

Status of the Diamond Storage Ring RF Systems

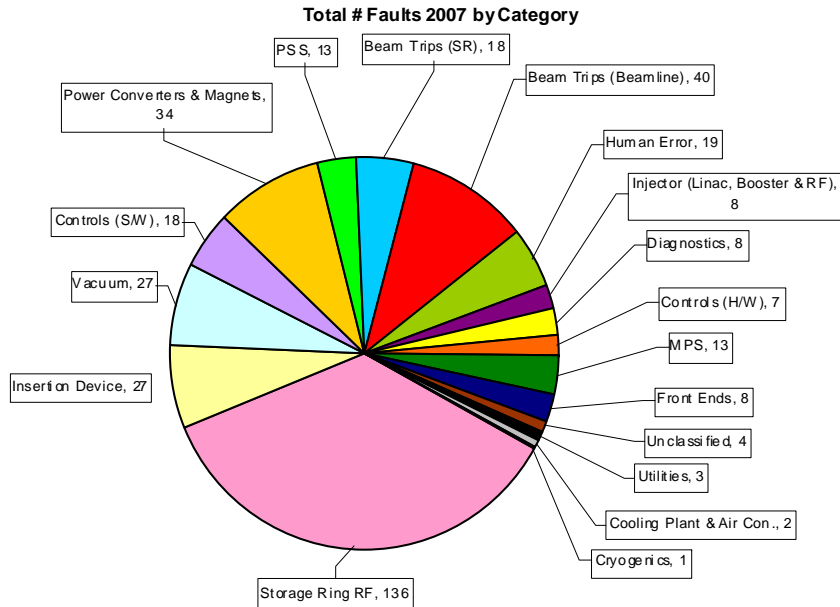
Morten Jensen
on behalf of
Diamond Storage Ring RF Group



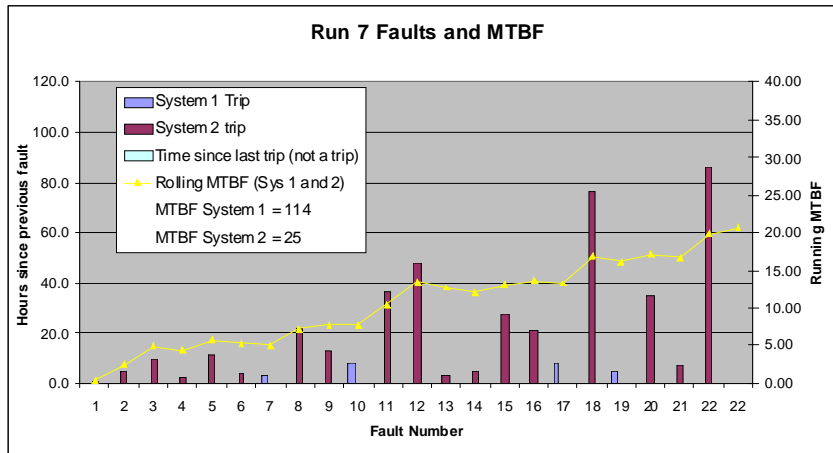
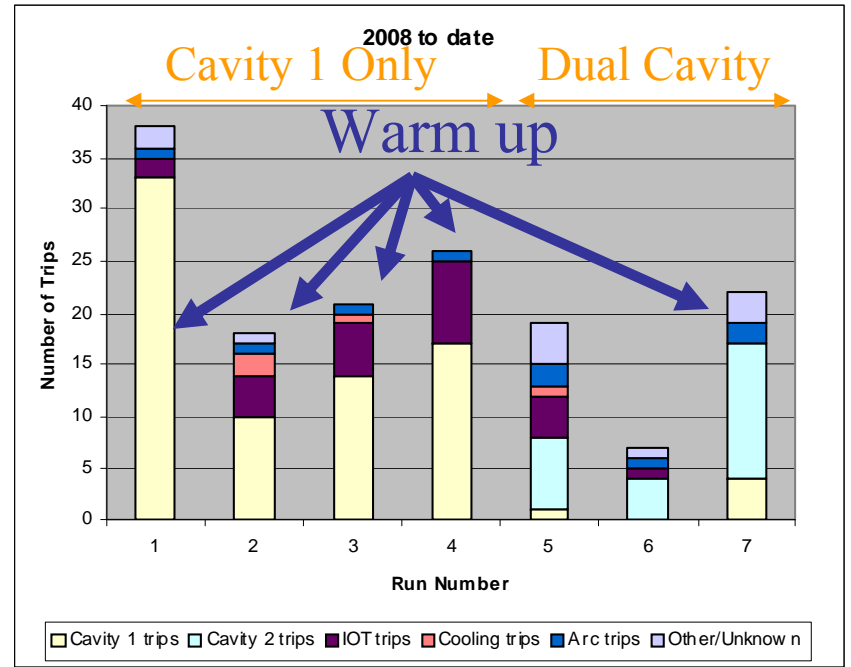
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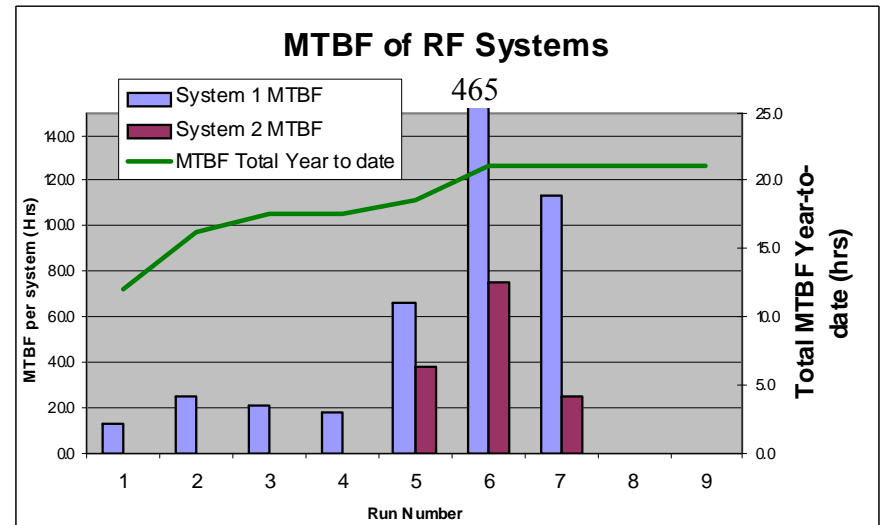
General Operational Status



