Superconducting LINAC for RIB

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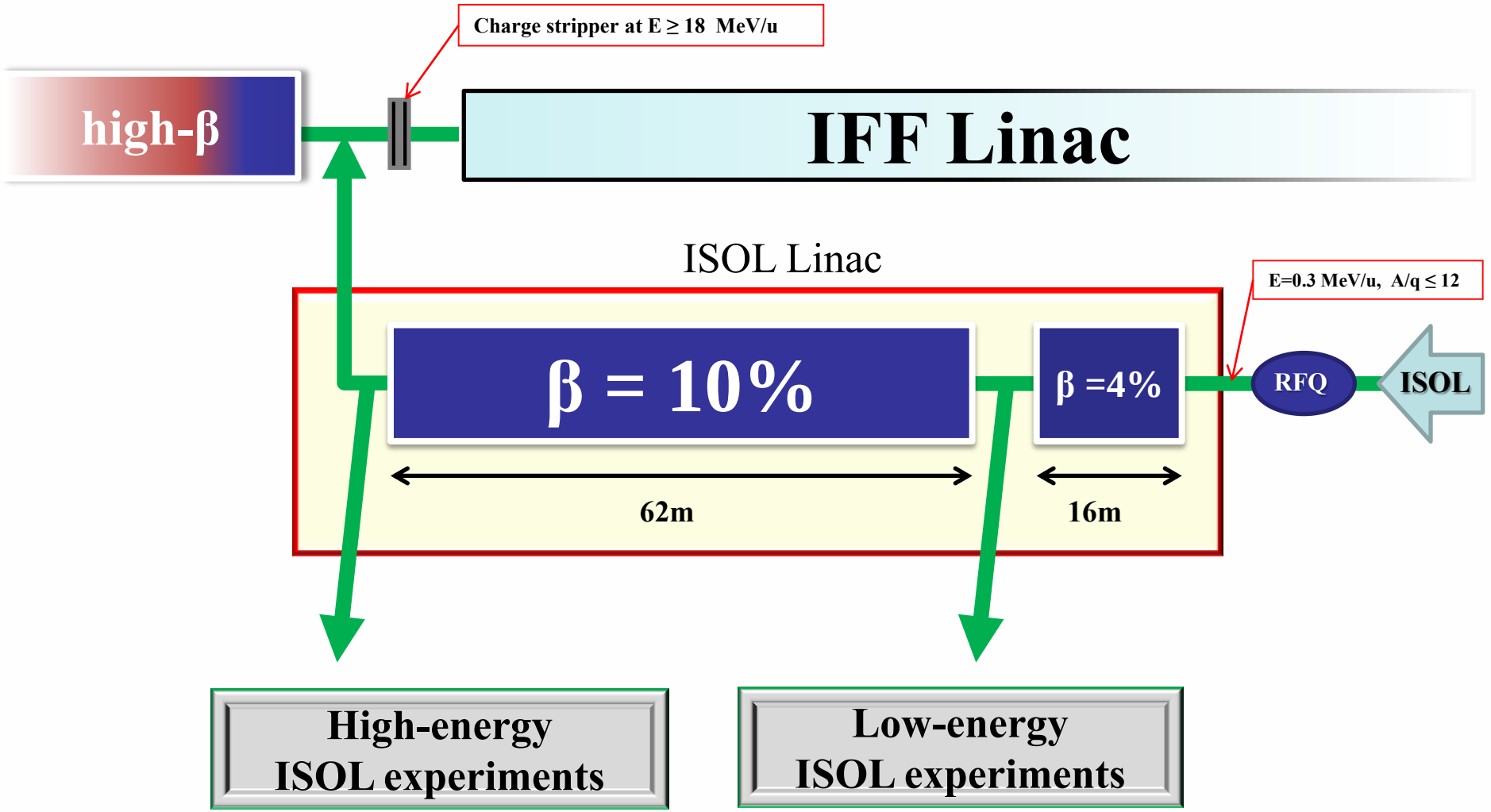
Layout of KoRIA Project

Unique Origin
Unique Future



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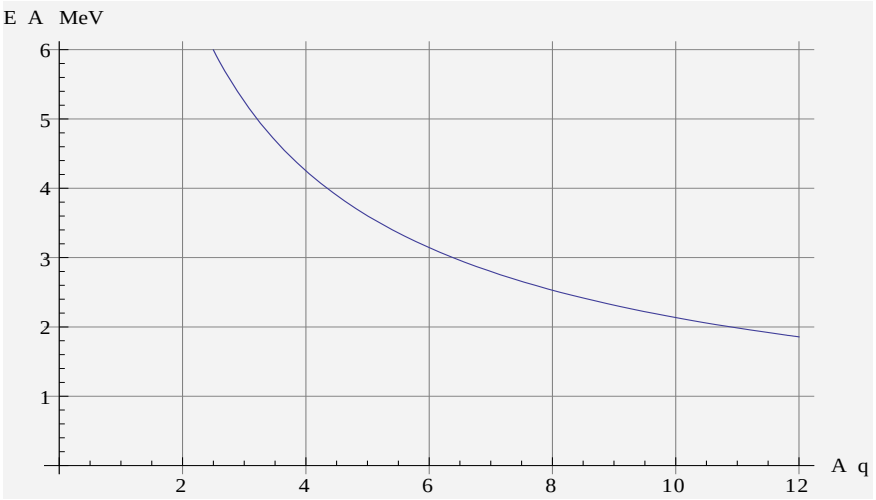
ISOL Linac Design Goals

