

Diamond Storage Ring RF Update

ESLS-RF 2006

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On behalf of the SR RF Group

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Agenda

1. General status
2. Amplifier
3. Cavities
4. Liquide Helium Refrigerator
5. Summary



General Status

**700 MeV Storage Ring
commissioning** – low energy as no
water available for dipoles

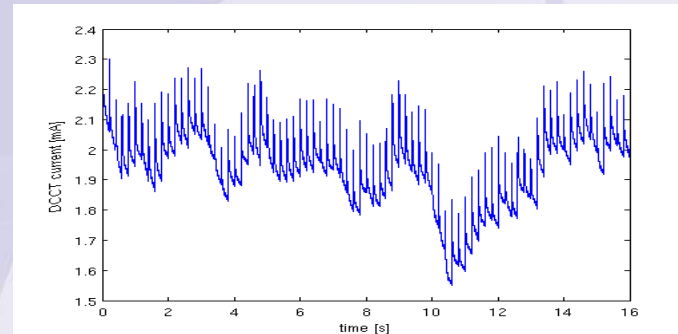
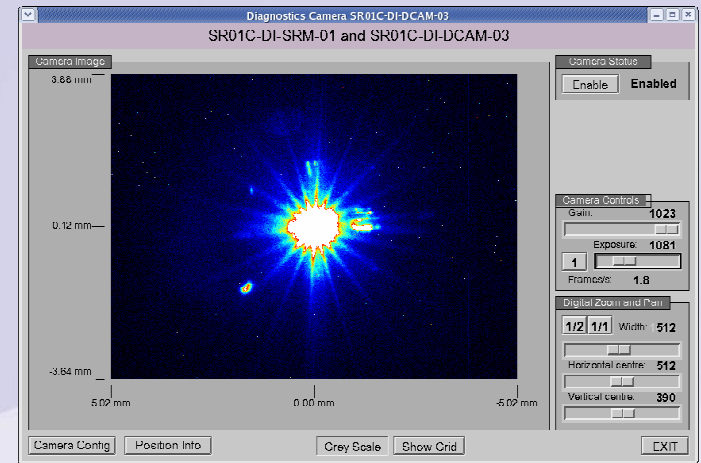
First turn achieved on 5th May 2006

Accumulation to 2 mA

Loss per turn = 3 keV

RF voltage = 20 keV

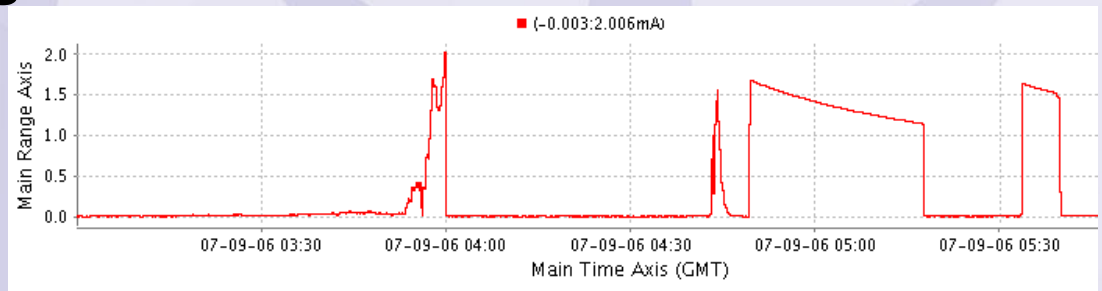
RF power to beam ~ 6 W!



