$$^{3}\mathrm{He} + \mathrm{p} \rightarrow {}^{4}\mathrm{He} + \mathrm{e}^{+} + \nu_{\mathrm{e}}$$

Hep analysis update

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Outline

- Personnel
- Immediate goal
- Analysis method
- Backgrounds
- Expected results
- To do
- Summary

Personnel

- Ferenc Dalnoki-Veress (now at MPI Heidelberg)
  - Revived *Hep* analysis (two previous SNO PhD theses)
  - Sole group member for many months.
  - ^{8}B and Leslie background, expected UL.
- Miles Smith (now at South Pole)
  - Background from ^{8}B + noise.
- David Waller
  - Loose ends for Ferenc.
  - High energy backgrounds (from atm. ν interactions).
- Neil McCauley
  - Current group leader.
  - ^{8}B and Leslie background, expected UL.
- Noah Oblath
  - NUANCE (code for ν_{atm} interactions).
- Bill Heintzelman
  - Reduction of ^{8}B background.

Immediate goal

- Measure central value or UL of ϕ_{Hep}.

- Do "fast" analysis.
  - Use D_2O only.
  - Use simple "box" analysis.

- More sophisticated analysis (with salt data) to follow.

- With adequate manpower, can pursue fast and sophisticated analyses in parallel.

Analysis method: box analysis

- Simple counting exp't.
- Use cuts to reduce backgrounds (^{8}B ν_{solar}, Leslies, and ν_{atm}).
- Pick best E window.
- Estimate background.
- Count events.
- Calculate central value or upper limit.
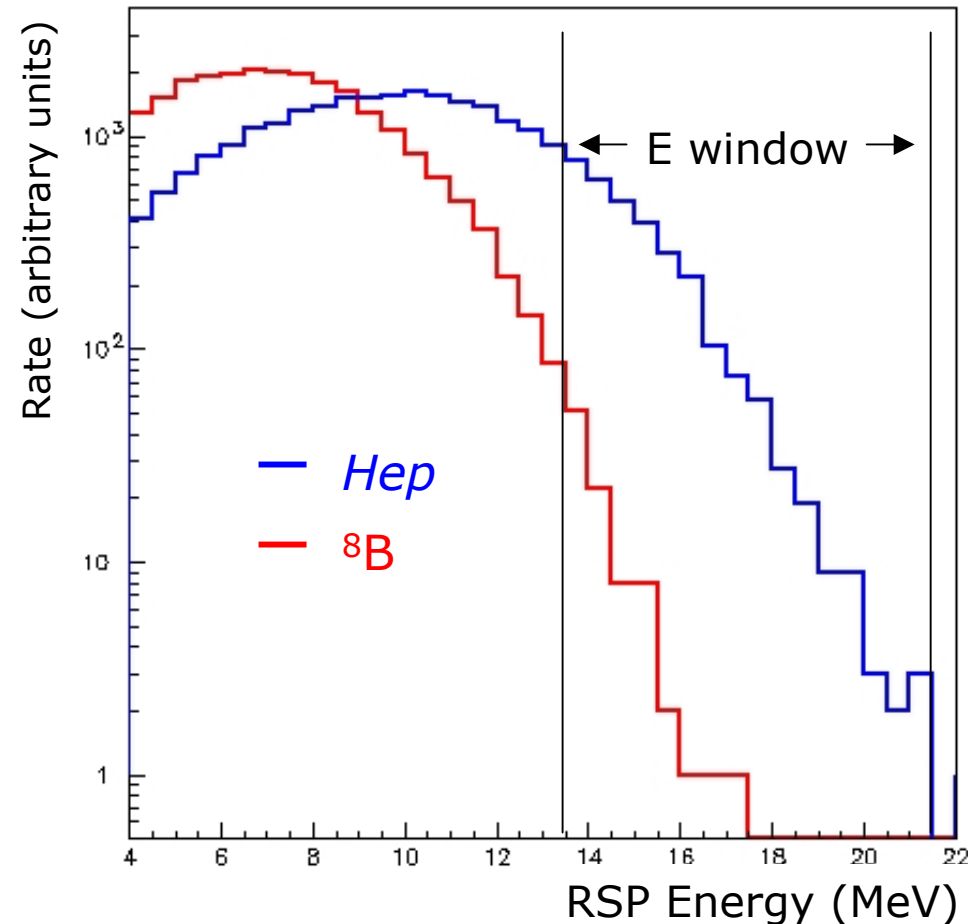
Backgrounds: ν_{solar} from ^8B

- CC and ES reactions of ν_{solar} from ^8B expected to be main background.

- Number of expected events depends on E window.

- Systematic uncertainties must be carefully determined (depend on E window).

- Many possible sources of systematics have been studied.

Source	Status	Size
E scale	✔	big
E resolution	✔	big
Vtx accuracy	✔	medium
Noise + ^8B	✔	small
E non-linearity	✔	small
Cross-talk	✔	small
^8B shape	✘	?

Backgrounds: high energy

- Leslie events: two inconsistent results…
- Muons: easy to cut.
- Atmospheric ν: in progress.
  - Protons, pions, muons, electrons produced by ν_{atm} interactions.
  - NUANCE produces text files; must interface with SNOMAN.

Source	Status	Size
Leslie events	✘	?
Muons	✔	small
ν_{atm}	✘	?

Expected results

- $\sigma_{syst} \approx \sigma_{stat}$

- Calculation of UL requires extension to Feldman-Cousins (large σ_{syst}). $\Rightarrow$ Neil and Ferenc have investigated `Pole` program (used by AMANDA).

- 90% C.L. upper limit: $\phi_{Hep} \geq 5(\phi_{Hep}$ of SSM). $\Rightarrow$ High energy systematics to come.

- Competitive with Super-K result with 1258 days.

To do

1. Resolve Leslie event background discrepancy.

2. Determine uncertainty due to ^{8}B shape.

3. Interface NUANCE with SNOMAN.

4. Determine ν_{atm} background.

5. Finalize method for confidence interval calculation.

6. Analyze data!

7. Assemble unidoc and write paper.

Summary

- *Hep* group has several active members.

- Simple "box" analysis with D_2O first.

- ^8B background almost done.

- High energy backgrounds need work.

- UL calculation under study.

- Results should be competitive.

- **Note**: No promises about publication dates! Work is proceeding but still a few unknowns.