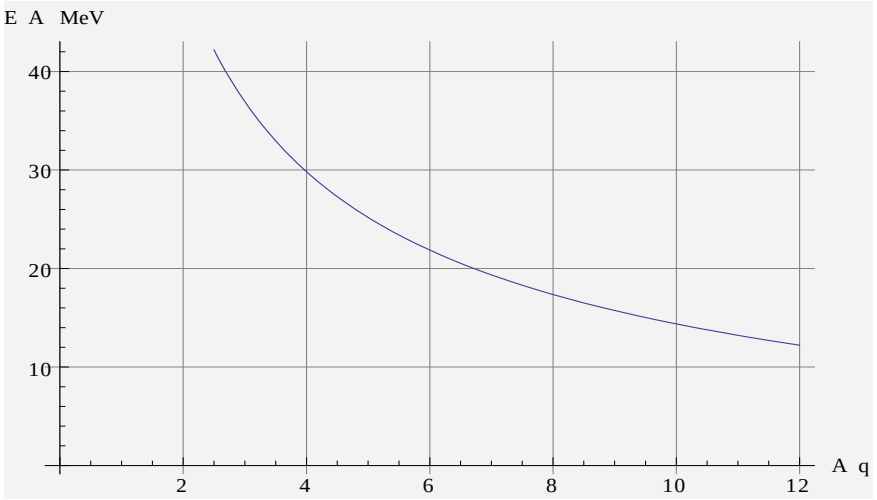
Beam energy :

- Input from RFQ: E = 0.3 MeV/u, for A/q ≤ 9
- for injection to ch. stripper: **E ≥ 18 MeV/u, for A/q ≤ 7.5**
- for low-energy ISOL exp.: E ≥ 1.8 MeV/u, for A/q ≤ 9(see below fig.)
- for high-energy ISOL exp.: E ≥ 12 MeV/u, for A/q ≤ 9(see below fig.)

Beam energy at beam ports (E/A [MeV] w.r.t A/q)



Low-E ISOL exp.



High-E ISOL exp.

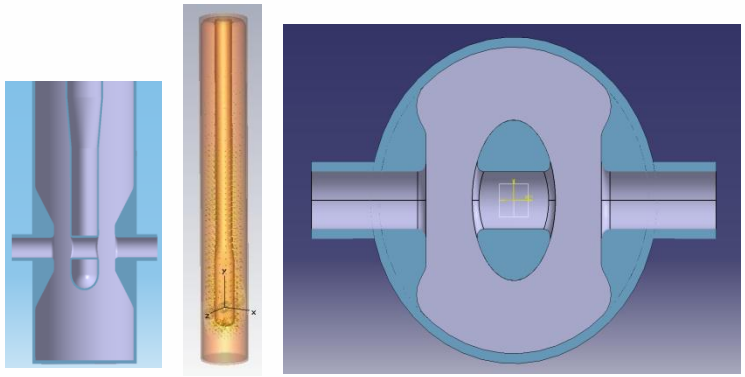
Cf) Available beam energy: From ~0.2 MeV/u to the above curves

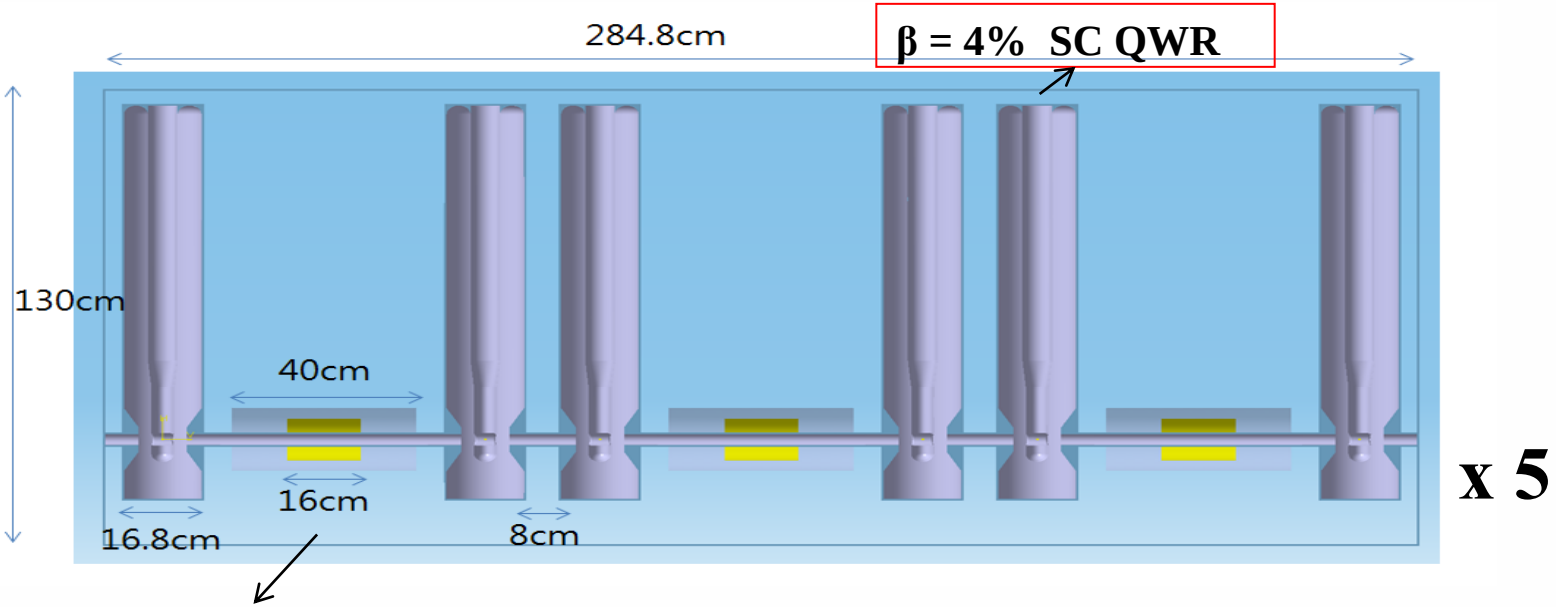
ISOL Linac Details

- Frequency = 70 MHz
- Energy for charge stripper (of IFF Linac) ≥ 18 MeV/u
- Max. A/q value: 9
- Both CW and pulsed mode
- Consists of
  - ✓ 2 kinds of SC quarter wave resonators (QWRs)
  - ✓ SC solenoids as focusing elements
  - ✓ Operating temperature: T=4.5 K

