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# **Overview and initial results from Diamond**

**ESLS-RF 2005**  
**Morten Jensen**



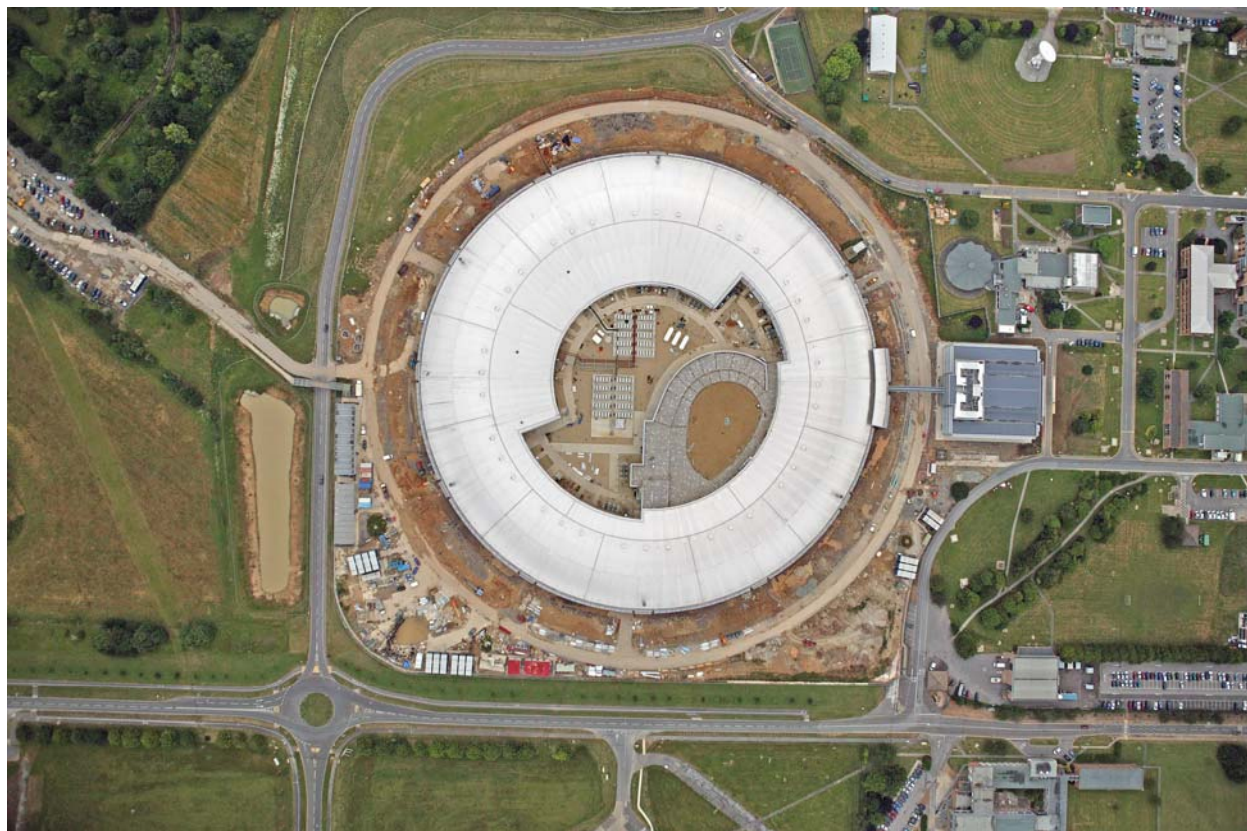
# Agenda

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1. General status of the building and RF equipment
2. Linac and Booster RF systems
3. Storage Ring RF systems
4.     RF amplifier
5.     RF cavities
6.     Low Level RF
7.     Liquid Helium Refrigerator
8. Summary

## Aerial Photo – July 2005

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## General status of the building and RF equipment

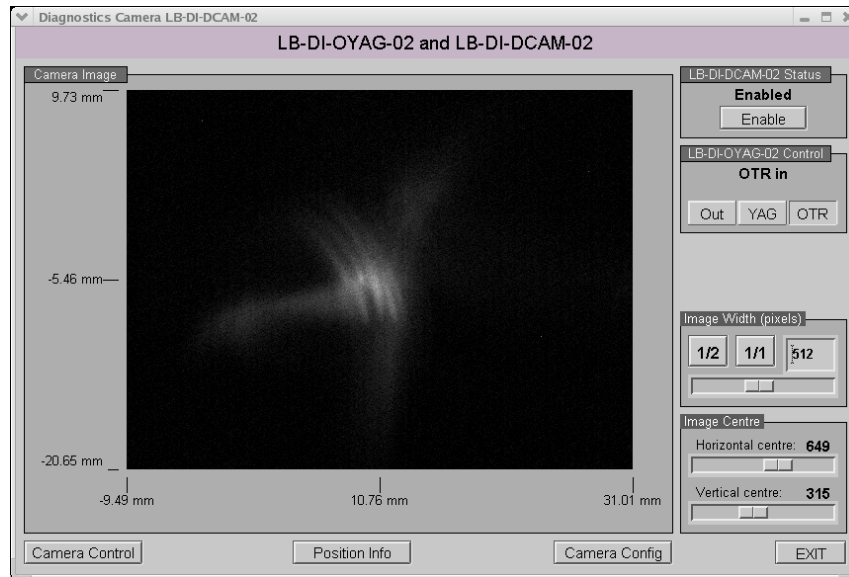
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Linac	Installation 100% complete Commissioning underway with 3 weeks prior to Acceptance Tests Acceptance testing due to complete by end of October '05
Booster	Girders installed 25 of 42 RF amplifier installation 100% with commissioning due 10 <sup>th</sup> October RF cavity installed, commissioning complete by start of November Overall booster commissioning: Start of December '05
Storage Ring	Girders installed 22 of 72 Machine Cabling ~55% with 10% terminated Rigid pipe work ~50% Mains power is available Water available End of November LN2 available Shortly! Storage Ring commissioning: March 2006 (unofficial)

