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A multiPMT for SWGO water Cherenkov detectors

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Water Cherenkov detectors are playing a central role in neutrino physics, gamma-ray astronomy, and cosmic-ray research. These detectors usually rely on the use of large area photomultiplier tubes (PMTs) to detect Cherenkov radiation emitted by particles moving faster than the speed of light in water. Recent studies suggest that using multiple small area PMTs in a compact structure enhances the performance of these detectors. Such a solution has been adopted in several experiments.
This work focuses on the design and optimization of an hemispherical module with several 3" PMTs, called multiPMT, and of related electronics for a possible use in the water Cherenkov detectors of the SWGO Experiment. This study shows that such devices have promising features in terms of both cost and performance compared to large-area PMTs.
The cost per area of photocathode is similar to large PMTs even including the additional channels of electronics. Dividing the signal into multiple PMTs reduces requirements on the electronics max rate and max dynamic range. The enclosure which keeps the PMT face dry provides convenient housing for the electronics and allows for easy access in case of repair.
Finally, the intrinsic directionality may prove useful for shower reconstruction and to the discrimination of gamma initiated showers against the hadron background.

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