AARM Collaboration Meeting Minutes

FRIDAY 3/19/10

time	Comments/discussion during and after talk
0900	**Introductory remarks from Kevin Lesko**
0904	**Introductions etc.**
0908	**Prisca Cushman - Presentation of AARM Goals** -Is the design for FAARM separate from exp halls? We have to interface with them, experiment hall is one area.
0922	**Steve Marks - DUSEL S4 schedule** -in response to question: most/all halls will be outfitted for cryo, and appropriate ventilation systems. -construction may start at 7400L sooner than 4850L because of limited rehab needs in comparison. (all construction schedules in talk are optimistic in terms of funding, etc.) -Ross will support construction activities, Yates will be science. -plans on 800L for storage/CUBED? Not currently. Possible locations elsewhere, footprint document for available areas is out there somewhere. -stub for short module, its cross section? Not sure, but on the order of 5-6m wide and similar height, essentially same size of drift. -FAARM would fit in lab module 2. There might be other locations that may make more sense later. -transition from less clean to cleaner in foot print? Complicated question, no definite answer yet, considered having an entire lab module as a clean space, there will certainly be clean transitions into a clean room. It won't be a huge improvement over Gran Sasso. Issues now include the low-radon air, which may require dedicated ducts from surface, which increase costs a lot due to extra excavation and stuff…. So, not really an answer yet. -couldn't some of these industrial things could be done at a shallower depth at the 1250L, or storage which at the 1250L which may be sufficient since the stuff came from the surface anyhow? Things like crystal growing, machining, and stuff like that might just as well be done at the 1250L to conserve space. This sort of thing would involve excavation costs involved in refurbishing some of these areas for utilities and stuff. -part of the 800L may be open -at one point there was a discussion of putting more hazardous activities at the 800L, and again it came down to costs—it seemed it may be better to have one campus. Even 300L was looked at once because you can drive to it, but that came down to costs again as well because of excavation. -have you considered requirements of various exps? Yes, we've done a first round asking for requirements from experiments. We have also been suggested that groups start gathering requirements for screening and stuff like that.
0958	**Lee Petersen – Engineering requirements, conceptual plans, discussion** -comment-egress has already been folded into the 17m space limitation -deeper pool in cavern- cost to DUSEL or AARM- Steve :first is it allowed, then who would pay for it. For one it would be preferred to use same contractor for excavation. If it were allowed, and necessary, they would probably require the exp to fund that. This has to do with customizing space for exps that may not be permanent. But a FAARM would

	be ideally a permanent facility, so that may or may not be an issue. Take off back rather than floor? Well, ideally they'd prefer to do neither and fit in the space allotted. -assumption now is that transition space is needed. -plugs/doors-detaching plumbing and utilities whatever could be an issue when accessing water shield. Flexible plumbing, that would unravel/coil would be a good solution for that. -rhyolite is sprinkled across the whole area, the geology in the slides isn't necessarily up to date. -if there were a water leak, the floor is graded such that it would go towards the other experiments. The entire hall would likely have more cryo, water in it and everyone may have to plan on having any critical electrical a set amount of distance off of the floor in the case of a leak. -ground flow from mine? There would be a sump anyways likely. Amount of inflow in that area is in the cups per day range. -why is machine shop included? Wanted a place in the clean environment to make repairs or assemblies, idea would be just a small one for simple stuff. It may seem excessive to have every exp do their own machine shop. -function of elevator-people and potentially things too, this has the potential to mess up the clean room, needs to be reconsidered. Are there requirements for elevator in terms of safety or accessibility? Certainly in terms of safety it's not a requirement (fires, etc.) but in terms of accessibility that's unknown. -does the top of the water tank need to be accessible? Yes, for cabling/maintenance and that sort of thing. Perhaps some of this could be a space, not a clean space. -amount of shielding inside detector? Will be determined by sensitivity of detector, etc. You won't need a large lead castle for each one. -class of clean room? Backed off of defining a class, mostly concerned with air exchanges, want a generally clean space. -is there a benefit to staying below the bridge crane? If you're on one end of the module, you don't necessarily need service from the bridge crane (except perhaps for construction). the crane could service the other exps on the other part of the module. -can some mechanical be left in drift? General electrical mechanical for the space would be out there, but there could be space for some other stuff. -could part of the egress serve as an emergency exit. -why water instead of copper or something? Cost (for one). Other advantages are rigging it as an active shield with pmt's to actually measure neutrons as a veto or an underground neutron monitoring system. -discussion on neutron threat, need for water shield. -still issues with design for fitting prescribed space, material handling, etc. -three areas of construction: civil-architectural, infrastructural, experimental
1058	Coffee
1114	**Chao Zhang – External Background: gamma, neutron, muon** -gamma ray flux is location dependent.
1150	**Keenan Thomas – Radon Measurements** -ventilation likely to change quite a bit- new air doors, upgrades to fan, etc.
1221	**Dongming Mei – Sanford Lab and future plans** -gamma ray screener costs- ~$1.36M (estimates in slides for individual HPGe dectors

