



The Neutron Long Counter is an important tool for fast-neutron measurements. As a result of its sophisticated internal structure, it has a nearly flat (+/- 15%) efficiency as a function of neutron energy from ~150 keV to > 15 MeV. Thus relative neutron output of various neutron sources can be quite accurately measured independent of source type. This is in stark contrast with the order-of-magnitude efficiency variation over the same energy range for simpler spherical-moderator-type systems.

Since its development in 1947 by Hanson and McKibben[1], the long counter, more than any other instrument, has been used to calibrate unknown isotopic neutron sources against various national neutron standards and to quantify neutron production in targets of various accelerators for producing monoenergetic neutrons via common reactions such as d-d, d-T, p-T, and p-⁷Li. Almost every laboratory involved in neutron physics and neutron dosimetry has a long counter on its list of essential equipment. Discussions on long counters, including later variants of the initial design, can be found in

standard reference books [2,3].

Despite its popularity among neutron experts, the commercial availability of long counters has been problematic in recent decades. Upon request from governmental groups, BTI has constructed a modern long counter that matches the efficiency performance of the Texas Nuclear Model 9100 system at the 1%-2% level verified over a range of neutron energies from <300 keV to >17 MeV. The BTI long counter is available with a sturdy lockable gimbal mount on a wheeled cart for ease of positioning. Initial factory efficiency calibration using NIST traceable laboratory sources and standard procedures are provided.

[1] A.O. Hanson and J.L. McKibben. 1947. Phys. Rev. 72: 673.

[2] W.D. Allen. 1960. Flat Response Counters in Fast Neutron Physics Part 1. J.B. Marion and J.L. Fowler, editors. Interscience, (NY), 361.

[3] Glenn F. Knoll. 2000. Radiation Detection and Measurement (3rd ed.). John Wiley & Sons, 542.

TECHNICAL SPECIFICATIONS

PERFORMANCE

Sensor Type: BF₃ proportional counter

Energy Range: Thermal to ~20 MeV

Efficiency: ~1.2 x 10⁵ counts/neutron emitted at a recommended standard distance of 137.5 cm from Cd snout for a PuBe source. Efficiency constant to about +/- 15% over operational energy range

Maximum Count Rate: >10,000/s

Efficiency Calibration: Factory calibration with NIST-traceable ²⁵²Cf source

MECHANICAL CONFIGURATION

Counter Assembly

Weight: ~46 kg (102 lb)

Dimensions: 42 cm high x 51 cm wide x 51 cm long (16.5" high x 20" wide x 20" long)

Stand/Cart

Weight: ~41 kg (90 lb)

Dimensions: 76 cm high x 61 cm wide x 76 cm long (30" high x 24" wide x 30" long)

POWER REQUIREMENTS

110V 50/60 Hz

(220 V to 110 V step down transformer available)

OUTPUT

Scaler Counts, Measurement Time, Remotely Operable

ENVIRONMENTAL

Temperature Range: 0 °C to +40 °C (32 °F to +104 °F)