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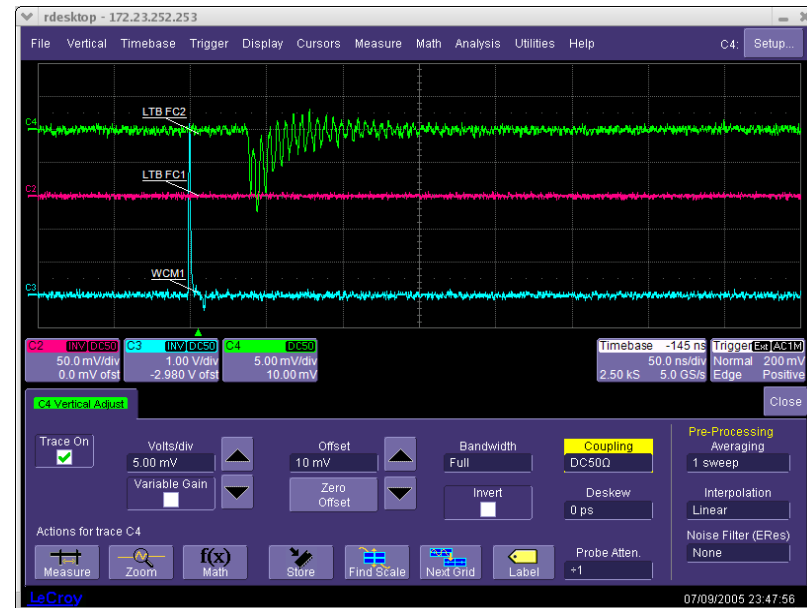
# Linac beam Commissioning

## first Beams at 100MeV 7/9/05 23:00hrs.



EPICS screen for LTB diagnostics

100 MeV Beam spot from Linac onto  
Linac to Booster OTR Screen 2 (after  
energy analysis in LTB dipole 1).



Diagnostics group – fast scope

Linac to LTB Faraday cup 2 (green trace)  
showing an estimated 1 nC of charge at that  
point. Shows no signal on FC1 ( good!) and  
the exit charge of the linac on Wall Current  
monitor 1.

