CDF/DOC/CALORIMETRY/CDFR/6653

Proposal to install the new CPR2 inside the B0 collision hall

J. Huston, S. Kuhlmann, S. Lami, M. Lindgren,
P. Lukens, L. Nodulman, R. Roser

September 16, 2003

Abstract

The CDF Collaboration has proposed to replace the present *Central Preshower* (CPR) and *Central Crack* (CCR) detectors with an integrated detector based on scintillator (CPR2). In this note we present a first plan to install the CPR2 upgrade inside the B0 collision hall during a short (10-12 weeks) shutdown.

1 Introduction

In order to maintain the same Run I capabilities, the present *Central Preshower* (CPR) and *Central Crack* (CCR) detectors will be replaced by scintillator counters read out by *Wave-Length Shifting* (WLS) fibers. The new CPR will also have a better segmentation and will be used to improve the jet energy resolution by both correcting for energy loss in the dead material in front of it and adding its information in jet algorithms incorporating charged tracking.

The new CPR will be based on 2cm thick scintillator tiles segmented in η and ϕ and read out by a 1mm diameter WLS fiber running into a groove on the surface of each tile. Six tiles (12.5x12.5 cm^2 each) will cover the front face of each calorimeter tower, and the tiles will be assembled in 48 modules like the one shown in Fig. 1 covering the 48 central calorimeter wedges. After leaving the tiles, the WLS fibers will be spliced to clear fibers which will terminate into plastic connectors at the higher η edge of each module. There $\sim$5m long optical cables will transmit the light to 16-channel *PhotoMultiplier Tubes* (PMTs) at the back of the wedge. Each CPR module weighs about 100 pounds.

The new CCR will use the same technique but the available space will limit the scintillator thickness to 5mm. Ten tiles, $\sim$5cm wide, will cover each ϕ-crack with the same calorimeter segmentation of 10 towers/wedge, after a $10X_0$ tungsten bar. In spite of the smaller size, the addition of the tungsten bar makes a CCR module as heavy as the CPR one.

The replacement was originally supposed to happen at the time of the Silicon Vertex detector upgrade for Run IIb, which would have required a shutdown of six months to

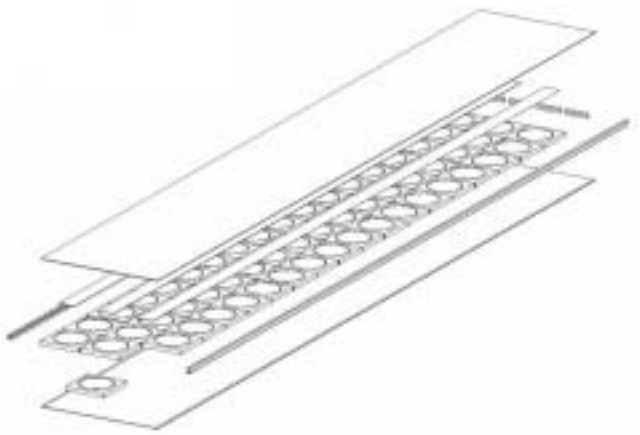

Figure 1: View of the CPR upgrade design.

roll out the CDF detector. As a consequence of the latest developments, in the last weeks we started studying the possibility of a CPR2 upgrade installation disengaged from a silicon upgrade. In this note we discuss the CPR2 installation inside the B0 collision hall during a shorter ($\sim$ 10-12 weeks) shutdown, and propose further technical studies during the Fall 2003 shutdown.

2 Installation in B0

Fig. 2 shows an elevation view of the CDF II detector, while fig. 3 shows the maximum opening of the South central arches inside the collision hall. The North arches are on the side of the movable wall of the collision hall, while the South arches are definitely constrained by the tunnel. From fig. 3, it is clear that access to the South arches is pretty much limited by the magnet yoke, even in their max opening. However, once the North arches are pulled out, the South arches are easily accessible passing under the solenoid (see fig. 2). The idea is to start working on the South arches as soon as they become accessible, while the North arches are still being pulled out.

