

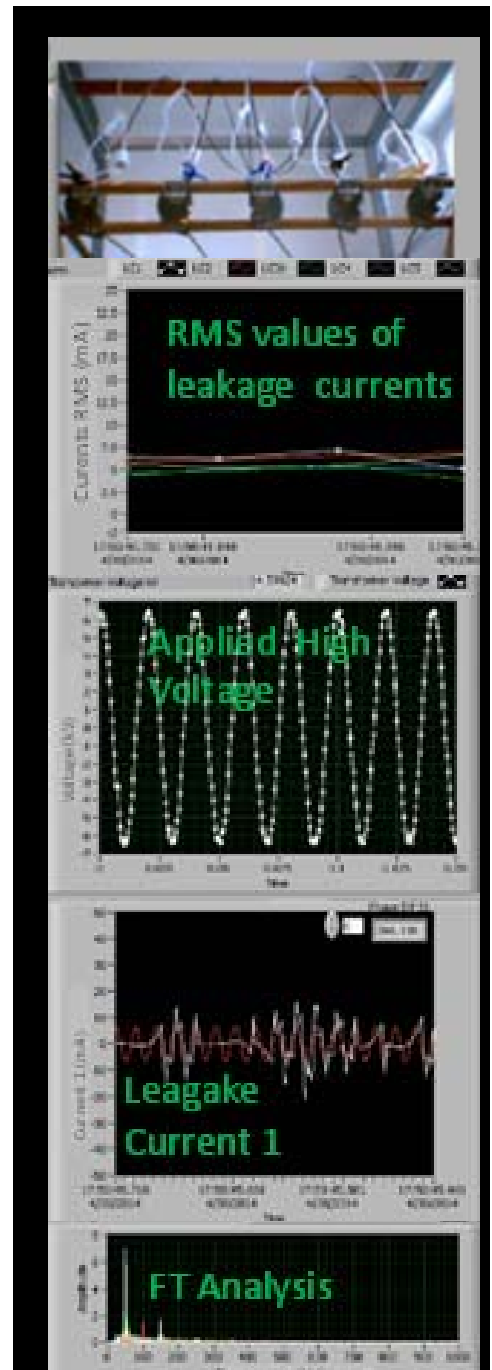
A Labview Based Leakage Current Monitoring System For HV Insulators

