

HEBT optimization quadrupole magnet Q11

V. Vostrikov (BINP)

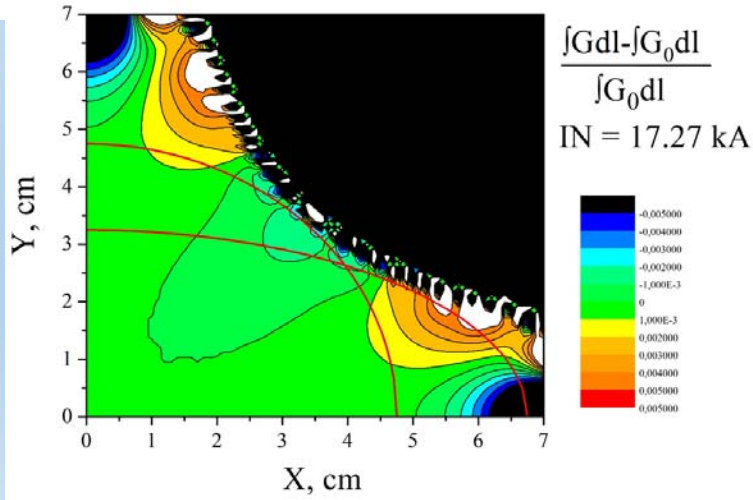
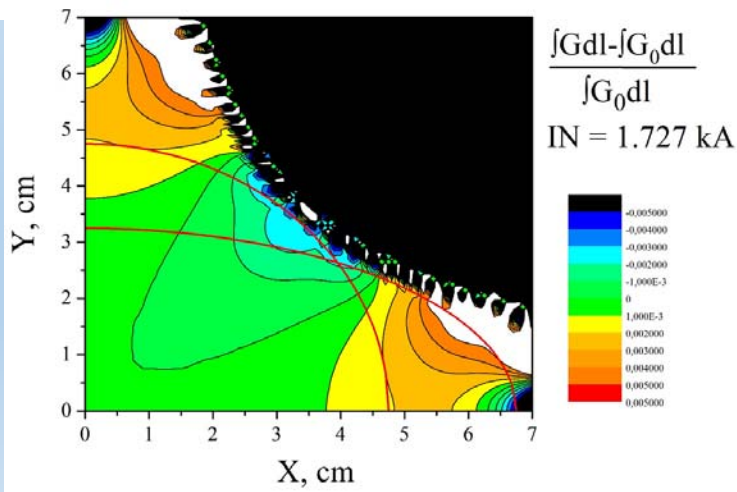
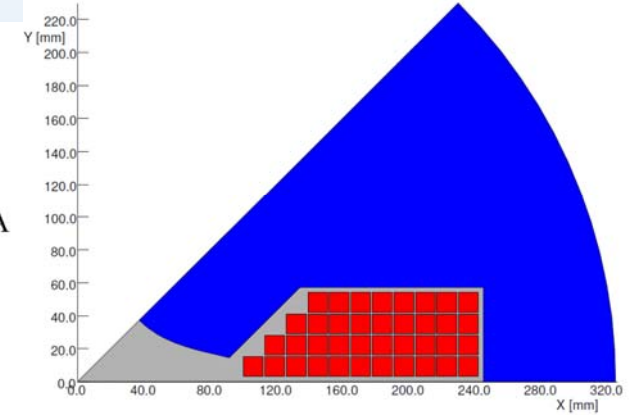
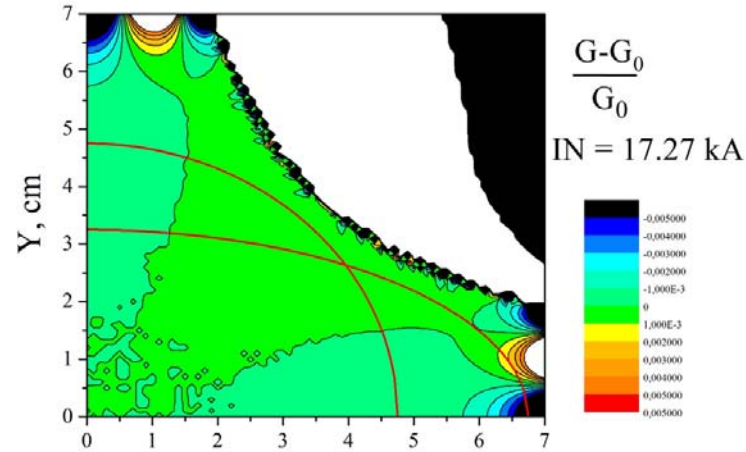
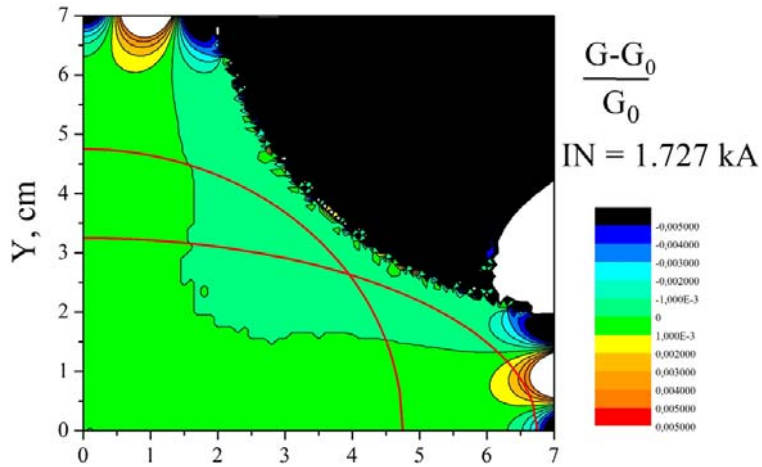
6th BINP-FAIR Collaboration Coordination Workshop

