

# Measuring the SNO+ Scintillator Optics With SMELLIE

NuPhys2023



**Po-Wei Huang, Ana Sofia Inácio \***, Daniel Cookman  
On behalf of the SNO+ collaboration



\* funded by

THE  
ROYAL  
SOCIETY

**KING'S**  
*College*  
**LONDON**



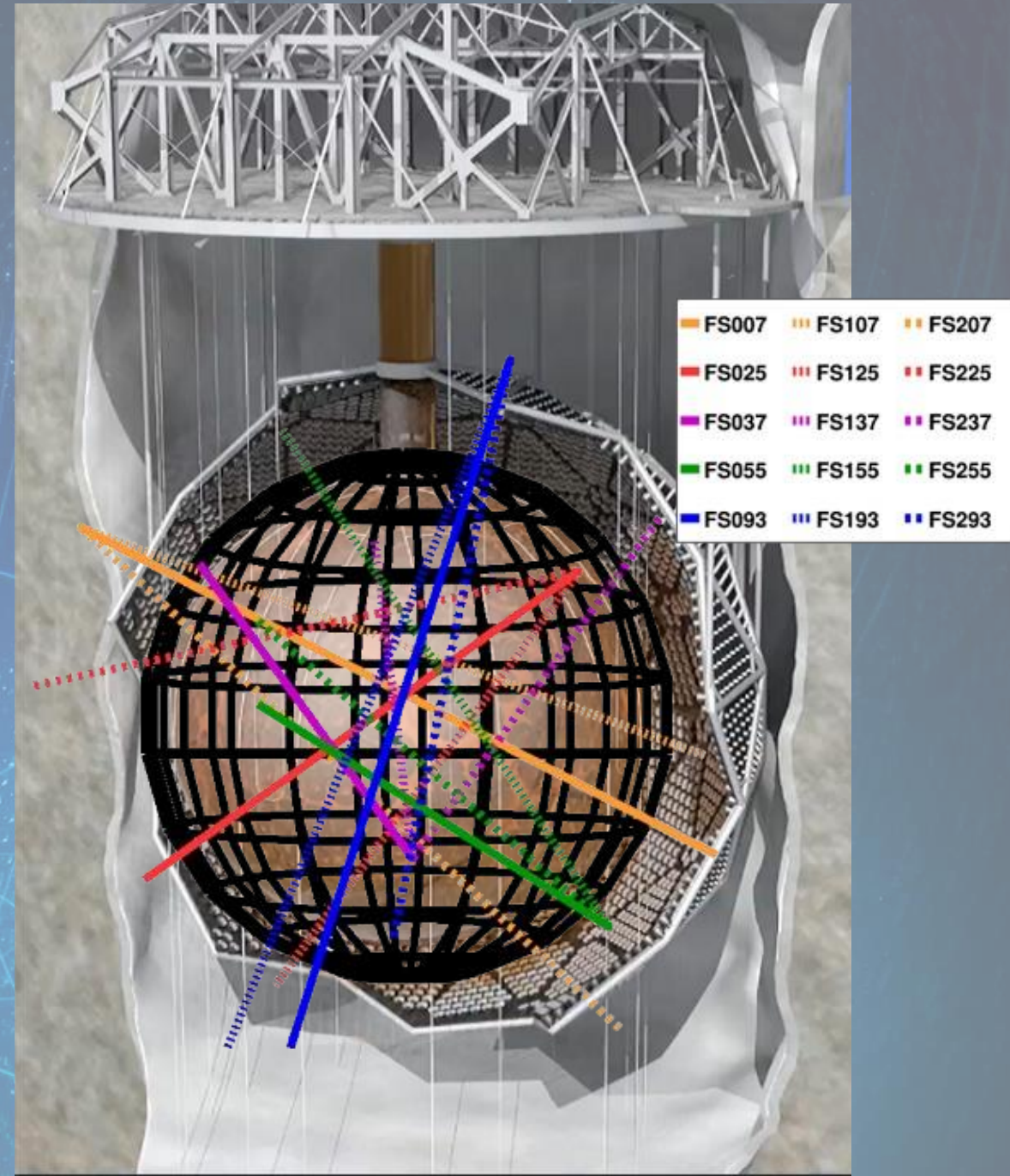
UNIVERSITY OF  
**OXFORD**



# What is SMELLIE?

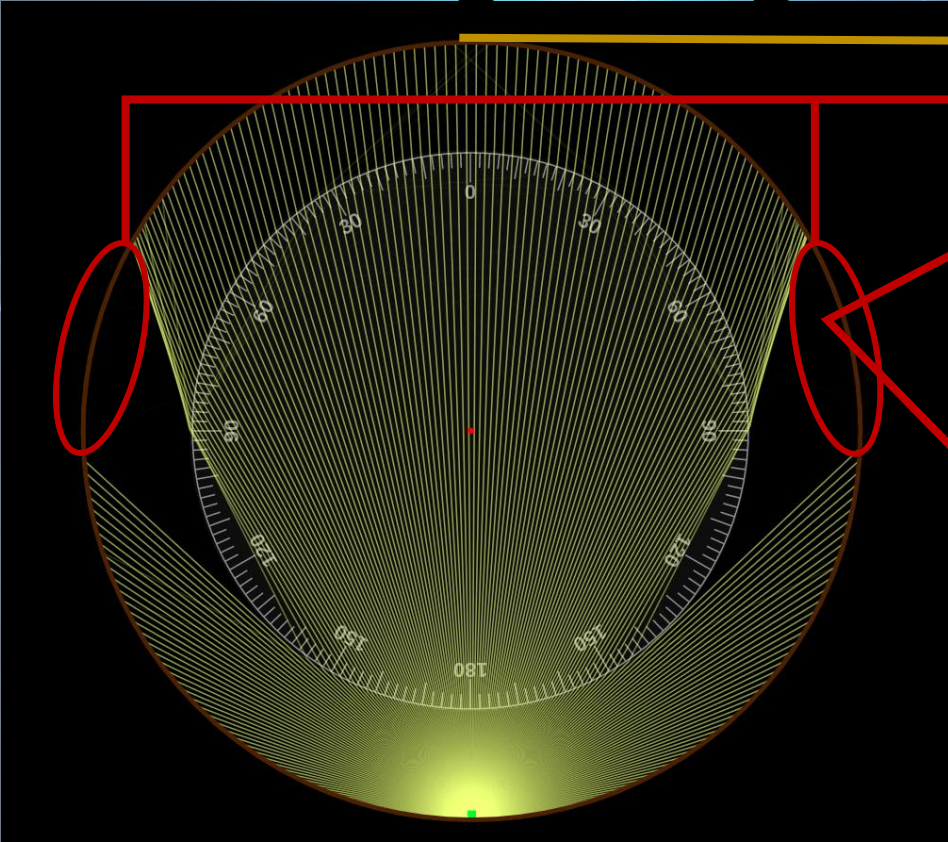
- Scattering Module of Embedded Laser Light Injection Entity
- Goal: Measure the extent of absorption and scattering in multiple detector phases
- **Advantage: In-situ optical calibration system**

Laser Type	Wavelength
PQ375	Peaks at 375 nm
PQ405(407)	Peaks at 407 nm
PQ440(446)	Peaks at 446 nm
PQ495	Peaks at 495 nm
SuperK	400 – 700 nm

