BUDKER INSTITUTE OF NUCLEAR PHYSICS

SILICA FIBER CHERENKOV RADIATION MONITOR TO STUDY TRANSVERSE BEAM TAILS IN STORAGE RING

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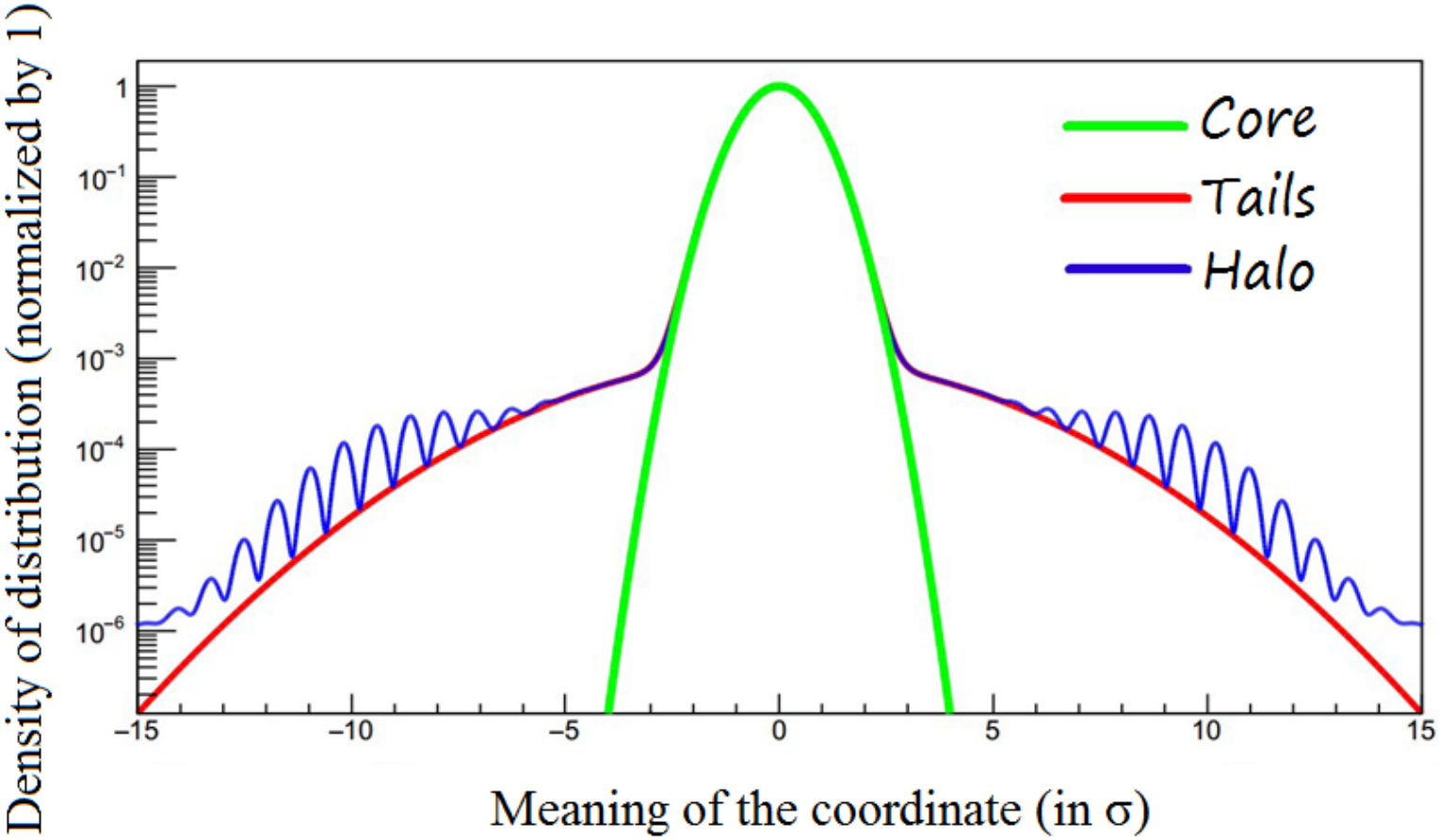
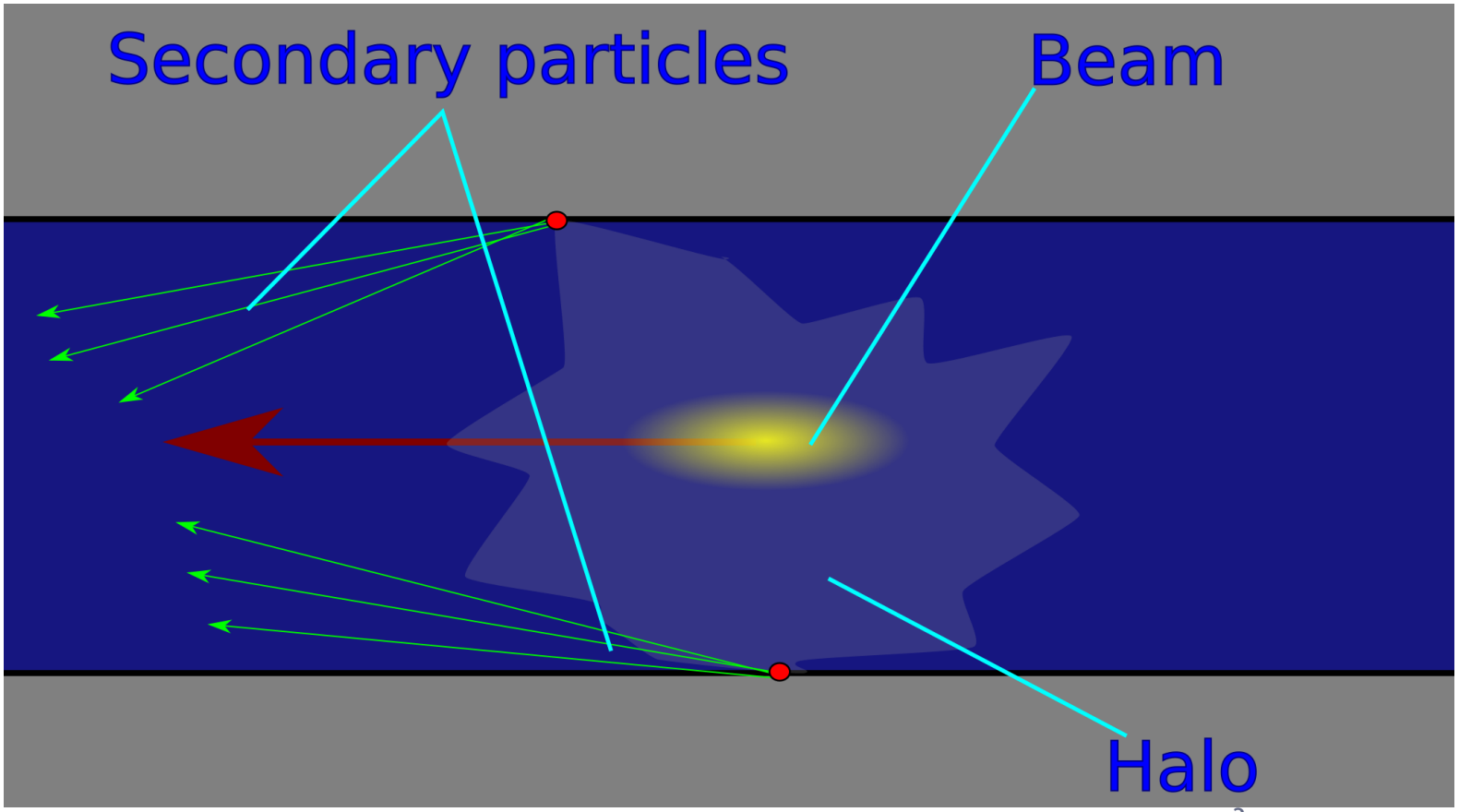
TRANSVERSE BEAM DISTRIBUTION