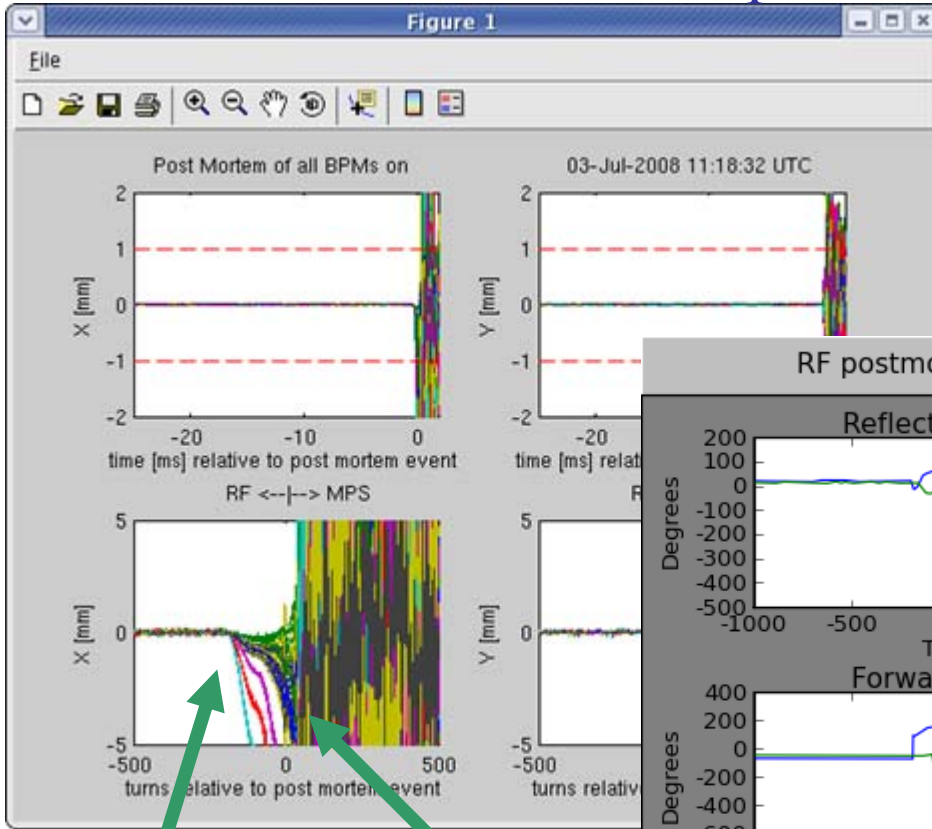
First year of operation



Typical run following warm up



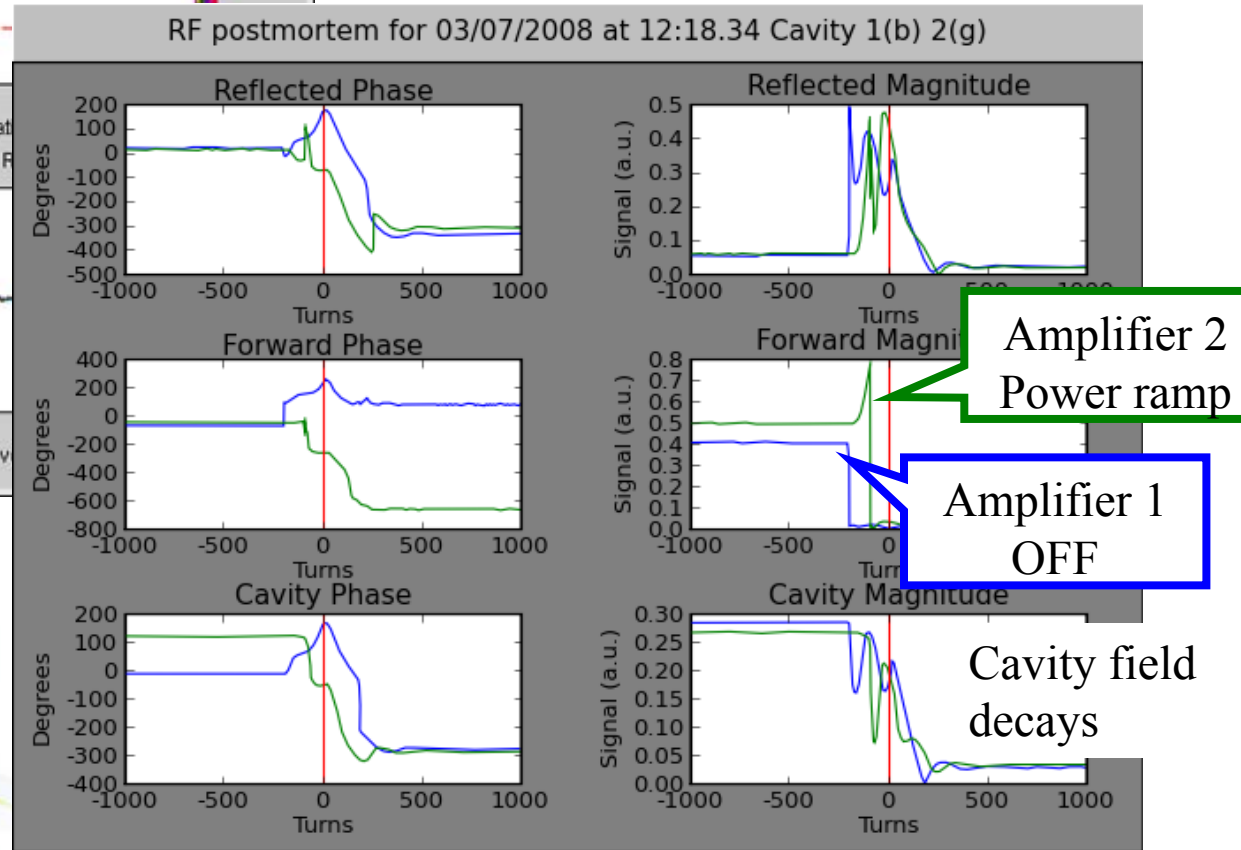
Main issues and causes of trips



Beam spirals
