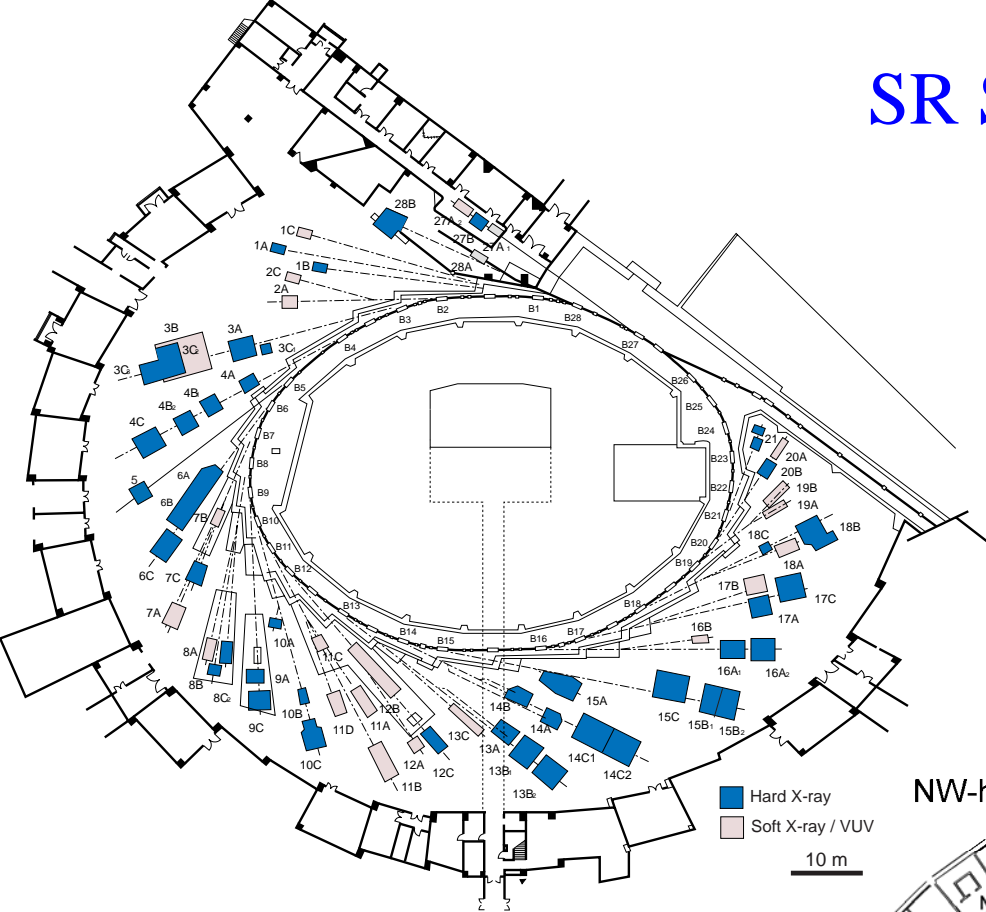


# 新型アンジュレータの可能性

高エネルギー加速器研究機構  
物質構造科学研究所

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# SR Sources in KEK-PF



PF ring: 2.5GeV, 450mA, 36nm

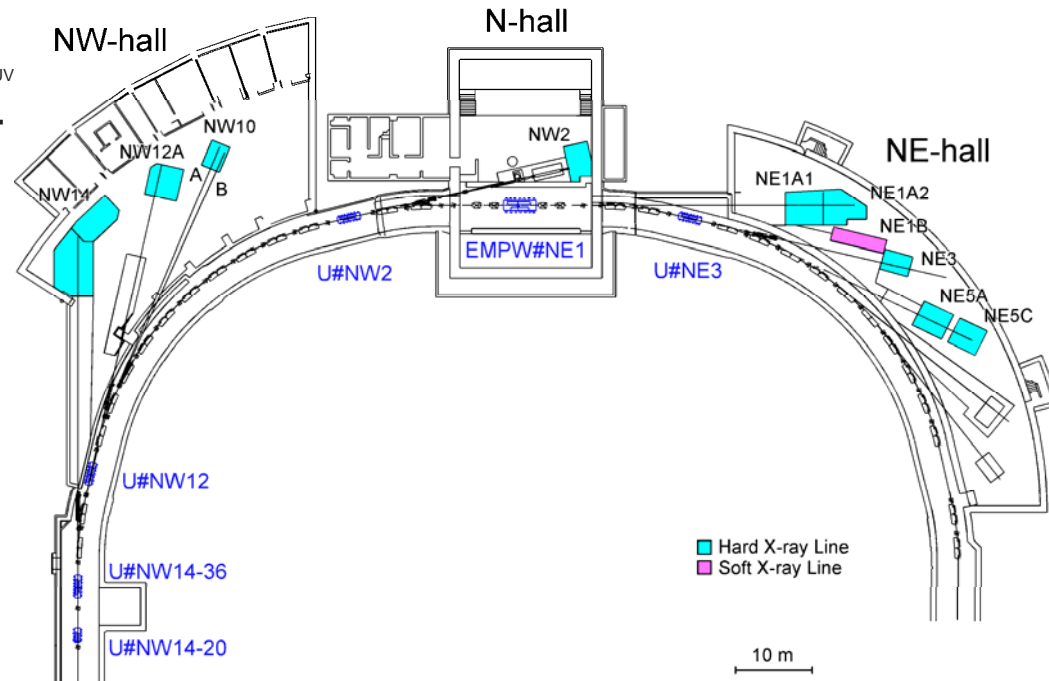
Bend 16

ID 8 + 1

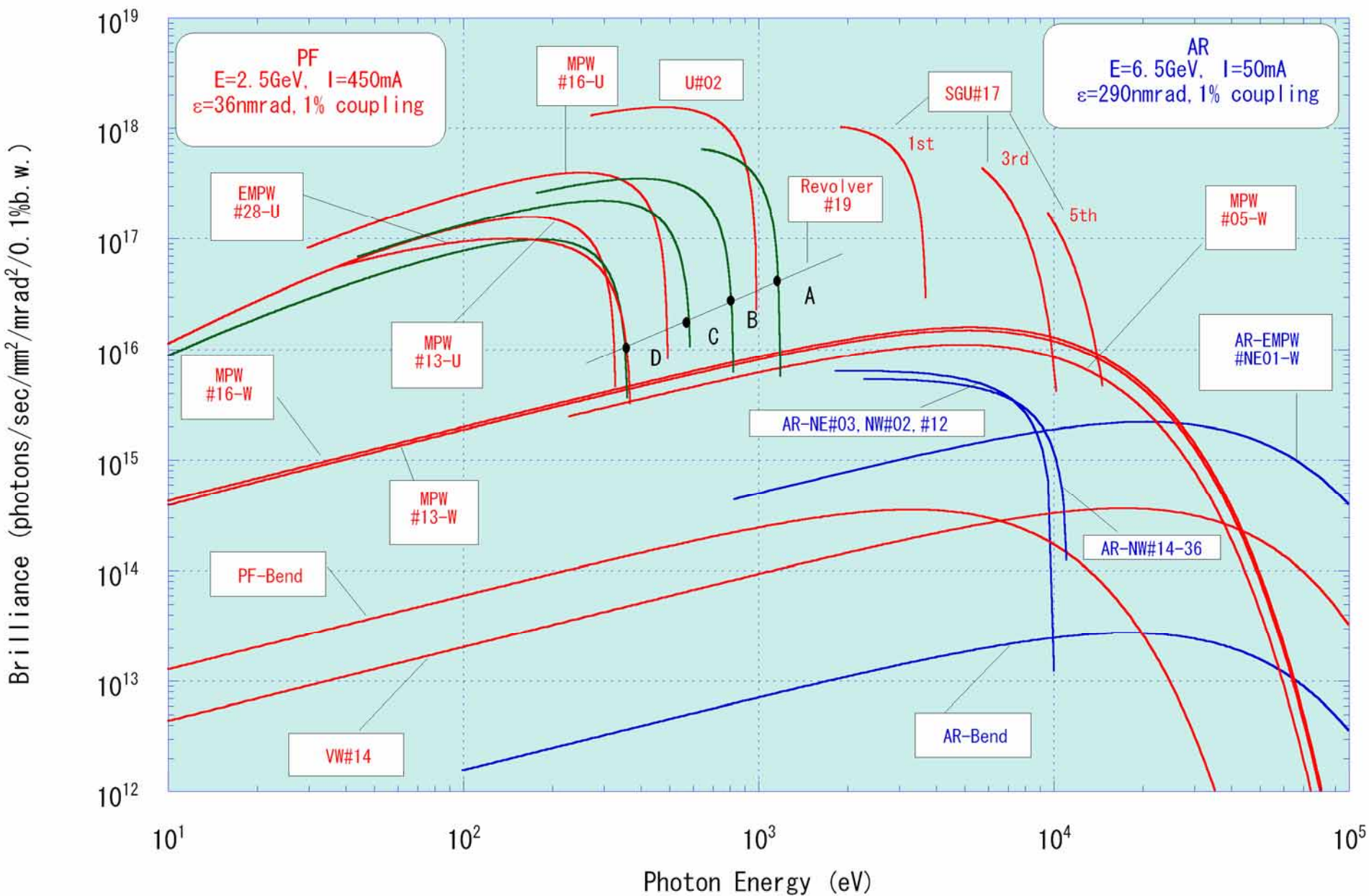
PF-AR: 6.5GeV, 50mA, 290nm

Bend 2

ID 6



# PF および PF-AR の光源一覧



## Historical time table of the Insertion devices at PF and PF-AR

PF		PF-AR		R&D
#	Name	Location	Make	Specifications
1	MPW#16	PF	1986	First multi-pole wiggler
2	Revolver#19	PF	1987	Revolver type undulator
3	EMPW # NE1	PF-AR	1988	Polarizing X-ray MPW; first in the world
4	EMPW#28	PF	1988	Polarizing undulator/ MPW
5	MPW#13	PF	1988	
6	U#NE3	PF-AR	1990	In-vacuum undulator; first in the world
7	U#02	PF	1990	Magnet remodeling; from SmCo <sub>5</sub> to NdFeB
8	TOK#02/U#02	PF	1991	FELexp./User exp.
9	MPW#16	PF	1992	Magnet remodeling
10	XU#MR0	MR	1993	TRISTAN Super Light Facility experiment
11	U#NW02	PF-AR	2000	Tapered in-vacuum undulator
12	Chevron Switching Pol. U	PF&AR	2000	Mechanically switching undulator test
13	U#NW12	PF-AR	2001	Tapered in-vacuum undulator
14	SGU#17	PF	2003	Short gap in-vacuum undulator
15	MPW#05	PF	2003	
16	U#NW14-36	PF-AR	2004	In-vacuum undulator
17	U @SP8 Diagnostic BL	SP8	2004	Collaboration with SP8Accelerator division
18	U#NW14-20	PF-AR	2005	In-vacuum undulator
19	SGU#03	PF	2005	Short gap in-vacuum undulator
20	Edge-focus Wiggler	Osaka Univ.	2005	Edge focus test; measured in KEK
21	U#16-1	PF	2006	Rapidly switching source; 1st of 2
22	SGU#01	PF	2008	Short gap in-vacuum undulator
23	U#16-2	PF	2008	Rapidly switching source; 2nd of 2



