Low Background Facility at LBNL

- History:

  Established by A.R. Smith in the late 1950s for quantifying the stray radiation field of the newly operational Bevatron at LBL. Since the early 1980s, the LBF has become increasingly utilized to select low-activity construction materials for use in experiments searching for rare events, as in double beta-decay, dark matter, and neutrino interactions.

- Location:

Underground Site
(Oroville, Ca)

LBLF
OROVILLE LBNL

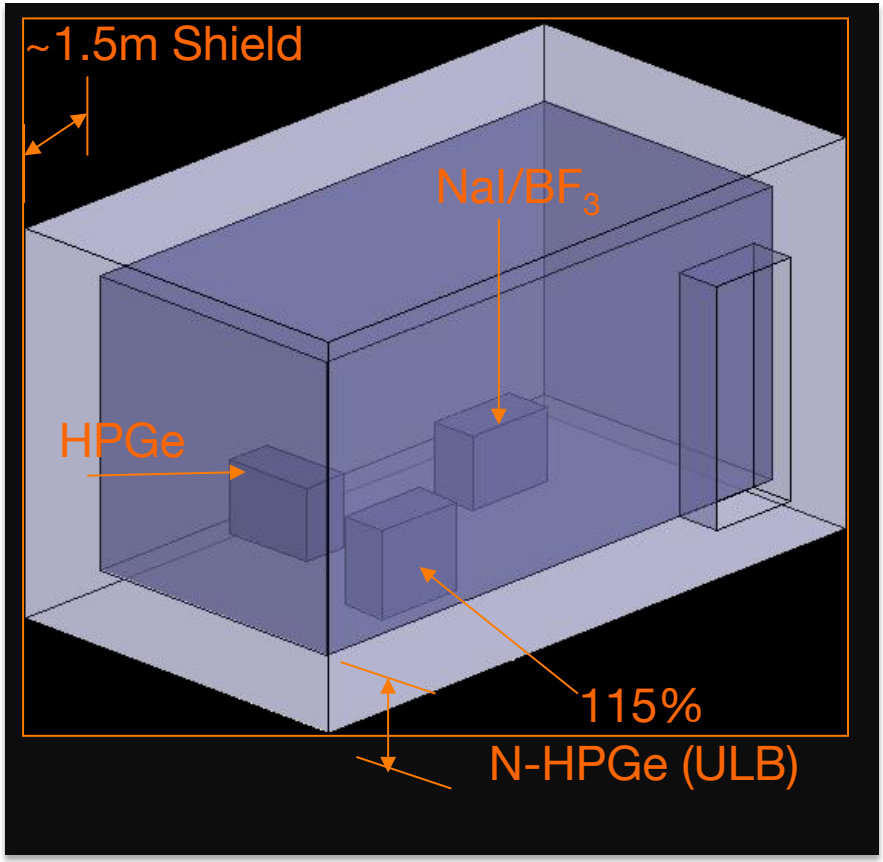
Surface Site
(LBNL, Berkeley, Ca)

- Contact: A.R. Smith (arsmith@lbl.gov) Y.D. Chan (ydchan@lbl.gov)

LRT2010

Onsite (Bldg.72) Surface Facility

- Environmental Study
- Waste Analysis
- Neutron Action Analysis
- Physics (pre-screening)



- Features
  - Special 4π-shielded room with concrete walls made from ~500 tons of selected low-radioactivity serpentine rock ($Mg_6Si_{10}(OH)_8$) concrete (wall thickness ~ 4-6 ft)
  - 115% N-type Low Background HPGe Detector, w/J-hook mount. Counting chamber has outer Pb and inner Cu (OFHC) shielding layers
  - Other HPGe, NaI, and BF3 couners

Offsite (Oroville Dam) Underground Facility

- ~180 mwe, site of the UCSB-LBL Ge 0νββ expt.
- Low activity Pb and Cu shields
- Radon flushed counting chambers
- 85% P-Type HPGe/ULB detectors *(~14 yr UG)*

