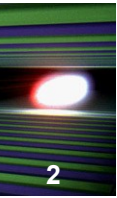


# Status European XFEL .

Winni Decking (DESY)

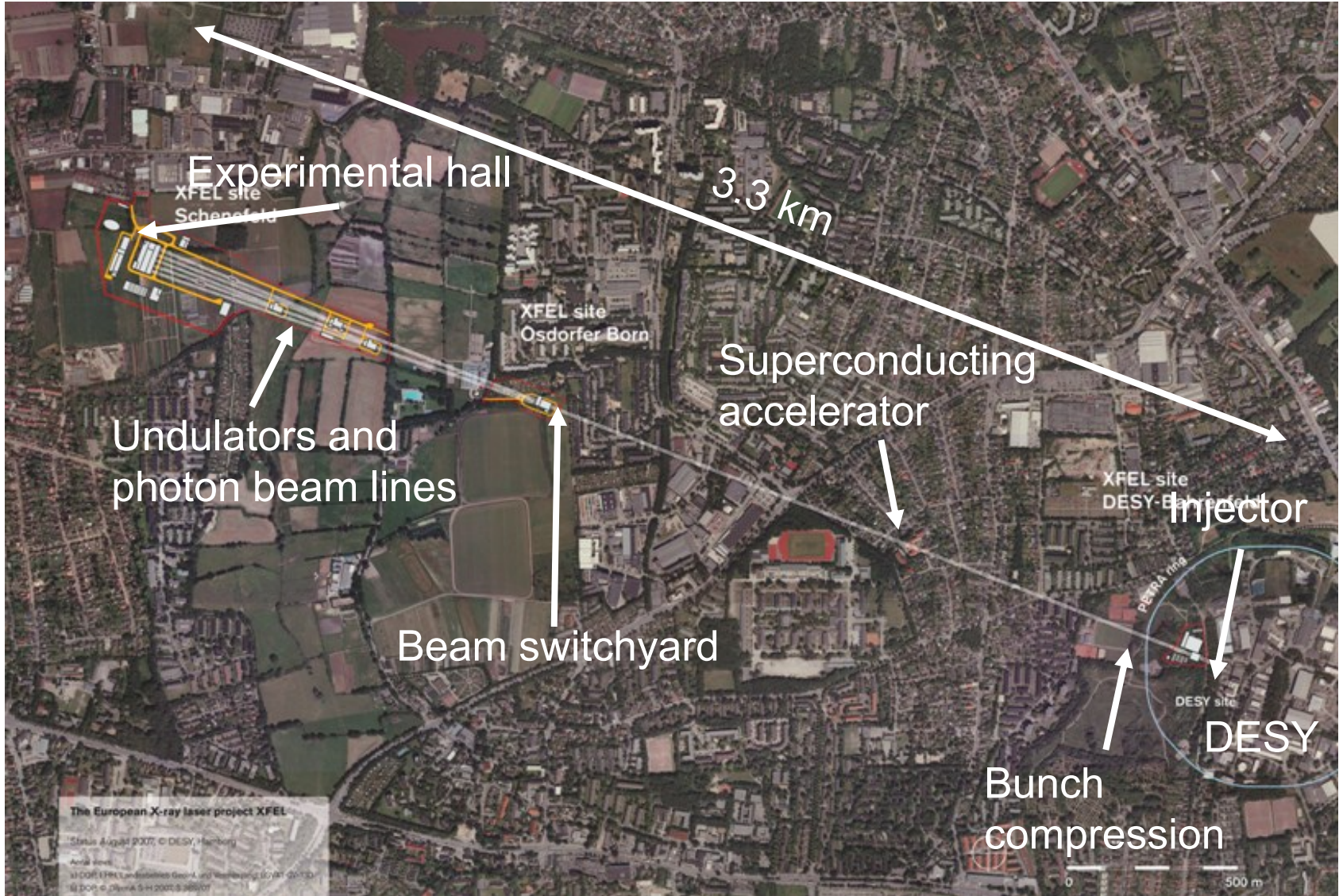
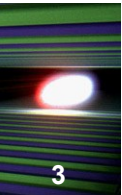
Grömitz, 26.09.2011

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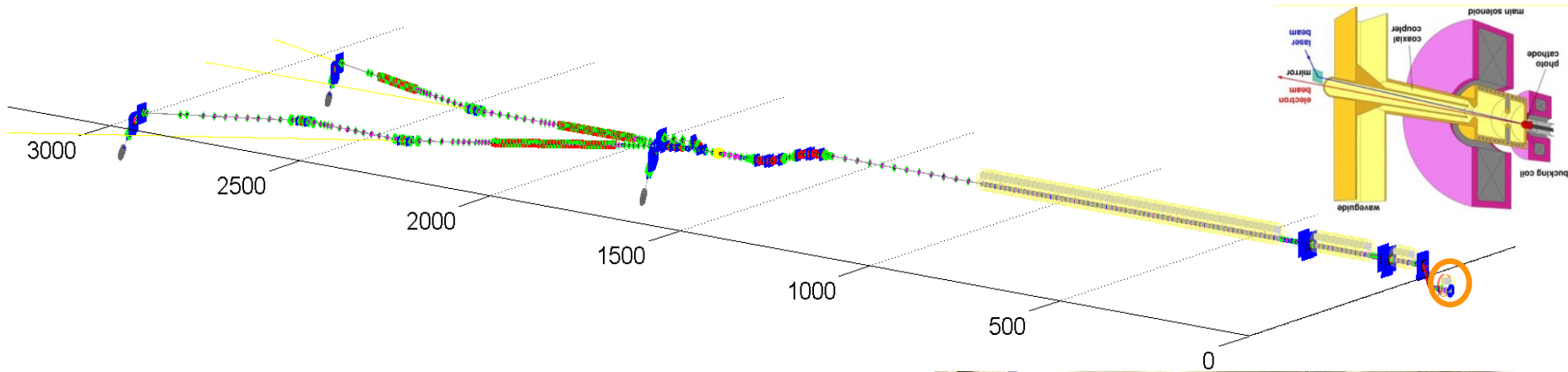
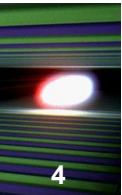


- Projekt Überblick
- Status Bau
- Organisatorisches
- Zeitplan

# European XFEL in Hamburg



# European XFEL - Injector



- Normal-conducting 1.3 GHz RF photo injector
- CsTe Cathode
- 4.5 MHz, 10 Hz Laser @ 260/1030 nm
- $\epsilon_n < 1\mu\text{m}$  at 1 nC
- Performance demonstrated at FLASH and PITZ