A tentative daily schedule for the installation is summarized in tab. 1, assuming an 8-man team. The total is 12 weeks of 5 working days each, 8 hours a day. It includes the total process to open and close the detector. To pull out the North arches we need to remove a 1200 ton door and the false floor, install braces on muon wall, remove the muon wall, install the transporter and finally pull out the arches; we hope it could be done in one week, however we count conservatively two weeks in tab. 1. The 8-man team is supposed to work in the following scheme: after removing the old CPR and CCR modules from the bottom wedge of the arches and installing scaffolding instead, 3 men per arch (3+3 on the same side) remove the old modules and mount the new ones, while the remaining 2 men go to and fro carrying old/new modules.

If two 8-man team shifts per day could be organized instead, this will obviously cut in half the module mounting, reducing to 8 weeks the total shutdown time.

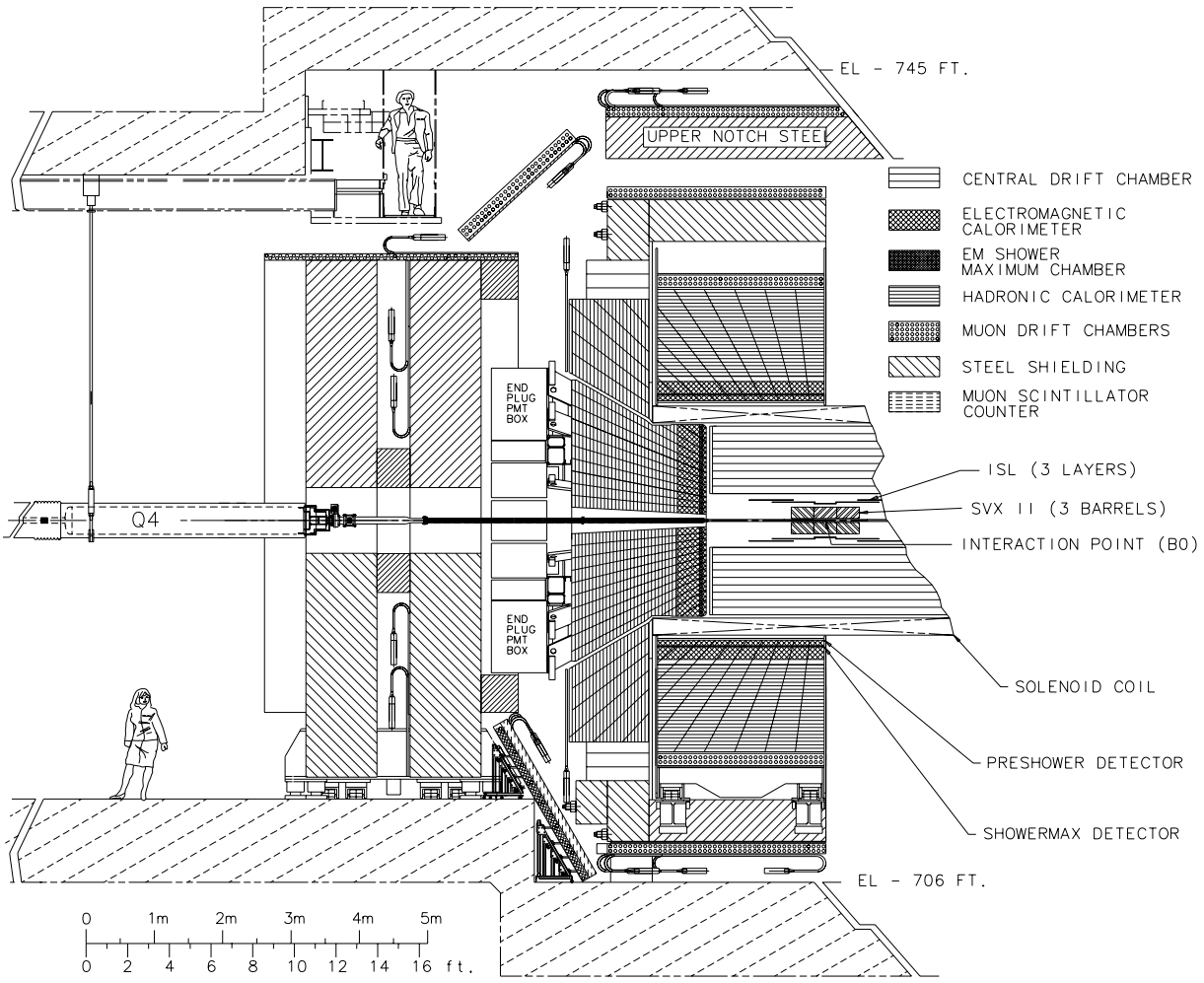

Figure 2: An elevation view of the CDF II detector.

The present CPR modules are much lighter than the new scintillator tiles that we want to mount, and the present studs/brackets need to be replaced. The time needed for this operation is probably the biggest unknown in tab. 1. In order to minimize this time and its uncertainty we are working on a specific design for the module support, that we might test on the spare calorimeter wedge in B0.

3 Plan for this Fall shutdown

There is a request to move out two arches for several years now, in order to bring the current CPR and CCR systems to over 95% working (we believe one CPR chamber is unplugged). We have not had access to these detectors since the electronics was installed 3 years ago.

The present time schedule for this fall shutdown foresees the opening of the End-Plugs on Week Two (september 15th) and the pull of the central arches on Week Three

Table 1: Tentative time schedule for the CPR2 installation:

	Action	Hours
