



1. Layout.

2. Status

1. Civil Construction
2. E-beamline
3. Photon Beamline

3. Timeplan

4. Finances

5. Personnel Situation

6. Simultaneous Operation of FLASH1 and 2

FLASH II is a combined proposal of HZB and DESY.
It has been approved in Summer 2010: total Budget 29.6 M Euro.

Why FLASH II.

Problem

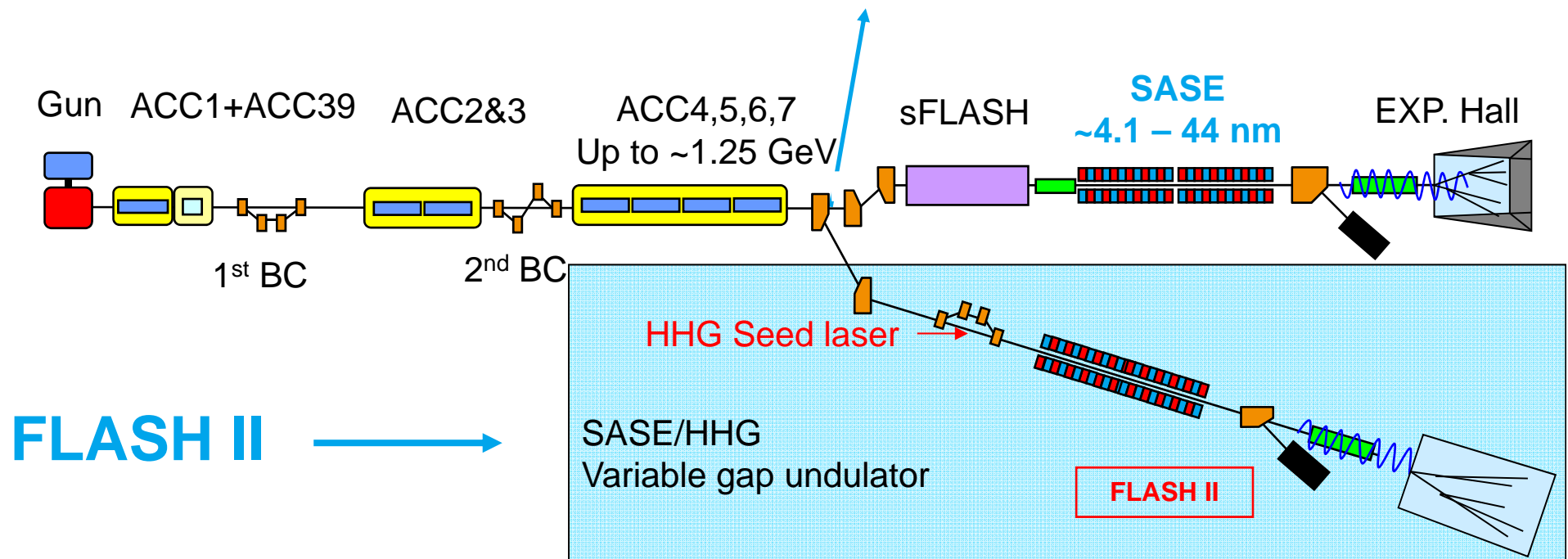
1. FLASH is overbooked by a factor 4.
2. SASE principle is intrinsically unstable.
 1. *Time arrival jitter (partially corrected by fast feedback within pulse train).*
 2. *Shot-to-shot fluctuation in intensity (starting from noise).*
 3. *Wavelength variation/mode structure (coherence length versus bunch length).*
3. FLASH delivers only linear polarization.

Solution

1. Doubling number of experimental stations (simultaneous operation?).
2. Make an amplifier (stability/availability of seeding?).
 1. HHG
 2. ~~HGHG~~
3. ~~Use variable polarization undulators (Tolerances/alignment).~~

Upgrade: layout after upgrade FLASH II.

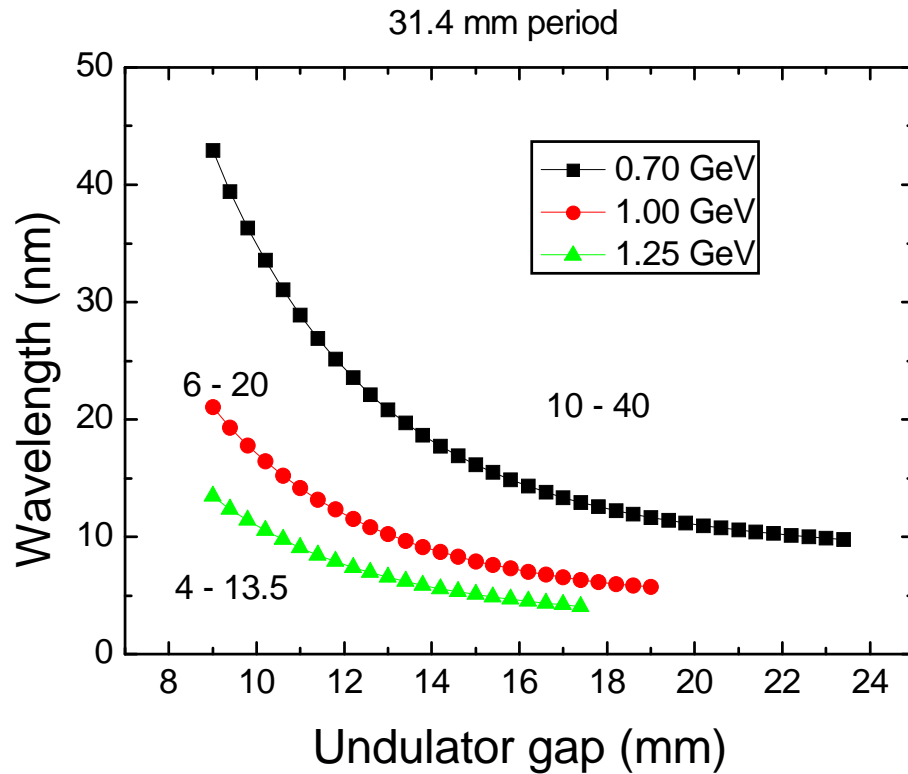
- Separation FLASH and FLASH II behind last accelerator module
- Tunability of FLASH II by undulator gap change
- Extend user capacity with SASE and HHG seeding
- Use of existing infrastructure up to last accelerating module



FLASH II: Electron beam parameters.

