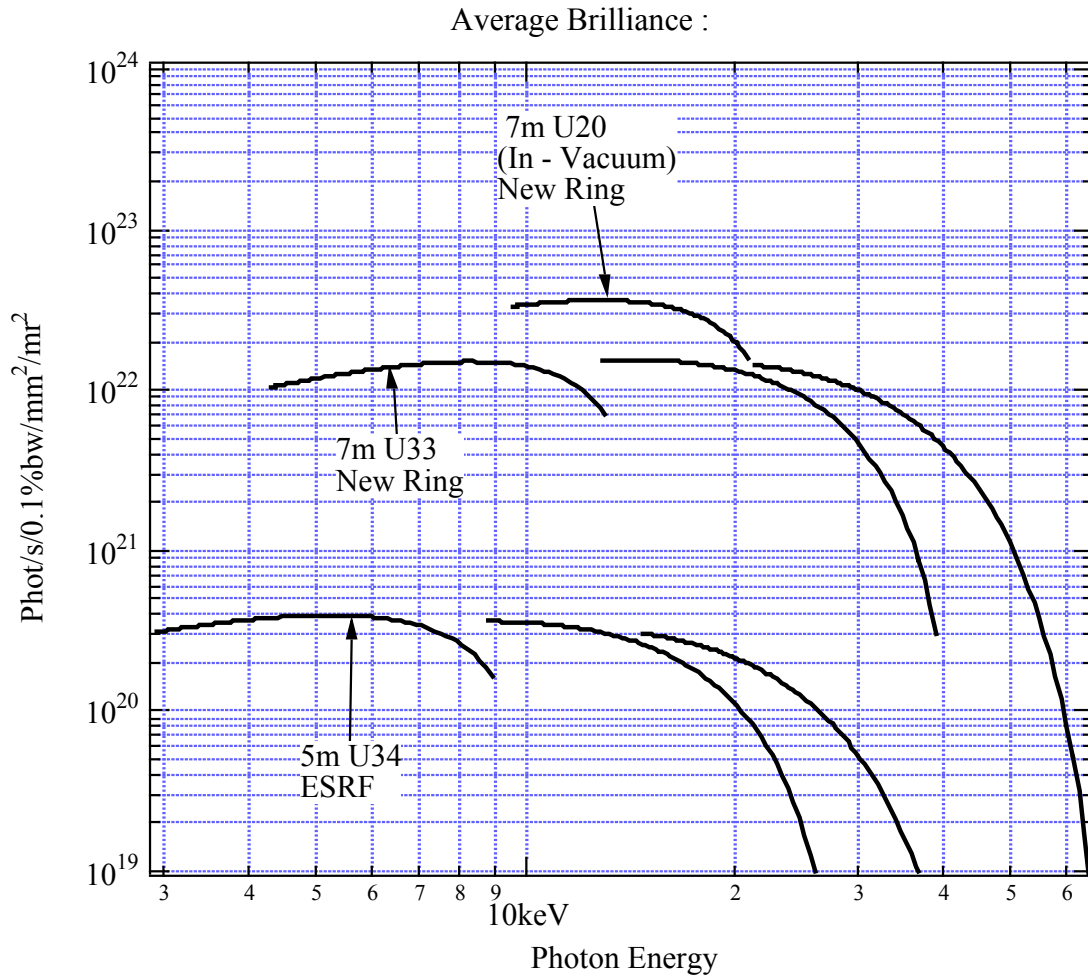
