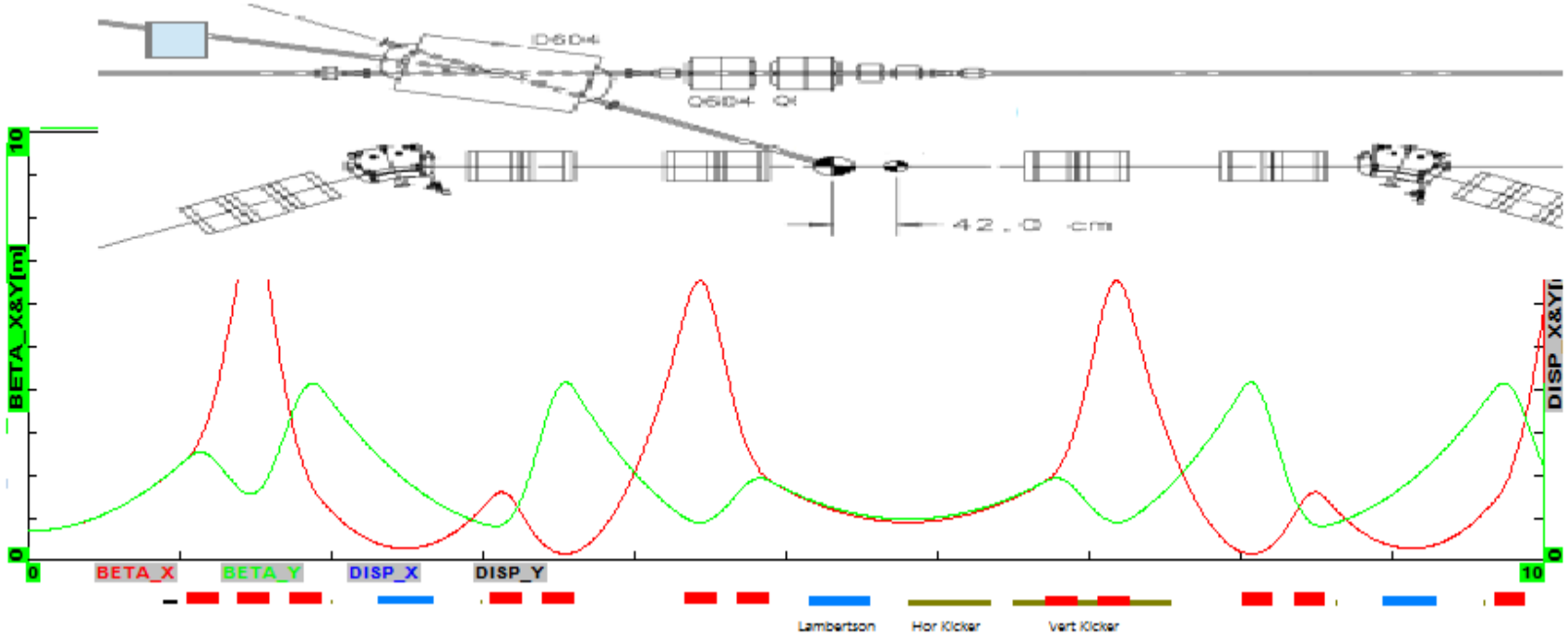
IOTA Kickers

SERGEY ANTIPOV, ALEXANDER DIDENKO

Elements and their Positions

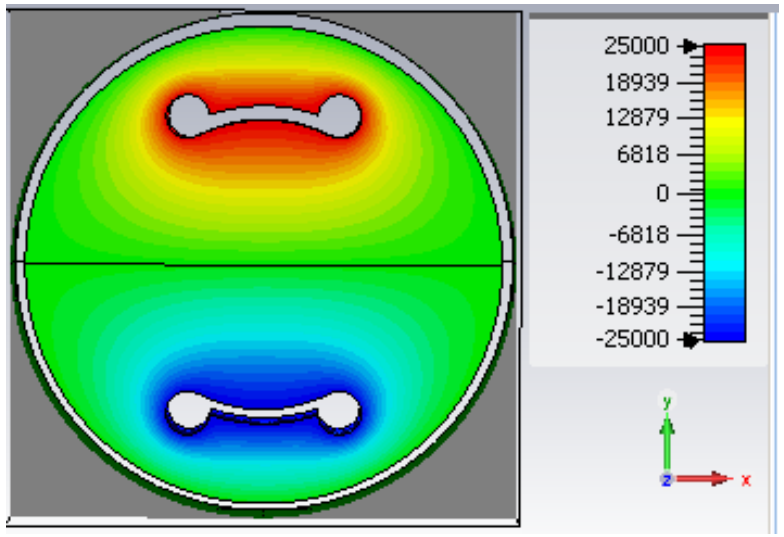
- Lambertson septum magnet + vertical and horizontal stripline kickers
- Injection in the vertical plane