in on loss of
RF

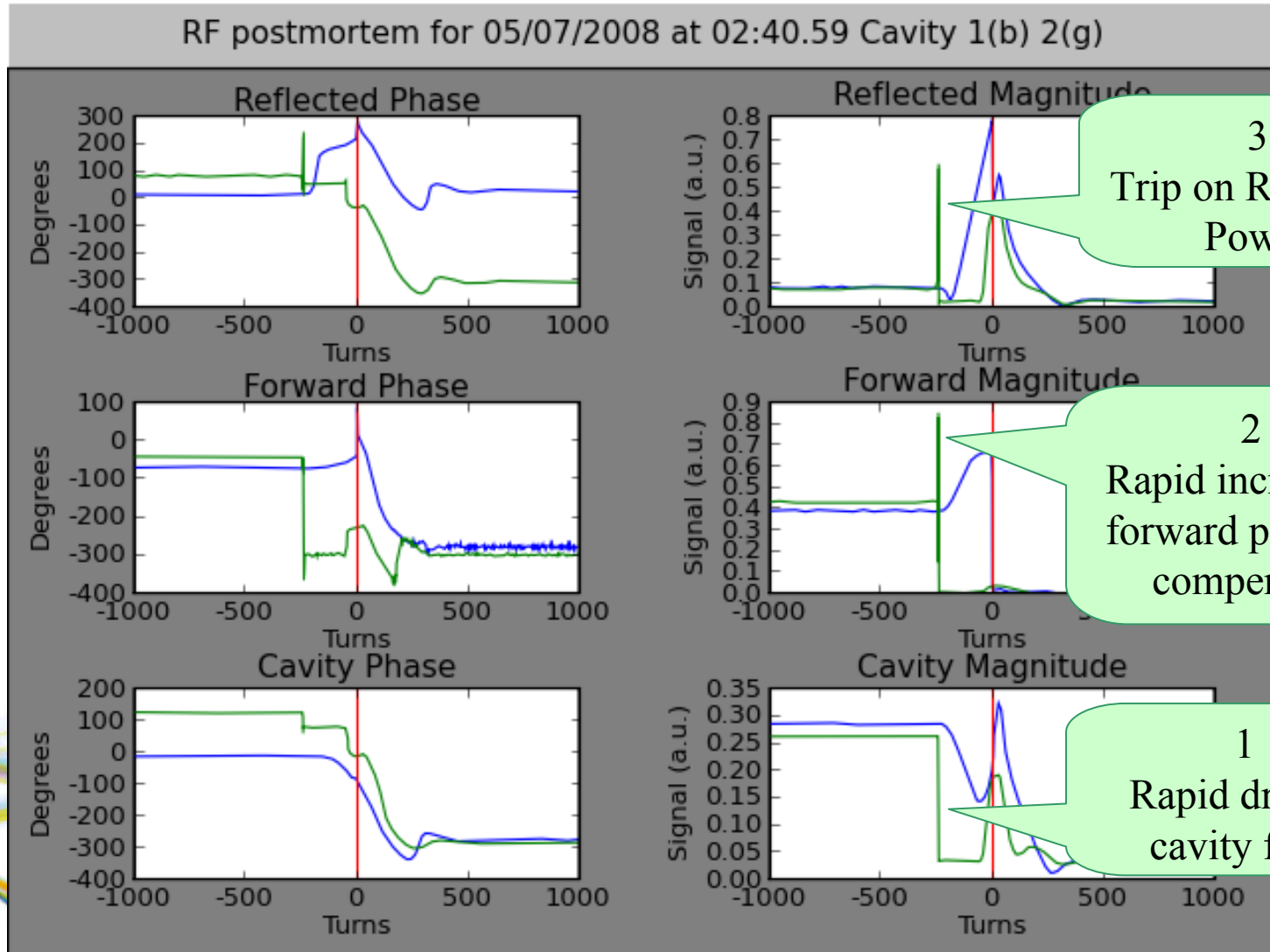
Beam lost

Amplifier 1 IOT trip with stored beam
System 2 follows on MPS.
Note increase in power on system 2 as
