

Review of the project of Electron - Ion Collider

Petr Shatunov, BINP, Novosibirsk

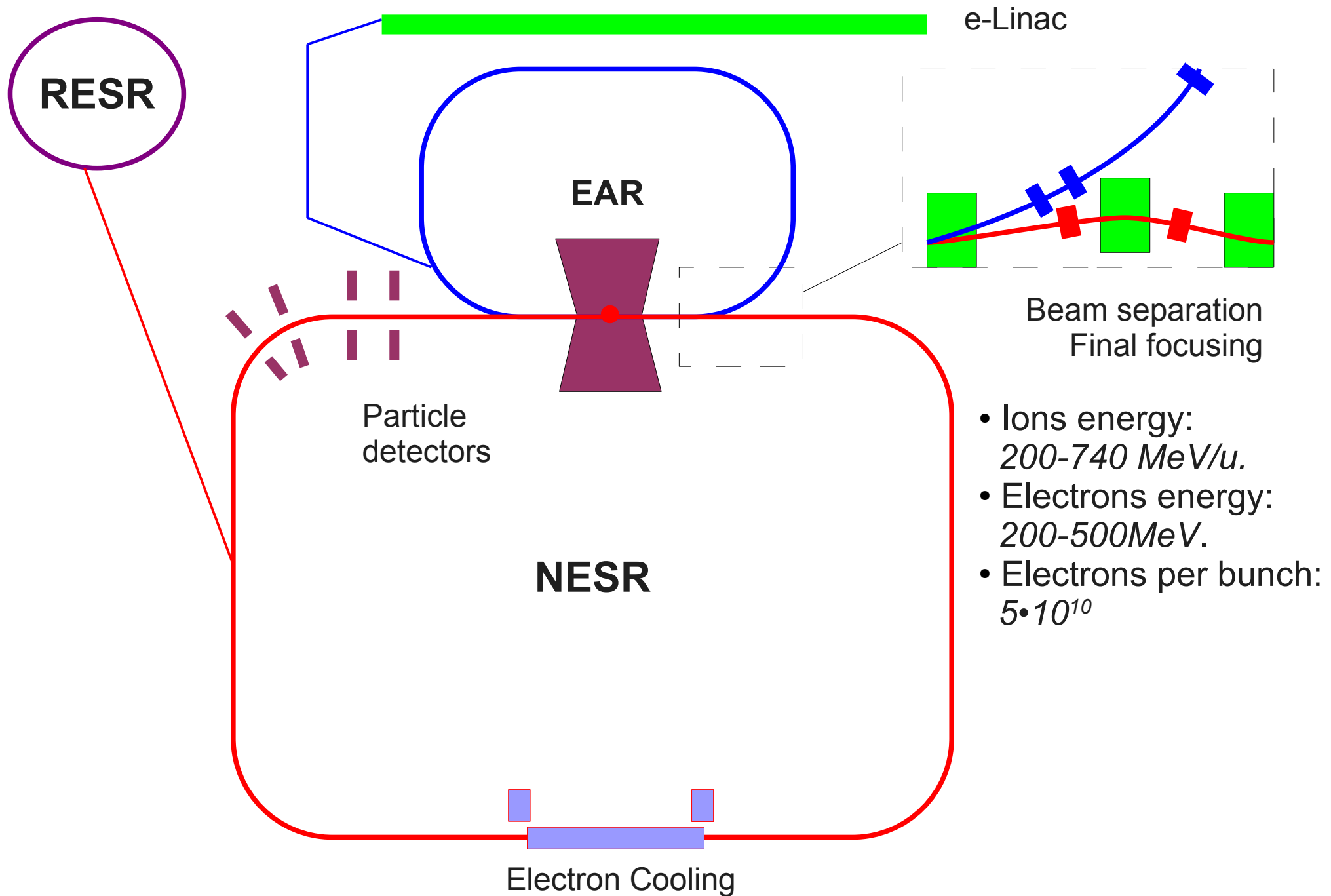
Moscow, 2009

Short Overview

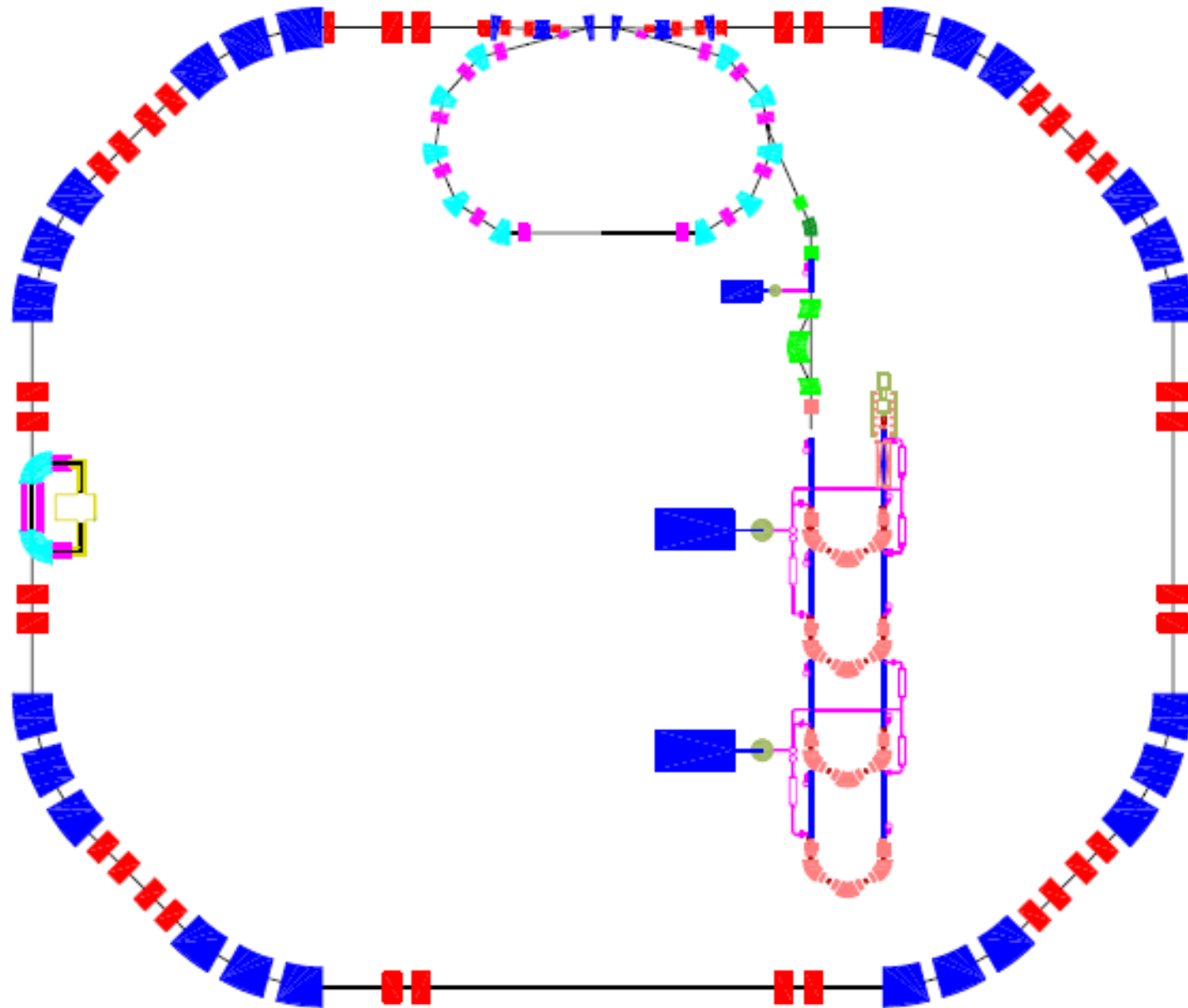
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- Storage of rare ions with short life times at variety of energies.
- High intensity electron beam with tunable parameters.
- Electron spectrometer with energy resolution $\Delta p/p = 10^{-4}$.
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<i>Nucleus</i>	<i>Life time</i>
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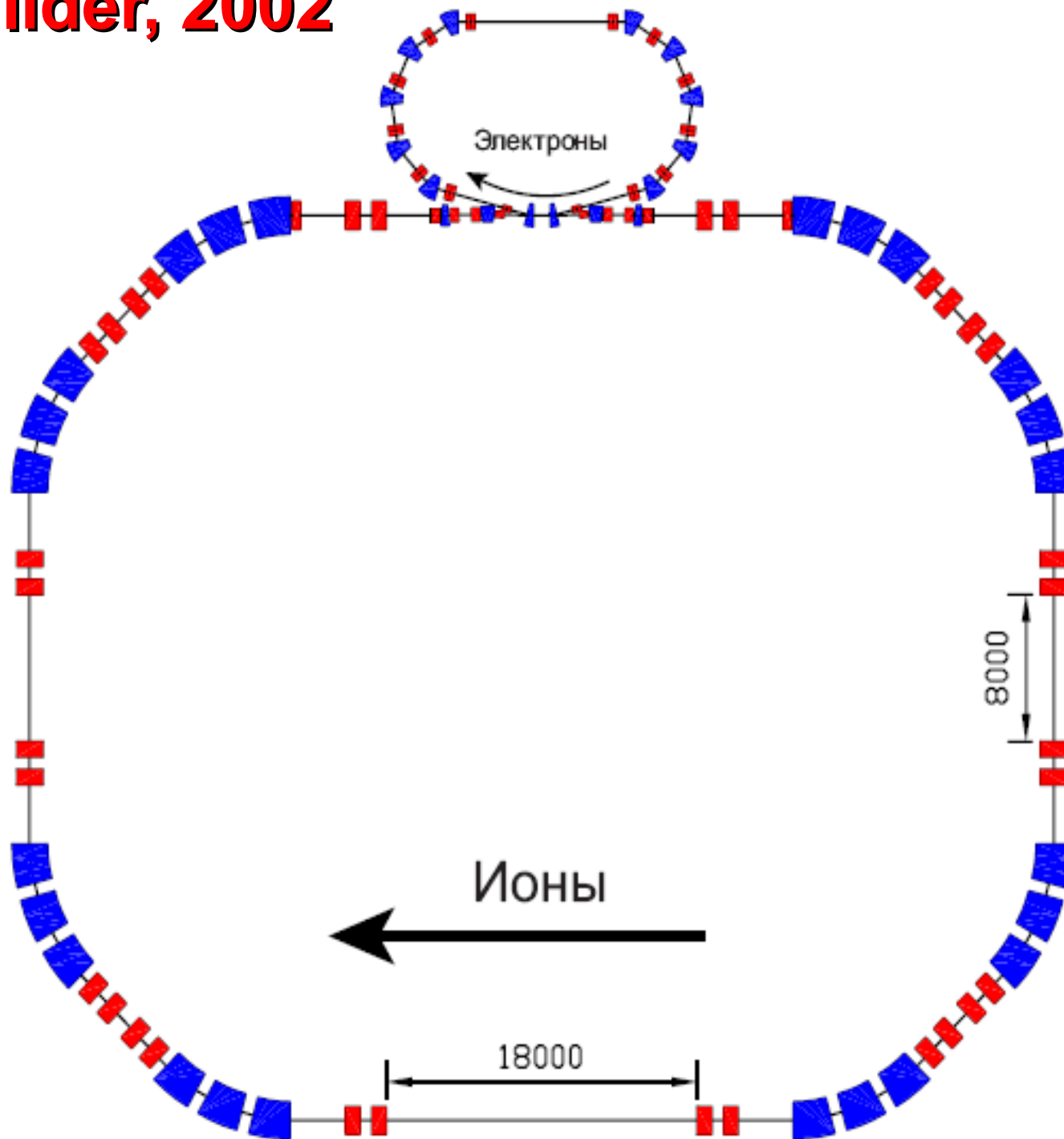
What do we need to create a Collider?



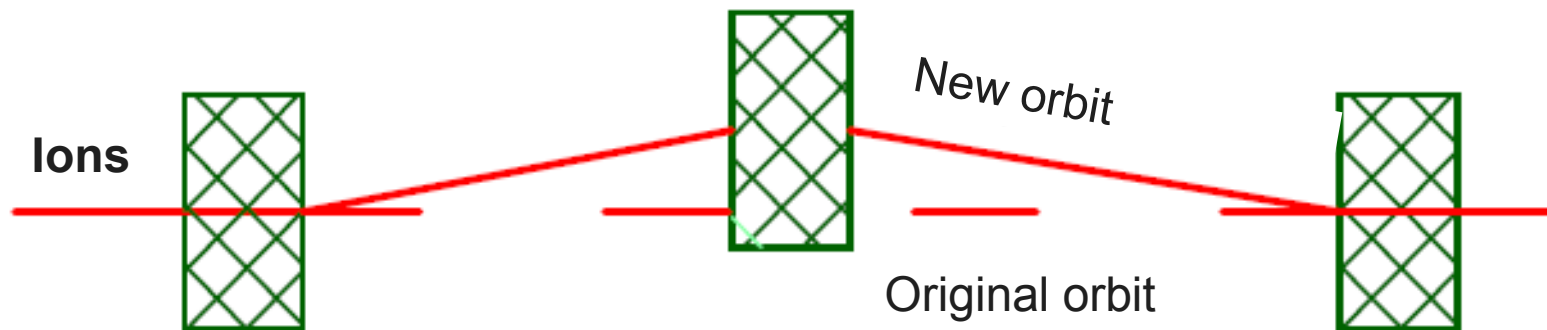
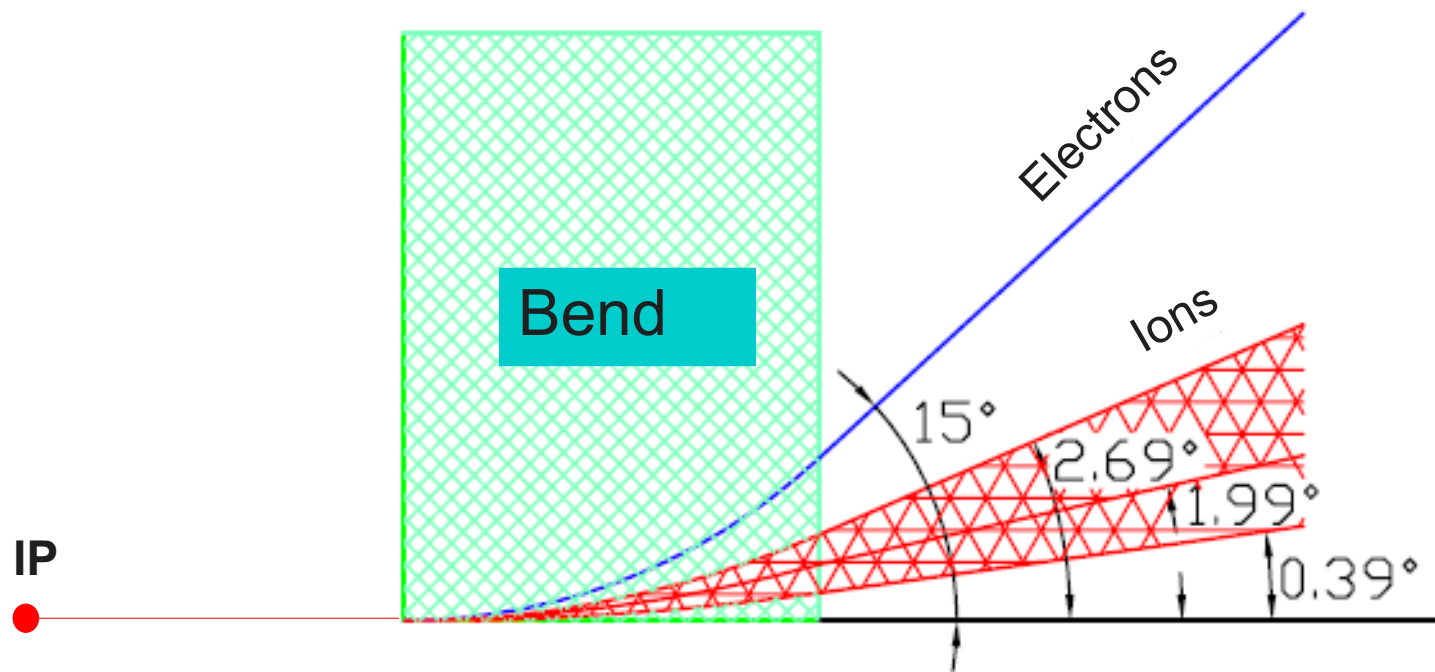
The Collider, 2000



