

The Track Imaging Cerenkov Experiment

S. A. Wissel^{a,b,1,*}, K. Byrum^c, J. D. Cunningham^d, G. Drake^c, E. Hays^{a,c,2}, D. Horan^{c,3}, D. Kieda^e, E. Kovacs^c, S. Magill^c, L. Nodulman^c, S. P. Swordy^{a,b,4}, R. Wagner^c, S. P. Wakely^{a,b}

^a*Enrico Fermi Institute, University of Chicago, Chicago, IL 60637, USA*

^b*Kavli Institute for Cosmological Physics, University of Chicago, Chicago, IL 60637, USA*

^c*Argonne National Laboratory, 9700 S. Cass Ave., Argonne, IL 60439, USA*

^d*Loyola University Chicago, 1032 W. Sheridan Rd., Chicago, IL 60660, USA*

^e*Department of Physics, University of Utah, Salt Lake City, UT 84112, USA*

Abstract

We describe a dedicated cosmic-ray telescope that explores a new method for detecting Cerenkov radiation from high-energy primary cosmic rays and the large particle air shower they induce upon entering the atmosphere. Using a camera comprising 16 multi-anode photomultiplier tubes for a total of 256 pixels, the Track Imaging Cerenkov Experiment (TrICE) resolves substructures in particle air showers with 0.086° resolution. Cerenkov radiation is imaged using a novel two-part optical system in which a Fresnel lens provides a wide-field optical trigger and a mirror system collects delayed light with four times the magnification. TrICE records well-resolved cosmic-ray air showers at rates ranging between 0.01-0.1 Hz.

Keywords: Cosmic-ray telescope, Multi-anode Photomultiplier Tube, Imaging Atmospheric Cerenkov Technique