

Organizational Details

<https://zzz.physics.umn.edu/lowrad/meeting6>

Reimbursement procedure should be specifically to this meeting
See wiki for form. Fill out and return to Jody Kaplan.

All talks must be uploaded to wiki BEFORE you speak (for remote participants)

Upload them yourselves or give memory stick to the Secretary of your session.

Assay and Acquisition of Radiopure Materials

The **AARM Scientific collaboration** is open to all interested parties

Original Goals were tied to Homestake: AARM was a 3-yr DUSEL S4
Characterization of backgrounds at all levels of Homestake
Design a common low background counting facility: **FAARM**
Develop common screening tools (R&D as needed)

Current Goal is to forge an alliance between experiments searching for rare events, to help understand and mitigate backgrounds.

Simulation recognized as a major “infrastructure”

Validate and improve current simulation tools

Background characterization more broadly defined as

Materials database

Neutron benchmarking (data vs sim)

Integration of existing assay resources around the world

and the development of a unified plan to increase availability

FAARM (the counting facility itself) needs to be re-imagined

to other sites, different Homestake location, increased functionality

“Integrative Tools for Underground Science”

Principle Investigators

Priscilla Cushman (University of Minnesota)

Jodi Cooley (Southern Methodist University)

Toni Empl (University of Arkansas, Little Rock)

Angela Reisetter (Evansville University)

Richard Schnee (Syracuse University)

A new 2-year proposal starting last October to continue AARM work in following areas

1. Development of community-wide simulation tools,
2. Confirmation of simulation physics models and cross sections relevant to underground science by comparing to data worldwide and supporting specific efforts in neutron benchmarking,
3. Establishment of a global materials database, and
4. Continuation of the integration workshops centered around simulation, material screening, and underground physics.

Workshops a.k.a. AARM Collaboration Meetings

Two 3-day Workshops per year continue under this new proposal

This Spring is special, though.

Short one-day workshop at SLAC to integrate with Snowmass Process

Increased US participation in LRT2013 by providing travel fellowships to Gran Sasso. We sponsored 13 attendees. As a point of reference, the last time it was held in Europe, only 2 people attended from the US.

At LRT2013 we will also have an AARM Planning meeting

- Inauguration of Universal Database – buy-in strategies

- Explore Cooperative Agreements between Europe and North America

- Formalize collaboration and programs between AARM and LRT

Organization of AARM

We are split into Working Groups with very specific tasks

You can always go to the Group Wiki to learn about it and to join meetings

http://zzz.physics.umn.edu/lowrad/#working_group_wiki_pages

- Depth Task Force
- Universal Materials Database
- Cosmogenic Simulation Group
- Radiogenic Cross Section Working Group
- FLUKA-Geant4 Comparative Study Group
- Neutron Benchmarking Data Group

Today's Agenda is structured around the Working Group Tasks. This is a Collaboration Meeting. Future planning of the Working Groups will make full use of Suggestions Topics brought up during today's discussions.

Cosmogenic Working Group

Members:

- Angela Reisetter
- Chao Zhang
- Dongming Mei
- Vitaly Kudryavtsev

Goals

- Track the cosmic ray background from surface down to underground and calculate the flux at different level of depth.
 - Validate Geant4 muon propagation
 - Establish whether to employ MUSUN in C++ as a standard, or just work with Geant4?
- Estimate the uncertainty of the cosmogenic background in different levels underground.
- Establish a standard method for each site to prevent having to re-generate the muons each time
- Continue to interact with Geant4 collaboration on the physics lists relevant to muon production of neutrons
- Link to the Fluka v Geant working group on physics issues

Universal Materials Database Working Group

Charge: Our goal is to develop a Universal Materials Database for use by the community of researchers who need materials with low radioactivity for the construction of their experiments. This database will be portable and downloadable with a well-designed data format and high quality interface. It is envisioned to be a reference guide for the low-background community to organize and share data, much like the Particle Data Group (PDG) provides for the particle-physics community.

Goal: Our year 1 goal is to have a working version 1 of the database for use and demonstration to the community at the LRT2013 conference. In year 2 our goal is to polish and refine the database into a well developed tool.

