

Insertion Device Needs of IXS-CAT

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APS-ANL
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IXS-CAT

A **second** generation beam line
dedicated for inelastic x-ray scattering

Plan:

Scientific agenda

Time table

Devices

What is needed ?

- **Specialized undulators**
 - Superconducting undulator
 - Short period planar undulator (15 mm)
- **A longer straight section (~10 m)**
- **A narrower minimum magnet gap**

Scientific Agenda

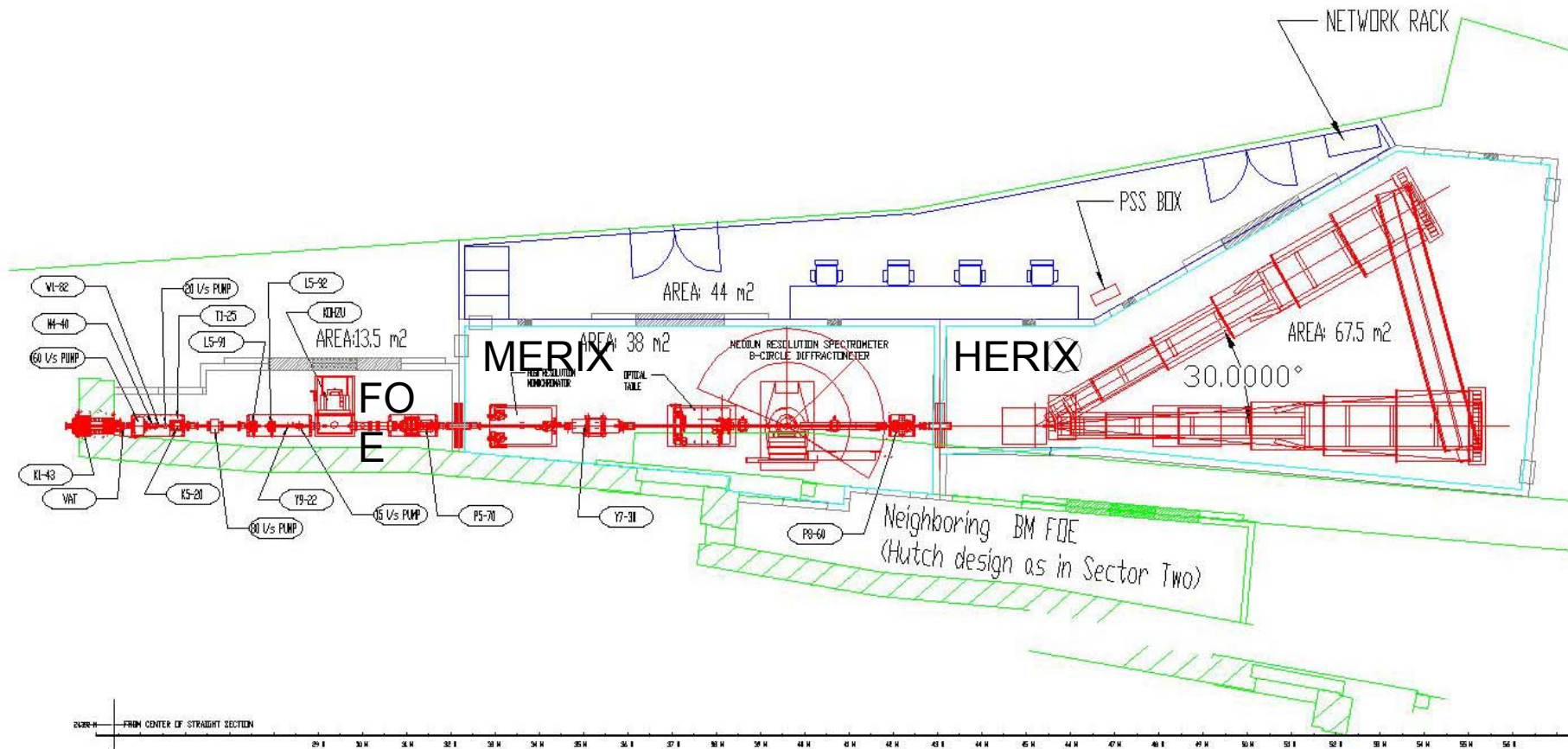
- Medium resolution inelastic x-ray scattering for electronic structure studies in e.g. correlated electron systems.

