Ref: PK/146

AC-DC Neutron Flux Monitor

Product Certificate

CIVIDEC Instrumentation

Vienna

04.07.2016

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1 Products

1.1 B6-HV Thermal-Neutron Diamond Detector

In the Table below the detector parameters are shown:

Type	Thermal-Neutron Diamond Detector
Serial number	B60043
Substrate material	sCVD diamond
Substrate thickness	500 μm
Active area:	diameter 3 mm
Thermal neutron converter	^{6}Li

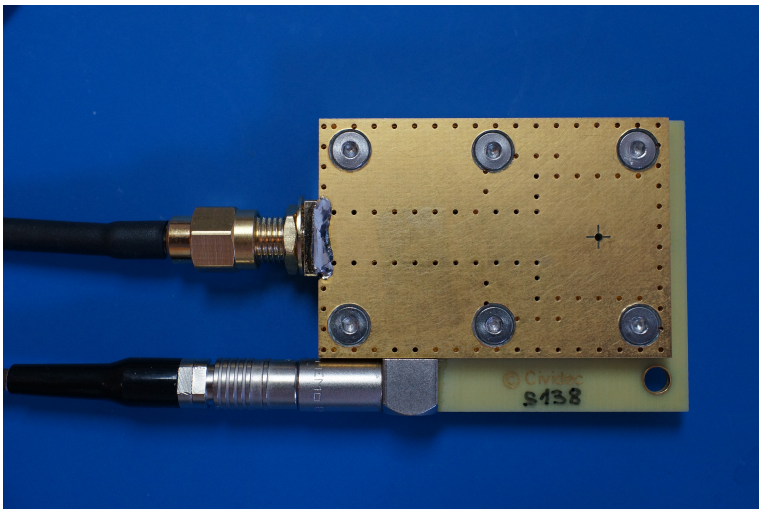

Figure 1: B6-HV Thermal-Neutron Diamond Detector.

1.2 C2 Broadband Amplifier

In the table below the amplifier parameters are shown:

Type	Broadband current amplifier
Serial number	C20103
Input coupling	AC coupled
Input polarity	Bipolar
Output polarity	Non-inverting, bipolar
Linear output voltage range	±1 V
Gain	151 (44 dB)
Equivalent input current noise	0.4 μA_{rms}

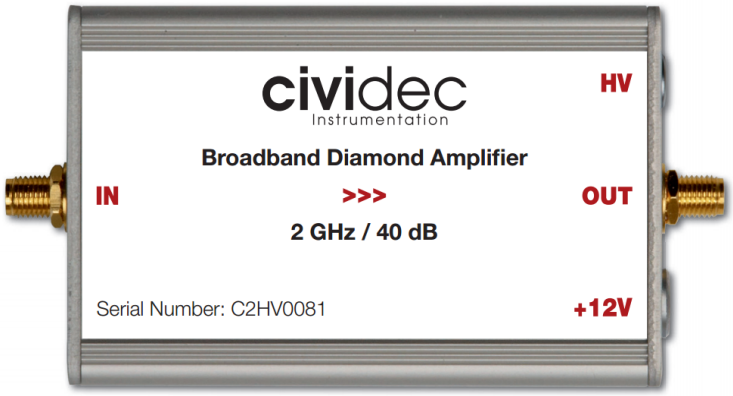

Figure 2: C2 Broadband Amplifier.

1.3 C8-Nano Electrometer Amplifier

In the table below the amplifier parameters are shown:

Type	Electrometer amplifier
Serial number	C8N0029
Gain	10 mV/nA
Range	10 V (1 μA)
Offset	<1 pA
Noise	<10 pA_{rms}

Figure 3: C8-Nano Electrometer Amplifier.