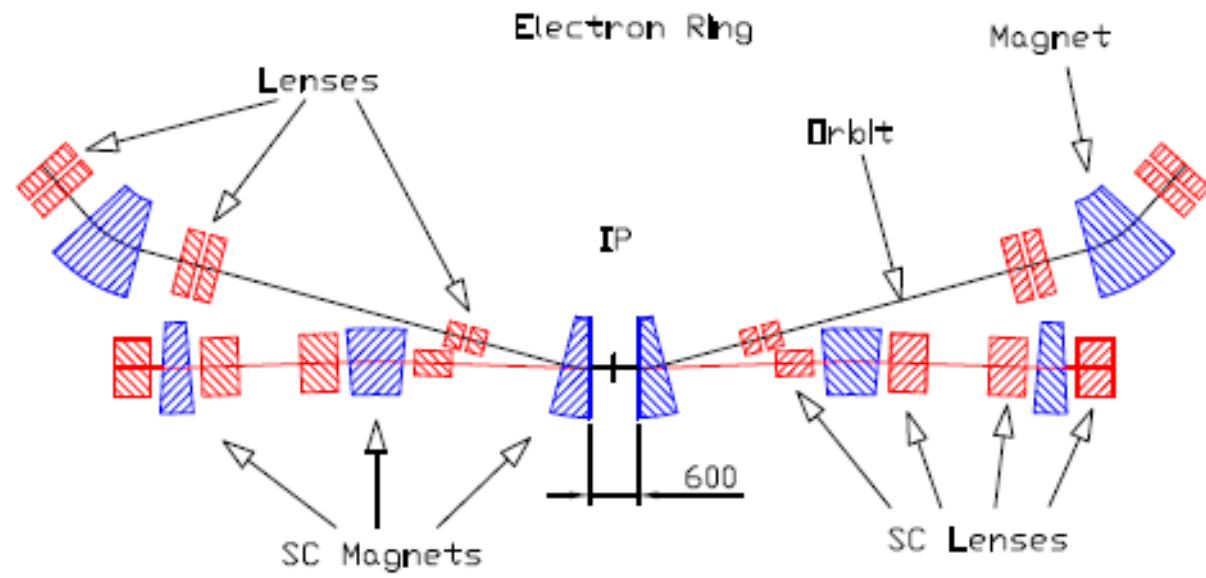
The Collider, 2002



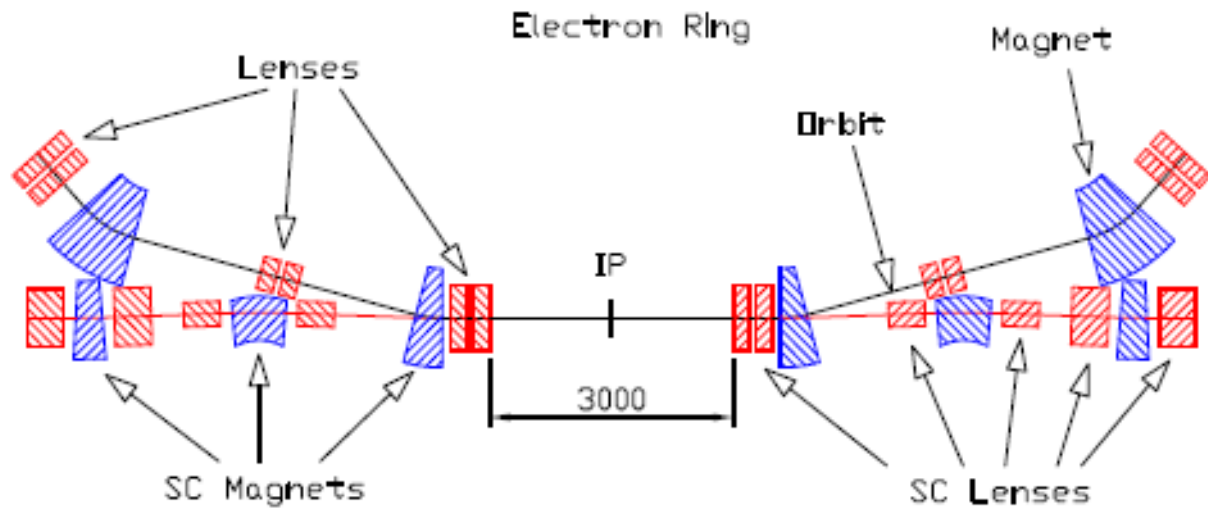
IP Region and Beam Separation



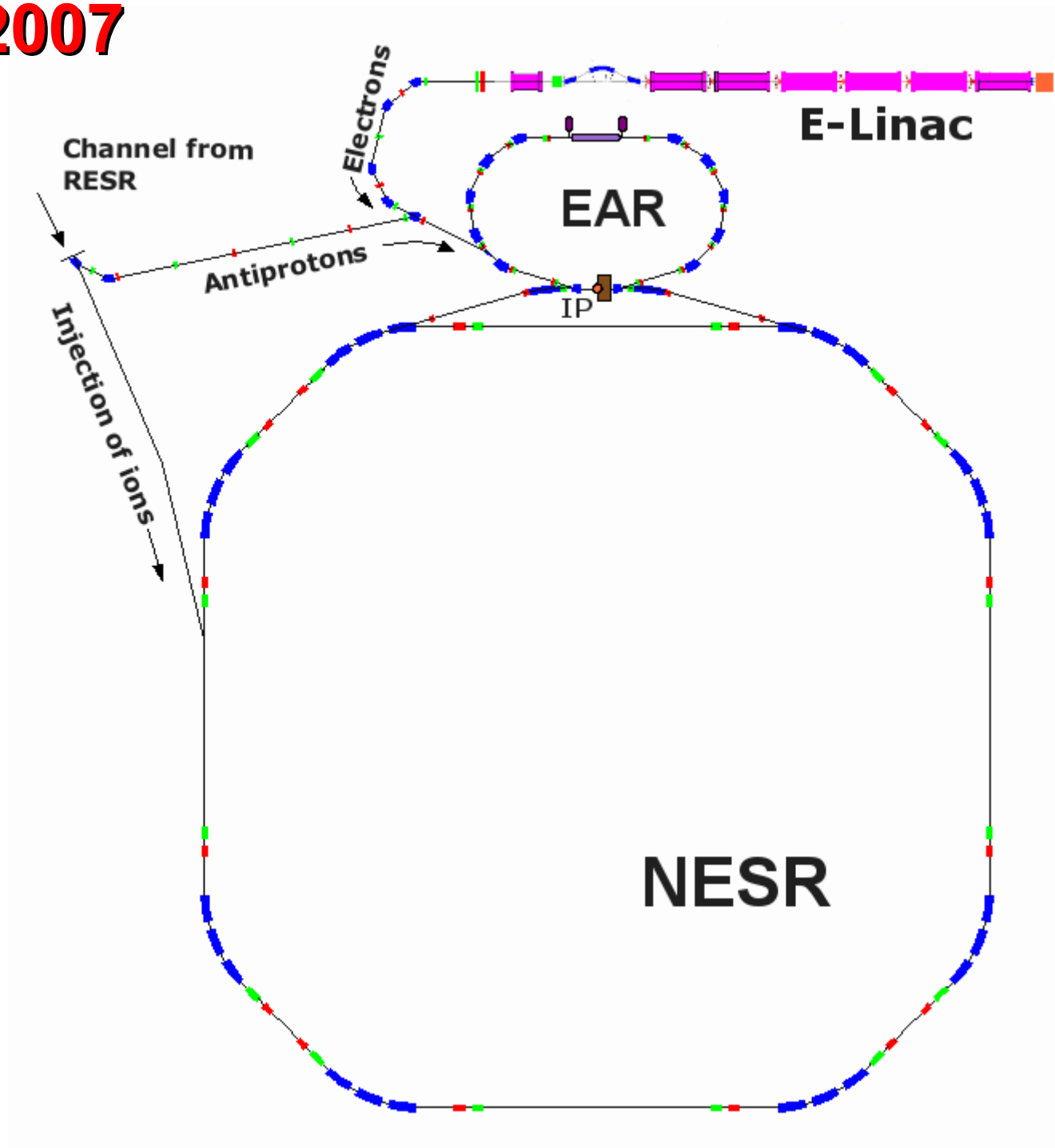
IP Region



Basic options

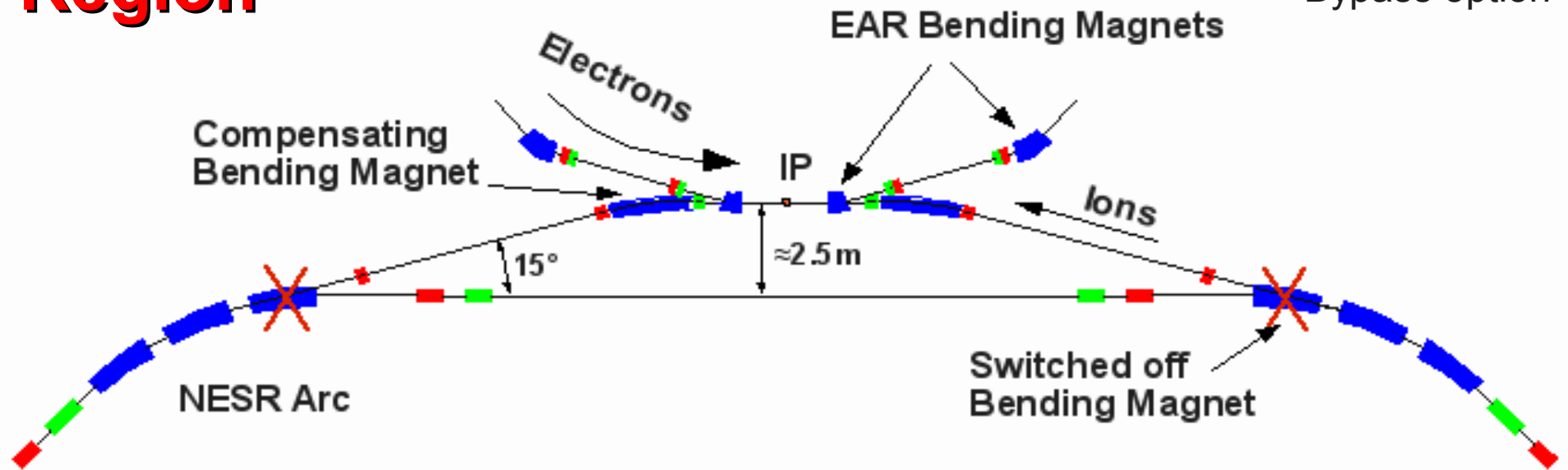


2006-2007



IP Region

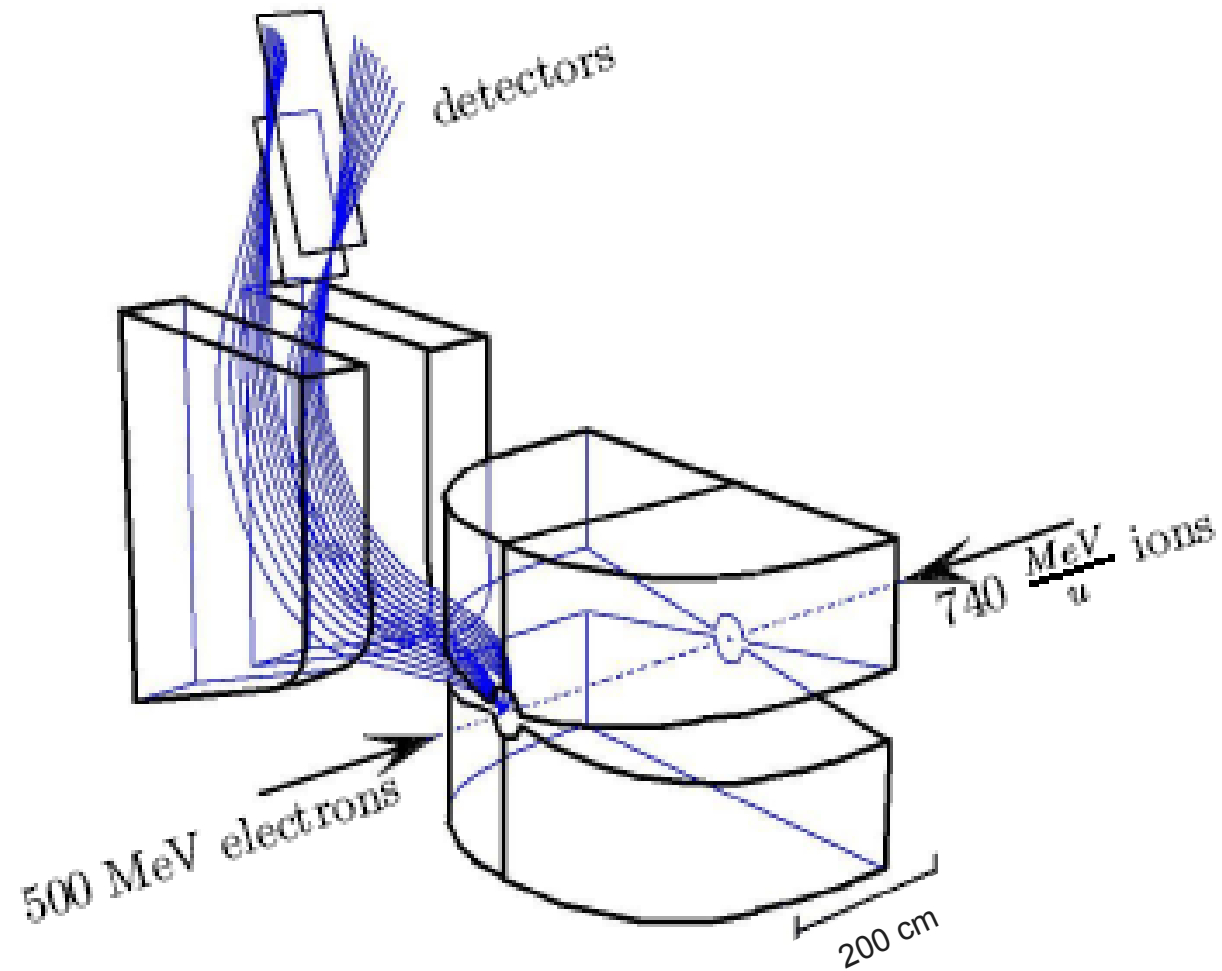
Bypass option



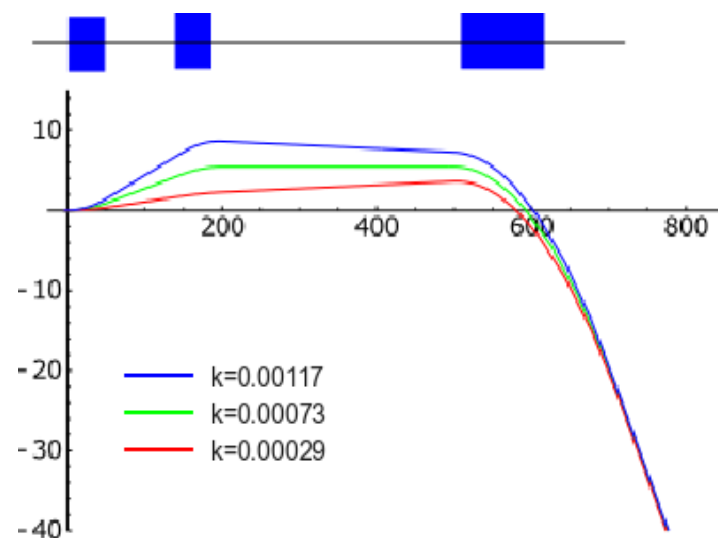
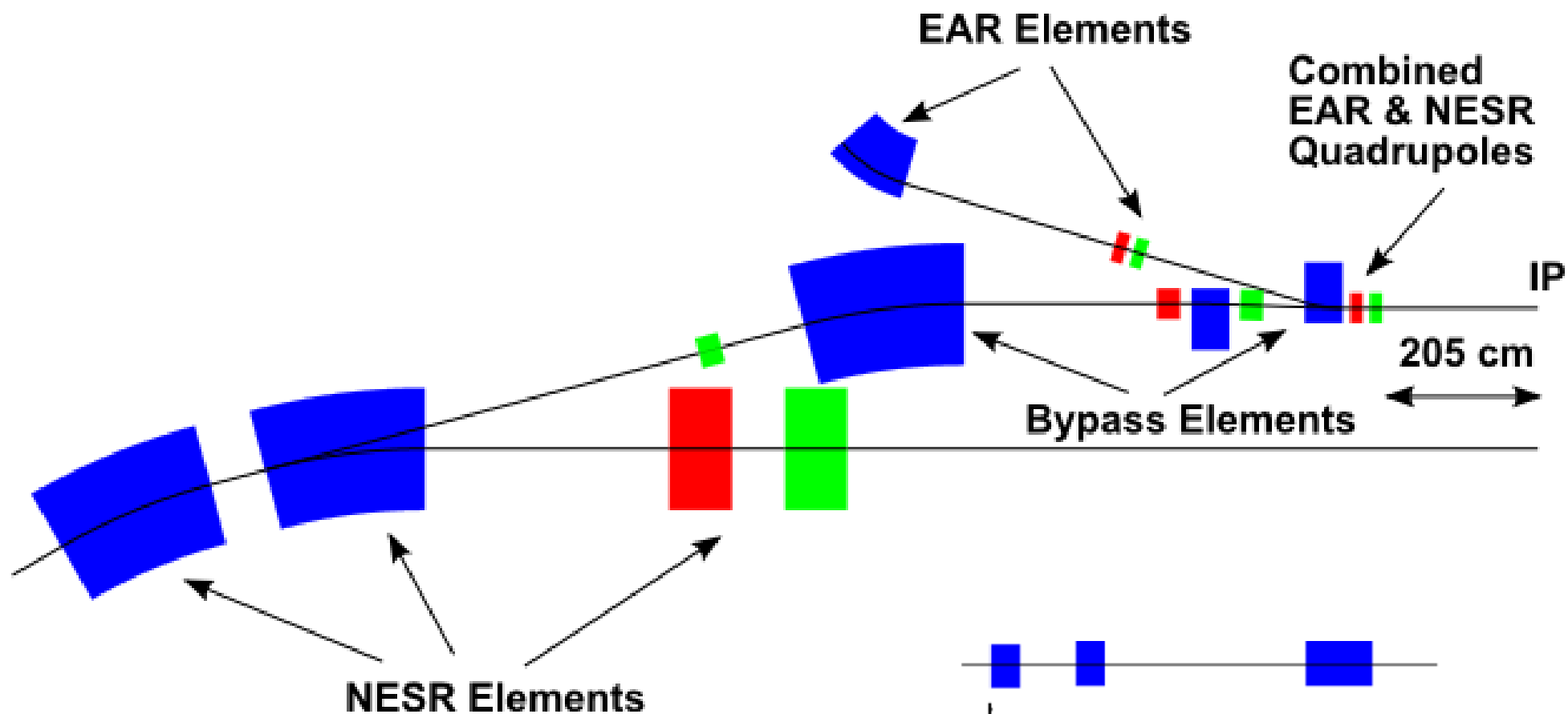
Some advantages:

- Reduced number of magnetic elements in IP
