X-band Single Cell and T18_SLAC_2 Test Results at NLCTA

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- Single cell SW structure test result

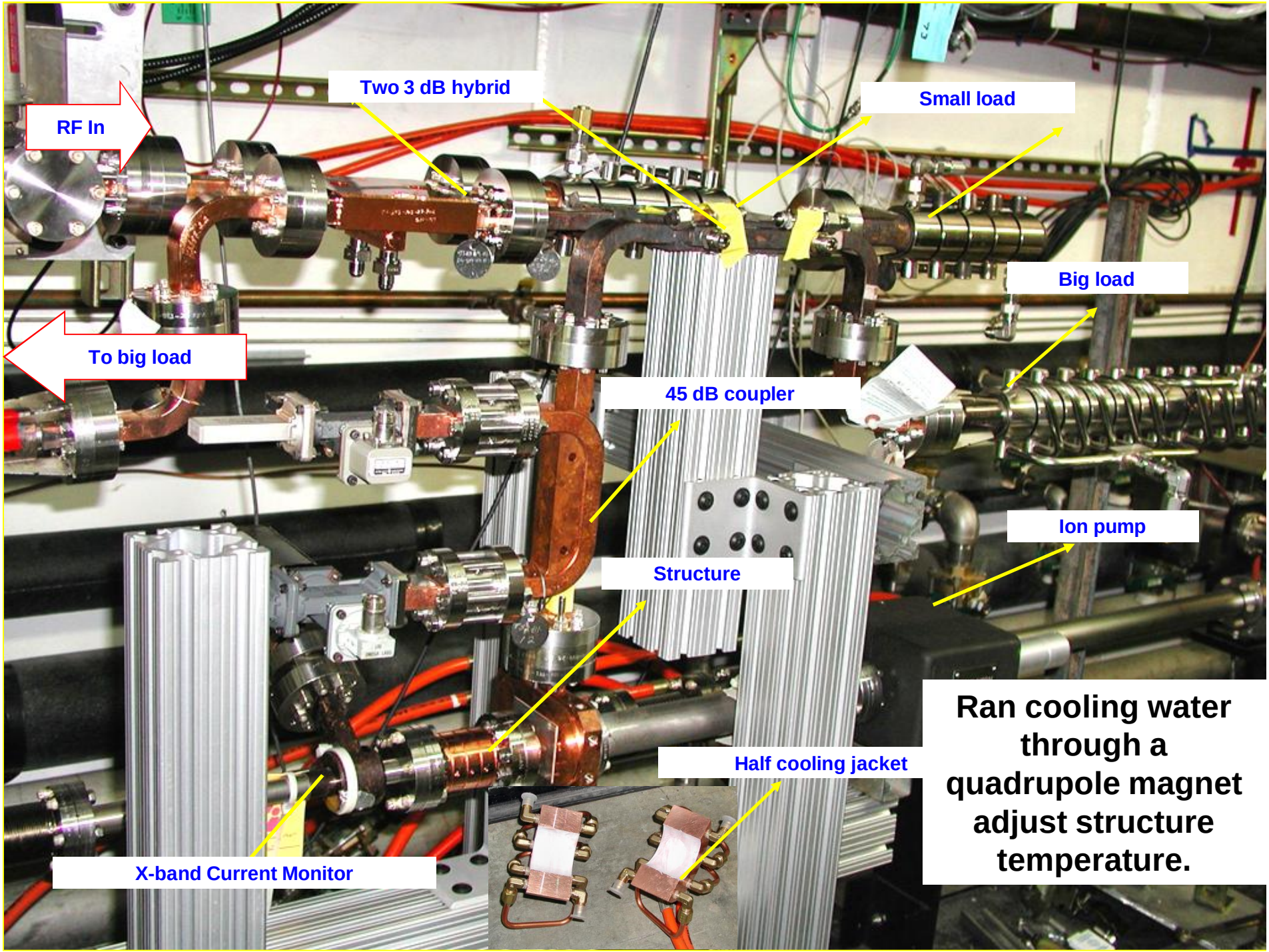
  Breakdown with constant gradient but different pulse heating