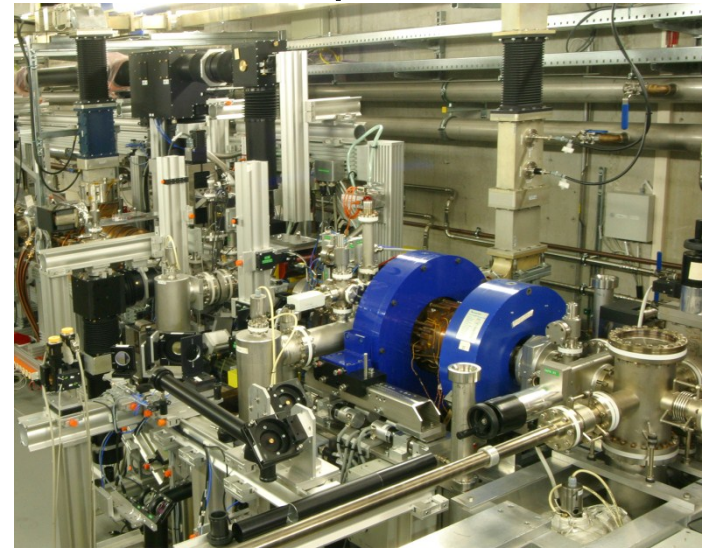
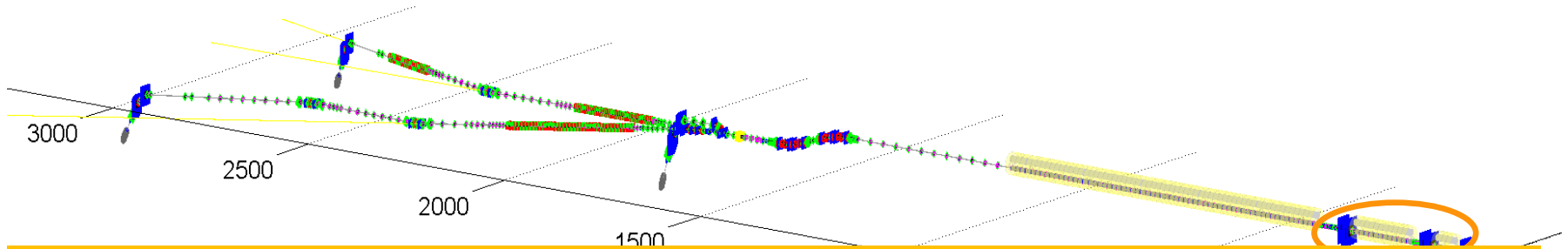
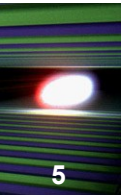
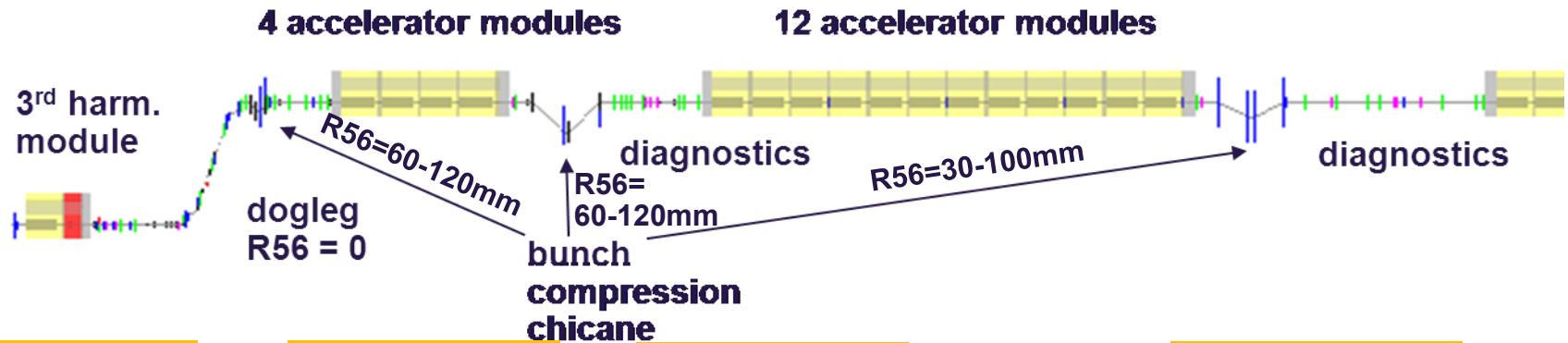


Photo Injector @ DESY Zeuthen

# European XFEL – Bunch Compression



3 stage bunch compression allows for wide range of compression scenarios while minimizing sensitivities to RF-regulation imperfections and electron beam driven instabilities

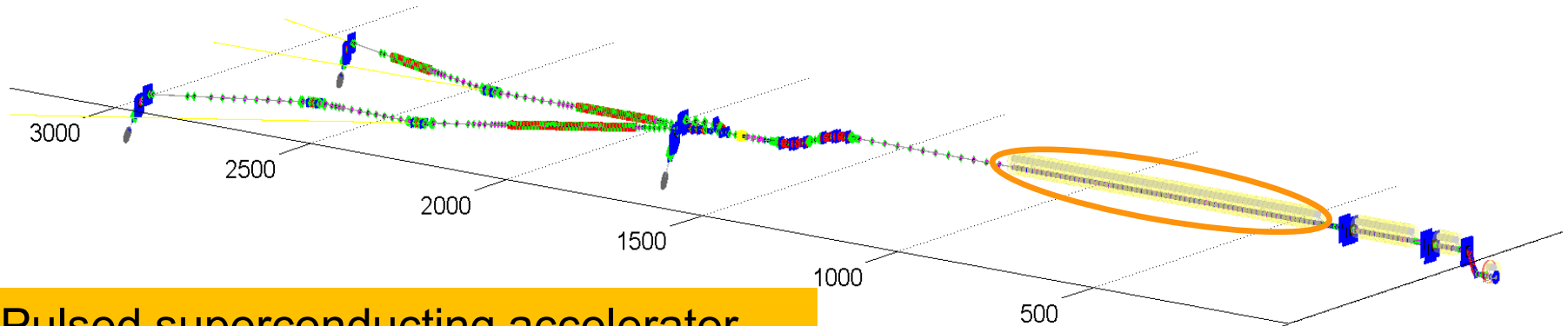


$\sigma_{\sigma} = 2 \text{ mm}$   
 $I_{\text{peak}} = 50 \text{ A}$   
 $\sigma_E = 0 \%$   
 $E = 130 \text{ MeV}$

$\sigma_{\sigma} = 1 \text{ mm}$   
 $I_{\text{peak}} = 100 \text{ A}$   
 $\sigma_E = 1.5 \%$   
 $E = 130 \text{ MeV}$

$\sigma_{\sigma} = 0.1 \text{ mm}$   
 $I_{\text{peak}} = 1 \text{ kA}$   
 $\sigma_E = 1 \%$   
 $E = 500 \text{ MeV}$

$\sigma_{\sigma} = 0.02 \text{ mm}$   
 $I_{\text{peak}} = 5 \text{ kA}$   
 $\sigma_E = 0.3 \%$   
 $E = 2000 \text{ MeV}$



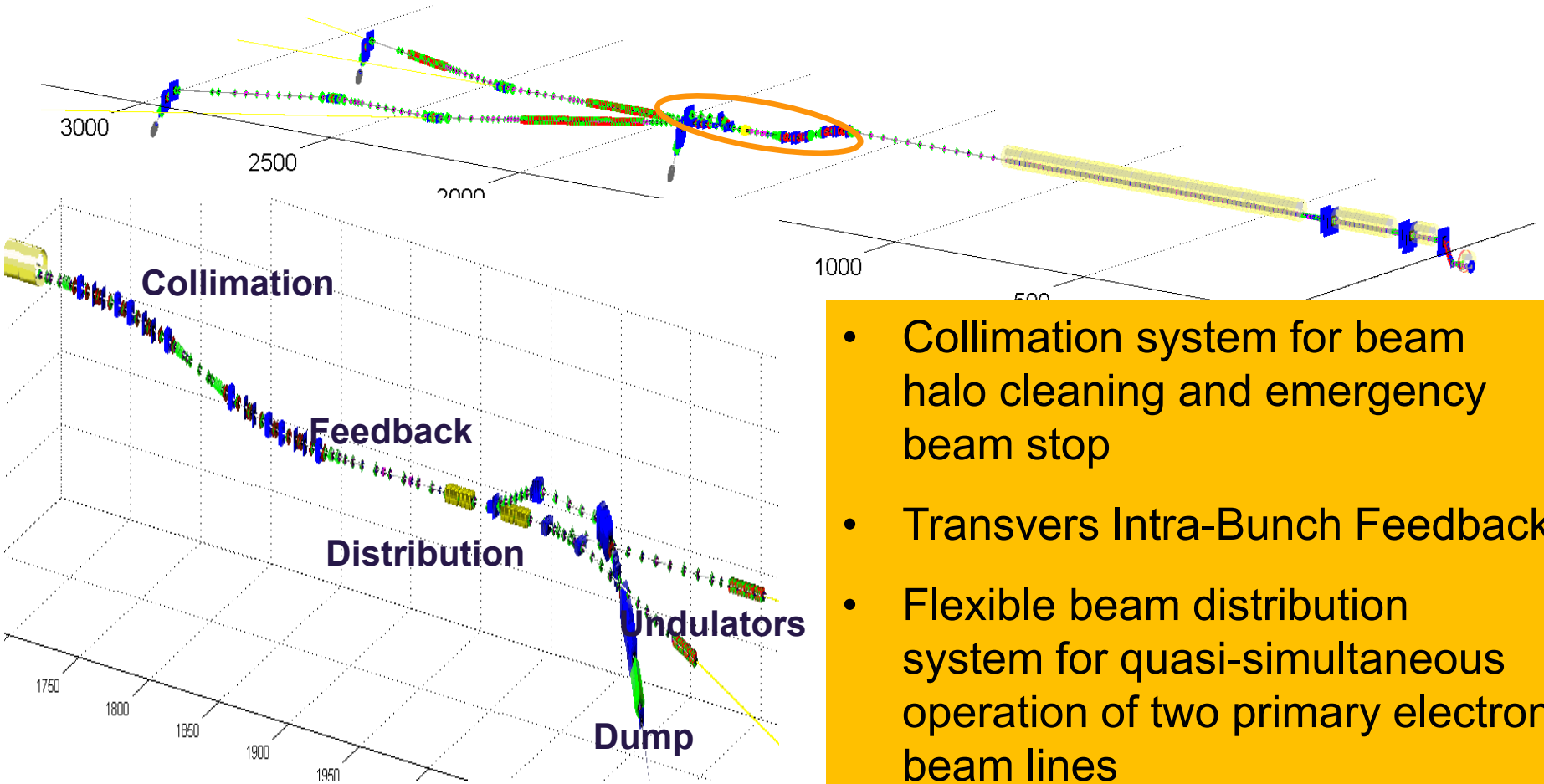
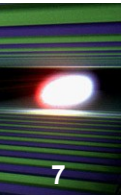
### Pulsed superconducting accelerator

