ELETTRA AND ELETTRA 2.0

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Abstract

The status of the Italian 2.4/2.0 GeV third generation light source Elettra is presented together with the future upgrade concerning the new ultra-low emittance light source Elettra 2.0 that will provide ultra-high brilliance while the very short pulses feasibility study for time resolved experiments is in progress.

Elettra 1.0 - Status:

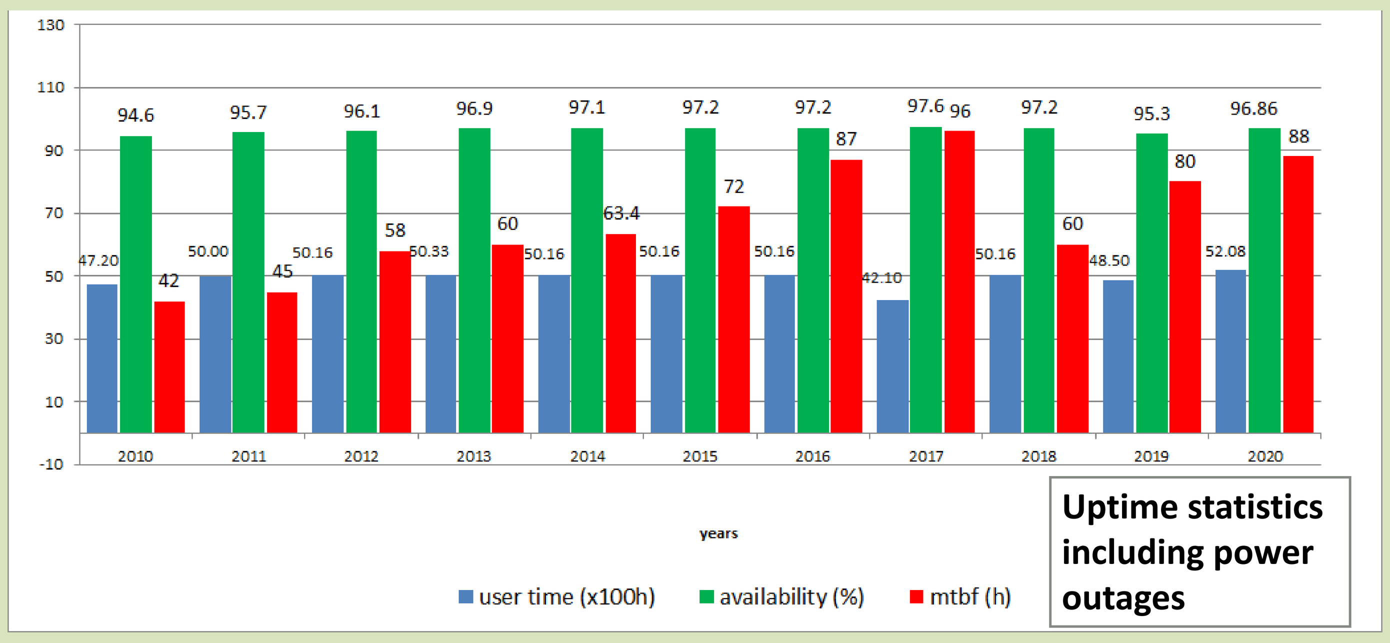
Elettra operates for users since 1994, 24 hours/day, seven days a week delivering 5000 hours/year of synchrotron light from IR to (soft) x-rays to 28 beam lines of which 10 are served from dipoles while 2 use light from a superconducting 49 pole 64 mm period 3.5 T wiggler.

The other types of insertion devices used are planar, figure-8, APPLE II, electromagnetic while one beam line uses a canted set of APPLE II type undulators.