S. Antipov, Injection Design for IOTA, 06/05/14

Unified Design for Horizontal and Vertical Kickers

The field is pretty uniform



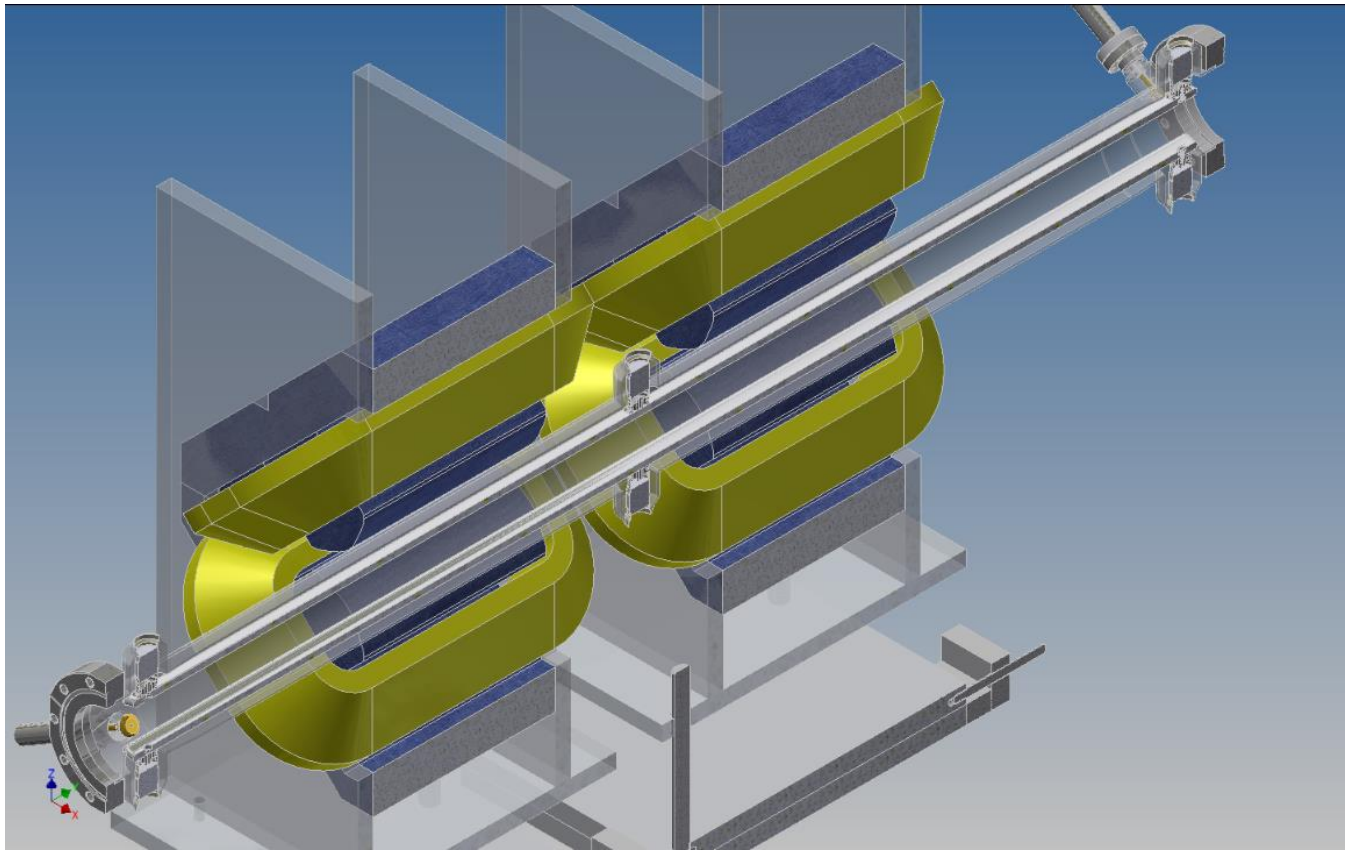
2D map of electric potential in the kicker

Voltage	**± 25 kV ***
Radius: • Pipe • Plates	 33 mm 20 mm
Thickness: • Pipe: • Plates:	 2 mm 2 mm
Opening angle	70 deg
Edge rounding radius	3 mm
Wave impedance: • Odd mode • Even mode	 50 Ohm 55 Ohm
Max E-field	13 kV/cm
Length: • Horizontal • Vertical	 55 cm 100 cm

* 10 % reserve

S. Antipov, Injection Design for IOTA, 06/05/14

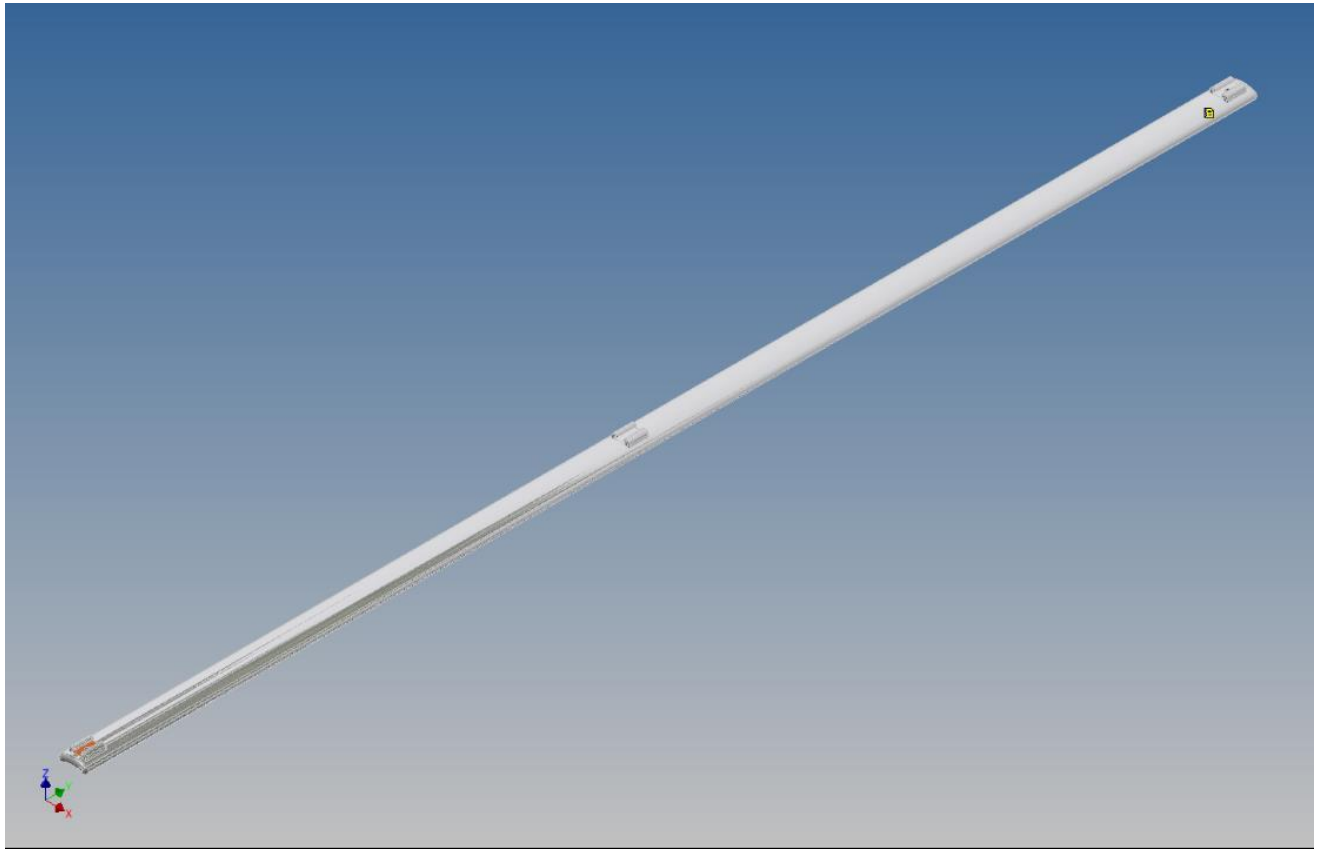
Vertical kicker fits inside quads



Max voltage	**± 25 kV**
Pipe	Elliptical: a = 35, b = 31 mm
Pipe thickness	2 mm
Plate thickness	6 mm
Opening angle	65 deg
Phys. aperture	40 mm
Length	1.1 (0.6) m
Ceramic inserts	3 (2)

(for horizontal kicker)

Plates



Material	Al
Length	1050 (550) mm
Thickness	6 mm
Mounts	3 (2)

Mounting point:

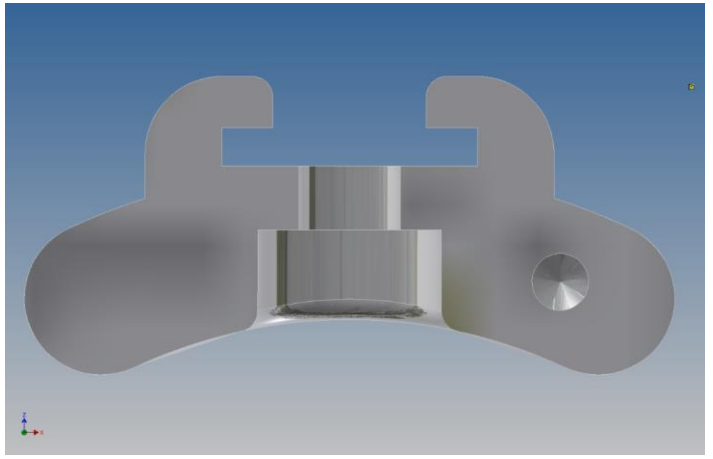
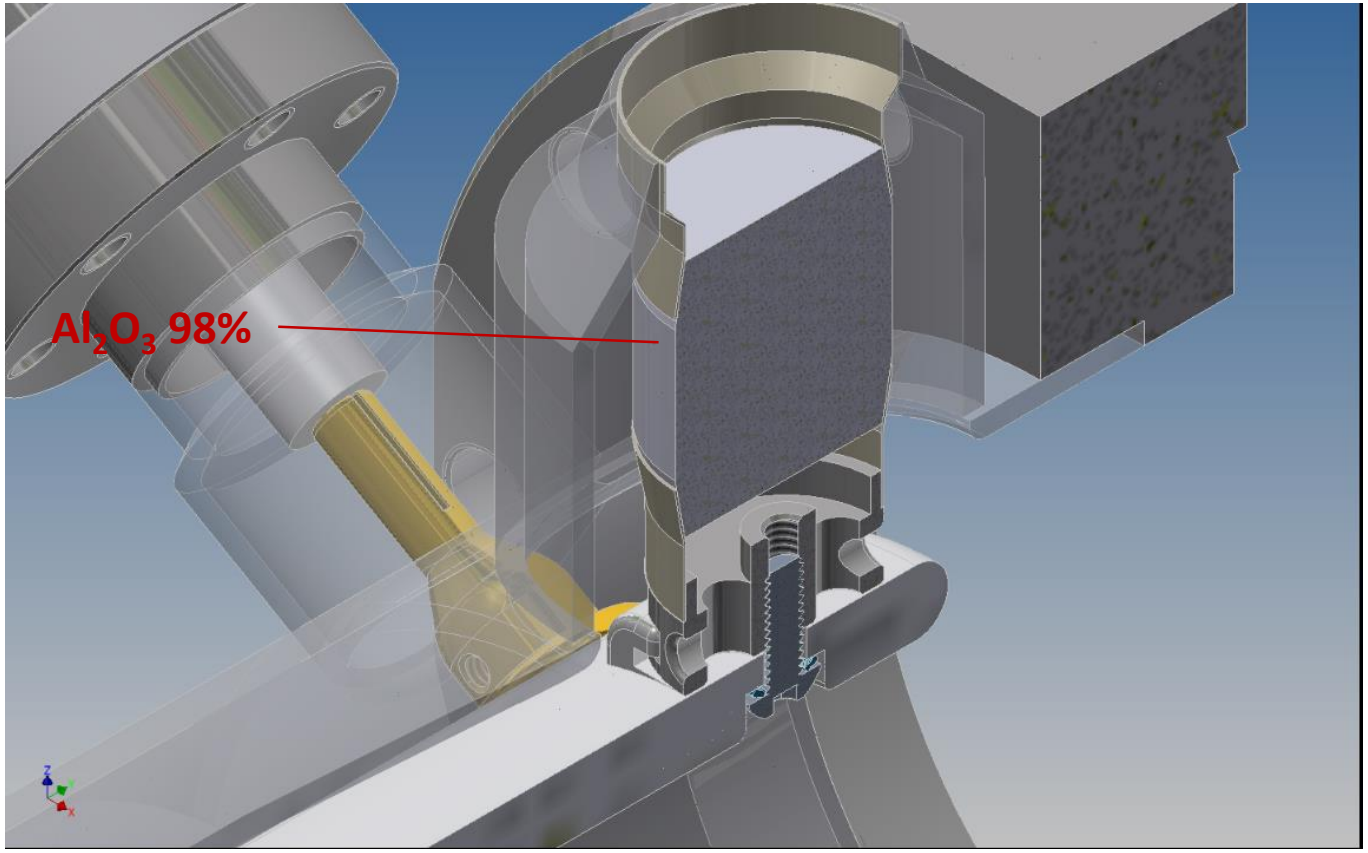