27.04.2021

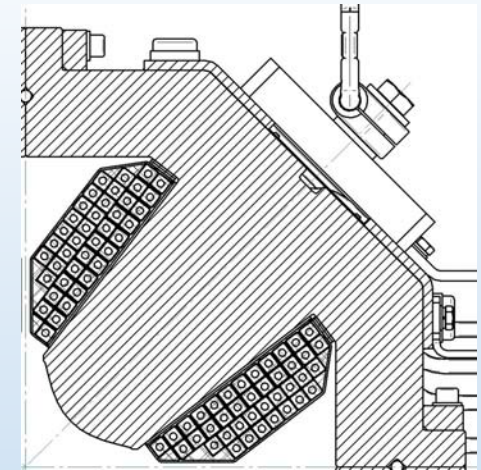
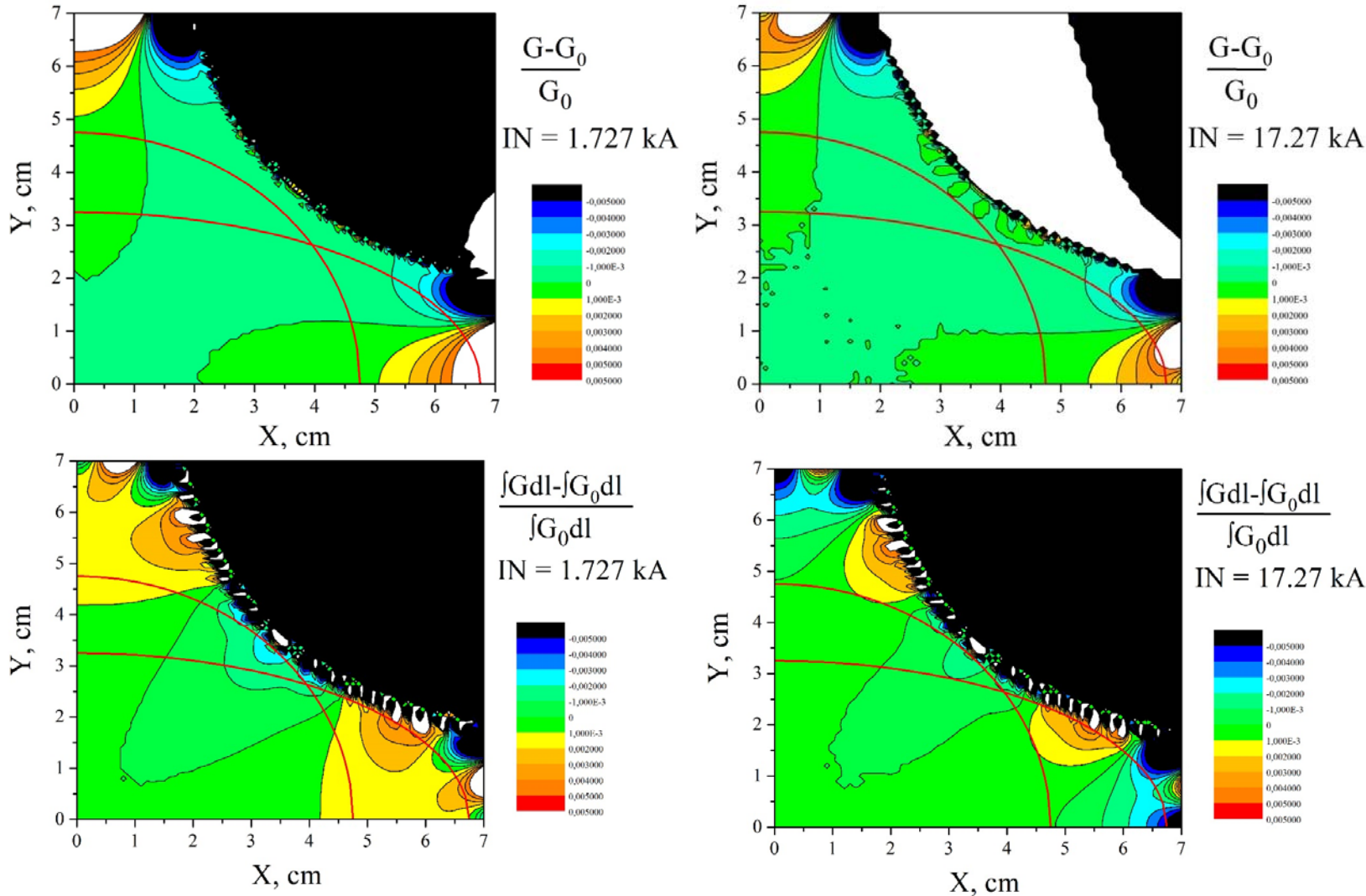
BINP TEAM

- HEBT Project Manager – Morozov I.
- Q11 Subproject Manager – Vostrikov V.
- Design – Lopatkin I., Poletaev I.
- Magnetic Measurements – Starostenko A., Pakhomov A., Okunev I.
- Magnetic simulations – Antokhin E., Starostenko A., Vostrikov V.
- Manufacturing – Ruvinskiy E.

GSI-MT-Ptab-2007-19.3 (August 2012)



GSI-MT-Ptab-2007-19.4 (March 2017)



BINP design (2016)

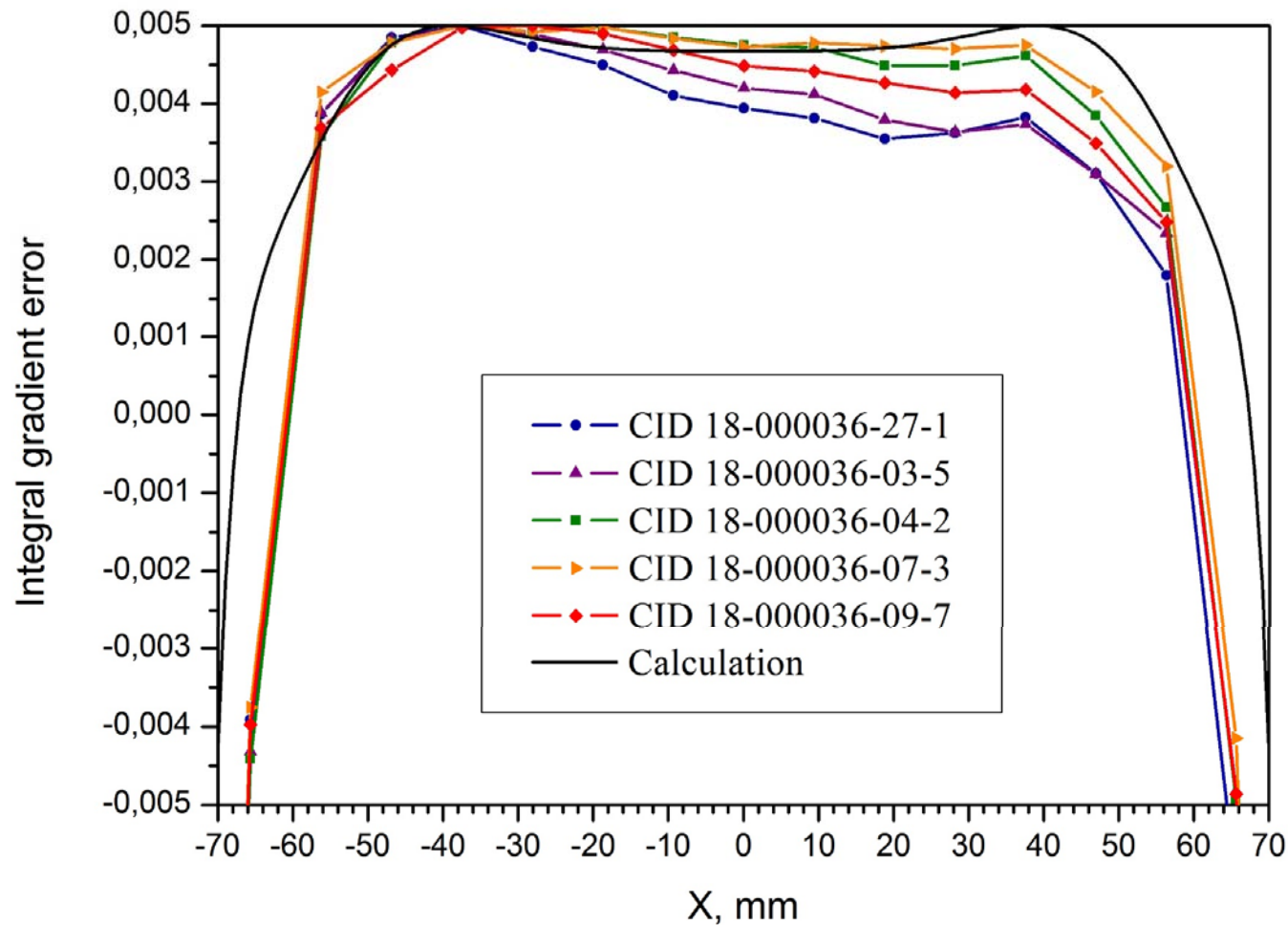
Exchange saddle coils to conical by technology reason

