

PRad Implementation Plan - Status Report

20 February, 2015

1 Introduction

We review the status of the PRad experimental setup and examine it with respect to the implementation plan that was presented and agreed upon during the March 2014 meeting.

Elements of the PRad experimental setup:

- Windowless hydrogen gas flow target system
- HyCal hybrid electromagnetic calorimeter
- New cylindrical vacuum box
- $X - Y$ tracking detectors
- beam-line for the experiment

2 Windowless Target

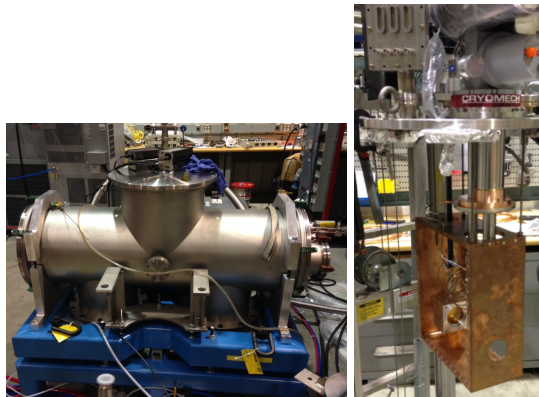


Figure 1: The target chamber (left) and the target cell (right)

As per the implementation plan the target including all chambers, pumps and cells were to be built and tested, and a set of target support stands were to be designed and constructed by January 2015 for installation in Hall-B. The installation was expected to take one week's effort by the target group.

The target system has been built and tested (see Fig. 1) and the support stands have also been built. During tests the desired pressure was achieved in the target cell (using ^4He instead of H), however some

instability was also observed in the target motion. The target is ready to be installed in the Hall-B beam-line and the target group expects it will take 8-10 days. However, stiffening the target motion mechanism may take up to a month.

In our implementation plan we had shown that the target could sit in the Hall-B beamline without interfering with the HPS experiment. The PrimEx Pair-spectrometer platform where the target is to be located is free and we still believe that the target can be installed immediately without interfering with the HPS experiment. However, any such installation requires a complete engineering design of the beamline.

3 HyCal Calorimeter

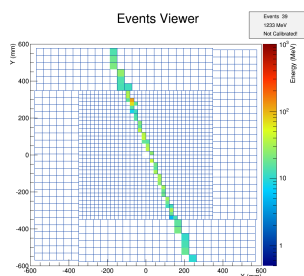


Figure 2: Results from cosmic ray tests of the HyCal calorimeter.

The implementation plan expected the HyCal calorimeter, its transporter and cart to be reassembled in Hall-B and be ready for cosmic tests by the end of Sept 2014. Getting it ready for cosmic tests included recommissioning all the HV supplies, the light monitoring system and the chiller. The electronic readout and the DAQ were also to be rebuilt. Despite some initial hick-ups and delays, this task was completed and several long tests were performed with cosmics. The detector system has been performing well, a typical cosmic ray track is shown in Fig. 2. The whole detector system is ready for beam.

4 Vacuum Box



Figure 3: The two sections of the large volume vacuum can under construction at Meyer Tools.

We had anticipated the vacuum box to be ready for installation by January, 2015. The vacuum box is a critical element of the experiment that required extensive JLab resources. The box was initially designed by an engineer at Duke University, and later validated by the JLab engineering team. Another critical piece of the vacuum box was the large area thin window at the HyCal end of the box. The window was designed and built at JLab using the Hall-C Cerenkov tank window as an example. Finally a vendor was selected to build the vacuum tank and the window was shipped to the vendor for assembly and testing with the vacuum can. The construction of the vacuum box is almost complete as can be seen in Fig 3. The vendor is getting ready to connect the window and blanks to perform a vacuum test. The vacuum can is expected to be shipped this week. Once at JLab the installation in the beamline by the Hall-B technical staff is expected to take 2 days.

5 X-Y tracking GEM chambers



Figure 4: The GEM chambers being assembled at UVa.

The GEM chambers were added to the list of equipment after the March 2014 meeting. Since then steady progress has been made in procuring and assembling the chambers. The two PRad GEM chambers were designed at UVa and the components were built at CERN. All components are on hand at UVa or in transit and the chambers are being assembled. The assembly is expected to be completed by the first week of March. The GEM DAQ system originally written for the ALICE collaboration has now been ported into CODA by the PRad experiment. This work is useful not just for PRad collaboration but for all the GEM chambers to be used in Hall-C (SHMS Collimator) and Hall-A (SBS trackers). Once at JLab the final installation is expected to take 1 day.