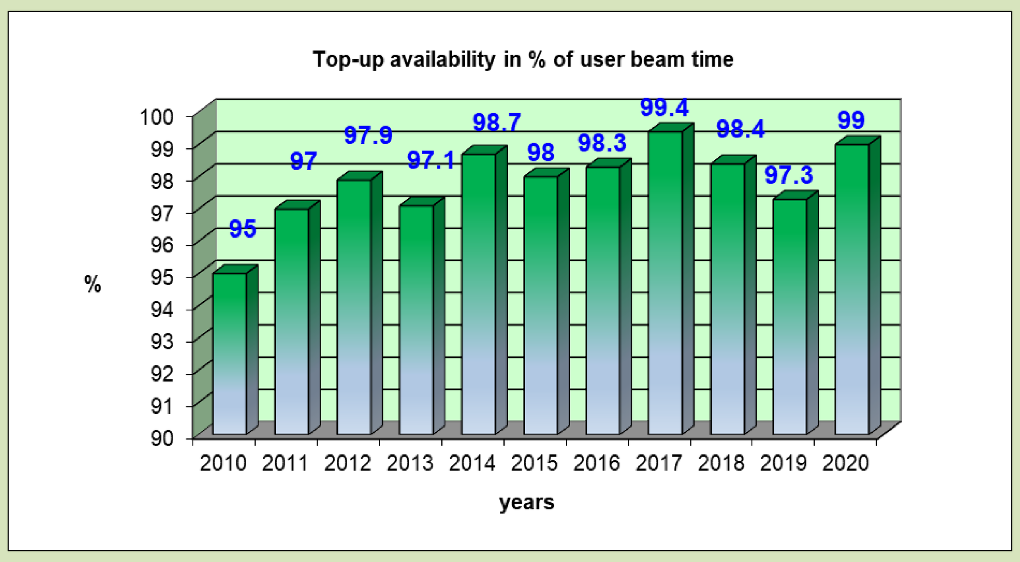
The machine consists of a 100 MeV linac, a 2.5 GeV booster, and a 2 / 2.4 GeV (with bare emittance of 7 / 10 nm-rad respectively) storage ring.

At about 75% of user dedicated time Elettra operates at 2 GeV while for the remaining 25% at 2.4 GeV being the only facility to operate at two energies (both in top-up).

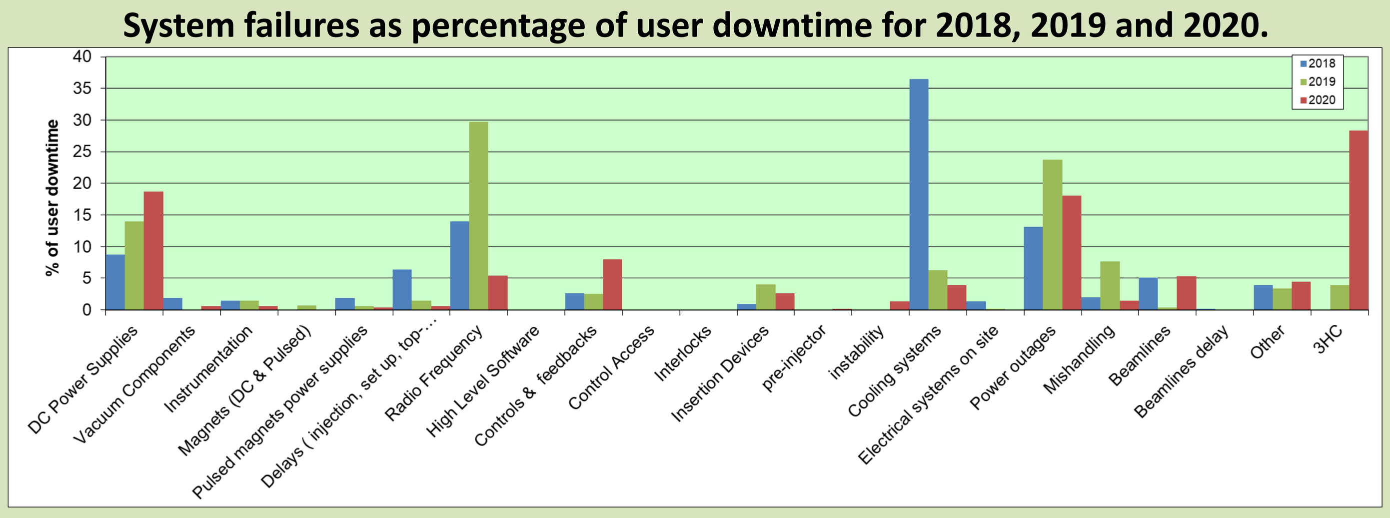
The main operating modes are multibunch with a dark gap of 42 ns and hybrid with one or two single bunches in the middle of the dark gap. The operating intensities are 310 mA at 2 GeV and 160 mA at 2.4 GeV with 5 mA for the single bunch(es) when in hybrid mode.



