NICA Collider Magnetic Field Correction System

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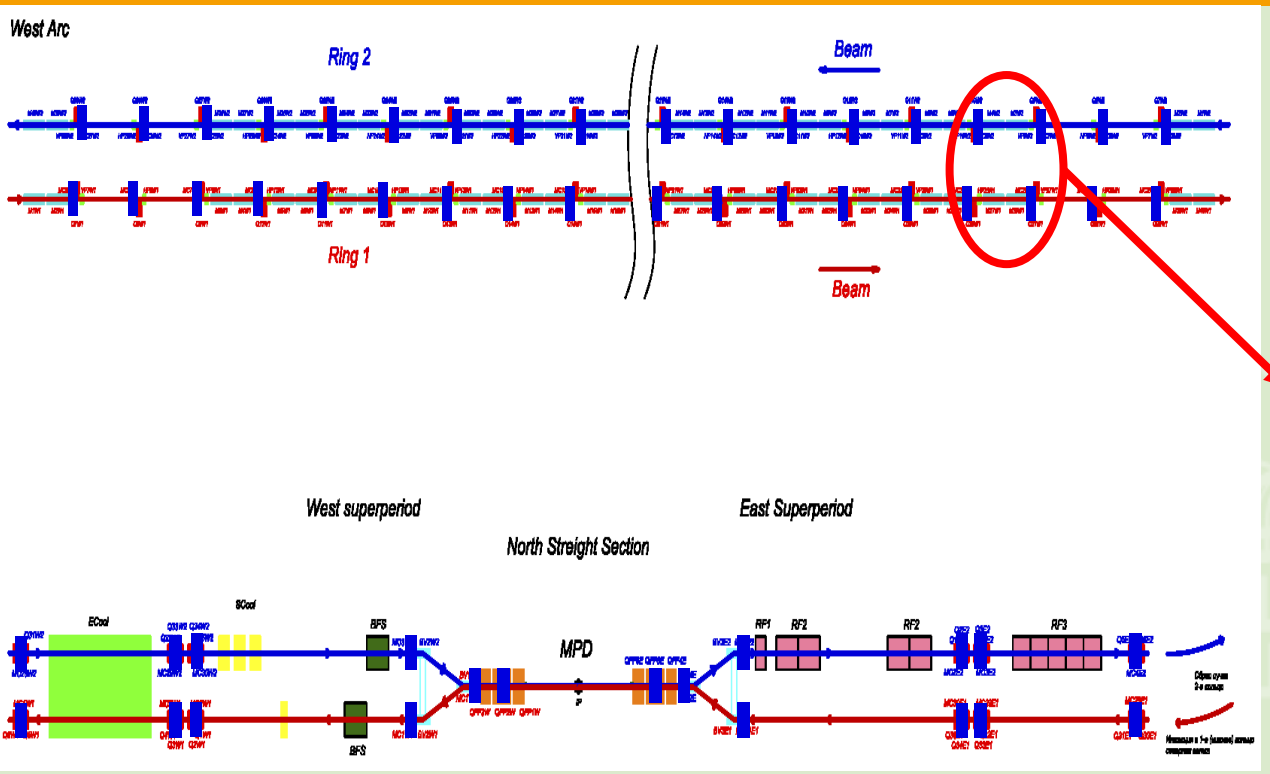
Introduction

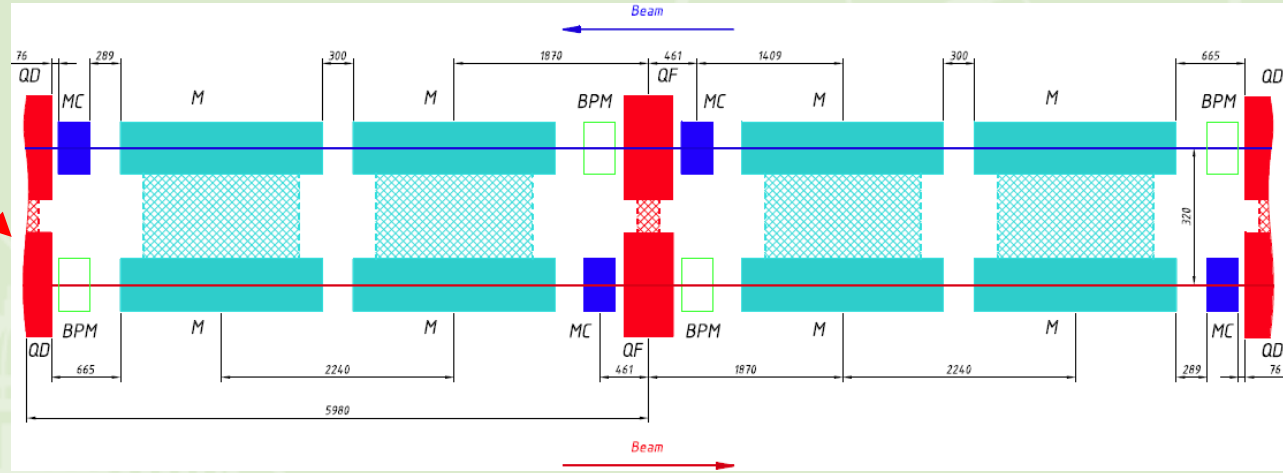
Outlines

- Magnetic Field Correction System
- Main Goals
- DA Calculation
- Magnets Design
- Magnetic Measurements
- Future Plans

