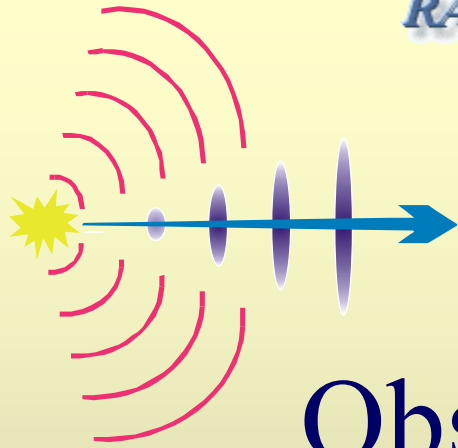


*RADIATION from RELATIVISTIC ELECTRONS
in PERIODIC STRUCTURES*



Observation of Relativistic Electrons Deflection by a Bunch Coulomb Field


G. Naumenko, Yu. Popov, M. Shevelev

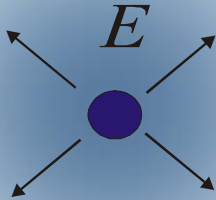
**Tomsk Polytechnic University
2011**

From the cycle of semi-bare electron investigations

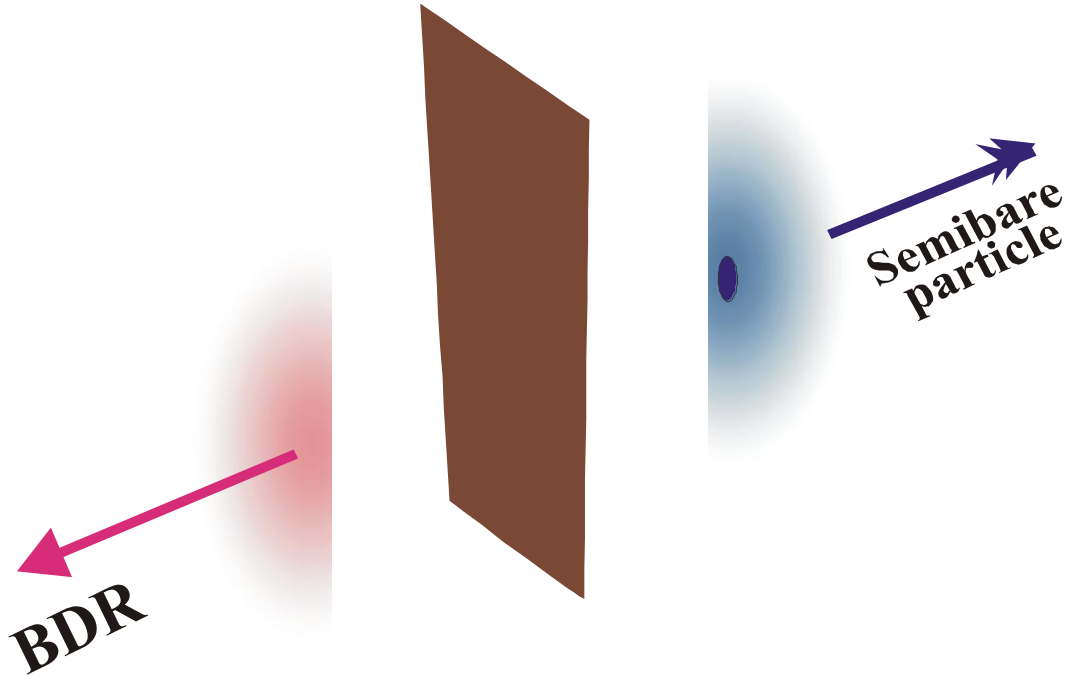
Relativistic particle field in interaction with conductive screen

Axial symmetry

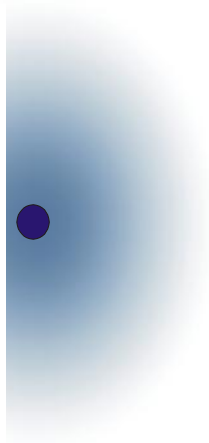
$\gamma \ll 1$  *Pseudo-photon
viewpoint is applicable*



