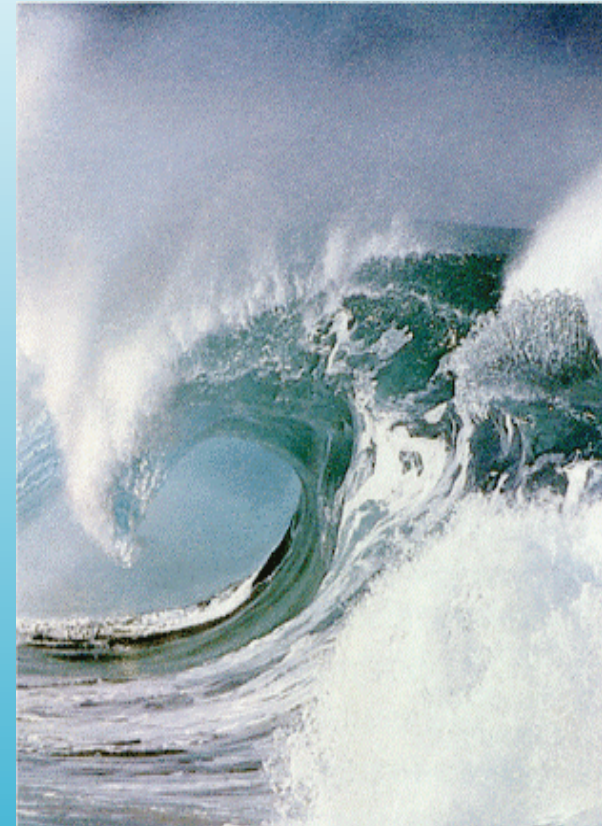




UK to NZ Mission on Renewable and Clean Energy

**AWATEA Meeting
Meridian Energy' Offices,
Wellington**

2 February 2009





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Power Plant Monitoring & Asset Management Research

School of Engineering and Computing

GCU Staff Researching Condition Monitoring of HV and MV plant

- Prof M Allan
 - power electronics, drives
- Mr G Cullen
 - electromechanical systems
- Dr D M Hepburn
 - materials analysis & monitoring
- Dr S G McMeekin
 - optical systems & plant monitoring
- Mr A Nesbitt
 - RF & electronics design/implementation
- Dr A J Shields
 - insulation materials studies
- Dr B G Stewart
 - RF & electrical design and software
- Dr P Wallace
 - physics and simulation of plant faults
- Prof C Zhou
 - cable and power plant monitoring



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Talk Overview:-



1. Cable monitoring - CZ
2. Renewable energy research - CZ
3. Power Tracker - SMcM
4. RF hand-held instrument - AN
5. RF 3-D location system - BGS
6. Component simulation - PW
7. Materials research - DMH

Recent Government Funding

- Proof of Concept
 - Power Tracker
 - Don McGlinchey et al.

- EPSRC
 - RF & IEC 60270 (with University of Strathclyde)
 - Condition Monitoring of MV Underground Cables
 - Knowledge Acquisition from On-line Monitoring Equipment (with University of Strathclyde)



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Recent Industrial Funding & Consultancy