3 GeV Commissioning

Accumulation to 10 mA

First light on beam line
expected this week

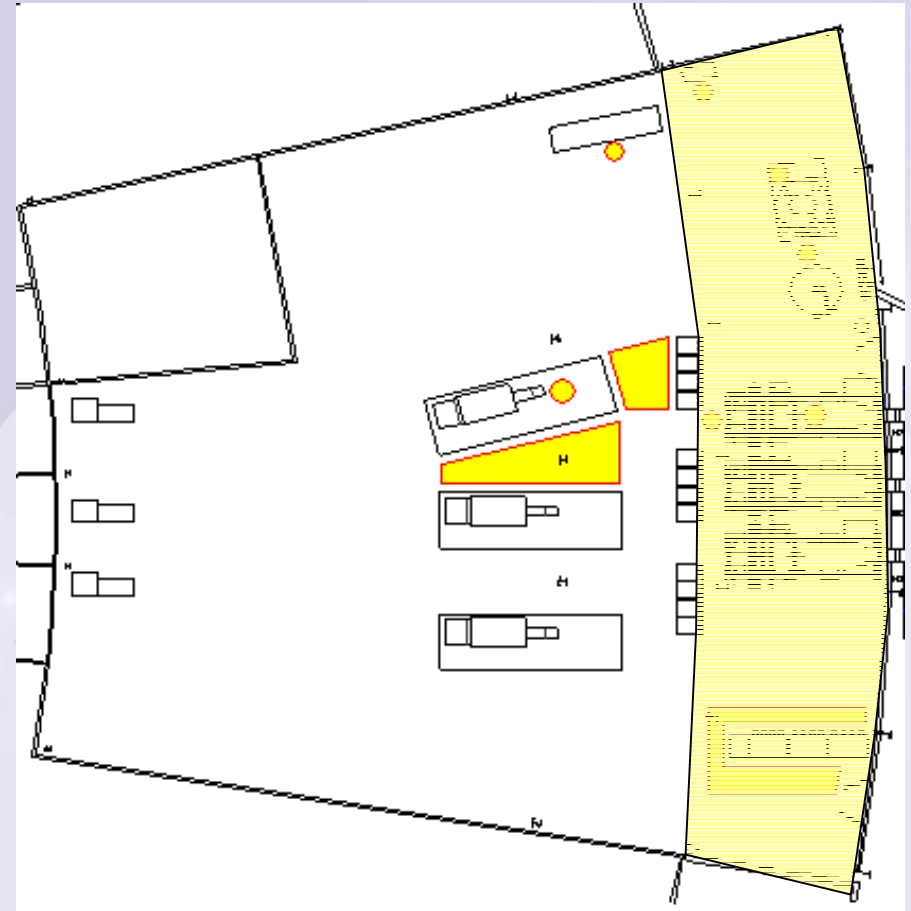


Flood in RF hall

Morning of 16th December 2005

Gasket failure in service gallery

Water came through plaster board on top of IOTs, combiner, helium fridge, racks and T&M equipment



Corrosion and dust deposits
within 24 hrs

Flood in RF hall

Summary

Significant refurbishment by Thales, all IOT cavities demounted, cleaned and repaired

Significant refurbishment by Air Liquide, but mainly electronics damaged

Delay caused > 2 months and 'damaged' warranty

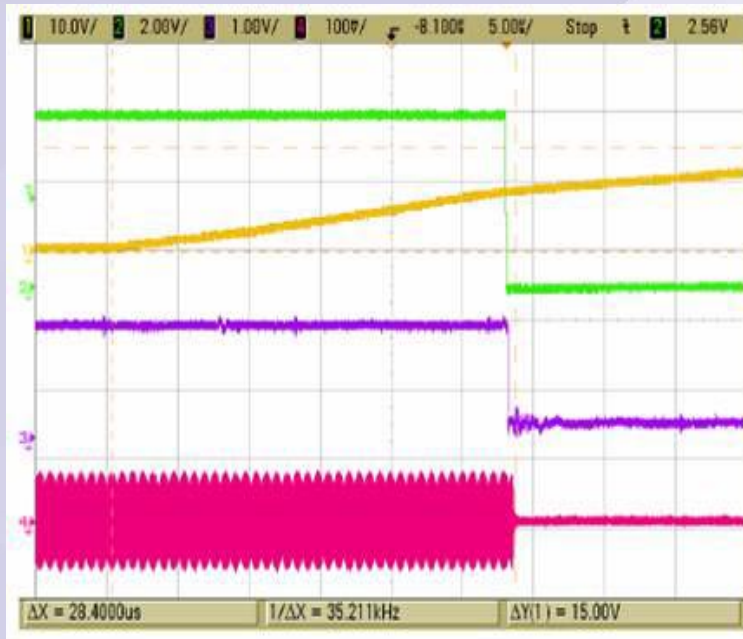
High Power Amplifier

Long term test at 250 kW of system 1
Operated for ~70 hrs with no trips

Selection of Results from 250 kW acceptance tests

Shut down time following trip (eg cavity arc, from time signal arrives at PSU)

