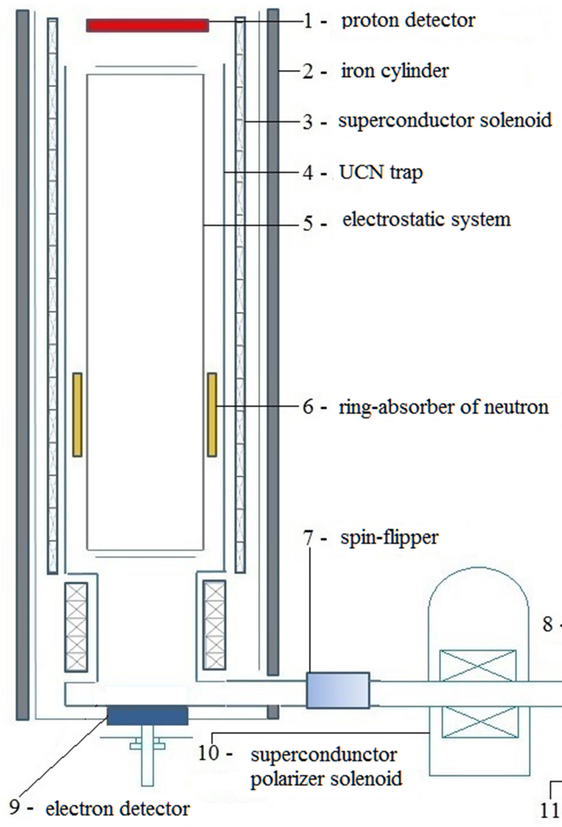
Experiment on measuring the ratio of the axial and vector constants of weak interaction

Petersburg Nuclear Physics Institute named by B.P. Konstantinov of NRC «Kurchatov Institute», Gatchina, Russia

Project leader: A.P. Serebrov
Presenter: A.K. Fomin

N.I. Boldyreva, O.M. Zherebtsov, V.G. Ivochkin, G.N. Klyushnikov, A.O. Koptyukhov, M.S. Lasakov, E.N. Leonova, A.N. Murashkin, O.P. Fedorova



Scheme of the set-up

$$\lambda = G_A / G_V = \frac{A_0 - B_0}{A_0 + B_0} = \frac{PA_0 - PB_0}{PA_0 + PB_0}$$

$$N_{ji} = F(E_j)\left[1 + a\left\langle\frac{v}{c}\right\rangle_j \langle\cos\theta_{ev}\rangle_{ji} + PA\left\langle\frac{v}{c}\right\rangle_j \langle\cos\theta_{eS_n}\rangle_{ji} + PB\langle\cos\theta_{\nu S_n}\rangle_{ji}\right]$$

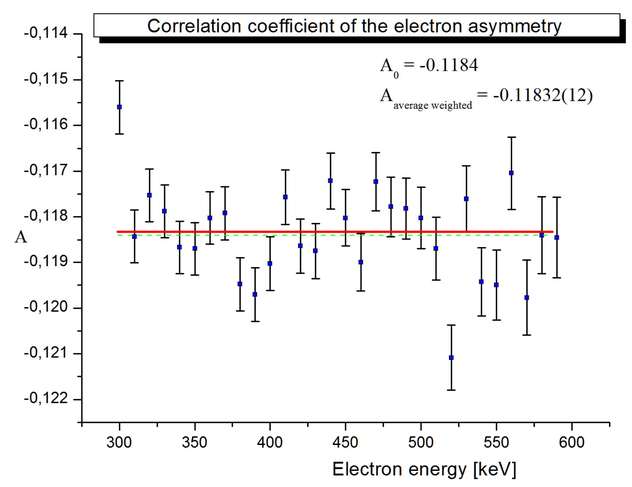
j – electron energy, i - time of proton flight

Electron asymmetry measurements

$$(PA)_j = \frac{N_j^{\uparrow} - N_j^{\downarrow}}{N_j^{\uparrow} + N_j^{\downarrow}} \times \left[\left\langle\frac{v}{c}\right\rangle_j \langle\cos\theta_{eS_n}\rangle_j\right]^{-1}$$

Gathering every proton in the neutron decay area with electric field at the proton detector

$$\langle\cos\theta_{\nu S_n}\rangle_j = 0 \qquad \langle\cos\theta_{ev}\rangle_j = 0$$



