

SBS Newsletter #3

June 12th, 2010

Letter from the Editor

The newsletter will be a forum for progress reports updating the collaboration on our response to the Technical Review's [report](#). At a recent Hall A collaboration meeting, reports on the SBS were presented (see [link](#) for talks). A reminder that by the middle of July 2010, each group will contribute a report that will be a part of the response to the TR.

Upcoming Conferences:

- [International Nuclear Physics Conference 2010 \(INPC2010\)](#), Vancouver, Canada 7/4/10- 7/9/10. Abstract deadline March 15.
- [Gordon Conference on Photonuclear Reactions](#), August 1-6, 2010, Tilton, NH, US .

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HCAL update (G. Franklin) June 9, 2010

The Hadron Calorimeter (HCAL) is expected to be based on the COMPASS hadron calorimeter design. However, the COMPASS HCAL design parameters were optimized for 5 to 100 GeV hadrons and studies are underway to re-optimize the design for 1 to 15 GeV hadrons. I. Savin, N. Vlasov, and V. Krivokhizhin (DUBNA) have written a report summarizing their studies with a GEANT4-based Monte Carlo. They have explored alternative scintillator/radiator configurations and their findings indicate that the number of scintillator/iron layers should be increased. F. Benmakhtar (CMU) has been studying the suitability of HCAL as the neutron detector for the GMn experiment.

The time-resolution of HCAL is of significant concern. We are considering upgrades designed to improve the timing resolution. These include the use of alternative PMTs and/or the use wave-shifter materials which produce faster rise-times than the wave-shifters used for COMPASS. We are also arranging for the purchase of a set of existing modules and shipping them to the U.S. for testing.

Status of the SBS Front Tracker Project

Date: 08 June 2010

Author: E. Cisbani

First full size 40x50 cm² module prototype (Rome: 1 physicist + 2 techs, CT: 1 mechanical engineer, + CERN support)

GEM foils: CERN delivery scheduled for week 22 and 23

Mechanical Frame: detailed drawings submitted for production beginning of May, expected delivery first half of June

Support Frame: design in progress

Electronics (GE – 1 electronics engineer + 1 tech)

Front end card: 5 prototypes with APV25 lab tests, bug fixed, improvements designed; in particular, the pads for the bonding of the APV25 chip has been redesigned in order to avoid potential shorts of the bonding wires, as observed in the first prototype. New prototypes (second runs) expected before June 14

VME64 ADC/Controller: 2 prototype produced and under tests; preliminary firmware designed and implemented.

Cabling: new scheme designed taking in mind the following constraints: total cable length from VME to Front-End to VME constant for each card; digital and analog signals shall run on twisted, shielded cables. HDMI type A and B adopted for digital and analog signals respectively.

We expect to start a preliminary production (after prototyping) of Front-end cards and VME64 controller within the next few weeks, after the lab tests on the second front-end card prototype have completed successfully. If anybody is interested in sample please let us know.

Ancillary components (BA: 1 physicist + 1 tech)

HV system: no progress respect to the previous report

LV system: none done yet

Gas System: no progress respect to the previous report

Infrastructure (Rome: 1 tech, CT: 1 physicist + 1 tech)

Clean room: 2 available (1 dedicated to production)

Foil stretcher: in productions, delivery expected before June 15

Assembling procedure: first draft version

Montecarlo (Rome: 2 physicist, CT: 1 PostDoc)

Simulation: working GEANT4 based code under revision/improvement: code customized to the SBS project, modular design implemented; improved parameter passing at run-time; improved hit detection.

Digitization: first version implemented; preliminary interface to the reconstruction implemented ; improvement in progress (in particular multiplication statistics must be reconsidered and time information better integrated).

Reconstruction: no progress from Italy

Prototype tests (Rome: 2 physicist + 2 techs, CT: 1 physicist, LE: 1 physicist)

Status of SBS Front Tracker (cont)

Test beam: next test on the first 40x50 cm² module with APV25 electronics scheduled for the last 2 weeks of July

PREX experiment: undergoing; main responsibility in US collaborators.

BA=Bari
CT=Catania
LE=Lecce
GE=Genoa

Update for GEM gas handling system costs

M. Khandaker

In the TR's recommendations (section 3.1) for the gas system for the GEMs it was mentioned, "... to review the cost estimate for the gas system which seems to be on the low side". In the current funding proposal the gas system is listed as an \$8k item (including a 20% contingency). The existing Hall A gas system is expected to deliver the chamber gas for the SBS GEMs.

The initial plans for the GEMs' gas is to use a Ar/CO₂=70/30 mixture that can be obtained from a pre-mixed delivery bottle. Tests for the LHCb GEMs have shown that such a mixture gives poor time resolution of about 10 ns (r.m.s.). Considerably improved time resolutions better than 5 ns (r.m.s.) have been obtained with Ar/CO₂/CF₄=45/15/40 mixture at a chamber gain of about 2×10^4 with the GEMs operating at 1350 Volts.

Initial design considerations for an independent system to mix three input gases with mass-flow controlled valves and an IEEE-488 compatible mass-flow controller, together with a distribution and delivery system without remote electrical control, is estimated to cost ~ \$40k. Details of such an independent gas system is currently underway. (For reference, the GEM gas system for the TOTEM experiment at the LHC with a Ar/CO₂ mixture is estimated at \$34k without piping and other accessories, and the one for LHCb is \$86k with full remote control. Similar estimate is for the forward GEM trackers' gas system for the STAR experiment at RHIC.)

Update on SBS magnet (J. LeRose) June 14th 2010

Robin Wines continues to work on the TOSCA model. She has promised preliminary results very soon. Actual design work will naturally follow from the TOSCA studies. There's nothing new on the magnet/power supply front. We still anticipate visiting Brookhaven in late August or September to scope out the situation.

Updates on SBS activities (O. Hansen) 9 June 2010

TR Recommendation 5 (Simulations):

During May, work continued on simulations of the SBS tracking system. The INFN group has largely completed the digitization and ROOT file output of the data simulated with Geant4. At present, the group is working on improving the modeling of the avalanche effect in the GEMs as well as details of the Geant4 modeling. First ROOT files of fully digitized GEM data are available for testing. At the same time, the JLab group has largely finished the decoding of the simulated ROOT data and the fitting of the simulated 3 sample points from the APV25. Currently underway is the implementation of the algorithm to match 2-d tracks found in the coordinate projections via amplitude correlations. We expect to have working GEM tracking code by mid-June.

GEM tests update (A. Camsonne) June 15th 2010

Quite some progress in those last few weeks. On the PREX data, we found close from optimum high voltage settings and took advantage of the low current data to gather a large set of data of reasonable quality which would allow to do tracking. A preliminary result from crude tracking using the 4 GEM chambers seems to give an intrinsic resolution of 70 to 80 micrometers. The major work now is on software and calibration to have tracking accuracy similar to VDC and really evaluate the performance of the chambers. We are assessing the performance of XY configuration for all trackers which could perform well in the resolution of ambiguities thanks to the amplitude information. We also have put together a test stand with the help of the Gep collaboration in the EEL which will be used during additional beam tests. Thus we are already now in position to implement the tests from the technical review to evaluate the strip noise as soon as the chambers are fully tested.

Below is a plot of the residuals for tracking in the GEMs installed in the HRS during PREX. This preliminary analysis is by Megan Friend. The residuals are around the expected 80 μm . More analysis work is planned but these plots show great promise. The residuals are calculated only using the GEM information.

