Science & Technology Facilities Council

Multi-stacked dipoles: a cost cutting configuration.

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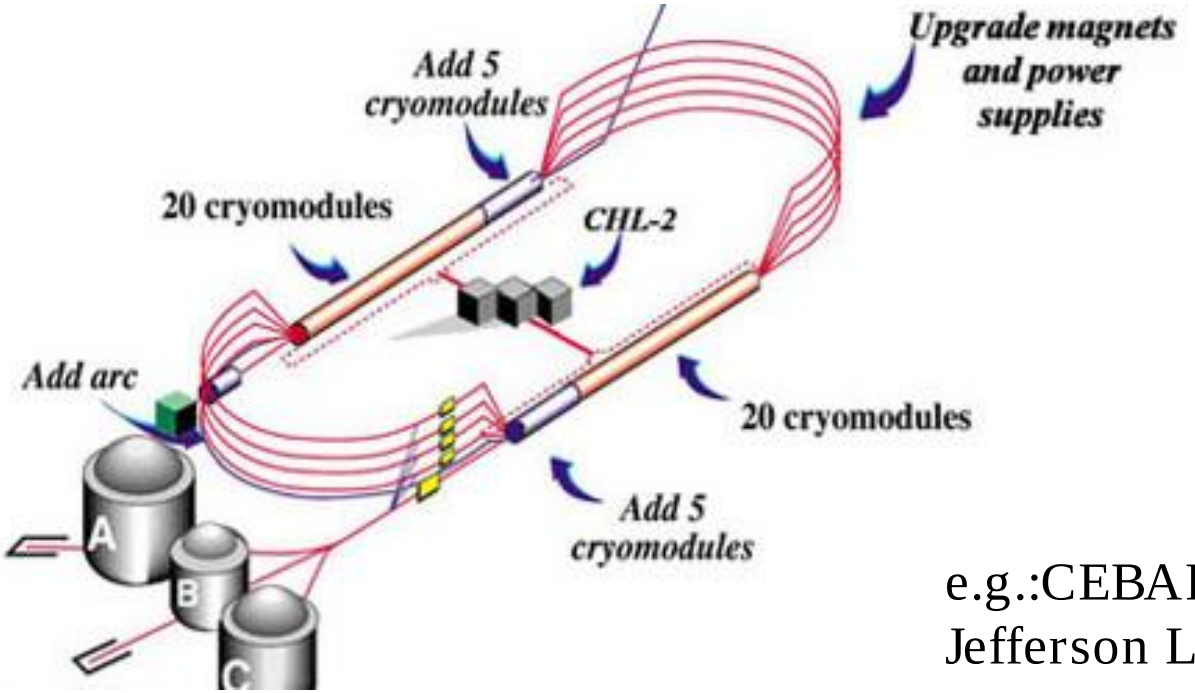
Multi-stacked dipoles

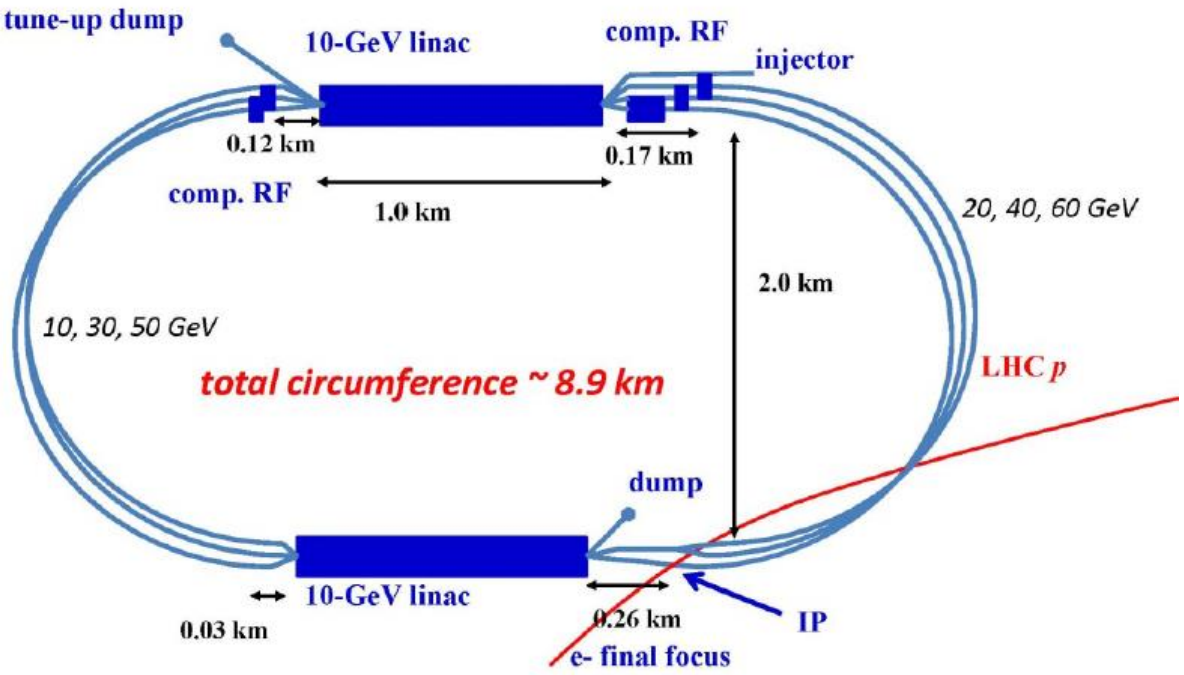
Colliders with a pair of linacs accelerating in a racetrack configuration over a small number of turns use vertically stacked dipoles (for different momenta particles) at each 180 degree bend:



e.g.:CEBAF at Jefferson Lab, USA.

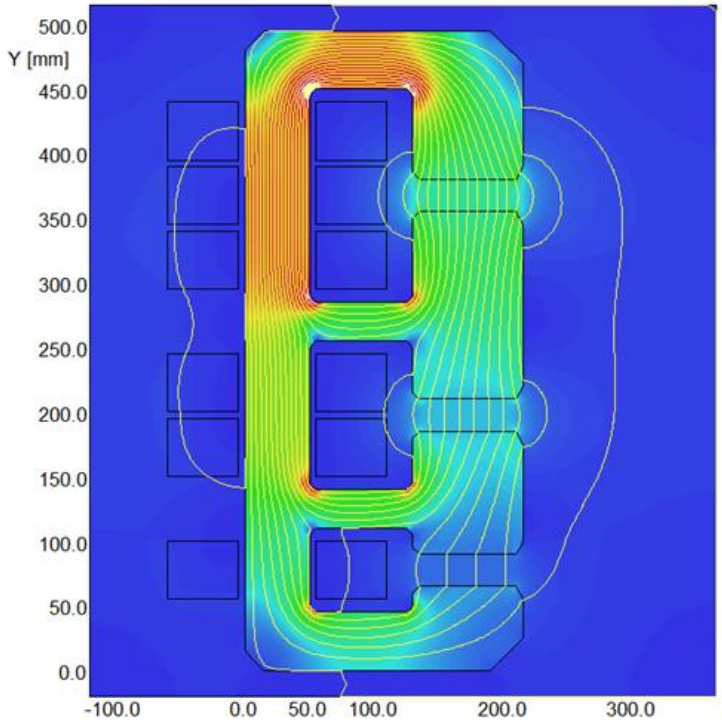
Multi-stacked dipoles

The linac-ring option in the proposed LHeC also featured vertical stacked dipoles in the bends:



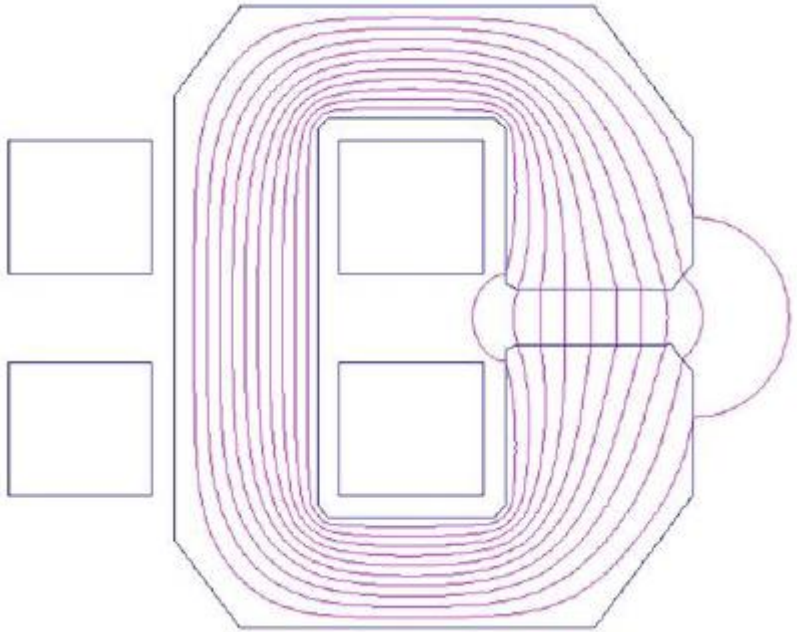
LHec; A Large Hadron Electron Collider at CERN; sections 8.1.2, Fig 8.5.

Initial proposal for circulating dipole:



A. Milanese, O. Bruning, CERN;

CERN-ECFA-NuPECC Workshop, June 2012.

