The liquid parahydrogen target of the NPDGamma Experiment

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Target Requirement

- Sensitivity of $10^{-8}$, needs greater than $10^{16}$ events
- Must use large hydrogen target to capture most of the neutron beam
- Must have highly polarized neutron beam
- Also must keep neutrons from depolarizing in target region
- Thus we are required to use a dense para hydrogen target
- Minimize target material background to hydrogen signal
- Low maintenance and high reliability
Why Para-Hydrogen?

- Two nuclear spin states for LH2 with $\Delta E = 15$ meV
- Ortho-H2 has high incoherent scattering cross section
- Use catalyst to convert ortho into para
- Can monitor OP conversion rate by looking at beam flux after target
- running at >99.9% para fraction
Schematic Drawing of target and fill/vent system
courtesy of Walt Fox
LH2 Target Cool Down April 2012

- Start of cool down
- LH2 Condensation
- Finished Filling

Temperature K vs. Time (day/month)
Summary

• We have a working 16L liquid hydrogen target
• it has one year of stable running
• it has been demonstrated to safely vent all three times
• the vessel has met all safety requirements at a national lab