

# Electron and Positron Beams Transportation Channels to BINP Colliders

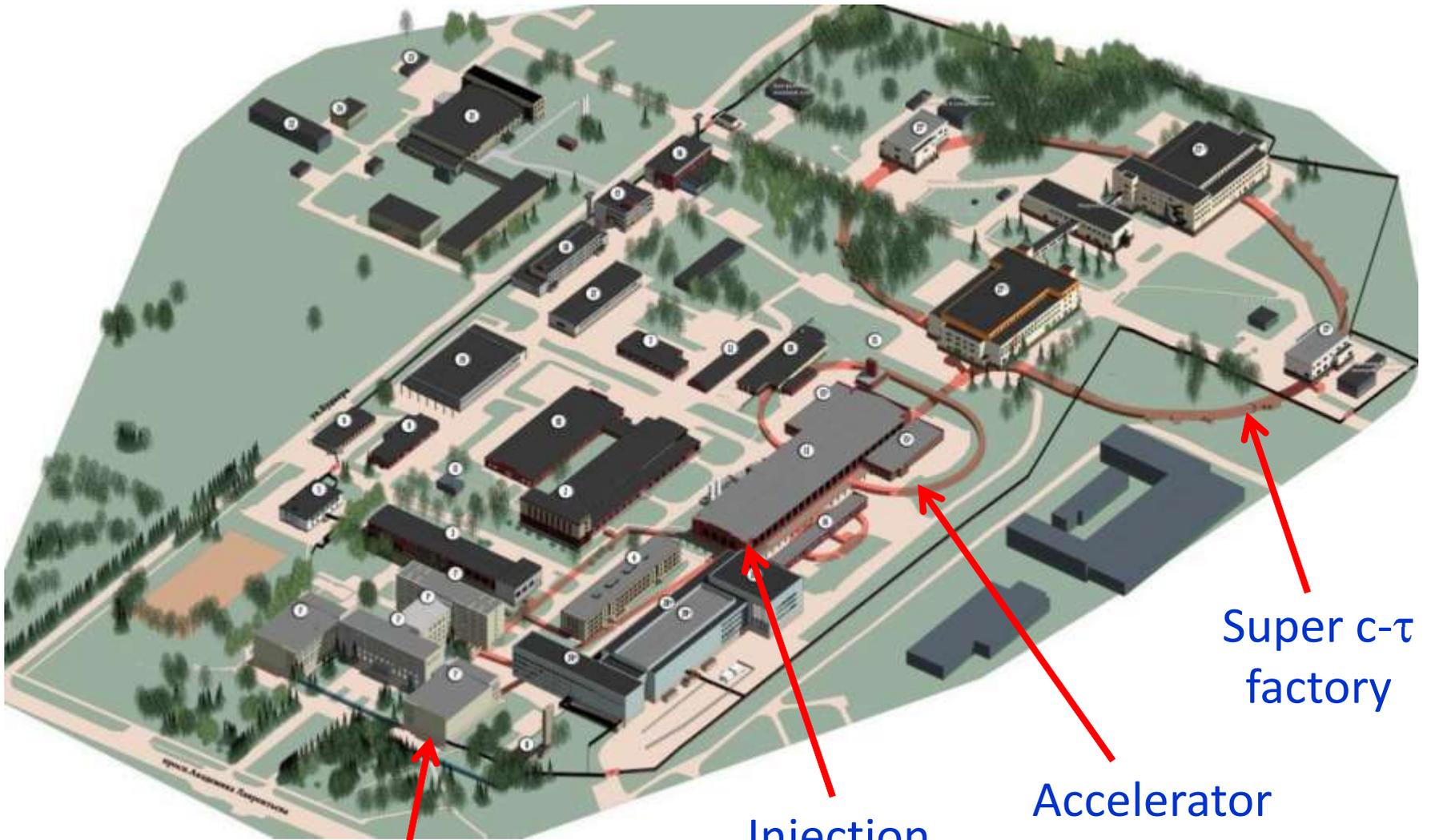
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A. A. Starostenko, D. E. Berkaev, A. M. Semenov

Budker Institute of Nuclear Physics, Novosibirsk, Russia

RuPAC-2014, Obninsk, Russia

October 6-10, 2014

# BINP Colliders and Injection Complex



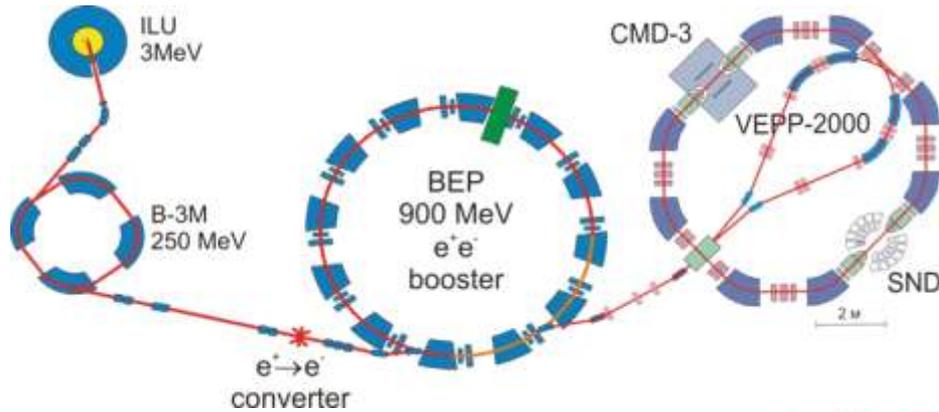
Accelerator complex  
VEPP-2000

Injection  
complex  
VEPP-5

Accelerator  
complex  
VEPP-4M

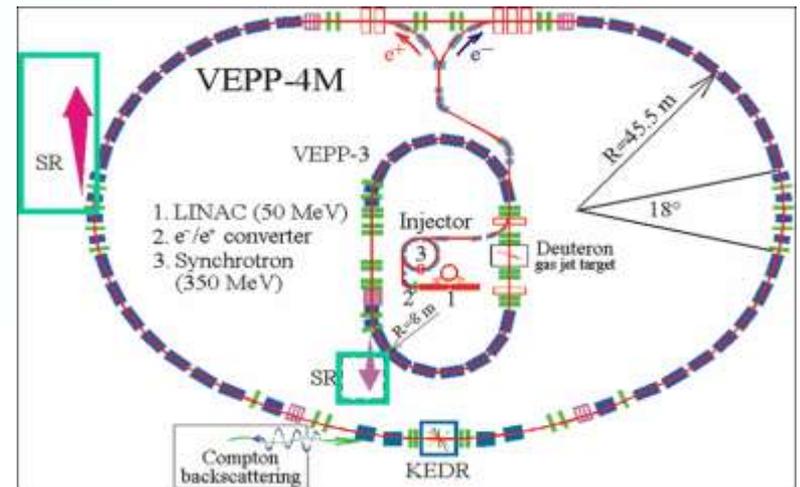
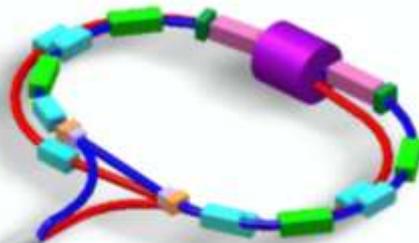
Super  $c$ - $\tau$   
factory

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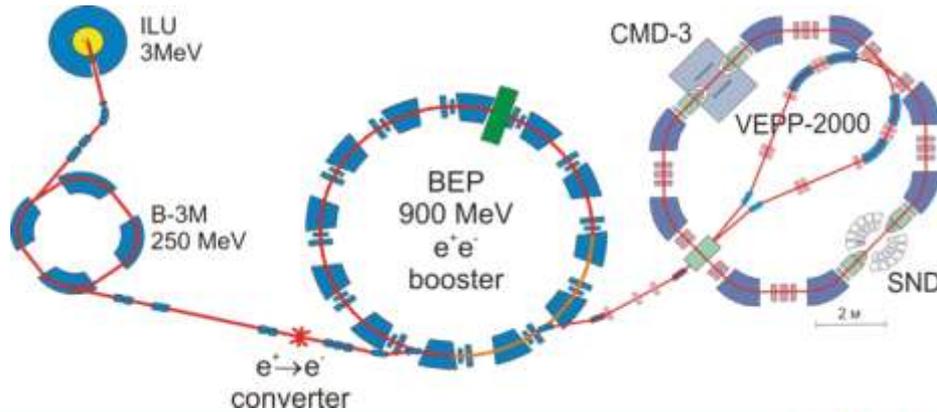