1.4 D1 AC-DC Splitter

In the table below the parameters are shown:

Type	AC-DC Splitter
Serial number	D10059
AC Bandwidth	4 GHz
DC Bandwidth	16 Hz
AC Coupling	1.5 nF / 1 kV
DC Coupling	1000 kΩ

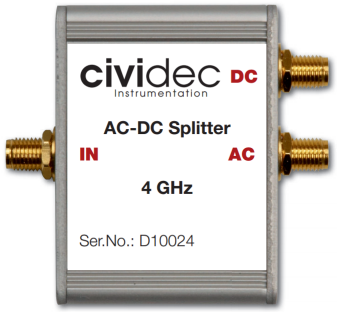

Figure 4: D1 AC-DC Splitter.

2 Calibration

2.1 Response to the α-particles

In Figure 5 the B60043 detector response to the 5 MeV α-particles, measured with the C2 amplifier, is shown.

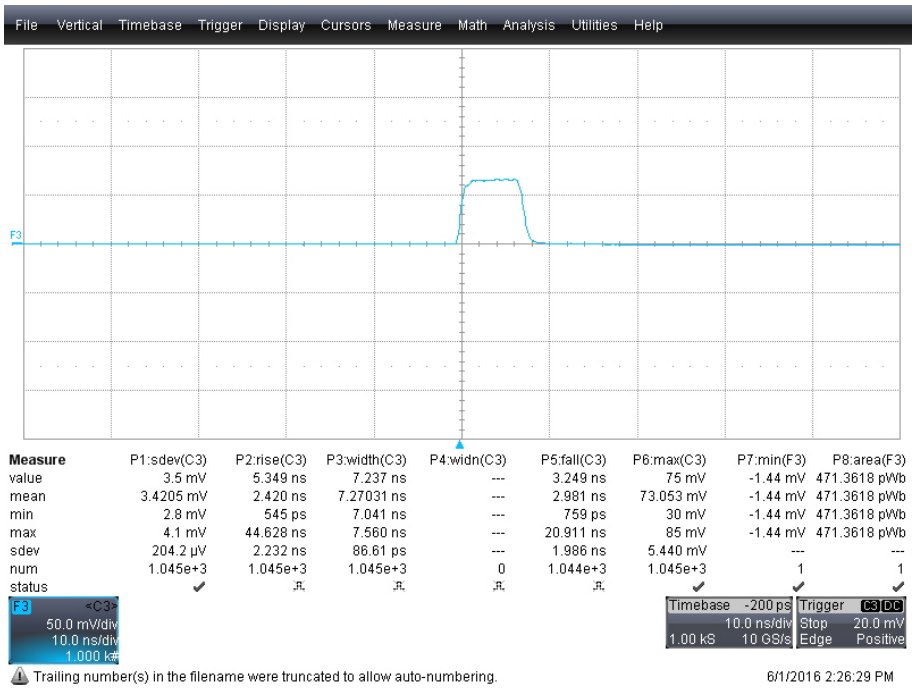

Figure 5: Detector response to the α-particles.

The detector current pulse has 7.2 ns FWHM, and the amplitude of 75 mV. The baseline noise is 3.5 mV.

2.2 Calibration with thermal neutrons

In Figure 6 the measured spectrum of the energy deposition in diamond using a thermal neutron beam is shown. The bias voltage was set to +400 V in the measurement. The CIVIDEC ROSY® Neutron-Gamma Discrimination Application was used in order to separate the two peaks of the ^{6}Li(n,t)^{4}He reaction from the γ-background with the C2 amplifier. The total measured deposited energy spectrum is shown in blue. The spectrum of tritons and α-particles of the ^{6}Li(n,t)^{4}He reaction, selected using the ROSY® n-γ Discrimination Application, is shown in yellow.

