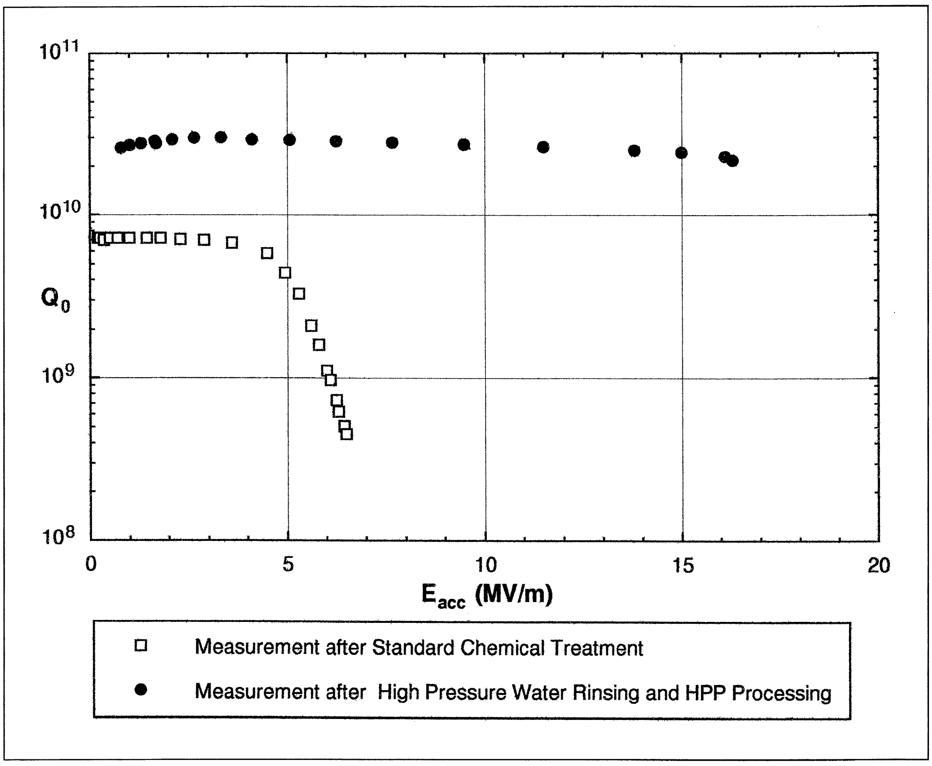
The existence and particularly the experimental verification of a phase transition should be easier to see in larger nuclear systems and/or higher beam energies. The next round is the lead beam experiments which begin at CERN's SPS this year, with a longer term view at Brookhaven's RHIC collider and subsequently the LHC at CERN.

As Ingvar Otterlund pointed out in his opening address, the European Research Conference could also demonstrate the healthy age distribution in the field. Among the 110 participants, almost half of the researchers were still below 35.

From L. Csernai and K.H. Kampert



After high pressure water rinsing and high peak power (HPP) radiofrequency treatment at DESY's TESLA Test Facility, promising accelerating fields have been produced by prototype superconducting cavities for a proposed TeV Superconducting Linear Accelerator (TESLA).

Linear Colliders TESLA

The aim of the TESLA (TeV Superconducting Linear Accelerator) collaboration (at present 19 institutions from seven countries) is to establish the technology for a high energy electron-positron linear collider using superconducting radiofrequency cavities to accelerate its beams. Another basic goal is to demonstrate that such a collider can meet its performance goals in a cost effective manner.

For this the TESLA collaboration is preparing a 500 MeV superconducting linear test accelerator at the DESY Laboratory in Hamburg. This TTF (TESLA Test Facility) consists of four cryomodules, each approximately 12 m long and containing eight 9-cell solid niobium cavities operating at a frequency of 1.3 GHz.

The infrastructure to process and test these cavities has already been installed. This heroic work calls for scrupulously clean conditions to avoid contamination which would otherwise mar performance. The facility thus includes a complex of clean rooms, an ultraclean water plant and a chemical etching installation for cavity surface preparation and cavity assembly. To improve the cavity performance a firing procedure at 1500 C in an ultrahigh vacuum furnace is foreseen.

Radiofrequency power will be provided by a 4.5 MW klystron (pulse length 2ms) in connection with a modulator, built by Fermilab. This system is also used for a high peak power radiofrequency treatment (HPP) to further improve cavity performance by eliminating potential sources of field emission. For cavity testing, an existing cryogenic plant has been modified to cool the cavities to 1.8 K and measure them in vertical and horizontal test cryostats, provided by Fermilab and Saclay respectively.

Prototype cavities have been already delivered to DESY and are presently being used to commission the complete infrastructure. First measurements indicate that cavity performance can be drastically improved by advanced surface processing techniques like high pressure water rinsing developed at CERN and high peak power radiofrequency treatment developed at Cornell. Further improvements are expected from high temperature cavity annealing in the UHV furnace. The initial TTF goal is an accelerating field of 15 MV/m at a resonance (Q) value of 3×10^9.

The first series cavities for the TTF arrived in September and initial beam tests of a complete TESLA cryomodule (constructed by INFN Frascati/Milan/Rome) with an injector

(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.

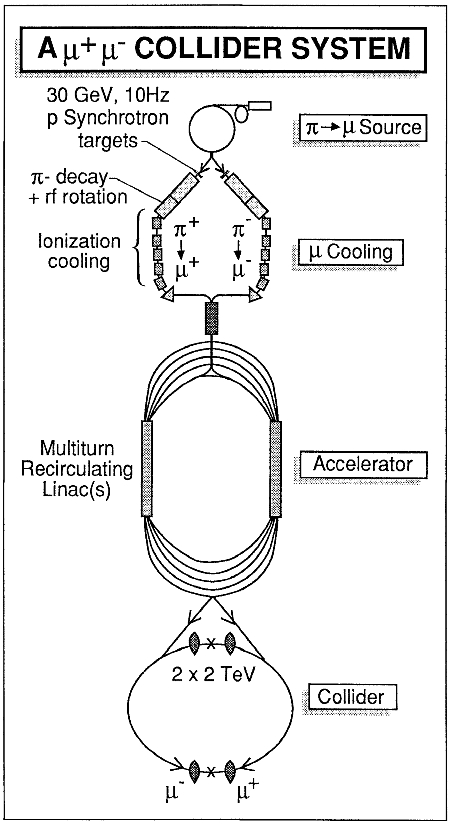
An alternative approach would be a muon-muon collider, with synchrotron radiation suppressed by the 'heavy' muons - more than two hundred times heavier than electrons. The machine could be circular, much smaller than an electron machine of the same energy, and could give a comparable luminosity.

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.