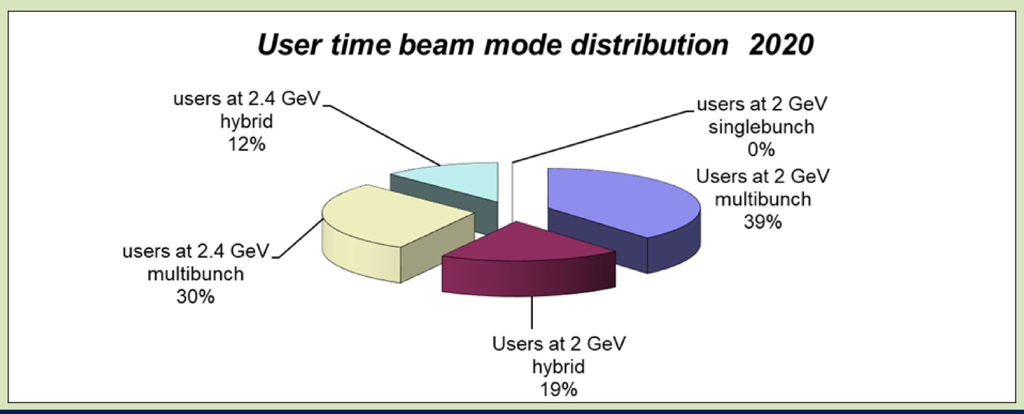
Uptime statistics including power outages

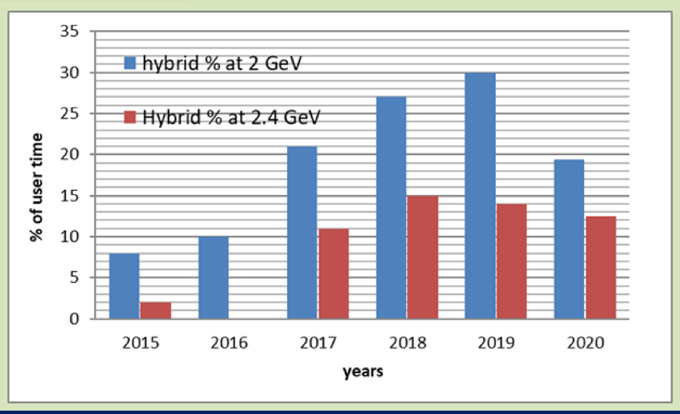


System failures as percentage of user downtime for 2018, 2019 and 2020.