- 100 TESLA type modules
- 25 10 MW RF stations
- 600  $\mu$ s flat top pulse width
- Up to 30 Hz repetition rate
- 23.6 MV/m average accelerating gradient
- 17.5 GeV final energy



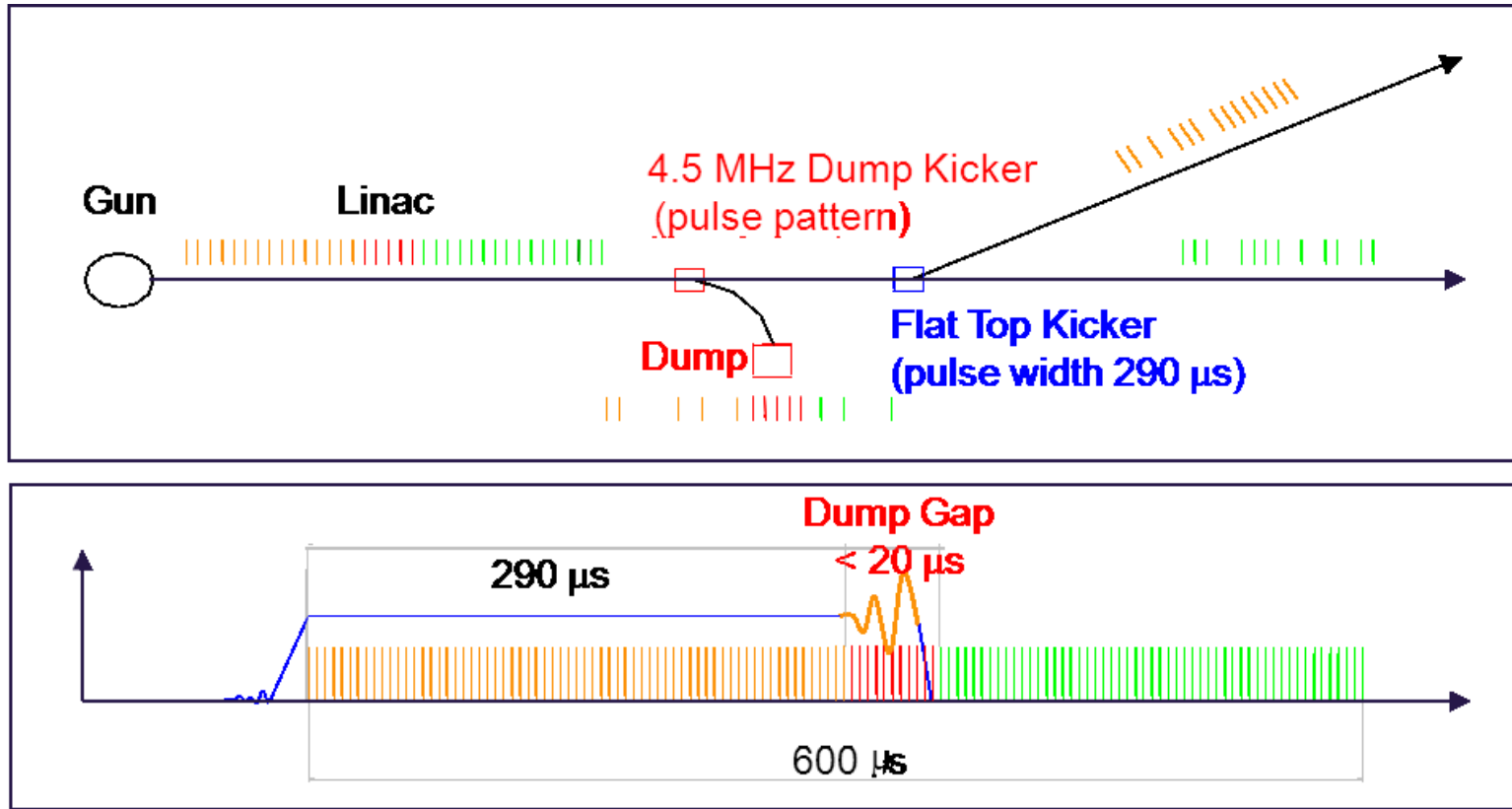
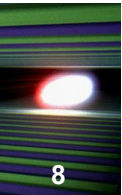
First XFEL prototype module  
(now installed in FLASH)

# European XFEL – Collimation & Beam Distribution

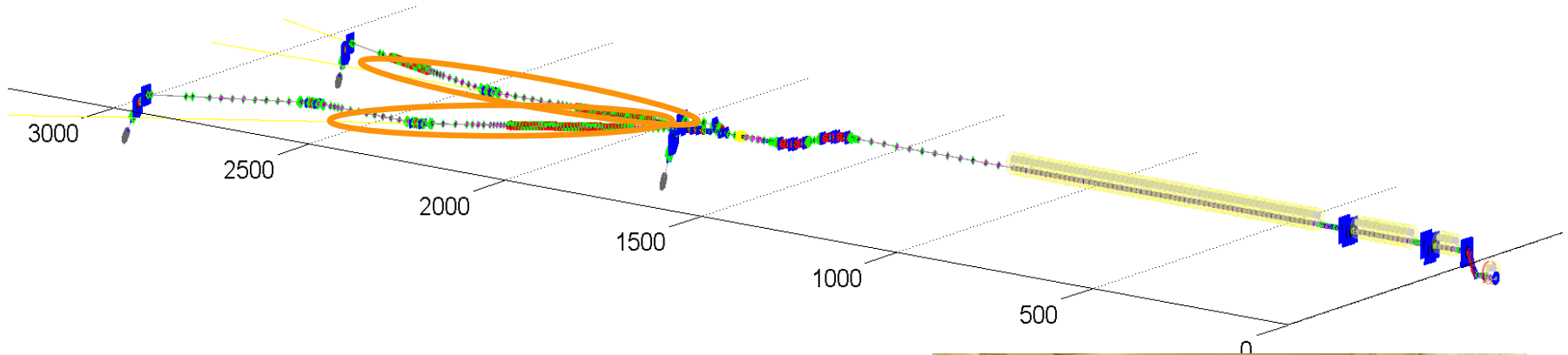


- Collimation system for beam halo cleaning and emergency beam stop
- Transvers Intra-Bunch Feedback
- Flexible beam distribution system for quasi-simultaneous operation of two primary electron beam lines

