DIAGNOSTICS OF NANODISPERSIVE POLYCRYSTALS USING POLARIZATION BREMSSTRAHLUNG FROM RELATIVISTIC ELECTRONS

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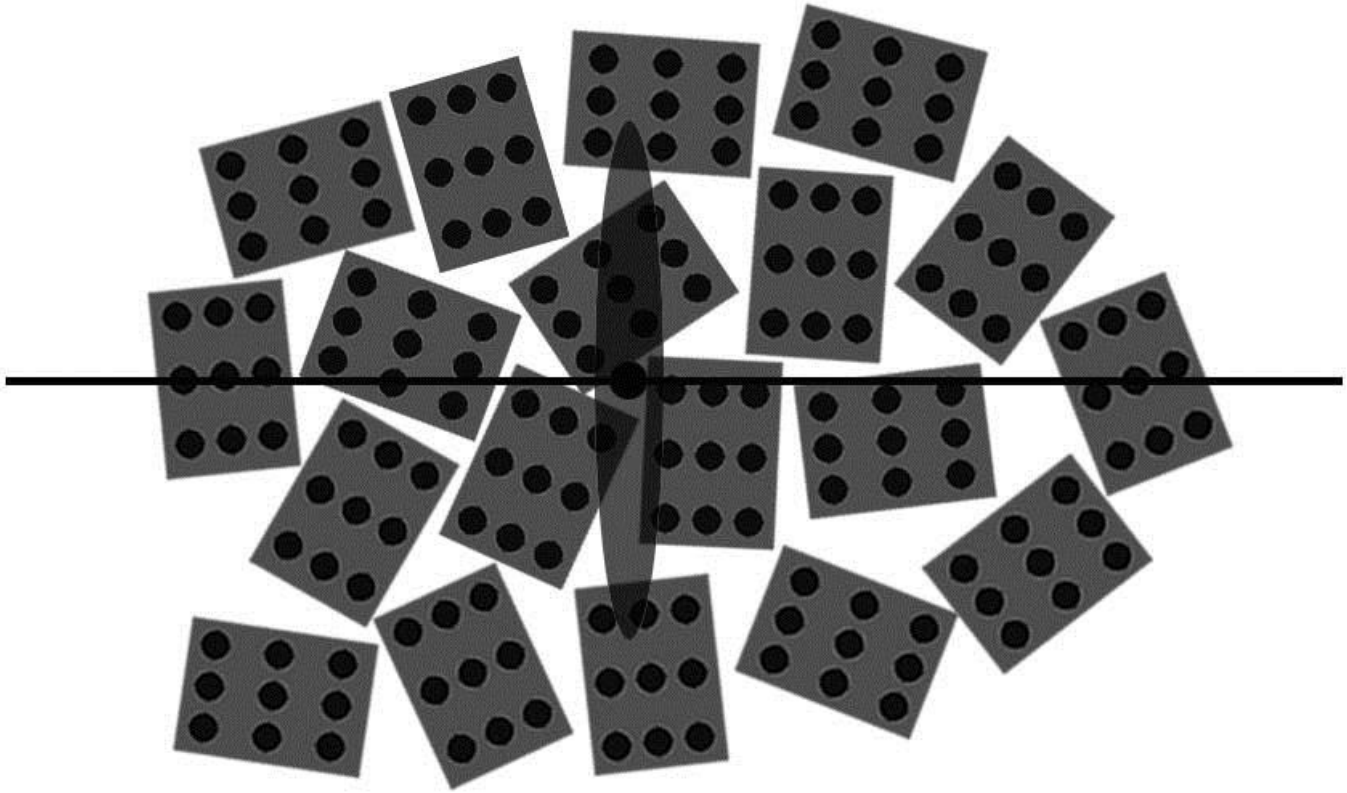
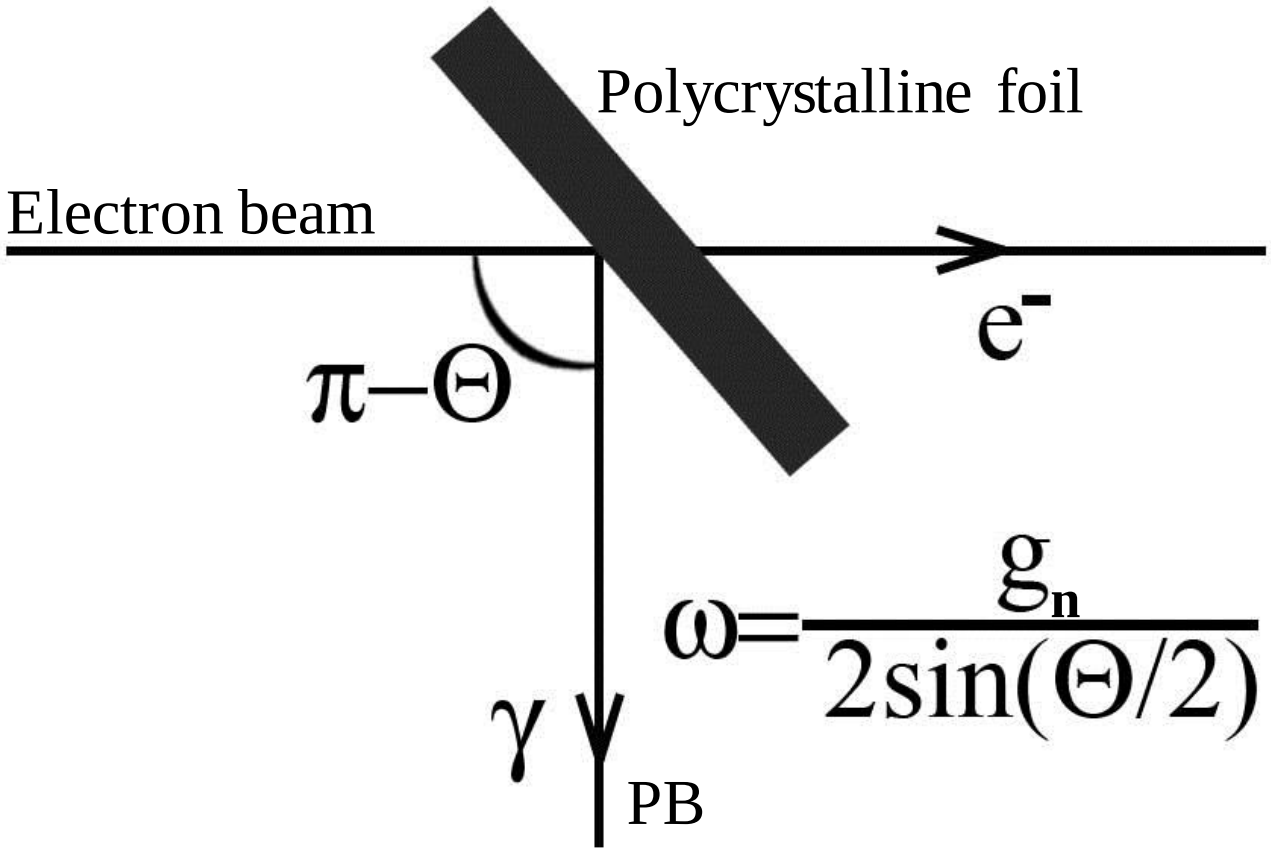
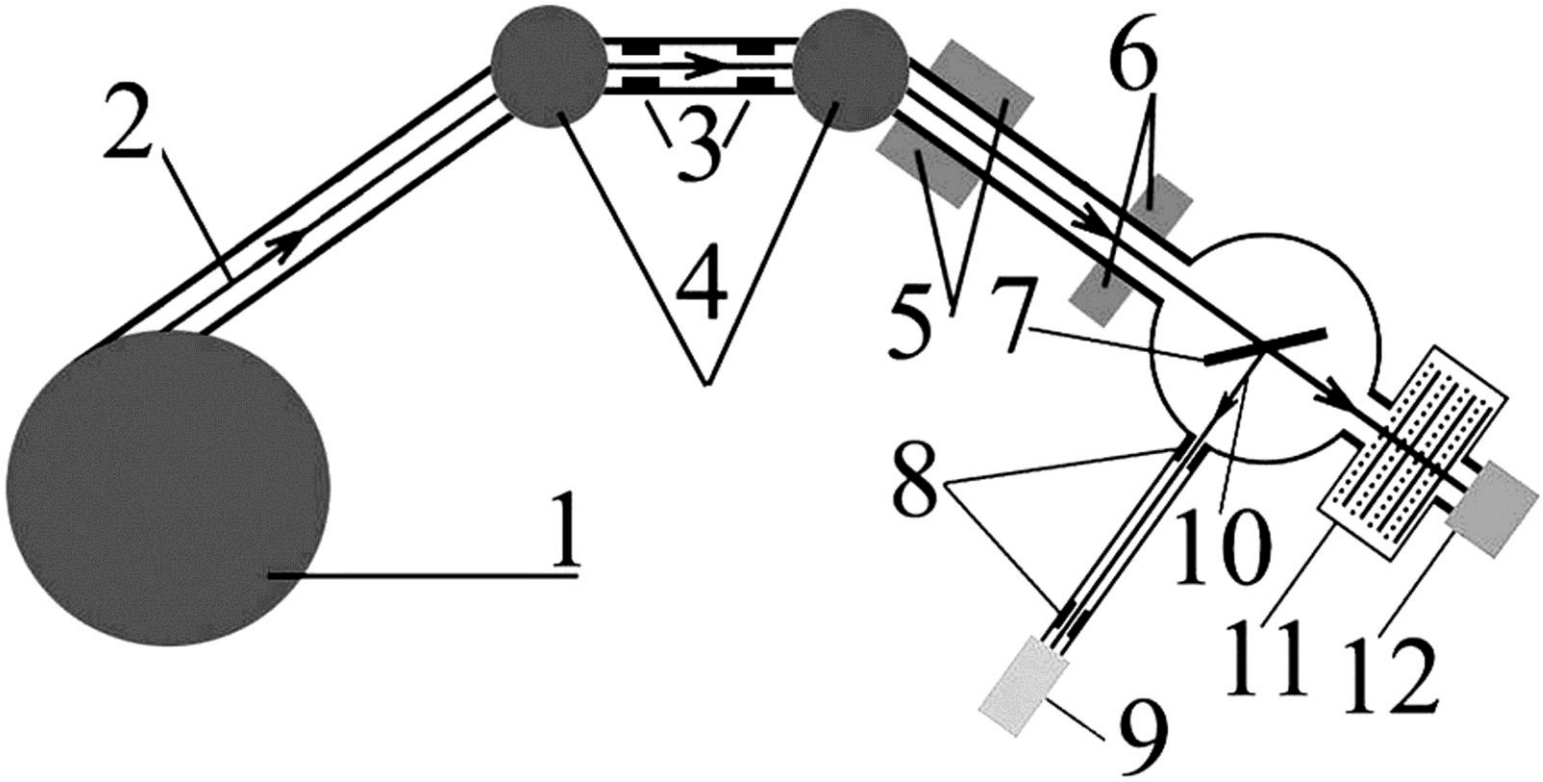
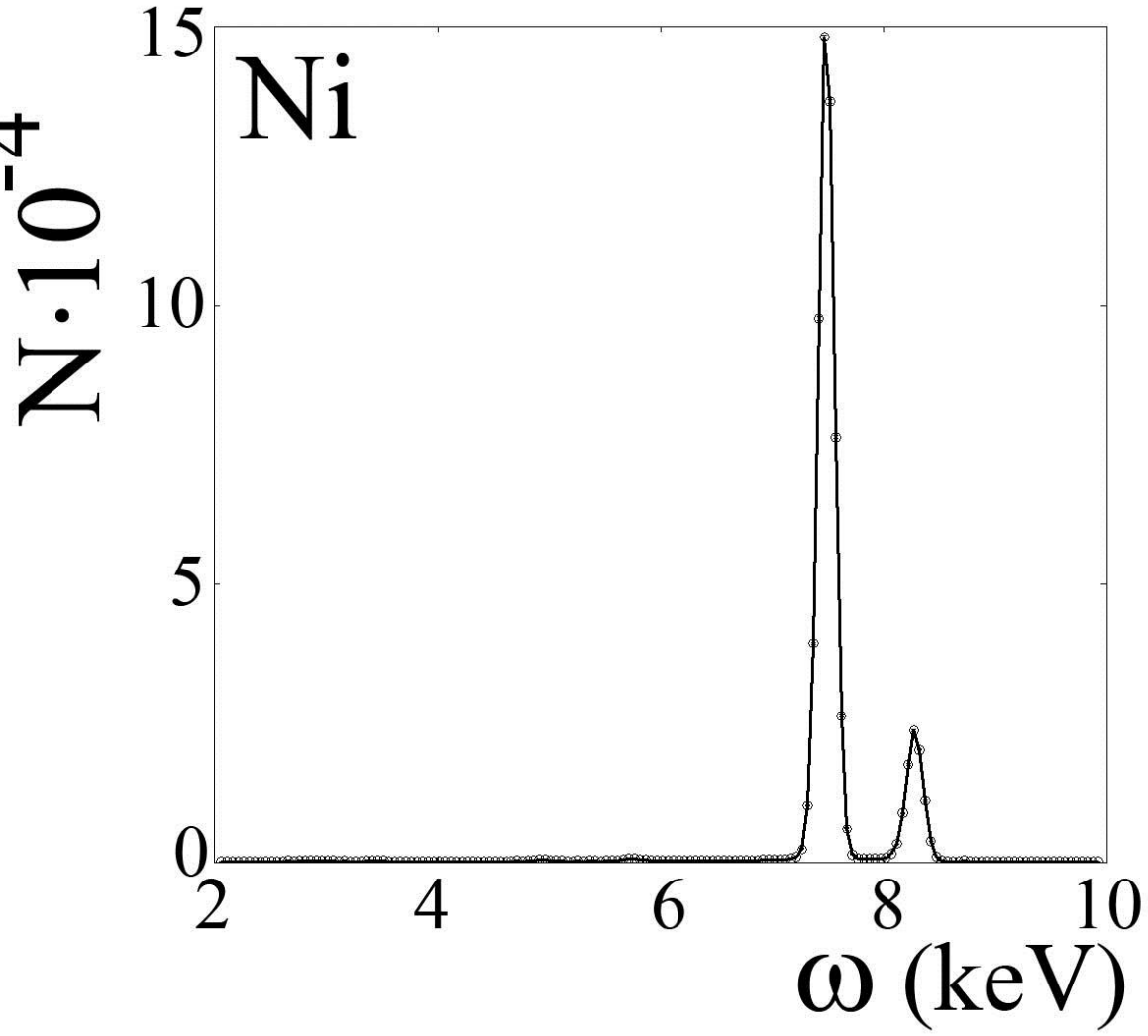


