REQUEST FOR

FIBER IRRADIATION STUDIES IN THE CØ REGION

Fiber Tracking Group (FTG)

University of California at Los Angeles
Fermilab National Accelerator Laboratory
University of Illinois at Chicago
University of Notre Dame
Oak Ridge National Laboratory
Osaka City University
Pennsylvania State University
Purdue University
Rice University
University of Texas at Dallas
Tsukuba University

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Contact Persons:

S. Margulies, UI Chicago
(312) 996-3407
bitnet: MARGULIES@UICPHY

J. Piekarz, Notre Dame
(708) 840-4634
hepnet: FNAL::JPIEKARZ

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Submitted by the Fiber Tracking Group*

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1. Introduction

The Fiber Tracking Group (FTG)* is a collaboration of ten institutions working on the development of central and forward trackers, based on scintillating-fiber technology, for both the D-Zero upgrade and for the Solenoid Detector Collaboration (SDC) at the SSC. This work is supported, in part, by the SSCL/DOE and the Texas National Research Laboratory Commission. Basically, the proposed trackers consist of scintillating fibers of 830 μm diameter, each coupled to an optical light-guide fiber that delivers the scintillation light to a remote photodetector. The photodetector is the small, solid-state, multichannel visible-light photon counter (VLPC) being developed by Rockwell International.

One of the issues in this project is the stability of the fibers -- core, cladding, primary and secondary waveshifters, and joints -- under intense radiation exposure. As an example, the annual dose expected at a distance of 50 cm from the beam line at the SSC is about 10 krad.

While the proposed trackers employ fibers of significant length (up to 2.7 m in D-zero and up to 4 m in SDC), most irradiation studies have been performed using bulk scintillator samples. Consequently, tests of full-length fibers, containing the best waveshifters developed by FTG and associated vendors, are essential.

FTG proposes to make such measurements, and requests space in the CØ intersection region during the coming Tevatron fixed-target run to irradiate fiber samples. A similar use of this region was made several years ago by members of the E735 collaboration.[1]

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*University of California at Los Angeles, Fermilab, University of Illinois at Chicago, University of Notre Dame, Osaka City University, Pennsylvania State University, Purdue University, Rice University, University of Texas at Dallas, Tsukuba University. Contact Persons: M. Atac (Fermilab/UCLA), J. Elias (Fermilab), R. Ruchti (ND).

[1] F. Turkot et al., "Studies of Beam Induced Radiation for Experiment 735 at the CØ Intersection Region and its Effect on Detector Components", Fermilab TM-1395, 2563.00, 12 June 1985 (unpublished).

2. Experimental Plan

The CØ region includes both the Tevatron beam pipe and abort line, and the Main Ring and its abort line. Consequently, the area provides a rich background from beam-gas interactions, beam-halo interactions with surrounding material, and losses. During fixed-target running, exposures can reach as high as 10 krad/week,[2] and graded exposures are available by locating samples at increasing distances from the beam lines and in the CØ spectrometer room.

FTG proposes to irradiate sample fibers maintained in controlled atmospheres in the CØ region. The samples will be contained in sealed stainless-steel tubes 4.3 m long and 1 inch in diameter fitted with a removable flange cover at one end for fiber insertion and removal. Atmospheres under consideration include air, dry nitrogen, oxygen, and argon, at atmospheric pressure and at 50 psig. Some tubes may be operated with continuously flowing gas. The tubes will be provided by UIC.

Samples will be irradiated at three different levels: maximum intensity, obtained by placing the tubes close to the Tevatron and Main Ring beam pipes, and at two lower levels obtained at appropriate distances. Exposures will be measured using thermoluminesence detectors (TLDs). Harshaw/Solon Technologies has offered to collaborate in measuring the radiation doses and to provide TLDs and to read them.

Fiber characteristics will be measured before and after irradiation to various doses. (Of course, a set of unirradiated fibers will be maintained in the same controlled atmospheres as references.) Samples will be added or removed from the CØ region during periods when the accelerator is down. For this purposes, two members of FTG (J. Piekarz from Notre Dame and H. Mendez from UIC) have already been certified for work in ODH areas.

3. Requirements

a. Support stands

Three support stands to hold irradiation tubes at three different distances from the beam pipe will be needed. Each stand will hold about ten tubes 4.3 m long and 1 inch in diameter.

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[2] C.S. Lindsey et al., Nucl. Instrum. and Methods A254, 212 (1987).

b. Temperature monitoring

Remote continuous monitoring of the temperature at each support stand is desirable.

c. Gas system

If FTG decides that some samples should be irradiated under flowing gas, we would like to use the plumbing and gas shed of E735.

d. Access

Controlled access to the CØ region is required.

e. Services

No special services except for a.c. power are envisioned.

f. Computing

No request for Fermilab computing is anticipated.