By Chris Christou and Vince Kempson

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## Booster RF systems

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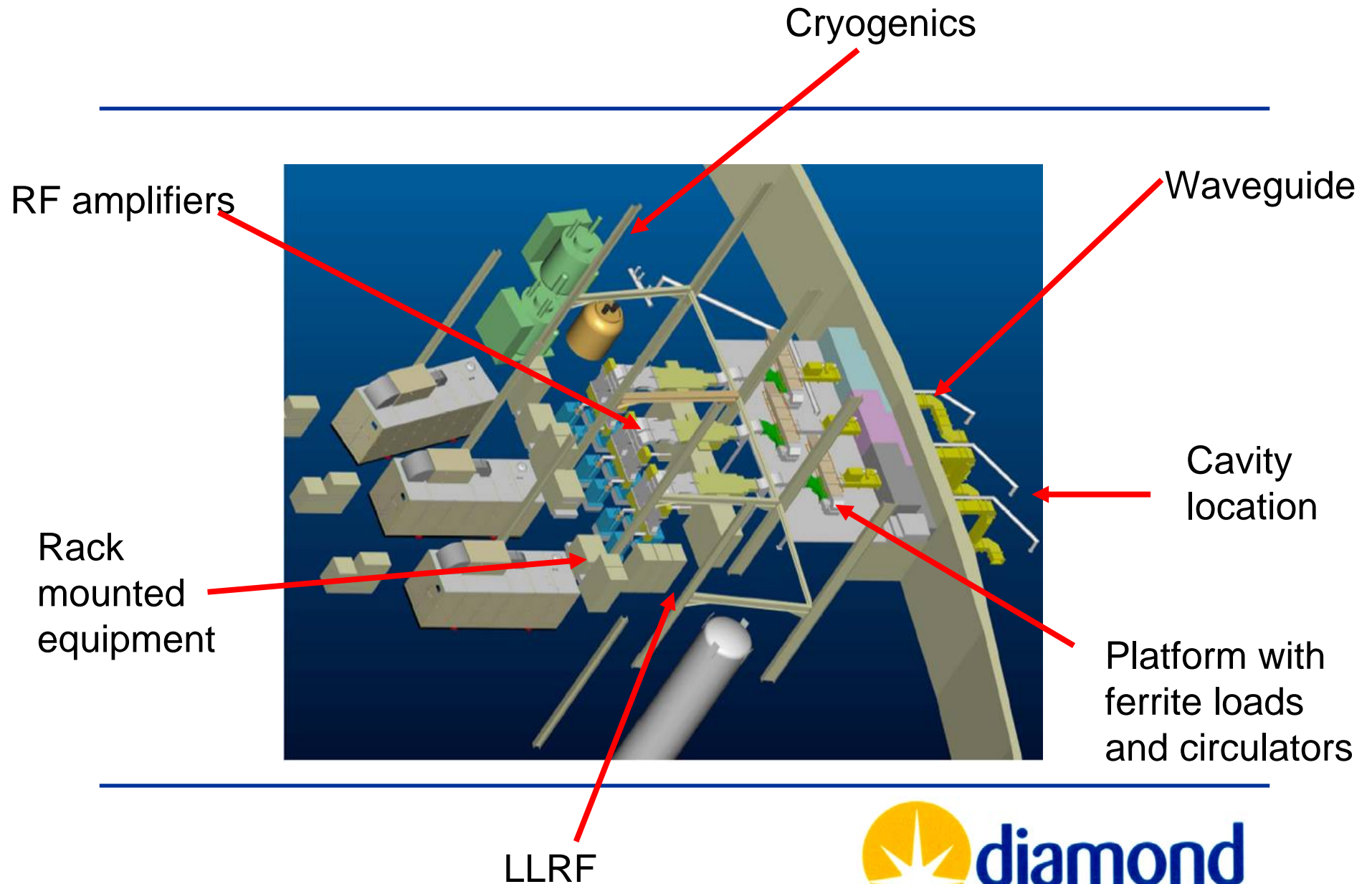


Installation complete with amplifier connected to the Cavity

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# General SR RF Plant



# Storage Ring Amplifiers



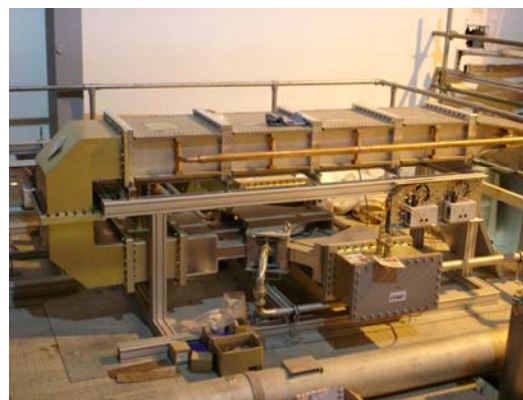
Power  
supplies  
feeding  
the IOTs



IOT in  
frame



Combiner system



RF load and circulator



## Failed RF load

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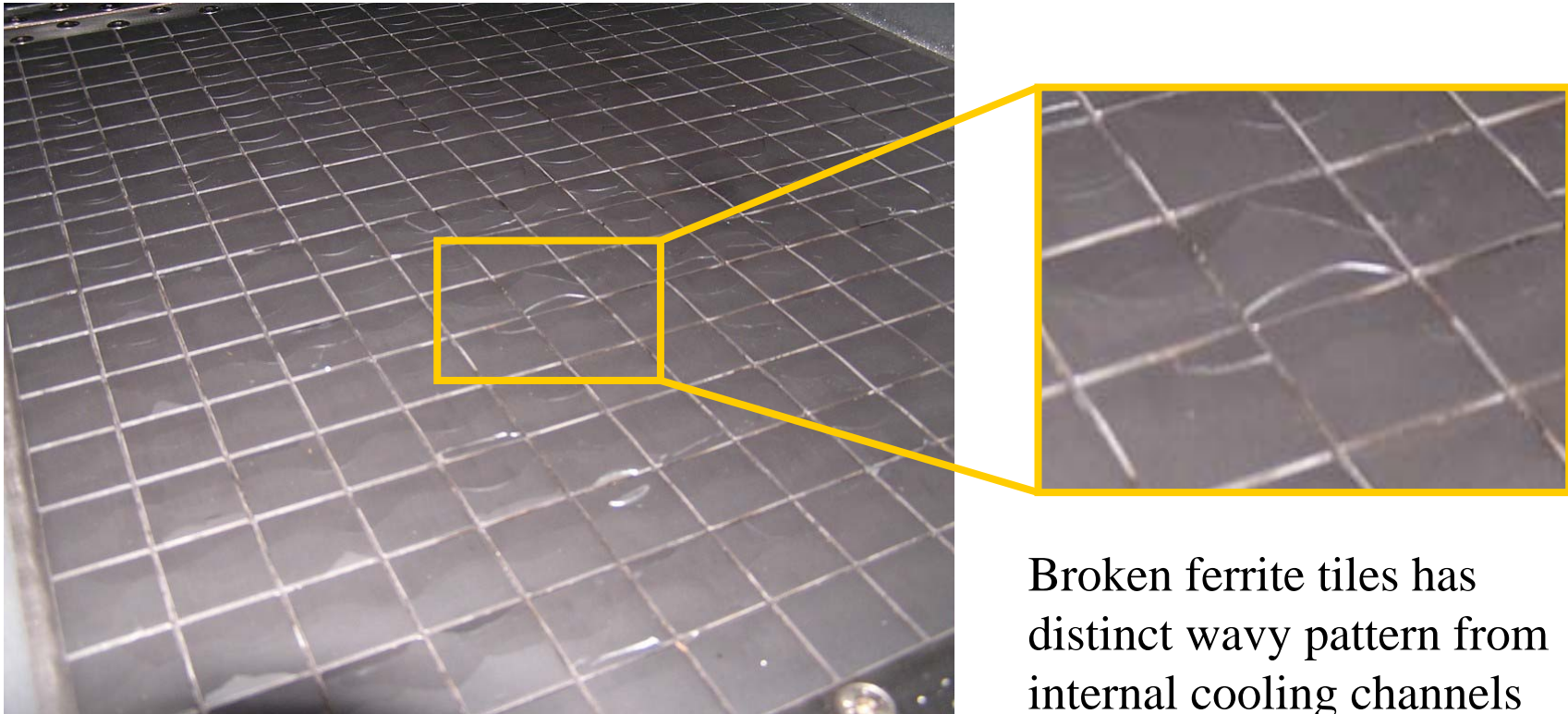