MERIX :10-200 meV @ 5-12 keV

- High resolution inelastic x-ray scattering for collective excitations in solids and liquids

HERIX :1 meV@ 25.7 keV, 2 meV @ 21.567 keV

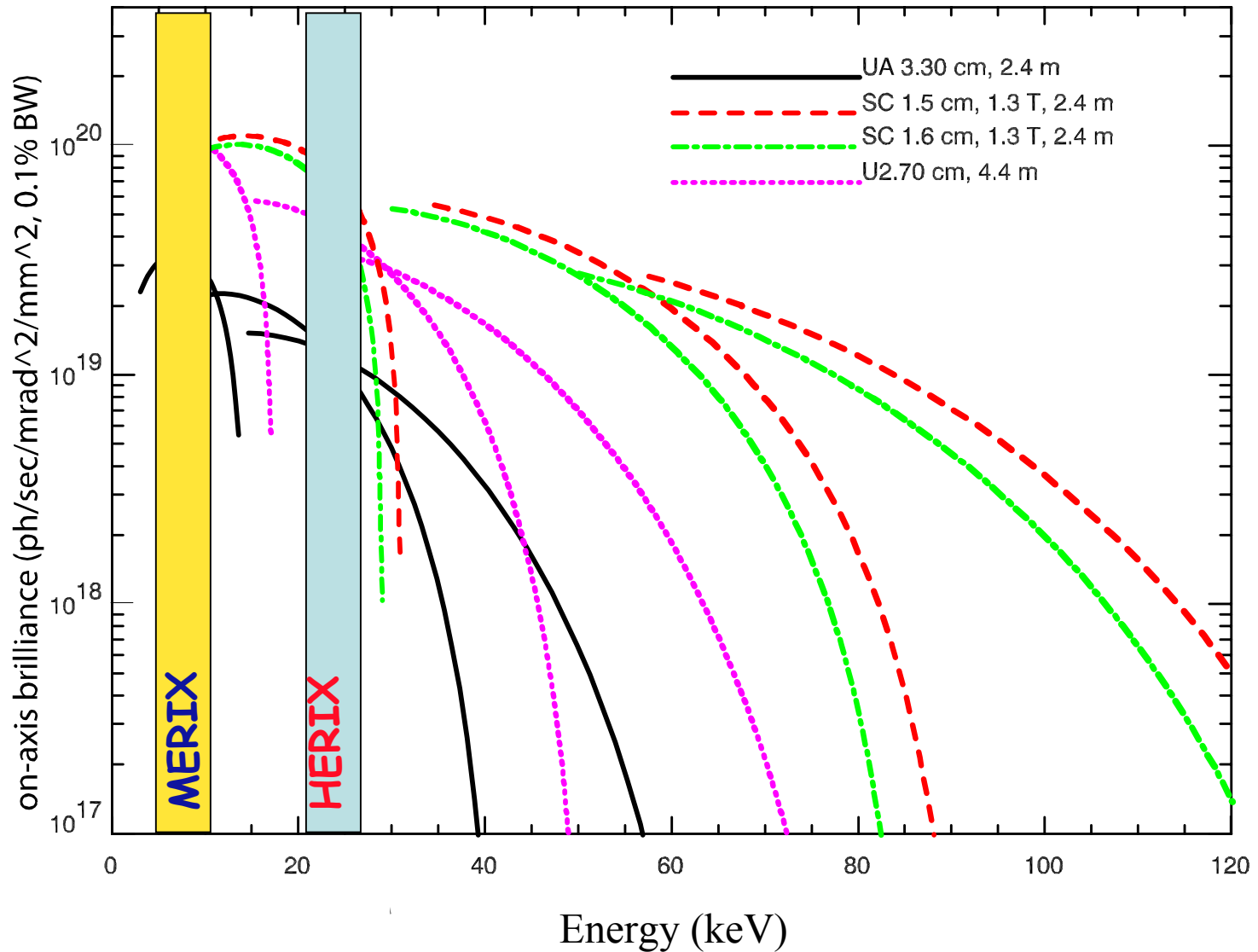
