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Reviewers Report: GEM Electronics Design Review

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February 24, 1993

Abstract:

The one day review consisted of 20 presentations followed by a discussion between the three reviewers, D. Marlow, and G. Sanders. This note summarizes this discussion. The amount of information presented by the 20 speakers was such that we cannot comment on each subject. We have concentrated on catching possible problem areas and are thus not commenting on many items we feel to be well under control. Obviously, such a report reflects the personal bias, as well as the experience of the reviewers: some of our comments may not be valid or difficult to implement in the SSC environment.

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Introduction

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Silicon Vertex Detector

We fear that the design parameters given to the electronics engineers are straining the limits of feasibility, leaving at best no safety margin. This may be due to the 18cm strip length; possible remedies include lower capacitance and lower resistance micro strips. We suggest a critical review of possible compromises by the physicists designing the detector and by the electronics engineers working on the readout. Electronic engineers should prepare a quantitative description of the relation among the noise, detector capacitance, pulse shaping time, and power dissipation for such a review.

The power dissipation inside the detector is another concern; not only is its average value quite high, but there are large peak values during readout. The transient demand on power supplies may cause spurious effects which should be considered; the readout scheme could conceivably be modified to minimize transients if they turn out to be a serious problem.

Rad-Hard Process

We gather from the presentations that production of Rad Hard chips is almost solely based on the Harris process. Alternate processes should be sought or adequate guarantees obtained from Harris.

Fail-Safe Design

A large fraction of the electronics cannot easily be accessed for repairs. It is thus most important that the consequences of a single failure be limited to a few detector cells; some designs presented included potential failure points which could affect many cells at once. The comment applies to data path, calibration and clock paths, and also to some extent to cooling and power distribution paths.

System Overview

Several presentations were extremely specific concentrating on the design and interconnection of a few chips; we feel that for each subsystem there must be one person in a position to oversee and defend the system as a whole. Dan Marlow is doing an excellent

job of coordinating and supervising the electronics as a whole, but we think that he should get more help at the subsystem level.

Crates and Busses

The selection of standard crates and bus systems has not yet taken place in GEM. There are significant savings in terms of spares, trained manpower and software development when using a standard system.

Industry Involvement

At present, the industry is involved at the chip level, but not at the subsystem level. Because of the large number of channels in each subsystem, it is conceivable that the commercial CAMAC, VME and FASTBUS suppliers could produce complete subsystems in a competitive way. Although GEM has enormous electronics expertise, the amount of work is so staggering that farming out one or two subsystems to the industry would certainly benefit the collaboration.

Group Boundaries

The GEM Collaboration has set up a separate group for the on-line computers. Because of the strong interdependence between the trigger, DAQ and on-line computers and software, we recommend that the interaction between these two groups be closely watched to avoid development along diverging paths.

Presentations

A word of advice concerning presentations to formal reviews, from people who have suffered through many reviews chaired by Ed Temple.

> Each talk must be rehearsed, if necessary several times; the transparencies must contain only essential facts and be readable from everywhere in the room.
>
> There should be one main speaker for each subsystem, possibly with experts talks on critical items and experts answering questions.
>
> Results already obtained must be emphasized; problems encountered should be presented along with their solution.
>
> Technical feasibility, time schedule and cost effectiveness, of chosen and alternate solutions, should be presented.

Conclusion

We have tried to be as critical as possible in the hope of helping people to prepare future reviews. Let us now say that we were also most impressed by the expertise, the amount and quality of the work already performed and by the enthusiasm of the speakers.