PROPOSAL FOR MVD RADIATION MONITOR

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May 12, 1997

1 INTRODUCTION

The Multiplicity-Vertex Detector (MVD) of PHENIX is an inner detector; and as such, it is subjected to higher degree of radiation than other detectors. The radiation damage from genuine collision products is something MVD has to live with. The unintentional radiation exposure (stray beams, etc.), however, can be very damaging to the detector elements and the electronics. Thus, we would like to characterize the radiation environment of the inner region of PHENIX prior to the installation of the MVD. This would then determine how much radiation we can expect the MVD to be subjected to. Perhaps more important is to be able to monitor the beam quality so that should it begin to degrade, the experimenter and/or RHIC will be alerted. For the purpose of this proposal, we define *background* radiation as anything other than the genuine collision products.

The radiation monitor would have two components. First would be a temporary unit that occupies the MVD space for several months. While it is in place, it would measure the radiation levels during running conditions at RHIC. The second component would be a permanent device that would serve as a monitor during the actual running of PHENIX. It is our intention that while both of these components are in place, we'd characterize the correlation between the two, so that the monitor can be reliably used when the temporary device is removed and the actual MVD is installed.

We describe in this proposal the general outline of the monitor's objective, implementation, and its impact on integration into the overall PHENIX.

2 Monitor's objective

The monitor's objective is to characterize the radiation environment in the inner detector region, so that serious radiation damage to the MVD can be avoided. The first phase of the monitoring will involve installing two components: First is a device that occupies similar volumn as the MVD. It will then measure the amount of radiation coming from both the collisions as well as the backgrounds. The most damaging of the backgrounds would be the stray beam. This device will be installed at the beginning of RHIC turn-on, prior to MVD installation, and stay in for several months. The second component consists of a permanent set of detectors that will be installed at the same time as the temporary device. It will stay in place permanently, however. Its function is to provide the PHENIX experimenter and/or RHIC with monitoring and/or warning of degrading beam quality that could damage the MVD. During the initial phase when both of these components are in place together, this permanent device's response will be correlated to the MVD-like temporary device, and be calibrated.

The proposed MVD radiation monitor has a secondary function. The MVD's performance depends on how well it is aligned with the beam. We intend to chracterize the beam using the monitor, and make sure that the installed MVD (according to PHENIX specs) will indeed be centered properly around the beam and the collision centroid.

It is our intention that the MVD radiation monitor system impact the rest of PHENIX as little as possible. This means simple mechanical installation, standalone electronics and readout, and minimum background for the rest of PHENIX (certainly no more background than the real MVD).

3 Implementation

3.1 Temporary MVD-like device

This device will be shaped similar to the actual MVD in physical dimensions; it's mass will be much less. It consists of scintillators positioned along the Z-axis, with distance from nominal beam being same as that of the inner barrel's silicon strips. The primary purpose of these scintillators is to determine the extent of radiation the inner silicon strips are subjected to, from both collision products and backgrounds. To study the background level as a function of azimutal angle ϕ, there will be two *endcaps*, each being a circular disk segmented into pie-slice shaped scintillators. We envision less than 10 slices for each endcap. Figure 1 shows a sketch of the device. The support structure of this device will consist of rohacell tube and endcaps. The tube/endcaps will have to be in the form of clam-shell halves to be able to assemble around the beampipe. Both of these relatively light halves will be attached to the nosecones via the same mounting hardward designed for the actual MVD.

The scintillators will be optically coupled to light-guide fibers, and these in turn will be coupled to photomultiplier tubes located below the beamline. As of now, there is a plan to place the MVD access lift table (see the attached MVD memo PHENIX-MVD-97-7) on top of the lower return yoke, which is 2.95 m below the beamline. The table's dimensions are 36" x 66". This, along with adjustable height, makes it an ideal place for the array of photomultiplier tubes and high-voltage supply. Some or all of the readout electronics can be placed there as well. The readout will be done by a completely standalone DAQ. We estimate the total number of channels read out to be under 50.

We plan on making this device such that the two clam-shells with light guide fiber *pigtails* are assembled in a lab. The final assembly will consist of mating the pigtails to the photomultiplier tubes, and this will take place on the lift table.

3.2 Permanent monitoring device

This device consists of a handful of detectors placed out of the way of the experiement. The choice of type of detector is yet to be defined, as is the precise location for this device. During the period when the temporary MDV-like device is in place, we plan to read out this permanent device as well. Then we will look for correlations between the premanent monitoring device and the temporary device. The purpose of this is to be able to have a constant monitor that can warn the experimenter of degrading beam quality that can damage the actual MVD.