Magnetic design by MERMAID code

Deviation of local gradient for compensation of edge influence

Simple chamfer 10x45°

Magnetic measurements

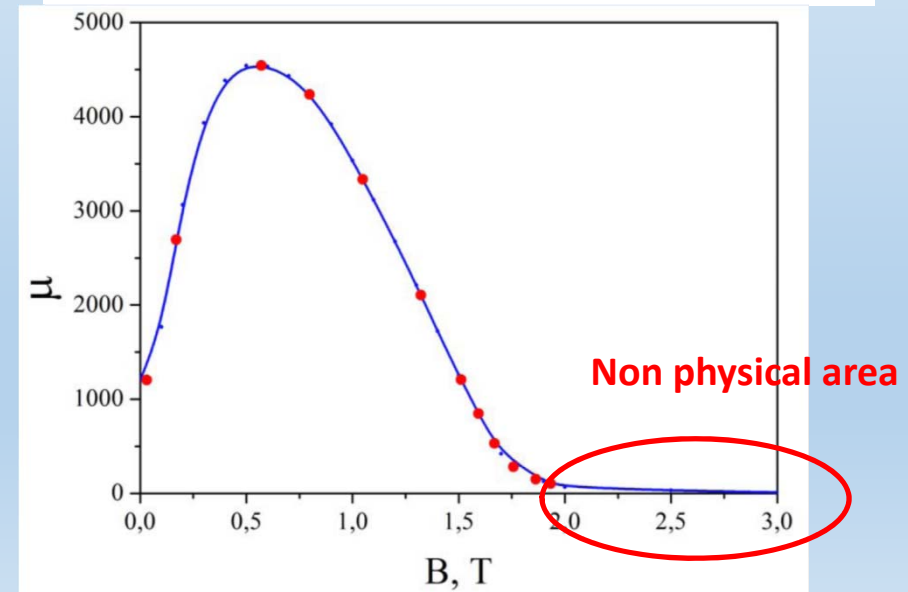
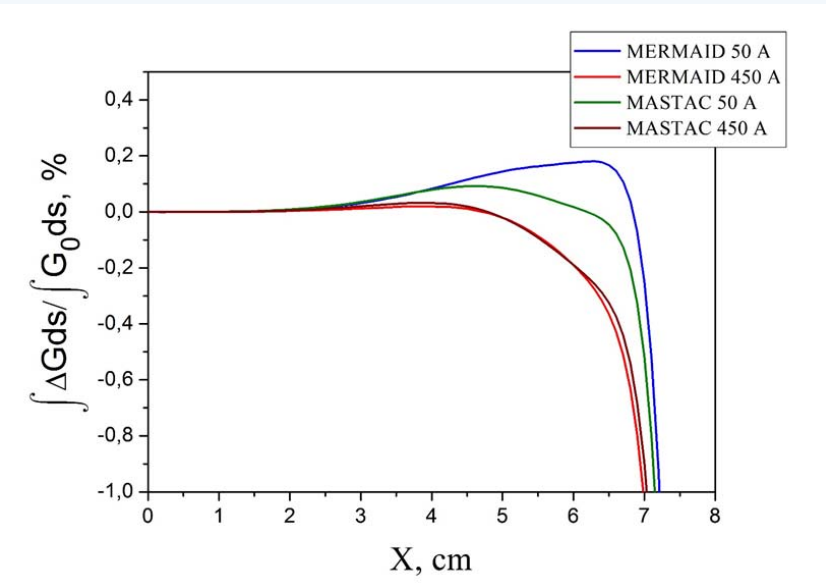


- Good agreement for local gradient
- Disagreement for integral gradient
- Not enough good field area (especially for high current) for elliptical chamber

