

BaF₂ ARRAY DEVELOPMENT AND OPERATION

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The ORNL BaF₂ array¹ is a complete instrument for detection of photons from 0.25 MeV to 100 MeV and higher, and is designed to operate alone or in coincidence with particle detectors of various kinds. It is composed of about 150 BaF₂ detectors with phototubes, electronics for signal processing and triggering and a data acquisition system developed at the HRIBF facility at ORNL. For experiments it has been arranged either as a single wall of 150 detectors or as two walls of 72 detectors each. It has been used frequently over the past two years by the three institutions involved, ORNL, MSU and Texas A&M University (TAMU), predominately at the NSCL and the TAMU Cyclotron Institute, but also at the Nuclear Structure Laboratory of the State University of New York at Stony Brook (SUNY-SB).

Table 1: Experimental Schedule of the BaF₂ array

Location	Dates	Experimental program
MSU	Oct 1996 - Dec 1996	¹¹ Be nuclear excitation and decay
SUNY-SB	Dec 1996 - Mar 1997	Heavy ion fusion-fission, GDR decay
MSU	Apr 1997 - May 1997	¹¹ Be Coulomb Excitation, GDR strength function
TAMU	Jul 1997 - Oct 1997	Heavy ion fusion-fission, neutron decay, GDR decay
ORNL	Oct 1997 - Sep 1998	Repair and development
MSU	Sep 1998 - Feb 1999	²⁰ O GDR; ¹²⁰ Sn GDR temp; ¹¹ Be particle decay

We have made several technical developments in the past two years. First, we have replaced 25 of the photomultiplier tubes (PMT) in the ORNL part of the array and the 21 PMT's of the NSCL detectors because of the continuing degradation of the resolution of the original PMTs. Many of the replaced PMTs had resolutions worse than 20% FWHM for the 662 KeV line in ¹³⁷Cs. The replacement phototubes have resolutions around 13%, which has improved the resolution of the array somewhat, but we still have about 40 PMTs to replace in order to restore the original resolution. Second, we have had substantial experience in operating the array in coincidence with particle detectors such as PPACs, plastic arrays, the neutron wall and, most recently, the S800 spectrometer. This last configuration required us to setup and readout the S800 focal plane detectors into the BaF array data acquisition system. To support these readouts we have utilized hardware and software developments in the ORPAS data acquisition system which are described elsewhere.²

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References

1. R. L. Varner, et al., ORNL Physics Division Progress Report, ORNL-6916(1996) p. 2-21.
2. J. W. McConnell, et al., ORNL Physics Division Progress Report, (1998).