Trip detection
Controls signal
RF Shutdown
RF signal from pick-up



Total RF-OFF Delay $28.4 \mu s$

High Power Amplifier

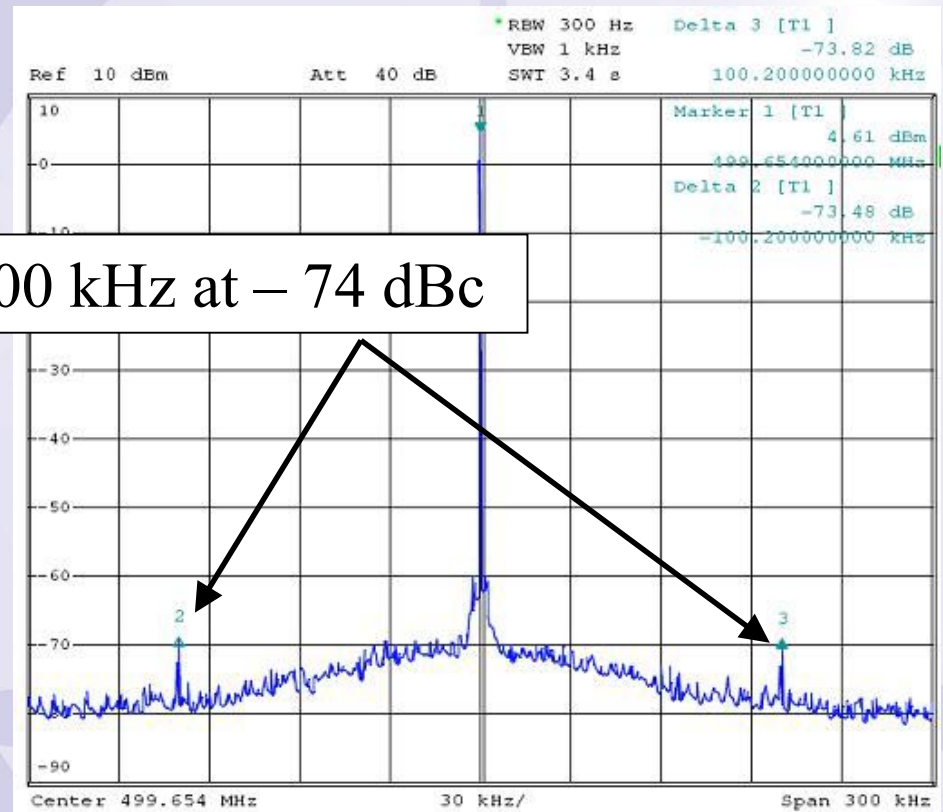
Voltage Ripple

Output Power	Voltage [kV]	Current [A]	Ripple [Vrms]	Accuracy
-	36.1	0.6	5	36.1 (+0.1)
150kW	35.9	8.8	5	35.9 (-0.1)
300kW	35.9	12.6	8.5	35.9 (-0.1)

Phase Noise

@ 1.56 kHz < 70 dBc -
rotational frequency of power
modules

@ 100 kHz < 70 dBc -
switching frequency of power
modules



High Power Amplifier

RF Power output	kW	100	248
Efficiency RF	%	39.3	61.0

Wall plug efficiency and includes filament, focus and HV supplies. Air cooling and water cooling pump for IOT and reject loads. All combiner losses and TWO passes through the circulator.

BUT at 300 kW

System trips after 1 – 8 hours

Tripping due to high total body current, grid current and audible arcing

High Power Amplifier

Repairs include:

- Fitting of new corona ring and spacers to improve voltage hold off

- Fitted resistors to dampen oscillations on grid supply

- Introduced delay to trip following arc which does not go to ground

- Introduced delay to arcs in the ferrite load

 - mask arcs caused by falling ferrite tiles

 - new response time of 10 ms still protects against continuous arc

IOTs still arcing

- Dust found to accumulate in high field area in I/P cavity

- Air flow re-directed and additional dielectric added

IOTs still arcing

- Large number of broken ferrite tiles found on load – load to be repaired

- Air hoses replaced for anti-static hoses

Black dust found in air hoses and ventilation system

- Fan belts disintegrating

- New fan installation ordered

- Input cavities returned to TED for refurbishment now back at DLS

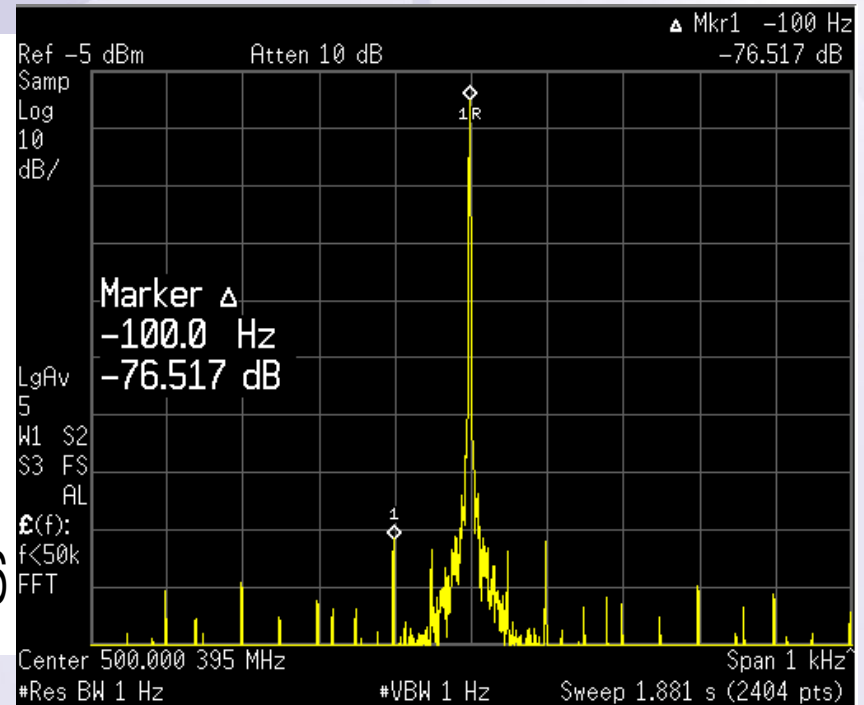
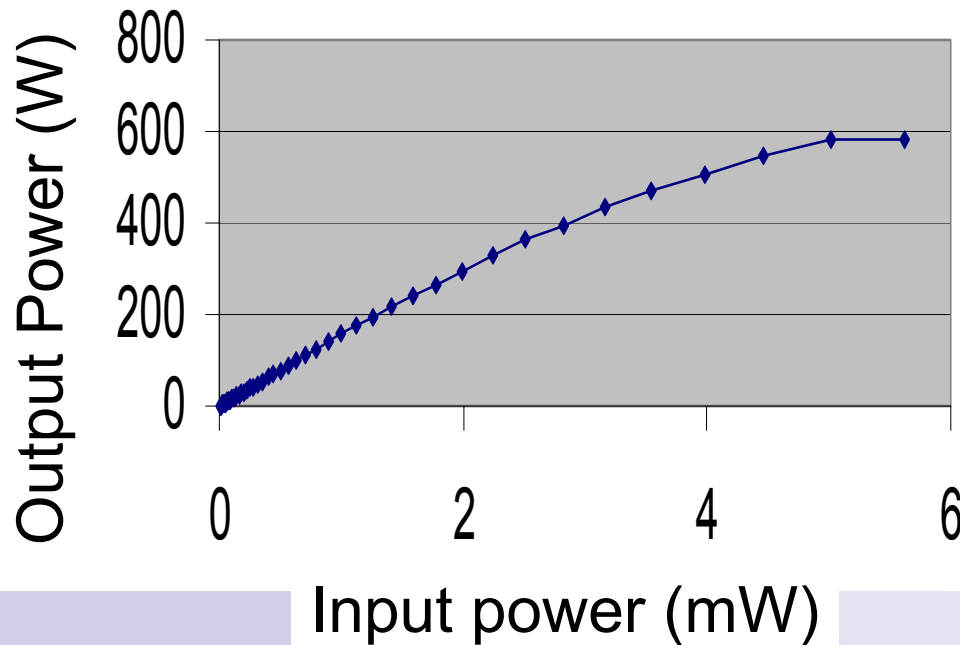
Commissioning starts again on 27 September 06



