The following are the collected comments from the MI8 collimator review committee, consisting of Peter Kasper, Bill Foster, Salman Tariq, and Mike Gerardi. The comments are organized according to the questions that the committee was charged to answer.

Several committee members expressed the concern that the case for building these collimators in addition to the collimators that have been proposed for the MI ring, has not been clearly presented. Though this is outside the scope of our charge, we nonetheless thought it important to raise the issue. As yet undocumented studies were mentioned that apparently indicate that scraping in the MI8 line does reduce losses in the MI ring. However, it is not clear that the proposed MI collimators would not also be largely effective in reducing these losses. Put another way, one might ask just how serious are single turn losses expected to be?

Will the system be effective at intercepting beam halo at the level of 1% of the total beam current?

From the presentations made, it was not clear to us that this question could be properly answered. A related concern is the stability of the beam position which will be addressed below.

Perform end-to-end simulation of the line, including the MP02 field non-uniformity, to optimize the collimator phase advance. (Isn't there an ORBIT simulation of MI injection which does apertures, etc?) At minimum, make a plot of the betatron acceptance versus dP/P. For various collimator positions, for sine-like & cosine-like Betatron phases.

Some consideration should be given to the changes expected with the installation of the new 8 GeV dump and any potential effects on the MI8 lattice.

Is the placement of the system optimal?

There was no clear presentation on the advantages of the proposed location over alternatives. The obvious options are 1) in the booster ring, 2) the upstream end of the MI8 line, and 3) the MI ring.

Doing the scraping in the Booster has the advantage that the collimators exist already, but would require the installation of some high power correctors and would help with beam halo generated during extraction (MP02 multipoles for instance).

There seems to be little reason to prefer the upstream part of the MI8 line over the downstream end if it is true that the halo causes no loss problems within the beam line.

The advantage of doing the scraping in the main ring is that these collimators may be able to become part of the proposed complete MI collimation system. This would be a significant cost saving. It is also clear that it does not prevent the single turn and injection losses attributed to the halo. However as mentioned earlier it is also unclear how significant these losses are.

At maximum absorption rates, is the integrated shielding sufficient in terms of external dose rates, sump and groundwater activation, residual dose, and air activation?

From the presentations it was clear that above ground dose rates would not be a concern with the proposed design. It was also felt that air and water activation would not be an issue though the calculations still need to be completed. It should be noted that the groundwater calculations will need to additively include both the collimation and beam dump since both affect the same collection area.

Activation of material just outside the marble such as the motion hardware may be an issue. The calculations need to include these items and should also take into account the reduction in shielding at the locations of the Thomson Rails

The type of marble used could be an issue which needs to be addressed. A small fraction of the wrong impurity may void all the advantages. We suggest that people with practical experience in the use of marble as a shielding material be consulted. In particular one should find out weather the expected gains were actually achieved.

The mask collimators need to be included into the design.

Some mechanism needs to be implemented to insure that too much beam is not lost in the collimators since they can only stand several seconds of full beam power. This could be done by applying beam trips to loss monitors placed immediately downstream of each collimator.

The steel and all associated metallic shielding materials should be primed or painted to prevent the creation of transferable contamination.

What are the requirements of the system in terms of beam position control and can these controls reasonably be met?

The numbers quoted on beam stability looked to be of some concern. Some extra effort will be required to address this issue.

Put Dual-plane BPMs right near each collimator (or at least each collimator pair). Consider using (lower drift) BPM electronics such as the Sten Hansen / Ashmanskas digital module.

Characterize and data log the orbit, emittance, and dP/P variations.

Consider an auto-tune program which operates a local bump to regulate the beam position at the collimators.

Consider a beam study to use orbit bumps to mock up exactly the aperture restrictions corresponding to the proposed locations of the collimators. Try to measure how much beam scraping you need to eliminate the MI injection losses. Try running like this for awhile to see if the orbit stability is adequate when you are scraping this close to the beam. (You don't have to do this test by running continuously, just turn the bumps on for a few pulses once per hour and see if the scraping is reproducible. The goal of this is to figure out how stable the beam has to be at the collimators.

Is the mechanical and control design sound?

Measure the actual distance from the floor and inside wall, to the beam pipe in all the proposed installation locations.

Minimize the footprint of the support mechanism; particularly minimize parts sticking out into the aisle.

Protect any components sticking out on the aisle side.

Hard stops should be incorporated in all drive directions. Their effectiveness should be verified, including reversing direction after a jam.

The collimators should be fully assembled and all motions checked out prior to moving them into the tunnel.

The design needs to better define how to achieve final alignment to the beam. Perhaps one could utilize leveling feet on base followed by grout?

We recommend using chain-type or similar "quick disconnect" couplings at each screw jack to help with individually leveling each jack to achieve the final alignment of collimator.

Do the radiation levels require the use of specialized lubricants in the screw jacks, gear boxes, and bearings? As a precaution, you should anticipate an increased amount of friction in the system over time and thus increased torque, motor & drive components should be able to handle this. Based on the torque numbers shown, this is probably not a problem.

Larry Bartoszek can provide valuable insight from his experience with the booster collimators. We suggest the project buy a few hours of his time to review the design and obtain advice on assembly and installation issues.

Are the budget and schedule realistic?

The schedule as presented was very optimistic on the amount of time required for assembly. It took several weeks to assemble the booster collimators and we see little reason to believe that these will require less time.

Order the cables ASAP. Cables are always on the critical path. Check lead times on screw jacks and other critical components, and try to order them ASAP.

The project does not appear to have considered the conflicts associated with installation of the new 8 GeV dump using the same assembly area and access hatch?

The budget is based largely on the actual costs of the booster collimators. The bulk steel came in very cheap for that project and it should not be assumed that this project will get as good a price.

Assembly and installation costs were not considered in the budget as presented.