CRYSTAL SEPTA FOR SLOW PARASITIC EXTRAPOLATION, AN UPDATE

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At the Snowmass Summer Studies in 1984, we proposed a scheme to extract 20 TeV beams from the SSC in a parasitic mode, using bent crystal septa.[1] Bent crystal septa have been success fully used at Dubna to extract test beams from the synchrophasotron and at Fermilab to steer external beams. Continued research on the crystals as practical extraction devices has led to significant progress during the past two years. We would like to summarize the highlights of the progress which we believe further strengthen our original proposal.

High energy performance

In our 1984 paper, the expected performance of the crystal septa was extrapolated from our experience at 8 GeV at Dubna and up to 400 GeV at Fermilab. Although we expect that the performance parameters should scale, experimentation at the highest available beam energy is certainly most useful.

In 1985[2] an 800 GeV parasitic beam was operated in the NE beam at Fermilab utilizing a crystal to deflect the beam three milliradians. The beam performed about as expected.

Dechanneling length

This is the length over which one-half of the initially channeled particles are dispersed due to the scattering on electrons and positive ions in the lattice.

In our 1984 paper we used calculated electron and nucleon diffusion lengths and then extrapolated to 20 TeV. During the past two years we have gained new experimental information and theoretical understanding of these dechanneling lengths. The information is quite consistent over a five decade range extending from 1 MeV to more than 100 GeV. In the 1984 Snowmass report a length of 60mm was assumed at 100 GeV as a basis of extrapolation. The five decade region is well fitted by $\lambda(\text{Si-}(110)) = 70 \pm 15$ mm,[3] where λ is $\lambda(1/e)$.

Radiation Damage

Since 1984 we have exposed bent Si crystals to a fluence of 10^{18} protons/cm^2 in the U line at the AGS at BNL. Channeling analysis of the exposed crystal showed no noticeable degradation of the channeling properties.[4]

Conclusions

From the knowledge and experience we gained with crystal septa since 1984, we feel more confident that they can be used as a practical device to extract 20 TeV beams from the SSC in a parasitic mode as described in the 1984 proceedings.

References

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* Operated by Universities Research Association for the Department of Energy.