BEAM DYNAMICS INVESTIGATION FOR A NEW PROJECT OF COMPTON BACK SCATTERING PHOTON SOURCE AT NRNU MEPhI

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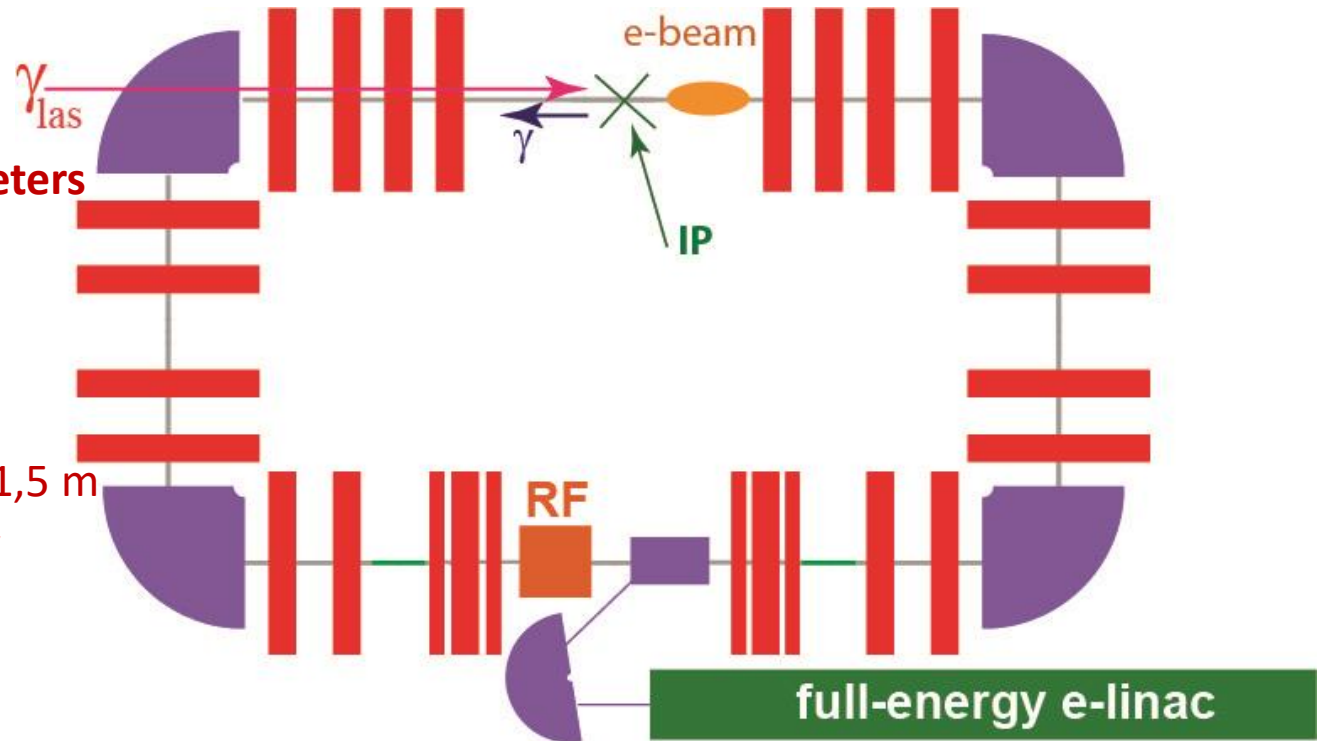contact: vsdyubkov@mephi.ru