Drive amplifiers

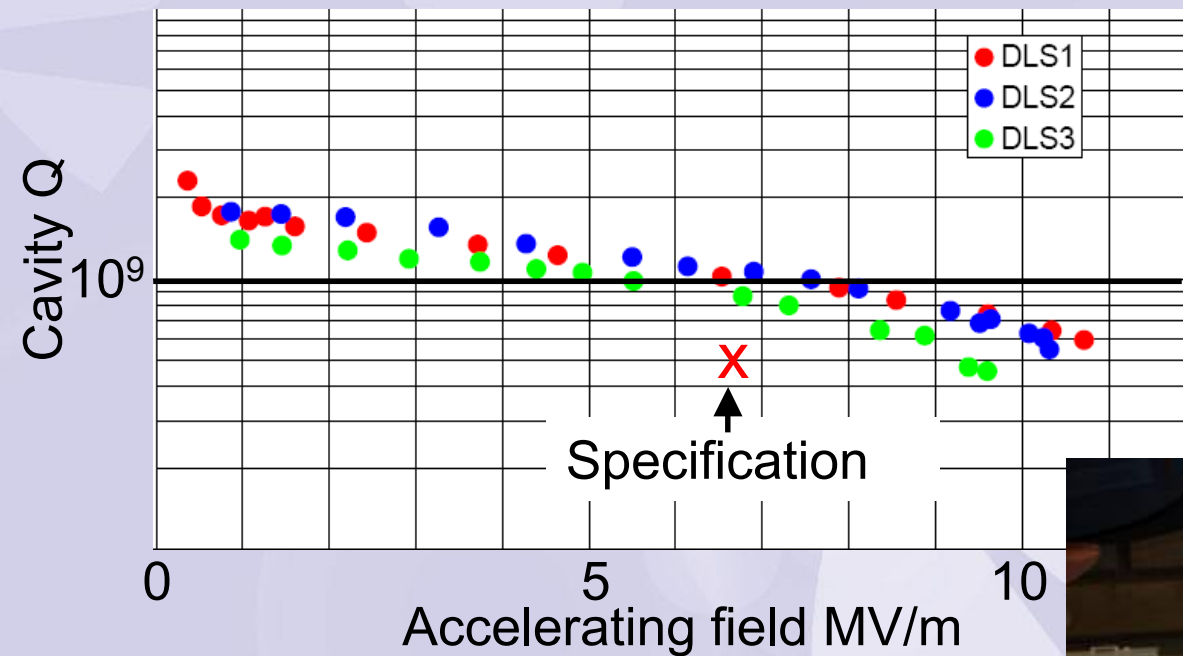
Original drive amplifiers replaced by TH15701 525 W from TED

First 4 delivered and installed. Two further units delivered.
Delivery of remaining units shortly.