system 1 is tripped. Beam 178 mA



IOT Short Circuit indicating HV breakdown

Fast Cavity Trip



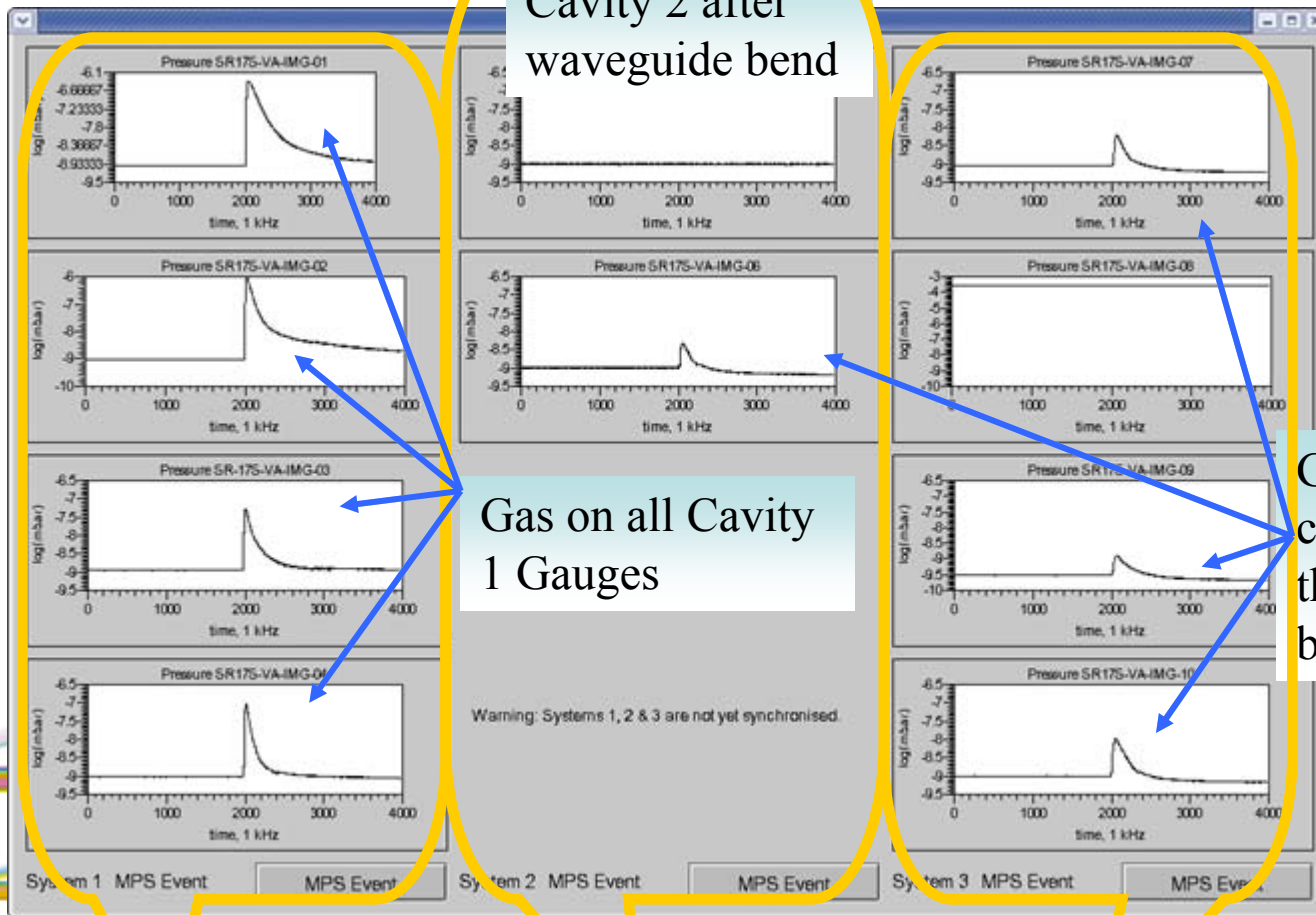
Cavity field collapses in 2-3 turns
→ no longer a high Q cavity

