



1. Layout.

2. Parameters.

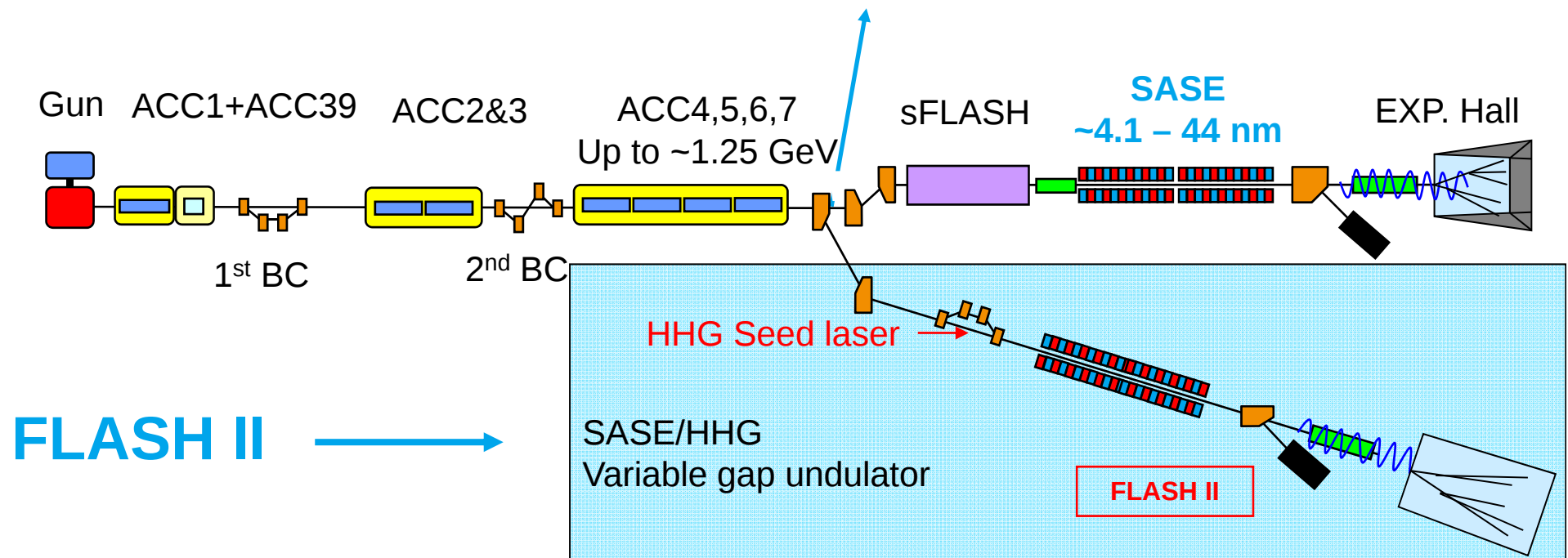
3. Civil Construction and Components.

4. Commissioning/Tests.



Upgrade: layout after upgrade FLASH II.

- Separation FLASH and FLASH II behind last accelerator module
- Tunability of FLASH II by undulator gap change
- Extend user capacity with SASE and HHG seeding
- Use of existing infrastructure up to last accelerating module



FLASH II: foreseen operation modes.

Self Amplified Spontaneous Emission (**SASE**) mode: Start from fluctuation in electron density spiky, but at full rep.rate and short and long pulses possible.

SEEDING SCHEME PHASE 1 (with delay):

High Harmonic Generation (**HHG**) mode (see also sFLASH):

Amplify an external, frequency multiplied seed laser.

Only short pulses, but close to single mode down to ~10 nm.

Seeding: presentation during “science opportunities with FLASH” by S. Reiche

FLASH II: Electron beam parameters.

Beam parameters	
Beam Energy	0.5 – 1.25 GeV
Normalized emittance (proj.)	1.4 – 3 mm mrad
Energy spread	0.5 MeV
Peak Current	2.5 kA
Bunches per second	<8000
Bunch Charge	0.02 – 1 nC
Undulator parameters	
Period	31.4 mm
Segments length	2.5 m
Number of segments	12
Focusing Structure	FODO

FLASH II: Photon beam parameters.