N. Mavrikakis
EE Dept, TEI of Crete,
Greece

I. Androulidakis
University of Ioannina,
Greece

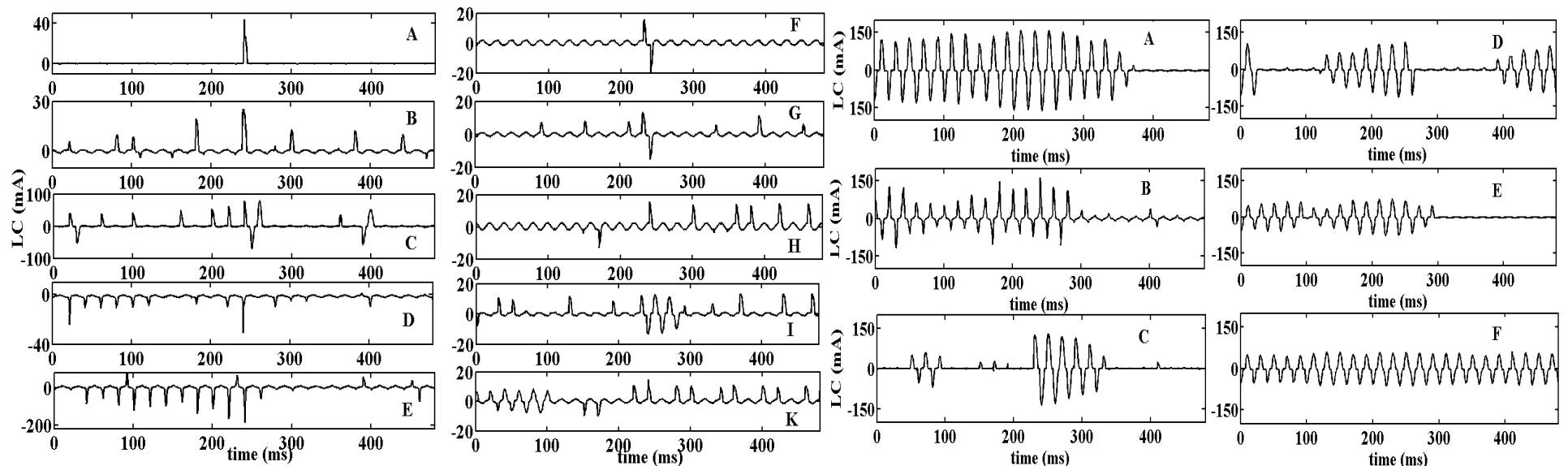
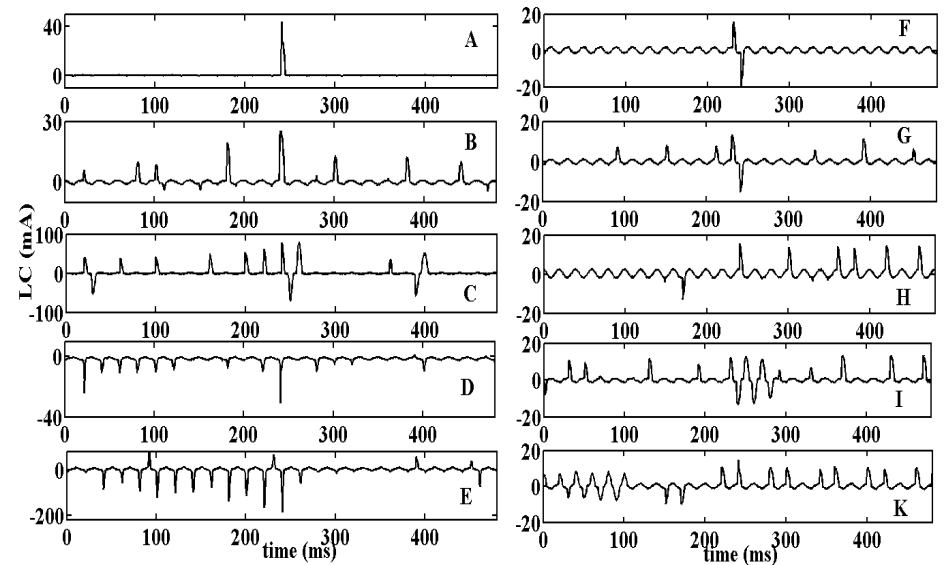
D. Pylarinos
Islands Network
Operations Dept
HEDNO S.A., Greece

K. Siderakis
EE Dept, TEI of Crete,
Greece



Leakage Current Monitoring

- Widely employed tool for high voltage insulator monitoring and research
- The shape of the waveform illustrates surface electrical activity
- Vast amounts of raw data, extracted values usually considered



