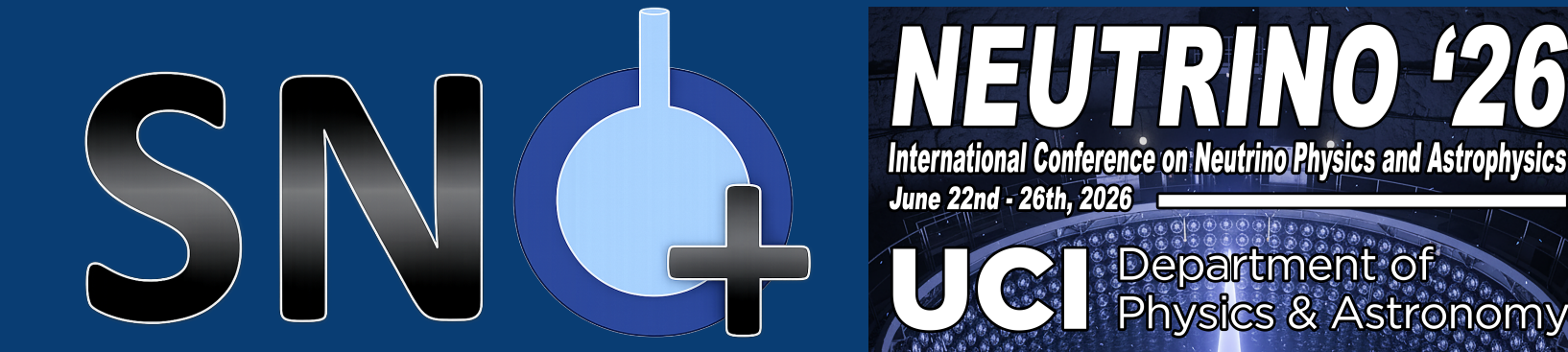


SNO+: ^8B solar neutrino flux measurement from scintillator phase

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SNO+ Experiment

SNO+ is a neutrino detector located deep underground in Sudbury, Ontario. SNO+ is filled with **liquid scintillator** to pursue a **broad physics program**, including the study of solar neutrinos, reactor and geo antineutrinos, as well as $0\nu\beta\beta$ with the addition of Te.

SNO+ consists of a **spherical 6m radius acrylic vessel**, filled with ~ 780 tonnes of liquid scintillator, surrounded by ultra-pure water shielding and ~ 9400 photomultiplier tubes (PMTs) [1].

