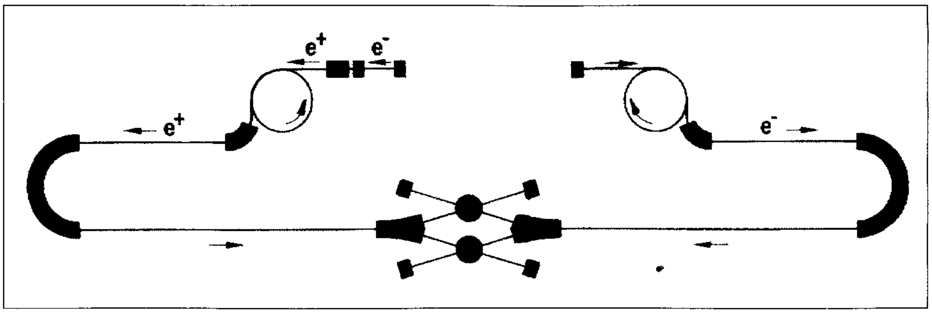
from a major Laboratory such as CERN.

The NESTOR collaboration hosted an informal workshop in Pylos for deep water neutrino detection in October.

A possible scheme for incorporating two beam intersections in an electron-positron linear collider.



LINEAR COLLIDERS 1992 workshop

As work on designs for future electron-positron linear colliders pushes ahead at major Laboratories throughout the world in a major international collaboration framework, the LC92 workshop held in Garmisch-Partenkirchen this summer, attended by 200 machine and particle physicists, provided a timely focus.

With the goal of exploiting conventional technologies for attaining electron-positron energies in the TeV region, the workshop was the fourth in a series. Previous meetings were at SLAC, Stanford (1988), KEK, Japan (1990) and Protvino, Russia (1991). At Garmisch-Partenkirchen, discussion focused on building a machine to attack the 300-500 GeV region, beyond the energies which soon will be opened up once CERN's LEP electron-positron ring is equipped with its full complement of superconducting radiofrequency accelerating cavities.

In addition to working groups on electron-positron sources, damping rings, radiofrequency sources, main linac, and final focus, this year's meeting saw the introduction of four new working groups – critical comparison of machine proposals, design of experiments, work towards a superconducting machine, and instrumentation.

With a view to finding the best technical solutions for the 500 GeV machine, technology groups had lively discussions comparing engineering solutions for the various components under study at different Laboratories. As Maury Tigner put it, 'it is manifest that the competition of ideas that took place has already made considerable improvements in the various approaches'. Superconducting machine studies by the TESLA (TeV Superconducting Linear Accelerator) collaboration are now included in general linear collider technology discussions.

The work of the instrumentation group was based on the important lesson learned at Stanford's SLC linear collider that good monitoring and feedback systems are needed for the control necessary to achieve reliable and stable operation.

The experimentation group looked at various detector designs and physics issues and their relation to the machine design. New theoretical and experimental progress in understanding the 'minijet' background (due to quark/gluon jets from subsidiary photon-photon collisions accompanying the main electron-positron collisions), together with the introduction of multibunch operation, seem to be significantly reducing this problem.

The important machine feature of being able to accommodate two interaction regions, indispensable for scientific cross-checking, was addressed for the first time. The physics case for 300-500 GeV operation was reviewed positively and it was stressed that the energy of such a machine should be upgradable to around 1 TeV.

	TESLA	DLC (D-D)	NLC (SLAC)	JLC (KEK)	VLEPP (P/N)	CLIC (CERN)
Collision Energy (GeV)	500	500	500	500	500	500
Gradient (MV/m)	25	17	38	28	96	80
Active Length (km)	20	30	14	17	6.4	6.6
Frequency (GHz)	1.3	3	11.4	5.7	14	30
Pulse rate (Hz)	10	50	180	150	300	1700
Bunches per pulse	800	172	90	72	1	1-4
Luminosity ($10^{33}cm^{-2}s^{-1}$)	8	4	9	9.7	12	.8-3.2