Inside view of ferrite load

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## Failed RF load

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## Failed RF load

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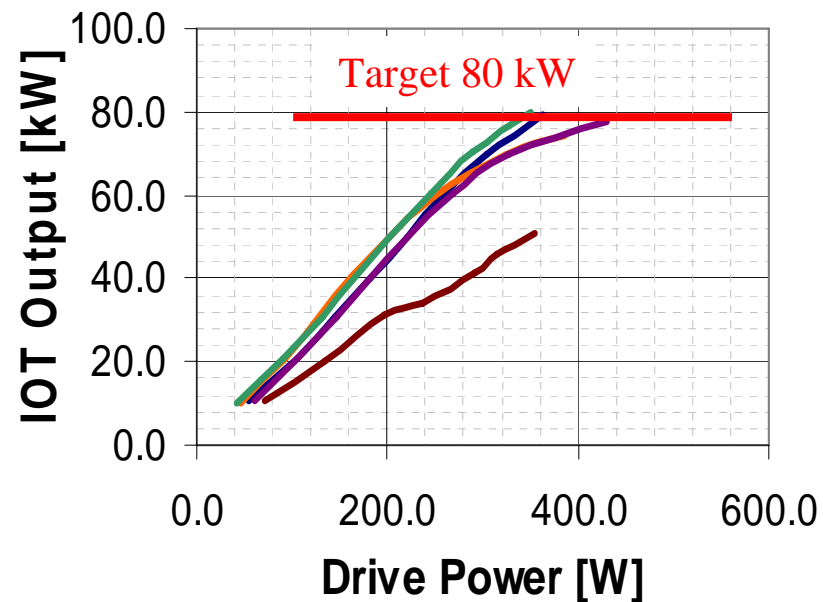
Mechanical damage on RF load also visible on underside of load

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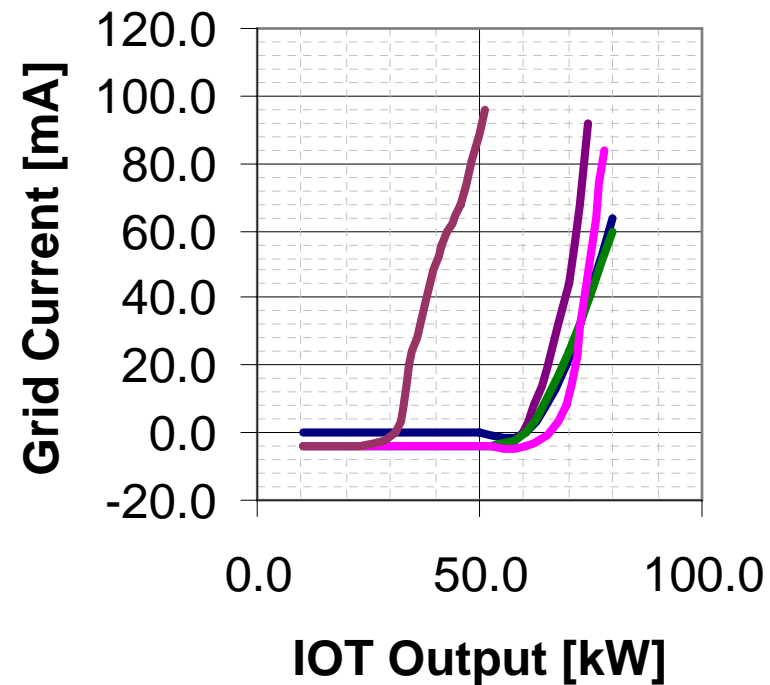
## Preliminary 300 kW amplifier results