Radiation	SASE
Wavelength range SASE (nm)	4-60
FWHM Pulse Length (fs)	10-500
Peak Power (GW)	1-5
Bandwidth (%)	0.5 – 2%
Number of pulses	<8000**
Peak Brilliance*	10^{28} - 10^{31}
Pulse Energy (μ J)	1-500

*Photons/(s mrad² mm² 0.1%)

**with zero pulses for FLASH1

40 (@0.7 GeV), 60 (@0.6 GeV) or 80 nm (@0.5 GeV) as maximum wavelength
Only <100 μ rad rms opening angle loss free transport (probably around 60 nm)

Time plan

Civil Construction

Phase 1 (connection FLASH): Sept. – Dec. 2011

Phase 2 (connection PETRA III): Jan. – 15 Febr. 2012

Phase 3 (main tunnel + Hall): Febr. – ... 2012

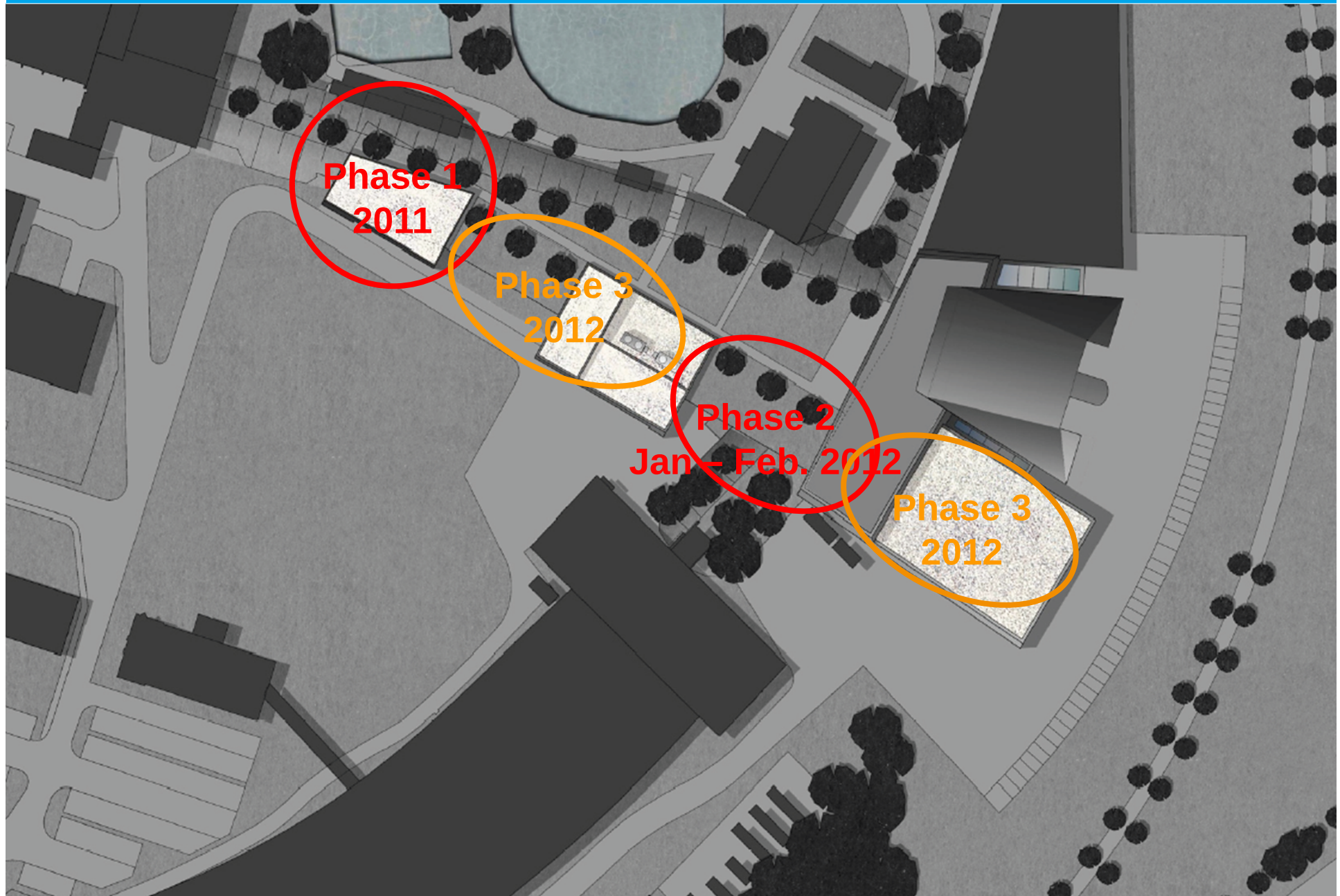
Building up hardware

Hardware main tunnel: Aug. – Dec. 2012

Tunnel+ Vacuum connection FLASH: Jan. – March 2013

HHG: 2014 (Laser and source development ongoing)