Cryostats and Cavity design

β = 4% SC QWR





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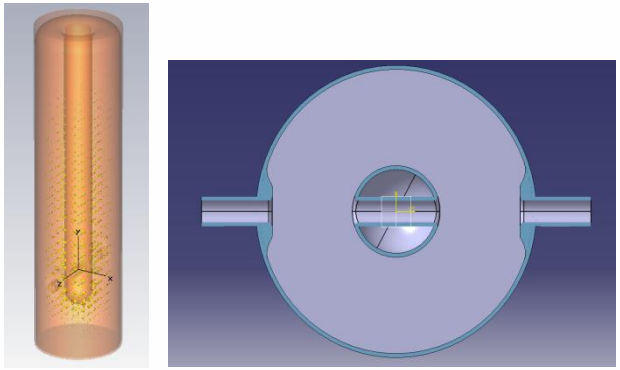
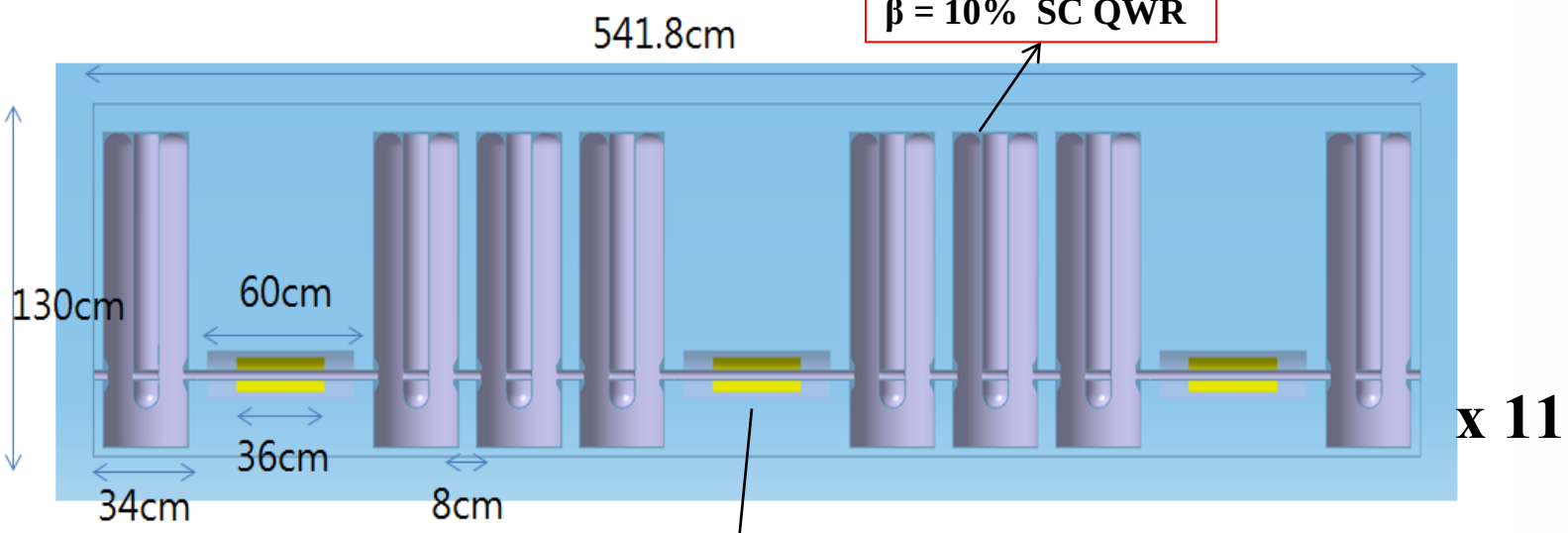
Cryostats and Cavity design

β = 10% SC QWR





x 11

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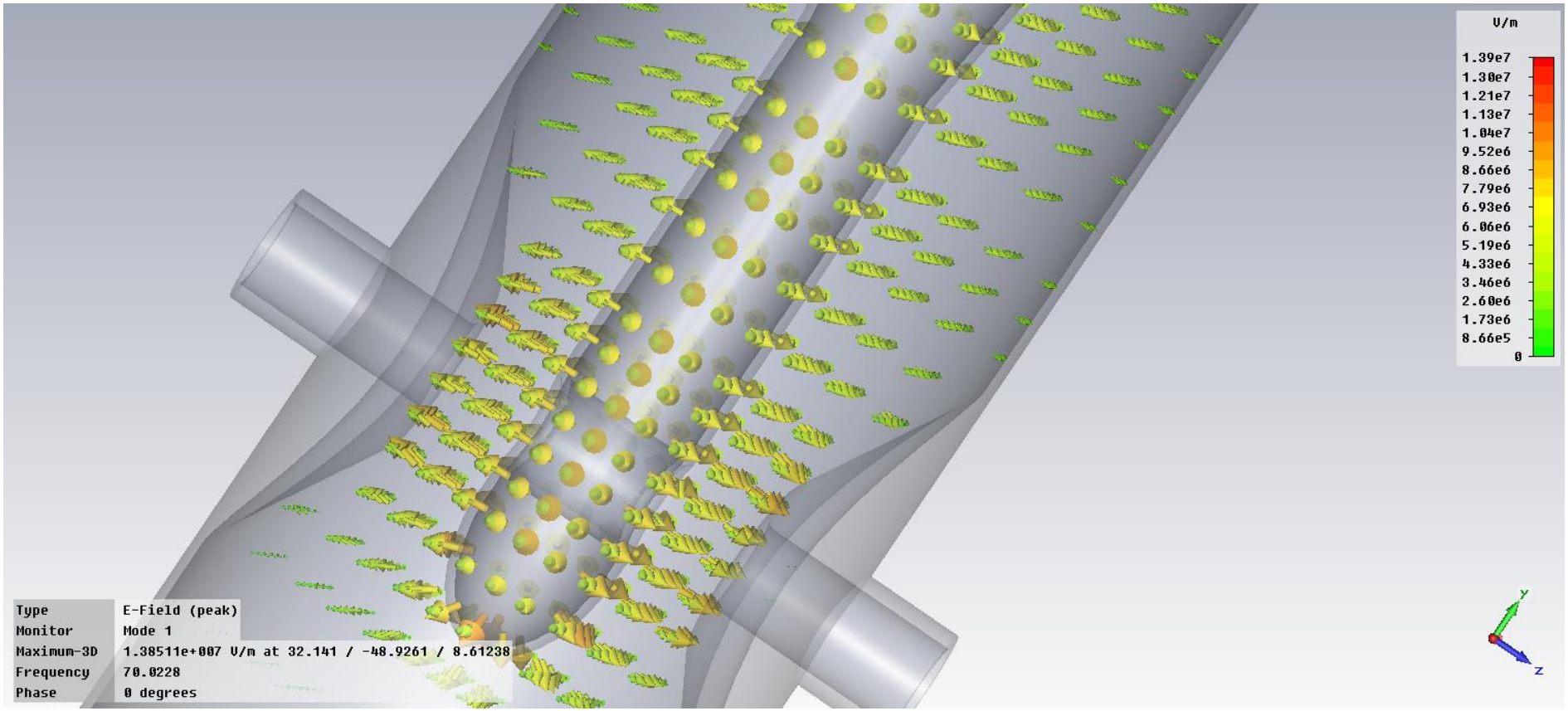
Optimizing Cavity Properties