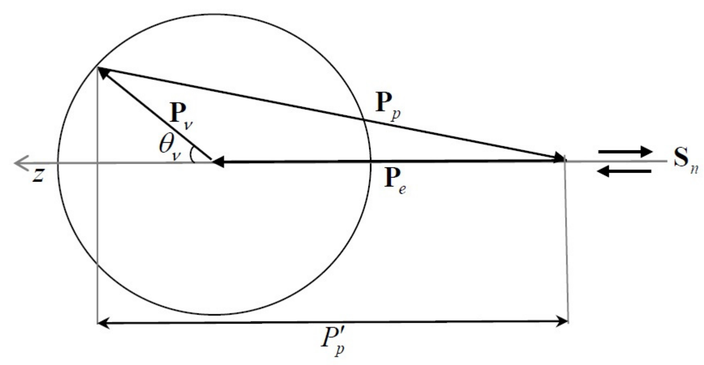


Diagram of the particle momenta in the polarized-neutron decay

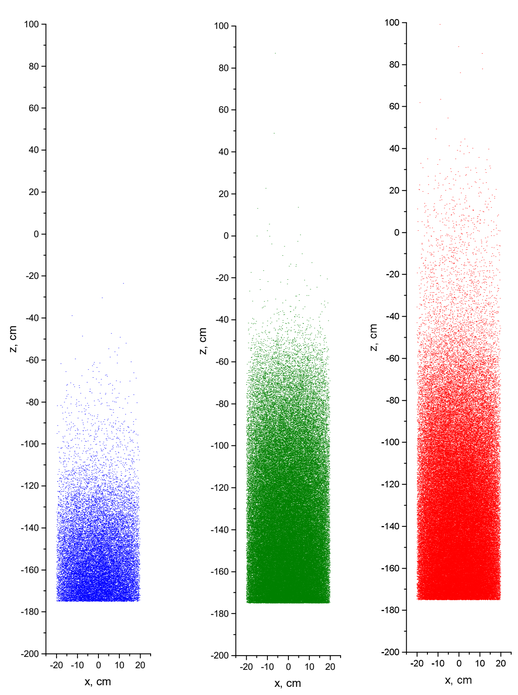
Neutrino asymmetry measurements

$$(PB)_{ji} = \left(\frac{N_{ji}^{\uparrow} - N_{ji}^{\downarrow}}{N_{ji}^{\uparrow} + N_{ji}^{\downarrow}} \times \left[1 + a\left\langle\frac{v}{c}\right\rangle_j \langle\cos\theta_{ev}\rangle_{ji}\right] - PA\left\langle\frac{v}{c}\right\rangle_j \langle\cos\theta_{eS_n}\rangle_{ji}\right) \times \langle\cos\theta_{\nu S_n}\rangle_{ji}^{-1}$$

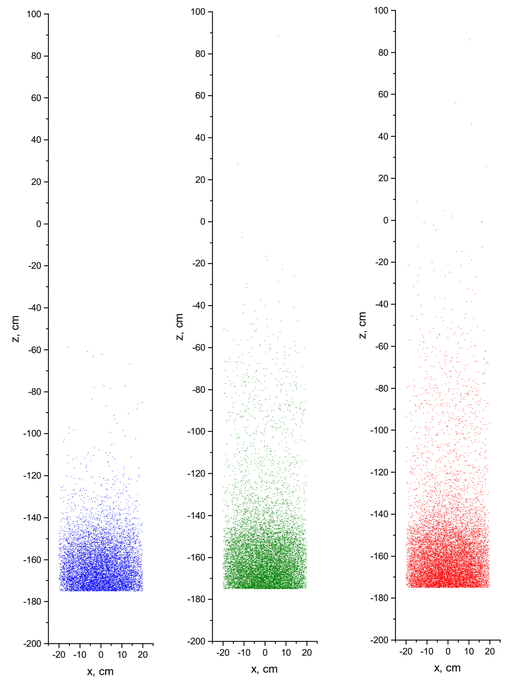
$-(\mathbf{p}_\nu)_\parallel = (\mathbf{p}_p)_\parallel + (\mathbf{p}_e)_\parallel$ Electric field in the neutron decay area is absent $(\mathbf{p}_p)_\parallel = m_p L t^{-1}$