Correctors in the Collider Lattice



FODO-Cell



- 92 correctors in arcs (46 per each beam)
- 32 correctors in straight section (16 per each beam)
- 4 correctors in straight section (combined for 2 beams)
- 4 dodecapole correctors in central QFF
- Total: 132 correctors

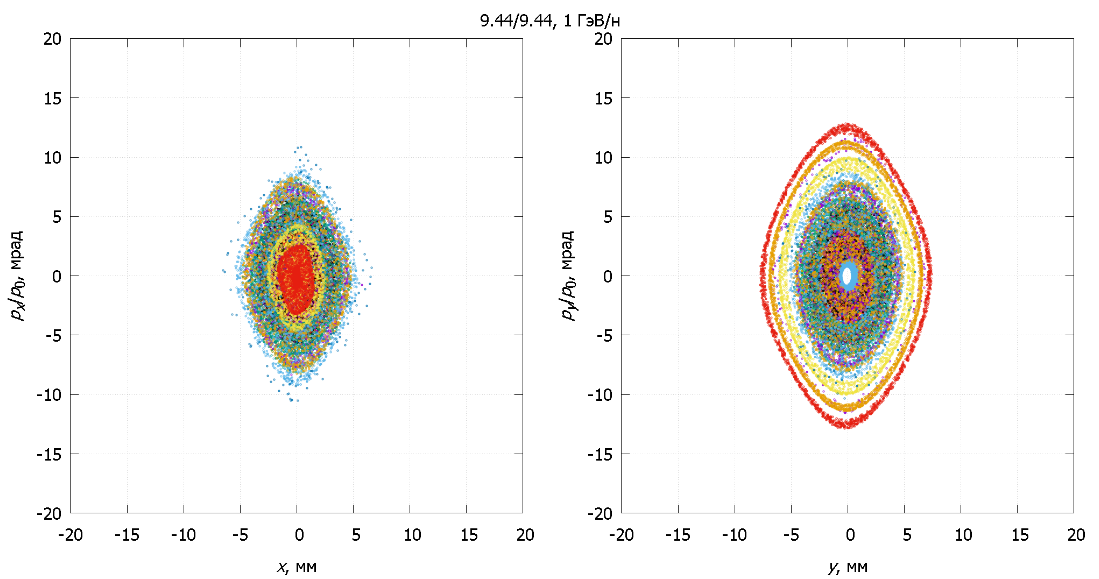
Goals of the Correction System

Field Type	Correction goal	Field Strength	Ampere-turns
"Normal" dipole (b_0)	Horizontal orbit	0.15 T	11500
"Skew" dipole (a_0)	Vertical orbit	0.15 T	11500
"Normal" quadrupole (b_1)	Betatron tune	3 T/m	12500
"Skew" quadrupole (a_1)	Betatron tune coupling	3 T/m	12500
"Normal" sextupole (b_2)	Ring chromaticity	175 T/m^2	8260*
"Normal" octupole (b_3)	Fringe field influence	1300 T/m^3	4890
"Normal" dodecapole (b_5)	Fringe field influence	125000 T/m^5	1000

