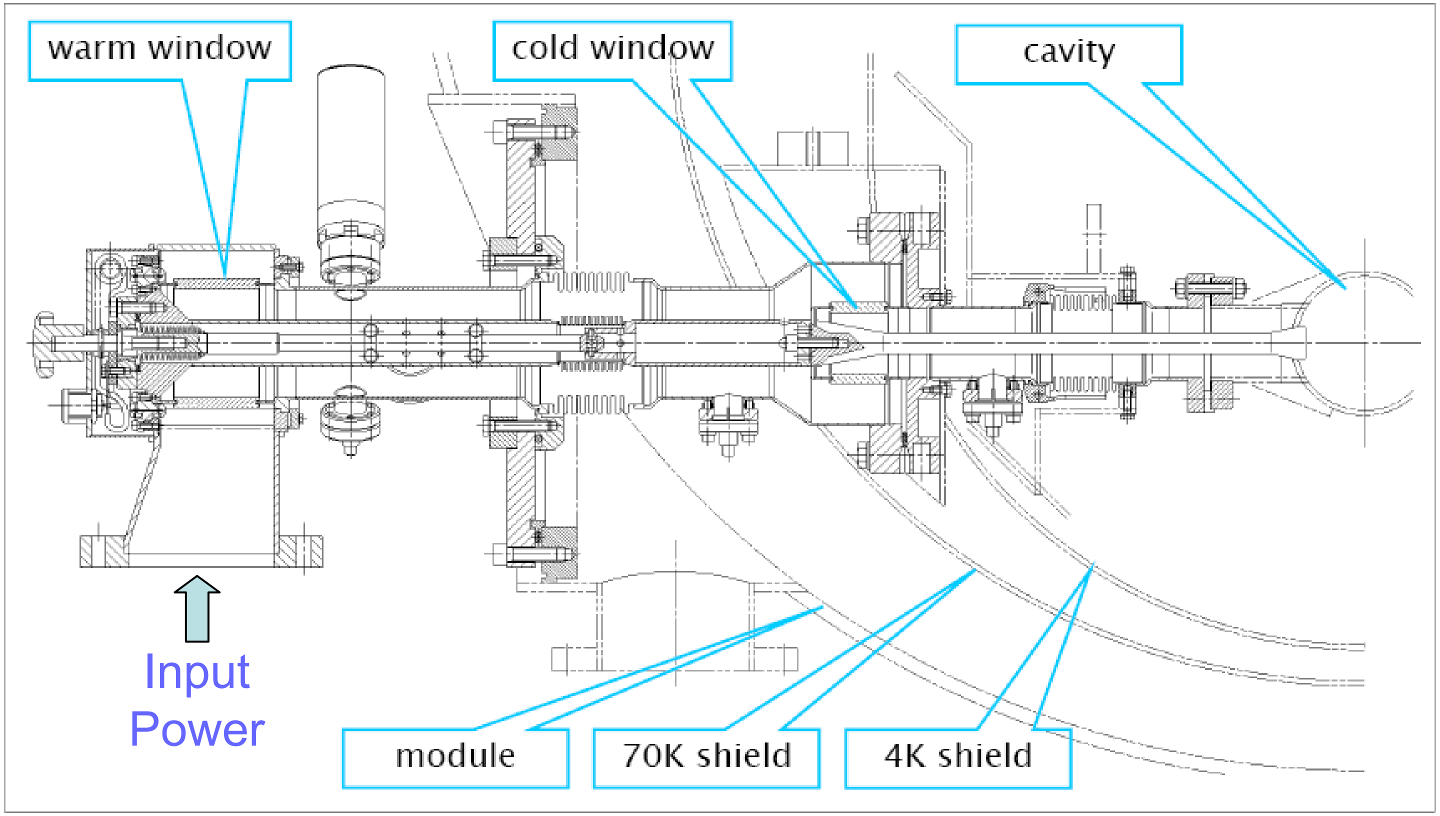
SLAC Proposal for PX L-band Couplers

Chris Adolphsen

TTF-3 Coupler Design

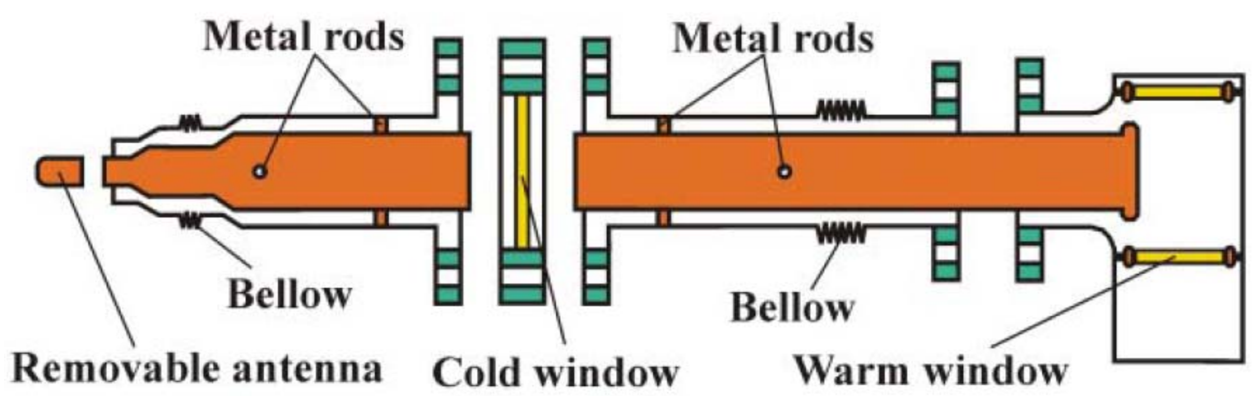
Design complicated by need for tunablity (Qext), dual vacuum windows and bellows for thermal expansion.

Coaxial Power Coupler

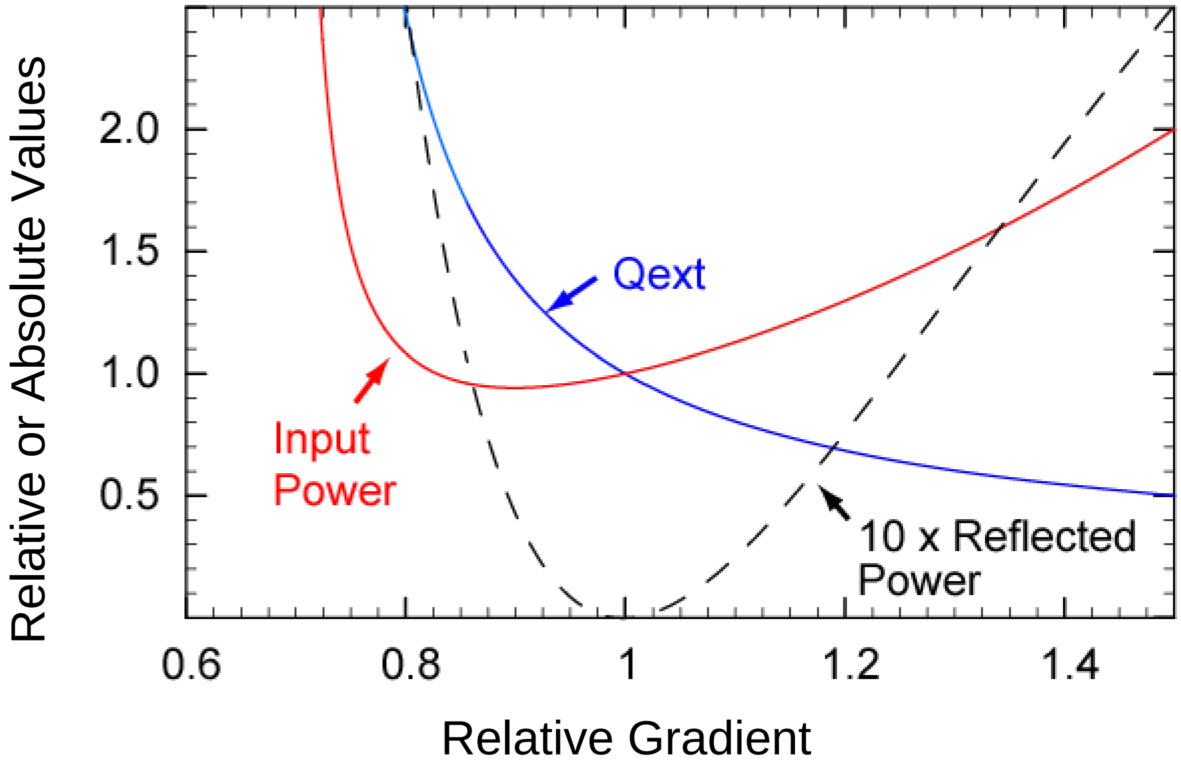


Baseline and Alternative Coupler Designs

	Cold Window	Bias-able	Variable Qext	Cold Coax Dia.	# Fabricated
TTF-3	Cylindrical	yes	yes	40 mm	62
KEK2	Capacitive Disk	no	no	40 mm	3
KEK1	Tristan Disk	no	no	60 mm	4
LAL TW60	Disk	possible	possible	62 mm	2
LAL TTF5	Cylindrical	possible	possible	62 mm	2



Achieving Uniform Gradient Along the Bunch Train in Each Cavity



Relative Gradient = Actual Cavity Gradient (due to TTF and Field Limits) /
Nominal Gradient for RF Unit (roughly the average)

