ASYMMETRIC *B* FACTORY COLLIDER NOTE
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Layout of the LER Arc

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1. Introduction

We have recently been trying to accumulate all of the information necessary to decide on the layout of the regular curved arcs of the Low Energy Ring (LER) and there have been several ABC Notes published on different aspects of the problem. This note will describe the layout that has been derived from these considerations.

2. Period Length

The period length should be identical to that of the High Energy Ring (HER), and approximately the same as that of PEP, 14.2 metres. The slight differences are due to changes of circumference required to accommodate the change of RF frequency to 476 MHz, and to rearrangements of the magnets in the tunnel.

3. Period Layout

Each period will consist of the following elements:

Corr - S_d - Q_d - Bend - Space - Corr - S_f - Q_f - Bend - Space

where the XY Corrector, Sextupole, Quadrupole and Bend are close together on the same support girder/raft and the Bend must be downbeam of all the other elements. The vacuum pumping will then mostly be required in the space between the girders/rafts.

4. Maximum Energy

The magnetic and vacuum components should be dimensioned to permit conservative operation at 4.0 GeV with a beam current of 3 Amperes. It is most likely, however, that the initial project will only include a reduced RF power installation and, perhaps, reduced electrical power and cooling capacity.

5. Aperture

The minimum aperture was defined in ABC 6. For reasons of standardization it seems reasonable to evaluate the option of making the magnet apertures equal to that of the PEP magnets which will be used for the HER. The choice should be examined on a case by case basis and if there are strong technical or financial advantages to using the smaller aperture this should be done.

6. Bends

The bends should have a nominal magnetic length of 1 metre. This implies that the bending radius should be about 30 metres. The uncertainty comes from the exact design of the dispersion suppressors and the use of bends of ≈10% field at the beginning of the experimental straight sections. Since the synchrotron radiation power density within the bend will be small there is no necessity for an open side to the magnet. Both C and window frame magnets may be considered. The impact of using solid core magnets should be evaluated both technically and financially.

7. Quads

The quadrupoles should be dimensioned to allow operation of the LER at phase advances of 115° at 4 GeV. With a gradient-length product of 3.9 Tesla, all of the quadrupoles in the ring could be identical and meet this requirement. If the PEP profile and bore (10 cm diameter) is used, these quadrupoles could have a magnetic length of about 50 cm. The option employed in PEP of building two or three different quadrupole types may be evaluated but since the magnets are so short, the cost differential will be less than for PEP.

8. Sextupoles

The sextupole requirements are scaled from PEP as the necessary work on chromaticity correction has not yet been done. The scaled gradient length product should be 50 Tesla/metre. For the same pole tip field as PEP (0.9 Tesla) and the same inscribed circle (11.4 cm diameter), the length of the sextupole need only be about 10 centimetres. These parameters would therefore give a sextupole with large end effects and an engineering design will be needed to choose the optimum length.

9. Correctors

Again scaling from PEP gives a maximum field-length product of 0.017 Tesla-metre. For a magnet length of 10 cm, this would correspond to a field of 0.17 Tesla. The use of a combined horizontal/vertical corrector (with separate windings) should be investigated.

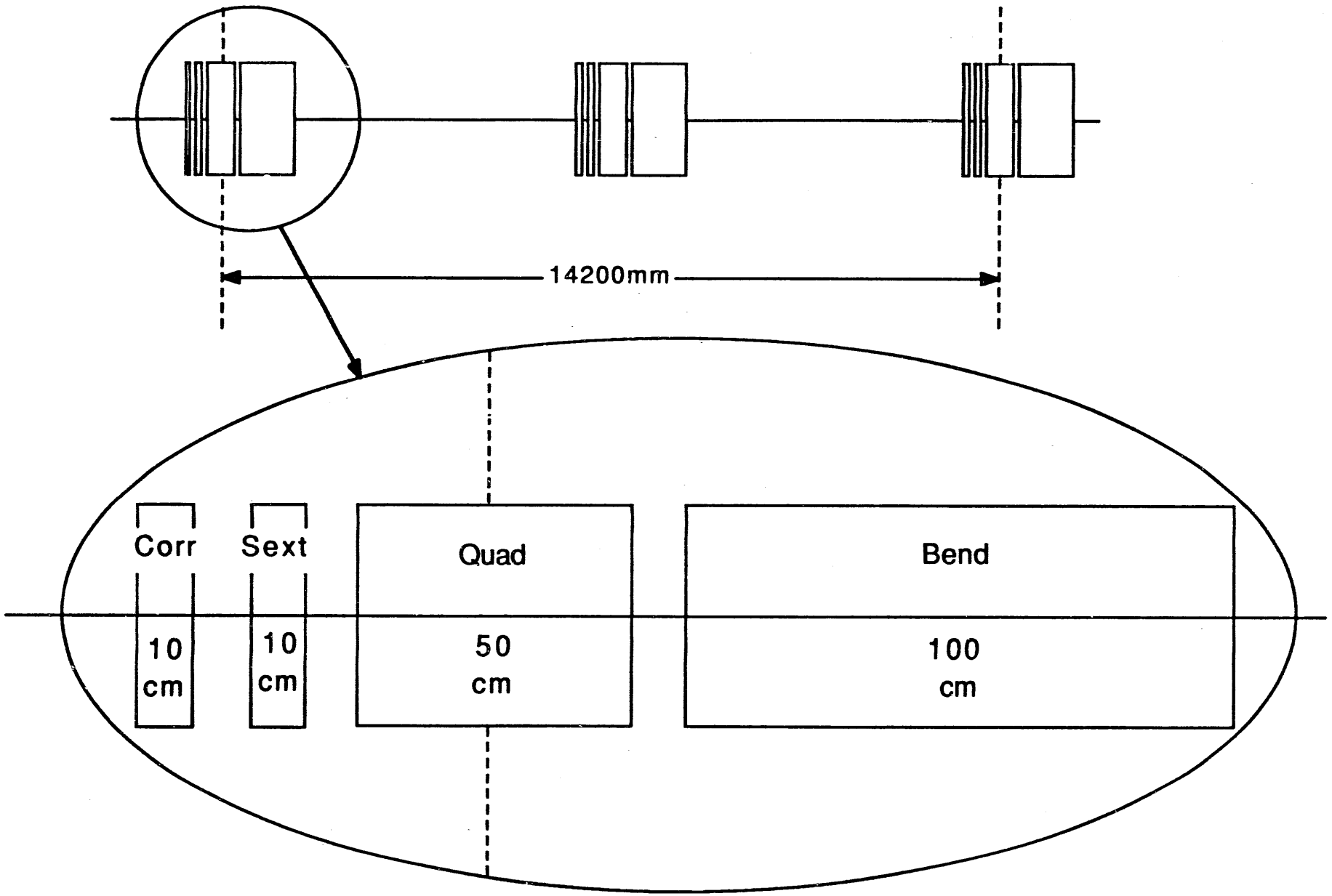
10. Element Separation

The minimum element spacing should be determined by coil overhangs and access considerations. Note that there is no accelerator physics issue necessitating extremely close packing of the elements and the separation should be chosen on engineering grounds to minimize total cost. In the spirit of cutting costs, the possibility of re-using some of the PEP vacuum chamber components should be evaluated.

11. Summary

The resulting layout is shown schematically in the Figure. The engineering parameters in this note are intended as guidelines rather than exact numbers. It is expected that they will change as detailed studies are carried out.

LER Period Layout



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