Injection complex  
VEPP-5

Super  $c\text{-}\tau$   
factory

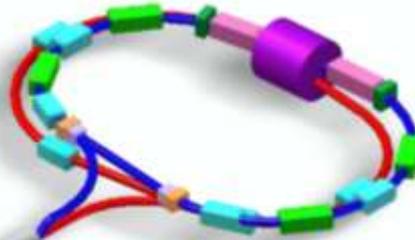


# BINP Colliders and Injection Complex

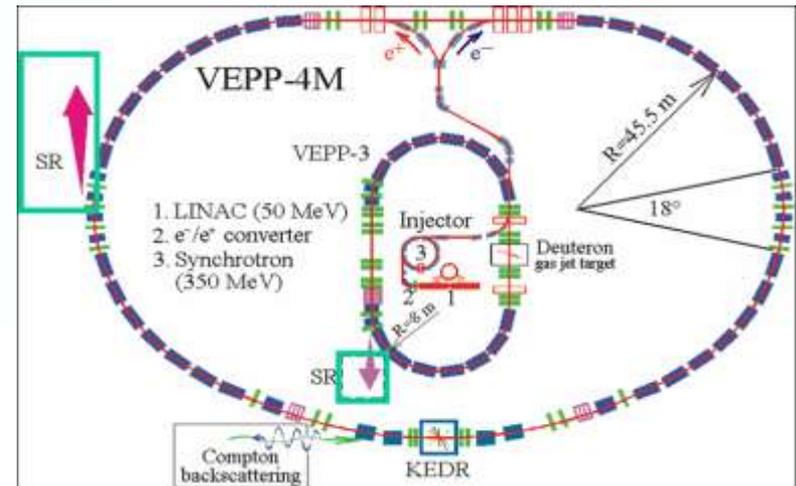


Injection complex  
VEPP-5

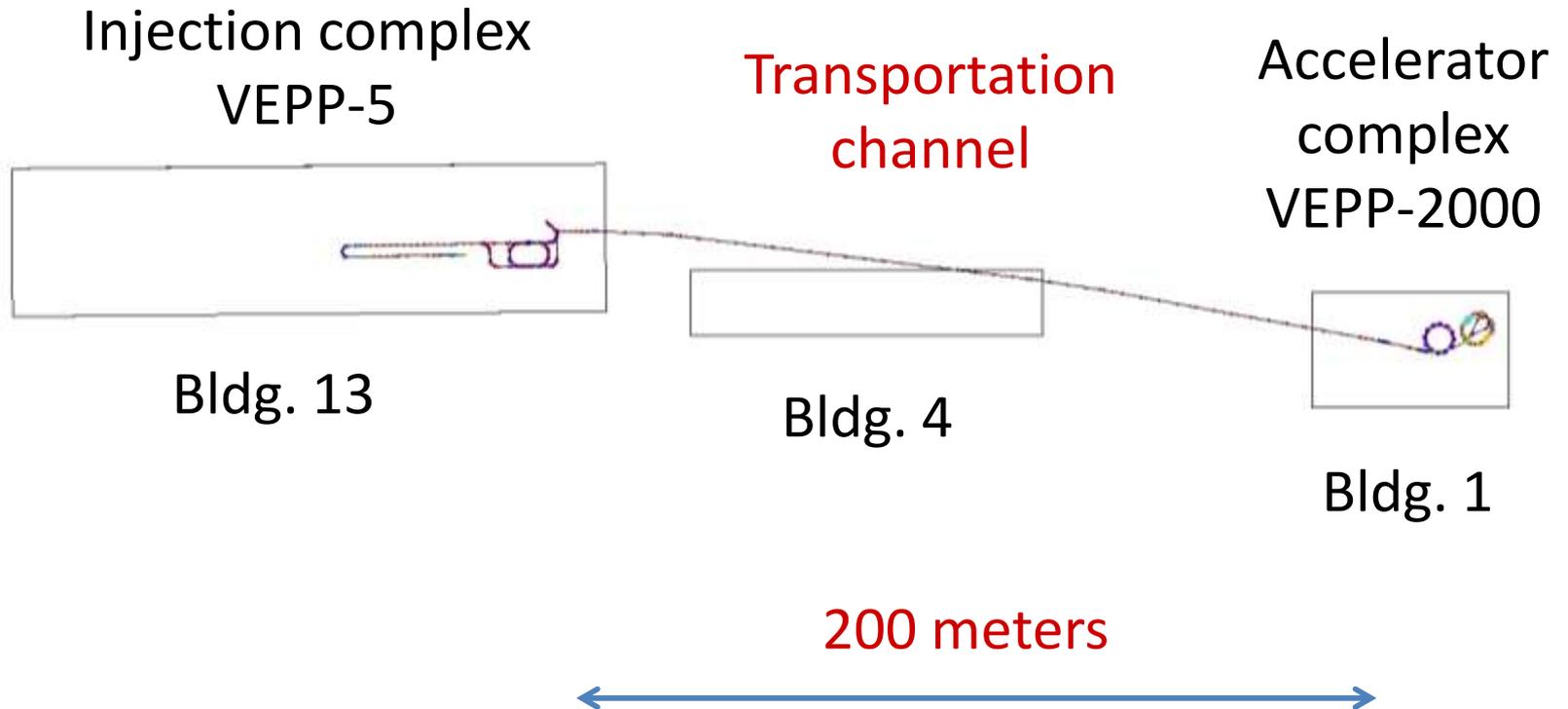
Super  $c\text{-}\tau$  factory



VEPP-2000, $\dot{N}=2 \times 10^7 e^{+/-}/c$ $L=5 \times 10^{30} \text{ cm}^{-2}c^{-1}$	$L=1 \times 10^{32} \text{ cm}^{-2}c^{-1}$ $E=1 \text{ GeV}$ $\dot{N}=1 \times 10^8 e^{+/-}/c$
VEPP-4M $\dot{N}=2 \times 10^8 e^{+/-}/c$ $L=2 \times 10^{30} \text{ cm}^{-2}c^{-1}$ $E=1.8 \text{ GeV}$	$L=8 \times 10^{31} \text{ cm}^{-2}c^{-1}$ $E=5.5 \text{ GeV}$ $\dot{N}=2 \times 10^{10} e^{+/-}/c$
Super C-tau factory	$L=1 \times 10^{35} \text{ cm}^{-2}c^{-1}$ $E=1\text{-}2.5 \text{ GeV}$ $\dot{N}=6 \times 10^{11} e^{+/-}/c$
Injector VEPP-5	$\dot{N}=2 \times 10^{10} e^{+/-}/c$



# Location of the transportation channel in the BINP



# Parameters

## Storage ring of the Injection complex VEPP-5

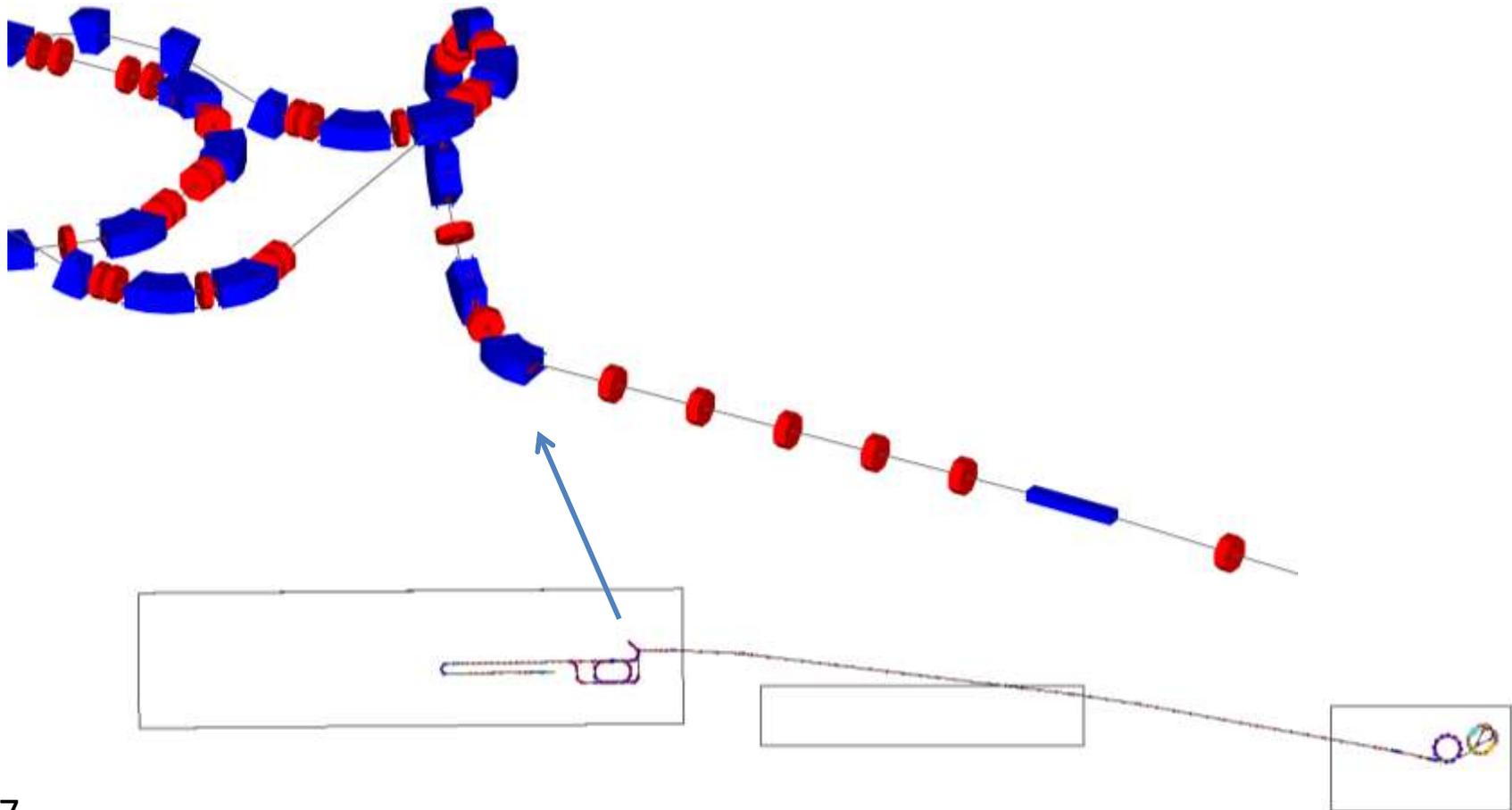
Energy, MeV	510
The number of e <sup>±</sup> /s	2x10 <sup>10</sup>
Energy spread, %	0.051
Emittances $\epsilon_x, \epsilon_z$ , cm·rad	2.3x10 <sup>-6</sup> , 5x10 <sup>-7</sup>
Operating frequency, Hz	0,033

## Booster BEP of the Accelerator complex VEPP-2000

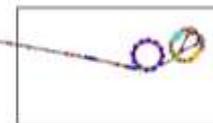
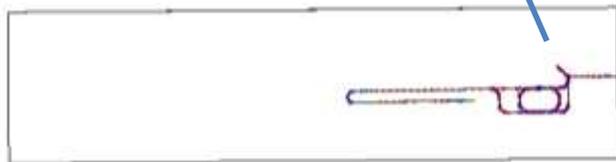
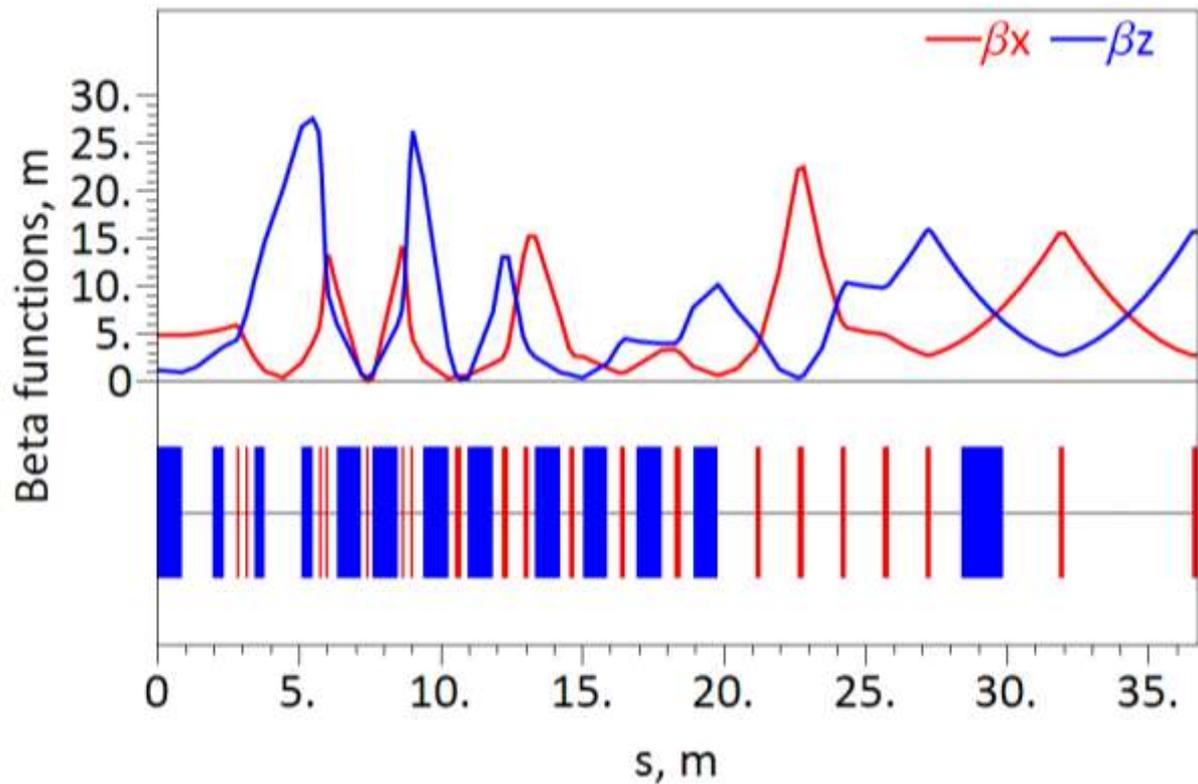
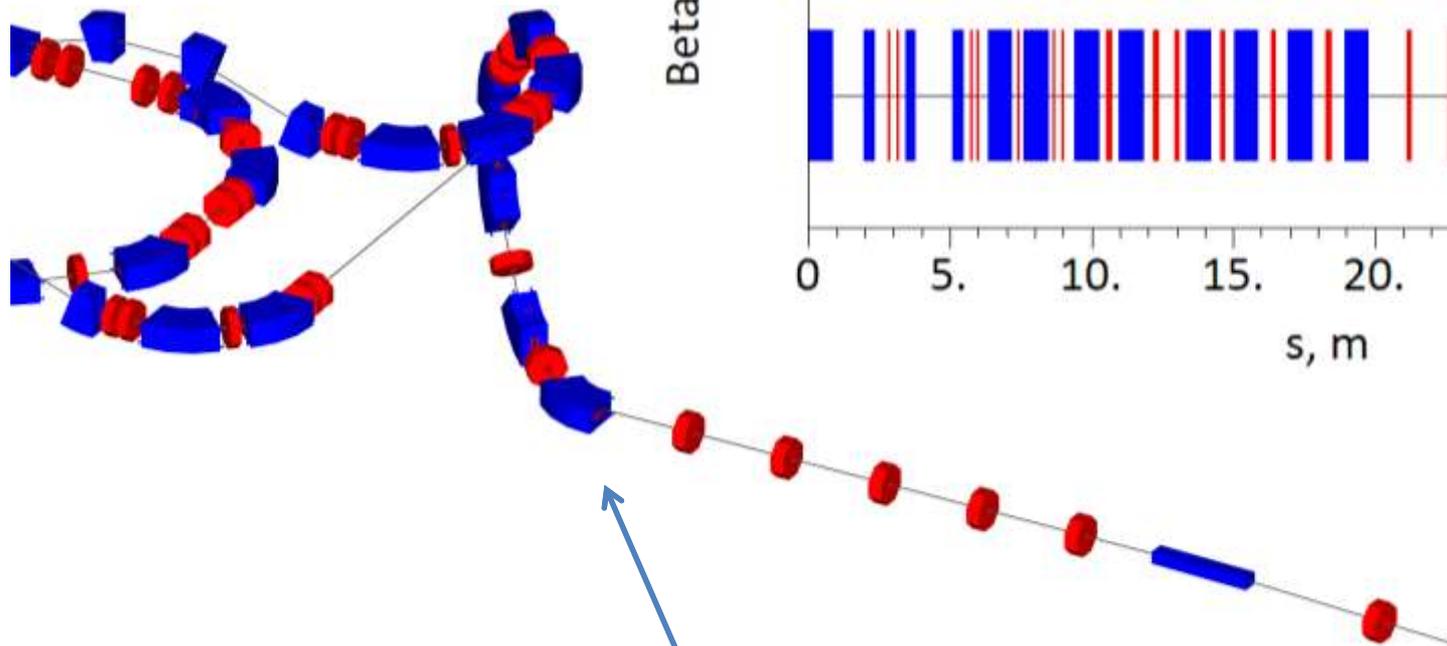
Energy, MeV	160-1000
Betatron frequency $\nu_x, \nu_z$	3.4, 2.4
Emittances $\epsilon_x, \epsilon_z$ , cm·rad, E=510 MeV	2.1x10 <sup>-6</sup> , 3x10 <sup>-7</sup>
RF frequency, MHz	174.376
RF harmonic number	13
RF voltage	110 kV



