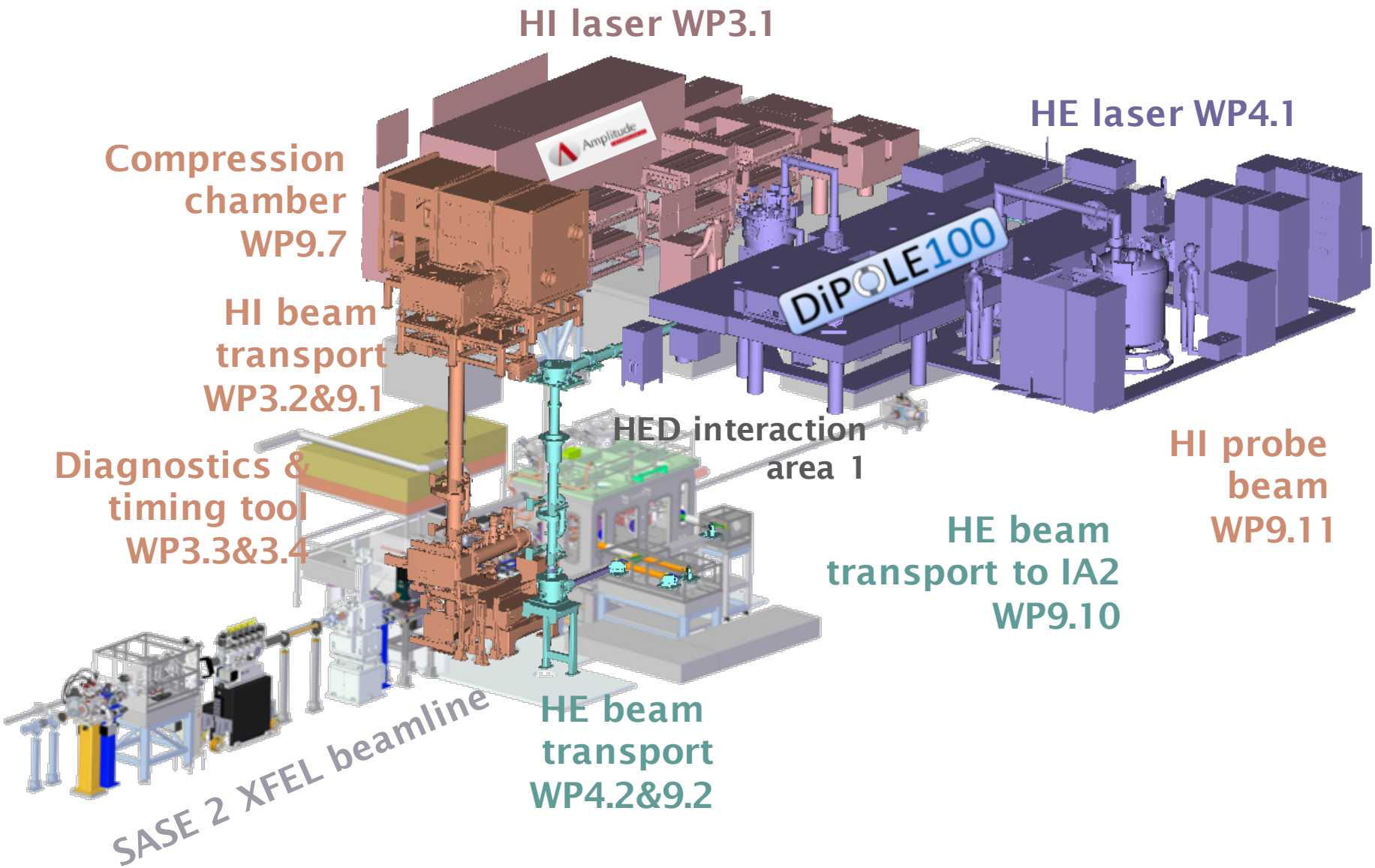
Status of HED HI Laser

T. Toncian – HZDR

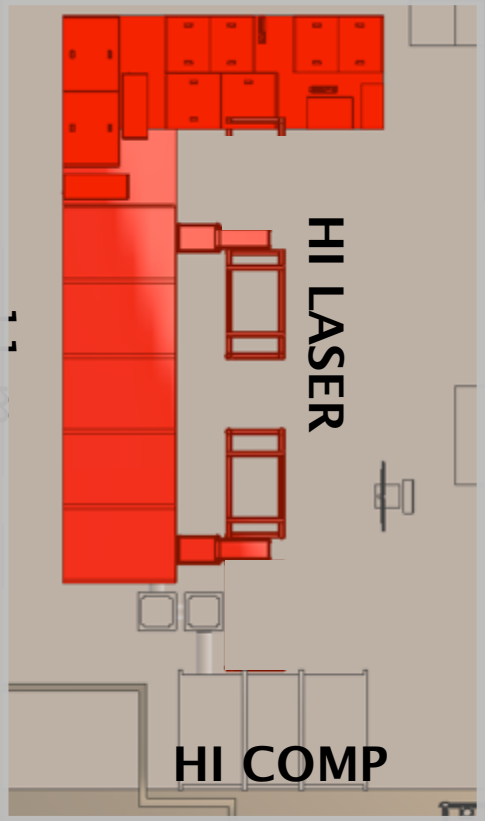
on behalf of HIBEF UC

Overview of the HED endstation



WP 3.1 The High-Intensity Laser System

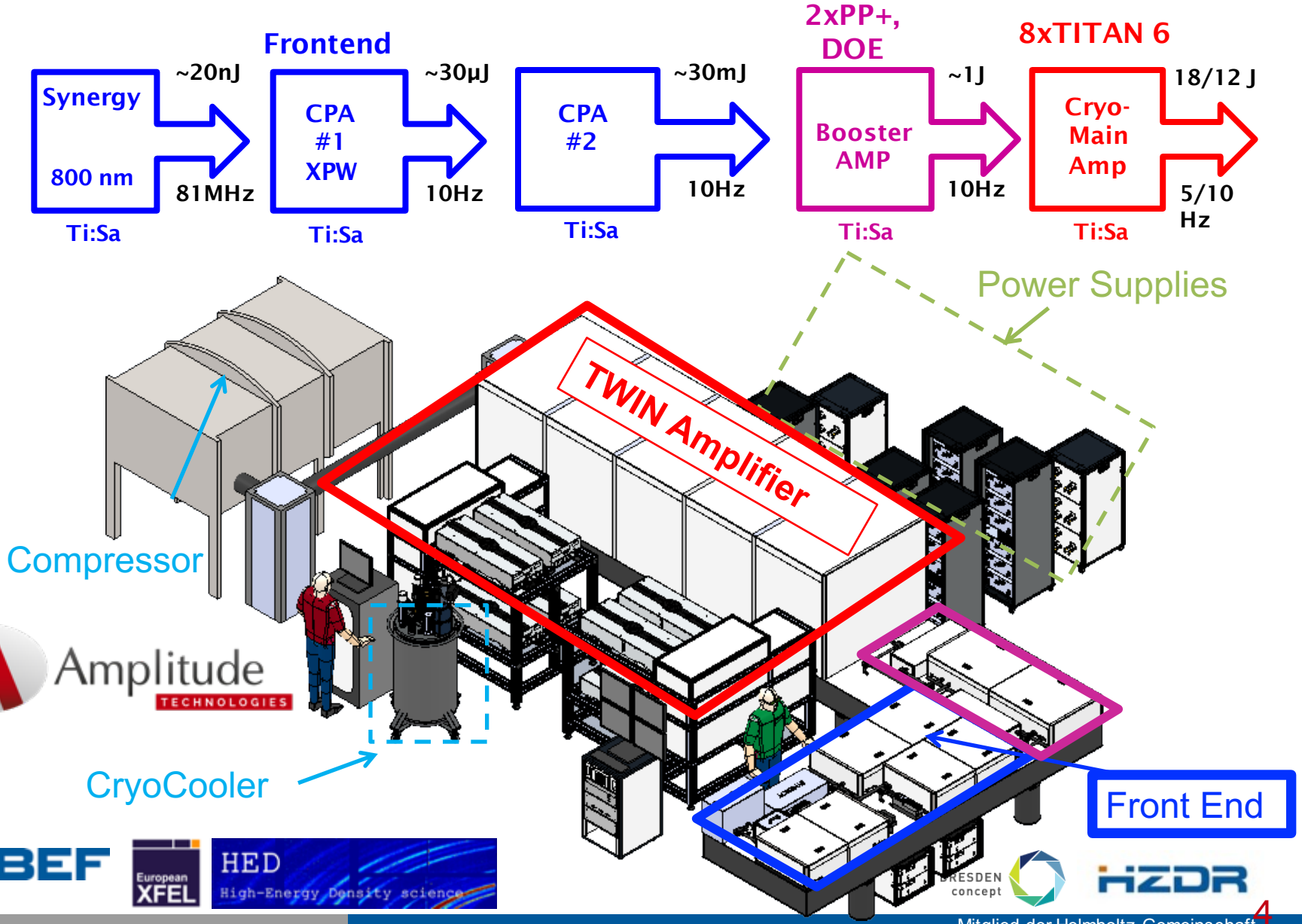
- key properties-



Amplitude TECHNOLOGIES

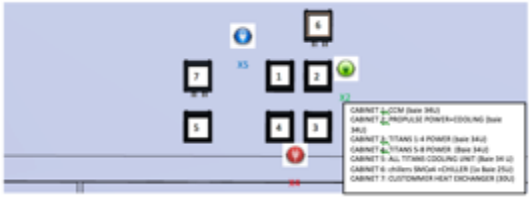
- >100TW @ 10 Hz
- >300 TW @ 5 Hz
- double CPA Ti:Sa
- shot on demand