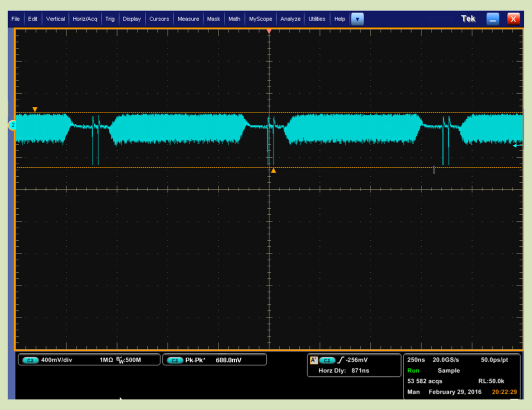


excellent orbit stability for 1 day





Time resolved distribution in % of user time for the last 5 years



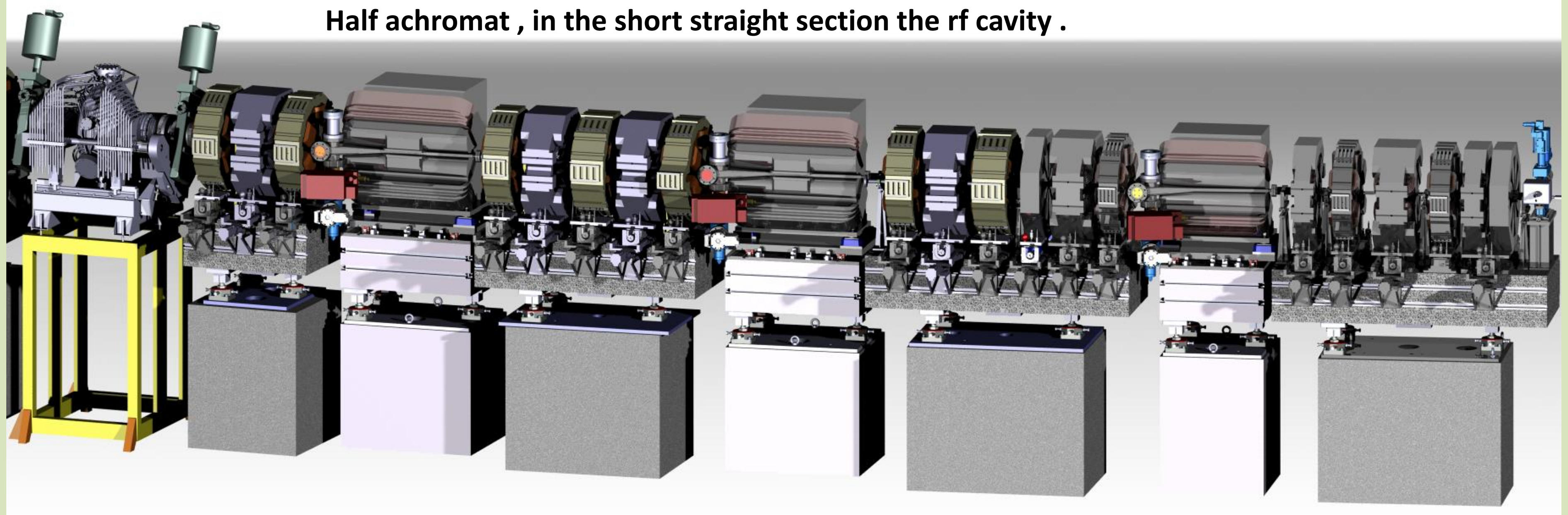
ELETTRA 2.0

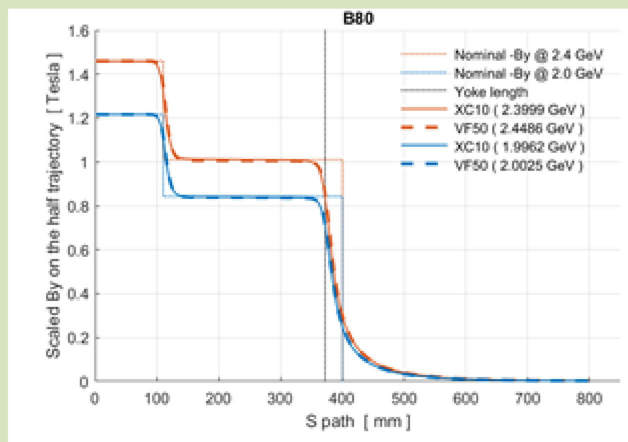
The lattice of next generation DLSR Elettra 2.0 was constructed taking into consideration the users requests, optimizing the relation emittance vs. final photon beam at the experiment and maximizing the slots available for insertion devices. Based on the new revised requirements an enhanced version of our S6BA (symmetric six bend achromat) was produced namely S6BA-E with 12-fold symmetry by using longitudinal gradient (LG) dipoles (4 per achromat) and anti-bending quadrupoles (8 per achromat). The project is approved and financed by the Italian Government.

