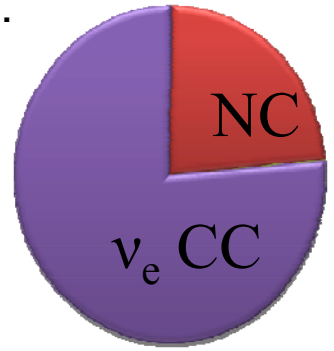
HALO for Supernova neutrinos - summary -

HALO is an operating lead-based supernova detector constructed from 79 tonnes of lead and instrumented with ^{3}He neutron counters. In contrast to Water Cherenkov and Liquid Scintillator detectors HALO has a nuclear target hence our interest in low energy ν–Pb x-sections.

Advantages of lead as a SN neutrino target

- Readily available and inexpensive
- Highest x-sections of any material likely to be used for a kT-class SN detector
- ν_e CC and NC sensitivity only (complementary to other SN detectors)
- Lower CC and NC thresholds than either O or C
- Distinct 1-n and 2-n thresholds give handle on ν temperatures and pinching parameters
- Low neutron capture cross-section of Pb leads to high capture efficiency on ^{3}He
- High (α,n) threshold; tolerant to moderate material radio-purity
- HALO is effectively background free over timescales of a SN burst
- Dense - implying compact detector; reduced need for shielding
- Low tech, low maintenance hence suitable for high livetime and long lifetime

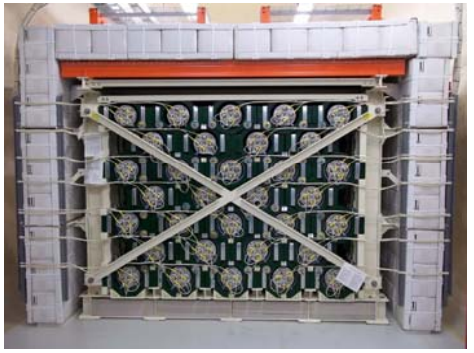


Lead

HALO for Supernova neutrinos
- summary -

Disadvantages of lead as a SN neutrino target

- No energy information other than 2-n to 1-n ratio
- Calculated ν–Pb x-sections have significant uncertainties
- There are no measured ν–Pb x-sections in the energy range of interest
- There is no directionality to assist in locating SN
- No sensitivity to charged particles so no CC/NC discrimination



Plans

- Exploit advantages, mitigate disadvantages
- Operate HALO with ~100% livetime until the next galactic supernova
- Measure ν–Pb x-sections at the SNS at ORNL if possible
- Continue to investigate the scalability of a lead-based detector to kT size
- Grow the collaboration for future endeavors