- high redundancy
- Q2 2018

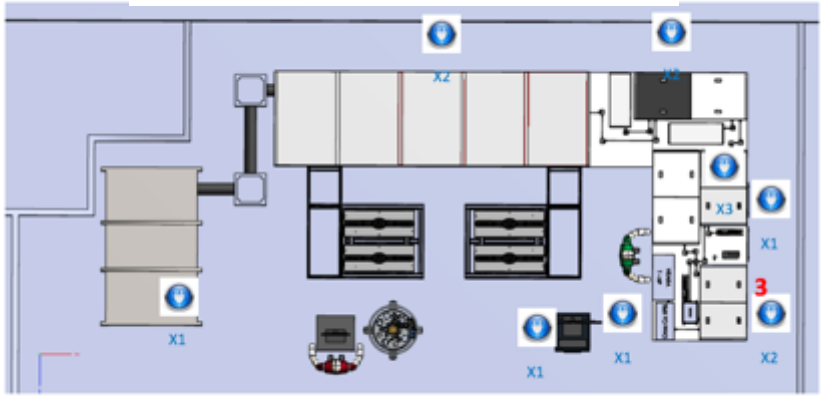
HI Laser Setup



WP 3.1 The High-Intensity Laser System
- laboratory interfaces -

- ✓ AC and clean room
- ✓ electric requirements- cable trays
- ✓ cooling- water and LN2
- ✓ double floor





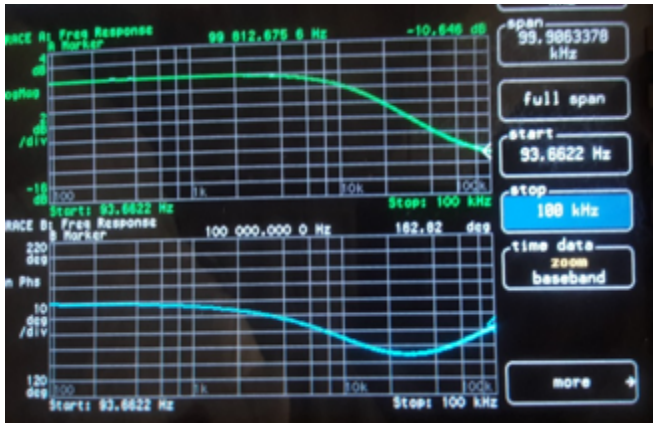
- AT requirements
  - communicated
  - implemented in lab design
  - **LN2 available since Dec 1st.**