## Revolver#19 in PF

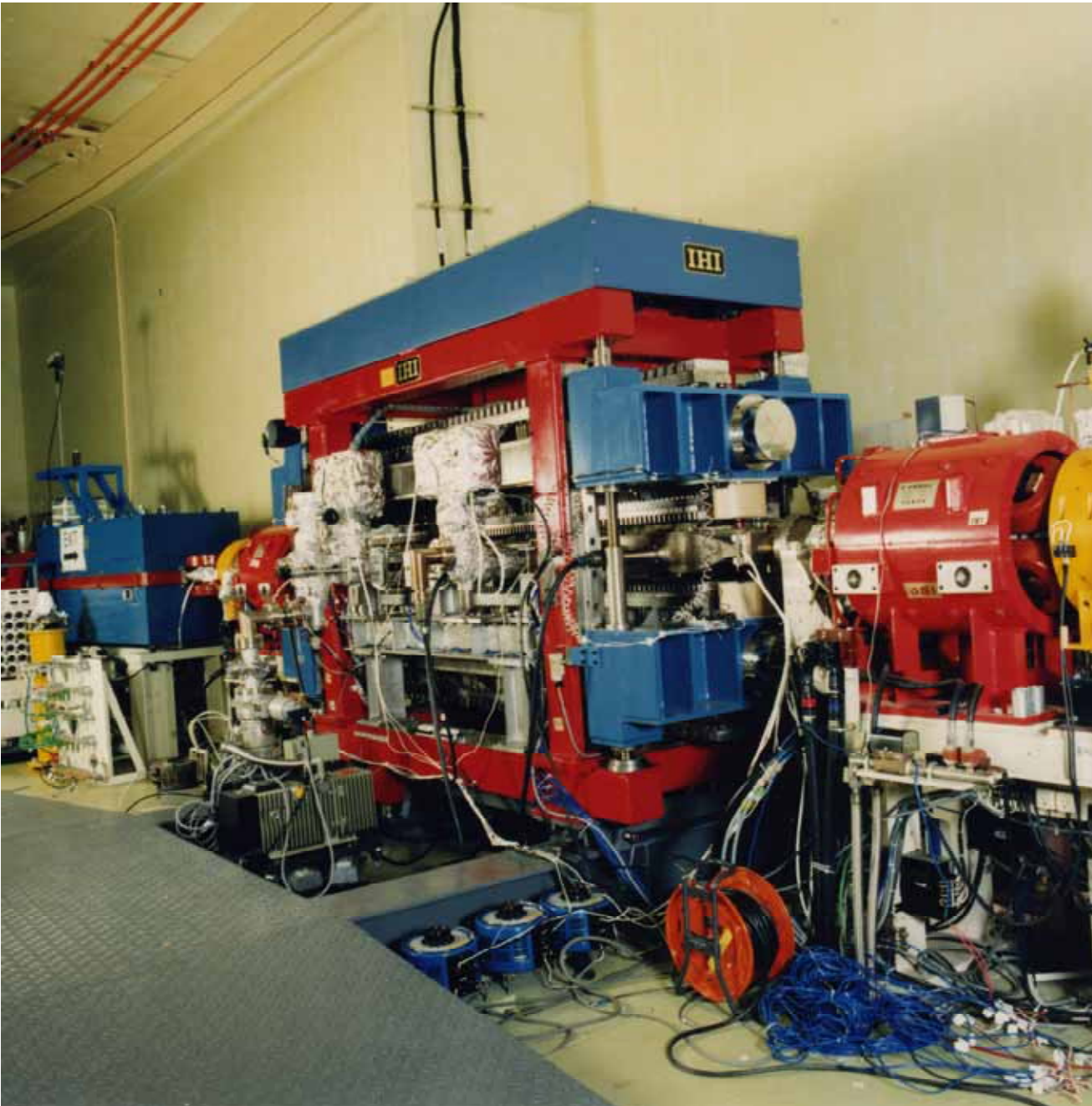
4 magnet arrays;

