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25 September 1990

Dr. Taiji Yamanouchi
Wilson Hall 2 East, MS 105
Fermi National Accelerator Laboratory
P.O. Box 500
Batavia, Illinois 60510

Dear Dr. Yamanouchi,

I am enclosing a request from the Fiber Tracking Group to study the performance of a small-scale prototype system in a Fermilab test beam during the coming winter/spring fixed-target running period.

As you know, such studies are extremely urgent in order to allow the Solenoid Detector Collaboration to prepare an SSC proposal by Summer of 1991, and to allow the DØ collaboration to prepare an upgrade request on the same time scale.

Please do not hesitate to contact me if any additional information is required.

Sincerely yours,

S. Margulies

S. Margulies

enclosure

SM/jh

REQUEST FOR FERMILAB TEST-BEAM TIME

Submitted by the Fiber Tracking Group*

25 September 1990

1. Introduction

The Fiber Tracking Group (FTG)* is a collaboration of ten institutions working on the development of an SSC central and forward tracker based on scintillating-fiber technology. This work is being performed under the SSCL/DOE major subsystem program. [1] Basically, the proposed tracker consists of some 10^6 scintillating fibers of 500 μm diameter, each coupled to an optical wave-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. Details of the proposed system may be found in Ref. 1.

The Solenoid Detector Collaboration (SDC) has proposed a scintillating fiber tracker as an option for the central and forward regions.[2] The development of the technology and the design of the system is being performed principally by FTG. The fact that the SSC Laboratory schedule requires detector proposals to be submitted by Summer, 1991, makes testing a small-scale scintillating fiber prototype system in a charged particle beam extremely important.

In addition, a large segment of FTG is also working to develop a fiber tracker -- similar to, but smaller, than that for SDC -- for the 1993 run

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Contact Persons: M. Atac (Fermilab/UCLA), J. Elias (Fermilab), R. Ruchti (ND).

[1] "Proposal to Develop a High-Rate Tracking Detector Subsystem for the SSC Using Scintillating Fibers", submitted to SSCL by FTG, 1 Oct. 1989 (unpublished).

[2] "Expression of Interest by the Solenoid Detector Collaboration", submitted to SSCL on 24 May 1990 (unpublished).

of the DØ detector at Fermilab. The schedule for the DØ upgrade decision makes beam testing of a small-scale system even more urgent.

To date, individual fibers and fiber ribbons have been successfully tested using radioactive sources and cosmic rays. Needed now are measurements of the response of fibers, layers, and superlayers to beam particles, and track reconstruction studies. Also, beam-induced signals are needed to optimize readout electronics, including cold preamplifiers, a digital pipeline, and a trigger processor prototype, and to study multi-anode phototubes as alternate photodetectors.

To perform these studies and to provide a demonstrably viable tracker option for SDC and DØ, we request test-beam time during the coming winter/spring Tevatron fixed-target run.

2. Apparatus

A sketch of the prototype tracking test system is shown in Fig. 1. Each superlayer consists of four parallel ribbon layers containing scintillating fibers about 4 m long. Each scintillating fiber is connected to a 4-m-long optical wave-guide fiber that transports the light to the photodetectors. The Rockwell photodetectors, operating near 10°K in a helium cryostat, will be tested using 500-μm-dia. fibers. Initially, 64 channels will be instrumented.

Multi-anode vacuum photomultipliers will also be investigated as a backup alternative to the solid-state photodetectors. In particular, a 256-channel Hamamatsu tube and a 64-channel Philips tube will be studied using a tracking test system similar to that described above but employing 1-mm-dia. fibers.

The tracking test systems will be mounted on a device which allows motion in two orthogonal directions in a plane normal to the beam, and also allows the angle between the beam and the fibers to be varied (see Fig. 2). FTG will

provide beam counters and trigger electronics, as well as test-system readout electronics and the cryostat for the solid-state photodetectors.

3. Requirements

a. Beam

Any charged-particle beam with momentum greater than 10 GeV/c with an intensity of a few kHz over an area approximately 1 cm x 1 cm is satisfactory. Neither momentum analysis nor a Cerenkov tag is required, and a muon beam is quite acceptable.

While FTG will provide beam counters, a table to allow them to scan and be centered on the beam is needed.

b. Space

A floor area of about 9 m x 4 m will allow the test system to be oriented in various positions relative to the beam (see Fig. 2), and will suffice to contain the solid-state photodetector cryostat, a helium dewar, and the electronics. A counting area -- remote, if necessary -- is needed.