Movement of FLASH and PETRA during civil engineering

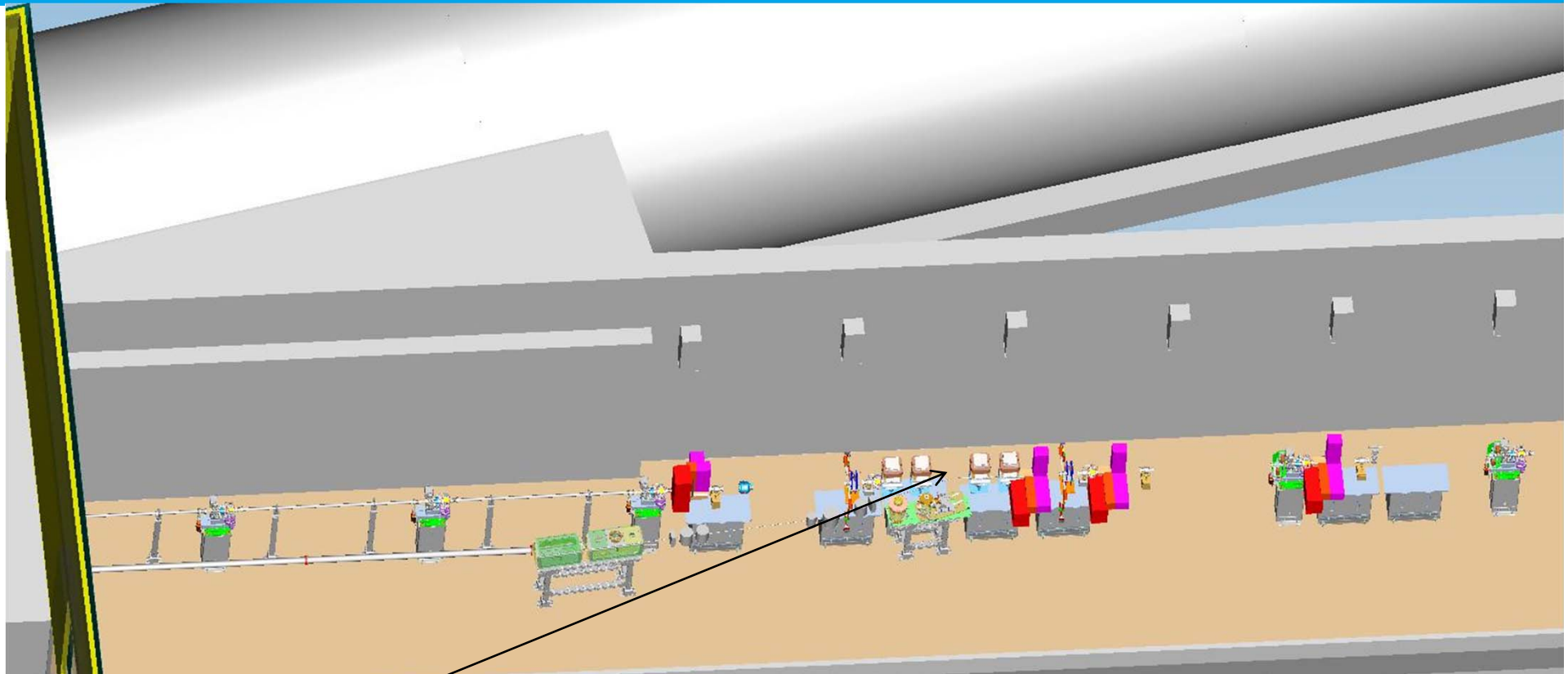


Movement (in cm) of FLASH and PETRA during construction

Negative is up, positive is down

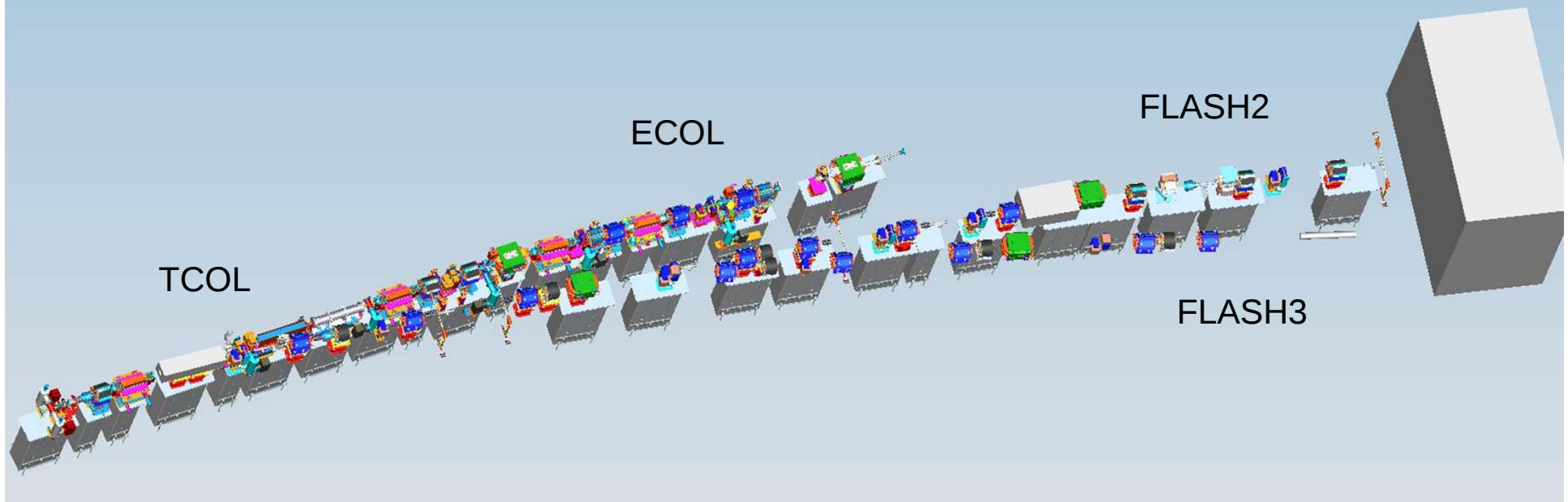
Period	Place	Activity	Movement
Sept – Dec 2011	Extraction FLASH1	Shielding away	-0.6
Sept – Dec 2011	Extraction FLASH1	Concrete	1 to 2
Jan – Feb 2012	FLASH1 Undulator	Shielding away	-0.1
Jan – Feb 2012	PETRA crossing FLASH2	Shielding away	-1.1 to -0.3
Jan – Feb 2012	PETRA crossing FLASH2	Concrete and Minimum Shielding	1.5
Mar – Oct 2012	FLASH1 Undulator	FLASH II tunnel	0.5
Mar – Oct 2012	FLASH1 Hall	FLASH II Hall	0.1

HHG Seeding.