A.  $\lambda u=5\text{cm}$ ,  $N=46$

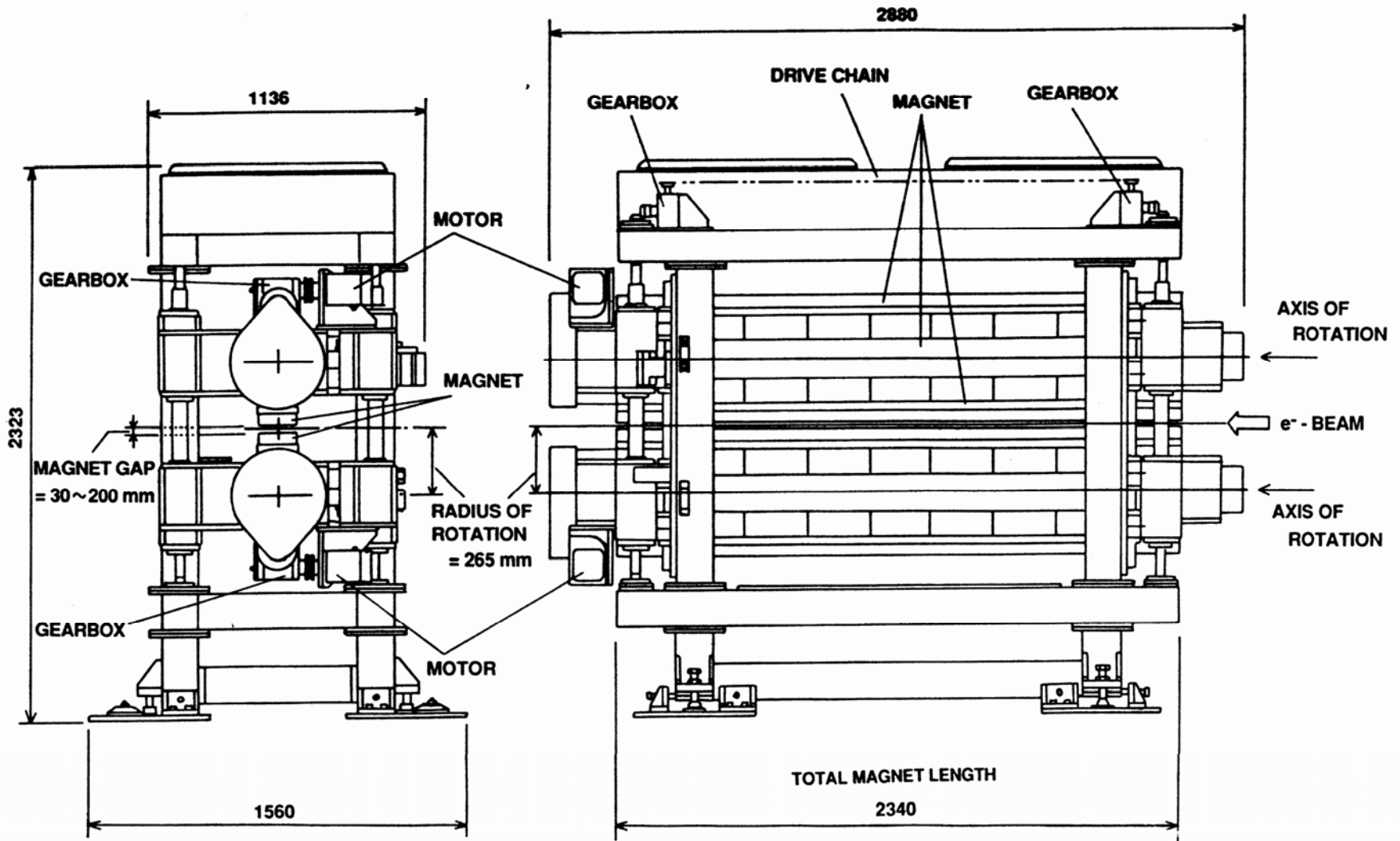
B.  $\lambda u=7.2\text{cm}$ ,  $N=32$

C.  $\lambda u=10\text{cm}$ ,  $N=23$

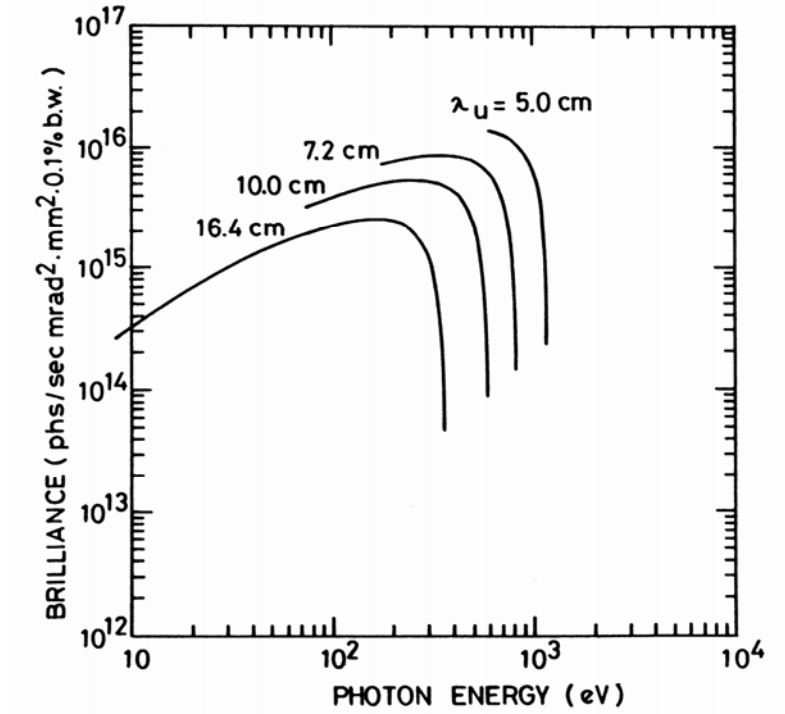
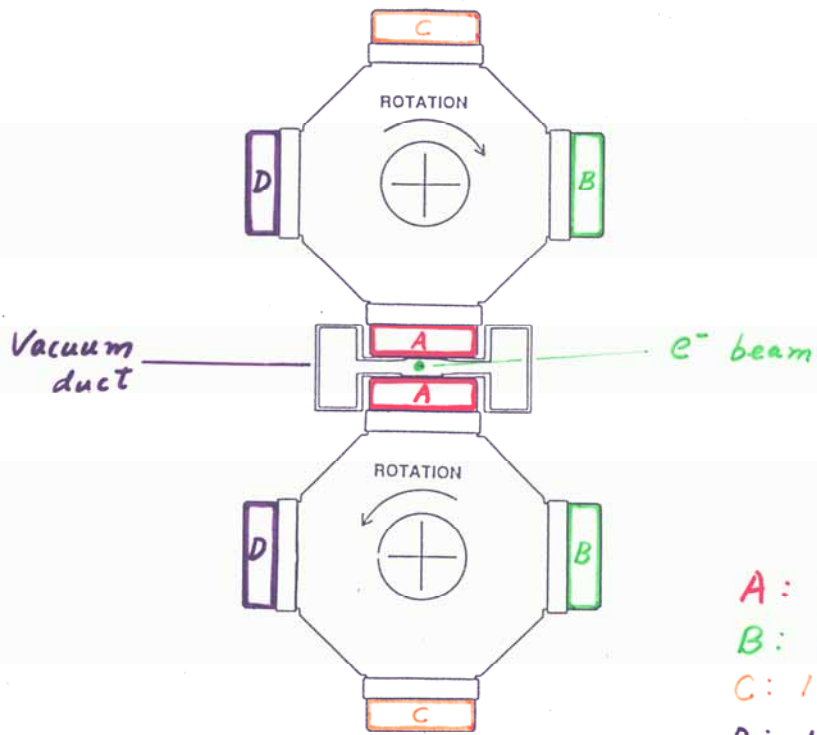
D.  $\lambda u=16.4\text{cm}$ ,  $N=14$



