

# **Standards and Research**

## **Paul Jarman**

**17<sup>th</sup> July 2019**

# Background

- National Grid Transformer Technical Manager
  - Research 1984-1990
  - Engineer 1990-1998
  - Manager 1998-2001
  - Technical Manager 2001-2018
- IEC TC14 Technical Committee Chairman
  - 2008-2017
- CIGRE UK regular member A2 2008-2016

# Starting points

- Nominated to BSI ISE/108 Magnetic steel
- Joined CENELEC WG on harmonic loading of transformers
- Joined CIGRE WG on effect of particles
- Attended CIGRE Merida colloquium 2003
- Discussion led to idea for WG on condition monitoring facilities

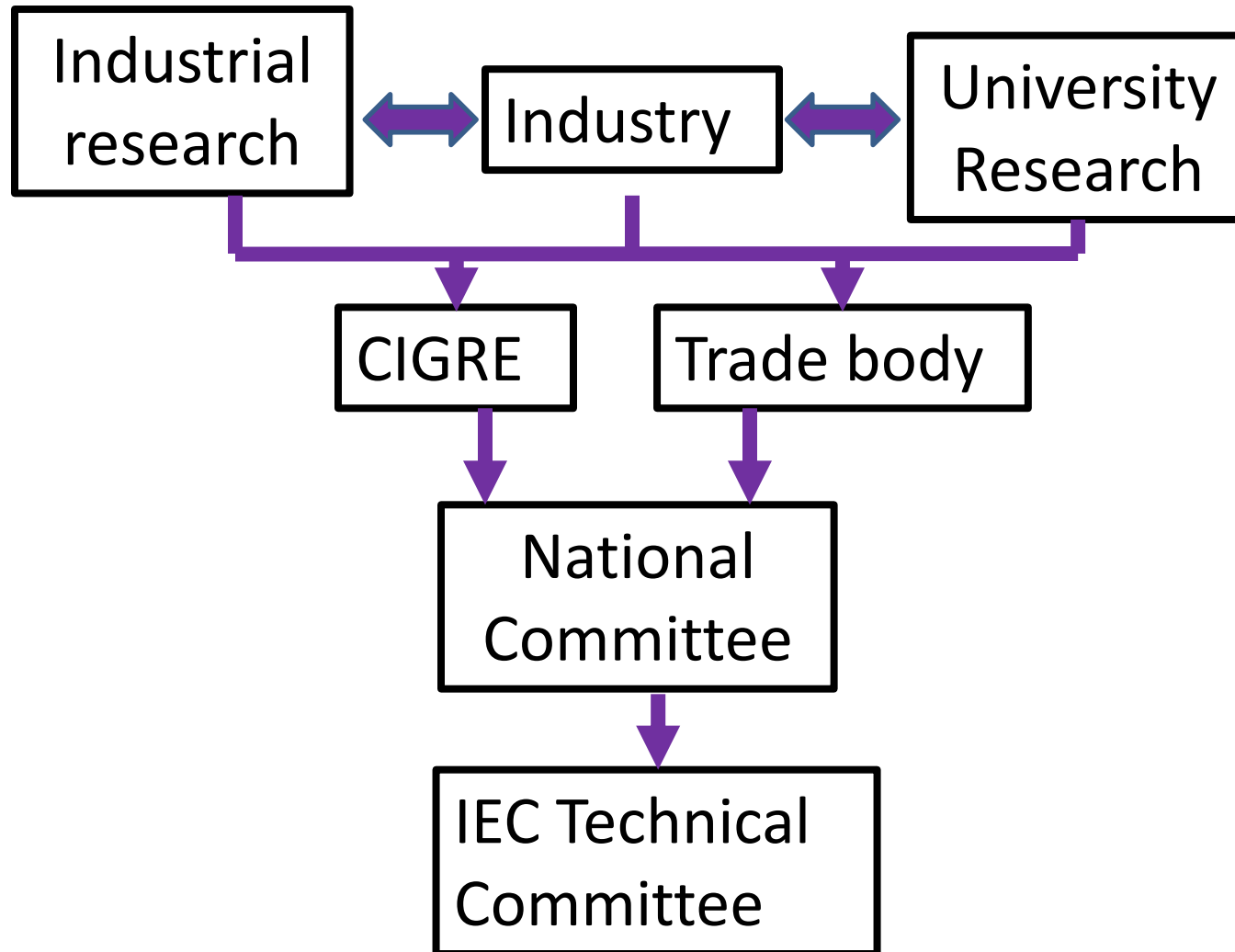
# Development

- IEC maintenance team on reactors
- IEC maintenance team on Transformers
- Chair of National Committee
- Chair of IEC Transformer Technical committee
- Involvement with IEEE Transformers committee and harmonisation of standards
- Development of European Transformer Efficiency standards

