Recording of tomographic image of direct illumination target at the iodine laser facility «Iskra-5»

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Experiment conditions

Target parameters:

D_{target} = 513 μm;
Δd= 1.3 μm;
P_{DT}= 3 atm.

Laser beams parameters:

λ = 0.66 μm (2ω);
E_L= 175 $\times$12 =2100 J;

$\tau_{0.5}$= 0.6 ns;

Recording conditions:

Multichannel pinhole cameras - 7 pcs;
θ: 43º 43º 43º   43º   137º 137º 137º
φ: -10º -80º 170º 100º -135º   135º   45º

$\varnothing_{hole}$ = 9$\div$30 μm;

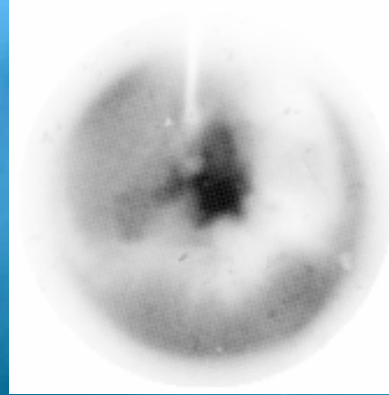Magnification: M$^{\times}$= 4.3$\div$4.6;

Resolution up to 11 μm;
Filter: 20 μm Be, hv >1.5 keV;

