LBNE EPSCoR: Work proposed by SDSMT

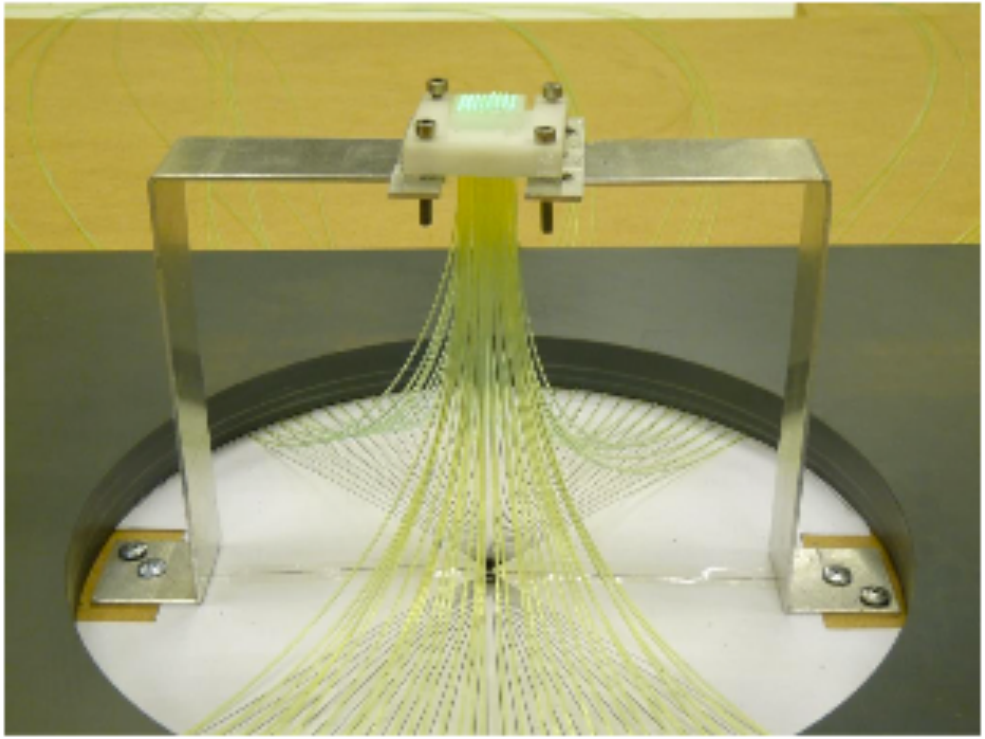
1. Develop low cost muon tagger for the calibration of WC and LAr detectors using cosmic ray induced muons.
2. Measure the group velocity of light in water as a function of wavelength.
3. Simulation: WC and LAr detectors.
4. Super sensitive radon monitor.

✓**Participation from other groups is welcome**
✓**Cooperation with other groups is expected**

1. Develop low cost muon tagger for the calibration of WC and LAr detectors using cosmic ray induced muons

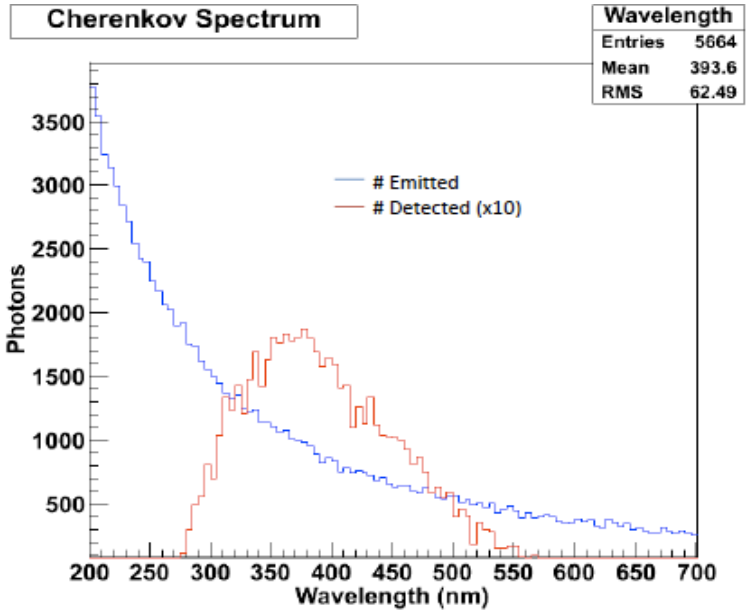
- Low muon rate → Large area → High cost

