The Coordinate Sensitive Detector with High Space and Time Resolution Based on the MA-20 Multianode PMT

Authors:

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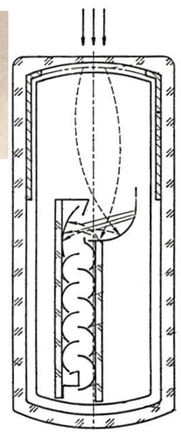
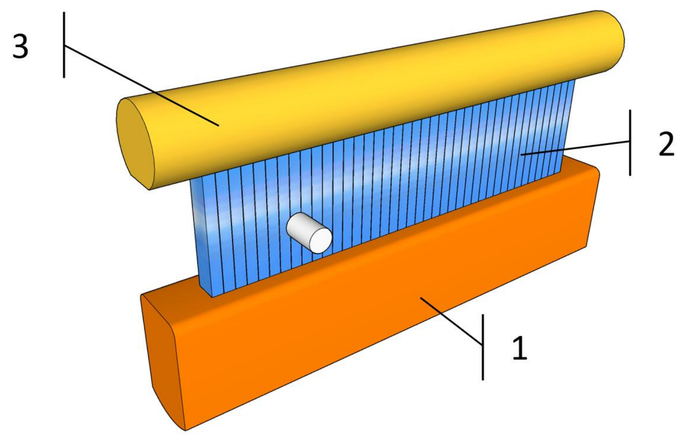
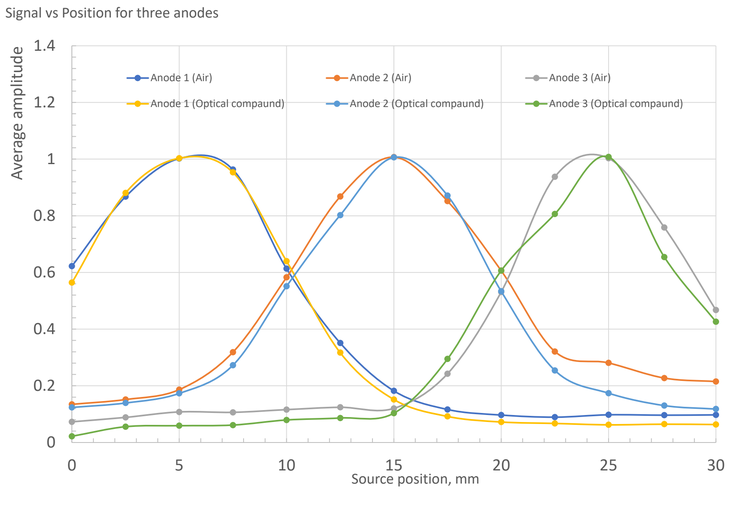


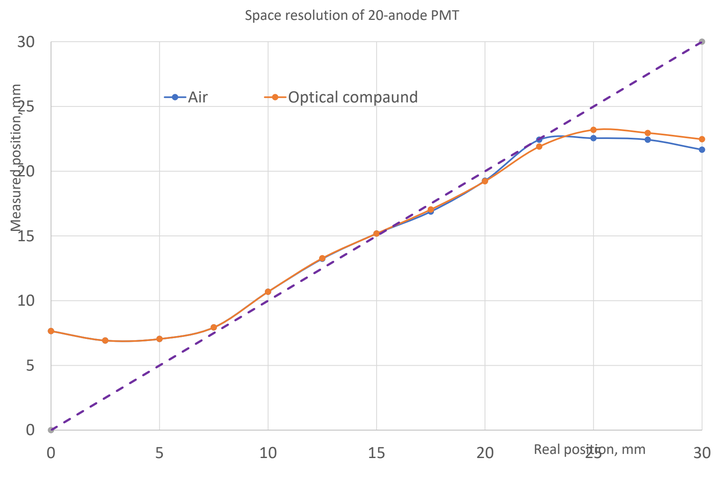
- the tube of PM high - 42 mm and width 34 mm.
- the tube of PM length – 320 mm
- the size of photocathode – 10 × 200 mm^2
- the type of photocathode – CsSb or KCsSb
- the range of spectral sensitivity – 350 ÷ 600 nm
- the spectral sensitivity ≥ 40 mA / W (λ = 400 nm)
- the type of dynodes – CsSb or KCsSb
- the number of anodes – 20
- the gain at the maximum voltage – 10^6 (1500V)
- the single electron signal width (at 10% level) < 5 ns