Recorded images

43º; -10º   43º; -80º   43º; 170º   43º; 100º
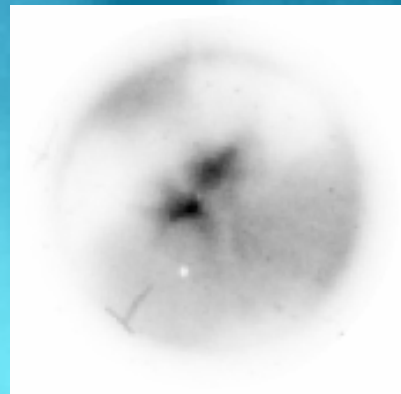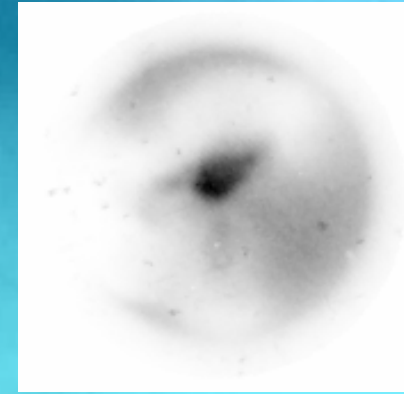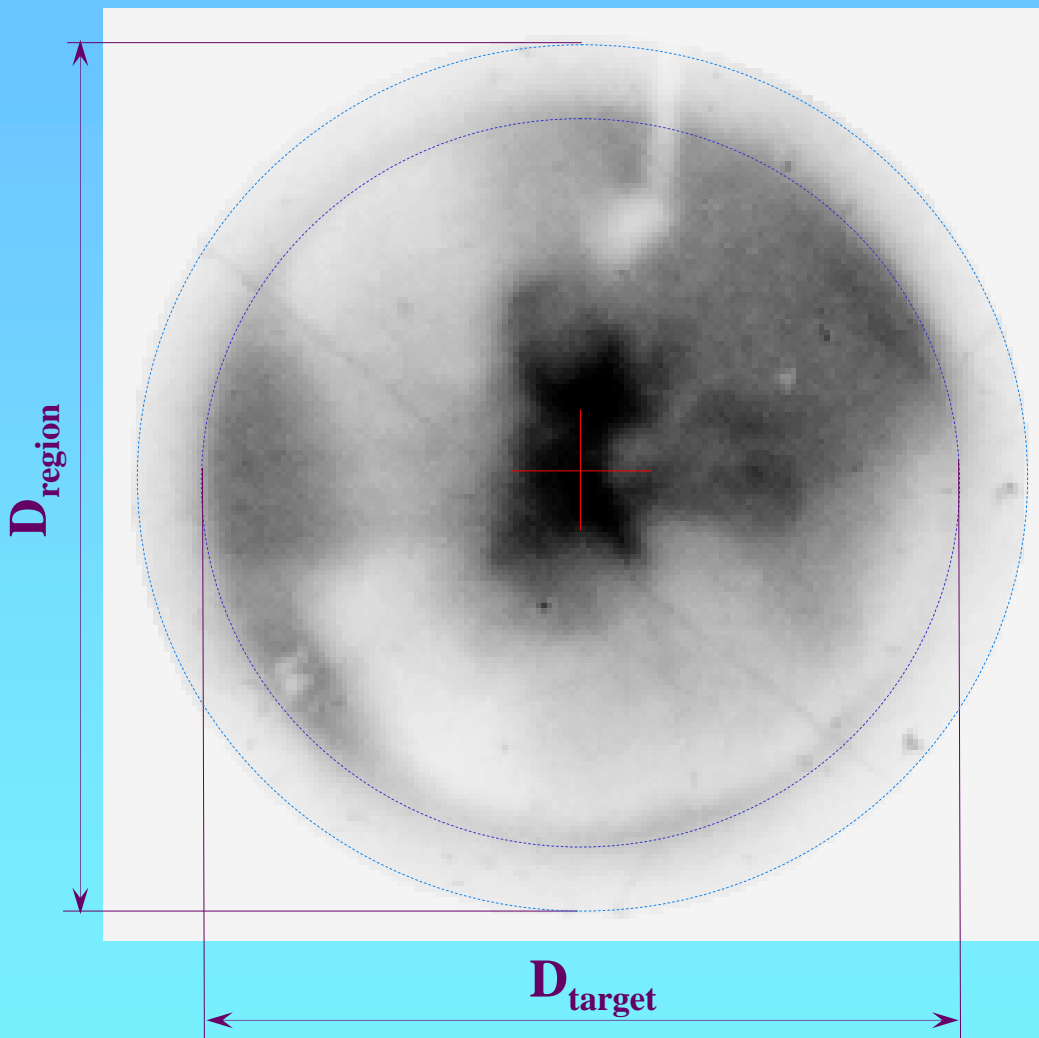
137º; -135º   137º; 135º   137º; 45º
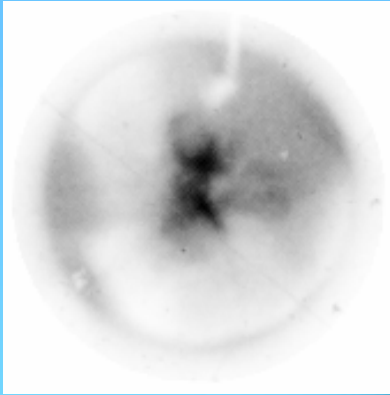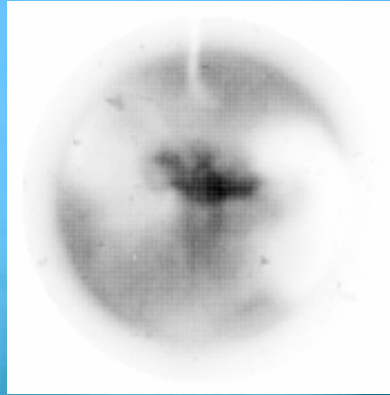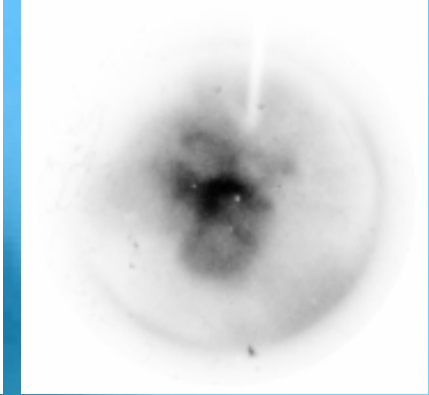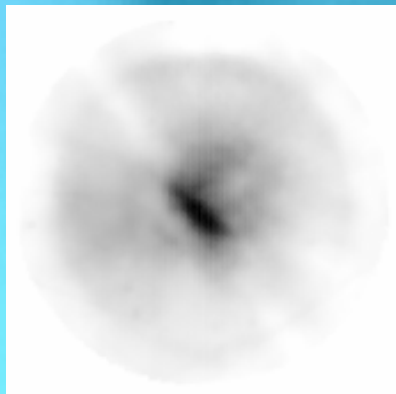
Neutron yield: $Y_N = 2 \cdot 10^8$