Final requirements

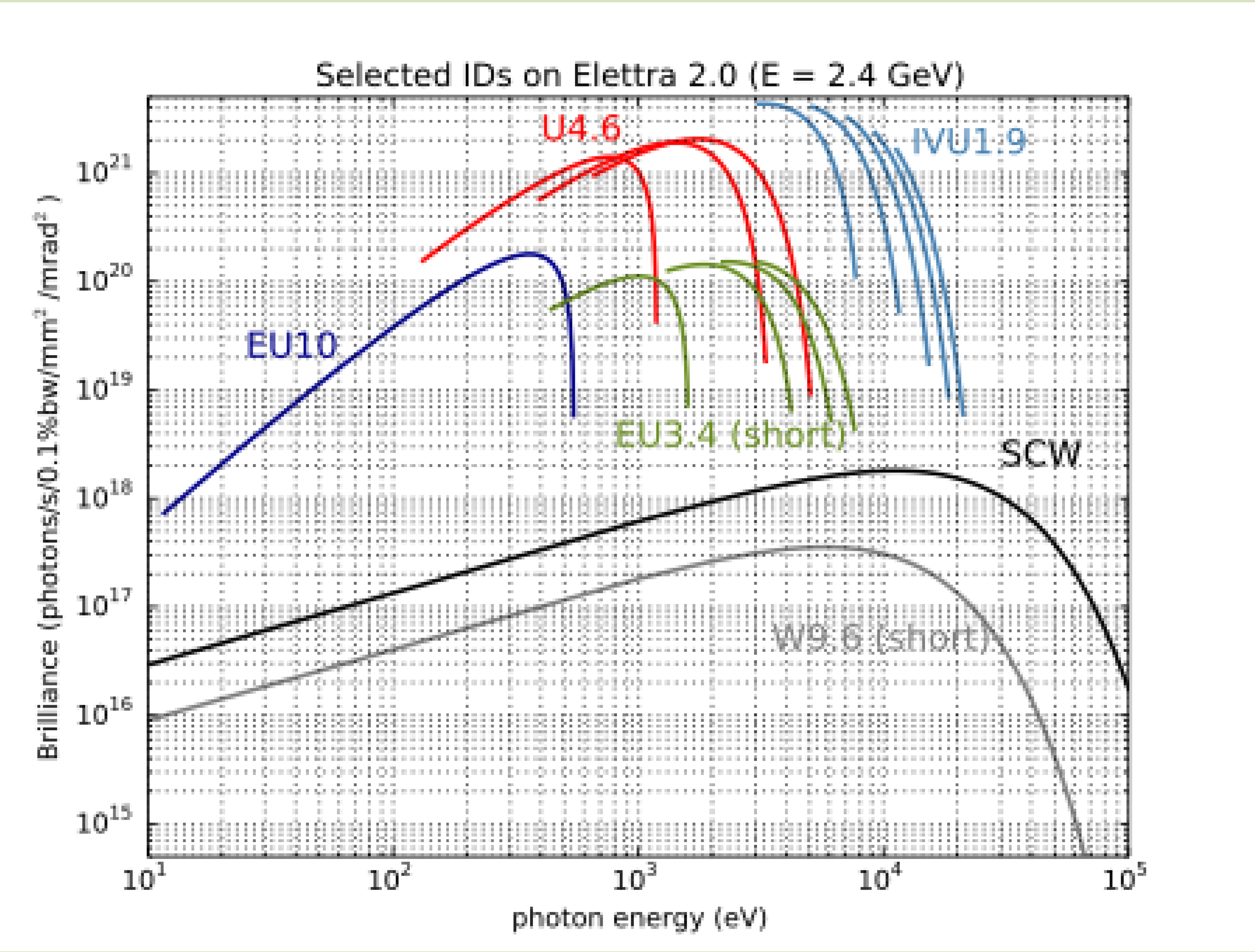
- ✓*Main operating energy 2.4 GeV (and for some time also at 2 GeV)*
- ✓*Reduce the horizontal equilibrium emittance at least one order of magnitude*
- ✓*Conserve the existing ID beam lines in LS at the same position*
- ✓*Conserve the existing dipole magnet beam-lines*
- ✓*Conserve the slots available for insertion devices*
- ✓*Preserve the present intensities and the time structure of the beam*
- ✓*Let open the possibility for installing bunch compression scheme*
- ✓*Include super-bends and in-vacuum undulators*
- ✓*Keep the present injection scheme and injection complex*
- ✓*Keep the same building and the same ring circumference (259.2 m)*
- ✓*Minimize the downtime for installation and commissioning to about 18 months maximum.*