  Breakdown with constant pulse heating but gradient

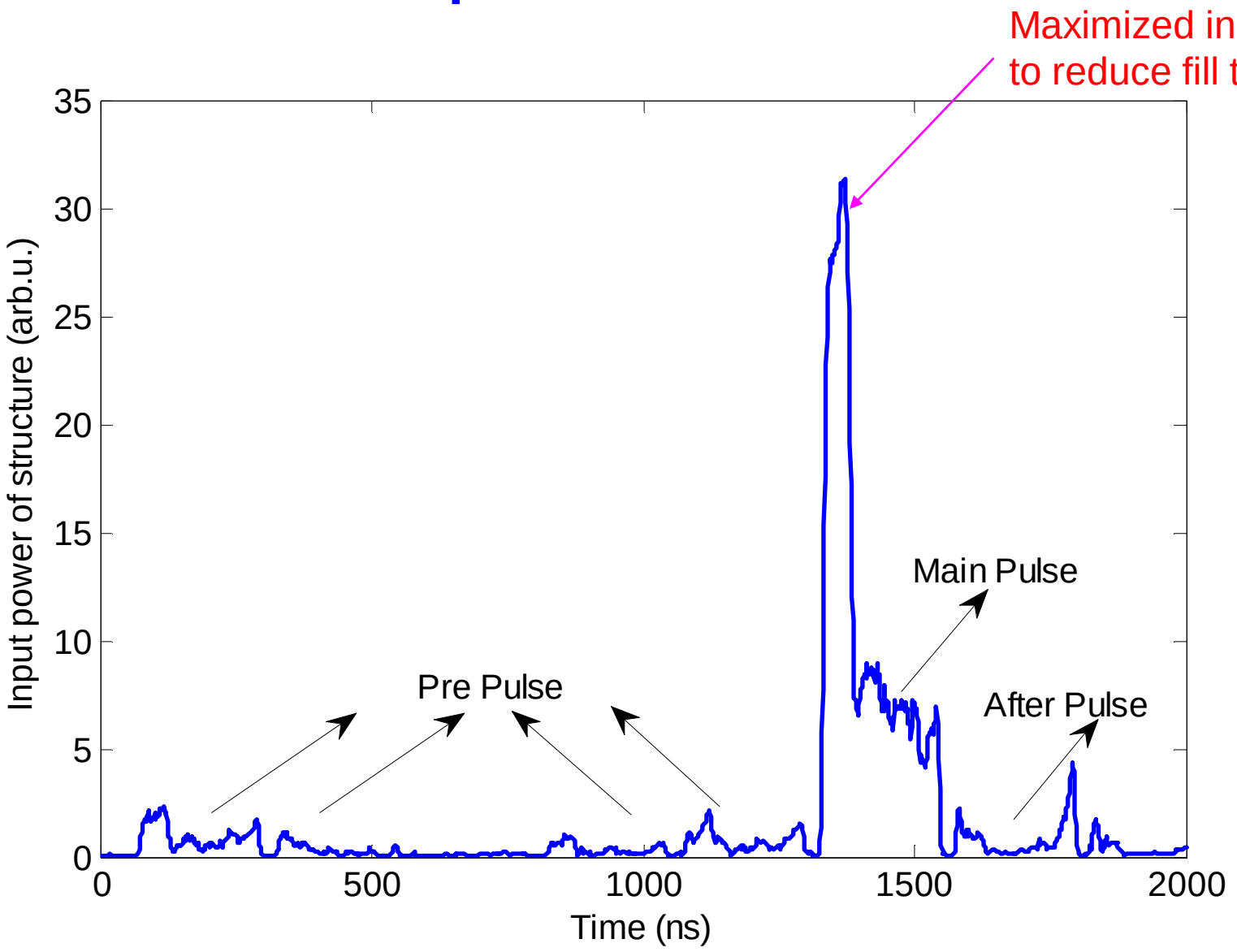
- 2nd SLAC made T18 test result

1C-SW-A3.75-T2.60-Cu6N-KEK structure parameters		
Parameters	**Unit**	**Value**
Frequency	GHz	11.427 (Nitrogen, 20 ^{o}C)
Cells		1+matching cell + mode launcher
Q (loaded)		4661
Coupling		0.97
Iris Thickness T	mm	2.6
Iris Dia. a	mm	3.75
Phase Advance Per Cell	deg	180
E_s/E_a		2.03
Maximum surface electric field for 10 MW	MV/m	398.9
Maximum surface magnetic field for 10 MW	A/m	667978.1
Peak pulse heating for 1 μs pulse with flat field of 100 MV/m	^{o}C	24

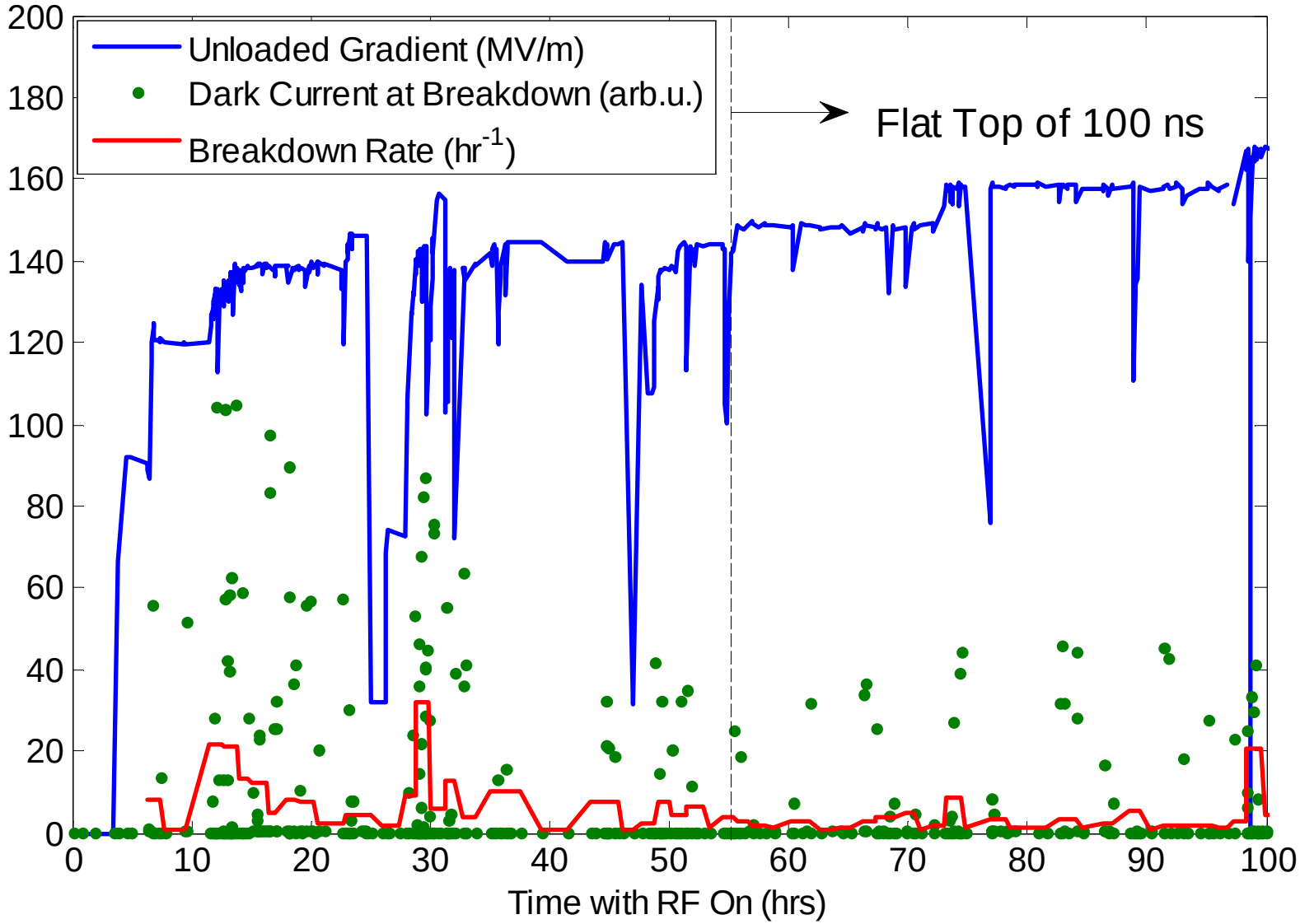
from Valery Dolgashev and James Lewandowski


RF In
Two 3 dB hybrid
Small load
Big load
To big load
45 dB coupler
Ion pump
Structure
Half cooling jacket
X-band Current Monitor
Ran cooling water through a quadrupole magnet adjust structure temperature.