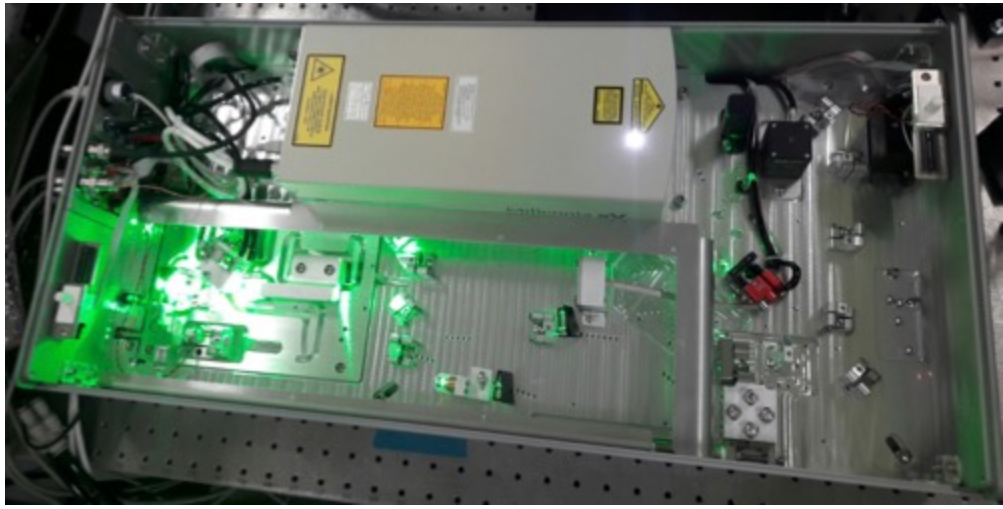
WP 3.1 The High-Intensity Laser System

- Oscillator -

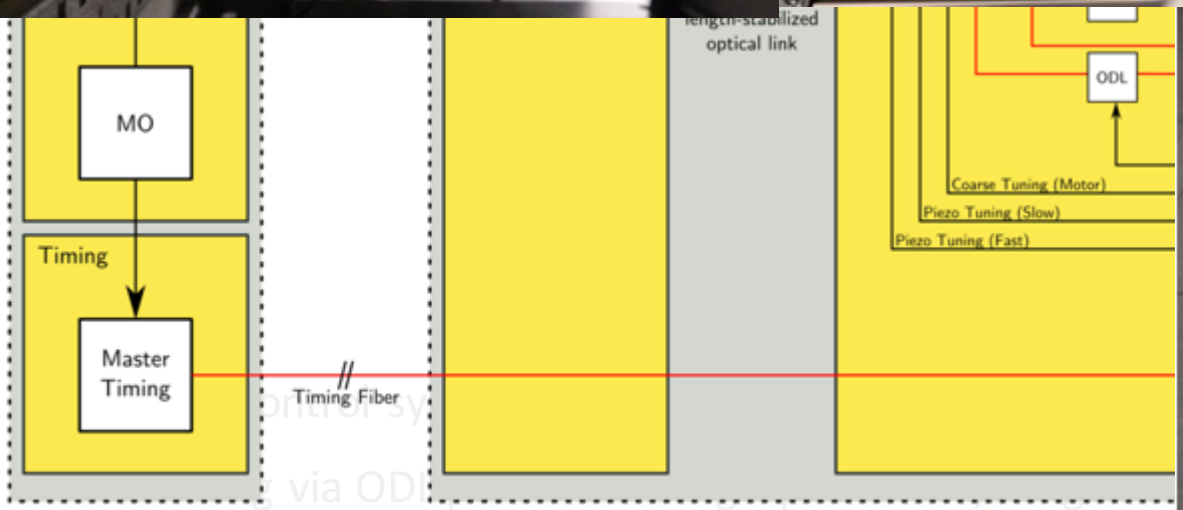
Newport/Spectra Vienna SYNERGY 20 UHP

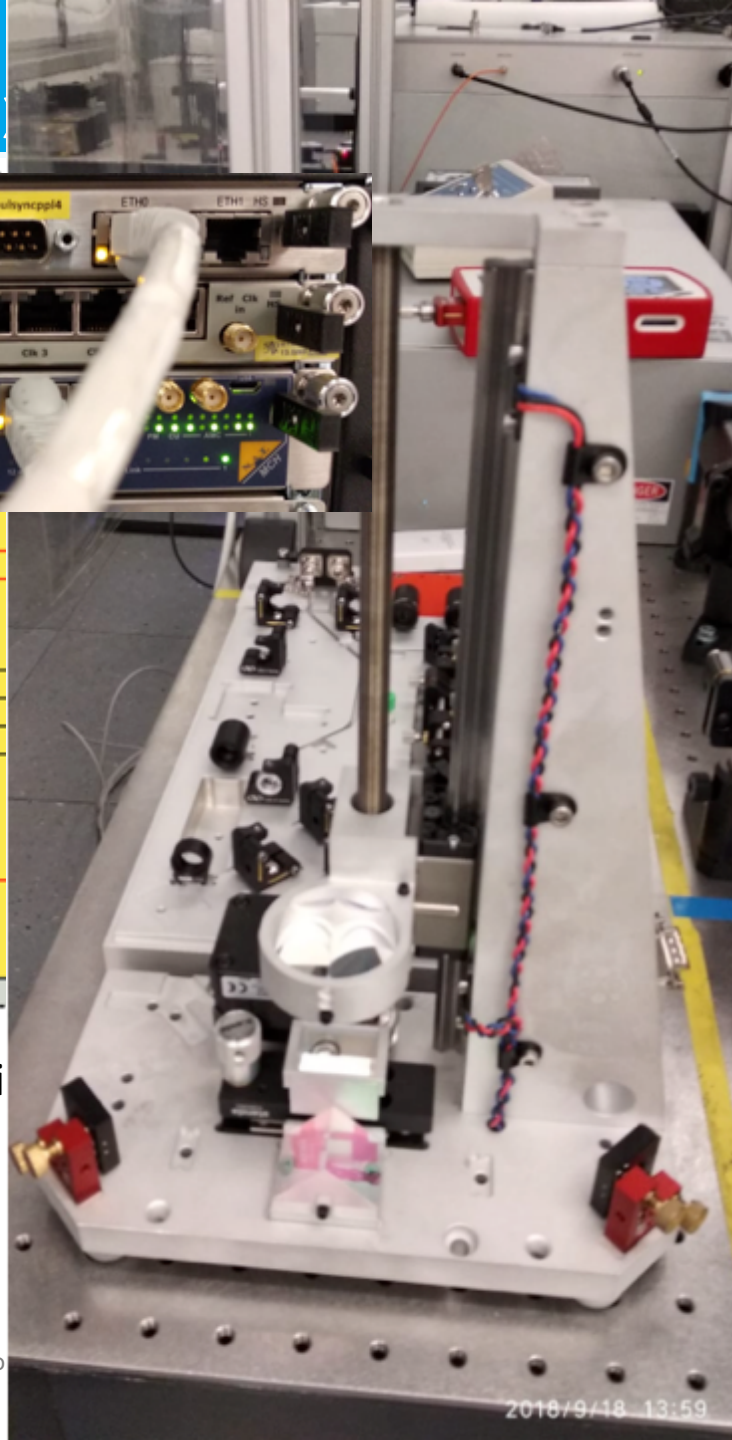
- pumped by Millennia eV 10
- repetition rate matched to 16th subharmonic of XFEL 81.25 MHz
- DESY synchronization tailored design and components
- target: jitter to XFEL < 15 fs
- diagnostic: balanced autocorrelator
- OSAT at AT 8 June 2017
- OSAT XFEL 2nd July 2018





