UNIVERSITY OF CALIFORNIA, SAN DIEGO

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DEPARTMENT OF PHYSICS, B-019
LA JOLLA, CALIFORNIA 92093

11 April 1991

Dr. Taiji Yamanouchi
Directorate
Fermi National Accelerator Laboratory
Batavia, IL 60510

Dear Taiji,

I enclose a proposal, by the Barium Fluoride Calorimeter group of the L* collaboration, for test beam time, during the 1991 Fixed Target period, in the N-T beam line.

We have discussed this proposal with Carlos Hojvat (Fermilab) and Frank Sciulli (Columbia University). No obvious difficulties became apparent during these discussions.

In the name of my collaborators I wish to express our appreciation for your assistance, and that of your colleagues, in the development of a successful SSC detector.

Sincerely,

Hans Kobrak

REQUEST FOR TEST BEAM TIME FOR BaF_2 CALORIMETER DEVELOPMENT

We request the use of an electron/pion beam to test prototypes of a Barium Fluoride electromagnetic calorimeter and its associated electronics. The test will be made with a 7 by 7 element array of 50 cm long tapered BaF_2 crystals. The development of a precision BaF_2 calorimeter subsystem is supported by SSC detector development funds. BaF_2 is the primary choice for the electromagnetic calorimeter for the L^* detector at the SSC. Its chief advantage is its excellent energy resolution ($\sigma_E/E = 1.3\%/\sqrt{E} + 0.5\%$) which allows the clear detection of $H^0 \rightarrow \gamma\gamma$. This is the best way to detect a Higgs in the intermediate mass region between 80 and 150 GeV.

The preferred characteristics of the beam are given in the table below. For this first test beam run we will attempt to improve the electron identification which can be achieved in the beamline to meet the goal given.

TEST BEAM SPECIFICATIONS

Momentum range:	10 GeV/c - 180 GeV/c
Intensity:	100 - 1000 tagged particles/second
Momentum resolution	0.5 %
Space resolution	0.1 cm
Electron misidentification	$\leq 0.1\%$
Pion misidentification	$\leq 1\%$

The prototype under test (see Fig. 1) will measure somewhat less than one meter cubed. Its weight will be less than 500 Kg. We request the use of an adjustable support structure which would allow us to illuminate the prototype with particles over a wide range of impact points and directions.

We estimate that the tests would require two "beam on" periods of about one month each, separated by a data analysis period of about one month.

We have discussed with Frank Sciulli (Columbia University) the possibility of sharing the use of the test beam commissioned by him and his colleagues in the N-T line (Fermilab E-790), for the calibration of the ZEUS calorimeter for HERA.

A currently possible scenario would have the BaF_2 development collaboration place a physicist and a graduate students with Sciulli's group at the beginning of the current Fixed Target period, to assist them in bringing up the beam line and data acquisition equipment. In that manner, the L* group would acquire the expertise needed to operate that system. It appears likely that the ZEUS test would be finished two months into the Fixed Target period. Upon the completion of those tests and the removal of the ZEUS modules to DESY, we would perform the tests on the L* calorimeter prototypes.

The support requested from Fermilab for this activity is:

1) Assistance in the operation of the N-T beam line.

2) Occupancy and use of the Lab F building, its equipment and its associated porta-camps.

3) Priority in the assignment of dormitory rooms for University personnel while working on the test run.

GOALS FOR THE BEAM TEST

A test in an electron beam is the only sure way to establish that the design energy resolution can be achieved. It is clear that a constant term of 0.5% is a difficult goal. Early test beam running will allow us to eliminate systematic problems in the final detector.

The test beam will also be needed to accurately establish the energy scale for the BaF_2 calorimeter for both electrons and pions. We must make tests of the linearity of response at the 0.5% level. This linearity is affected by the crystal wrapping and by the details of the light collection. A good systematic understanding of the beam energy is necessary to make this important test.

We will use our test beam results as a baseline for other calibration systems. We must carefully search for changes over the long time scales that the detector will be active.

Finally we wish to use the pion component of the beam to investigate what e/π separation can be achieved. We expect that a contamination of pions in the electron sample will be smaller than 1 in 10^3. We wish to identify electrons in the beam with a similar reliability to get our first measurement of e/π separation in BaF_2 .