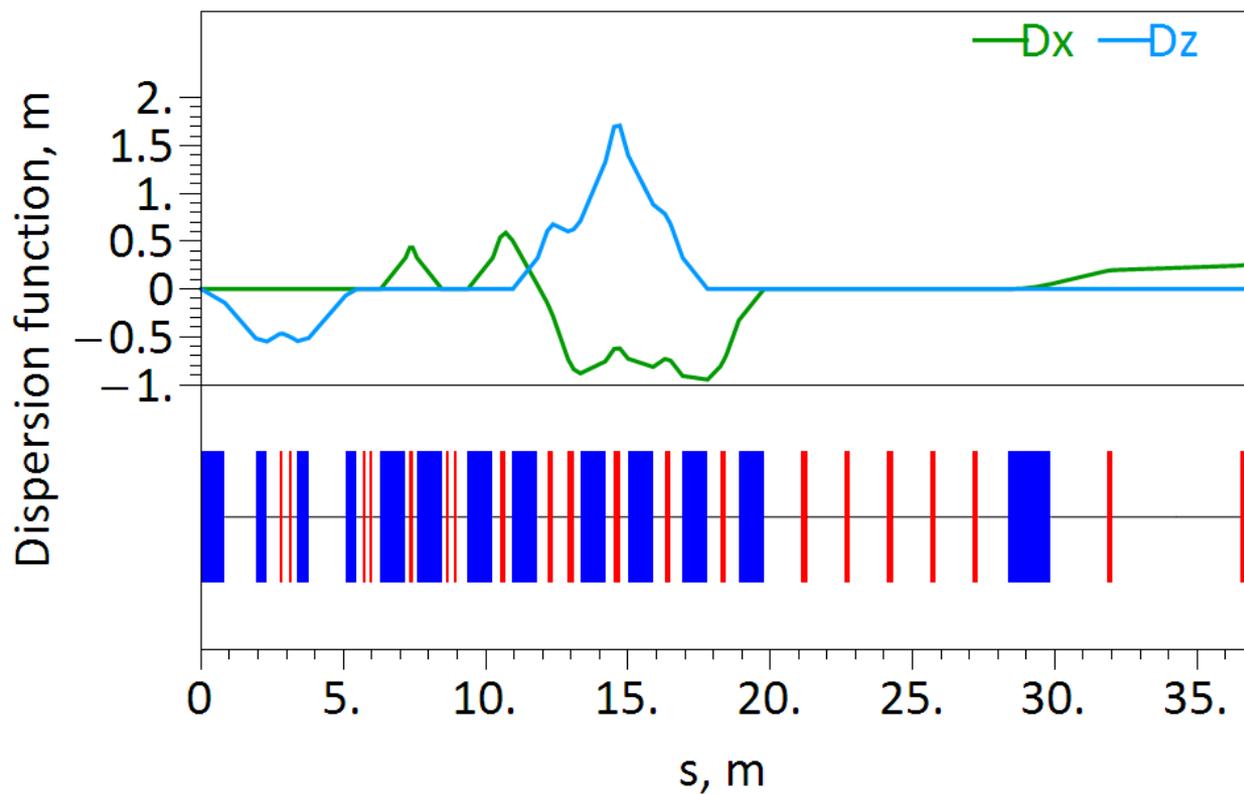
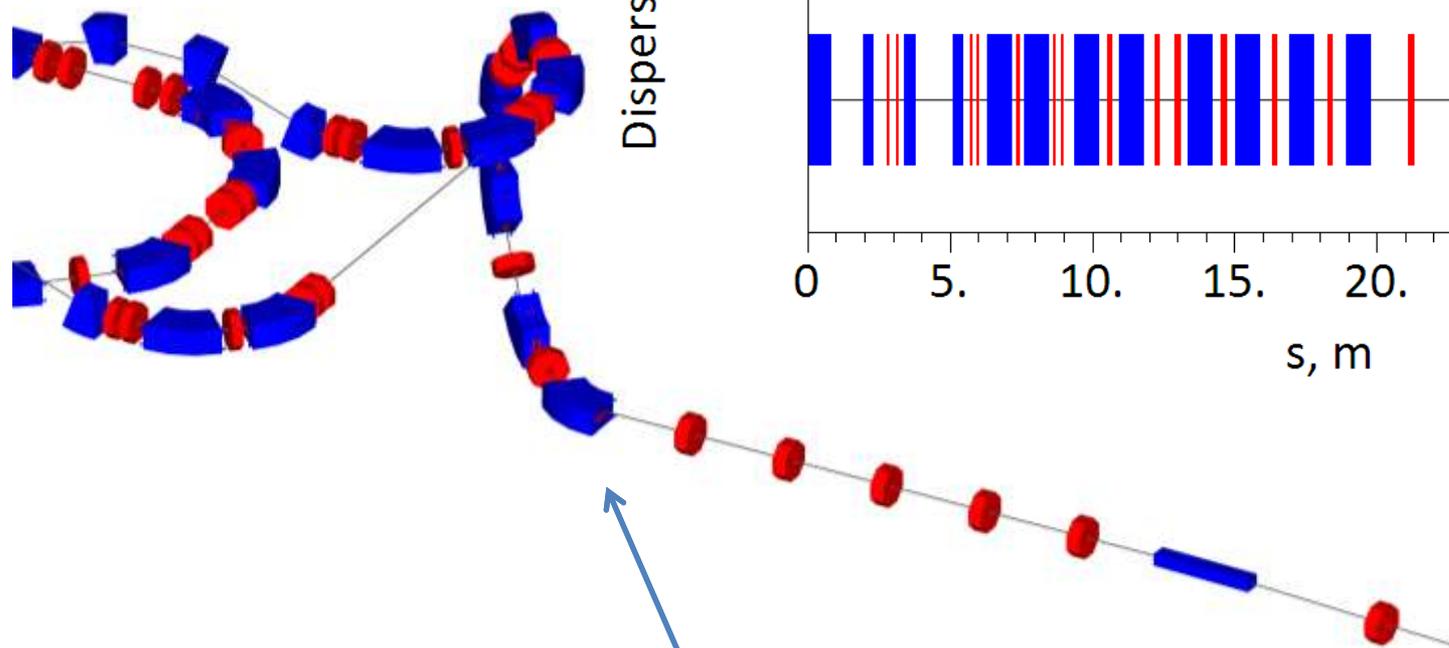
# Descent



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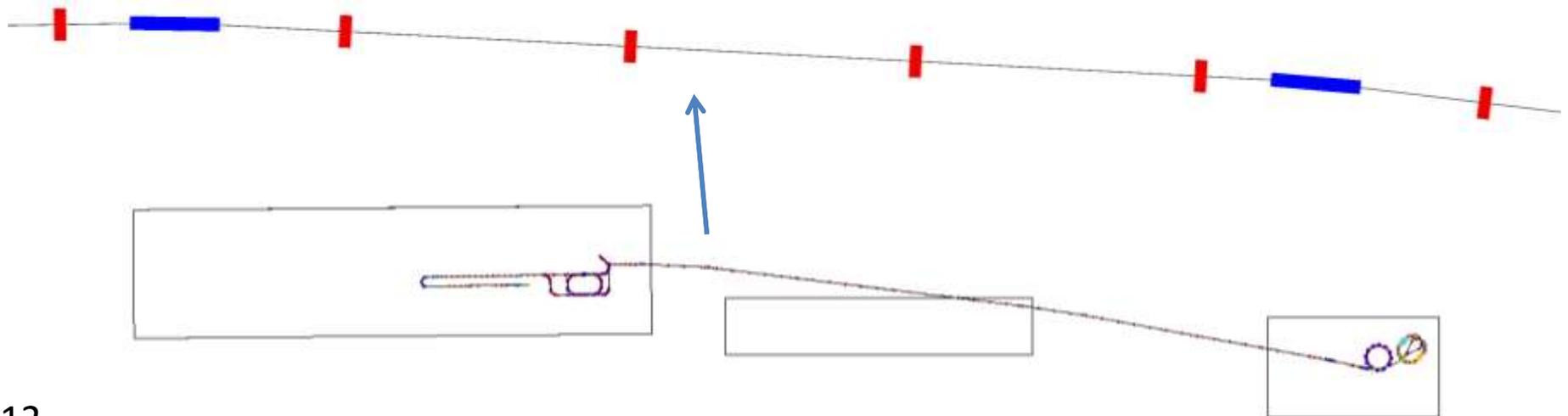




