

Date: December 2, 1993

Minutes of the AGS Radiation Safety Committee

Subject: SEB Switch; Ring Shielding for FEB & HITL;  
Acceleration Clearance; and Red Tags.

Meeting Date: March 12, 1993

Present: D Beavis, G Bennett, H Brown, A Etkin, JW Glenn,  
E Lessard, A McGeary, S Musolino, K Reece, J Spinner, K Woodle,  
L Ahrens, J Preisig, W VanAsselt, & T Vetter.

Summary

A partial SEB "Switch" was approved along with modifications to the HITL and FEB tunnel spurs toward the AGS. All requirements of "Accelerated Clearance" are no more stringent than "Injection Clearance", thus this clearance is no longer needed. A Subcommittee will look at the LOTO problems associated with radiation safety and report back.

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SEB "Switch"

L Ahrens presented the reasoning for a maximum circulating beam angle of 7 milli-radian toward the SEB line at F10 (Attachment #1). The limit is due to the 400 foot wavelength of betatron oscillations and the 6 inch aperture of the AGS. Thus the angle to the SEB becomes 12 mrad. H Brown estimates 30 to 50 Barns/SR at this angle, thus the maximum efficiency of "scattered extraction" from F10 is  $2 \times 10^{-3}$  for greater than injection energy. The attenuation for the second scatter after CD1 remains the same, thus the beam out is expected to be less than  $5 \times 10^7$  per sec with  $6 \times 10^{13}$  protons accelerated every 3 seconds.

For 1.2 GeV injected beam, the beam could be bent directly out by a magnet failure. The second scatter attenuation of 400 would still prevent unacceptable levels in the A cave. Five times the intensity, but one twentieth the energy and a wider angle scatter after D1 would increase the attenuation to about  $5 \times 10^{-4}$  equivalent or possibly  $10^{10}$  extracted per second.

Thus a "partial" SEB switch is approved: F10 locked off, CD1 and CQ1-4 locked off, and an interlocking Chipmunk installed along the beam line. This switch being off, with the A line beam off, will allow access to the A Cave with beam in the AGS (AGS CK 1&2). When possible, fault studies will be performed to confirm these attenuations and determine if the Chipmunk is necessary or if access can be made to the Switchyard cave with beam in the AGS.

## FEB Tunnel

The upstream magnets of the old FEB have been removed, reducing some shielding between the FEB tunnel and the AGS ring (See Attachment 2 of March 9 meeting for details). D Beavis presented the results of calculations (Attachment 2) showing a maximum of 45 rem/hr at the fence in the FEB tunnel without considering the scattering effects of the iron upstream of the one foot diameter pipe between the AGS and the FEB tunnel. This is not inconsistent with Glenn's results from Attachment 2 of the March 9, 1993 meeting which consider this scattering. Even at these levels, an interlocking Chipmunk to protect people in the Radiation Area near the fence is acceptable. The area enclosed by the fence should be treated as a Class II area. Fault studies will be required to confirm the calculations and to probe for a possible muon beam. Possible muon fluxes have not been calculated, though experience indicates they will be minimal (AGS CK3).

## HITL

Again old beam line components have been removed, reducing shielding. Glenn's calculations from Attachment 3 of the March 9, 1993 meeting predicting levels of less than 22 rem/hr in this area was reviewed. Making the area Class III (AGS CK4), as the Chipmunk in the D Fanhouse will prevent excursions to these levels, is acceptable to the Committee. A Fault study will be needed to confirm these numbers.

## Acceleration Clearance

Glenn presented a comparison between shielding source terms, for injected and accelerated beams (Attachment 3). As they are nearly equal per unit length,  $1.2$  &  $1.8 \times 10^{13}$  "GeV/sec/ft", the precautions called out for spiralling beam are sufficient for acceleration also. Thus the the Committee agrees that there is no longer any need for "Accelerated Beam" clearance.

## LOTO

E Lessard presented a draft charge (Attachment 4) for a Sub-committee to make a recommendation to resolve the present conflicts between Radiation Safety and Electrical Safety needs for LOTO.

The committee encouraged the sub-committee to: Include EP&S and Operations representatives; Require a "memo" giving reasons for the Tag; Recommend actions with "un-lockable" devices; and Use the existing Red Tag.

They will present their recommendations to the full committee.

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Attachments (file only): 1) Ahrens to Glenn Mar 8, '93 Draft  
2) Notes by Beavis  
3) Viewgraph by Glenn  
4) Ed to Woody Mar 12, '93

Check List Items:

- AGS CK1: F10, CD1 and CQ1-4 locked off w/o A secured.
- AGS CK2: Interlocking Chipmunk installed along the beam line at upstream end w/o A secured.
- AGS CK3: FEB tunnel upstream of fence (at ~180') to be controlled as a Class II area.
- AGS CK4: HITL spur toward AGS controlled as a Class IV area.

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