# European XFEL – Collimation & Beam Distribution





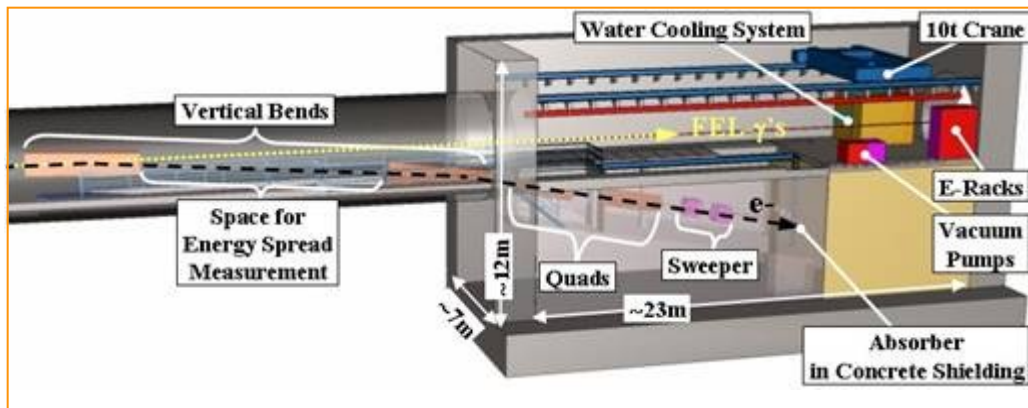
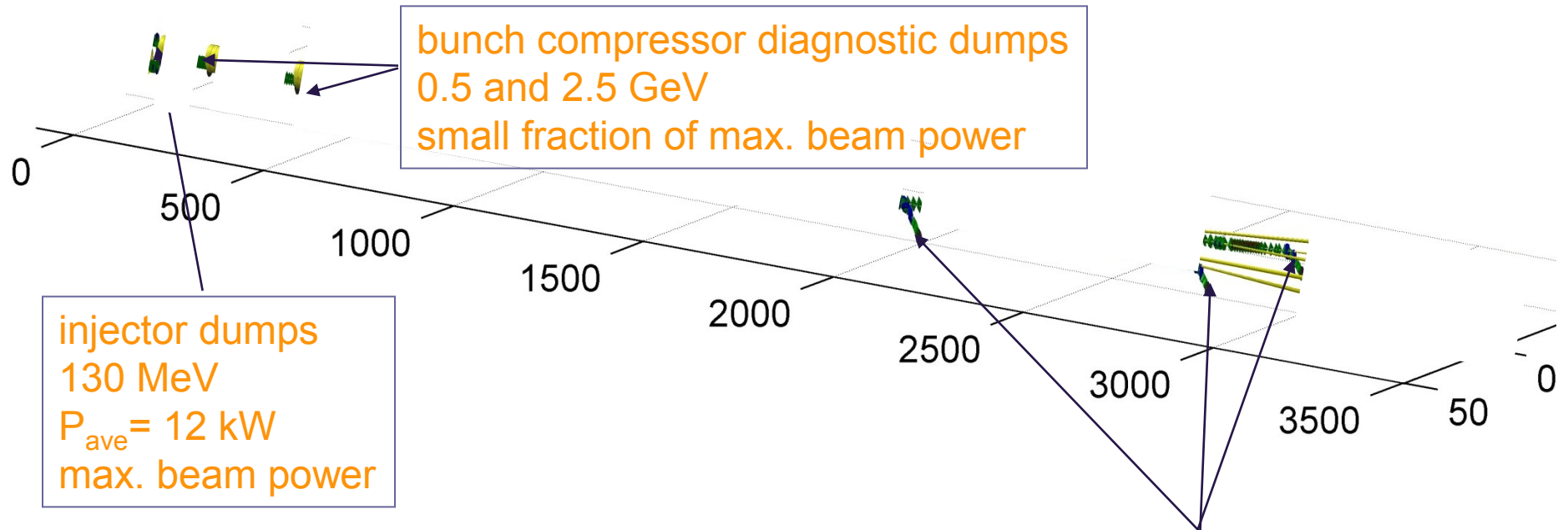
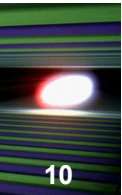


- Five long undulator(-tunnel)s ensure saturation at  $<1 \text{ \AA}$  and leave room for more options and improvements
- Available straight section length 1500 m
- Initial total undulator length 455 m
- Out of vacuum, moveable gap ( $g_{\min} = 10 \text{ mm}$ ) permanent magnet undulators with 40 resp. 68 mm period length

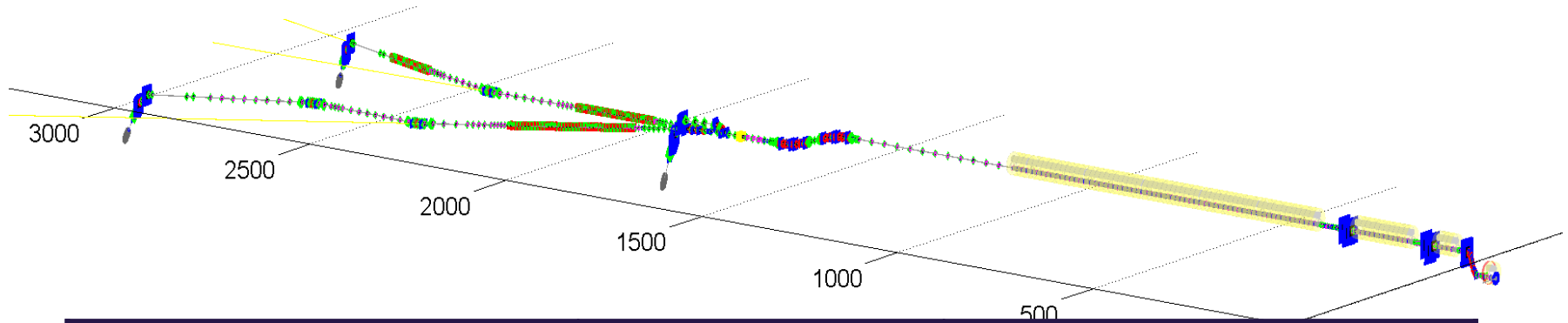


PETRA III undulator (XFEL prototype) in undulator measurement lab

# Beam Dumps

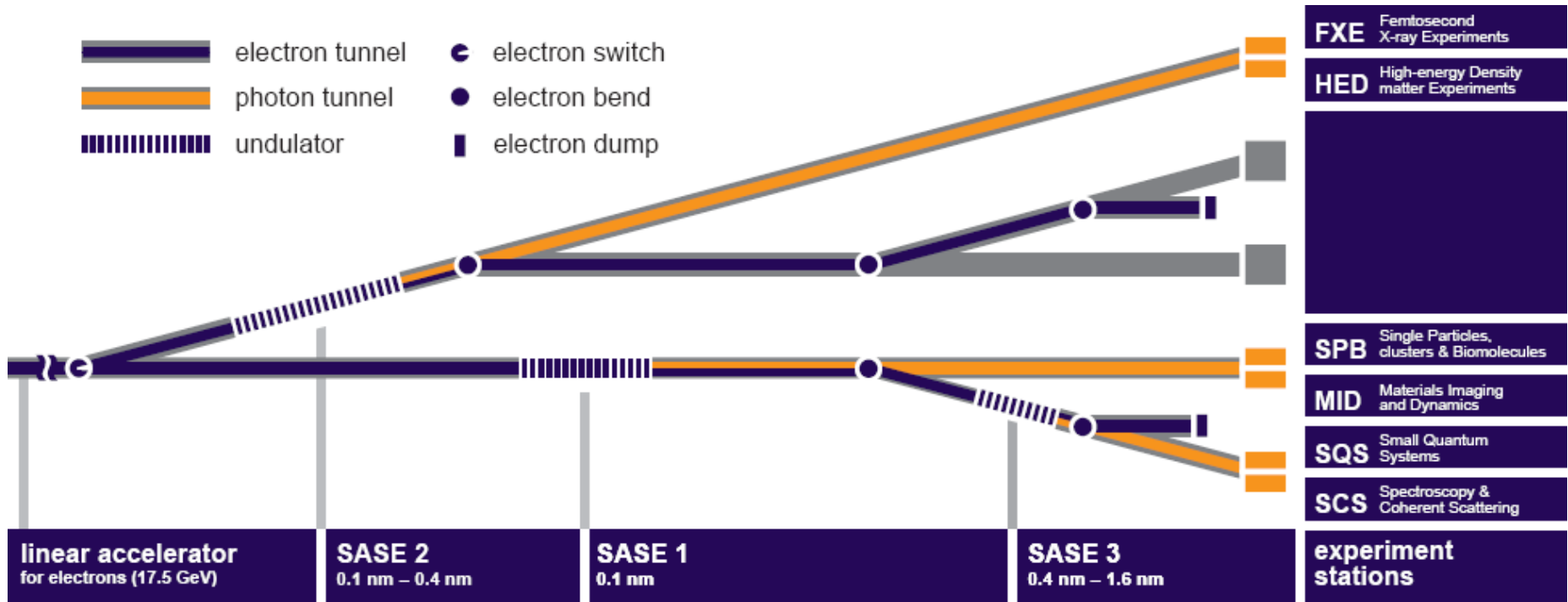
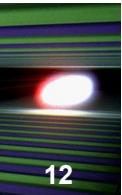


main beam dumps  
up to 25 GeV  
 $P_{ave} = 300 \text{ kW}$   
1/2 max beam power  
beam magnified  
slow sweep to distribute heat