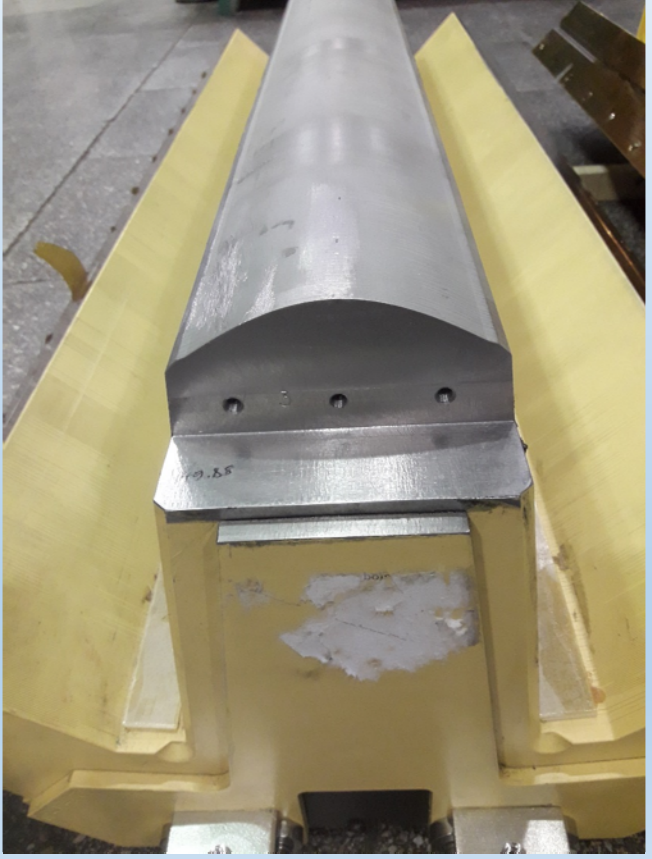
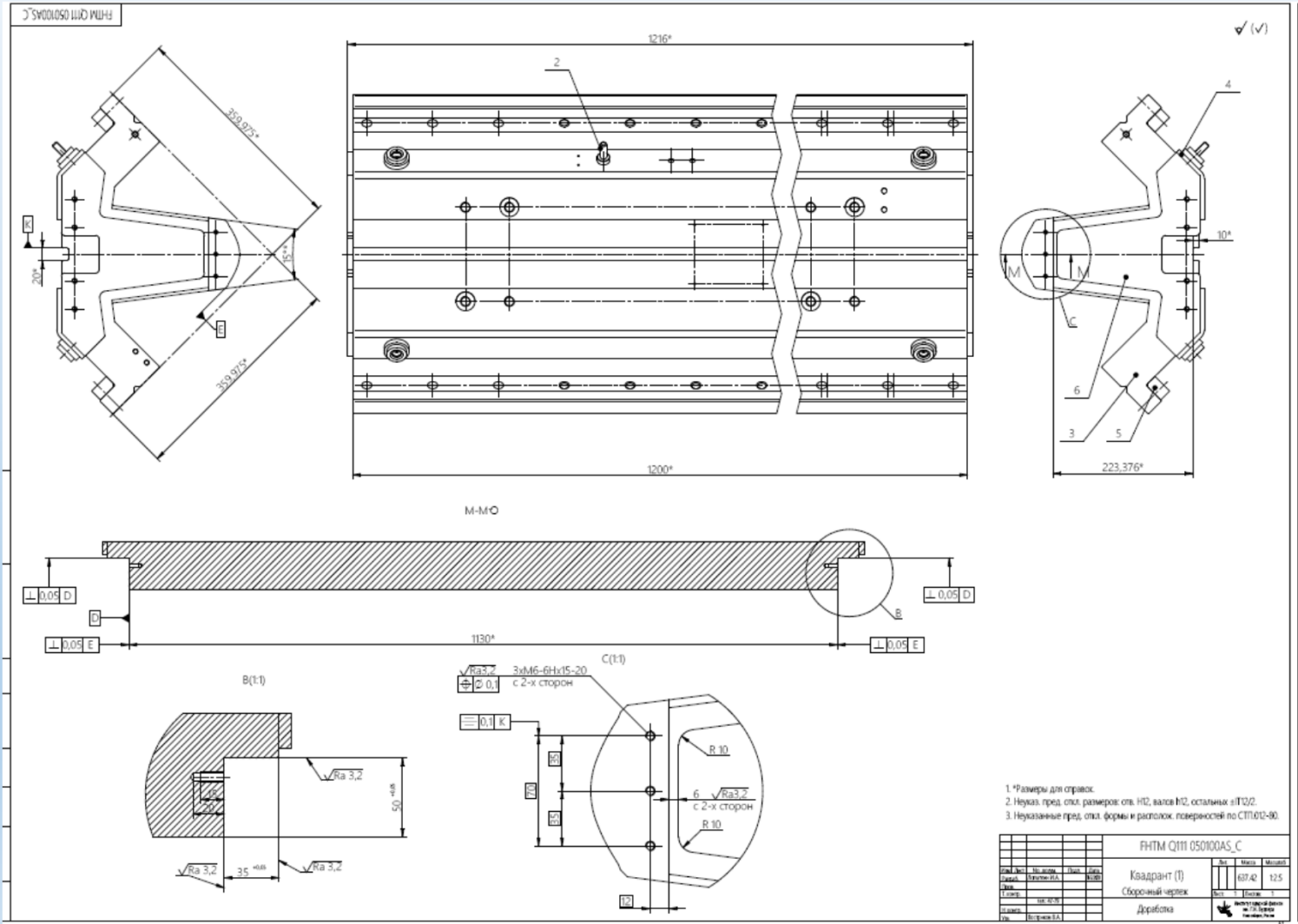
CID	Δ^-	Δ^+
18-000036-27-1	1,6	3,2
18-000036-03-5	1,7	1,8
18-000036-04-2	1,7	1,8
18-000036-07-3	1,5	1,8
18-000036-09-7	1,5	1,6

Strategy

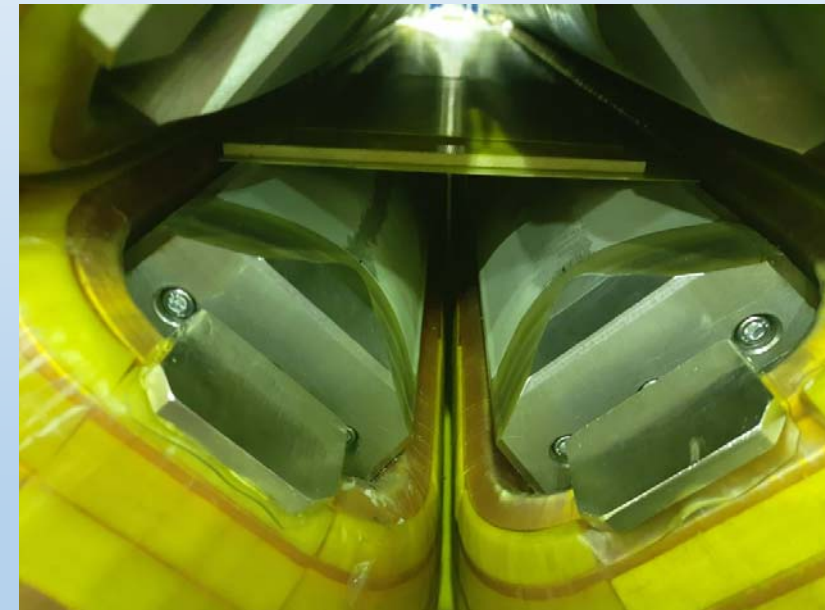
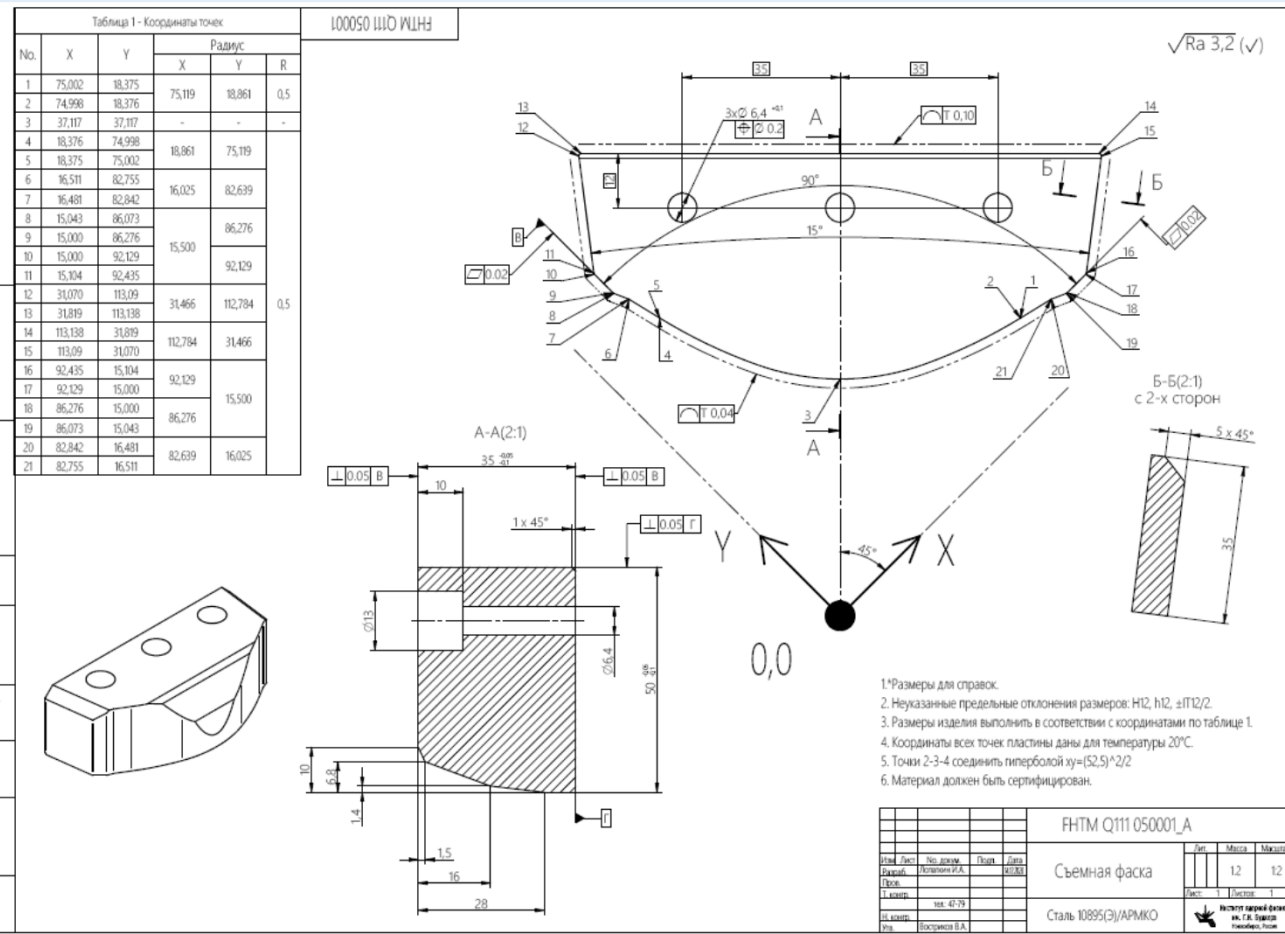
- **Search of reasons and confirmation of results**
- Independent check of magnetic design
- Check of lamina
- Check of assembly procedure
- Check of measurement system
- Check of steel properties
- Independent measurements in GSI
- **Search of solution**
- Simulation with different shims
- Removing capton layer
- Milling mating surfaces
- External shimming
- Removable shims