- Reduced strength of magnetic elements in IP
- Reduced complexity and price of magnetic elements in IP
- Possibility to provide set up work at EAR independently of the NESR program
- Additional space to place systems that are needed for collider mode only
- Additional space to place some of detectors.
- Possible independent experiments at EAR

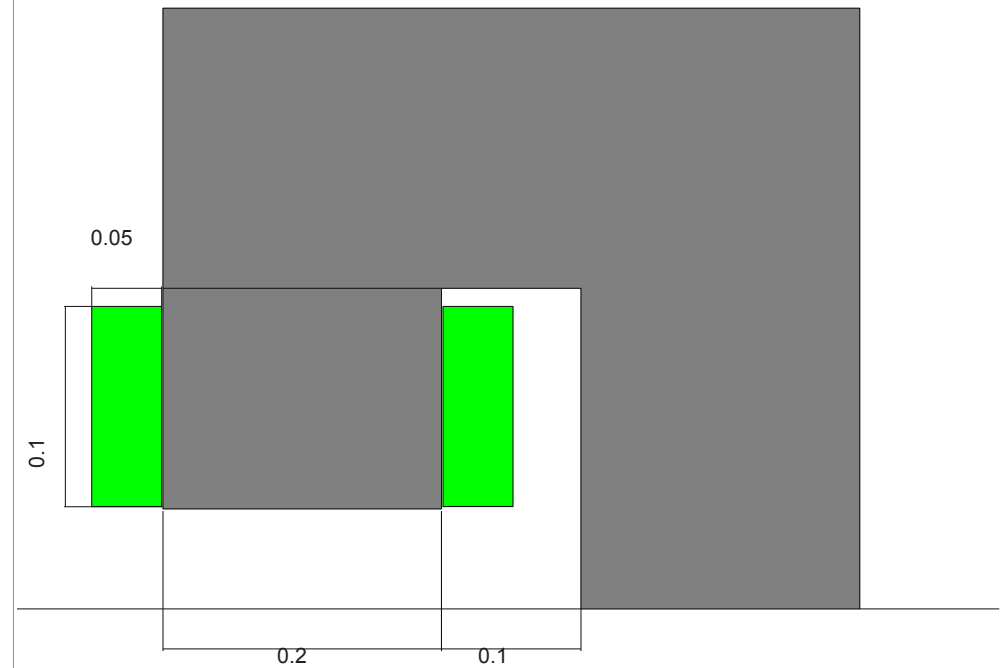
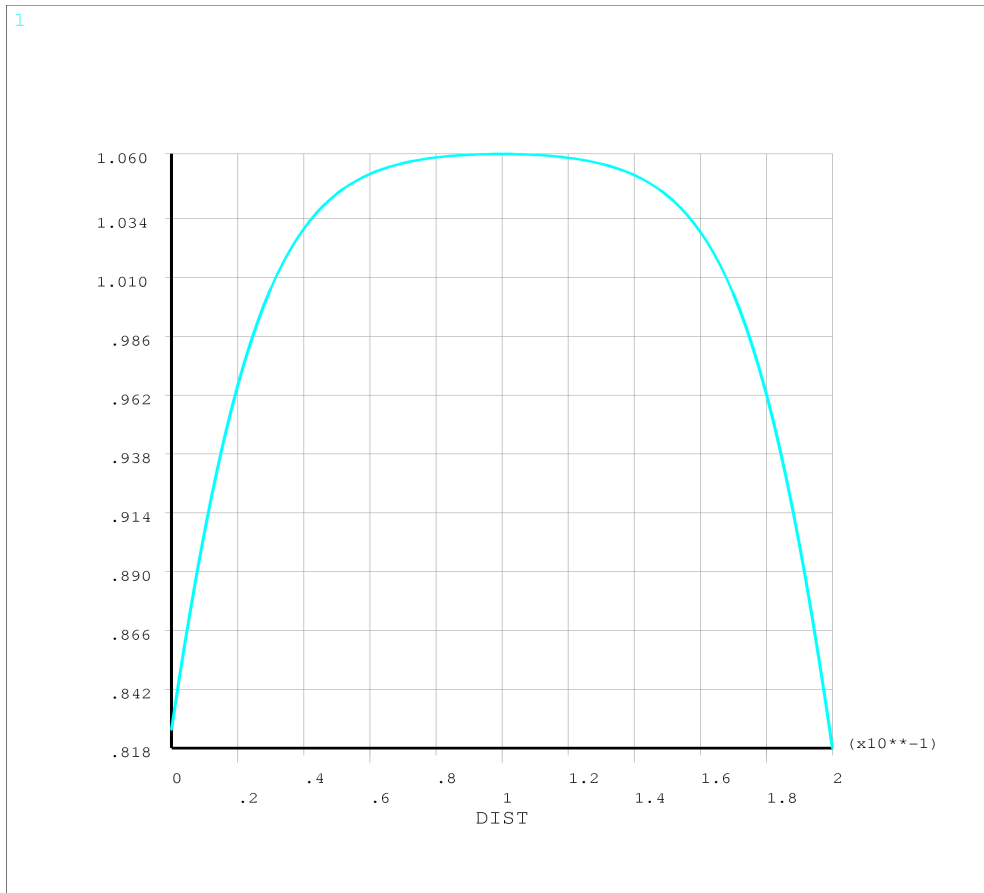
Preliminary design of electron spectrometer