- In e^+/e^- colliders transverse beam distribution can be divided into three areas



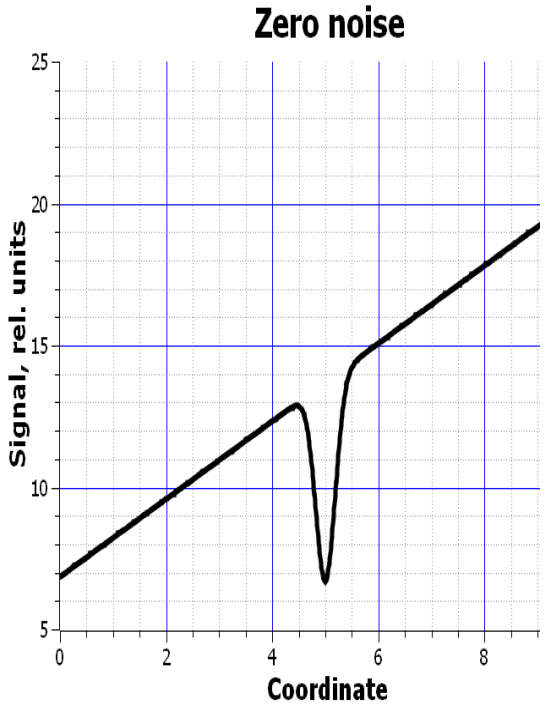
THE PROBLEM OF HALO

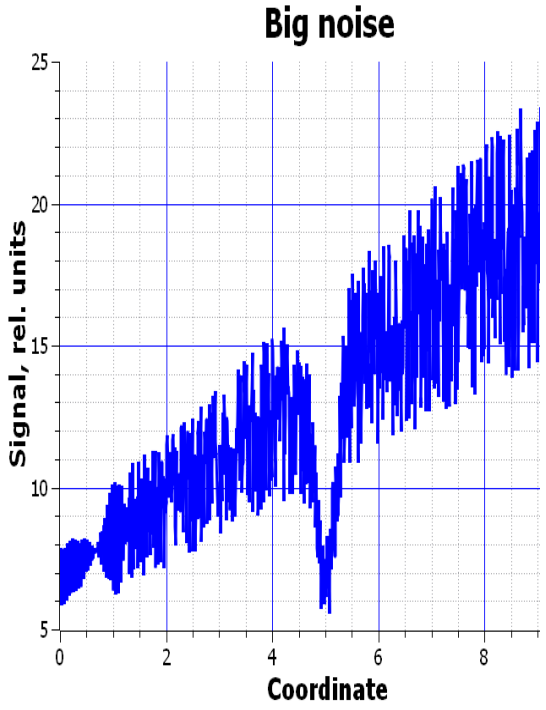
- Once particle arrives into halo, it will die on the walls of the vacuum chamber

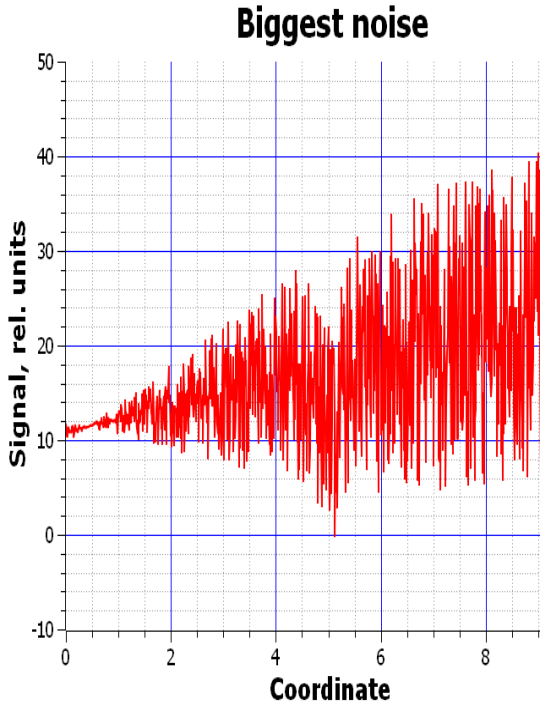


THE PROBLEM OF HALO

- Dying particles lead to increasing of the background noise level on particle detectors