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Drive Power vs. Output Power

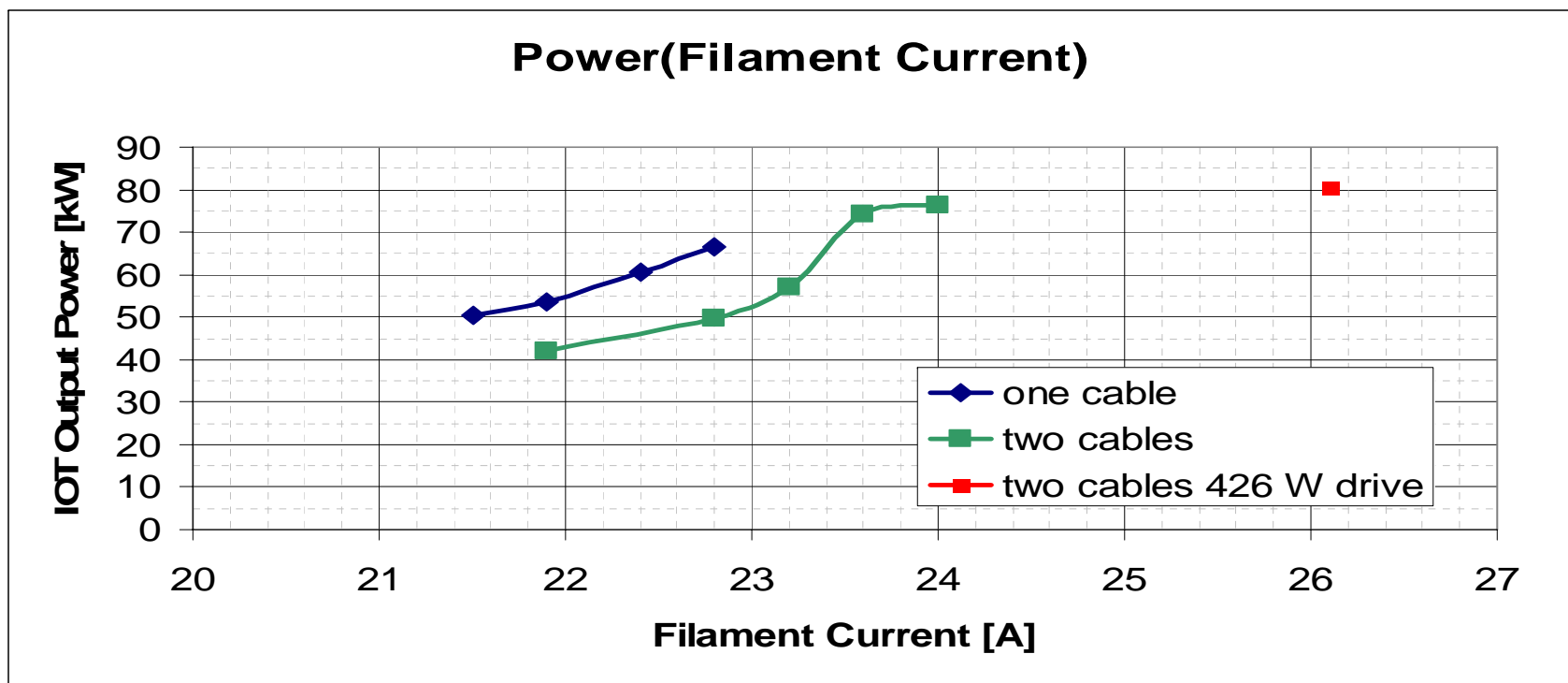


Output power measured from  
5 IOTs during commissioning



Grid current measured as a  
function of output power

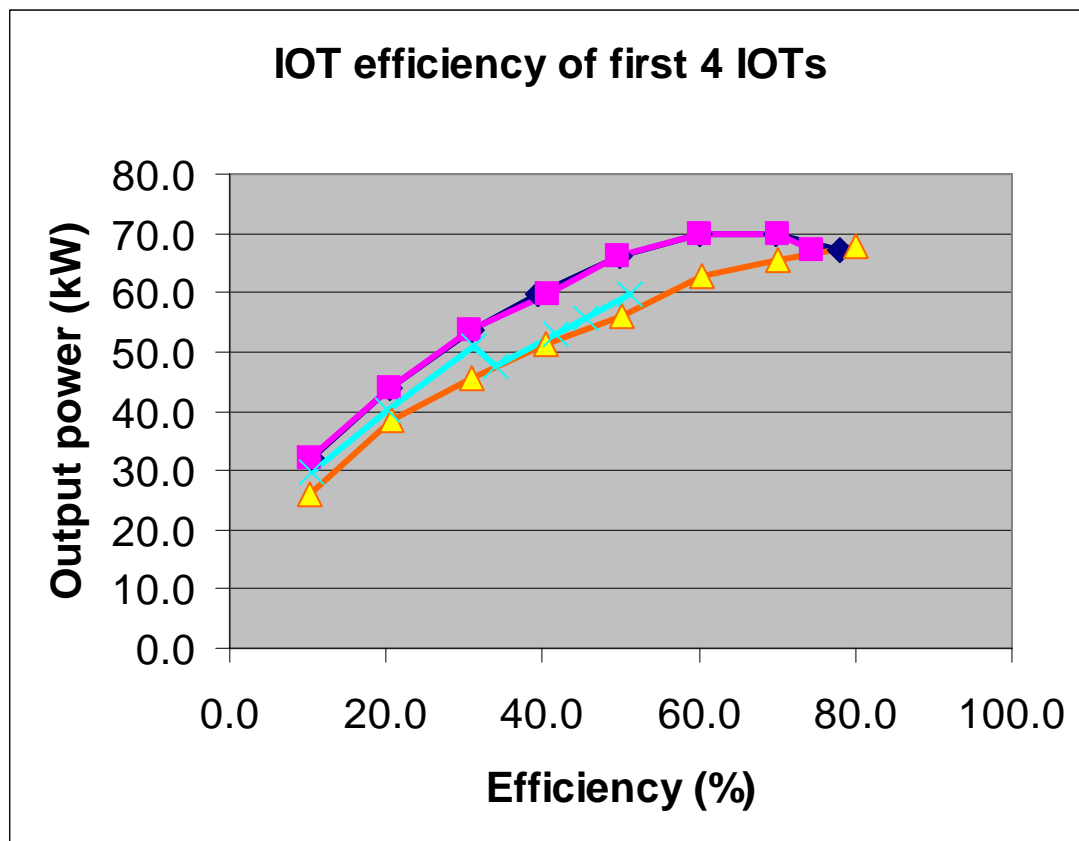