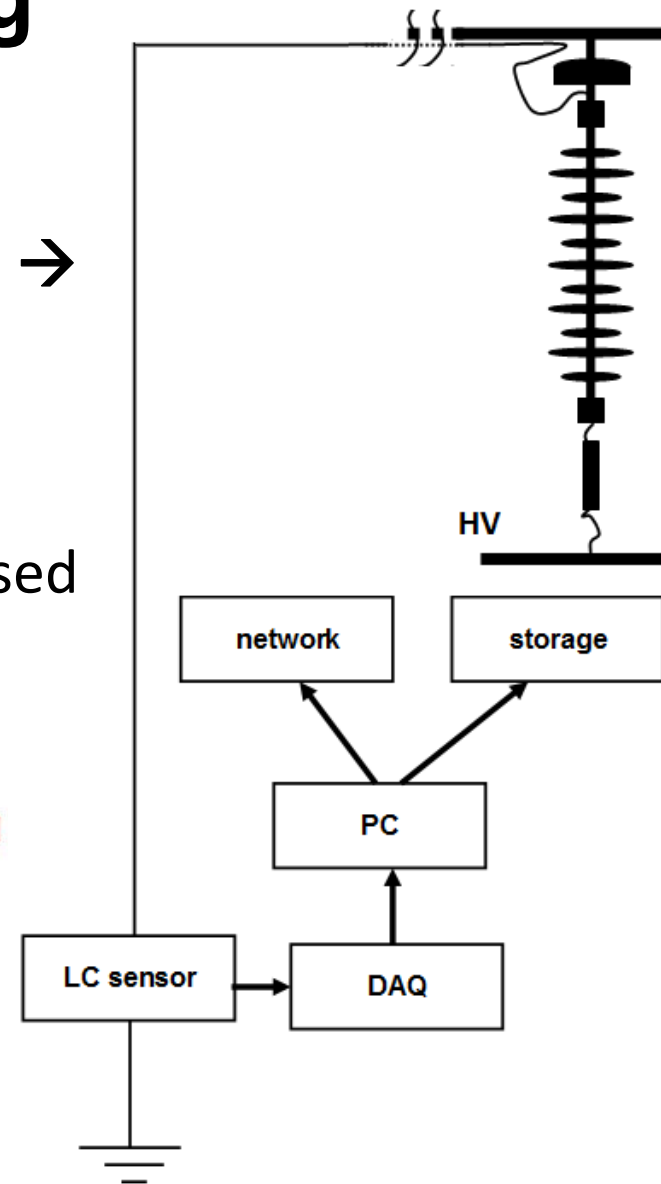
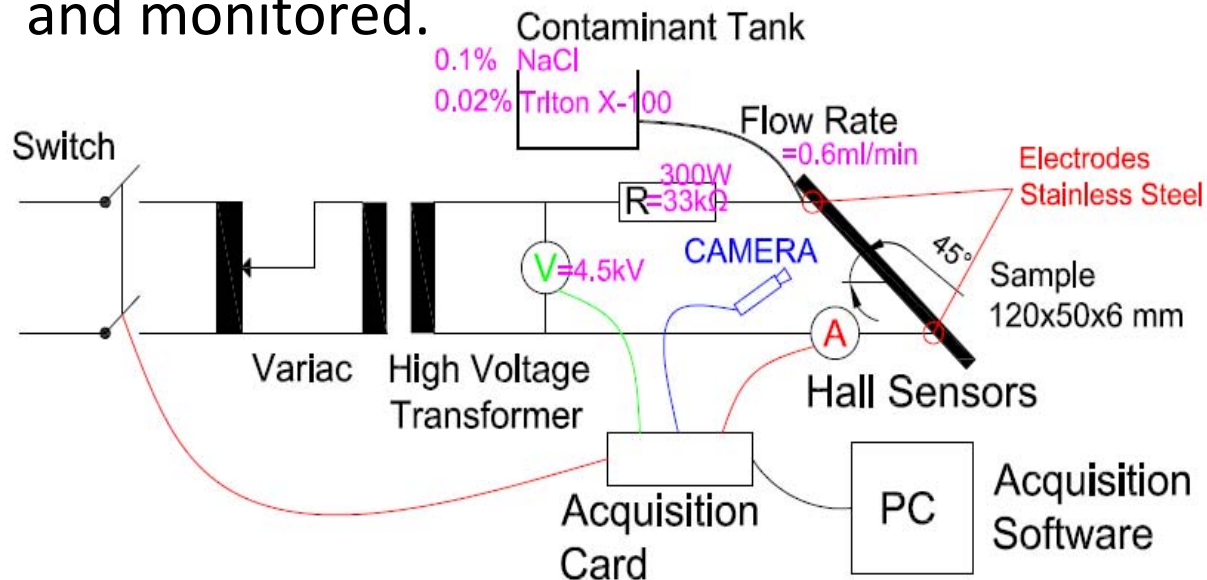
Leakage Current Monitoring

General scheme:

leakage current → current sensor → DAQ → PC → storage or upload

Lab variations: e.g. inclined plane test

A small part of the insulator shed is stressed and monitored.



Leakage Current Monitoring

- A LC monitoring system should be as flexible as possible in order to cope with different testing scenarios and to be able to incorporate future processing techniques.
- Customizable software provides a solution.