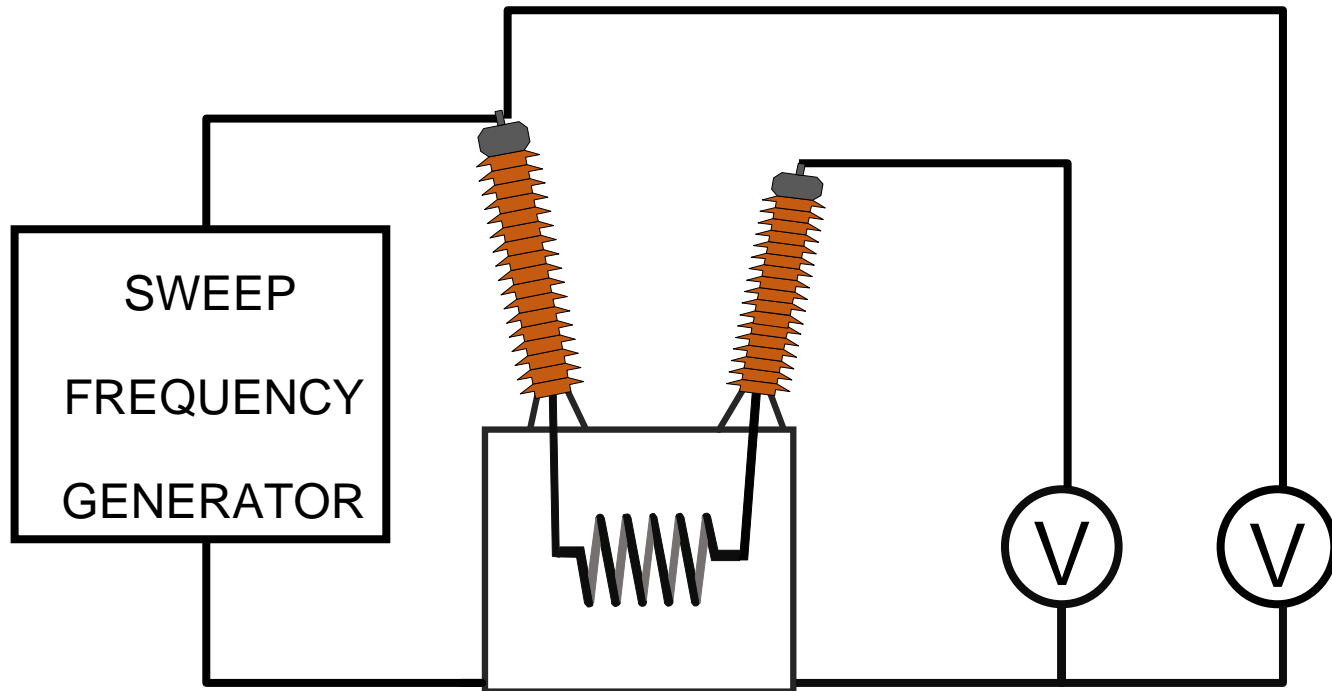
# Motivations

- Industry
  - Standards that reflect their requirements and incorporate the most up-to-date knowledge
- Academia
  - Direct impact of work and close relationship with industry and applications
- Personal
  - Leverage of knowledge, transferrable skills, professional profile

