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A study of the attainable Cherenkov angle resolution in cylindrical mirror-based Focusing DIRC designs using BaBar style radiators

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We have previously built and tested a full scale prototype of a Focusing DIRC (FDIRC) detector [1]. This device was based on the BaBar radiators and bar box enclosures attached to a new cylindrically focused camera, and intended for the upgrade of the BaBar detector for the SUPERB factory. Similar optical concepts are now being considered for the GLUEX experiment at JLAB, and possibly, the Electron-Ion collider PID detector at BNL. In this paper, we probe the Cherenkov angular resolutions attainable with similar radiator designs (which could make use of the available BaBar radiator bars) and FDIRC style focusing camera techniques. We compare four designs via Monte Carlo (MC): (a) the SuperB FDIRC with 6mm x 6mm pixels, (b) a similar device with smaller photodetector pixels (3mm x 12mm) as provided by the Hamamatsu H-9500 MaPMT and using the BaBar bar box without modification, (c) another device that again uses the BaBar bar box without modification, which is attached to a more compact camera with a much smaller FDIRC focusing block (FBLOCK) with photon detector pixel sizes of 1.6mm x 25.6 mm, as provided by the Photonis 1024-pixel XP-85022 MCP-PMT connected in this case as 1 x 16 small pixels, and (d) other possible concepts. The talk will compare and contrast the MC angular performance attained by each scheme.

[1] B. Dey et al., "Design and performance of the Focusing DIRC detector", NIMA 775(2015)112-131.

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