Synchronised Fast Vacuum Data Acquisition Cavity 1 trip

Cavity 2 after waveguide bend

Gas on all Cavity 1 Gauges

Gas travels through the cavities but not around the cold waveguide bend



Cavity 1

Cavity 2

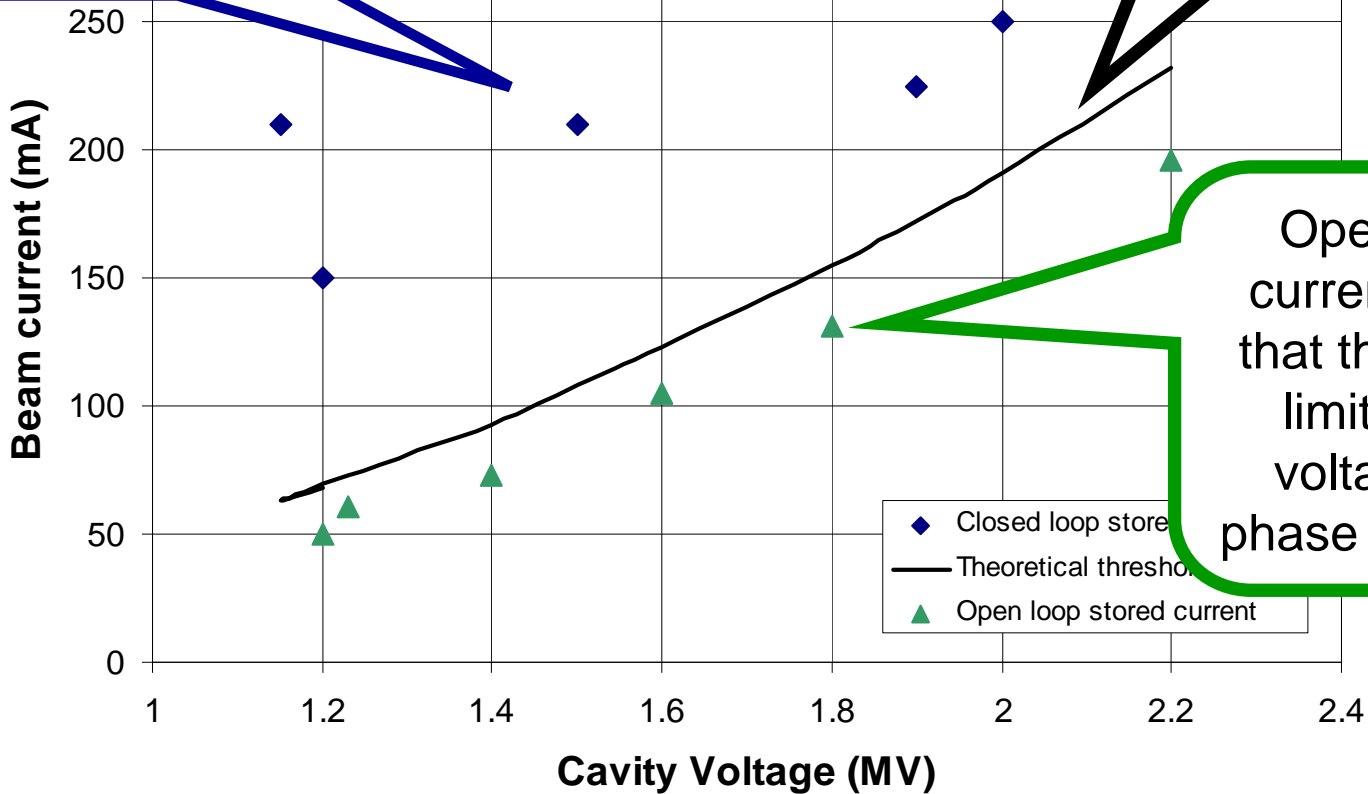
Beam pipe
(Cavity 3 space)