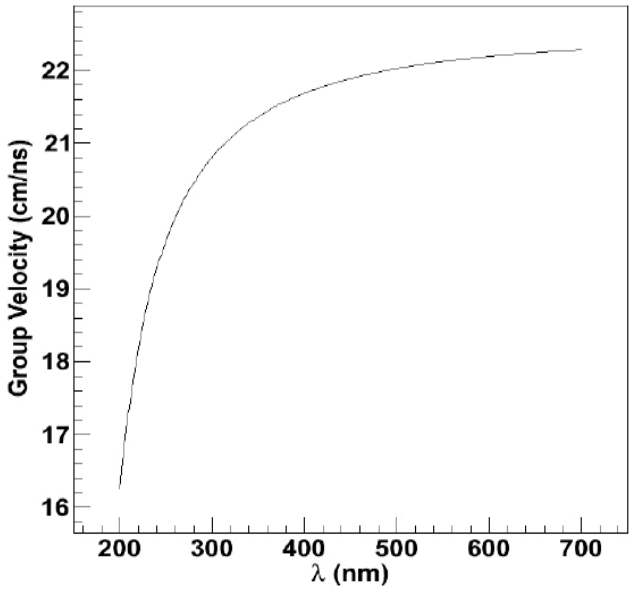
- What to study:
  1. Scintillator + fiber: Large piece fabrication
  2. Light collection efficiency: material selection, material processing, optical coupling
  3. Calibration
  4. Uniformity
  5. Size/Efficiency/Cost

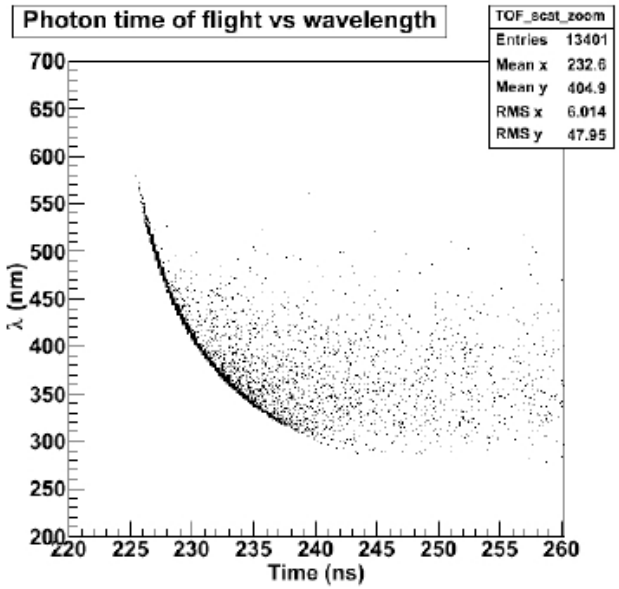


An example in Auger work.

2 (a). Measure the group velocity of light in water as a function of wavelength - Why







Left: The spectrum of Cherenkov radiation in water. Both emitted and detected photons are simulated. The distribution of the detected photons reflects the quantum efficiency of the PMTs.

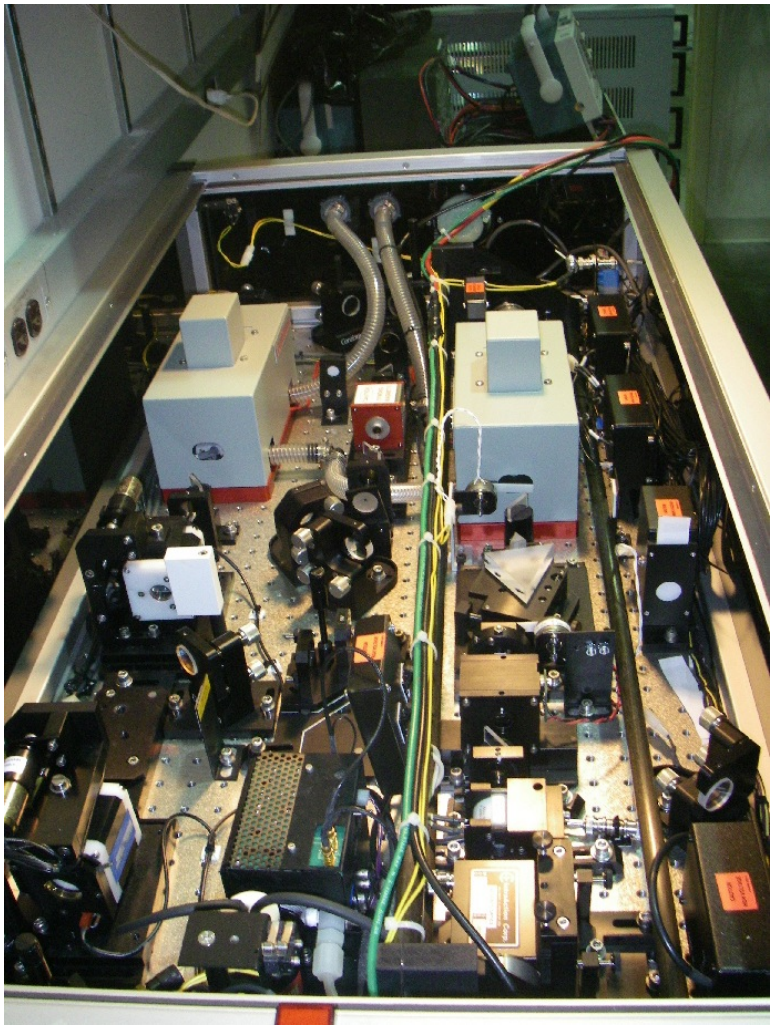
Middle: Expected light group velocity as a function of wavelength in water. **Data for LBNE water/temperature is missing!**