Beam parameters	
Beam Energy	0.5 – 1.25 (1.6) 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	F0D0

Wavelength range for main energies by varyang the undulator gap



Energy (GeV)	31.4 mm
0.7	10 – 40
1.0	6 – 20
1.25	4 – 13.5

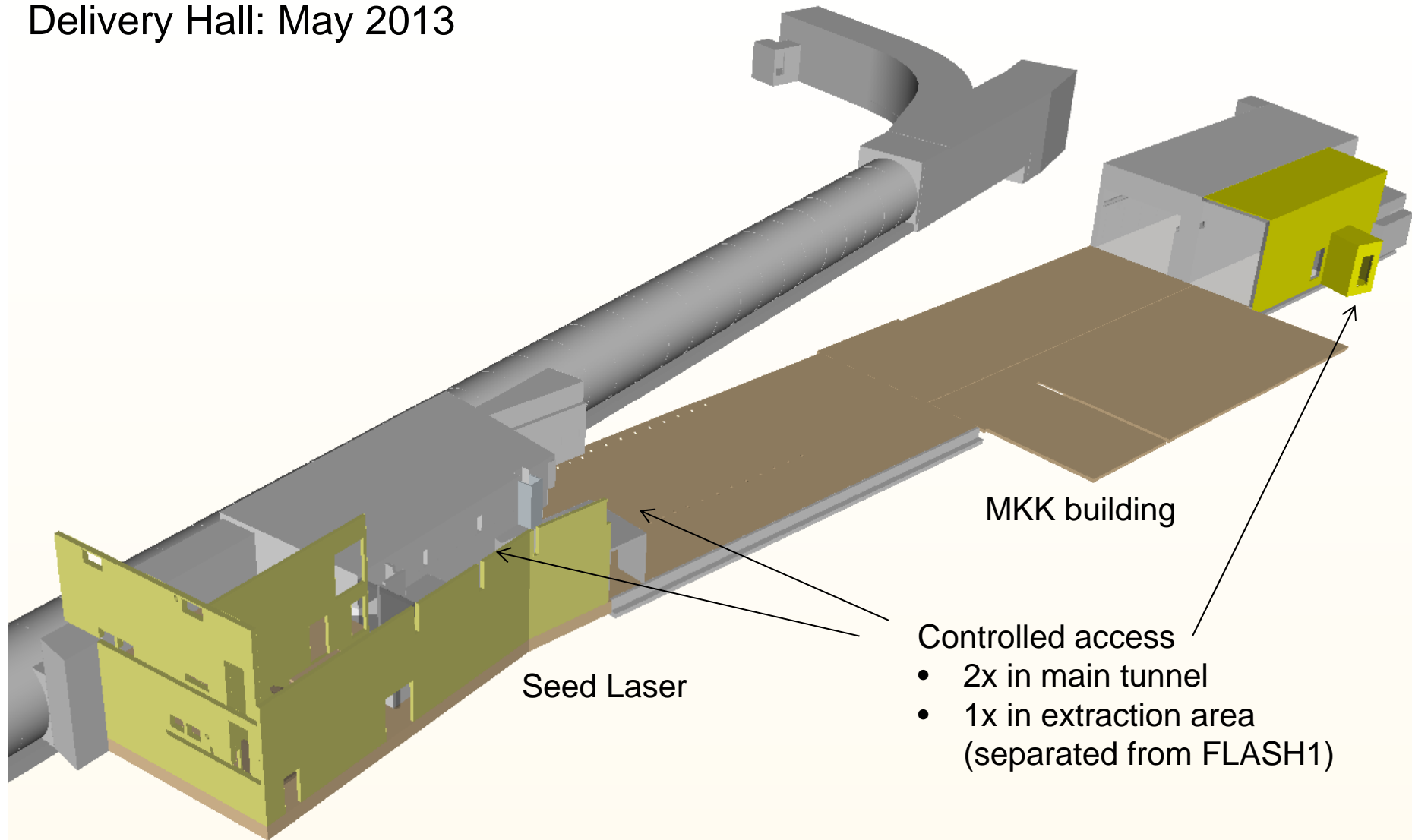
10-40 nm at 0.7 GeV with HHG seeding
 >40 nm with energies below 0.7 GeV

Civil Construction: status September 2012.

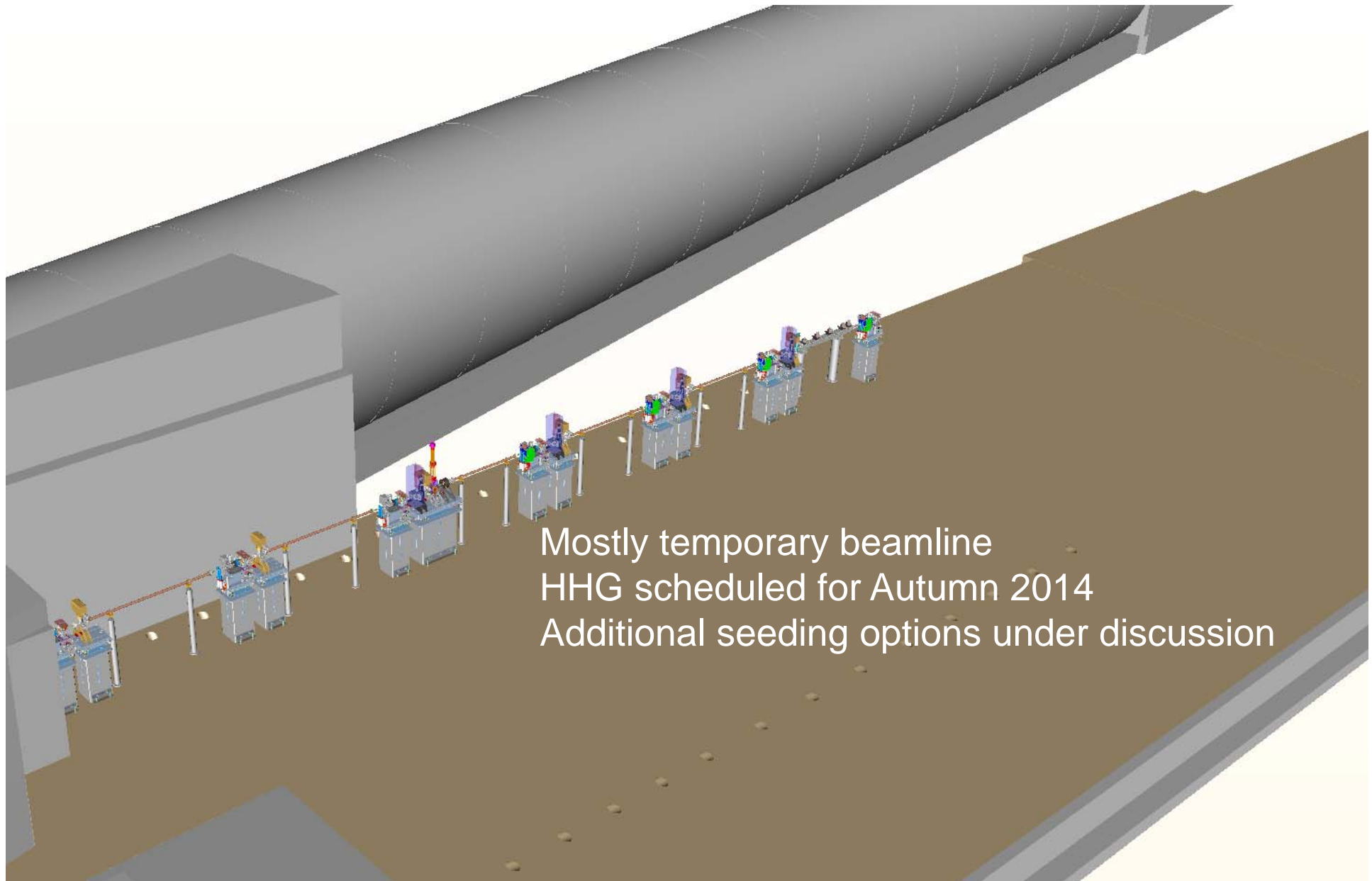
Tunnel ready for technical infrastructure (MKK): 11.12.2012

Delivery complete Tunnel: March 2013

Delivery Hall: May 2013



FL2SEED: Ready for cleaning end of september.