IXS-CAT Layout



Time table

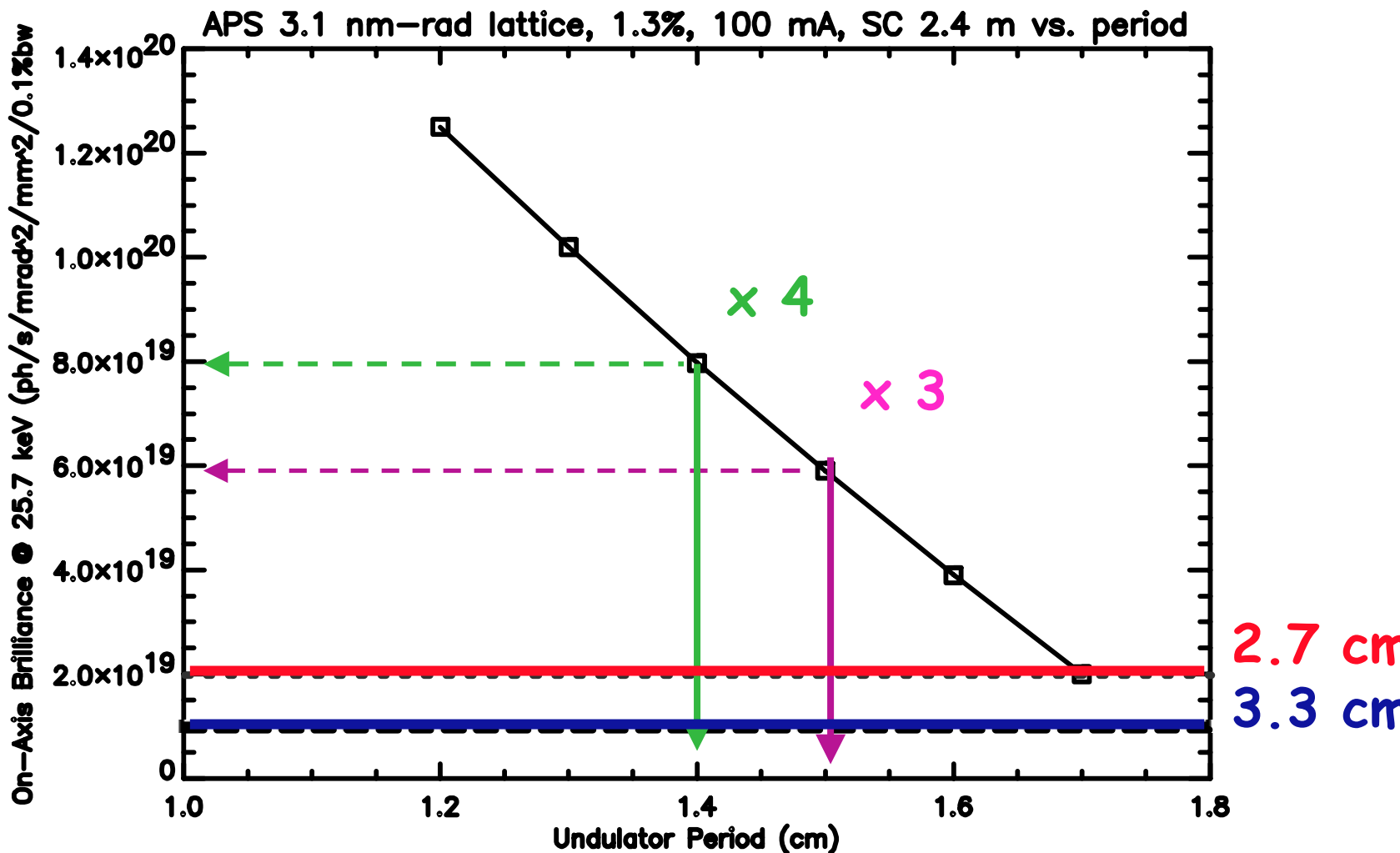
- **Start of the project :** 2002
- **Start of construction:** 2003
- **Start of commissioning:** 2004
- **End of the project :** 2005