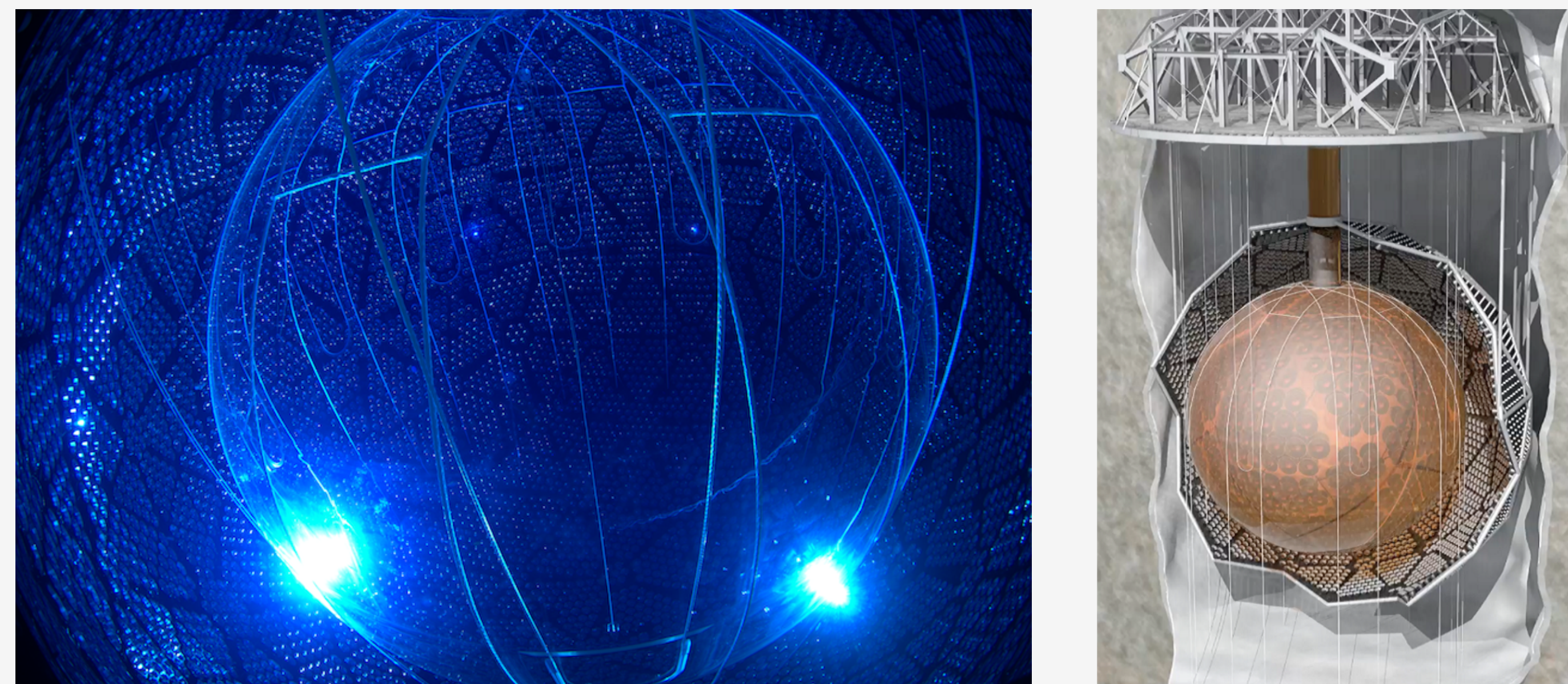


FIG. 1. Image (left) and schematic (right) of SNO+

^8B Solar Neutrinos

^8B solar neutrinos are detected via **elastic scattering**:

$$\nu_x + e^- \rightarrow \nu_x + e^-$$

SNO+ reported the first ever evidence of ^8B solar neutrino interactions on ^{13}C [2]. This interaction proceeds via **charged current**:



This is included as a signal in the analysis in addition to the elastic scattering events.

Data and Fit Method

This analysis uses **143.08 days of net livetime** of data with LAB + 2.2 g/L PPO scintillator.

The fit uses **2D binned distributions of reconstructed energy and radius**. The MC is fit to data using **binned log-likelihood** optimization via MINOS from the MINUIT package.

Cuts applied to events:

- Fiducial Volume ($R < 5.7\text{m}$)
- Energy (2.5-14.0 MeV)
- 20s veto after muons to remove followers
- Broad coincidence tagging to remove $^{214}\text{BiPo}$ and $^{212}\text{BiPo}$ backgrounds from the ^{238}U - and ^{232}Th -chain decays