Superconducting Cavities

Vertical test results

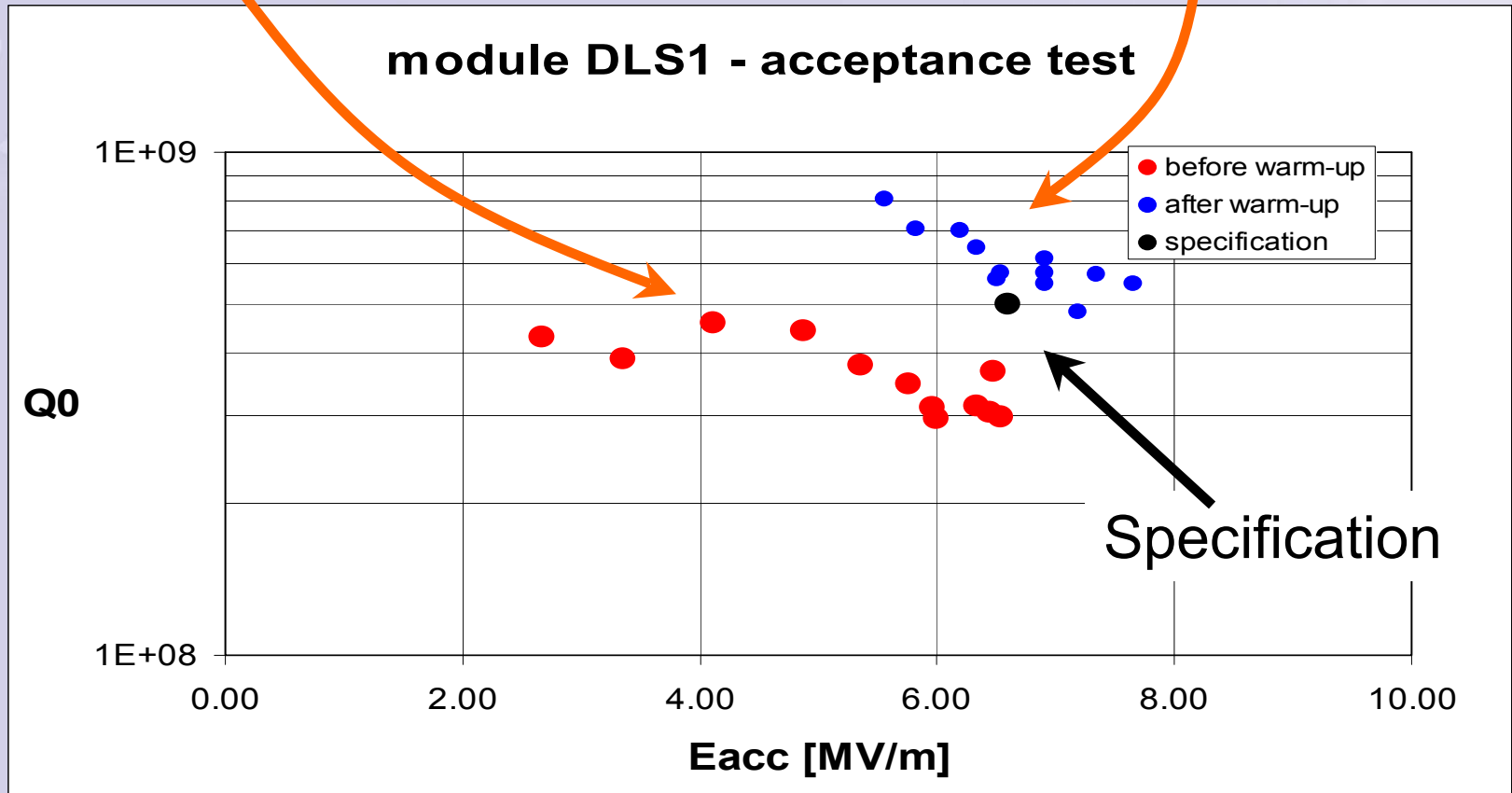


Superconducting Cavities

Initially cavity took long to condition and Q_0 was poor

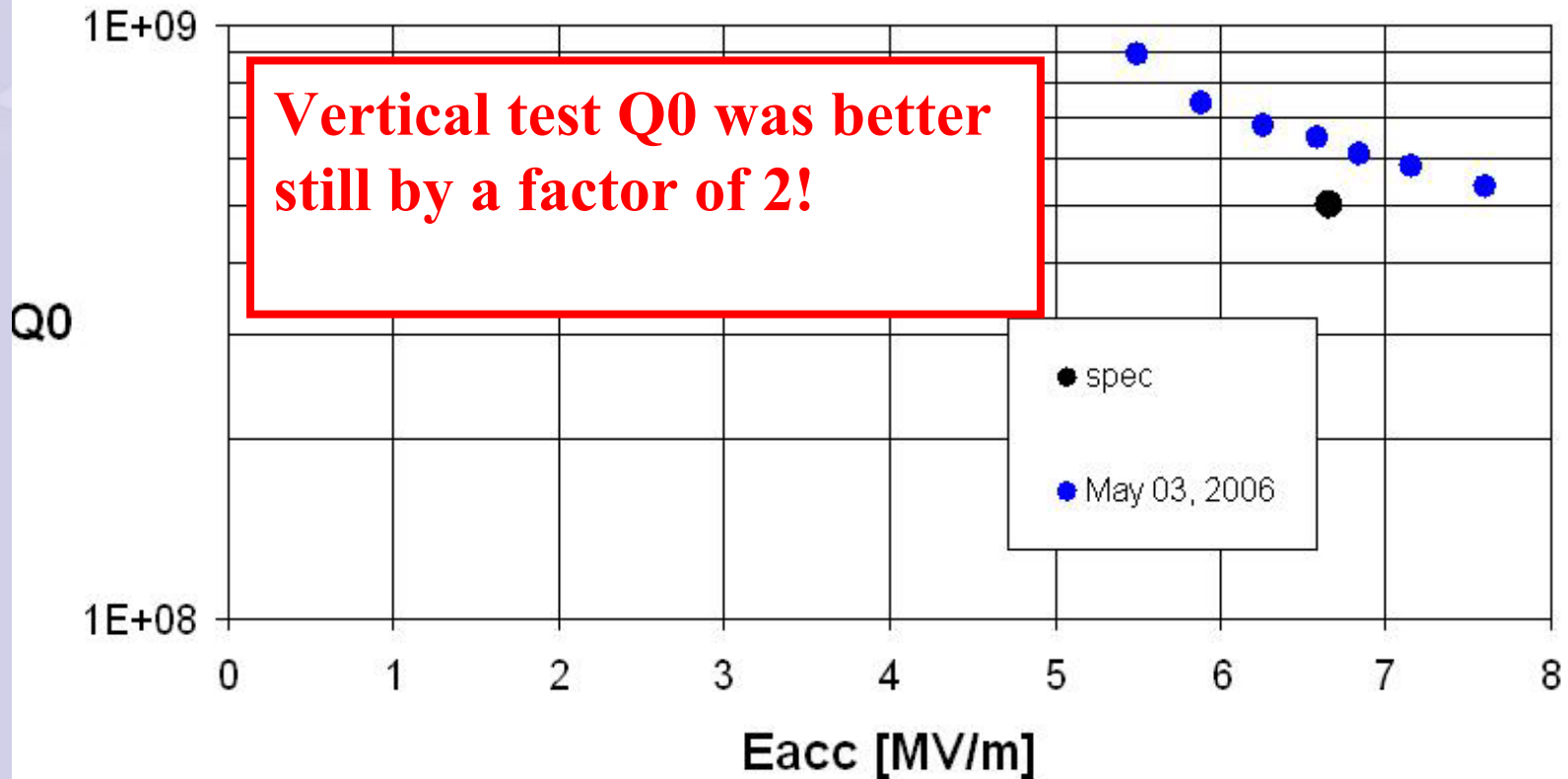


Cavity was warmed up and cooled back down



Superconducting Cavities

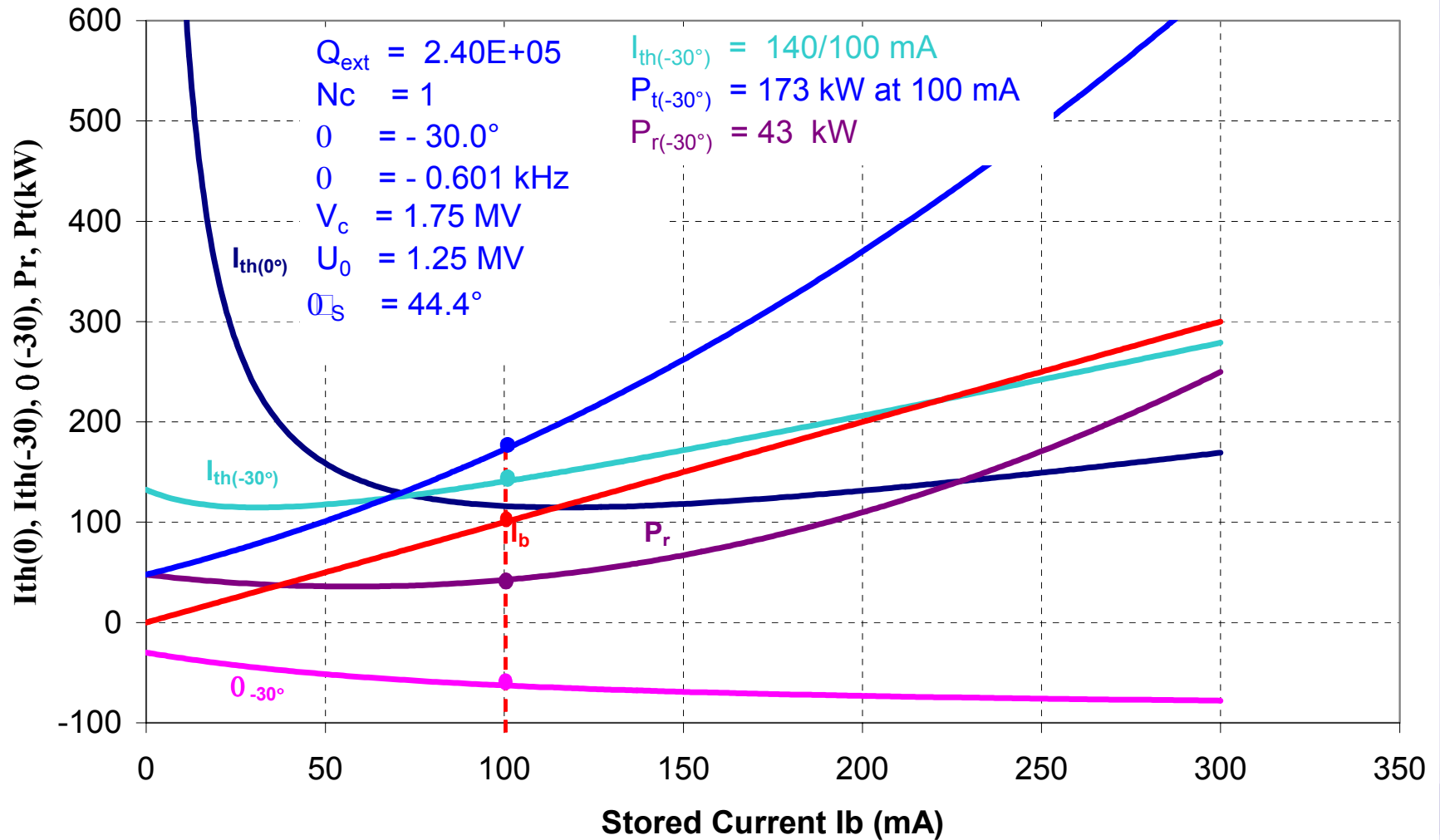
module DLS3 - acceptance test



Robinson Stability

Single Cavity Operation