APS, 3.1 nm-rad lattice, 1.3 % coupling

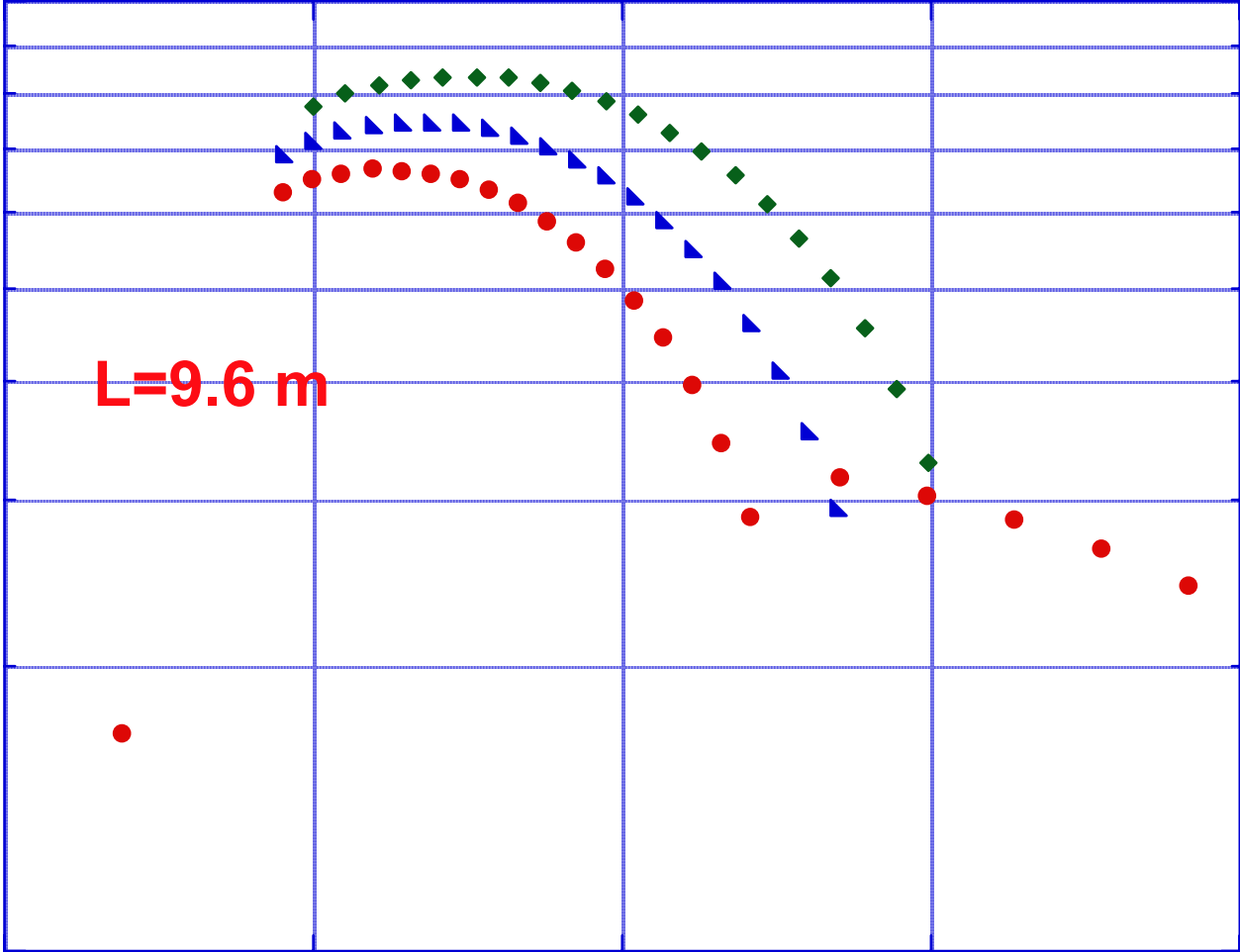