$$\Delta r_{centre} = D_{target}/150$$

$$D_{region} = 1.2 \cdot D_{target}$$

$$\Delta I/I = 20\%$$

Rotation of images

Line of pinhole row
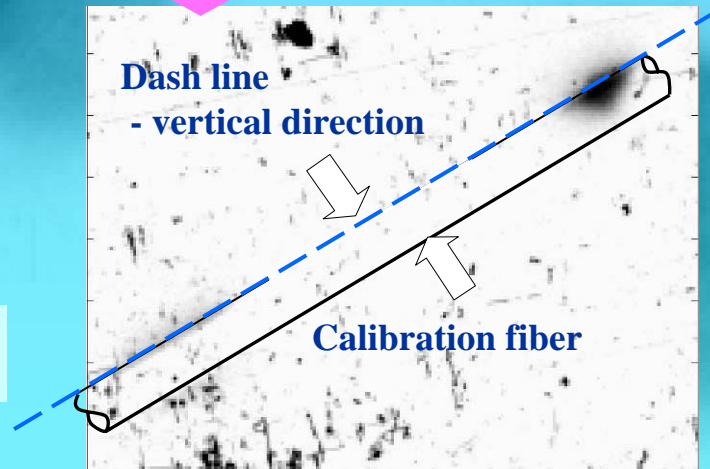