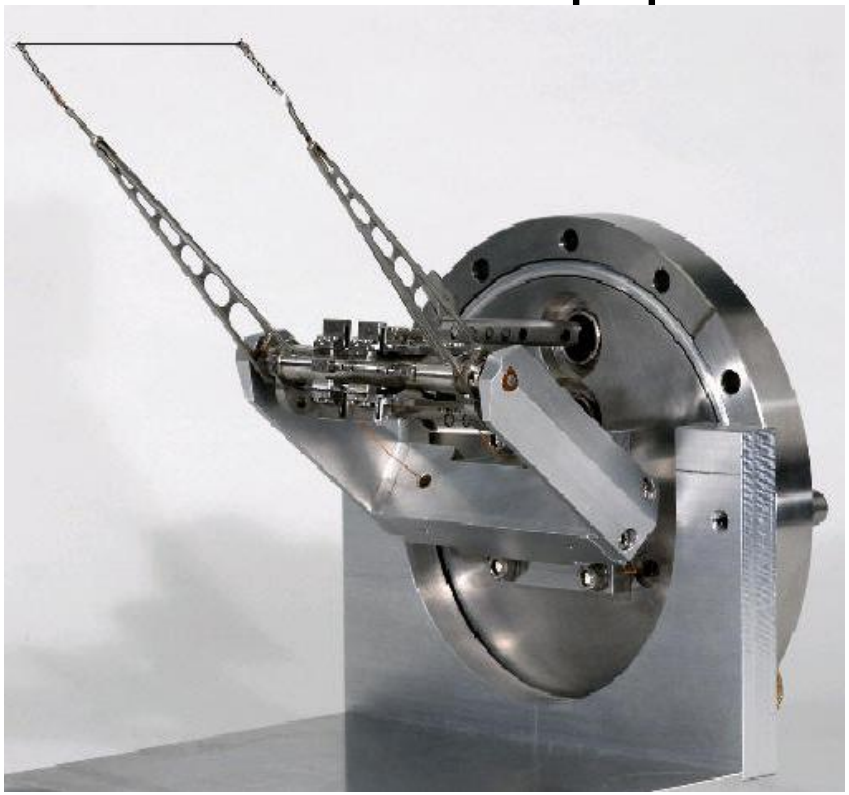




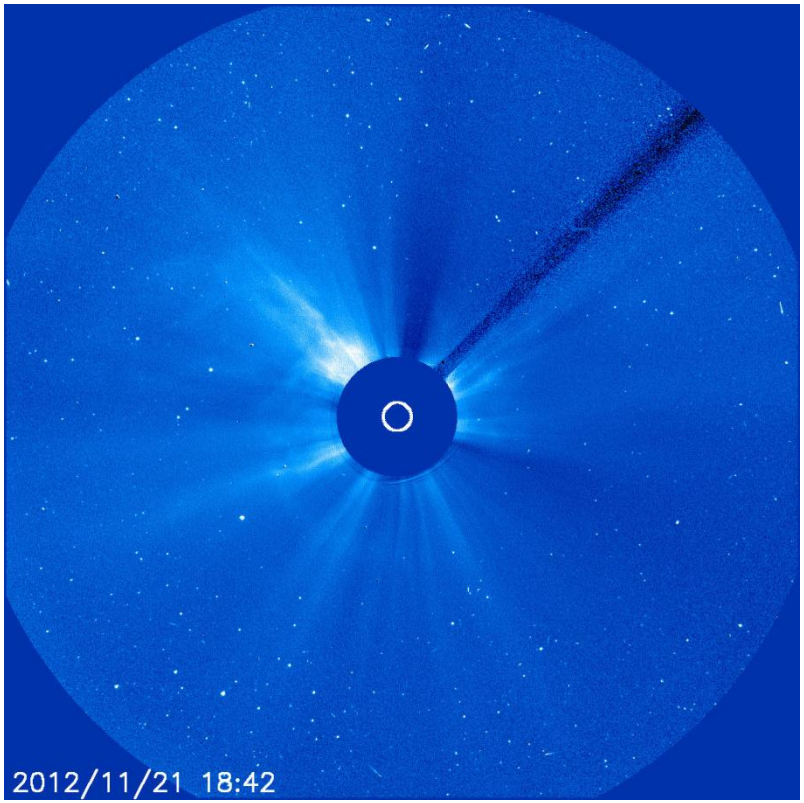


MEASURING THE HALO

- It is necessary to have an opportunity to measure halo population level



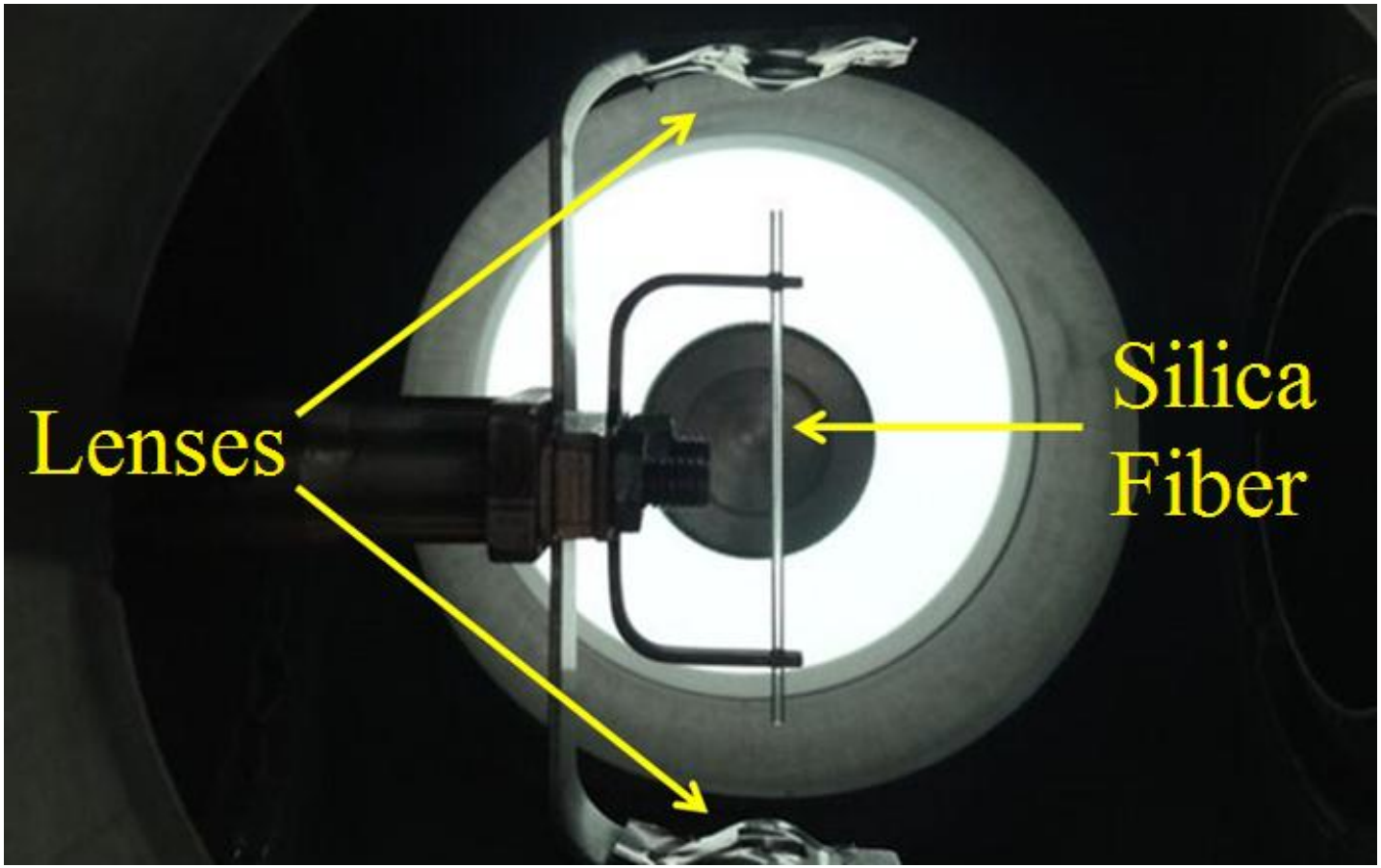
Wire scanner



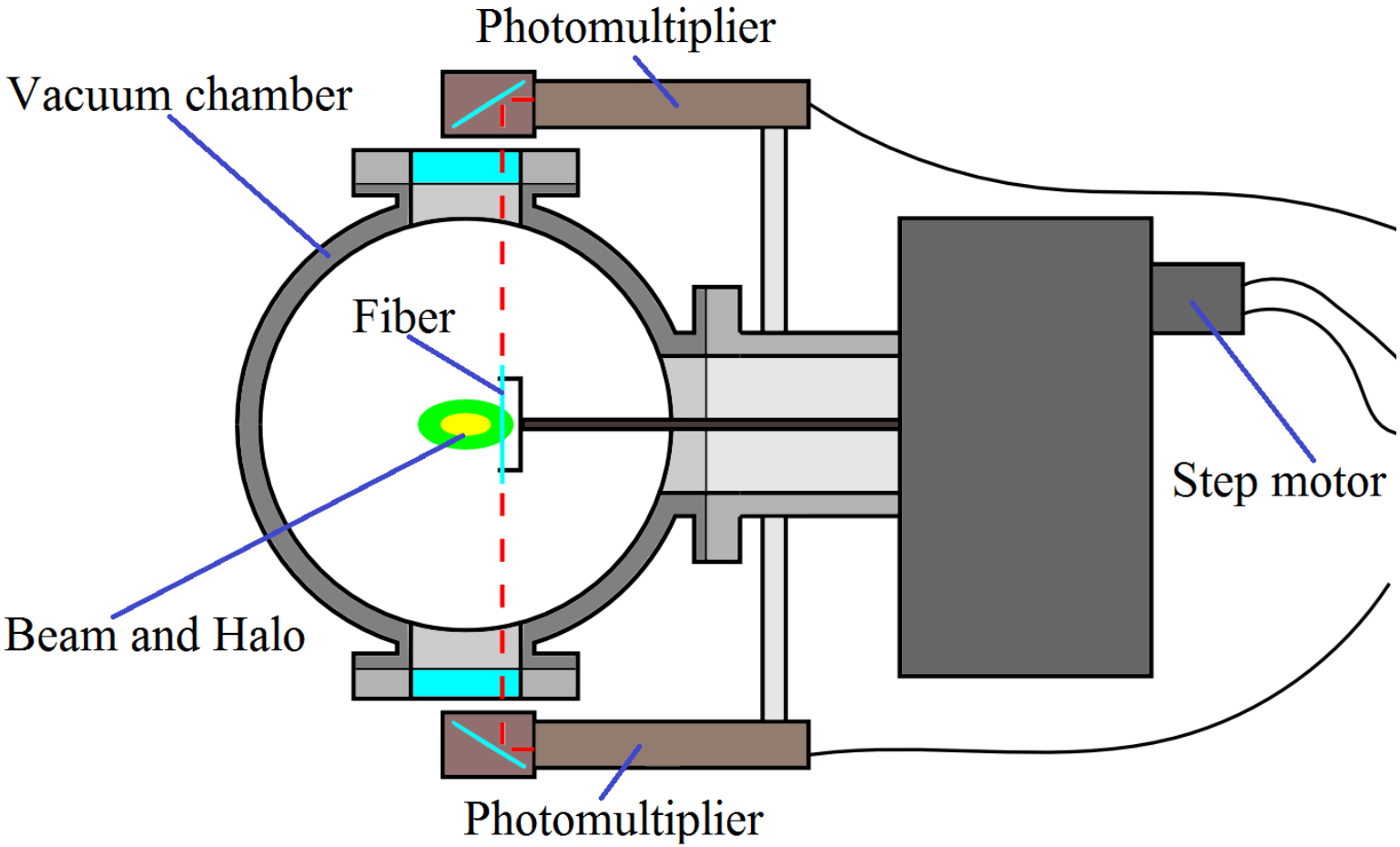
Coronagraph

NEW DIAGNOSTIC TOOL

- The new diagnostic tool was proposed