Assume all cavities in RF Unit run at the same rf phase

SLAC Coupler Facilities and Capabilities

SLAC Cleanroom Dedicated to Coupler Assembly

- Building 006 High Bay before cleanroom (left picture)
- Building 006 High Bay after cleanroom (right picture)

SLAC Cleanroom

- Class 10 cleanroom 24 ULPA Filters (99.999% @ 0.12)
- Cleanroom size is 16’ x 12’

SLAC Cleanroom

Ultra Pure Rinse Station in class 10 area

SLAC Cleanroom

- Class 100 cleanroom 10 HEPA Filters (99.97% @ 0.3)
- Cleanroom size is 12’ x 12’

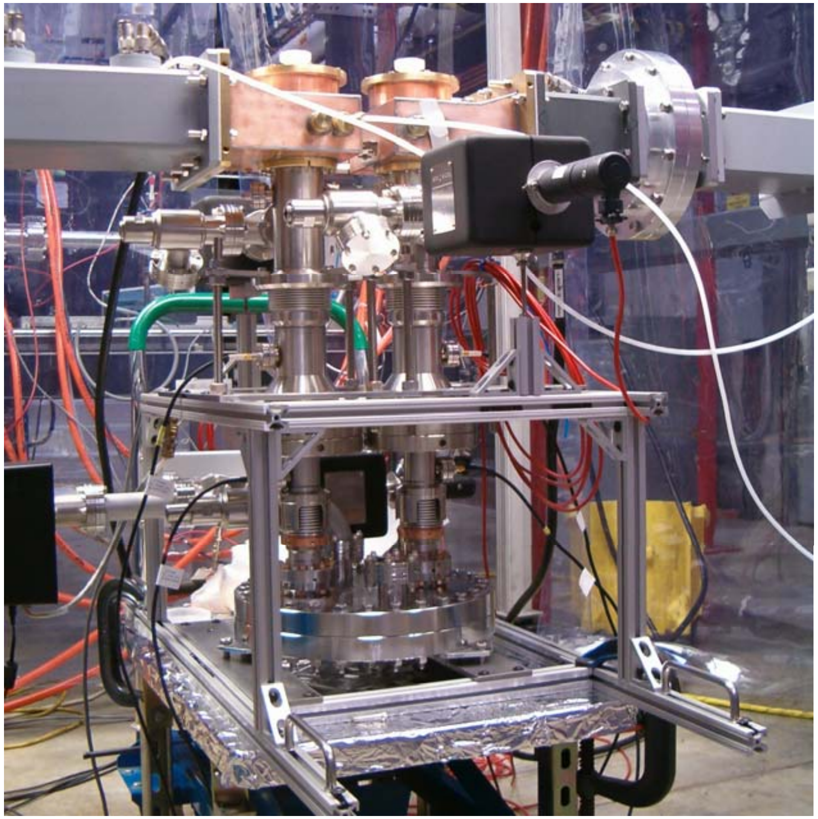
SLAC Cleanroom

Ultrasonic Wash Station in Class 100 area

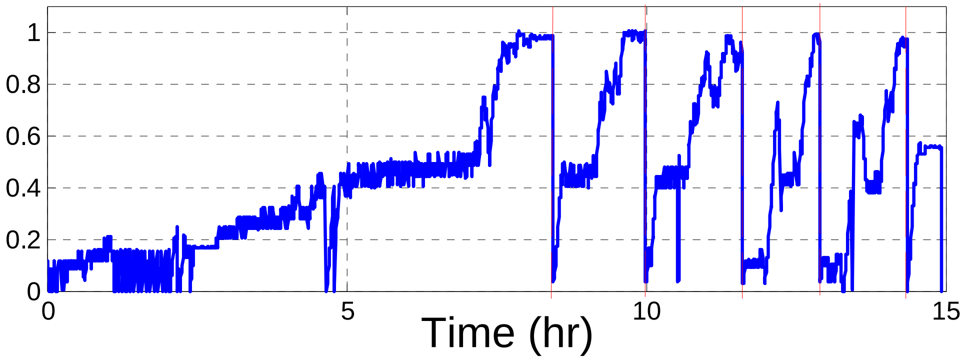
SLAC Cleanroom

- Air Shower
  - All material and personnel will go through the Air Shower to remove particulates prior to entering into the cleanroom.