Not any deflection

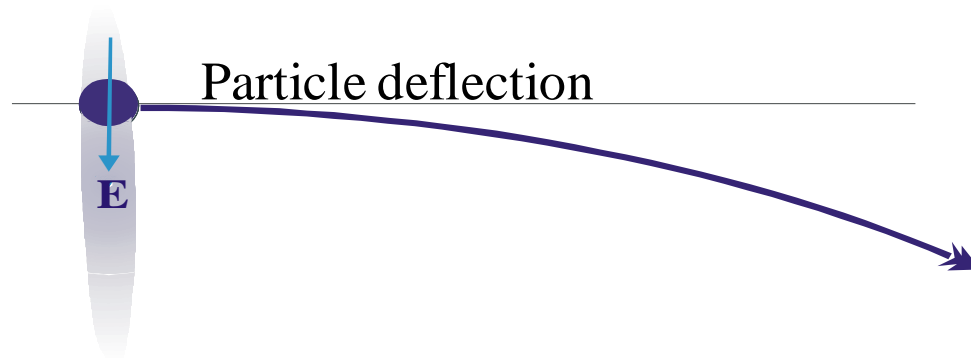


Unstable state



Field redistribution

The particle is in a region of nonzero field



For single electron the deflection is negligible, but for bunch with population 10^8 this effect is estimated to be observable.

Experiment

Tomsk microtron

Beam parameters

Electron energy **6.1 MeV**

Macro-pulse duration **4~5 ms**

Pulse repetition rate **1~8 Hz**

Micro-pulse length **$\sigma \approx 2.3 \text{ mm}$**

Electrons number per

micro-pulse $\approx 10^8$

Micro-pulses number

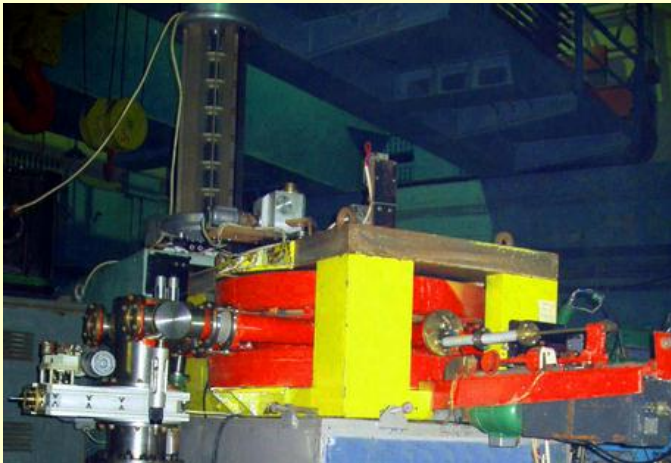
per macro-pulse $\approx 10^4$

Beam size at the output $\sigma \approx 4 \times 3 \text{ mm}^2$

Emittance of extracted beam:

horizontal $3.2 \cdot 10^{-2} \text{ mm} \times \text{rad}$

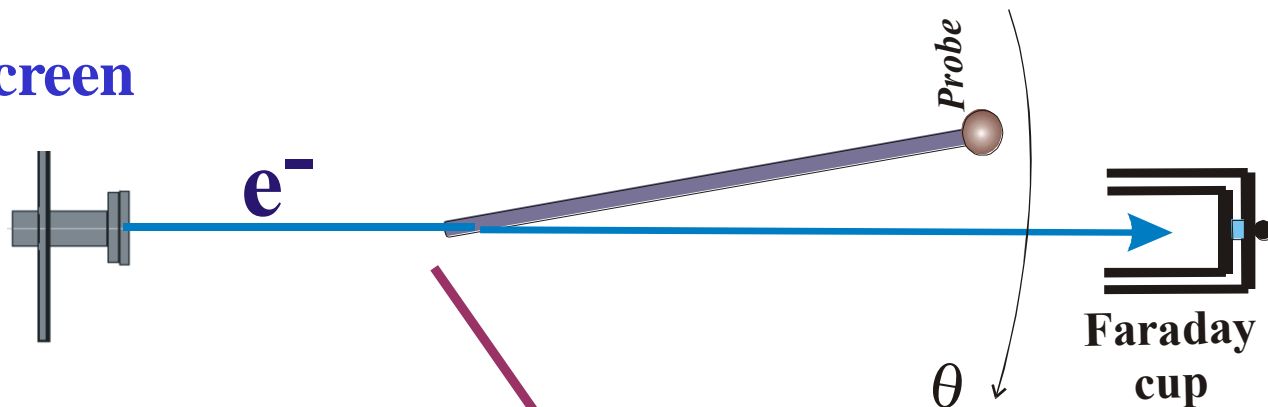
vertical $2.8 \cdot 10^{-2} \text{ mm} \times \text{rad}$