IP region, 2008

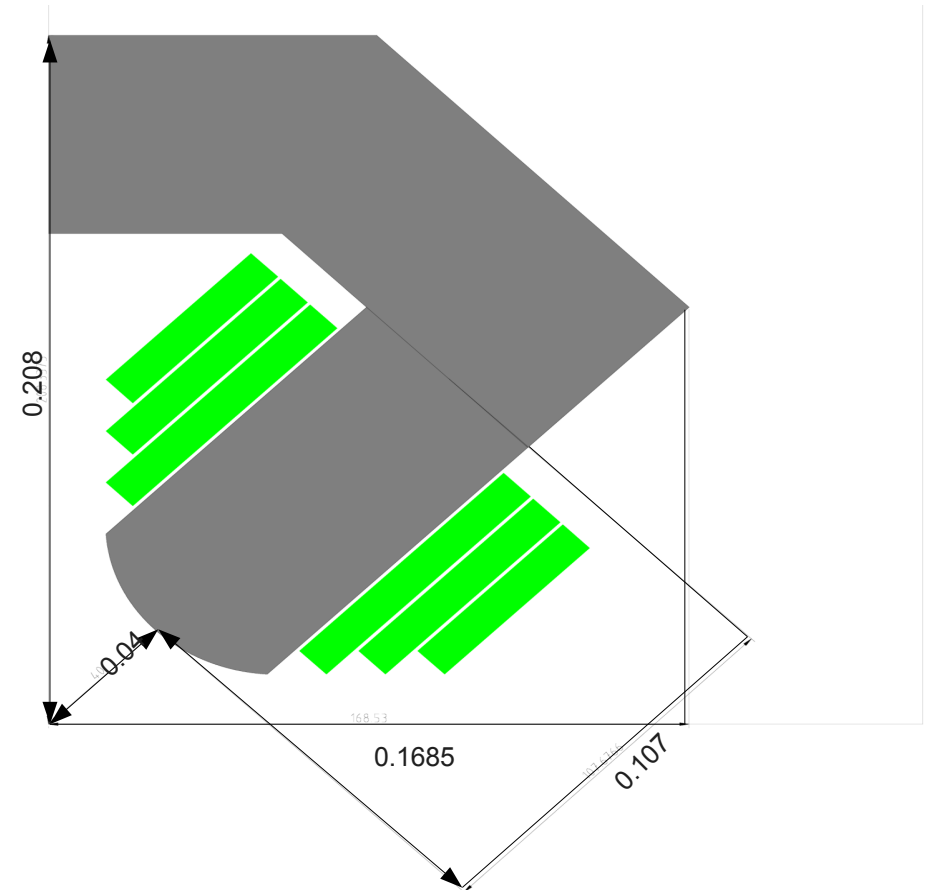
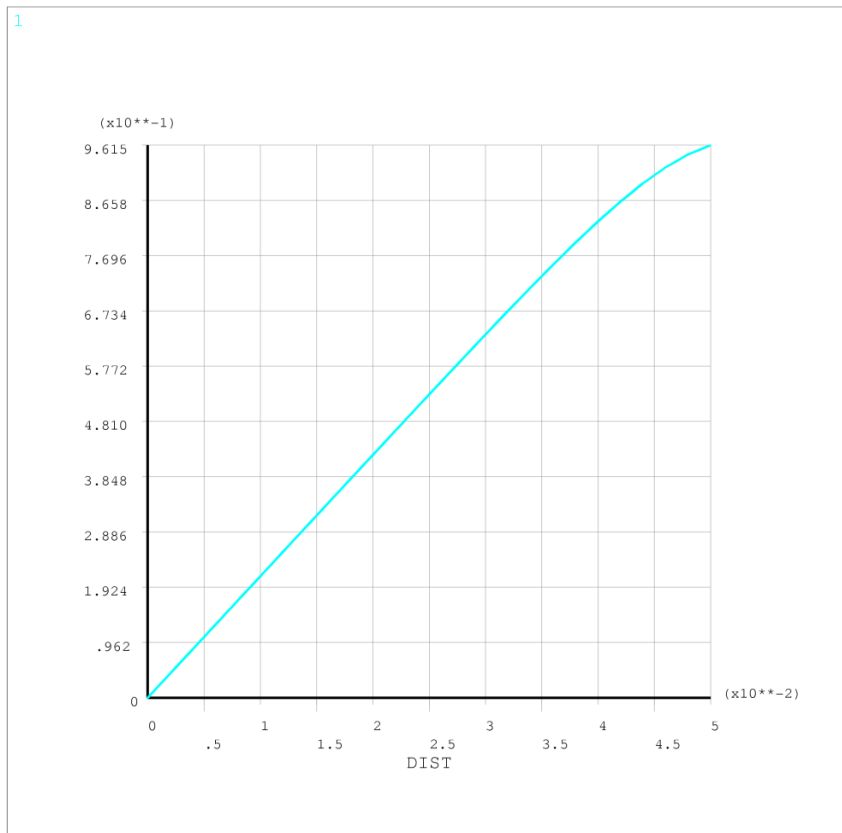


Preliminary design of magnetic elements in IP region



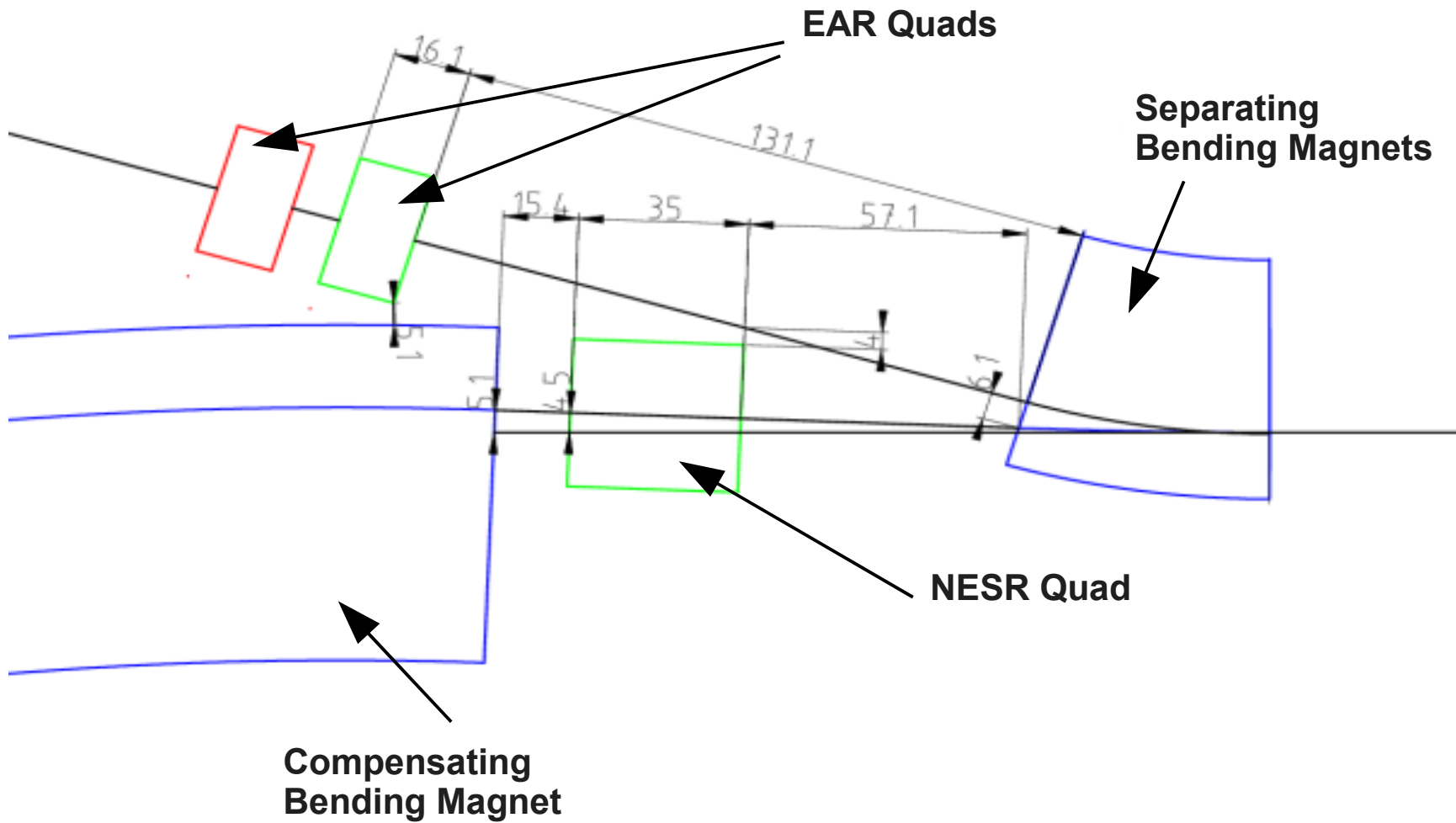
Separating magnet

Preliminary design of magnetic elements in IP region

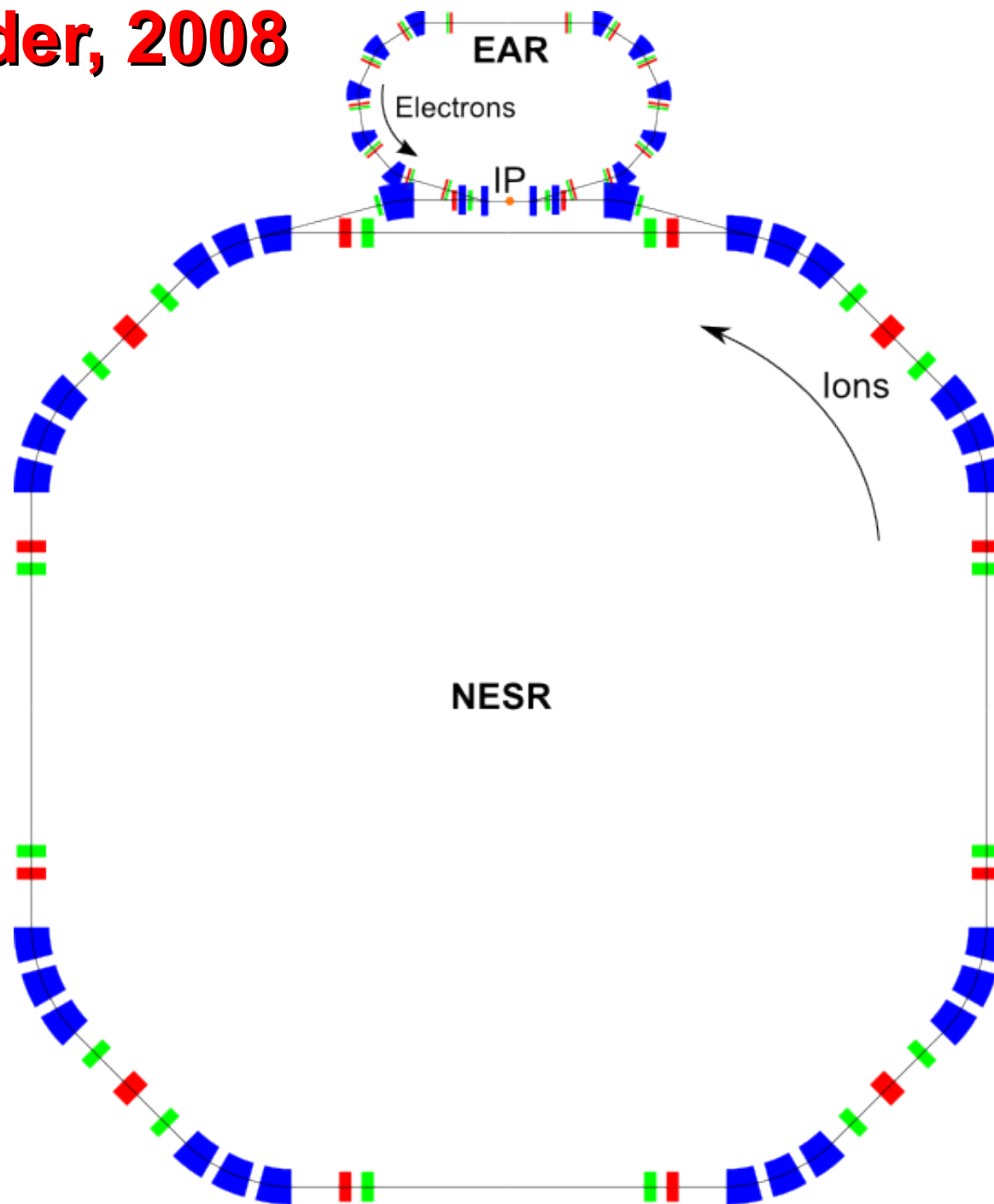


Quadrupole magnet

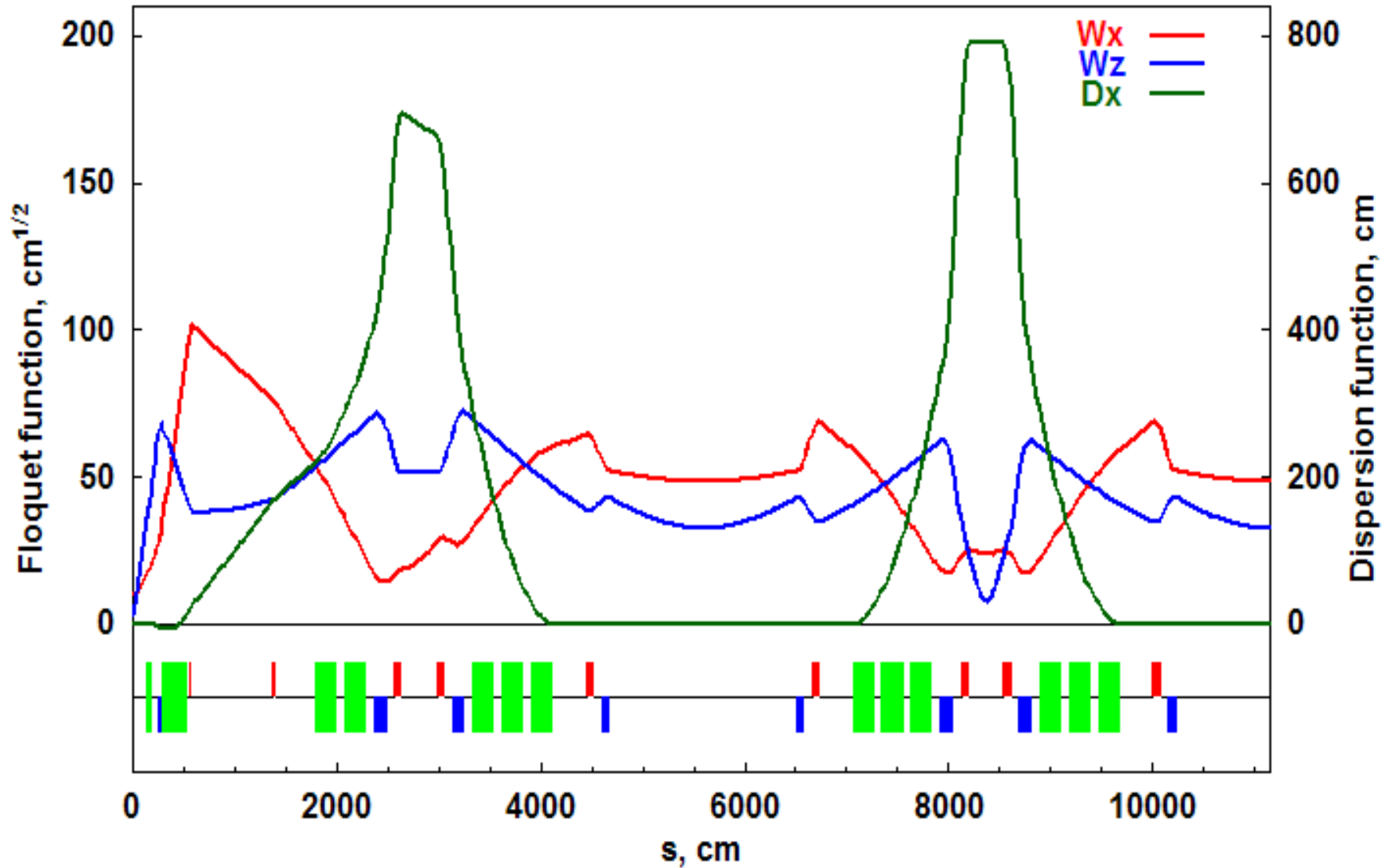
IP Region (close view)