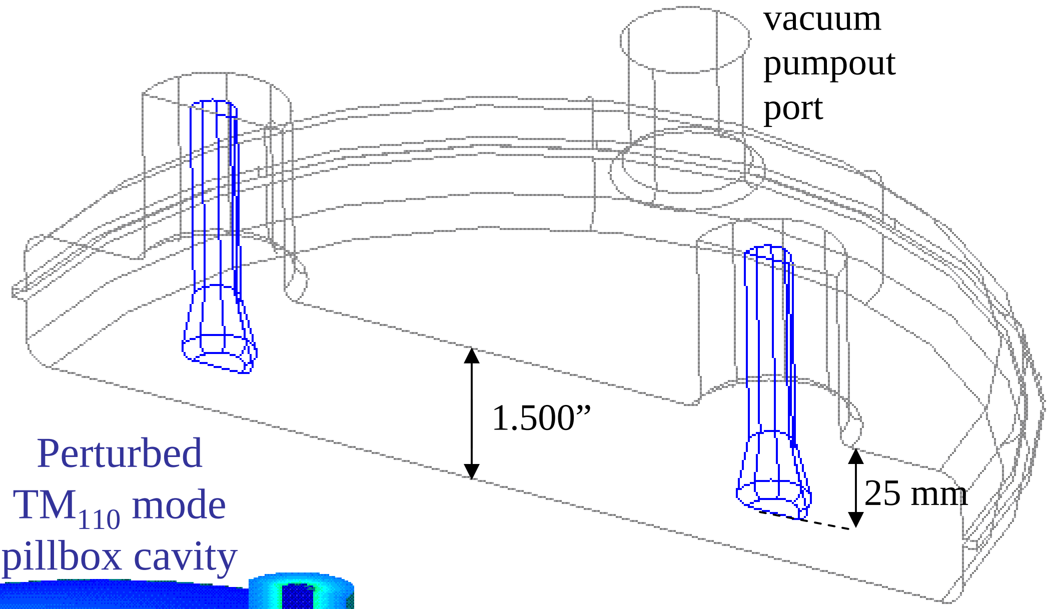
Power Coupler Sub-Assemblies and RF Processing Stand (4 MW Peak Power)



Processing of First Pair after 150 °C Bake: Power (MW) -vs- Time for Pulse Widths of 50,100, 200, 400, 800, 1000 μs