6 PRad Beamline in Hall-B

The beamline work includes the design and manufacture of the stands for the vacuum chamber, installing the standard Hall-B collimator box and harp and procurement as well as installation of the vacuum flange, quick connect and beam pipe that will connect the thin window of the large volume vacuum tank to the beam dump. The beam pipe will travel through the GEM chambers and HyCal calorimeter. The Hall-B technical staff estimates that the beamline work could take up to 6 weeks to complete. Although, some of these activities can be performed in parallel with the target installation, but, the beamline design needs to be completed before the target can be installed. The Hall-B technical staff estimate that the total time for switching from the HPS experiment to the PRad setup including the target installation is about 20 days. A possible draft installation schedule is shown in Fig. 6.

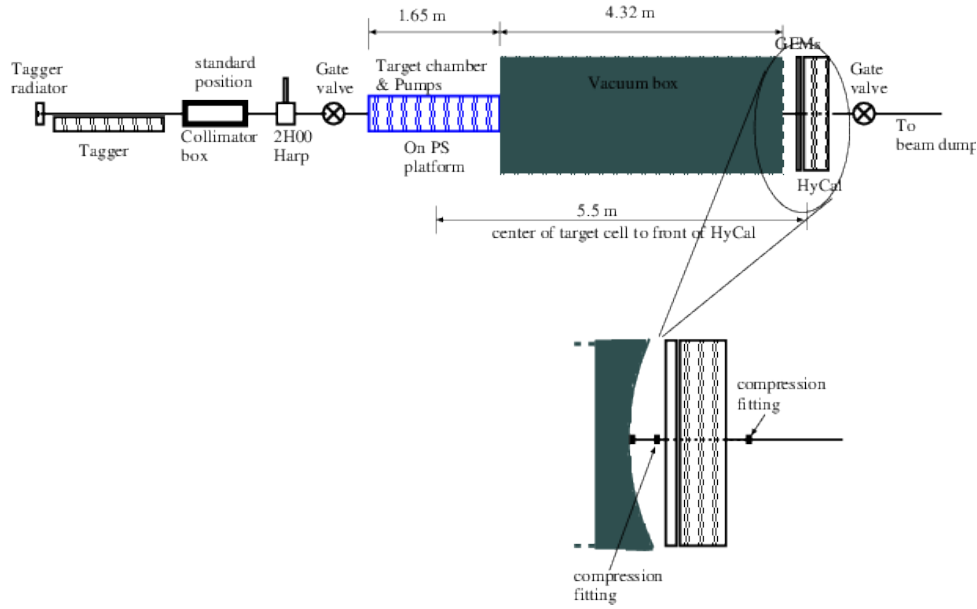


Figure 5: The beamline for PRad experiment.

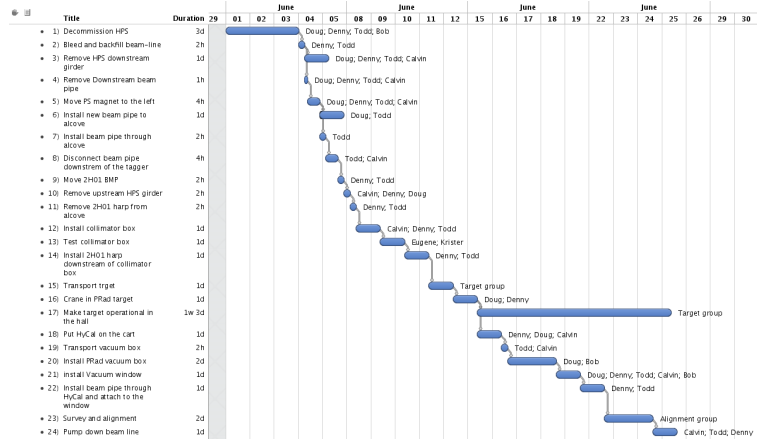


Figure 6: A draft schedule for PRad installation.

7 Summary

In summary, JLab and the PRad collaboration has already devoted a tremendous amount of effort and resources to complete all major elements of the experiment other than the beamline. We believe that with a little more effort we can install the experiment in Hall-B and be ready to take any opportunistic beam that may become available in the Fall. Moreover, we believe that installing PRad on the beamline will not interfere with the HPS experiment.

Table 1: PRad Checklist

Subsystem	Items	current status
Target	cells chambers& pumps stands gas panel controls stiffen motion mech. installation	completed completed completed completed completed up to 1 month 8-10 days
Vacuum box	chamber window installation	under construction completed 2 days
HyCal	individual channels light monitoring system chiller & interlock transporter cart HV system cabeling testing	ready ready operational in beamline in beamline tested completed completed
GEM tracker	GEM chambers readout electronics mount DAQ installation	being assembled on hand on hand ready 1 day
Beamline	harps, collimator, pass through beamline. vacuum box stands	2 weeks 4 weeks
Switch-over from HPS to PRad	including target installation	20 days