MSW Scan Using Extended Maximum Likelihood Method

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ECG meeting, Carleton University,

November 12, 2003

Oscillation Parameters: dm^2 and $\tan^2\theta$

- By using two oscillation hypothesis, we can calculate expected neutrino yield in each point on MSW plane and compare it with the experimental data
- In order to produce exclusion plots on MSW plane and to extract the best estimates for the oscillation parameters we can use either χ^2 or EML method

$L = -2 ln \mathbf{L} =$
$\mathbf{2 * \nu_{tot} - 2 * \Sigma\, n_k ln\, \nu_k}$

- $\nu_{tot}(dm^2, \tan^2\theta, \phi_B^8)$: total expected yield
- ν_k : expected yield in bin k
- n_k : measured yield in bin k

Why EML?

- Instead using just energy, we can include $\cos\theta_{sun}$, isotropy and radial information in the fit
- The variances of the estimates for the osillation parameters should be reduced by including the information from total number of events (extended part of the likelihood function)

MSW scan with SNO pure D_2O day/night or averaged spectra

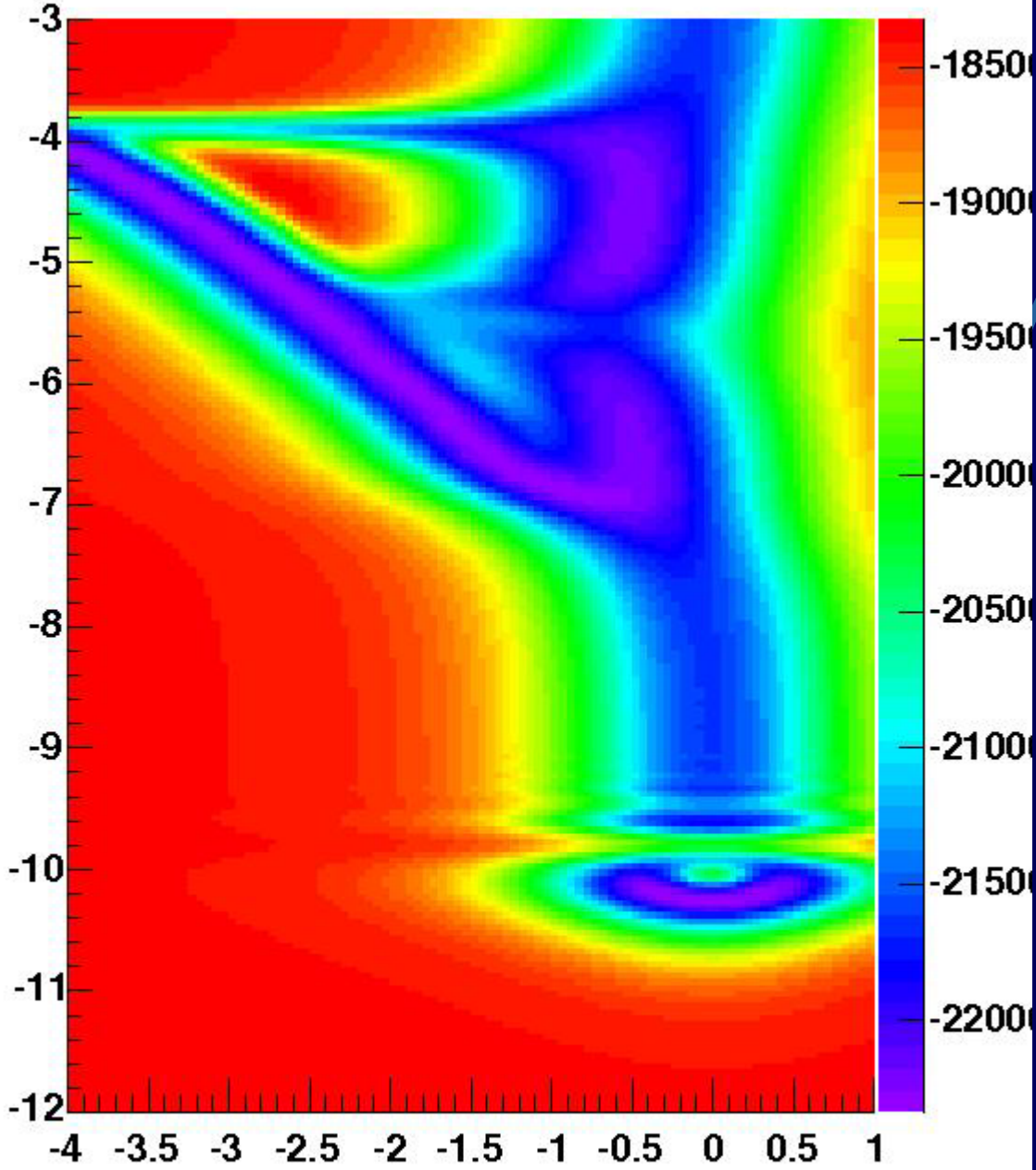
- SNO spectra : NC, CC, ES and backgrounds (LE and NC)
- Precalculated shape tables for the expected yield which are weighted for the real zenith-livetime distribution
- Radial cut, correction factors (CC, NC, ES : both for day and night), NC detection efficiency factor
- Backround pdf's included in calculation of the expected yield

- Fixed boron eight flux (SSM value)
- day/night livetime corrections
- Fit only for the flux and energy spectrum
- No systematics, yet…

Contour plot

SNO pure D_2O day/night data:

Likelihood projection plot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1
-1850
-1900
-1950
-2000
-2050
-2100
-2150
-2200
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To come …

- Inclusion of the systematics (most important)
- Inclusion of zenith-energy, isotropy and radial information
- Fit for the combined measurements
- Unbinned fit
- ….