# AMANDA 2000-2006 Solar WIMP Search

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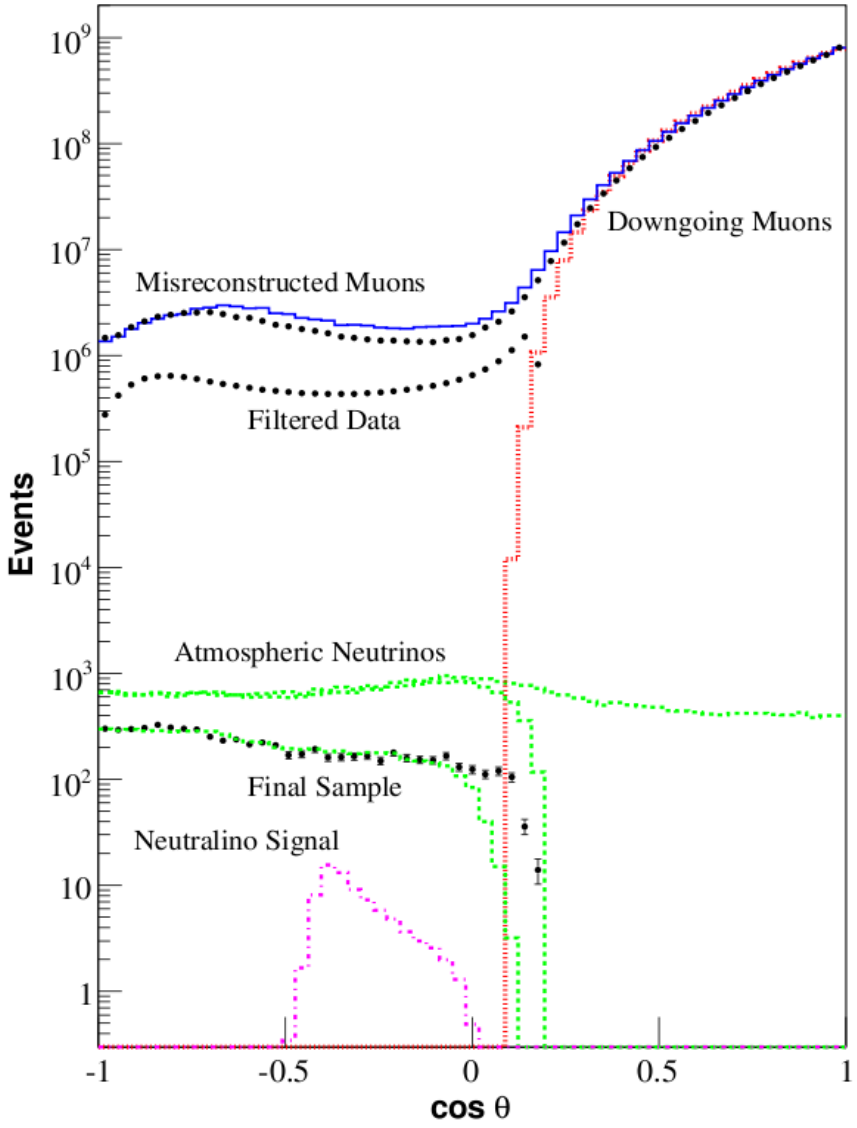
# Scope of Analysis

- Use the AMANDA 7-year point source data sample for a quick and easy solar WIMP search
- Independent check of current AMANDA and IceCube solar WIMP results
- Expect limited sensitivity for low neutralino masses since event selection is optimized for $E^{-2}$-$E^{-3}$ power law spectra.
- Expect reasonable sensitivity for high masses due to large livetime of 953 days

# Event Selection




- 4665 events while Sun is above the horizon
- String trigger essentially irrelevant
- Cuts are tighter than typical solar WIMP analyses
  - Less than 5% CR muons ($\delta>5^{o}$)
  - Lower signal efficiency
  - Better angular resolution

# Analysis

- Generate WIMP annihilation neutrino spectra and propagate to Earth with WimpAnn and DarkSUSY

- Use diffuse ANIS neutrino MC as signal simulation
  - Reweight to solar declination distribution using Daan's method:

$$w(\theta_\nu, \phi_\nu) = \frac{1}{\sqrt{1 - \left(\frac{90 - \theta_\nu}{23.45}\right)^2}} \frac{1}{\sin \theta_\nu}.$$

