

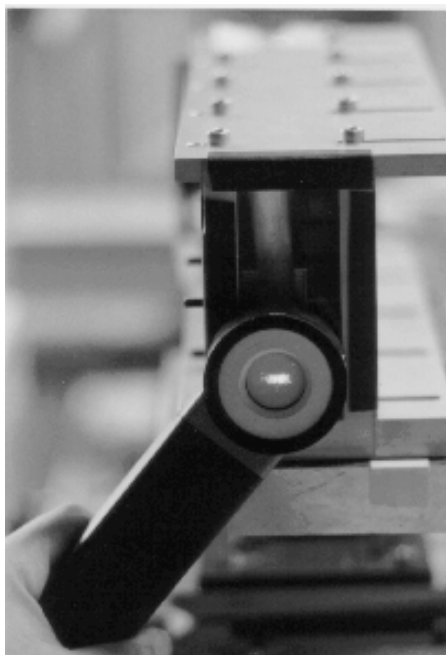
ND&M

Neutron Detectors and more ...

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ND&M Neutron Handmonitor



This hand-held device is intended for visualizing neutron beams. It can be used for adjusting neutron experiments, finding leakages in shieldings and many other purposes.

The main constituents of the device are a neutron scintillator, a proximity focussed image intensifier and battery powered high voltage supply, all incorporated in a handy housing for ease of use.

The Handmonitor allows you to view even weak beams (down to only a few neutrons/cm²/sec) under daylight conditions, since every detected neutron (detection efficiency approx. 20% at thermal wavelengths) produces a clearly visible light spot. By changing the scintillator, one can cover the whole range of neutron energies from UCNs up to thermal neutrons.

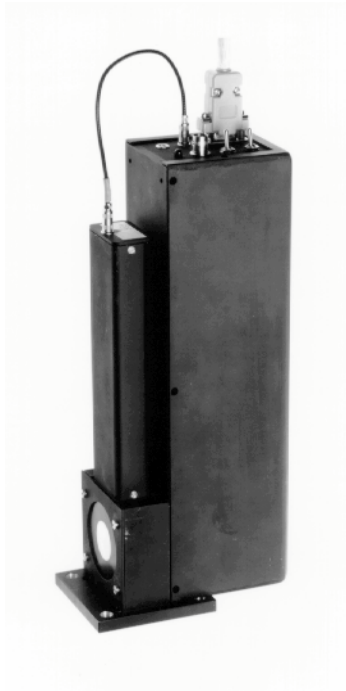
The active diameter of the standard detector is 25 mm. Versions with a larger active areas are also available. The following standard versions can be produced:

- 25 mm version with 25mm intensifier
- 40 mm version with 40 mm intensifier

The following versions are available on request:

- 50 mm version with fiberoptic taper and 25 mm diameter intensifier
- 80 mm version with fiberoptic taper and 40 mm diameter intensifier.

ND&M Readout Unit



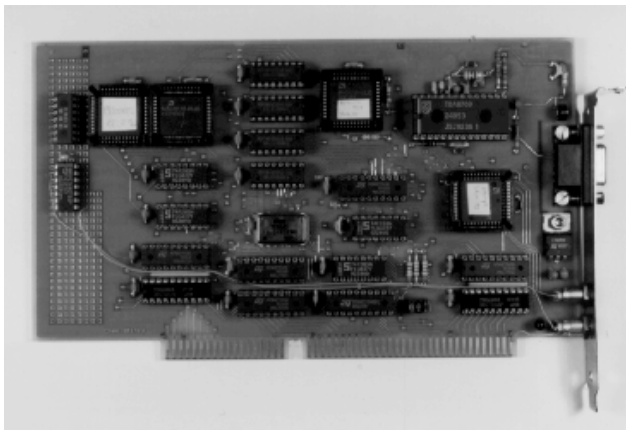
The ND&M Readout Unit allows you to view your ND&M Neutron Handmonitor from remote by means of a built-in CCD camera. This device together with the ND&M Accumulating Framegrabber or the ND&M Realtime Centroiding Processor turns your Handmonitor into a position sensitive detector with outstanding properties. Used alone, you can view the screen of your Handmonitor by simply connecting it to a standard video monitor (European video standard).