To variate of the length of proton flight L a ring absorber is used

The density of UCN in the decay area for Cu, Be, ^{58}Ni Mo coating

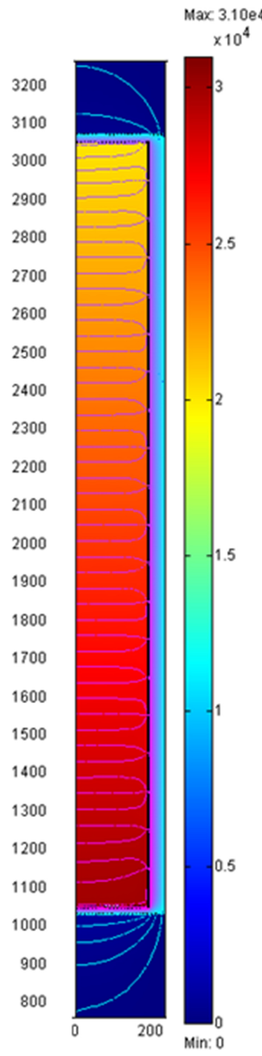


Absorber in the upper position

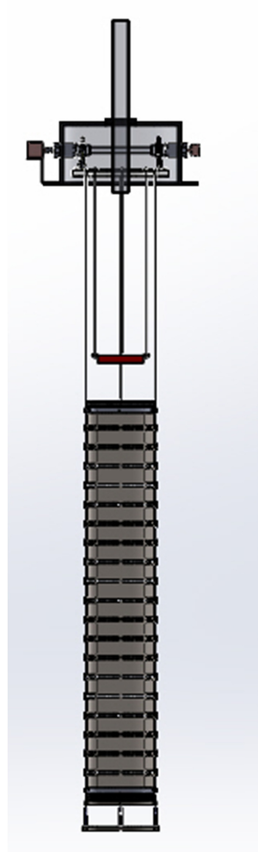


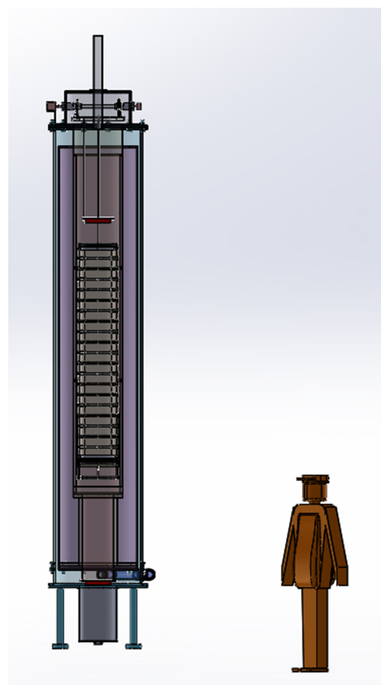
Absorber is lowered in volume

Electrostatic system includes 20 190 mm radius ring electrodes with the height of 95 mm

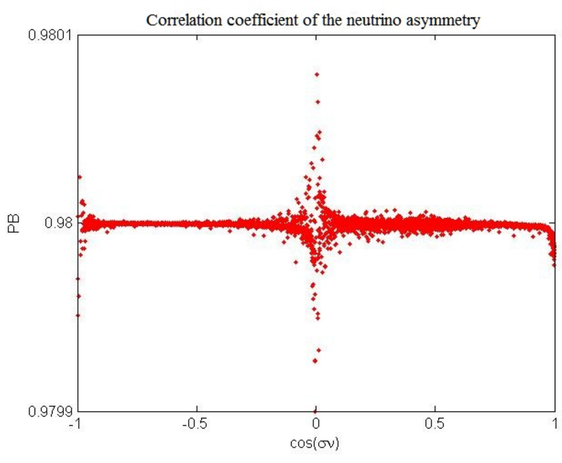


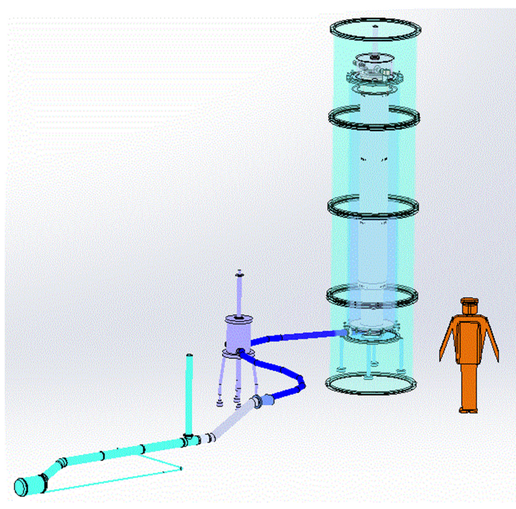
Electrical potential of the system for A coefficient measurement



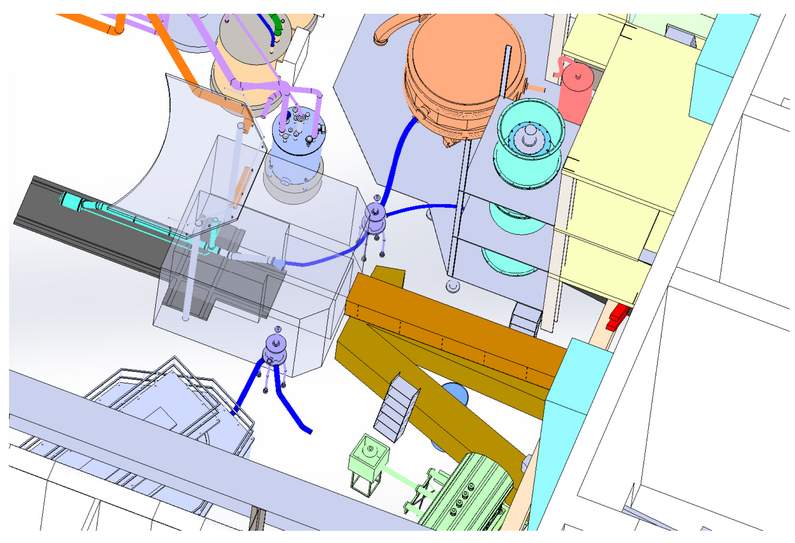


The electrostatic system is mounted inside the UCN trap





Neutron guide system of the experiment at the WWR-M reactor



The position of the set-up in the reactor hall

The work is supported by the Russian Foundation for Basic Research, grant no. 19-02-00547-a.