COMPACT RING-BASED LIGHT SOURCE

Required e-beam parameters

$\varepsilon_{x,rms}$ = 100 nm

$\sigma_{x,rms}$ = 30 um
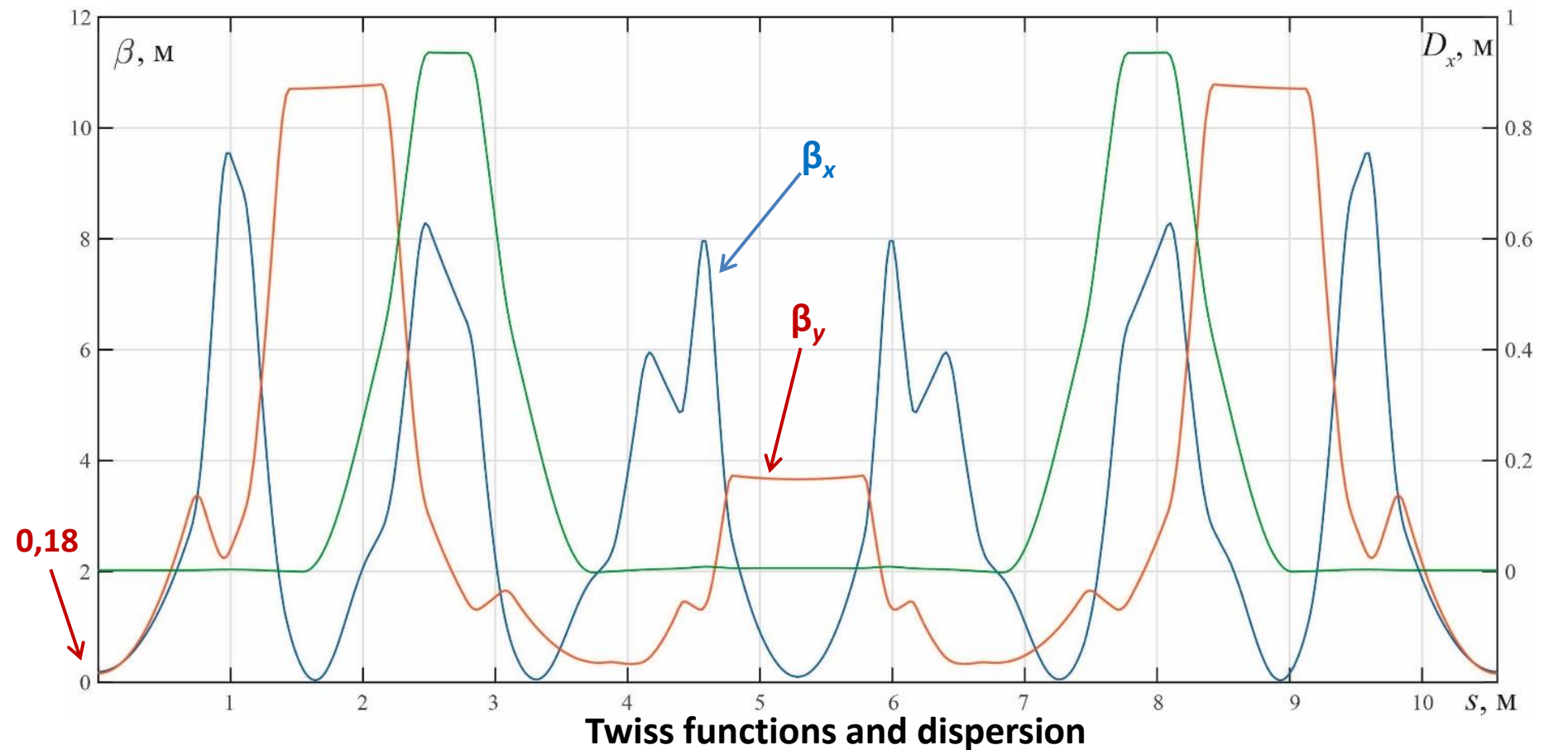
Straight section length > 1,5 m
Beam energy: 20-60 MeV

$$\beta_x = \frac{\sigma^2_{x,rms}}{\varepsilon_{x,rms}} \implies \text{30 cm}$$

$$\sigma^2_{x,rms} = \beta_x \varepsilon_{x,rms} + D_x^2\left[(p - p_0)/p_0\right] \implies D_x = 0$$

Twiss functions and dispersion

Momentum compactification factor - **0,0671**

frequency - **4,1** MHz

circumference - **10,568** m

ν_x = **3,545**; ν_y = **4,931**
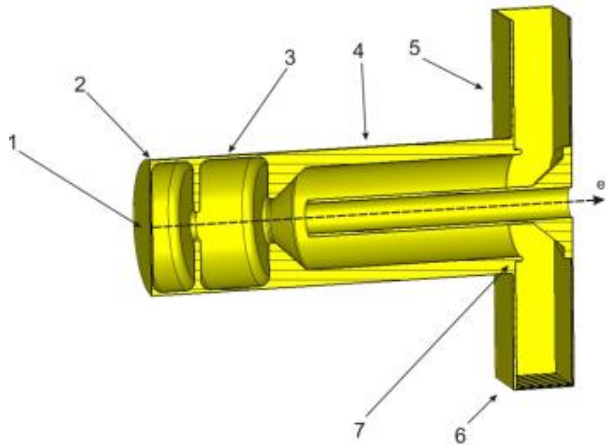
ξ_x = **-12,564**; ξ_y = **4,937**