* – Average value for 3 layers

$$B_n = \frac{1}{n!}\frac{\partial B_y^n}{\partial x^n}, n = 0,1, \ldots$$

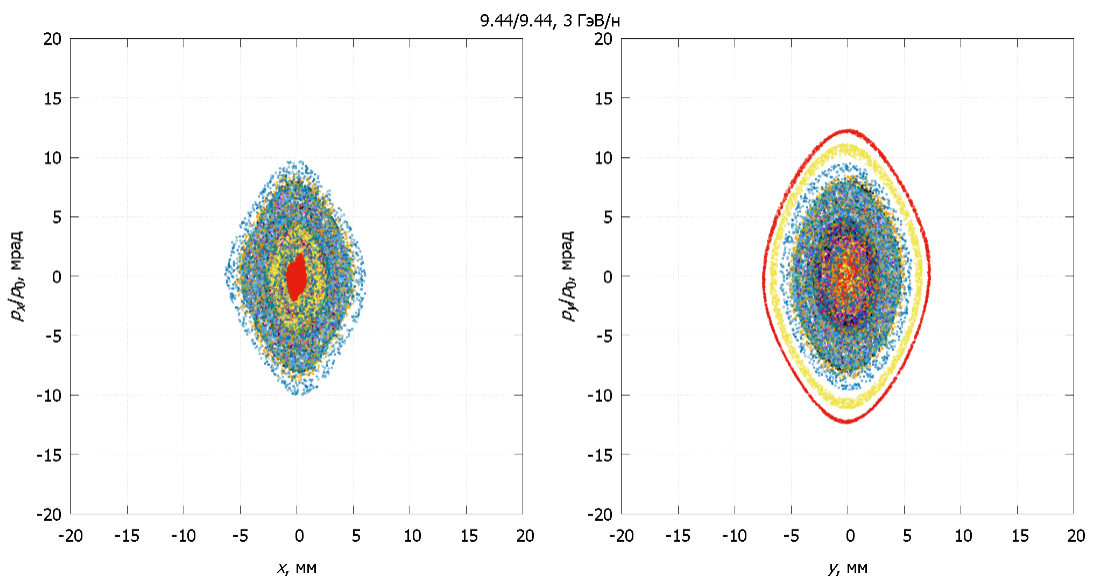
DA Calculation

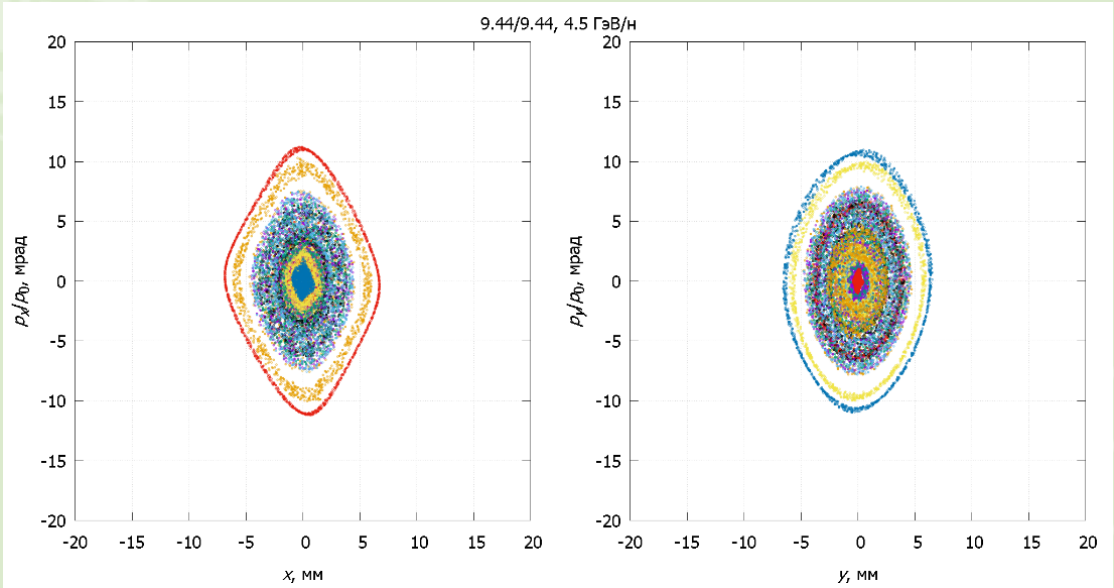


Optimization of the NICA collider optics structure

A. V. Philippov et. al., 2019

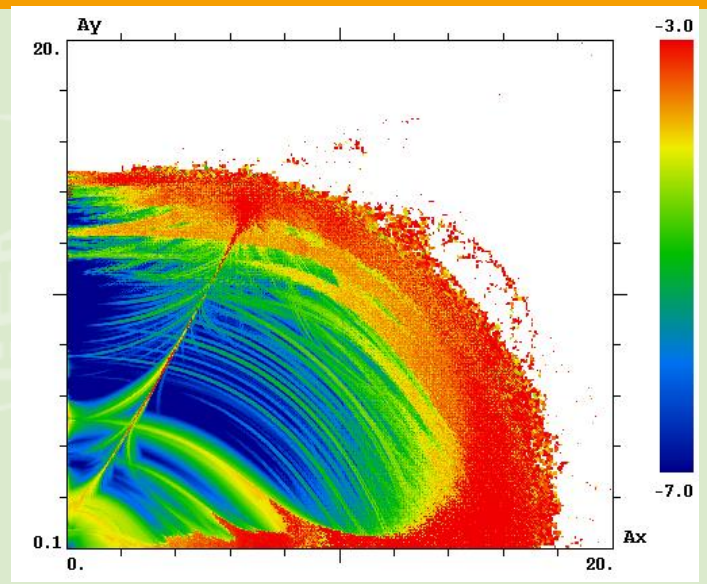
DA ≈ 8 ÷ 9 σ (MAD – X)

