Conditioning and Test Protocols

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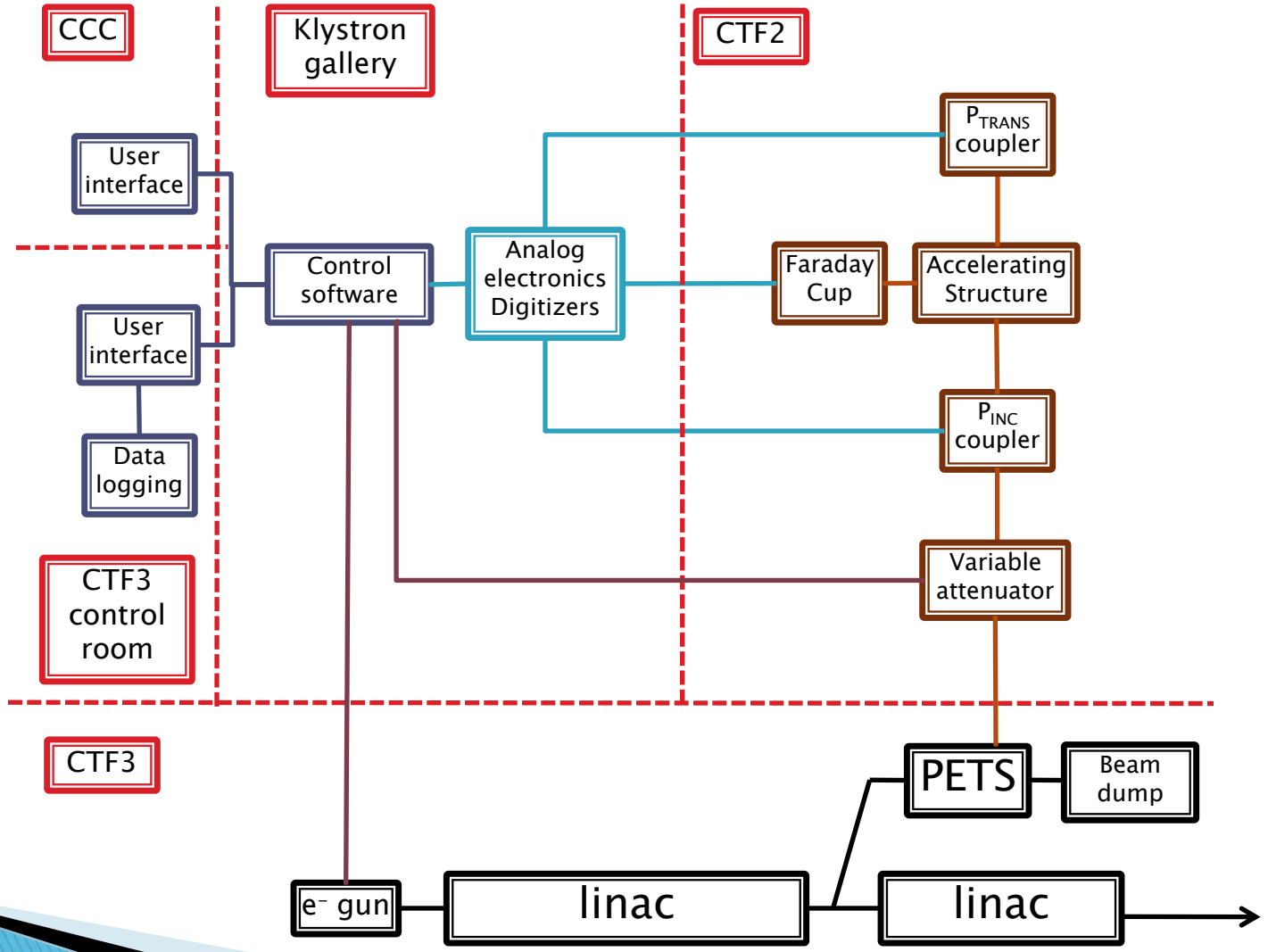
Objectives of this presentation

- Describe how we currently characterize structures at CTF3
- Describe how we want to improve the characterization
- Learn from your suggestions and comments

Contents

- Description of the 30 GHz test stand
- Before the test starts
- Typical testing history
- After the test is finished

Description of the test stand



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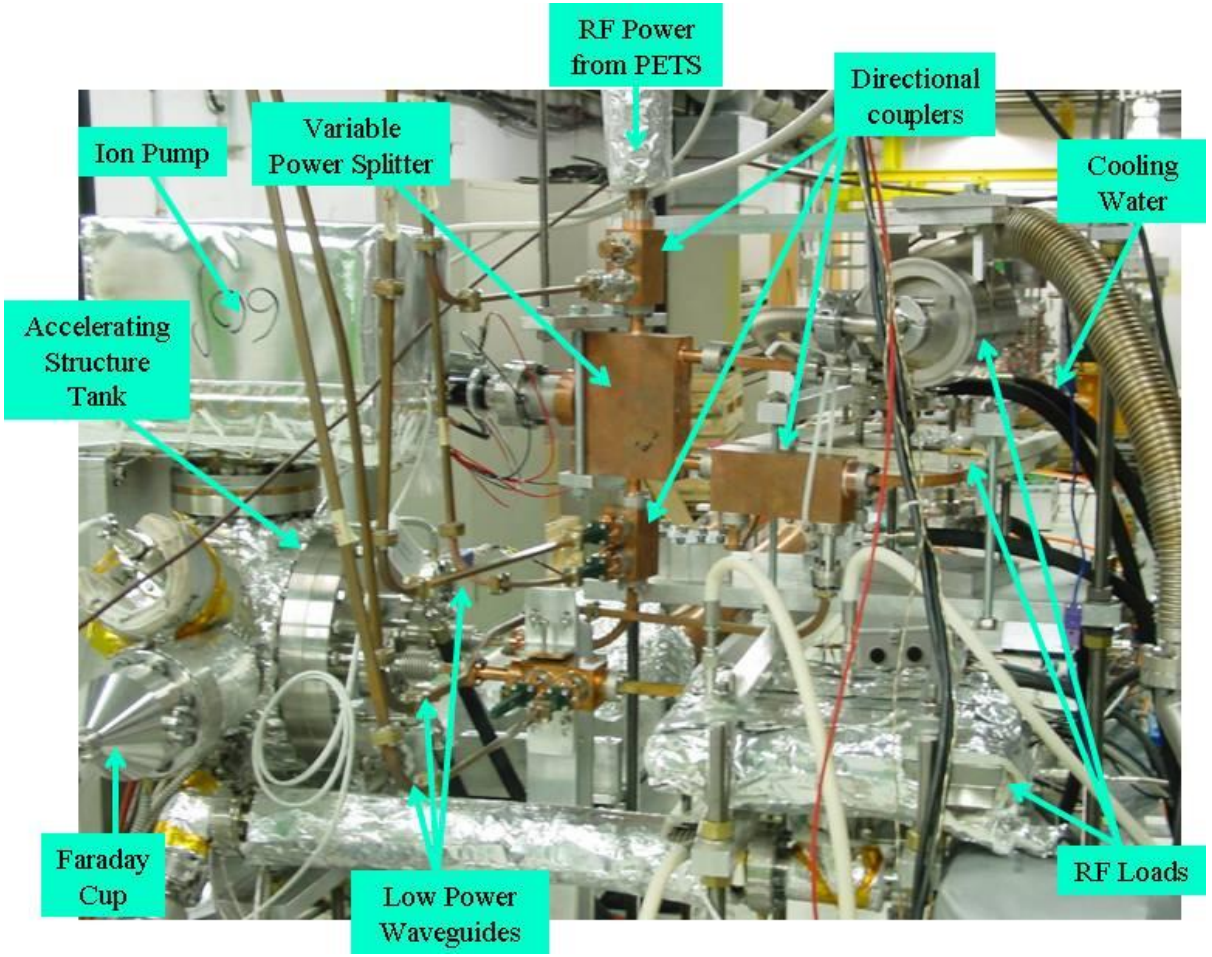