Proposed Approach:

- largely based on commercially available general purpose equipment
- a rugged and reconfigurable chassis equipped with a microprocessor and user-programmable FPGA
- and multiple hot-swappable I/O modules
- Labview based software
- fully customizable
- low-cost solution
- increased flexibility and adaptability

however

sensor trouble

Leakage Current Monitoring Sensors

Have to be able to:

- monitor a small leakage current
- have a large bandwidth (at least 500 Hz)
- provide isolation and/or protection
- provide output that suits low cost general purpose DAQs

Already available:

- Hall sensors equipped with a protection scheme
- came with a no-longer commercially available DAQ (OLCA by CTLab)
- 0 to 500mA range
- ± 15 V output

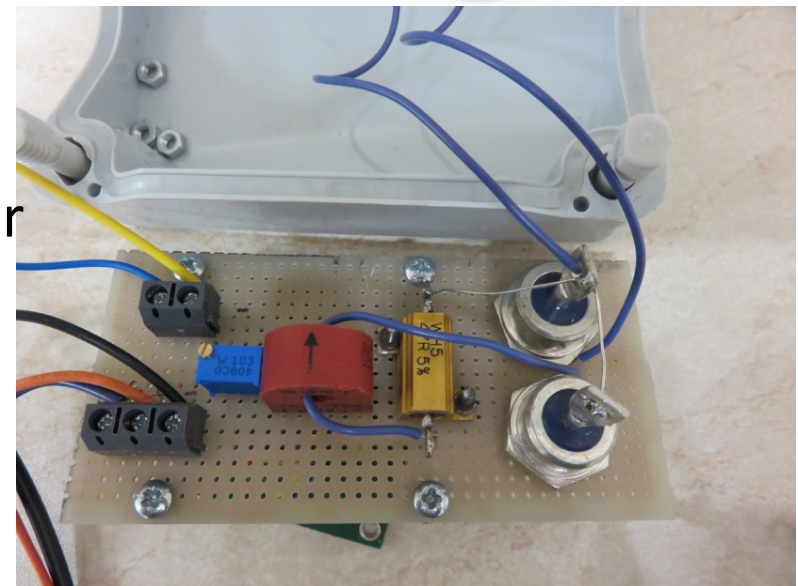
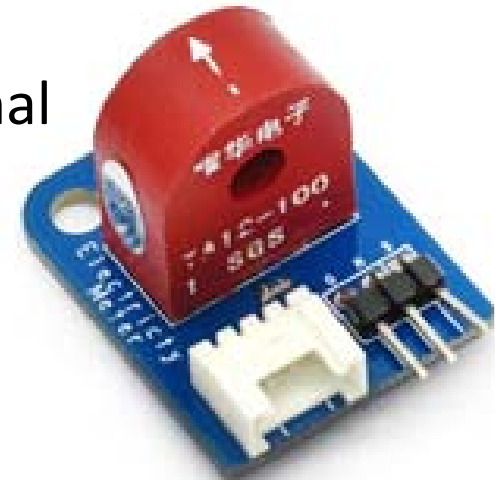
**low cost DAQs
require a ± 10 V
input**



Leakage Current Monitoring Sensors

Custom made ($\pm 10V$ output):

- built around a current sensor driving an operational amplifier
- 1 mA current resolution
- 1 mA to 1.5 A current range
- 1 mA to 10 mV current to voltage conversion
- based on IM120710018 “electronic brick”
- equipped with protection diodes
- measure the inductive current via the respective voltage drop in a shunt resistor
- a generic, unpopulated printed circuit board (PCB) for single operational amplifiers was also employed



The DAQ

NI Compact cDAQ-9184 chassis:

- accepts more than 50 different modules
- USB connection

NI 9221 module:

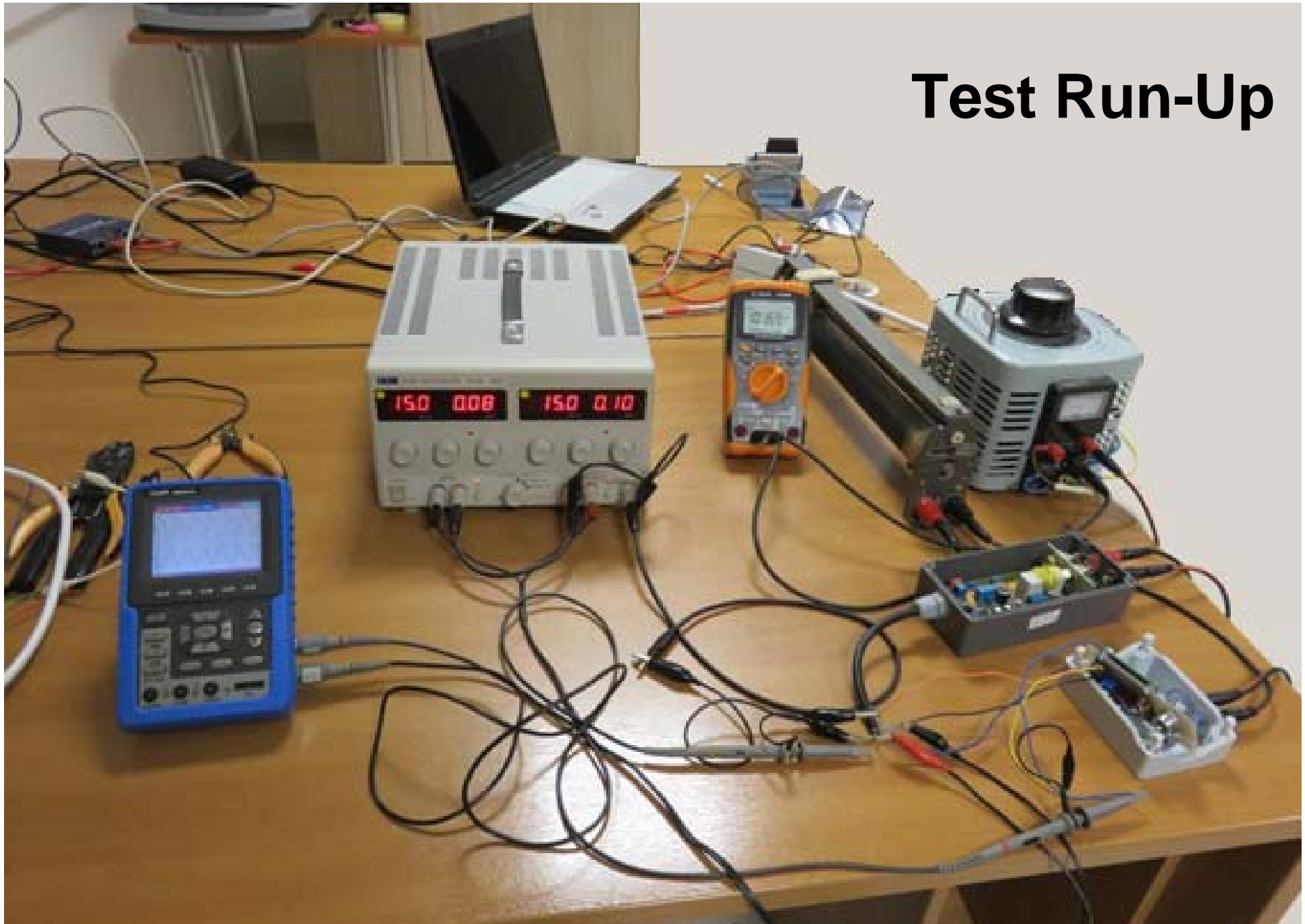
- 8 single ended inputs
- ± 60 V input range
- suitable for lab measurements
- in the field, differential inputs should be preferred (NI 9229)

NI 9205 module:

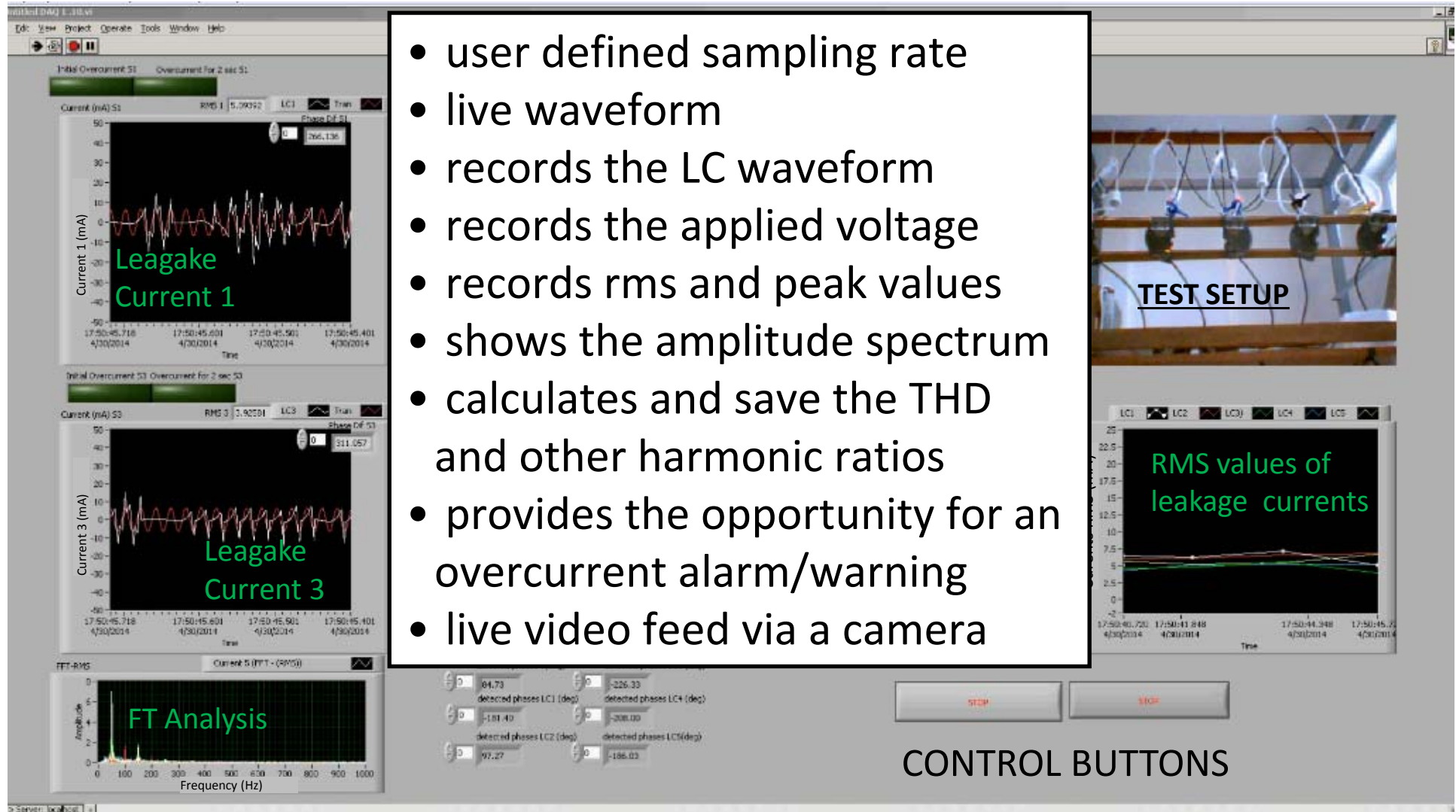
- 32 single ended channels or
- 16 differential channels
- ± 10 V input range