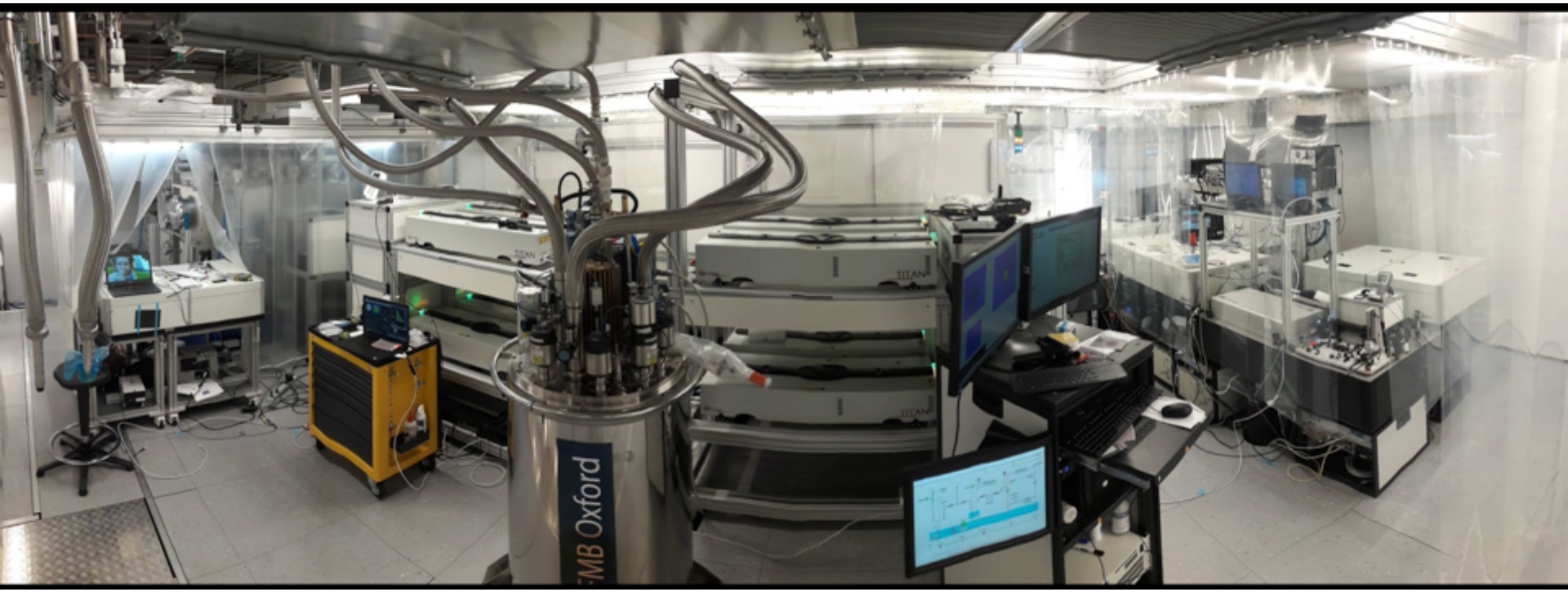
WP 3.4 Timing Tool:
- Executed by DESY: Laser Synchronisation



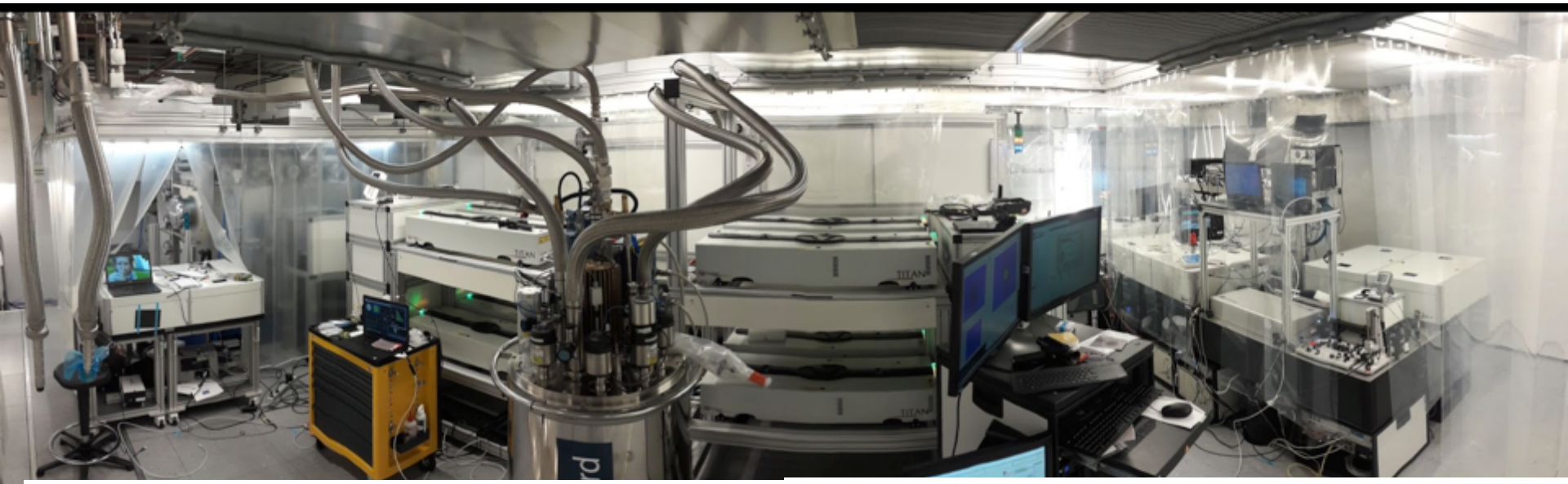


- 260 MHz laser link to be installed March/ X2 timing dai
- opto-mechanical assembly started in A23 laser bay:
- **progress**

Status in the Lab



Status in the Lab



- between June 15th-1st October:
  - front end recommissioned
  - all pump lasers rechecked
  - pump laser training received
  - TWIN aligned with CW
- LN2 unavailability break until Dec.