Input RF Pulse

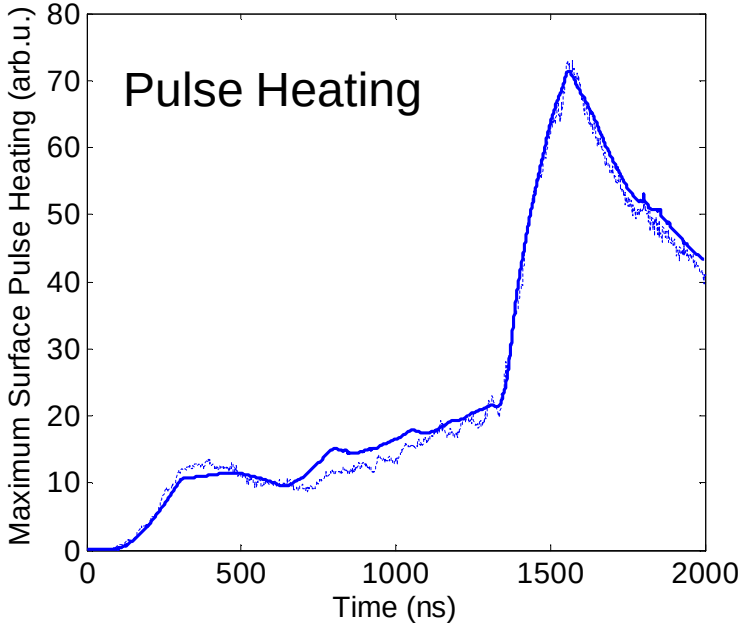


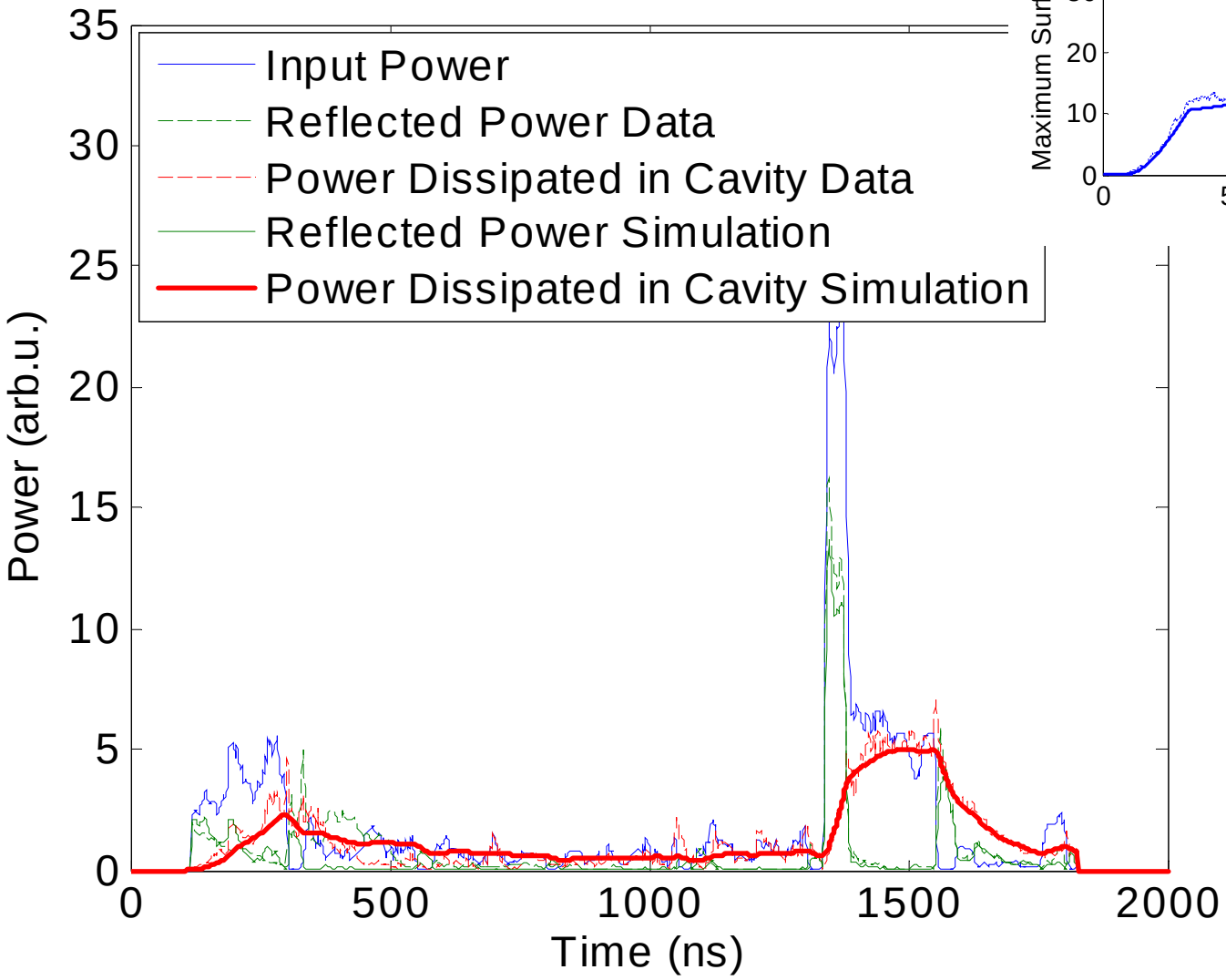
RF Processing History During First 100 Hours

