FLASH2020+

Progress Review

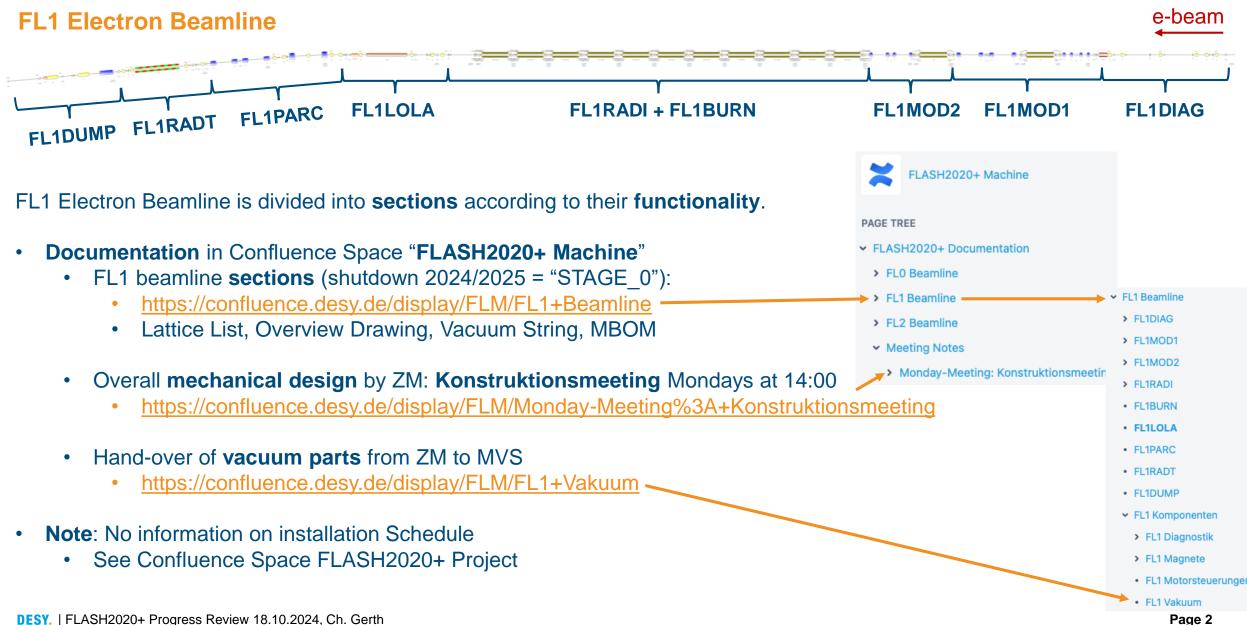
FL1 Electron Beamline (Installation)

Christopher Gerth 18 October 2024





Introduction / Reminder



Status Overview – Progress Review 08/03/24

Status of Sections

08 March 2024

FL1 START: z = 146,7610004 m

CADNAME	x	Y	Z	DG Assembly	Section Review	Lattice released	Vacuum parts (ZM3 to MVS)
FL1DIAG	0,000000	0,000000	0,000000	D1000000523348	🖻 22 Jan 2024	🖻 22 Feb 2024	
FL1MOD1	0,000000	0,000000	12,389219	D1000000523351			
FL1MOD2	0,000000	0,000000	25,289219	D1000000523352			
FL1RADI	0,000000	0,000000	33,389217	D1000000524071			
FL1BURN	0,000000	0,000000	69,354218	D1000000523353	🖻 08 Jan 2024	🖻 22 Feb 2024	🔅 08 Feb 2024
FL1LOLA	0,000000	0,000000	72,569221	D1000000523354			🔅 07 Mar 2024
FL1PARC	0,000000	0,000000	82,469215	D1000000523355	🖻 05 Feb 2024	🖆 23 Feb 2024	
FL1RADT	0,828233	0,000000	93,838875	D1000000523356	🖻 19 Feb 2024		🖻 22 Feb 2024
FL1DUMP	1,516764	0,000000	101,708817	D1000000523357			