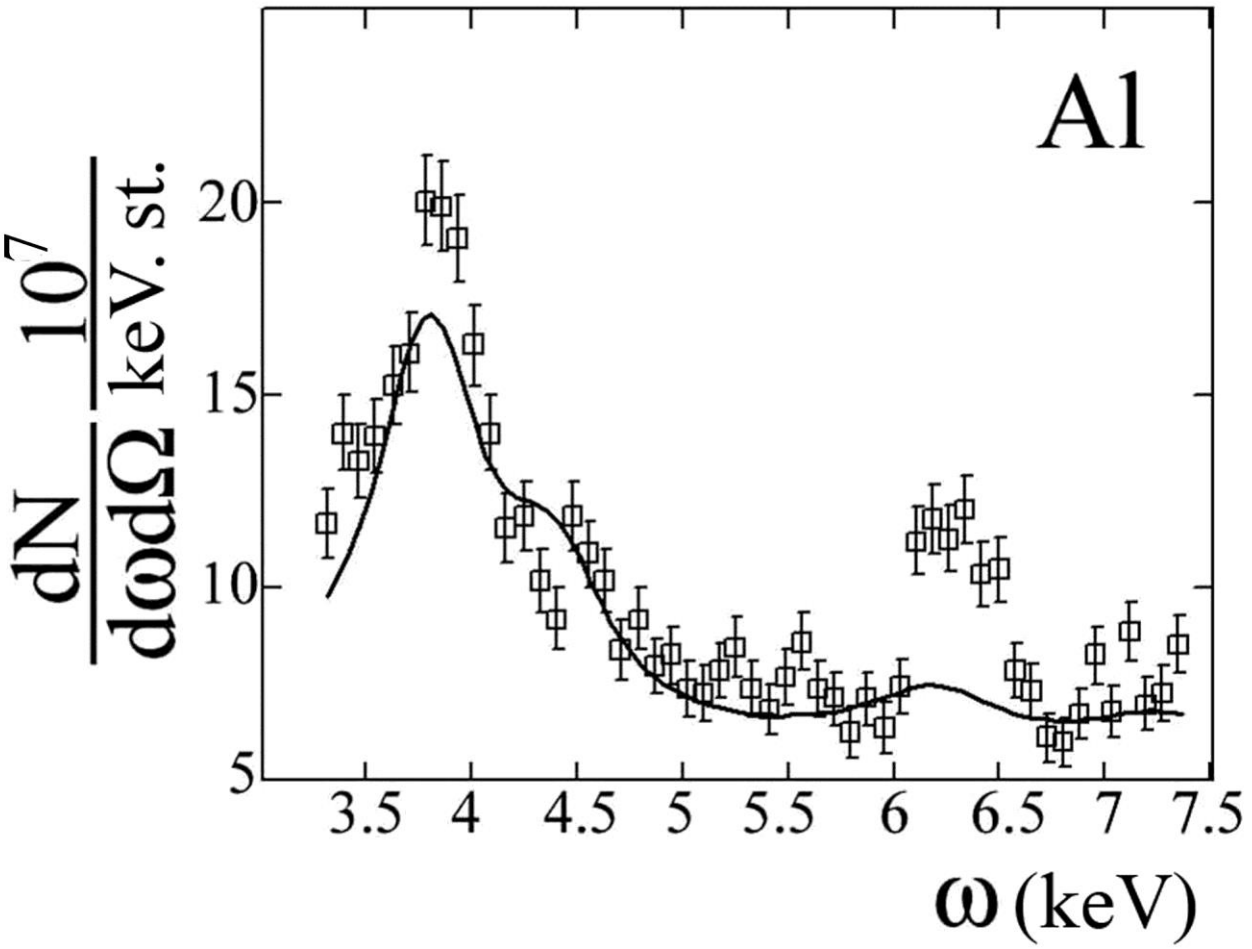

Polycrystalline foil
Electron beam
e-
π–Θ
ω=gn/2sin(Θ/2)
γ
PB



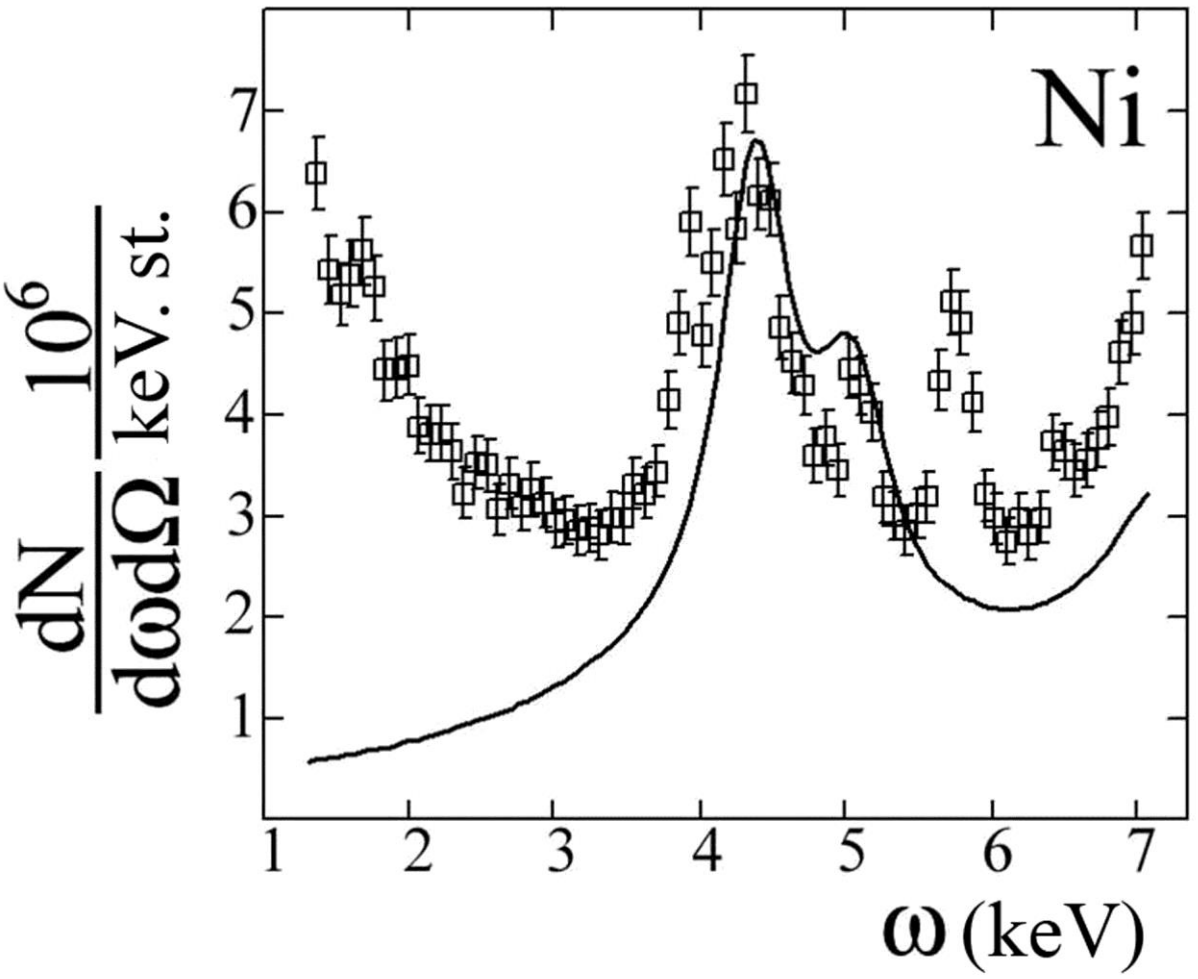
1 - 7MeV microtron
2 - electron beam
3 - carbon collimators
4 - magnets
5 - lenses
6 - corrector
7 - target
8 - PB collimators
9 - detector
10 - PB
11 - proportional counter
12 - Faraday cup



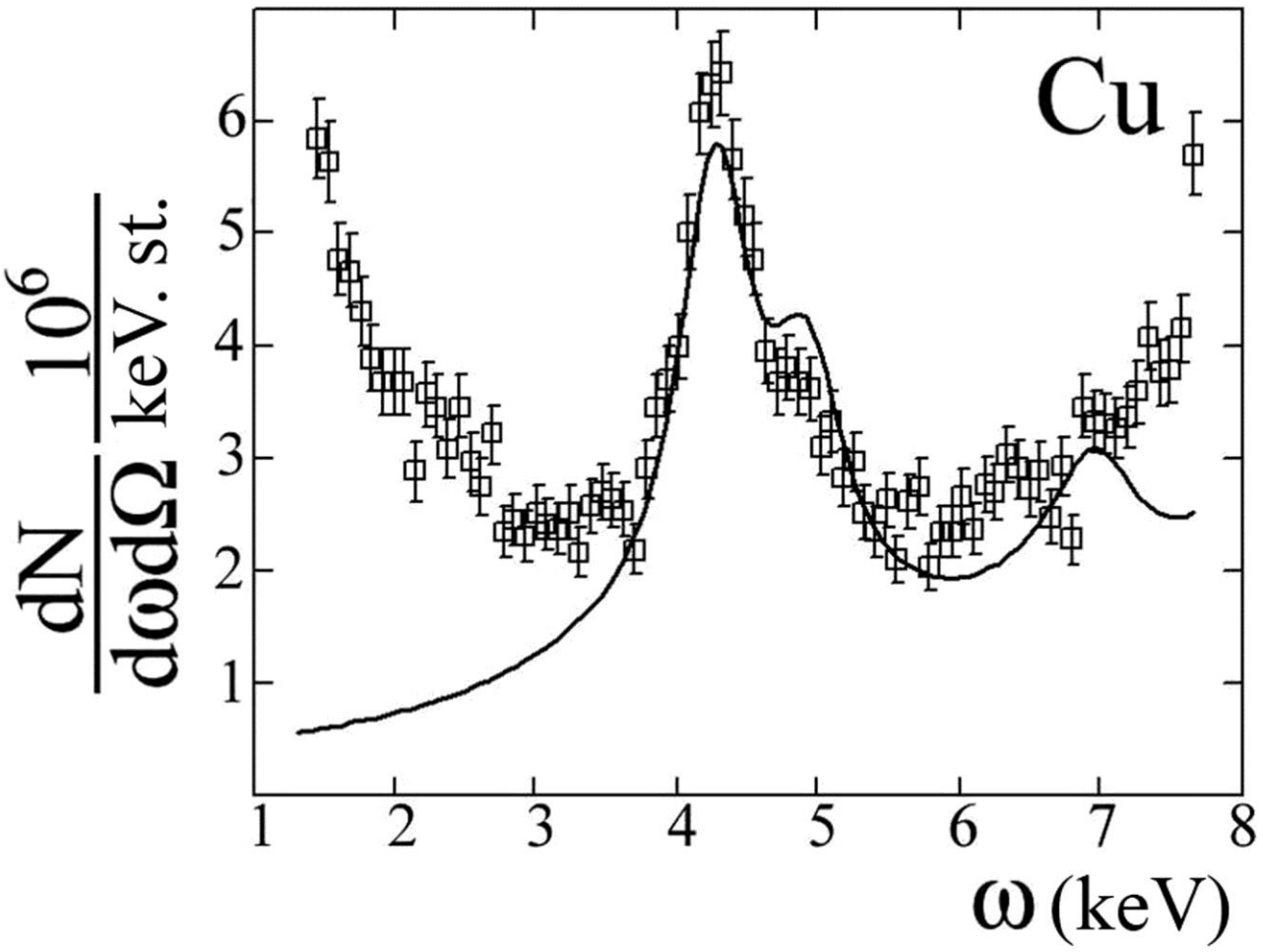
The collected spectrum in condition of the electron beam interaction with Ni polycrystalline foil.



