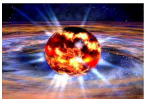


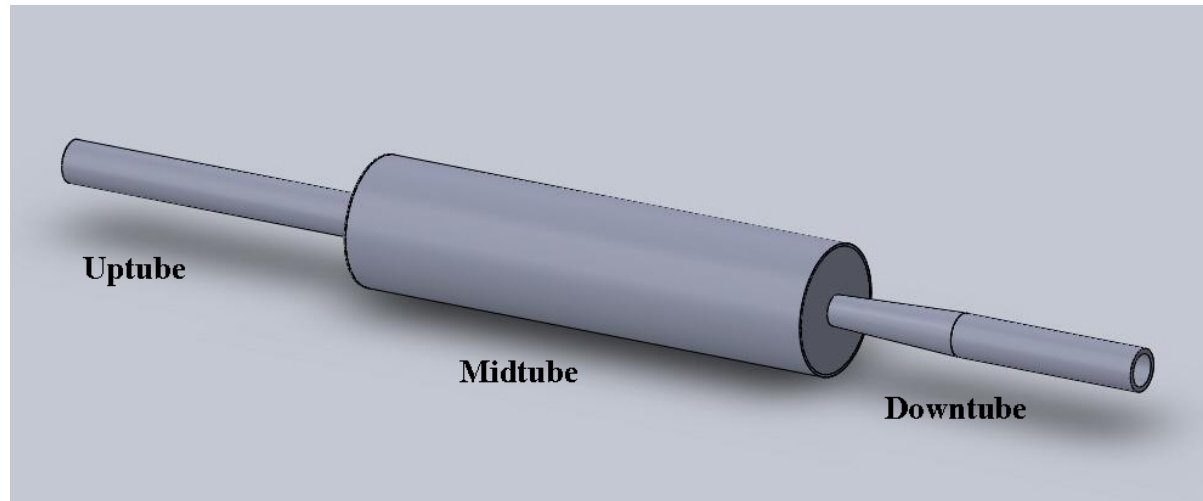
# Calcium Target for use during PREX

Dustin McNulty  
Idaho State University  
*[mcnulty@jlab.org](mailto:mcnulty@jlab.org)*

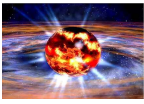
December 16, 2014



## CREX $^{48}\text{Ca}$ Target Details

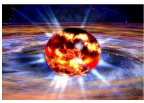


- $1\text{g}/\text{cm}^2$  ( $\sim 6.5\text{mm}$  thick  $\Rightarrow 6.2\%$   $X_0$ ) isotopically pure  $^{48}\text{Ca}$  puck. Cost est. \$400k - \$500k (can lease for \$10,000/year according to Dave Meekins)
- Note that the  $^{48}\text{Ca}$  puck from E08014 (which Dave still has) closely matches our requirements.

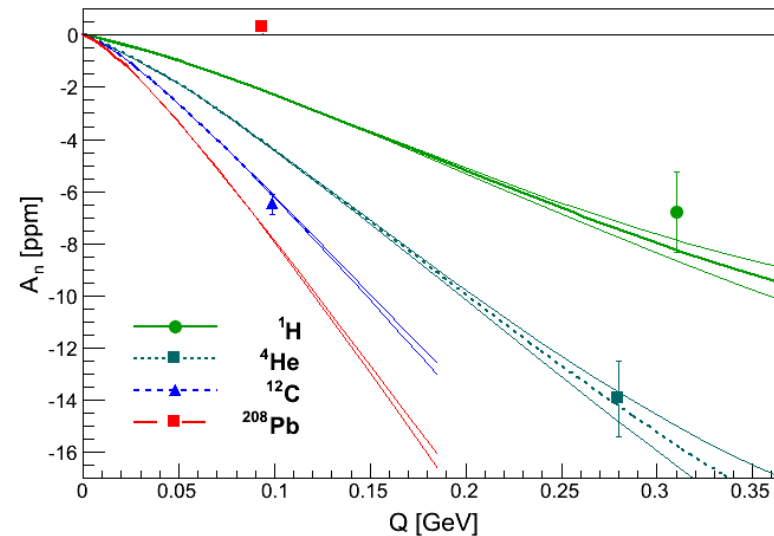


## Why Calcium-40 for PREX?

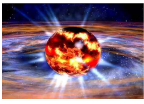
- Measure beam-normal, single-spin asymmetry ( $A_n$ )
- Perform thermal stress test at  $150\mu\text{A}$  (proposed CREX current)