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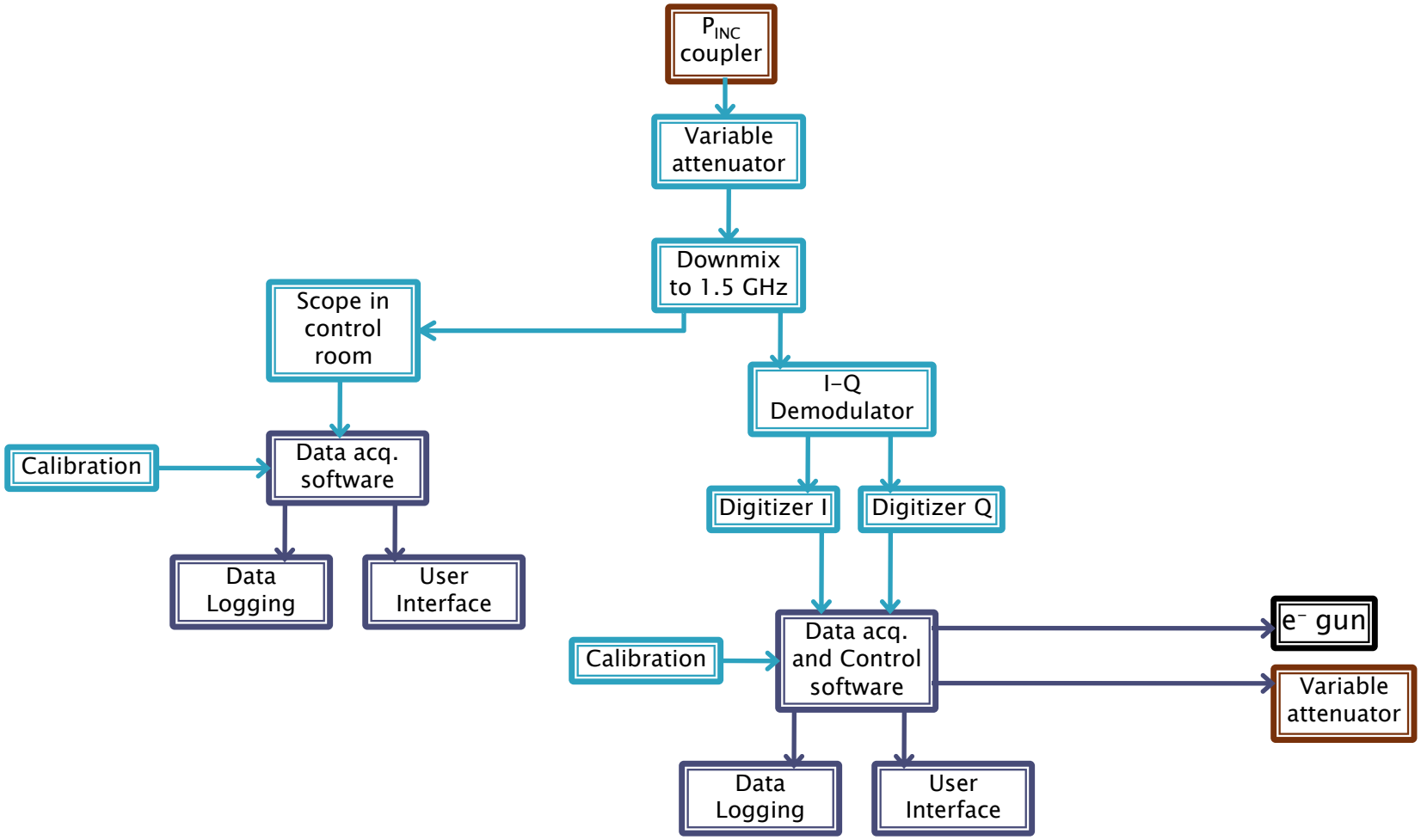


Before the test starts

- Cold rf measurements
- Metrology
- Cleaning
- Surface treatment
- Inspection with an optical microscope
- Inspection with SEM
- Final assembly
- Cold rf measurements

Typical Testing history

	DESCRIPTION	*ESTIMATED TIME (days)*
NEW STRUCTURE INSTALLATION		
1	Opening CTF2 Removing cover plate of the previous structure	1
2	Low level RF measurements of previous structure Installing new structure in the cover plate Low level RF measurements of new structure	1
3	Installing cover plate with new structure in the tank Installing all the other RF components Leak checking	2
4	Pumping down to ~ 10^{-7} - 10^{-8} torr	2
	TOTAL TIME	7