SCHEME OF THE PROPOSED EXPERIMENT



THEORETICAL ESTIMATION OF LIGHT EMISSION

- We can estimate the number of photons per 1 electron

$$N_{ph} = 2\pi\alpha d \cdot \left(\frac{1}{\lambda_{min}} - \frac{1}{\lambda_{max}}\right) \cdot \left(1 - \frac{1}{n^2}\right)$$

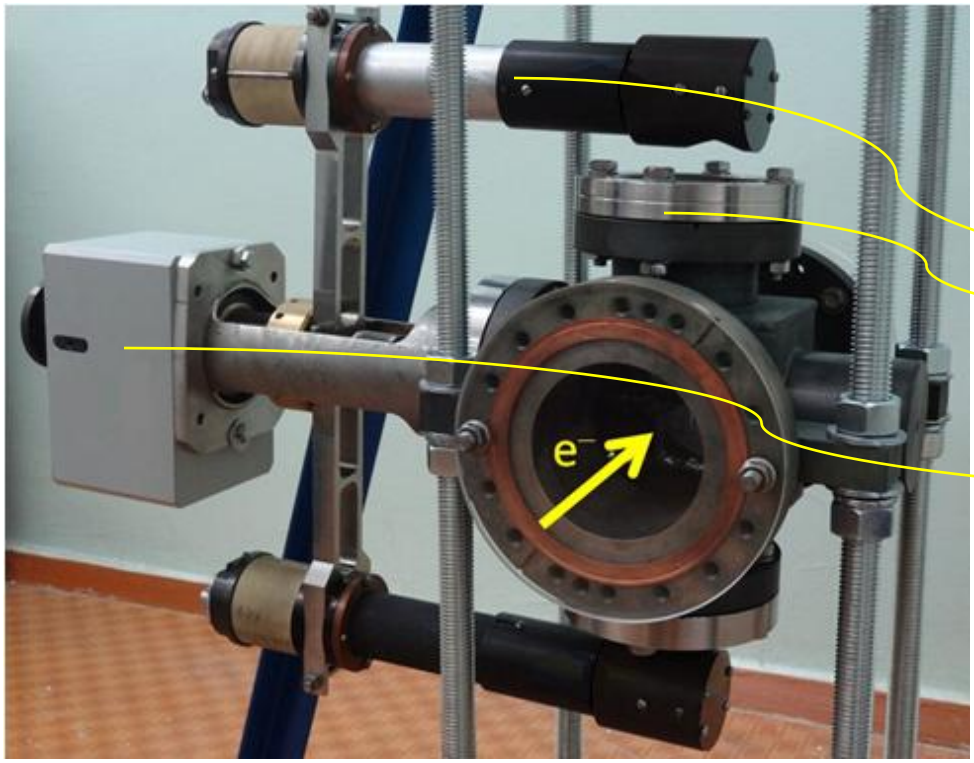
$$\alpha \approx \frac{1}{137}, d = 1\ mm,\ \lambda_{min} = 400\ nm$$