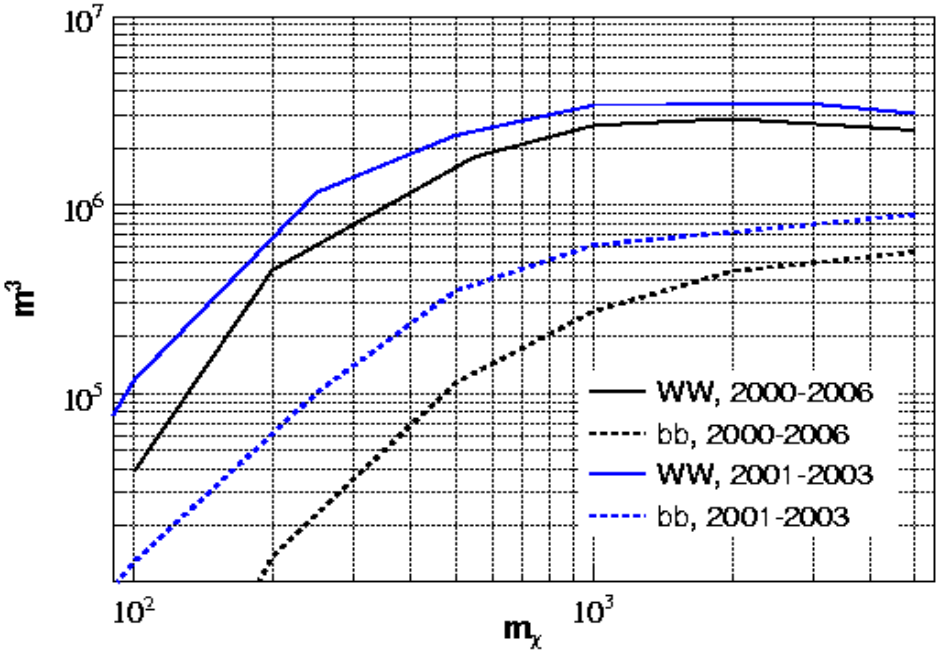
- Use the unbinned point source search method

# Effective Volume

- Calculate effective volume from generation area and existing event weights

$$V_i^{gen} = \frac{A_i^{gen} \cdot P_i^{\nu \to \mu}}{\frac{dP_i^{\nu \to \mu}}{dZ}}$$

$$\frac{dP_i^{\nu \to \mu}}{dZ} = \sigma_i \cdot N_A \cdot \rho_{ice}$$



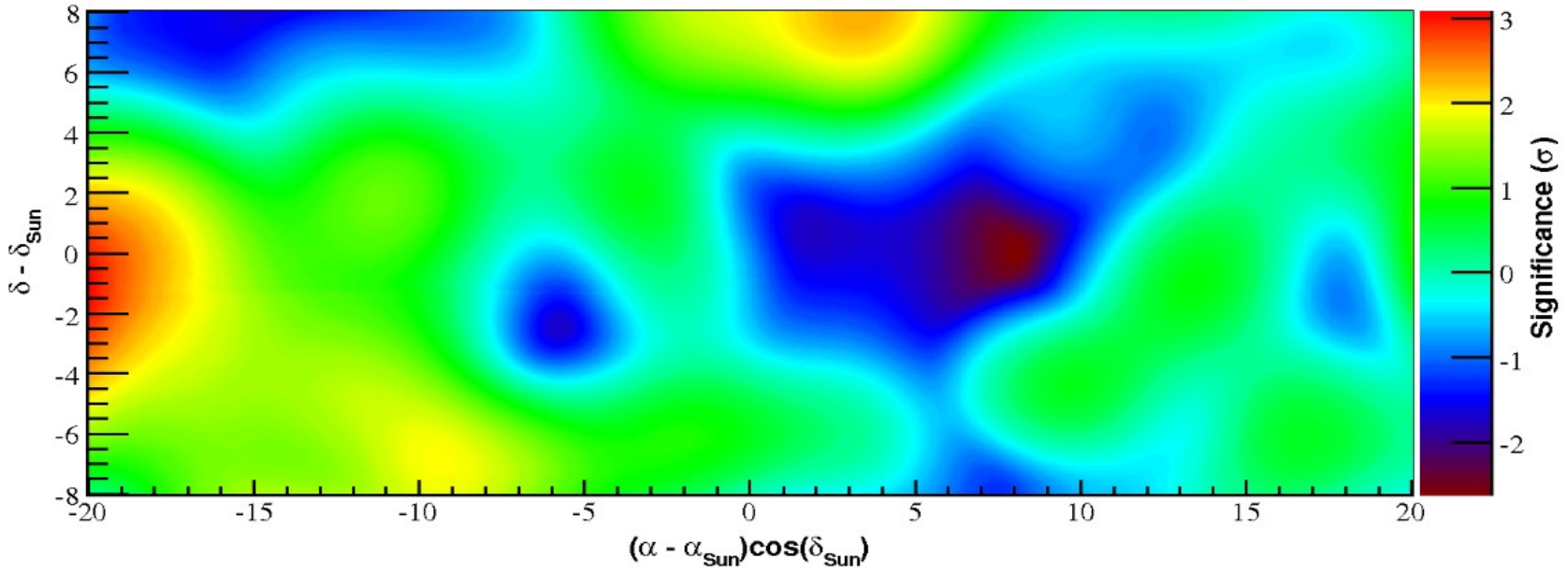

- Calculate average effective volume for a given spectrum

$$\overline{V^{eff}} = \frac{\int_0^\infty V_\nu^{eff}(E)\sigma_{\nu N}\frac{dN_\nu}{dE}(E)dE}{\int_0^\infty \sigma_{\nu N}\frac{dN_\nu}{dE}(E)dE}$$