Typical Testing history

	DESCRIPTION	*ESTIMATED TIME (days)*
CONDITIONING THE STRUCTURE		
5	Implementing and checking calibrations	0.25
6	Conditioning of a Cu like structure	7.25
	TOTAL TIME (assuming 75% machine uptime)	10
INTERMEDIATE STRUCTURE CHARACTERIZATION		
7	Searching working conditions	0.5
8	BDR ~ 10^{-3}, T = 70 ns, f = 10 Hz, N = 100	0.125
9	BDR ~ 10^{-4}, T = 70 ns, f = 10 Hz, N = 100	1.25
10	BDR ~ 10^{-5}, T = 70 ns, f = 25 Hz, N = 25	1.25
11	BDR ~ 10^{-4}, T = 70 ns, f = 10 Hz, N = 100	1.25
12	BDR ~ 10^{-3}, T = 70 ns, f = 10 Hz, N = 100	0.125
	TOTAL TIME (assuming 75% machine uptime)	6

Typical Testing history

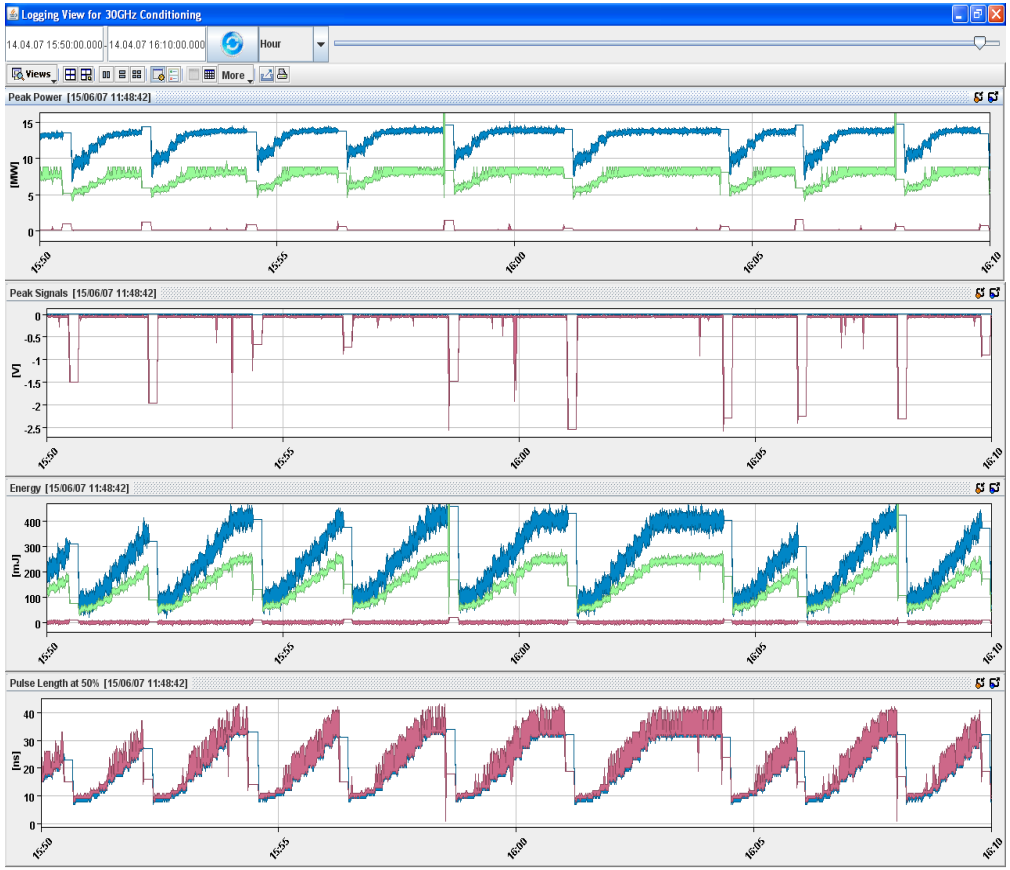
