(built by Saclay/IPN Orsay/ LAL Orsay) is scheduled for fall 1995.

Colliding muons

Is a muon-muon collider really practical? That is the question being asked by Bob Palmer. Well known in particle physics, Palmer, with Nick Samios and Ralph Shutt, recently won the American Physical Society's Panofsky Prize (March 1993, page 26) for their 1964 discovery of the omega minus. As well as contributing to other major experiments, both at CERN and in the US, he has contributed ideas to stochastic cooling and novel acceleration schemes.

Earlier this year he gave a series of CERN academic lectures on electron-positron colliders. Such machines with collision energies up to 1 TeV seem relatively practical, but, because of energy loss due to synchrotron radiation, must be linear (which makes them expensive) and suffer from additional energy loss (beamstrahlung) at their collisions.

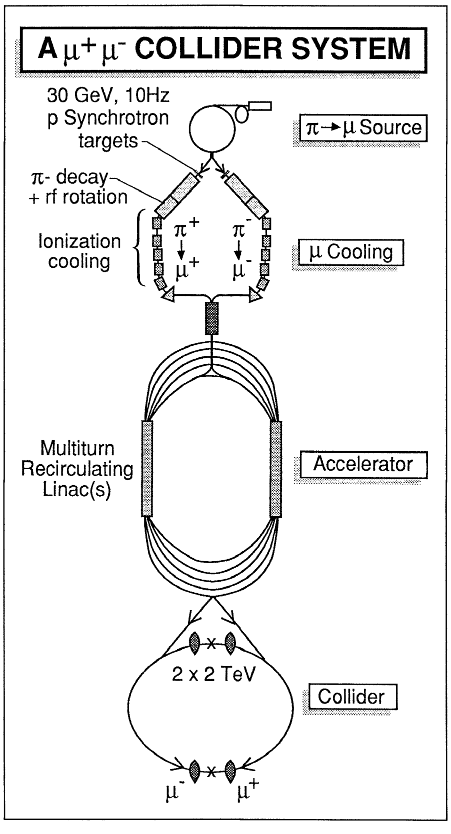
An alternative approach would be a muon-muon collider, with synchrotron radiation suppressed by the 'heavy' muons - more than two hundred times heavier than electrons. The machine could be circular, much smaller than an electron machine of the same energy, and could give a comparable luminosity.

Muon colliders were first proposed by A.N. Skrinsky (in the 60s), using Gersh Budker's ionization cooling ideas to control the muons. He and others have proposed various parameter sets, but no complete scenario has been presented. This year David Neuffer and Bob Palmer presented one.

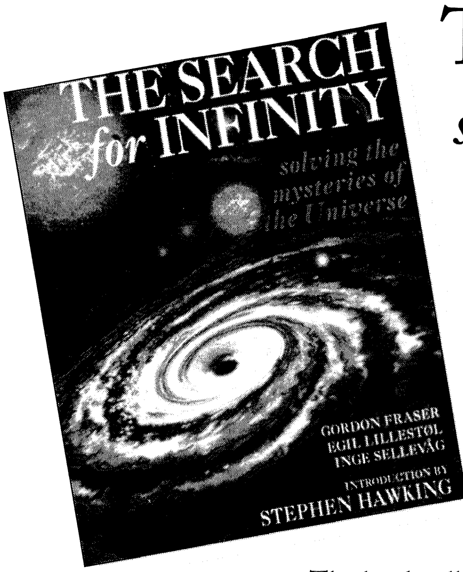
With a small group at Brookhaven, they have started to simulate the production, transport and cooling of the muons. Using a realistic proton source (like that proposed for the Vancouver KAON machine), realistic targeting (such as used in CERN's antiproton scheme) and ionization cooling using current-carrying rods, they calculate a luminosity of 3×10^{34} $cm^{-2} sec^{-1}$ at a beam energy of 2 TeV.

Such a machine would be of moderate size (it might fit in a Fermilab-size ring of some 6 kilometres). It appears to use more or less conventional technology, and might be almost an order of magnitude cheaper than an electron machine of the same energy.

However unlike electrons, muons are not stable, and decay into electrons and neutrinos. The greatest problem may be background in the detectors due to these decay electrons. The proponents of the idea are looking into this and other problems and are hoping to form a collaboration to look in more detail at all aspects of this proposal, and to perform an experiment to demonstrate the feasibility of ionization cooling.



Possible muon collider, as envisaged by Dave Neuffer and Bob Palmer, with the muon beams (from the decay of pions) controlled by ionization cooling before injection into a multi-turn recirculating linac arrangement, à la CEBAF, before finally being prepared for collision.