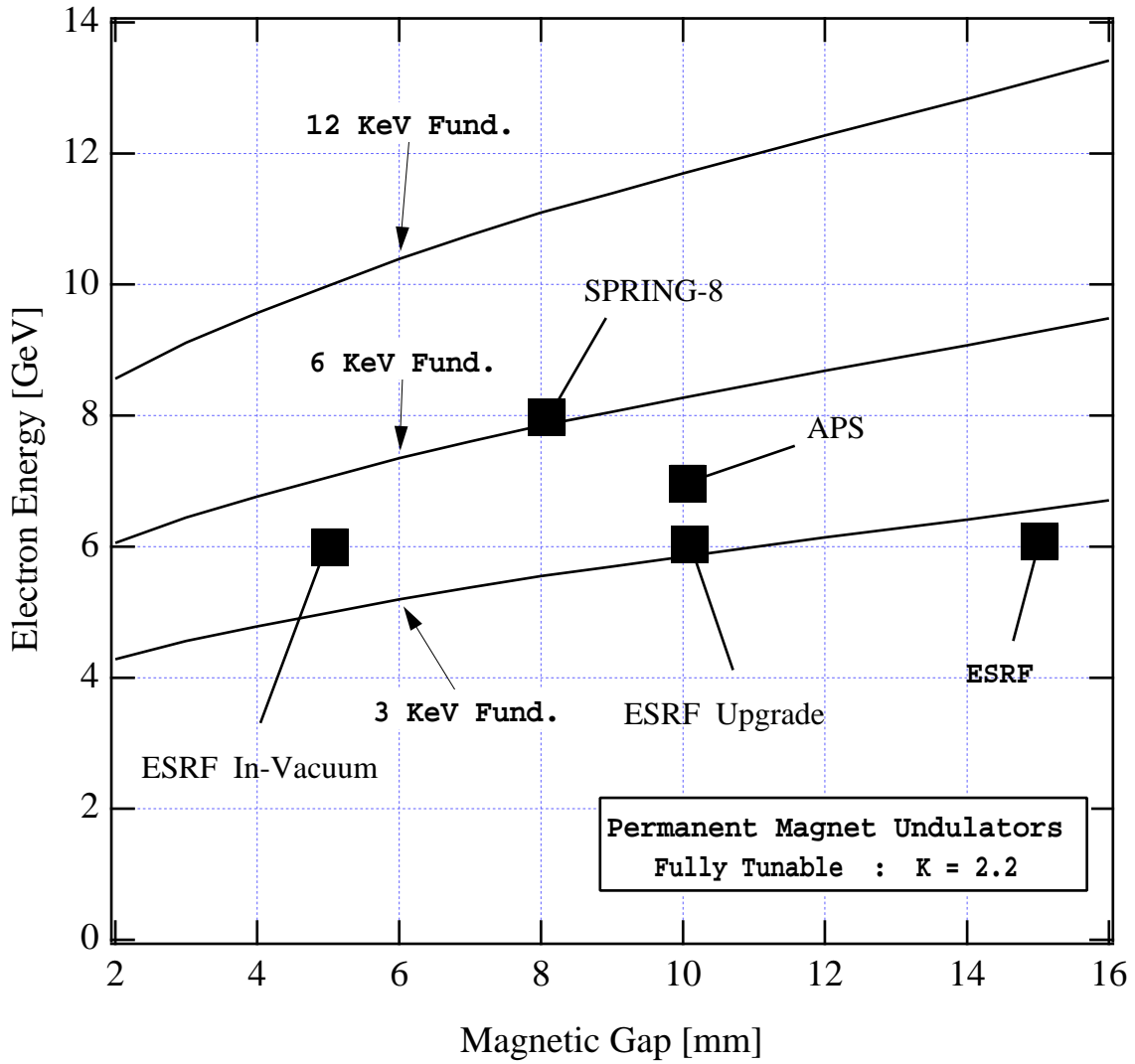


