EXPRESSION OF INTEREST FOR THE SSC

1) Members by Institution

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2) Physics Goals

The search for magnetic monopoles is a long standing quest of particle physics. A number of reviews have discussed the physics motivations behind such searches (1-3). In the last decade the focus has shifted to Grand Unification Magnetic Monopoles. With masses in the 10E16 GeV range these are well beyond the reach of accelerators, even the SSC. There is no doubt these searches are extremely important.

Nevertheless it is also possible to imagine other models where monopoles appear in the mass range accessible for the SSC. One example is the model of Rosner et al (4). We see no reason to rule out searches at the SSC on the basis of theory.

There are several routes open to pursue the search for magnetic monopoles at the SSC. One possibility is to use the general purpose detectors. There may be quite good reasons to pursue this coarse. However, experience at the Tevatron and other colliders has shown that these experiments obviously focus first on themajor tasks while the dedicated monopole searches produce results immediately.

Thus a simple passive detector seems to be well justified.

3) Conceptual design of the experiment.

The proposed detector is an assembly of CR-39 and lexan track detectors which can detect particles with electric charge Z>5. The detector consists of interleaved sheets of CR-39 of thickness 1.4 mm, and of Lexan, of thickness 0.15 mm,arranged in stacks. Each stack may be deployed either around the beam pipe as done at Fermilab (5) or in a polyhedral configuration that surrounds the intersection region, as shown in figure (1). This shape would maximize the probability of tracks from the intersection region traversing the detector as near to normal incidence as possible (it is well known that track detectors are more sensitive to particles at normal incidence). A similar geometry was used for monopole searches at PEP, and now is in use at LEP.

The passage of a highly ionizing particle through a track detector is revealed as a cone-shaped pit when the surface of the plastic sheet is etched in a controlled manner using 6N, Na OH solution at 70 degrees C (8N, 80 degrees C for the first sheet of CR-39). The depth of the etched pits is an increasing function of the parameter Z/beta, where Z is a electric charge and beta=v/c. The trajectory of a highly ionizing particle can be traced by having a number of layers of detectors. Lexan is sensitive to Z/beta>70, Cr-39 is sensitive to particles with a Z/beta>5. The normal charged particles produced in pp interactions would not be recorded.

4) Milestones and key events

This apparatus can be assembled quickly (in less than one year). Design of an appropriate installation point could await the assignment of other detector locations. Once those are established the main design consideration will be avoiding conflicts with the SSC vacuum

and cryogenic installations around the vacuum pipe. We anticipate no major problem there. Processing and scanning facilities already exist. (5)

5) Performance

We see the search proceeding in stages. In the early stage the detector will operate when the luminosity is still low. Current track detector techniques have been demonstrated at instantaneous luminosities of at least 10**31 cm**-2 s**-1.

To handle higher rates we may have to change detectors a few times. This should not have any interference with the accelerator.

6) Preliminary cost estimate.
Essentially zero if the beam pipe thickness is 1mm of stainless steel.The cost of the detectors will be covered by us.

a) Management-optional section

b) Beyond approval-optional

c) Adding new collaborators.
Will agree to new collaborators based on 2/3 vote of existing members

d) Request for FY91 funds.
We would like to investigate radiation-hardened plastic detectors, as part of our development work of the CR39 detector used for the MACRO experiment at Gran Sasso.

References

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[3] N. Craige Editor, Theory and detection of magnetic Monopoles in gauge theory, World scientific Co, Singapore (1986).
[4] E. J. Weinberg, D. London, and J. L. Rosner, Nucl Phys. B236 90 (1984).
[5] M. Bertani et al., search for magnetic monopoles at the Tevatron Collider, DFUB 90/3.

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