**LVD** is 3600 m.w.e underground and uses 1 tower containing 38 modules. Each module consists of 8 scintillation counters, measuring 1.5 m × 1.0 m × 1.0 m, and 4 layers of streamer tubes attached to the bottom and to a vertical side of the support structure. Each counter has 3 PMTs on top of the counter and is triggered by the three-fold coincidence of the PMT signals after discrimination.

Neutrons are detected by the delayed coincidences between the high-energy pulse from a muon or muon-induced cascade and a delayed second, low-energy pulse from a neutron capture gamma. The high-energy threshold (HET) is set at 4 - 5 MeV for the inner counters. After 1 ms when the HET is triggered, a low-energy threshold (LET) is enabled for counters in the the same quarter of the tower. This is for the 2.2 MeV photons from neutron capture by protons.

Muons can be divided into two sets of events: single muon events where a single track is reconstructed, and cascades where the energy release is high enough to indicate at least one muon is present. Neutrons are detected by two pulses: the first pulse above the HET from recoil protons from n - p elastic scattering and the second pulse above the LET within 1 ms due to the 2.2 MeV gamma emitted from neutron capture by a proton. Random coincidences that mimic the neutron signal are determined by the counting rate of low-energy pulses in the counters when no high-energy pulses are measured. The distance between the muon and the neutrons produced is found by the minimal distance between the center of counters where the neutron and the single muon track or cascade is found.

Using the LET pulse time distribution after the HET pulse with random coincidences subtracted, the distribution is fit with dN/dT = B + (Nn /τ )e^(−t/τ) where B is the background rate per bin, Nn is the total number of neutrons, and τ is the mean time of neutron capture. The average number of neutrons produced by a muon per unit path length in the liquid scintillator can be found by NnQ/(NcL epsilon) where Nn is the number of neutrons at all distances from the track, Nc is the number of counters crossed by the muons, L is the mean path length of the muon travels in the counter, epsilon is the efficiency of neutron detection in the inner LVD counters, and Q is the correction factor associated with neutron production in the iron from the counter walls and supporting structure. For LVD, the average number of neutrons per muon event/g/cm^2 is (1.5 ± 0.4) × 10^−4.

Recent measurements from LVD give a neutron yield for iron and a higher value for neutrons produced from liquid scintillator, which is consistent with the general trend of neutron yield as a function of muon energy from other underground experiments. The data from this analysis spans from 2005 - 2008

and uses a HET set at 5 MeV and LET set at 1 MeV. A muon event is classified as having at least 2 HET signals within the 250 ns time window. Further cuts on these muon events are the 2 HET signals must have > 10 MeV signal, at least one counter with muon signal must be in an inner tank, and the counters must have a flat time distribution of LET signals for neutrino-like events. Neutrino like events, used for background events, have only one HET signal or have multiple HET signals that are not in time coincidence in a 250 ns window. The neutron signal comes from its capture on a proton of the liquid scintillator or the iron in the LVD structure, producing a LET signal that must be lower than 5 MeV.

The number of neutrons is obtained by fitting the time distribution of the LET signals to a flat component due to background and an exponential part due to neutrons with a slope of 150 μs. The number of neutrons is found as mentioned above using the following equation: Nn fi/(NμLμ,i ρi Sm epsiloni) where Nn is the number of neutrons from the fit, fi is the fraction of detected neutrons produced in i-th material, Nμ is the number of muons, Lμ,i is the mean muon track length in the material, ρi is the density of the i-th material, Sm is the scaling factor that accounts for the number of internal active counters, and epsiloni is the detection efficiency. The background is obtained using neutrino-like events where the counters are grouped as those with and without an HET signal. The background rate is found for each counter for the time period that the data was taken. The efficiency is derived using MC simulations. MC simulations were also used to determine the amount of neutrons produced from different components of the detector, including the liquid scintillator and the iron. The muon path length is found by summing all the step length of muons that pass the selection cuts divided by the number of muon. The neutron yield is found to be (1.9 ± 0.1) ×10^−3 n/g/cm^2 for iron and (3.2 ± 0.2) ×10^−4 n/g/cm^2 for liquid scintillator after applying a correction derived from MC that compares the LVD detector neutron rates for different materials versus a homogenous block of iron or liquid scintillator.