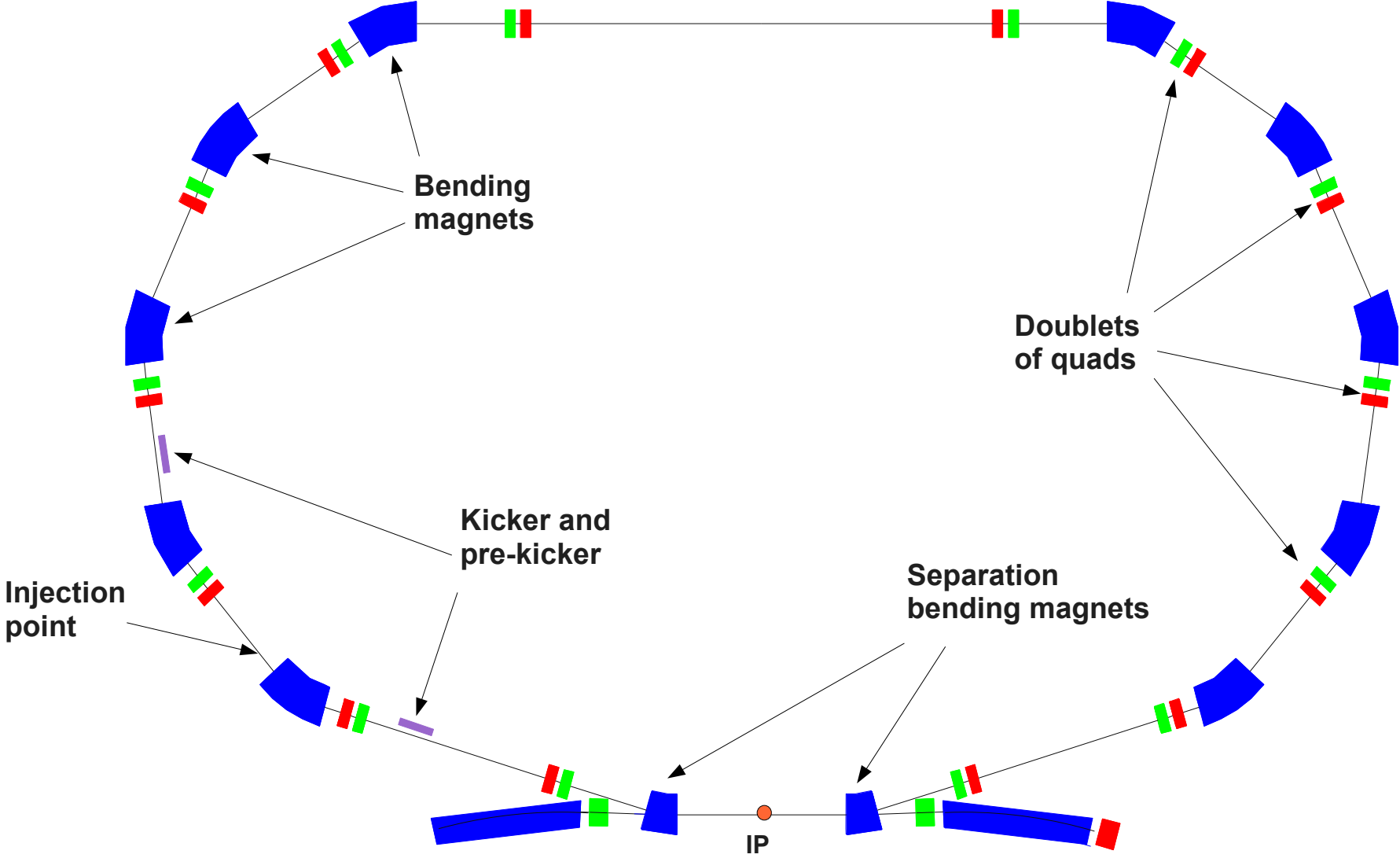
The Collider, 2008



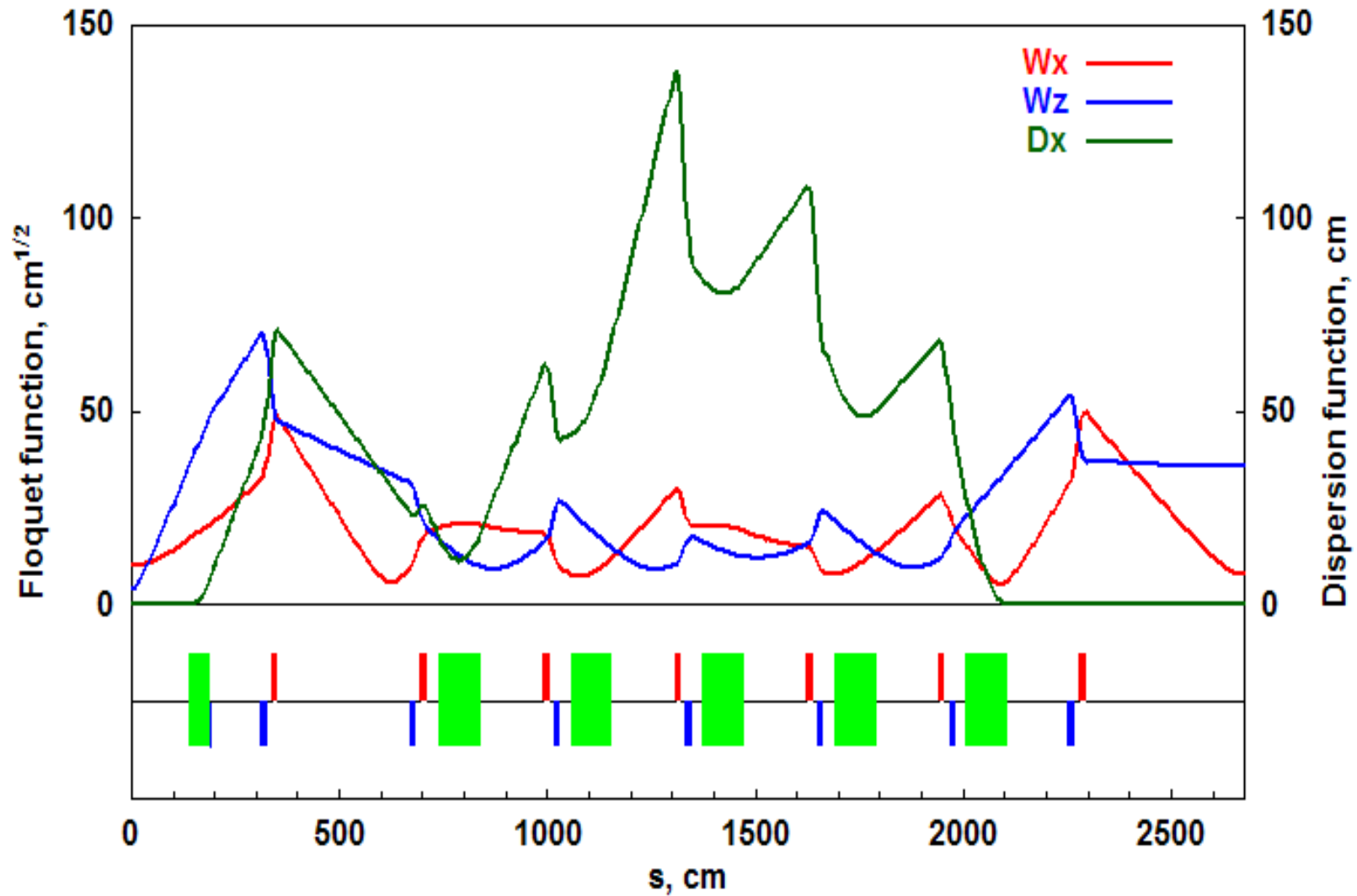
NESR Structure Functions



Electron Ring



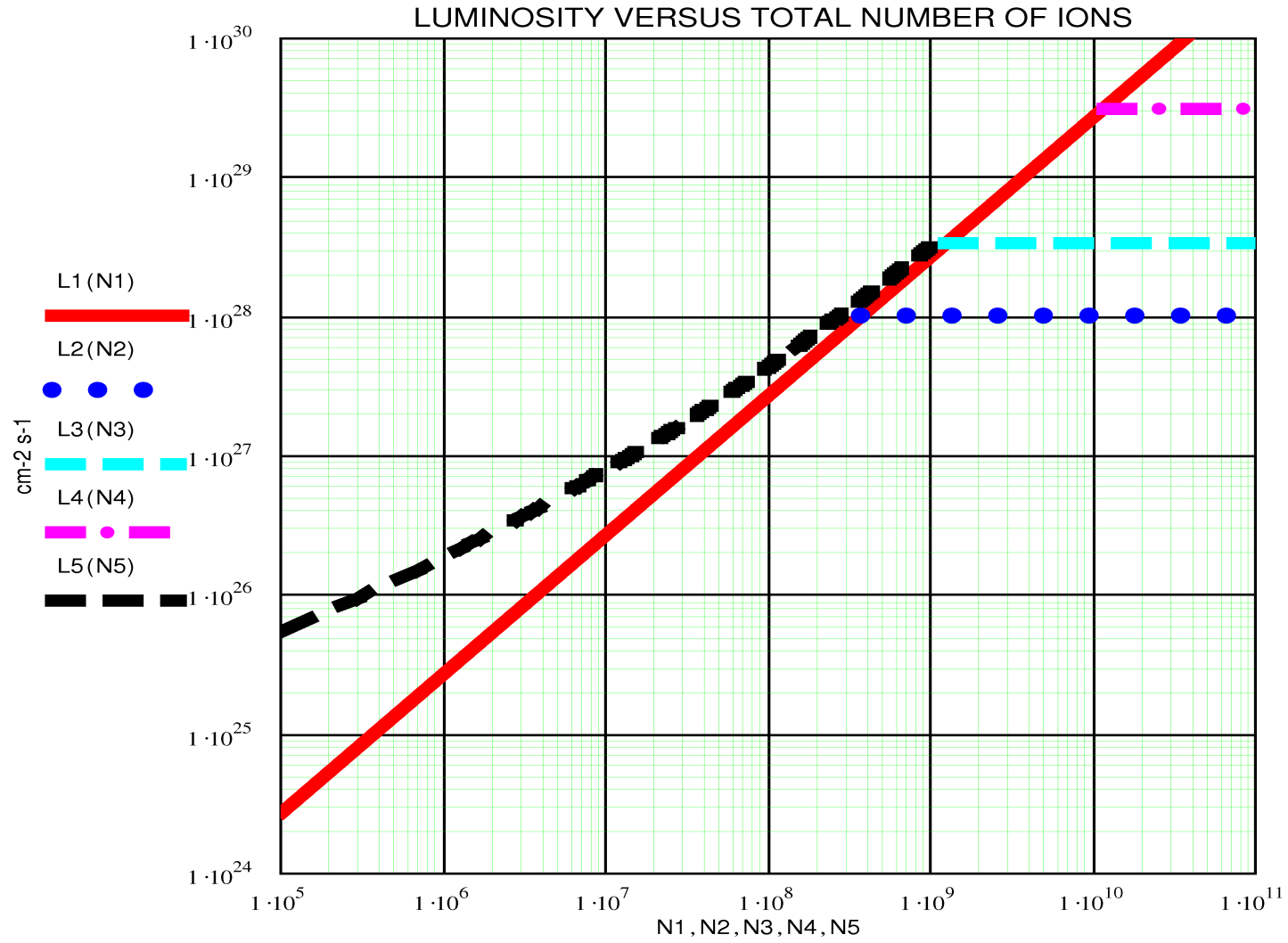
Electron Ring Structure Functions



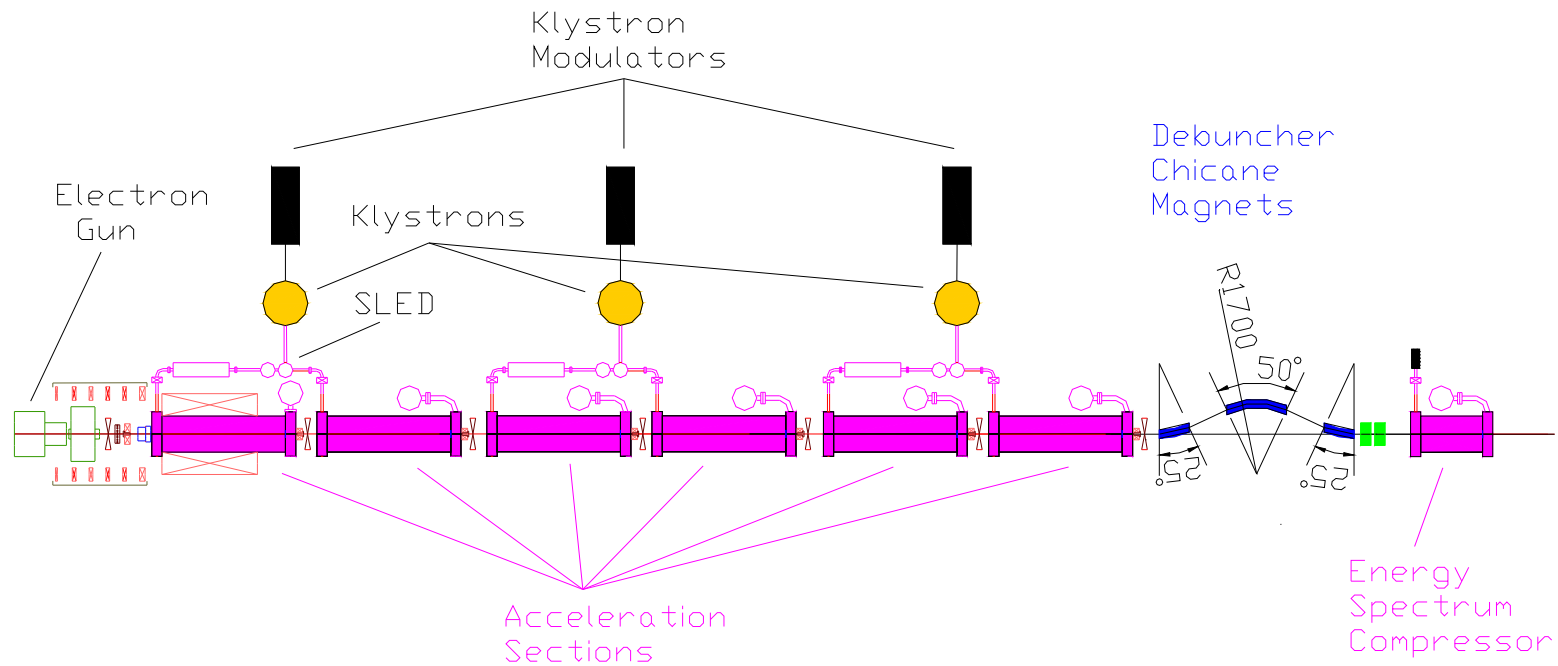
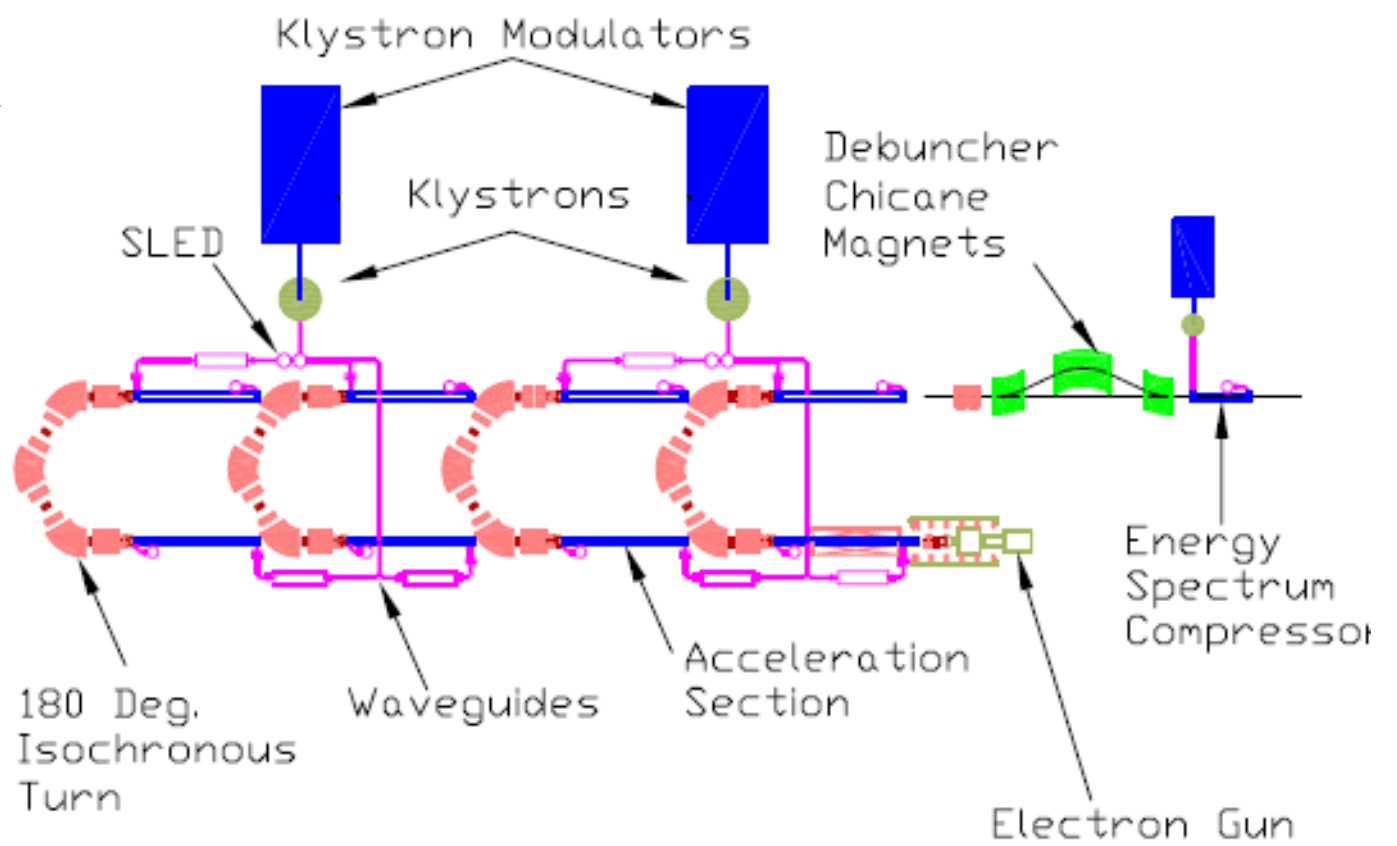
General parameters of the electron-nucleus collider

	<i>Units</i>	<i>Electron ring</i>	<i>Ion ring</i>
Circumference	<i>m</i>	53.693	222.916
Energy	<i>GeV, GeV/u</i>	0.500	0.740
Revolution frequency	<i>MHz</i>	5.583	1.117
Betatron tunes, ν_x, ν_z		4.2, 3.2	3.55, 2.55
Compaction factor, α		0.049	0.036
Bending Radius	<i>m</i>	1.75	8.125
Number of bunches		8	44
Bunch to bunch spacing		6.7	5.58
Bunch population		$5 \cdot 10^{10}$	$0.86 \cdot 10^7$
Beam currents	<i>mA</i>	358	5.65
Damping time, τ	<i>ms</i>	73	20
Beam emittances, $\epsilon_{x,z}$	<i>$\mu\text{m} \cdot \text{mrad}$</i>	47.6	50