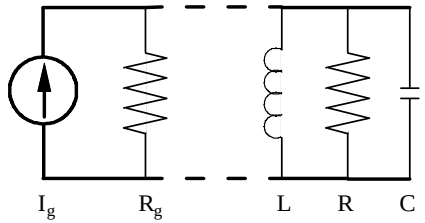


Detect breakdown from the large (> 0.8 on above scale) current produced

RF Power and Heating Measurements and Simulations

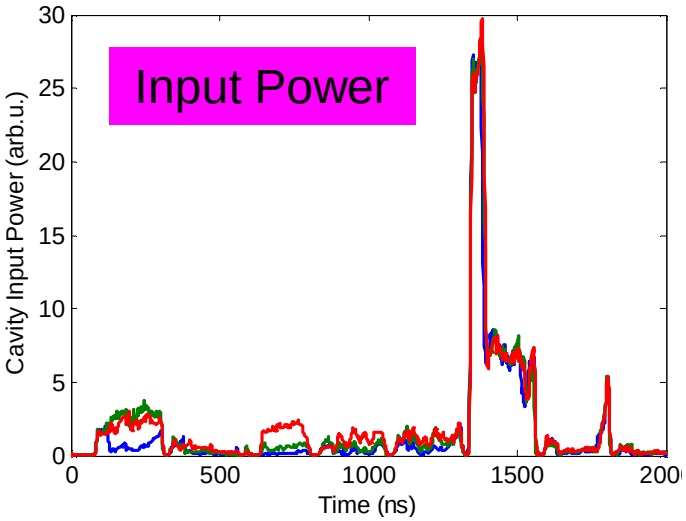


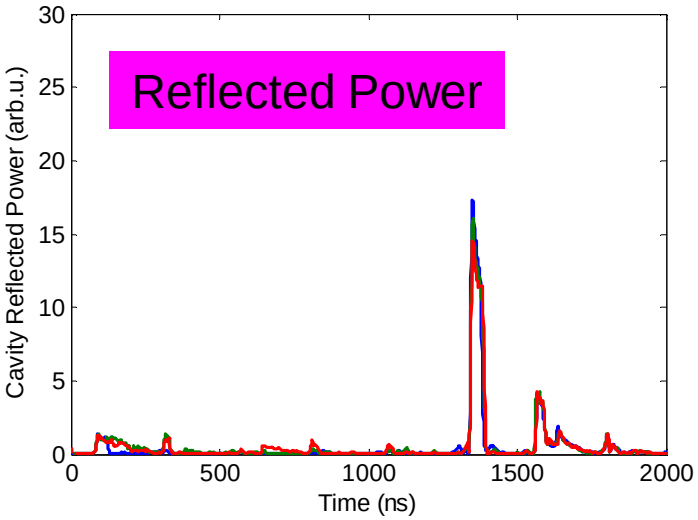


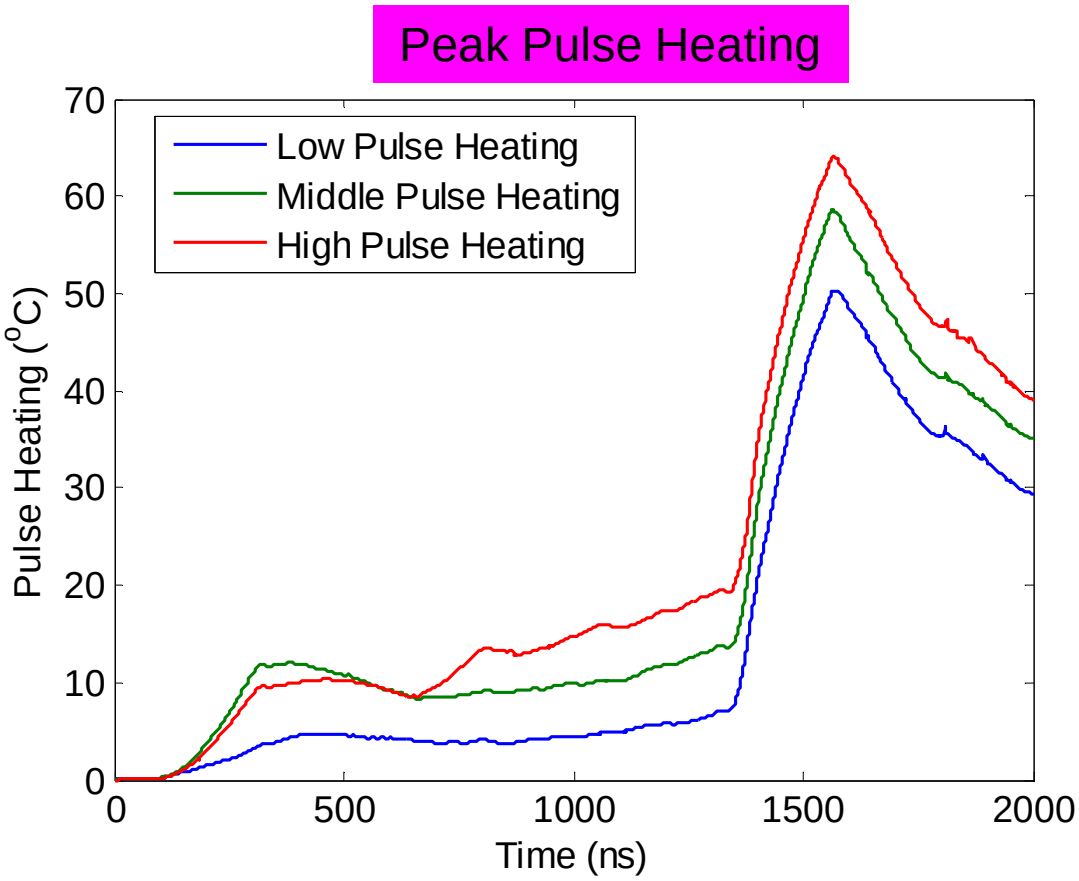


Simulations based only on measured input power

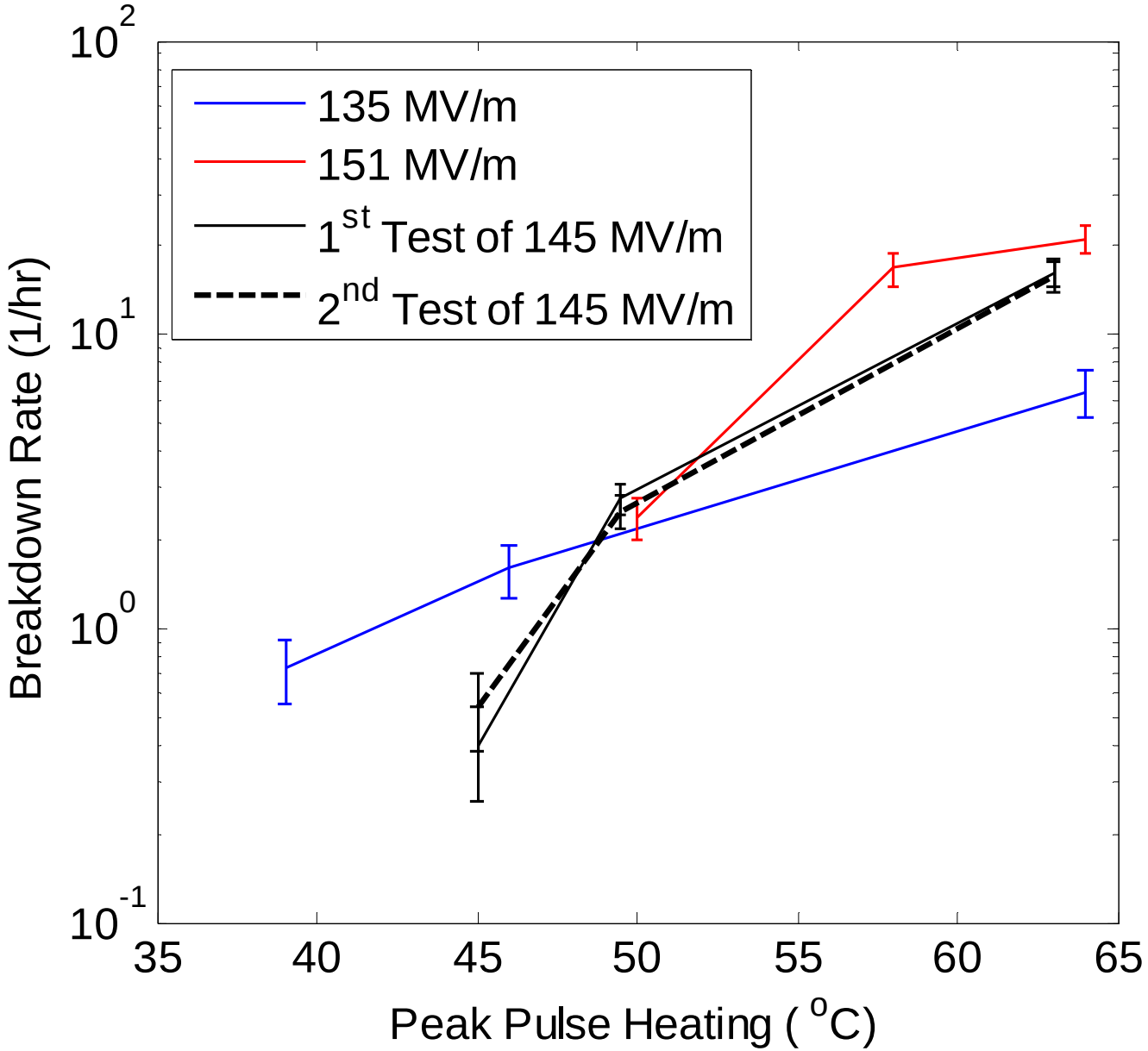
Breakdown Study with Constant Gradient but Different Pulse Heating from the Pre-Fill 'Warm-up'