Line of image row

γ

β

α

Vertical direction

Line of pinhole row

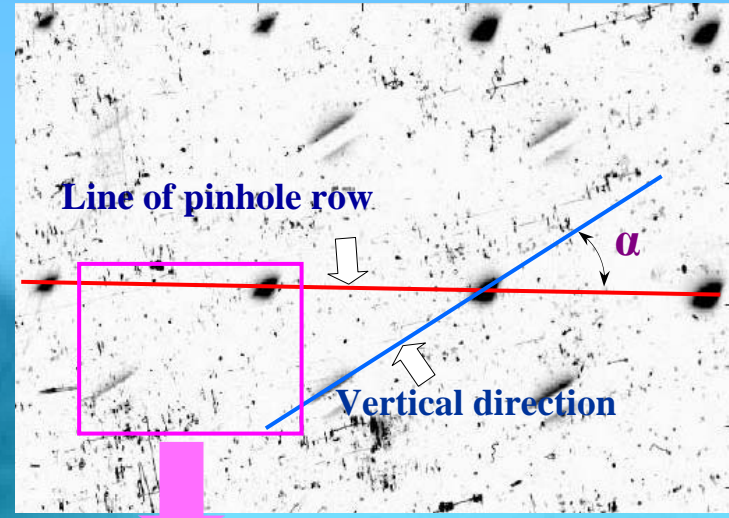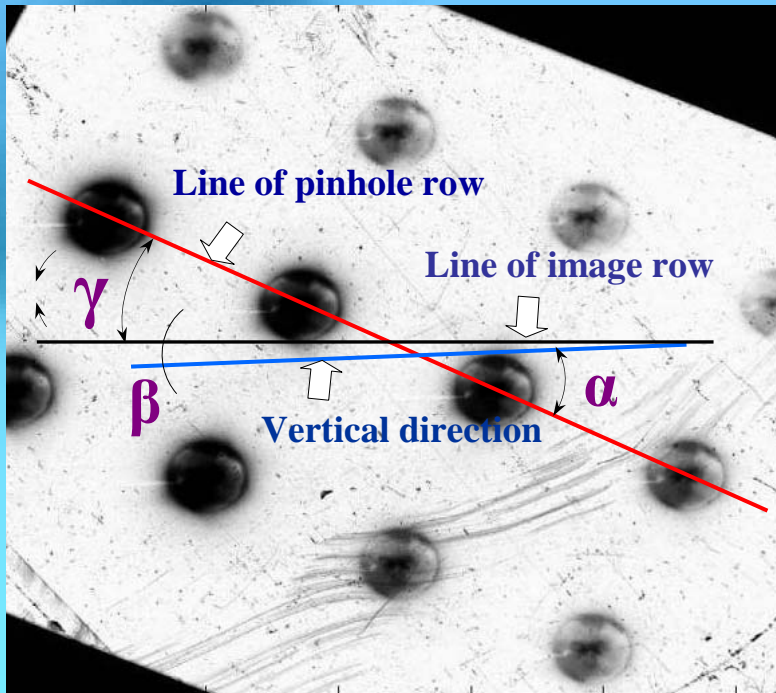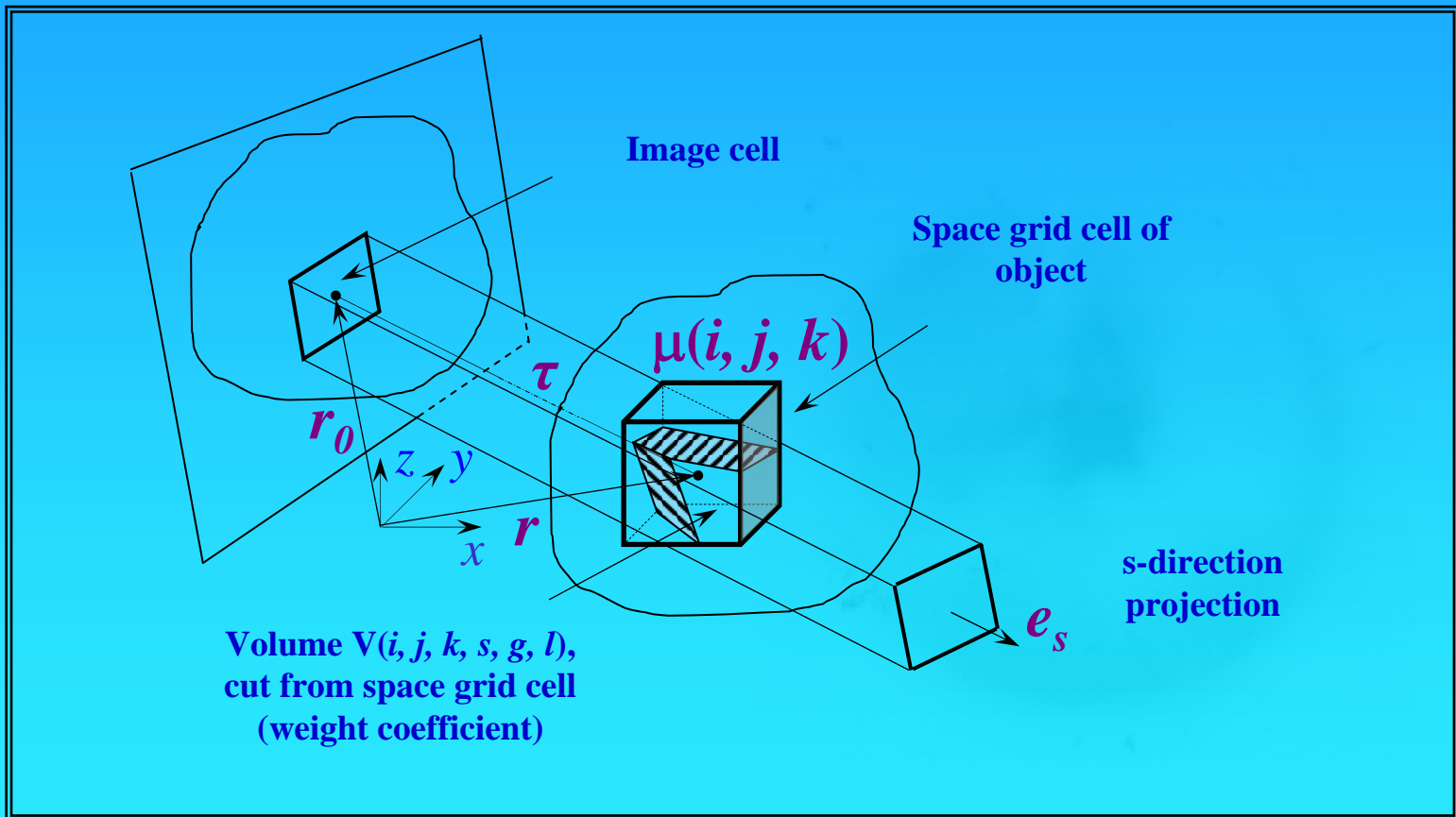α

