MIRION TECHNOLOGIES

JCC-41™

Flat-Squared Neutron Coincidence Counter

KEY FEATURES

- Well-type neutron coincidence counter for in-plant applications
- Special design features give uniform spatial response axially over the sample cavity
- Relatively insensitive to sample matrix effects
- Relatively flat neutron energy response
- Twenty-four ^{3}He Detectors
- Fast Amptek electronics
- Large (61 x 24 cm) sample cavity
- Exterior neutron shielding
- Unit's high efficiency (>22%) provides high counting rates and good precision
- Response is better than 28 counts/sec per gram ^{240}Pu (a 1000 second counting time gives a precision of 2.4% for 0.06 gram ^{240}Pu)[1]

DESCRIPTION

The JCC-41 counter, which is based on Monte Carlo design calculations performed at Los Alamos National Laboratory[1], measures the effective ^{240}Pu mass in a sample by detecting coincidence neutrons from the spontaneous fission of the even numbered isotopes of plutonium. The JCC-41 unit is designed for in-plant measurements of large plutonium samples (up to several kg Pu), but can be used for plutonium waste samples with milligram quantities of plutonium. The JCC-41 counter has a higher efficiency, larger sample size and flatter axial response than the transportable JCC-31™ unit. The system consists of a JCC-41 counter head and sample hoist mechanism.

The JCC-41 counter has a cylindrical-shaped sample cavity. It is intended to assay plutonium samples including PuO_2, mixed oxides (PuO_2-UO_2), metal carbides, fuel rods, fast critical assemblies, solution, scrap, and waste. A cadmium sleeve surrounds the sample cavity to prevent the reentry of thermalized neutrons into the sample, which could induce fission in the sample and adversely affect the results.

Outside the cadmium sleeve is a polyethylene/cadmium liner to flatten the axial response. Twenty-four ^{3}He tubes are embedded in the high-density polyethylene. The tubes are arranged in a single ring around the sample with optimum spacing between the tubes for maximum counter efficiency.

The tubes are divided into six groups of four with each group wired together and connected to one of the six JAB-01 Amplifier/Discriminator circuit boards which are mounted inside a high voltage junction box. LED indicator lights are placed externally on the junction box to indicate proper operation of each JAB-01 channel. Electrical connections between the JCC-41 counter and the JSR-12™ unit include +5 V and HV. The combination of signals will be combined into a logical OR.

A cadmium sleeve wrapped around the outside of the JCC-41 unit provides radiation protection for personnel as well as background reduction.

The external polyethylene shielding and special design (graphite end plugs and polyethylene/cadmium liner) give uniform response axially over the sample cavity, making the counter relatively insensitive to matrix effects.

A JSR-12 Neutron Coincidence Analyzer, a computer and analysis software are required for coincidence counting but are not included with the JCC-41 counter.

SPECIFICATIONS

PERFORMANCE

- HV Setting – 1680 V.
- Gate Setting – 64 µs.
- Die-Away Time – 53.5 µs.
- Detector Efficiency – 22.8%.
- Sensitivity[1] – 28.3 cps/g ^{240}Pu, effective.
- Precision[1] – 2.4% for 0.06 g ^{240}Pu.
- Axial Response[1]
- ±5% for Totals using ^{252}Cf source.
- ±2% for Totals using PuO_2 sample.
- ±12% for Reals using ^{252}Cf source.
- ±4% for Reals using PuO_2 sample.
- ±2% for multiple-corrected Reals for a PuO_2 sample.

PHYSICAL

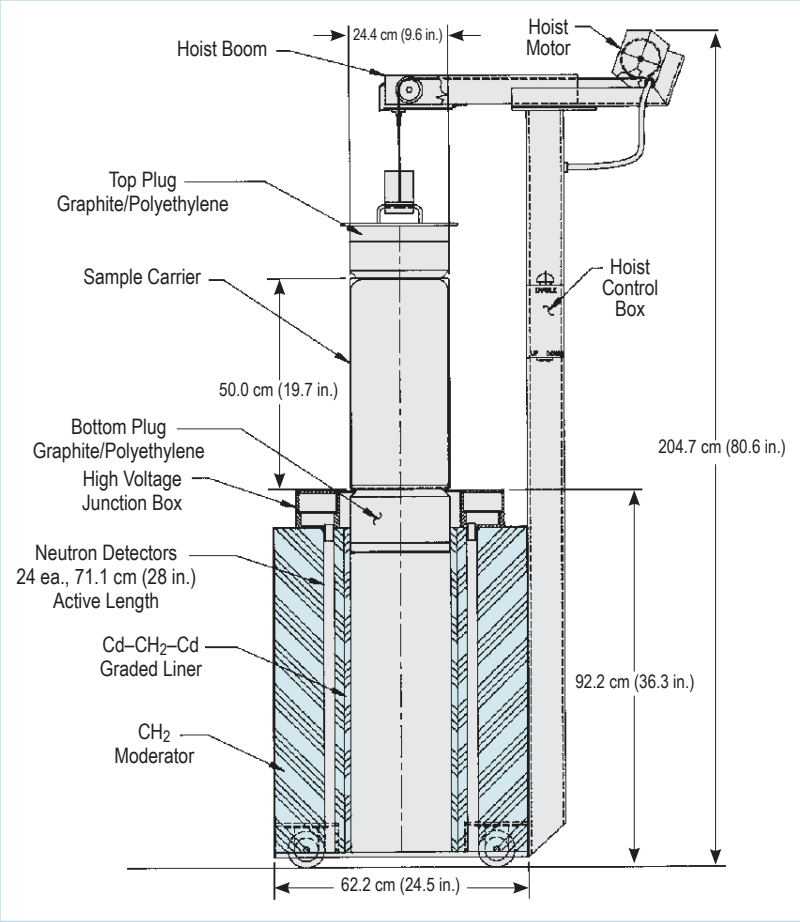
- Overall Size – 204.5 x 62.2 x 62.2 cm (80.5 x 24.5 x 24.5 in.) H (including sample hoist mechanism) x L x W.
- Counter Size – 92.5 x 62.2 x 62.2 cm (36.4 x 24.5 x 24.5 in.) H x L x W.
- Weight – 318 kg (700 lb).
- Sample Cavity Size – 50.0 x 24.4 cm (19.7 x 9.6 in.) H x Dia.
- ^{3}He Tubes – 24.
- ^{3}He Rings – 1.
- ^{3}He Active Length – 71 x 2.5 cm (28 x 1 in.) L x Dia.
- Cladding – Aluminum.

OPTIONS

- ^{252}Cf neutron source (one each) with source strength of $5x10^4$ neutrons/sec for making routine normalization measurements. An aluminum source rod that reproduces the position of the source is included with the counter.

REFERENCE

1. Menlove, H.O., Palmer, R., Eccleston, G.W., and Ensslin, N. (1989). *Flat-Squared Counter Design and Operation Manual*. Report LA-11635. Los Alamos, New Mexico: Los Alamos National Laboratory.



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