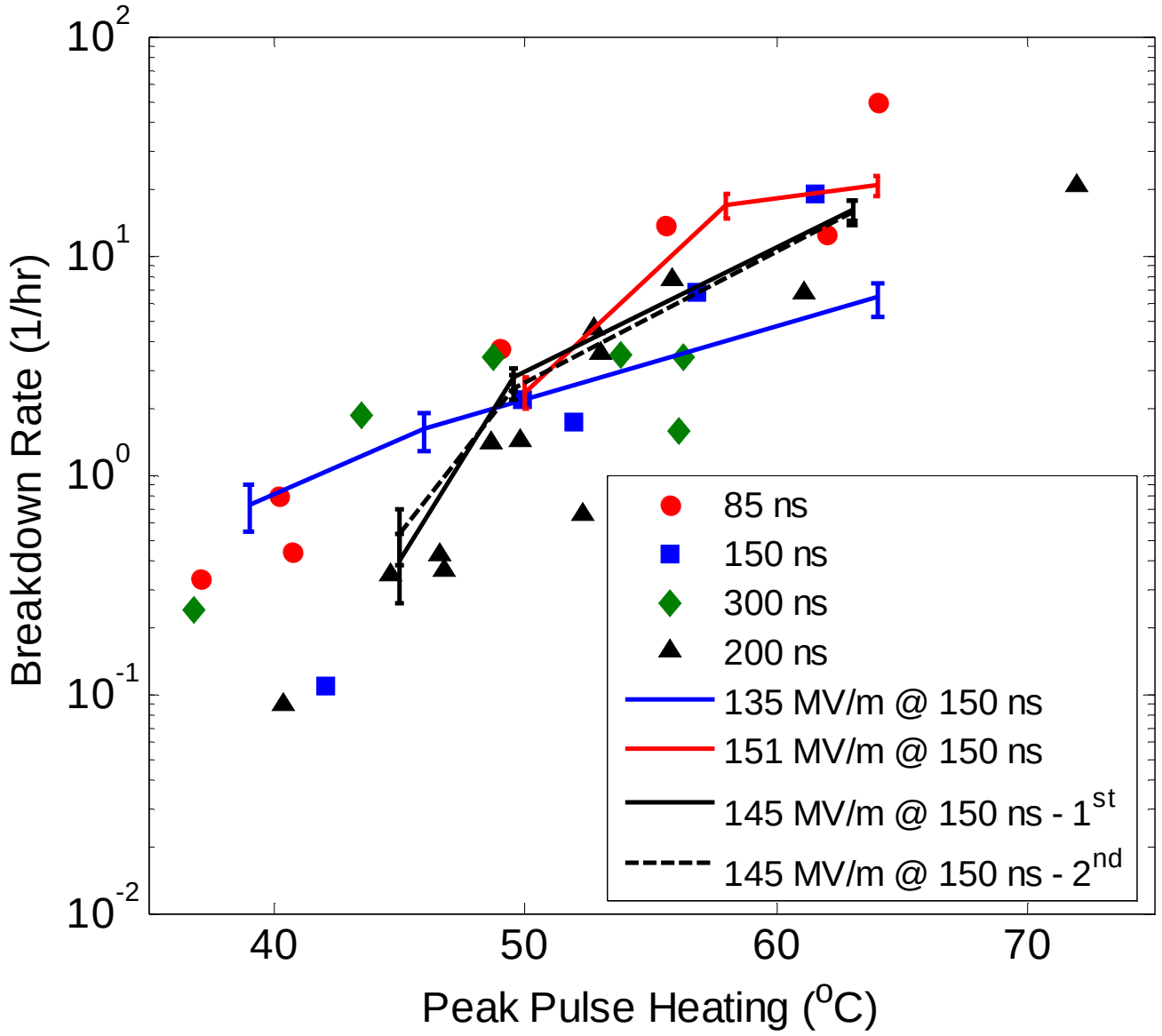




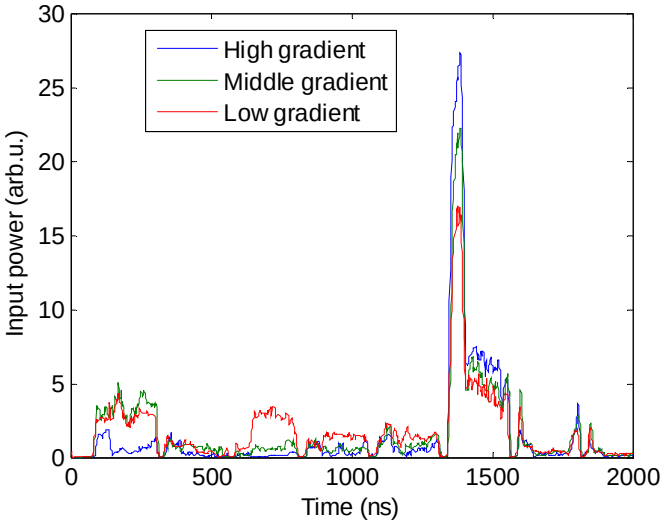
Breakdown Rate for Fixed Gradient

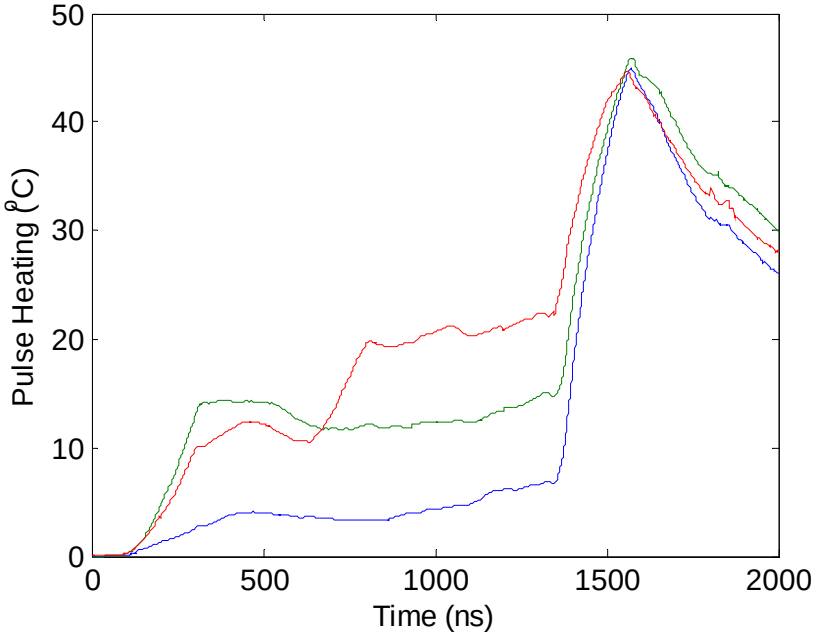


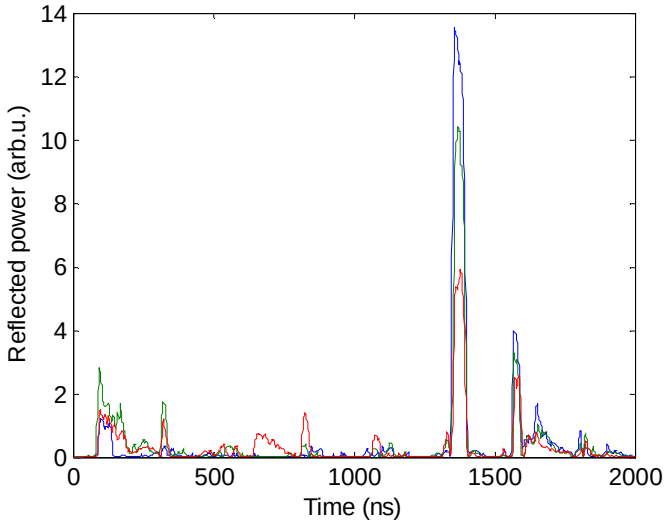
Comparison of these results with those from a similar structure (same a/λ) tested at the Klystron Test Lab where the pulse shape was fixed so the gradient varies with pulse heating