Members:

Core Group		
Name	Institution/Experiment	Email
Jodi Cooley	SMU/SCDMS	cooley.physics.smu.edu
James Loach	LBNL/Majorana	james.loach@gmail.com
Keith Adler	SMU	kadler.smu.edu
Matthew Bruemmer	SMU	mbruemmer@mail.smu.edu
Ben Wise	SMU	bwise@mail.smu.edu

Advisory Group		
Name	Institution/Experiment	Email
Adam Cox	KIT/Edelweiss	adam.cox@kit.edu
Prisca Cushman	U Minnesota/SCDMS	prisca.physics.umn.edu
Klaus Eitel	KIT	klaus.eitel@kit.edu
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Keenan Thomas	LBNL	kjthomas@lbl.gov
Mani Tripathi	UC Davis/LUX	mani.physics.ucdavis.edu
Anthony Villano	U. Minnesota/SCDMS	villaa.physics.umn.edu

Meetings

Date	Agenda and Minutes	Keywords
2013/01/23	Agenda and Minutes	Current Progress and Goals
2012/12/19	Agenda and Minutes	tasks
2012/12/12	Agenda and Minutes	tasks

Radiogenic Data and Cross Section Working Group

Members:

- Dongming Mei
- D'Ann Barker
- Iseley Marshall
- Chao Zhang
- Silvia Scorza
- Hang Qiu
- Kimberly Palladino
- Jodi Cooly

Goals

- Calculate more (α, n) neutron yields and energy spectra for the materials used in ultra-low background experiments
- Validate the calculations with other simulation packages
 - Compare cross sections from EMPIRE vs TALYS
 - EMPIRE provides the excited states and x-sections for SOURCES
 - Dongming's website at USD (neutronyield.usd.edu) using TALYS to do his calculations
 - Want to compare for common materials such as Cu, poly, Pb, norite and PMT glass
 - Kimberly Palladino (MIT) to visit SMU in January to work with Silvia and Hang
- Convert the calculated (α, n) cross-sections into GEANT4 data format
- Create physics links in GEANT4 for (α, n) reaction
- Make GEANT4 package available for (α, n) simulation
- Compile the measured radioactive background data at the Homestake Mine to be useful for large community
- Generate the Mine background data files for large community

Ongoing Geant4 and FLUKA comparison (and development)

Working Group Goals and People

People:

- Vitaly Kudryavtsev (The University of Sheffield) can we list Vitaly?
- Anton Empl (University of Arkansas at Little Rock)
- Sarah Lindsay (University of Arkansas at Little Rock)
- Anthony Villano (University of Minnesota)
- Allison Kennedy (University of Minnesota)
- Chamkaur Ghag (University College London)

Goal:

To produce a coherent Geant4 to FLUKA comparison across most modern versions of the codes and including all observables related to cosmogenic neutron production. In addition a detailed understanding of the modeling approaches used in each of the codes is desired.

Help to improve FLUKA physics relevant to the simulation of cosmogenic muon-induced backgrounds at deep underground facilities. Investigate a FLUKA user interface/framework for cosmogenic background simulation.

Initial Comparison

The initial comparison includes one suggested by Vitaly Kudryavtsev, to observe the simulations for monoenergetic muons at several energies traversing large homogeneous media of various compositions which are of interest to underground science.

- The plots for the initial comparison are stored here: [link](#)

Meetings

[12/11/15-Updated!](#)

Members

Name	Affiliation	Contact	Interest(s)
Dan Akerib	Case Western	akerib@phantom.phys.cwru.edu	NMM
Ray Bunker	Syracuse	raybunker@gmail.com	NMM, Soudan Veto Shield, Detector Development
Yu Chen	Syracuse	ychen87@syr.edu	NMM, Soudan Veto Shield, Detector Development
Prisca Cushman	Minnesota	prisca@physics.umn.edu	NMM, Soudan Veto Shield, Detector Development
Emily Dragowsky	Case Western	michael.dragowsky@case.edu	NMM
Anton Empl	UALR	anton.empl@gmail.com	FLUKA Sim of NMM
Raul Hennings-Yeomans	LBL	raulhennings@gmail.com	NMM, FLUKA Sim of NMM
Chang Lee	Case Western	clempiric@gmail.com	NMM
Sarah Lindsay	UALR	sxlindsay@ualr.edu	FLUKA Sim of NMM
Dongming Mei	South Dakota	Dongming.Mei@usd.edu	USD Neutron Detector, Davis Cavern
Harry Nelson	UCSB	hnn@hep.ucsb.edu	NMM
Joel Sander	TAMU	joel@physics.tamu.edu	NMM, Soudan Veto Shield
Richard Schnee	Syracuse	rwschnee@phy.syr.edu	NMM, Soudan Veto Shield, Detector Development
Melinda Sweany	Livermore	sweany1@llnl.gov	NMM, Detector Development
Mani Tripathi	UC Davis	mani@physics.ucdavis.edu	NMM
Anthony Villano	Minnesota	villaa@physics.umn.edu	NMM, Soudan Veto Shield, Detector Development
Chao Zhang	South Dakota	Chao.Zhang@usd.edu	USD Neutron Detector, Davis Cavern

