

LEP 2000

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Summary

During 1997 LEP was operated for the first time with energies per beam of more than 91.5 GeV, significantly above the threshold for W^\pm production. This beam energy was made available by the installation of a total of 240 superconducting cavities.

Phase VI of the LEP2 project foresaw a total of 272 superconducting cavities which would allow a maximum beam energy of around 95 GeV.

At the beginning of 1997, in response to requests from the LEP200 physics working group and the LEPC, a working group was set up to investigate the possibility of operating the existing sc cavities at higher gradients (around 7MV/m) to allow a beam energy of 100GeV/beam. The major problems were identified as the following.

1. the production of an **average** gradient of 7MV/m in the superconducting cavities
2. the cryogenics power required to cool the cavities at this increased gradient,
3. the influence of the high energy synchrotron radiation on the various vacuum components.
4. the dynamic aperture required for the increased beam sizes at the higher energies.

These topics have been given considerable attention during 1997 with the following results.

- Several “better” LEP modules were operated above their design gradient during 1997 operation. One modules was successfully operated at 6.7 MV/m for several hours in the presence of a beam current of around 4mA. However a lot of detailed work needs to be undertaken during 1998 in order to have any chance of operating all cavities at a significantly higher gradient in the presence of high beam intensities.
- Various spare parts have been identified which, with the purchase of some additional ancillary equipment, will allow construction of an additional 16 superconducting cavities, bring the total to 288 and alleviating to a small extent the requirements on the maximum gradient.
- An upgrade to the cryogenics plants of LEP2 has been proposed. This proposal anticipates the early use (for LEP) of part of the cryogenic upgrade needed for the LHC machine. With the presently existing LEP cryogenics system the maximum energy with reasonable luminosity is between 96 and 97 GeV depending on the magnetic configuration.
- During the 1997-1998 shutdown the LEP vacuum system will be significantly improved in order to allow it to be more resilient to the high energy, high flux synchrotron radiation.
- During the last two weeks of operation in 1997 a new high energy optics (“102/90”) was successfully tested.

In summary, we have not yet found any insurmountable, fundamental effect which would exclude operation at energies around 100GeV. Nevertheless many significant improvements need to be made to many systems if we hope to operate LEP at such high energies.