1	Access begins.	
2	North arches are pulled fully out.	10 days
3	2 2-man teams work on South arches while North are pulled. They: 1) remove old transition cards, undress old cables; 2) install new transition cards, dress new cables; 3) mount phototube boxes on arch;	10 days all overlap
4	Remove CPR and CCR/bar from 1 bottom wedge on 1 North arch. Mount new detectors on that wedge to find problems and prove installation design.	2 days
5	Remove bottom CPR and CCR/bar from other North arch.	0.5 days
6	Install scaffolding on bottom wedges of North arch.	1 day
7	8-man teams now start removing all CCR and CCR/bar from both North arches.	3 days
8	2-man teams completely install studs and brackets and other installation equipment on both North arches.	6 days
9	During n.8, physicists not in the other teams mount new CCR on old bars.	1.5 days all overlap
10	During n.8, bottom wedge CPR and CCR/bar are removed from both South arches by 8-man team.	0.5 days all overlap
11	During n.8, scaffolding is installed by 8-man team on South arches.	1 day all overlap
12	During n.8, 8-man teams remove all remaining CPR and CCR/bars from South arches.	3 days all overlap
13	2-man teams install studs etc. on South arches.	6 days
14	2 2-man teams then install electronics and phototube boxes on North arches.	5 days
15	During n.13 and n.14, 8-man teams mount new CPR and CCR/bar on North arches.	6 days all overlap
16	During n.15, physicists not in the other teams mount new CCR on old bars for South arches.	1.5 days
17	8-man teams mount new CPR and CCR/bar on South arches.	1 day
18	During n.17, a small team of physicists/techs not in 8-man teams start installing optical cables on North arches, all the way to the phototube box, plugging in tubes.	6 days all overlap
19	The team of physicists/techs not in 8-man teams install optical cables on South arches, all the way to the phototube box, plugging in tubes.	6 days
20	Cosmic ray checkout by physicists, starts during n.18.	5 days
21	North arches move back in.	10 days
	Total	60 days