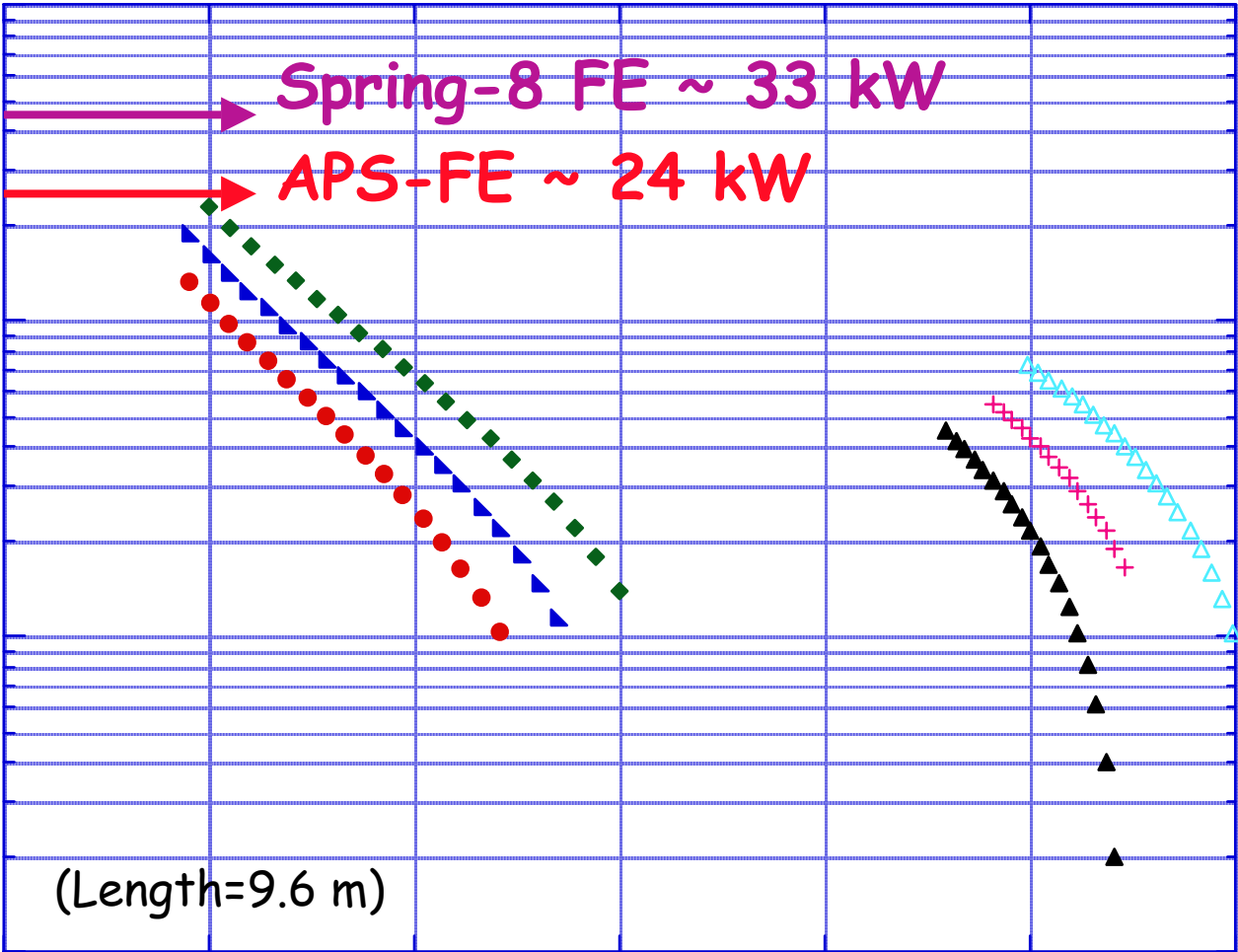
(from R. Dejus, 2002)