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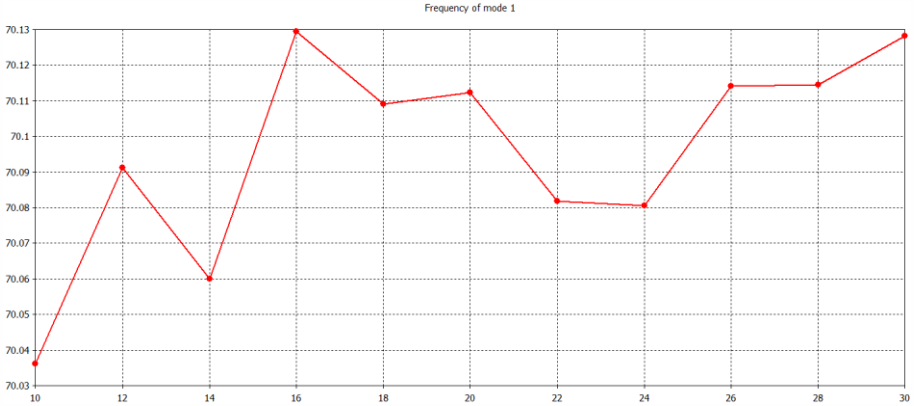
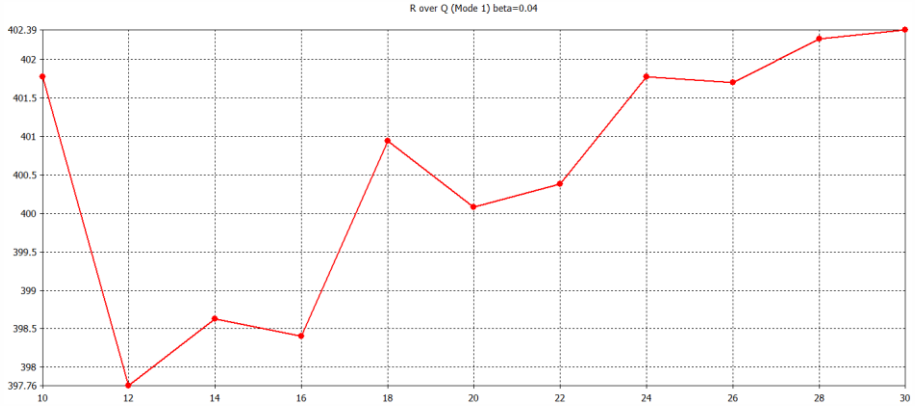
Optimizing Cavity Properties