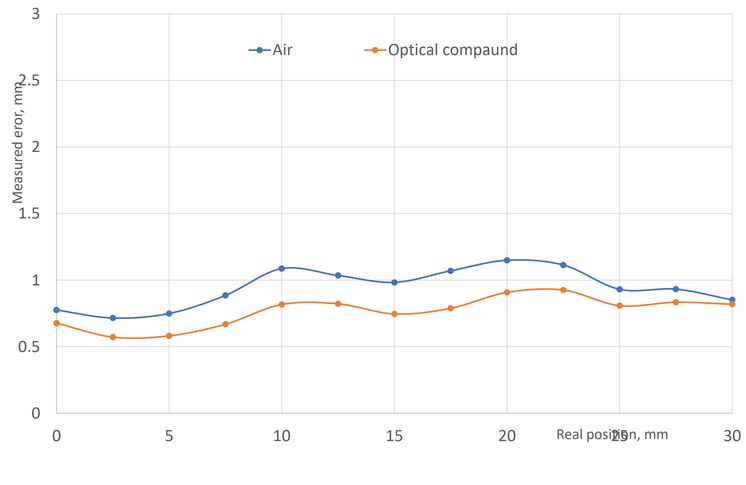
Photomultiplier MA-20: general view, cross-section view, and technical characteristics.



General view of the measuring assembly. 1 – MA-20 PM; 2 – set of crystal slabs; 3 – KS PM trigger and grey cylinder – radioactive source in the collimator.

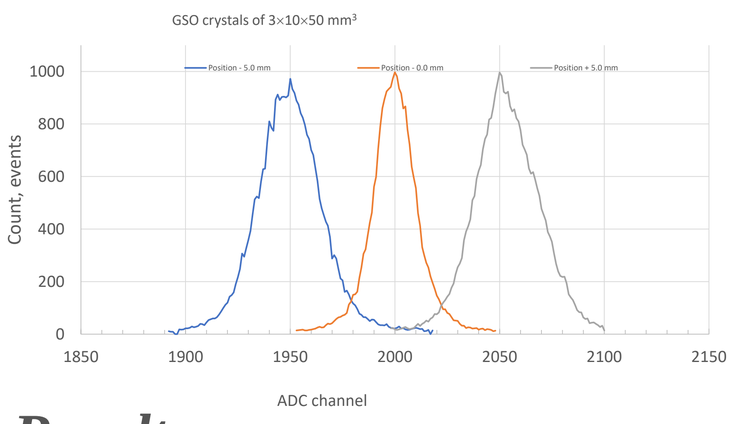


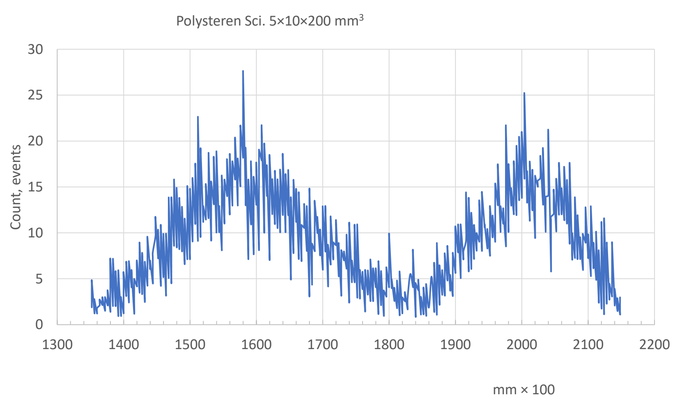


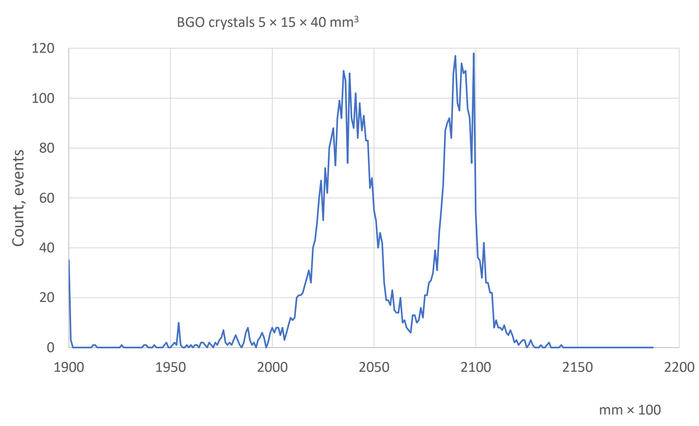


$$X = \frac{\sum_1^N A_i \times x_i}{\sum_1^N A_i}$$

the formula for finding the center of gravity of the resulting signal can be used to restore the signal with a good accuracy, where X – is targeted value; A_i – amplitude signal from i-th anode and x_i – coordinate of the i-th anode







Results

GSO crystals showed the result of an average of 15 photoelectrons per channel when irradiated with gamma from ^{137}Cs. And the resolution turned out to be about ±0.7 mm.

Polystyrene-based scintillator showed the result of an average of 10 photoelectrons per channel when irradiated with Sr. And the resolution turned out to be about ±0.9 mm.

BGO crystals showed the result of an average of 20 photoelectrons per channel when irradiated with Cs. And the resolution turned out to be about ±0.6 mm.

Conclusions

The use of a multi-anode photomultiplier in combination with the array of crystal or plastic scintillators allows one to get a simple linear detector with high performance in both spatial and temporal resolution and also with a low level of intrinsic noise in comparison, for example, with silicon PMTs.