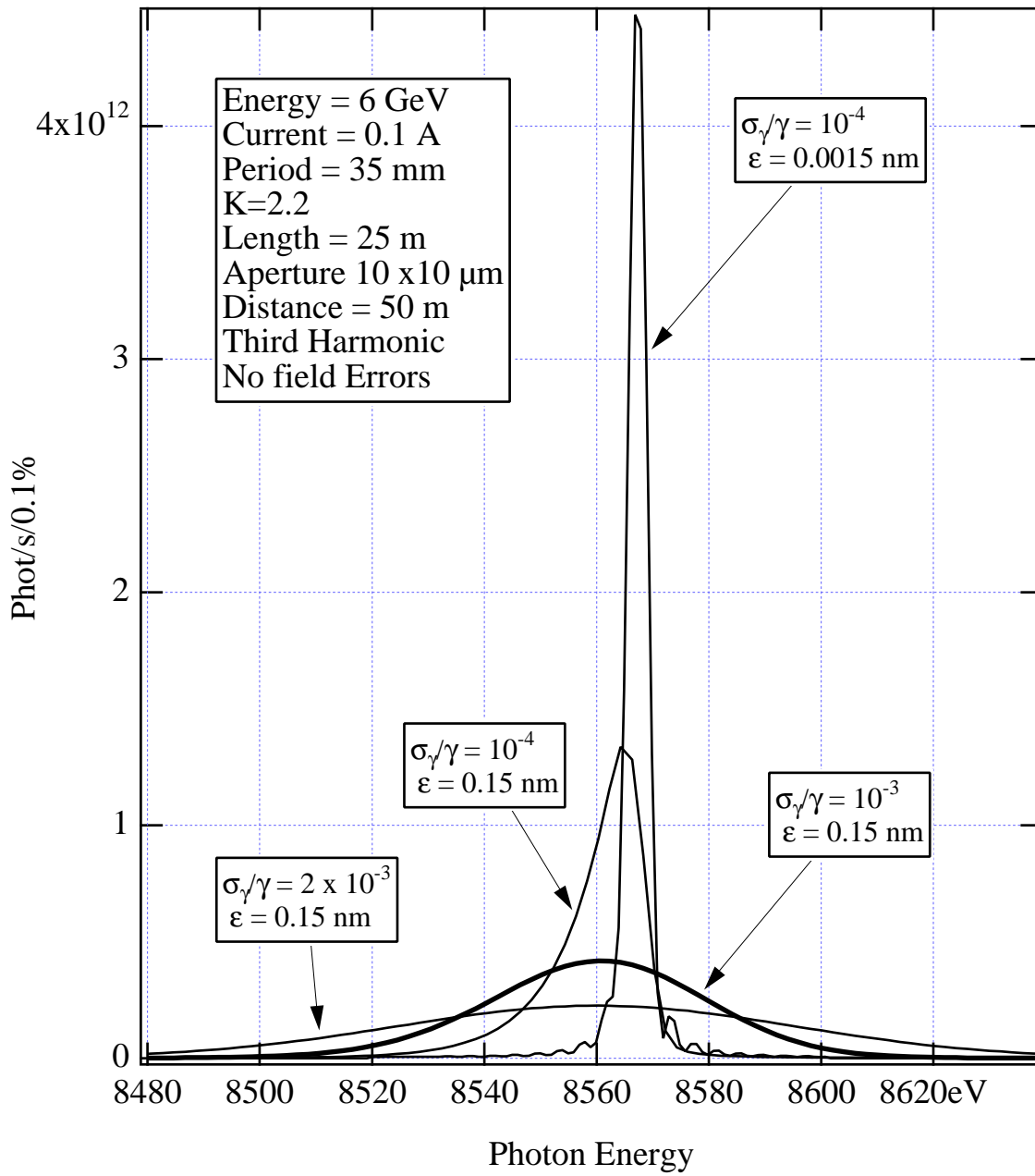
Ultimate Storage Ring Capabilities in the Hard X-ray

