Jefferson Lab

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SPECIFICATION NO:
D00000-01-07-SXXX

TITLE: Lead for the Hall D Barrel Calorimeter DATE: DRAFT October 13, 2008

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1. Introduction

Thomas Jefferson National Accelerator Facility (JLab) is engaged in a project to double the energy of their accelerator from six to 12 GeV. This project also includes upgrades to the experimental equipment in the three experimental areas, B, and C, as well as the construction of a fourth experimental area, Hall D, with its own experimental equipment. The new beam facilities and the improved detection systems will be used to carry out the proposed scientific program.

The experimental equipment in Hall D is based on a superconducting solenoidal magnet. The detectors will consist of drift chambers, scintillating counters, and electromagnetic calorimeters. The barrel calorimeter is based on a lead-scintillating fiber design, consisting of 48 modules, each 390 cm long and 25 cm deep. Its purpose is to measure the energy, position and timing of photons; and energy loss, and timing of charged particles.

2. Statement of Work

The selected vendor shall provide all labor, equipment, and facilities to fabricate, test and deliver all the lead for the barrel calorimeter of the Hall D detector with the dimensions and other properties as specified in this document. In addition, the vendor shall deliver all documentation and test samples required in this specification.

Question: will there be testing and samples?

Input from George: It's a good idea for the vendor to provide us with a "sample" of the exact same material (purity and thickness of Pb) that they will send us for the construction. We will then do our own thickness (uniformity) measurements before and after swaging to make sure of the quality of construction with that specific type and thickness of Pb. However, once deliveries start, I believe that just the certification of purity and thickness uniformity should suffice. After all, if we measure deviations from specs, we will have the reasons we need to reject that particular shipment.

3. Quantity

The vendor shall deliver approximately 26 metric tons of pure lead, as defined below, to allow us to produce a total of 8592 13 cm x 400 cm x 0.05 cm strips of Pb. (This is the exact count)

Note: Let us start out with an exact count for lead until we all agree on this number. Later we can decide to add more as spare excess to the order. Based on George's experience this will be a minimum of 15%. It might also depend on the sizes of bulk material.

Here is my estimate: The required number of layers per module is 179 Pb strips, and there are 48 modules. Therefore we require 8592 strips (exact count, no waste). Total weight per module is 0.5283 metric tons. Total weight for the Bcal would be 25.9 metric tons.

Question: How much spare material should we order?

Input from George: We need to order enough Pb to make 49 modules, not 48. This makes it 8771 strips but I also don't understand the reference to 15.6 rolls per module. Where does this come from? If we order a 10% spare we can always order an additional quantity if midway

down the construction we see we need it.

4. Dimensions

The lead shall have a thickness 0.5 ± 0.02 mm. The corresponding English dimension is 0.0197 ± 0.0008 inches. The nominal detector strip size is 13 cm (5.11") wide by 400 cm (157.5") long, which will be cut from the bulk material. The vendor can propose sizes of sheets, which best match their production and shipping operations and minimize waste when cut into detector strips

4. Lead purity

The lead shall be 99.97% pure, conforming to the LME specification for pure lead material number PB970R.

5. Shipments

Indicate maximum sizes of containers and weight for shipments. Is this limited by fork lift and or cranes??

Input from George: If the mass of each crate or roll exceeds something like 1600 kg (~3500 lbs) it starts becoming an issue for crane availibility. Another concern for crates is that of the size (width) to fit within a standard door width but it's not a make or break issue. Having used both roll and crates, the latter is much easier to handle because the roll has to be rotated from vertical axis to horizontal and then mounted on the stand we have built. This is an operation that is difficult and rolls always get damaged along their exposed edges so crates are certainly more manageable.

6. Testing by manufacturer

The manufacturer must test and document its quality control of shipments. The lead purity must be tested and verified. Periodic chemical analysis shall be performed by the manufacurer, as well as measurements of the sheet uniformity and thickness.

7. Delivery Schedule

The delivery schedule shall be based on the JLAB funding profile for FY 09, 10, and 11 (Fiscal year is from October 1 to September 30) whereby the total shipments delivered for each FY shall be based on a percentage of the total funds JLAB has estimated to be available. We have estimated 25% in FY 2009, 37.5% in FY 2010 and 37.5% in FY 2011.

Question: check with procurement and schedule

The first-article sample lead shipment shall be due two (2) months from the subcontract

award date. JLAB personnel shall complete the first article acceptance review four (4) weeks after receipt of the first article.

Production shipments of lead shall begin one (1) month after the first article acceptance notification by JLAB. All subcontract deliverables shall be completed within 36 months of subcontract award. The shipments of lead are to be shipped to the following address:

Dr. James Pinfold
Centre for Particle Physics
445 CEB, 11322 - 89 Avenue
University of Alberta
Edmonton, AB T6G 2G7
CANADA

8. First Article Testing

Before production quantities are delivered, the manufacturer shall provide a sample of the lead shipment to Alberta for verification of all specifications. The lead sheets will be tested for density and geometrical tolerances.

Note: Acceptance testing needs to be setup at Alberta.

9. Acceptance of Shipments

Acceptance of lead shipments will take place within 20 working days after receipt of the shipment. Dimensional tolerances will be checked on each shipment.

Question: Do we want to add additional tests for acceptance, even periodically?

Input from George: Once the thickness uniformity is established for each shipment, the final and ultimate test is that of swaging! If the lead sheet has spots of thickness and/or hardness variation the swaging will result in "banana-like" grooved strips and this is a very sensitive indicator of quality problems. To put it bluntly, if the lead swages evenly and remains straight, it's good. Period. So, swaging is an ongoing and real time acceptance test!