Status Overview – Progress Review 31/05/24

Status of Sections

31 May 2024

FL1 START: z = 146,7610004 m

	x	Y	z	DG Assembly $_{\oplus}$	Section Review	Lattice released $_{\ddagger}$	Vacuum parts (ZM3 to MVS)	Vacuum parts
FL1DIAG	0,000000	0,000000	0,000000	D1000000523348	🖻 22 Jan 2024	🖄 22 Feb 2024	🖄 02 May 2024	🖄 13 May 2024
FL1MOD1	0,000000	0,000000	12,389219	D1000000523351				
FL1MOD2	0,000000	0,000000	25,289219	D1000000523352				
FL1RADI	0,000000	0,000000	33,389217	D1000000524071				
FL1BURN	0,000000	0,000000	69,354218	D1000000523353	🖻 08 Jan 2024	🖄 22 Feb 2024	🖄 08 Feb 2024	🖄 20 Mar 2024
FL1LOLA	0,000000	0,000000	72,569221	D1000000523354	🖄 08 Apr 2024		🖄 07 Mar 2024	🖄 08 Apr 2024
FL1PARC	0,000000	0,000000	82,469215	D1000000523355	🖄 05 Feb 2024	🖻 23 Feb 2024	🖻 14 Mar 2024	
FL1RADT	0,828233	0,000000	93,838875	D1000000523356	🖄 19 Feb 2024		🖄 22 Feb 2024	🖄 11 Mar 2024
FL1DUMP	1,516764	0,000000	101,708817	D1000000523357				

Status Overview – Progress Review 18/10/24

Status of Sections

18 October 2024

FL1 START: z = 146,7610004 m

CADNAME	x	Y	z	DG Assembly	Section Review	Lattice released	Vacuum parts (ZM3 to MVS)	Vacuum parts RFI
FL1DIAG	0,000000	0,000000	0,000000	D1000000523348	🖻 22 Jan 2024	🖄 22 Feb 2024	🖄 02 May 2024	🖄 13 May 2024
FL1MOD1	0,000000	0,000000	12,389219	D1000000523351	🖾 23 Sep 2024		X	
FL1MOD2	0,000000	0,000000	25,289219	D1000000523352	🖾 23 Sep 2024		X	
FL1RADI	0,000000	0,000000	33,389217	D1000000524071	🖄 09 Sep 2024	🖄 08 Oct 2024	🖄 26 Sep 2024	🖻 08 Oct 2024
FL1BURN	0,000000	0,000000	69,354218	D1000000523353	🖻 08 Jan 2024	🖄 22 Feb 2024	🖄 08 Feb 2024	🖻 20 Mar 2024
FL1LOLA	0,000000	0,000000	72,569221	D1000000523354	🖄 08 Apr 2024	🖻 08 Oct 2024	🖻 07 Mar 2024	🖻 08 Apr 2024
FL1PARC	0,000000	0,000000	82,469215	D1000000523355	🖄 05 Feb 2024	🖄 31 Jul 2024	🖻 14 Mar 2024	X
FL1RADT	0,828233	0,000000	93,838875	D1000000523356	🖄 19 Feb 2024	🖄 25 Jul 2024	🖄 22 Feb 2024	🖄 11 Mar 2024
FL1DUMP	1,516764	0,000000	101,708817	D1000000523357				

FL1MOD1/2 : the most complex sections with many new components + SEED1/2 laser beamlines
Mainly the chicane chambers (CH1, Ch2, CH3, DBA) are still in production (see next slides)
FL1DUMP lowest priority, only the DUMP dipole chamber in production (ZM), no copper coating

FL1MOD1

Status of Components

- Chicane Dipole Magnets
 - FL1CH1 (TDK): In fabrication: delivery date Jan/Feb 25, magn./transfer measuement

