# RF Processing of the Couplers for the SNS Superconducting Cavities*

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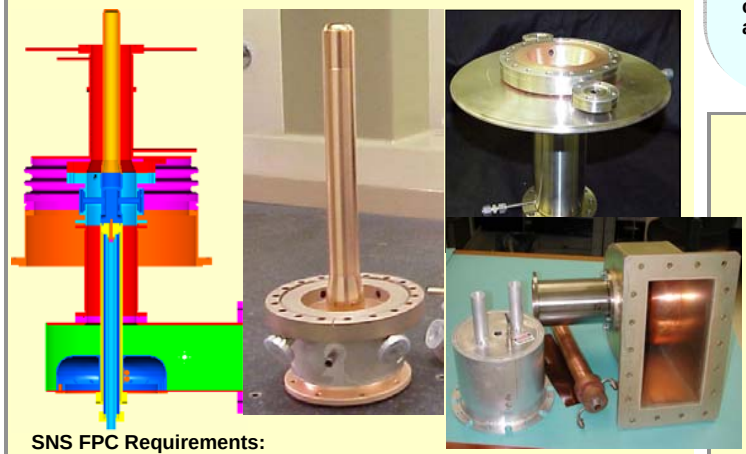
## Abstract

All eighty-one fundamental power couplers for the 805 MHz superconducting cavities of the SNS linac have been RF conditioned and installed in the cryomodules successfully. The couplers were RF processed at JLAB or at the SNS in ORNL: more than forty couplers have been RF conditioned in the SNS RF Test Facility (RFTF) after the first forty couplers were conditioned at JLAB. The couplers were conditioned up to 650 kW forward power at 8% duty cycle in traveling and standing waves. They were installed on the cavities in the cryomodules and then assembled with the airside waveguide transitions. The couplers have been high power RF tested with satisfactory accelerating field gradients in the cooled cavities.

## Introduction

The JLAB built 81 Fundamental Power Couplers (FPCs) for the superconducting linac (SCL) cavities of the SNS have been completely processed at the JLAB or at the SNS RF test facility. Baking and RF conditioning the ceramic windows and coaxial structures of the couplers have been done successfully. Assembling and testing the air-side coupler transitions for the FPCs also have been accomplished in the same test setup. The completely processed FPCs were installed on the SCL cavities in the cryomodules in the SNS linac tunnel.

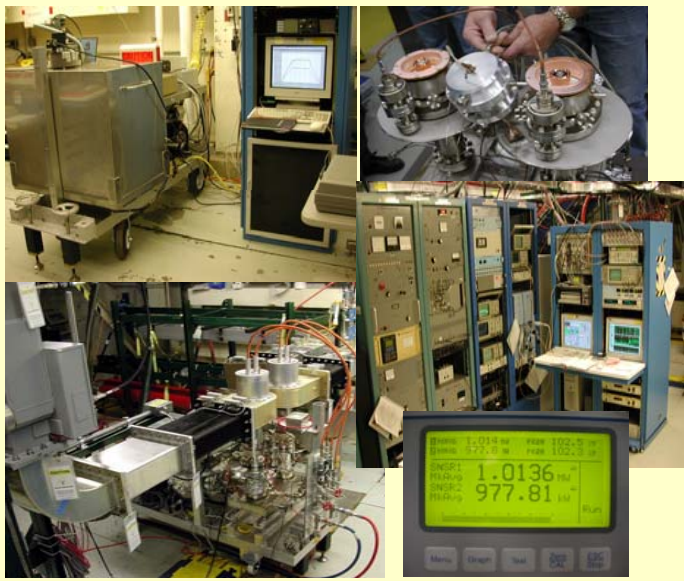
## Coupler Construction



SNS FPC Requirements:

- Quantity: 81 sets (33 MB and 48 HB)
- Frequency: 805 MHz
- Transmission Line: 50 Ohm Coaxial with WR-975 waveguide
- Peak pulse power: 550 kW
- Duty cycle: 8% pulsed, 1.3 ms, 60 Hz

## Processing at JLAB

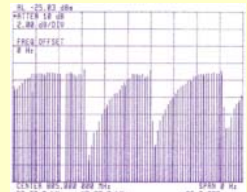



Couplers were RF conditioned to 650 kW forward power at 8% duty with a water load for traveling wave and with a variable short circuit for the standing wave. The RFTF test setup in the SNS uses 402.5MHz and 805 MHz klystrons in the HPRF systems as in its LINAC; present setups can accommodate the available spare klystron tubes that are being used in the SNS project. The high power RF system is equipped with a 8% duty, 11 MW in 140 kV peak pulsed HVCM with two klystron sockets that can support two RF klystron amplifiers with output powers up to 2.5 MW at 402.5 MHz and 5 MW at 805 MHz.

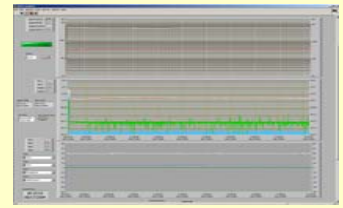
## Processing at the SNS RFTF

SNS Superconducting Linac power couplers processed at JLAB or at SNS

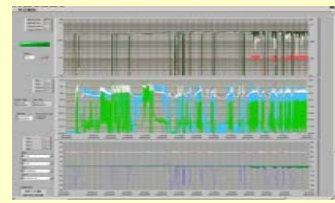
## RF Conditioning



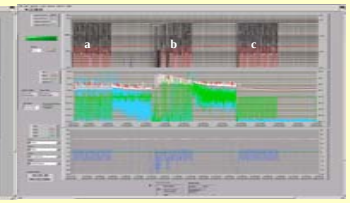
RF conditioning with pulse amplitude modulation as function of vacuum



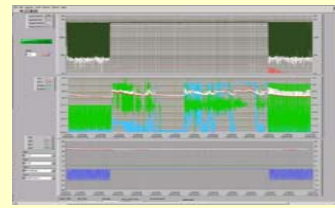
Long run constant amplitude power test at 650 kW 1 ms 60 Hz



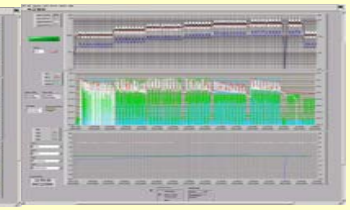
Vacuum and electron activity at the beginning of RF conditioning in TW mode




DC bias test: a) No dc bias ; b) -2.5 kV c) +2.5 kV



Deconditionig during high power RF tests



Vacuum and electron activity in SW mode up to FWD 600 kW

Procedures for RF conditioning and high power testing

## Conclusions

Optimal design, timely procurement of adequate coupler components and instrumentation, efficient methods for FPCs preparation and RF power testing, testing facilities and sustain team efforts are essential ingredients for quality coupler production. On room temperature high RF power test stand, all 81 FPCs qualified for SNS cavity production have demonstrated power capabilities exceeding specifications for machine operation.

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