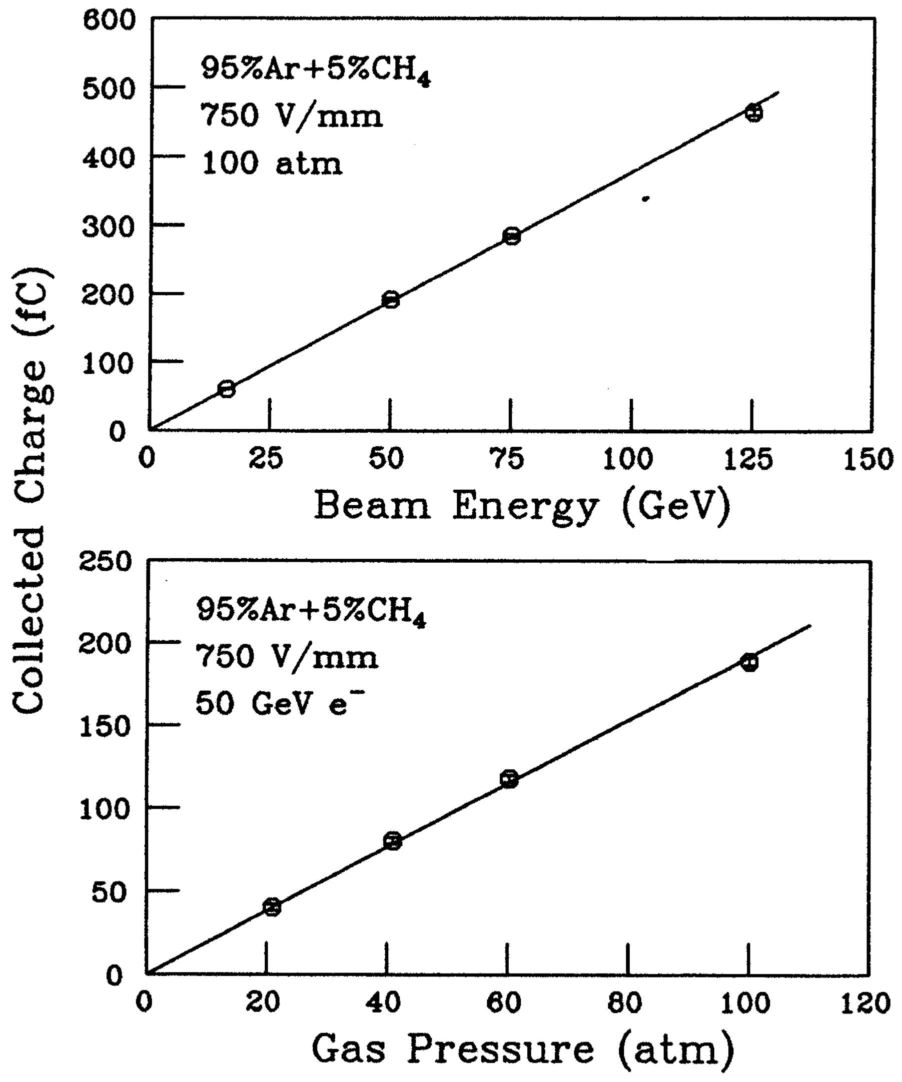
Examples of electron-positron linear collider projects now being studied. The TESLA collaboration (CEN Saclay, CERN, Cornell, Darmstadt. DESY, INFN Frascati and Milan, Wuppertal) is looking at a superconducting radiofrequency solution. D-D stands for DESY-Darmstadt, P/N for Protvino-Novosibirsk.

Finally the design parameter comparison group began to prepare for a convergence of conceptual design reports in 3-5 years, when a realistic proposal could be launched.

These discussions strengthened the collaboration between the various groups around the world and consolidated the groundwork so that the ongoing research and development programme can continue to proceed coherently. Next year's workshop will be held in SLAC in October.

From Ron Settles & Guy Coignet

Results from a 1991 test at Fermilab of a prototype electromagnetic calorimeter using high pressure gas and built by a US-Dubna group. The collected charge plotted against beam energy (top) and gas pressure (bottom) shows excellent linearity.



High pressure gas – a new approach to calorimetry

The high particle collision rate and radiation levels in detectors at the new high energy high luminosity proton colliders (SSC, LHC, UNK) put stringent demands on the design of detector components. In particular the forward calorimeters will have to deal with particle fluxes in excess of 4×10^6 per sq cm per s and high radiation doses (at the MGy level).

Traditional calorimetric techniques using scintillator, liquids or gases at one atmosphere as sampling medium, might not work in this demanding forward region. In the search for a new approach, several groups in Russia and the US have been investigating the possibilities of gas under high pressure, an inexpensive solution offering several advantages (radiation resistance, no cryogenics, fast response,....).

The first investigation of a multiplate, total absorption, high pressure ionization spectrometer was done by a Soviet group led by Dolgoshein in 1978, and subsequent research and development work for electromagnetic calorimeters pushed ahead in the USSR and at CERN, led by Chris Fabjan. The growing awareness of the challenges for detectors at the next generation of proton colliders intensified this effort.

In 1988, a Rockefeller/Fermilab/Wisconsin/Rochester collaboration studied the physics of signals produced by an americium source in argon and argon-methane gases at 100 atmospheres. They found that the collected signal is insensitive to oxygen contamination up to 80 ppm and that the electron drift velocity in a