Project funding

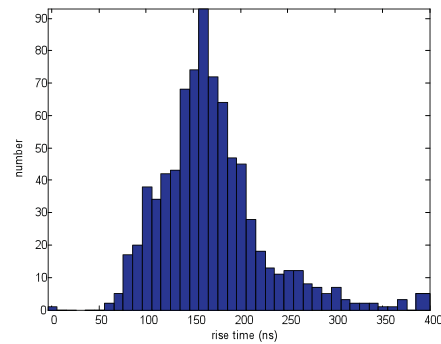
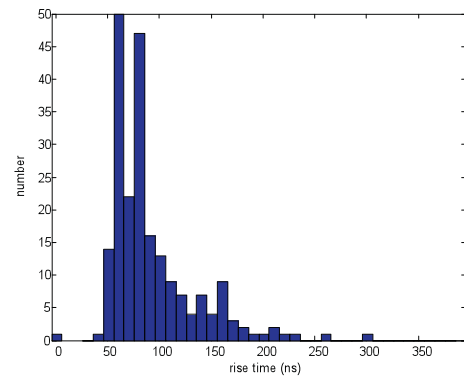
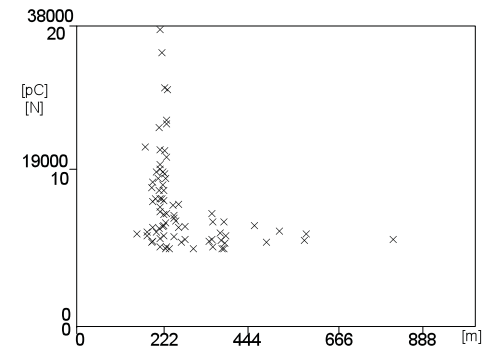
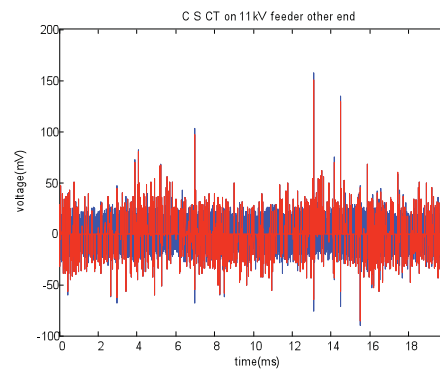
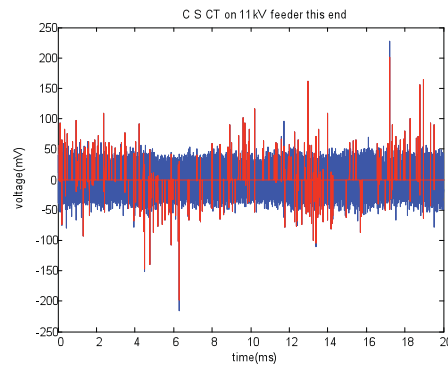
- National Grid
- Doble PowerTest
- EDF
- ScottishPower
- VATech

Consultancy

- MoD
- Glaxo-Smith-Klein
- National Semiconductor
- Statnet
- Norske Skog
- Elkhem
- Trondheim Energiverk AS
- National Grid
- Doble PowerTest
- INEOS
- ScottishPower