FL1CH2

Contraction of the second

FL1CH1

FL1CH2

Sheet width: 4 mm

FL1MOD1

FL1CH1

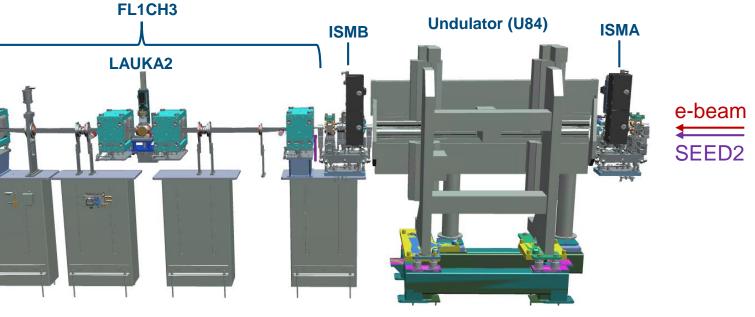
vacuum leak:

re-brazing of flange

- FL1CH2 (TDI): In fabrication: delivery end Jan 25, magn./transfer measuement
- Chicane Vacuum Chambers
 - FL1CH1: 2 mm (sheet width) chambers: next step: welding of 8 flanges
 - FL1CH2:
 - Chamber for laser beam line: vacuum leak (re-brazing)
 - 2 mm (sheet width) chambers: next step: welding of 4 flanges
 - 4 mm (sheet width) chambers: last step: copper plating
 - Mirror chambers LEIKA1 / LAUKA1-LEIKA2 : delivered
 - Next steps: transfer measurement, clean room assembly
 - Movers: CO₂ cleaning of bellow at MSL (J. Ziegler)
- Two Intersections (Type ISMA/B)
 - Pre-assembled, transfer measurement and RFI
 - (1 bellow has vacuum leak => resoldering at MKS)
- Supports
 - Mechanical design of supports on-going (many constraints due to high density of parts)
- Undulator (planar U84)
 - see presentation by K. Goetze
- SEED laser beamline:
 - see presentation by T. Lang
 - DESY. | FLASH2020+ Progress Review 18.10.2024, Ch. Gerth

FL1MOD2 Link to FL1MOD2





Status:

- Chicane Vacuum Chambers
 - FL1CH3: 2 mm (sheet width) chambers: next step: welding of 12 flanges
- Chicane Dipole Magnets
 - FL1CH3 (TDJ): assembled with new pole shoes
 - Next step: magnetic and transfer measurement
- Undulator (planar U84)
 - see presentation by K. Goetze
- SEED laser beamline (not shown above):
 - see presentation by T. Lang

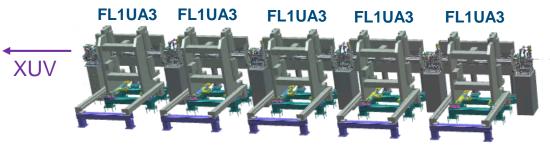
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FL1RADI

FL1RADI + FL1BURN

Link to FL1RADI



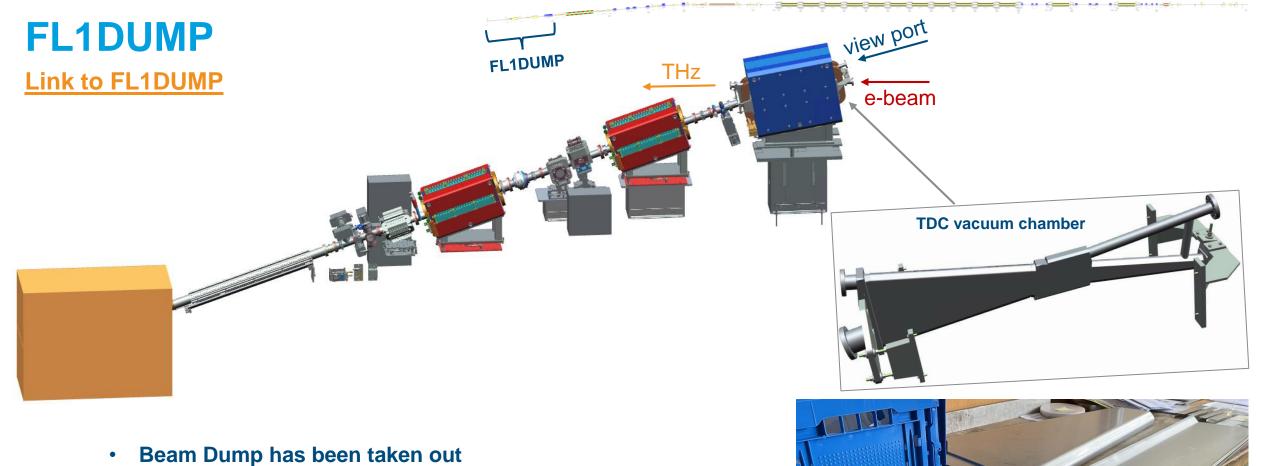




Status:

- Vacuum parts: RFI 🗹
- Radiators:
 - 3 PRN-2 undulators: magnetic structure remeasured and refurbished => RFI
 - 6 new APPLE3 type undulators (FL1UA3, 2.5m long)
 - => see presentation by K. Goetze
- **12 Intersections** ISRA/B/C/D (600 mm):
 - Girders with vacuum parts (incl. BPM) pre-assembled and transfer measured => RFI
 - EASy Movers: tested => RFI
 - Quadrupoles TQG70 => transfer measurement
 - Phase shifters (FS-US) pre-assembled => RFI
 - Steerers => pre-assembly at FS-US
 - => Test assembly of a full girder planned for mid November





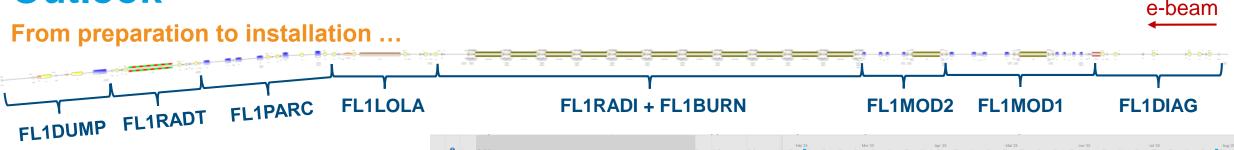
• Spare dump to be installed

Status: Slow but steady progress due to lowest priority

- Last section to be reviewed (lowest priority)
- Supports to be designed and manufactured
- All vacuum parts RFI apart from TDC dipole chamber
 - still in fabrication (... shall not become critical)



Outlook



FL1 beamline assembly & installation:

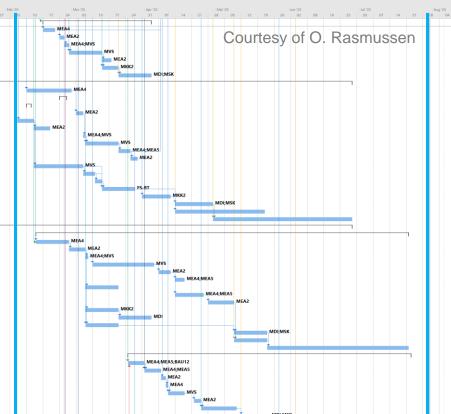
Time schedule: first assumption

- \Rightarrow Start: 06 Feb 25
- \Rightarrow sequential installation (DIAG to DUMP)

However, will require flexible re-scheduling

- \Rightarrow Availability of components
- \Rightarrow Coordination with other work in tunnel
- ⇒ Subject for next progress review meeting

