PERFORMANCE OF THE YAP:Ce SCINTILLATION DETECTOR

Masaaki HARADA, Kenji SAKURAI*, Hiromi EBA* and Shunji KISHIMOTO**

Fukuoka University of Education, Akama, Munakata, Fukuoka 811-4192
*National Research Institute for Metals, Sengen, Tsukuba, Ibaraki 305-0047
**Photon Factory, Oho, Tsukuba, Ibaraki 305-0801

Introduction

YAP:Ce is one of the important scintillators in X-ray region[1], and is a good candidate as an alternative to the conventional Nai:Tl in high counting rate applications, because of its rather short decay constant (25 ns). Recently, optimized electronics for signal processing from a YAP:Ce scintillator have been developed at the National Research Institute for Metals (NRIM), Tsukuba[2]. In this report, the performance of the detector system in SR experiments is described.

Experimental

The experiment was carried out at BL-14A with different monochromatic X-rays (8.0, 16.5, 25 keV). The photomultiplier (Hamamatsu R580) and the amplifier (special to NRIM) are built into the detector housing. The output pulse (0-10V) was fed to the 300MHz discriminator and scaler (Technoland Corp. C-TM 715 and C-KP 402)[3]. The dead time of the whole counting system is evaluated by the single foil technique[4], using metallic filters (Cu, Mo, Sn) of various thickness to attenuate X-ray intensity.

Results and Discussion

Figure 1 shows the shape of the amplifier output pulse. The pulse width is satisfyingly short (<100 ns), indicating its rapid counting ability. No inconvenient effects were observed in the pulse shapes even when the input rate was raised to as high as several Mcps. Figure 2 shows the counting characteristics for 16.5 keV X-rays. The results demonstrate that the response of the YAP:Ce detector is linear up to 1Mcps region in the input counting rate and that it can be used up to 5Mcps with counting loss correction. The obtained dead time is 84 ns, which means the system is almost ideal, because it is close to 3.5 times the decay time. The present result is superior to several previous reports[5] on the YAP:Ce detector. Similar results have been obtained during the present experiments for 8.0 and 25 keV as well, and it was noticed that the detector could be used for rather high-energy X-rays.

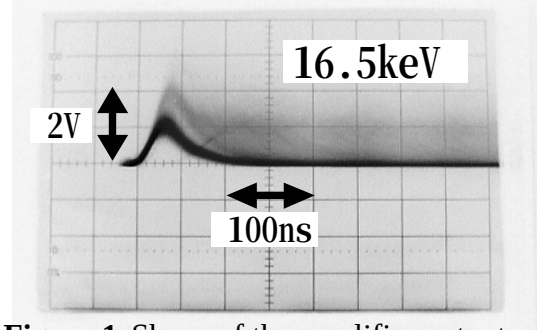

Figure 1 Shape of the amplifier output pulse.

References

1) V. G. Baryshevsky et al., NIM, **B58**, 291 (1991).
2) See http://inaba.nrim.go.jp/xray/
3) S. Kishimoto, NIM., **A397**, 343 (1997).
4) T. Fukamachi, Jpn. J. Appl. Phys., **8**, 851 (1969).
5) For example, S.Cockerton and B.K.Tanner, Adv. in X-Ray Anal., **38**, 371 (1995).

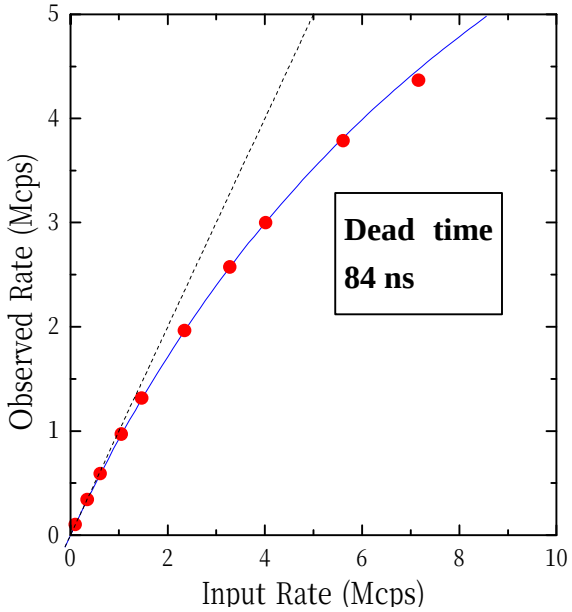

Figure 2 Counting characteristics of the YAP: Ce detector for 16.5keV X-rays.