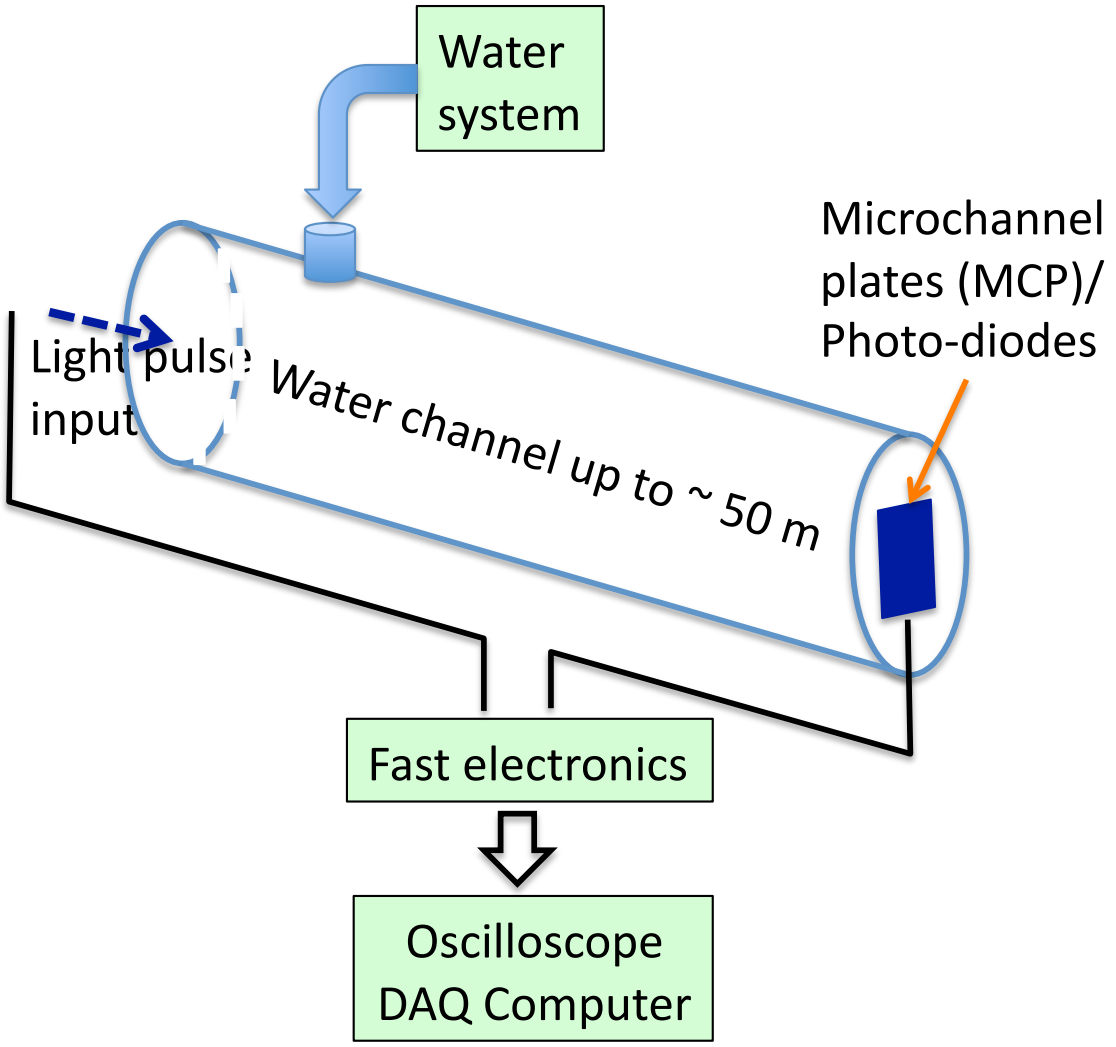
Right: Photon time of flight vs wavelength in Φ=50 m sphere water tank (simulation)

