Motivation

The PIZT facility experience with the RF photoinjector gun operation revealed some problems which have to be explored:

- Non-optimum machine parameters: experiment setup simulations
- Beam asymmetry studies
- Possible origins of e-beam asymmetry

The layout of the gun setup at PIZT

There are a few possible causes of the beam asymmetry:

- A) Design error (y difference between default (-1 mm) and asymmetric (2 mm) setups)
- B) RF coupler field asymmetry
- C) Solenoid imperfections

Possible origins of e-beam asymmetry

Electromagnetic fields and particle tracking simulations

Air field simulations for the full gun geometry (the gun cavity with RF coupler) RF field simulations of the full gun geometry revealed field asymmetry in the solenoid region. The field asymmetry can propagate to the electron beam motion plane. The transverse charge distribution is a reasonable approximation for the beam asymmetry.

Particle tracking simulations showed that the RF field asymmetry has an influence on the electron beam dynamics.

Beam asymmetry modeling by a rotational quadrupole

The method of the beam asymmetry compensation is described by a rotational quadrupole.

Design of compensating quadrupoles for the gun

The rotational beams asymmetry can be studied by a rotational quadrupole allowed to make a design and produce compensating gun quadrupoles.

Experiments with the gun quadrupole (with the 2nd design of the quadrupole)

The usage of the normal and skew quadrupoles combination allows to make much beams asymmetry compensation.

Other experiments

Some transverse experiments are aimed to provide an additional source of the beam asymmetry. The presented experiments eliminated some cause about asymmetry of the beam asymmetry.

Experiments as a beam acceleration & forward power

The idea of the experiment is to ensure only weak RF power in the cavity for the beam acceleration & forward power.

Experimental goal

- Demonstrate reduction of the beam asymmetry
- Observation of the beam asymmetry in the beam energy

Optical measurements

- Use cathetometer angular precision better than 0.1 mrad
- Measure the beam size, divergence, and angle of attack

Conclusion:

- The beam asymmetry is reduced
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