Metric and UNC type threads allow easy mounting to tripods or other mechanical supports. For standalone operation an additional 12V supply is required.

The Readout unit is delivered in a shock-resistant Aluminum case for protecting your equipment during transportation.

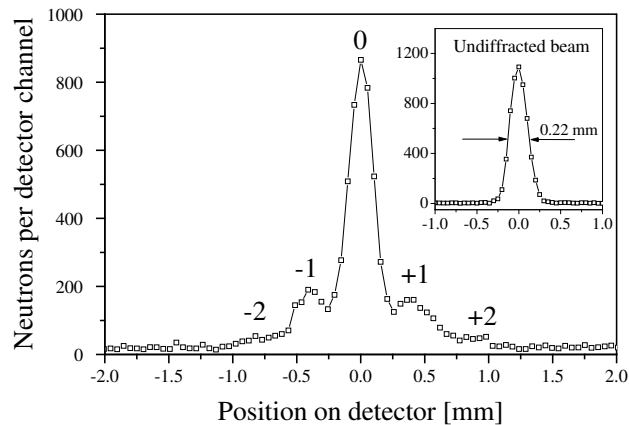
ND&M Accumulating Framegrabber

The ND&M Accumulating Framegrabber is an ISA-compatible slot card for use in PC-compatible computers. After inserting an ND&M Handmonitor into the Readout Unit and connecting the video cable to it, the Accumulating Framegrabber adds up the video frames delivered by the CCD camera inside of the Readout Unit. After a predefined exposure time, the software that is delivered with each card searches for neutron scintillation events, calculates the center of gravity of each, and stores it on disk. This method allows a very high suppression of background radiation and noise; the resolution that is achieved in this way is less than 40 μm (FWHM of the line spread function)!



Due to this method and the time consuming computations that are necessary for it, the maximum count rate is limited to some hundred neutrons per second on the detector area. At low count rates, it is also possible to achieve a high time resolution with the addition of photodiode and a semitransparent mirror in the readout unit (see Ref. 4) (available on request).

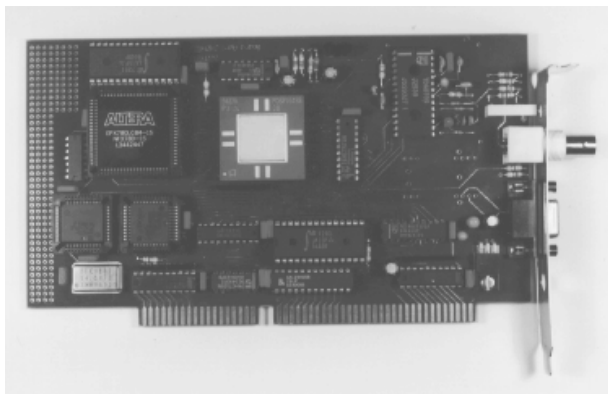
The Accumulating Framegrabber can also be used in integrating mode, i.e. without centroid finding, but without any practical limitations on the maximum flux, at the expense of a lower resolution of approx. 200 μm .



