X-Band RF Structure Design and Fabrication

Fermilab

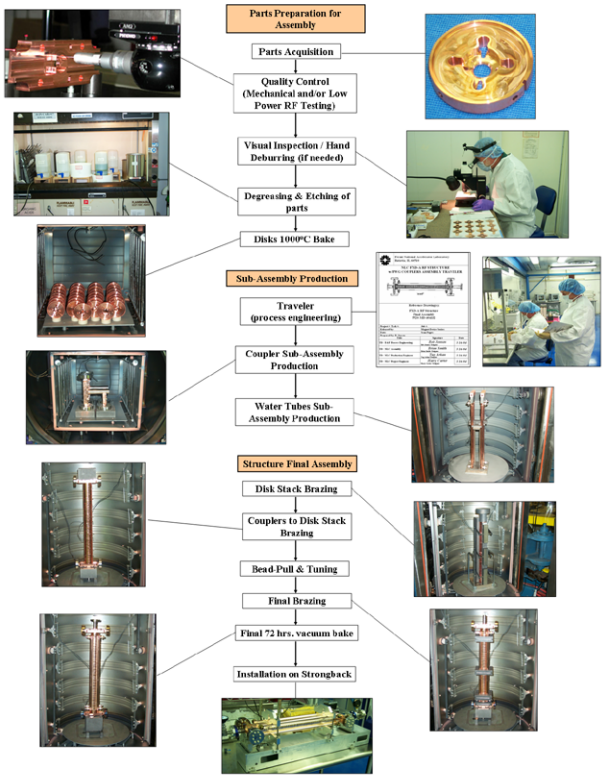
Structure production factory built up in 2-1/2 years from concept to a facility with a production rate of 2 structures per month.

Semi-industrial approach---All parts made in local industry using conventional precision machining with final assembly at Fermilab.

Excellent results achieved in reproducibility of single cells as well as flat field and phase profiles for entire structures.

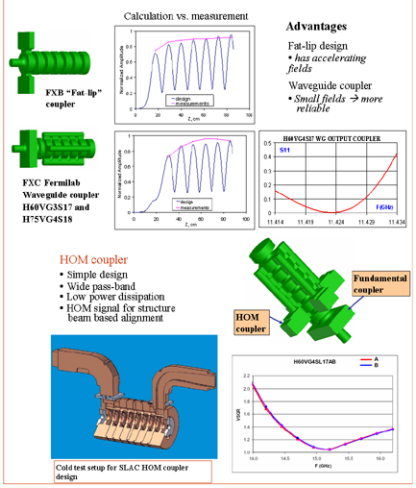
Structure cell-to-cell alignment and overall straightness routinely meets or exceeds mechanical requirements for NLC structures.

Structure Production at Fermilab



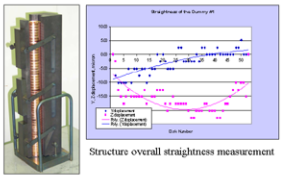
Structure RF and Mechanical Design

Fundamental Input/Output Couplers



Quality Assurance and Control

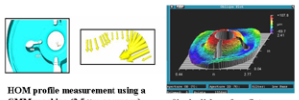
Parameter	Dimensions: Iris diameter	Dimensions: Cell diameter	Dimensions: Other	Alignment in structure: Cell-to-cell	Alignment in structure: Bow
Tolerances (μm)	10	10	25	20	50



Structure overall straightness measurement

To achieve required cell-to-cell alignment tolerances, the disk stack is assembled and brazed using a precision machined (10μm) carbon V-block.

Mechanical QC Measurements



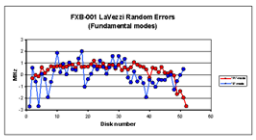
HOM profile measurement using a CMM machine (2.5 μm accuracy)

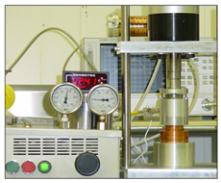
Single disk surface flatness measurement on Zygo Optical machine (full scale 4μm)

Low Power Testing

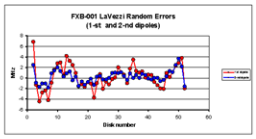
Single Disk /Assembled Coupler RF QC

Low pressure contact measurements
Pneumatic actuator, applied force 300±5 lb
Fully automated measurements of frequency (±500 kHz) and Q (5%)
Fundamental modes and HOM up to 40 GHz
Single disk, disk stack (up to 10 disks) and coupler assembly QC

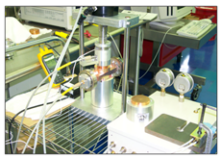




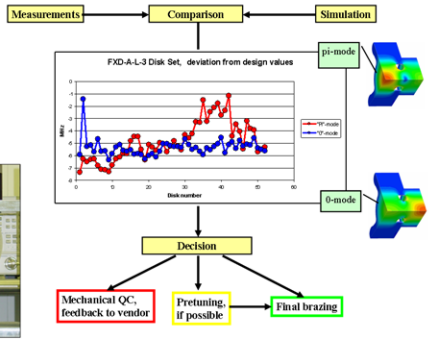
Single disk QC



Conventional Machining Reproducibility of Single Cells

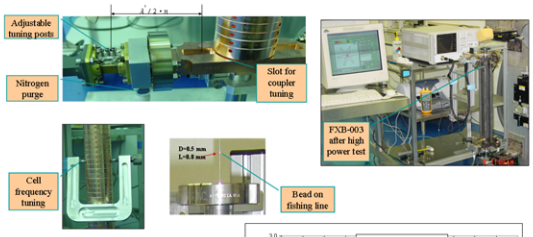


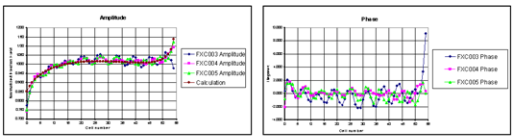
Coupler assembly QC



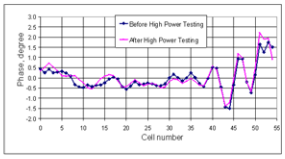
Bead-Pull and Tuning

Fully automated bead-pull measurements
S-parameter measurements
On-line cell and coupler tuning
Temperature control, nitrogen purge
Correction of systematic error due to fishing line





FXC Structures: Final Measurements (After Tuning)



FXB-002 RF Structure: Bead-Pull Measurements (Before & After High Power Processing) [7000 breakdowns]