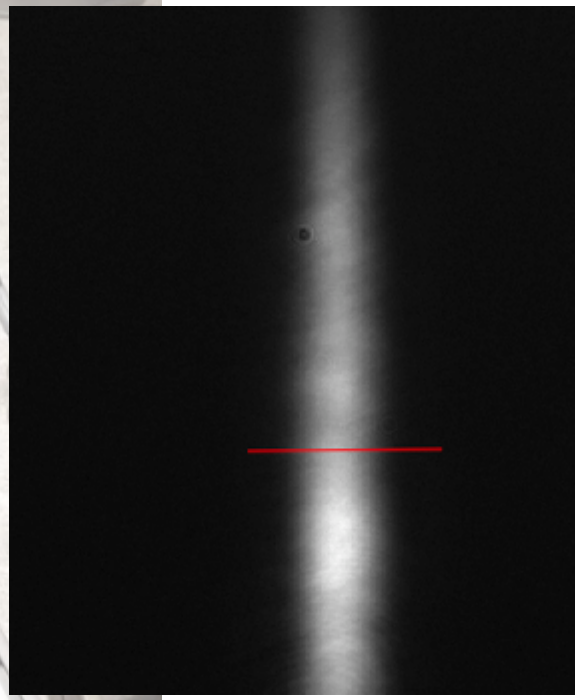
- From Dec 1st -NOW
  - TWIN commissioned
  - Emax and Enominal validated
  - energy and pointing stability/drift validated
  - main compressor setup ongoing
- Final OSAT 15 Feb 2019

WP 3.2 Beam transport

- Installation ongoing
  - SK1 vacuum commissioned
  - tube to laser shutter vacuum commissioned
  - ready for radiation interlock connection
  - rad. collars ready

WP 3.3 Diagnostics

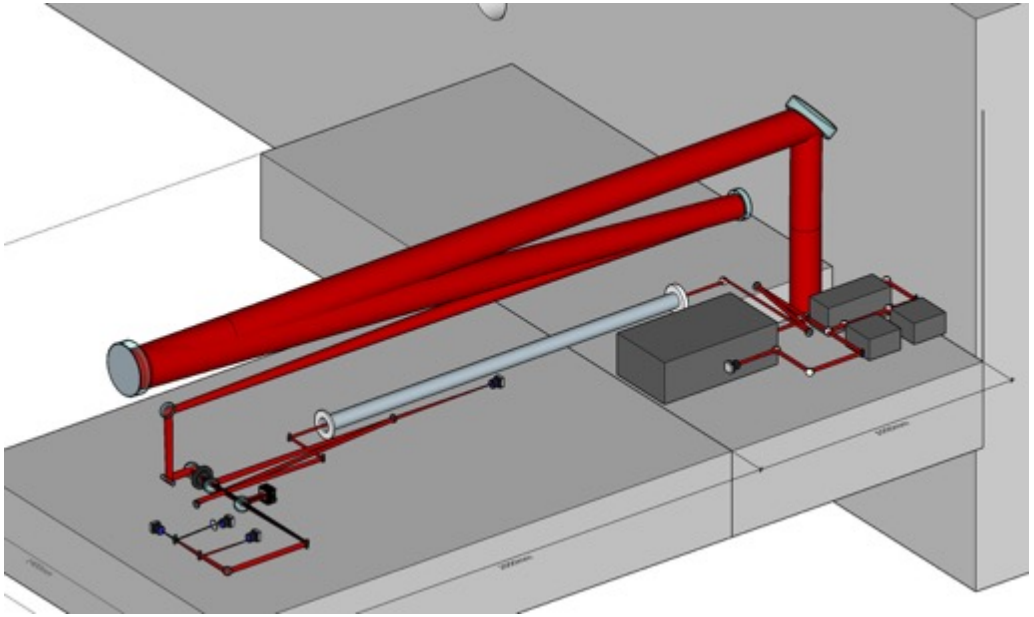
- home made spatial resolving AC commissioned
  - 22 fs pulses measured at oscillator
- Wizzler 800 measuring 21 fs at FE level
- CRDs for TW diagnostics and probe beam submitted
- mechanical design probe beam ongoing close to finish



Status of HI laser On Shot Diagnostic Package in HED exp. hutch

Equipment status: 85%

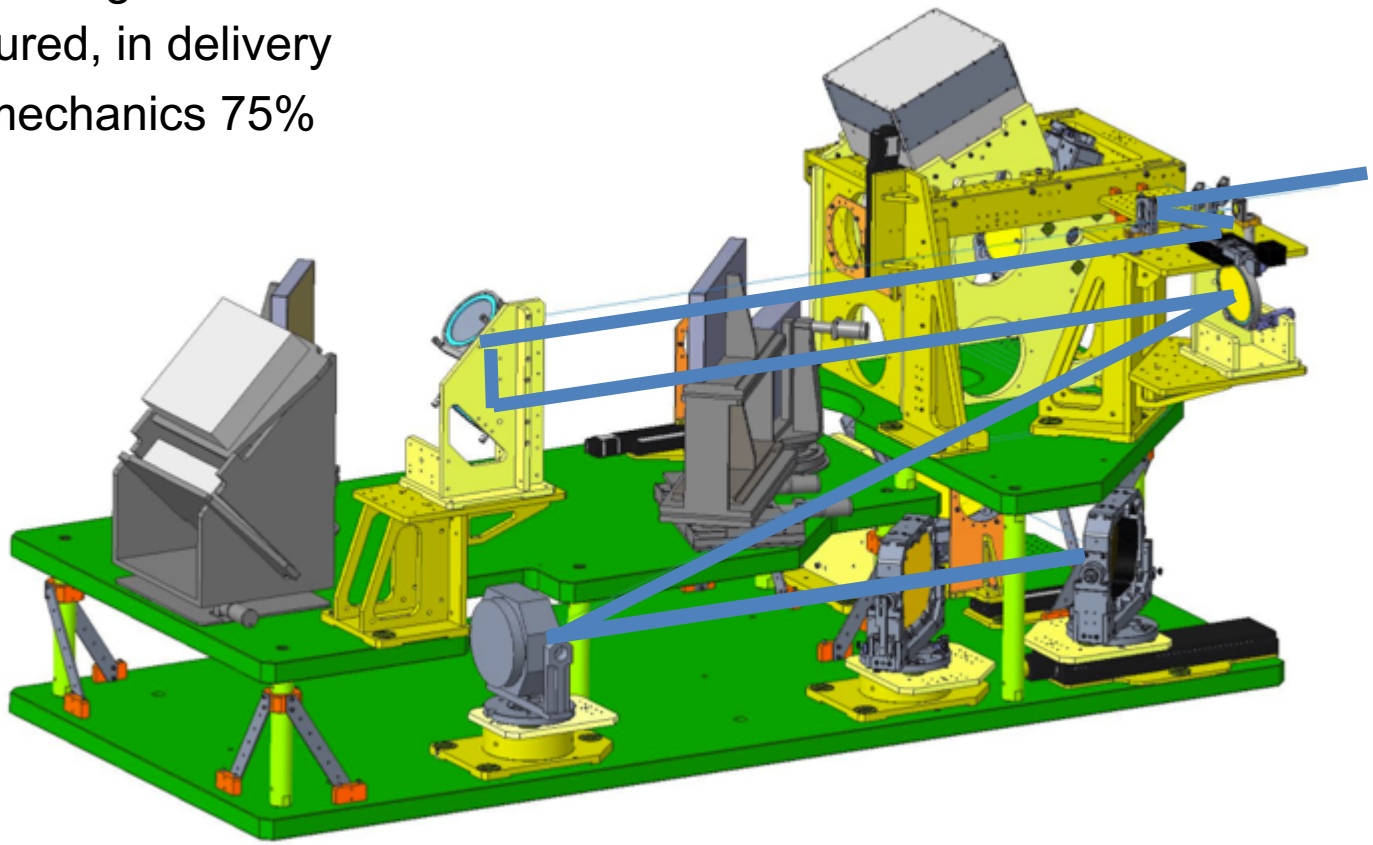
- ▶ Optics:
  - On table ✓
  - Connection SK3 ✓
  & diagnostic table ✗
- ▶ Optomechanics
  - On table ✓
  - Connection SK3 & diagnostic table ✗
- ▶ Vacuum vessel for focus ✓
- ▶ Diagnostics:
  - Wizzler ✓
  - Wavefront sensor ✓
  - Sequioia ✓
  - AC & IFAC ✓
  - NF & FF ✓
  - Darkfield ✓
  - Spectrometer ✓
  - Powermeter ✓