200 mA + operation → Qext modification

Single Cavity Operation

Beam stored with LLRF operating in Closed Loop mode increasing stability

Theoretical Robinson Threshold current

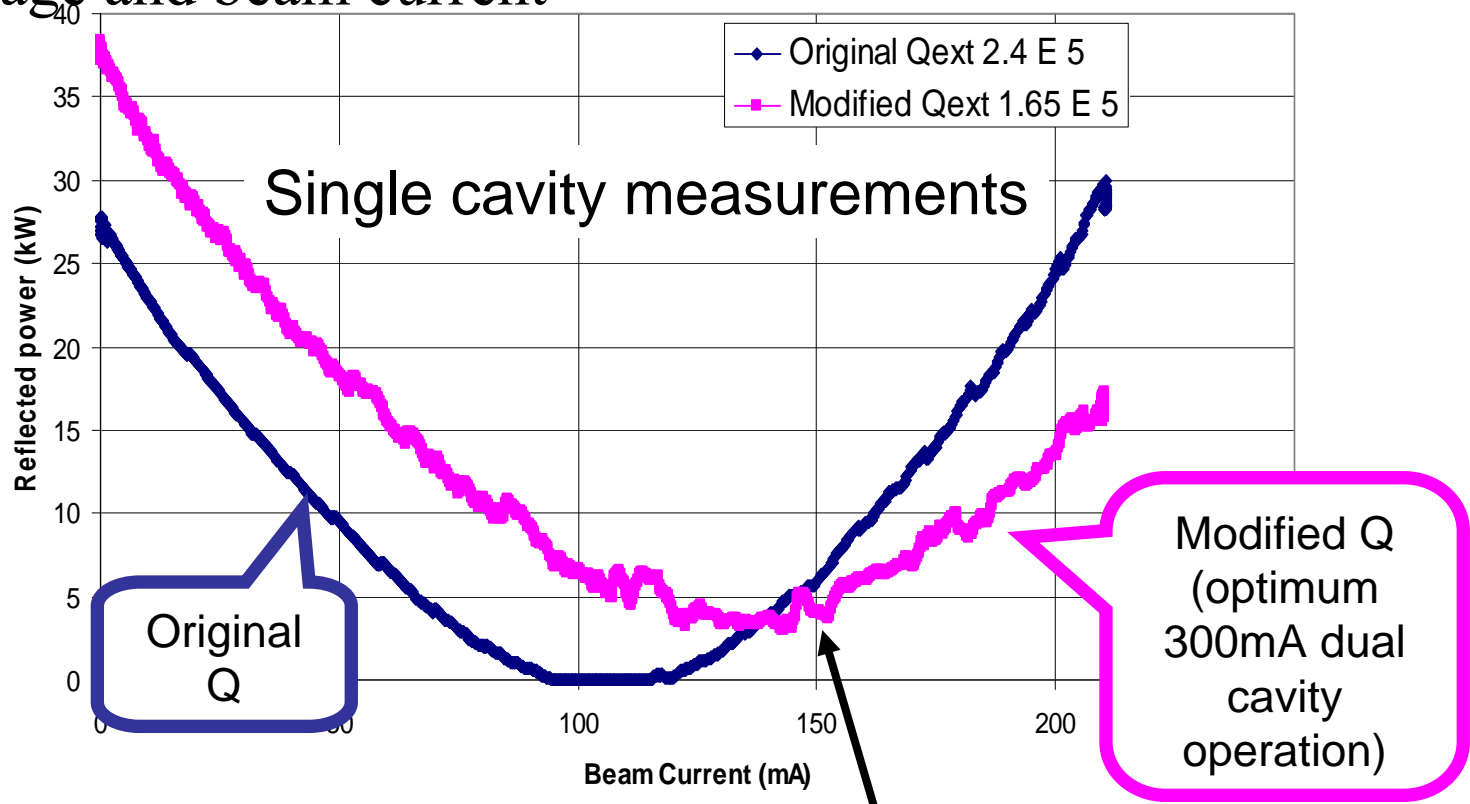


Open Loop current is less than theoretical limit due to voltage and phase variations

Separate RF Feedback is not required to maintain Robinson Stability

200 mA + operation → Qext modification

Qext is modified by installation of a 3-stub tuner between the circulator and the cavity coupler
→ Qext can be adjusted for particular operational parameters i.e. voltage and beam current