@ 60MeV
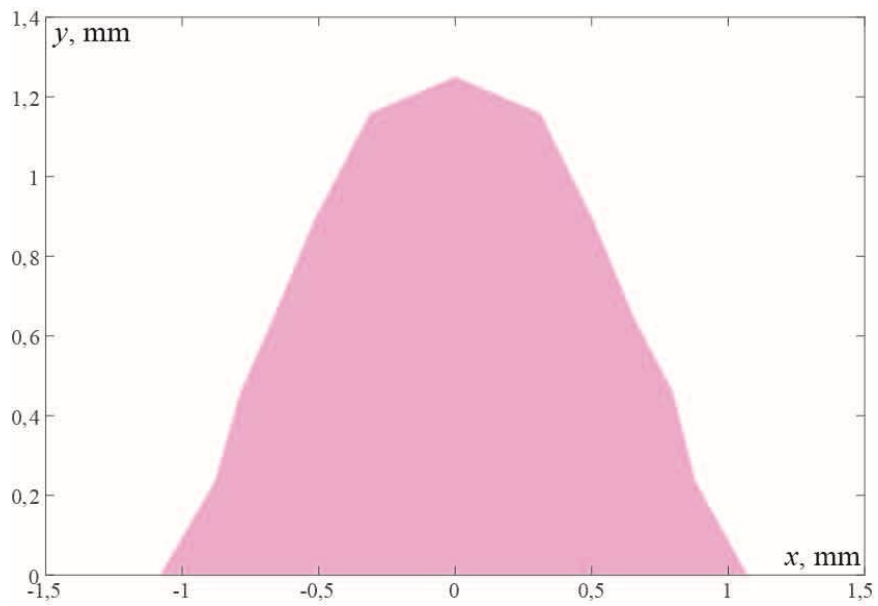
Dynamic aperture
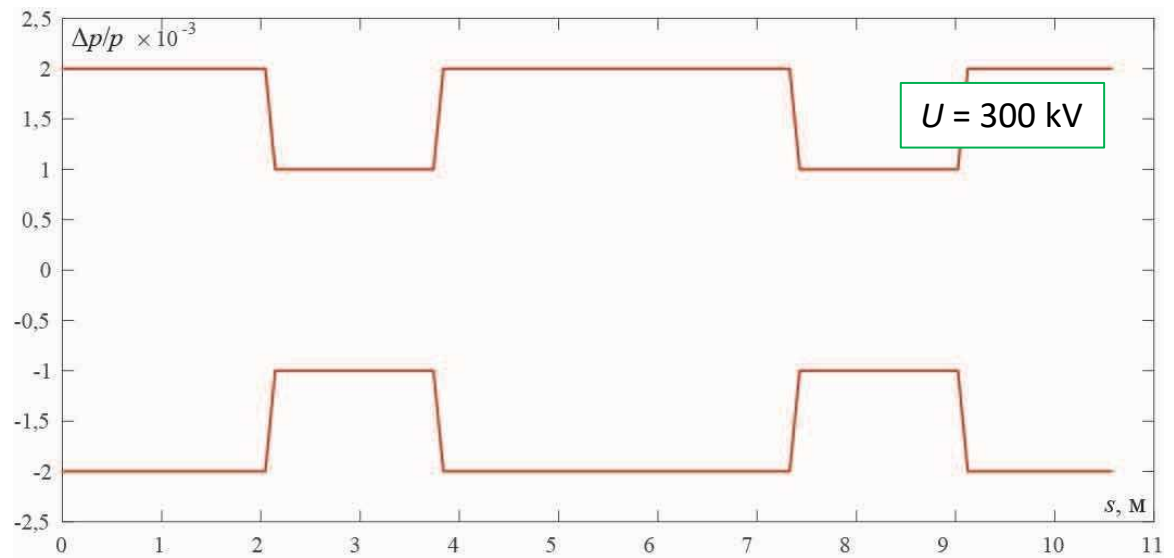
Momentum acceptance

LINAC INJECTOR
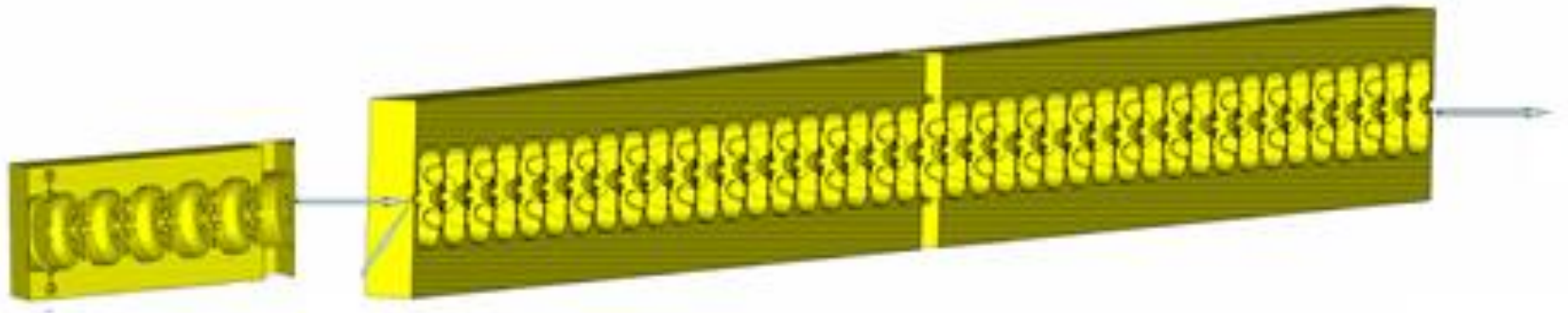
| Cells	E, kV/cm	ϕ_{inj}	W_{max}, MeV	$\Delta W/W$, %
3.5	600	2.0	6.2	1.8
5.5	600	2.7	8.1	0.9
5.5	700	2.8	8.2	1.2