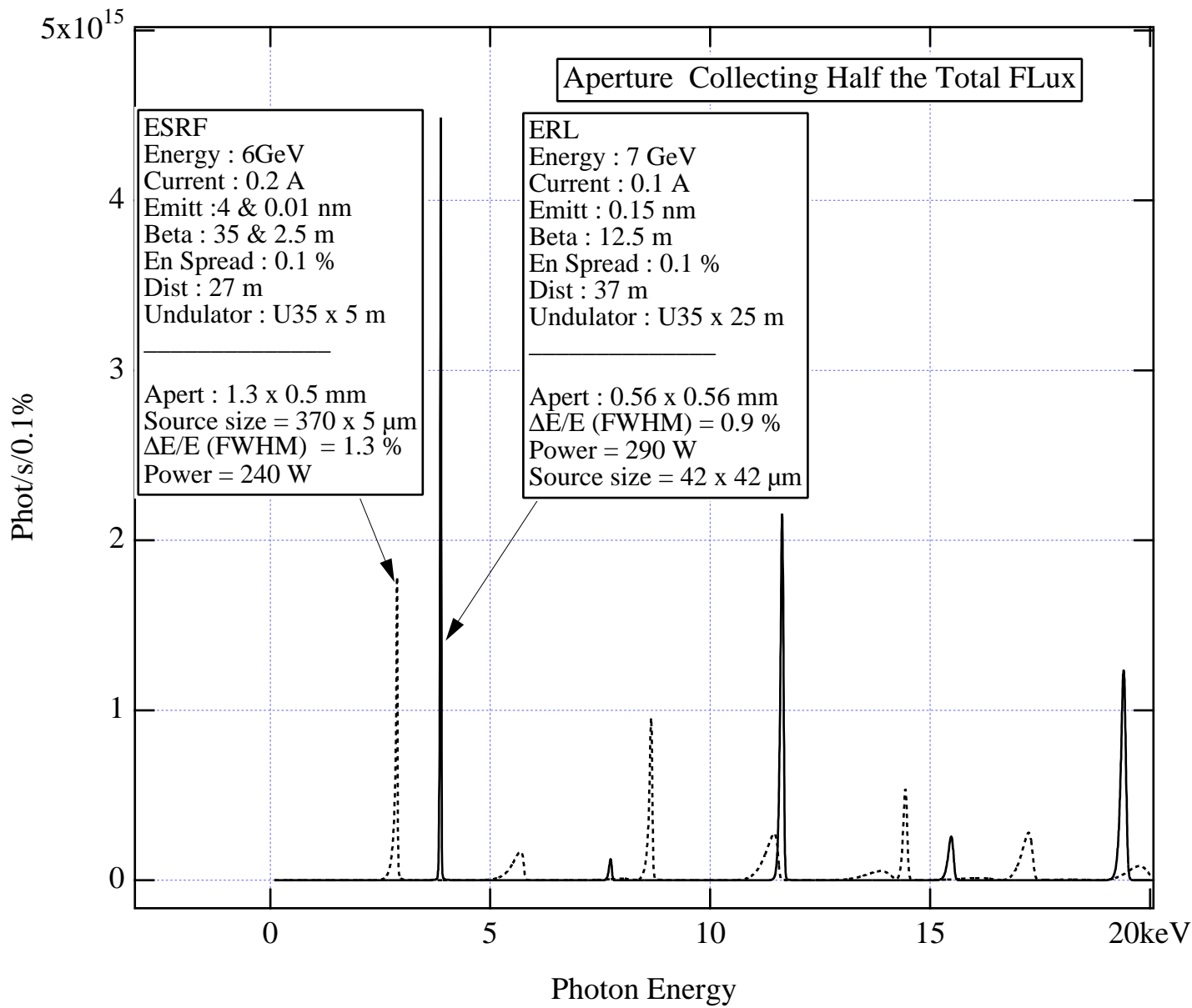
(A. Ropert, J.M. Filhol, P. Elleaume, L. Farvacque, L. Hardy, J. Jacob, U. Weinrich., EPAC2000)