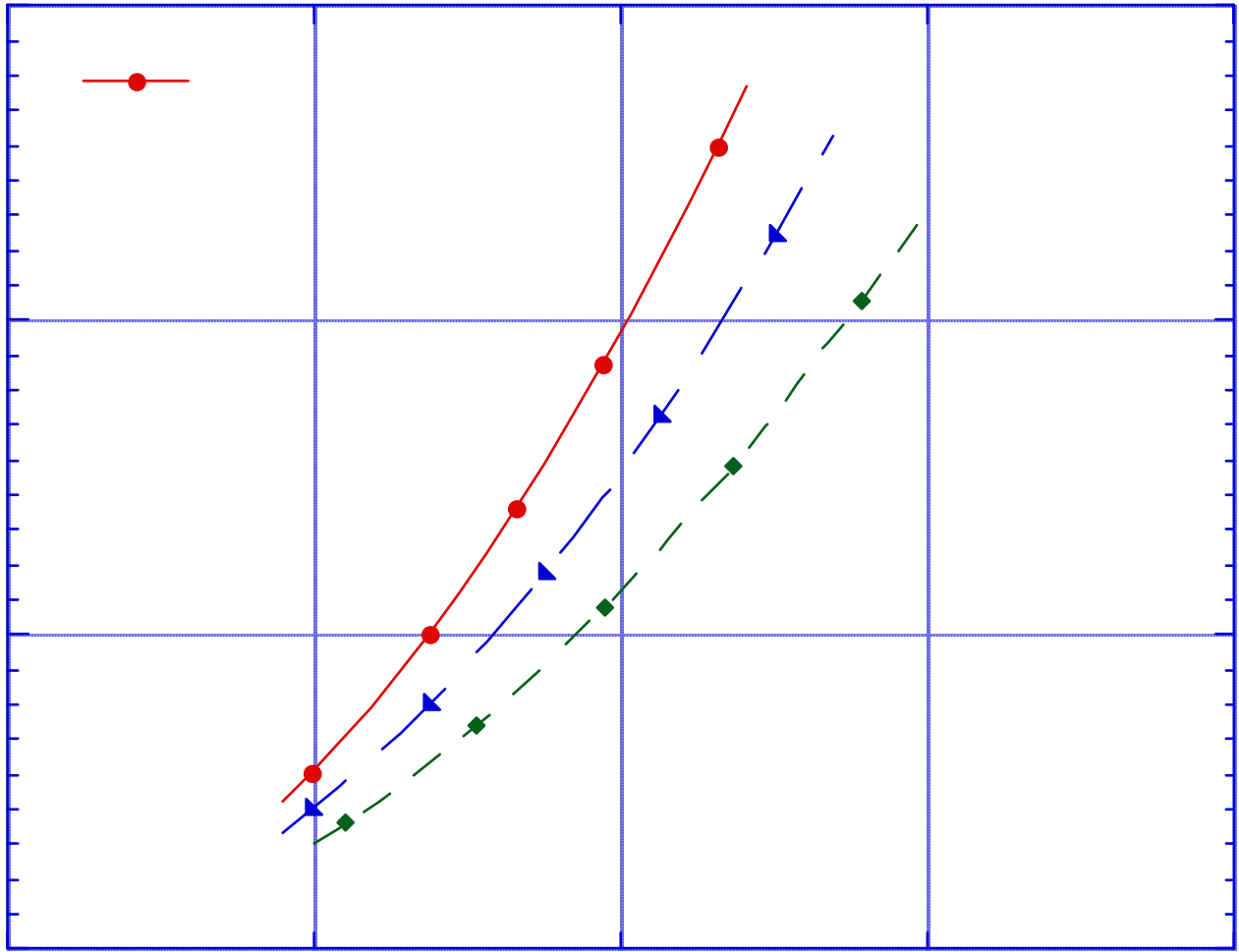
Performance of Superconducting undulators at 25.7 keV as a function of period