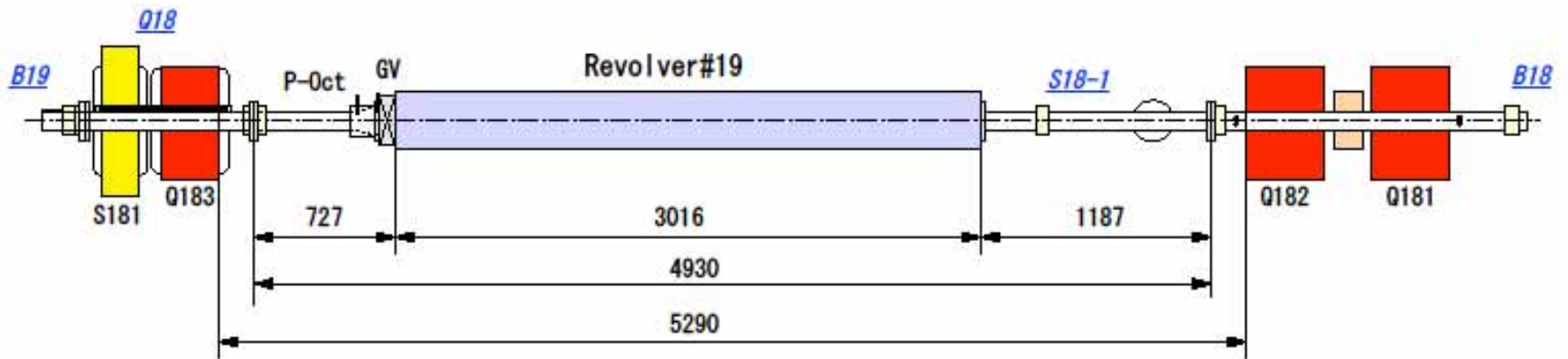
# Revolver#19 Undulator



# "Revolver" #19



# BL19 Straight section @ PF



Straight section B18-B19



# 新型アンジュレータと物性研仕様

User friendly

experience @ SOLEIL

Energy region

covers Revolver#19

10eV – 1keV:  $\lambda_{u,L}=20\text{cm}$  &  $\lambda_{u,S}=5\text{cm}$

Polarization

LH OK

# 如何にして広いエネルギー領域をカバーするか？

1. Revolver-type Mechanical frame  
switches  $\lambda_{u,L}/\lambda_{u,S}$  by rotation

2. Electro-magnetic undulator

switches  $\lambda_{u,L}/\lambda_{u,S}$  by sw-circuits

& enables quasi-periodic option

& may have other options such as  
polarization

# New Revolver-type Undulator

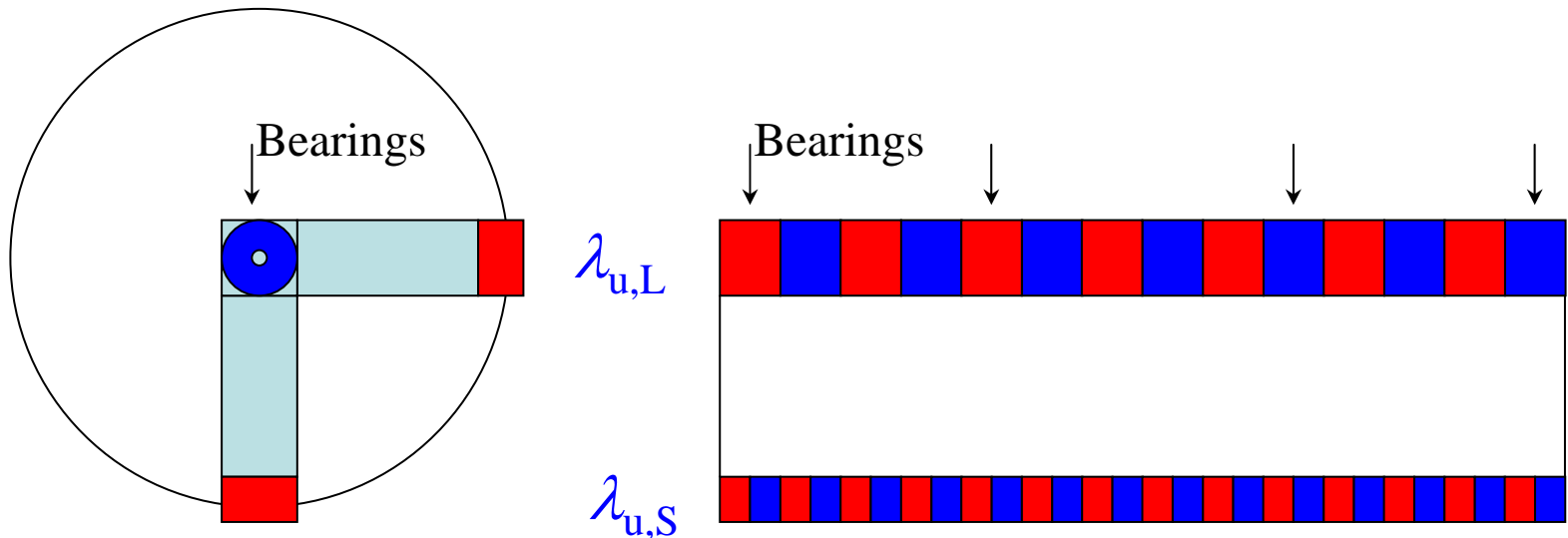
1. Length limitation;

$$\text{sag} \propto L^3$$

$$L < 2m; \text{Revolver\#19}$$

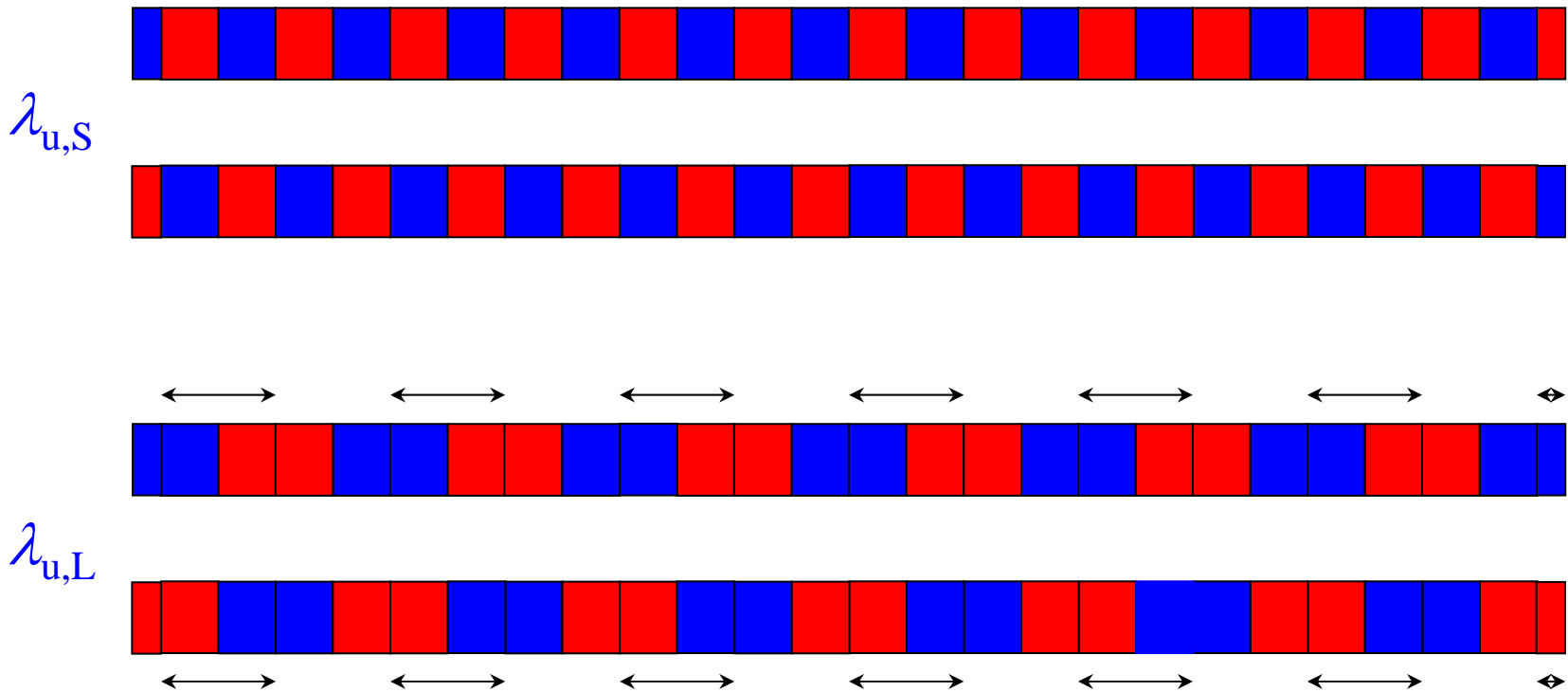
2. Limitation on  $2\pi$  rotation (or  $< \pi$ );