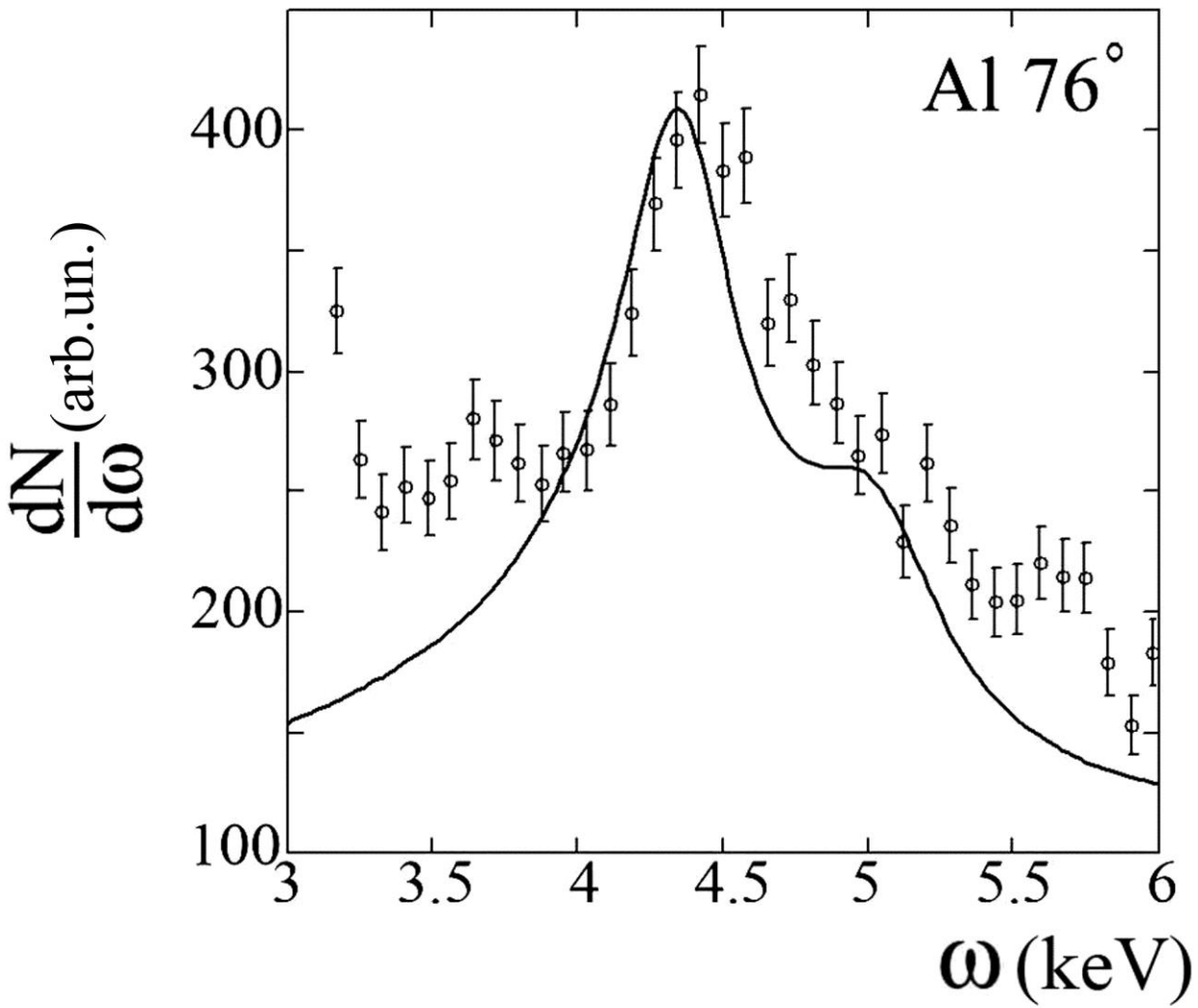
PB spectrum from 8.5μm Al foil
at the observation angle 90^0.



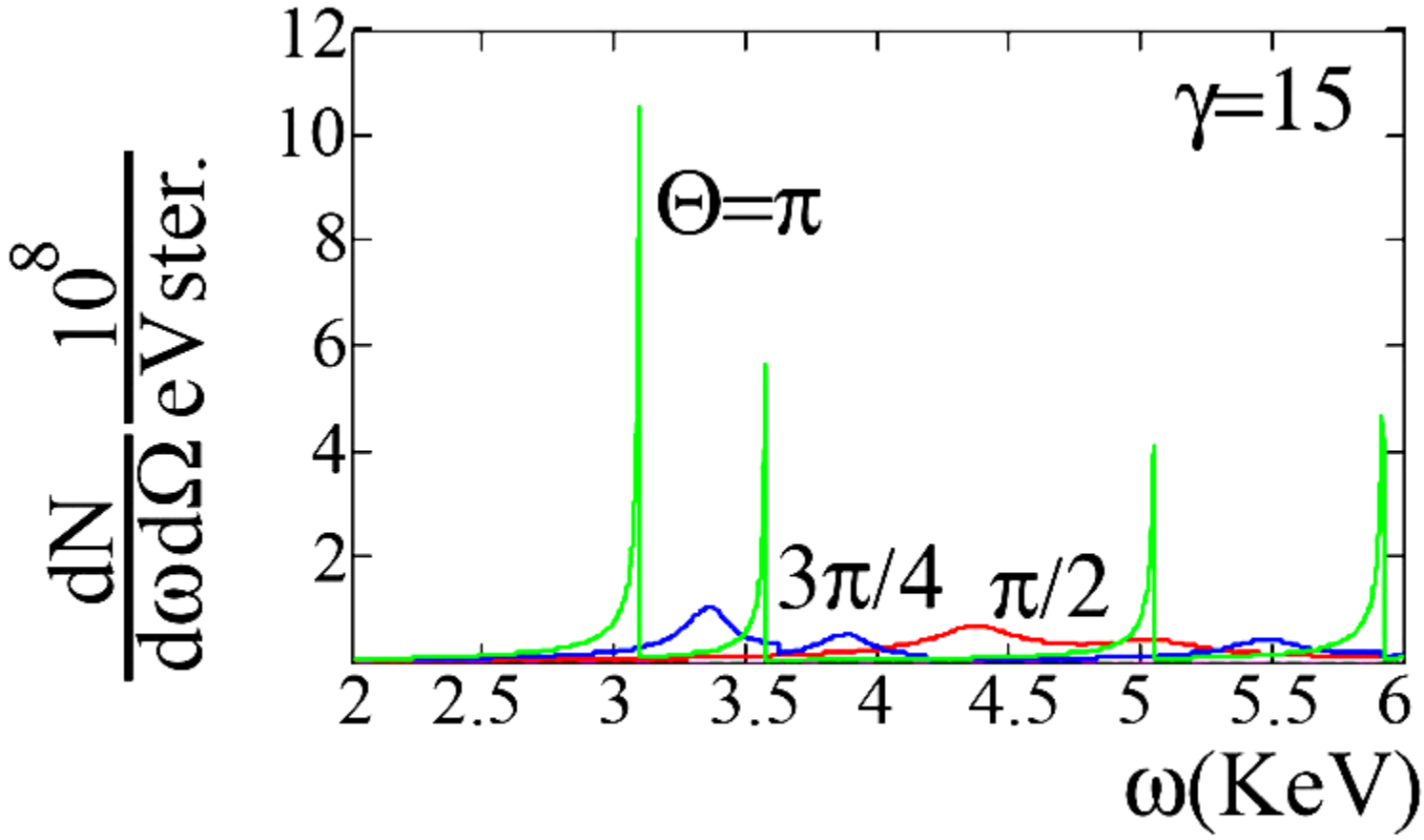
PB spectrum from 15μm Ni foil
at the observation angle 90^0.