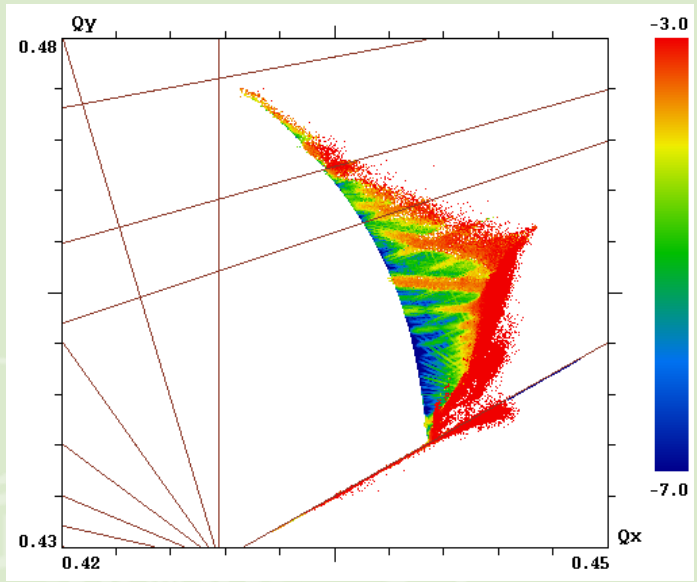




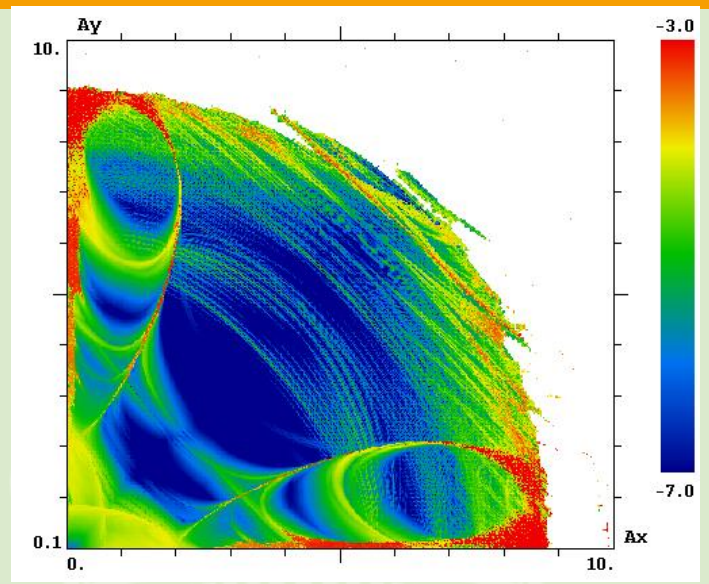
DA Correction. Example

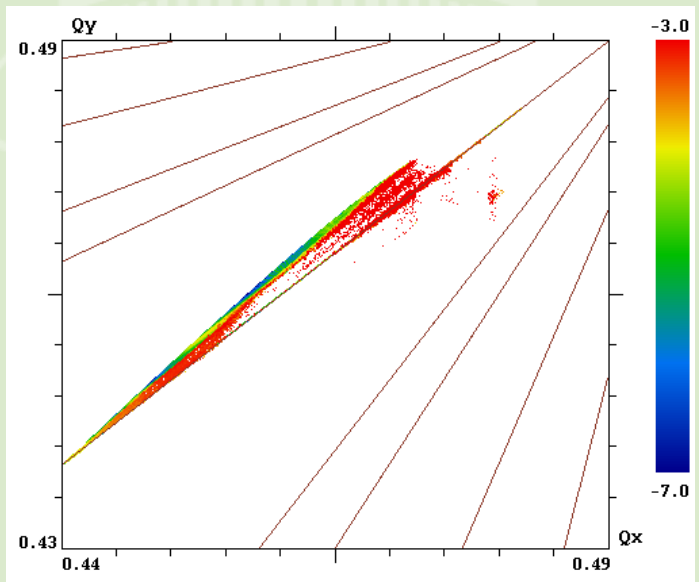
Coupling + Chromaticity Correction



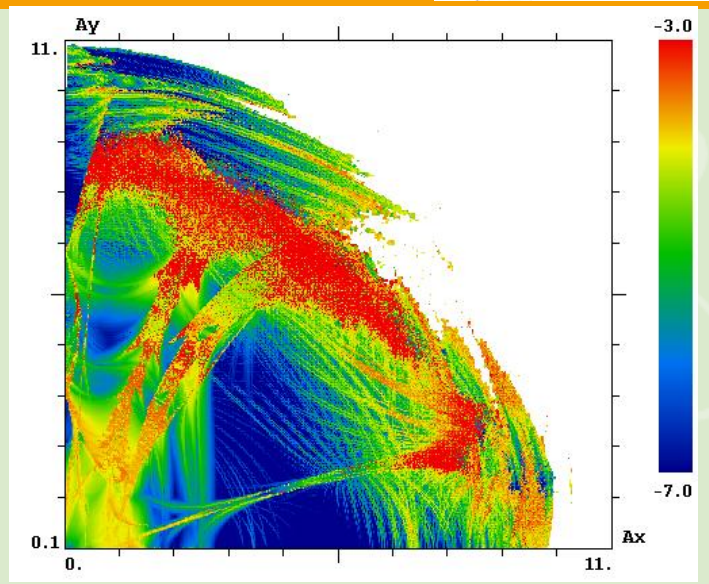


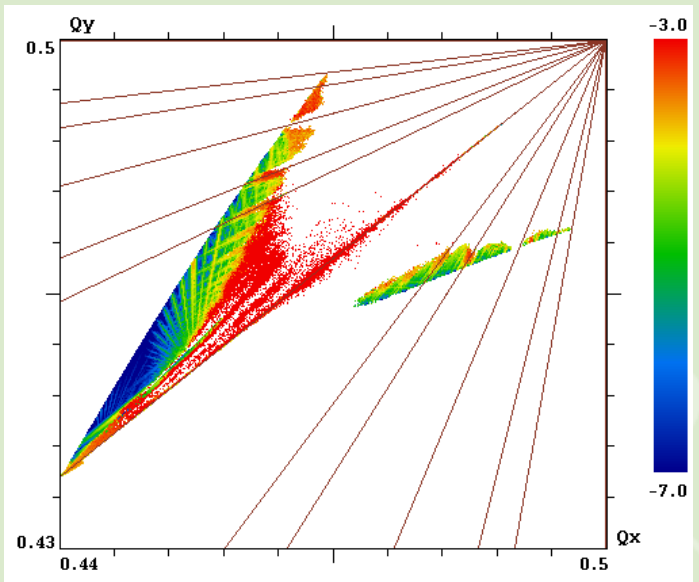
Qedge On





DA Correction (b_3)