Half achromat , in the short straight section the rf cavity .

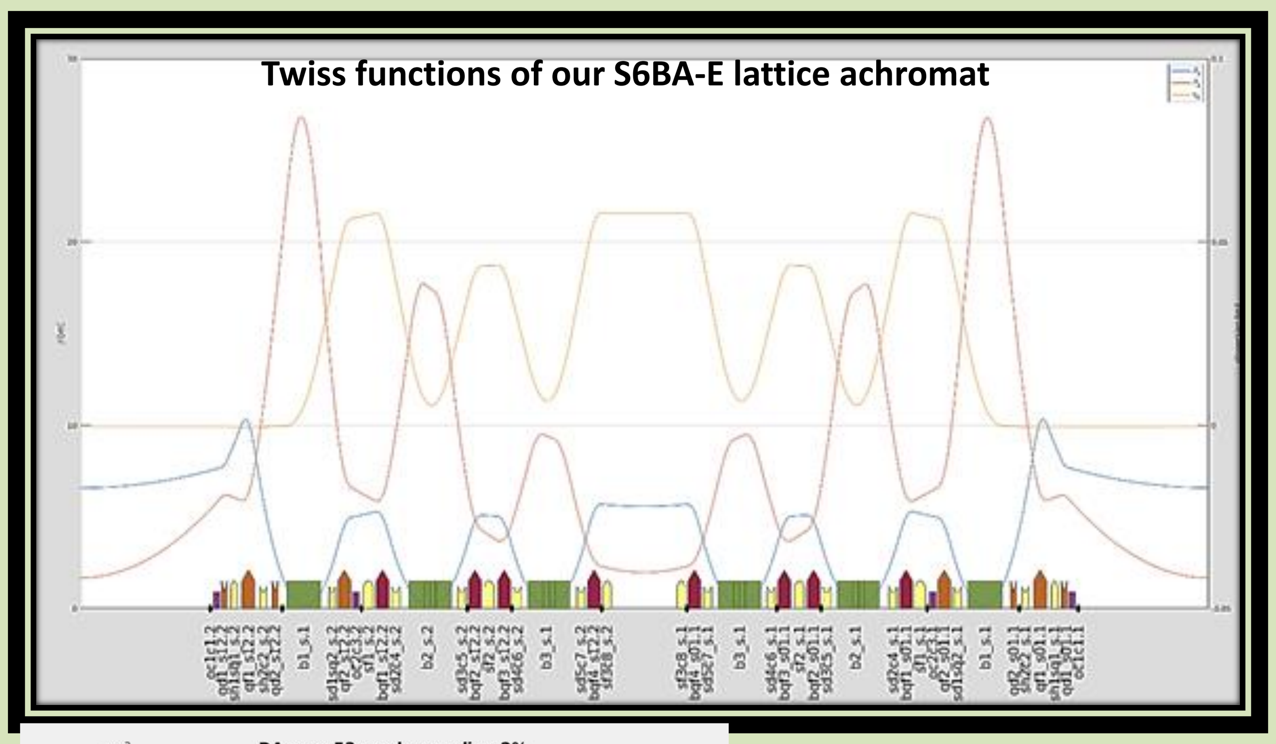


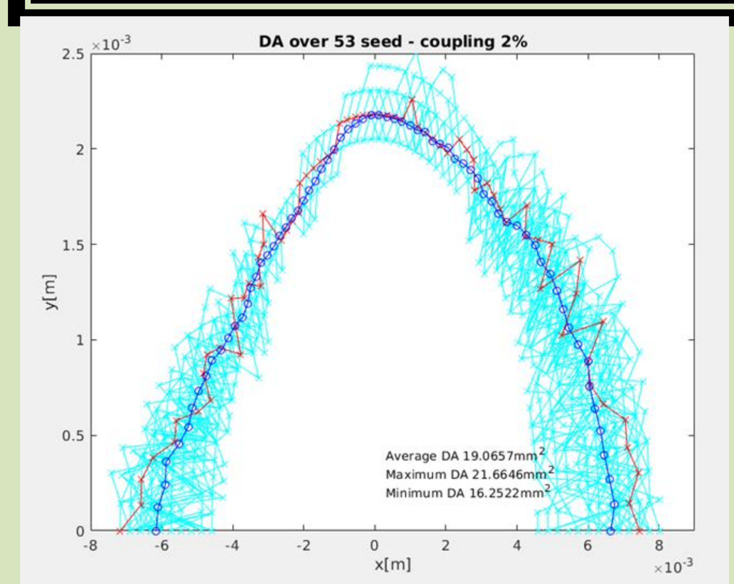


LG dipole field. In the low field region there is also transverse gradient



Old and new IDs brilliance profile





On-energy dynamic aperture including all errors, all IDs at functioning settings and the chamber dimensional limitations .

Section	Beamline	Lowest photon energy				Highest photon energy			
		Δt_{FWHM} (ps)		ΔF/F (%)		Δt_{FWHM} (ps)		ΔF/F (%)	
		DR	*IM*	*DR*	*IM*	*DR*	*IM*	*DR*	*IM*
1.2	Nanospectroscopy	16.5	10	1	3	2	1.8	0.2	3
2.1	TwinMic	48	1.2	1	1.6	45	0.8	0.5	1.7
3.2	Spectroμ	47	10	1	1.6	45	2.9	1	2
4.2	MOST	14	18	0.5	8	2.8	4.5	0.1	10
5.1	XRD1	1.8	1.4	0.2	3	1.3	1.4	0.2	3
5.2	μXRD	9	0.9	1	2	5.8	0.8	1	2
6.2	CDI	3.5	5.3	0.5	5	1	2.4	0.1	5
7.2	μXRF	5.5	1	0.4	2	2.4	0.9	0.4	2
8.1	Aloisa	27	1.1	1	1.6	9.4	0.8	0.3	2
8.2	BACH	15	6	0.5	3	2.5	1.8	1	4
9.2	APE LE	38	7	0.2	2	13	1.9	1.5	2
9.2	APE HE	15	2.2	1.5	2	5	1.2	1	2
10.1	APE TX	17	0.8	0.5	1.6	7	0.7	0.5	1.6
10.2	HB-SAXS	1.2	1.3	0.1	3	0.9	1.2	0.1	3
11.1	XAS-mW	1.4	23	0.1	50	1	22	0.1	50
11.2	Xpress (SCW)	30	1.1	0.5	2	17	1.1	1	2.5

Fwhm photon pulse length (ps) corresponding at each beamline.

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