluca Geloni, Svitozar Serkez

WP73: Natalia Gerasimova (max. 50%)

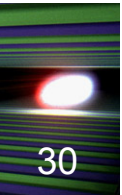
WP74: Andreas Koch (max 50%)

WP82: Karen Appel (max 50%)

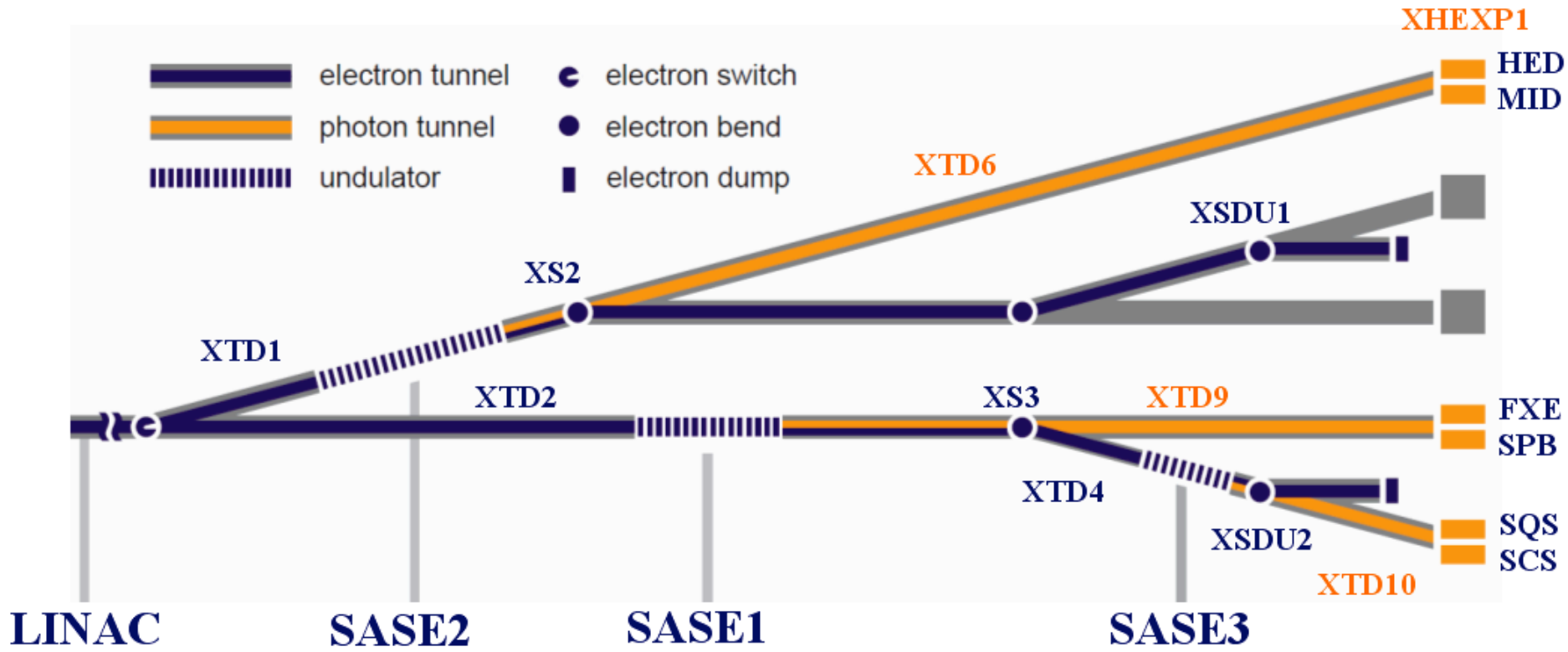
WP84: Marc Messerschmidt

= 10 + 6 members

Photon beam transport @ EXFEL



← 1 km →



Orange color: Beam Transport and X-ray optics