	DESCRIPTION	*ESTIMATED TIME (days)*
FINAL STRUCTURE CHARACTERIZATION		
13	BDR @ 70 ns (as in intermediate characterization)	4.5
14	BDR @ 40 ns (as in intermediate characterization)	4.5
15	Dedicated pulse length dependence measurements	1
16	Dark current and ion current measurements	1
17	Calibration checking	0.5
18	Investigation of structure transmission properties: nonlinearity and effect of temperature (repetition rate)	1.5
19	BDR as a function of repetition rate	2
20	Vacuum related experiments	0
	TOTAL TIME (assuming 75% machine uptime)	20

Conditioning of the structure

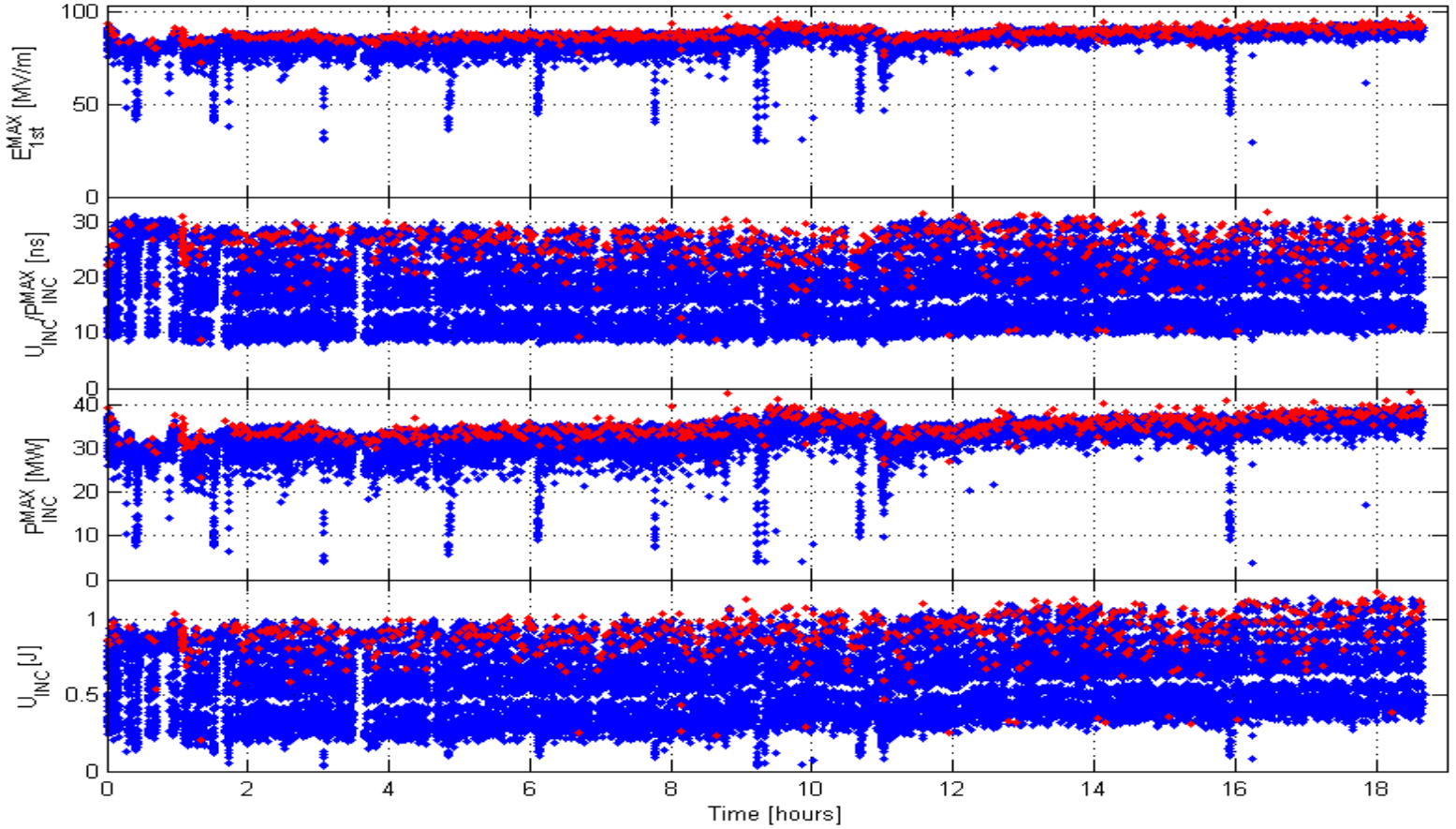
We can capture, analyze and log information about every rf pulse (tested up to 25 Hz)