Mostly temporary beamline
HHG scheduled for Autumn 2014
Additional seeding options under discussion

Vacuum in the SEED Section.



Akropolis:

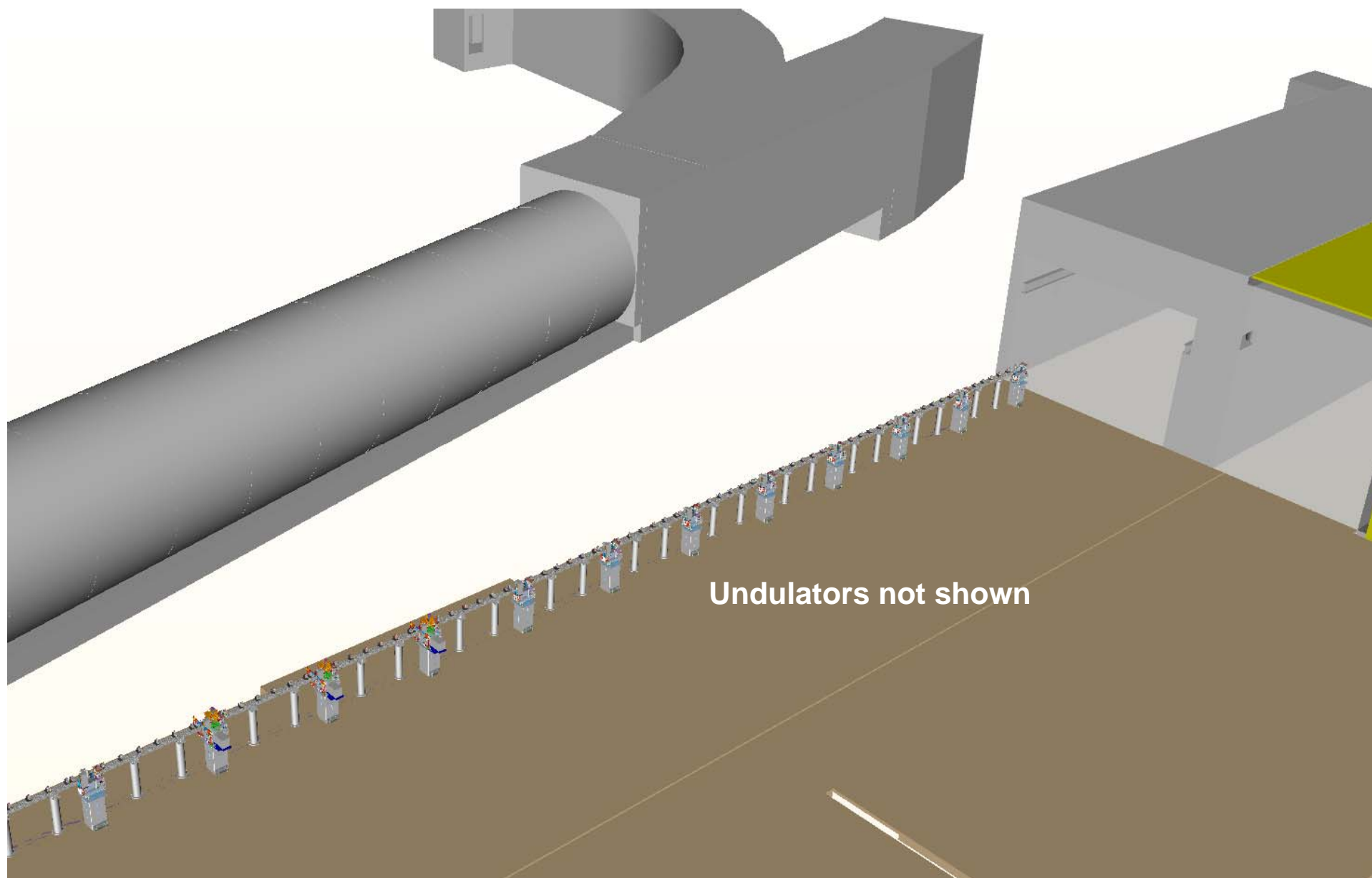
- Cu Rohre

Weiter Verwendung:

- Reinraum → Reinigung H.55
(T. Wohlenberg)



FL2SASE: Ready for cleaning end of september.



Vacuum in the SASE Section.



Akropolis:

- AL Undulatorkammer

Weiter Verwendung:

- ??? T. Wohlenberg

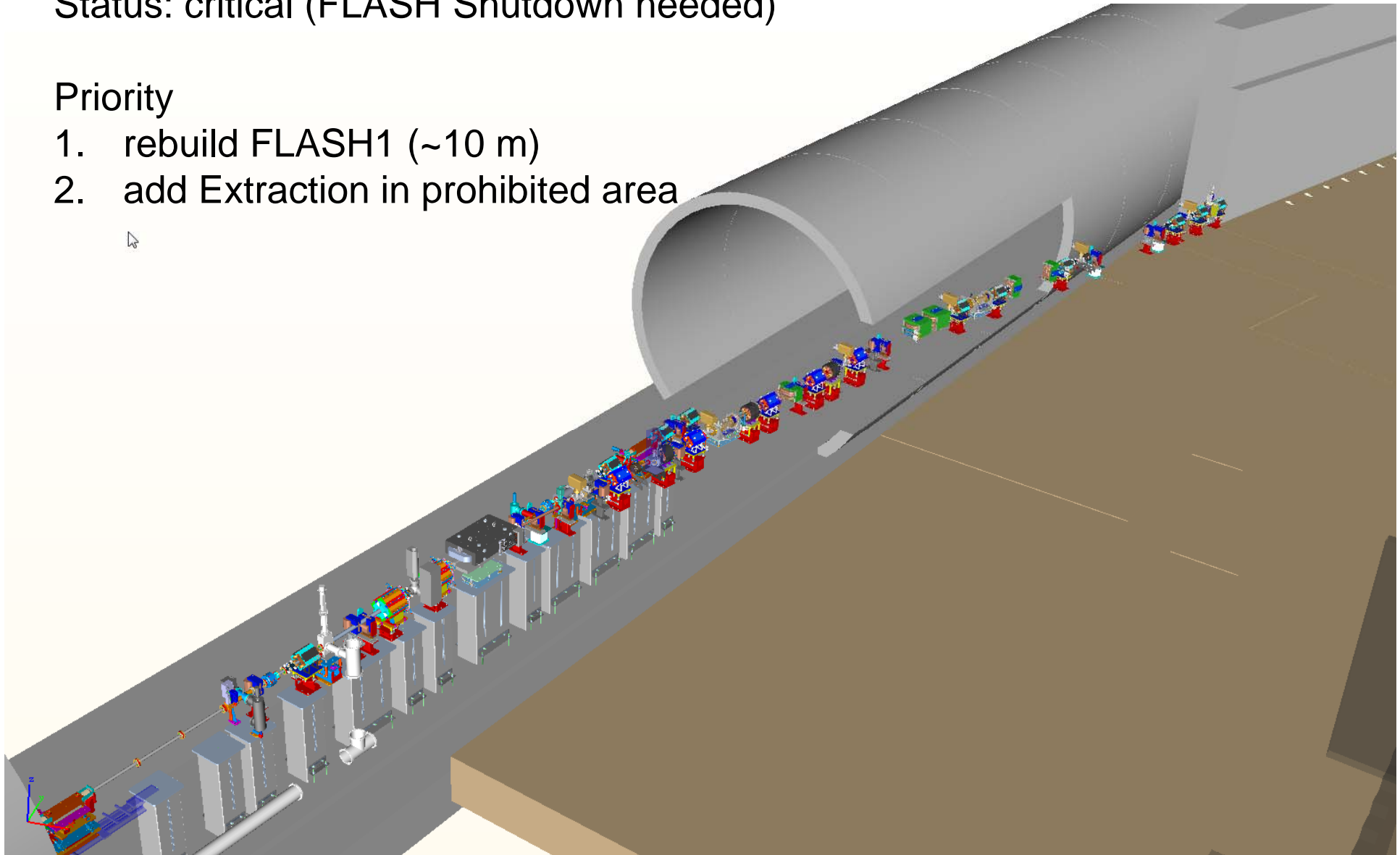


FL2EXTR: Vacuum Design ready and partially ordered.

Status: critical (FLASH Shutdown needed)

Priority

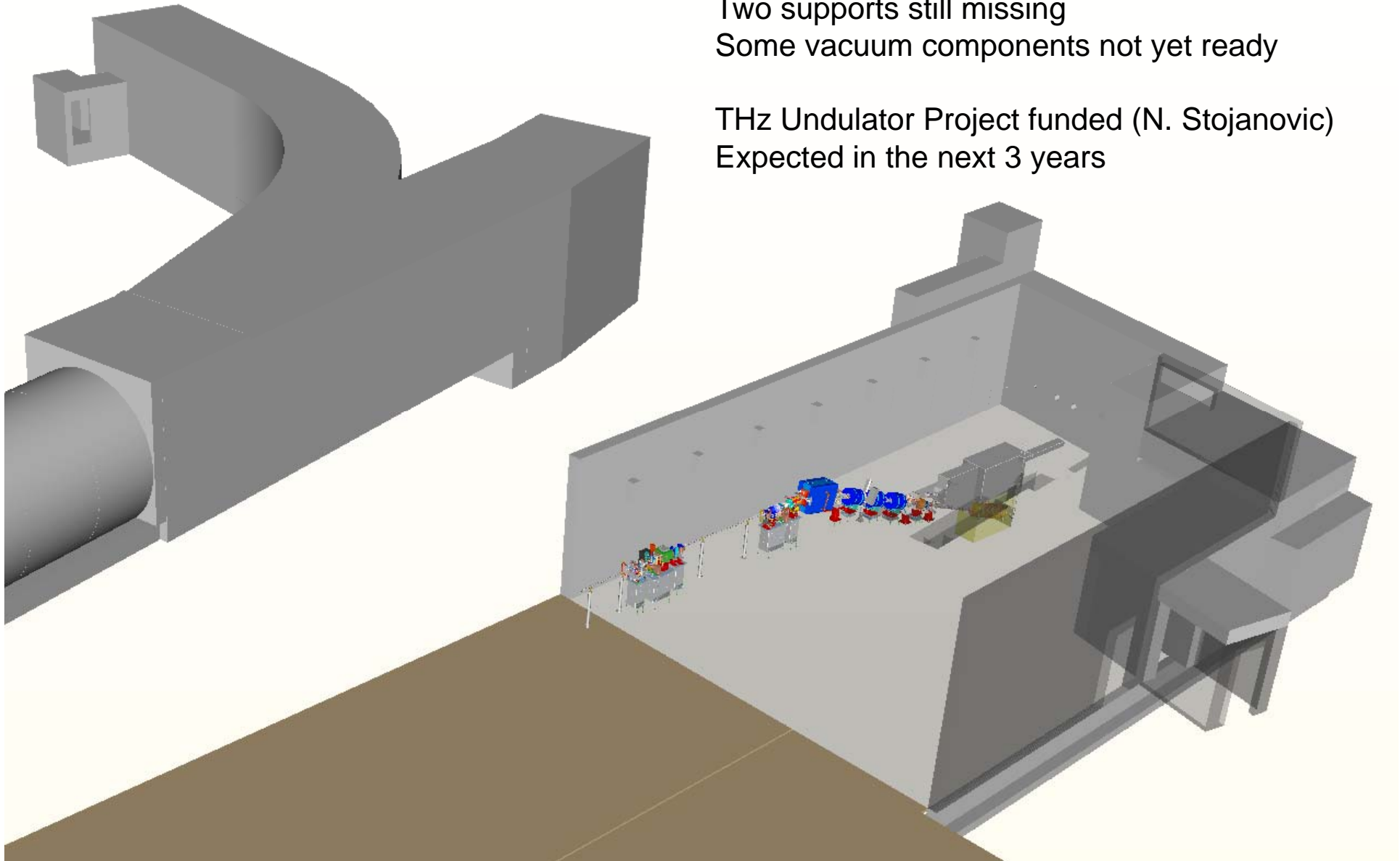
1. rebuild FLASH1 (~10 m)
2. add Extraction in prohibited area



FL2BURN/FL2DUMP: Ready for cleaning end of september.