- Do the analysis using neutrino effective area

$$\Gamma_{90}^A = \frac{4\pi R^2 \mu_{90}}{T_L}\left[\int_0^\infty A_\nu^{eff}(E)\frac{dN_\nu}{dE}(E)dE\right]^{-1}$$

# Result

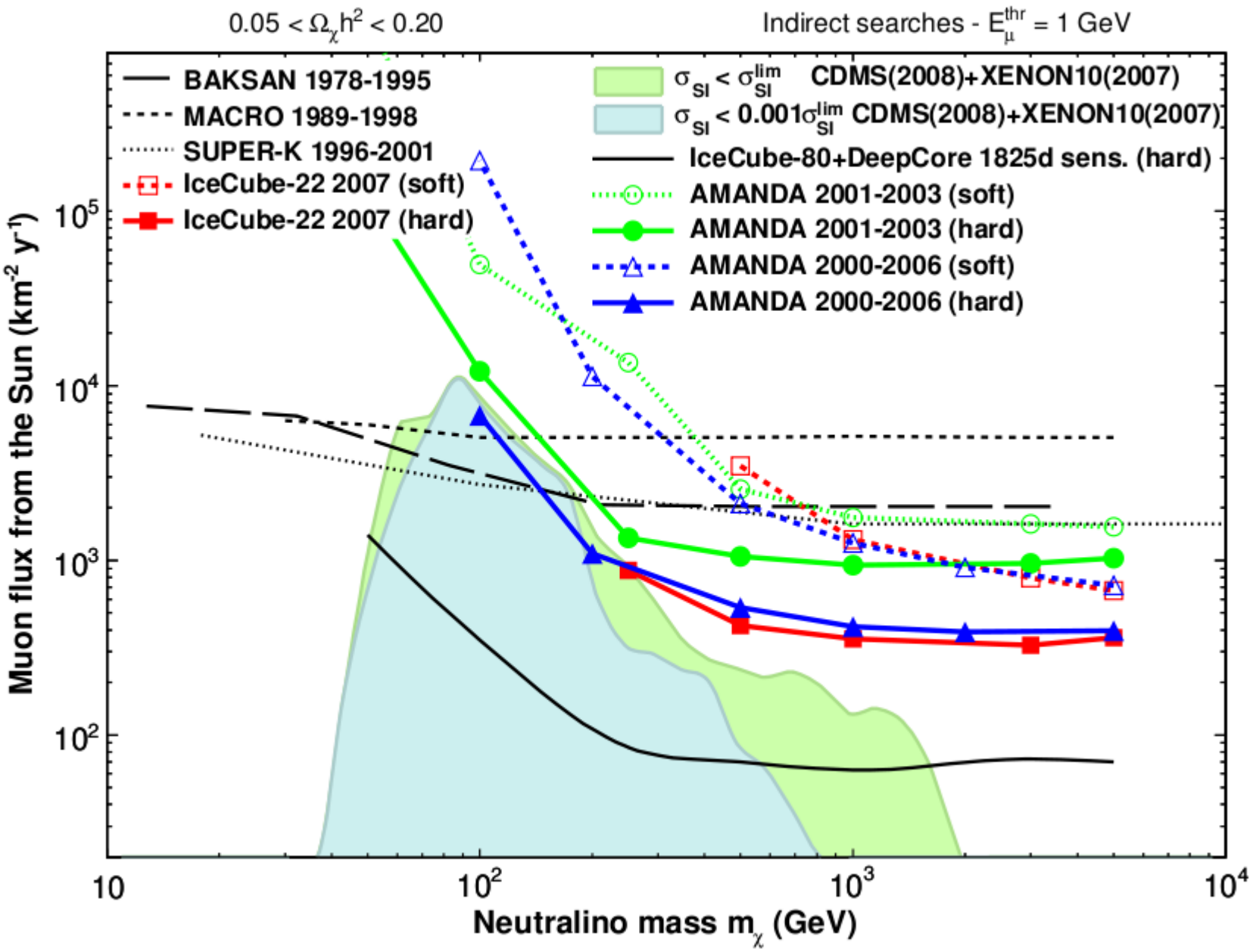



- 0.8σ deficit from direction of the Sun

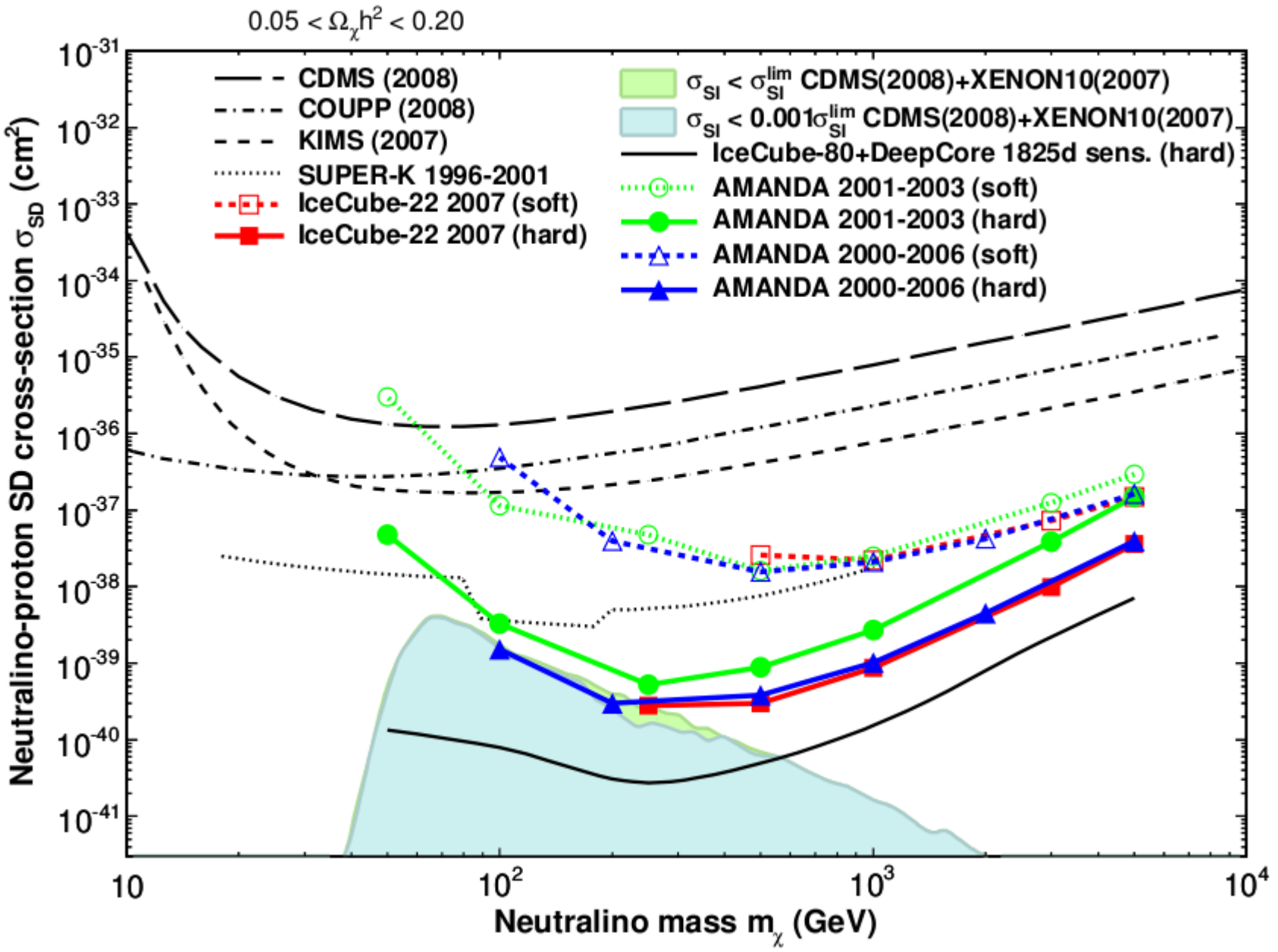
# Systematics

- Systematics dominated by uncertainties in OM sensitivity and photon propagation in ice
  - Ice + OM Sensitivity: 10% - 21%
  - Event Selection: 4% - 8%
  - Oscillations: 5%
- Center rectangular uncertainties and transform to Gaussian
- Add uncertainties in quadrature
  - Total Offsets: 15% - 39%
  - Total Uncertainties: 13% - 24%
- Incorporate uncertainties into limits using Conrad-Hill confidence band construction

# Muon Flux Limits



# Cross Section Limits



# Discussion

- Limits for low masses are interesting
  - Extend the IceCube-22 string limits from Gustav
- Limits will be presented at ICRC alongside Daan's
- How do we proceed with a journal publication?