MV Cable Monitoring

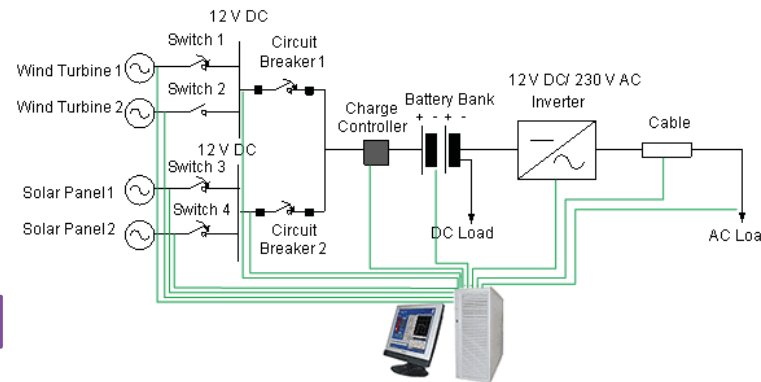
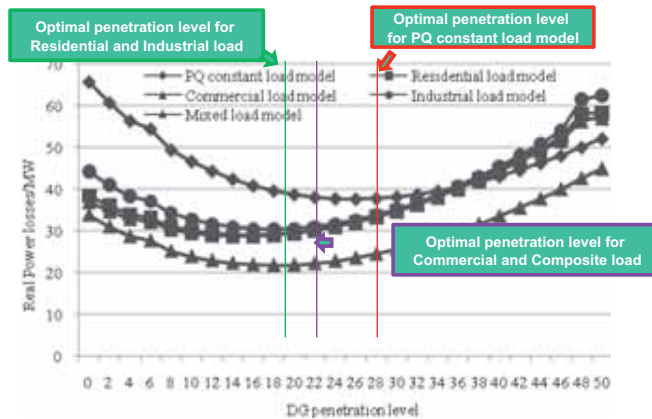
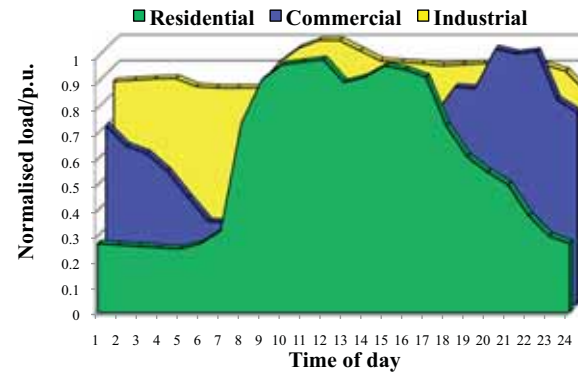
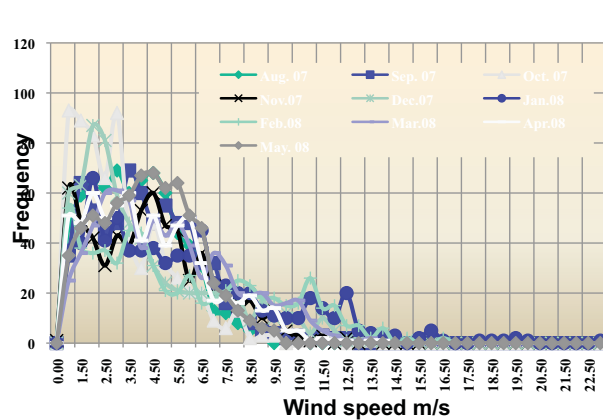
- 2 EPSRC funded projects, with strong industrial support, totalling over £750,000 in
 - signal denoising, and PD feature extraction
 - knowledge discovery for localisation and diagnostics
 - Insulation degradation and aging analysis
- High volume of publications in leading journals and conferences
- Invited presentations to leading conferences



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Renewable Energy Research

- Novel load modelling for future power system analysis
- To optimise the role of DG in power system operation with novel model
- Optimal design and implementation of micro generation / smart grid

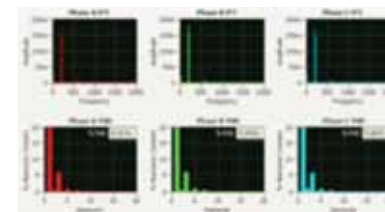
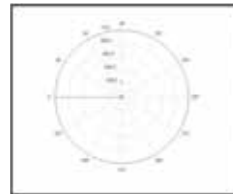
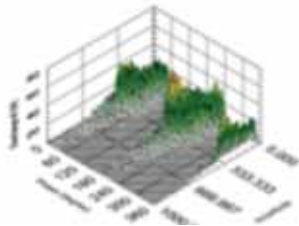
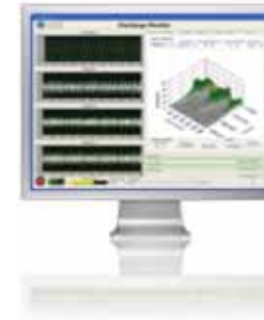


GCU Micro Gen /Smart Grid Laboratory

Power Tracker

A novel on-line condition monitoring system for power transformers that uniquely provides actionable information on the major faults affecting transformers.