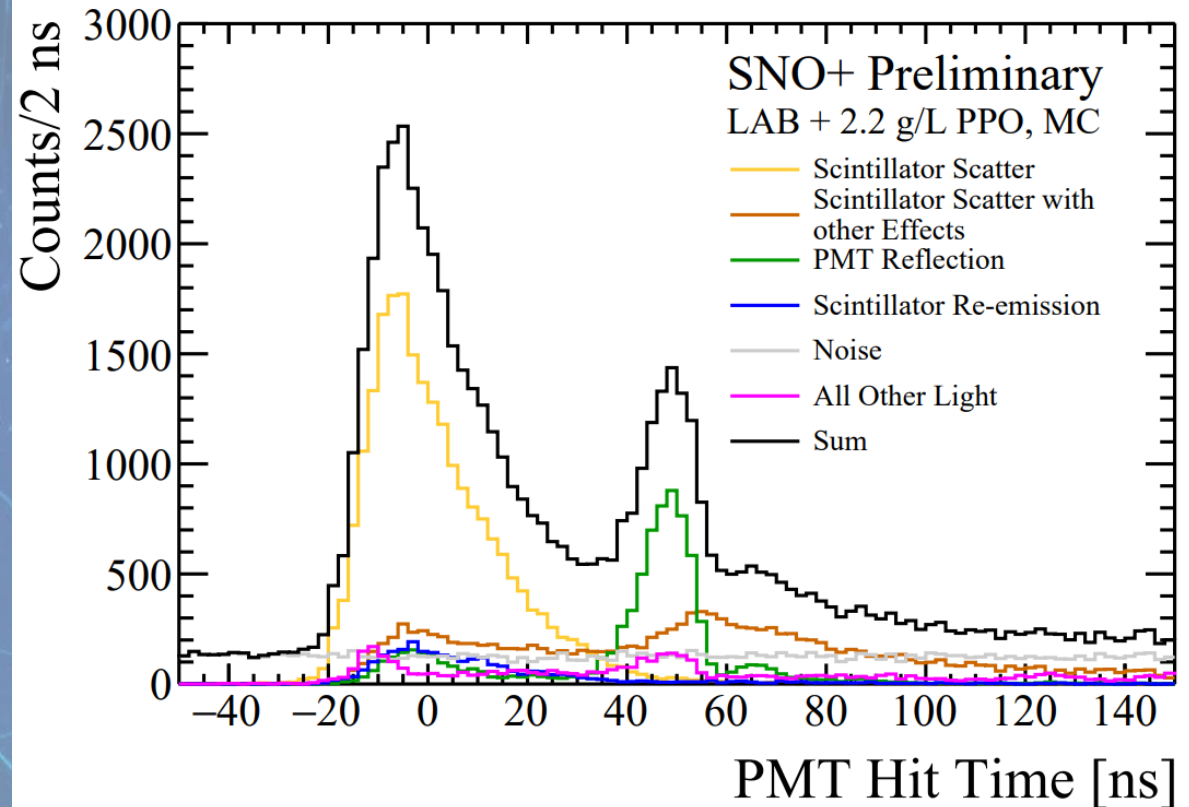




# Scattering Length Analysis



Direct Light Regions  
Scattering Signal Regions



The proportion of “Scintillator Scatter” is the largest in this signal region.