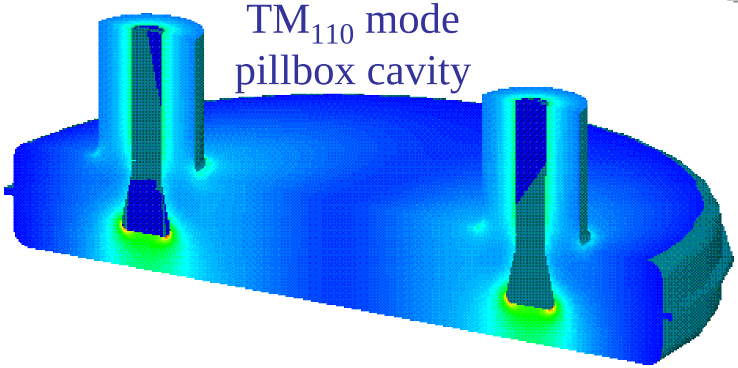


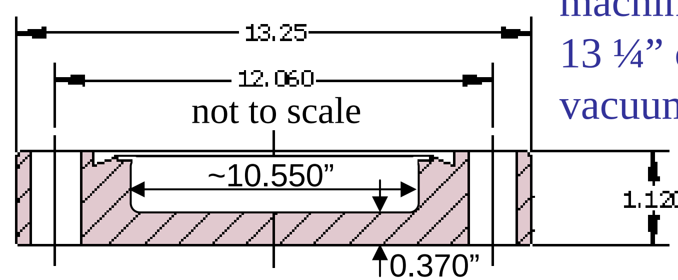
SLAC Connection Cavity



Opens fully for cleaning compared to enclosed DESY/Orsay design

Perturbed TM_{110} mode pillbox cavity





machined from two 13 ¼” conflat vacuum flanges

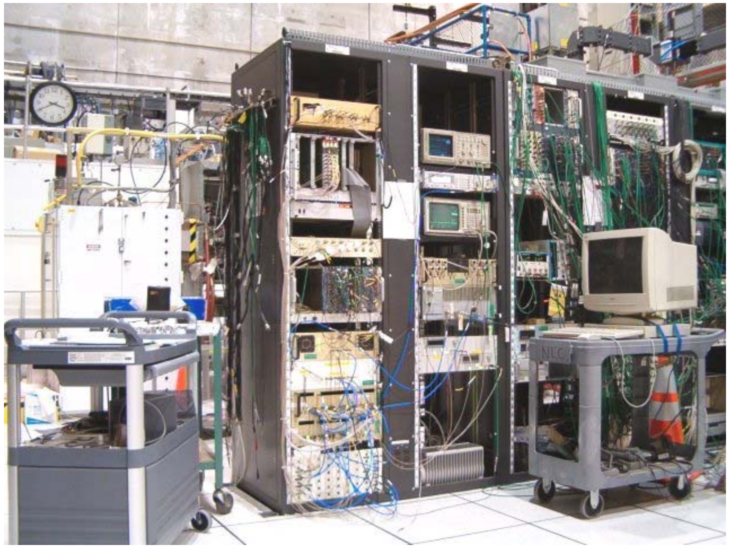
BW(S_{11}<-20 dB) = ~30 MHz

average dissipated power (Cu plated) = 0.13% × 1.3MW × 1.5ms × 5 Hz = ~13.2 W

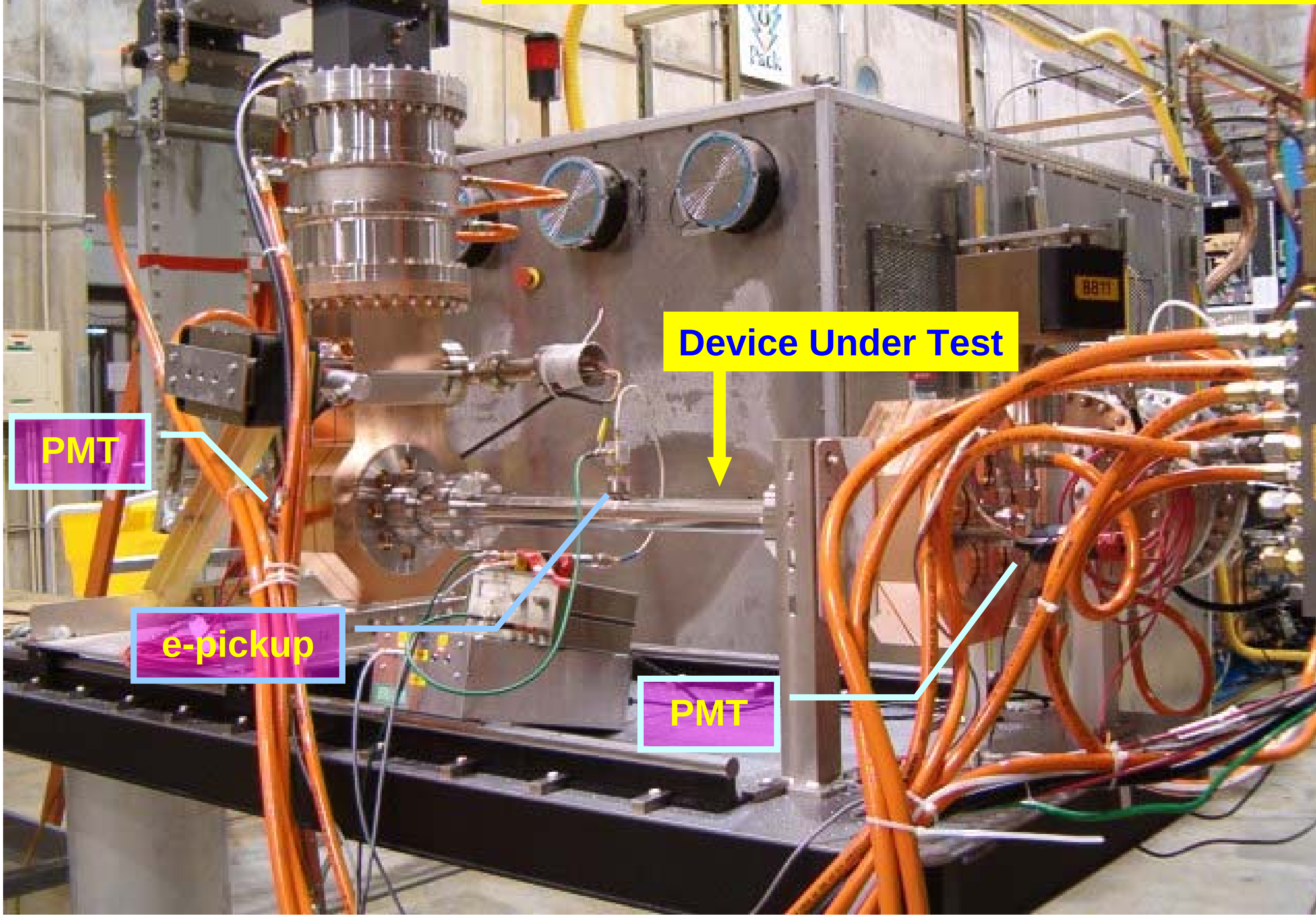
average dissipated power (stainless) = 0.23% × 1.3MW × 1.5ms × 5 Hz = ~22.3 W