## $^{40}\text{Ca}$ $A_n$ Measurement

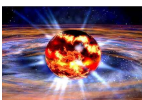


- No calculations yet (C. Horowitz and X. Roca Maza agreed to do these at PAVI)
- If coulomb distortions and dispersion corrections do not play strong role here, then expect  $A_n^{Ca} \sim 7\text{ppm}$  at  $\sqrt{Q^2} \sim 0.1$  GeV
- What thickness  $^{40}\text{Ca}$  target do we want for this publishable physics measurement? Balance rate and precision
- Note we also want this same target for CREX—to measure  $A_n^{Ca}$  at  $\sqrt{Q^2} \sim 0.15$  ... to accompany our  $^{48}\text{Ca}$   $A_n$  meas. at same  $Q^2$



## Thermal Stress Test

- For this test, we want the full  $1\text{g}/\text{cm}^2$  thickness of CREX production target
- Need to think about best way to mount target for meaningful tests:
  - Windows/cell walls? Are these important for the power/heat loads? Note we will not be able to fully replicate CREX cell
  - Mimic CREX's thermal coupling to frame (most important?)
  - Run long enough to achieve steady state at  $150\ \mu\text{A}$ . Do we need any special diagnostics here?



# American Elements: High purity Calcium-40 foil

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Calcium Foil Ca | AMERICAN ELE...

www.americanelements.com/cafoil.html

AMERICAN ELEMENTS THE MATERIALS SCIENCE COMPANY

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## Calcium Foil

High Purity Ca Foil  
CAS 7440-70-2

Product	Product Code	Order or Specifications
(2N) 99% Calcium Foil	CA-M-02-F	<a href="#">Contact</a>
(2N5) 99.5% Calcium Foil	CA-M-025-F	<a href="#">Contact</a>
(3N) 99.9% Calcium Foil	CA-M-03-F	<a href="#">Contact</a>
(3N5) 99.95% Calcium Foil	CA-M-035-F	<a href="#">Contact</a>
(4N) 99.99% Calcium Foil	CA-M-04-F	<a href="#">Contact</a>
(5N) 99.999% Calcium Foil	CA-M-05-F	<a href="#">Contact</a>

CHEMICAL IDENTIFIER	Formula	CAS No.	PubChem SID	PubChem CID	MDL No.	EC No	Beilstein Re. No.	SMILES Identifier	InChI Identifier	InChI Key
	Ca	7440-70-2	<a href="#">24852872</a>	5460341	MFCD00085314	231-179-5	4241647	[CaH2]	InChI=1S/Ca	OYPRJOBELJOOCE-UHFFFAOYSA-N

PROPERTIES	Mol. Wt.	Appearance	Density	Tensile Strength	Melting Point	Boiling Point	Thermal Conductivity	Electrical Resistivity	Electronegativity	Specific Heat	Heat of Vaporization	Heat of Fusion	MSDS
	40.07	Silvery	1.55 gm/cc	N/A	839°C	1484°C	2.01 W/cm/K @ 298.2 K	3.91 microhm-cm @ 0 °C	1.0 Paulings	0.156 Cal/g/K @ 25°C	36.74 K-Cal/gm atom at 2467°C	2.23 Cal/gm mole	<a href="#">Safety Data Sheet</a>



## American Elements Quote

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Previous Next 1 (1 of 1) Fit Page Width

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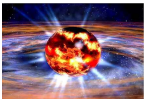
**DATE:** May 19, 2014

**PAYMENT TERMS:** CIA/CC or Submit references to apply for terms

**SHIPPING TERMS:** FOB Los Angeles, CA

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<b>MATERIAL</b>	<b>DESCRIPTION</b>	<b>QTY</b>	<b>UNIT PRICE</b>	<b>TOTAL</b>
Calcium Metal Foil PN: CA-M-025M-F.2250 Purity: 99.5% (metals basis)	Diameter: 2.0" Thickness: 0.250"	2pcs	\$998.03/pc	\$1,996.06
Shipping (Estimated)				\$34.72
<b>TOTAL</b>				<b>\$2,030.78</b>



## Summary Discussion

- High chemical purity Ca-40 targets are cheap. \$1k for thick puck; Need to contact other vendors for thinner target possibilities
- Is 99.5% pure good enough? Probably, but what are impurities? How does vendor deal with oxidation (packaging/shipping)?
- How will we deal with the oxidation problem? Various options discussed with Dave here: Store in mineral oil...can install without windows, clean oil off and pump-down, ...
- How many targets to purchase for this? 2 thick, 2 thin
- What else?