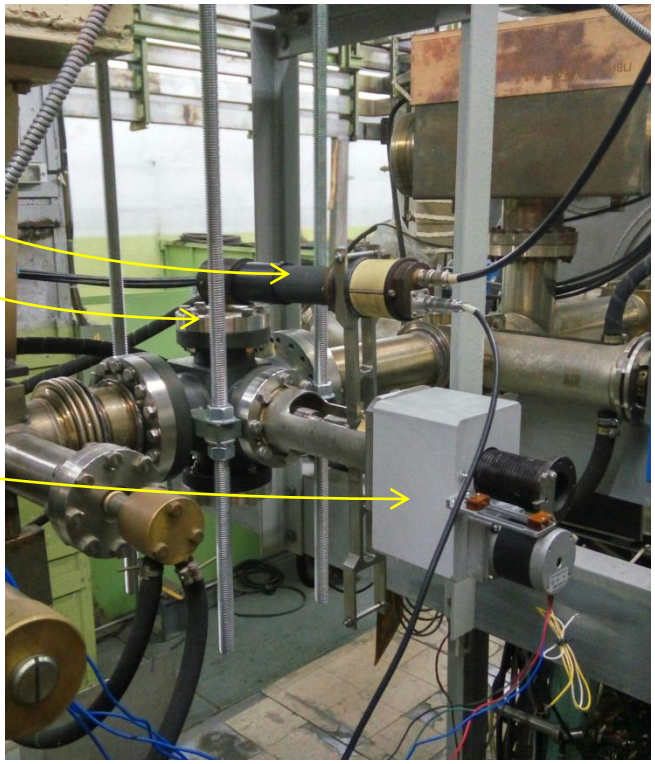
$$\lambda_{max} = 700\ nm, n \approx 1.5$$

$$N_{ph} \approx 27$$

DESIGN OF THE PROTOTYPE

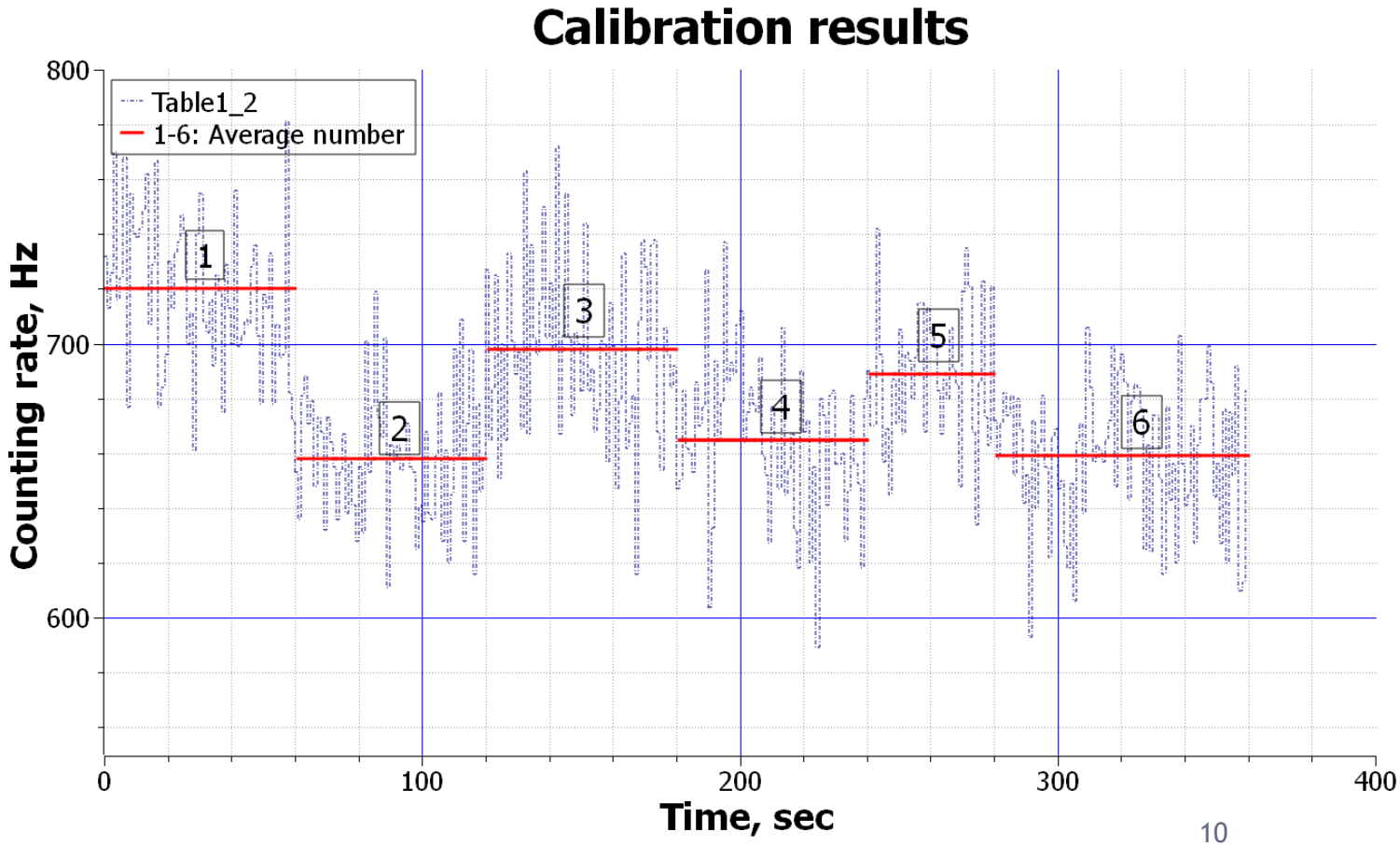
- To check the operability of this kind of diagnostic tool, the prototype was designed and constructed