integrated field from antenna tip = ~28.76 kV

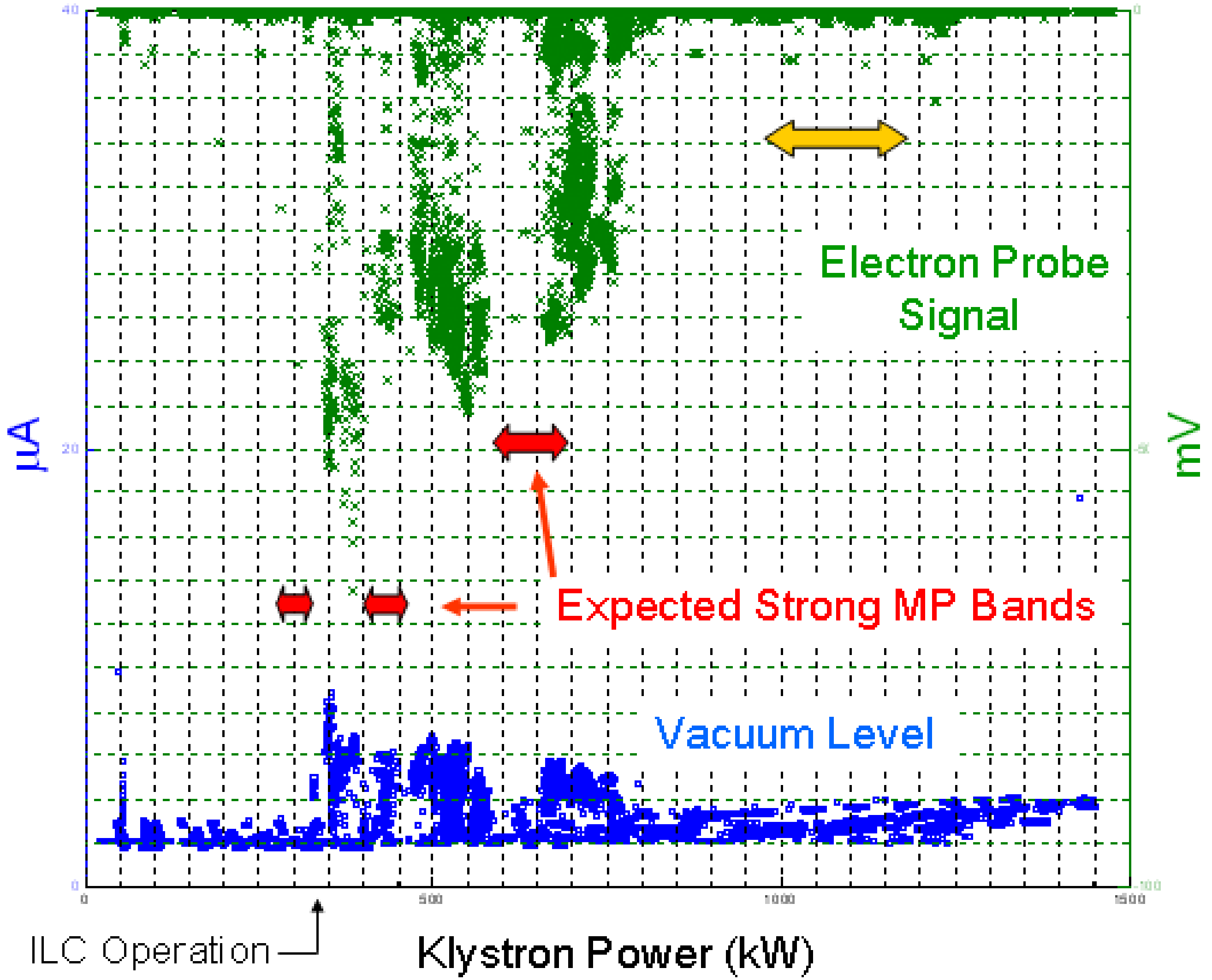
Current L-Band Test Stand in ESB



Coupler Component Test Stand



Multipacting in 40 mm Diameter SS Coaxial Line after Initial Processing



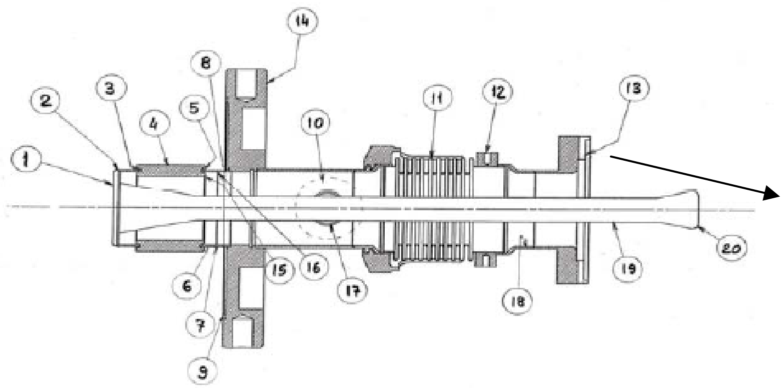
Coupler Fabrication

12 Couplers Ordered from CPI by FNAL have been Inspected – 4 warm and 3 cold sections being repaired

STANFORD LINEAR ACCELERATOR CENTER

TTF3 Coupler Metrology Report

Inspection of Cold Part 3964328/A.000						
Serial Number:	CP3C41	Inspector:	Keith Caban (CMM)		Date:	11/9/2007
Serial Number:	CP3C41	Inspector:	Tom Nakashima Video		Date:	11/14/2007