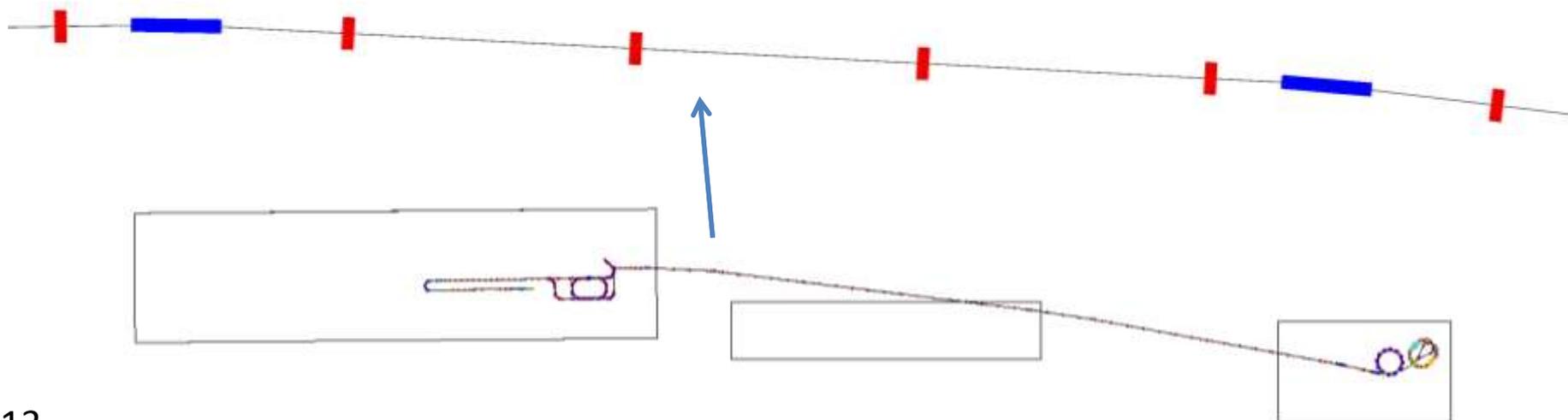
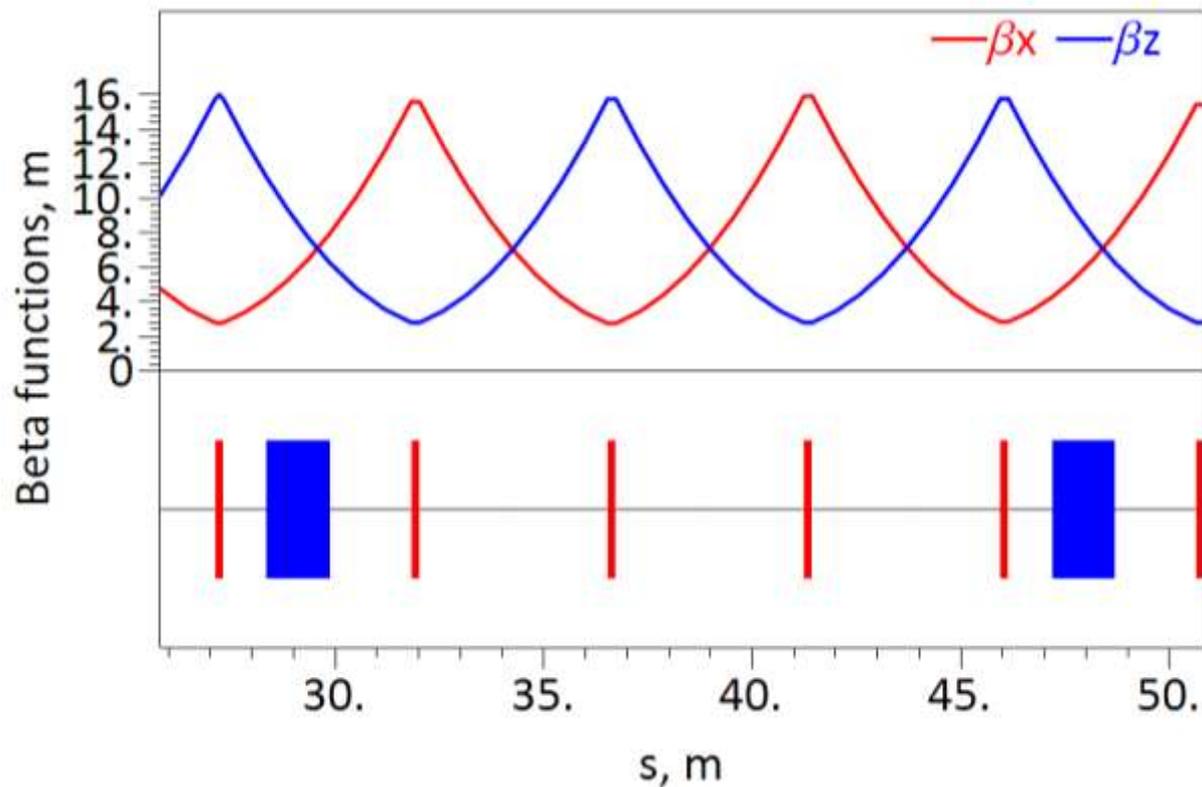
6M4



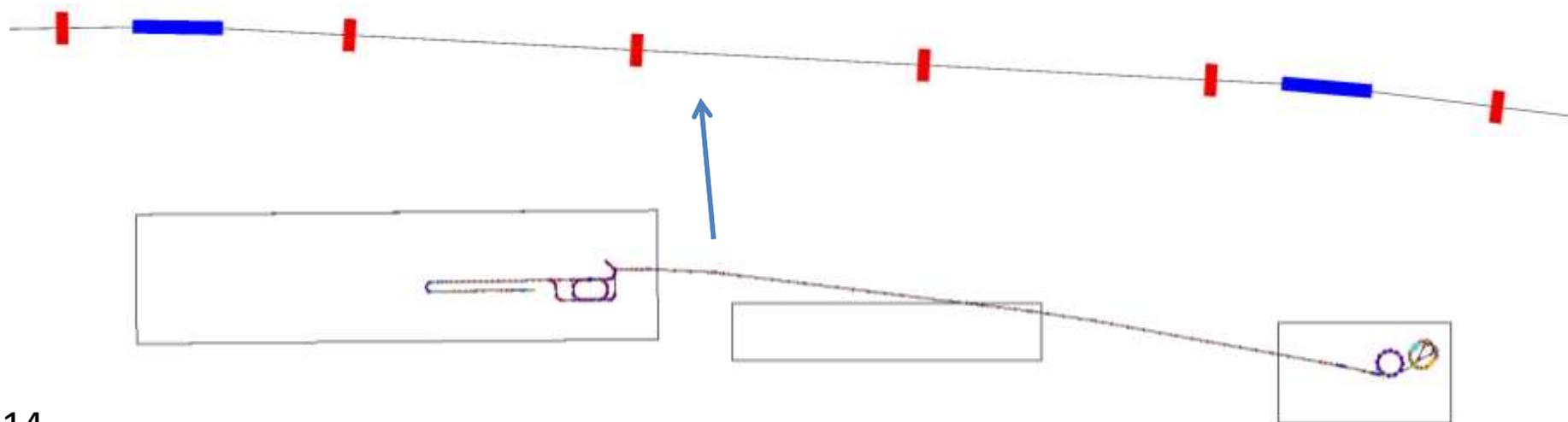
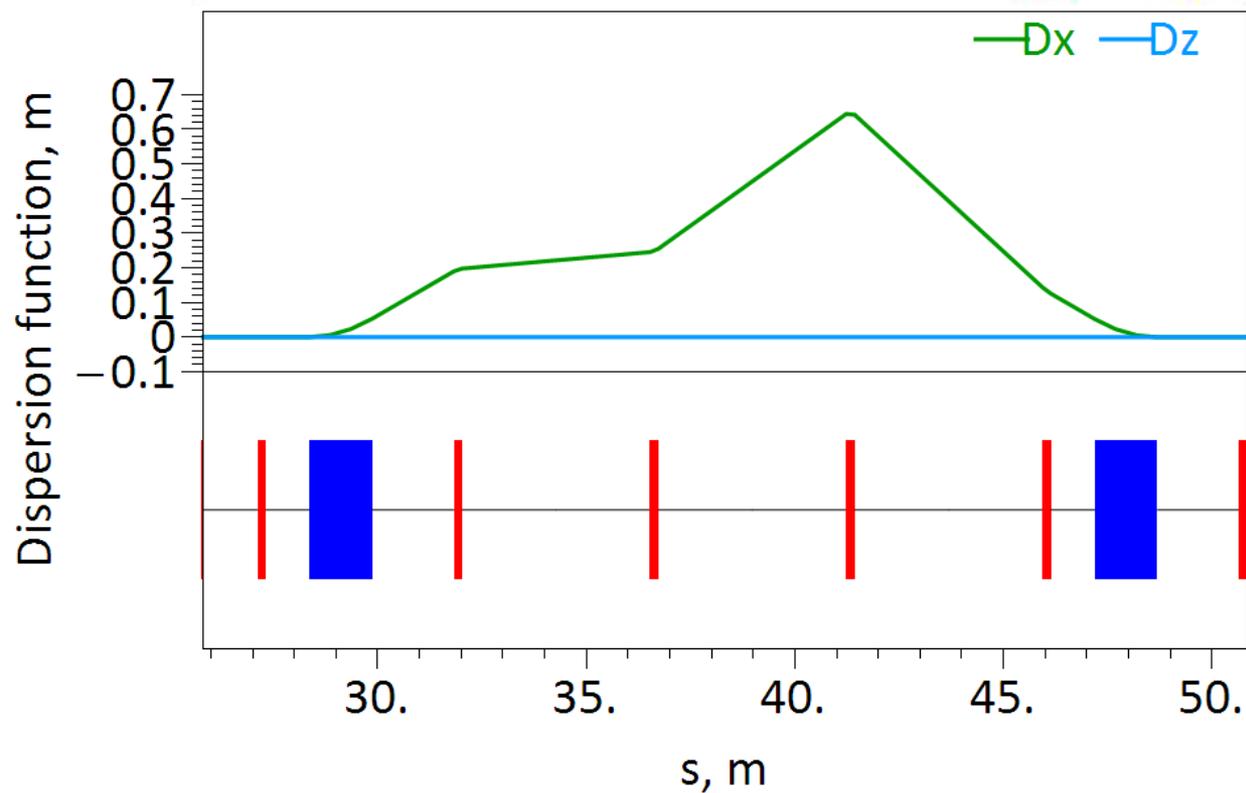
# First horizontal bend