	Vorgi →		Task Name	- Dauer-	Anfang -	Ende • 2 Don 03.04.25	
198				34 d	Mon 17.02.25		
199	٠		Install magnet supports, magnets, collimator, components with survey mark	5 d	Mon 17.02.25	Fre 21.02.25 :	
200		-5	Survey/Adjust	2 d	Mon 24.02.25	Die 25.02.25 :	
201	٠		Prepare vacuum installations (open magnets etc.)	2 d	Mit 26.02.25	Don 27.02.25	
202	٠	-	Vacuum installation	10 d	Fre 28.02.25	Don 13.03.25	
203			Final Survey/Adjustment of DIAG section	2 d	Fre 14.03.25	Mon 17.03.25	
204			Prepare and connect local cables, connect water	5 d	Fre 14.03.25	Don 20.03.25	
205	٠	-	Install and test electron beam diagnostics	10 d	Fre 21.03.25	Don 03.04.25	
206			MOD1 & MOD2 Section, Seed laser beamline	260 d	Die 11.06.24	Fre 27.06.25	
207	٠		Install magnet supports, magnets, components with survey marks	15 d	Mon 10.02.25	Fre 28.02.25 :	
208		-5	MOD1 Section	3 d	Mon 24.02.25	Mit 26.02.25	
213			MOD2 Section	2 d	Mon 10.02.25	Die 11.02.25	
216			Survey/Adjust all remaining components	3 d	Mon 03.03.25	Mit 05.03.25	
217		-5	Install mirror and screen chambers (if not done earlier)	5 d	Don 06.02.25	Mit 12.02.25 :	
218		-5	Survey mirror and screen chambers (if not done earlier)	5 d	Don 13.02.25	Mit 19.02.25	
219			Prepare vacuum installations (open magnets etc.)	1 d	Don 06.03.25	Don 06.03.25	
220	٠		Vacuum installation (incl. Undulator vacuum chambers)	10 d	Fre 07.03.25	Don 20.03.25	
221		-5	Install MOD undulators (2 new planar undulators)	3 d	Fre 21.03.25	Die 25.03.25	
222			Final Survey/Adjustment of MOD1 & MOD2 section	3 d	Mit 26.03.25	Fre 28.03.25	
223			Install and connect seed laser beamline in FL1 tunnel	15 d	Don 13.02.25	Mit 05.03.25	
224			install optical tables in FL1 tunnel	3 d	Don 06.03.25	Mon 10.03.25	
225		-5	install power cabling for optical tables in FL1 tunnel	3 d	Die 11.03.25	Don 13.03.25	
226			Install seeding diagnostics (on optical tables)	10 d	Fre 14.03.25	Don 27.03.25	
227			Prepare and connect local cables, connect water	10 d	Mon 31.03.25	Fre 11.04.25	
228			Install and test electron beam diagnostics	10 d	Mon 14.04.25	Die 29.04.25	
229		-5	Alignment and commissioning of seed laser beamline	25 d	Mon 14.04.25	Mit 21.05.25	
230			Technical commissioning MOD section and seed laser beamline	40 d	Mit 30.04.25	Fre 27.06.25	
231	-	-	Seed laser beamline (Extraction)	260 d	Die 11.06.24	Fre 27.06.25	
246		-5	#RADI + BURN + LOLA section	107 d	Fre 14.02.25	Mon 21.07.25	
247	٠	-5	Install supports, magnets, intersections, LOLA, components with survey marks	10 d	Fre 14.02.25	Don 27.02.25	
248	•	-5	Survey/Adjust	5 d	Fre 28.02.25	Don 06.03.25	
249	٠	-5	Prepare vacuum installations (open magnets etc.)	1 d	Fre 07.03.25	Fre 07.03.25	
250	4	-5	Vacuum installation (incl. undulator vacuum chambers)	20 d	Mon 10.03.25	Fre 04.04.25	
251		-5	Survey/Adjustment of Undulator vacuum chambers	5 d	Mon 07.04.25	Fre 11.04.25	
252		-	Install 3 old Xseed undulators	4 d	Mon 14.04.25	Don 17.04.25	
253		-	LOLA: Connect LOLA waveguides	10 d	Fre 07.03.25	Don 20.03.25	
254		-	Install APPLE undulators	8 d	Mon 14.04.25	Fre 25.04.25	
255		-	Final Survey/Adjustment of RADI/BURN/LOLA section	8 d	Mon 28.04.25	Don 08.05.25	
256		-	BURN+LOLA: Prepare and connect local cables, connect water	10 d	Fre 07.03.25	Don 20.03.25	
257		-	BURN+LOLA: Install and test e-beam diagnostics	10 d	Fre 21.03.25	Don 03.04.25	
258	•	-	RADI: Prepare and connect local cables and water (intersections)	10 d	Fre 07.03.25	Don 20.03.25	
259		-	RADI: Install and test e-beam diagnostics	10 d	Fre 09.05.25	Don 22.05.25	
260		-	RADI: Install and test undulator controls	10 d	Fre 09.05.25	Don 22.05.25	
261		-	Technical commissioning	40 d	Fre 23.05.25	Mon 21.07.25	
262		-	# PARC + RADT + DUMP section	40 d 81 d	Die 25.03.25	Die 22.07.25	
263		-	Install supports and stones + THz undulator and Dump dipole	5 d	Die 25.03.25	Mon 31.03.25	
264		-	Install magnets, components with survey marks	5 d	Die 23.03.25 Die 01.04.25	Mon 07.04.25	
264			Install magnets, components with survey marks Survey/Adjust	2 d	Die 01.04.25 Die 08.04.25	Mit 09.04.25	
265			Survey/Adjust Prepare vacuum installations (open magnets etc.)	2 d 1 d	Die 08.04.25 Don 10.04.25	Don 10.04.25	
200			Prepare vacuum installations (open magnets etc.) Vacuum installation	1 d 5 d	Don 10.04.25 Fre 11.04.25	Don 10.04.25	
267				5 d 3 d		Don 17.04.25	
268			Final Survey/Adjustment of PARC & RADT & DUMP section	3 d 10 d	Die 22.04.25		
209			Prepare and connect local cables, connect water	10 d	Fre 25.04.25	Fre 09.05.25	