Item	Inspection Criteria	DESY Print Number	LAL Print Number	Findings	Pass
1	Visual: Nicks, scratches, proper edge chamfers	3964328/A.003	I65-3D-1250		X
2	Visual: Weld form, size, and porosity	3964328/A.000	I65-2E-1200		X
3	Visual: Brazing: Irregularities, centering of groove , buildup Ceramic: metallization borderline,coverage, chamfer	3964328/A.200	I65-3S-1260		X

Coupler Inspection Results

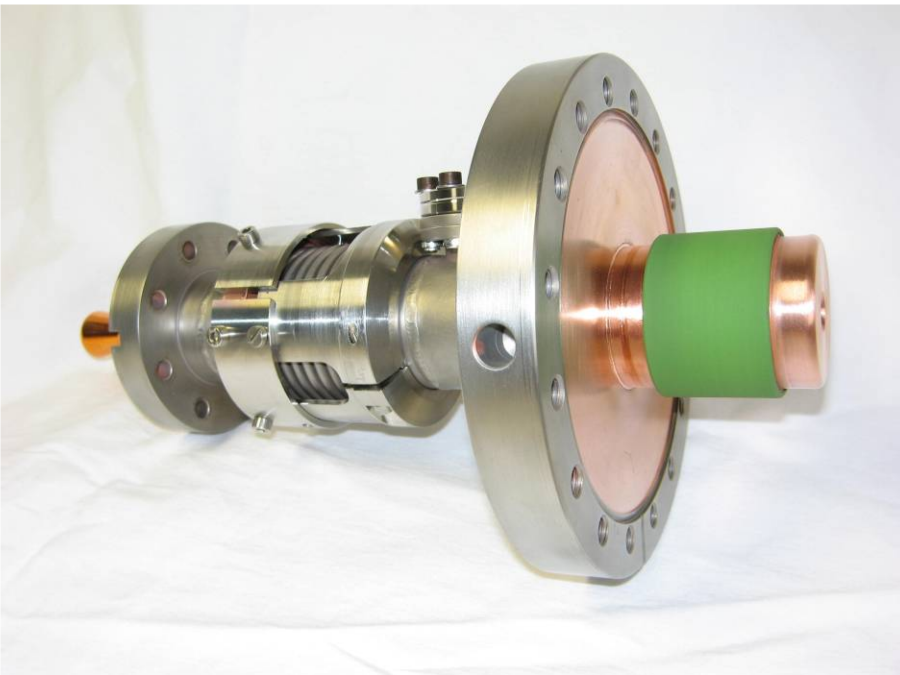
Failed inspection: Warm inner conductor with extensive oxidation.

Coupler Inspection Results

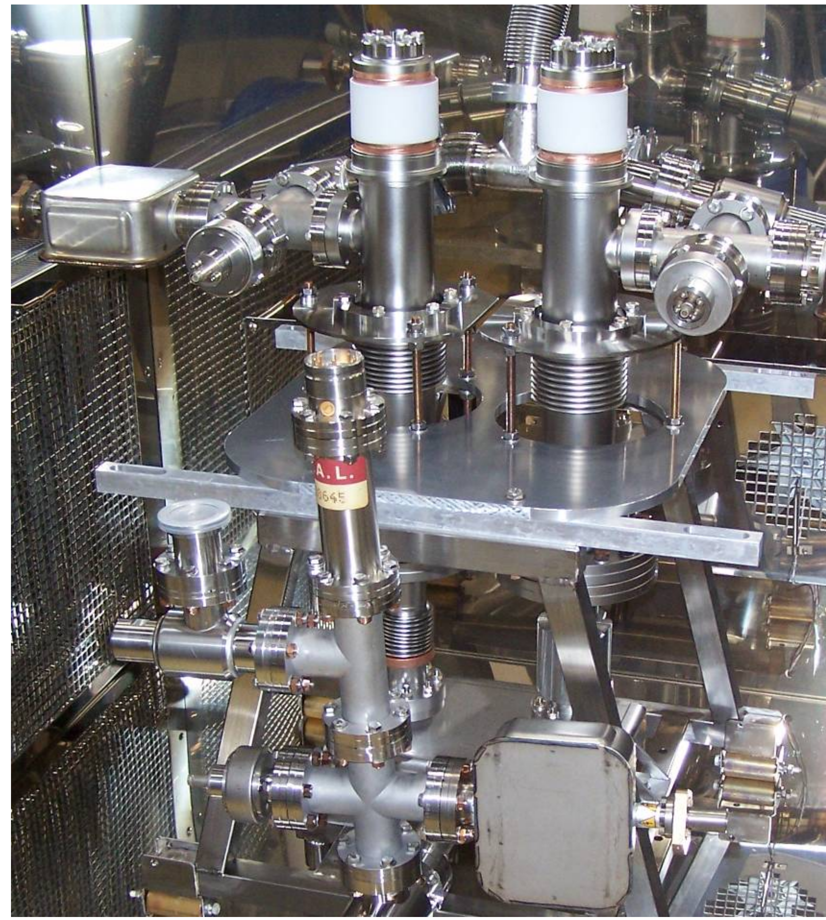
Failed Inspection: Here the part has copper plating on the ceramic. The ceramic has to be free of metallization.