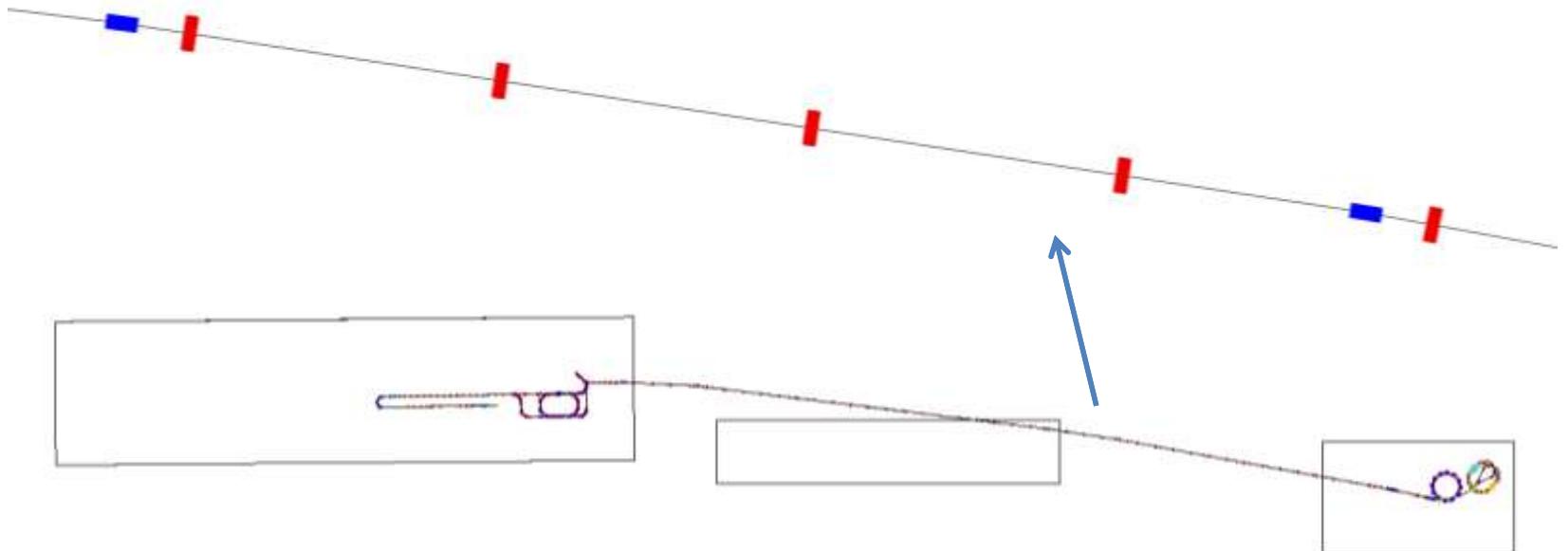
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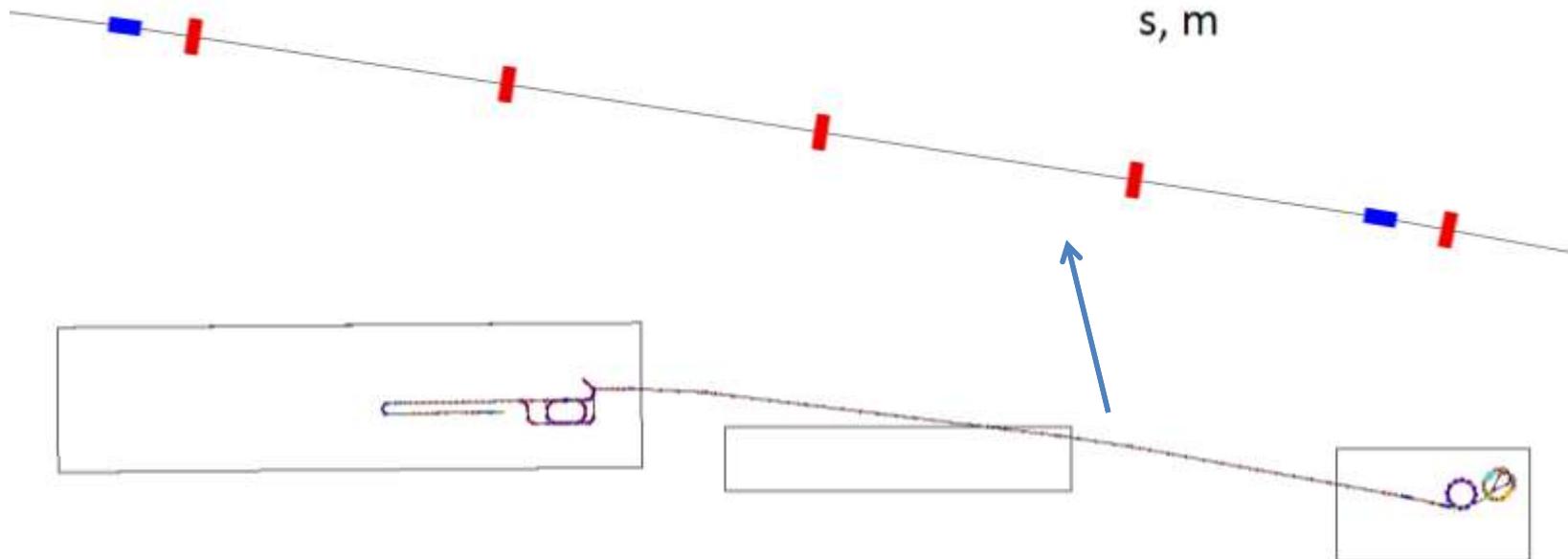
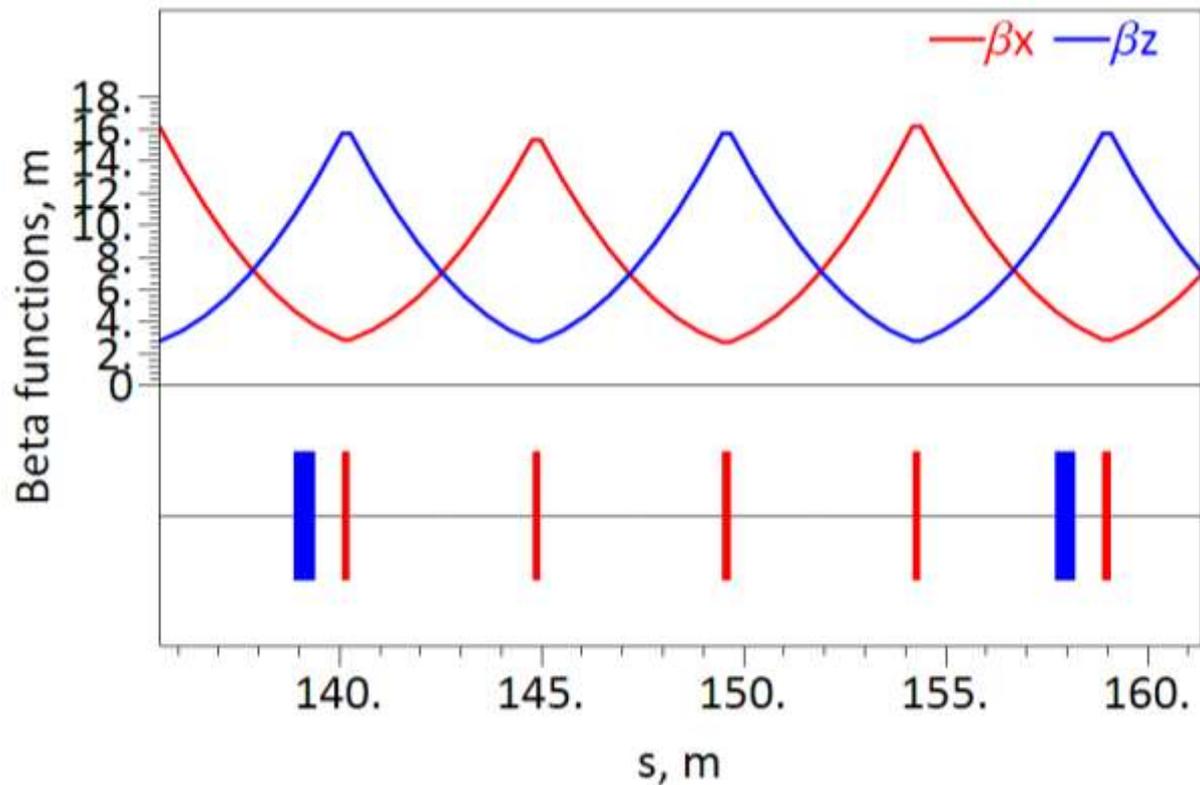
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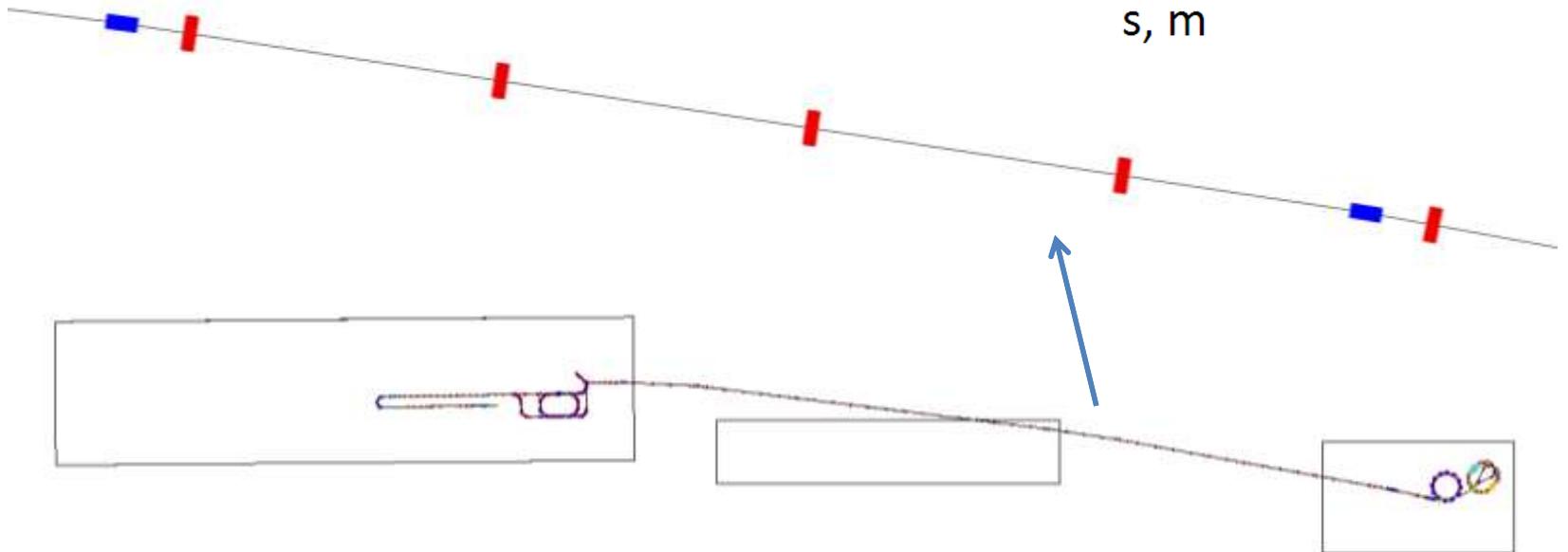
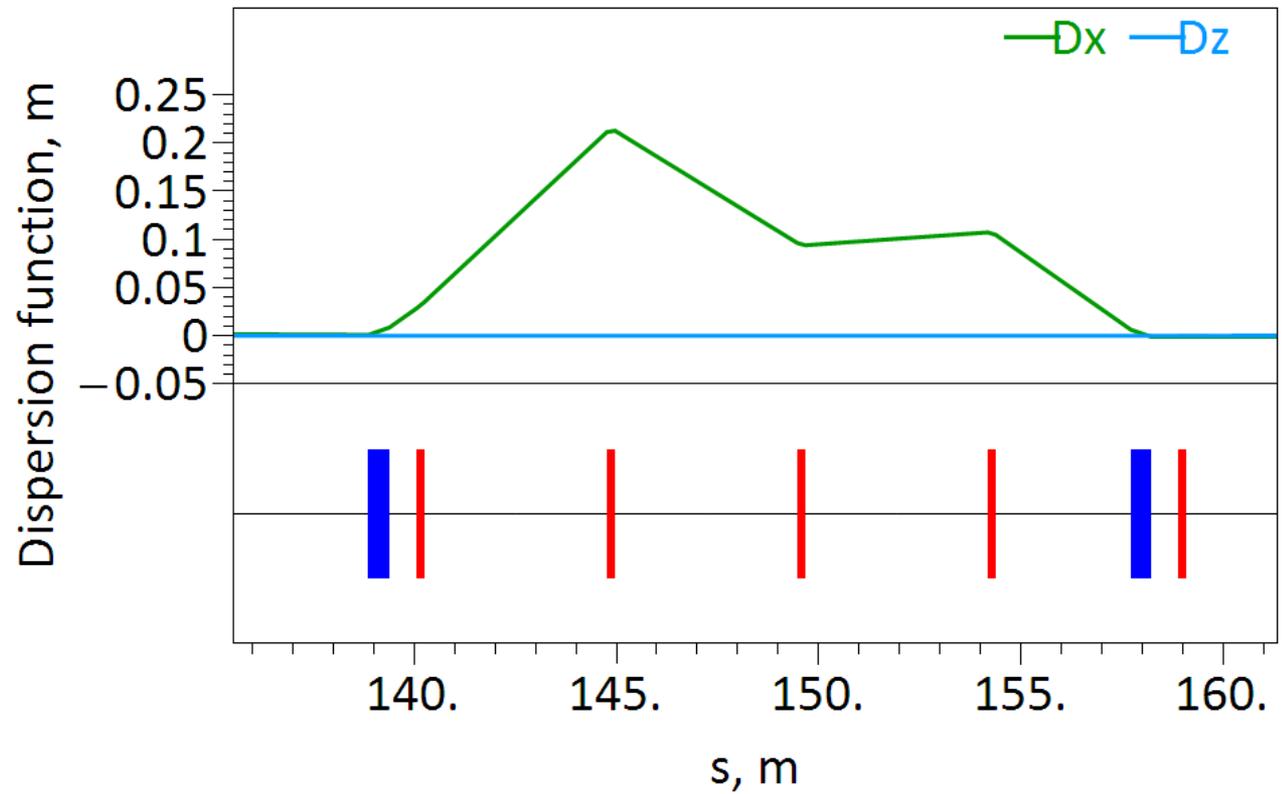
# Second horizontal bend