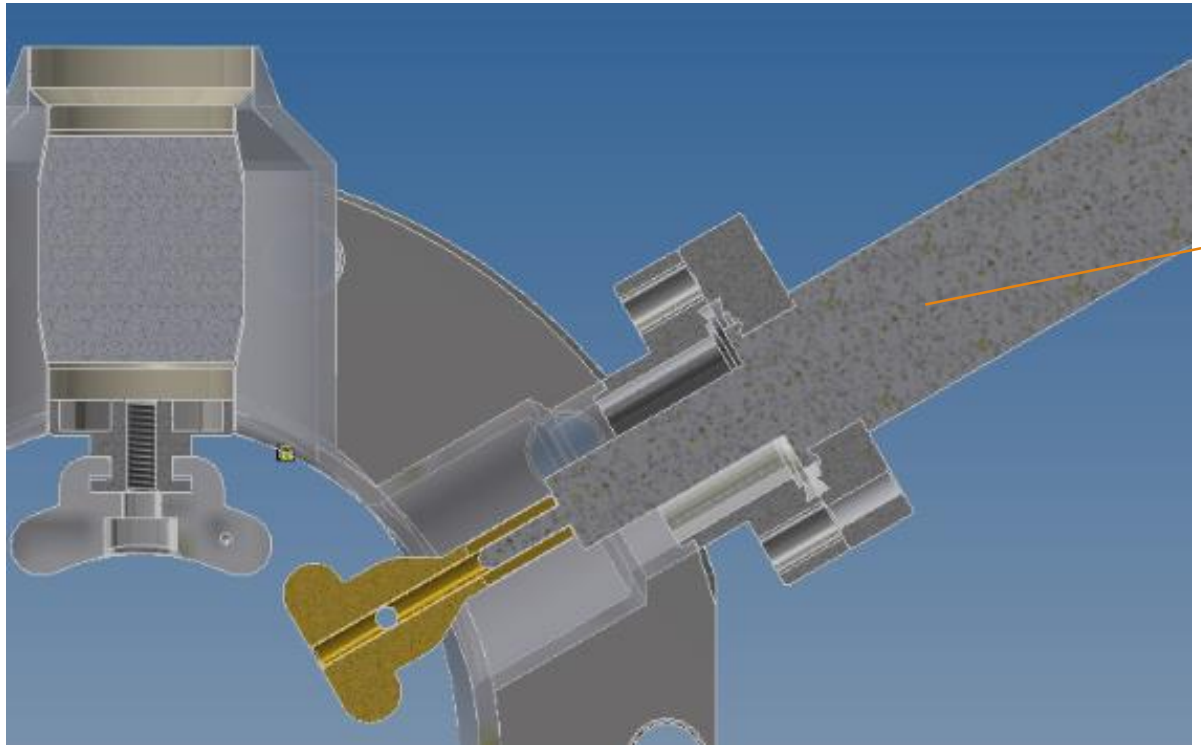
Plate mounting

One end – fixed
The other – loose

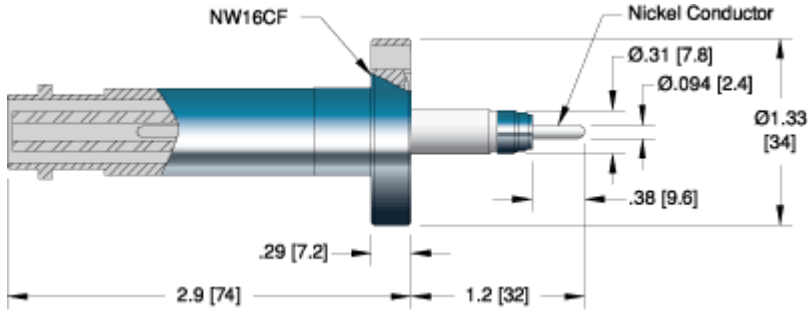
Beam does not
see ceramics



Electric current input/output



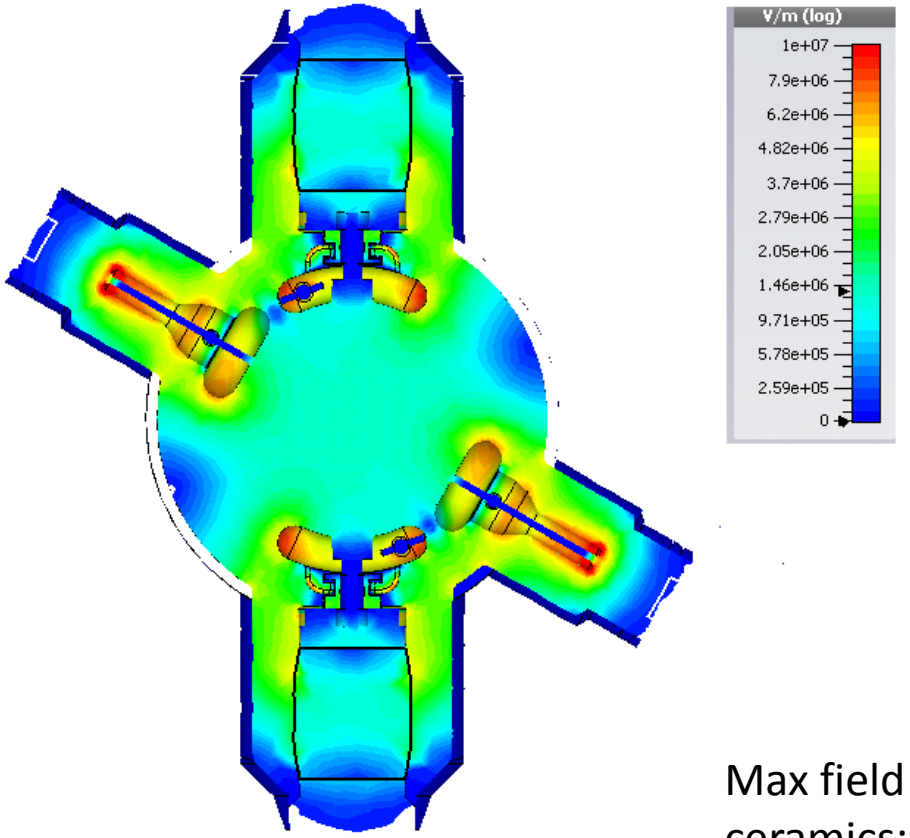
Ceramtec feedthrough



Wave impedance and breakdown voltage tested by S. Antipov and C. Jensen

Field simulation

Electric field does not exceed 50 kV/cm