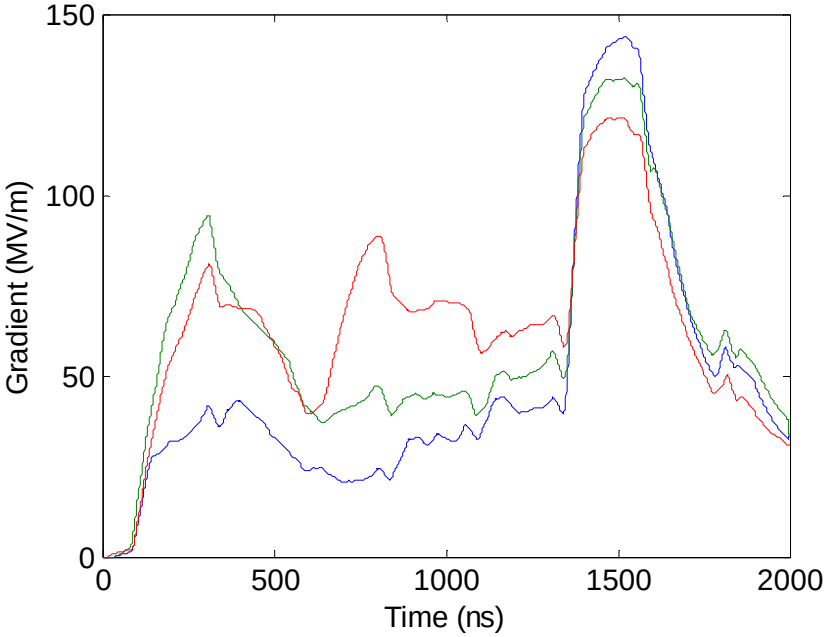


Breakdown Study with Constant Pulse Heating

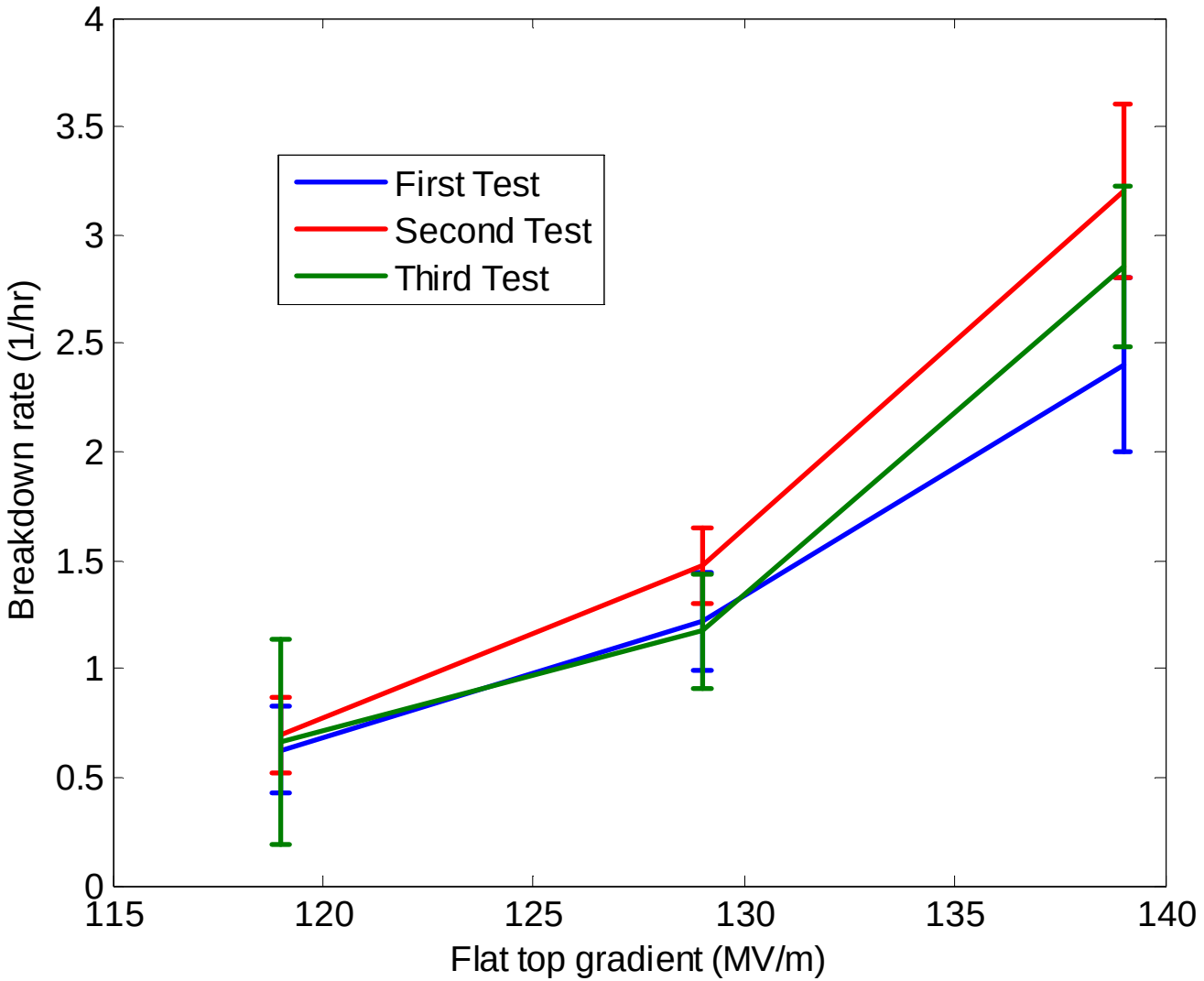








Breakdown Rate for Fixed Peak Pulse Heating



Flat top gradient for 160 ns.

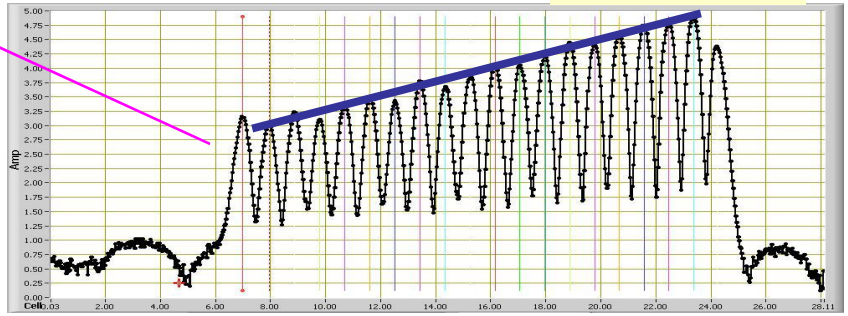
(139/129)^25 =6.5

(139/119)^25 = 48.6

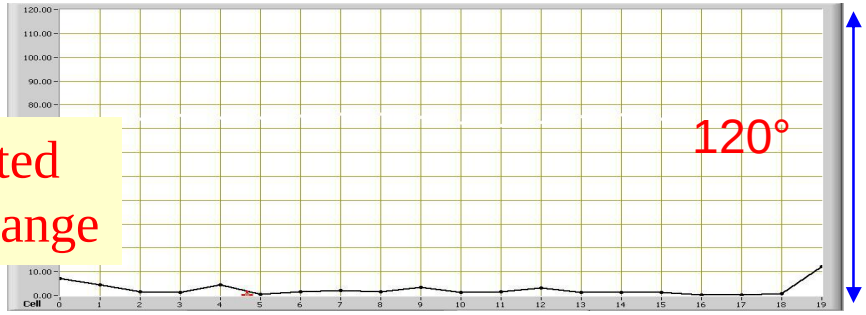
Test Results from Second SLAC T18 Disk Structure