Optimizing Cavity Properties with sweeping parameters

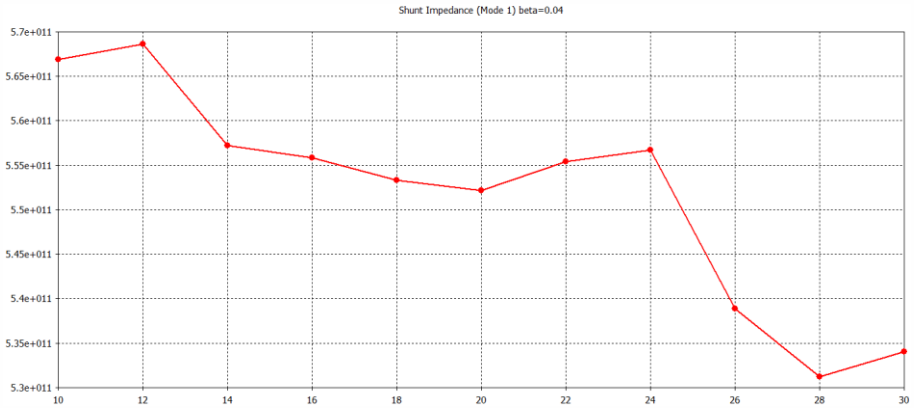
Frequency



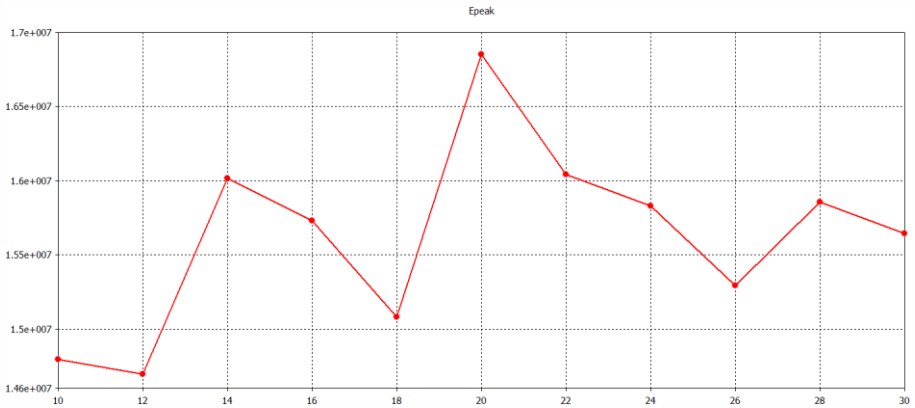
R / Q



Q-factor



Epeak



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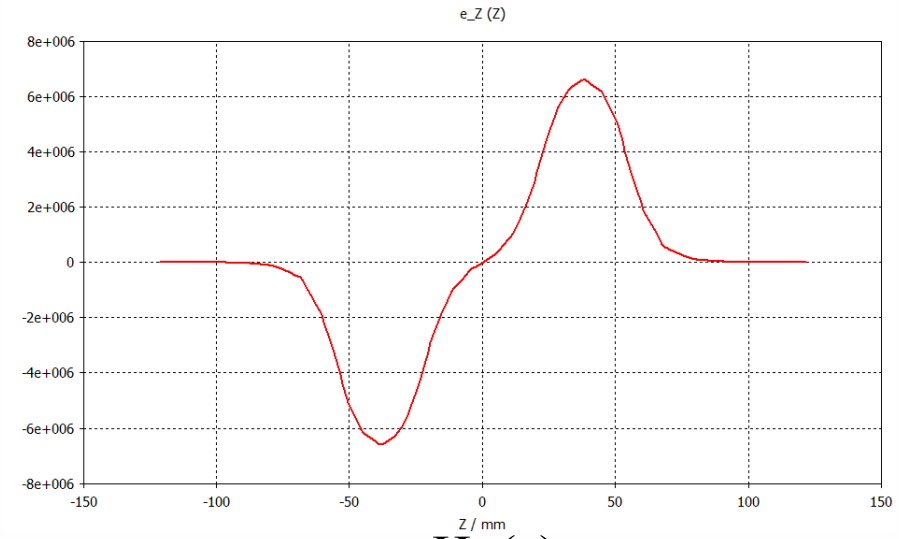
Specs of QWRs

	β = 4%	β = 10%
β_{opt}	3.9%	10.0%
L (diameter of O.C)	168 mm	340 mm
V_0 (Input)	0.9 MV	2.0 MV
E_p	30.8 MV/m	33 MV/m
$E_0 = V_0/L$	5.36 MV/m	5.88 MV/m
T_{opt}	0.87	0.89
Q_0 (@ R=10 nΩ)	1.4×10^9	2.8×10^9
Q_0 (@ R=20 nΩ)	0.7×10^9	1.4×10^9
P_{diss}(@ R=10 nΩ)	1.1 Watt	2.2 Watt
P_{diss}(@ R=20 nΩ)	2.2 Watt	4.4 Watt
R/Q (with TTF included)	412 Ω	510 Ω

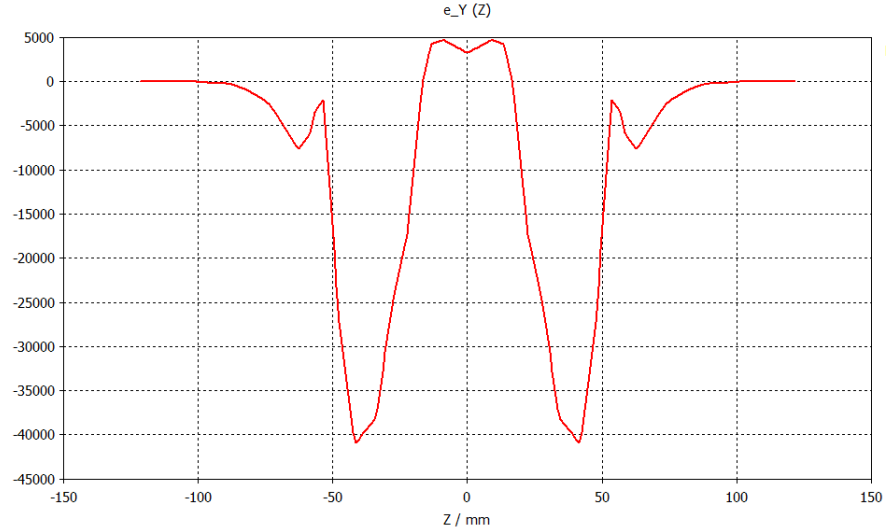
Dipole steering

Unique Origin
Unique Future

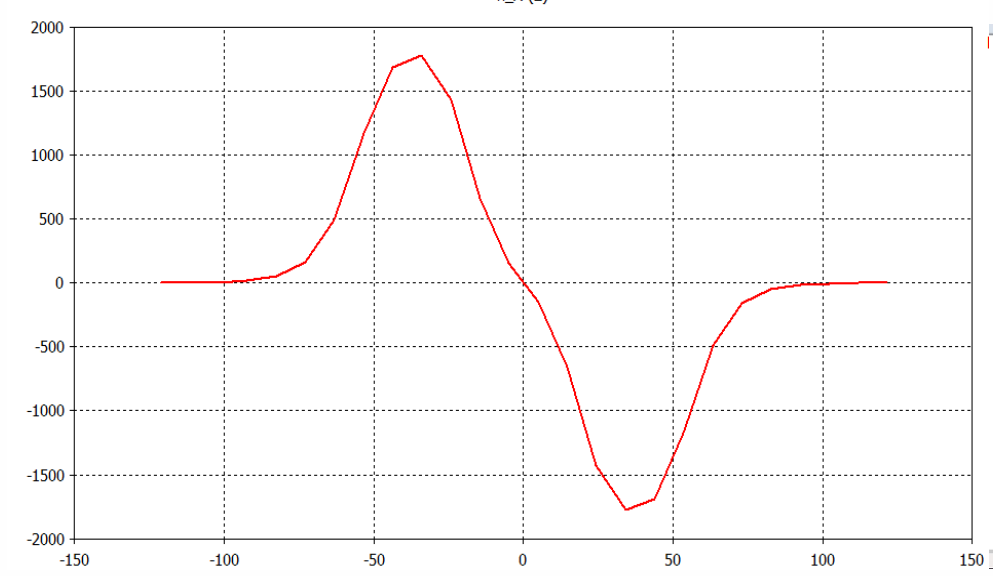
Ez(z)