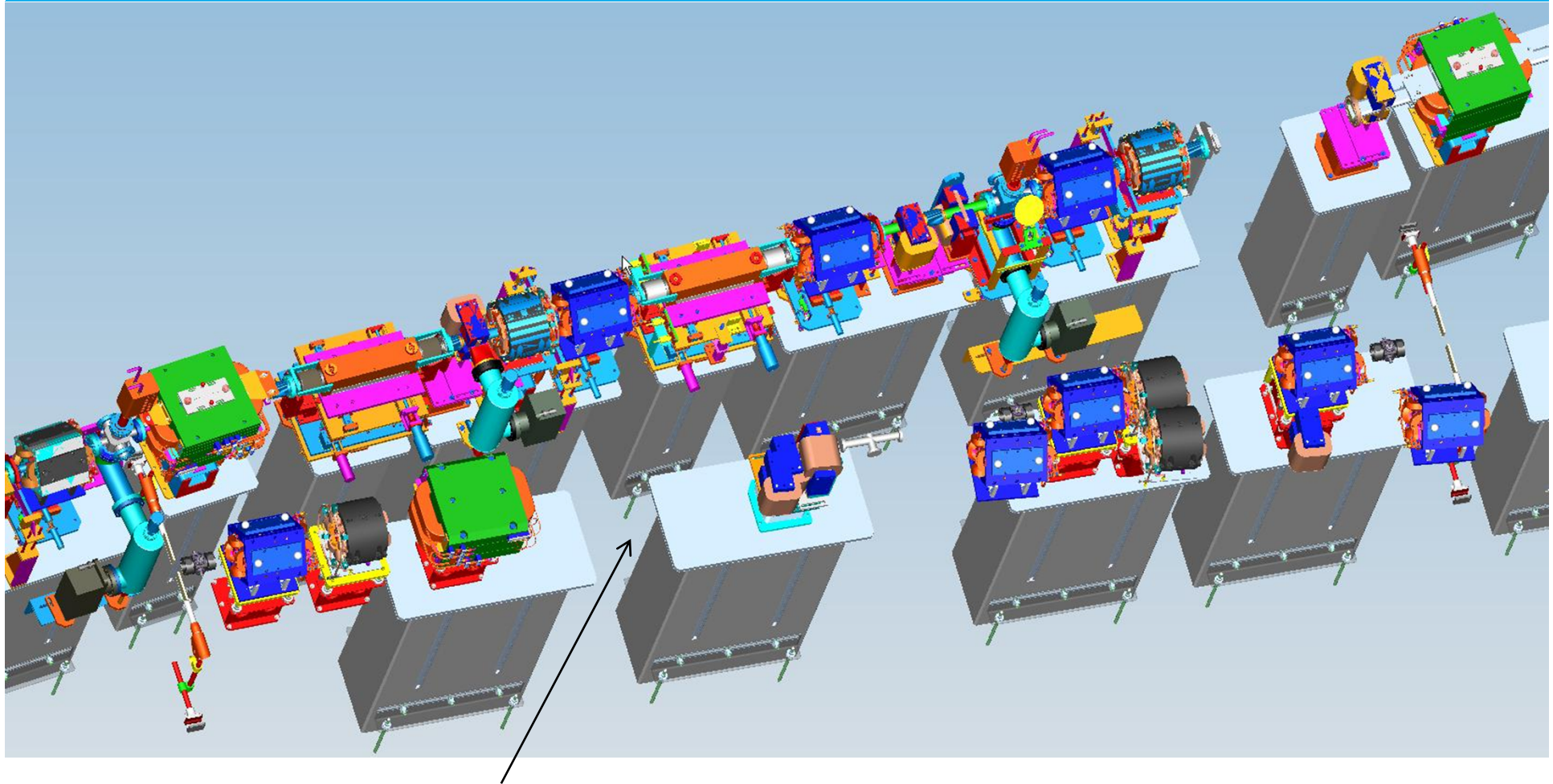
Incoupling of HHG delayed
Development on seed laser, source and diagnostics ongoing

FLASH2 and 3 extraction.