limitation on a selectable set of  $\lambda_u$   
due to mechanical support



# Electro-magnetic Undulator

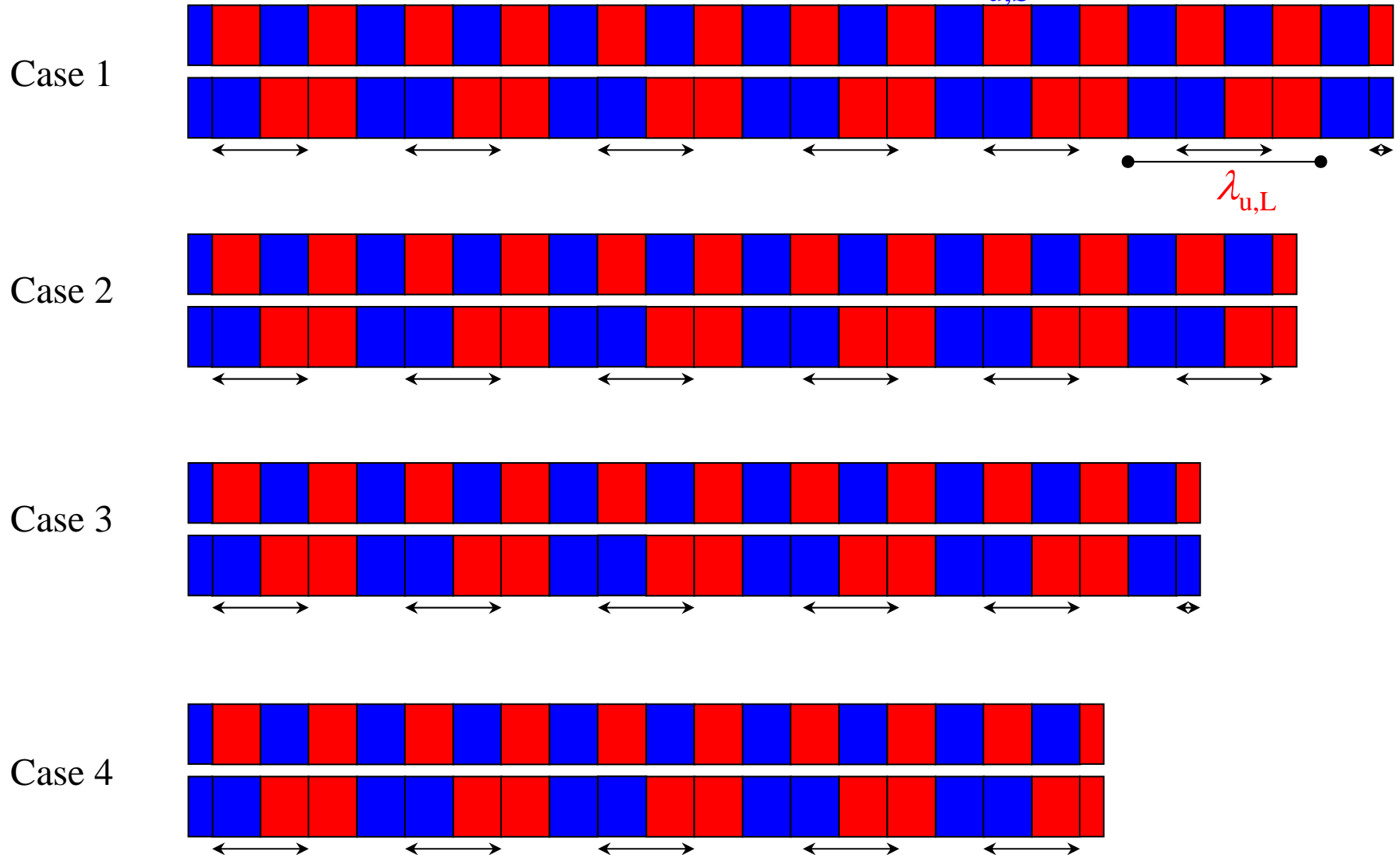
$$\lambda_{u,S}/\lambda_{u,L} = 1/2$$



$\longleftrightarrow$  Reverse current direction

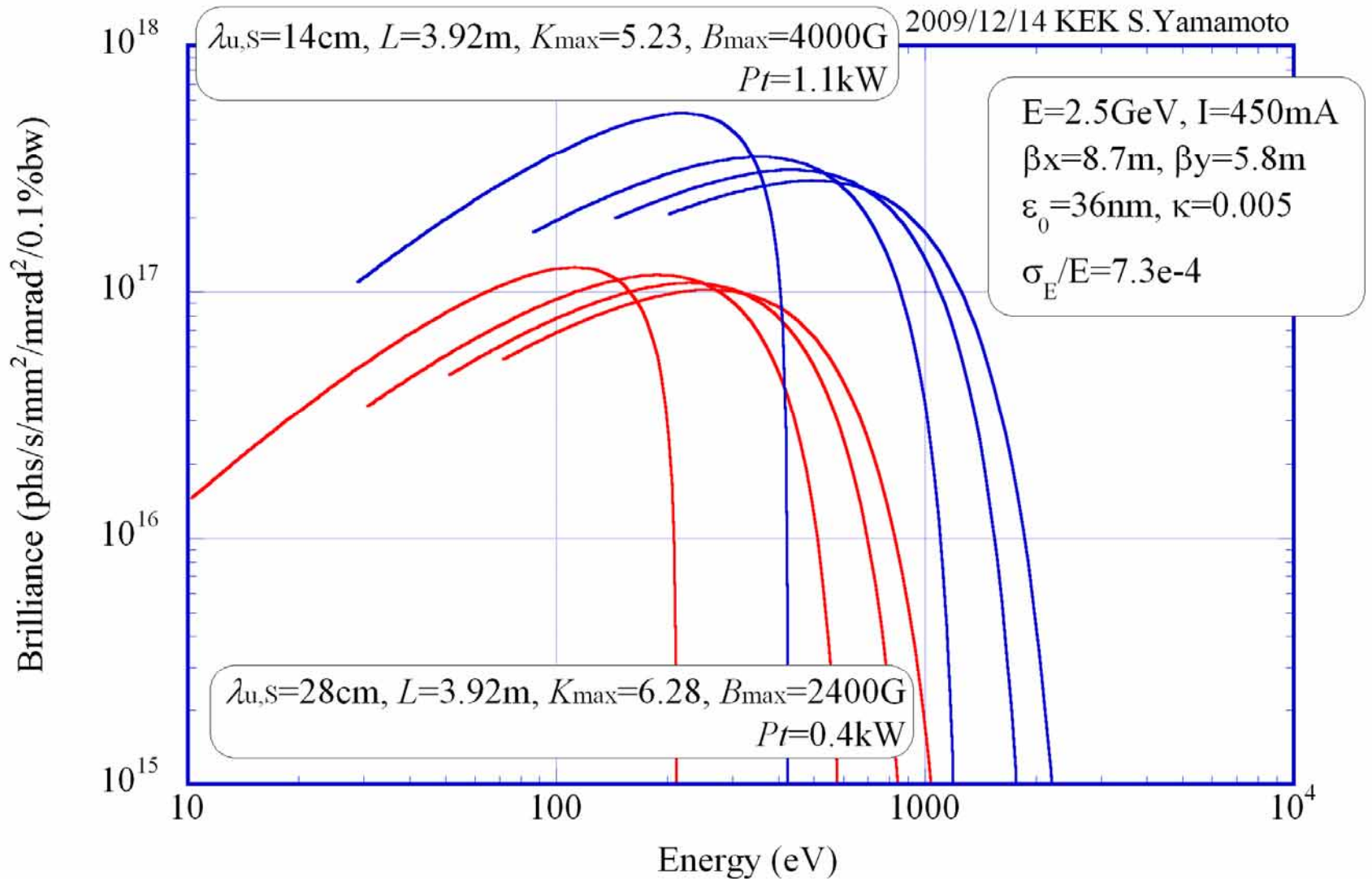
# Electro-magnetic Undulator (2)

