

STATUS OF HEPS INSERTION DEVICES DESIGN

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ABSTRACT

HEPS is a 4th generation light source with the energy of 6 GeV and ultralow emittance of 34 pm.rad. A total of 14 beamlines with 19 insertion devices has been planned in the first phase, including 6 cryogenic undulators, 5 in-vacuum undulators, and two special non-planar IDs. The schemes and parameters of all the IDs are planned to be determined in this year. We report on the status of the design of these IDs and their effects on beam dynamics.

Introduction

The first phase of HEPS is planned to be completed in 2025. A total of 14 ID-based beamlines are required in the first phase of HEPS. The photon energy range is targeted at hard-X ray (>10KeV) regime for most beamlines except one for the research of the high resolution nanoelectronic structures which the interest energy range is at 100-2000 eV.

After several years of iteration and consultation with beamline users, schemes of ID type selection and parameters have frozen in Oct. 2020.

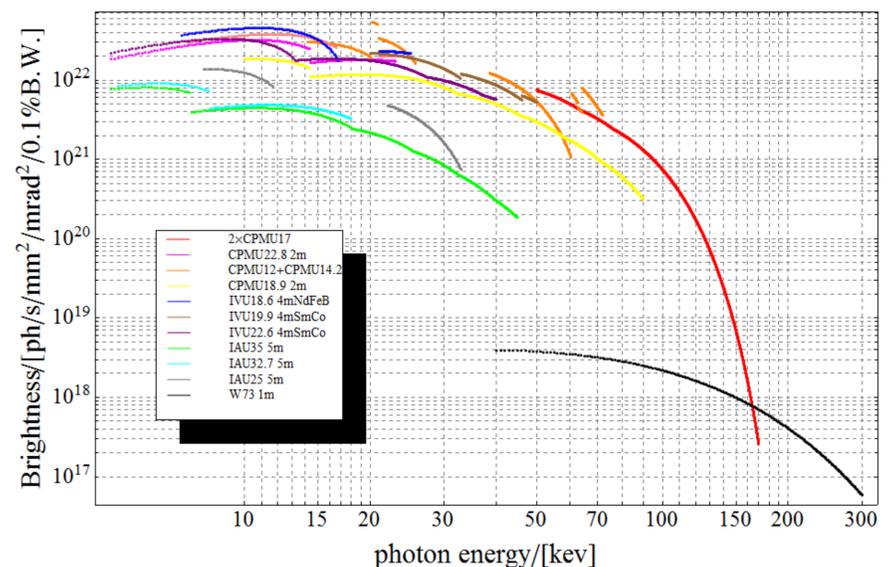
Types and parameters of all IDs for 14 beamlines

ID Number	Type	Period length (mm)	Period Number	Peak field (T)
ID07	CPMU	16.7	117	1.19
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ID19	IVU (SmCo)	22.6	174	1.1
ID23	CPMU	12	164	0.81
ID23	CPMU	14.2	138	1
ID09	IVU (SmCo)	19.9	199	0.97
ID33	IVU (NdFeB)	18.6	213	1.04
ID31	IVU (SmCo)	19.9	199	0.97
ID21	CPMU	18.8	104	1.35
	wiggler	73	13	1.64
	Mango wiggler	51/50	18	1
ID05	IVU (SmCo)	22.6	174	1.1
ID42	CPMU	22.8	85	1.18
	IAW	73	13	1.64
ID46	IAU	35	141	0.88
ID02	IAU	32.7	151	0.8
ID08	IAU	25	199	0.54
ID30	IAU	32.7	141	0.88
ID06	APPLE-KNOT	256.8	18	Hl:By/Bx: 0.8/0.66
				Vl:By/Bx: 0.77/0.41
				C:By/Bx: 0.82/0.46