	may be low). Estimates may be out-of-date. -may need electroformed copper for shielding to reach desired sensitivities
1243	Lunch
1322	**Discussion on counted materials databases** What's going on in Europe for what everybody screens? There was an initiative to build a database(its managed by Pia), the idea was to get as much info as they can. It's materials oriented, has information of gamma spectra and things like that. It works as a guide for selecting construction materials, although they are generally screened again when actually building somehing. Pia thinks it would be a good thing to compile data together somewhere. Link below. The database is publicly accessible online, associated with the ILIAS. There are some concerns about putting results from the testing of trademarked materials online. For now, they are including information such as manufacturer. There are concerns whether a company would be uncomfortable having "bad press" online, and whether they could have the power/rights to request that it is taken offline. Perhaps that is something to worry about only if/when a problem arises. http://radiopurity.in2p3.fr/ Al Smith-He's had experiences with another aspect, where different experimental groups are willing to share their testing results with others. Cushman- FAARM may need to develop a testing policy, for instance, that the information from any testing done at the facility would be publicly shared to everyone.
1337	**Tullis Onstott – Bio and Geo needs** -The measurement device would benefit from a clean, low-bkd environment such as the FAARM. -The radiopurity of the water used isn't very important, since it is only used for transport. -The goal isn't to disturb the environment, to use a low level, injected tracer to detect the consumption of organisms. -The induced activities wanting to be measured are in the nCi-pCi range. -Expected as they go deeper they'll get away from the cosmogenic contaminants in the water. -Could these radio-biological samples contaminate the low-levels in the counting facility? Some samples are frozen/killed when collected. How much, for instance, of C-14 be contained in a micro-gram of RNA… -What are some of the needs for geology applications? Who's the best person to contact? -How much are we a user facility, in general? Only the physics community, or do we market ourselves to other applications? Other samples being brought in might have the potential to be very interesting, and perhaps would never have been thought of for testing from the physics perspective. -FAARM activity overtime is likely to fluctuate depending on scheduling of experimens, but it is unlikely it will last much longer than 10 years.
1416	**Dongming Mei – Shield Thickness** -simulation for SSteel is a 'skin' i.e. no inner supports, not modular design, etc. so it would be a lower limit for backgrounds. -rhyolite could change the effectiveness of the shielding. -in the model, most of the SS gamma contribution was from the inner surface/skin. Could this inner surface be made of something else? Aquarium companies have experience with load-bearing acrylic

	-YDC- if one doesn't want to instrument the shield, does one need to worry as much about purifying the water? Will these supporting and purfication systems for the water affect cost adversely, as opposed to copper or something? -Richard Ford- if you're thinking acrylic, perhaps you could have a manufacturer make a test batch by distilling the monomer for evaluation. -Acrylic was kind of just chosen for convenience. Are there any other materials that could be considered? Could a high-purity polyethylene be found? Structurally, polyethylene isn't as good as acrylic. Poly-carbonate? Other materials may make thinner walls possible (compared to the thickness needed for acrylic). -High-density poly-ethylene is a trade-off, because it has less H. -Acrylic from SNO 10^-1 ppt. -Sometimes the contamination just depends on the cleanliness of the place that made it. Maybe something that is also used as a medical-grade material may be made in a cleaner environment. -SNOLAB is making a burning facility for measuring more acrylic, by neutron activation.
1442	**Vitaly Kudryavtsev – Eureca water shield simulations** -FAARM- instrument for muon veto, or make passive and put a separate system on top? -cost of phototubes per tank: 50.
1518	**Pia Loaiza – Background Studies for Eureka** -plans about cosmogenic activation? plan to buy materials, copper, and store underground. -Are companies able to ship Cu quickly, to store underground? Arrangments are being made to get fresh batches of copper to put underground right away. -Problem with first design was essentially the Co60 in the steel. (the source of Co60 is from the production of it, it gets in the steel from Co60 in the crucibles) Some companies will salvage shipwrecks for low activity steel, but its unknown how much stainless steel older ships would have, versus regular steel. -Ti is being used by LUX. (better for cobalt 60 contamination, but worse for others)
1546	**Bob Altes – Water shield engineering issues** -talk serves as a good starting point for some issues. -question on hot cell water shield Bob previously made, the tanks were filled with potassium bichromate to keep the rust down
1607	**Lee Petersen – (Water Shield) Baseline concept and approximate costs**
1637	**Steve Marks – LBNE Water System** -large capacity, may make sense to have a shared fill system with other experiments -not sure exactly what was meant by the 'optional' uranium content on one of the first slides
1648	**Lee Petersen – LUX Water Purification System** -fairly small footprint, in the Davis Cavern, but it also has a fairly slow flow rate, 7gpm -potential for radon transmission, so will be in an airtight room covered with Tekflex (Mineguard-ish product), which is resistant to radon diffusion -it fills and continuously recirculates into a buffer tank (not water shield), with a total cost of $118K (not including some consulting, some operating costs)
1657	**Richard Ford – CTF at Gran Sasso (overview of hardware)** -cost estimates from >10yrs ago
1714	**Lee Petersen – LUX Water Tank**