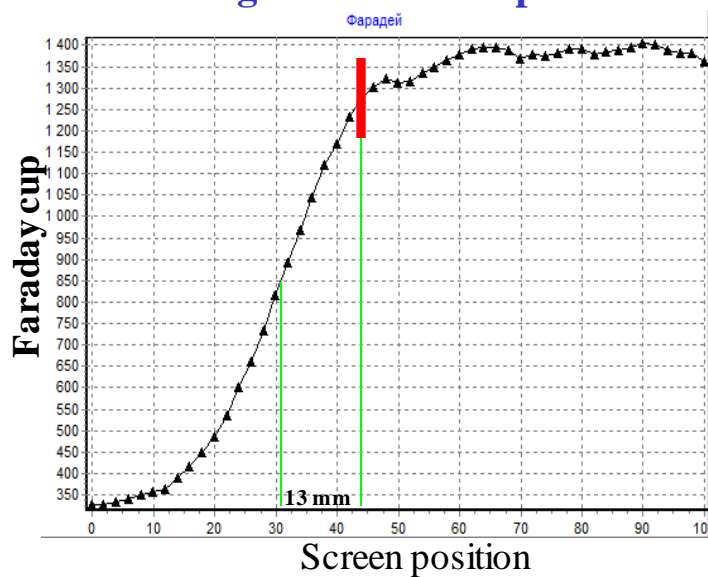
Experimental setup and methodic

Angular beam profile measurements

right screen

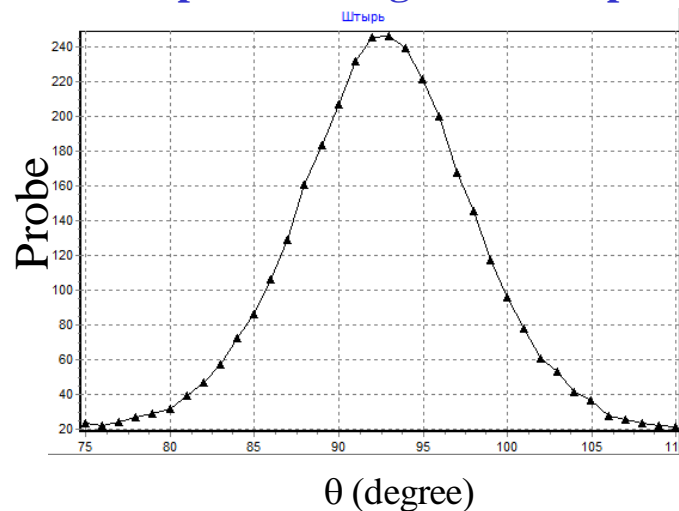


Choosing of the screen position

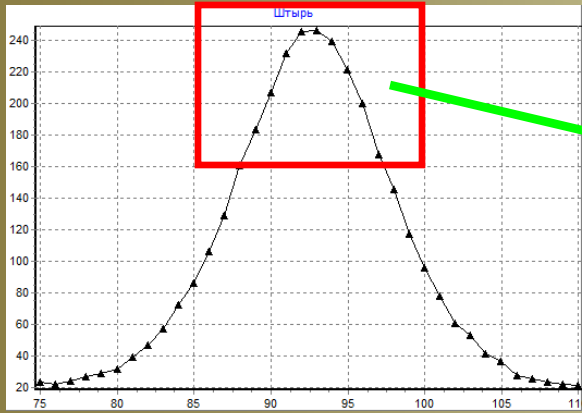


Screens are inclined to exclude an influence of the BDR on the electron beam

Sample of an angular beam profile



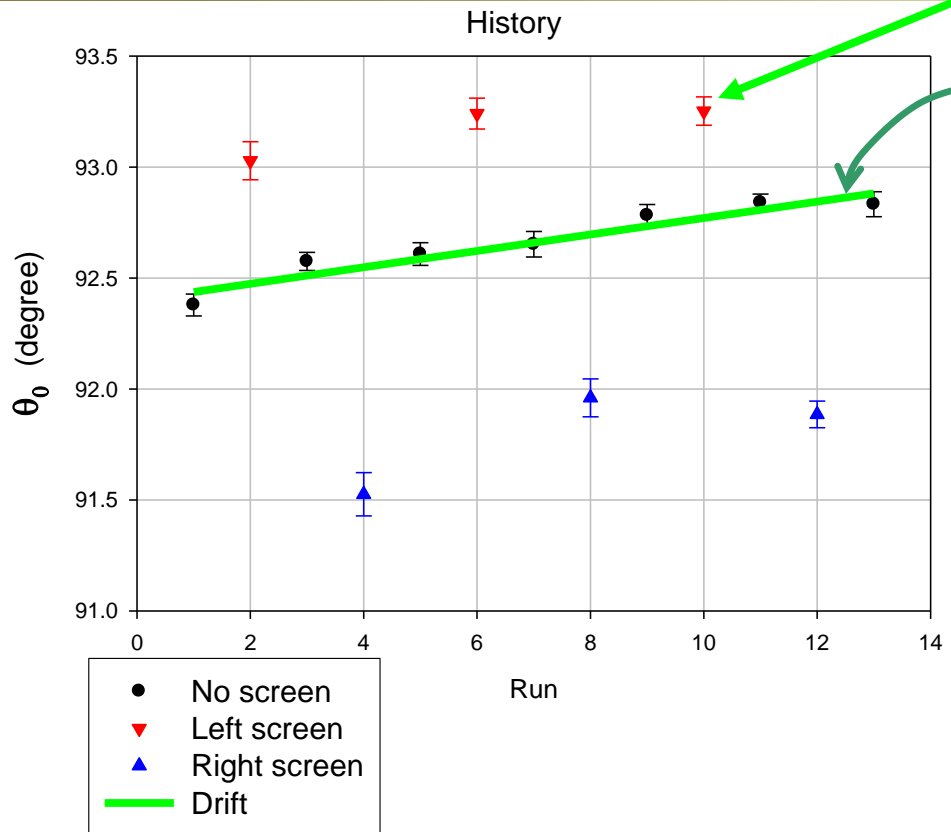
Beam deflection measurement



