Recommendation # 1:   …the BLM upgrade be done

The plan for upgrading the BLM systems is solid, worth pursuing, and the committee recommends the BLM upgrade be done. We do have a list of suggestions which we hope will lead to a more successful project.

Response to #1: Great - thankyou for this endorsement and for your recommendations.

Recommendation # 2: Focus on the Tev BLM system.

Focus on the Tev BLM system.
The focus should be on meeting the requirements of the Tevatron and using the BLM system as part of the Abort System to protect the Tevatron from damage due to extreme beam loss.

Using the same system for the Main Injector or Booster should be considered as well, but these considerations should not delay the work on the Tevatron.

Specifications on limits and system sensitivity and dynamic range need to be worked out for the Main Injector and Booster magnets and operation conditions. This can be done on the basis of corresponding energy deposition calculations

Response to # 2: We are indeed focusing on the Tevatron system which is the most complex since it needs abort capabilities. The dynamic range and sample rate are set by the Tevatron requirements as is the need for the Abort Controller Card and the communications between the ACC and the individual digitizer cards.

Recommendation # 3:   Continue Efforts on existing system.

Continue efforts on protecting the Tevatron with the existing BLM system.
While an upgraded BLM system is recommended, this will not directly address the more immediate concern of protecting Tevatron from damage until the BLM upgrade is completed approximately August 2005. Therefore the effort to replace the old system should not divert attention from or consume resources needed to address immediate concern of protecting Tevatron until the BLM project is finished approximately Aug 2005.

Response to # 3: A number of us (Olson, Pordes, Lewis) are developing a scheme to implement the ability to abort on in-house multiplicity and a scheme to make ring-round BLM status available to enable developing aborts based on multi-house information - using the present BLM system. The go-ahead on a full upgrade in fact emphasizes the need to make improvements on the present system quickly.

Recommendation # 4: Create a requirements/specifications document.

Create a requirements/specifications document. The design of the upgrade BLM system was presented in significant detail for the committee to form an opinion regarding the proposed system. For completeness, we recommend that a single, working requirements/specification document including software interface and applications programs should be created ASAP and maintained as project progresses to establish common reference for all working on and reviewing the project. This could be a "living" document which is updated as the design of the system matures.

Specifications on limits and system sensitivity and dynamic range need to be worked out for the Main Injector and Booster magnets and operation conditions. This can be done on the basis of corresponding energy deposition calculations (from recommendation #1)

Response to # 4: We appreciate the usefulness and importance of a requirements and specification document including the software interface - and will construct such a document. We would like to address the issue of applications programs in response to recommendation # 5.

Specific Main Injector and Booster requirements need to be generated by the machine groups themselves. Both machines are engaged in this project.

Recommendation # 5:   Include application programs

Include application programs as part of the BLM upgrade. Flexibility of the new system implies a well thought-out and implemented software system to provide a user friendly set-up and diagnostic interface in order to be successfully integrated into machine operations. Therefore, the development of the applications programs for the BLM system should be included as part of the project. This should include specifications for the software and estimates for the time and manpower. This will involve members of the Tevatron group since they will be responsible for configuring the BLM system to protect the Tevatron.

Response # 5: In order to implement this recommendation, the project needs resources which it presently does not have. It needs application programmer resources and it needs a commitment of resources from the Tevatron group (and eventually the MI and Booster) to develop the specifications for applications beyond those already available.

Recommendation # 6: consider a BLM front-end separate from the BPM upgrade front-end

Consider using a BLM front-end system which is separate from the BPM upgrade front-end and make a decision in this regard as soon as possible. It is important that a decision regarding the BLM "front-end" processing be made quickly since it will impact both the BLM upgrade and the BPM upgrade. As proposed, the MOOC/ACNET interface (or the BLM "front-end") would become a part of the BPM upgrade project and use the resources of the BPM front-ends. In this regard, we ask that the BLM project consider using its own front ends and separating itself from the BPM project. We note that the CPU in the proposed system serves a specific dedicated function in the chain of abort logic. Therefore, that same CPU must not also be expected to serve MOOC/ACNET interface functionality if the decision is to not use BPM CPU for that purpose.

Continued on next page.

Recommendation # 6 continued: (re a BLM front-end)..

We make no recommendations about this except that it should be considered. There are advantages/disadvantages for both a separate front end system and for using the BPM front end system. For example, separate front ends will have more M&S cost for VME processors, but the convenience of a separate system may be worth the extra cost. (One downside of making the BLMs into a separate front end is that the GAS speaking BPM modules would have to remain in place and functional until the end of the BLM replacement project in late 2005 rather than being replaced by the BPM project this year.)

Response # 6: recommendations 5, 6 and 8 are tightly coupled. Please see our response to the main parts of these recommendations below recommendation # 8

On the specific point of maintaining the Multibus sytem; one could imagine that the new BPM system support the old BLM system. This would be work for the new BPM system to be balanced against the effort of maintaining the Multibus system.

Recommendation # 7: Use C-language for development of the CPU system.