Vertical direction

Dash line
- vertical direction

Calibration fiber

Image rotation angle: $\beta = \alpha - \gamma$

$$m_s(\,\boldsymbol{r}_0\,) = \int \mu(\,\boldsymbol{e}_s \cdot \tau + \boldsymbol{r}_0\,)d\tau$$

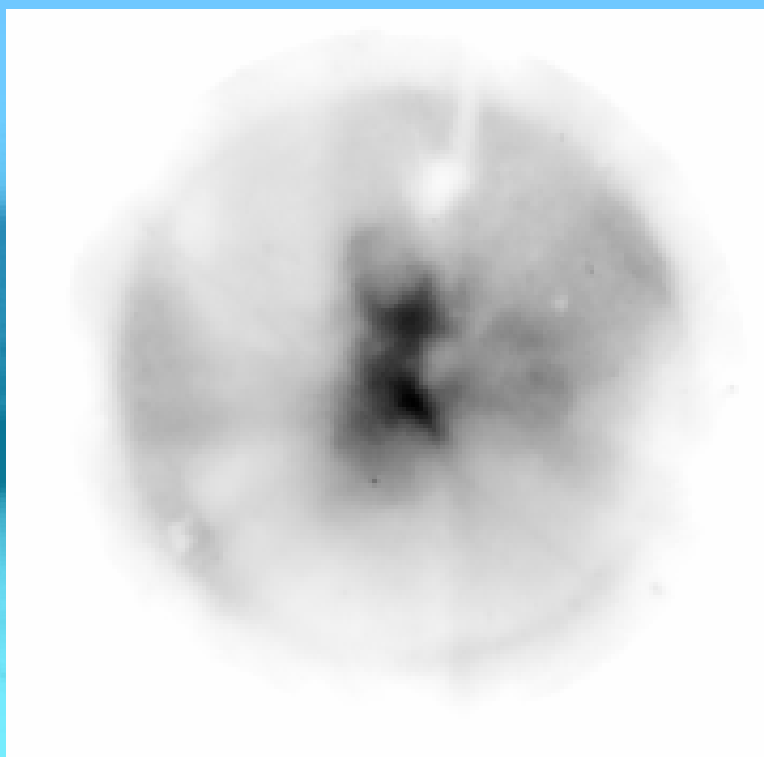$$m_{s,g,l} = \sum_i \sum_j \sum_k V_{i,j,k,s,g,l} \cdot \mu(i,j,k) \quad i,j,k,g,l = 1, \ldots, 200, \quad s = 1, \ldots, 7$$

Image cell

Space grid cell of object

$\mu(i, j, k)$

τ

r_0

z y

x r

e_s

s-direction projection

Volume V(i, j, k, s, g, l), cut from space grid cell (weight coefficient)