PARTICIPANTS

The following members of the L* collaboration will participate in this test run:

Brookhaven National Laboratory
Craig Woody

California Institute of Technology
Harvey Newman, Ren-Yuan Zhu, Xiaorong Shi,
Wenwen Lu, Sanza Kazadi, Mbuyi Kazadi

University of California, San Diego
James Branson, Hans Kobrak, Robert Swanson, Andre Sopczak

Carnegie Mellon University
Helmut Vogel, Zheng Wang

Princeton University
Dan Marlow

Oak Ridge National Laboratory
Martin Bauer, Ken Read

Tata Institute of Fundamental Research, Bombay
Sunil Gupta

The contact person for this activity is

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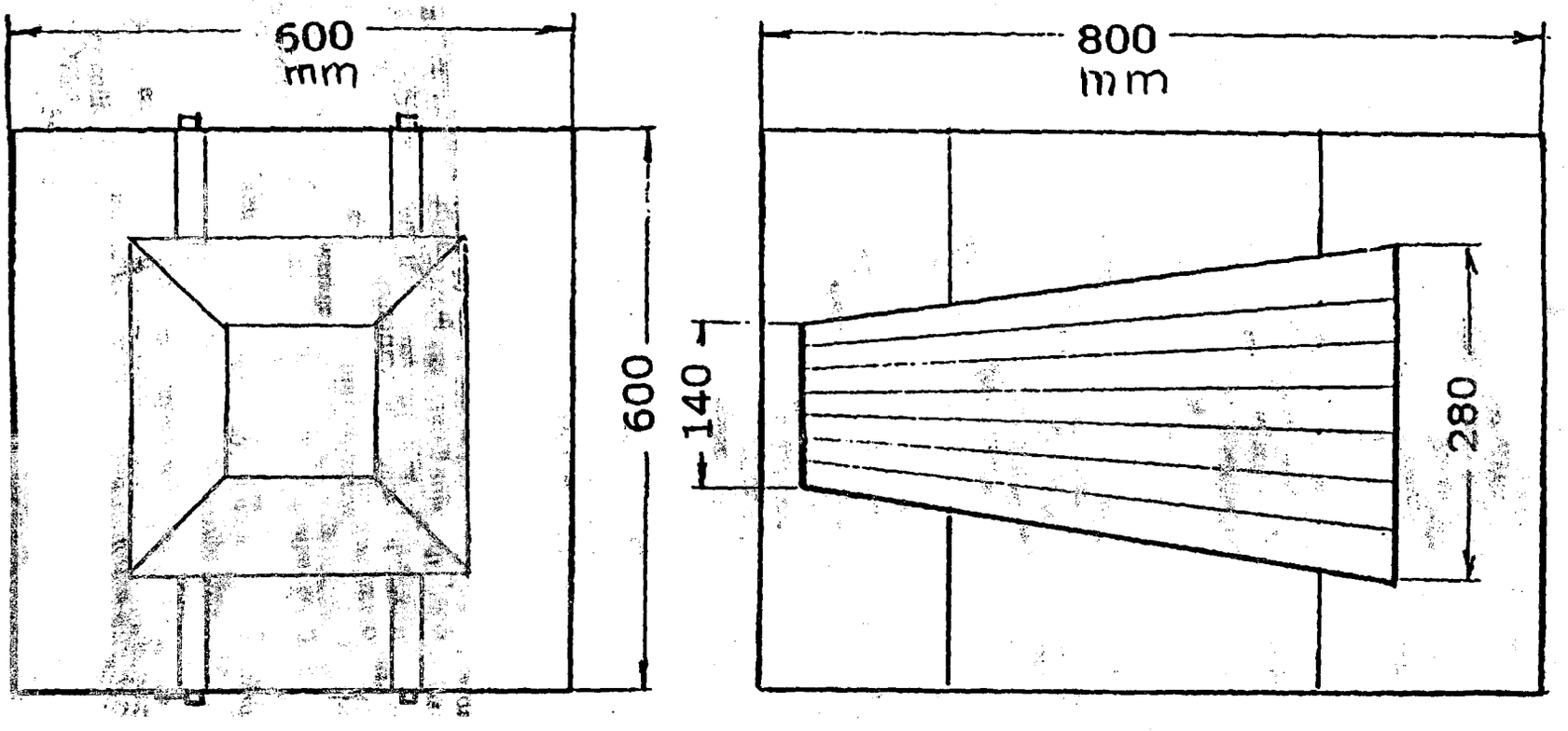
Funding for this activity is provided by the U.S. Department of Energy through SSC Subsystem funds. The contact person for the BaF_2 collaboration is Harvey Newman of Caltech.

BaF_2 Test Matrix (7 × 7)



Approx. Weight: 200 kg

Fig. 1