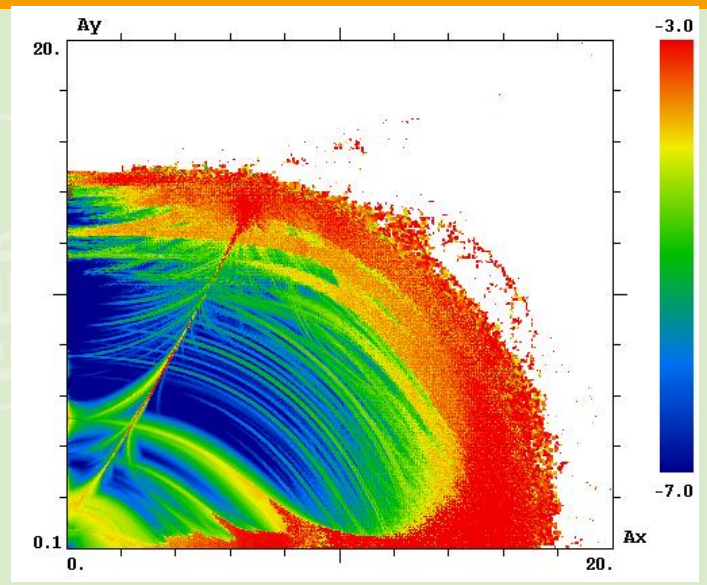


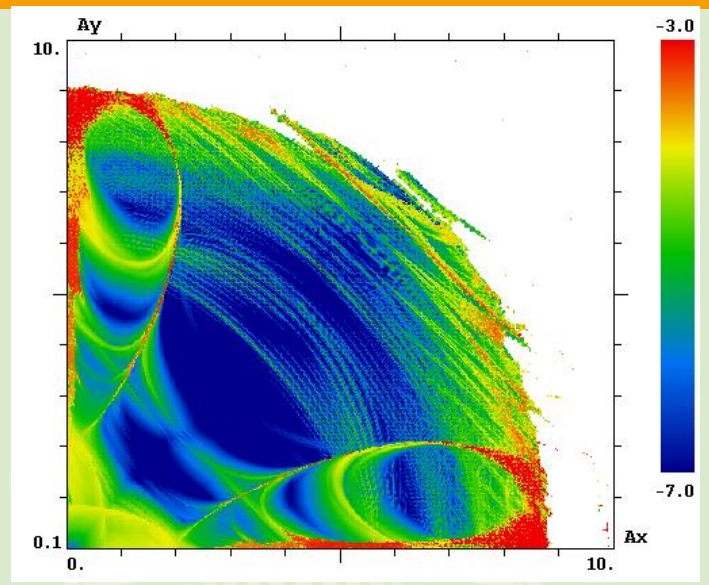
DA Correction. Example

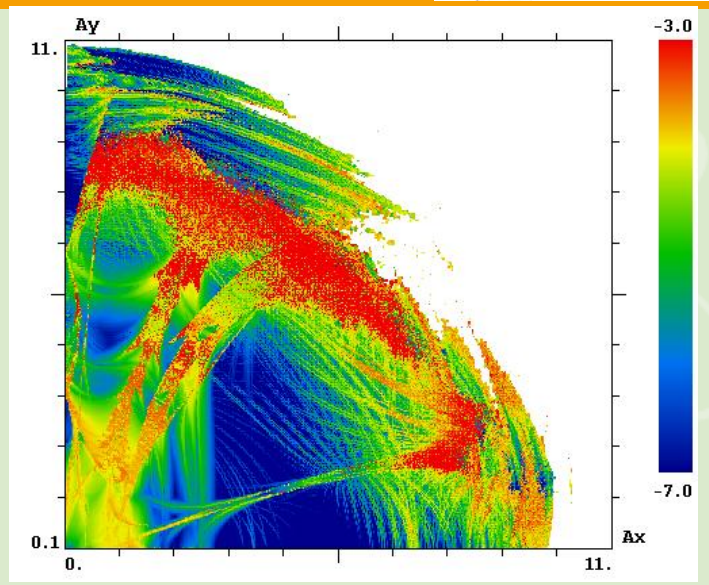