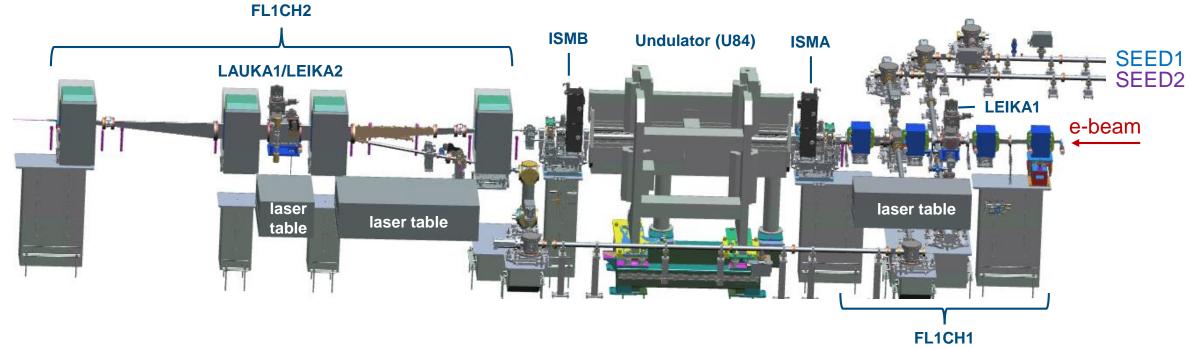
Start: 06 Feb 25 (> Install mirror chambers)

03 Aug 25 End of shutdown

FL1MOD1

FL1MOD1

Assembly strategy



For assembly of FL1MOD1 and FL1MOD2 a more detailed installation schedule / workflow is required:

- Many groups are involved (M and FS)
- Many interfaces / overlap of e-beamlines (FL2 not shown) and both SEED laser beamlines
- Many components only hard to access after installation of others (many parts are not shown above)
 - Cabling work, access during technical commissioning (movers (e.g. position switches), cameras, ...)
 - survey (visibility of fiducials)
 - "Late in-vacuum components" require local clean room

• ...

Summary / Outlook

FL1 Beamline Installation

- Sections: Most sections are RFI < except for Seeding (MOD1/2) and DUMP section
- Vacuum Parts (smooth workflow from ZM to MVS)
 - Almost all parts are RFI except for chicane chambers (and TDC chamber)
 - Remaining steps:
 - Welding of flanges: shortage of man power
 - Copper plating: last fabrication step at external company

Magnets

- Almost all magnets to be re-used except for chicane dipoles
 - So far, delivery / RFI dates not delayed
 - TDK / TDI: In fabrication (delivery date Jan 25, Feb 25 RFI \rightarrow reflected in schedule)
 - TDJ: assembled with new pole shoes \rightarrow reflected in schedule

• Undulators

• See next presentation by K. Goetze

Outlook

- Still: All vacuum components in time according to assembly and installation schedule (start 06 Feb 25)
- Nevertheless, flexible adjustment of installation schedule according to availability
- Complex FL1MOD1/2 sections require more detailed planning of workflow

Contact

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