An adjustable-height table for supporting the test system is also requested.

c. Surveying

A survey locating the height and centerline of the beam is needed. Some measurements locating the test system may also be needed.

d. Services

FTG will provide liquid helium, so no special services beyond power for the electronics are required.

e. Computing

FTG will provide a data acquisition computer system, and no request for Fermilab computing time is envisioned.

f. Schedule

FTG would like to begin setting up in December, 1990, for the winter/spring fixed-target run. An on-and-off mode of operation (one-week data-taking periods alternating with one-week analysis and apparatus-modifications periods) is anticipated for a total time of about two months.

Additional beam-test time will be requested in the future.

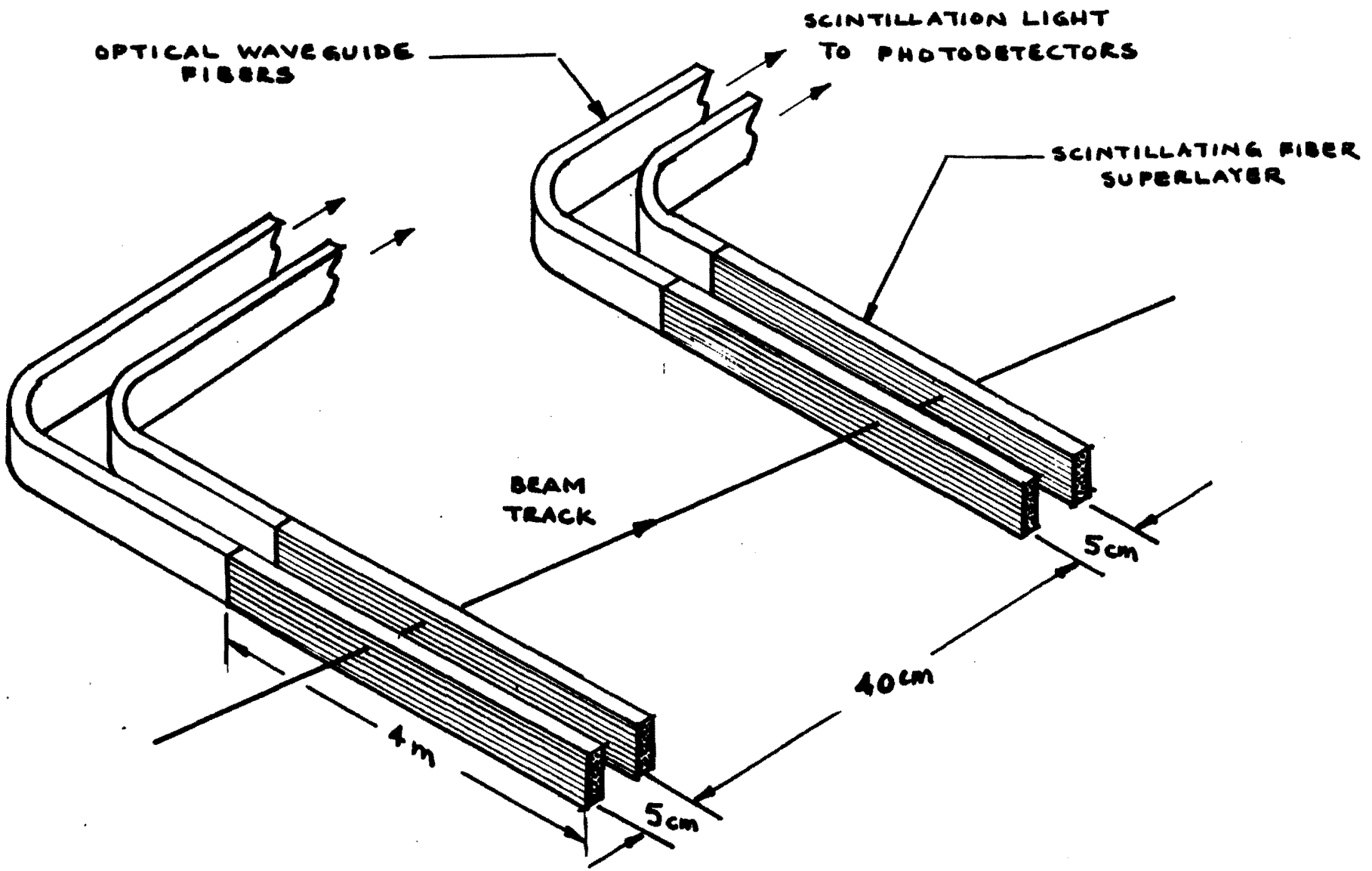

FIGURE 1. SKETCH OF FIBER TRACKER TEST PROTOTYPE
(NOT TO SCALE)