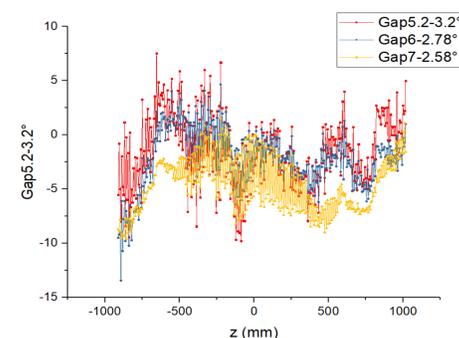
SUMMARY

Up to now, all types and parameters of most of the IDs are chosen after the long-term iteration design between the accelerator and the beamline experts. However, physical designs of two special non-planar IDs are still in progress. Nevertheless, development of the first CPMU has not yet been completed that means the fabrication process of standard CPMU is still need time to be explored. Fabrication of the first 4 meters long IVU is planned to start in 2021.

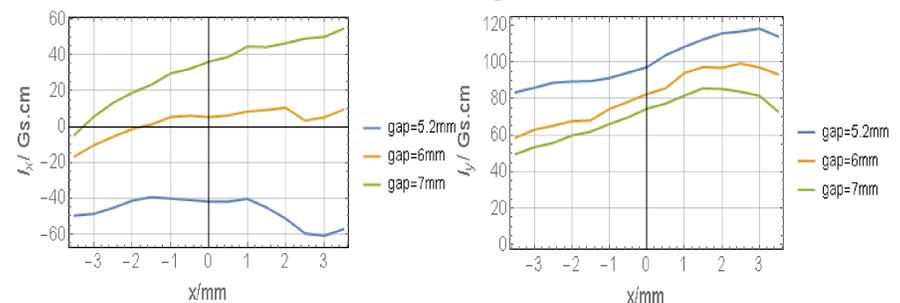
Brilliance of all IDs for 13 beamlines at high-brightness mode



Status of CPMU12 measurement

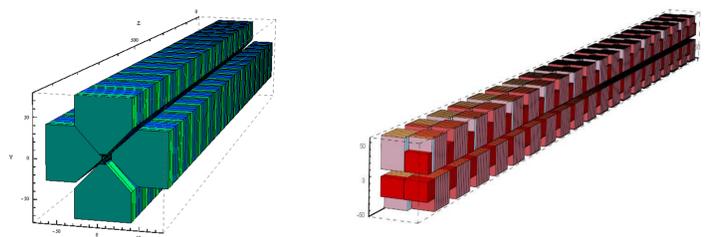


Phase errors@80K



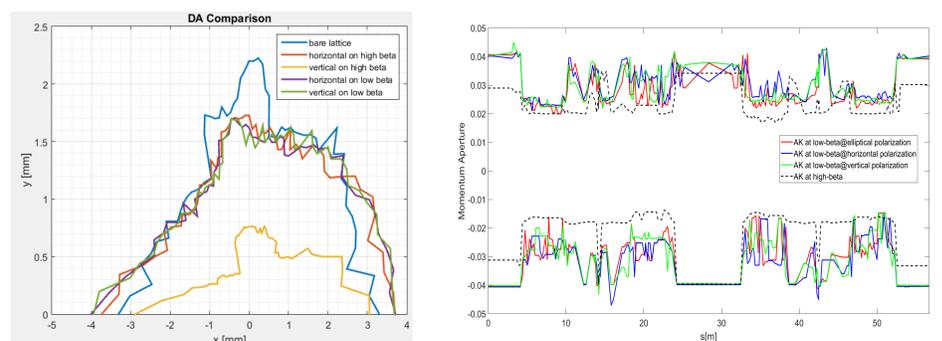
Field integral error distribution in the good field region@80K

Special non-planar IDs



Delta-type Mango wiggler(left) and 4-rows APPLE-Knot undulator(right)

Dynamic effects



Dynamic aperture comparison(left) and 4-rows Local momentum acceptance comparison(right)

We have changed the planned location of APPLE-Knot ID from the high beta straight section to the low beta straight section to increase the DA and LMA and finally ensure the beam life time over 1.6 hour (with all IDs but without errors) for the high-bunch-charge mode at 200 mA.