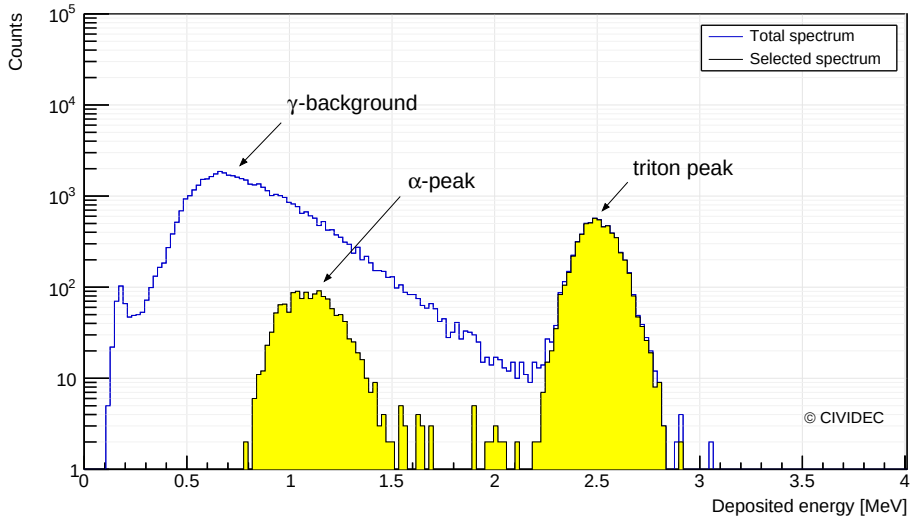

Figure 6: Deposited energy spectrum measured with the B6 detector.

Triton and α peaks of the ^{6}Li(n,t)^{4}He reaction are clearly visible at 2.5 MeV and 1.1 MeV, respectively.

2.3 Electronic calibration of AC-DC measurement

In Figure 7 the electronic calibration of the AC-DC Neutron Flux Monitor using the CIVIDEC Calibration Setup is shown.

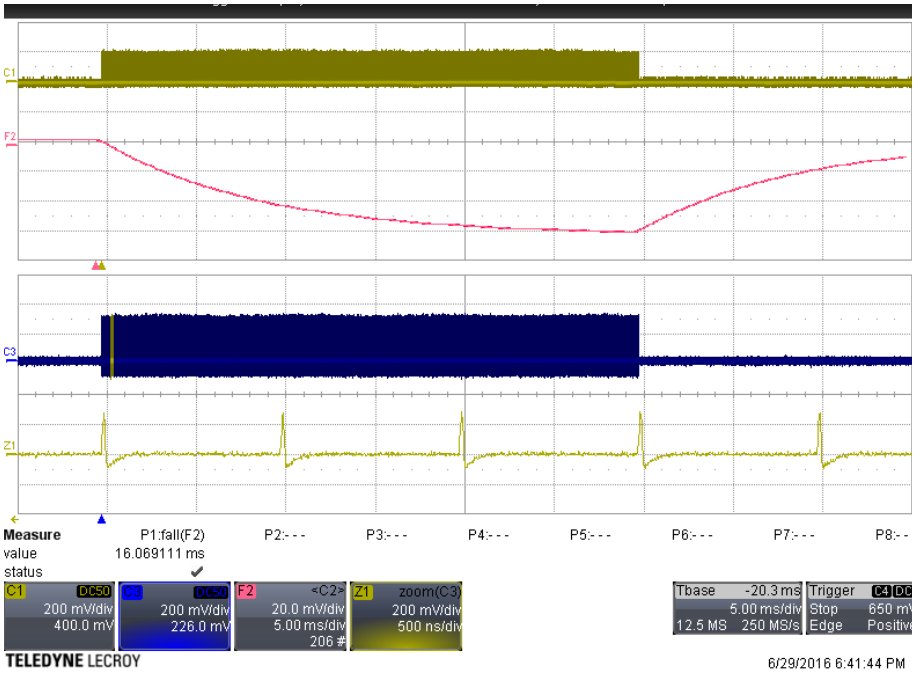

Figure 7: Electronic calibration.

The top half shows the input signal: Bunch train of 30000 pulses, 30 ms long (in dark green). The DC response of C8-Nano Electrometer Amplifier is shown in red. The DC response has a time constant τ=16 ms.

The bottom half shows the response of the C2 Broadband Amplifier (in blue). The zoomed in response shows the pulses separated by 1 microsecond (in green).

NB: In the counting mode, the pulses can be counted using the CIVIDEC ROSY® Data Acqusition System, with the rate up to 10 MHz. The DC-mode can be used for the high intensities.

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