We can define:
-Target final values for T and P
- Speed to approach target final values
- Intermediate T and P values
- Interlock on Faraday cup currents, reflected power, missing energy, vacuum pressures…

We will implement feedback loops to improve stability of the rf pulses in the near future

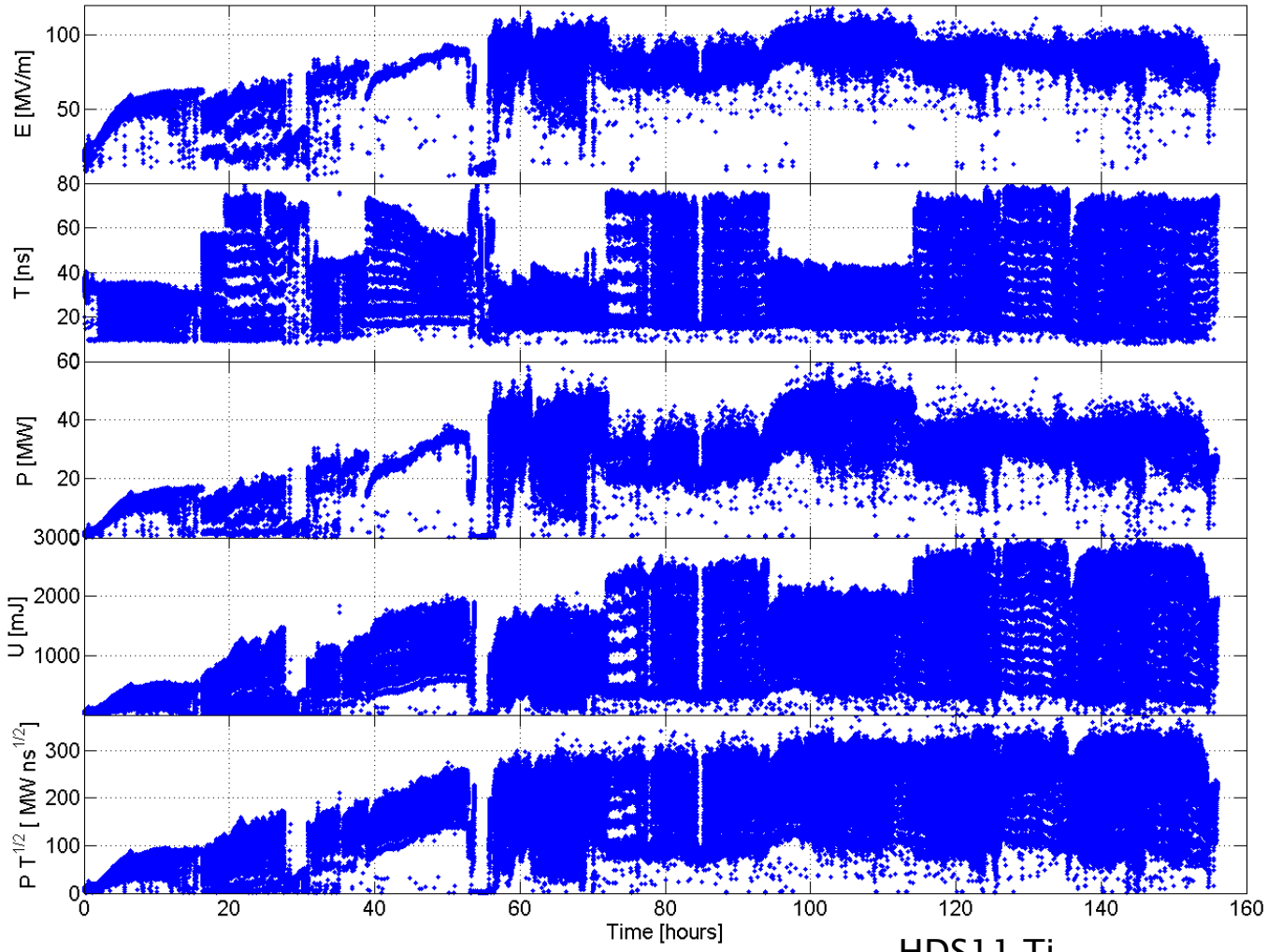


Conditioning of the structure



Circular π/2 Cu

Conditioning of the structure



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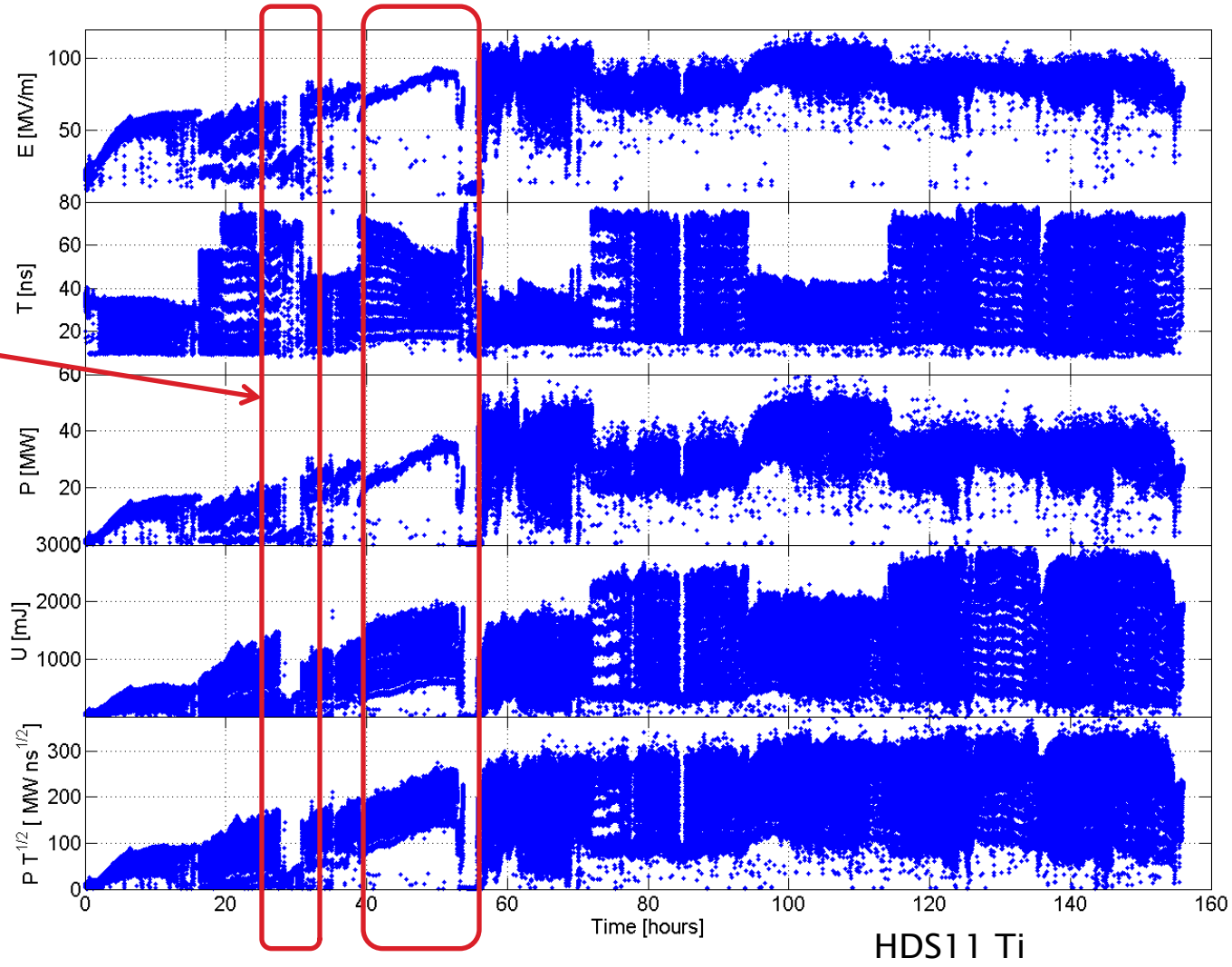
Conditioning of the structure