## Preliminary 300 kW amplifier results



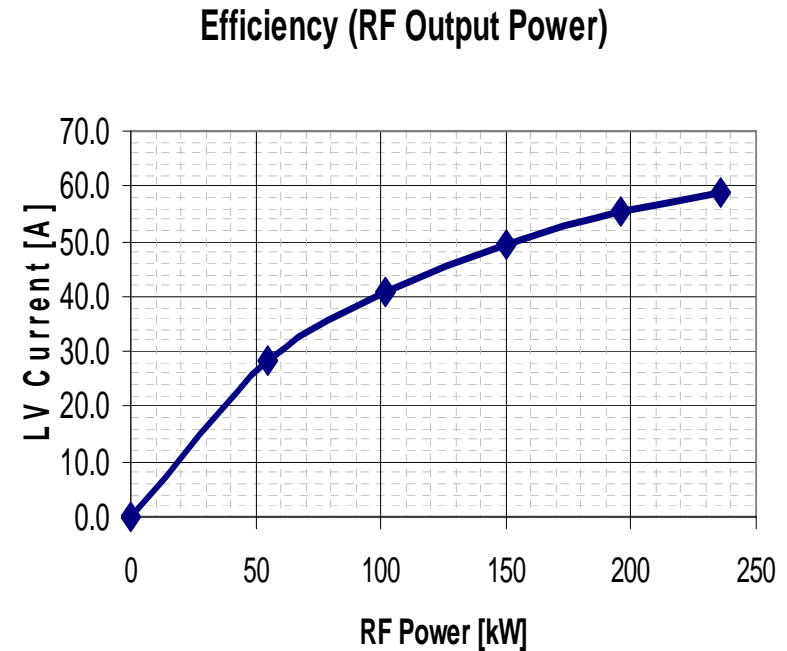
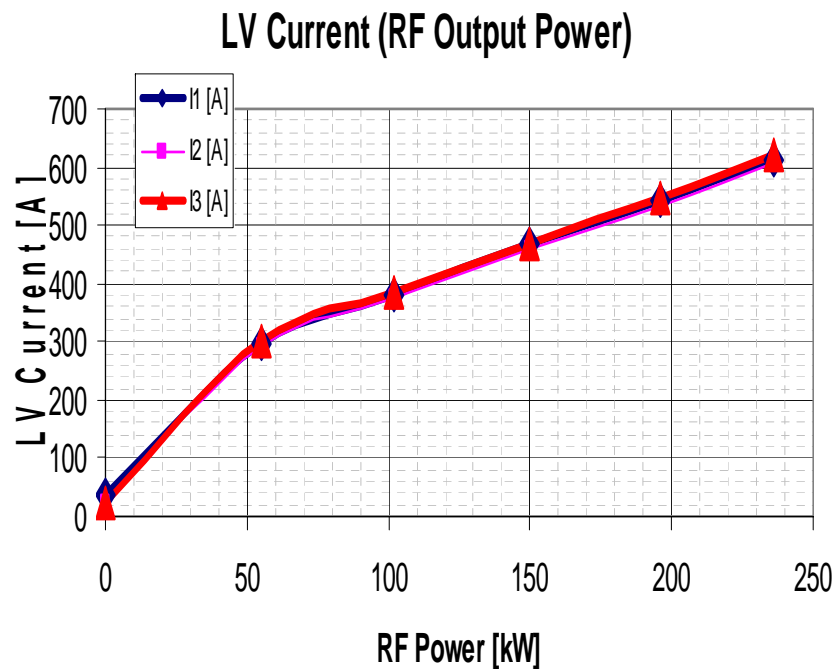
Low gain and power caused by voltage drop in HV cables resulting in cathode being under normal operating temperature