Beta functions at IP, $\beta_{x,z}$	<i>cm</i>	100, 15	100, 15
Beam size at IP, $\sigma_{x,z}$	<i>μm</i>	210, 85	220, 87
Momentum spread, $\sigma_{\Delta p/p}$		0.00036	0.0004
Bunch length, σ_s	<i>cm</i>	4	15
Beam-beam parameters, $\xi_{x,z}$		0.005, 0.002	0.044, 0.017
Laslett tune shift, Δu			0.08
Luminosity	<i>$\text{cm}^{-2} \text{s}^{-1}$</i>	$1 \cdot 10^{28}$	

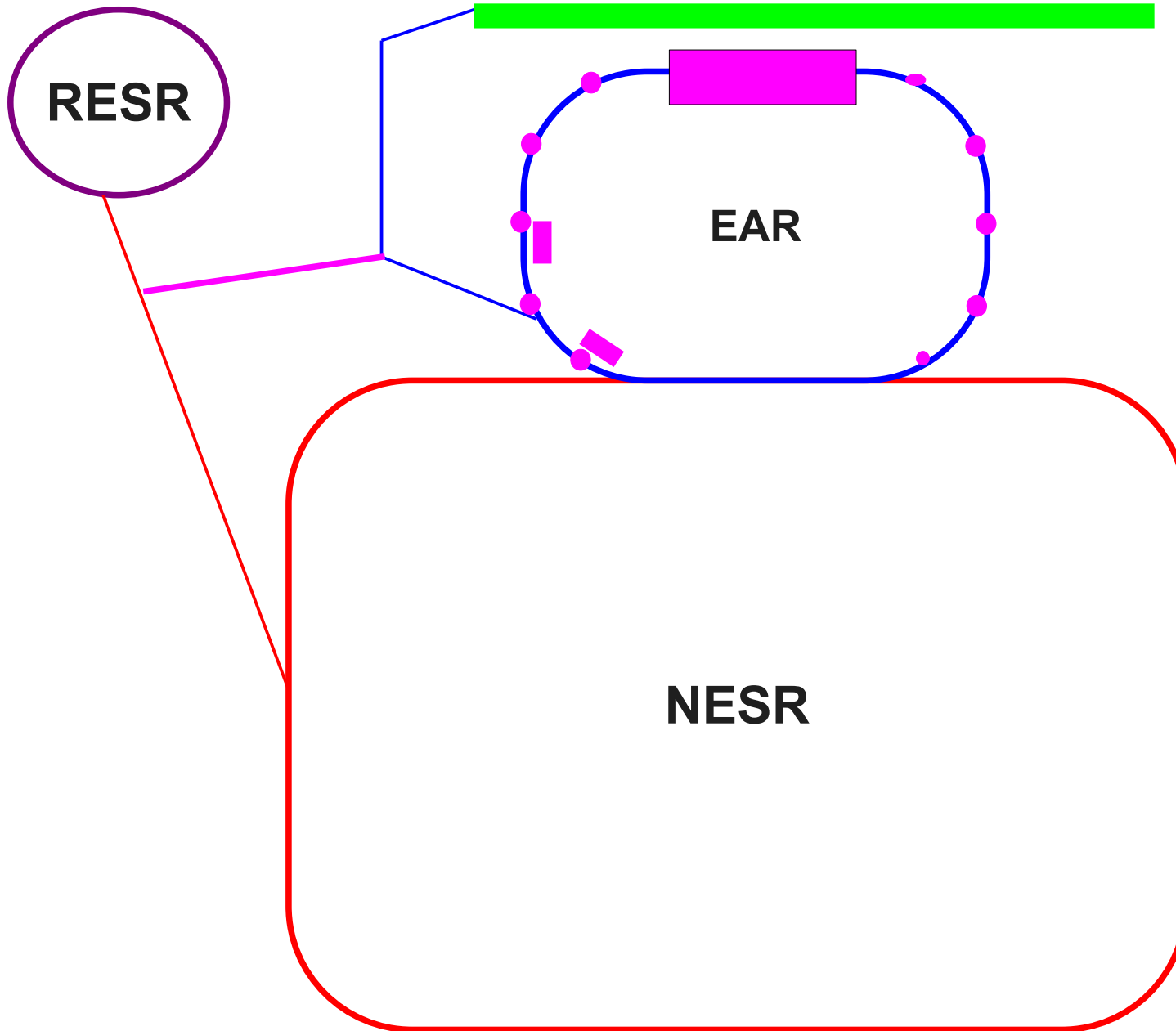
Luminosity



Electron Linac



Some words about AIC



e-Linac

- Additional beamline
- Electron cooling
- Modified injection
- Modified beam observation system
- Additional Vacuum Requirements
- Other Questions: beam lifetime, deceleration process and so on...

Research Plans for 2009

- Finalization of the Interaction region and rings optics in collider mode.
- Computation and optimization of dynamic aperture in NESR in collider mode
- Magnetic design of dipoles and quads in EAR and the interaction region.