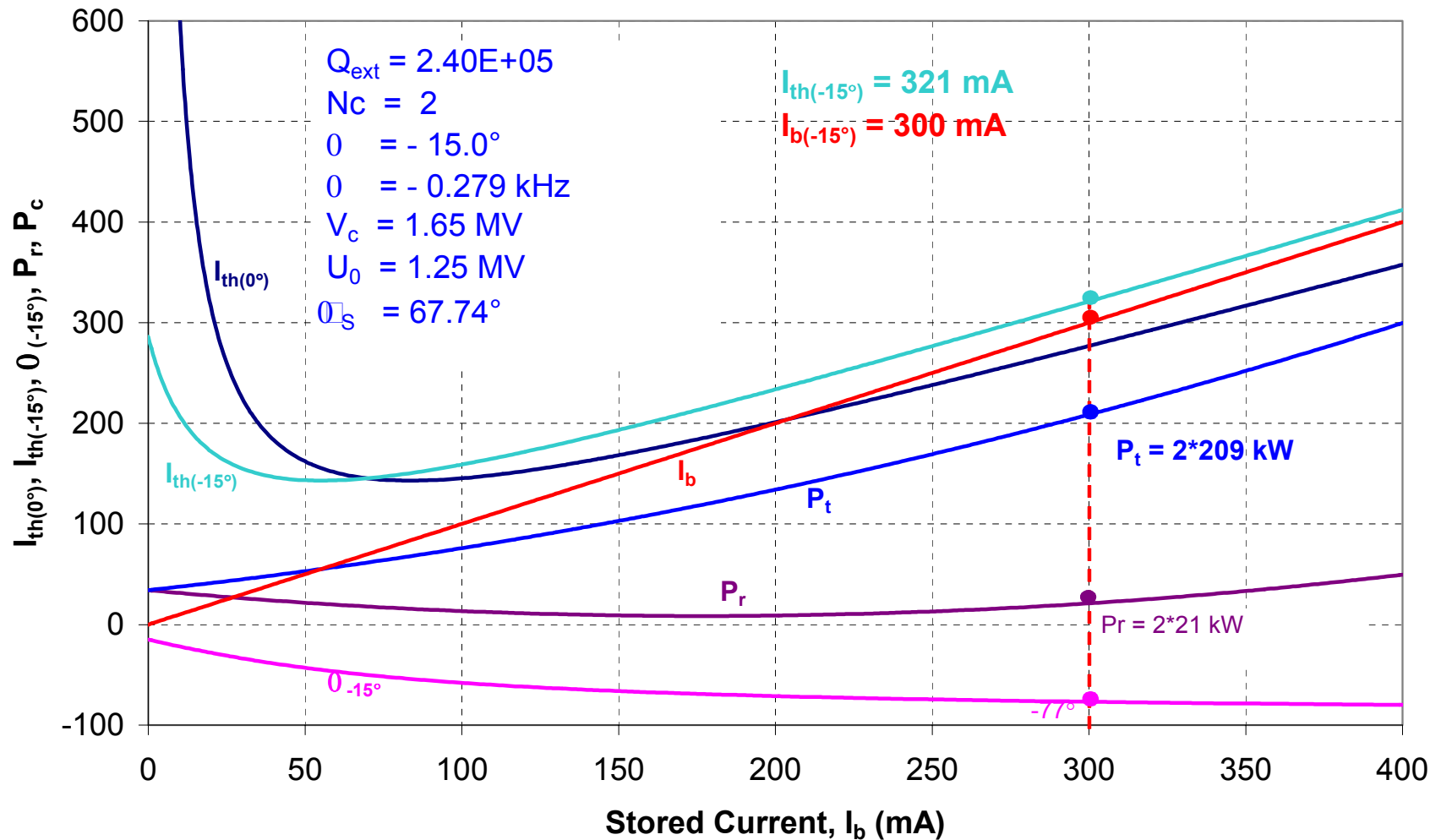
Target current 100 mA



Robinson Stability

Two Cavity Operation

Target current 300 mA



Helium Liquefier

Liquid helium refrigerator refrigeration	488 W (+ 20 L liquefaction)
Liquid helium refrigerator liquefaction	189 L/hr

Key notes since installation

Cold start is difficult
Compressor PLC replaced
Pressure sensor replaced
Fault with temp. sensor



All too familiar!

Summary

Tough time with site conditions and accidental flooding
Significant problems with achieving 300 kW on main amplifiers

Amplifier 1 used for 3 GeV commissioning
- not one (non user) trip to date

New Drive amplifiers performing well

Cavities 1 and 3 installed, commissioned and performing well
Cavity 3 being repaired due to leak

Helium liquefier performing well