S.M. Polozov, V.I. Rashchikov, M. Krasilnikov. An Improved Model for Photoemission of Space Charge Dominated Picosecond Electron Bunches: Theory and Experiment. IPAC-2021, ID: 1089

Second linac section: BAS (*L* = 2,1 m, 40 accelerating cells, RF field gradient is 400 kV/cm: RF power supply is 20 kW), energy gain is about 45 MeV
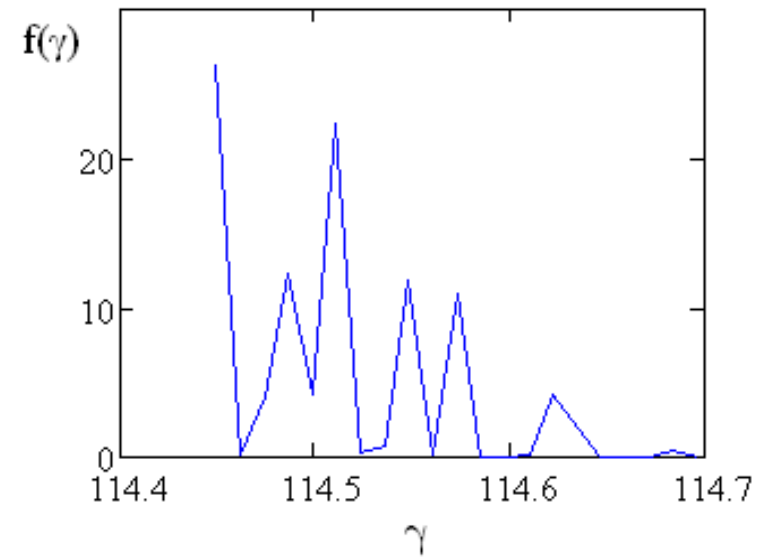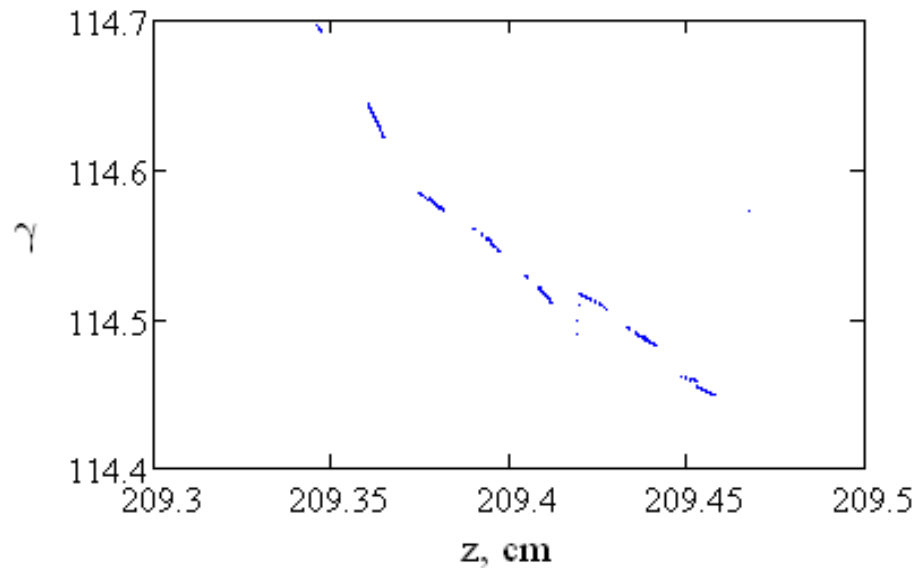
Particle distribution in longitudinal phase space and energy spectrum of electrons (duration 1 ps) after 5.5-cell-photogun and BAS

Thank you for attention