

# Klystron Cluster Availability

- Faults before the 'tap in' CTOs.
  - Any mod/kly can be shut off and the 'backward' flowing rf will go to a isolator. There would also be a slow (1 min) switch to isolate the rf power just before the CTO.
  - Would have two spare klystrons per cluster, so effectively no downtime from any faults in this area (assume fault repaired before second one occurs).
- Faults between the 'tap in' CTOs and 'tap off' CTOs
  - Define spec to limit downtime to  $< 1\%$  per year (7000 hr). For each of the 20 clusters, assume two types of faults:
    - Ones that take 1 min to recover – could have 100 faults per year per cluster for  $\frac{1}{2}\%$  downtime
    - Ones that require 18 hours to recover (replace pipe) – could have 2 per year for  $\frac{1}{2}\%$  downtime
- Faults after the 'tap off' CTOs
  - Would have three slow (1 min) power dividers just after the CTO to control power going to each cryomodule.
  - Downtime basically the same as in the RDR case.