# Extinction Length Analysis

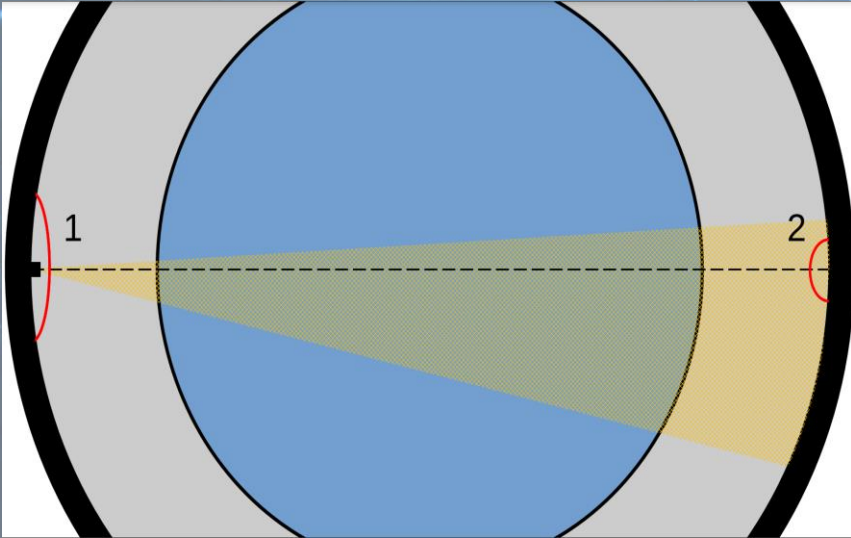
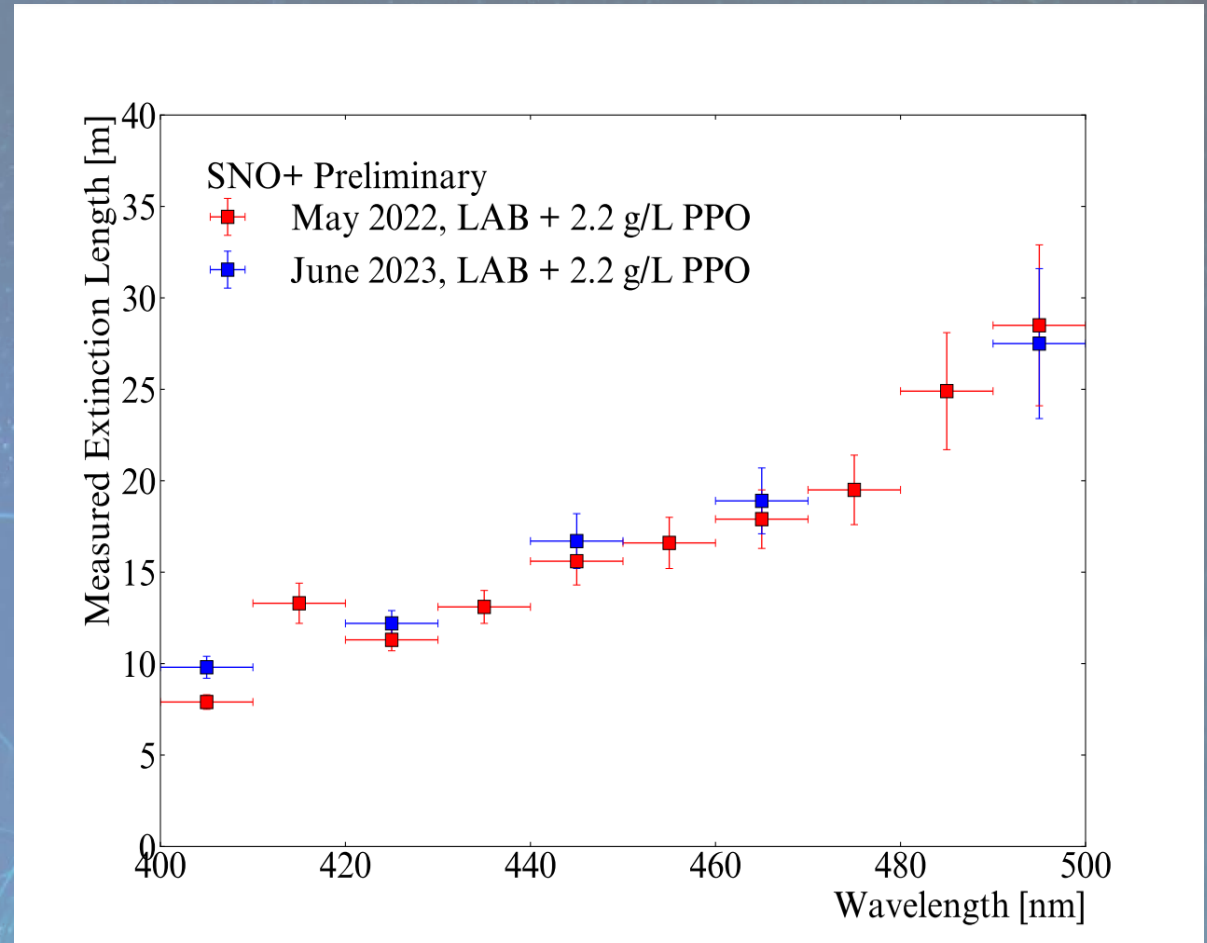


Illustration of two signal regions in extinction length analysis.



Wavelength-dependent extinction length measurement, with data taken at the start and end of the LAB + 2.2 g/L PPO scintillator fill phase. The SuperK laser was used for data points shown.