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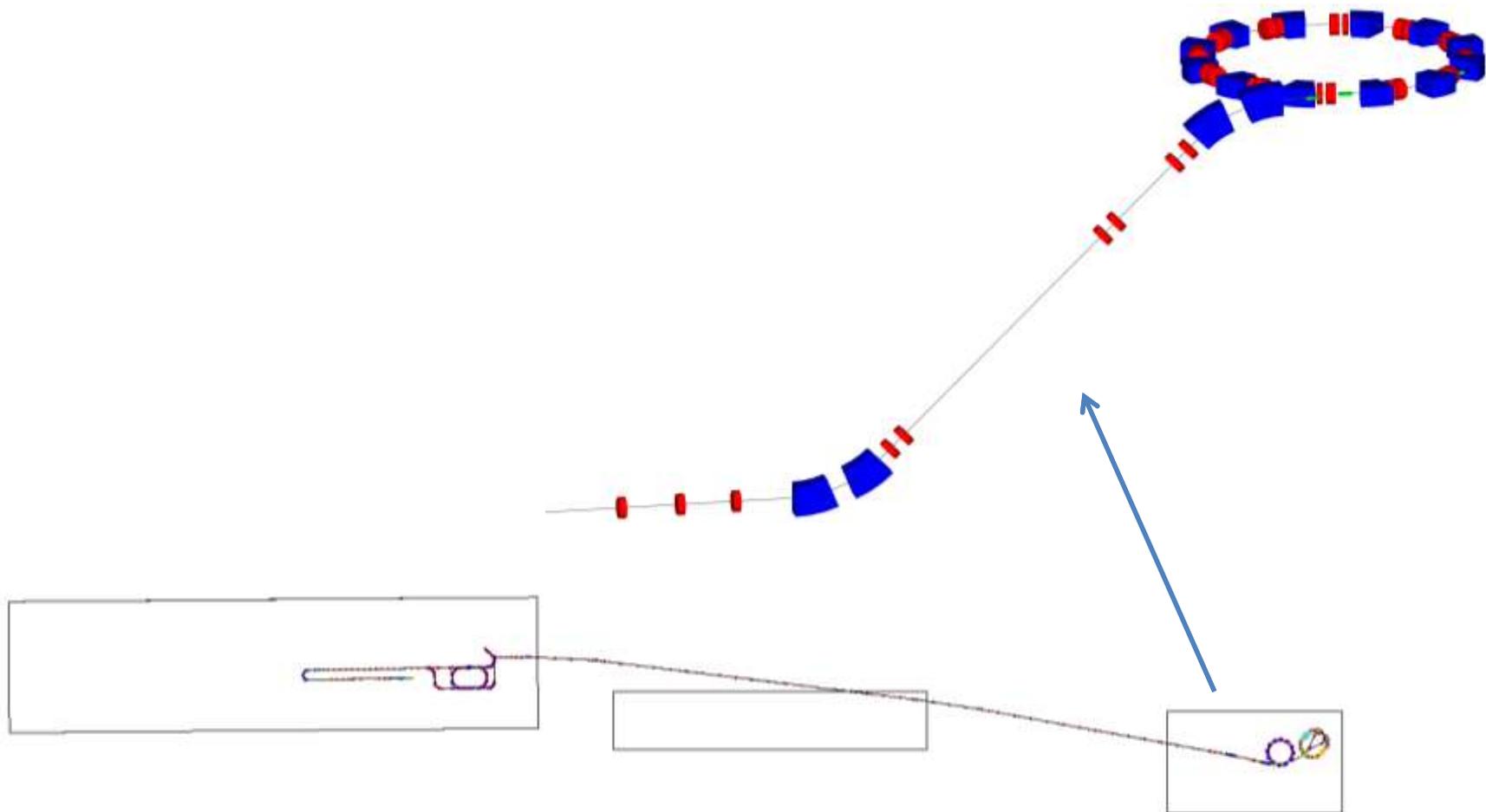
# Second horizontal bend