Based on anti-symmetric array for  $\lambda_{u,S}$  magnets

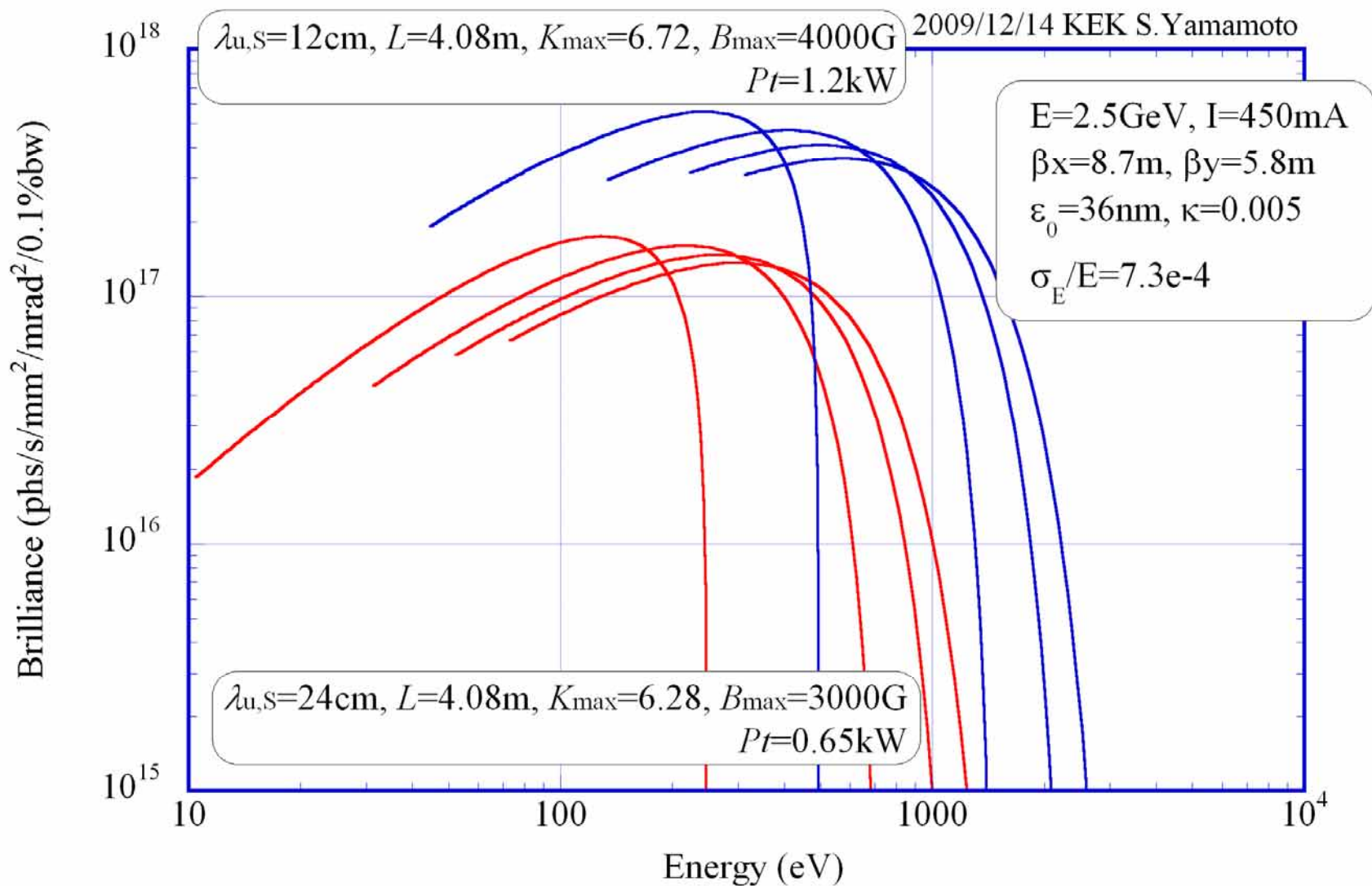




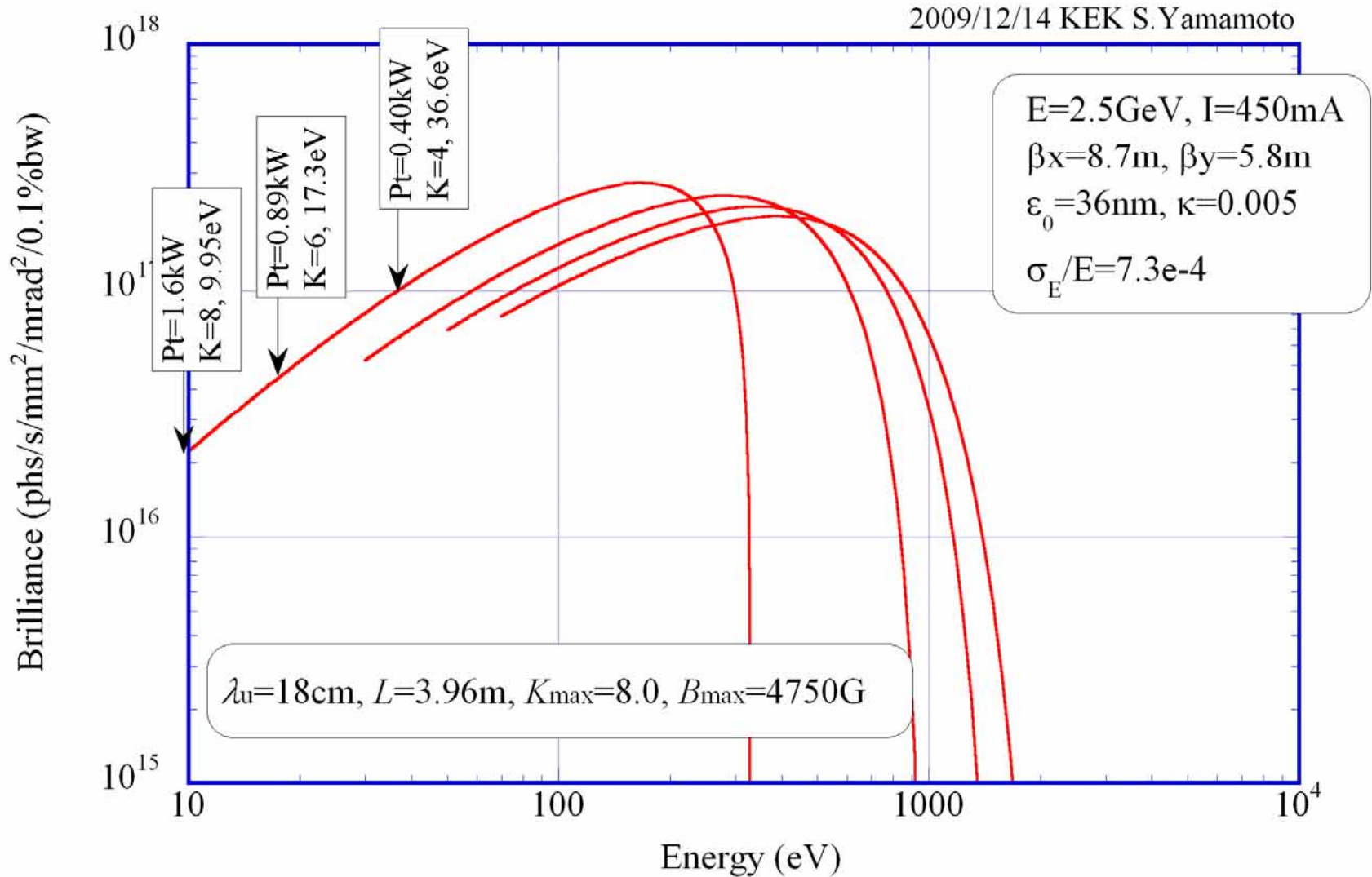
# New U#19 possibility (1)



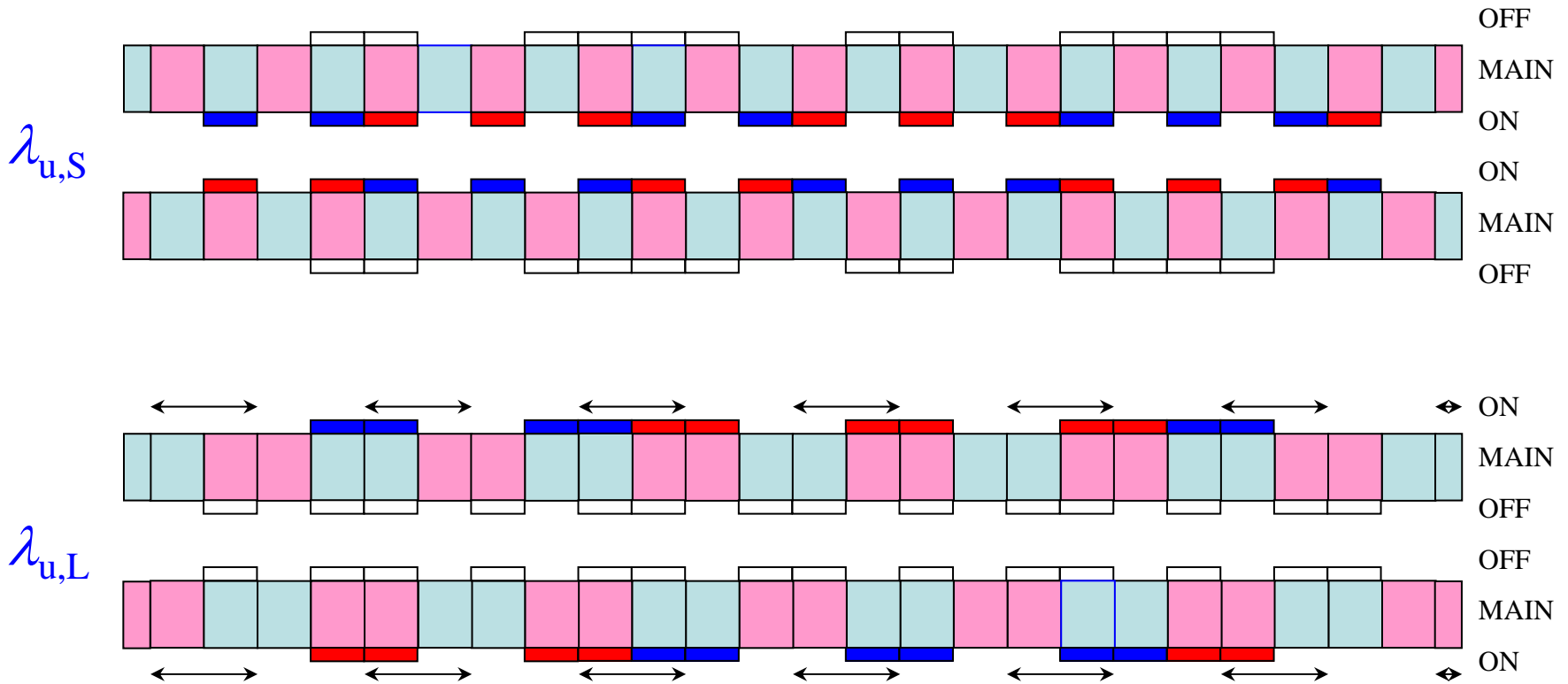
# New U#19 possibility (2)



# New U#19 possibility (3)



# Example of quasi-periodicity (1) due to Fibonacci sequence



$\longleftrightarrow$  Reverse current direction





# Summary

	$\Delta E$	tune	$\lambda_{u,S}/\lambda_{u,L}$	option
<u>Rev with PM</u>	wide	good	arb.	Periodic <b>or</b> quasi-P
<u>EM*</u>	wide	good	1/2	Periodic <b>a/o</b> quasi-P

\* not so bad