- For physics projects

1 Bq ^{238}U/kg ≅ 81 x 10^{-9} g/g
1 Bq ^{232}Th/kg ≅ 246 x 10^{-9} g/g
1 Bq ^{40}K/kg ≅ 32 x 10^{-6} g/g

Sensitivity for ~kg Samples ~1 Day ~1 Week

Contaminant	LBL Surface Facility	Oroville Facility
^{238}U and Daughters	0.5 ppb (6 mBq/kg)	50 ppt (0.6 mBq/kg)
^{232}Th and Daughters	2.0 ppb (8 mBq/kg)	200 ppt (0.8 mBq/kg)
^{40}K	1.0 ppm	100 ppb
^{60}Co	0.04 pCi/kg	0.004 pCi/kg

Recent Projects Supported by LBF

LBYF
OROVILLE LBNL

LOW BACKGROUND FACILITY

at the Lawrence Berkeley National Labortory

Serving the Reseach Community Since 1962

IceCube DUSEL

SNO KamLAND CUORE DoubleCHOOZ Daya Bay MAJORANA KATRIN Sandford Lab LUX

Facility - Open to the Research Community

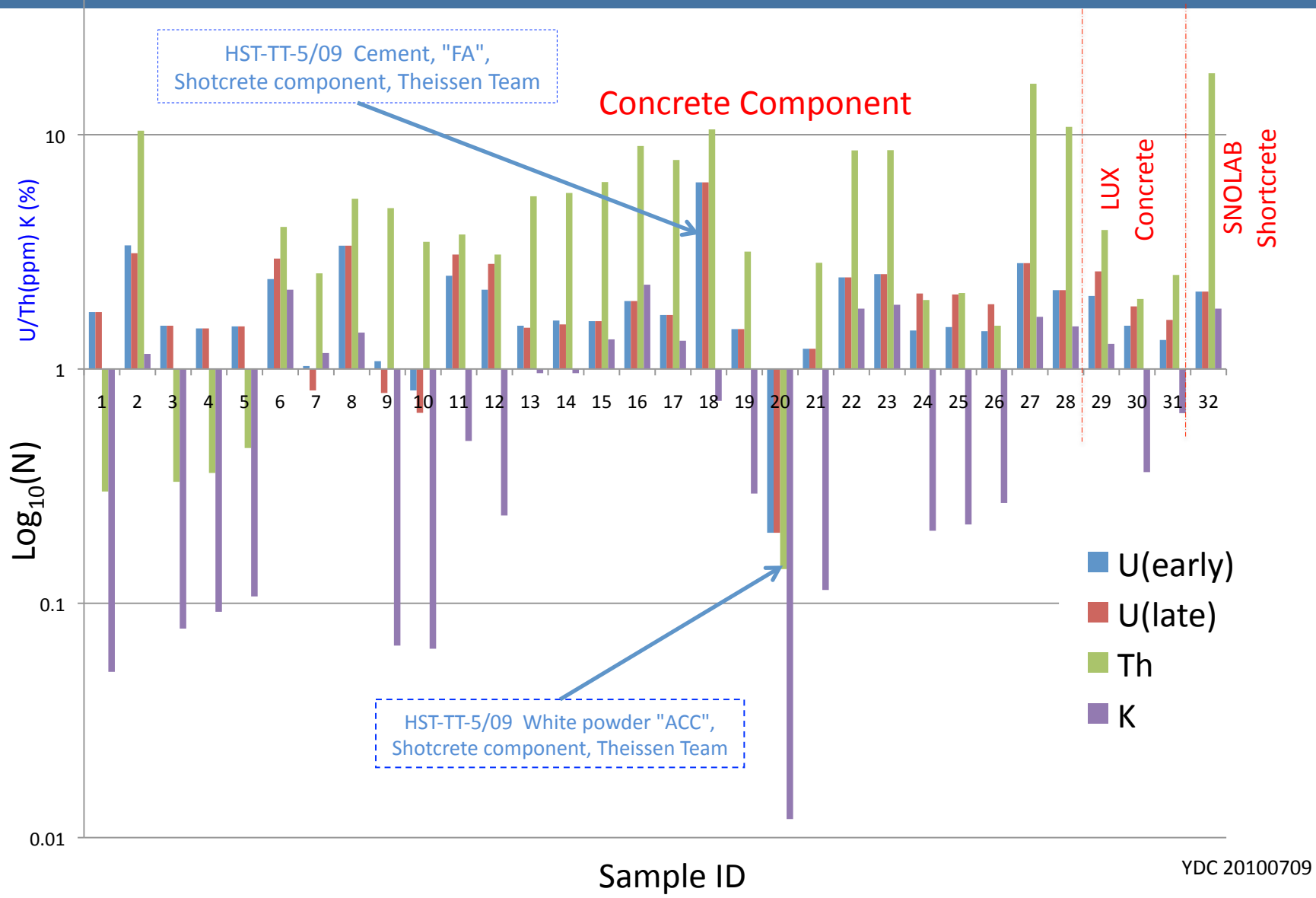
COUPP

Contact:
ydchan@lbl.gov
arsmith@lbl.gov

BERKELEY LAB

Comparison of concrete/aggregate samples at LBF

(from Al Smith emails and reports)



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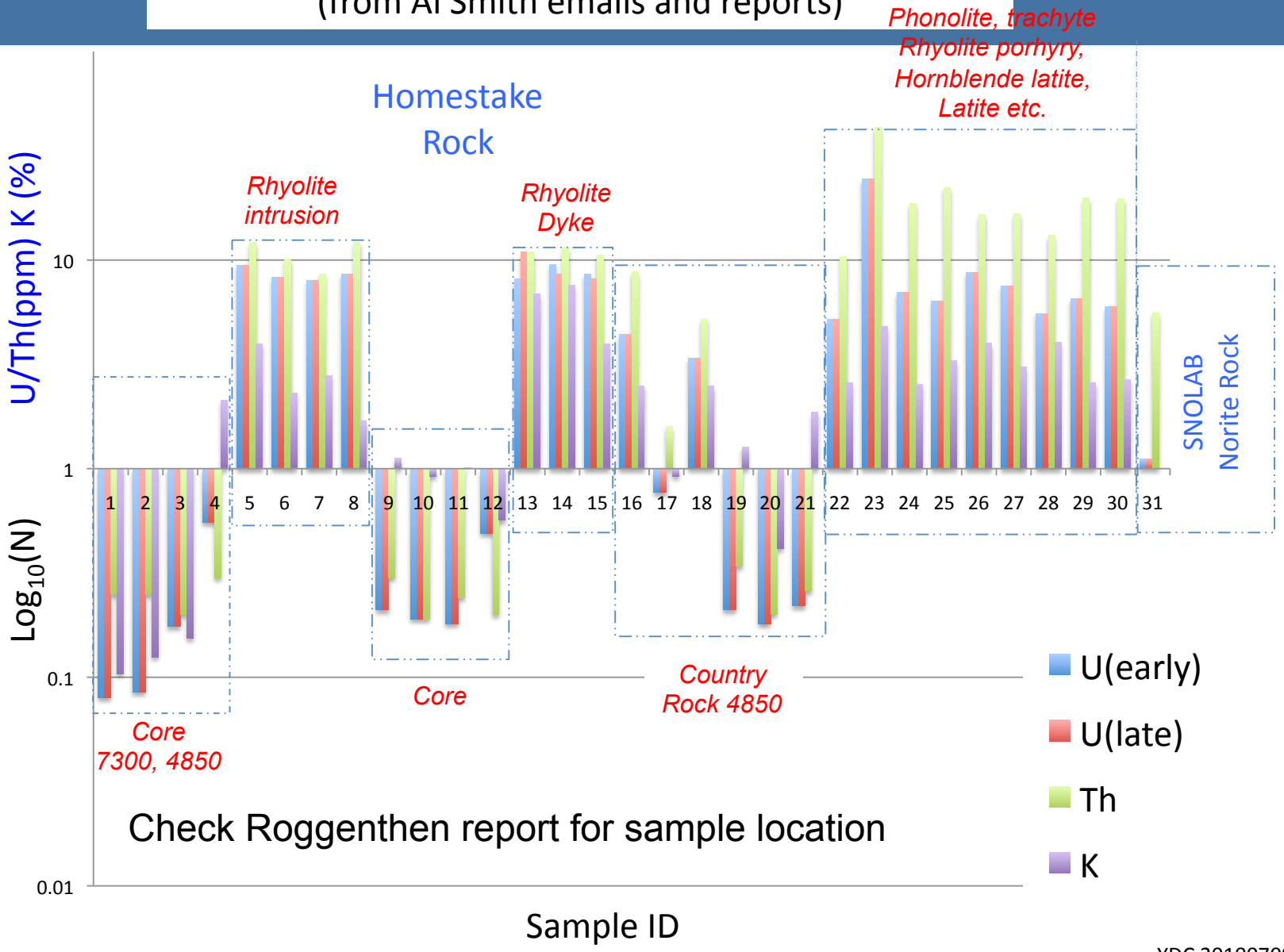
Comparison of rock samples at LBF

