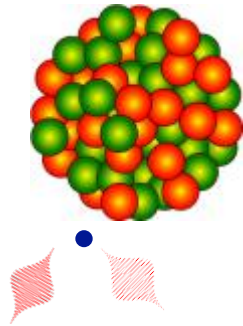


# Coherent pion photoproduction

Photon probe ✓  
Interaction well understood



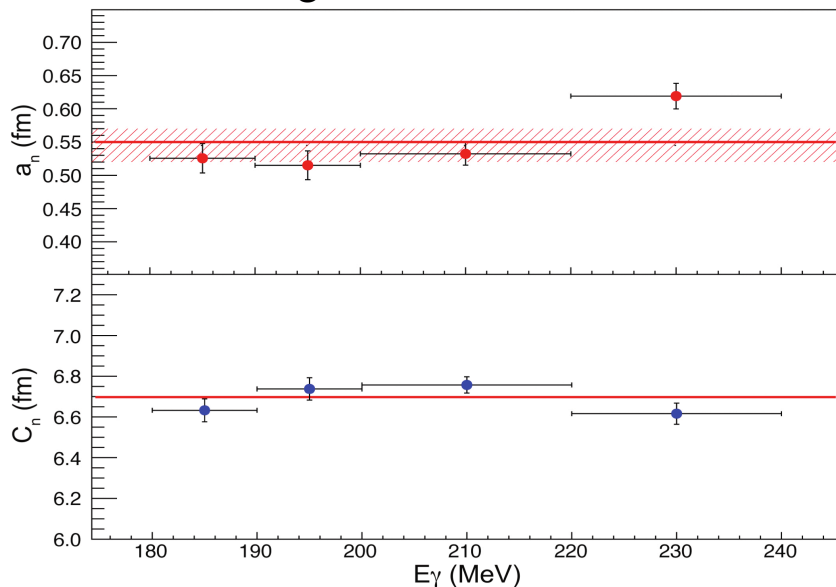
$\pi^0$  meson – produced with  
~equal probability on  
protons *AND* neutrons.

Reconstruct  $\pi^0$   
from  $\pi^0 \rightarrow 2\gamma$  decay

- Angular distribution of  $\pi^0 \rightarrow$  PWIA contains the matter form factor

$$d\sigma/d\Omega(\text{PWIA}) = (s/m_N^2) A^2 (q_\pi^*/2k_\gamma) F_2(E_\gamma^*, \theta_\pi^*)^2 |F_m(\mathbf{q})|^2 \sin^2\theta_\pi^*$$

- $\pi^0$  final state interactions - use latest complex optical potentials tuned to  $\pi$ -A scattering data. Corrections modest at low pion momenta



$$a_n = 0.55 \pm 0.01(\text{stat.})^{+0.02}_{-0.03} \text{ fm}(\text{sys.})$$

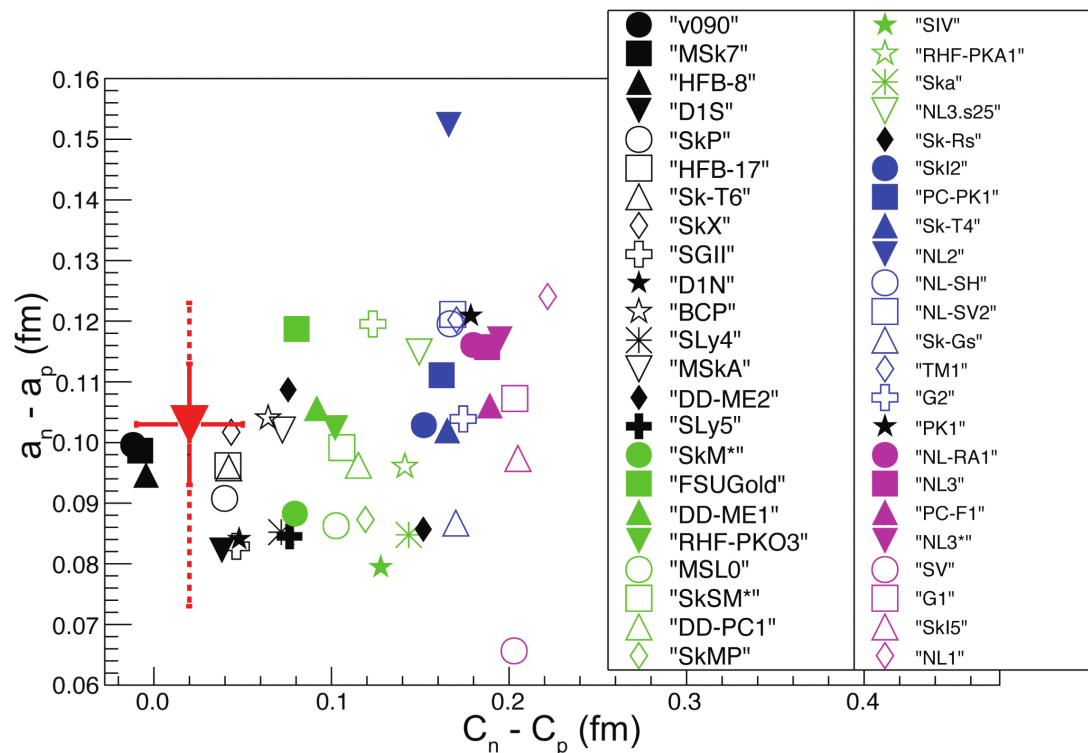
$$c_n = 6.70 \pm 0.03(\text{stat.})\text{fm}$$

$$\Delta r_{np} = 0.15 \pm 0.03(\text{stat.})^{+0.01}_{-0.03} \text{ fm}(\text{sys.})$$