^8B Solar Flux Fit Results

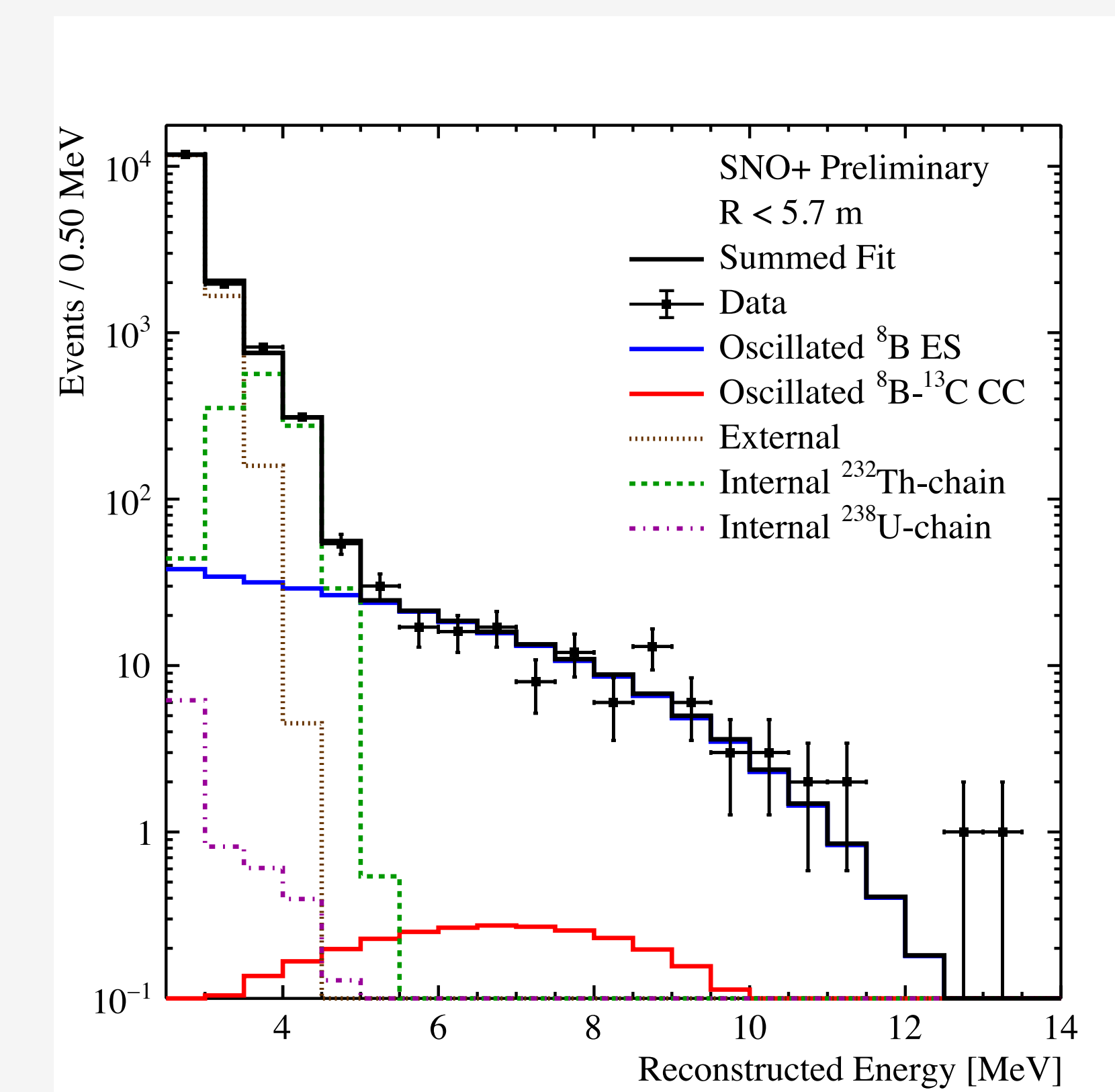


FIG. 2. The reconstructed energy fit above 2.5 MeV, showing the ^8B solar neutrino interactions, backgrounds, and summed fit.

Measuring the ^8B solar neutrino flux and oscillation parameters (ongoing joint analysis) is a principle aim of the SNO+ detector during the liquid scintillator phase.

The ^8B solar flux analysis fixes the oscillation parameters to the global best fit values, and allows the ^8B solar flux to float freely.

