PROGRAMME QUALITY ASSURANCE IN RADIOSURGERY CARRIED OUT AT THE LNPI SYNCHROCYCLOTRON AND EXPERIENCE IN STEREOTACTIC PROTON THERAPY

N.K.Abrosimov, E.M.Ivanov, Ya.A.Kasman, V.I.Lazarev, Yu.A.Malov, G.A.Ryabov, D.M.Seliverstov, A.A.Vorobyov, D.L.Karlin*, B.A.Konnov*, N.A.Lebedeva*, L.A.Melnikov*, T.V.Pushkareva*, I.Ya.Senitchev*, B.L.Vinogradov, N.N.Yalinitch*, O.P.Zargarova*, M.V.Zhidkov*, O.M.Zhidkova*

* Central Research Roentgenoradiological Institute of Ministry of Public Health of Russia, St.-Petersburg

In the world radiosurgery practice using different high-energy particles aimed to increase the efficiency of radiation therapy one of the main approaches is now the realization of the integrated quality assurance programme including physical-technical, radiobiological and clinical sections. Requirements of such programme is the unification of the irradiation procedure being done more simple comparing results obtained in different centers. The main established features of the erradiation by proton, photon and narrow heavy ion beams are the following:

1. Measurements of the radiation dose at the level ±5%.
2. The dose power constancy at the level of ±2%.

3. The stability of beam parameters — dimensions ±1% and maximum of the dose distribution ±2%.
4. The reproduction of the dose fields — ±0.5 *mm*.

The first three points are achieved by the good quality of measurements of proton beam profile and the intensity, the last one by the programme of the irradiation and its realization through computer control system. Such a system including a new construction of a patient turntable and a head fixator rotated in the angular range correspondingly and controlled by the computer system (PC — AT 286) was developed in LNPI and started in 1991. Due to this fact it becomes possible to obtain: the reproduction of angular parameters at the level ±0.25°, linear ones — ±0.1 *mm* and the constancy of the target isocentre. In the rotation its position coincides with the maximum of the dose field not less than ±0.5 *mm*. As a result the depth dose distribution along the beam direction (fig.) becomes more limited. The time of the irradiation was twice increased.

In 1990—1991 the stereotactic proton therapy was continued, data on the treatment are given in tables 1—3.

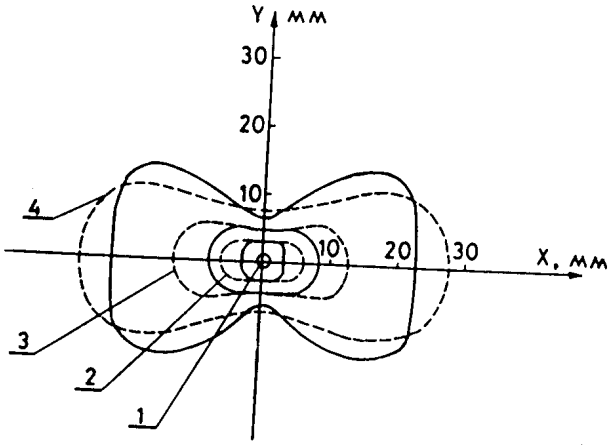

Fig. Relative dose distribution in frontal plane XY.

Axis X coincides with direction of proton beam 6×6 mm^2 at 50 per cent of isodose.

Dash-lines 1,2,3,4 correspond to 90, 50, 20 and 5 per cent of isodoses. Solid-lines show dose distributions obtained with computerized control system

Table 1

Experience of stereotactic proton therapy at the synchrocyclotron of LNPI in 1990—1991

	Hypophysectomy		
Total number of patients	Normal pituitary	Pituitary adenomas	Arterio-venous malformations
96(5)	10	31	55(5)

In brackets the number of repeated treatment of patients is given.

Table 2

Experience on normal pituitary

Total number of patients	Cancer of the breast	Ophthalmopathy
10	8	2

Table 3

Experience on pituitary adenomas

Total number of patients	Itsenko-Cushings disease	Prolactinomic	Somatotrophinomic	Non-functioning
31	13	10	4	4

Results of patient treatments in 1990—91 are being analyzied now.