## Preliminary 300 kW amplifier results



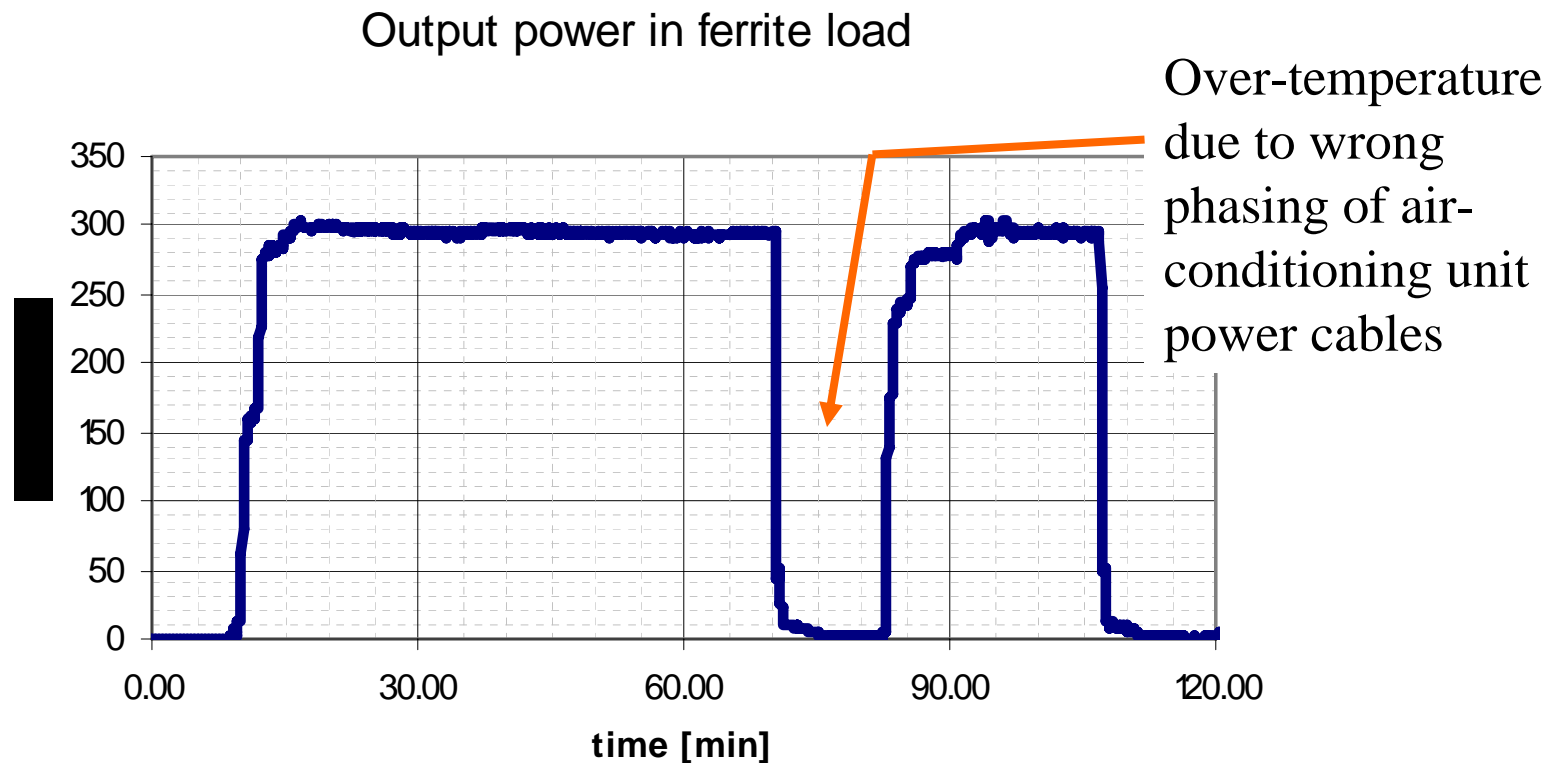
Low output power  
caused by lack of  
filament current



Efficiency of total system including focus, filament and bias supplies  
Control system, HVPS, secondary cooling system and IOT ventilation

## Preliminary 300 kW amplifier results

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Plot of Output power during continuous run

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But

There may be trouble ahead!