FLASH2 construction planned up to dump and into experimental Hall
FLASH3 construction only planned as diagnostics section with pulsed magnet
FLASH3 DUMP constructed together with FLASH2 DUMP

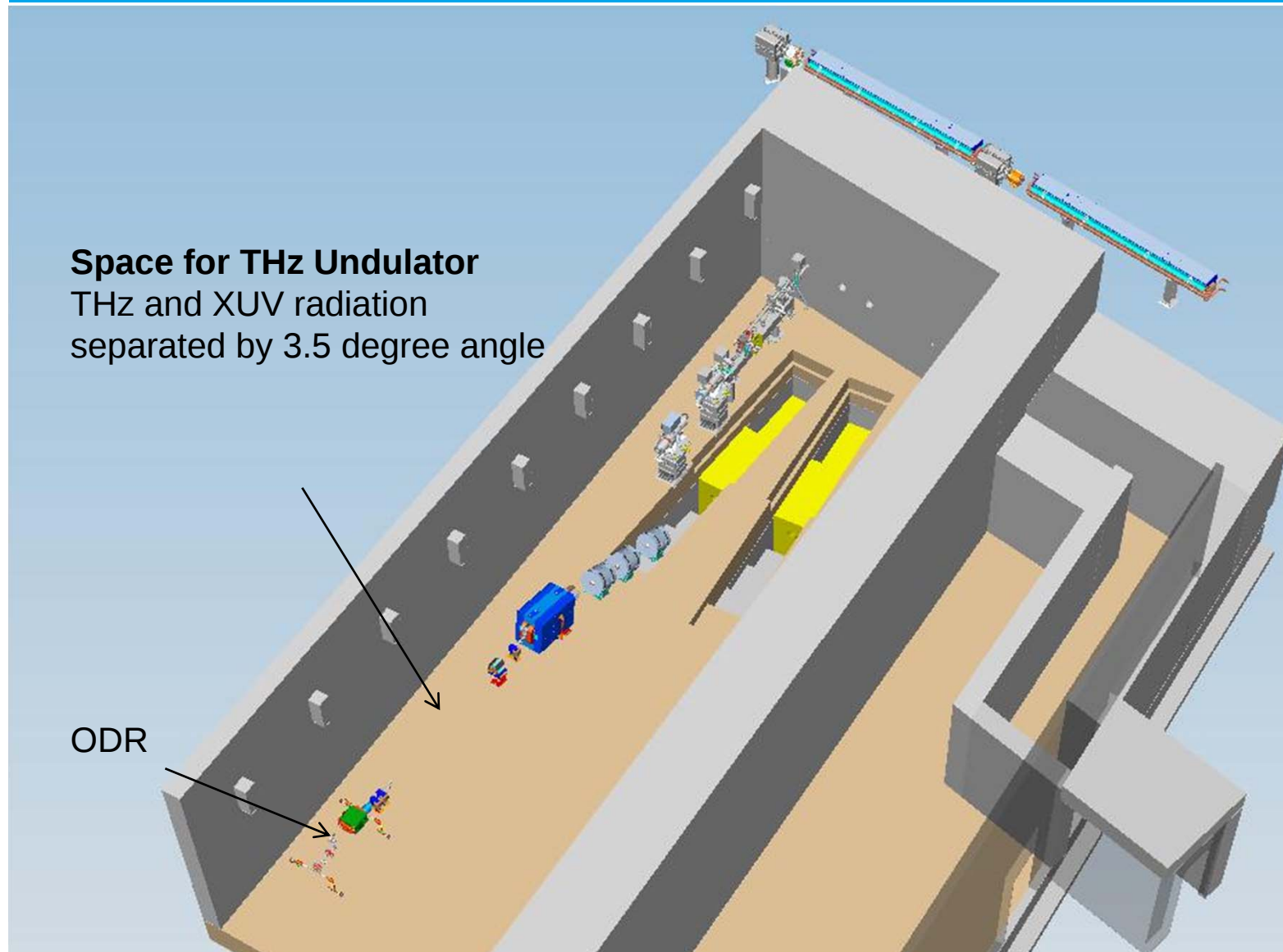
FLASH2 and 3 extraction: detail.



