RF System Configuration

Recommendations for Items 46,47

The following two slides illustrate an rf system configuration based on a peak gradient capability of 35 MV/m and an average operating gradient of 31.5 MV/m.

The first slide shows that with a 7% rf distribution loss (based on the TDR design) and an 11% power overhead (to operate below klystron saturation for rf stabilization), a single 10 MW klystron could power 24 cavities (this rf overhead is similar to the TDR value: however it is a guess and studies should be done at TTF to find a practical value). The cavities are divided into three cryomodules (instead of two) since (1) this is the configuration that has been used and will continue to be used for several years and (2) the cavity gradient variation can be more efficiently dealt with if there are less cavities per cryomodule - this assumes that there would be an attenuator on each cryomodule feed, as illustrated, to allow independent adjustment of the power to each cryomodule.

The second slide computes the number of such rf units required for 500 GeV operation (power for the bunch compressors and to make up for losses in the undulators is not included). It is assumed that a 5% overhead of rf units would be provided to replace failed units and for overhead for BNS phasing (this is the same overhead assumed in the US Options Study). Overall, 71% of the peak rf capability would be converted to beam power.

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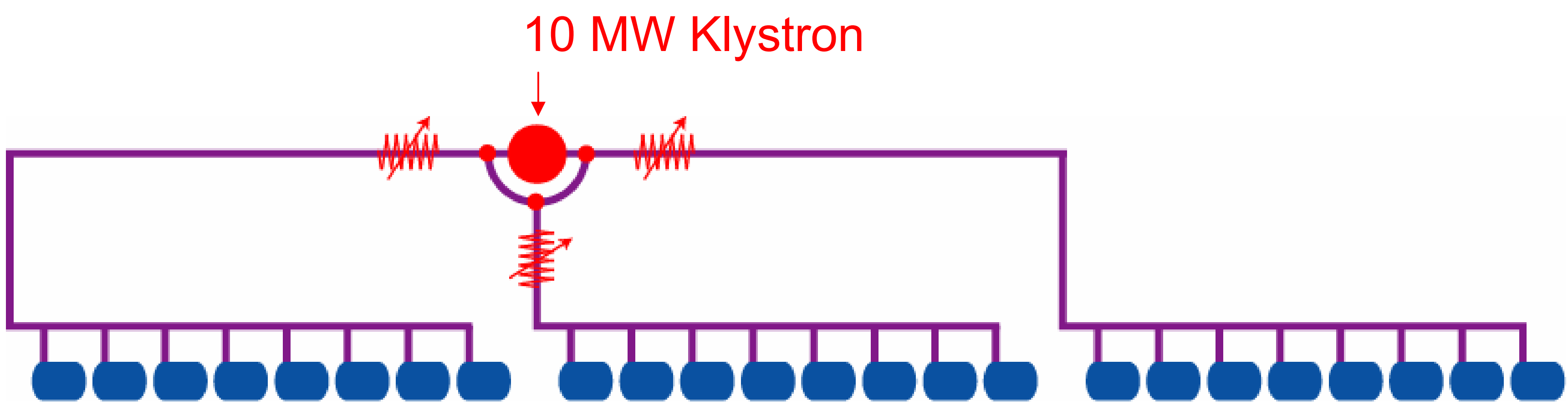
RF Distribution Math
(for 35 MV/m Max Operation)



35 MV/m * 9.5 mA * 1.038 m = 345 kW (Cavity Input Power)

× 24 Cavities

× 1/.93 (Distribution Losses)

× 1/.89 (Tuning Overhead)

= 10.0 MW

RF Components per Linac

- Average cryomodule gradient = 31.5 MV/m
- Overhead for BNS and failed units = 5%
- Number of cavities (ignoring BC, Undulator)

  = 1.05*(250-5)/(0.0315*1.038) = 7868
- Number of 8-cavity cryomodules = 984
- Number of 10 MW rf units = 328
- Beam Power / Peak RF Power Capability

  = 245 GeV * 9.5 mA / (328 * 10 MW) = 71%