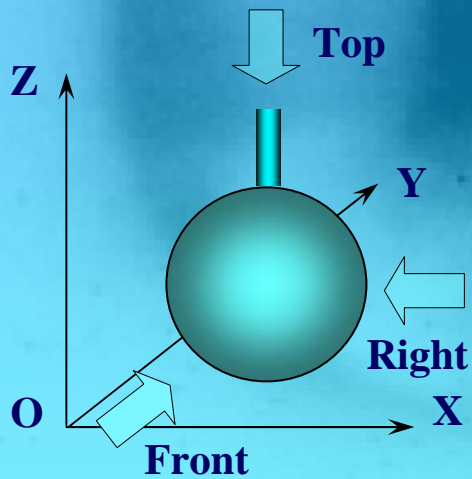# Recorded and reconstructed images
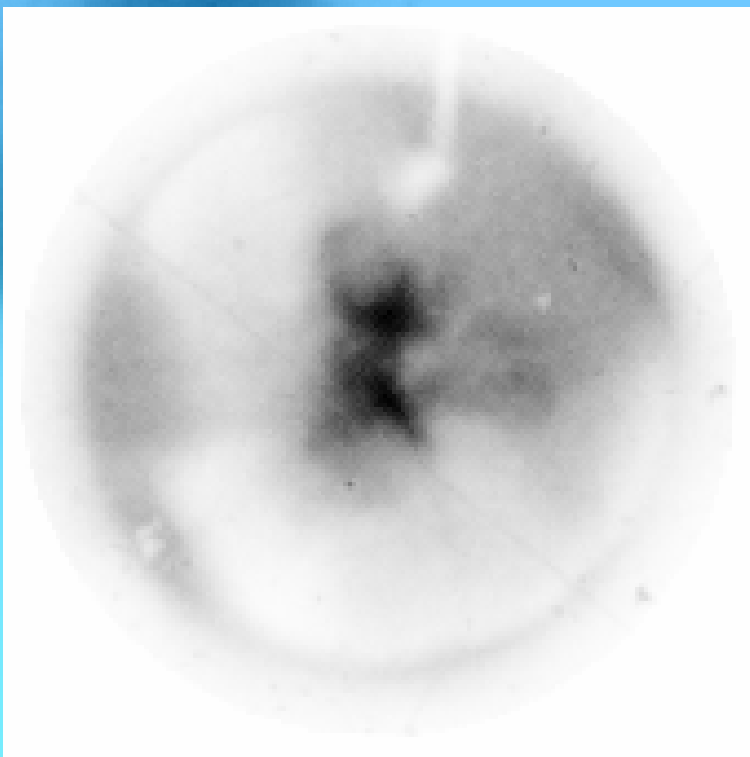
Recorded image