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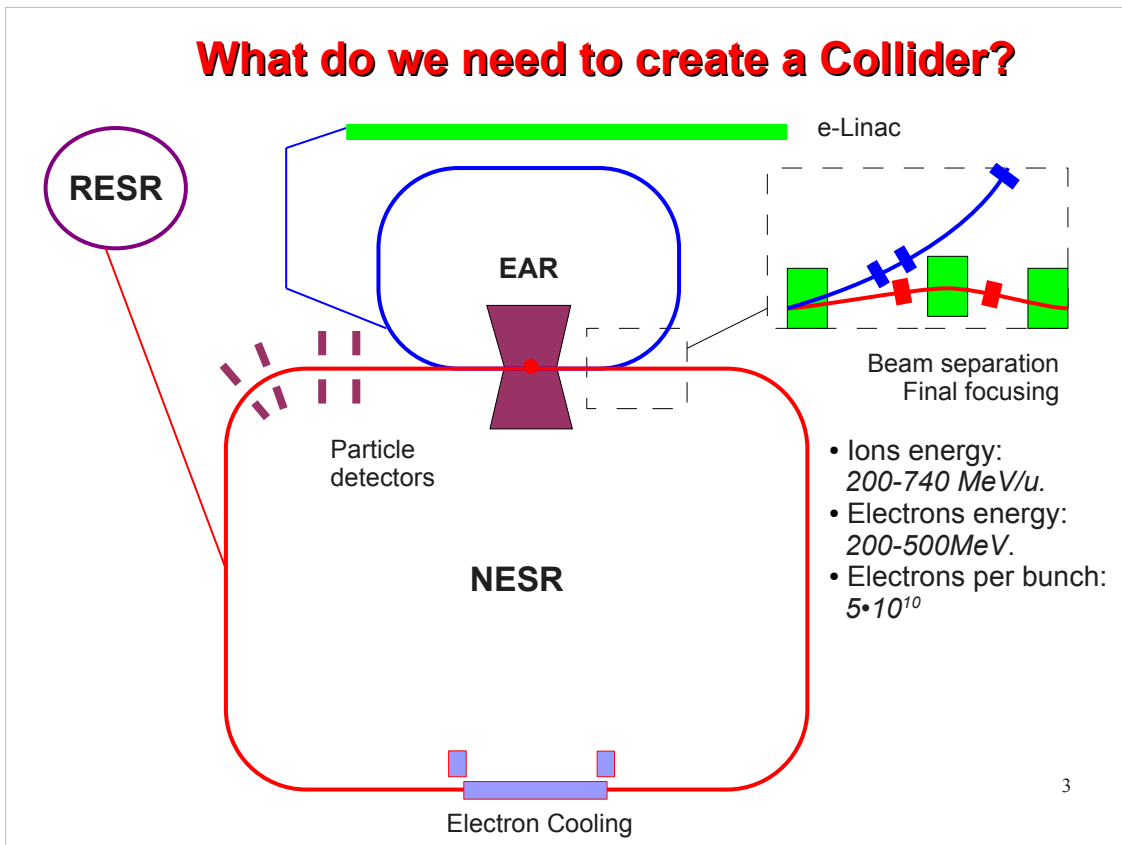
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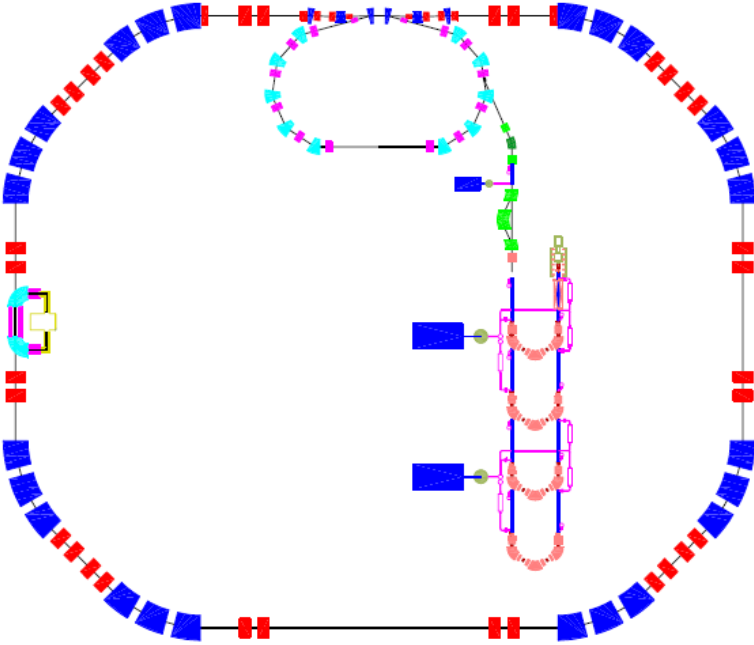
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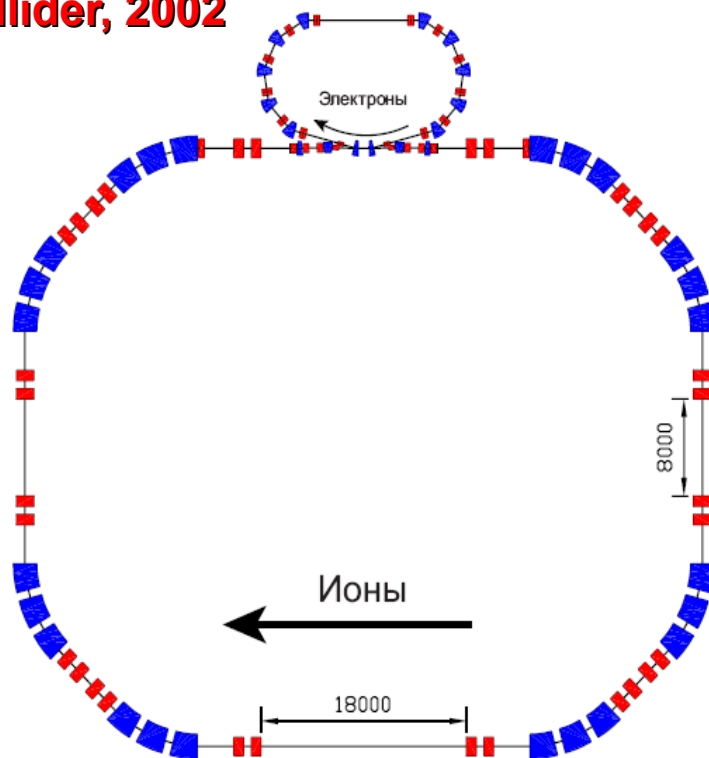
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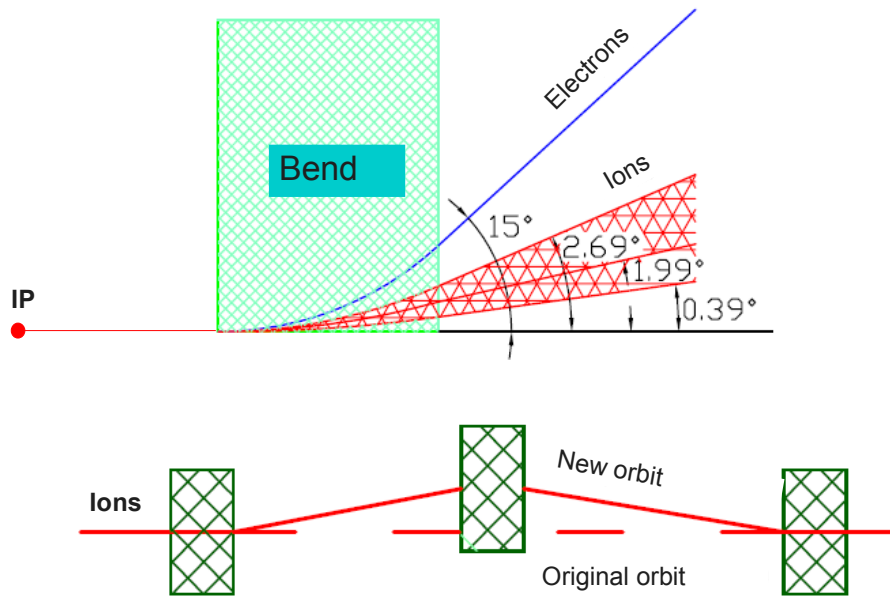
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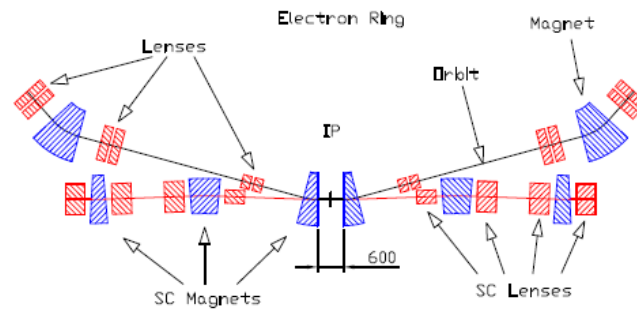
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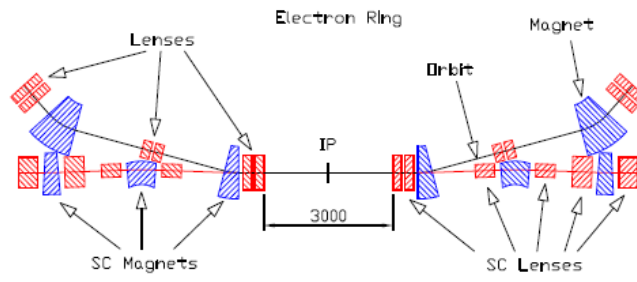
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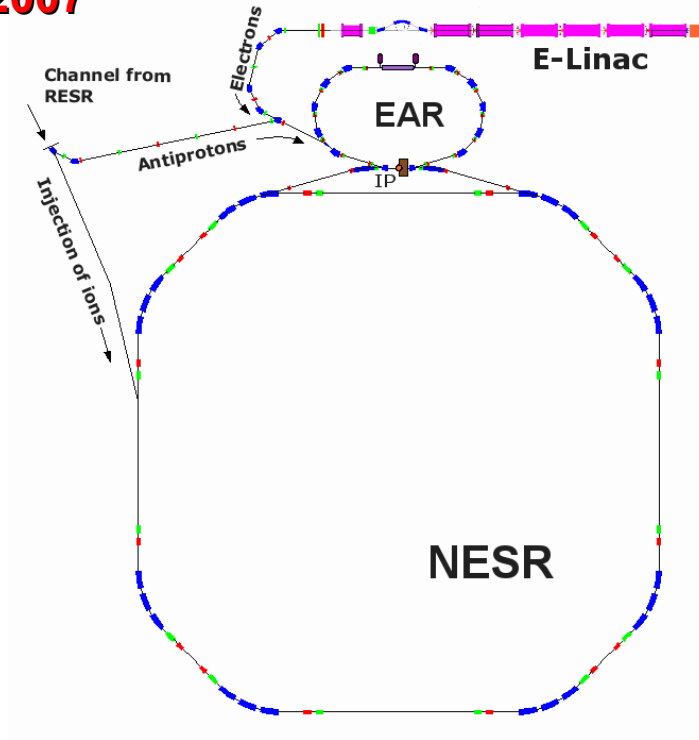
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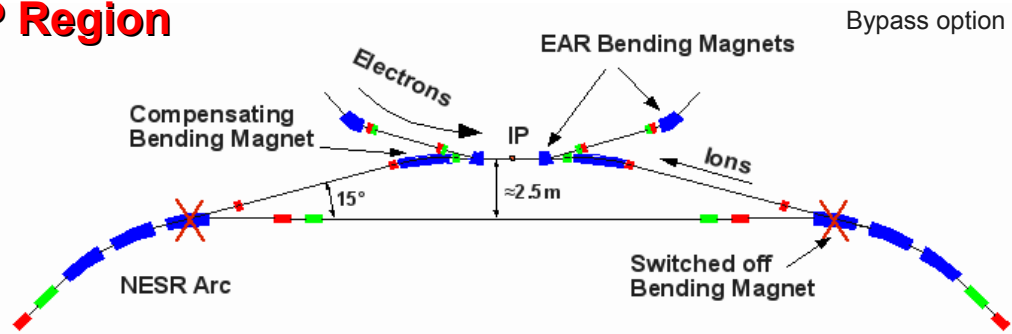
Basic options



2006-2007



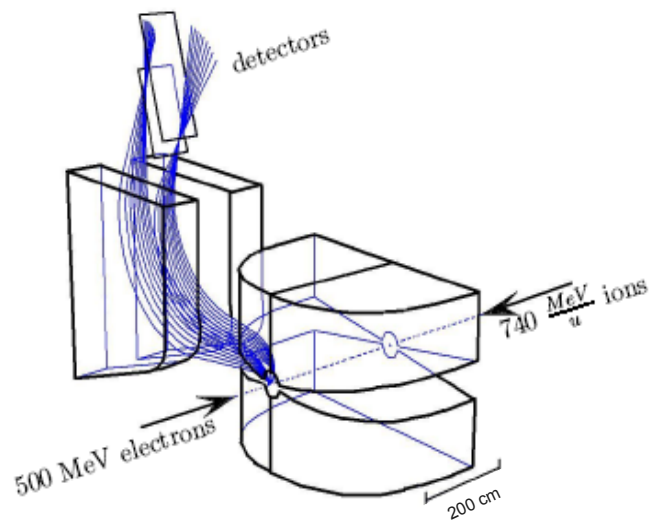
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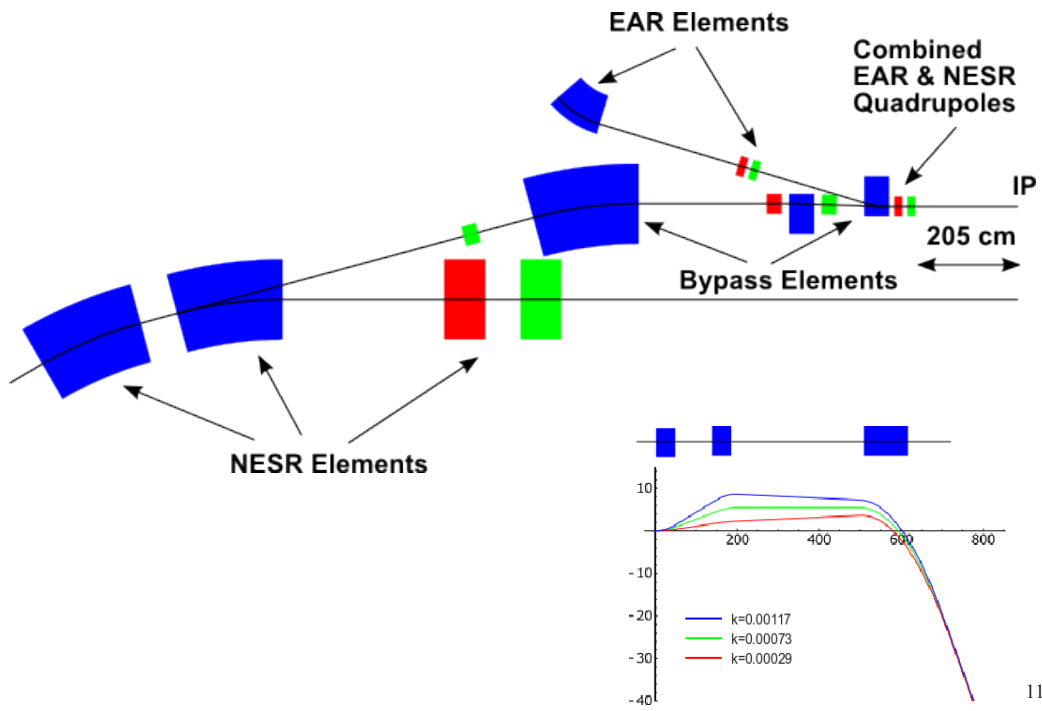
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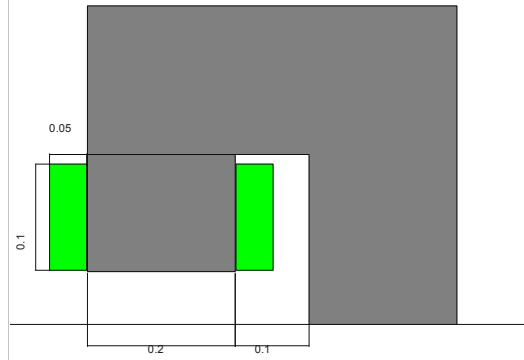
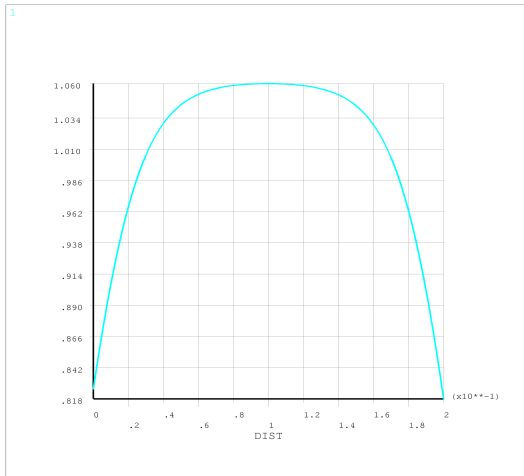
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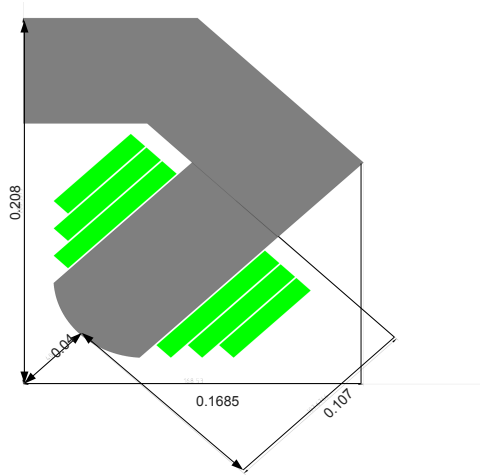
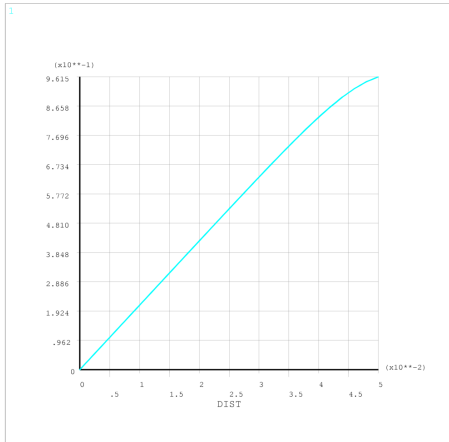


