WP9: 30 GHz stand-alone power source for development of CLIC RF equipment

Why? 'Isn't CTF3 the 30 GHz power source?'

- During CTF3 construction phase, only limited time will be available to produce 30 GHz power, but the test program is ambitious.
- CTF3 is a test facility, not a production accelerator.

What exactly would one require?

- High reliability (*we want to test structures, not this power source!*)
- 30 GHz, high peak power (≈ 200 MW) – high rep. rate (140 ns, 50 Hz), in WR34.
- 200 MW from a single device is very ambitious but power combination and pulse compression (see WP 2.3) can be considered.
- a highly reliable device even at 50 MW would be very useful in the initial stages of the structure test programme.

When?

- ASAP! Maybe more realistic: lead-time 2.5 to 3 years: operation from 2007.
- On the longer term (after CTF3), one would need a number of these power sources for structure and component tests and conditioning.

Candidates:

- Gyroklystron – state of the art: 32 MW at 20 GHz, 1.8 MW at 30 GHz (U Md).
- Magnicon: – state of the art: 10 MW at 34 GHz (Omega-P)
- Klystron: – state of the art: 25 MW at 17 GHz (Haimson)
- other: CARM?, Gyro-TWT?, FEM?, …

Results of preliminary design study (CPI):

A 200 MW power station could consist of (indicative):

- Four 50 MW gyroklystrons, 1.2 μs, 100 Hz, fundamental TE_{011} coaxial cavities.
- four SC solenoids 2 T + power supplies (≈ 300 k$ each)
- two 15 kW drivers + power supply (≈ 370 k$ each)
- one modulator 500 kV, 1.2 kA (≈ 1000 k$)
- two (or three) power combiners 50 MW + 50 MW (≈ 20 k$ each).
- ancillary equipment.

The overall cost estimate of 10 MCHF was based on this study.

Time schedule : Delivery mid 2006, ready for operation at CERN beginning 2007
Resources : 10 MCHF and 6 man.years

References:

- M. Thumm: "State-of-the-Art of High Power Gyro-Devices and Free Electron Masers Update 2003," http://bibliothek.fzk.de/zb/berichte/FZKA6957.pdf
- Steven H. Gold: "Overview of Advanced, Non-Klystron rf Sources," Snowmass 2001, http://www.slac.stanford.edu/econf/C010630/papers/T301.PDF