- High sensitivity PD Analysis
- Power Quality
- Relative Power Factor
- Transient Detection
- Event triggering



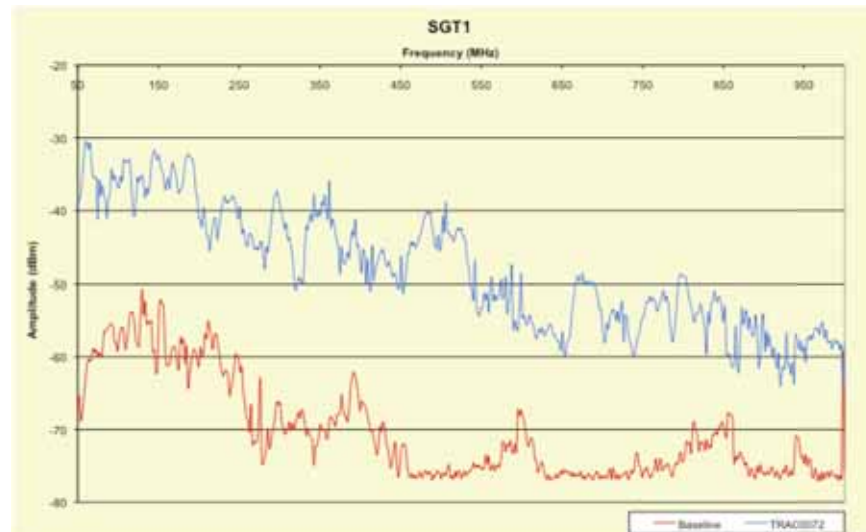
Hand-held Instrument for RF monitoring of PD



GCAL is at the forefront of research and development to deploy this technique.

Fault conditions identified in live plant.

RFI measurement is gaining increased acceptance as a front-line non-invasive technique to assess the condition of electrical plant.



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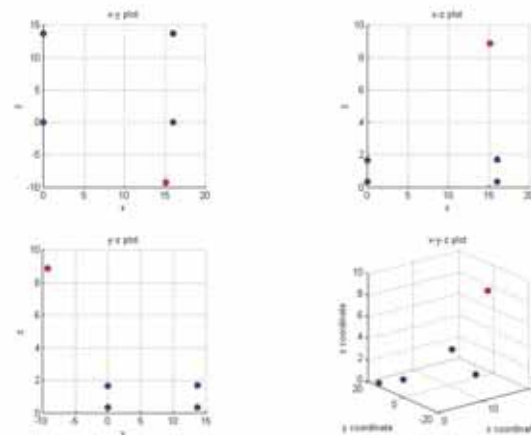
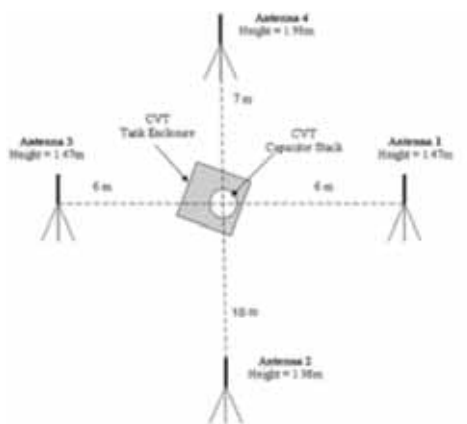
3-D Location of PD sources using RF Techniques



4 antennas are combined to produce a monitoring system able to determine the location of faults in power plant.

Substation plant is varied and spread over a wide area. Determining faults in these items is time consuming. This non-contact method locates faulty equipment to ensure safety and security of power supply.

Advanced DSP and analysis of the signals overcomes non-linearities and false indication of fault location – permitting timeous refurbishment or replacement of plant.