Preliminary design of magnetic elements in IP region



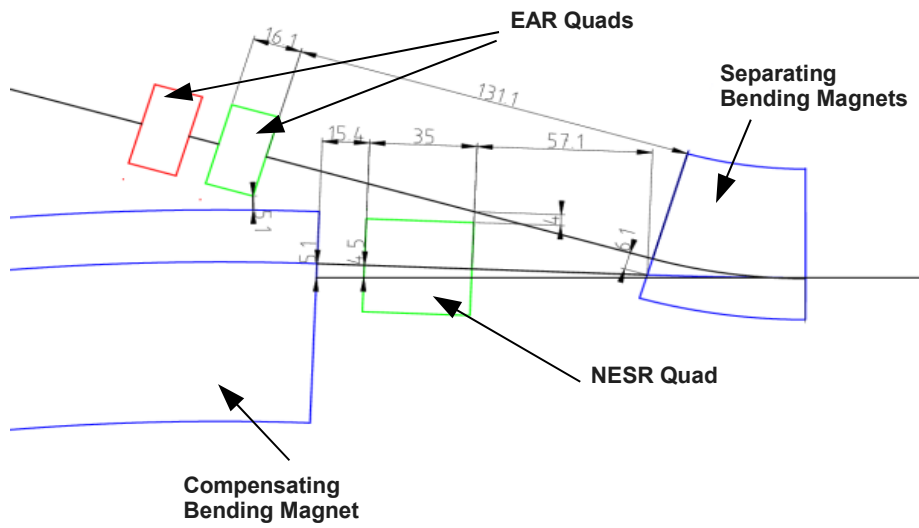
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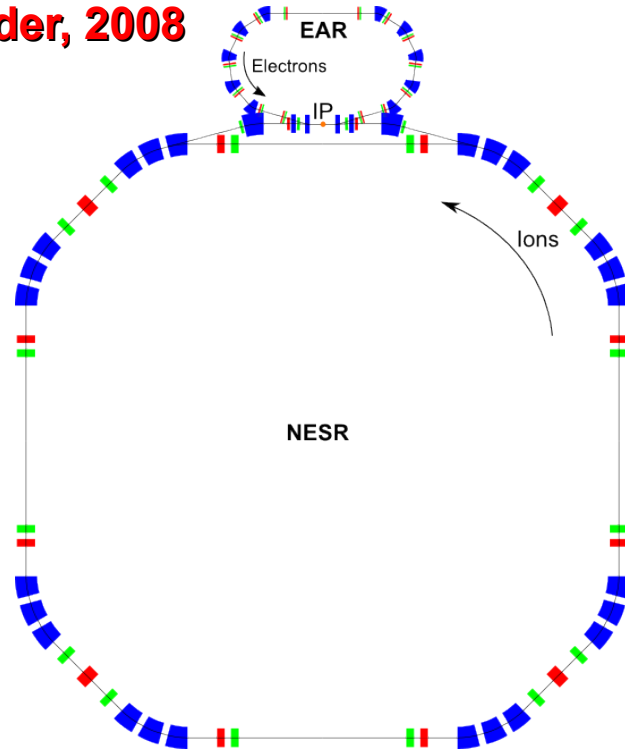


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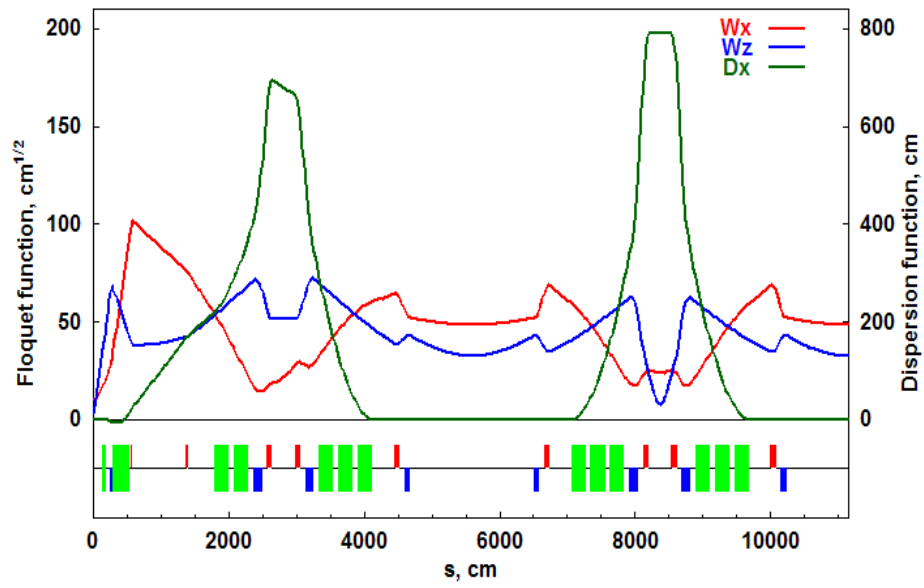
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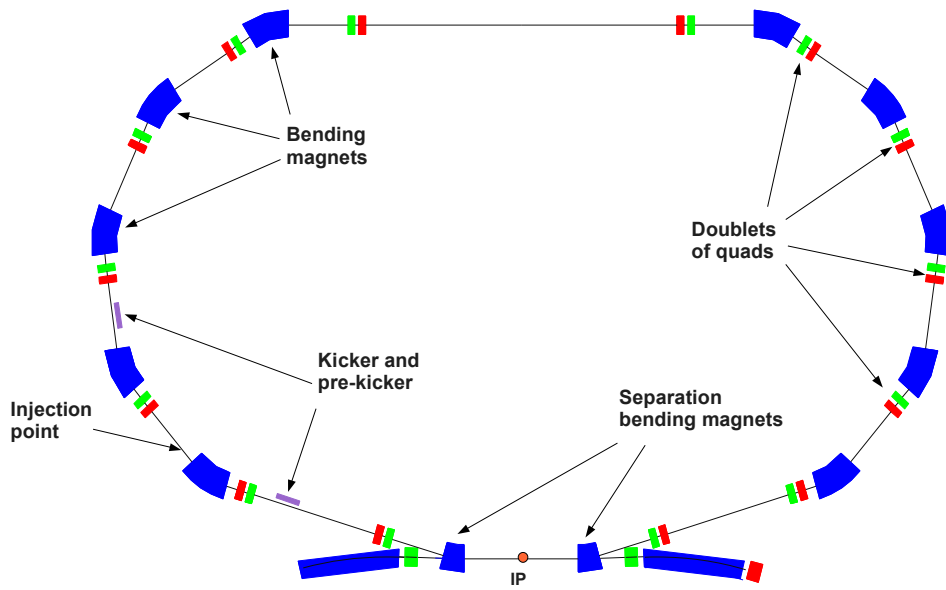
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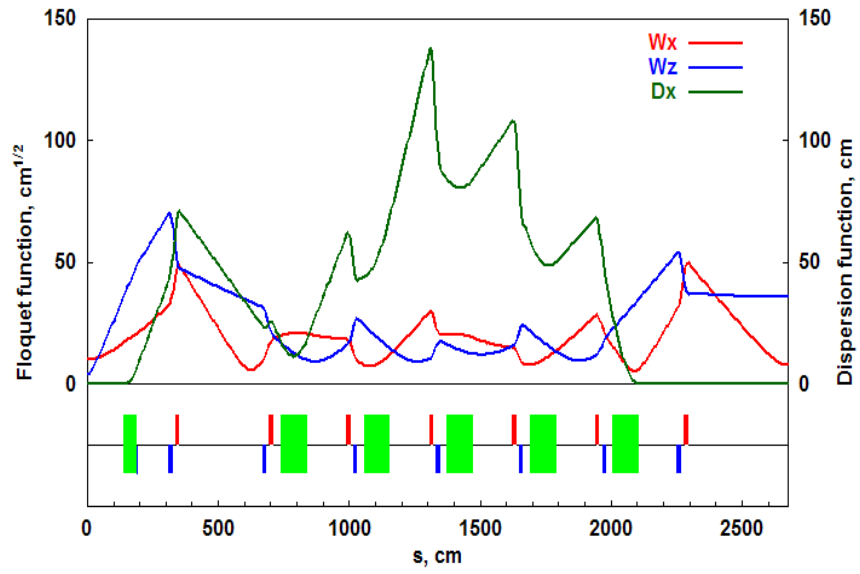
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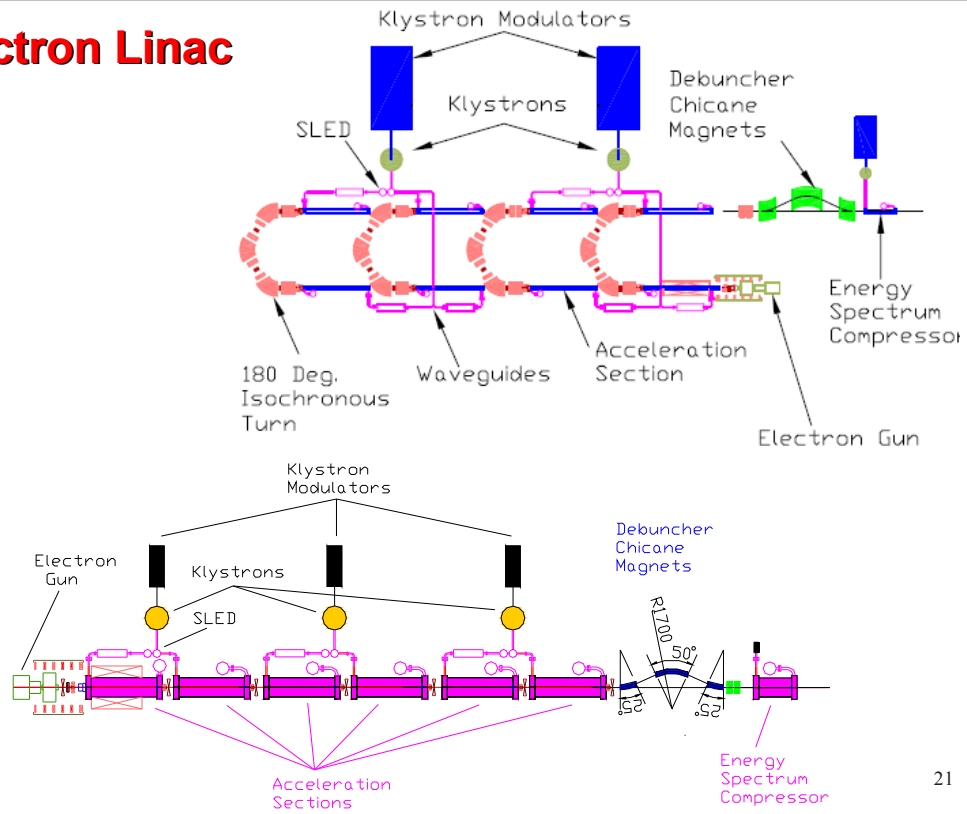
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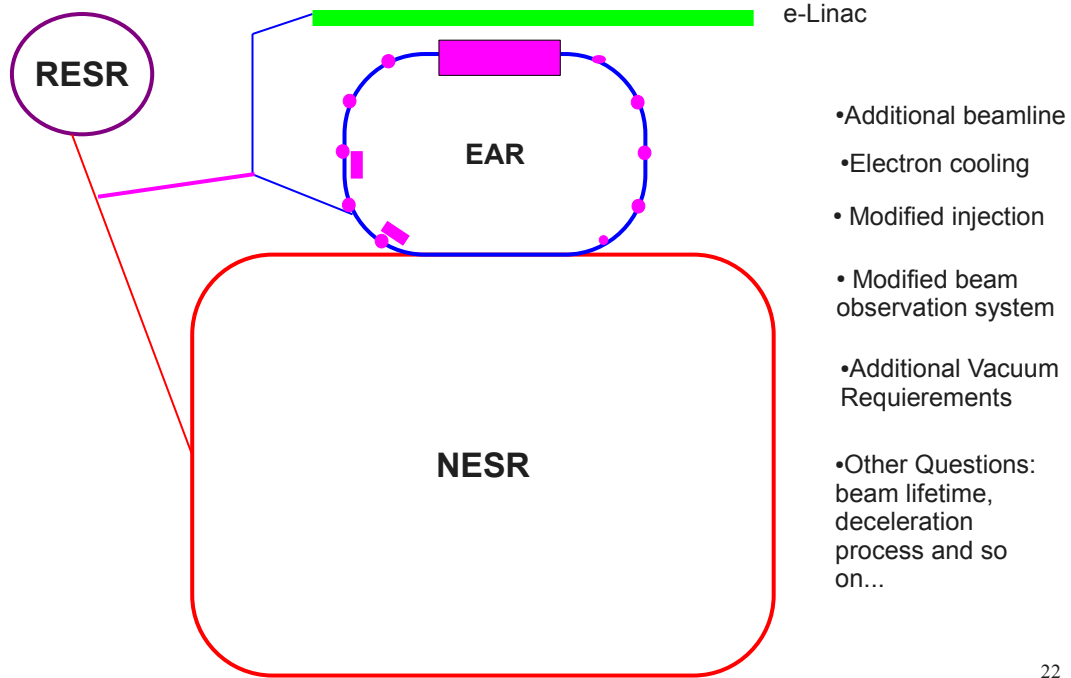
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