## Preliminary 300 kW amplifier results

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Sign of arcing on the IOTs

Signs of arcing inside the cavity





## Cavity Installation



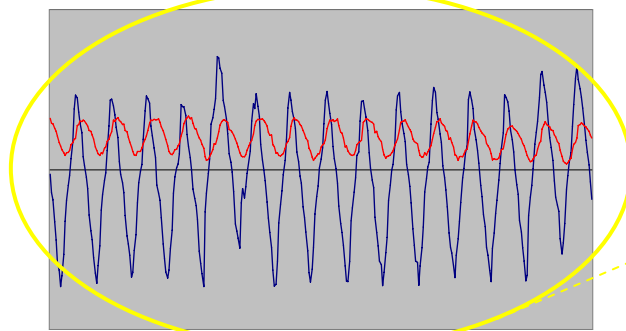
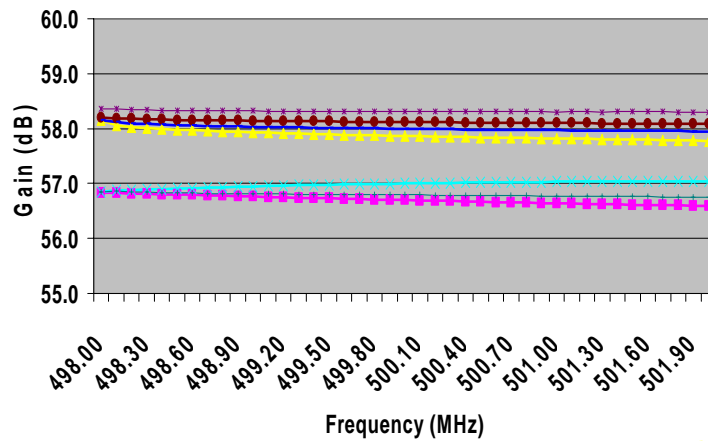
Cavity  
following  
installation



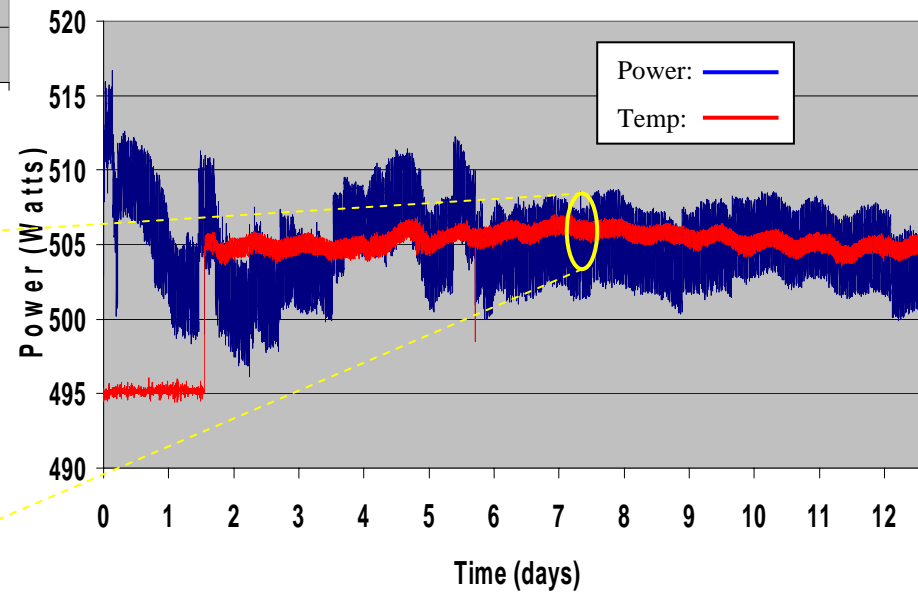
Cavity valvebox

# RF Drive Amplifiers

Drive amp gain w. Frequency



Single amp soak test results



By Matt Maddock

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# LLRF System

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## OUTLINE SPECIFICATION

- Built by ACCEL/Cryoelectra, with EPICS software included
- Analogue IQ system, based on commercial IC modulator/demodulators
- Variable bandwidth (from 10Hz to 100KHz) and variable gain (up to 40dB) control
- Target: 0.5% rms amplitude and 0.2° rms phase control over a 14dB range of cavity voltage

## RESULTS

- Excellent regulation of  $\pm 5^\circ$  microphonics has been achieved with a cavity simulator:  
~ 0.2°rms phase and <0.2% rms amplitude control possible (*exception* 0.3° phase in widest BW setting)

## OUTSTANDING ISSUES

- Final Acceptance Test to be completed on 29/30<sup>th</sup> September '05
- Extra amplifier stage is required to boost LLRF output level to +12dBm
- Delivery to Diamond expected 4<sup>th</sup> Oct '05

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By Alun Watkins

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# LLRF ACCEL/*Cryoelectra*

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Rack Front



Local  
control PC  
VDU and  
Keyboard  
Electronics  
Distribution  
interface  
VME  
crate  
Stepper motor  
control  
Stepper motor  
PSU

Rack Rear



RF and  
interlock  
distribution  
panel

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By Alun Watkins

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## Helium Refrigerator Installation

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Cold box and dewar in RF hall



Compressor and ORM





## Summary

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Linac commissioning well underway

Booster RF and commissioning due to start shortly

Complete Booster commissioning to start in December '05

### Storage Ring

First amplifier virtually commissioned and ready for acceptance test

Liquid helium refrigerator installed and part commissioned; awaiting LN2

First cavity partly installed, mainly wiring outstanding

First cavity cool down in October subject to LN2 and fridge

Second cavity delivery expected mid November '05

LLRF Factory testing partly complete, delivery October '05

Complete SR commissioning to start March '05 (unofficial)

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