installation is starting in shortly

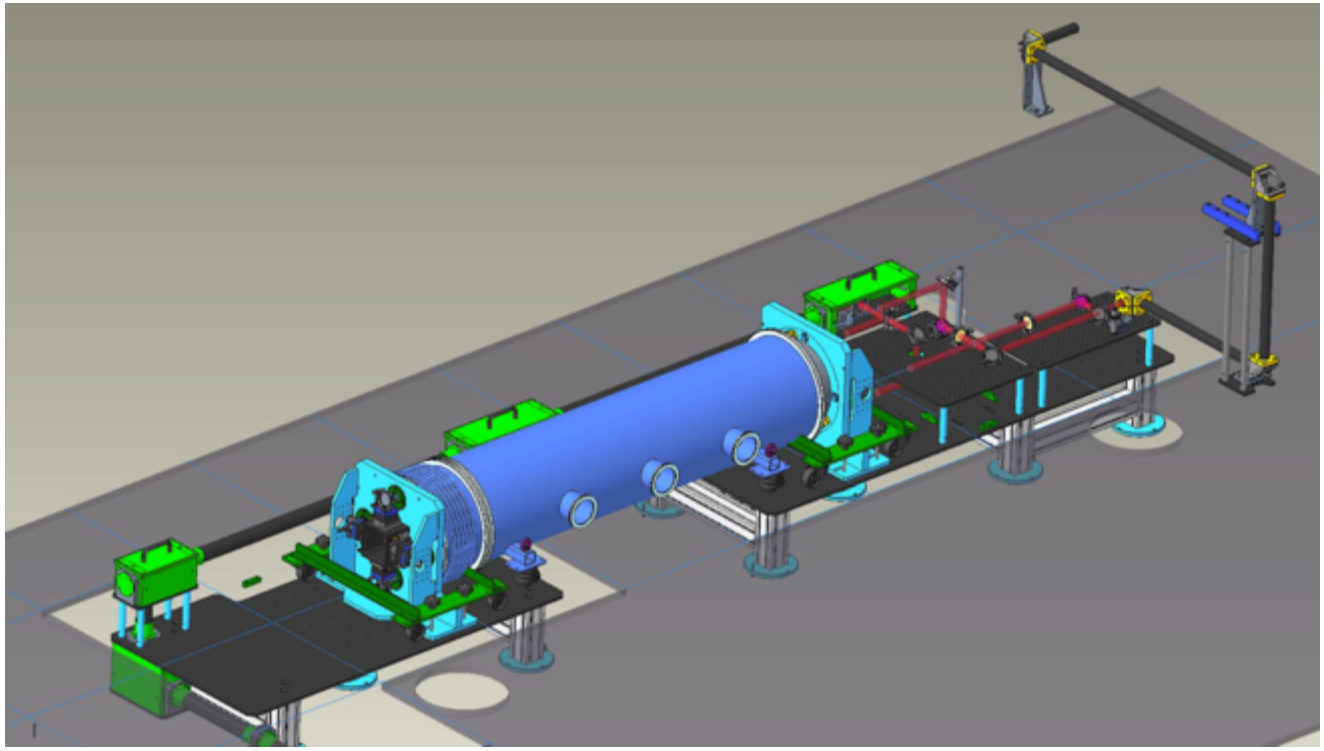
Status of HI laser On Shot Diagnostic Package in laser bay

- machanical design 90 %
- optics procured, in delivery
- other optomechanics 75%