(from Al Smith emails and reports)



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A database for the LBF

Vast historical archive will be made public

- Robust database built with CouchDB
- Web interface with powerful search

Dedicated database for each customer

- Separate and secure cloud storage
- Identical, protected web interfaces

Software will be open-sourced

- For use in the wider community

Demo/Test:
http://neutrino.lbl.gov:5984/homestake_v2/_design/lbf/index.html

A database for the LBF

Search

hamamatsu Go

☐ Include comments
☐ Numerical results only

Expand Collapse

Import / export

Export numeric results

Submit new measurement

Help

Instructions

Feedback

⊞ Hamamatsu 10 inch PMT glass, type CR-G(STD)
⊞ Hamamatsu 10 inch PMT glass, type CR-G(STD), crushed, 5/08 sample
⊟ Hamamatsu Type CR-G(STD) low-activity PMT glass

sample name	Hamamatsu Type CR-G(STD) low-activity PMT glass
sample geom	S6MB Annulus
sample mass	1006 g
count length	250264 s
data file	23520
date	13/04/2009
detector	MERLIN (BKY)
requester	Kam-Biu Luk (K_Luk@lbl.gov)
resp. person	Al Smith

results		
	U	142 (2) ppb
	Th	246 (5) ppb
	K	140 (3) ppm

orginal doc. email_13042009.txt

⊞ Hamamatsu Type CR-G(STD) low-activity PMT glass
⊞ SNL-46, Hamamatsu PMT glass, production #R708/MOD-Assy, 2/27/08
⊞ Hamamatsu 10 inch PMT, R7081/NG, NO. TA4760, BNL #19, Bulb glass
⊞ Hamamatsu Type CR-G(STD) low-activity PMT glass
⊞ Hamamatsu Type CR-G(STD) low-activity PMT glass
⊞ Hamamatsu Type CR-G(STD) low-activity PMT glass
⊞ Production sample #1, Hamamatsu type CR-G(STD), low-activity glass
⊞ Hamamatsu 10 inch PMT glass, type CR-G(LRI), ultra-low activity
⊞ Hamamatsu PMT circuit boards (loaded), 5 boards on S6MB core

Massive sample mass (~100kg) γ-assay

- Sensitivity proportional to “effective” sample mass
- Detectors with large “viewing surfaces” (to minimize sample self-absorption)
- Ge Array (multi small-detector) vs detector with larger surface areas
- Cost
- Alternative : low-impurity NaI

A 96 kg Cu example