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An Askaryan effect Calorimeter for the FCC-hh

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Dielectric-loaded waveguide detectors that measure microwave Cherenkov signals can be used to time and characterize high energy particle showers. Beam test results have been used to validate models and produce high-fidelity simulations of timing plane systems which yield picosecond time tags and millimeter spatial coordinates for shower centroids. These timing planes, based on the Askaryan effect in solid dielectrics, are most effective at the high center-of-momentum energies planned for the Future Circular Collider (FCC-hh), and are of particular interest in the forward region due to their high radiation immunity. Beam test results and GEANT4 simulations are used to validate a hybrid microwave detector model, which explores a reference timing plane design for an FCC forward calorimeter. Our results indicate that 0.5-3 ps particle timing is possible for a wide range of collision products in the reference FCC hadron collider detector, even with current technologies.

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