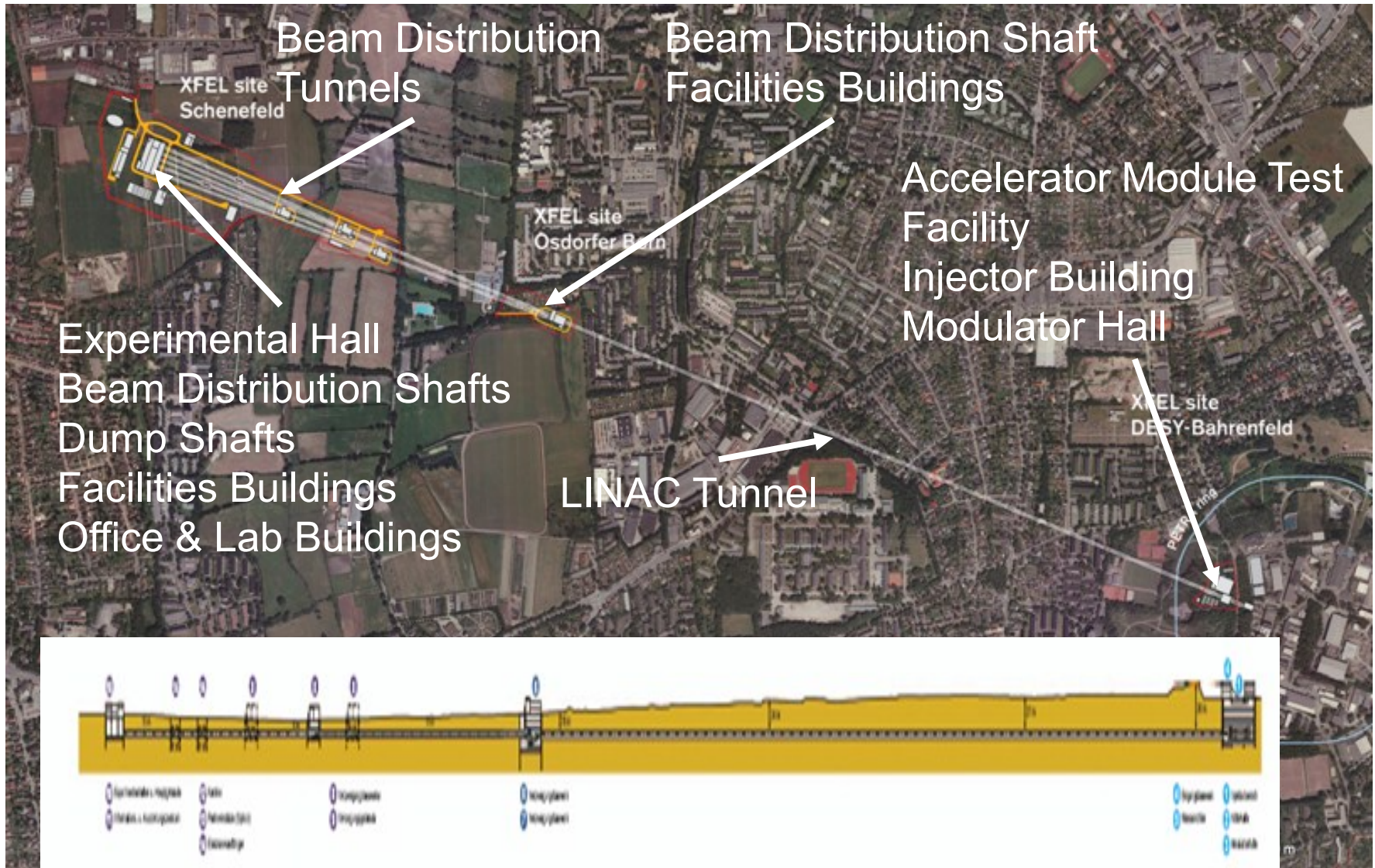
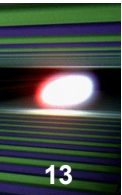


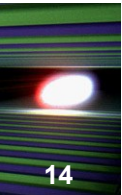
	Baseline	New Parameter Set
Electron Energy	17.5 GeV	10.5/14/17.5 GeV
Bunch charge	1 nC	0.02 - 1 nC
Peak current	5 kA	5 kA
Slice emittance	< 1.4 mm mrad	0.4 - 1.0 mm mrad
Slice energy spread	1.5 MeV	4 - 2 MeV
Shortest SASE wavelength	0.1 nm	0.05 nm
Pulse repetition rate	10 Hz	10 Hz
Bunches per pulse	3000	2700

# Photon Systems: Beam Lines & Experiments

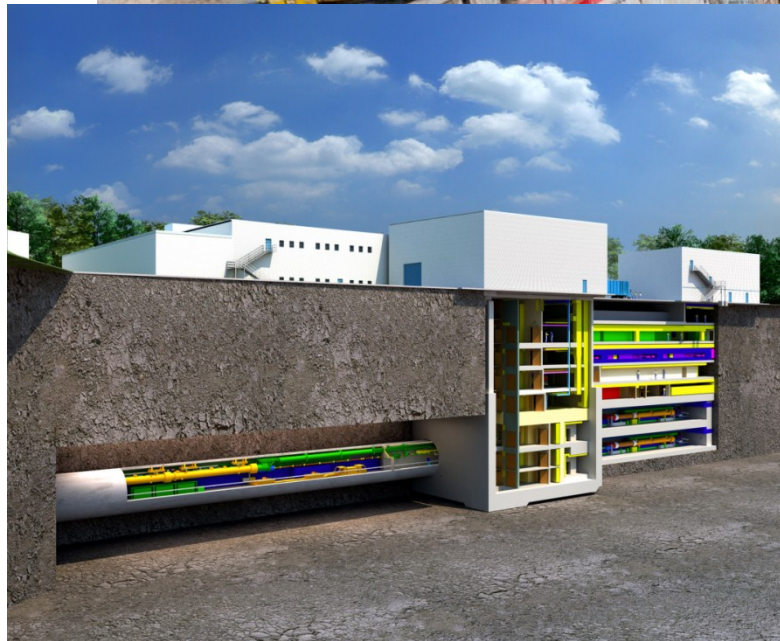


- 6 experiments fed from 3 SASE undulators in the start-up version
- Up to 15 experiments from 5 (SASE) undulators foreseen