Goals

To improve the accuracy of the Monte Carlo simulations used to estimate the rare-event-search background due to muon-induced high-energy neutrons in deep underground laboratories. Currently, this entails ongoing efforts to:

- Understand data recorded by the Neutron Multiplicity Meter (NMM) using a Geant4 detector model, and publish an NMM high-energy-neutron flux measurement (**NMM**, short-term);
- Better constrain the flux of radiogenic and muon-induced neutrons using data from the USD liquid-scintillator neutron detector at Soudan (**USD Neutron Detector**, short-term);
- Measure the neutron flux in the Davis cavern (**Davis Cavern**, long-term?);
- Fully instrument the NMM (and other LBCF experiments) with timing signals from the Soudan veto shield (**Soudan Veto Shield**, medium- to long-term);
- Conduct simulations that will inform next-generation neutron-detector and -veto designs (**Detector Development**, long-term);
- Develop a FLUKA model for understanding NMM data (**FLUKA Sim of NMM**, medium- to long-term); and
- Reach out to members of other collaborations (*e.g.*, LVD and Edelweiss) who share common interests (long-term).

Meetings

Morning Agenda

Please post your slides directly on the wiki agenda next to your name. You may also email slides to the corresponding secretary for your session or provide a memory stick.

8:30 Introduction to our plans and Snowmass Coordination (P. Cushman)

9-12: Simulation (Secretary: J. Cooley)

Advances and Future Plans in Geant4 (D. Wright, 20')

Update on FLUKA (M. Santana, 20')

FLUKA v Geant4 comparisons

- Cosmogenic neutron production physics (A. Villano, T. Empl, A. Kennedy, 20')

- Results from Homestake & Soudan (A. Reisetter, 10')

- Discussion of next steps (15')

Simulation Updates from the Experiments (Summary talk by M. Szydagis, 30')

- Discussion: connections and common initiatives between experiments (15')

Status of the Depth Task Force Simulations (LAr, LXe, Ge) (P. Cushman, 15')

Forum on Muon generation

- Muons generated through GEANT4 (C. Zhang, 10')

- Underground Muon Generation (MUSUN etc) in Geant4 (A. Villano, 10')

- Discussion (10')

12-1: Lunch. Aeolus Quartet (Kavli Auditorium)

Afternoon Agenda

1-3: The Radiogenic Challenge (Secretary: A. Empl)

Universal Materials Database: Status and plans for LRT2013 (J. Cooley & J. Loach, 20')
Summary of evaluation of (alpha,n) reactions - (D.-M. Mei et al., 20')
(Alpha,n) neutrons measurements for DIANA at Notre Dame, (A. Best, 10')
40(n,p) reaction and neutron capture on 40Ar and 136Xe, TUNL (Megha Bhike, 10')
Neutron inelastic scattering odd 76Ge, natGe, and 136Xe, TUNL (James Esterline, 10')
Discussion and Planning for additional cross section data (35')

3:30-5:30 Experimental Handles on Neutron Bkgd (Secretary: R. Schnee)

The Neutron Multiplicity Meter at Soudan (Y. Chen, 20')
South Dakota neutron detector (C. Zhang, 20')
Coincident Events in the Soudan Muon-Shielded Room (A. Villano, 20')
The WATCHMAN Project (M. Bergevin, 20')
Neutron measurements at SNOLAB: SNO and HALO (N. Smith, 20')
CERN Neutron Production Project (C.-J. Lin, 15')

6-7 U.S. Screening Facility Planning

Discussion: A new model for funding low background facilities and technology centers
(P. Cushman, J. Orrell, J. Fast)

7 Adjourn – Dinner