	-quotes have been solicited for the FAARM tank -they have a hoist/rail for loading detector assembly
1726	**Kara Keeter- Ultra-Sensitive Immersion Tank** -pmt estimate in posted slides may be low, from discussion. Low activity phototubes are generally smaller in diameter for an order of magnitude of lower contamination in the window. -electronics? Need a DAQ system that can link together, reconstruct coincidences, etc. -Borexino DAQ: home grown setup- a few flash ADC channels, basic system has ADC converter similar to SNO. -Need to decide, what to measure with this? The ls gamma resolution is poor. -Times may have changed, this may not be necessary.
1745	**Discussion...** -What sensitivity will clients/users desire? Sub ppt levels would be a good target. -Build something similar to GERDA? -It might be possible to find something of value with very large, pure NaI. Internal contamination may not show peaks, just a bkd continuum. Well style? -should part of the water shield buldge out to house a newly-designed screener detector? Perhaps it would purify the shield water a stage further. -Maybe just design and propose this low-background room, reserve space for a next generation screener to be put in later. -A dedicated R&D space has its merits too. (not like a workbench, more like a space for testing fully assembled/developed detectors). -Electronics, LN feeds, etc. would be outside the tank. -Haven't contacted Homeland Security about what types of sample requirements they would be interested in. -Perhaps a custom, advanced detector would be valued to create a state of the art facility. Perhaps simply buying detectors from Ortec or Canberra wouldn't be enough. Perhaps a custom designed screener or something to optimize sample flow (samples tested per month) would be valuable for service. -Only one or two detectors at Gran Sasso can measure down to a few ppt levels (after measuring a few kg of copper for two months). Need to consider present and future requirements. -Richard mention a mini-Borexino-type detector that can get down to U,Th -0.01 ppt. Perhaps a detector of this nature may be nice for very low activities, looking for just raw counts above background. (*talk Richard found discussing this added to archive of meeting talks) -Samples would have to be in contact with the liquid scintillator in the immersion detector to get down to the fraction of a ppt? -Raise threshold to avoid Pb-210 problem? -We still could make the case that this immersion is useful, and cost it. It would perhaps be a useful thing to build if it performed as advertised. Would this be useful for any specific component of an experiment? -Maybe cost this immersion and also a multiple element Ge detector array, made with high purity materials. A Ge array would expensive, but a LS would need an expensive purification system also (which would add to the costs of the pmts,etc). For the same cost, you could buy a few germanium detectors.