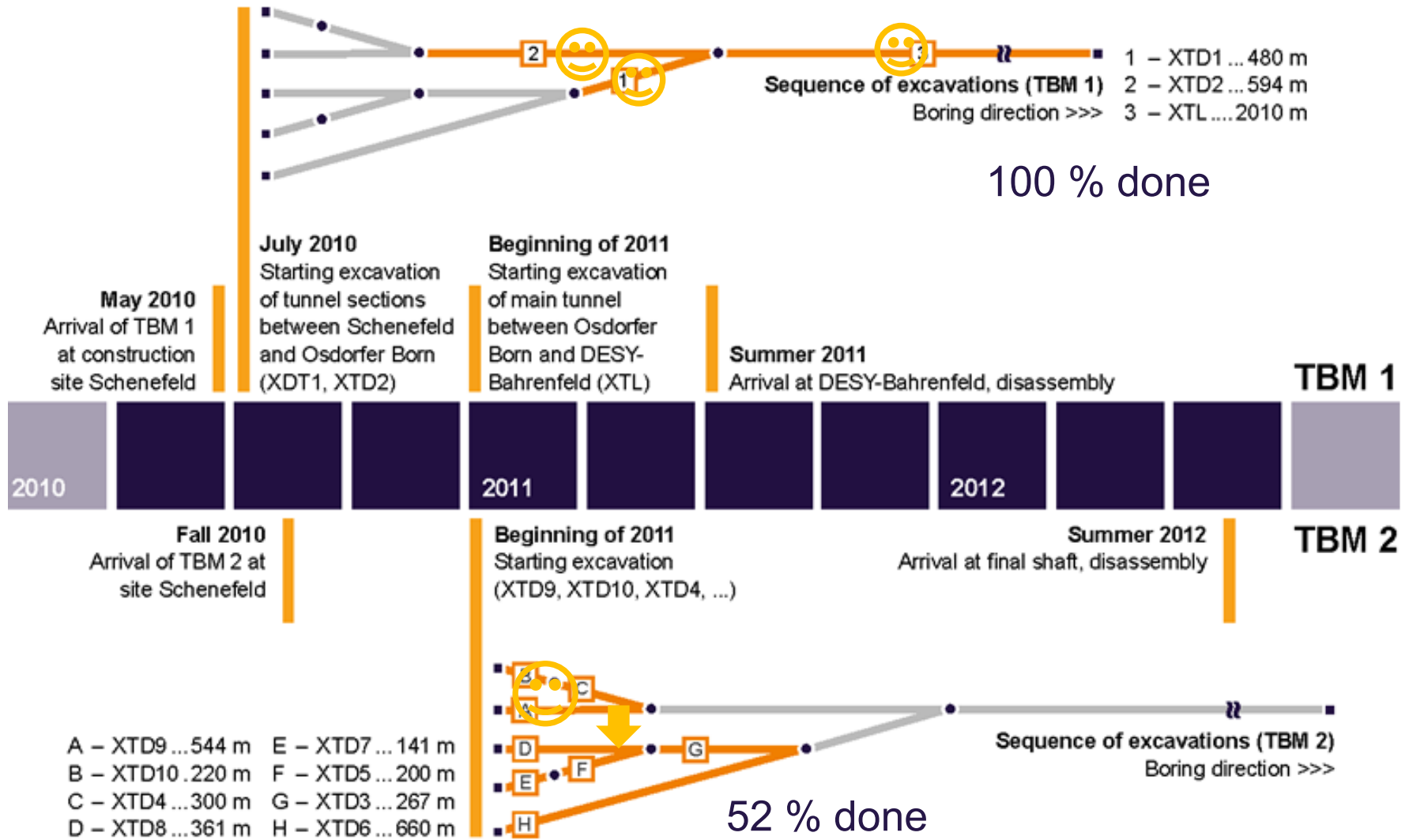
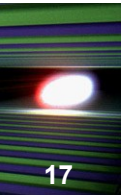
# Injector Building – An Underground High Rise





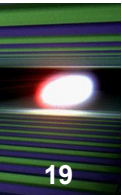


# 6 km of tunnel construction





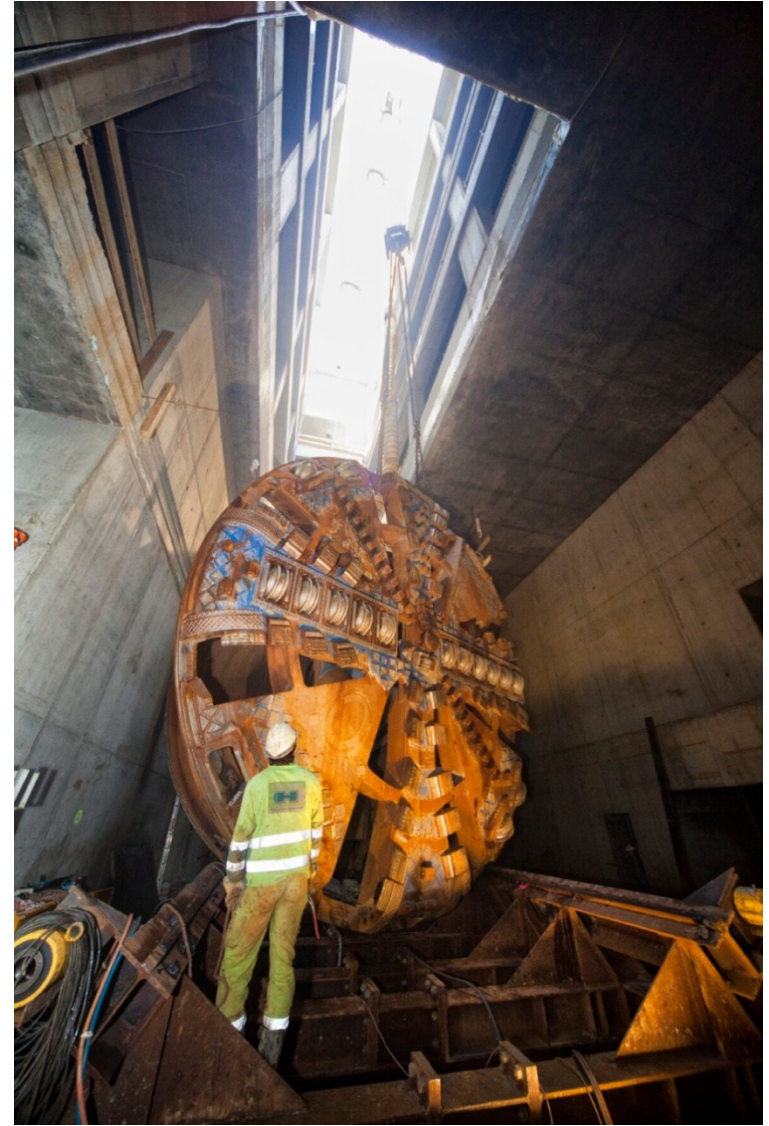
# First Tunnel Ready – October 2010



# August 2011 – ‘TULA’ Schneidrad wird ausgebaut



# August 2011 – 'TULA' Schneidrad wird ausgebaut





## ■ RF system

klystrons, modulators, pulse transformers waveguide  
assembly & testing, overall coordination

## ■ LLRF complete system

## ■ Accelerator Cryomodules

Cold masses for Cryomodules (33 pieces)

## ■ Superconducting cavities

50% of cavities; 100% Nb/NbTi

## ■ Power couplers

coupler interlock

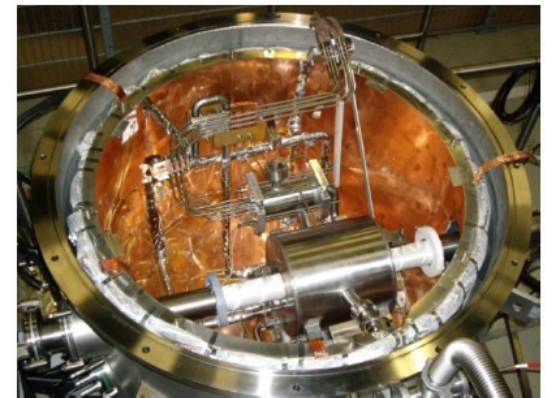
## ■ HOM couplers

overall coordination





- **Frequency Tuner**
- **Cold vacuum** (approx. 75%)
- **Cavity string assembly** (approx. 20%)
- **AMTF cryogenics** (approx. 60%)
- **Cold Magnets**
  - magnet testing & current leads
- **Warm Magnets**
  - overall coordination
- **Cryogenics for Linac** (approx. 2/3)
- **Injector**
  - overall coordination and approx. 80% of hardware