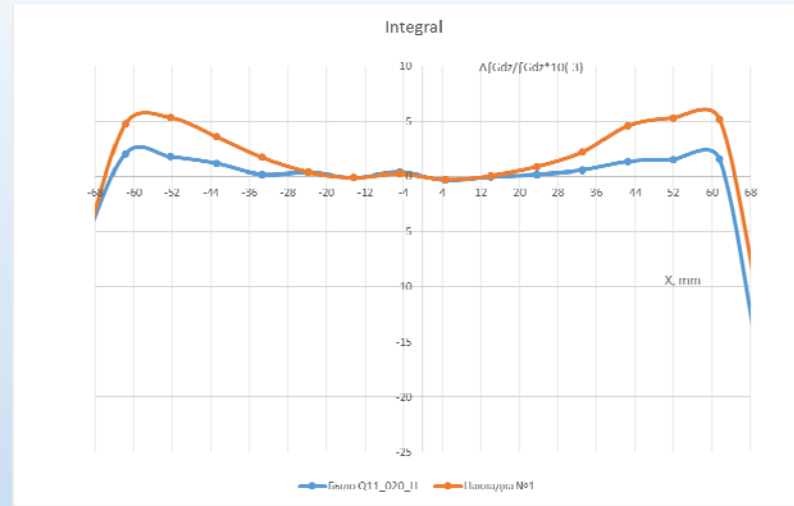
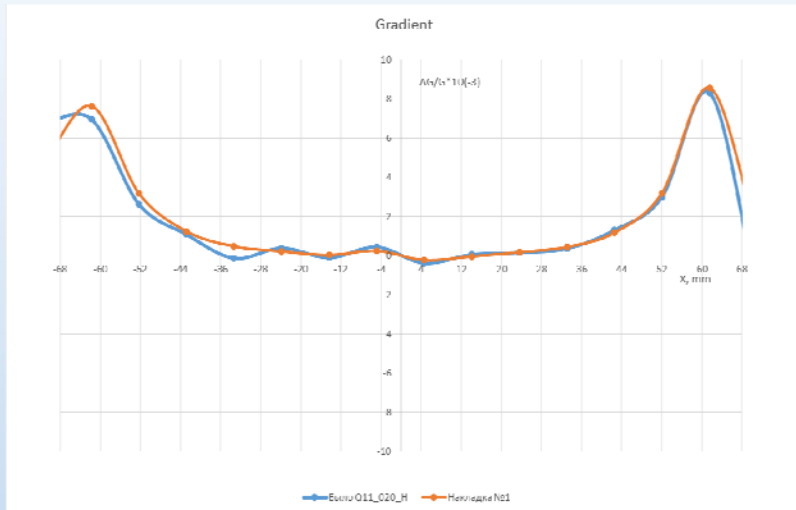
Reworking yoke for removable shims installation



Shim #1 Rogovsky chamfer

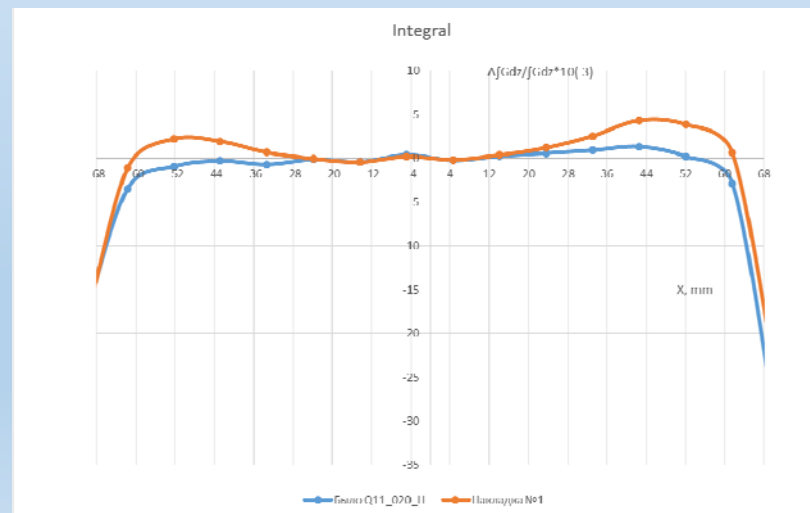
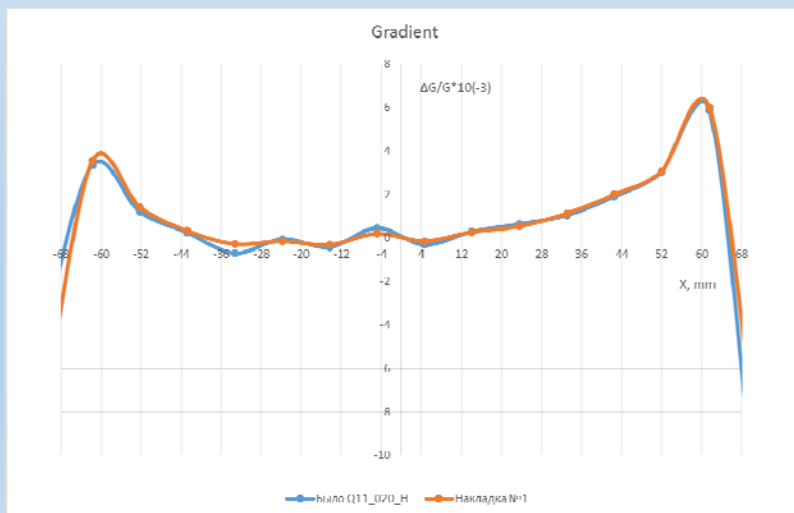