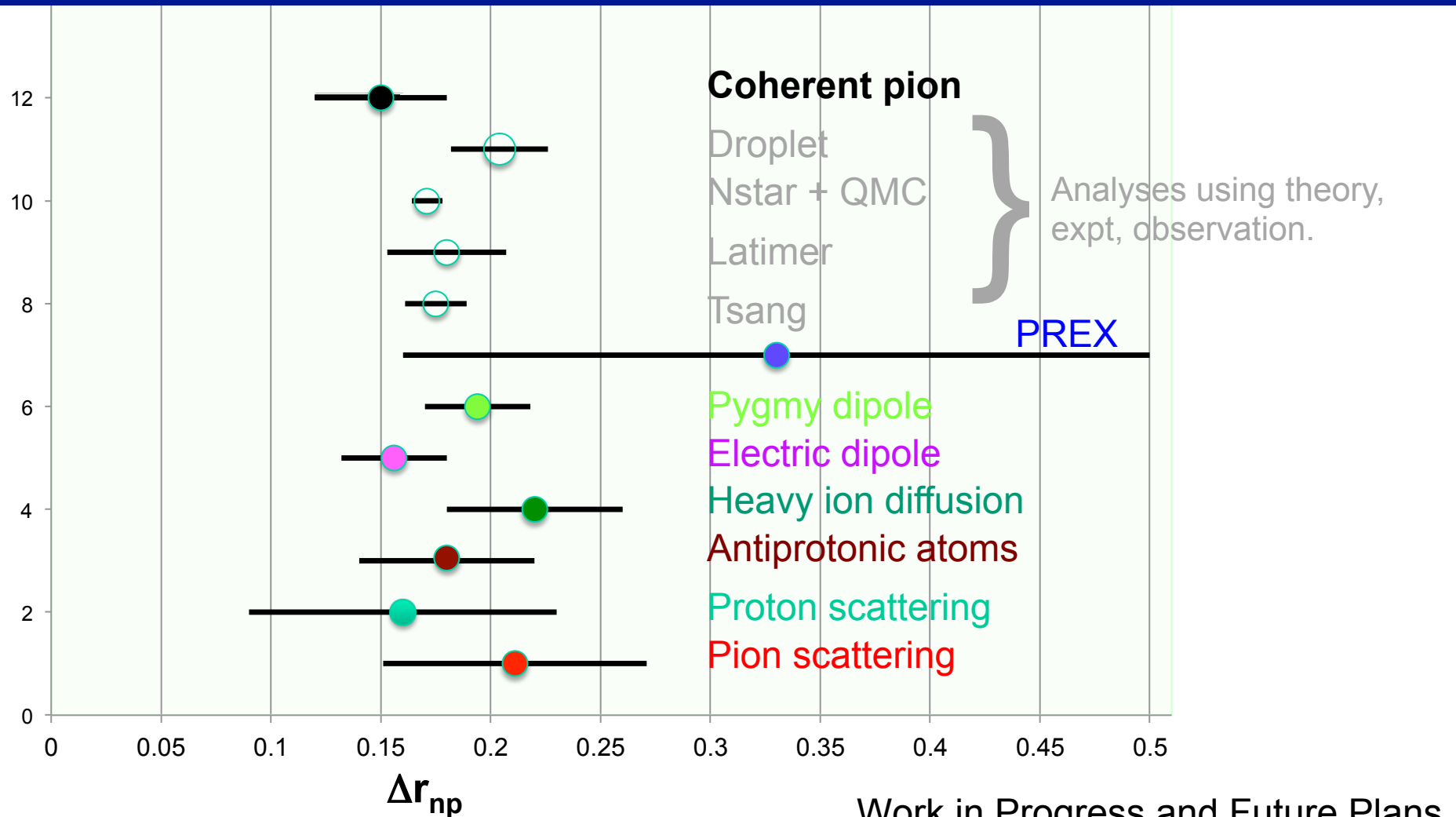
# The extracted skin properties

- Systematics:
  - Normalisation parameter within  $\pm 5\%$  of unity for all bins
  - $E_\gamma$  dependences –  $a_n$  high  $E_\gamma$  bin  $3.5\sigma$  away from average
  - Vary yield fitting procedure
  - 10% variation relative p,n amplitudes in the model (mainly affects diffuseness)
  - Different fit ranges

## Comparison with theory



# New results in agreement with with previous measurements



## Work in Progress and Future Plans

- Data under analysis for  $^{116}\text{Sn}$ ,  $^{120}\text{Sn}$ ,  $^{124}\text{Sn}$  &  $^{56}\text{Ni}$
- Future Plans for  $^{48}\text{Ca}$ ,  $^{40}\text{Ca}$
- Discussions Xenon isotopic chain

Needs: Availability of Isotopically Separated Targets  
More and Continuing Theoretical Support