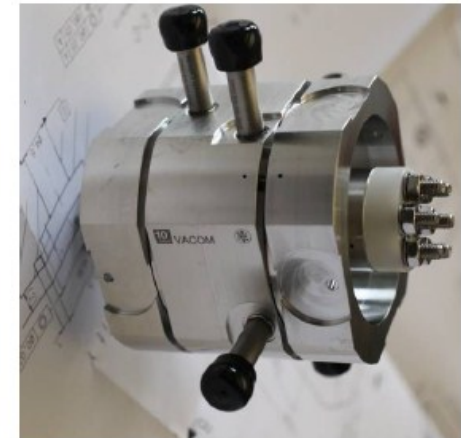
## ■ Bunch Compressor Lattice

Beam Optics Design & Beam Distribution Kickers

- BPM system (approx. 50%)
- Special Beam Diagnostics (approx. 75%)
- Warm vacuum (approx. 80%)
- Beam dumps (approx. 25%)
- FEL Concepts
- Control System
- Operability
- Survey / Alignment



magnet holder of undulator

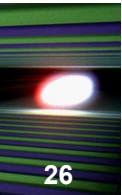






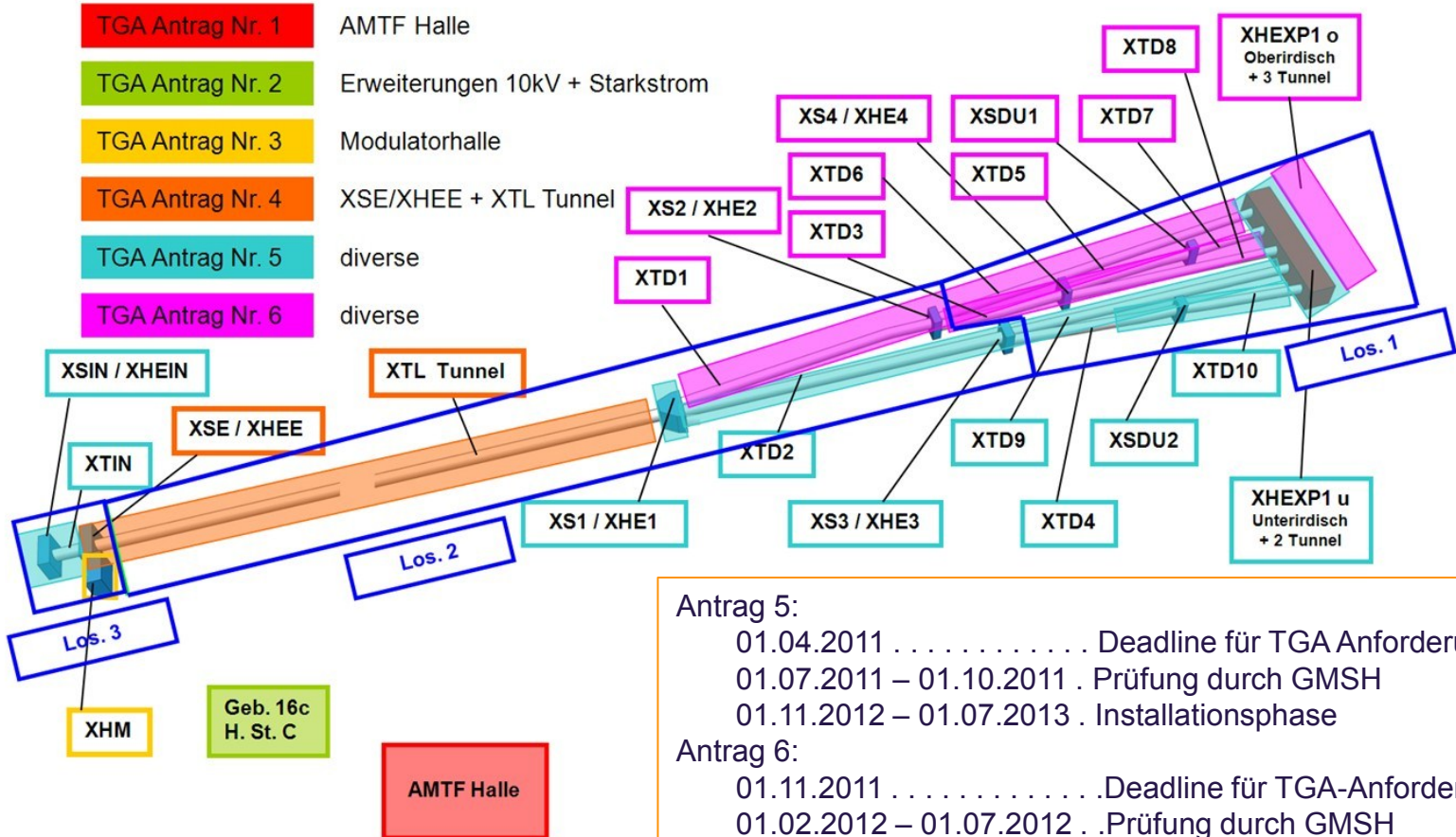
- Installation
- Utilities
- Radiation safety
- General safety
- Personnel interlock
- EMC
- Information & Process Support
- AMTF Hall
- 3.9 GHz system (approx. 2/3)





■ Technical Coordination, WP34 (MKK), WP36 (SAVE), IT, ...

TGA Anträge für GMSH XFEL





## European XFEL GmbH

Shareholders: Institution or Agencies from 11 European Countries

Council

Management Board

Entrusted the construction and operation of the European XFEL

Other In Kind Contributors

## Advisory Bodies:

SAC, MAC, AFC, IKRC, ACB

## Accelerator Consortium

Coordinator DESY

16 Institutes that construct the European XFEL accelerator by contributing in kind

Accelerator Consortium

Coordinator

## XFEL Construction Project Board

### Accelerator Consortium Coordinator

- Cold Linac Coordinator
- Machine Layout  
Coordination

### European XFEL GmbH Management

- Photon Systems Coordinator

- Technical Coordination
- Project Office

Accelerator  
Related Work  
Packages

Common Work  
Packages

Photon System  
Work Packages

## XFEL Project Management

### Accelerator Consortium Coordinator

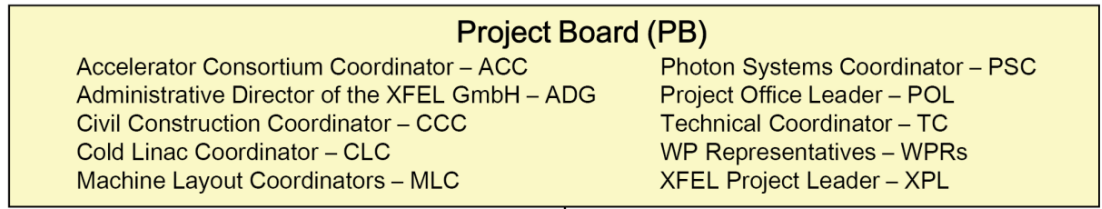
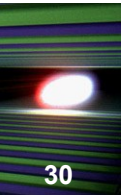
- Cold Linac Coordinator
- Machine Layout  
Coordination