Problems with the stability of the power source



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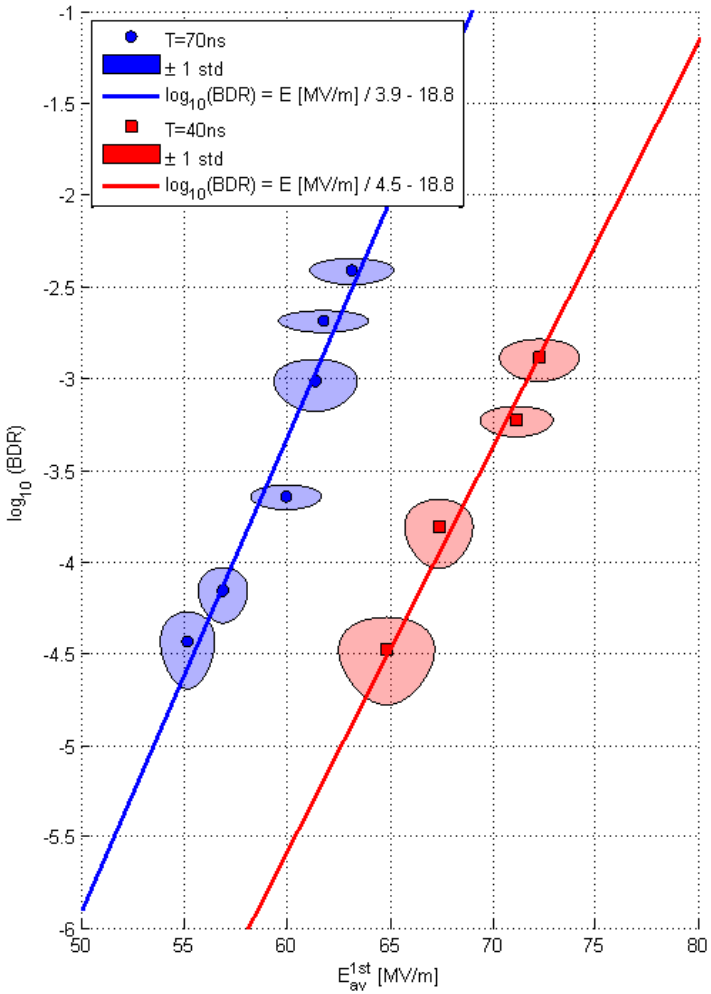
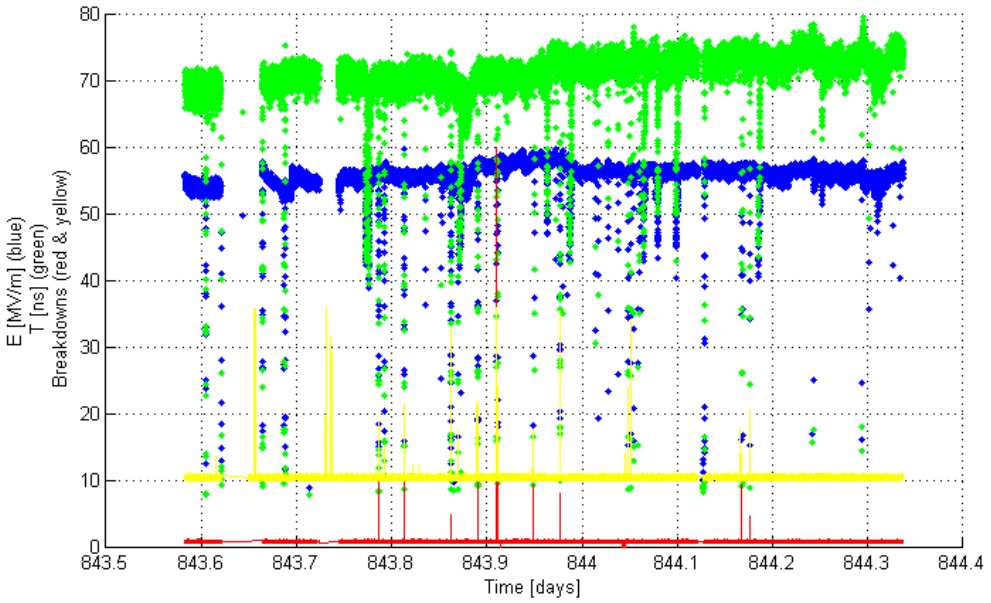
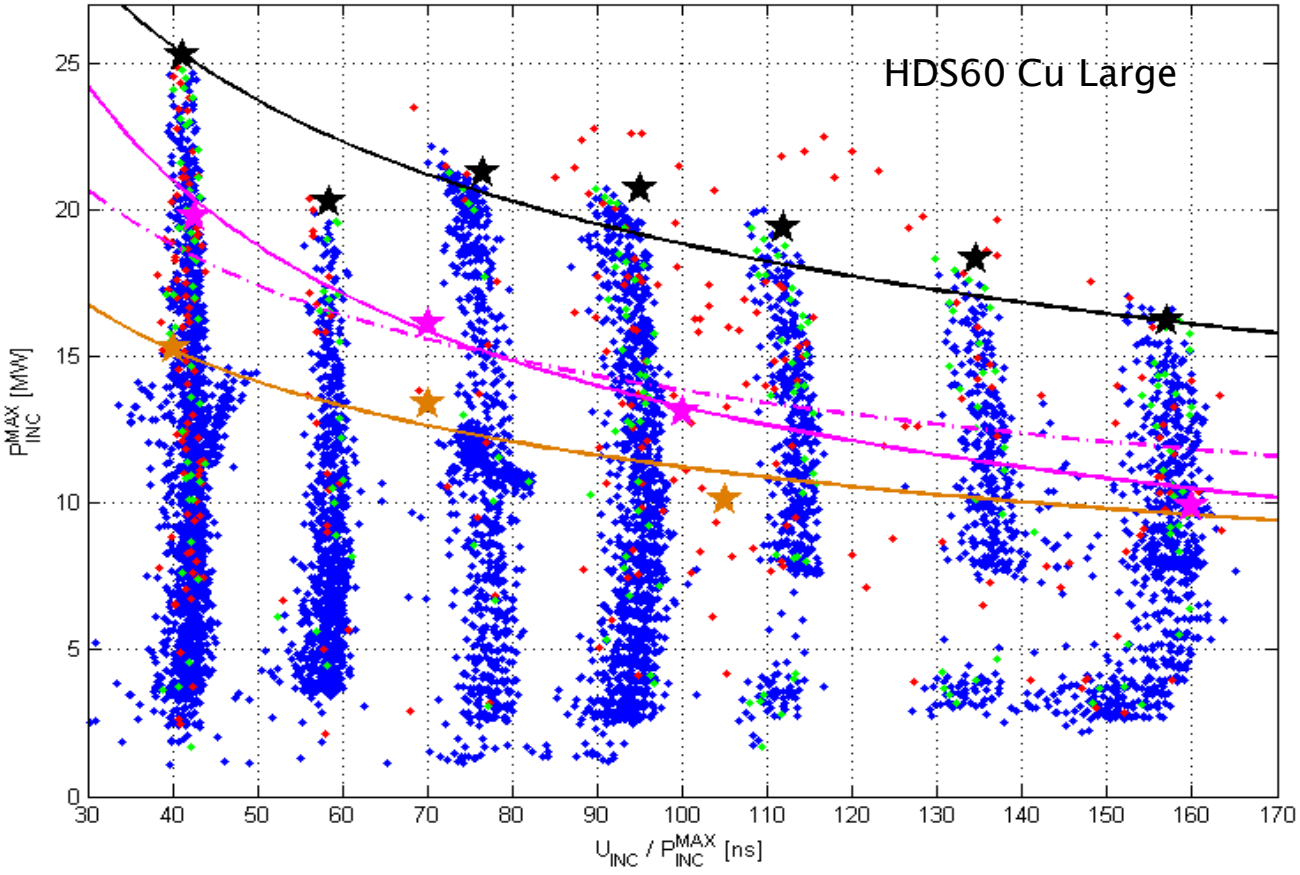
Breakdown rate vs. gradient