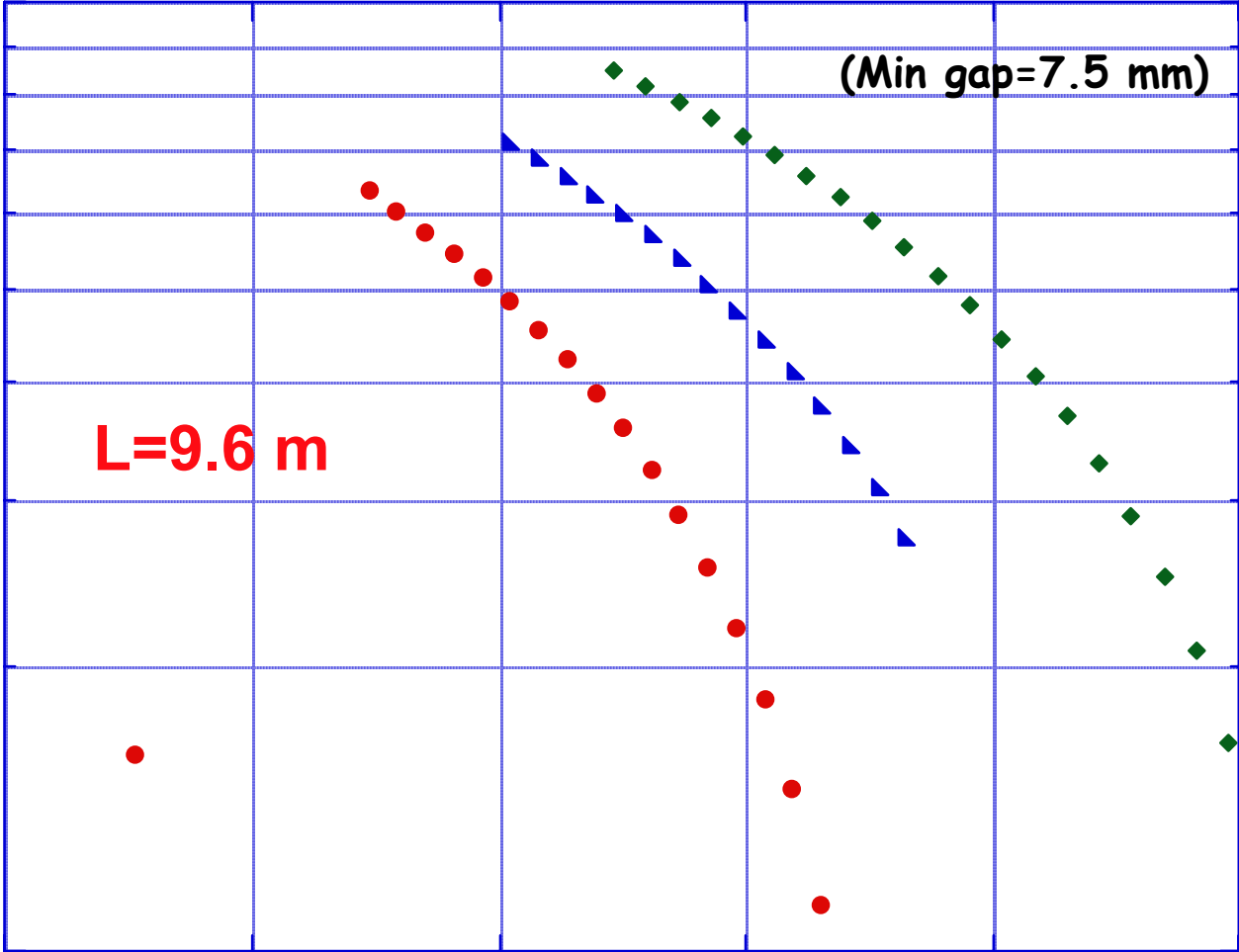


(from R. Dejus, 2002)