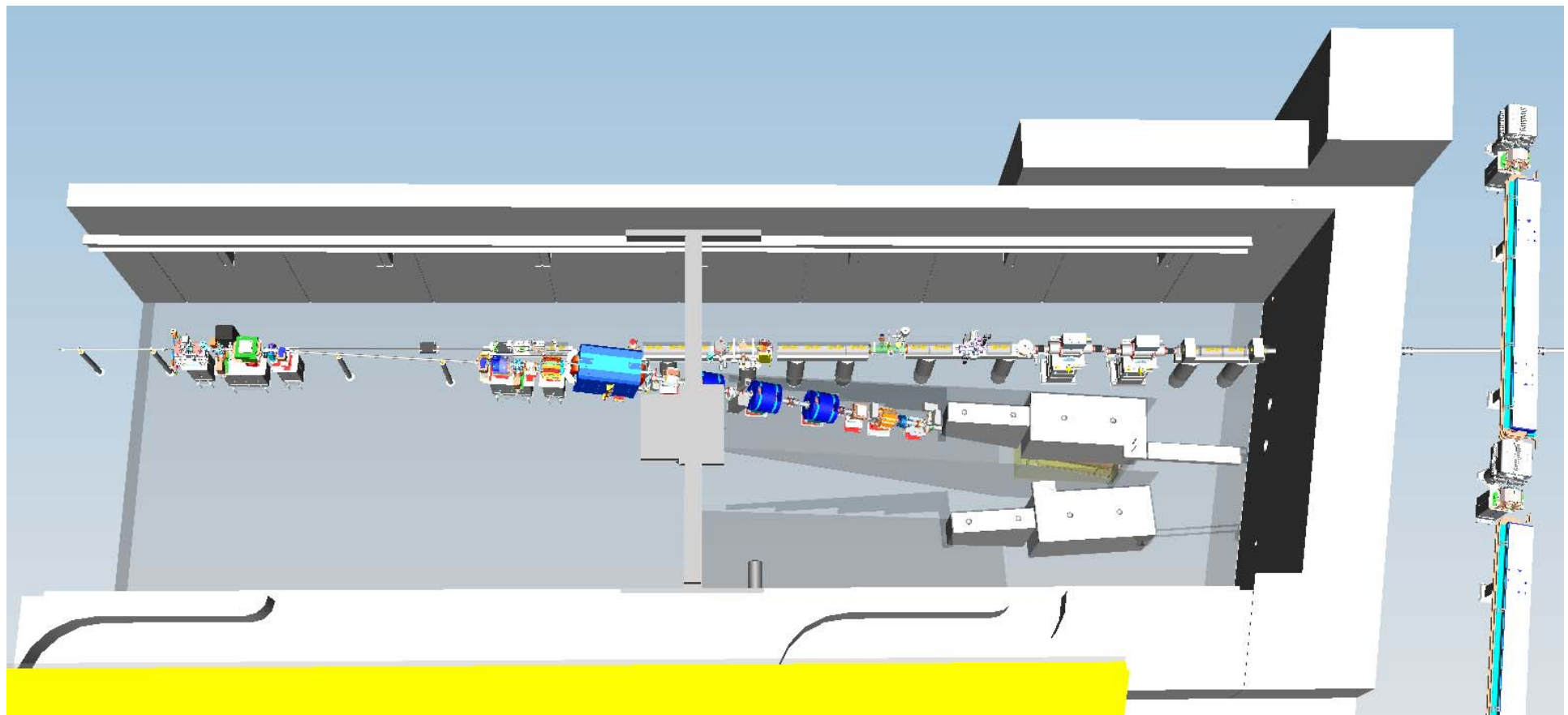
Two supports still missing
Some vacuum components not yet ready

THz Undulator Project funded (N. Stojanovic)
Expected in the next 3 years



Photon Diagnostics Tunnel.

Proposed Version of Tunnel Diagnostics



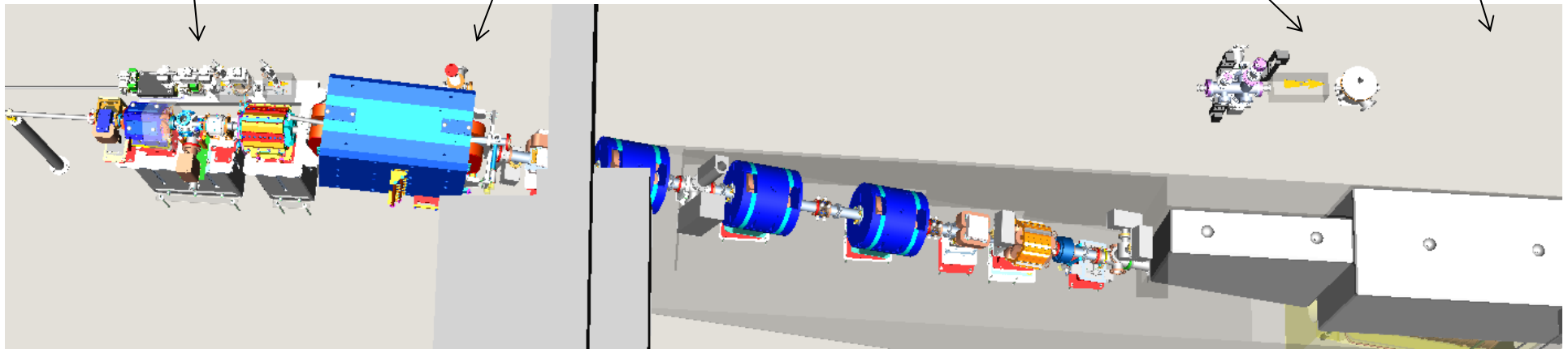
Photon Diagnostics Tunnel: minimal Version.