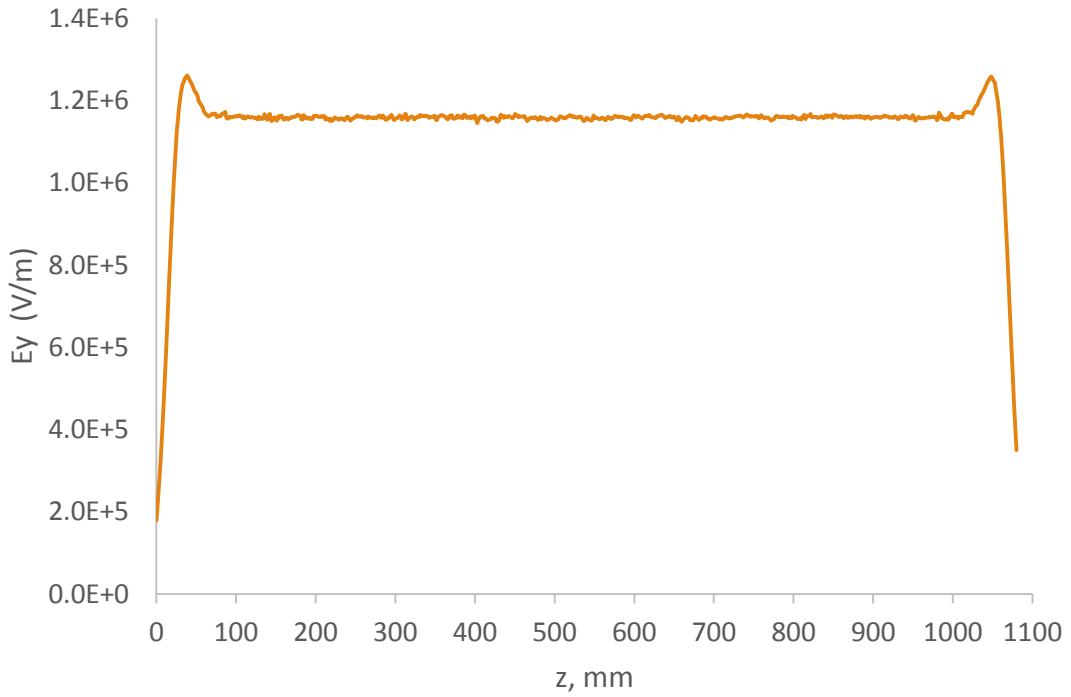


Max field along ceramics: 15 kV/cm

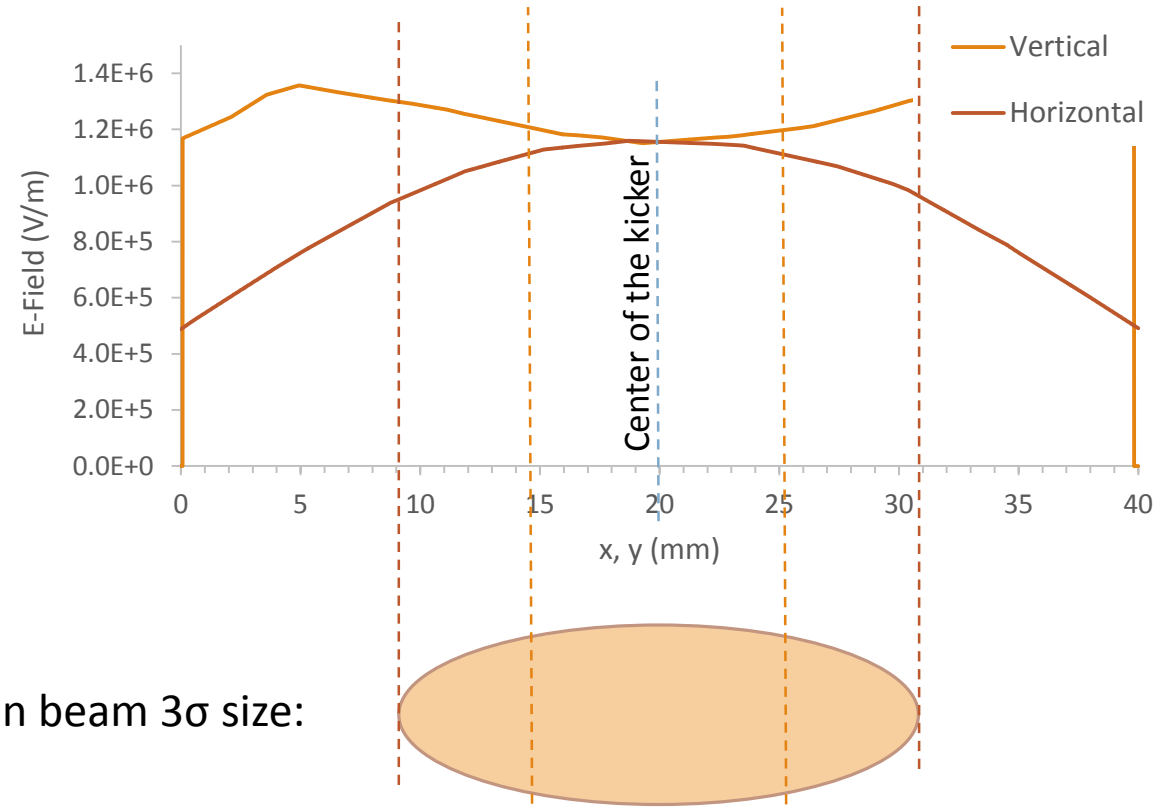
	Wave impedance
Dipole	45 Ohm
Sum	49 Ohm
1 plate	47 Ohm

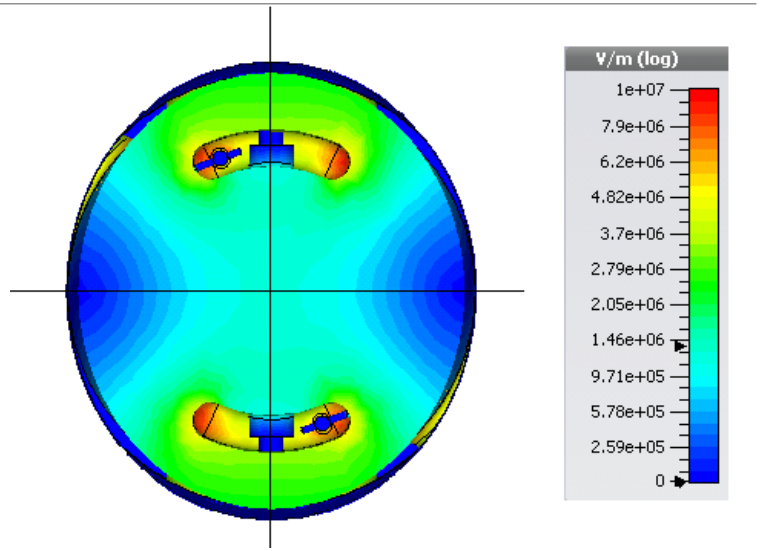
Reflections less or of the order 5%

Integrated field: 1.23 MV -> 16 mrad kick



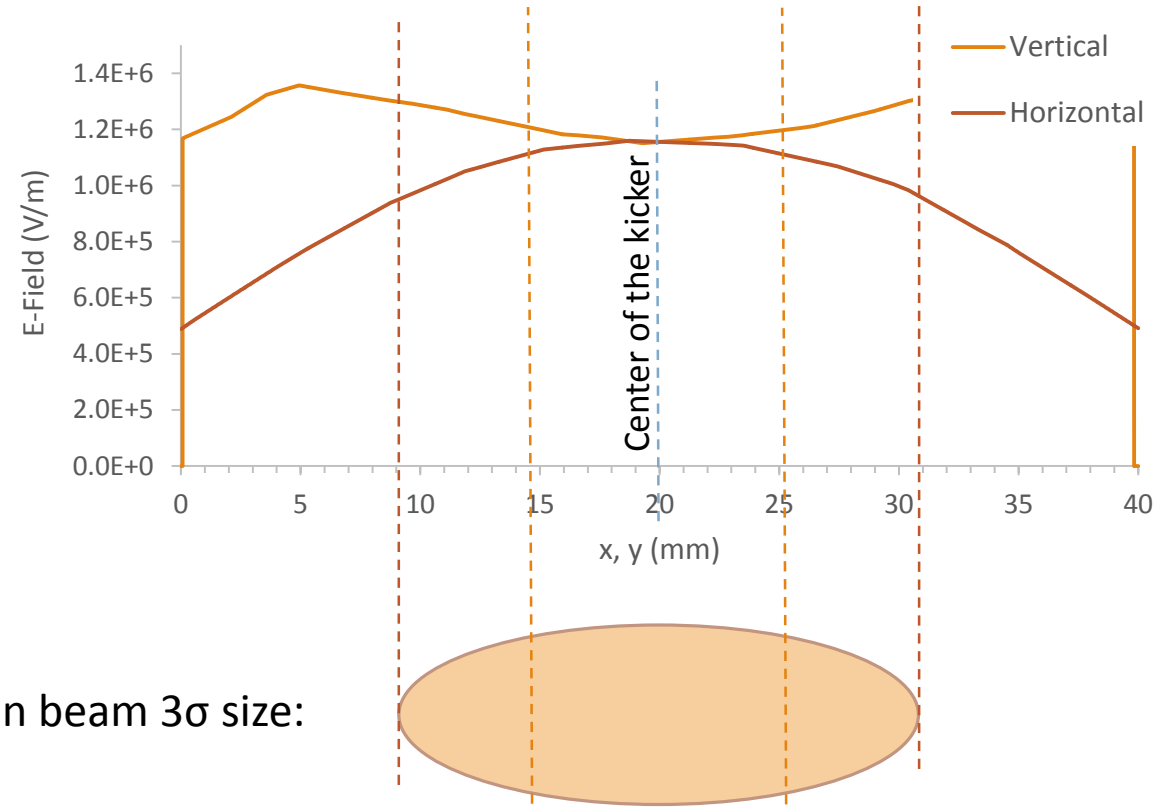
Less than 5% change of field on RMS size of proton beam