WP 3.11 Probe beam development status

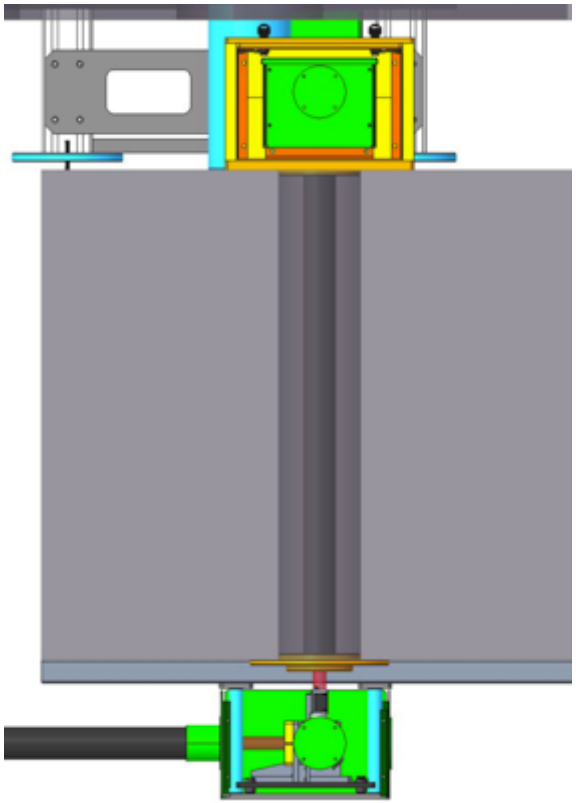
- Amp2 to A12 setup



optics and mechanics in manufacture / delivery due May

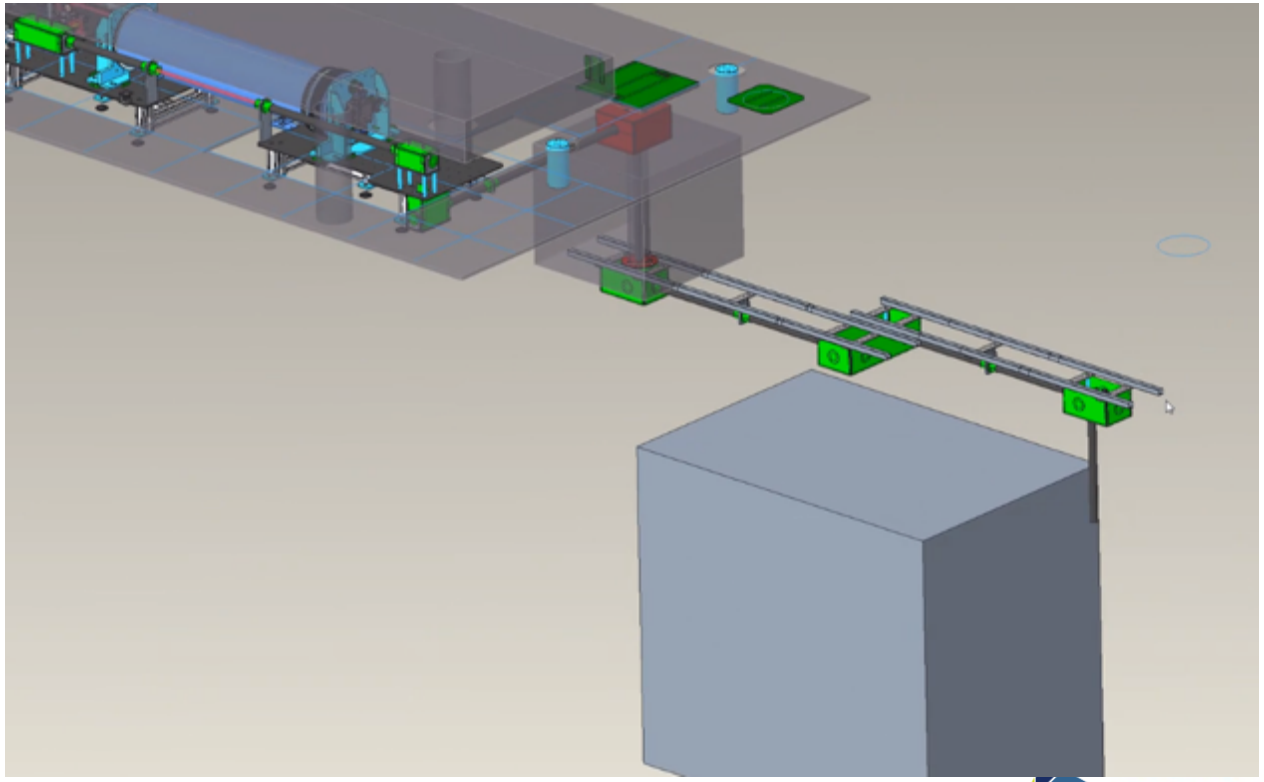
Probe beam development

- rad. safety mini-bunker in A23
  - installation Feb 2019



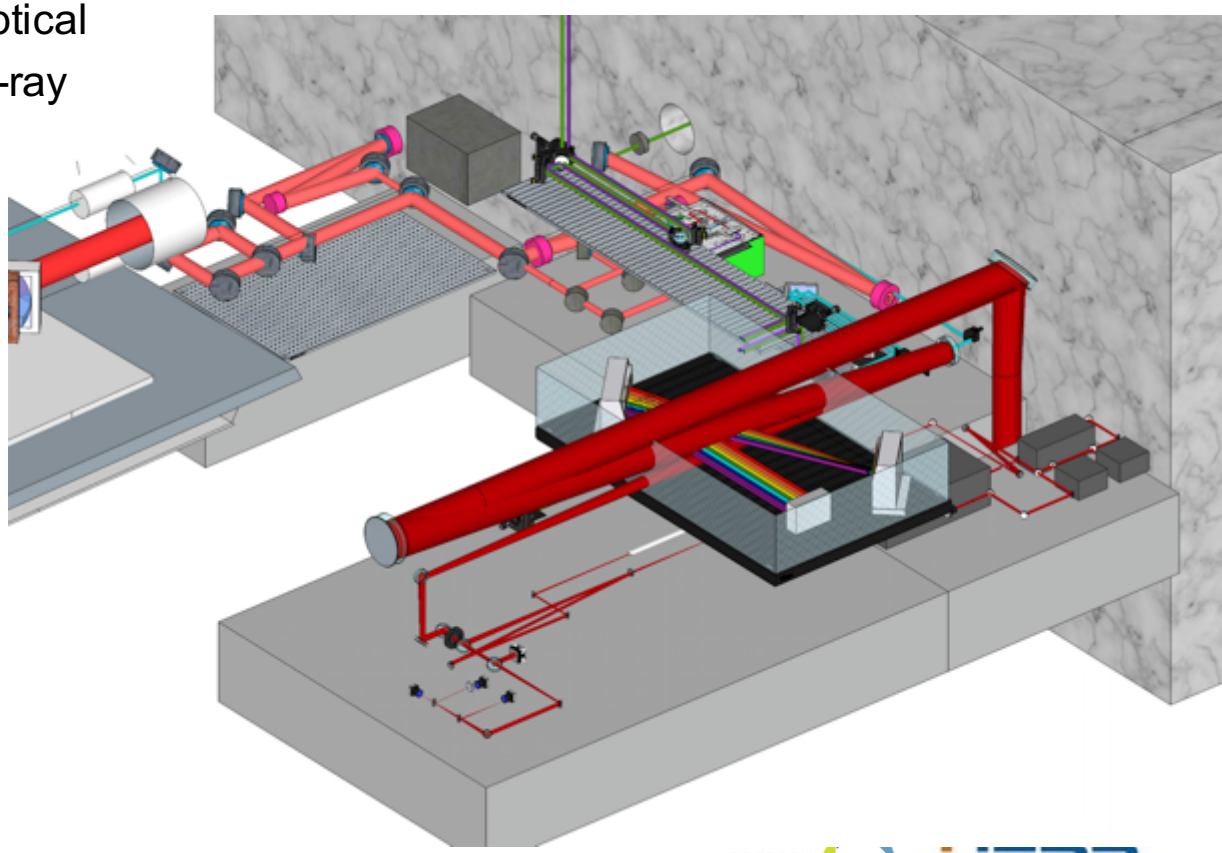
Probe beam development

- Probe beam transport in A12
  - construction defense Feb 5
  - installation will follow.