Reconstructed image

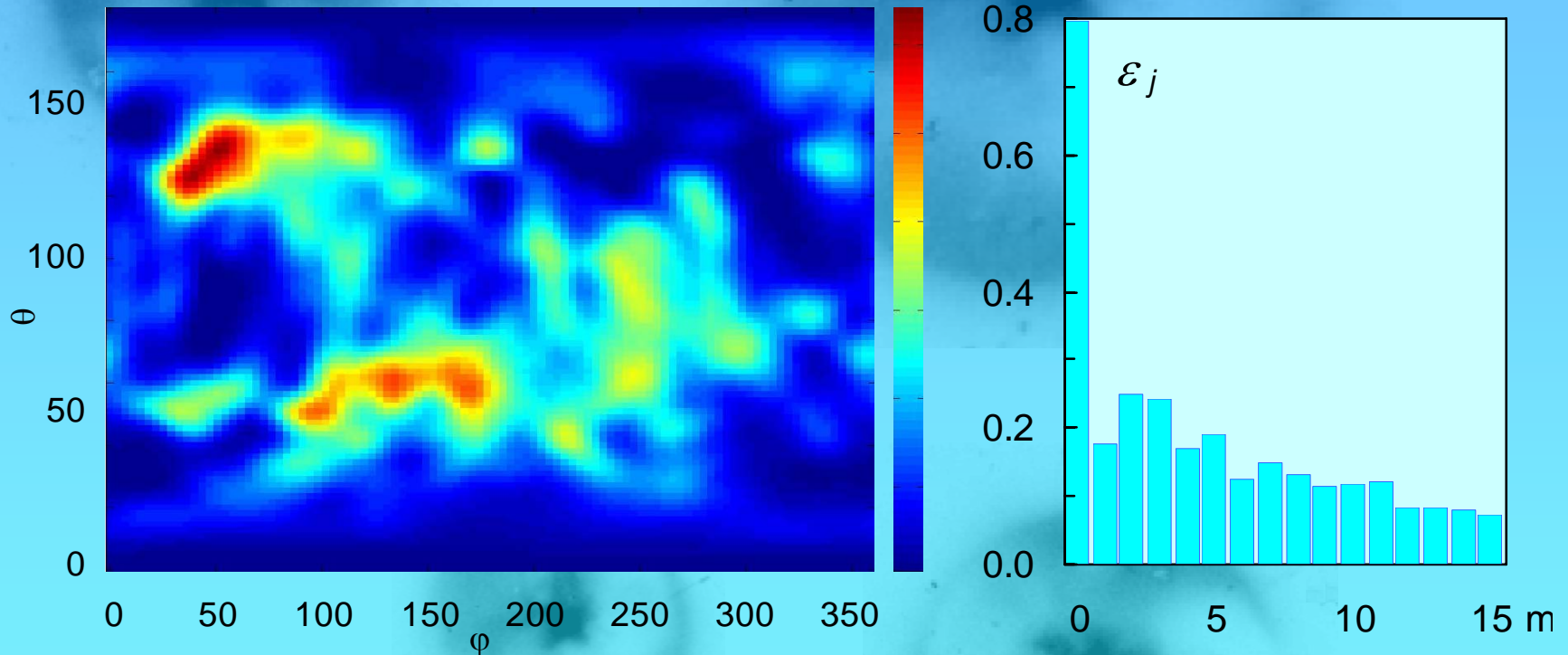# Compressed core image

Top

Front
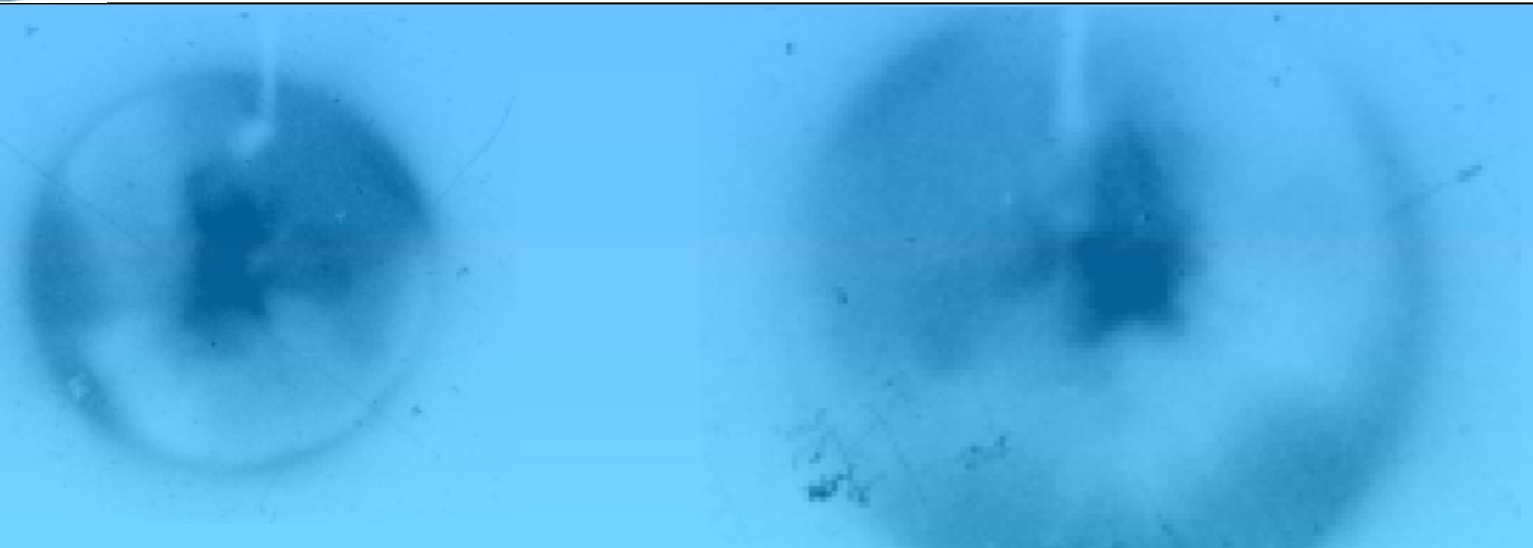
Right

Reconstructed target illumination

Target illumination nonuniformity ~ 60% (rms)

Conclusion

• **The method of recording tomgraphic image of microshell is realized in experiment on direct illumination of a microsphere by twelve laser beams on the second harmonic (λ= 0.66 μm) of iodine laser «Iscra-5».**

• **A tomographic imaging of the shell are performed using pinhole images of the target in x-rays of hν > 1.5 keV recorded from seven different directions.**

• **The analysis of the tomographic image made possible to estimate an initial nonuniformity of shell illumination. The root-mean-square nonuniformity of the shell illumination is evaluated ~ 60%.**

• **Compressed core in the shell centre has a complex non-symmetrical shape. The structure details with dimensions of ~ 20-30 μm are well visible in it. A displacement of core from the shell center is about 30 μm.**

Thank You!