Pulsed magnet to separate FLASH2 and 3

Design not finished: still conflict of magnet/diagnostics positions

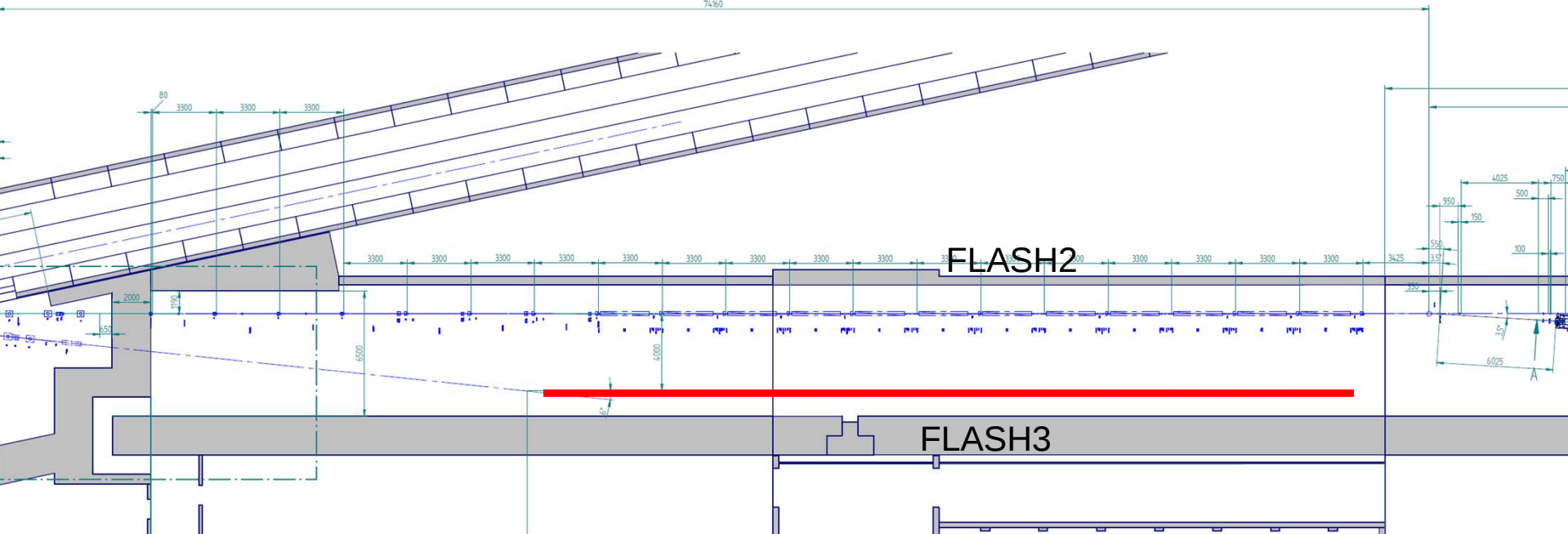
BURN Section with THz and ODR.



FLASH3.

FLASH3 stretch parallel to FLASH2 starts in SASE section (total length $12 \times 3.3 = 40$ m)

- Material stress test induced by extremely high power particle beam (Staufenbiel)
- Laser- and beam driven wakefield acceleration studies (Osterhoff)
- R&D beamline for Seeding schemes >2015 (Faatz)
- User Operation at long wavelength >2018?



Work to be done 2012 and 2013.

2012

- Continue **kicker** tests: flatness, stability and leading/trailing edge.
- **LLRF** gradient and phase stability test with beam.
- **Controls** to enable independent operation of FLASH2 and 3.
- Switching between **lasers** 1 and 2 with rep. rate/bunch number ...
- Lasing with different charges
-

2013

- Continue tests of 2012
- Starting summer 2013 tests with beam in FLASH2/3
- SASE FLASH2 (non-parasitic, using steerers or kickers)
- ...

Starting 2012 regular but short intervals for 1 to 2 hour tests?