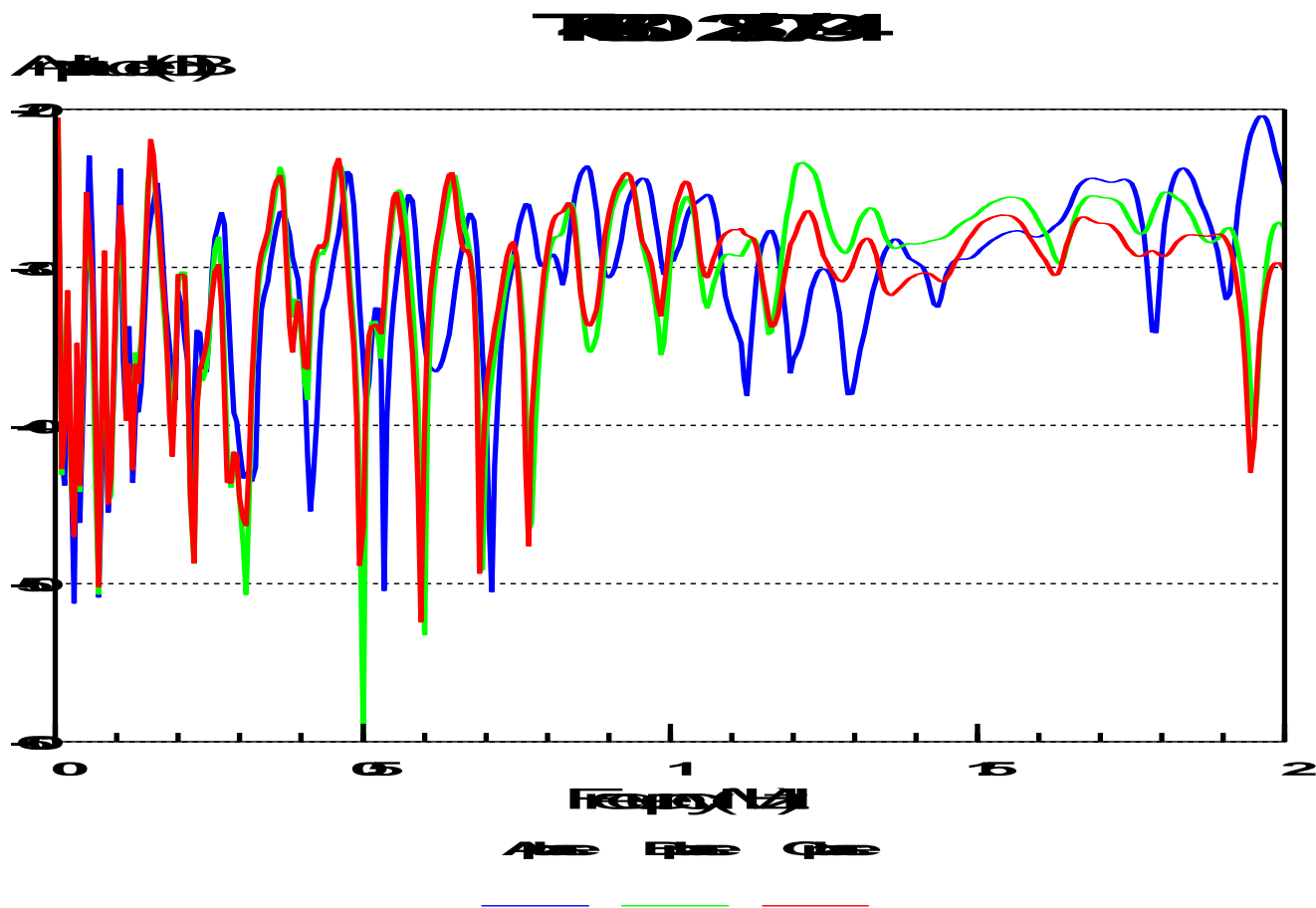
## Pre Standardization work



# Case study Frequency Response Analysis



# Case study Frequency Response Analysis





# Case study Frequency Response Analysis



## FRA Timeline

- 1989 First research into technique as adaption of old technique using new technology
- 1990-2000 Research and trials carried out papers published
- 2003 CIGRE group established
- 2004-2008 PhD working at Manchester
- 2008 CIGRE brochure published including research
- 2008 IEC group established on measurement method
- 2012 IEEE C57.149 Published
- 2012 IEC 60076-18 published
- 2017 CIGRE group formed to look at interpretation

# Other case studies

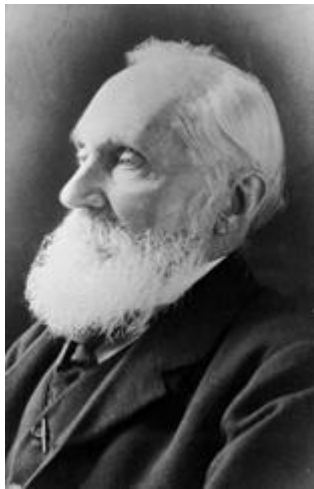
- Transformer condition monitoring  
research – CIGRE – informative annex-  
revision
- Phase shifting transformers  
– IEC/IEEE 60076-57-1202
- Use of ester liquids at high voltage