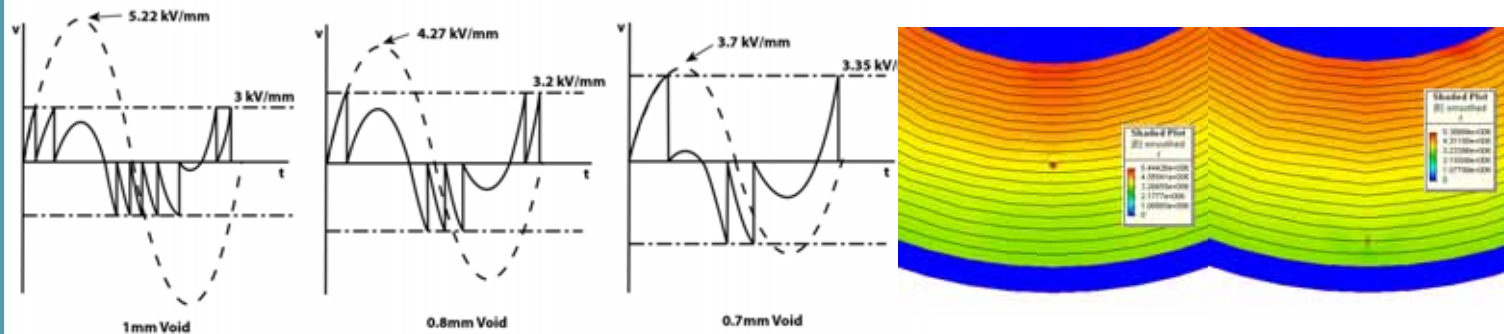
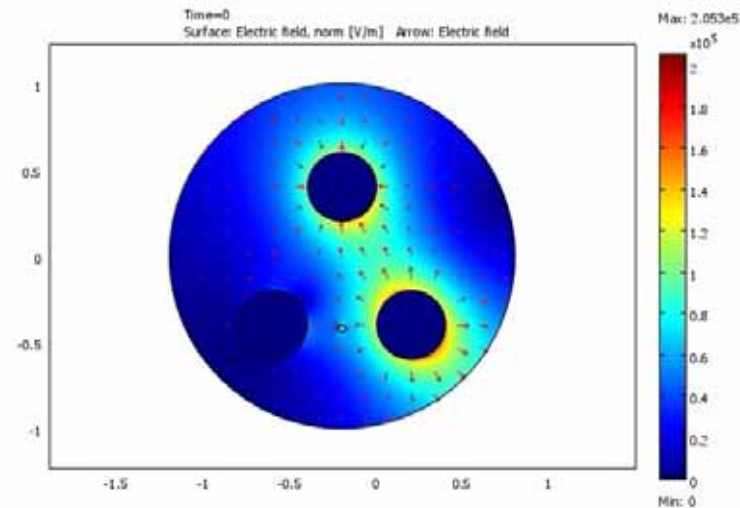


Fault Simulation in HV & MV Plant

Comsol, Magnet and Elecnet software are used to simulate stress within power plant.

Correlation of simulated stress outcomes and laboratory tests using constructed samples allows confirmation of outcomes.

Current research is investigating current loading on thermal effects in MV cable systems.



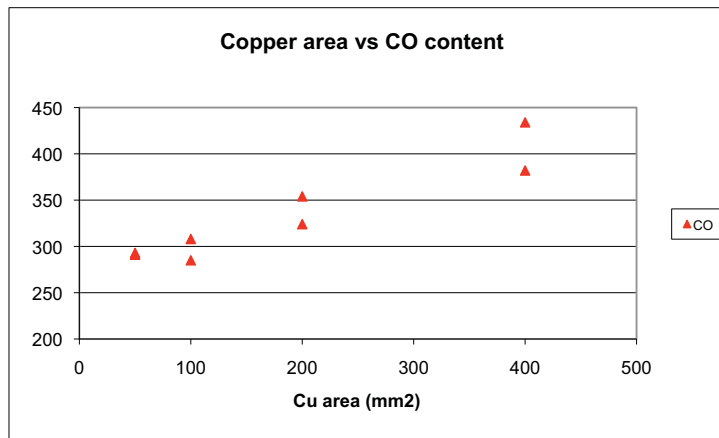
Insulating Materials Research

Physical and chemical analyses techniques applied to solid, liquid and gaseous insulating materials, e.g. mica, polymeric, paper and oils.

Detection of changes in insulation properties, when considered in relation to operational stresses, allows life expectancy of system to be assessed.

Industrial contacts call on expertise of GCU staff.

Academic research feeds in to CIGRE and standards bodies.



Conclusions

- Multidisciplinary team
- Wide range of expertise available
- Good links with Equipment Manufacturers
- Strong links with Electrical Utilities
- Active academic links with national and international institutions
- Industrially focussed research activities



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