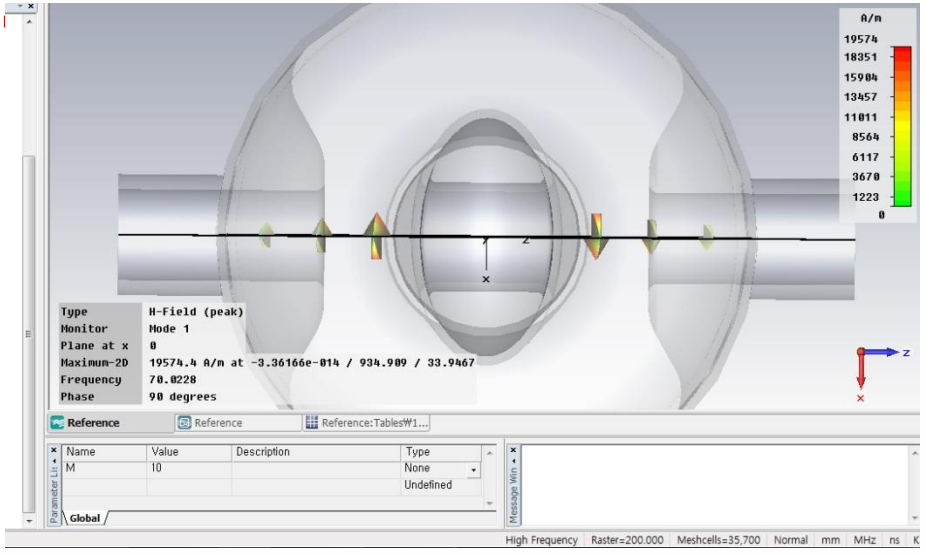
Ey(z)



Hx(z)

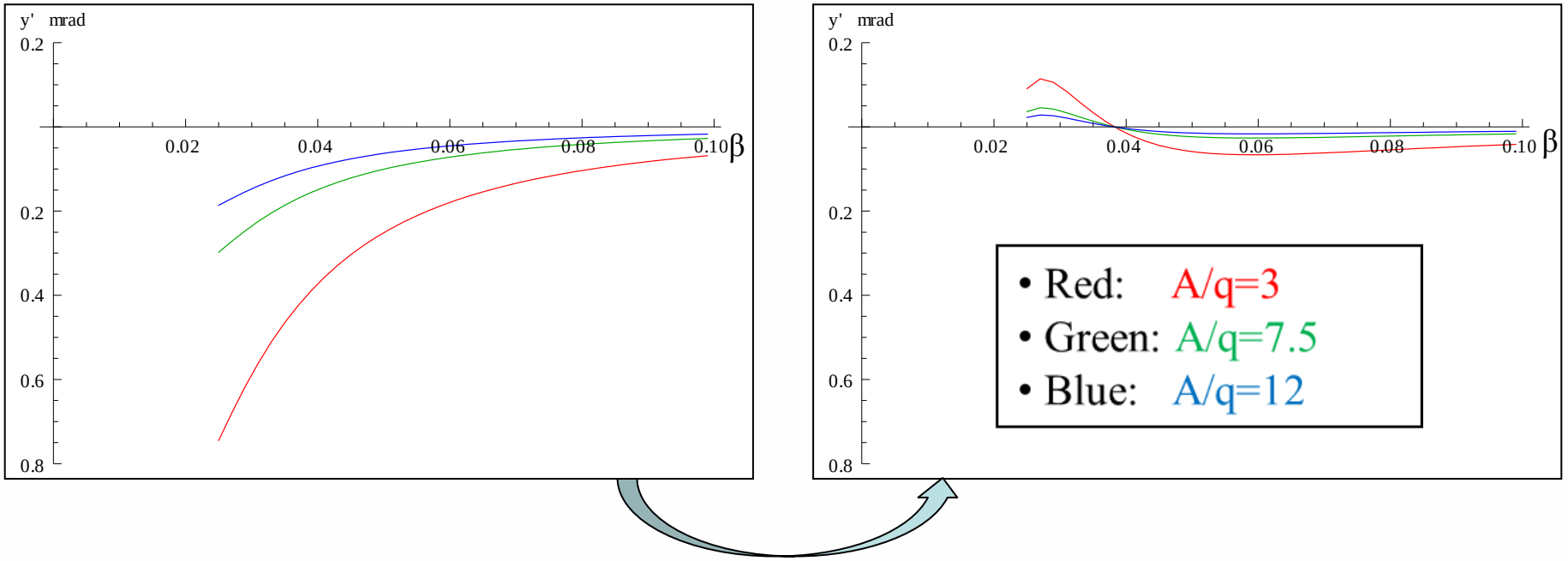


B-field (y=0 plane)



Dipole steering of β=4% QWR

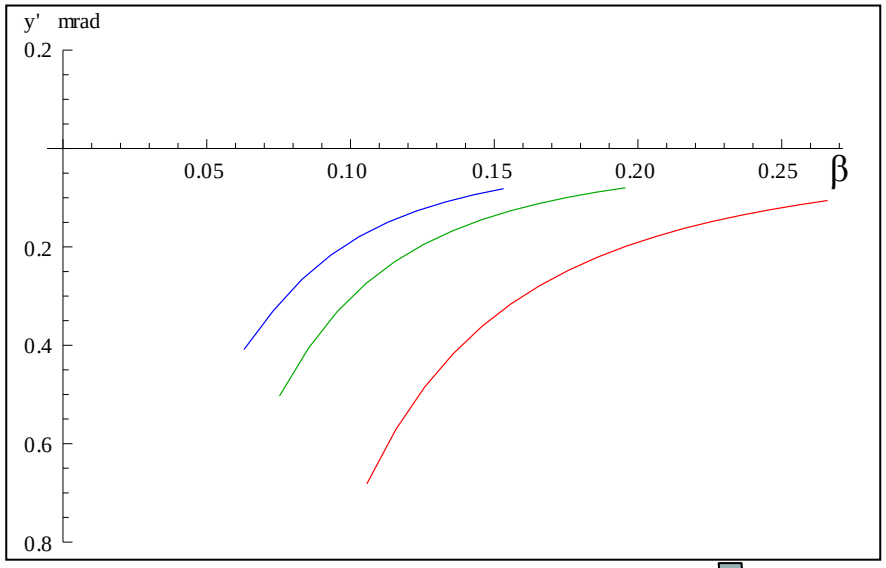
Steering: $\Delta y'$ [mrad]