Test Run-Up

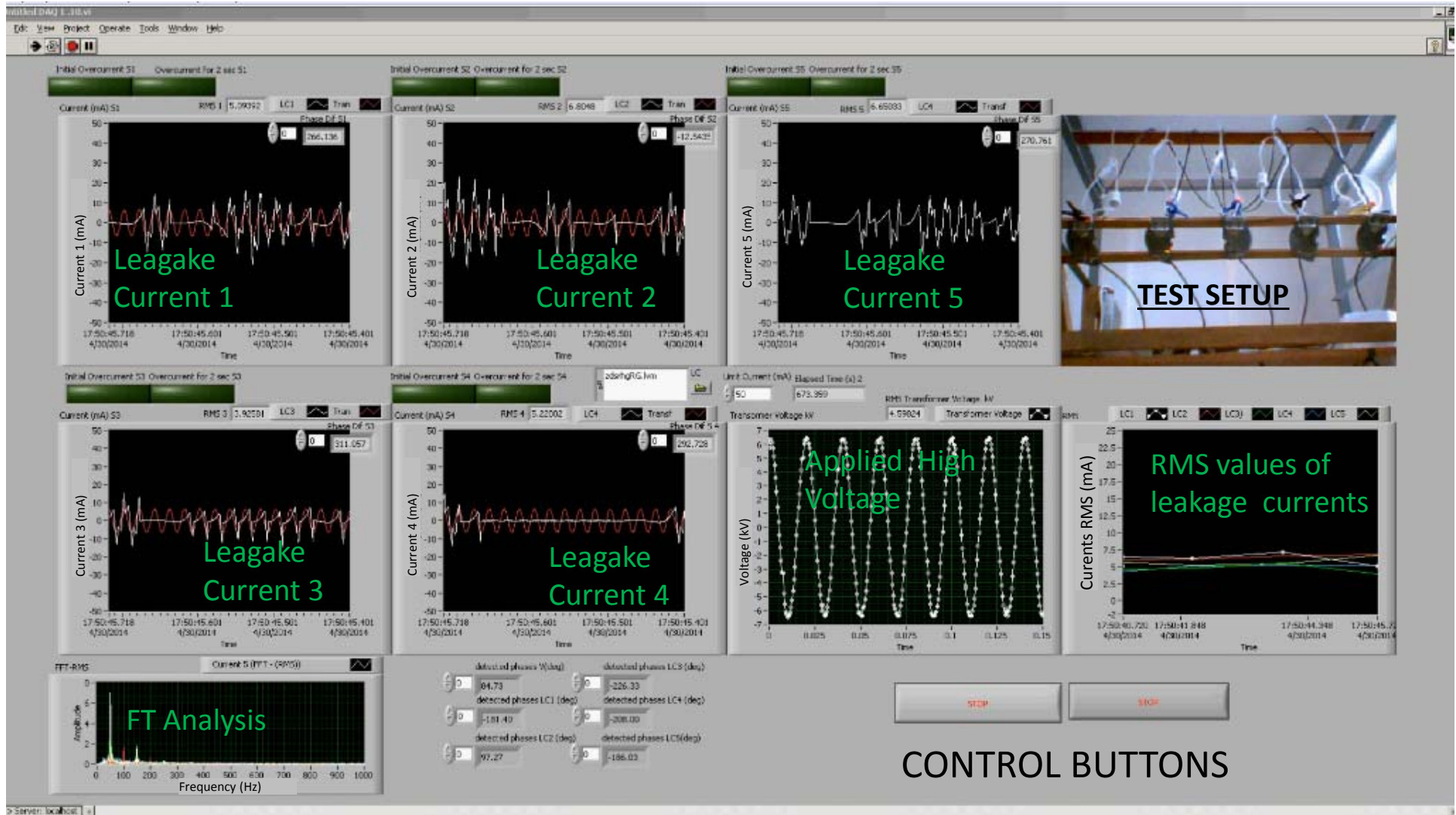


Labview Based Software



Labview Based Software

(during an inclined-plane test)



Conclusion

- leakage current monitoring a valuable tool for insulator research
- a fully representative value of the waveform's shape is yet to be defined
- the exact signal to be monitored may differ depending on the application/scenario
- some specially designed systems are commercially available
- however they suffer from zero customizability and poor support
- general purpose DAQs can offer a low cost alternative
- Labview based DAQs can provide maximum customizability
- custom made sensors may be needed in order to be able to work with general purpose DAQs of lower cost
- the Labview based system used in the HV Lab of the TEI of Crete is presented
- a variation of the system is used in TALOS High Voltage Test Station (previous presentation)

Funding

POLYDIAGNO (project code 11SYN-7-1503), is a research project implemented through the Operational Program “Competitiveness and Entrepreneurship”, Action “Cooperation 2011” co-financed by the European Union (European Regional Development Fund) and Greek national funds (National Strategic Reference Framework 2007 - 2013), focused on the monitoring and diagnosis of polymer based outdoor insulators used in high voltage applications



EUROPEAN UNION
EUROPEAN REGIONAL
DEVELOPMENT FUND



Ministry of Education and Religious Affairs, Culture & Sports
GSRT - Management and Implementation Agency for RTD and Innovation Activities

O.P. Competitiveness and Entrepreneurship (EPAN II), ROP Macedonia - Thrace, ROP Crete and Aegean Islands, ROP Thessaly - Mainland Greece - Epirus, ROP Attica