DESY/Orsay Developing Other Vendors

(ACCEL, Thales and Toshiba)

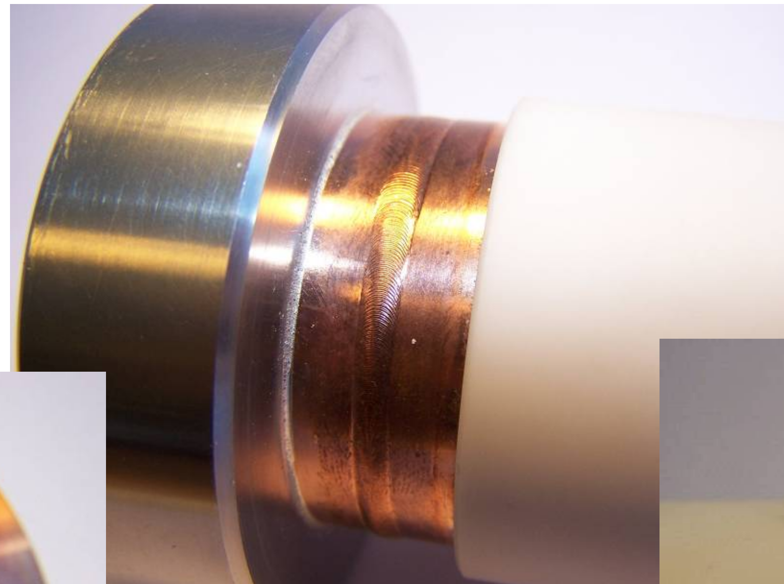


ACCEL

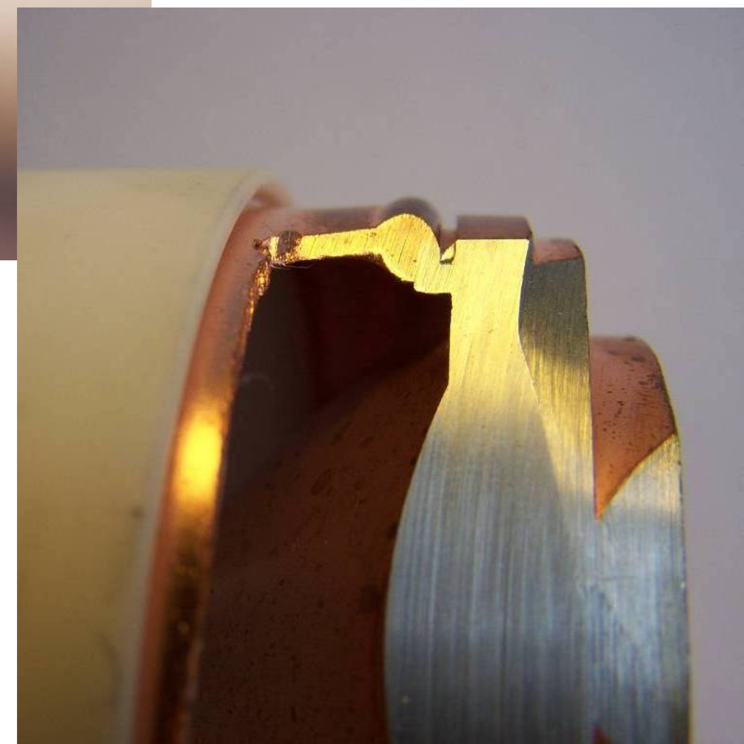


Thales

SLAC Klystron Group is Building a Cold Section using TIG Welding instead of E-beam Welding



Parts from an Orsay sponsored study of TIG Welding



Elements of a PX Coupler R&D Program

- Study power and multipactor limits of TTF3 coupler using coupler processing stand and coupler component test stand at SLAC
- Continue program of building coupler cold parts without e-beam weld to allow more vendors and lower cost
- Build and test 60 mm diameter cold section to see if it is more robust at higher power
- Re-examine design of the warm section – e.g., may want to eliminate the HV bias option to reduce cost