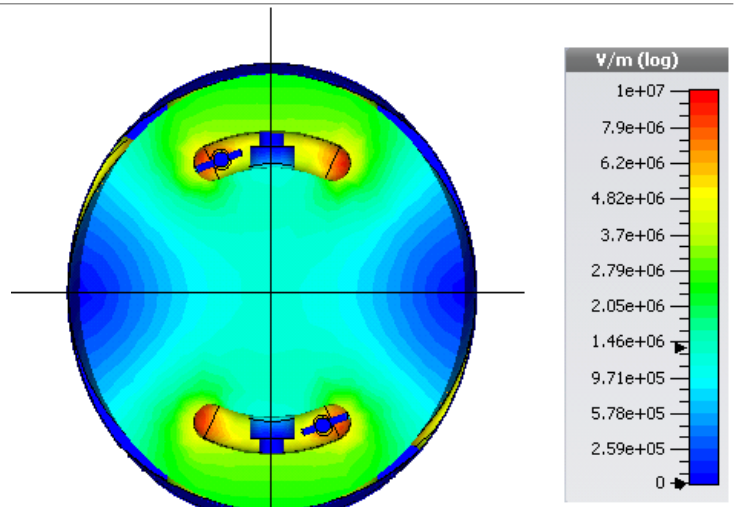


Proton beam 3σ size:

Less than 5% change of field on RMS size of proton beam



Proton beam 3σ size:



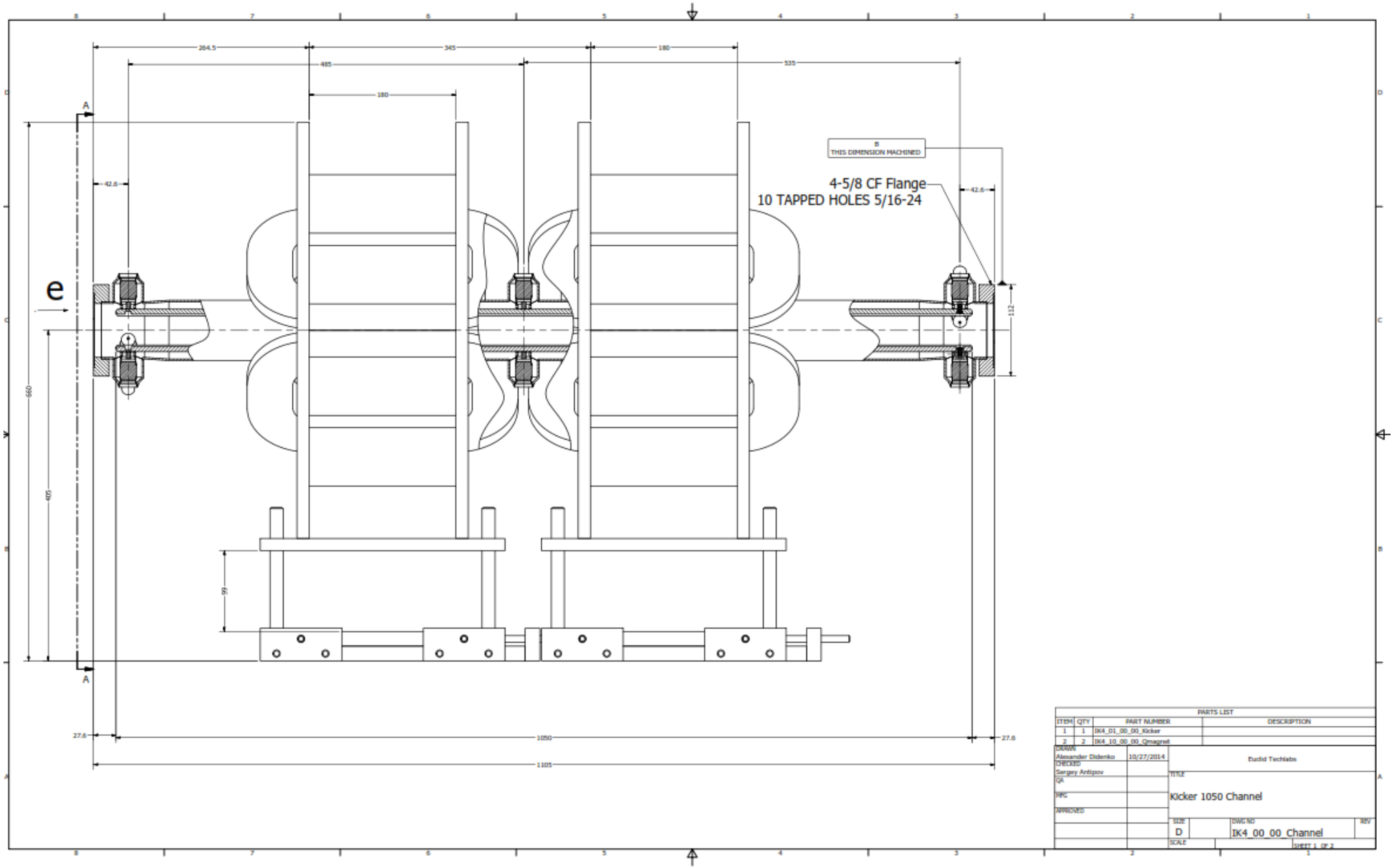
Emittance growth during injection:

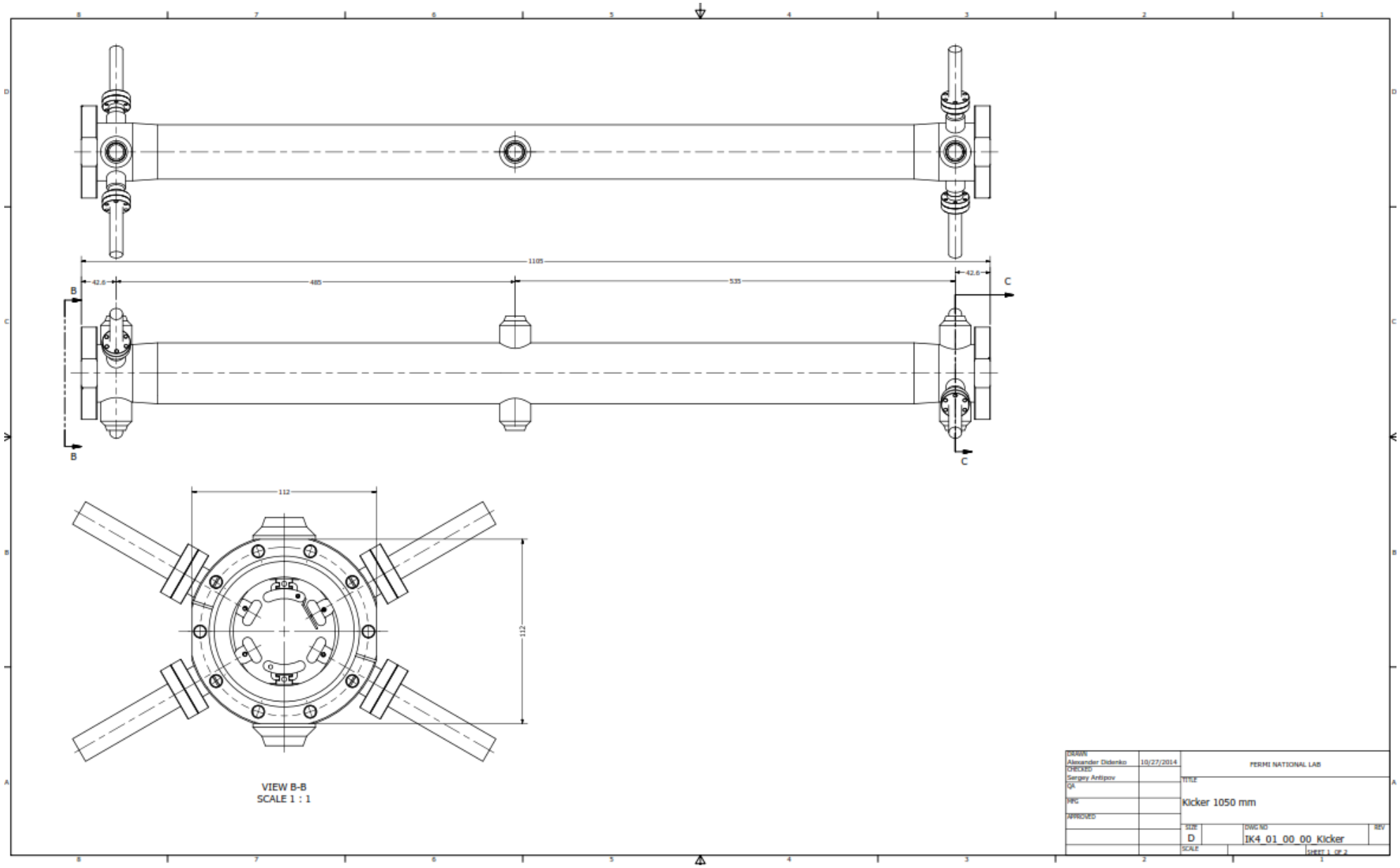
$\Delta\varepsilon_y = \beta_y \langle \delta^2 \rangle \sim \beta_y (\langle \delta_x^{\,2} \rangle + \langle \delta_y^{\,2} \rangle)$, where

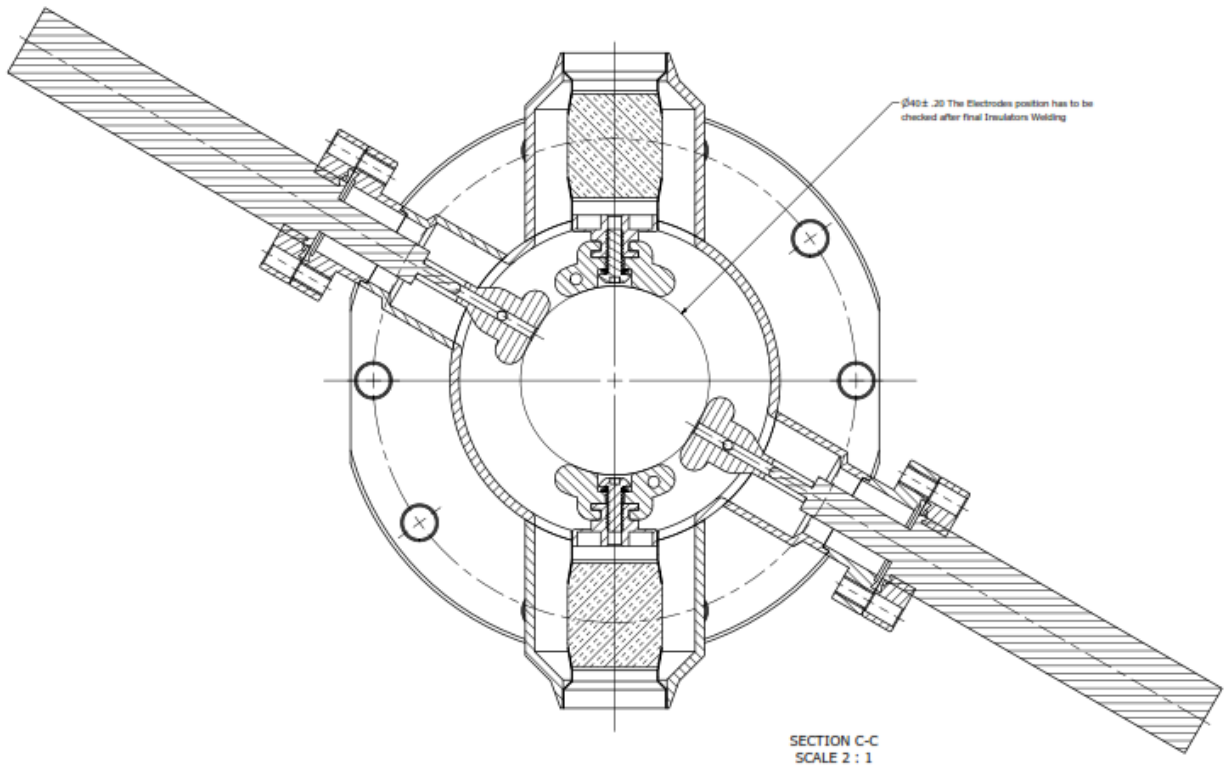
$\langle \delta_x^2 \rangle = \int \delta(x)^2 \rho(x) dx$

