Status and outlook of the European Scanning System

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Introduction

The European Scanning System (ESS) is being used to read out emulsion films to investigate volcano structure by muon tomography. While first experience shows the signal/noise ratio is favorable, more work is required to speed up scanning and improve the total statistics available. The upgrade program has already begun and results are expected shortly.

The ESS and nuclear emulsion films exposed at the Unzen volcano

The European Scanning System (ESS) is being used without modifications for the data-taking and analysis of emulsion films exposed at the Unzen site (Japan). The ESS is largely based on software, which simplifies evolution. A dynamic program structure allows tuning more than 100 acquisition parameters. New algorithms and technologies can easily be accommodated in the general framework. The distributed computing model allows continuous increase of the available processing power.

Most of the research on system development has been focused on getting a reduced number of instrumental fake tracks. Currently, no more than 3 fake tracks (3 aligned segments) in a set of 50,000 are found in 100 cm^2, over the whole angular spectrum ($|\tan\theta_{x,y}| < 0.65$). The ESS is being upgraded to increase its data readout and processing speed. Such upgrades require new hardware and new software. The current benchmark of 20 cm^2/h/side/microscope will be superseded in few months by a new record (50-80 cm^2/h/side/microscope), made possible by new technologies such as GPU computing and fast cameras. This will be an intermediate step before a system exceeding 100 cm^2/h/side/microscope is set up with limited hardware investments. GPU-based image processing and improved motion control for the new system have already been completed; most of the work in the next months will dwell on optics and camera-frame grabber coupling.

A faster system will be able to process data from larger emulsion film-based detectors. The increase in the available statistics will allow probing regions of volcanoes with high absorption rates of cosmic rays, typically with low elevation and near the center.