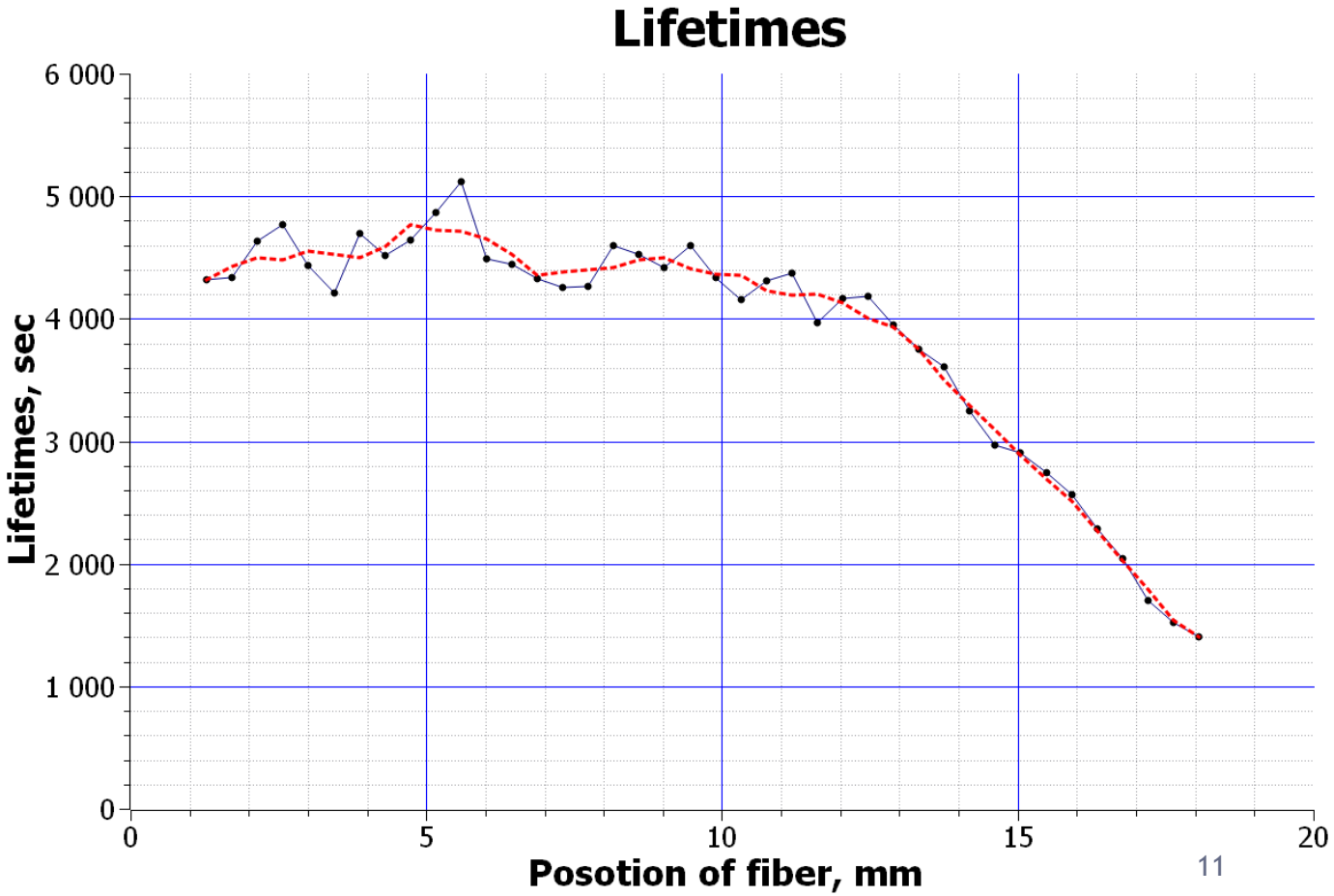
CALIBRATION OF THE PROTOTYPE

- The prototype was calibrated by Sr-90 radioactive source



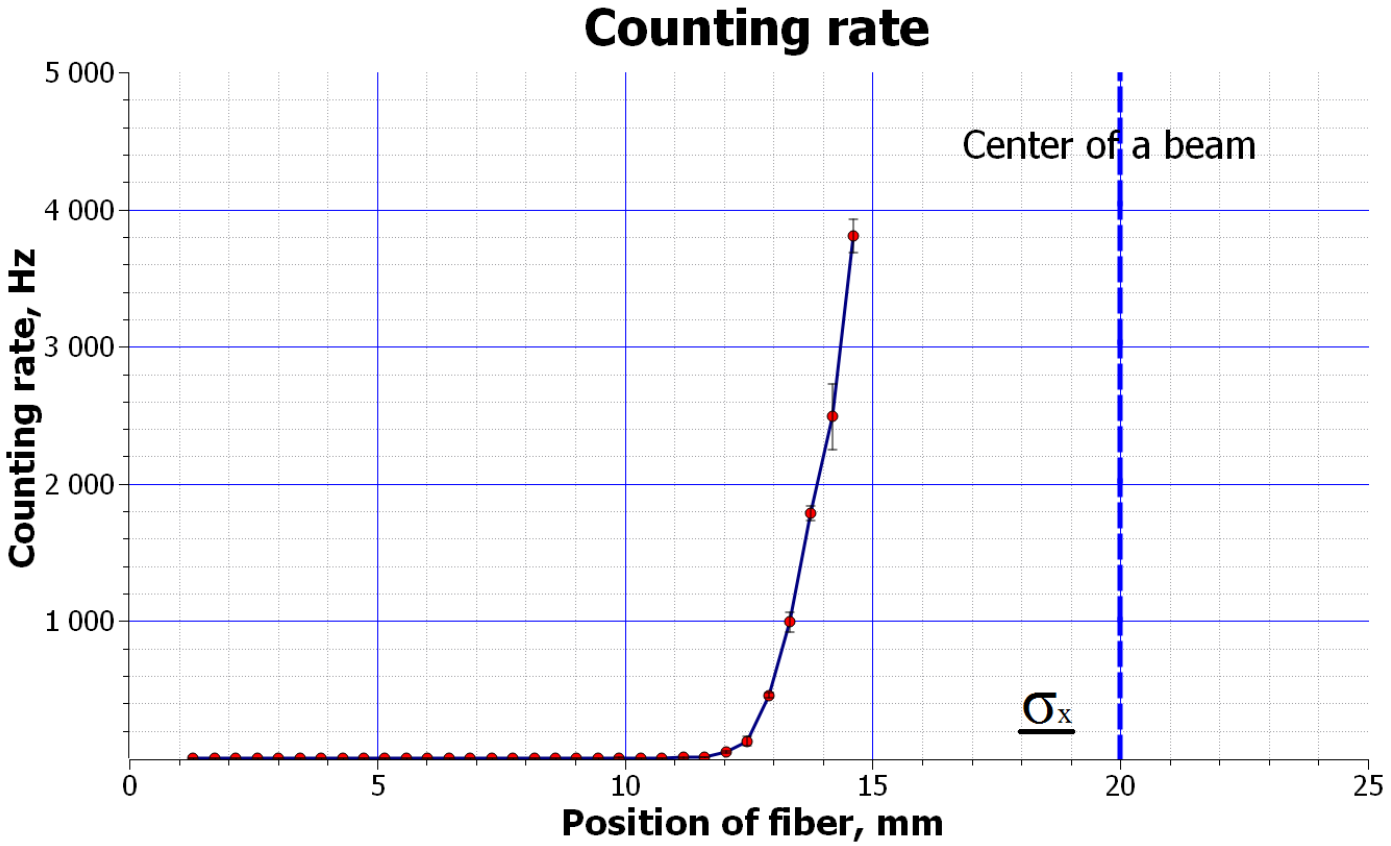
EXPERIMENT: DESTRUCTIVE INFLUENCE ON A BEAM