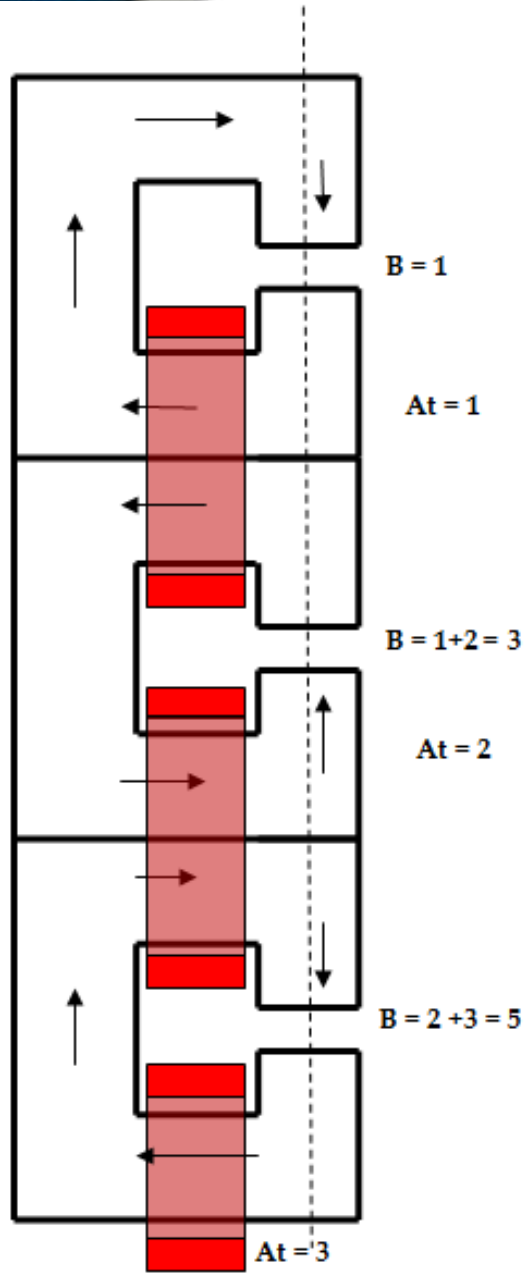


LHec; A Large Hadron Electron Collider at CERN;

Section 9.2.1 p 335

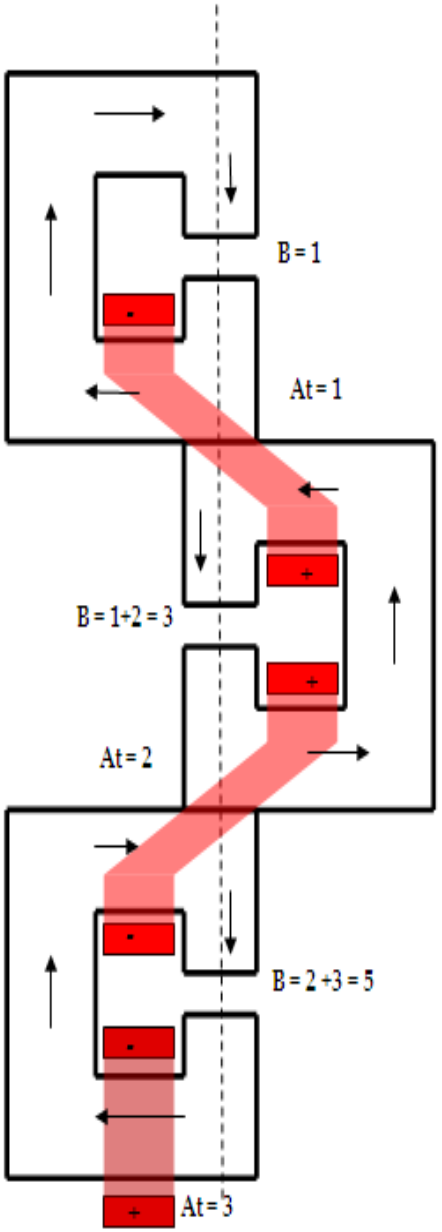
The possible use of a smaller number of coils by linking adjacent yokes with a single coil was explored.

The initial layout (as shown) produced the wrong polarity of flux density in the central magnet.



Solved by rotating the central magnet about a vertical axis.

If the different momenta beams need to be horizontally in line, the central magnet needs to be displaced.



Saving

The figures relate to the amp-turns required for the two arcs in proposed LHeC linac ring option:

For the 1:3:5 arcs:

Conventional excitation:	1 + 3 + 5 =	**9**
Alternative arrangement as described:	1 + 2 + 3 =	**6**

For the 2:4:6 arcs:

Conventional excitation:	2 + 4 + 6 =	**12**
Alternative arrangement as described:	2 + 2 + 4 =	**8**

In both cases, there is a reduction of required amp-turns by a factor of 1/ 3.
Coil volume and losses are reduced by approximately that factor.

Problems

- The vertical limbs at the magnet ends will induce some horizontal stray field;
- if the central magnet needs to be displaced horizontally (to make the different momenta beams have the same horizontal position), the end links on the coils will also have a vertical component stray field;
- the stray fields will be generated by the full amp-turns – not just by a single conductor (as with power connection at the ned of a magnet);
- how is the assembly of the three magnets and associated three linked coils achieved?

Are triple deckers catching on?

The end!

Thanks for listening.