Freq.: GHz	11.424
Cells	18+input+output
Filling Time: ns	36
Length: cm	29
Iris Dia. a/λ(%)	15.5~10.1
Group Velocity: v_g/c (%)	2.61-1.02
S_{11}/S_{21}	0.035/0.8
Phase Advace Per Cell	2π/3
Power Needed $<E_a>$=100MV/m	55.5MW
Unloaded E_a(out)/E_a(in)	1.55
E_s/E_a	2
Pulse Heating ΔT: K (75.4MW@200ns)	16.9-23.8
High Power Test Time: hrs	1400
Total Breakdwon Events	2148

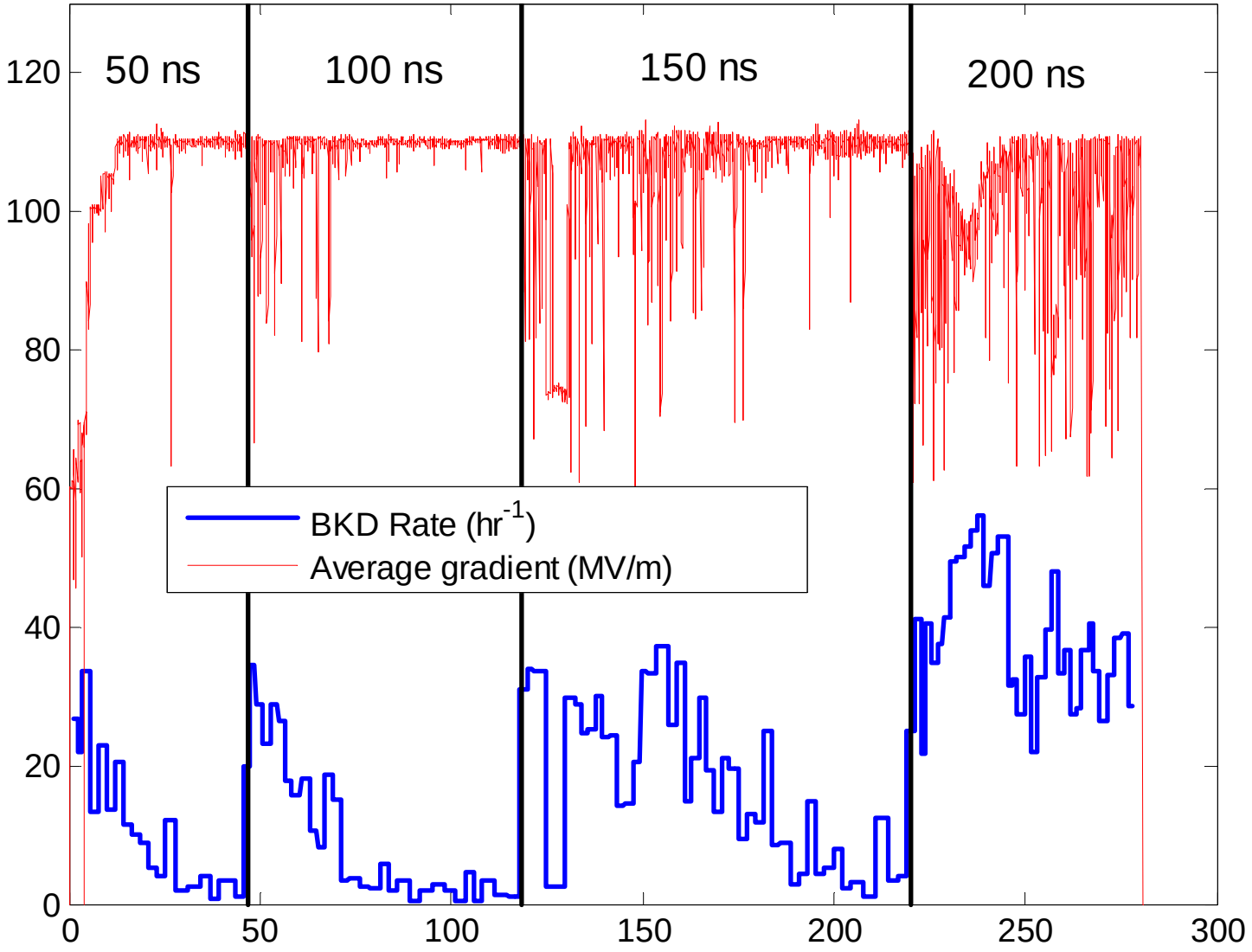
Field Amplitude



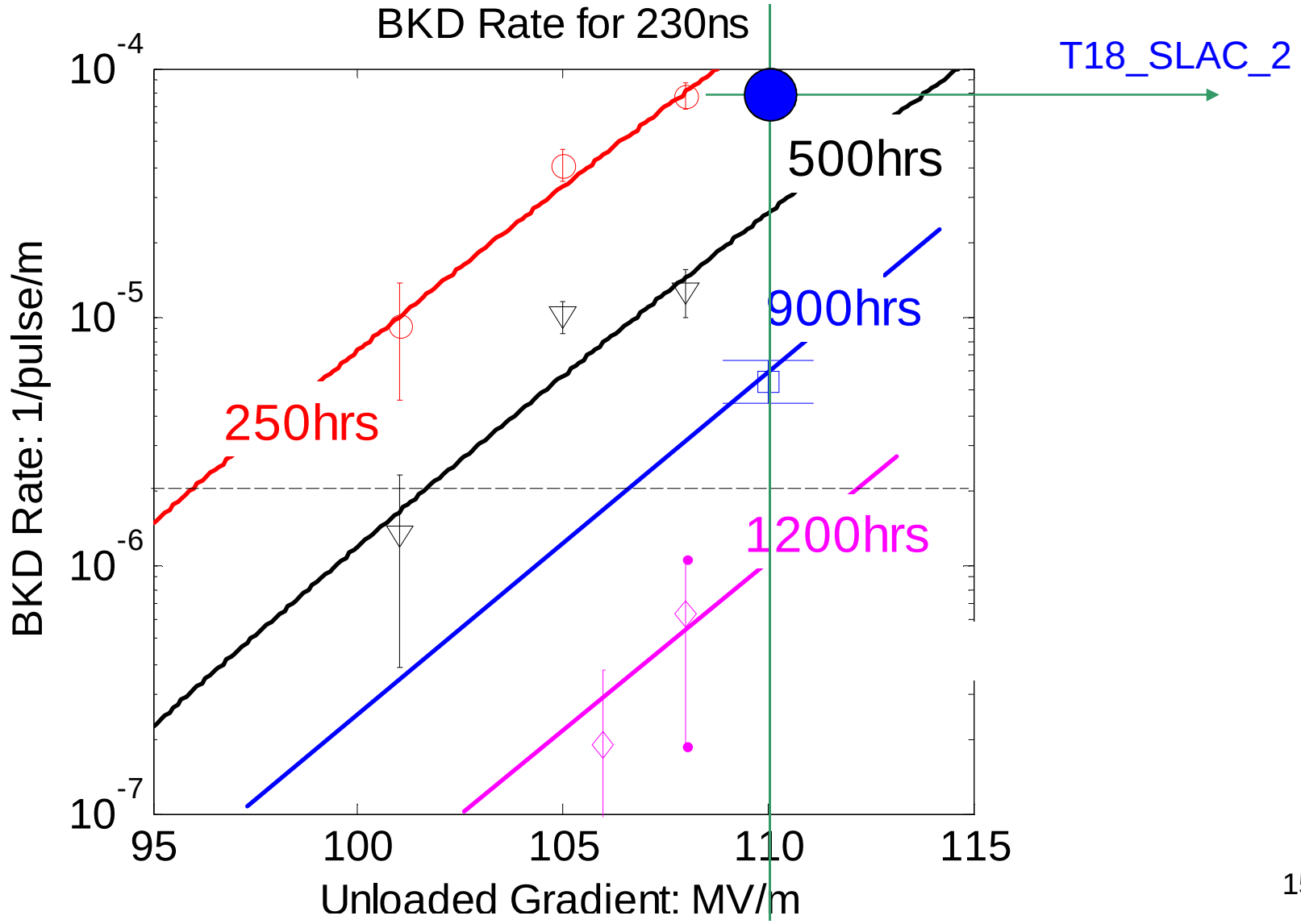
Cumulated Phase Change



This time, processed structure by progressively lengthening the pulse at constant gradient (110 MV/m)