The current analysis results in a measured flux of:

$$^8\text{B flux} = 5.81 \pm 0.48 \times 10^6 \text{ cm}^{-2} \text{ s}^{-1}$$

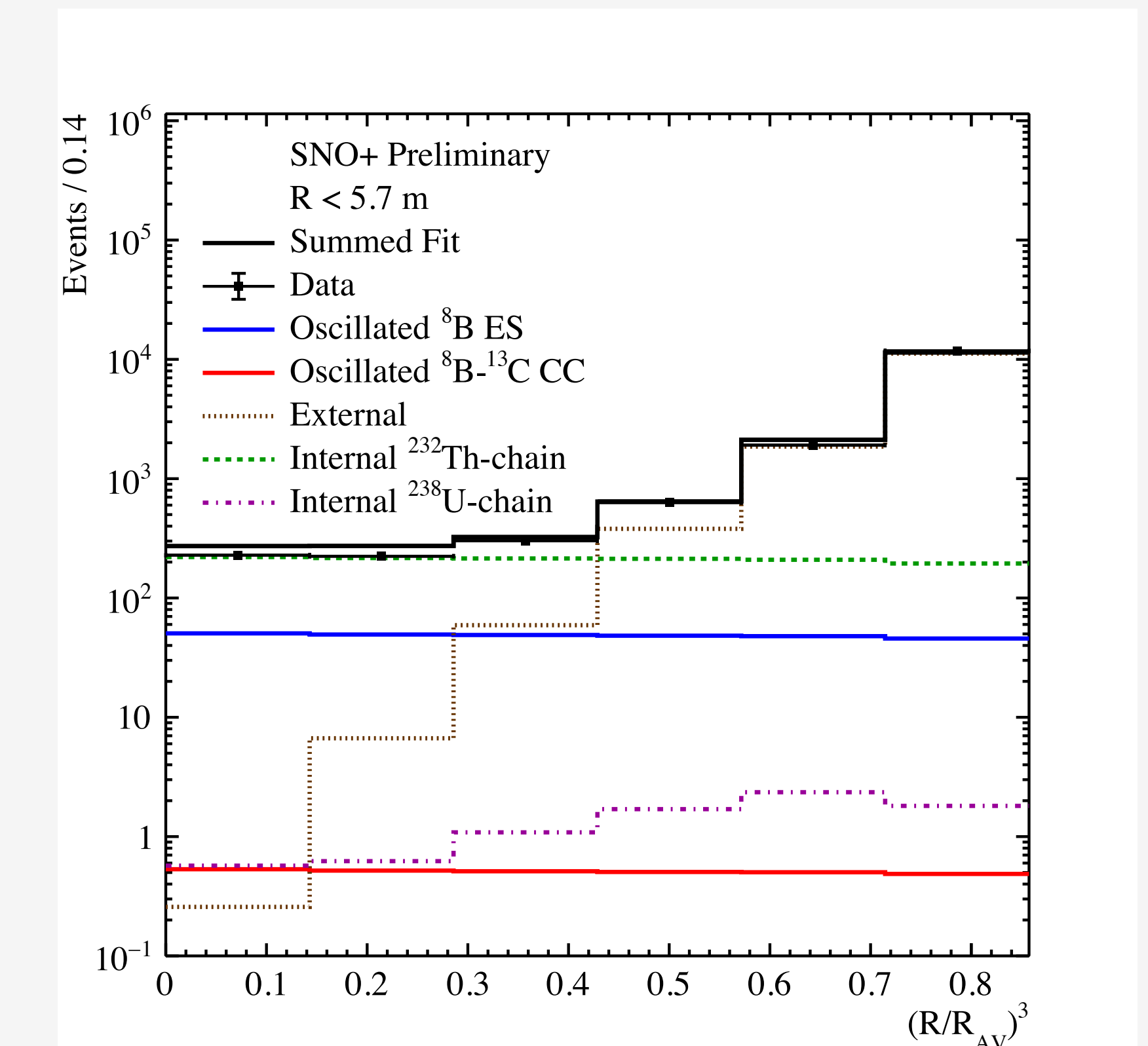


FIG. 3. The radial fit out to a 5.7m fiducial volume, showing the ^8B solar neutrino interactions, backgrounds, and summed fit.

Acknowledgements and References

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- [1] JINST 16 P08059 (2021)
[2] Phys. Rev. Lett. D 135, 241803 (2025)