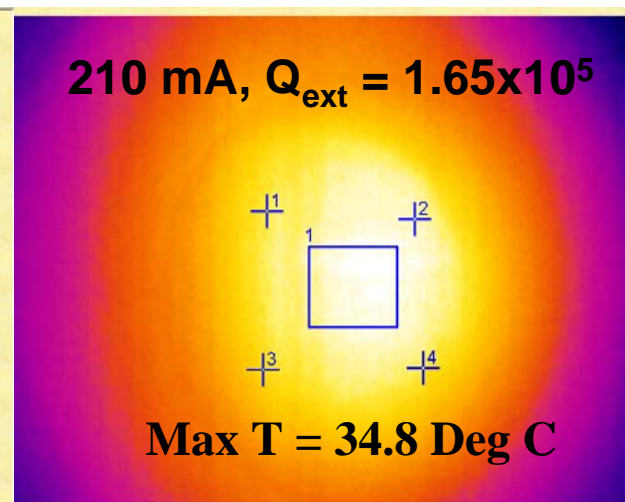
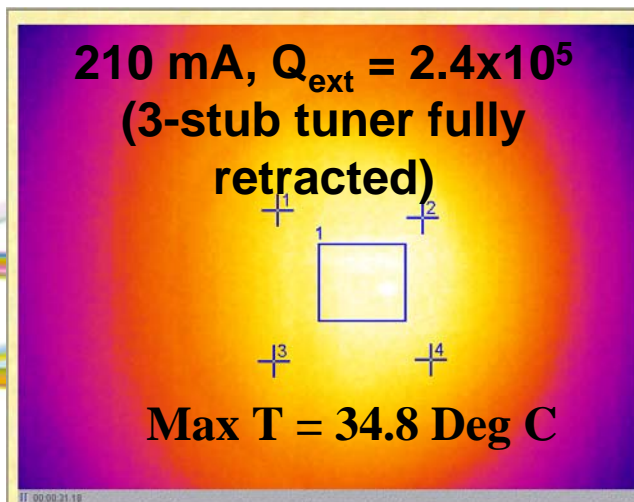
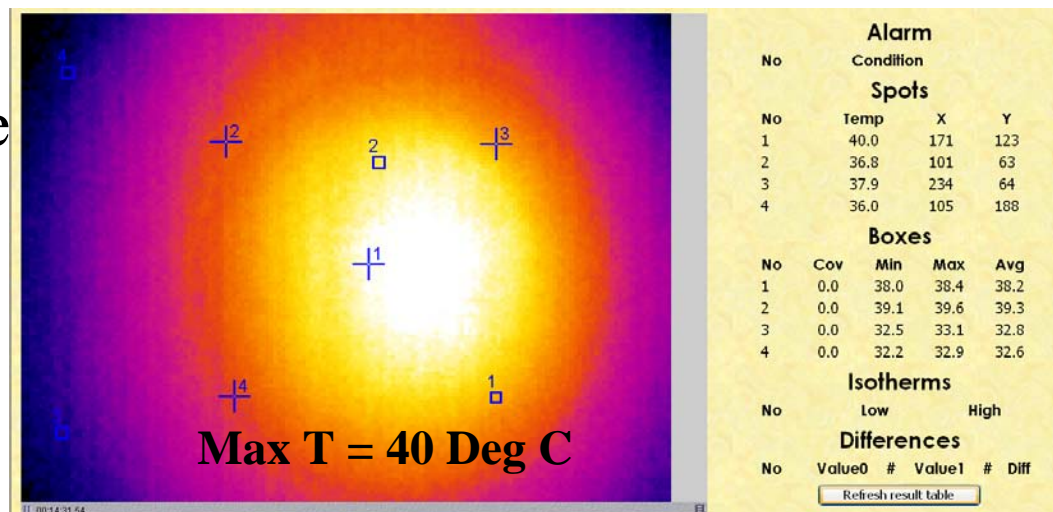
Non zero reflected power due to the cavity being slightly off resonance

200 mA + operation → Q_{ext} modification

Thermal Plots of Window Temperature Distribution

3-stub tuner = Standing Wave
How great is the risk?

No beam
104kw at - 40deg
off resonance



Main Upgrades in the previous 12 months

- Second Compressor installed and commissioned
- Compressor 1 and Cold Box serviced
 - → loss of performance after two weeks operation
 - → maintain operation by continuous flow of LN2
- Helium was contaminated reducing efficiency of top heat exchangers
- Cold box warm-up x 2 – discarded helium in cold box followed by multiple pump and purges
- Operation resumed – Nominal operation re-established
- **No ‘direct’ impact on operation**



Main Upgrades in the previous 12 months

New TED IOT to type 793-1 (one IOT only in R&D cavity)

RF Load upgrade for full power reflected capacity

Amplifier Upgrade incl. (new inductor, adjustable PSU ‘frequency’)