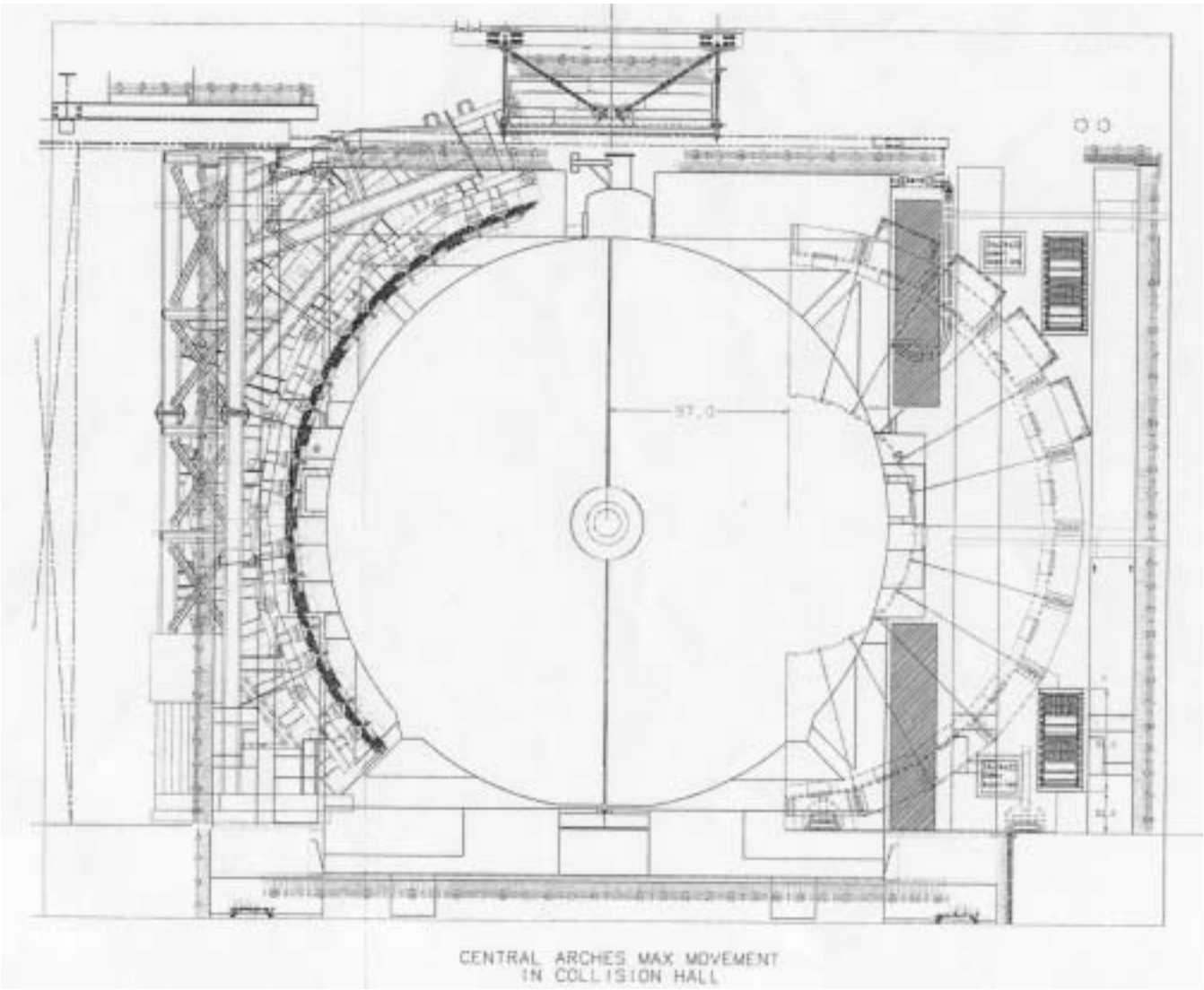

Figure 3: Maximum opening of the South central arches in the collision hall.

(september 22nd). The plan is to remove four PMT's from the bottom wedge of the central calorimeter and to sneak inside the arches passing under that wedge. This first on-situ investigation will give us a good idea on the difficulties.

More in general, we should start installing PMT boxes, HV and signal cables in the available short shutdowns before the CPR2 installation. This would reduce the current plan (a bit) and eliminate some possible surprises.