Circular π/2 Cu



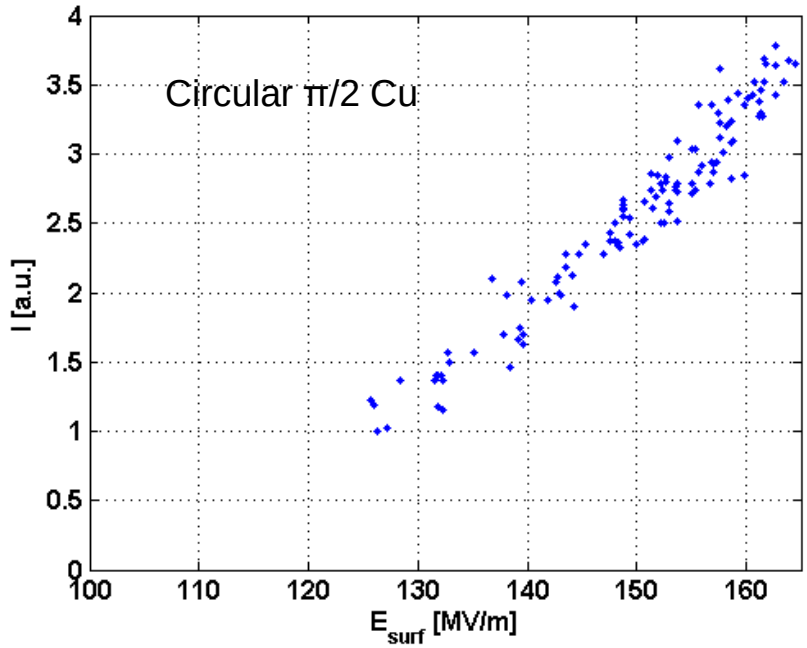


Pulse length dependences

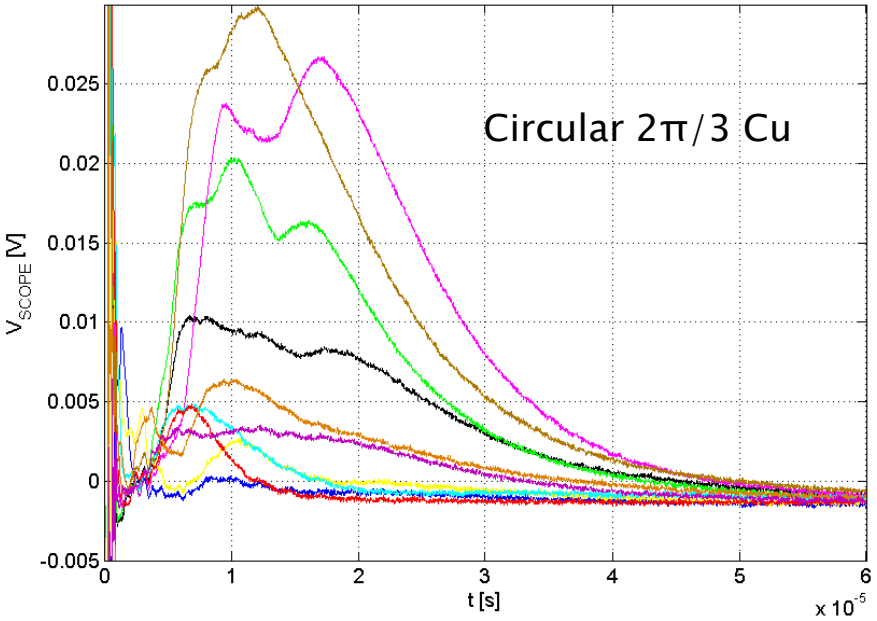


Dark current measurements

Dark currents to determine β at different conditioning states will soon be available

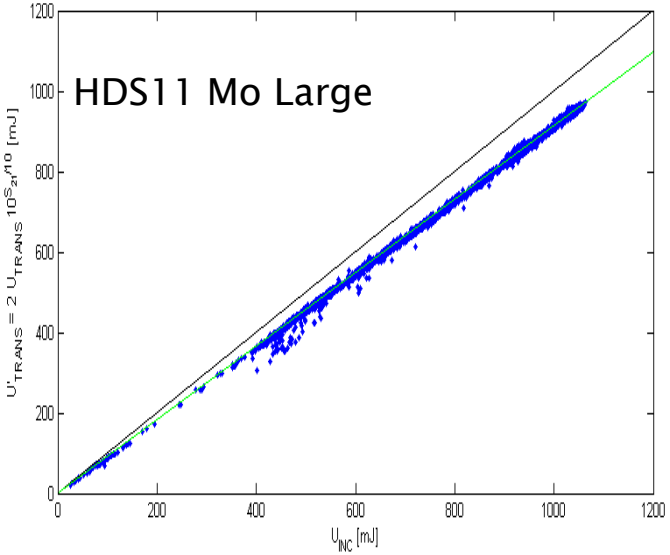


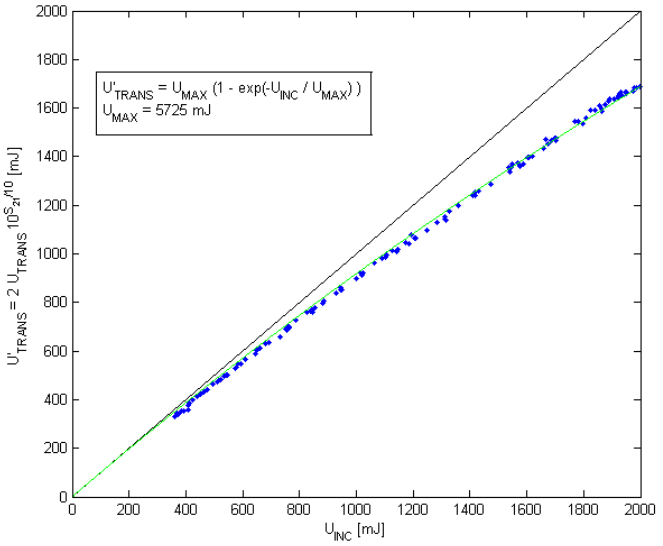
Positive ion currents were occasionally measured
It will be done systematically in the future

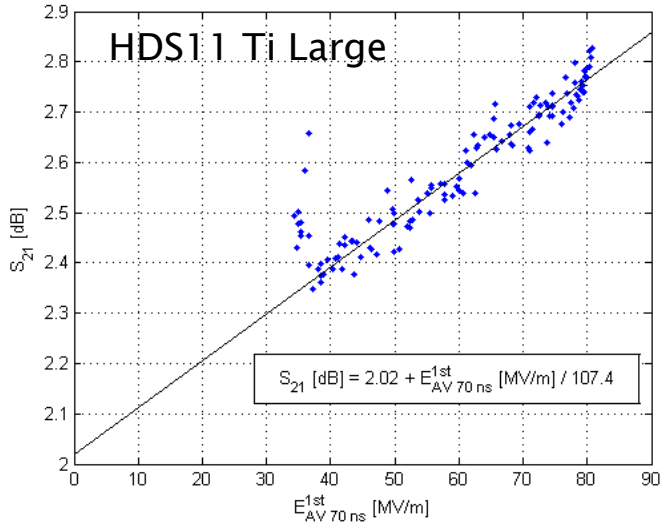


Calibration discrepancies & non-linear effects

Losses in the structure are measured using high power to detect discrepancies in the calibration and non-linear effects (maybe due to dark current capture)