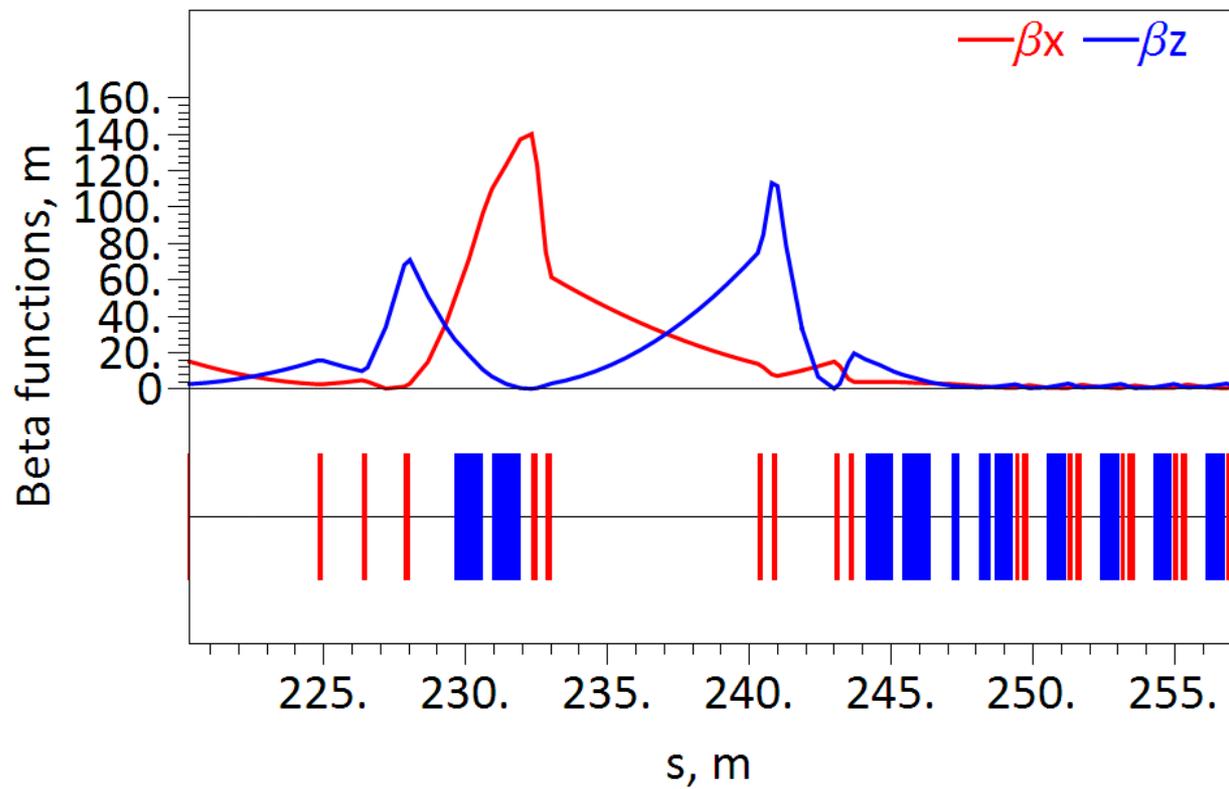




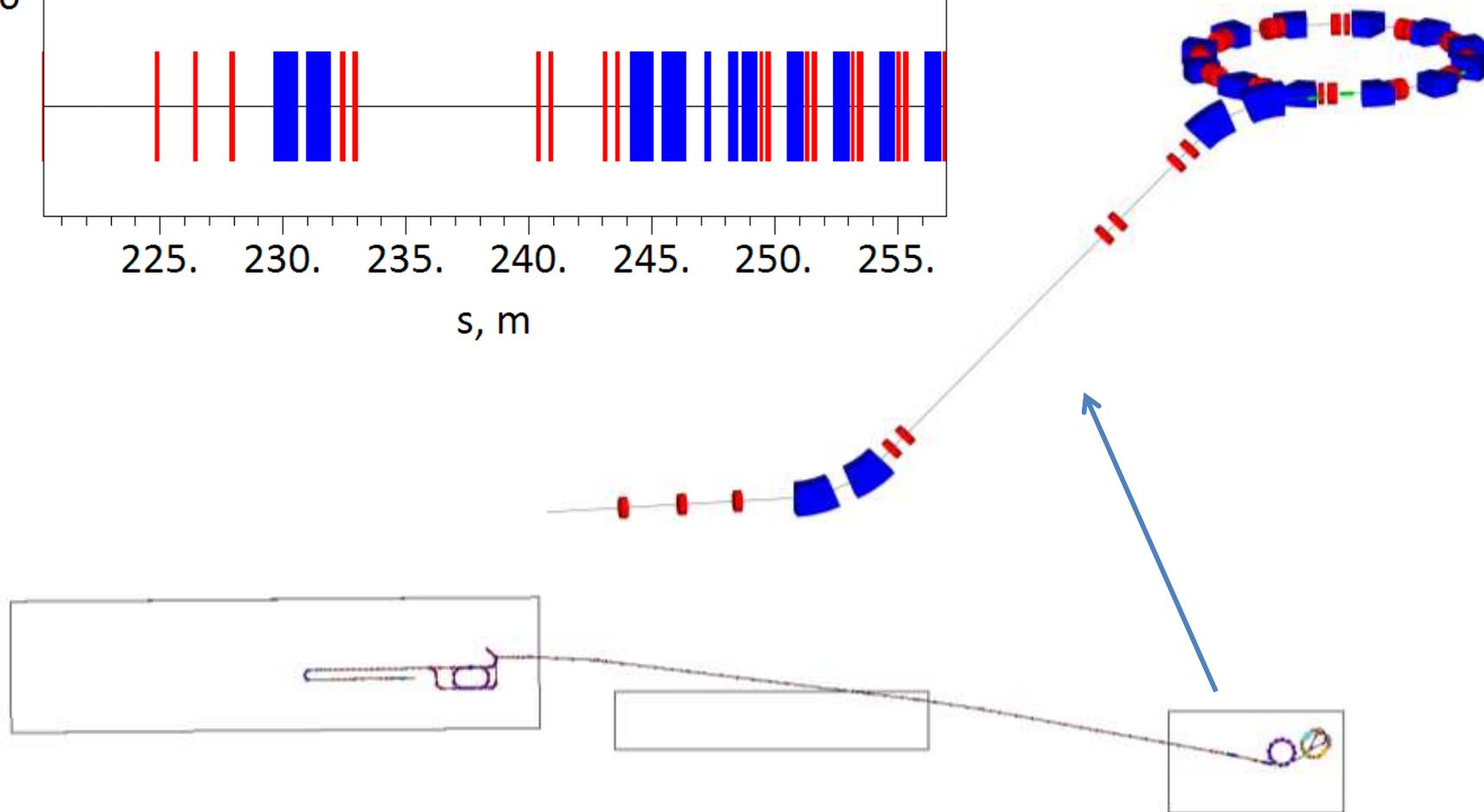


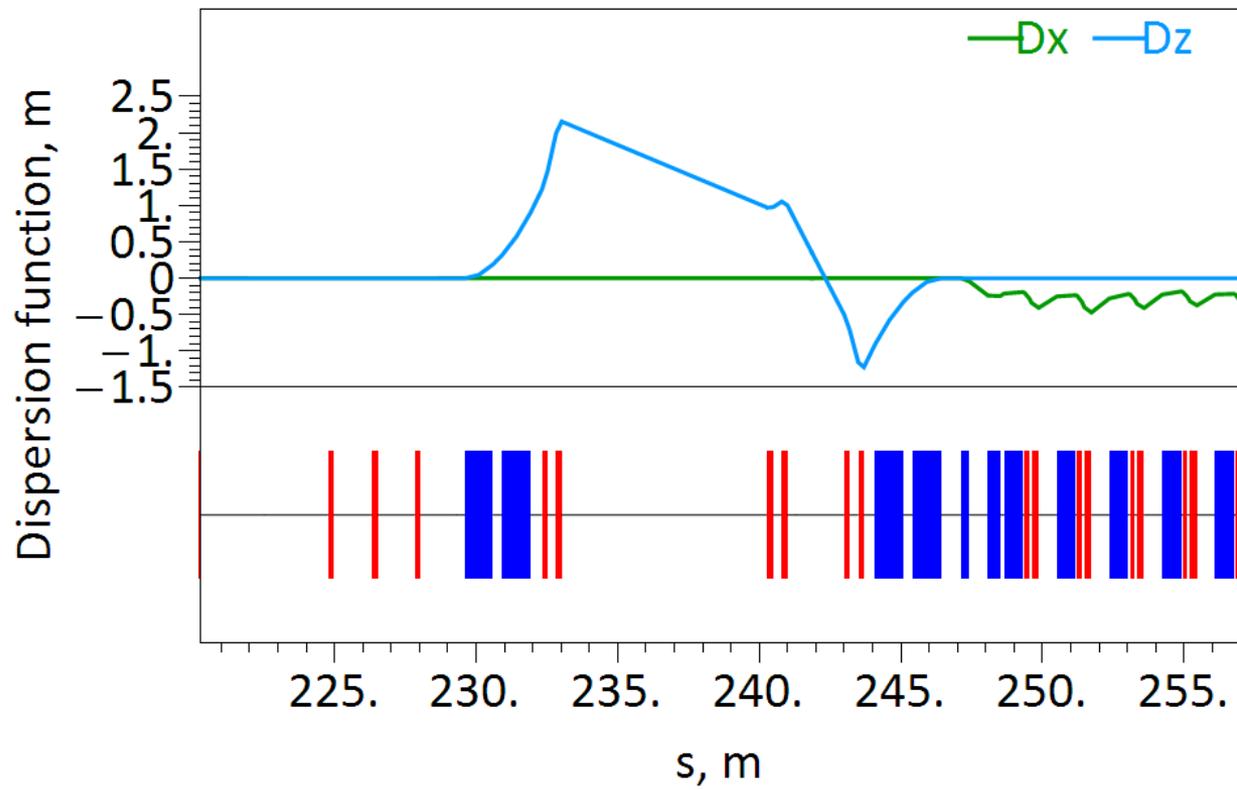
# Ascent



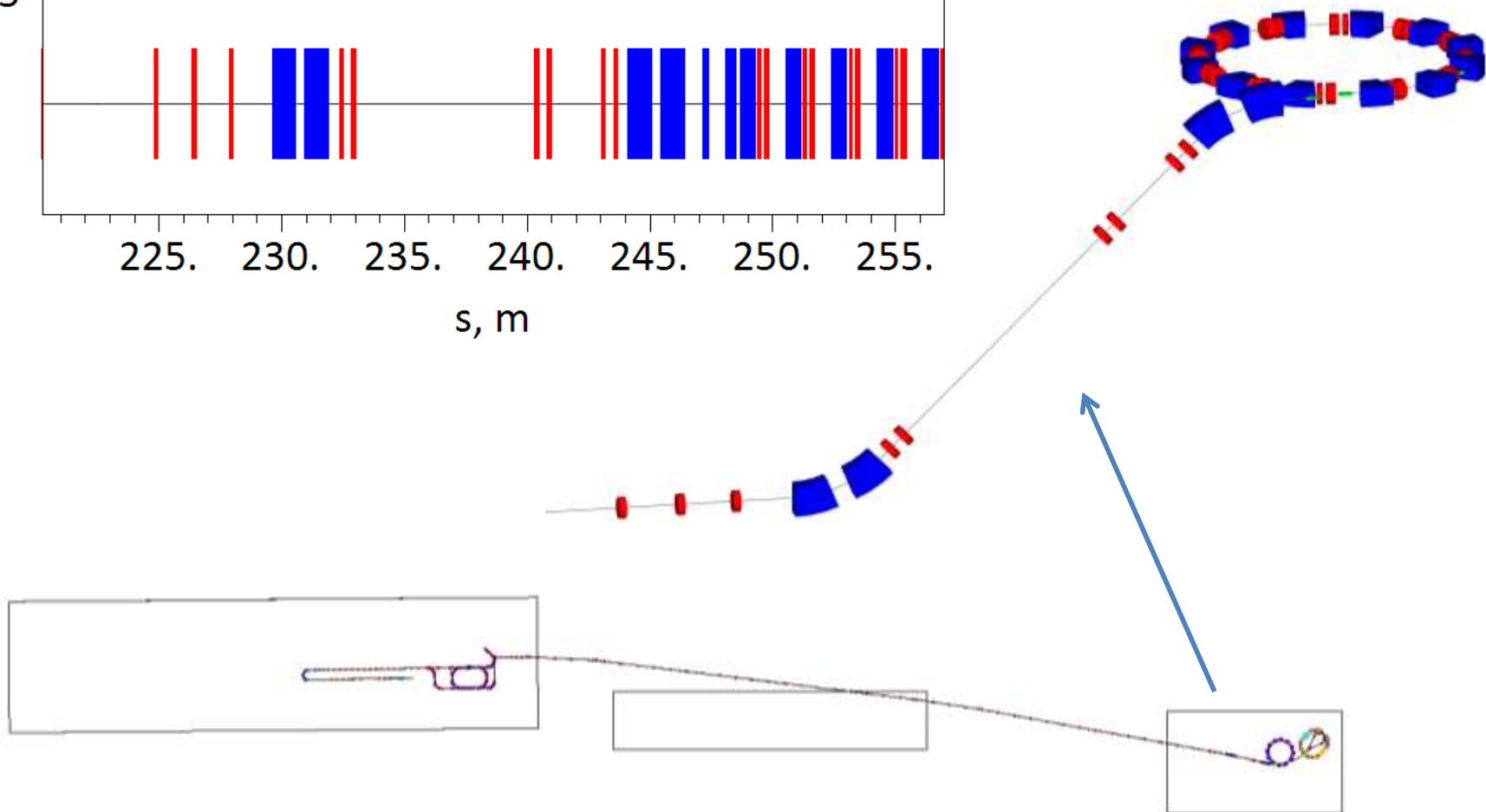


Ascent





Ascent

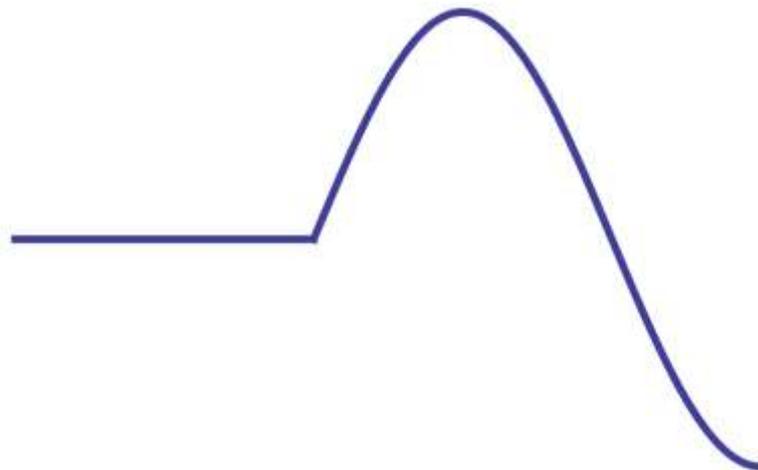


# Beam diagnostics and vacuum pumps

Element	Number
Luminophor probes: are used for the first beam pass, is not transparent to the beam	12
Image current monitors: to show the beam at the time of the bypass. Located after the dipole correctors shifted betatron phase of $2/3\pi$	23
Vacuum pumps NMD-016: now the vacuum in the vacuum chamber is $10^{-8}$ Torr	8

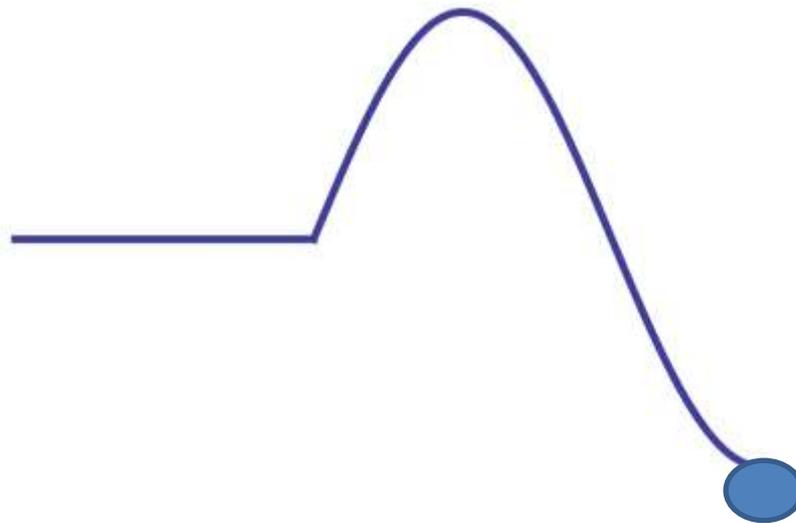
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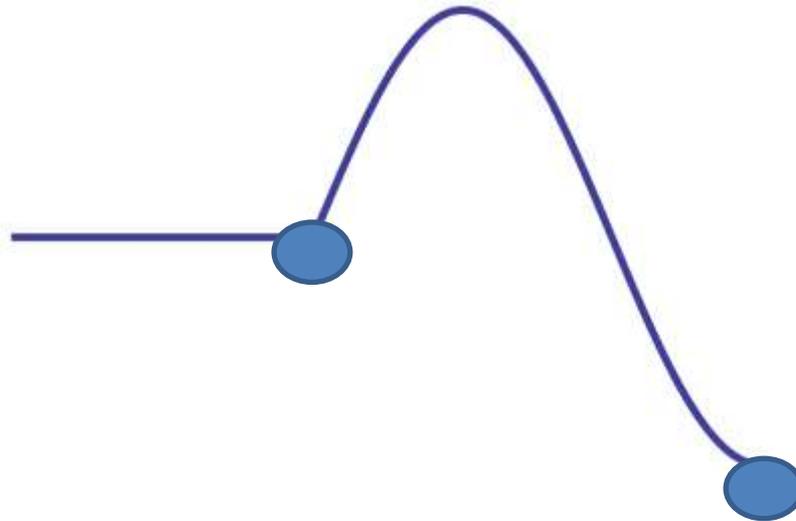
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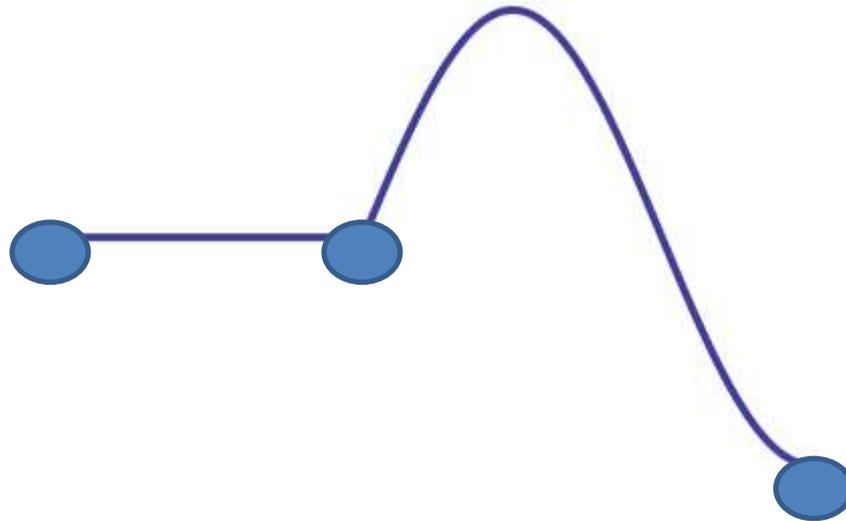
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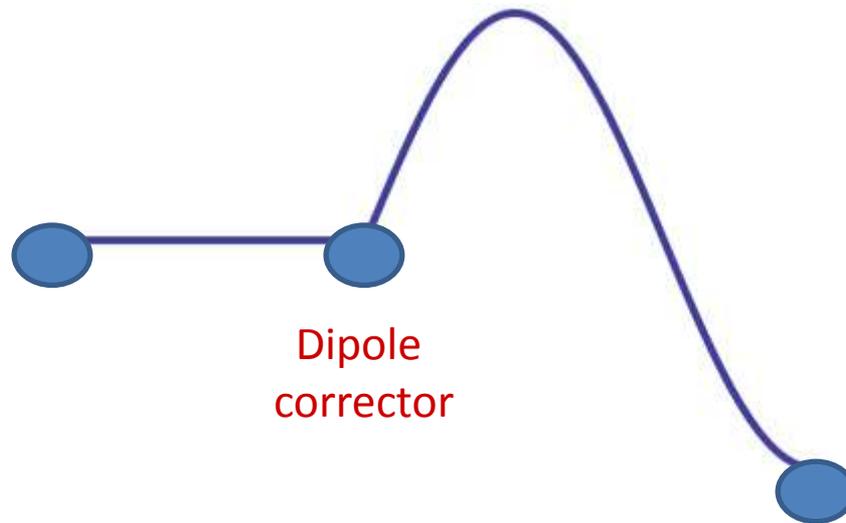
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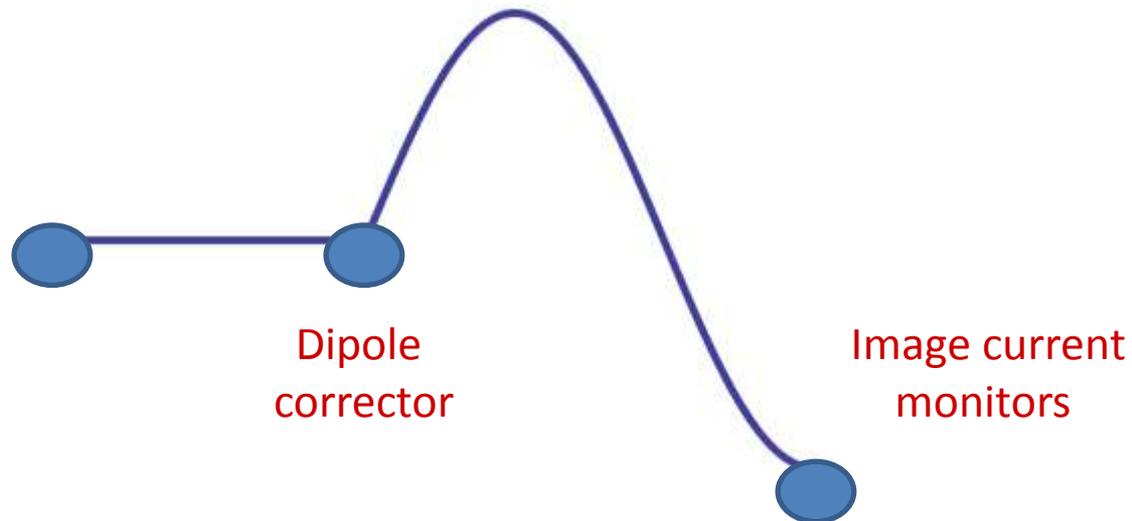
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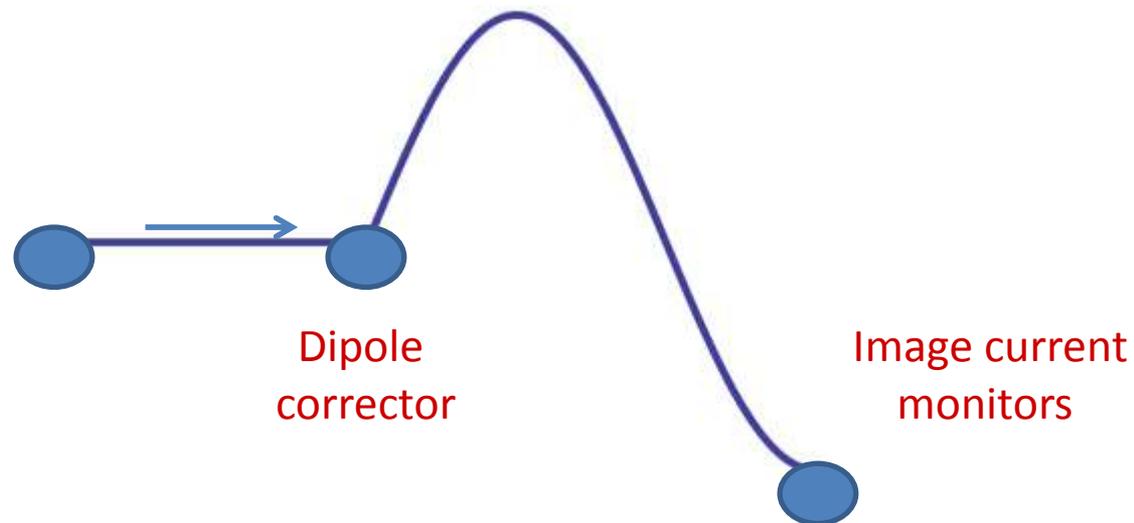
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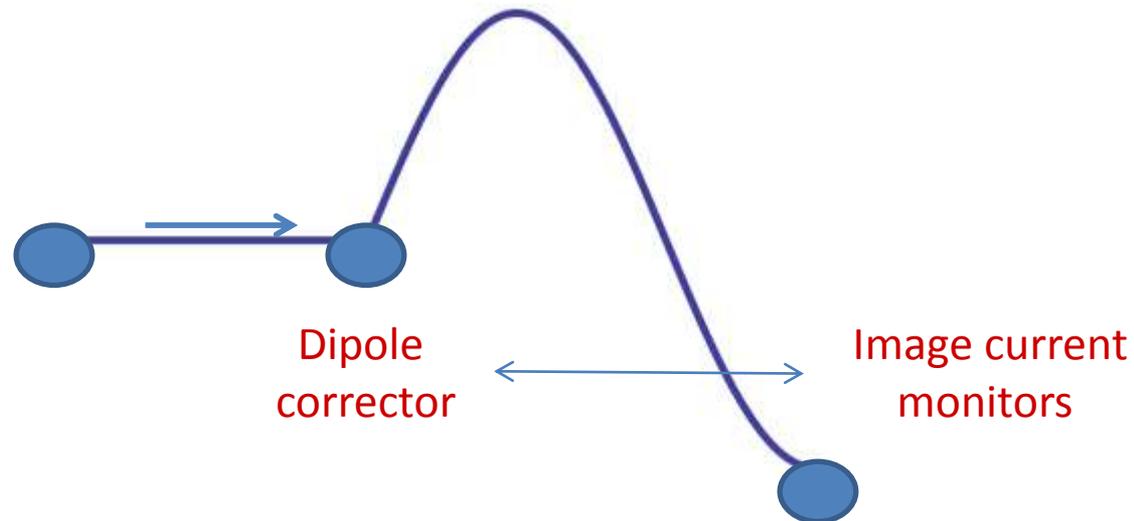
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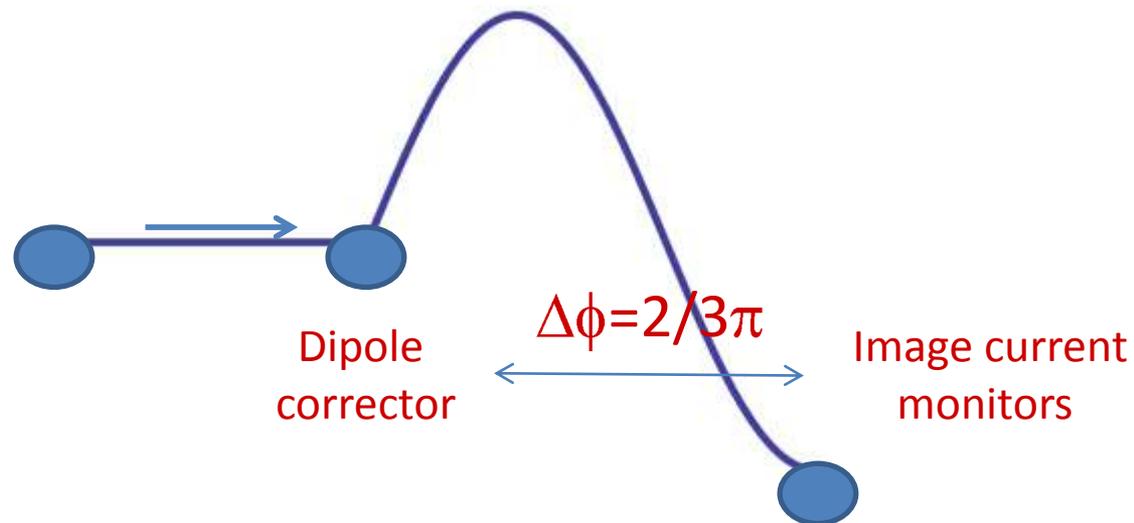
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# Operation: Injector VEPP-5 for VEPP-2000 & VEPP-4M