Rogovsky chamfer pole



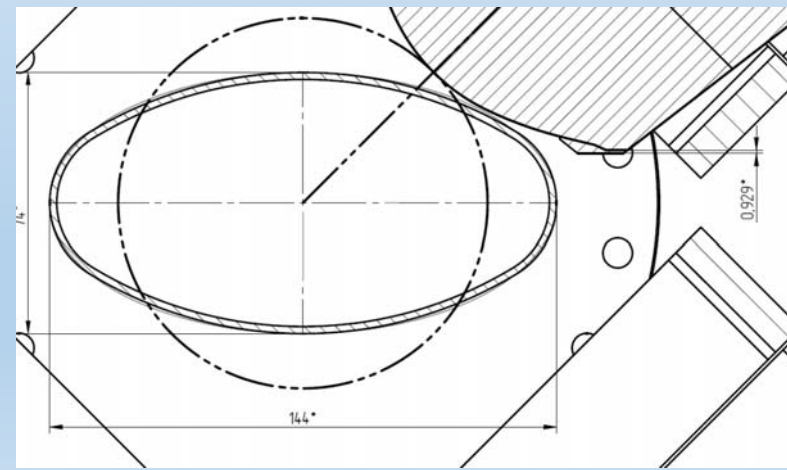
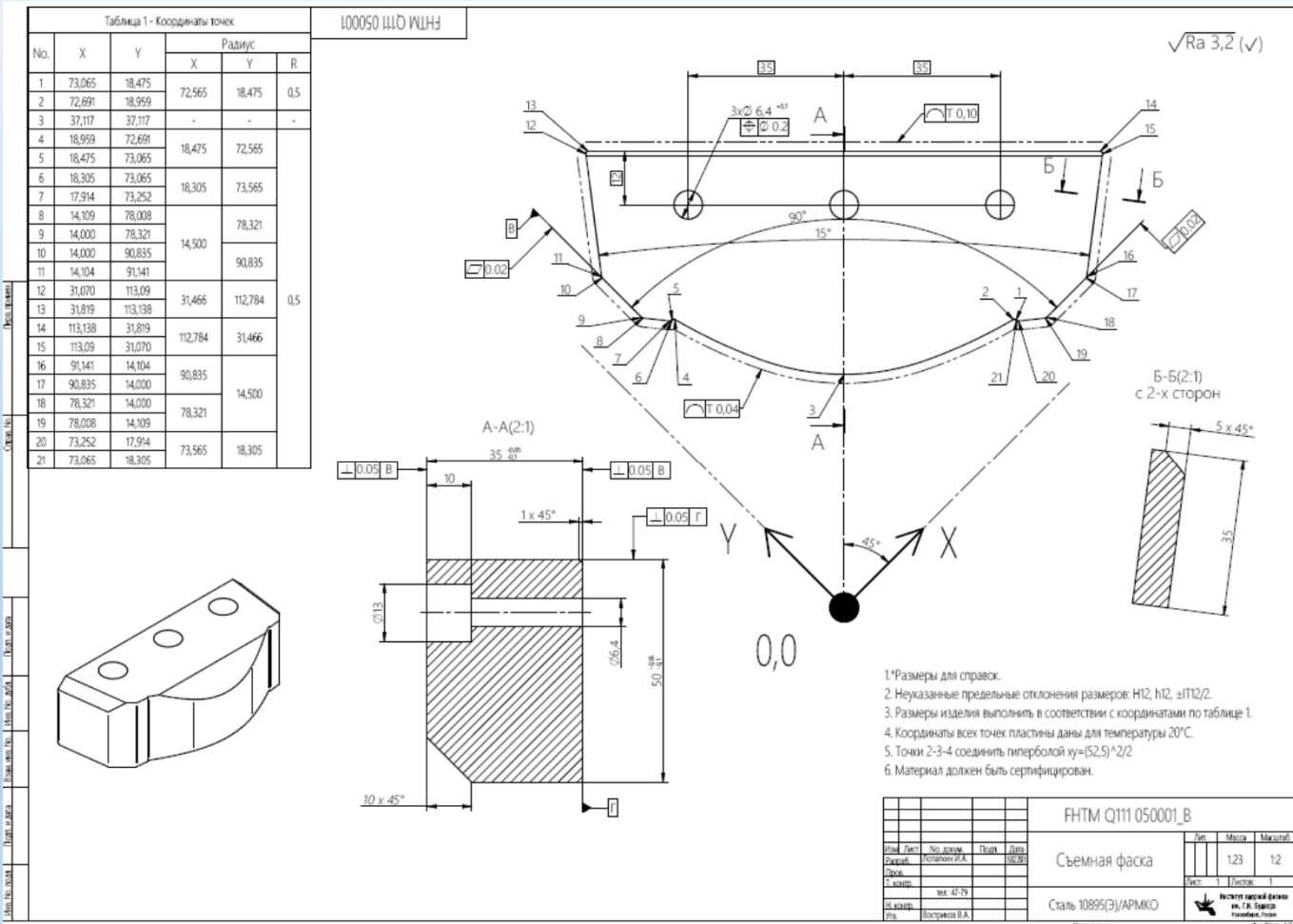
255 A

Resume: Rogovsky chamfer works good at low current, but not enough at high current