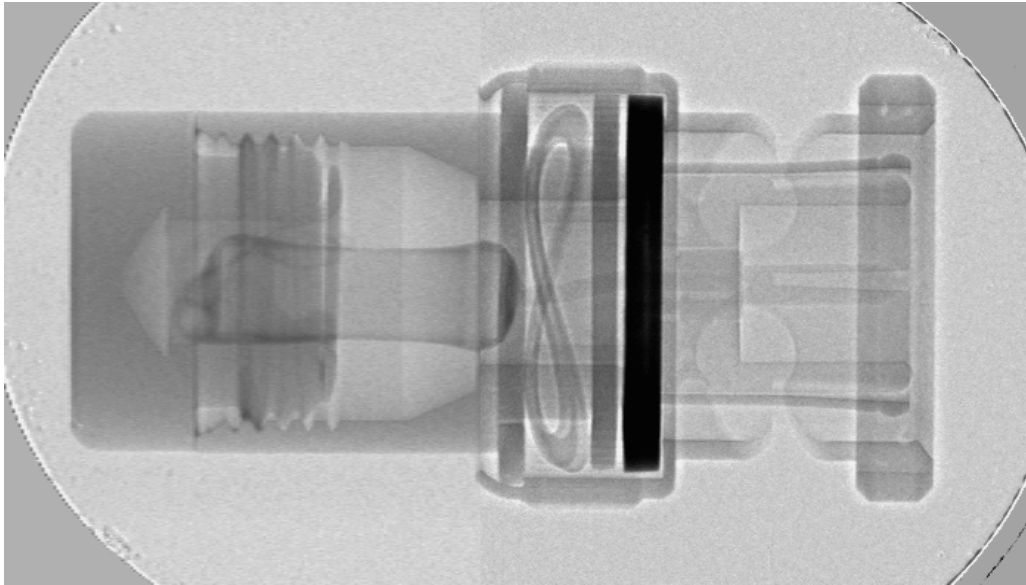
Diffraction Pattern of an absorbing line grating, measured with the Handmonitor and Accumulating Frame Grabber. The count rate was only 0.2 neutrons/sec over the whole detector area. Although the measurement was performed in a gamma field of 10 μ Sv/h, no background had to be subtracted. The insert shows the primary beam, which appears almost perfectly triangle shaped due to the high resolution of the detector.

ND&M Realtime Centroiding Processor

The ND&M Realtime Centroiding Processor is an ISA-compatible slot card for use in PC-compatible computers. After inserting an ND&M Handmonitor into the Readout Unit and connecting the video cable to it, the Realtime Centroiding Processor analyzes each video frame from the CCD camera inside of the Readout Unit. Each frame is searched for scintillation events in realtime and their positions are stored on disk. Due to the simpler centroid searching algorithm, the resolution is lower than the resolution of the Accumulating Framegrabber (65 μ m in horizontal direction, 100 μ m in vertical direction), but the maximum count rate is more than a factor of hundred higher.



The Realtime Centroiding Processor is delivered with a software package for taking exposures of a predetermined time, storing and converting data files, setting discriminator levels and much more.



Radiography of a 50-Ohm-BNC termination resistor, measured with the Handmonitor and the Realtime Centroiding Processor. This image is a compound of two separate radiographs, each one showing only part of the object. The applied thermal flux was 30000 neutrons/sec over the whole detector area. The exposure time was 3 hours.

Technical Specifications

ND&M Detector Characteristics	Handmonitor (25mm) & Accumulating Frame Grabber	Handmonitor (25mm) & Realtime Centroiding Processor
scintillator (standard)	Li ⁶ F + ZnS(Ag)	Li ⁶ F + ZnS(Ag)
sensitive area	25 mm dia	25 mm dia
DQE @ 1.8 Å	11 %	11 %
DQE @ 2.44 Å	18 %	18 %
DQE @ 5 Å	~ 50 %	~ 50 %
resolution hor. (FWHM _{1sf})	40 µm	60 µm
resolution ver. (FWHM _{1sf})	40 µm	100 µm
max. flux @ 1 % lin.	30 / sec / det. area	3000 / sec / det. area
background count rate	< 10 ⁻³ /sec / det. area	< 10 ⁻³ /sec / det. area
gamma sensitivity @ 662 keV	< 4 x 10 ⁻⁶	< 4 x 10 ⁻⁶
geometric distortions	not noticeable	not noticeable
cooling/vacuum required	no	no
weight approx.	2 kg	2 kg
size approx.	10 x 15 x 30 cm ³	10 x 15 x 30 cm ³
readout time approx.	100 ms	online

All users of the ND&M Accumulating Framegrabber and/or the Realtime Centroiding Processor receive software updates, free of charge, as soon as they become available.

Clients: Hahn-Meitner-Institut Berlin, Atominstut Wien, National Institute of Standards and Technology Washington, Brookhaven National Laboratory, Universität Bayreuth, CEA Saclay, ILL Grenoble.

References

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