$\Delta\varepsilon_{y,RMS} \sim 0.4$mm-mrad, $\Delta\varepsilon_y / \varepsilon_y \sim 0.12$

Drawings

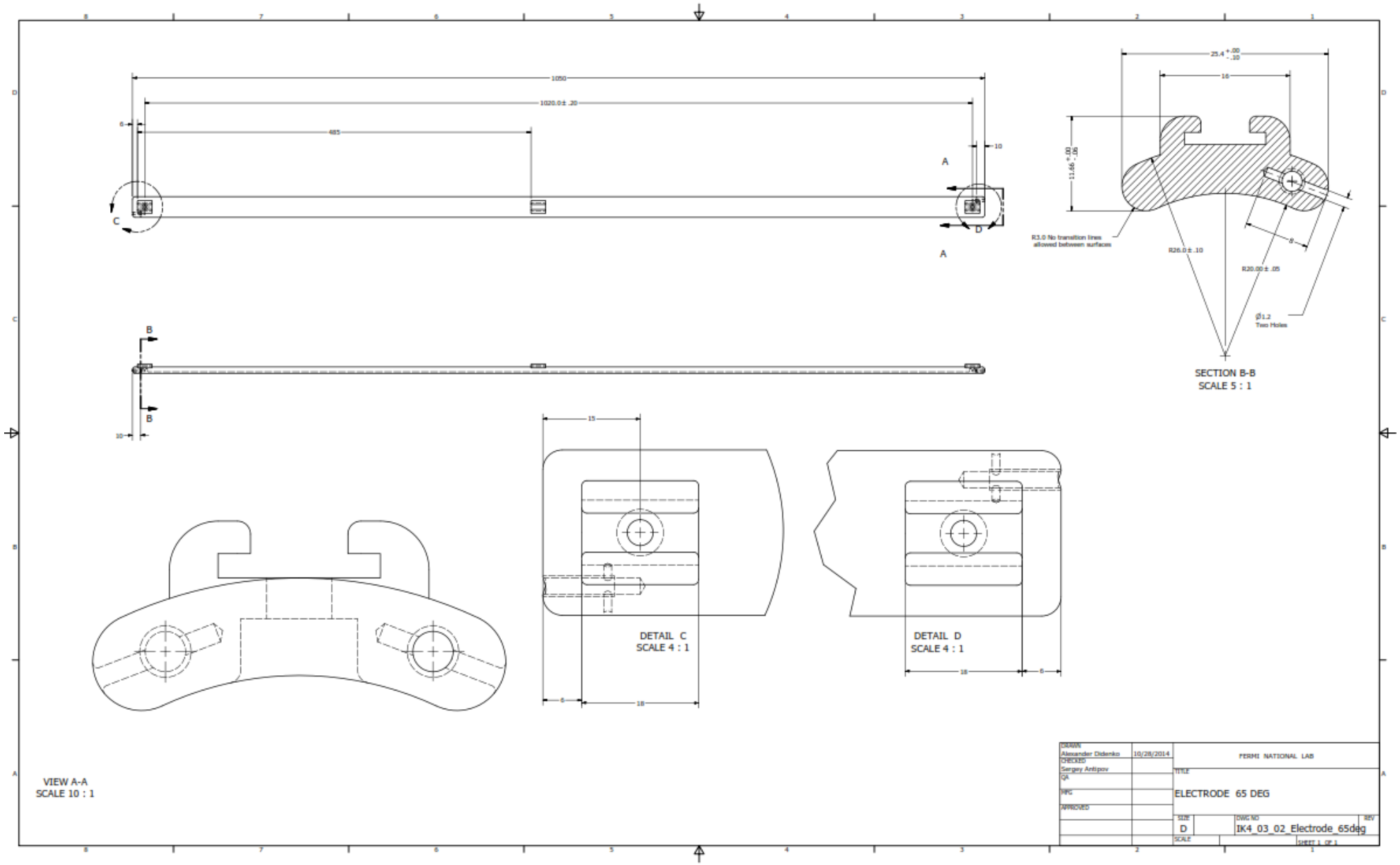

B
THIS DIMENSION MACHINED
4-5/8 CF Flange
10 TAPPED HOLES 5/16-24
e
A
A
264.5
345
180
485
535
180
42.6
42.6
112
660
405
99
27.6
1050
27.6
1105
PARTS LIST
ITEM QTY PART NUMBER DESCRIPTION
1 1 IK4_01_00_00_Kicker
2 2 IK4_10_00_00_Qmagnet
DRAWN
Alexander Didenko 10/27/2014
CHECKED
Sergey Antipov
QA
MFG
APPROVED
Euclid Techlabs
TITLE
Kicker 1050 Channel
SIZE
D
DWG NO
IK4_00_00_Channel
REV
SCALE
SHEET 1 OF 2


1105
42.6
485
535
42.6
B
B
C
C
112
112
VIEW B-B
SCALE 1 : 1
DRAWN
Alexander Didenko
10/27/2014
CHECKED
Sergey Antipov
QA
MFG
APPROVED
FERMI NATIONAL LAB
TITLE
Kicker 1050 mm
SIZE
D
DWG NO
IK4_01_00_00_Kicker
REV
SCALE
SHEET 1 OF 2



SECTION C-C
SCALE 2 : 1

DRAWN Alexander Didenko	10/27/2014	FERMI NATIONAL LAB	
CHECKED Sergey Antipov			
QA			
MFG		TITLE Kicker 1050 mm	
APPROVED			
		SIZE D	DWG NO IK4_01_00_00_Kicker REV
		SCALE	SHEET 2 OF 2


1050
1020.0± .20
485
6
10
A
C
D
A
B
B
10
25.4 +.00 -.10
16
11.66 +.00 -.06
R3.0 No transition lines allowed between surfaces
R26.0 ± .10
R20.00 ± .05
8
Ø1.2
Two Holes
SECTION B-B
SCALE 5 : 1
15
6
18
DETAIL C
SCALE 4 : 1
18
6
DETAIL D
SCALE 4 : 1
VIEW A-A
SCALE 10 : 1
DRAWN
Alexander Didenko
10/28/2014
CHECKED
Sergey Antipov
QA
MFG
APPROVED
FERMI NATIONAL LAB
TITLE
ELECTRODE 65 DEG
SIZE
D
DWG NO
IK4_03_02_Electrode_65deg
REV
SCALE
SHEET 1 OF 1

Thank you