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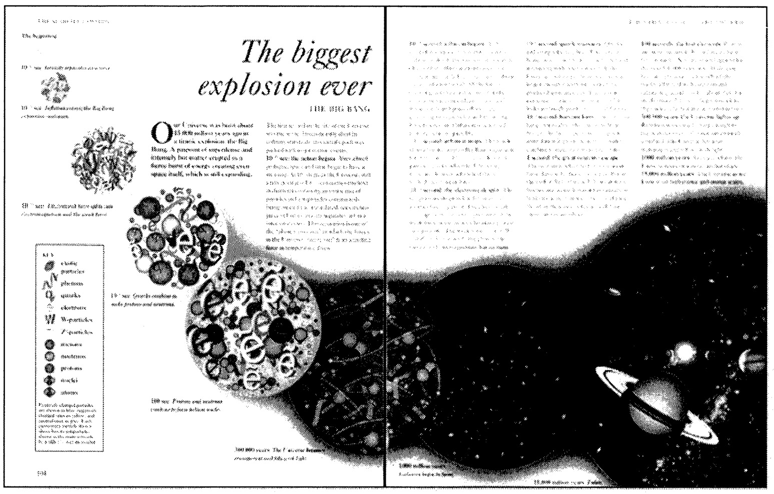

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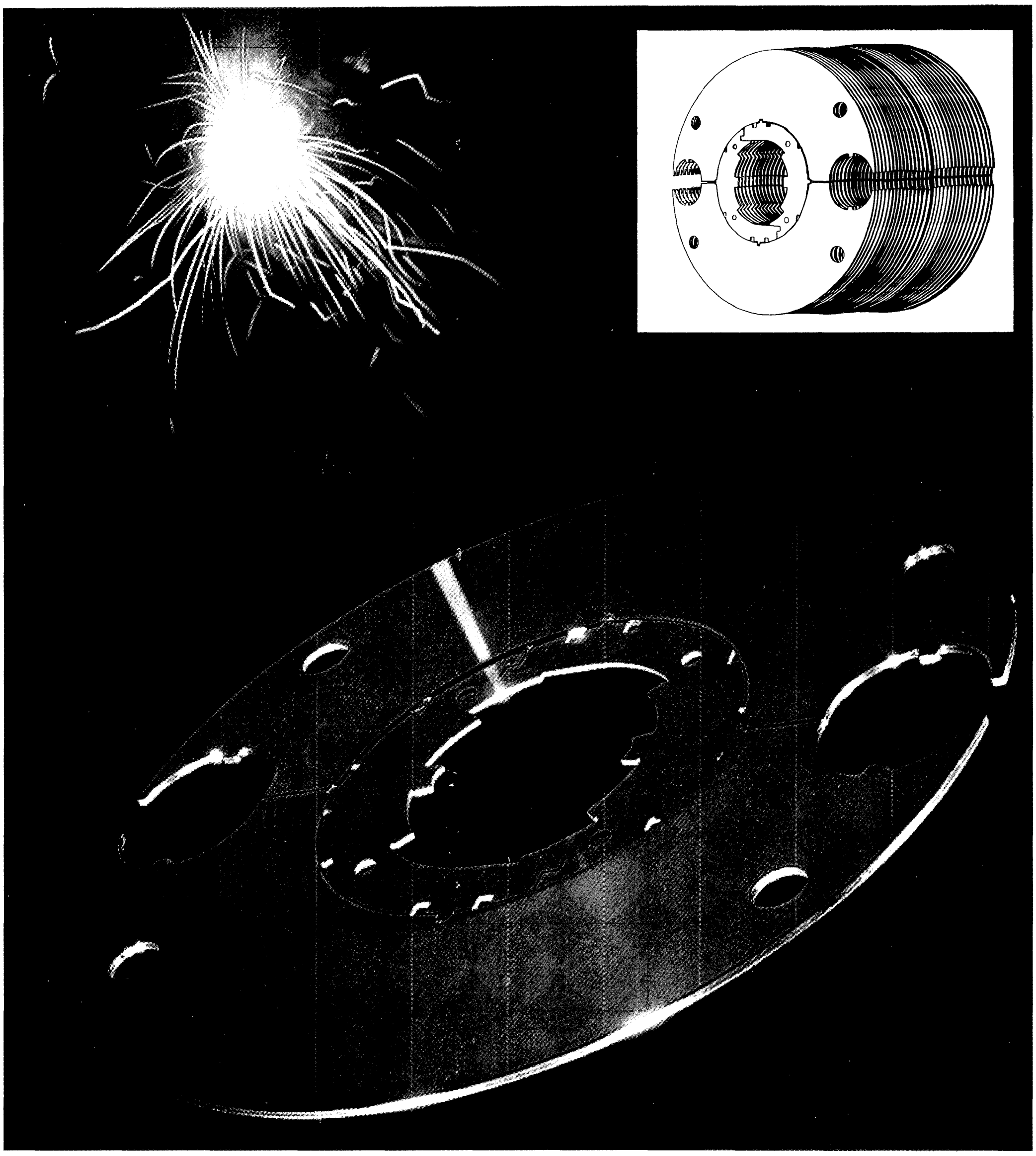

Die Spulen der ca. 6 m langen Magnete eines Speicherrings bestehen aus rund 3000 zusammengefügten "Scheiben" zu je vier Feinschnittteilen. Geringste Mass- und Planheitsabweichungen würden sich addieren. Feintooling, die wirtschaftliche Kombination Feinschneiden/Umformen erfüllt diese höchsten Anforderungen.

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