

European Industry's Potential Capabilities for High Power RF Systems for the Future ILC

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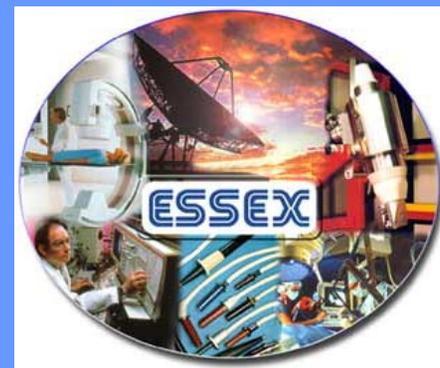
Acknowledgements



ACCEL



THALES
Thales Electron Devices



Introduction

- ILC needs less expensive components
- Technically, RF system is not ideal but is acceptable
- The present cost is too high but manufacturing expertise and scale of requirement will reduce them
- But the severity of the challenge may, in some cases, imply a need for new technology
- European industry is in a strong position
- The question of funding needs to be addressed particularly for ILC-specific tasks

European industrial capability

- Substantial RF systems capability due to history
- Presently constructing several new accelerators
- XFEL will provide good experience for ILC
- Manufactures full range of accelerator RF components and systems
- Manifestly has the capability for system integration, installation and testing
- New concepts and products are emerging

RF system examples

Experimental multiphase resonant converter modulator

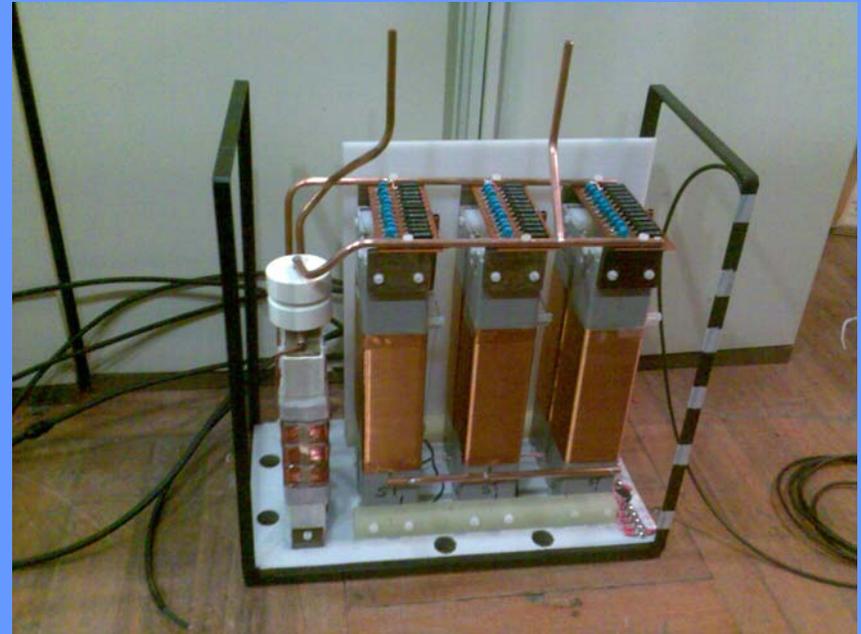


Power circuit

Power 312kW peak; 25kW mean

Pulse length 1.5 μ s

Pulse Voltage 26kV



Transformer/rectifier before oil immersion

Measurements from experimental modulator

Magenta:

Voltage to one resonant tank from one H-bridge
Droop ~25%

Green:

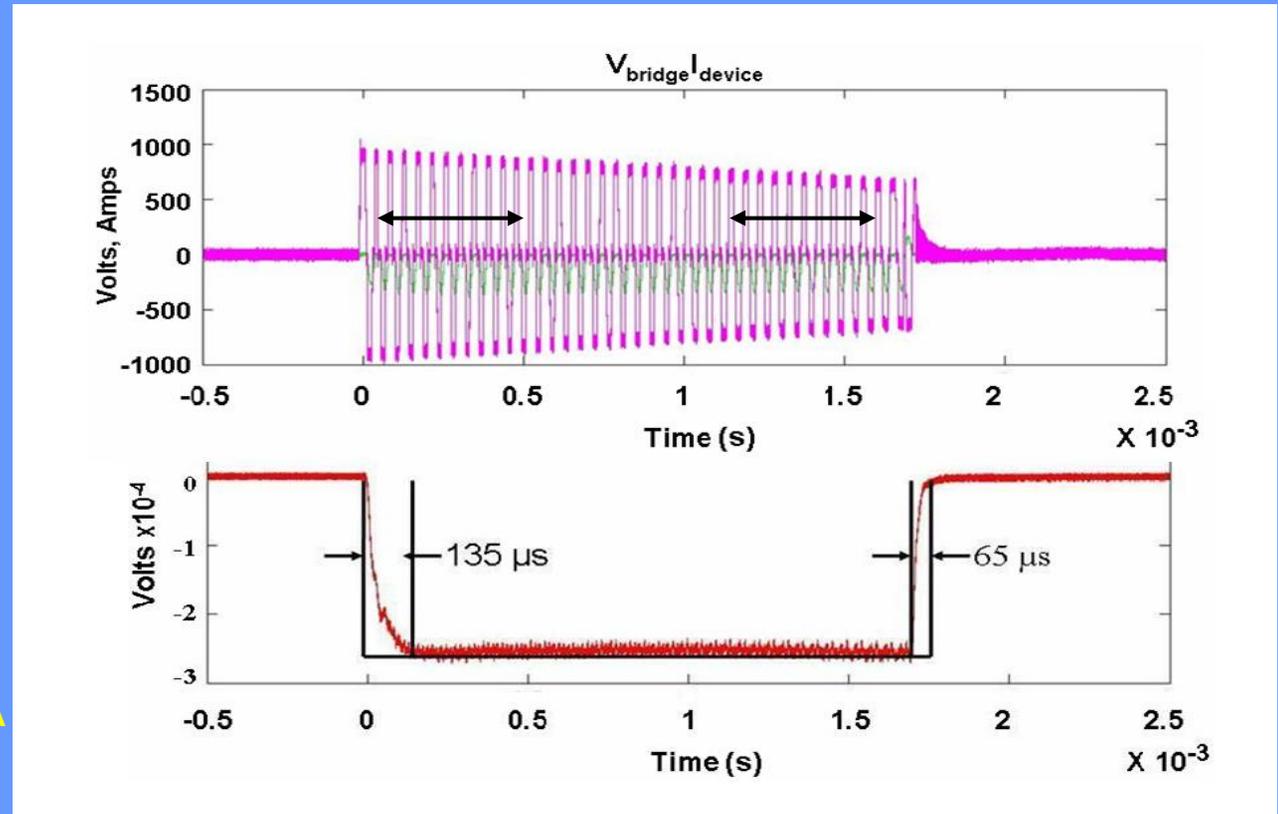
Current through one IGBT. All soft switching

Red:

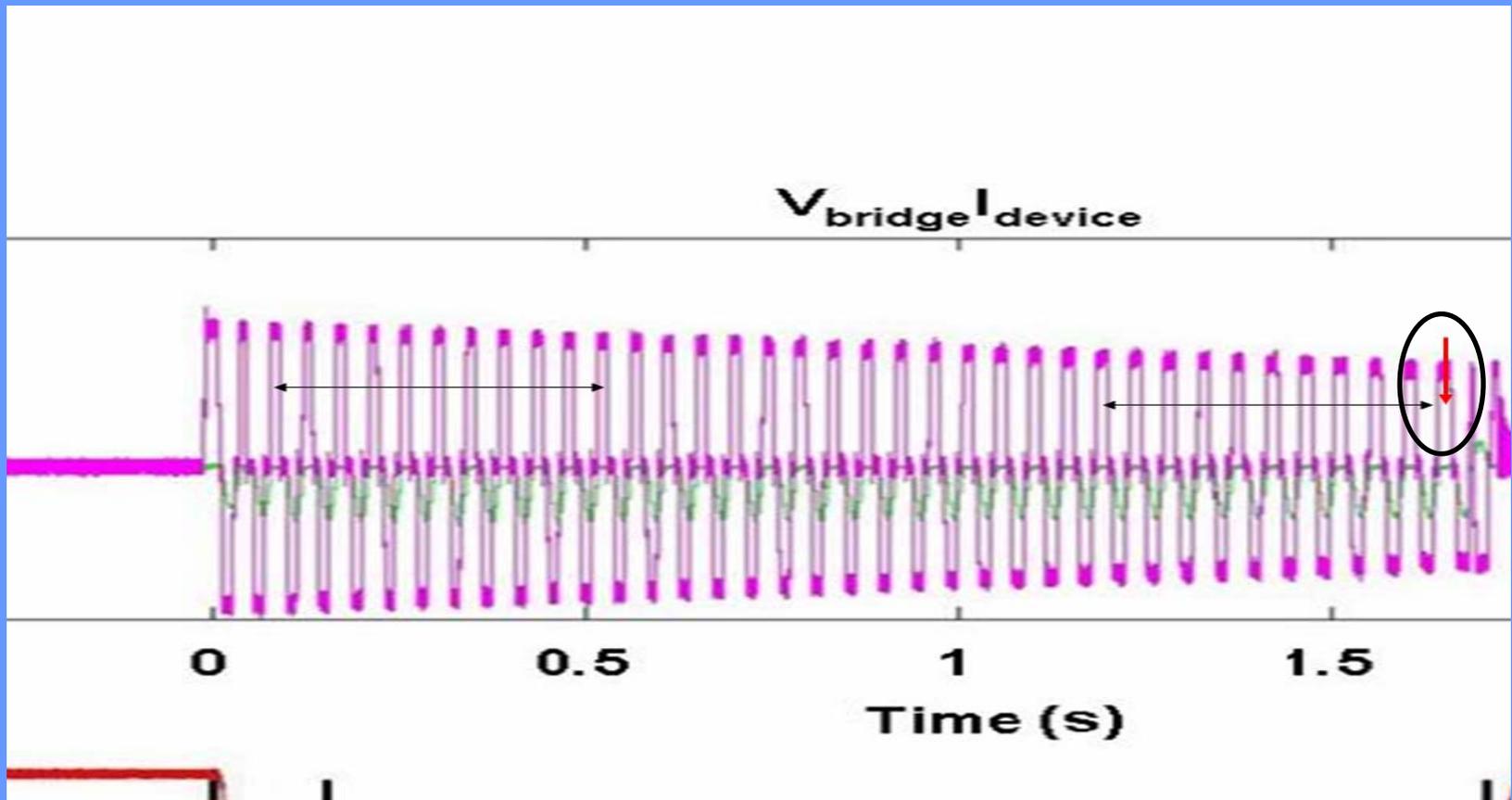
Output pulse 26kV, 12A

Flatness and ripple <0.5%

Stored energy < 2J



Measurements from experimental modulator – zoomed trace



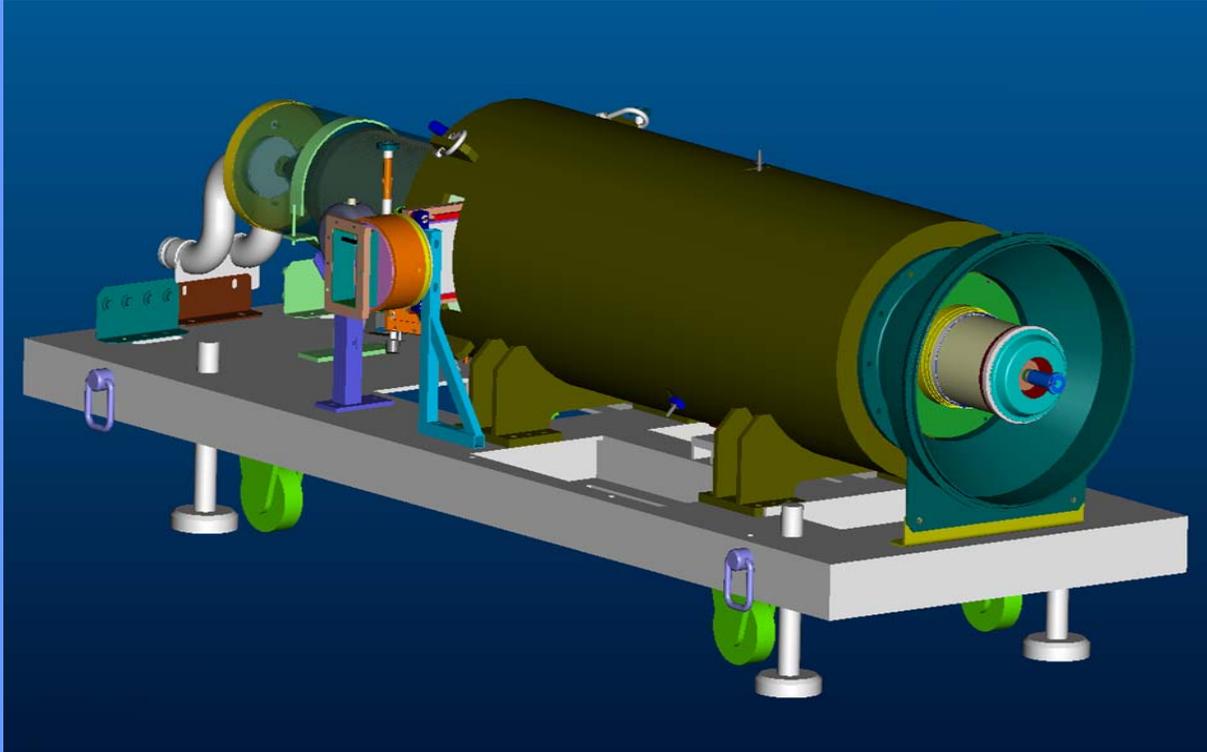
Multiphase resonant converter modulator

- Compact
 - small footprint
 - Less costly to house
- Modular
 - Scalable
 - Redundancy
- Efficient
 - Less heat dissipation
 - Smaller cooling system
- Readily adapted to new device technology (e.g. SiC)
 - Higher rating therefore even more compact

High voltage DC cable



RF Power Amplifier



Schematic view



Tube only

TH1802, 1.3 GHz, 10 MW multibeam
horizontally mounted klystron

Klystron driver amplifier



650 W, 1.3 GHz driver developed for XFEL

Waveguide components



AFT circulator type CPR650 1300MHz 10MWp

Waveguide

An opportunity for innovation?

- A connection method that does not require ~2 million fasteners for ILC?
- Big saving on assembly hours?

Where should we be looking to reduce cost?

- Raw materials
- Components
- Integration and installation
- Commissioning
- Size i.e. real estate

Biggest component is labour

Message

- European industry considers the ILC to be a great business opportunity.
 - some uncertainty over timescale and in the choice of some RF systems technology
- But companies must justify R&D plans to stake-holders
 - important to minimise the impact of uncertainty (= financial risk!)

So reduce uncertainty by (at least):

- Maintaining the flow of up-to-date information
- Engaging industry early to maximise its impact on design
- Ensuring suitable external funding is available - in particular for ILC-specific tasks

So...

We assume these requirements can be satisfied therefore...

European Industry is eager to play its part in the design, construction and commissioning of the ILC!



Acknowledgements