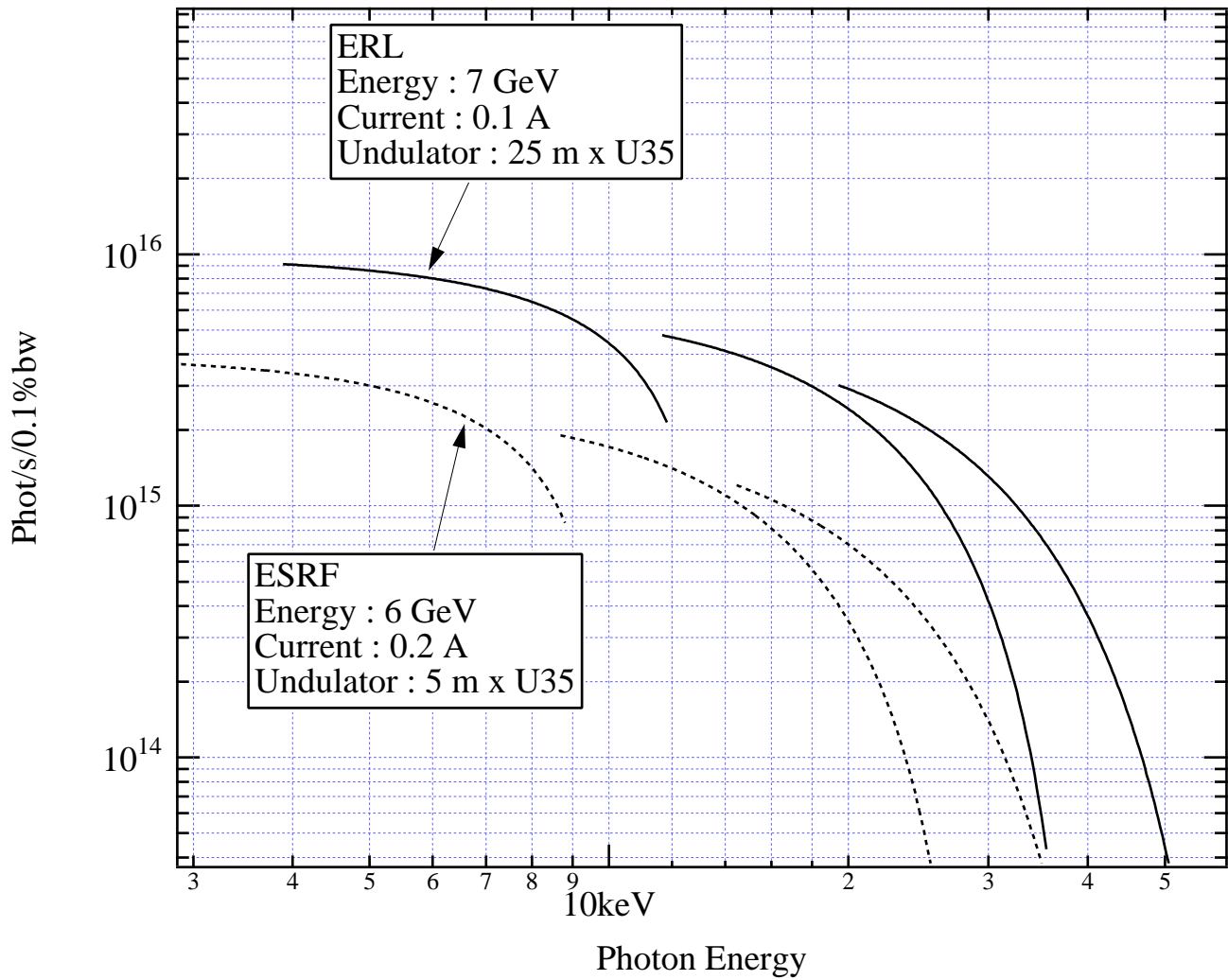
Energy : 7 GeV
Perimeter : 2.2 km
Number of Straight : 50
Horizontal Emittance : < 300 pm
Vertical Emittance : < 3 pm
Average Current : 500 mA (with superconducting RF)