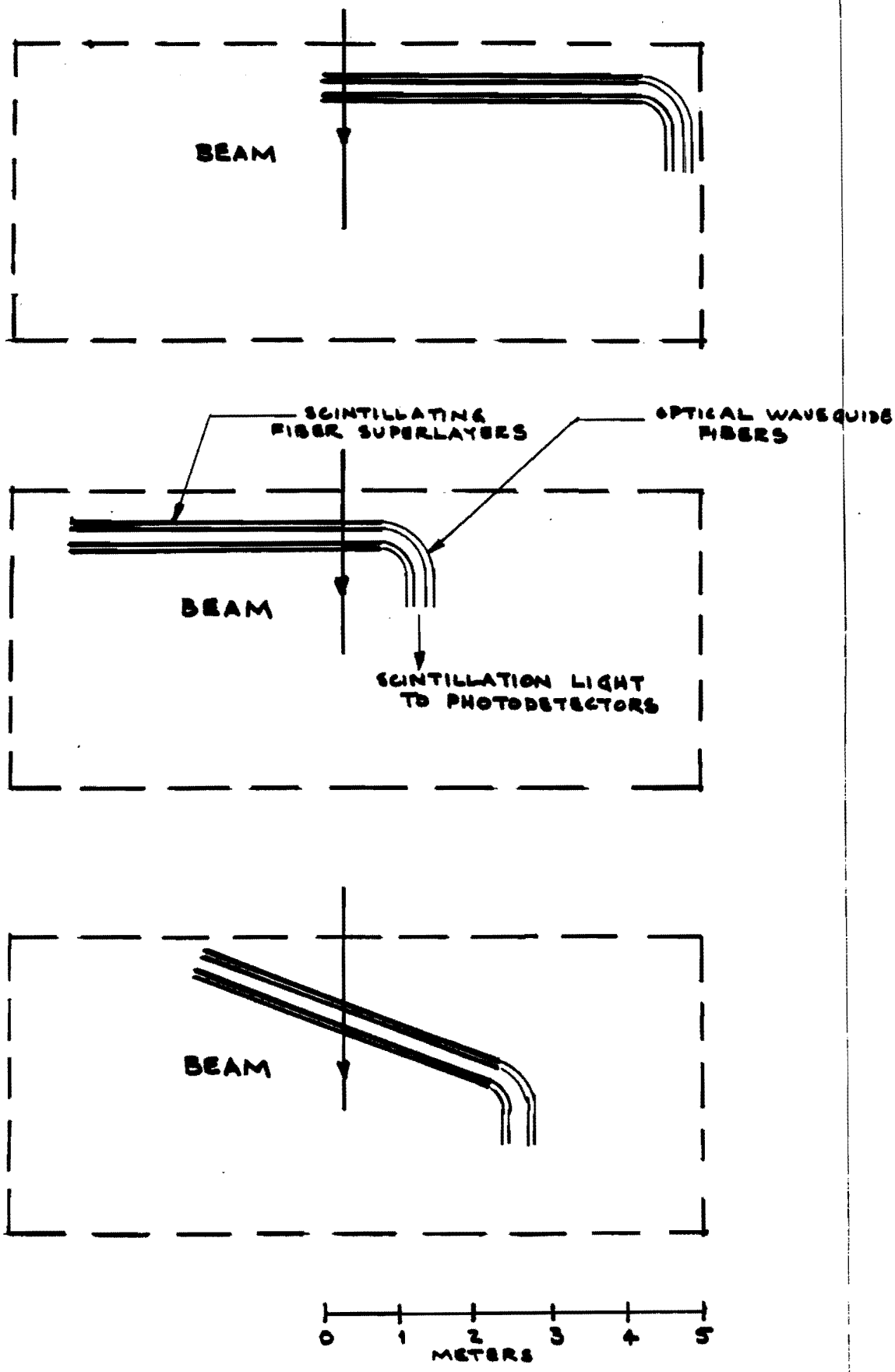

FIGURE 2. FIBER TRACKING TEST SYSTEM SHOWN IN DIFFERENT ORIENTATIONS