Proposed Version of Tunnel Diagnostics for July/Aug. 2013

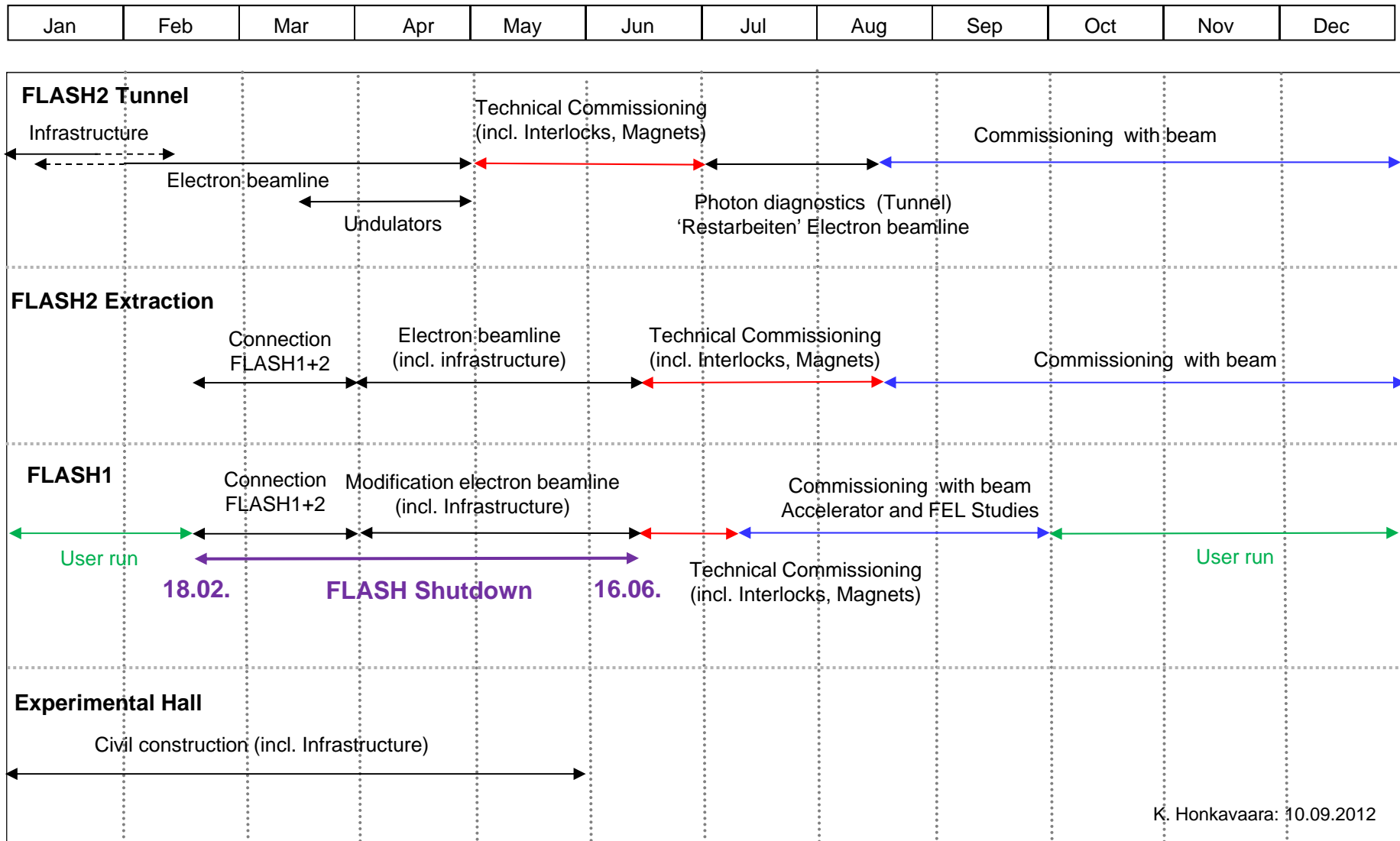
Compact Spectrometer

Safety magnet
Alignment laser
Absorber/V0
1st differential pumping station
Aperture 1

MCP
Aperture 2
YAG
Absorber



Tentative FLASH time schedule 2013.



Tentative FLASH time schedule 2013.

> Discussions ongoing

- TGA main tunnel until 22.01
- TGA MKK Building until 05.04
- TGA Elektronikabseite until 22.05
 - Will be modified and discussed in detail in 2 weeks
 - Priority on “Abseite Nord”: contains all personeninterlock crates for complete FLASH

> FLASH1 Startup

- Interlock tests mid June
- Startup with beam first half of July
- Start user run beginning of October

> FLASH2 Startup

- Technical commissioning beginning of May
- With beam 2nd half of August
- First lasing 2nd half of 2013 (first photon diagnostics Tunnel July/Aug. 2013)
- Pilot experiments starting mid-2014

Finances: Original 2010.

Group	2010	2011	2012	2013	2014	Sum
Bau	0.1	1.8	7.4	0.5	0	9.8
Machine	0.4	2.4	5.9	0.3	0	9.0
Exp.	0.9	2.9	5.0	1.6	0.5	10.9
Sum	1.4	7.1	18.3	2.4	0.5	29.7

With
HGHG,
reduced undulator length
Components from the Bypass

Finances: Present Situation.

Group	2010	2011	2012	2013	2014	Sum
Bau	0	1.9	4.7	6.4	0.0	13.0
Machine	0	1.2	2.8	4.7	1.2	9.9
Exp.	0.6	1.1	1.7	3.7	2.7	9.8
Sum	0.6	4.2	9.2	14.8	3.9	32.7

Full Undulator Length
Synchronization system
Higher demands climatization

Civil Construction

- 3 GU → 3 construction sites
- Improve quality soil/surface
- General increase in prices
-

Personnel Situation.

FS

2011 (2010 = 1)

2011 hatte nur FS-US Personalkosten

M

2011 (2010 = 0)

Aktivitätsbezeichnung	Kostenst.		unbefristet	Befristet	Grand Total
FLASHII Maschine	38035		0.3		0.3
	38135	MEA	0.3	0.3	0.6
	38835		0.6		0.6
	38935		0.6		0.6
	60235			0.5	0.5
	63235			0.3	0.3
	63635		0.3	0.1	0.4
	63735	MDI	0.3		0.3
	65135	MKK1	0.3	0.1	0.3
	65235	MKK2	0.2	0.3	0.5
	65335	MKK3	0.2	2.1	2.3
	65635	MKK6	0.1		0.1
FLASHII Maschine Total			3.0	3.6	6.6

2012

Group	befristet	unbefristet	Sum
BT			1.3
TI			0.5
US			3.5
FL	2.0		2.0

2012

Group	unbefristet	befristet	Sum
MDI	0.6	0.1	0.7
MEA	1.8	0.3	2.1
MKK	1.0	2.4	3.4
MVS			?
MPY			?

ZM1: H. Damker working for FLASH II

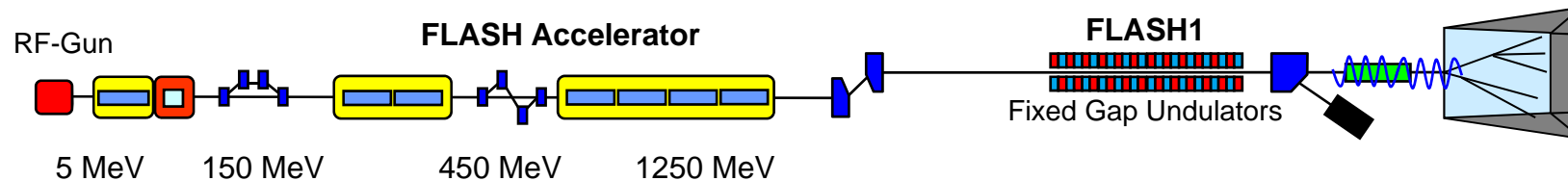
ZM3: 75% outside of DESY

FTEs FLASH II: Annual (assume construction start 2012)

Group	2010	2011	2012	2013	2014	SUM	
FSUS (Undulator)	0	2	3	3	1	9	
FSBT (HASY Vacuum)	1.5	2	2.5	3	1	10	
HASYLAB (HALL)	0	2	3	4	1	10	
	1.5	6	8.5	10	3	29	F
MCS	0.25	1	2	3	1.75	8	
MDI (Diagnostics)	0.25	1	2	3	1.75	8	
MEA (Magnets, drawings, ..)	0.25	3	4	2.75	0	10	
MIN (laser, kicker, dump)	0	1	1	1	0	3	
MKK	1	2.5	3	2.5	1	10	
MKS (change He 47A)	0	1	0	0	0	1	
MPS	0	0.3	0.4	0.3	0	1	
MPY (Simulations)	2	2	1	0	0	5	
MVS (Machine Vacuum)	3	4	4	3	2	16	
	6.75	15.8	17.4	15.55	6.5	62	M
ZBAU (Tunnel/Hall Preparation)	0.5	1	1	0	0	2	
ZM (construction Extraction)	1	1	1	0	0	3	
	1.5	2	2	0	0	5	Z

