REVIEW OF SESSION 1.2   KLYSTRON TECHNOLOGY

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These were 4 completely different papers with essentially nothing in common except that all devices were designed or built to power accelerators.

To summarize:

1. The CPI paper (Ed. Eisen)

CPI is developing klystrons for SNS at 805 MHz. Ed discussed the experimental performance of the high power tube (2.5 MW peak, 250 kW average) and the predicted performance of a lower power tube (550 kW peak, 8% duty cycle) for superconducting cavities. These are pretty straightforward klystrons, with good efficiency. The design (single beam, ordinary cavities) is optimised for the frequency and power.

2. The TMD Technologies paper (Graham Phillips)

This is a paper tube, so far, but a design that will probably be successful. The problem is getting a very wide bandwidth (10%) at a relatively low power (500 kW) at L-band. At 100 kW and a microperveance of about 2, and 30% efficiency the beam impedance is about 2500 ohms. If one assumes a required gap impedance of perhaps 3000 ohms and an R/Q of 120 in a single cavity, then the Qext would be about 25, which would only produce a half-power band width of 4%. The fact that an overlapping mode (0-π), 2-gap output cavity was used and the 10% bandwidth obtained, is quite impressive.

3. The THALES paper (Armel Beunas)

This is the first MBK built and delivered to a customer in the Western world. It is assumed that the reasons for the 7 beams are both lower the voltage and increased cooling surfaces, in addition to higher efficiency at lower perveance, (which is the main reason). The tube appears quite uncomplicated despite the seven cathodes and drift tubes. If a single beam tube had been attempted, instead of an MBK, and if a comparable efficiency was desired, then a klystron with μK = 1 and an efficiency of 50% would have a beam voltage of 210 kV, instead of 117 kV. The tube would have also been much longer.

4. The SLAC paper (George Caryotakis)

This is perhaps the first fully simulated sheet beam klystron. It uses 2 sheet beams (with a 10:1 aspect ratio) to produce 150 MW peak, and 50 kW average power, at 11.4 GHz. Simulations performed so far suggest that the beam and circuit will be stable, the efficiency is high, and parts count very low, hence a low cost source for the NLC which requires over a 1000 klystrons at half that power.

We believe that a “DSBK” klystron at 30 GHz (for CLIC) could be designed to produce 50 MW at good efficiency (> 50%).