LBNE Far Water Cherenkov Detector ~ 50 m → Spread will be as large as a few nano seconds →Impact on event reconstruction

2 (b). Measure the group velocity of light in water as a function of wavelength - How

Continuum picosecond laser DD-10 at BNL: to be used for the measurement





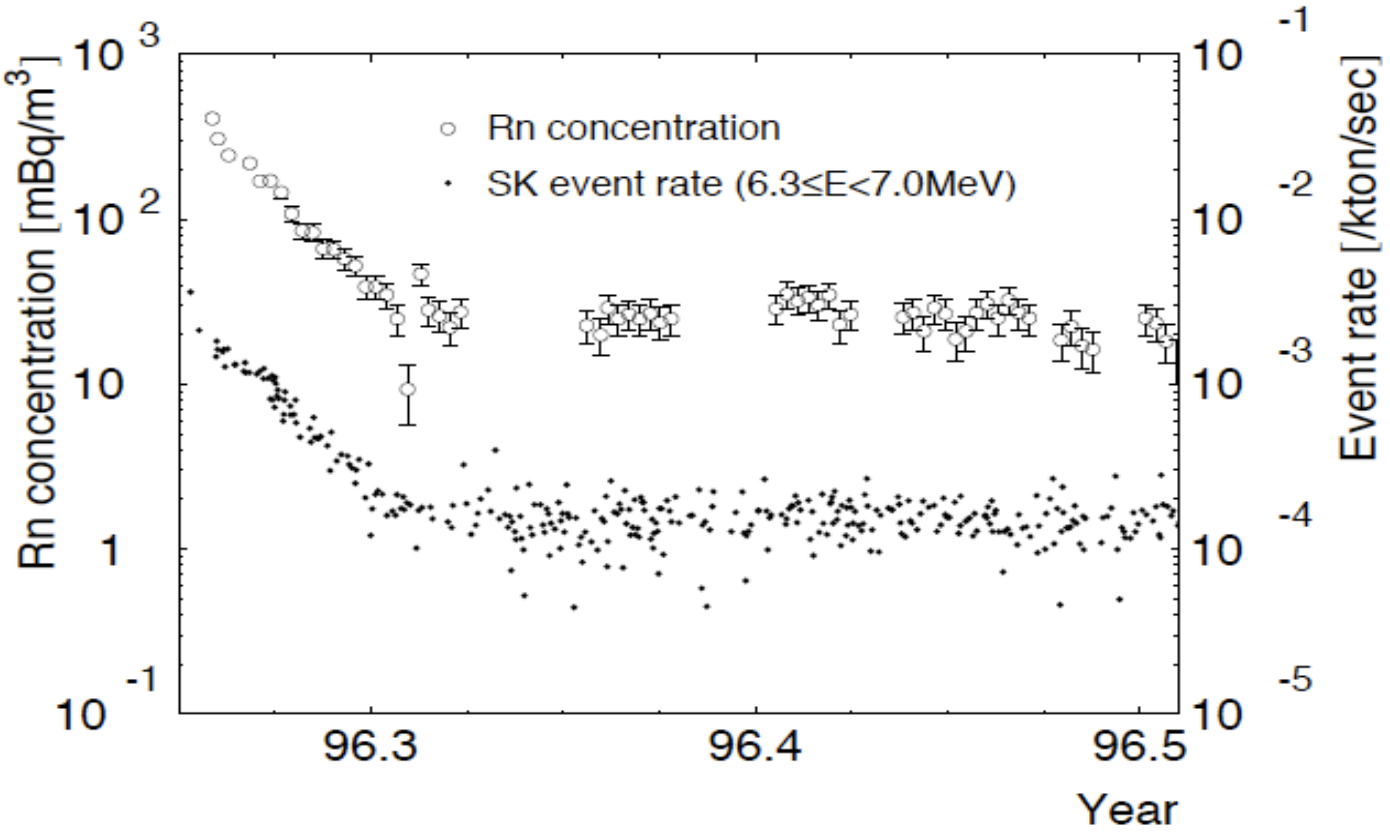
Personnel pending in DOE

Hardware needs more $: laser source/electronics

3. Simulations: WC and LAr detectors.

1. **With data from 1 & 2, we can:**
   - **Verify the simulation & tune simulation parameters**
   - **Improve reconstruction**
2. **Background study: Simulation + comparison with data**
3. **Calibration + Background data base:**
   - **to serve analysis and simulation.**
4. **Explore the impact of uncertainties in calibrations**
5. **Resources needed: Computer & storage disks**
6. **Work together with other EPSCoR groups & LBNE simulation working group.**