LLRF software loop to compensate for beam current

Dedicated cooling for the drive amplifiers

Drive amplifier tuning upgrade

IOT Enclosure built and commissioned

Measurement patch panel partly installed

MPS upgrade to enable operation of RF

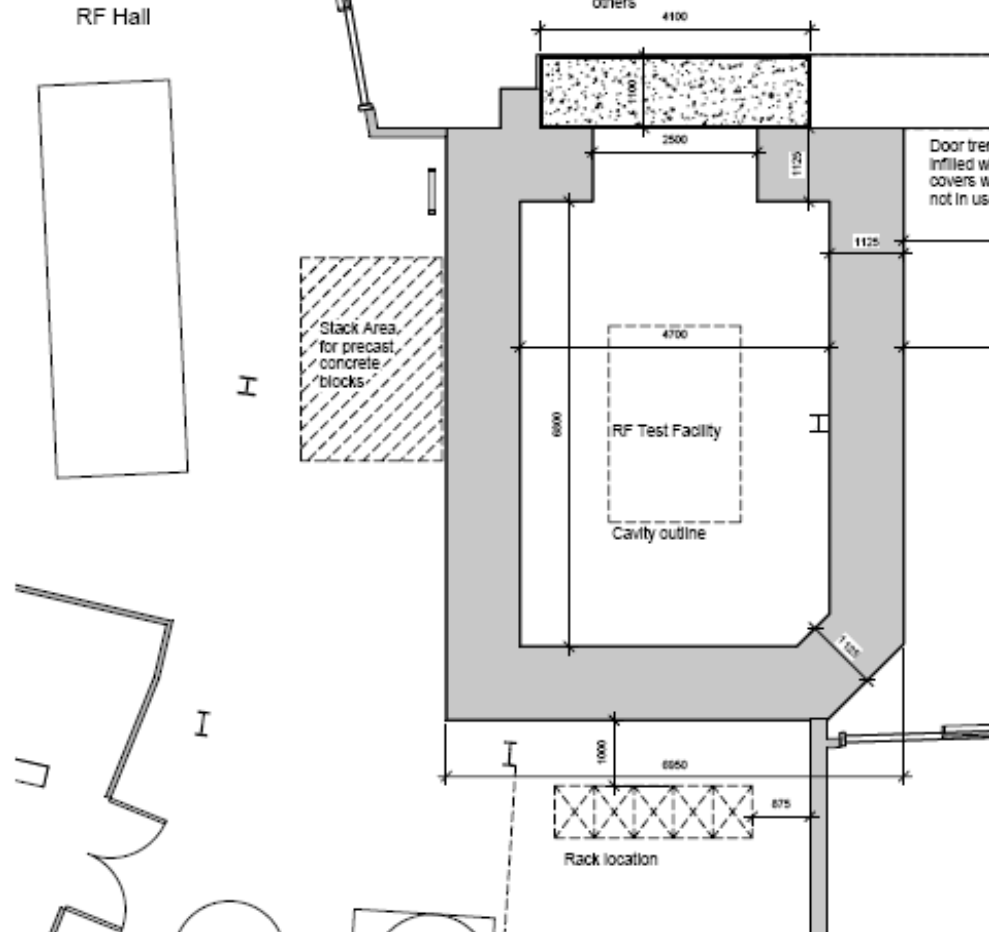
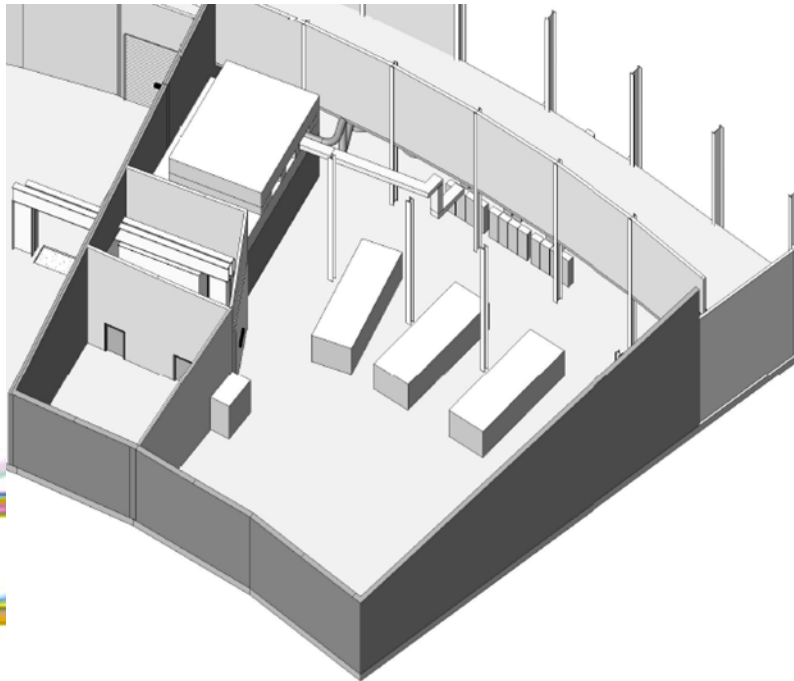
New window bake out boxes designed and built



RF Test Facility

- High voltage and high power test of accelerating modules
 - Pulse and cw conditioning of cavities
 - RF supplied from any one of three high power amplifiers
 - Connection to helium dewar, LN2 supply and cold helium return via MCL
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- **Main structure complete by end of October 2008**
 - **Classical M&E complete mid December 2008**
 - **Technical Services incl. Waveguide and Cryogenics complete by end of January 2009**
 - **Facility ready for operation early 2009**

What will it look like?



Current Status:

- Services relocated, piling complete
- Foundations cast
- Walls Cast
- Roof shuttering being installed
- Door being manufactured



Thank you for your attention!