$$a \cdot e^{-\frac{(\theta - \theta_0)^2}{2c^2}}$$

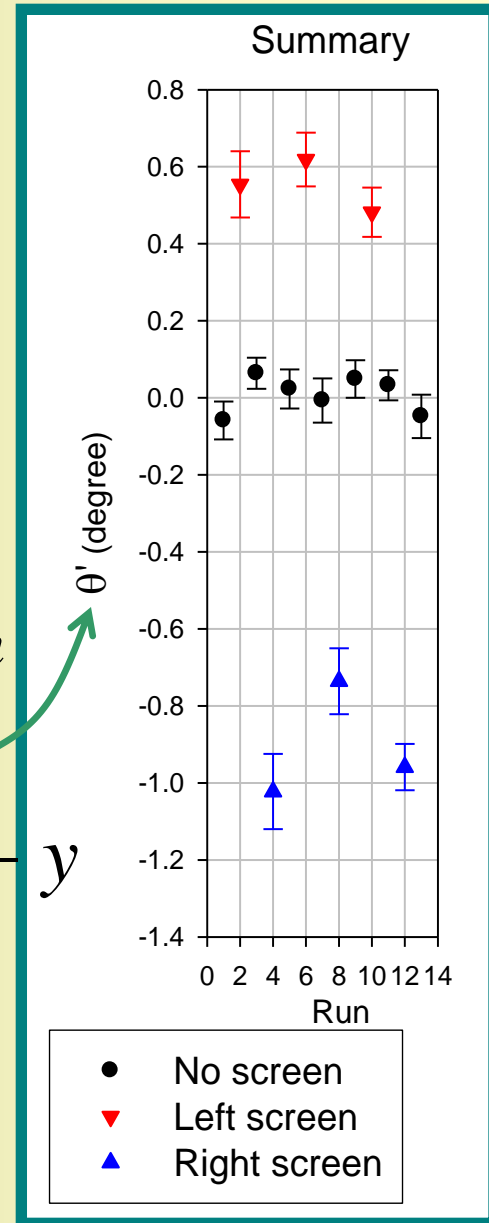
confidence probability

P=95%



$$y = A + B \cdot n$$

$$\theta' = \theta_0 - y$$



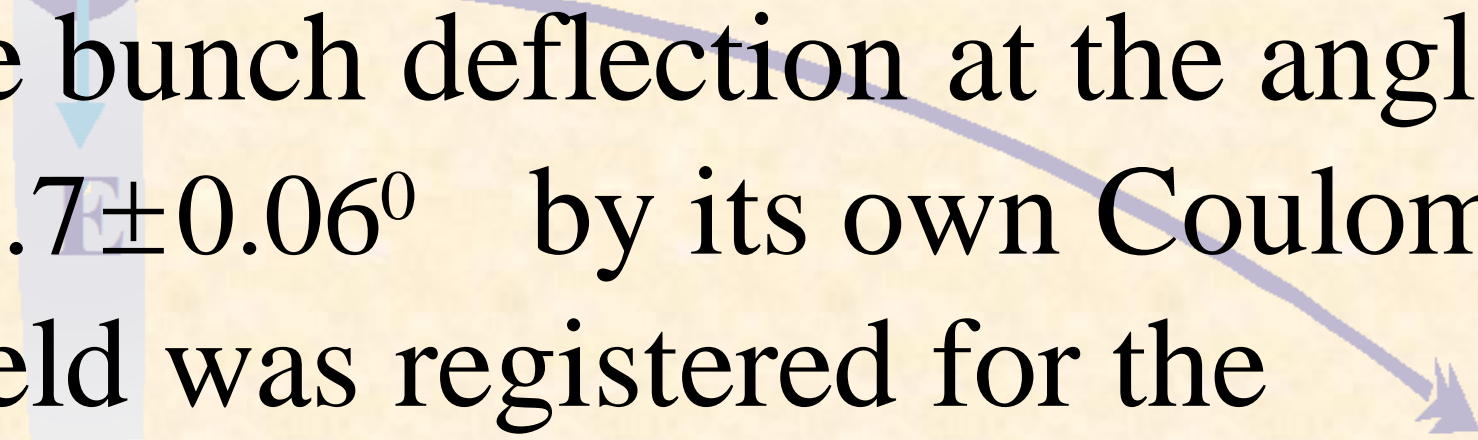
About recoil effect

The expressions for recoil effect are built using the energy and pulse conservation law without any information about a mechanism of phenomenon.

In [[Dao Xiang. Phys. Rev. ST - AB 11, 024001 \(2008\)](#)] is said that a recoil effect is quantum, but not a classical effect, while in our presentation it is purely classical one.

In addition: when in our experiment the conductive screen was replaced by absorber for millimeter wavelength region, the **obtained result was the same**

Resume



The bunch deflection at the angle $\approx 0.7 \pm 0.06^\circ$ by its own Coulomb field was registered for the relativistic electron with energy 6.2 MeV at Tomsk microtron.

Thank you
for attention