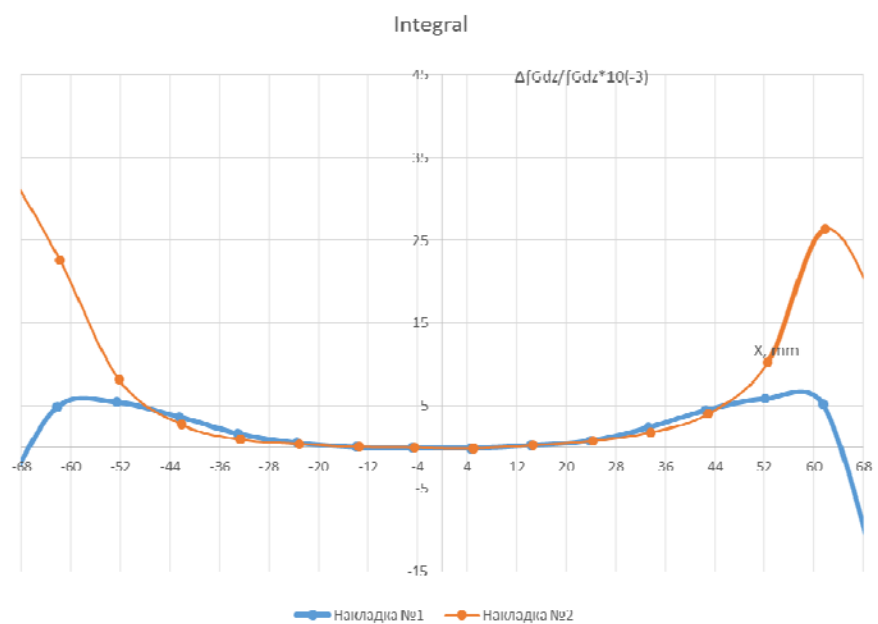


485 A

Shim #2 Oversize

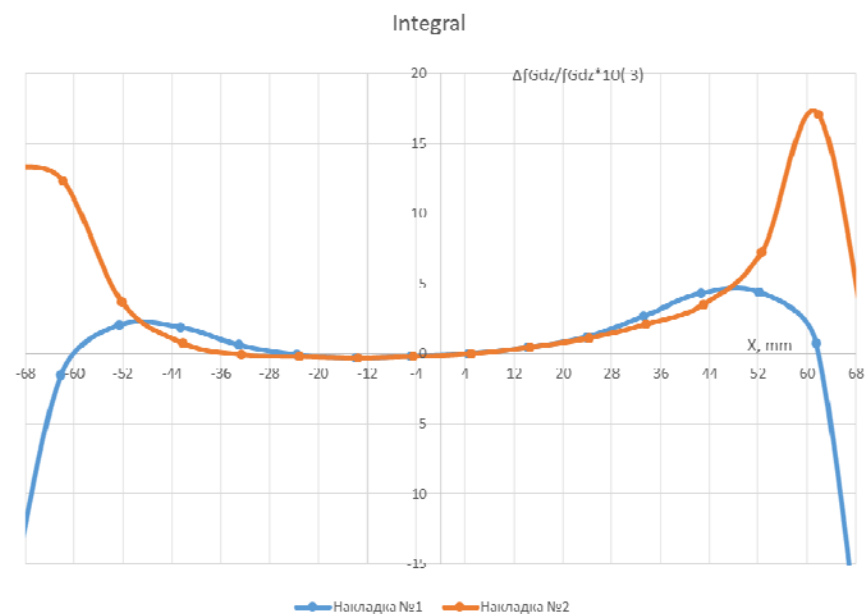


Shim #2



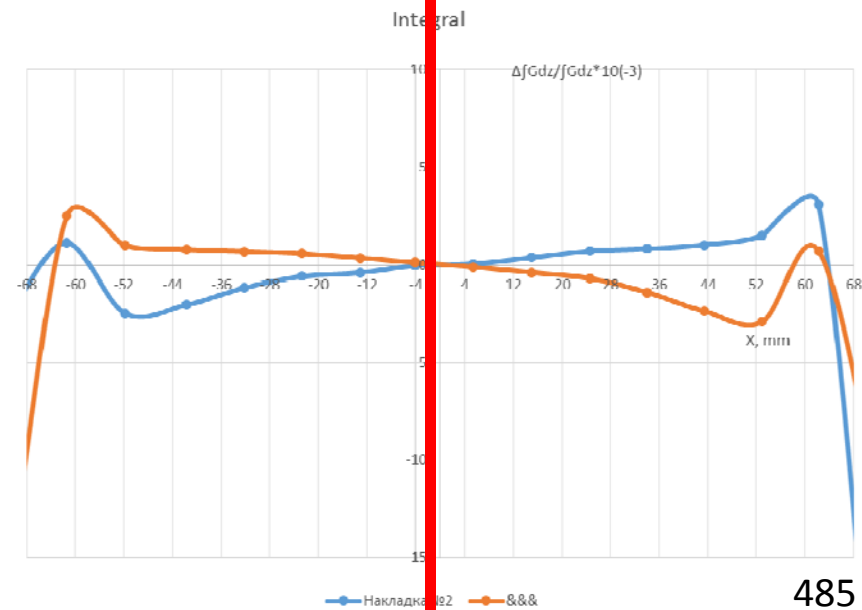
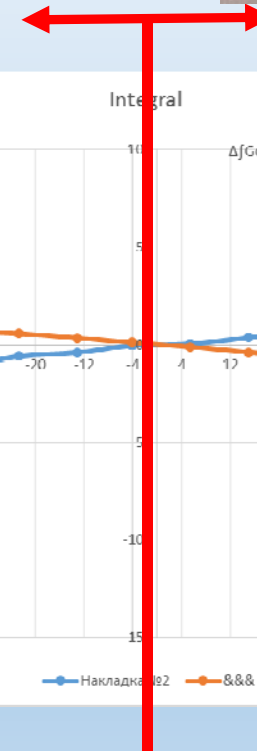
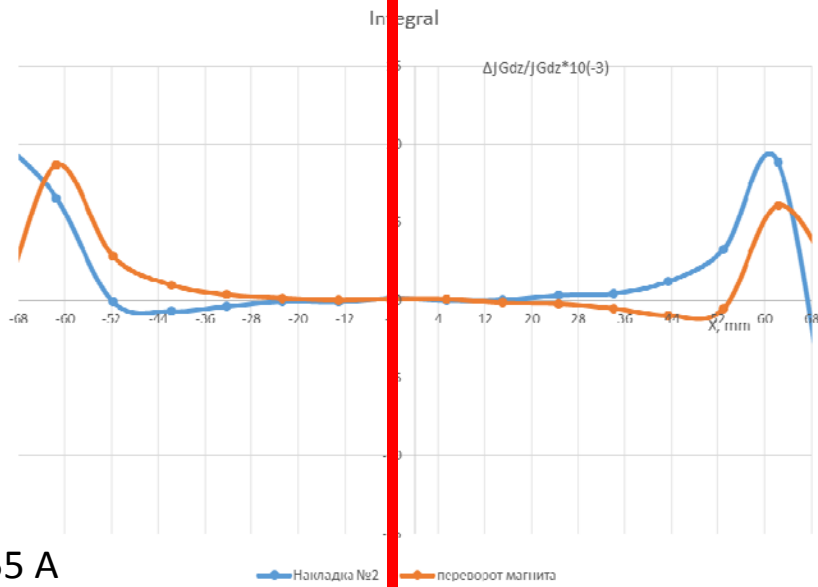
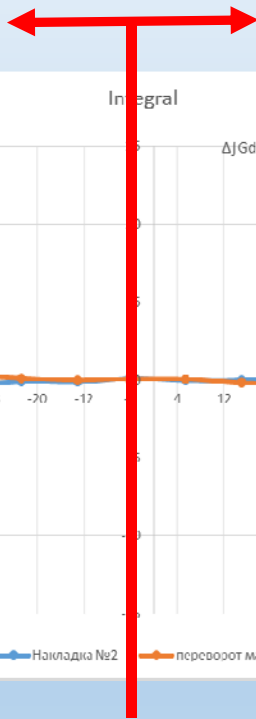
255 A