- Decreasing of the beam lifetimes was chosen as a measure of destructive influence



EXPERIMENT: RECEIVING THE PICTURE OF HALO DISTRIBUTION

- First run was conducted with the discrimination level 20 mV



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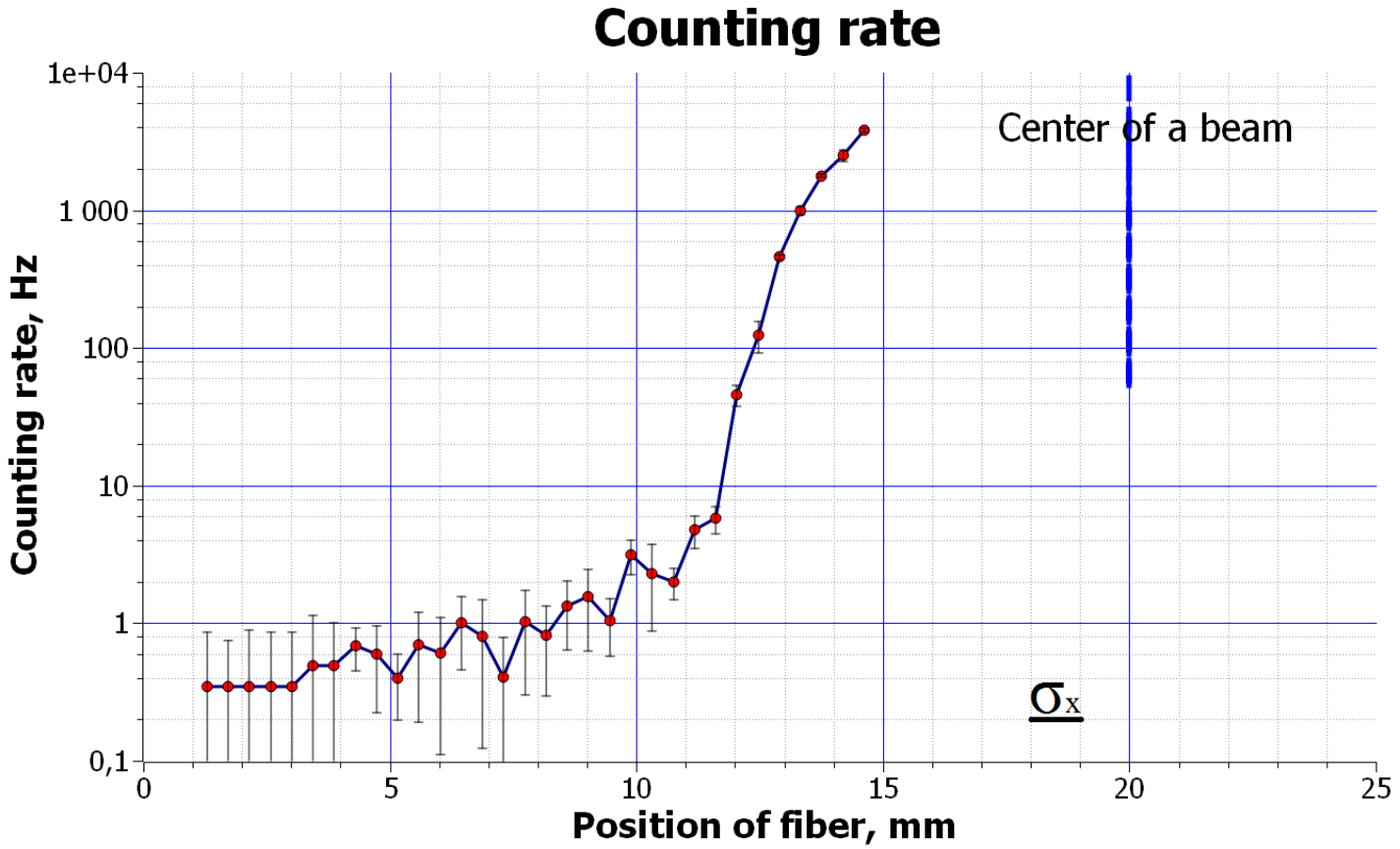
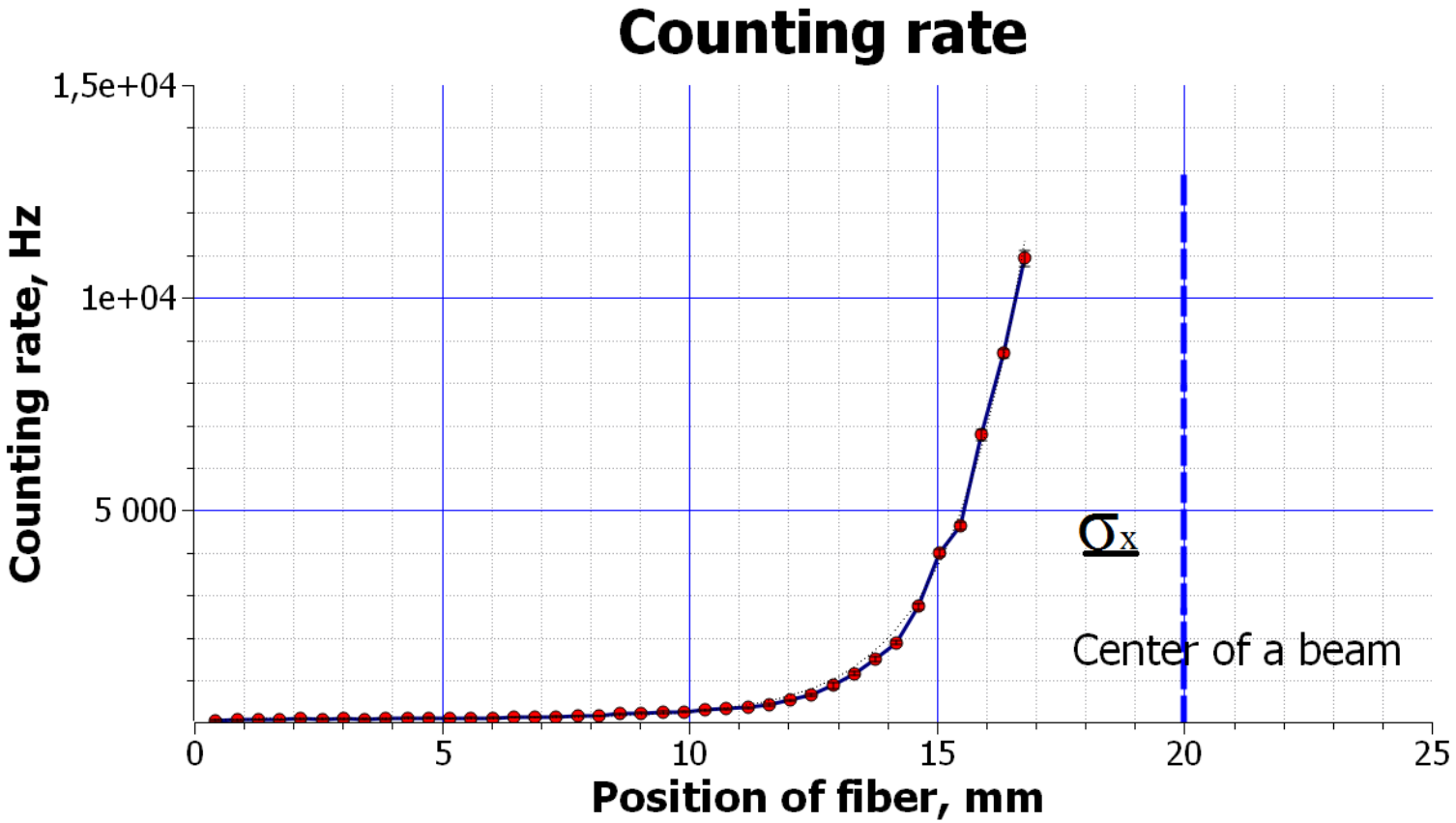