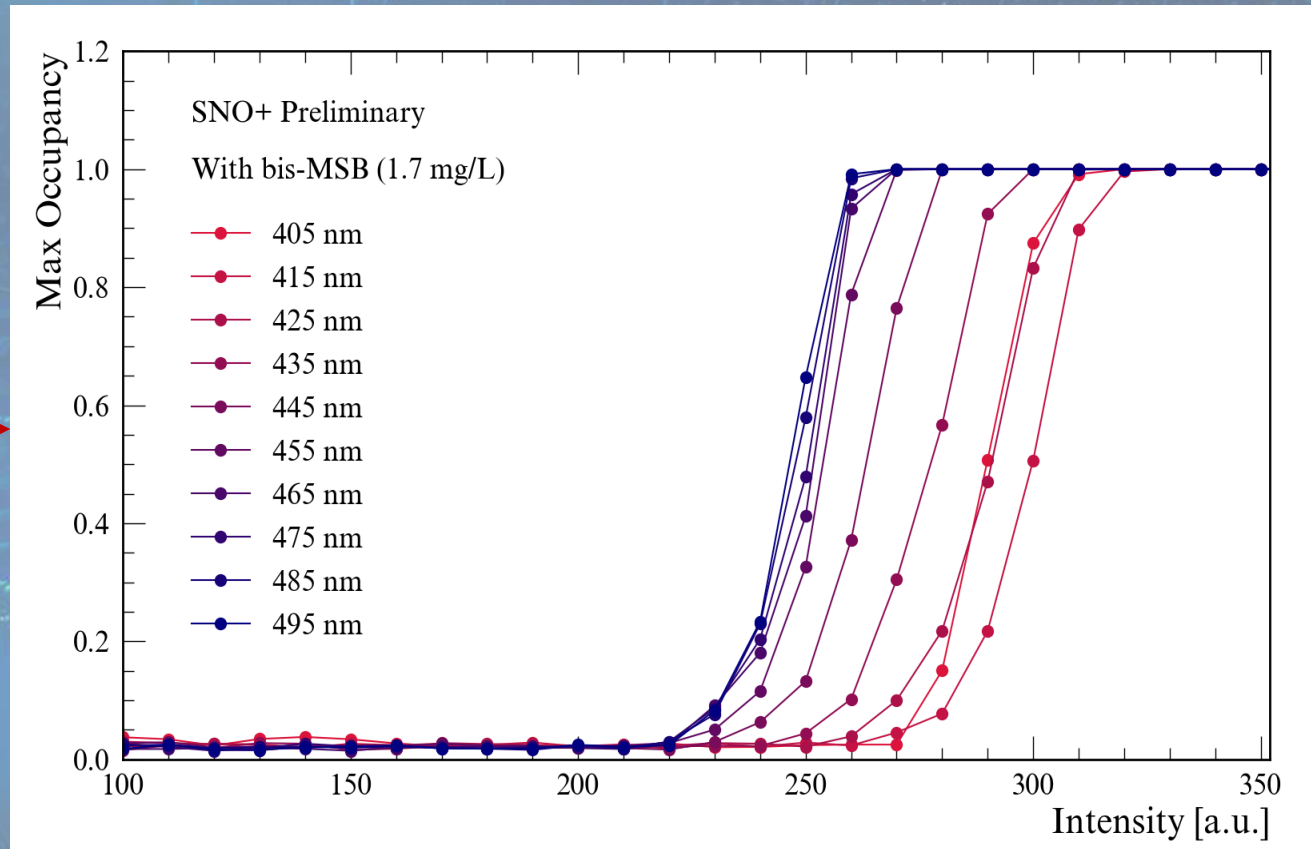


# Ongoing/Future Work

Commissioning with bisMSB  
Intensity scan

Commissioning with bisMSB  
Gain Scan

Data analysis to extract the optical properties



Intensity Scan through FS225 fibre. Occupancy is defined as the fraction of event in which a PMT can hit, which is useful to convert Occupancy to NPE via  $\mu_{\text{NPE}} = \ln(1 - occ)$