Calculated field strength (B), undulator deflection parameter (K) and minimum reachable energy (E1) in the first harmonic for undulators with different periods

Period (mm)	B(T) 5 mm	B(T) 6.5 mm	B(T) 8.5 mm	B(T) 10.5mm	K 5 mm	K 6.5 mm	K 8.5 mm	K 10.5mm	E1(keV) 5 mm	E1(keV) 6.5 mm	E1(keV) 8.5 mm	E1(keV) 10.5mm
13	0.58167	0.37877	0.22787	0.14745	0.70605	0.45977	0.27659	0.17898	28.663	32.385	34.488	35.24
14	0.64812	0.43066	0.26384	0.17212	0.84723	0.56297	0.34489	0.22499	24.468	28.702	31.384	32.42
15	0.71316	0.48288	0.30120	0.19845	0.99884	0.67632	0.42186	0.27794	20.705	25.257	28.498	29.87
16	0.77652	0.53504	0.33961	0.22620	1.1601	0.79933	0.50737	0.33793	17.391	22.050	25.776	27.52
17	0.83801	0.58682	0.37877	0.25513	1.3302	0.93147	0.60123	0.40498	14.529	19.097	23.191	25.30
26	1.3024	1.0105	0.73198	0.53999	3.1618	2.4531	1.7770	1.3109	2.9847	4.4660	6.9425	9.629
27	1.3448	1.0518	0.76916	0.57208	3.3903	2.6515	1.9391	1.4422	2.5553	3.8183	5.9863	8.451
28	1.3856	1.0919	0.80570	0.60395	3.6226	2.8546	2.1064	1.5790	2.1986	3.2763	5.1654	7.400
29	1.4249	1.1308	0.84157	0.63556	3.8583	3.0620	2.2788	1.7210	1.9011	2.8221	4.4632	6.470
30	1.4627	1.1686	0.87676	0.66686	4.0973	3.2734	2.4559	1.8680	1.6518	2.4406	3.8639	5.653
31	1.4991	1.2053	0.91124	0.69782	4.3393	3.4888	2.6376	2.0199	1.4418	2.1192	3.3529	4.939
32	1.5342	1.2409	0.94503	0.72841	4.5841	3.7077	2.8237	2.1764	1.2642	1.8476	2.9172	4.318
33	1.5681	1.2755	0.97811	0.75860	4.8316	3.9301	3.0138	2.3375	1.1132	1.6171	2.5455	3.779
34	1.6007	1.3090	1.0105	0.78838	5.0816	4.1557	3.2079	2.5028	0.98418	1.4210	2.2279	3.313
35	1.6321	1.3416	1.0422	0.81773	5.3339	4.3844	3.4058	2.6724	0.87356	1.2534	1.9560	2.909

E. Alp, et al, Nucl. Instr. Meth. **A467** (2001) 617.

Conflicting Aspects & Solution Prospects

- Higher flux with modest K (~ 2) : FE heat load capacity
 - Narrower fixed masks and reduced horizontal emittance for novel masks and shutters
- Too many undulators :
 - Adjustable period (?) devices
- Long straight section and narrow vacuum chamber
 - Superconducting undulator with $K \sim 1$ at 10 mm gap

Summary

- Need to have a ~1.5 cm period, 2.5 m long superconducting undulator in 2.5 years
- Need to have 2 Undulator A type device

Acknowledgments

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