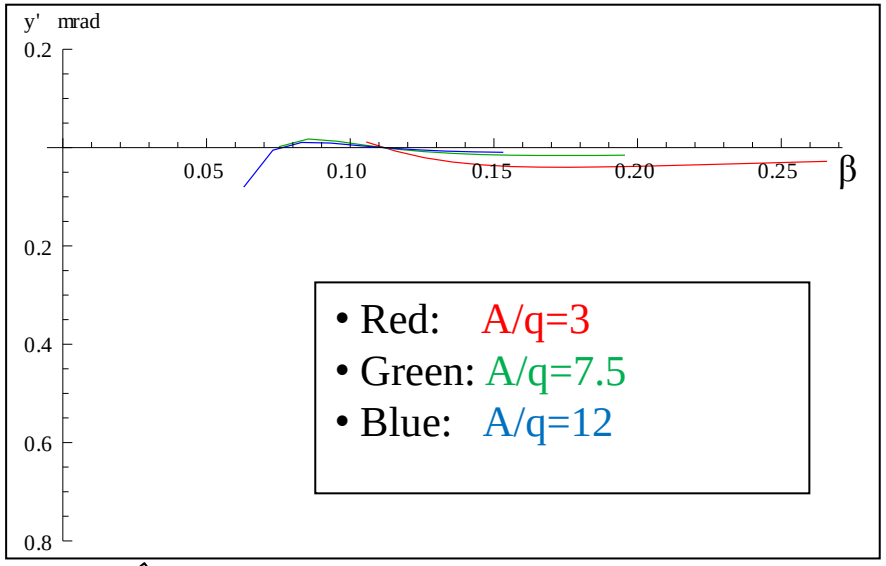


By shifting beam axis 0.2 mm upward, steering reduced to within 0.1 mrad

Dipole steering of β=10% QWR

Steering: $\Delta y'$ [mrad]





By shifting beam axis 2.6 mm upward, steering reduced to 0.1 mrad.

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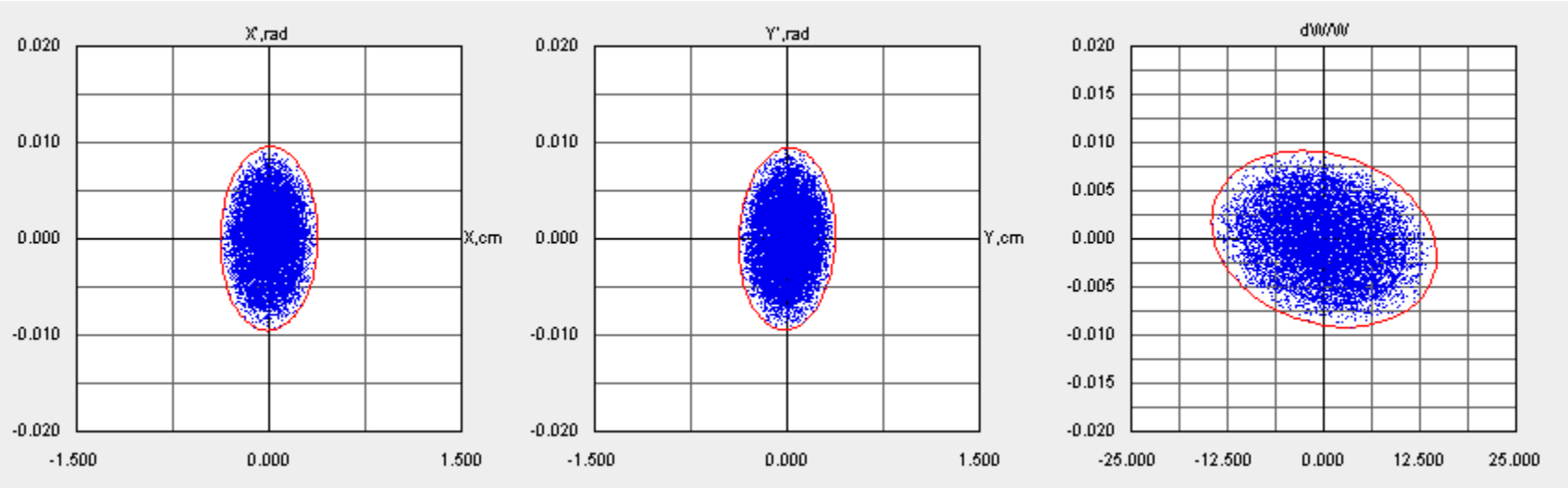
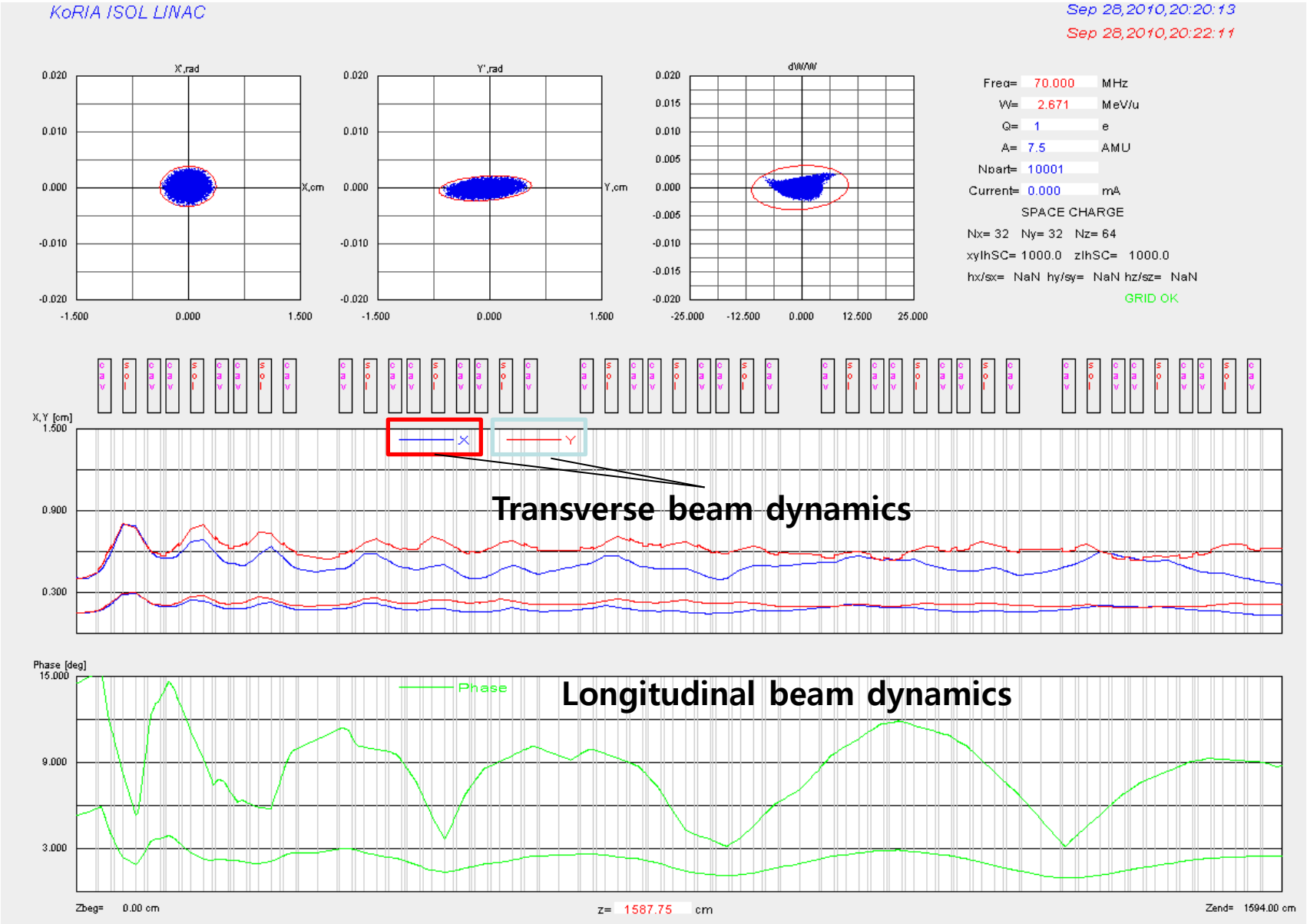
TRACK simulation