Coupling + Chromaticity Correction

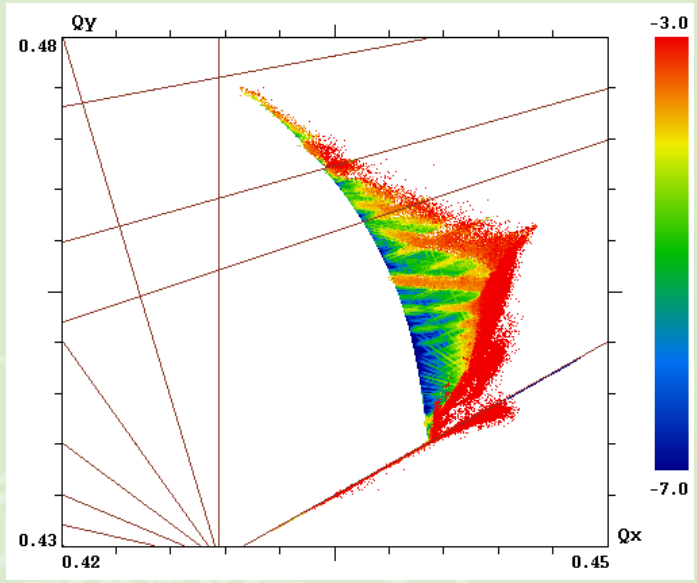
Qedge On

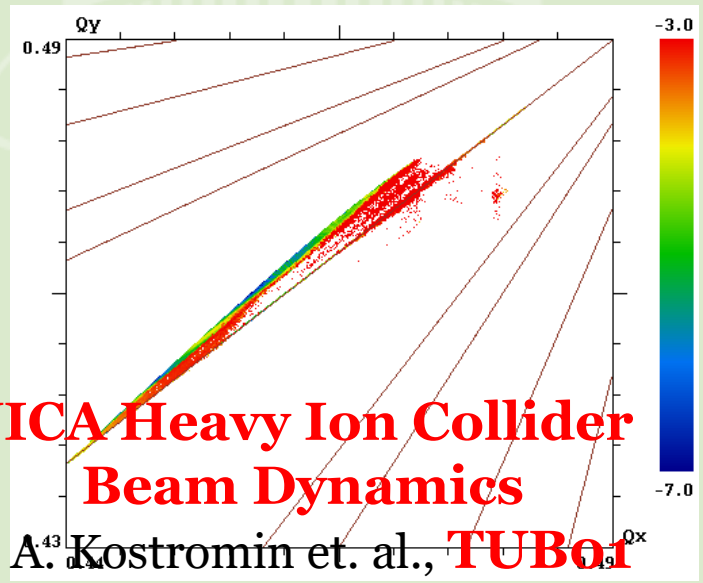
DA Correction (b_3)