Operation for VEPP-4M, c	e-			e+			e-			e+			
injection to Booster VEPP-3	60			60			60			60			
Energy ramping in VEPP-3		600			600			600			600		
injection to VEPP-4M			1			1			1			1	
VEPP-3 polarity change				120			120			120			120
Experiment													10800

Operation for VEPP-2000, c	e-			e+			e-			e+			
injection to BEP, E=510MeV	1			1			1			1			
Energy ramping in BEP		10			10			10			10		
injection to VEPP-2000			1			1			1			1	
BEP polarity change				20			20			20			20
Experiment													

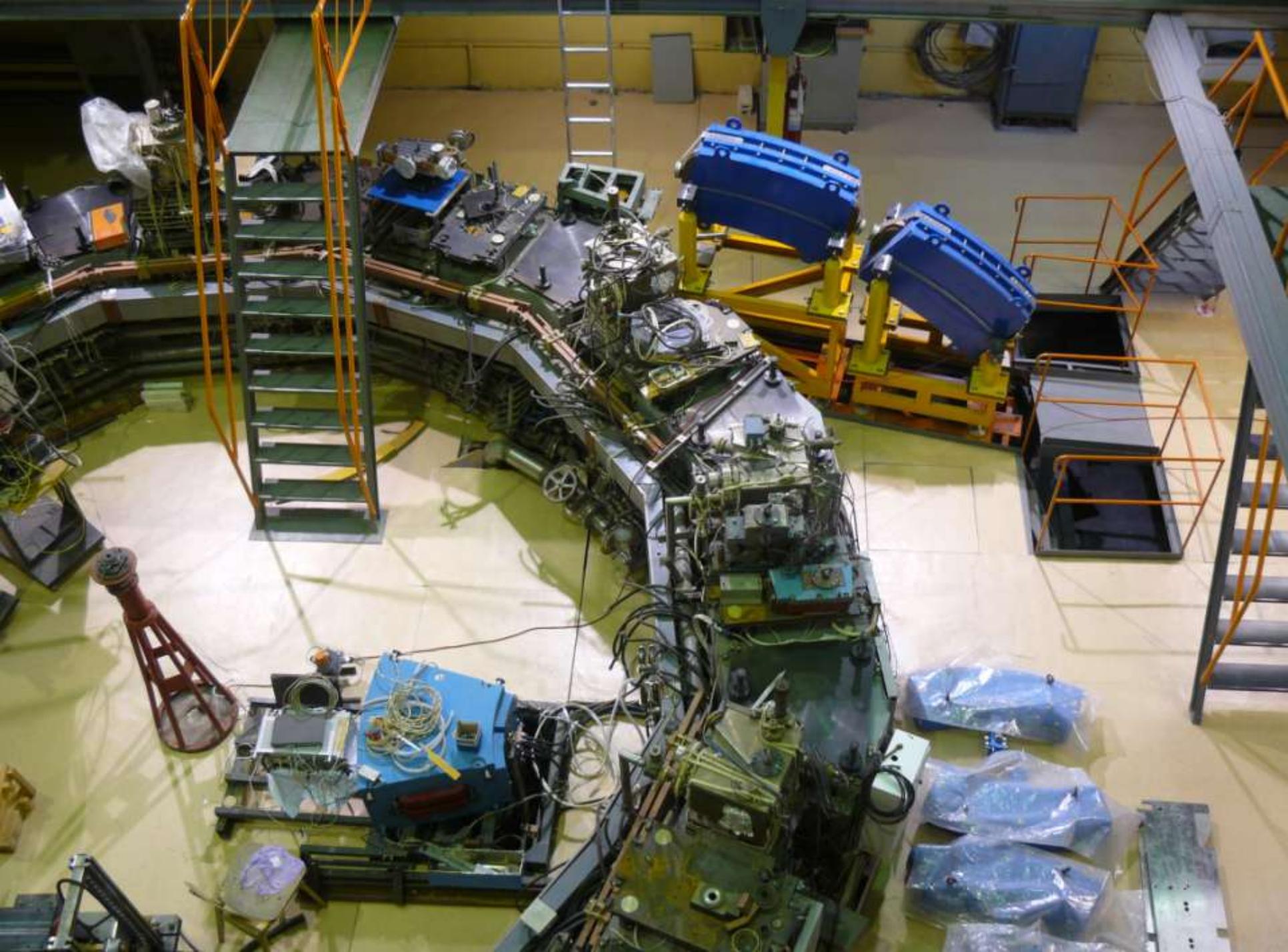
# Magnets

Element	Parameters	Power supply
2 horizontal magnets , 1-st bend	$H=0.08T$ , $L=0.5m$	1 DC, UM-20, $I=20A$
2 horizontal magnets, 2-nd bend	$H=0.08T$ , $L=1.5m$	1 DC, UM-20, $I=20A$
4 vertical magnets of the Ascent	$H=0.7T$ , $L=1m$	1 AC, GID-3000, $W=3kJ$
1 horizontal magnet before the septum magnet in the Booster BEP	$H=1.7T$ , $L=0.3m$	1 AC, $W=2.4kJ$
1 septum magnet of the Booster BEP	$H=1.7T$ , $L=0.4m$	1 AC, $W=2.4kJ$
42 lenses of regular part	$G=2.5T/m$ , $L=0.2m$	8 AC, GID-25, $W=25J$
17 lenses of matching parts	$G=10-20T/m$ , $L=0.2m$	17 AC, GID-25, $W=25J$
12 dipole correctors in 12 lenses	$H_{max}=0.2T$ , $L=0.1m$	12 AC, GID-25, $W=25J$
27 dipole correctors	$H_{max}=0.2T$ , $L=0.1m$	27 DC, PS-3-A, $I=3A$

in the manufacture

available









# Perspective

2014				2015				
	October	November	December	January	February	March	April	May
Injector VEPP-5	Yellow		Green					
Transportation channel	Red	Yellow				Green		
Booster BEP	Red				Yellow		Green	
Collider VEPP-2000	Red				Yellow			Green

Assembling	Commissioning	Operation
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Thank you for your attention!