CLIC (Compact Linear Collider)

future electron-positron collider in the multi TeV range
3 TeV center-of-mass energy (< 50 km total length)

TWO-BEAM ACCELERATION

- Drive beam is decelerated in the power extraction structure
- The 12 GHz RF power is transported to the accelerating structure
- Probe (main) beam is accelerated by the extracted power

The feasibility of the concept is demonstrated at CTF3:
THE CLIC TEST FACILITY AT CERN

NEW 12 GHZ TEST STAND

Most effective way to achieve high statistic data on breakdown physics

RF TESTS:

- the conditioning of the structure
- measurement of the breakdown rates at different power levels
- detection of dark current and light emissions directly relevant to breakdown physics
- measurement of dynamic vacuum due to breakdowns and dark currents

ACCELERATING STRUCTURES

- CLIC beam accelerating structures have to provide an average of 100MV/m gradient (150MV/m achieved in TBTS this year)
- Only room temperature travelling wave structures at high frequency are likely to achieve this gradient.
- Present record is 193 MV/m (at 30GHz with a pulse length of 15ns)

Total number of accelerating structures in future CLIC ~ 140000!
Current limitation is
RF BREAKDOWN
(max. breakdown rate for CLIC <10^-8)

RF BREAKDOWN
(RF initiated surface plasma process)

Direct effects:

- heavy reflections back to the RF source
- a cut-off of the transmitted power
- a collapse of the accelerating field inside the structure
- possible stimulation of transverse fields which can give a transverse kick to the passing beam

Accompanying effects:

- the ejection of electrons and ions out of the structure
- light and X-rays emission
- surface damage

DYNAMIC VACUUM

Very difficult to measure
During the 240 ns RF pulse pressure changes in a small volume faster than sampling of the vacuum gauges

Idea ⇒ Laser-based system:
(collaboration with Helsinki Univ.)
- Widening of a mode-locked short laser pulse
- Spectroscopy (emission, absorption, Raman)
- Detection of refraction changes

DARK AND BREAKDOWN CURRENT:

Spatial and energy distributions of the emitted electrons?
Idea ⇒ pepper-pot with an external magnetic spectrometer
Fast (single shot) measurement of the area occupied by the exiting electrons in the phase-space together with energy determination

This work is supported by the Swedish Research Council and the Knut and Alice Wallenberg Foundation