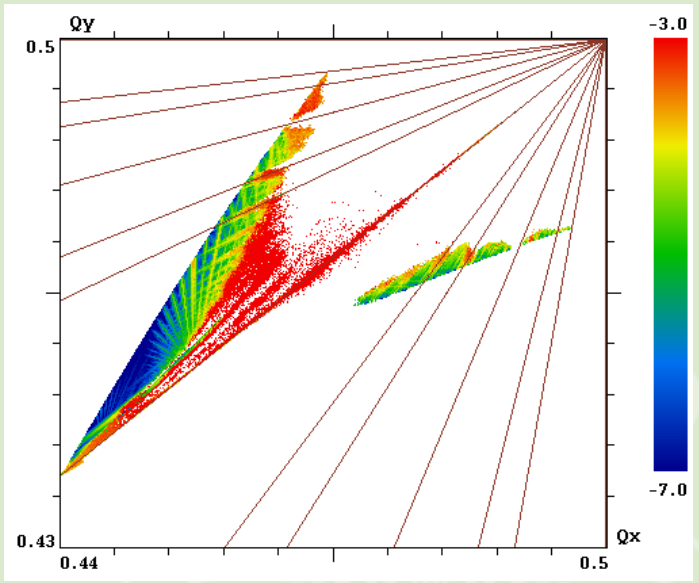








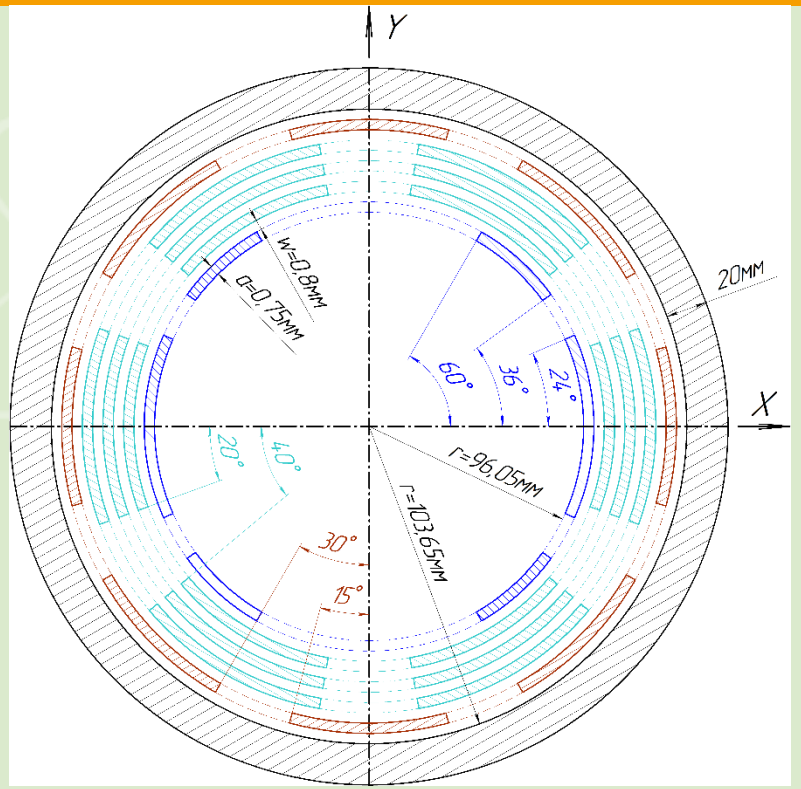




NICA Heavy Ion Collider Beam Dynamics

S. A. Kostromin et. al., **TUBo1**

Magnet Design



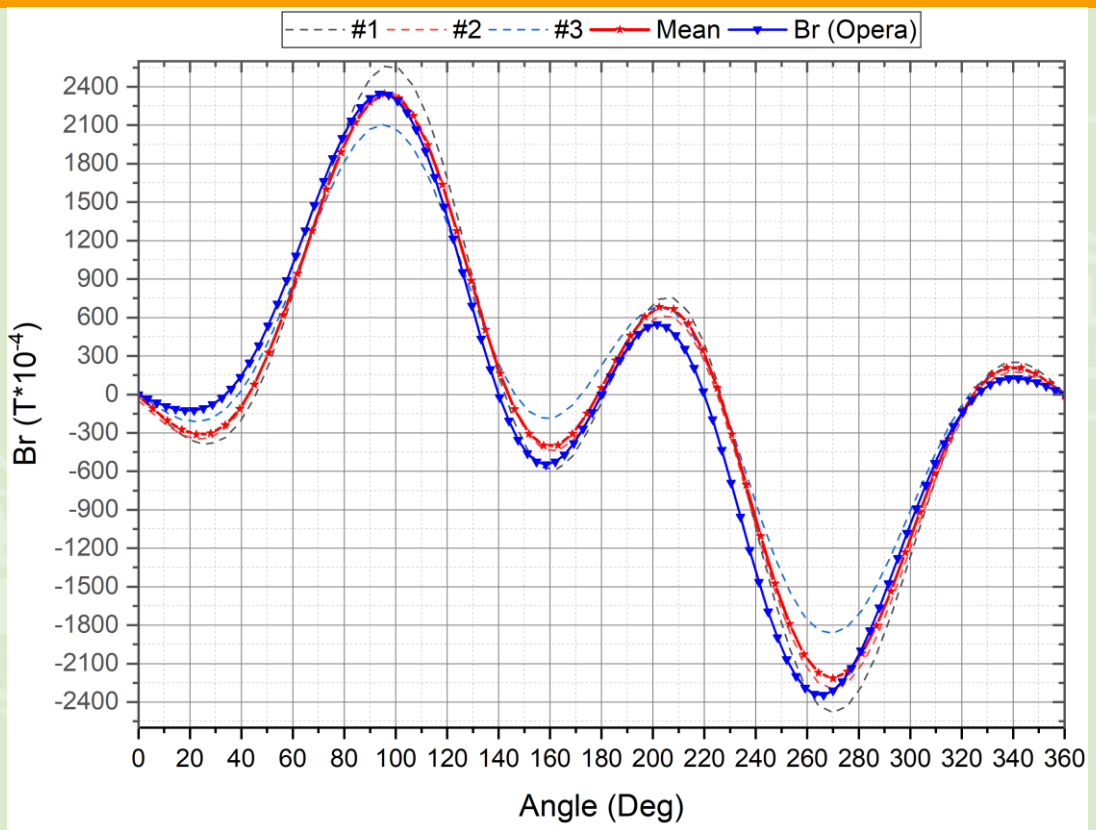
- **Dipole**
- **Sextupole**
- **Octupole**

Correctors' Magnets for the NICA Booster and Collider
M. M. Shandov et. al., 2019

