LBNL Neutron Facility for PGAA and NAA Experiments

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Various types of neutron generator systems have being made and tested at the Plasma and Ion Source Technology Group in Lawrence Berkeley National Laboratory. These generators are based on D-D fusion reaction. These high power D-D neutron generators can provide neutron fluxes in excess of the current state of the art, D-T neutron generators, without the use of pre-loaded targets or radioactive operation gases. The safety of operation and reliable long-life operation are the typical features of these D-D generators.

All of the neutron generators developed in the Plasma and Ion Source Technology Group are utilizing a powerful RF-induction discharge to generate the deuterium plasma. One of the advantages of using the RF–induction discharge is its ability to generate high fraction of atomic ions from molecular gases, and the ability to generate high plasma densities for high extractable ion current from a relatively small discharge volume. Further advantages are the reliable, long life-time operation and easy, turn-key operation.

The neutron generator is based on a novel co-axial design, which maximizes the target area compactly at the outer dimensions of the generator. Large target area enables one to operate at high beam power, thus yielding high neutron fluxes. The generator is currently operating at 120 kV of acceleration voltage and 50 mA of deuterium beam current. This beam power yields a D-D neutron flux of $>10^9$ n/s. This neutron generator coupled with shielding/moderator structure in a test stand at the Plasma and Ion Source Technology Group has made possible a small scale neutron facility for NAA (Neutron Activation Analysis) and PGAA (Prompt Gamma Activation Analysis) experiments. Figure 1 shows a picture of the experimental set-up and the co-axial neutron generator.

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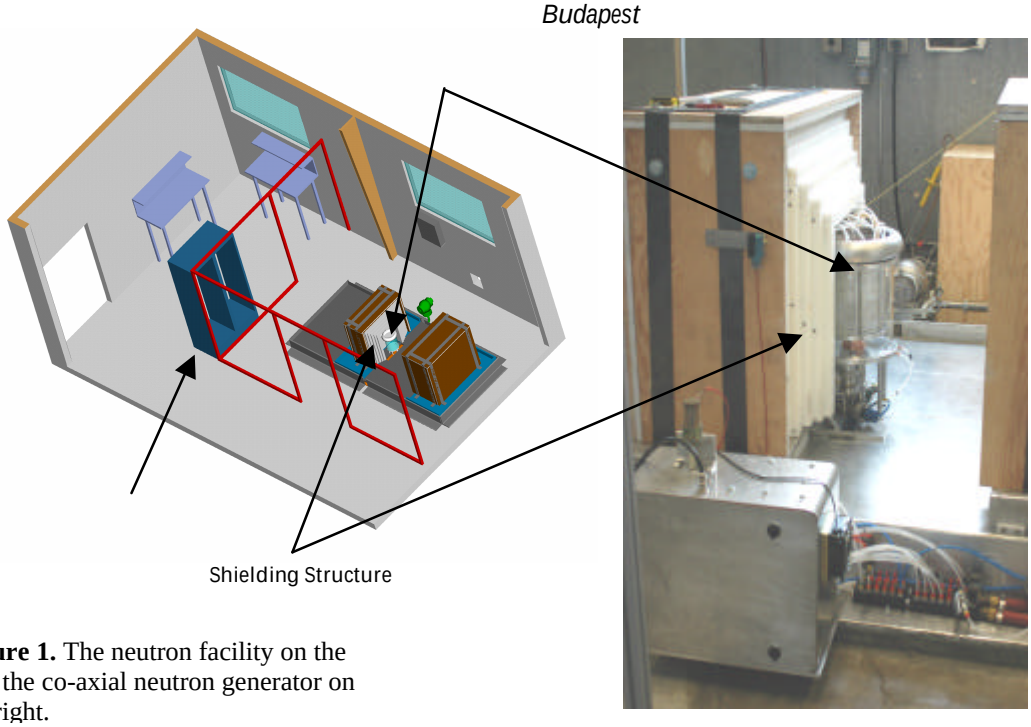

Figure 1. The neutron facility on the left, the co-axial neutron generator on the right.