



An Optimal Procedure for RF Conditionning at the FREIA Laboratory

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- Condition: defined by experts

 (interlock trig threshold and auto conditioning threshold)
- Acquisition system: RF power, vacuum levels and all the interlocked signals.
- Control system : software controlling (duty and peak power of pulse, switching on and off the RF power, and resetting system)



RF-Vacuum Feedback system



Fig. Layout of a simple RF-Vacuum Feedback system

Following principles need to fulfil for an effective feedback system:

•Regulate RF power as a function of vacuum pressure around the coupler as fast as possible.

•Apply a longer repetition period than the vacuum reading delay.

Conditioning procedure logic





Hardware list

The main devices for the RF conditioning process are: Programmable Logic Controller (PLC)

- Signal Generator
- Power Meter
- Vacuum Gauge Controller (VGC)
- Cold Cathode Gauges (CCG)
- Arc Detector
- Electron Detector
- Fast RF Interlock Switch
- Voltage Controlled Attenuator
- Vacuum Pumping Cart



Conditioning program



- > FREIA conditioning system has been verified on ESS spoke package.
- > The overall FREIA system worked as expected

UNVERSITET FREIA RF Conditioning Sys	stem time: 03-30-13:27:42 QUT HELP
	Instrument State Initial State Power State Checking state
Calibration Auto Process Auto Cycle Calibration On Auto Process Start Auto Cycle Off	Current parameters Vaccum Upper Limit (mbar) RE Upper Limit (dBm) Parameter setting mode 1E-6
Instrument state	Vaccum Lower Limit (mbar) RF Lower Limit (dBm) Auto reset Interlock? 1E-8 1E-7 -60 -40 -20 0 10
Cold Cathod Gauges Power Meter RF Station Signal Generator Interlock system	RF Increment (dB) Soak Time (Sec) Pulse Width (us) ⊕ 0.1 ⊕ 900 ⊕ 500
Procedure state	RF TB Increment (dB) Step interval (Sec) Pulse Delay (us)
Increase state Vaccum Upper Limit state Initialize state Hold state Fault Detection state Initialize state End state Decrease state Ramp After Fault Detection	RF Pulse Width List 20 50 100 200 500 1000 2500 2861 0 0 us RF Pulse Delay List 1990 1975 1950 1500 1250 1000 750 569.5 0 0 us
Vaccum Gauge Current Worst Vaccum 0	Conditioning chart Multipacting monitor
Current Vacumm (mbar) Interlock reset time 0 Z3E-8 Multipacting activity (A) 0	
flow_FT03 97.04860687 flow_FT04 87.15277863 RF Interiock System RF Switch Amplifier On	Among and a set of the
temperature_TT03 28.5 temperature_TT04 28.79999924 Forward Power (dBm) Forward Power (80.8528088 Signal Generator	-40
Refrected Power 0.95580399 Transmitted Power 0. BFF On 352,21 - 3,2	-100 ⁻ 10 -11<
Target Amp lasting time (s) 760000	Waveform Pause Waveform Pause RF power (dBm) Vacuum (mbar) Save Plot Signal generator output power (dBm) Vitility



LA Main Parameters of Spoke Cavity Conditioning

- For different cavity, parameter would varied.
- > This depend on the highly likely outgassing region.

Parameter	value
Loop interval time(s)	1
Pulse repeat rate (Hz)	14
Power increase increment (dB)	0.1
Power TB increment (dB)	1
Vacuum upper limit (mbar)	1e-6
Vacuum lower limit (mbar)	5e-7
RF Lower limit (dBm)	-23.3 (generator) 100 W (coupler)
RF Upper limit (dBm)	-3.2 (generator) 120 kW (coupler)
Initial pulse length (µs)	20
pulse length step	20 μs, 50 μs, 100μs, 200 μs, 500 μs, 1ms, 1.5 ms, 2 ms, 2.5ms, 2.86ms



Software logic





Conditioning Logic Layout





- Initialize state
- Increase state
- Hold state
- Decrease state
- Vacuum upper limit state
- Fault state
- Ramp after fault state
- End state



Initialize State



Increase State



Hold State



Vacuum Upper limit State



Fault Detect State



Ramp After Fault Detect



Decrease State



End state