PB spectrum from 15μm Cu foil
at the observation angle 90^0.



PB spectrum from 8.5μm Al foil
at the observation angle 76^0.



The dependence of PB spectra on observation angle.

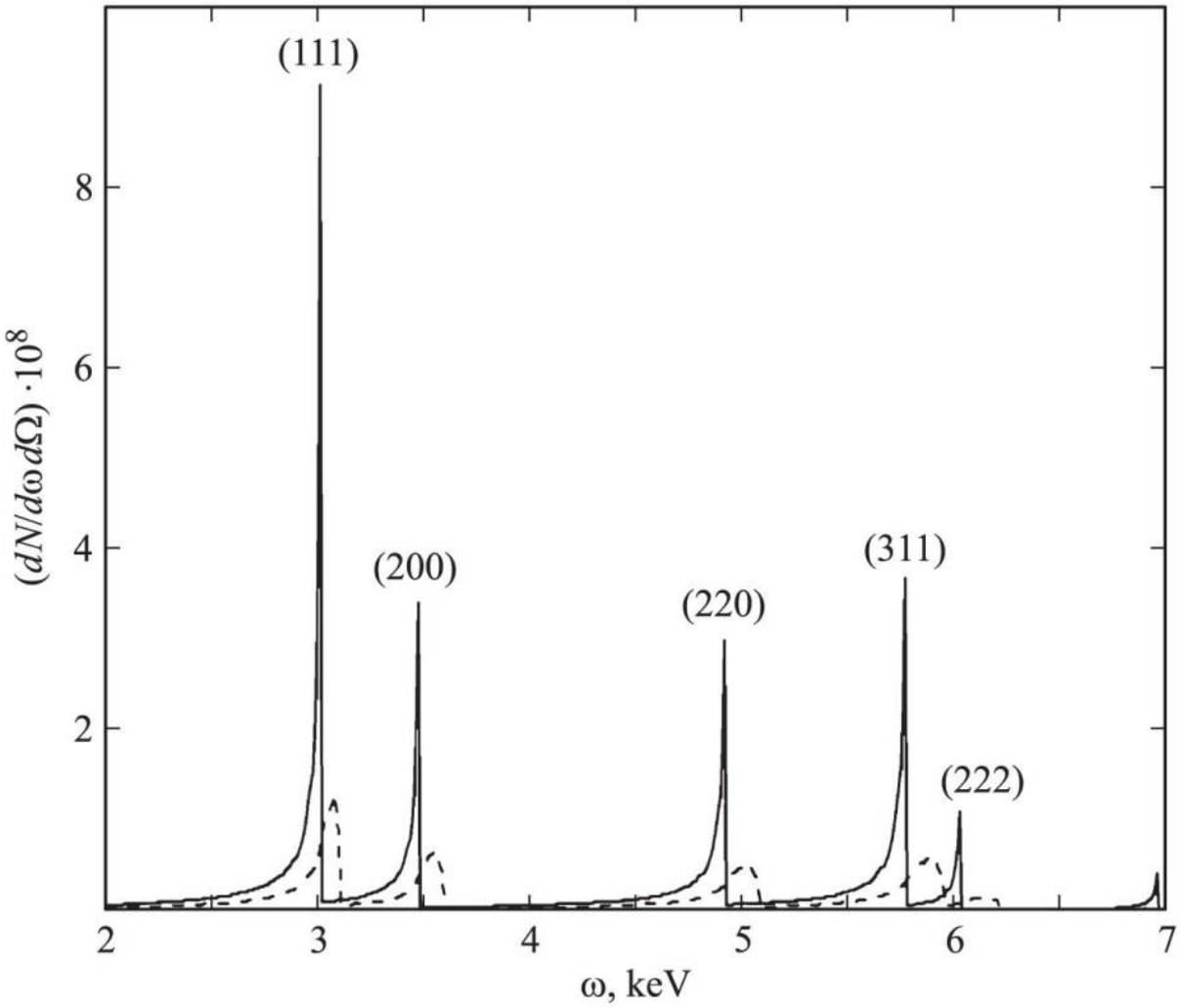
The width of spectral PB peaks

$$\frac{\Delta\omega}{\omega} \approx \frac{\sqrt{\cos^2(\theta/2) - \frac{1}{4}\rho^2 \cos(\theta)}}{\rho^{-1}\sin(\theta/2)}$$

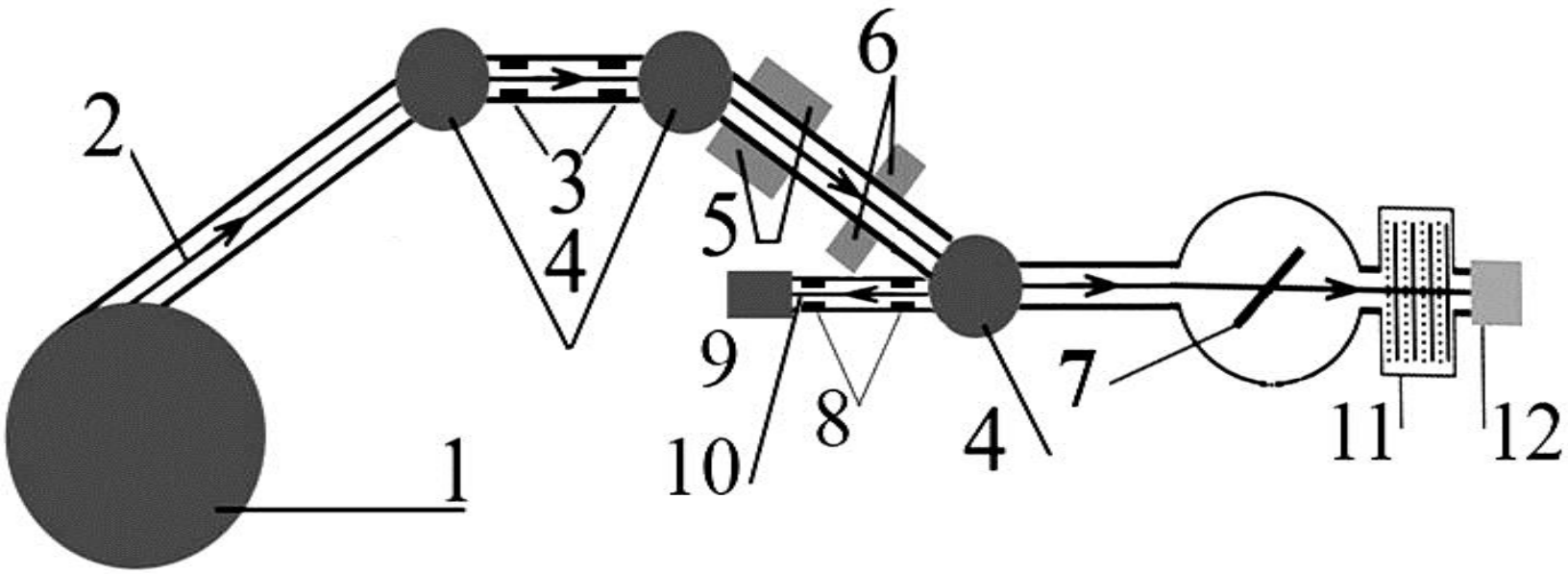
$$\rho^2 = \gamma^{-2} + \omega_0^2/\omega^2$$

$$\frac{\Delta\omega}{\omega} \approx \gamma^{-1}$$ **- usual geometry**

$$\frac{\Delta\omega}{\omega} \approx \frac{\rho}{2}\sqrt{\rho^2 + (\Delta\theta)^2} \rightarrow \frac{\rho^2}{2} \approx \frac{\gamma^{-2}}{2}$$ **- backscattering geometry**



The spectral-angular distribution of PB from Cu polycrystal for different observation angles - $\theta=180^0$ (solid line) and $\theta=160^0$ (dash line).