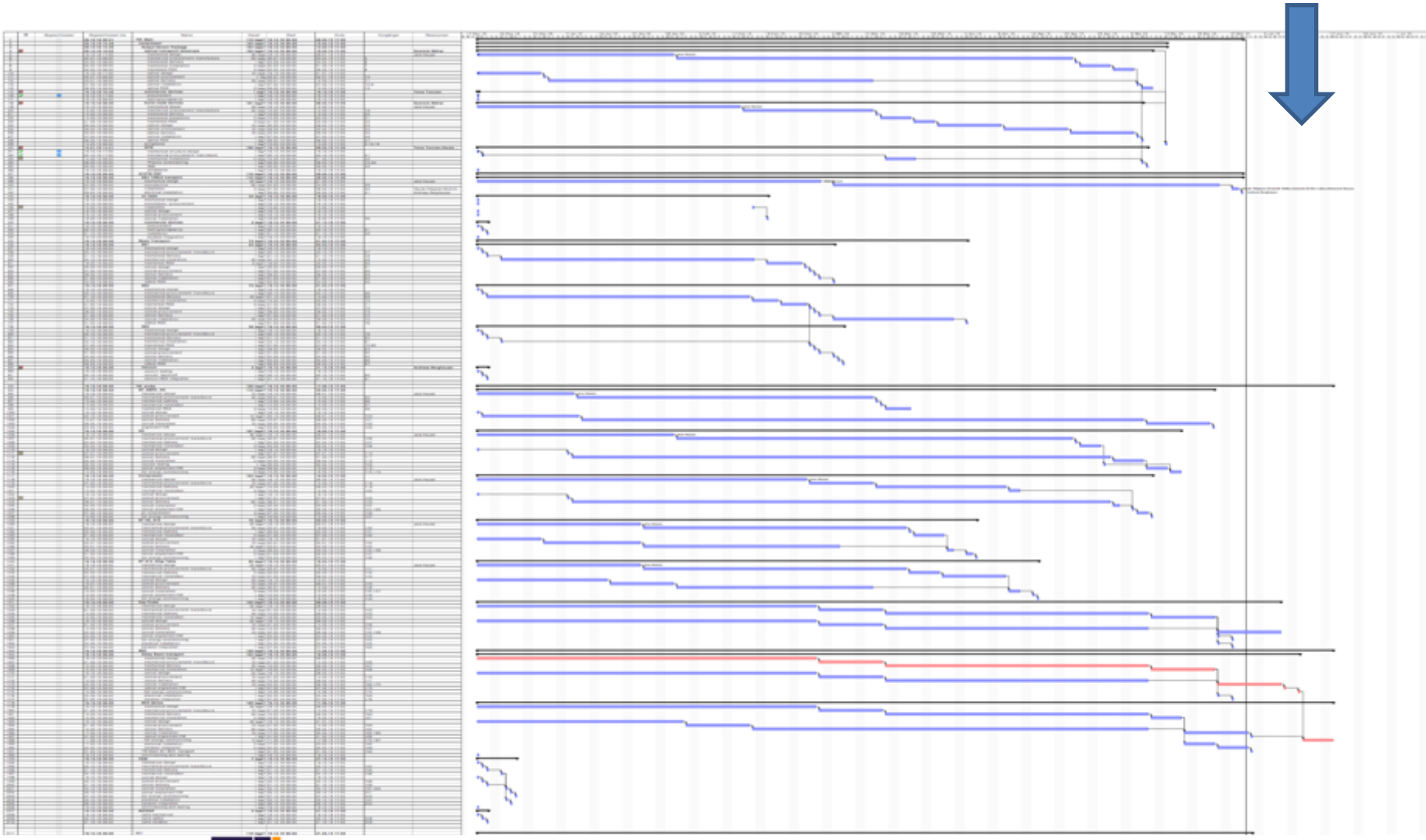
Probe beam developments

- 3 delay lines
  - experimental probe
  - timing probe optical-optical
  - timing probe optical- x-ray



The Plan….

June



Commissioning road map

OSAT → Feb 2019

Milestones

- *beam transport*
- *IC1 setup*
- *timing tools*

internal commissioning tests → Summer 2019

- *benchmark experiment*
- *x-ray timing success*
- *EMP tests*

first user availability → call Nov 2019

first day experiments community workshop Sep/Oct 2019

HiBEF European XFEL HED High-Energy Density science DRESDEN concept HZDR

WP 3 Status

Status Workpackages			prercent of readiness							Date: 06.09.2017	
Projekt HIBEF			5	10	20	50	80	90	100		
Project title	**WP Number**	**work package description**	work package description	concept	design	purchasing	assembling/installation	commisioning	in operation	**remarks**	**readiness [%]**
WP 3 HI Intensity Laser											
	WP 3.1	Laser **U.Schramm / T.Toncian**	✓	✓	✓	✓	✓	✓			90%
	WP 3.2	Beam transport **T.Toncian**	✓	✓	✓	✓	✓			please refer to WP 9.1	80%
	WP 3.3	Beam & Puls diagnostic **T.Toncian**	?	✓	✓	✓					50%
	WP 3.4	Timing tool **T.Toncian**	?	✓	✓	✓					30%
	WP 3.5	Eqipment **T.Toncian**	?	✓	✓	✓	✓	✓			90%
	WP 3.6	Laser Interlock **T.Toncian**	?	✓	✓	✓	✓			execution transfered to XFEL SRP	80%

HiBEF –Staff @ XFEL and HZDR

- Toma Toncian
  FWKX Group head
  Laser and Plasma Scientist

- Hauke Höppner
  Laser Scientist
  HI and HE

- Monika Toncian
  Laser Engineer
  HI and HE Laser

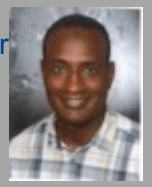
- Andreas Berghäuser
  M&E Engineer
  Infrastructure & Instrumentation

- Samuele Di Dio Cafiso
  Laser Engineer
  HI and HE Laser

- Carsten Bähtz
  Project Coordinator
  HiBEF

- Alexander Pelka
  Laser and Beamline Scientist

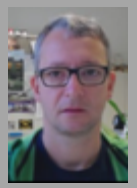
- Dominik Möller
  Laser Engineer
  HI and HE Laser



- Mohamed Hassan
  Laser Engineer
  HI and HE Laser

- Klaus Knöfel
  Project Manager (Dresden)
  Controlling, procurement …

- Wolfgang Seidel
  Scientific engineering
  - J. Dreyer (Control Systems)
  - Fabian Donath, Frank, Albinus, mechanical and electrical engineering
  - Jens Hauser, Oliver Baehr
  Research technology HZDR



Many Thanks!

- **XFEL Laser Group**
  - **E. Brambrink and M. Lederer**
- **XFEL HED Group**
  - **A. Schmidt, I. Thorpe,**
  - **M. Nakatsutsumi and U. Zastrau**