

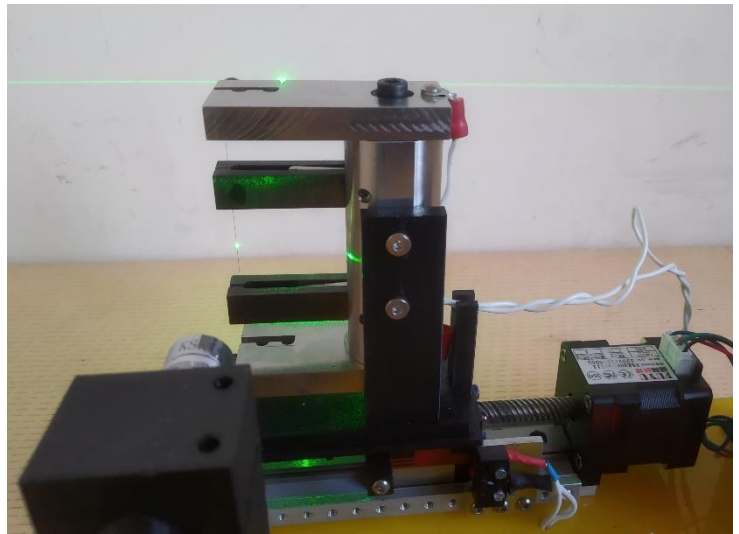
Vibrating wire monitors and beam profile measurements

The course includes a detailed overview of existing beam profiling methods: beam scintillator screens, secondary emission monitors, wire scanner, multi-wire proportional chambers, residual gas monitors, optical transition radiation monitors, synchrotron radiation monitors, laser wire scanner. The specific parameters and usage features of different technics are presented.

In the course students will be familiarized with a new diagnostic instrument for beam profile measurement – the Vibrating Wire Monitor (VWM), the operation principle of which is based on a simple and clear idea of a mechanical resonator (stretched wire) and its frequency dependence on the wire tension. The wire tension, in turn, depends on its temperature, i.e. the instrument is essentially a precise thermometer. The dependence of the wire temperature on its position in the beam determines the beam profile. A wide dynamic range (in the temperature equivalent to fractions of milli Kelvin to hundreds of degrees), high accuracy of the measurements, good long-term stability, resistance to high background radiation and electromagnetic interference, and digital nature of the measurement of the output value (i.e., the frequency of natural oscillations of the wires) make this method a versatile tool for measuring the profiles of beams of charged particles, electromagnetic radiation, and neutrons in a wide range of energies. The large dynamic range, in particular, allows for measurements in both the halo and core of the beam.



Left: general view of test bench of VWM equipped with stepper motor feed. As a beam the semiconductor laser is used. The monitor is covered with a box to protect it from convective air streams



Right: general view of VWM irradiated with laser beam