a constant incident flux [see Fig. 7.3.4.2(*c*)]. On this curve, the width of the plateau and a value of the slope about 10^{-4} (in relative variation of counts per mV) give an indication of the detector quality. A good compromise is to set the threshold T at the middle of the plateau.

It is also necessary to verify that the detector high voltage, *i.e.* the gas-amplification coefficient M (see Subsection 7.3.3.1), is well adapted. With the value of the threshold T adjusted as above, the number of counts per unit time is plotted as a function of the high voltage [see Fig. 7.3.4.2(*d*)]. Typical values for the width of the plateau and its slope are 200 V and a few per cent per 100 V. If the high-voltage setting given by the manufacturer must be modified (owing to the worsening of the gas or constraints from the electronic chain, *etc.*), the complete adjustment procedure of the G and T parameters must be repeated.

The electronic adjustments and controls of types of detector other than $^{10}BF_3$ gas detectors are basically the same once the changes in the amplitude spectrum have been taken into account. We present in Fig. 7.3.4.2(*e*) the amplitude spectra for an ^3He gas detector with significant wall effects, for a ^{10}B solid-deposit detector with very low efficiency, and for a scintillator. The energy of the secondary particles produced in an ^3He gas detector is 765 keV, about three times less than in $^{10}BF_3$, reducing the signal-to-noise ratio; the relative importance of the wall effect is greater and extends to $A_0/4$. In the case of the ^{10}B deposit detector, only one of the secondary particles escapes the foil, so that we do not detect an amplitude A_0 corresponding to the full capture-reaction energy, but only that corresponding either to an average α or Li trace. The quality of the valleys depends on the t/r (foil thickness/particle range) ratio in the ^{10}B solid (see Fig. 7.3.3.2). The figure corresponds to a monitor where $t \ll r$. For the scintillator, the valley in the amplitude spectrum is not very good, even for good glasses and without γ radiation. The discrimination is therefore always much inferior to that of a gas detector. Moreover, the gain of the photomultiplier is very sensitive to the high voltage and has long-term stability problems.

7.3.5. Typical detection systems

7.3.5.1. *Single detectors*

In order to measure the scattered intensities, the single detector is mounted in a shield equipped with a collimator between sample and detector. The collimator is adapted to the sample (5 to 20′ Soller collimator for a powder diffractometer, or a hole adapted to the size of the beam diffracted by a single crystal). The sensitive area of the detector matches the size of the collimated diffracted beam. This geometry allows one to localize the scattered beam with adequate resolution and to avoid parasitic neutrons. In a powder diffraction measurement, the detector is scanned with a goniometer, each step being monitored.

7.3.5.2. *Position-sensitive detectors*

With the advantages of speed and simultaneity of data collection over broad angular ranges, position-sensitive detectors

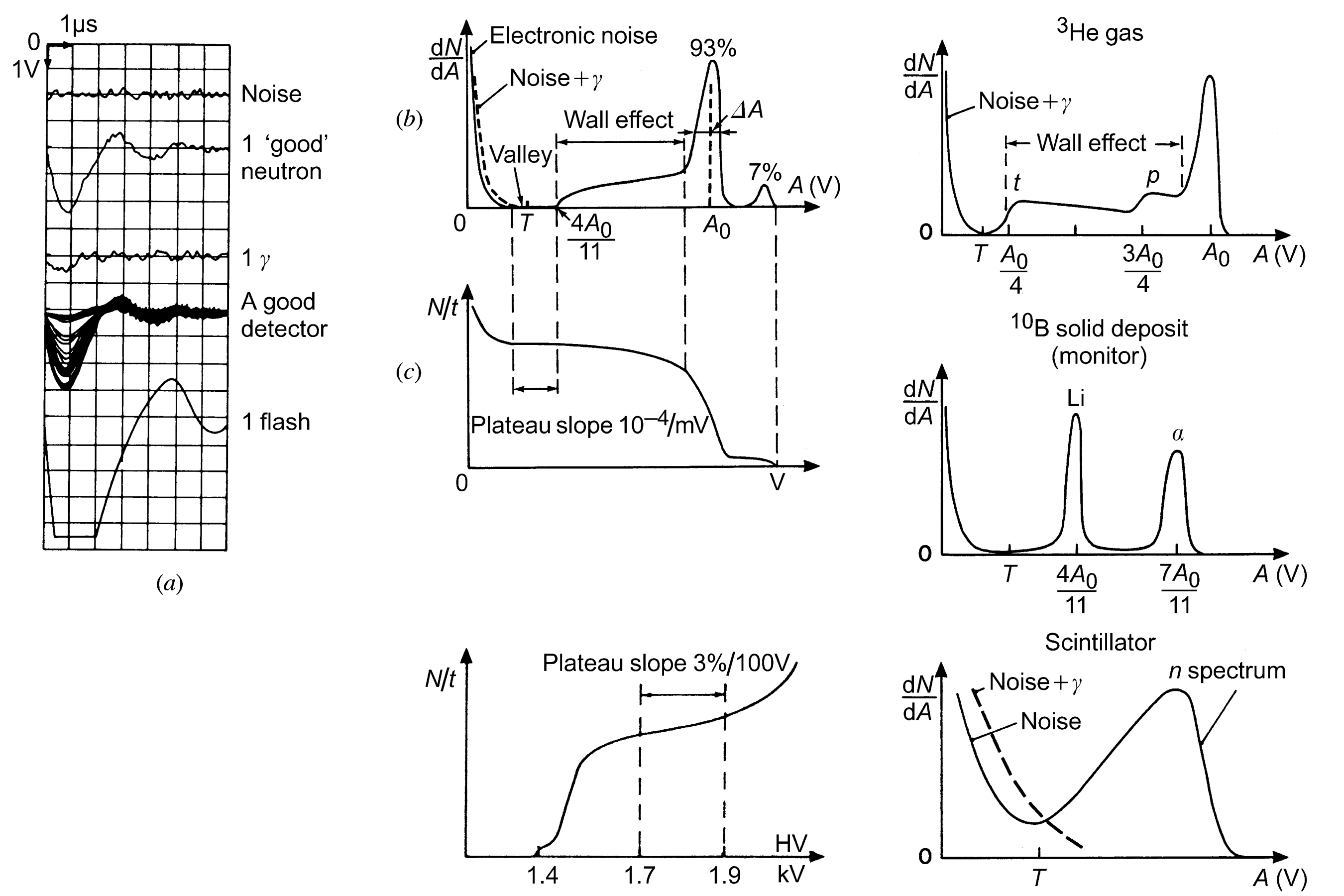

Fig. 7.3.4.2. (*a*) Characteristic $^{10}BF_3$ gas-detector analogue pulses seen on an oscilloscope. (*b*) $^{10}BF_3$ amplitude spectrum. (*c*) Plateau of a $^{10}BF_3$ detector as a function of the threshold voltage. (*d*) Typical plateau of a $^{10}BF_3$ detector in proportional mode as a function of the high voltage. (*e*) Amplitude spectra of various detectors.