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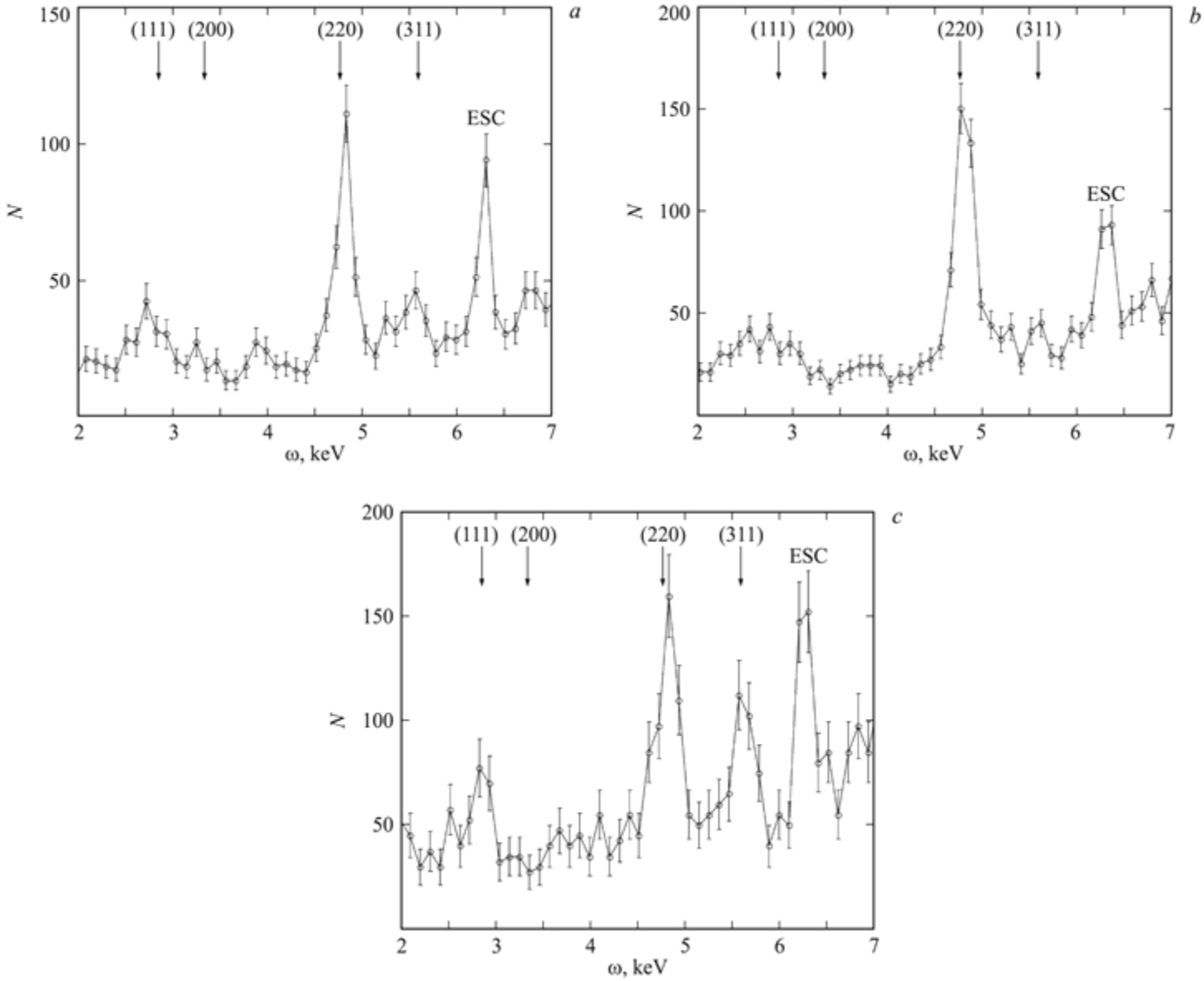
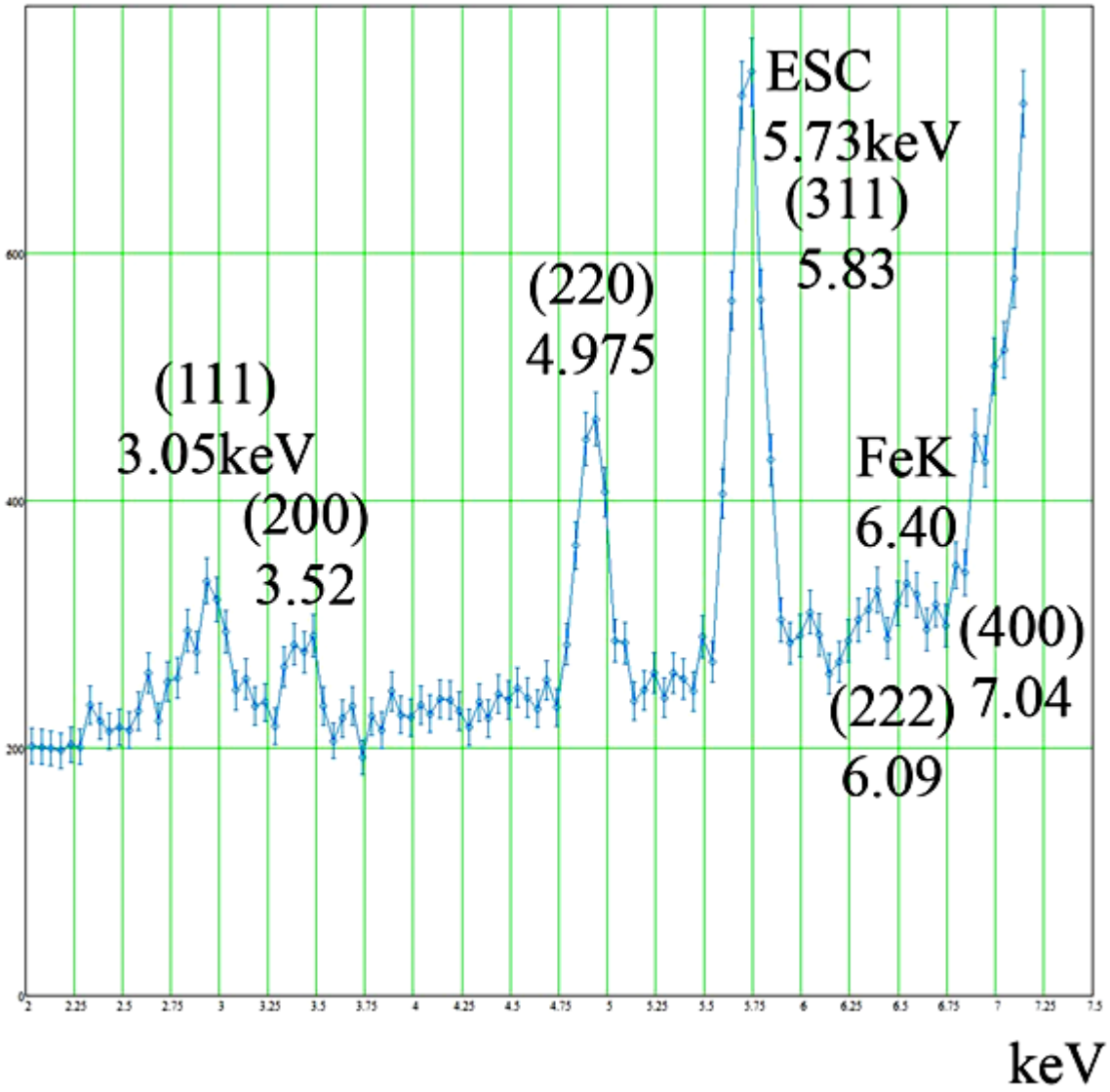
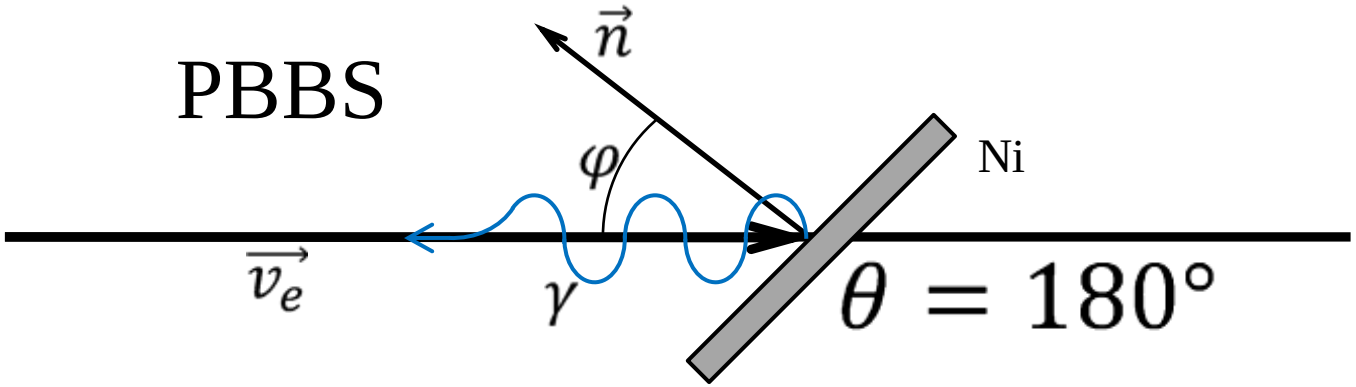