# Standards organisations

- International
  - International Electrotechnical Commission IEC
  - International Standards Organisation ISO
  - ITU information and communication technologies
- European
  - European Committee for Electrotechnical Standardization CEN/CENELEC
- American
  - Institute of Electrical and Electronics Engineers IEEE
  - American National Standards Institute ANSI
- National
  - British Standards Institution BSI

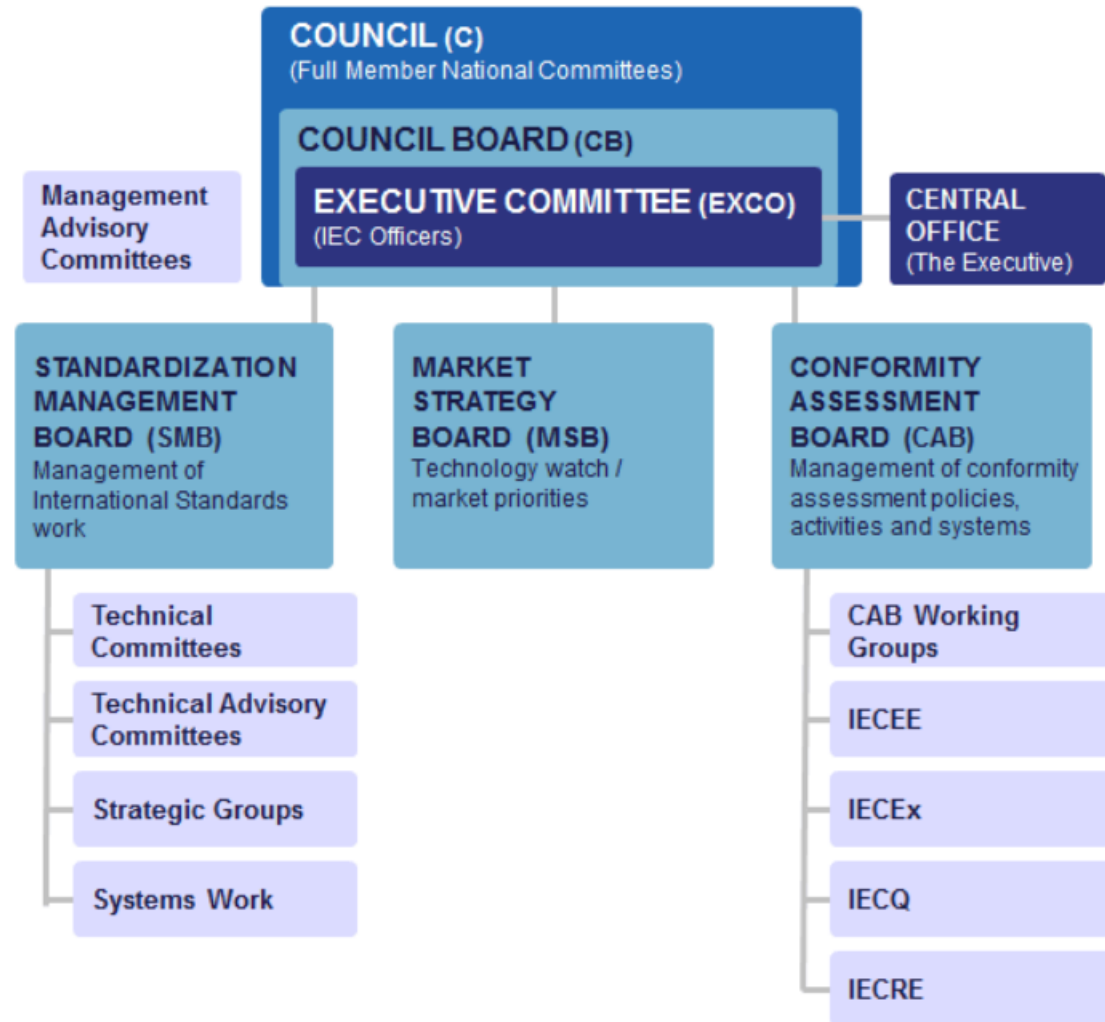
- In European Union
  - Utilities obliged to use CENELEC standards (ENs)
- Most ENs are based on IEC standards
  - Dual numbering
  - Some additions to text
  - Some additional standards
- Can use National standards
  - These must not conflict with EN
- IEC does not enforce standards
  - National responsibility