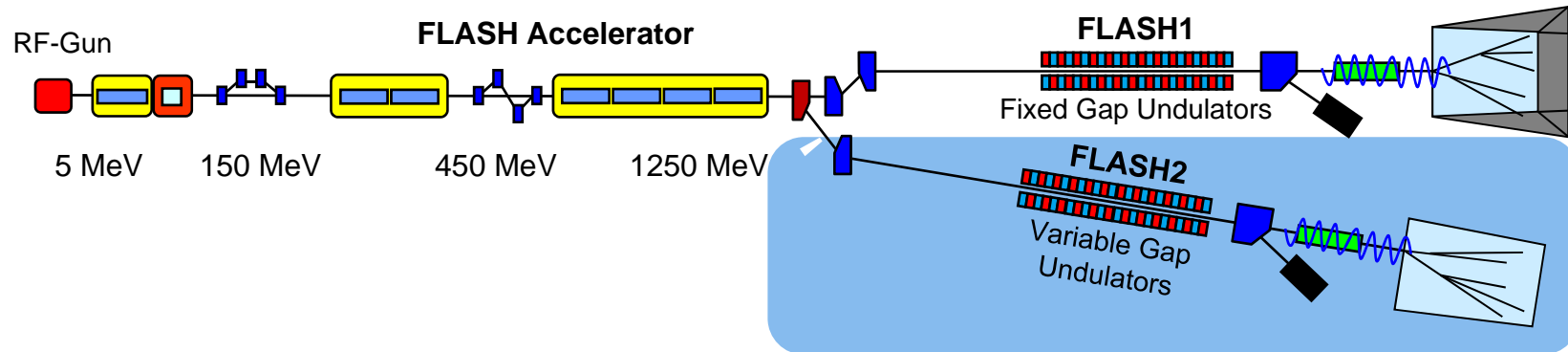
Based on discussion with group leaders and Bereichsleitung
 Numbers for „M“ are those needed in addition

Lasing at FLASH.



- > Pulse trains delivered at 10 Hz
- > Parameter changes requested by users
 - Different wavelength → different optics and RF settings
 - Fine-tuning wavelength → changes in dogleg and RF settings
 - Different pulse length (=charges:P 0.07 – 0.7 nC) → different RF settings and focusing
 - Different number of bunches (1 -...-30-...-max) → different laser settings
 - Different rep.rates (50, 100, 200, 250, 500, 1000 kHz) → different laser settings
 - Different position/Angle → Orbit correction
 - Small spectral width → dispersion/orbit correction and ?????
 - “Nice” spot on YAG-screen → ?????

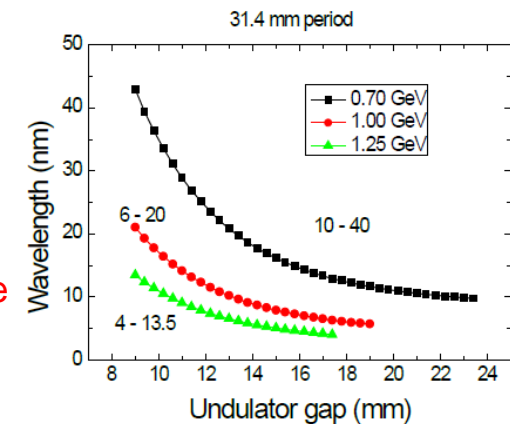
Lasing of FLASH1 and FLASH2 Simultaneously



> Both running at 10 Hz → fast kicker system with DC septum

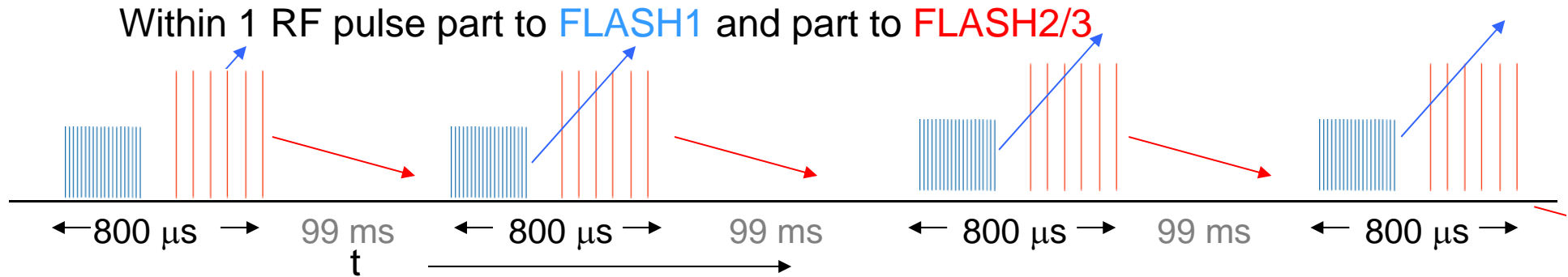
> Parameter changes requested by users

- Different wavelength → different undulator gap (within limits)
- Different charges (0.07 – 0.7 nC) → different RF settings within an RF pulse
- Different number of bunches (1 -...-30-...-max) → different laser
- Different rep.rates (50, 100, 200, 250, 500, 1000 kHz) → different laser



