“Anatomy of a big stereo hybrid event from the Auger Observatory”, James Cronin

The Pierre Auger Observatory is now operating with more than 420 tanks and two complete fluorescence telescopes. On average 2.5 events with energy $\geq 10^{19} \text{ eV}$ are recorded with the present configuration. Recently a beautiful event with energy $\sim 5 \times 10^{19} \text{ eV}$ was observed by the surface detector and both fluorescence telescopes. The view of the event on the surface is shown in Figure 1.

**Figure 1.** A hybrid stereo event. The core of the event must lie at the intersection of the two indicated shower detector planes. The tank indicated in red has the largest signal.

The axis of the shower was aimed at Coihueco and the light received was totally dominated by Cherenkov light. The observed light profile at Coihueco is shown in Figure 2. The light observed is so dominated by direct Cherenkov light that the profile, while useful for geometric reconstruction is not suitable for energy determination.
Figure 2. The light profile seen at Coihueco. The observed curve comprises several components. The dominant contribution is direct Cerenkov light shown in red. In green is the fluorescence light. The blue is scattered Cerenkov light.

The light received at Los Leones is nearly pure and after a small correction for scattered Cherenkov light and atmospheric absorption the number of charged particles can be determined using the fluorescence efficiency determined in laboratory experiments. Integration of this curve using a $dE/dx$ of 2.2 MeV/gm/cm$^2$ gives an electromagnetic energy of $4.9 \times 10^{19}$ eV. Correcting for the energy carried by muons and neutrinos the total energy is estimated to be $5.4 \times 10^{19}$ eV. The number of charged particles as a function of atmospheric depth is shown in Figure 3.
Figure 3. The number of charged particles as a function of atmospheric depth observed at Los Leones. 

\[ E_{\text{tot}} = \sim 5.4 \times 10^{19} \text{ eV} \]