Description
Mines environments are often faced with various accidents. Communication and position location during an accident can be crucial to the lives of the mine workers. Ultra Wide Band (UWB) based radios can be used to provide both communications and position location information. The first step on developing a complete communication and position location scheme for mine environments is to characterize the UWB channel in mine environments.

A preliminary UWB propagation measurement campaign was conducted on past January at the Kimbalton Limestone Mine, west of the Virginia Tech campus.

The Team: In the group photo above, from left to right: Dr. R. C. M. da Silva, Dr. R. M. Buehrer, Dr. C. R. Anderson, H. I. Volos, and W. C. Headley from Wireless@VT and Dr. A. Nieto from VT dept. of Mining and Minerals Engineering.

Measurement Method
The UWB measurements were done using a sliding correlator system operating at a center frequency of 3GHz with a total bandwidth of 900MHz. CW measurements were performed using a spectrum analyzer.

Measurement Locations
First Transmitter Location

Second Transmitter Location

Path Loss For the First TX Location

CDF of UWB & CW RX Power on a Grid

Delay Statistics

Simple RF Fingerprint Analysis
Five Locations were denoted: The four RX locations in the second TX location and the whole first TX location. All the points of each location (except one) were used to generate an average PDP, then, all the points were correlated against the five average PDPs using Spearman's rank correlation.

From the graph above, it can be seen that all the points except point 33 correlate higher with their true location's average PDP.

Conclusions
The results of this initial campaign show encouraging characteristics of the UWB propagation. UWB has less local fading (less power deviation in a small area) compared to CW signals, which means less UWB power is needed to cover the same area. Furthermore, initial RF fingerprinting results are promising, but more data are required make solid conclusions. In addition, fingerprinting can be used to complement existing UWB position location schemes.