Use C-language for development of the CPU system. We recommend using C language instead of assembly for programming the abort logic. It seems like a clear advantage to program a modern processor in a language like C which will be easier to maintain in the future. There should be a more compelling reason for writing in assembly language. Along these same lines, it would not be necessary to use a Z80 microprocessor if assembly language was not used.

Response to # 7: the processor chosen is the EZ80, not a Z80. It is a 16 bit processor with 200 times the processing power of the installed Z80, and is in fact a popular modern microprocessor. The functionality of the CPU is limited to setting various thresholds and buffer lengths and fetching and serving data. We consider this a fixed piece of code that will not need development or maintenance. To implement this specific recommendation will require a shadow to the main architect of the system.

Recommendation # 8:   consider use of "6U" crates .

Use the more standard and larger "6U" crates instead of the smaller "3U" crates. Rack space does not seem to be the issue as it was once believed. Therefore we suggest the project consider using the taller "6U" crates rather than the less standard "3U" crates. This change would also allow for the use of VME front ends if needed. Also, the "6U" is a much more standard form factor, increases the amount of board real estate available for the digitizer boards, and also improves the availability of commercial cards. All of our standard CPU cards are apparently "6U."

Response to #6 and #8: Removal of the space constraints has a significant effect on the detailed design of the system. If the system has its own front-end to the controls system (6), we assume it will be a VME processor in a VME crate. Similarly, if the system is in a 6U crate (8), this makes implementing a BLM front-end natural. So, if we adopt either of recommendations 6 or 8, we would adopt both. (continued on next page)

Response to Recommendation # 8: continued.

We also recognize that a dedicated front-end interface to ACNet may facilitate the development of the BLM application programs compared to a situation where one relies on the Tevatron BPM front-end.

A significant advantage of adopting the VME crate backplane is that the Booster and Main Injector systems, which do not need the abort capability of the Tevatron system, can dispense with both the CPU and the ACC cards. The VME crate also allows for up to 64 channels per crate and this would be exploited in the MI and Booster where two or more existing 12 channel BLM chassis are in the same house or rack.

While this was not our guiding intention, the digitizer card in VME becomes a general purpose digitizer plus FPGA thus leveraging the design investment.

There is an increased M&S cost for the Tevatron which is not fully covered by our present contingency. The extra cost of 30 VME crates and 30 VME front-end processors above our present estimate is estimated at $150,000.

The project would need a front-end programmer assigned as soon as possible to participate in the system design.

Recommendation # 9: Control the abort threshold states via a newly created MDAT channel.

Control the abort threshold states via a newly created MDAT channel.
The Tevatron states are not broadcast on T-clock or MDAT and this affects the communication methods mentioned in the review. It is a combination of parameters, such as the collider state (V:CLDRST), the mode of operations (V:TEVMOD), the beam energy, collimator activity, SVX status and beam intensity that would be used to determine abort thresholds. At this time we do not know how to specify when different limits might be needed. We imagine that the BLM system will have a handful of states with different abort thresholds. The BLM state will be broadcast by an MDAT channel and will depend on many factors of the Tevatron operations such as beam type, state of the Tevatron, and beam intensity. Therefore relying on TCLK events is not sufficient.

Response to # 9: this has been explained to us and the design includes an MDAT decoder. We assume the Controls Dept. will program the MDAT channel.

Recommendation # 10: Keep CDF and D0 in mind.

Keep CDF and D0 in mind. D0 and CDF use a slightly modified version of the present BLM system to protect their detectors. It should be considered that D0 and CDF may want to use the upgraded hardware as well.

Response to # 10: we have been made sensitive to this and one of our project members is responsible for ensuring that the needs of the collider experiments are properly considered.

Recommendation # 11: the multiplicity feature may require rearrangement of the loss monitors.

Use of the multiplicity feature may require rearrangement of the loss monitors. When implementing multiplicity of loss monitors to generate beam aborts, it may be necessary to obtain loss signals from monitors that are currently in different houses. This means that we may need to communicate from house to house, or simply add an additional loss monitor to the end of a house.

Response to # 11: House to house communication - or more precisely fast knowledge at one location of the BLM status ring-round - is a feature of the upgrade being developed for the present BLM system. We plan to incorporate this development into the new BLM system. We would welcome input from the Tevatron group as to any need for more BLM's.

Recommendation # 12: Check with the Tevatron group before choosing clock events.

Check with the Tevatron group before choosing clock events. If clock events are to be used for BLM operation, these should either be programmable or reviewed with Tevatron personnel. Many clock events are used differently that originally intended, and there will be more changes in the future.

Response to # 12: We expect the definition of which clock events to be used will come from the Tevatron Dept. and that this list will be included in the specifications/requirements document.

Recommendation # 13: Provide an Alarm on loss reading levels.

Alarm on loss reading levels. In addition to alarming on the hardware status, (such as HV readback) also provide the capability to alarm on loss readings.

Response to # 13: We would like some clarification on what `providing the capability to alarm' means and will do our best to provide such a signal.