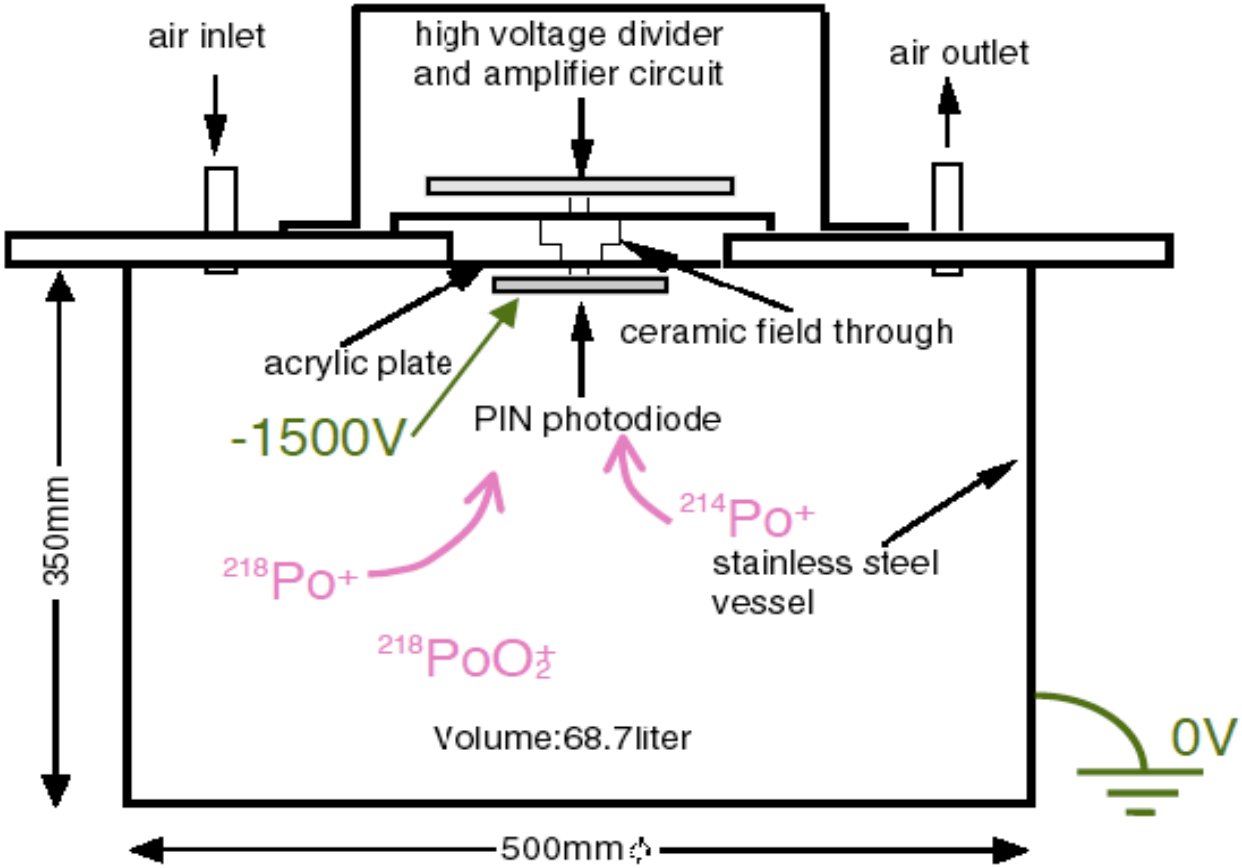
4 (a). Super-sensitive radon monitor



Time variation of radon concentrations in the Super-K water and low-energy event rate from April 1996 to July 1996. They show a strong correlation to each other.

Radon screening for LBNE detector and construction materials: Water, Ar, cables, steel, liners, …

4 (b). Super-sensitive radon monitor



A schematic view of the high sensitive radon monitor for air developed by the Super-K group.

Hardware in LBNE project → Budget cut → EPSCoR helps
Personnel proposal pending in NSF.