



## **Neutron Straw Detectors for Soil Moisture Measurement**

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Over the past decade, boron coated straw detectors have undergone rapid development driven by funding from nuclear security agencies. The straw neutron detector is a simple cylindrical tube with a thin copper wall (25  $\mu\text{m}$ ) and much thinner  $^{10}\text{B}_4\text{C}$  sputter coating ( $\sim 1 \mu\text{m}$ ) on the inside of the tube. Neutrons are detected in a gaseous avalanche process in close analogy with the Gold Standard  $^3\text{He}$  gas detector. The production capability for the required area of coated foil to meet the needs of this international application has been developed by Proportional Technologies Inc (PTI) along with the highly automated production of the straws from this material. As the field of international soil moisture monitoring is potentially quite large the availability of the low cost and highly sensitive Boron Straw detector may be very beneficial to the growth of the field considering the growing constraints of  $^3\text{He}$  availability for large applications. This paper reports the status of large scale straw detector production for numerous security applications and potential economic advantages of switching to straw detectors for environmental soil moisture monitoring. Properly configured straw detectors, can achieve highly sensitive soil moisture monitoring at a small fraction of the cost of conventional  $^3\text{He}$  systems and at the same time increase markedly the sensitivity in both fixed and mobile applications. Some straw detectors currently in mass production have 6 times the environmental sensitivity of  $^3\text{He}$  monitors while being produced for government security applications at a small fraction the cost of the  $^3\text{He}$  soil monitor systems.