May 15, 2002

The following note contains the responses of the CDF collaboration to the comments and recommendations of the Director's Baseline Review Committee, which met on 16-18 April, 2002 for the purpose of reviewing the CDF and D0 Run IIb projects. These comments and recommendations were distributed on 22 April 2002.

Scope of the Proposed Upgrades

The scope of the Preshower and calorimeter timing projects is not completely specified, because the technical choices for the detector are still being studied. There is some research and development work remaining for both. We anticipate a final scintillator design for the Preshower detector well in advance of the Critical Decision 3 request. Similarly, the timing project will settle its technical choices before that time. At this time, the scope of the project that directly affects data acquisition bandwidth is under review. The lack of experience with high luminosity data collection has hampered progress in this area. We expect to sharpen our plans by the time of the June, 2002 meeting of the Physics Advisory Committee.

The six month schedule shown for the Run IIb installation was motivated by our understanding that the six month installation was one of the constraints on the Run IIb. It is clear to CDF that the silicon system will be insufficiently commissioned for physics quality data at the end of a six month shutdown period. Future schedules will show a longer shutdown and more time for silicon detector commissioning. Additional commissioning time for the silicon system will be added, thereby extending the shutdown beyond the assumed six month limit. As mentioned above, the scope of the project will be settled by the time of the PAC meeting in June, 2002. All subprojects will be fully integrated into the CDF management by the time of the Critical Decision 1 review.

We agree with the comments about stave concepts and cooling and we have tried to build a conservative schedule which includes plenty of time for the construction of mechanical and electrical prototypes. We have always included a prototype phase (sometimes two), preproduction and production. We will fully test the stave concept before embarking on production of the staves. One advantage of the Run IIb design is that there is essentially only one type of outer layer stave. In fact there are two types, those with axial sensors on both sides and those with axial on one side and small angle stereo on the other side, but the fixturing for construction of modules and staves is independent of sensor type since the sensors are nearly identical in size. In addition, there is only one type of hybrid. This hybrid has only 4 chips. In SVXII we found that the more chips on a hybrid the harder it was to get it to work. In summary, by having only one type of hybrid and nearly identical staves throughout the outer layers, we will be able to concentrate on solving any problems that arise, and once solved, those problems will be solved for all the outer layers, or 94% of the Run2b silicon detector.

The stave cooling is more difficult in the sense that we have more fittings and manifolds to deal with at the ends of the staves, and, the bending and forming of the PEEK tubing

to the correct shape has presented some challenges (which we think have been solved). We are in the process of developing prototype staves and testing their mechanical properties (do they bow or distort when cooled), robustness (develop leaks), pressure drops per stave and thermal performance. On the other hand, once we decided we must put coolant through the individual staves, the cooling of the silicon became more direct (and somewhat easier), compared to Run IIa, where the silicon is primarily cooled by coolant flowing through a glued Beryllium Bulkhead which in some cases is far from the silicon sensors. In Run IIa we struggled to minimize every glue layer so that the heat could be conducted out more efficiently. We ended up with a system where the center silicon is expected to be around 12 deg. C with a coolant temp of -10 deg. C. The temperature for the Run IIb coolant will be set by the requirements on L0. Tests of the Run IIa L00 structure were performed prior to and during L00 construction and we use those as reference for further tests of the L0 structure. We anticipate the need to run the chillers at -15 deg. C and have set up a test at B0 to study the capacity of the chillers down to a temp of -20deg. C. With our current assumptions, the thermal studies predict that on layer 1 we will have average strip temperature of -10 deg. C if the coolant is at -15deg. C. The specification for Layer 1 of -5 deg. C already has a 50% safety factor built in. These results will be verified by tests in the next few weeks using prototype staves.

Marcel and Brenna (as leaders of Sidet) have set up a series of joint meetings between CDF and D0 to discuss common problems and solutions relating to stave cooling as well as in other areas such as epoxy choice and tests, L0 design etc. The current designs of CDF and D0 have the following items in common:> 1) Both use PEEK tubing with a 4 mil wall and a 0.195" diameter and jointly purchased the material for the prototyping efforts. 2) A CDF engineer designed the tube bending fixture and D0 adopted it. Both experiments will use the same tube bending fixture. 3) A CDF engineer developed a design for the nozzles at the ends of the staves. D0 is considering the same design with some minor modifications. The CDF order for prototype parts was increased to include some additional parts for D0 to test and consider. 4) CDF and D0 are working together to develop a procedure for leak checking the cooling tubes. This is tricky because the PEEK tubing is permeable to helium.

We also agree on the importance of a full prototype stave and are focused on producing a full functioning electrical prototype stave as soon as possible. We expect this to occur at the end of August if the prototype chips and hybrids (which arrive in late June) can be made to work at all. We have a test stand already setup at Fermilab in which the modules and staves can be tested with the full DAQ system Studies of the electrical performance are in progress at LBL using a G10 board for the bus cable and leftover parts from the SVX' detector. Noise can be seen at the transitions (e.g. digitize to readout). Different grounding schemes are being investigated. Preparation of a document summarizing the results will be completed this month.

Total Project Cost Estimates

We have decided for future reviews that costs kept and accumulated within the resource loaded schedule will not be used for presentations or estimates of total project cost. The resource loaded schedule will be used as input data to a financial package that will escalate costs to Actual Year values. This approach will provide a straightforward way of forcing common labor rates between projects and accounting for indirect costs.

A Resource Sheet that could serve as a common input for both projects has been created and sent to D0 for review (29 April). CDF has moved ahead with its implementation.

Basis of Estimate documents are being collected at this time. We will have this available well in advance of our next review.

Labor contingency will be installed into the schedules at the task level, as we currently do for M&S contingency. This contingency is explicitly available in the lowest level WBS dictionary, as resource FNALCONT. The contingency calculations will then be treated identically, in terms of their escalation. The explicit cost contingency has been removed from the silicon schedule.

Many of the recommendations made address the construction of the resource loaded schedules. We plan to adopt all of the recommendations either within the schedules themselves, or in the accessory financial package that will supplement the schedule and be used for tracking and earned value calculation. These include adding contingency on labor at the task level (M&S is already done that way), and including all resources in the schedules.

The personnel for a "Project Office" are included in our schedule named "Administration."

Schedule

We are currently reevaluating our schedule, and inserting schedule contingency where appropriate. We agree with the areas of risk that were identified by the committee, and explicit schedule contingency will be applied there. A master schedule will be built out of the subproject schedules.

The project schedules created for Run IIb have not been used for tracking the projects yet. The schedules have been, and continue to be, under development. Consequently, their use as tracking tools has not been appropriate so far. We are currently working with the budget office and our financial experts to incorporate our schedules into the tracking package (Cobra). This should be possible in summer 2002.

Use of common procurement and components for the silicon detector is being pursued and has been discussed earlier.

Management Considerations

CDF will review its contingency analyses with respect to the guidelines and make adjustments. This is an area where we will try to adopt a consistent approach with D0.

The Project Execution Plan and Project Management Plan are currently in draft form. A joint weekly meeting with D0 is occurring where these documents are being developed. We will strive for uniformity in these documents where possible.

Resources available for silicon construction have been discussed at great length with the Particle Physics Division. Current CDF estimates exceed the guidance we have been given only during a short peak period. We believe this peak can be covered by overtime and/or additional collaboration support. We are evaluating this further, and will firm our plans with respect to this period.

Schedule float and statusing have been mentioned earlier.