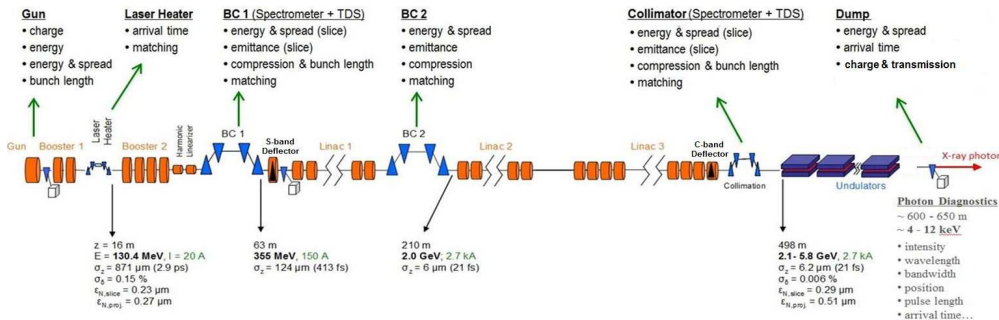


Commissioning Results and First Operational Experience with SwissFEL Diagnostics

V. Schlott, V. Arsov, M. Baldinger, R. Baldinger, G. Bonderer, S. Borelli, R. Ditter, D. Engeler, F. Frei, N. Hiller, R. Ischebeck, B. Keil, W. Koprek, R. Kramert, D. Llorente Sancho, A. Malatesta, F. Marcellini, G. Marinkovic, G.L. Orlandi, C. Ozkan Loch, P. Pollet, M. Roggli, M. Rohrer, M. Stadler, D. Treyer

Paul Scherrer Institut (PSI), Diagnostics Section, CH-5232 Villigen PSI, Switzerland

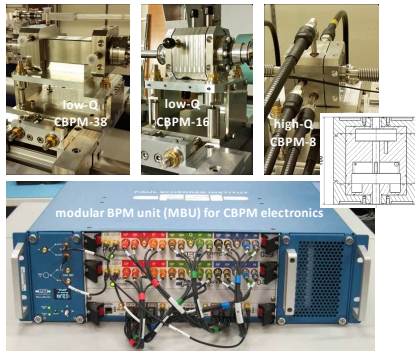
Diagnostics Overview of SwissFEL (ARAMIS Branch)



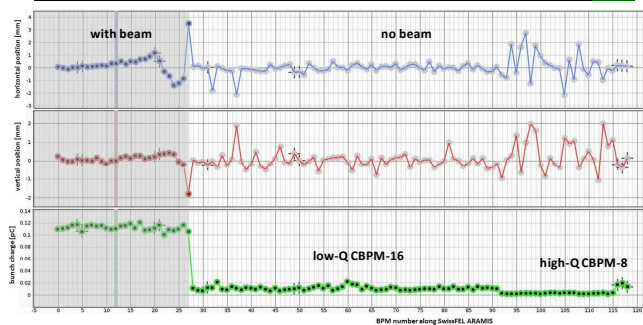
Diagnostics Device	Type	Number
beam position	cavity BPMs	119
transverse profile monitors	scintillator screens	24
	wire scanners	23
charge monitors	SR-monitors	3
	Turbo ICT	4
loss monitors	scintillating (local)	38
	Cerenkov (dist.)	8
dose rate monitors	Rad-FET	32
beam arrival time	electro-optical	4
compression	THz / FIR-vis	1 / 2
laser arrival time	electro-optical	1
transverse deflector	S-band / C-band	1 / 1

Beam Position Monitors

details on SwissFEL BPMs are presented in: Keil et al. TUPFC17 and Stadler et al. TUPFC18

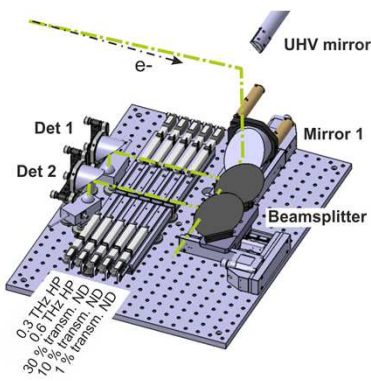


BPM control room display with beam in the SwissFEL injector at bunch charges of 120 fC