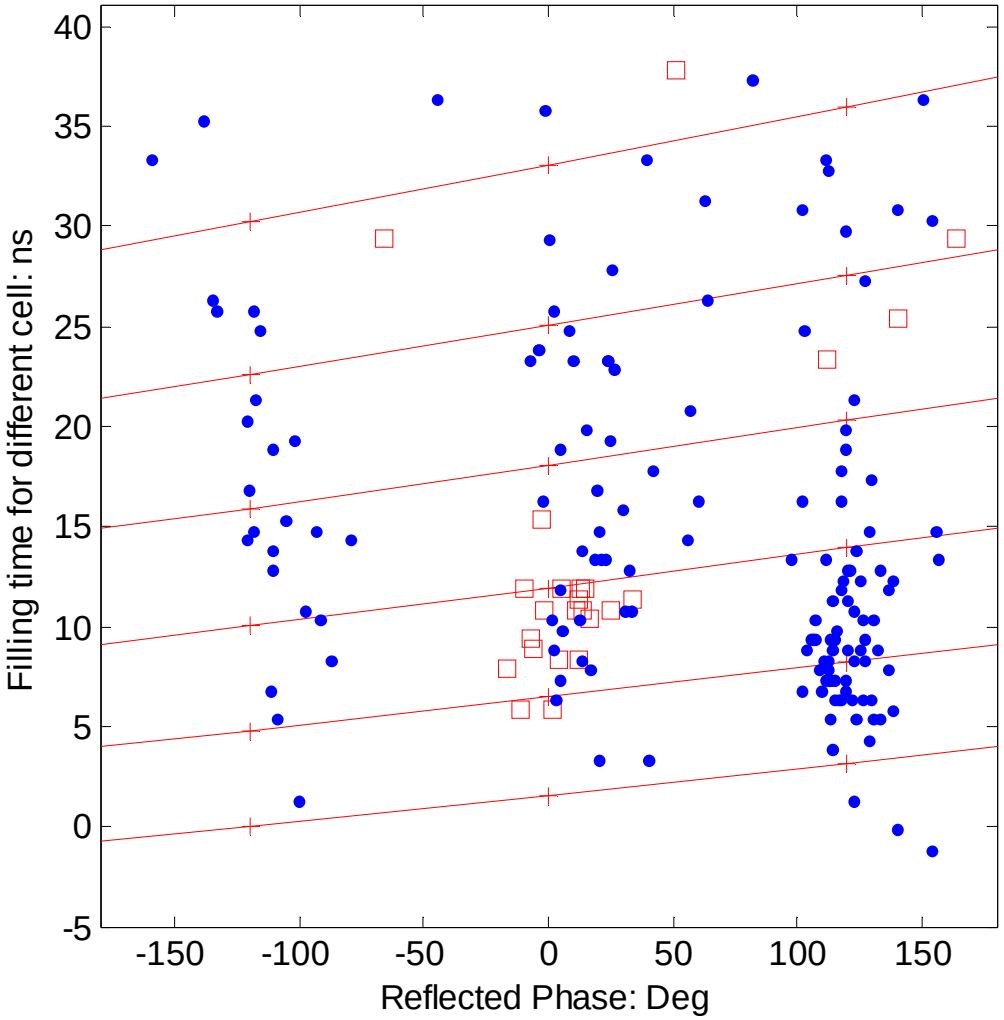
Comparison of current BDR rate (blue circle) with the rate curves from the First SLAC T18 structure at different processing times



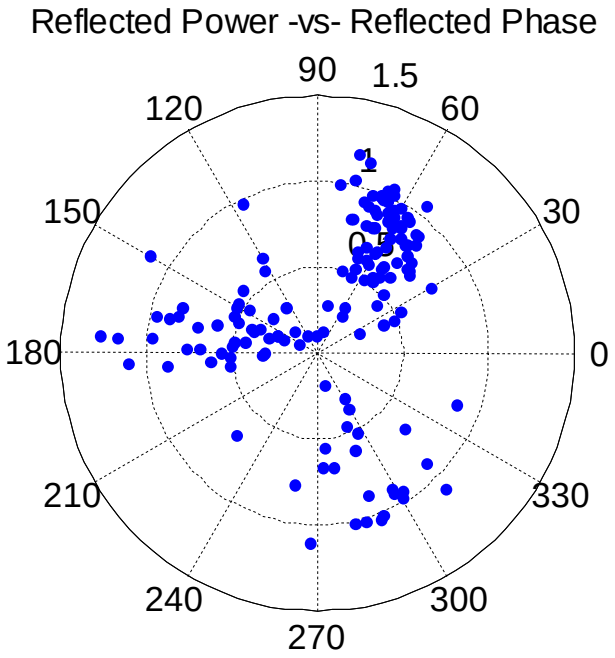
RF Breakdown Locations

Blue dot: T18_SLAC_2 after 250 hrs running

Red square: T18_SLAC_1 after 1200 hrs running



T18_SLAC_2



Summary

- Reduce fill time with SLED for SW cavity test
- It is possible to separate pulse heating and gradient with SLED for the same structure.

- T18 is a good structure, however it is not clear why there is a hot cell.