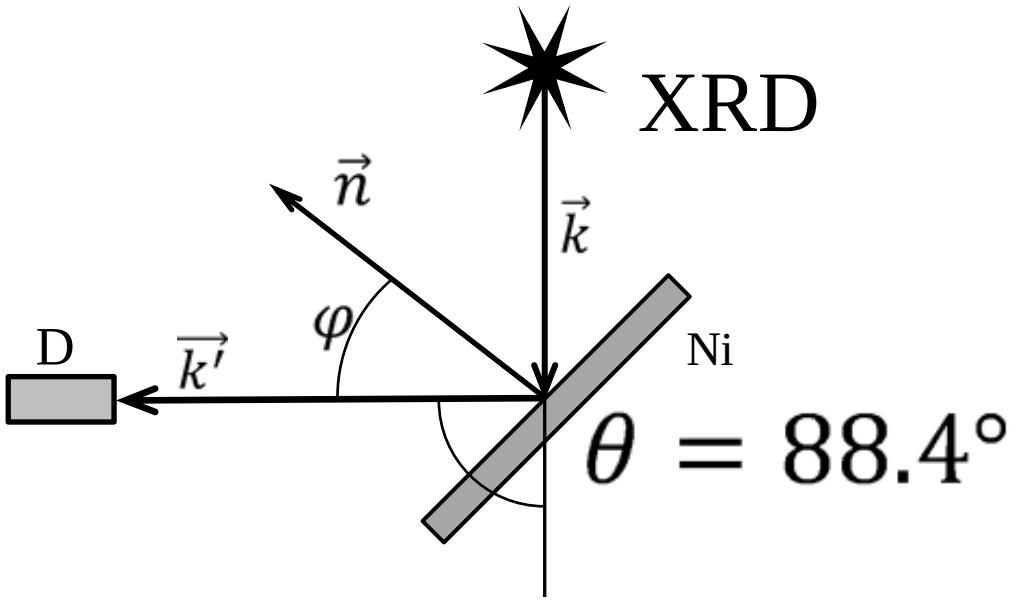
PBBS from textured 40μm Cu target. Random orientations.



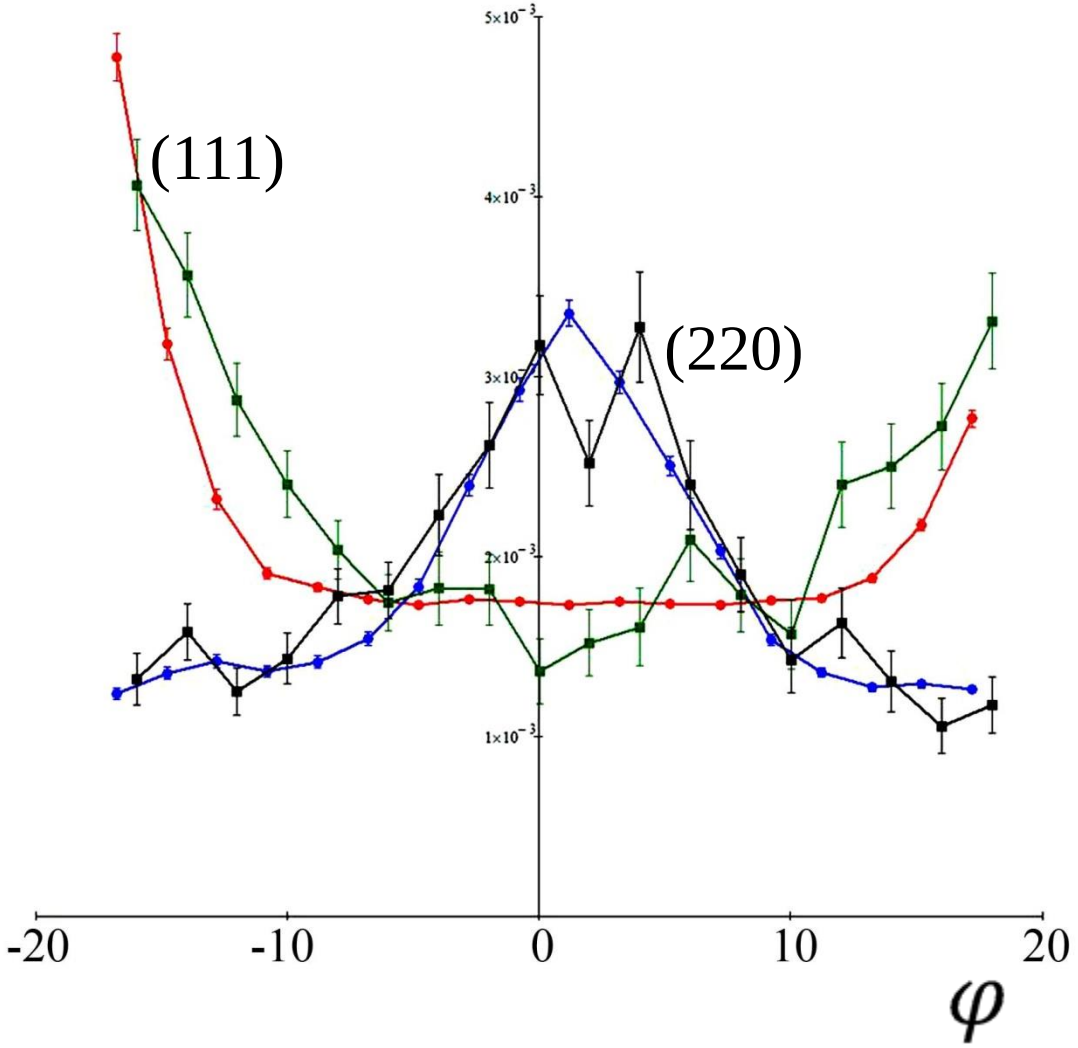
PBBS from 40μm Ni polycrystal. The average grain size is 300nm.

The research of textured targets.