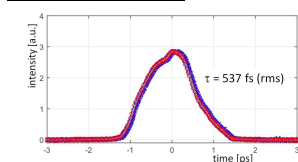


Parameter	CBPM38	CBPM16	CBPM8
Quantity	7	88	24
Locations	injector, LINACs, BCs, switchyard, transfer lines		undulators
Material (cavity / frame)	SS	SS	Cu / SS
Inner Aperture [mm]	38	16	8
Position Meas. Range [mm]	± 10	± 5	± 1
# of Bunches ($\Delta t = 28$ ns)	1 - 3	1 - 3	1
Bunch Repetition Rate [Hz]	100	100	100
TM ₁₁₀ Frequency [GHz]	3.3	3.3	4.9
Quality Factor Q _L	40	40	1000
Charge Range [pC]	10 - 200	10 - 200	10 - 200
Position Resolution [μ m pC]	8	8	5
- at 10 pC	< 1 μ m	< 1 μ m	< 0.5 μ m
Charge Resolution [%]	0.07	0.07	0.04
	(≤ 5 fC)	(≤ 5 fC)	(≤ 3 fC)

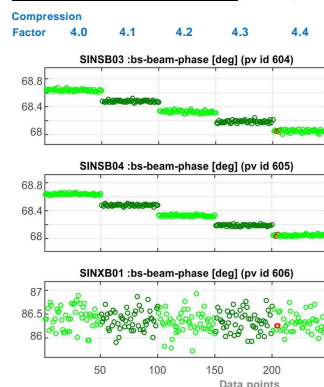
BC-1 Compression Monitor



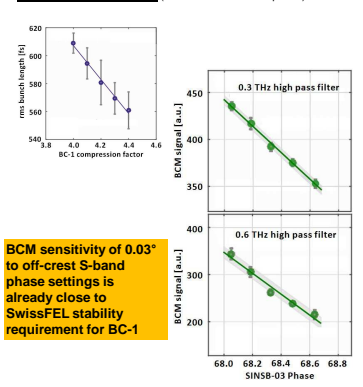
Bunch Length behind BC-1 (measured with S-band TCAV)



Phase Scans of S-band Structures (off-crest operation)



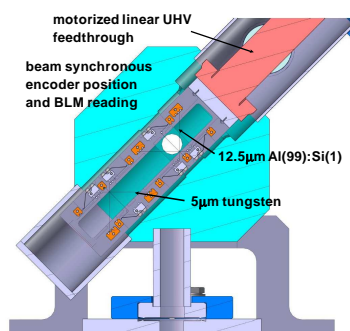
BC-1 BCM Sensitivity (to off-crest SINSB-03 phase)



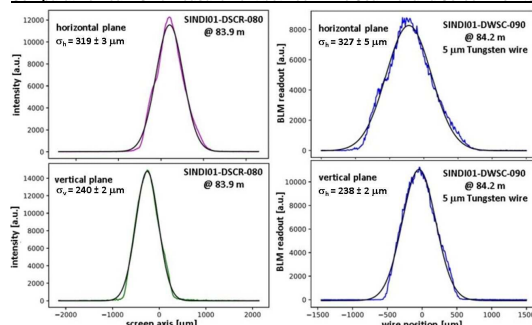
BCM sensitivity of 0.03° to off-crest S-band phase settings is already close to SwissFEL stability requirement for BC-1

Wire Scanner

details on SwissFEL WSCs are presented in: Orlandi et al. WEPCC16



Comparative Beam Size Measurement between Wire Scanner and Screen Monitor



Gun Laser Arrival Time Monitor

balanced optical cross correlator (BOXC) measures IR gun laser oscillator pulses vs. amplified IR output (1.3 km optical beam path) and stabilizes to <10 fs (rms).

In preparation: UV LAM stabilizing to pulsed optical reference signal