Tunability > factor 3

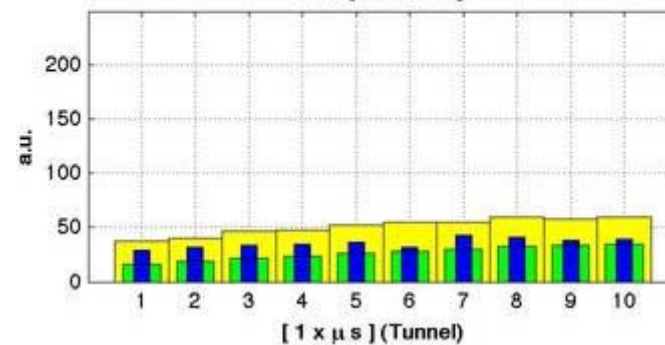
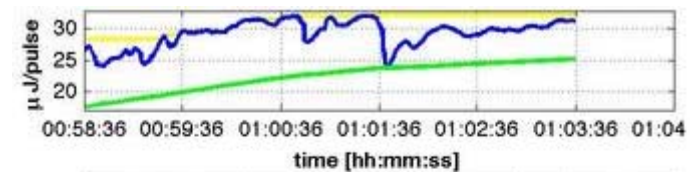
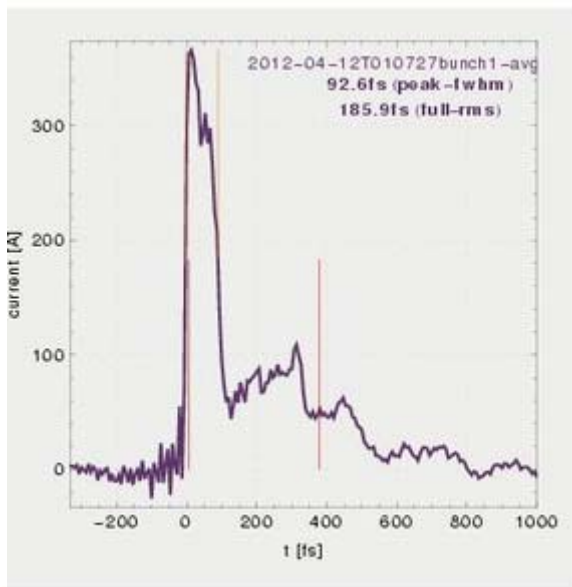
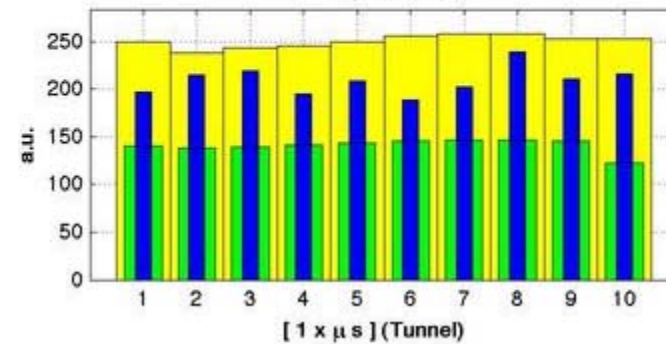
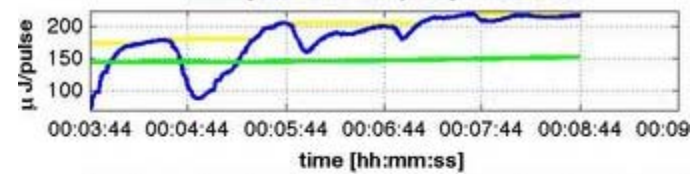
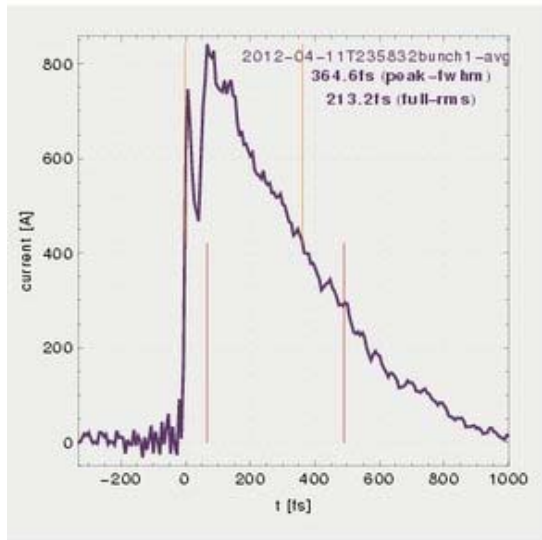
Beamline switching (FLASH1 and 2/3).



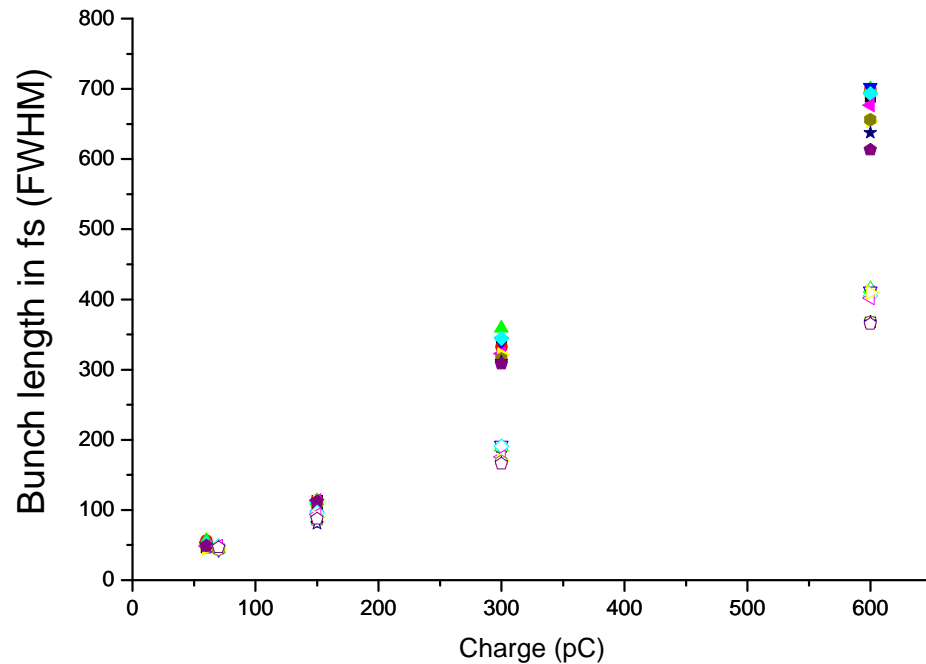
Requirements:

- Pulser/Kicker
 - Stability to avoid orbit jitter.
 - Flatness for long pulse trains.
 - Rise or Fall time of $<50 \mu\text{s}$.
 - Switch length and starting point variable.
 - 1st part or 2nd to FLASH2 depends on need of BAM FB without interference of “background” bunches
- Laser(s)
 - Different repetition rates and charges.
 - Switching to gun in $<50 \mu\text{s}$ at different start time (related to kicker).
- LLRF
 - Different beam loading FLASH1 and 2/3.
 - Tunability of gradient or ACC45 and ACC67 for wavelength scans FLASH1.
 - Tunability in phases of Gun, ACC1, ACC39 and ACC23 for variation in compression FLASH1, 2 and 3.

Charge dependence: 700 MeV, 0.3 nC and 0.07 nC



Charge dependence: Measurements at 0.7 (solid) and 1.08 GeV (open symbols)



Charge (nC)	SASE (μJ) @0.7 GeV	SASE (μJ) @1.08 GeV
0.6	210	165
0.3	170	80/100
0.15	110	75
0.07	30/55	35

Measurement:

1. Start with HIGH charge and go down, touching only RF parameters and orbit
2. Optimize at low charge
3. Start with LOW charge and go down, touching only RF parameters and orbit

Outlook.

- Schedule on critical path.
 - Implementation of FLASH3 extraction postponed.
 - Implementation of HHG Seeding postponed to 2014 (?)
- Construction FLASH1/FLASH2 Extraction on critical path.
 - Shutdown needed of FLASH1.
 - Priority at ZM may be needed for FLASH II beginning 2013.
 - *Already external personnel hired.*
 - *Already 75% of hardware from outside DESY.*
- Different works at the same time unavoidable.
- Necessity for more crews at the same time become likely.
- Because of delays conflict with XFEL and PETRA III more likely.
- ~14 FTE for commissioning needed in 2nd half of 2013.
- Only minimal version of control system will be working (?)
- **User Operation in 2014 only without seeding thinkable.**