4 Resources

The proposed MVD radiation monitor will utilize, as much as possible, existing resources. The R & D effort is being undertaken by James Chang of UC Riverside, with possible help from an undergraduate student. The photomultiplier tubes are also being supplied by the UC Riverside group. Scintillators and light guides will be supplied by both Los Alamos MVD group and the UC Riverside group. One should keep in mind that the total amount of scintillators is not very much, so collecting sufficient amount will not be very difficult.

The high-voltage supplies and electronics will need to loaned from both Los Alamos MVD group and the UC Riverside group, as well as other sources. In this aspect, one should keep in mind that bulk of the radiation monitor system is a temporary entity, and the electronics will not be tied up with the system for long.

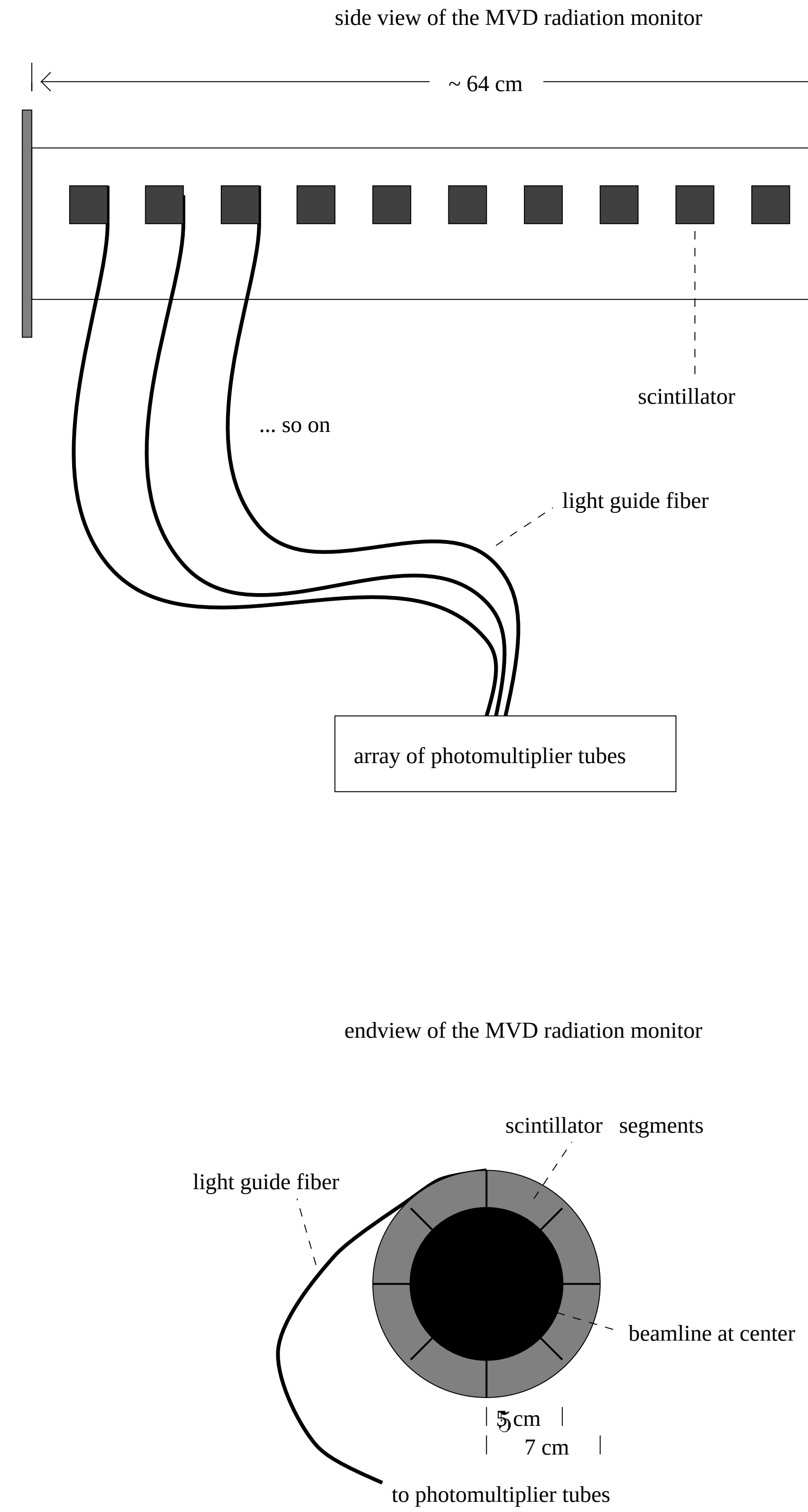

Figure 1: A sketch of the proposed MVD radiation monitor. The scintillators will be held in place by rohacell tube and endcaps.