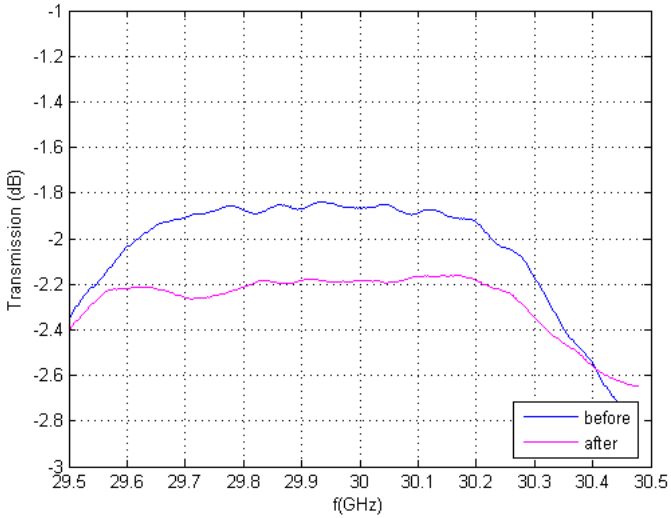






Cold rf measurements

Main rf properties of the structures are measured after every high power test



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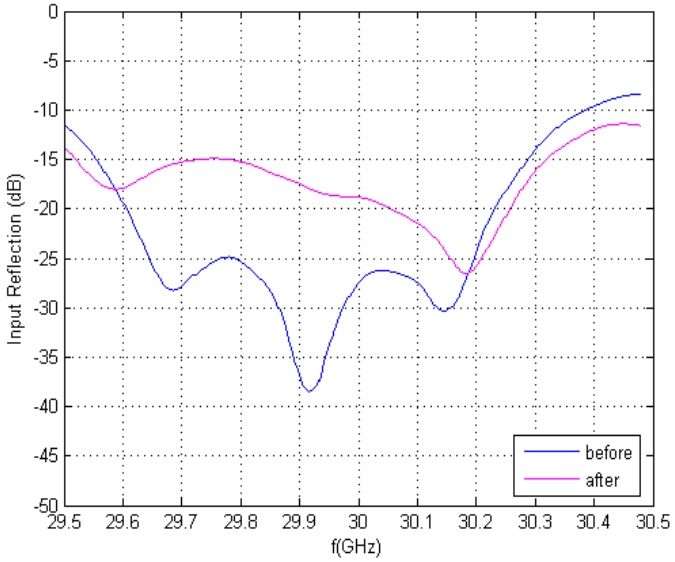
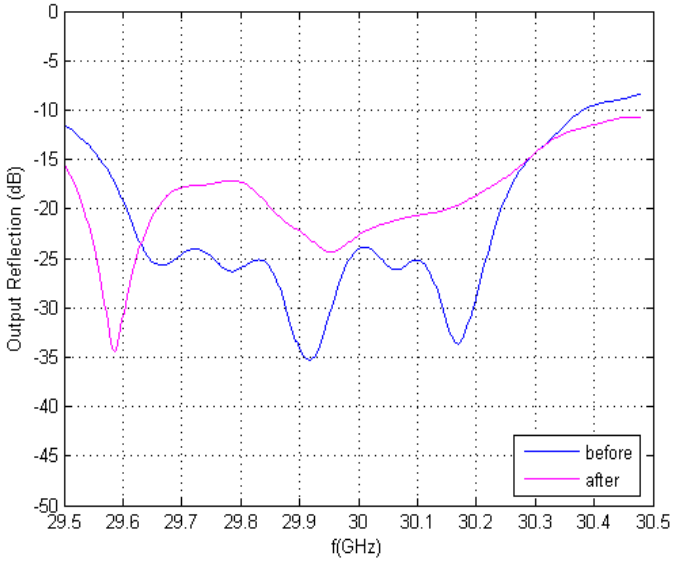
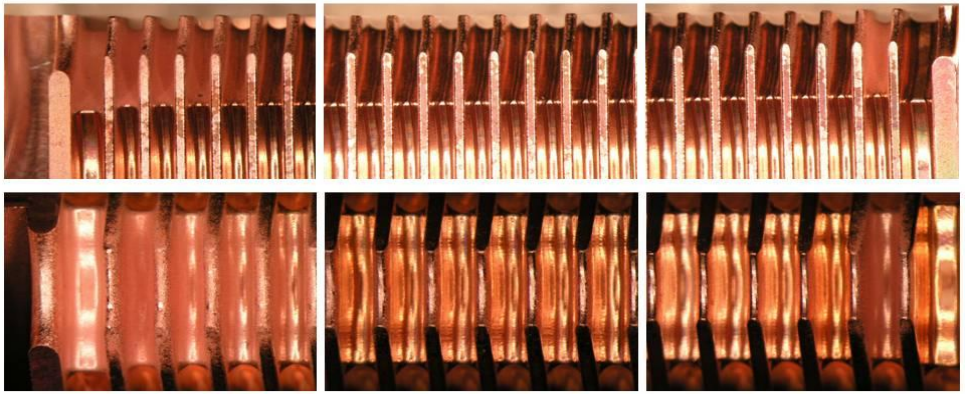




Visual inspection

The whole structure is inspected using an optical microscope



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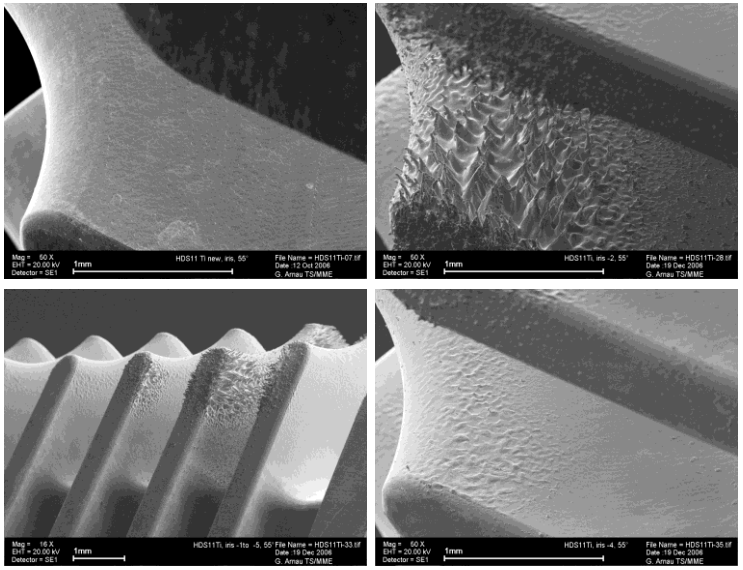
Generally one quadrant in inspected using a Scanning Electron Microscope (SEM)



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Thank you for your attention.

Questions?
Comments?