Blue line – Rogovsky chamfer, red line – shim #2



485 A

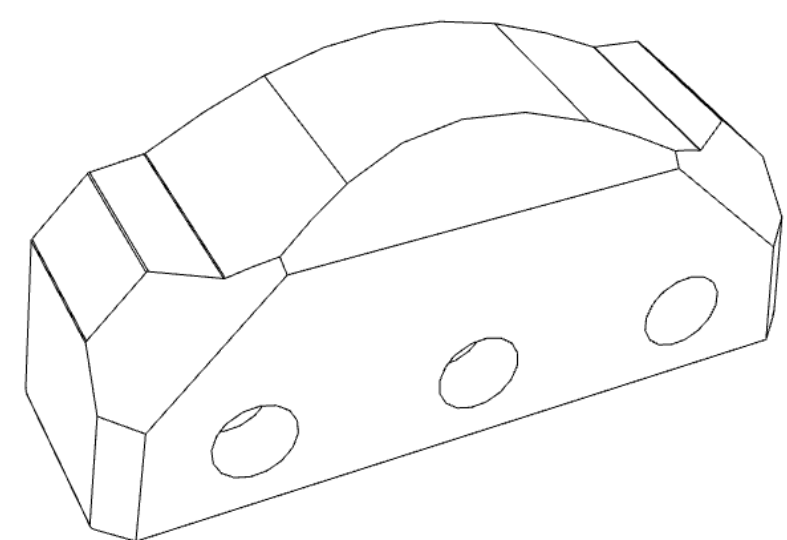
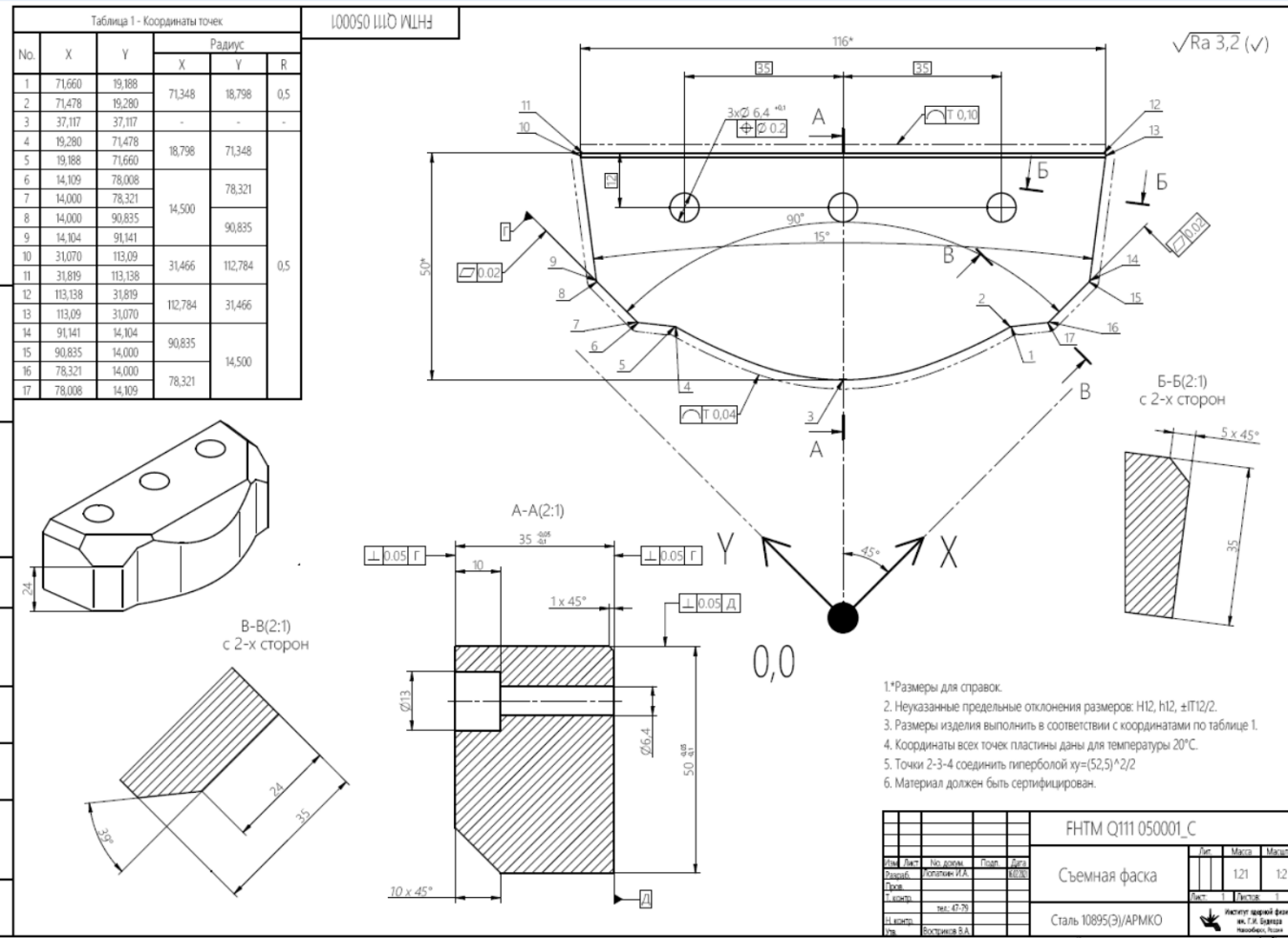
Shim #2 Hand milling



Milling was made from one side only.

Measurements with rotation of magnet allows measure with Hall probes in different positions

Shim #3 Modified oversize



Status of Q11

- 10 magnets (right, horizontal) with round chamber are manufactured (7 for HEBT A)
- 5 magnets delivered to GSI, 5 magnets prepared for FAT at 17.05.21
- For HEBT A magnets with round chamber are requested only (17 pcs)
- Planning manufacture Q112 (3pcs), Q114, and Q1111 (right inclined)
FHTQS133, FHTQS135, **FHTQS141**, FHTQS137, **FHTQS139**
- Reworking of ready horizontal left magnets to inclined Q113 (3 pcs), Q117 (1 pcs), Q118 (1 pcs): FHTQS049, FHTQS051, FHTQS053, FHTQS056, FHTQS047
- Manufacturing new set of shims, accordingly modification. Checking measurement.

THANK YOU FOR ATTENTION