# International Electrotechnical Committee



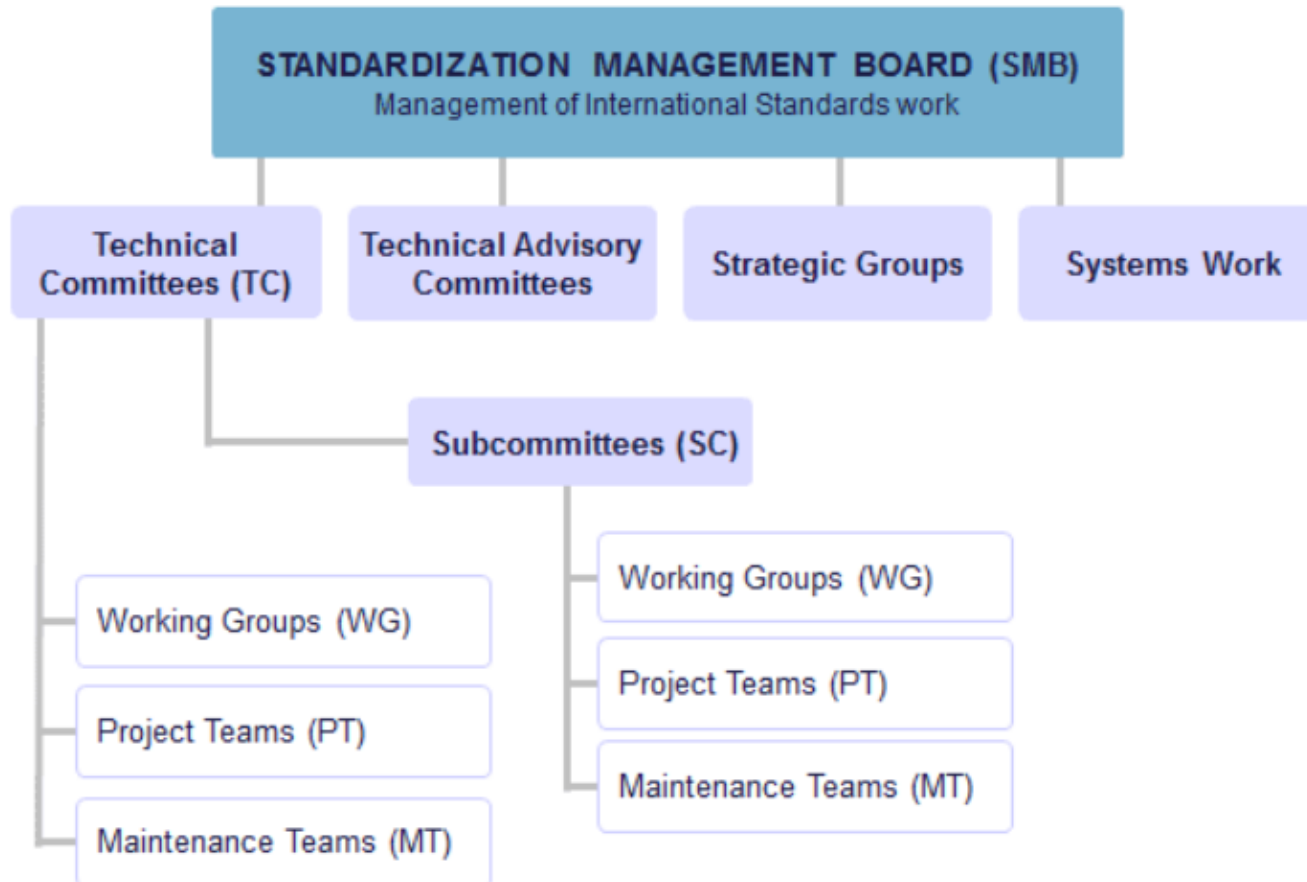
Established  
1906

William Thomson  
Lord Kelvin



# IEC Standards Structure

## Management of standards development



## Website

[WWW.IEC.CH](http://WWW.IEC.CH)