- Technical Coordination
- Project Office

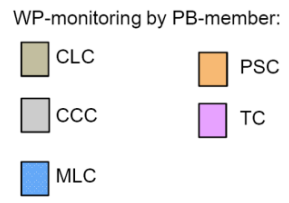
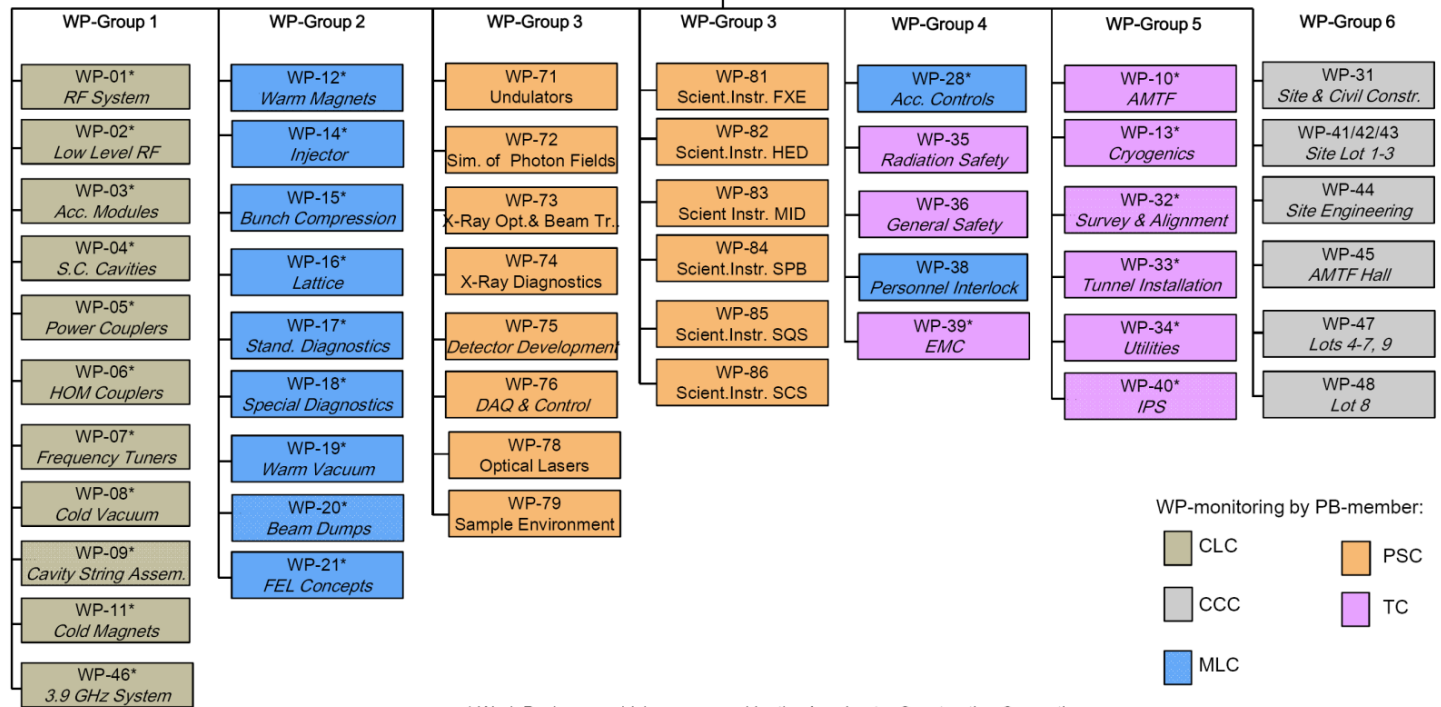
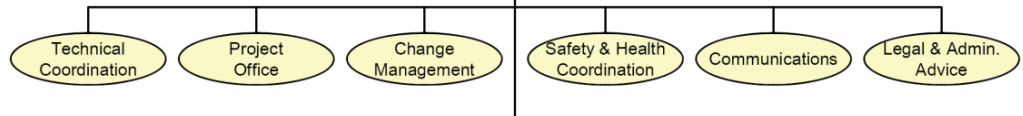
### Accelerator Related Work Packages

### Common Work Packages

# Organigram for the XFEL Construction Project

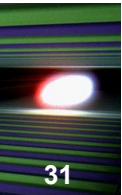


*Staff Functions*

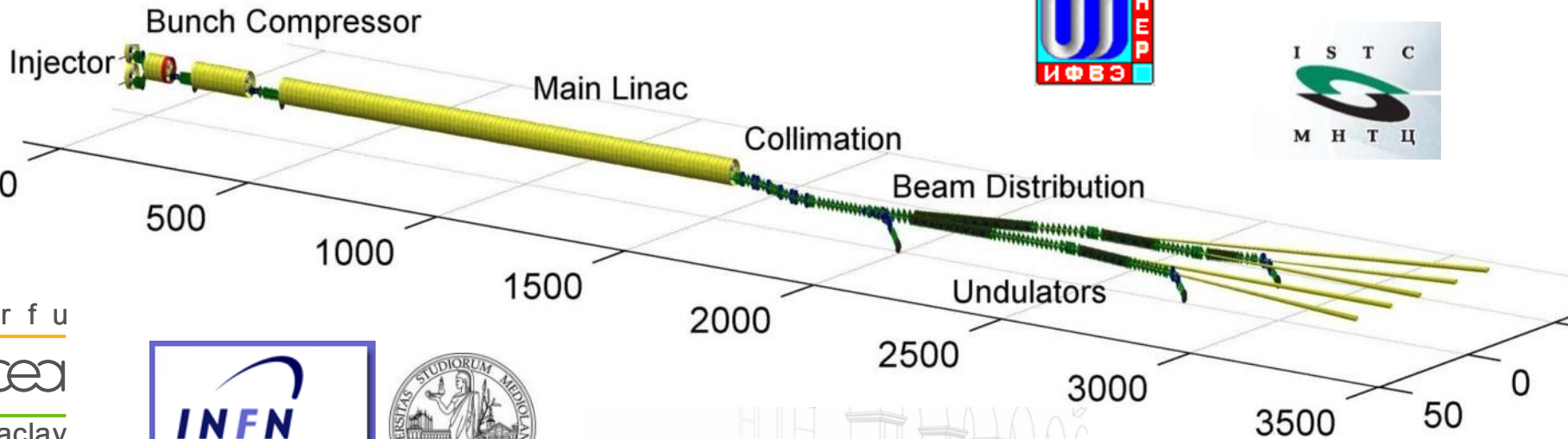
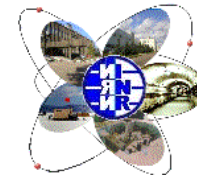


\* Work Packages, which are covered by the Accelerator Construction Consortium

# 16 Institutes Contributing to the accelerator



UPPSALA  
UNIVERSITET



irfu  
cea  
saclay



Wrocław University of Technology



PAUL SCHERRER INSTITUT  
**PSI**



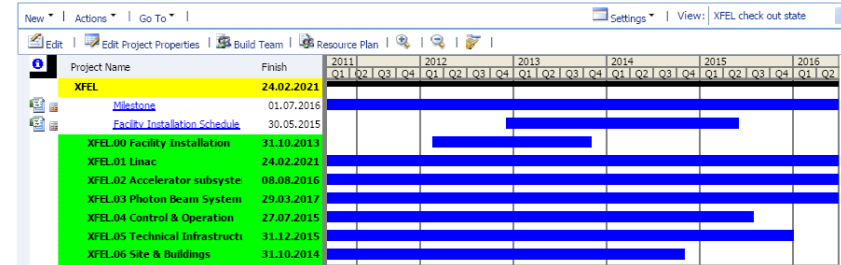
In2p3



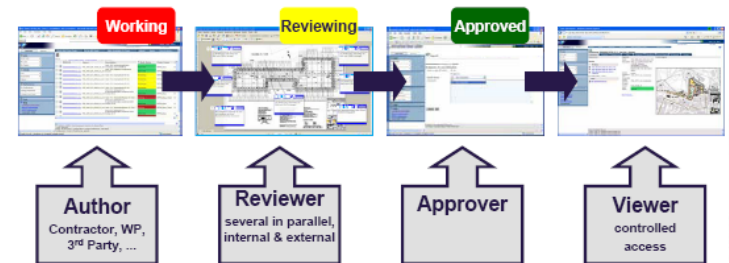
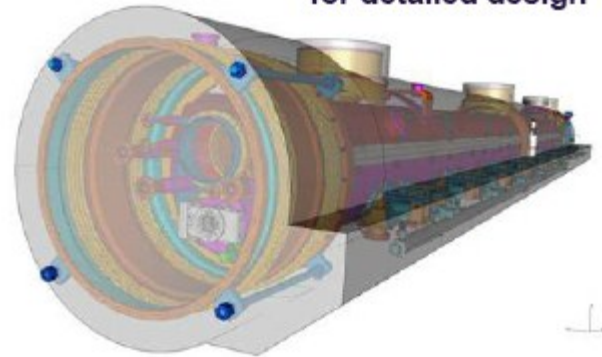
Institute of High Energy Physics  
Chinese Academy of Sciences



- All activities linked via a MSPE-plan
  - Connecting through linked milestones
  - Update at least quarterly
- Integration through 3D master model
  - Exchange of various CAD formats and integration into IDEAS master model
- Process (reviewing, documentation, ...) established in EDMS



Placeholder acts as reference for detailed design







- Detaillierte Installationsplanung
- Start Injektorbetrieb: Mitte 2014
- Cool-Down Linac & Start Beschleunigerinbetriebnahme: Mitte 2015
- Erster Strahl durch den Linac: Herbst 2015
- Erstes Lasen in SASE 1 möglich: Weihnachten 2015
- Inbetriebnahmeplanung läuft jetzt an
  - Inbetriebnahmephase mindestens 1 Jahr nach Cool-Down