SC Magnets for Project of NICA
D. N. Nikiforov et. al., **WEB01**

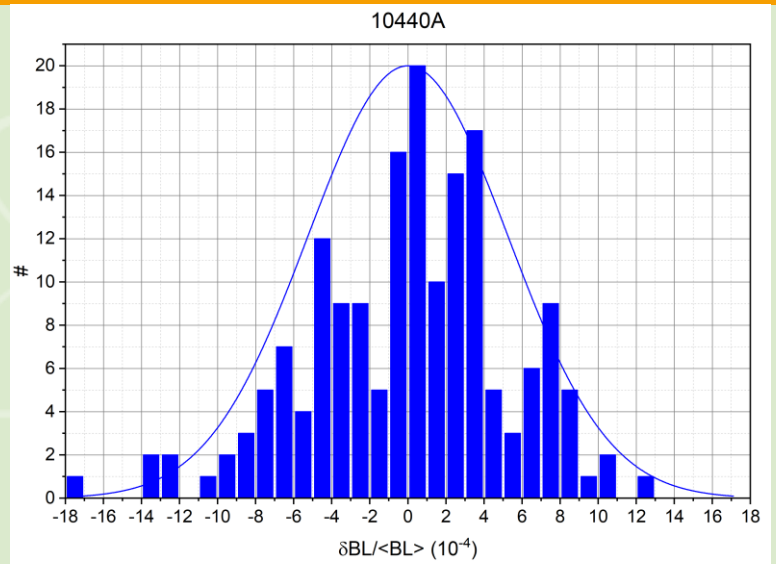
Magnetic Measurement

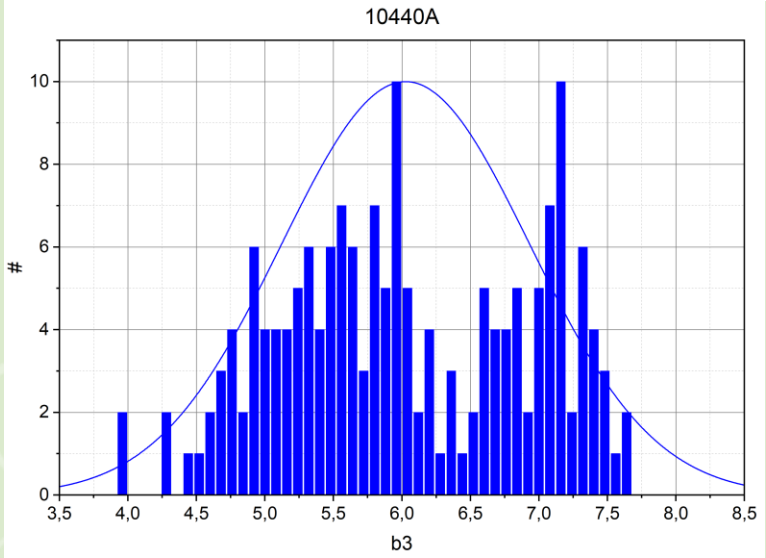
Field @R=46 mm



Field Type	Measurements	FEM 2D
Dipole (b_0)	0.127223	0.138722389
Sextupole (b_2)	0.0972577	0.095743794
Octupole (b_3)	0.0189354	0.021159588

Collider Magnets Measurement



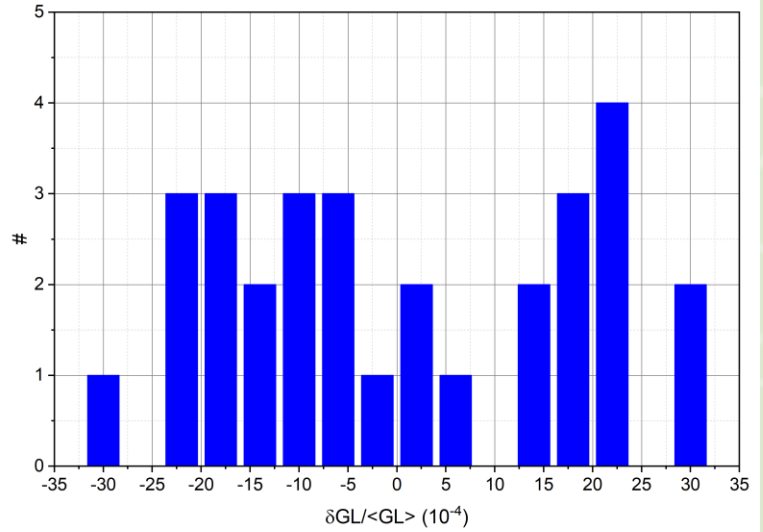


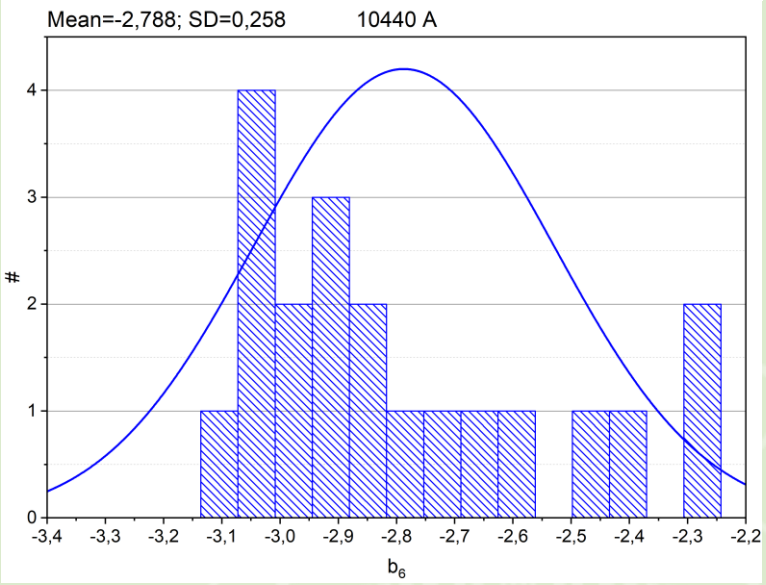
Serial MM of the NICA Collider Twin-Aperture Dipoles. The Main Results

D. Zolotykh et. al., **WEPSC18**

Dipoles 100%

Quadrupoles 34,8%





Conclusions

Magnetic Field Correction Systemm

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DA Calculation

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Magnets Design

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Magnetic Measurements

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Future Plans


THANK YOU FOR ATTENTION !!!