EXPERIMENT: RECEIVING THE PICTURE OF HALO DISTRIBUTION

- Next run was conducted with the discrimination level 10 mV



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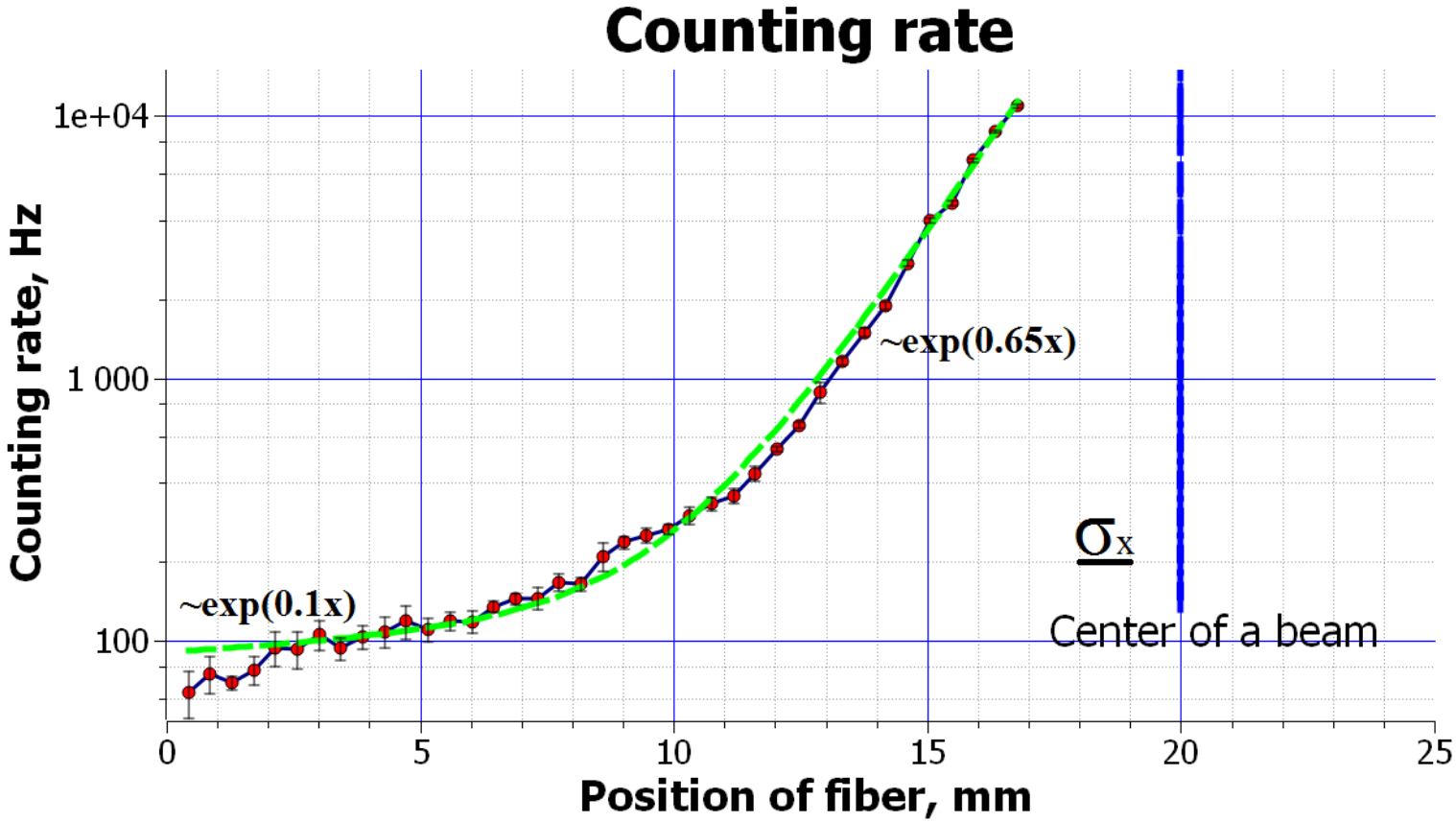

CONCLUSIONS

- The applicability of the detector was confirmed
- This type of the diagnostic tool let us achieve a big dynamic diapason
- The sensitivity of this kind of detector is big enough to measure the beam distribution in low-populated areas

PERSPECTIVES

- Some simple modification of counting system will provide an opportunity to measure transverse distribution of the single bunch
- Replacing photomultipliers by more sensitive ones let us achieve greater efficiency of registration
- By replacing silica fiber to the thinner one, destructive influence on the beam could be decreased

THANKS FOR YOUR ATTENTION