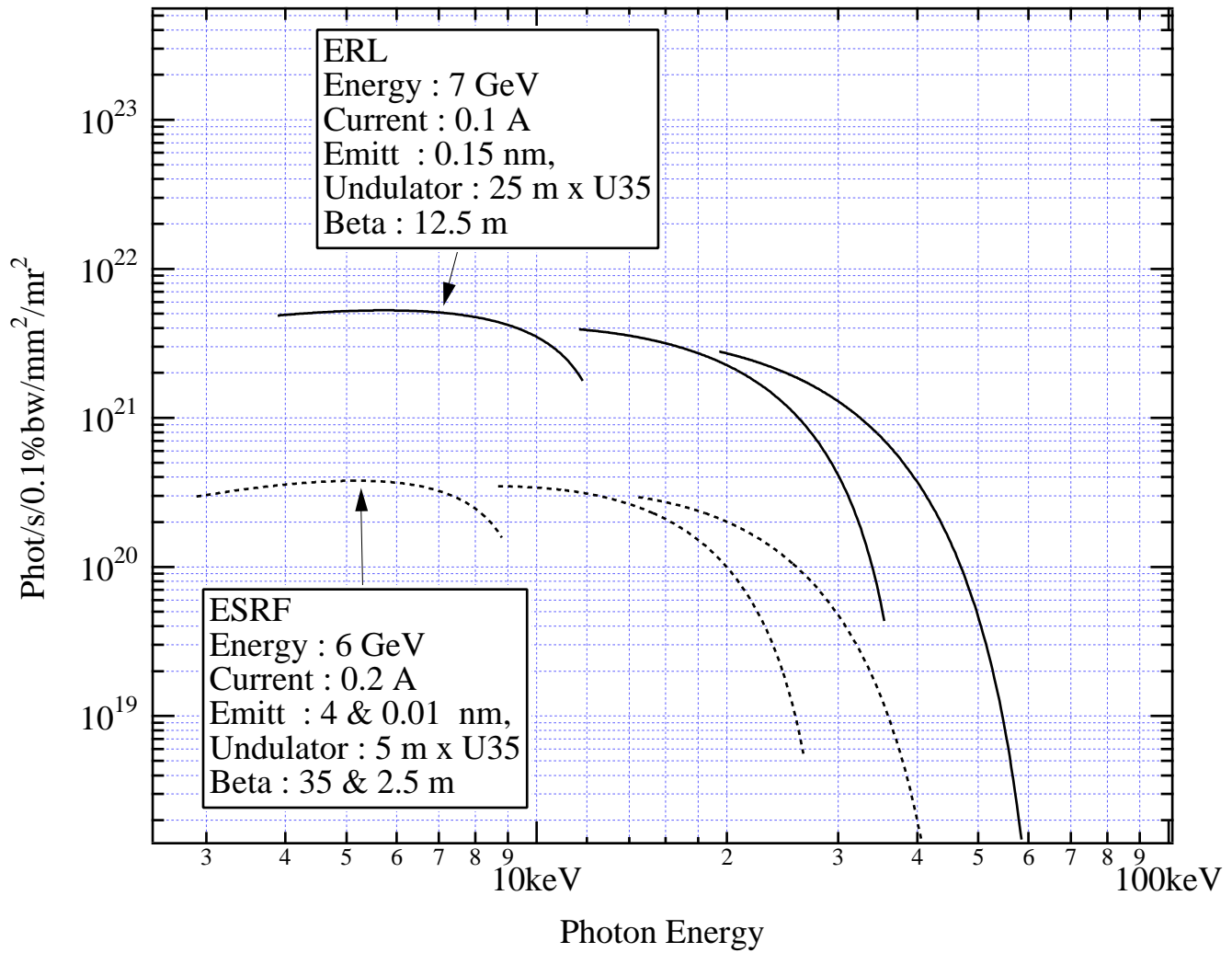


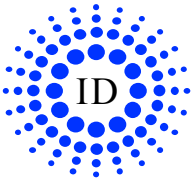








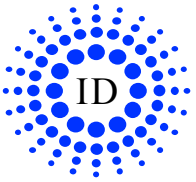




ERL Insertion Devices : Design Considerations

P. Elleaume, ESRF

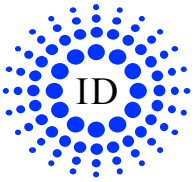
ERL Workshop, Cornell December 2-3, 2000



Technology available for a 25 m Undulator

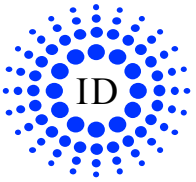


- † In-air permanent magnet undulator
 - Simplest and most flexible technology
 - Need to be segmented with phasing sections
- † In-vacuum permanent magnet undulator
 - More sophisticated and expensive
 - Can be made as a single continuous device (Spring8)
- † Electro-magnet technology
 - Only suitable for low photon energies or requires a higher electron energy.