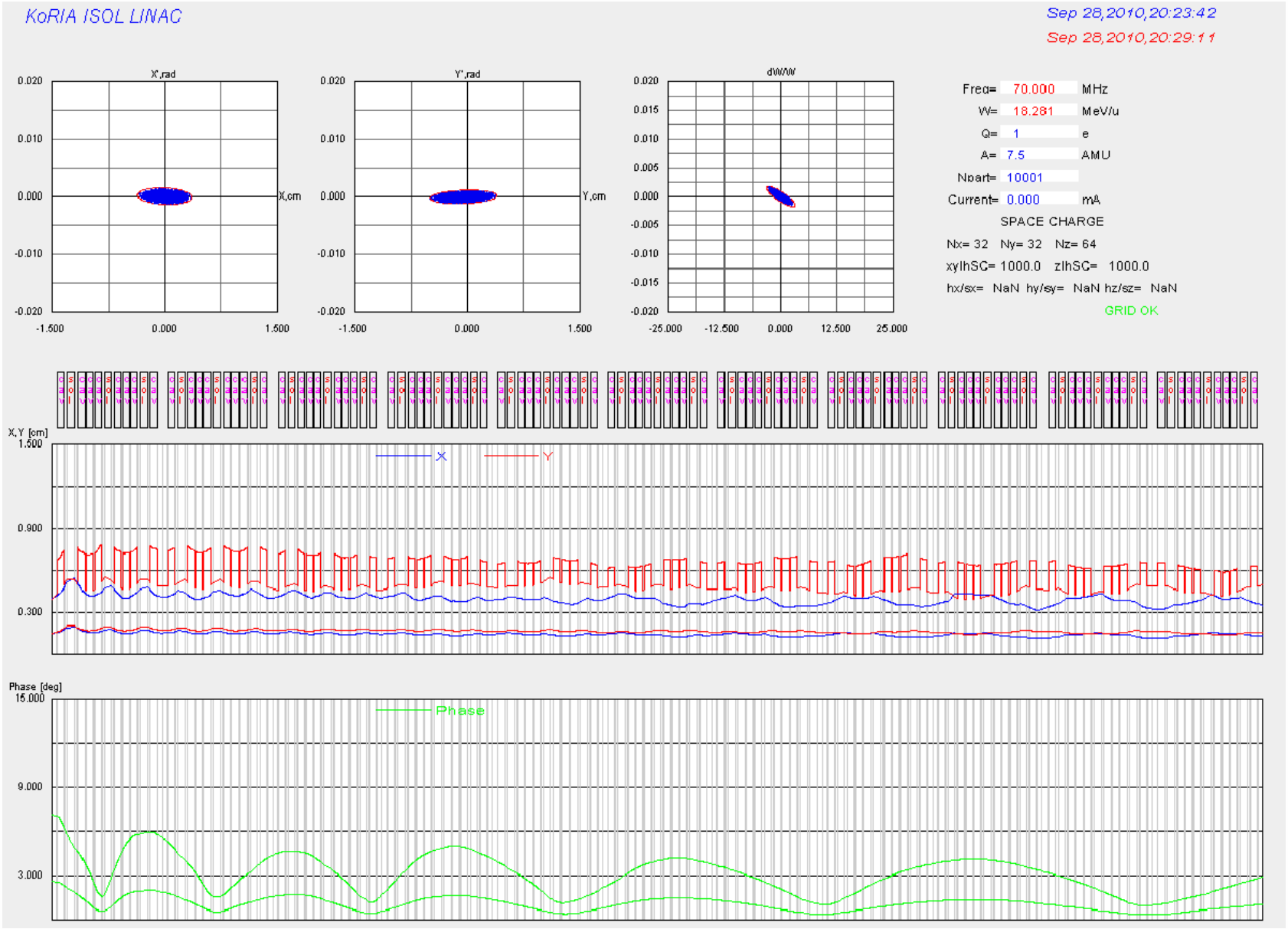
- We simulated for the cases of A/q=7.5
- Input beam parameters
  - $\alpha_x = \alpha_y = 0.12$, $\beta_x = \beta_y = 0.49$ mm/mrad
  - $\varepsilon_{nx} = \varepsilon_{ny} = 0.12$ mm*mrad (rms, normalized)
  - $\alpha_z = 0.2$, $\beta_z = 20.85$ deg/KeV/u, $\varepsilon_z = 5.4$ deg KeV/u



Low-energy part for A/q= 7.5



High-energy part for A/q= 7.5



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Thank You