Committee Report
CTB Mechanical
Final Design Review
July 31, 1996
STAR Note #265

Review Committee: Ralph Brown (BNL), Doug Fritz (LBNL), Russ Wells (LBNL, chair)
Attendees (Rice University): Billy Bonner, Bill Llope, Gordon Mutchler, Ed Platner, Harry Themann, Pablo Yepes.

Introduction
The purpose of this meeting was to review the mechanical aspects of Central Trigger Barrel design and fabrication. Review topics included structural adequacy, part and assembly drawings, manufacturing plans and the interface of the CTB with the rest of STAR. The cost and schedule were not topics for review. However, the relative cost of key components was used in arriving at some of the committee's findings. The review began with presentations of two documents, CTB Performance and CTB/TOF Spatial Accuracy Requirements, both authored by Mutchler and Yepes. These articles were written partially to address open PDR action items. The meeting then progressed into an informal session wherein drawings of the CTB components and the details of their fabrication were reviewed. The "stack-up" of part machining tolerances, CTB tray to TPC rail clearances, TPC rail straightness, TPC rail location tolerance and minimum CTB tray to tray gap was performed in a group setting. The meeting then proceeded to review the CTB installation tool drawings.

Executive Summary
The committee found that the basic design of the CTB mechanical structure is workable and that the fabrication approach is sound. However, some key drawings need to be reworked before fabrication by an outside vendor can begin. Specifically, the tray fabrication should be specified using an assembly drawing or drawings. Individual part drawings that imply fabrication methods should not be specified. Any special requirements, beyond those that can be indicated on the drawing should be incorporated into a written specification. Both drawings and specification should emphasize function rather than fabrication methodology. All drawings should follow established mechanical drawing conventions and utilize geometric tolerancing as required.

A beneficial result of having four STAR subsystems represented at this review was the simplification of the CTB installation tool. The original design presented was a space frame that mounted on the TPC wheel. While this approach is workable, it requires removing a host of cables, water lines and electronics. A much simpler approach is to mount separate tray guides from the TPC wheel perimeter and Magnet inner ring. The wheel perimeter is normally populated by brackets that hold the electrical connectors for the TPC sector power and signal cables. Temporarily breaking the connections and suspending the brackets appears to be a relatively simple process.

Key Issues / Recommendations

The committee feels that the basic design is sound but there are several details which need to be attended to prior to purchasing the CTB containers and scintillator paddles. The majority of these details and/or recommendations have been addressed in the action items that accompany this report but, for completeness, are listed below.

1. Drawings of items that are to be fabricated by an outside vendor must follow established drawing conventions and must specify all of the required features but should not delineate sub-part dimensions or fabrication methods. If a particular function or feature of the item cannot be communicated on the drawing then a written specification should accompany the order.

2. The committee recommends using an experienced designer to bring the existing drawings into conformance with established drawing conventions and to incorporate geometric tolerancing where needed.

3. Given the actual tolerances (straightness, width, height, and location) of the TPC rail, the design gap between adjacent CTB trays must be sufficient to assure that, in the worst case, no trays touch. This is the key mechanical issue. A through assessment of actual dimensions will determine the maximum width of the tray and the required accuracy of the CTB foot bonding fixture. An accurate CAD generated cross-section of the CTB tray on the TPC rail incorporating "worst case" dimensions and orientation would assure that this issue is resolved correctly. A preliminary walk through by the CTB staff and review committee indicated that the trays should be 1.5 to 3 mm narrower. This corresponds to a 1.5% decrease in CTB coverage.

4. The present design of the CTB enclosures no longer contains stiffening ribs. The prototype enclosure should be modified to reflect this change.

5. It is recommended that separate CTB and TOF trays be used. By eliminating the need for reusing CTB trays for the TOF, the bottom layer of rigid foam can be permanently bonded to the enclosure thus increasing the structures rigidity. Secondly, at 5 to 10 watts, the heat dissipation in the CTB module is 1/40th to 1/20th that of the TOF. Therefore, the feasibility of eliminating the cooling line from the CTB should be evaluated.

6. The committee views the foot bonding jig as a critical item that needs to be thoroughly critiqued prior to tray fabrication.

7. Given the number of enclosures to be made, the vendor should be required to produce a first article that must pass a quality assessment by the responsible CTB staff prior to full scale production.

8. As mentioned in the executive summary, a new two part installation tool mounted to the TPC wheel's perimeter and magnet end ring should be considered.