0903	**Pia Loalza – Laboratoire Souterrain de Modane** **-**4800 meter deep lab -3500 m3 -muon flux -neutron flux -primordial Radionuclides -radon concentration, chimney directly out of facility for circulating fresh air -radon trapping facility -can radon reduction facility be scaled down? In 5 years have not changed consumables. Fresh air treatment not the same. Initial investment very expensive. -How far is the distance to the detector from the radon reduction facility? 10meters -transport through pipe not the reason for rising radon but off gassing of Nemo materials -copper or lead shielding -Envirionmental studies of lake sediments -yearly renters for screeners, what is the sensitivity of the screener? -description of Detectors -newest, suited for <600 keV, good resolution at low energies, electrical cooking, more expensive in beginning, only good for small mass detector. Power restriction, gets to 77K, archeological lead story, 15 tons donation, low lead 210 but can it been used for experiments? Uranium ot at ppt levels? -gamma screener costs from 100kEuro (newest planner screener) to 200kEuro (on order) -shielding, 200-250Euros/kg (roman lead 400A.D.) Low activity lead: about 2 Euro/kg -lead casting, 20kEuros -hardware Eureka: needs 20 micro Bq Super Nemo: Need long time runs: 2-3 months Gran Sassa as done this level of sensitivity
1000	**Dongming Mei, Screeners and Shieldingwith pricing** **-**costing with and without water shielded room -need neutron shielding -use ultrapure water instead of ultrapure lead -are there measurements for the material holding the holding? -maybe cheaper, but circulation and maintenance more expensive -what is real contribution of neutrons? -approximate $10 million
1030	**Richard Schnee BetaCage** **-**confident to finish in 15 months -just built low-radon cleanroom at Syracuse, aluminum construction with overpressure to protect against leaks, vacuum swing system -exhaust allows Radon to back contaminate. *send the cost estimates and conparisons that lead to decisions in building low-radon cleanroom to wiki.

	-layout for Alpha-Beta Screeners -Noryl, dark colors are worse for radioactivity -reference to Pia's database as good source for radiopurity
1100	**Jodi Cooley XIA Alpha** -IBM demonstrated sensitivity of 0.0006 alpha/HR-cm2 -next interation has software improvements, water sensors -timeline, currently bottom half being built -current cost at 55K + 20% contingency per detector -need to discern mid air events -argon cost 10K/year -need to purge outside with "old air" -need to circulate air around outer chamber -operates just as well on the surface -developing travelling detector -may add on veto around detector
1130	**Eric Hoppe Electroforming Facility** -submicro Bq/kg is now possible -goal: highest purity copper in the world to be produced -underground, copper never sees light of day, avoiding cosmogenic formation of 60cobalt -move in summer '10 -old Ross Shop area in Homestake placement for electroforming facility, temporary -seven electroforming baths -Majorana Electroforming bath grow copper on ss surface of mandrel -etch surface to remove surface contamination, convinced that surface contamination in main problem. -Davis campus is delayed maybe fall'10, -several experiments require significant amounts of copper for cryostats and inner shield -what is total weight, 100kg/bath/year, each bath $50K, -can't be rolled, hardened with slow growth and electro shock to withstand vacuum. Flattened and milled to thickness Discussion: how many baths does FAARM need? Up to 23 baths in two locations could be available if 1ton Majorana not funded.2-4 people. -Mass Spectrometry tools to consider: ICP-MS for sensitivity and versatility, need to get to 0.6micro Bq 232Th/kg cu -radiopurity of acids from manufacture further distilled -background still drives preparations -mass spec in class 100 cleanroom and commercially available -use microwave digestion, can digest plastics. -Cost $200-250K more to support instrument than purchase -Do we need this kind of instrument under ground? Cobalt-60 rejects well. -local facility needed and need to train people -May not have to be underground or even on site, but training of technique needed and

	need to cost for supplement to March 31 figures. -who else is doing ICP-MS at this level? Don't know. If someone has the facility, this machine is commercially available. -subcontracting if specs followed? Very expensive and facility needs to be dedicated to this level of detection. Think about synergy aspects of what fields other than physics may need this level of screening and foster cooperation. -Other tools, SEM, Optical Microscopy -need integrated approach to these devices -laser oblation discussed
1210	**Henning Back Neutron Activation Analysis** -Pulstar reactor education reactor -technique of irradiating of samples, aluminum stringer is constraint -Exo has name of one guy making this plastic TE-6472 -human factor slows early counting How to include neutron activations? Any reason to put parts of this underground? If screeners at surface, why take underground? U and Th no reason underground. Once irradiated, no cosmological effects.
1245	**Priscilla Cushman Once more into the Breech** Discussion: What's missing? Radon Emanation Chambers Neutron and gamma shielding, activate shield as neutron detector? Neutron and gamma monitoring system at different location outside the shield. Can we improve supply of ancient lead, do we need to start obtaining now, is there a scarcity issue? Get lead under ground fast. Need estimated quantity of lead to start searching. Is there space to begin stock piling supplies if procured. Lots of space. Think about a possible substitution for water,…polycarbon, pellet system, spraying, need thickness. Collaboration with other labs, need web based interfaced, time-table, needs. Web based interface needs to already exist. Create working groups to include larger collaboration
1305	**Yuen Dat Conclusions** Review agenda, staging options, scaling options, geometry of detectors, initial scanners need to be shielded,