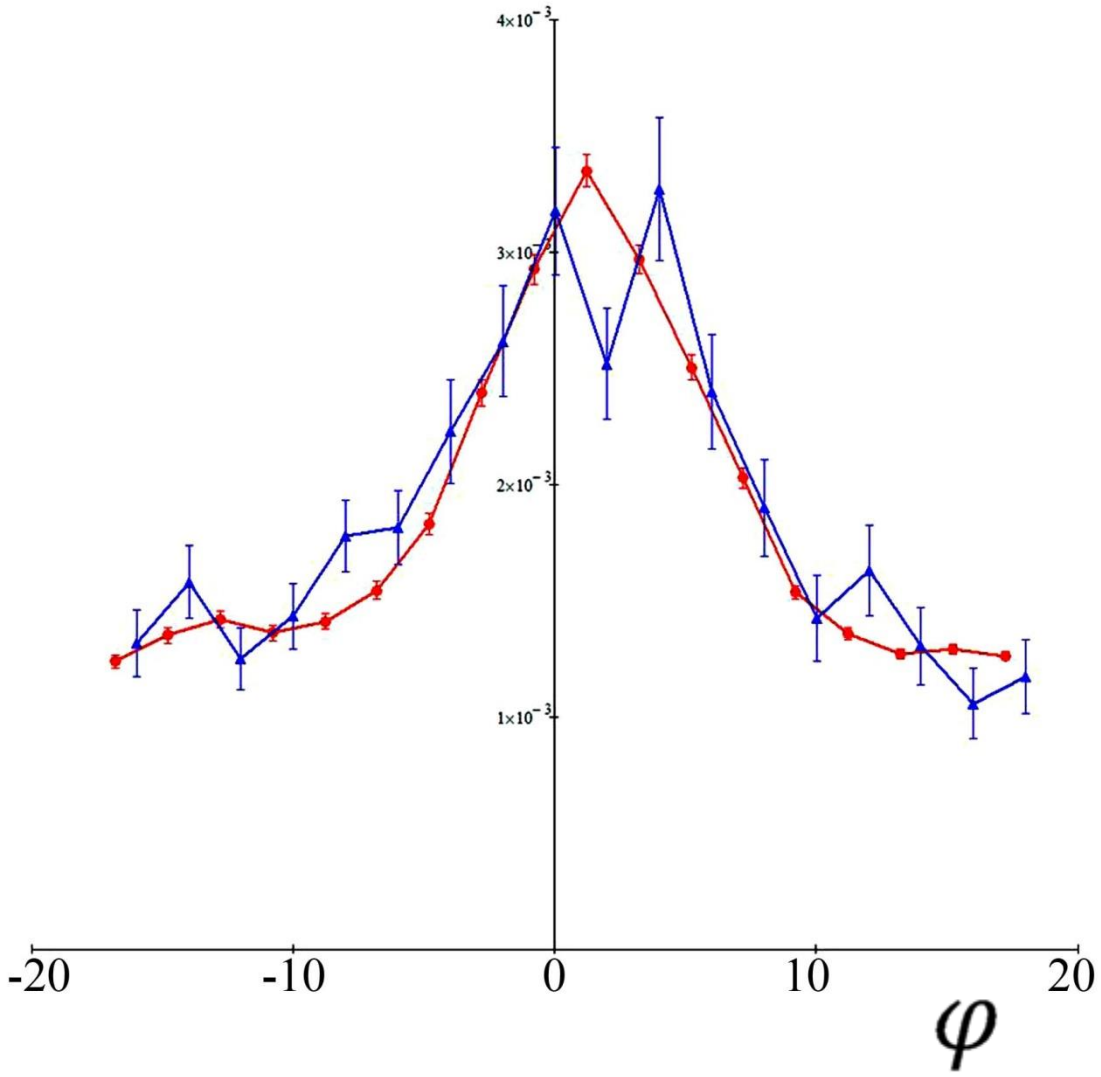


The orientation dependence of PBBS reflexes (111) and (220) from 60mk Ni textured polycrystalline foil. The comparison with XRD.



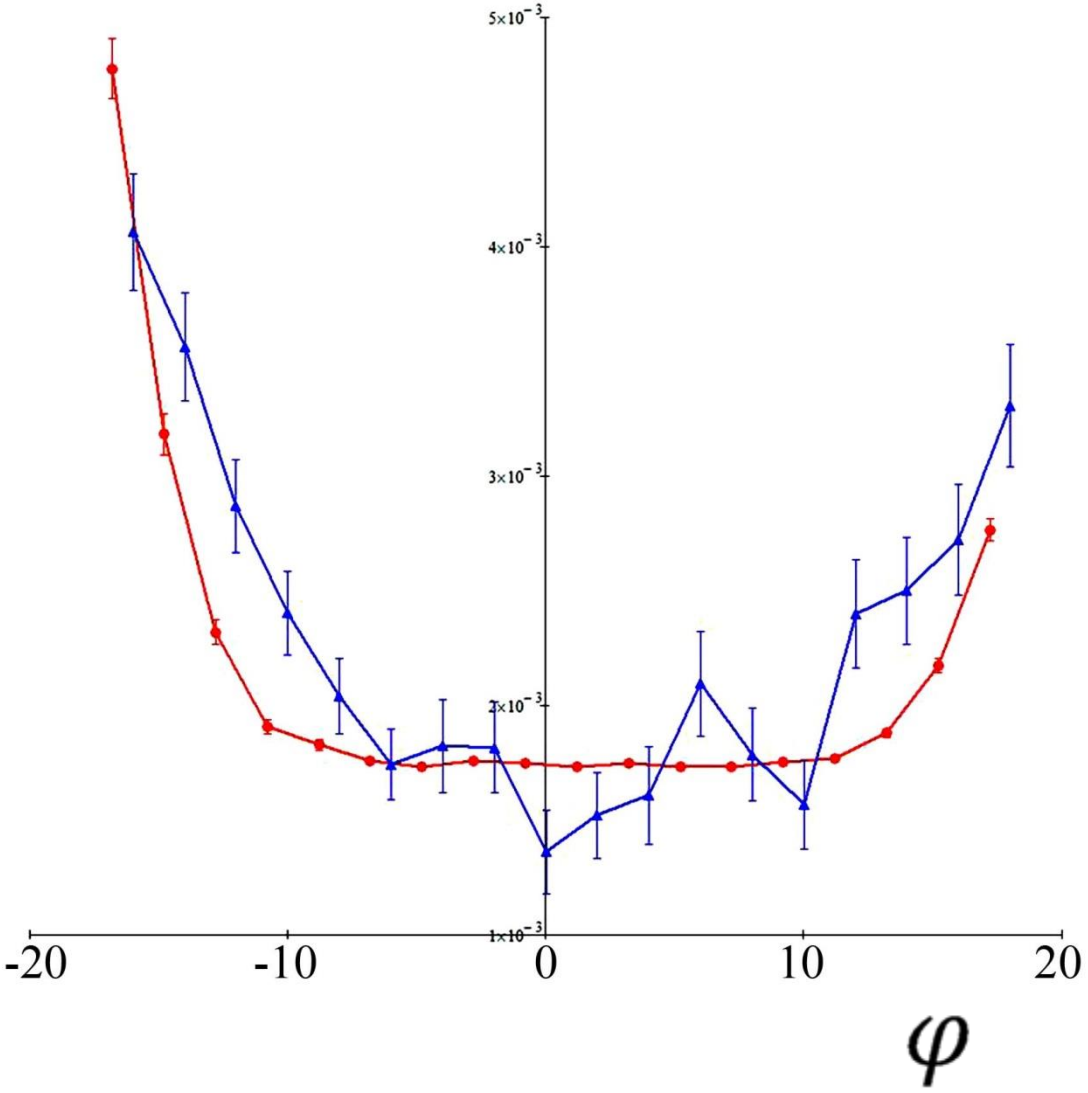
PB reflex (220) – 4.98keV

XRD (220) – 7.13keV



PB reflex (111) – 3.05keV

XRD (111) – 4.37keV



Conclusion

Narrow PB peaks at angle of 180^0 are reliably fixed in the work.
The measured peaks are very sensitive to the structure parameters of polycrystals. This result presents interest for the further development of a new energy-dispersive method for diagnostics of atomic structures of polycrystals.
The focusing of electron beams is easier task than the X-Ray focusing. It allows to achieve the high spatial resolution of measurements using a simple magnetic focusing of electron beam on a target.
The results of PBBS research from polycrystalline target with submicron size of grains allow to assume the efficiency of the developed technique for research on nano-dimensional structures.

Thanks for yours attention!