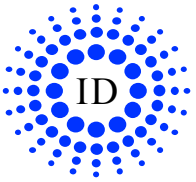
Lattice Functions

- † For a planar type undulator (well known technology + tunability through the harmonics), one needs to reduce the magnetic gap as much as possible in one plane (vertical, horizontal) in order to reach a given photon energy with the lowest electron energy.
- † It is desirable to use β_x and/or $\beta_z = L/2 = 12.5$ m
 - Maximize the electron beam aperture
 - Allow the minimum magnetic gap



Beam size and Divergence

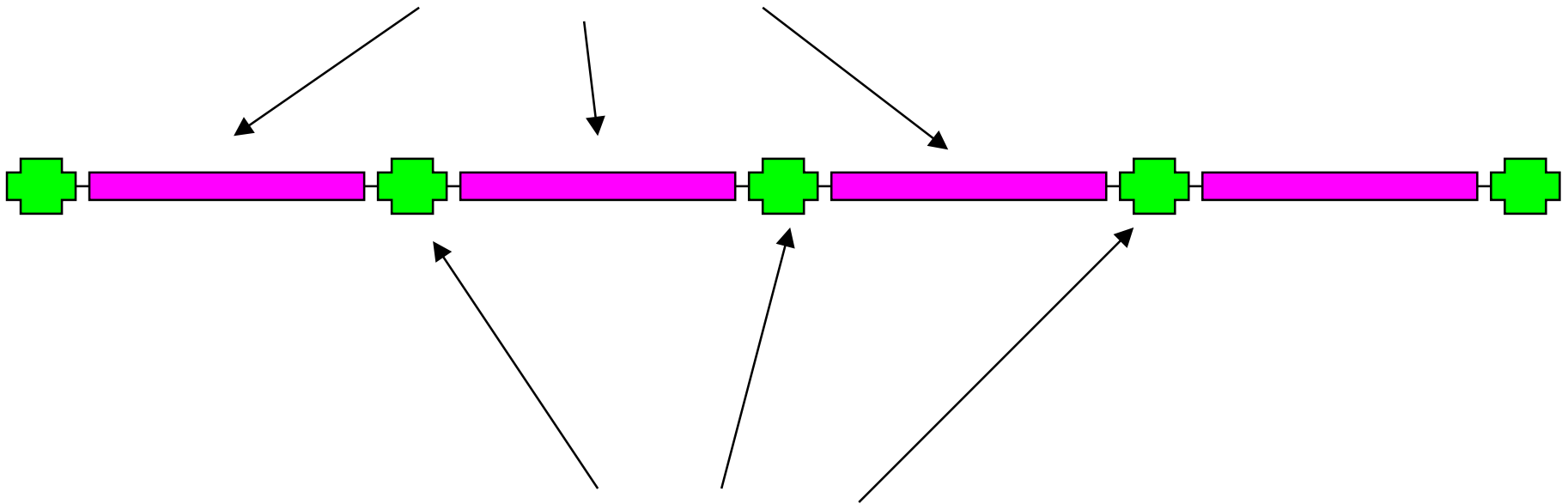
	ERL	ESRF		
Emittance [nm]	0.15	4 & 0.01		
Beta [m]	12.5	35 & 2.5		
Length [m]	25	5		
Wavelength [Å]	1	1		
	ERL	ERL	ESRF	ESRF
	0.15 nm	Filament	Horiz.	Vertic.
Rms Source size [μm]	43	11	374	5.0
Rms Divergence [μr]	3.7	1.4	11	3.7



Conceptual Design for an In-air 25 m Undulator

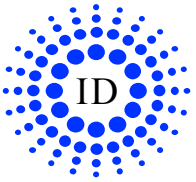


5m Undulator Sections



Transitions :

- Bellows & Flange
- Pumping (avoid Bremstrahlung)
- Phasing Section
- Diagnostics



Potential Benefits of an ERL over a Storage Ring

- † Short bunches 1 ps (ESRF 21 ps).
- † Potential very low energy spread.
- † Emittance at 100 mA is similar to what is expected from the ultimate storage ring in the hard X-ray.
- † Cost ??