Kimballton Underground Research Facility

www.phys.vt.edu/~kimballton
US Deep Underground Laboratories

Homestake (SURF)

Soudan

Kimballton

WIPP
Key KURF Features

• 1450 mwe shielding
• drive in access
• ample space
• ½ hour from major research university
• currently 13 user institutions on 8 projects
• potential site for DIANA program
Kimballton Underground Research Facility

26 miles from 25,000 student VT research campus

New Regional Airport
Three potential locations for surface office/assembly building
Kimballton Geologic Setting
Kimballton Interior

dimensions in feet
(blue inset is size of Hall C in Gran Sasso)
looking down 14 East #2  
(top of escape-way ladder from 15th level seen on left)

looking down 14 East #1  
(40 ft wide, 90 ft high typ.)  
tripod is 600 ft from KURF  
(seen in the background)

escape-way ladder to 13th level
Building KURF (for < $200k; funds from Provost, College of Science, Research Division)
Backgrounds in Kimballton

- Kimballton (limestone) (Bq/kg)
  - $^{40}$K $\rightarrow$ 18±1, 13±1
  - $^{226}$Ra $\rightarrow$ 1.2±0.1, 1.9±0.2
  - $^{226}$Th $\rightarrow$ 0.6±0.1, 0.9±0.2

- Radon concentration
  - $^{222}$Rn $< 14.8$ Bq/m³

- Rock Strength:
  - ~150 MPa

- Gran Sasso (Dolomite rock) (Bq/kg)
  - $^{40}$K $\rightarrow$ 15
  - $^{226}$Ra $\rightarrow$ 5
  - $^{226}$Th $\rightarrow$ 0.3

- Radon concentration
  - $^{222}$Rn $\rightarrow$ 40 – 70 Bq/m³
A. mini-LENS (Low Energy Neutrino Spectroscopy)
   Virginia Tech, Louisiana State University, BNL (Vogelaar)

B. Neutron Spectrometer
   University of Maryland, NIST (Nico)

C. $\beta\beta$ Decay to Excited States
   Duke University (Turnow)

D. HPGe Low-Bkgd Screening
   North Carolina State University (Henning), University of North Carolina, Virginia Tech

E. MALBEK (Majorana 0v$\beta\beta$)
   University of North Carolina (Wilkerson)

F. $^{39}$Ar Depleted Argon
   Princeton University (Calaprice)

G. Watchman
   LLNL (on 2nd level - Bernstein)

H. Proposals
   Berkeley (Bolometry - Kolomensky), FNAL (CENNS - Yoo)

Sub-set of about 60 trained users for biannual refresher
“VT-1” and “Melissa” Low-Background Detectors


DOUBLE-BETA DECAY OF $^{150}$Nd TO EXCITED FINAL STATES

APS Division of Nuclear Physics
Santa Fe, NM
November 5, 2010

M.F. Kidd*, J. H. Esterline, S. W. Finch, W. Tornow

Low-Energy Neutrino Spectroscopy (LENS)
The UMD-NIST Fast Neutron Spectrometer

T. Langford, E. J. Beise, H. Breuer
University of Maryland
C. Heimbach, J. Nico
National Institute of Standards and Technology
April 13, 2011

PPC Detectors
UNC (Majorana Collaboration)

Revised Neutron Detection

Optically coupled Scintillators

P-type Point Contact HPGe detectors
39Ar depleted Argon

National Security Detection and monitoring of reactors
Future Directions

Nuclear Astrophysics

LENS
Artist Concept of Complete Facility

DIANA design

Technical achievements:
- New acceleration tube design
- SC solenoid beam guide system
- High density jet confinement

$E = 10\text{keV-3MeV}$
$I = 0.5\text{mA to 10mA}$
$p = 10^{19}\text{prt/cm}^2$

$p, \alpha, \text{HI beams}$
$100 \times \text{LUNA luminosity}$
Figure 2 (continued): Cross-section and floor plan for DIANA located at KURF.
Three (of many) Underground locations for DIANA
The Indium Low Energy Neutrino Tag

B(GT) = 0.17; Q_e = 114
9/2^+ 115In (95.7%)
τ = 6.4x10^14 y
β_{max} = 498.8

115Sn

115In(p,n)
τ = 221 µs
11/2^+ 713.6
100.8 (e/γ = 5.7)
7/2^+ 612.8

115In(γ,n) 115In
τ = 4.76 µs
15/2^- 115.6 (e/γ = 0.96)
3/2^- 497.3
5/2^- 497.3
1/2^- 497.3

Δt
E_{e1}

13N vs 15O ??
Other uses? Please contact us.

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