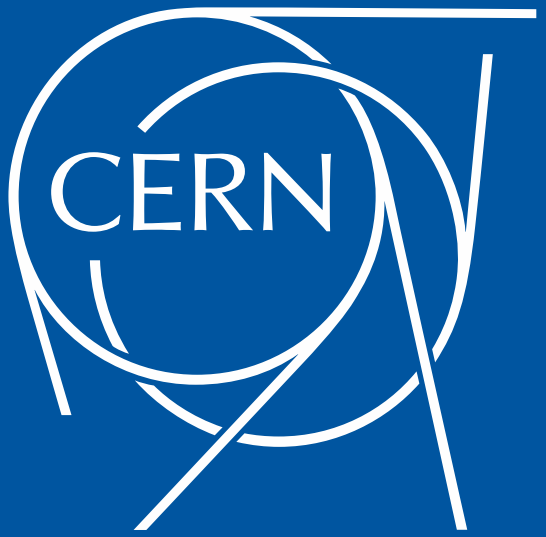
CERN

CLIC Workshop 2014

Monolithic transformer-based Klystron Modulator for the CLIC Drive Beam

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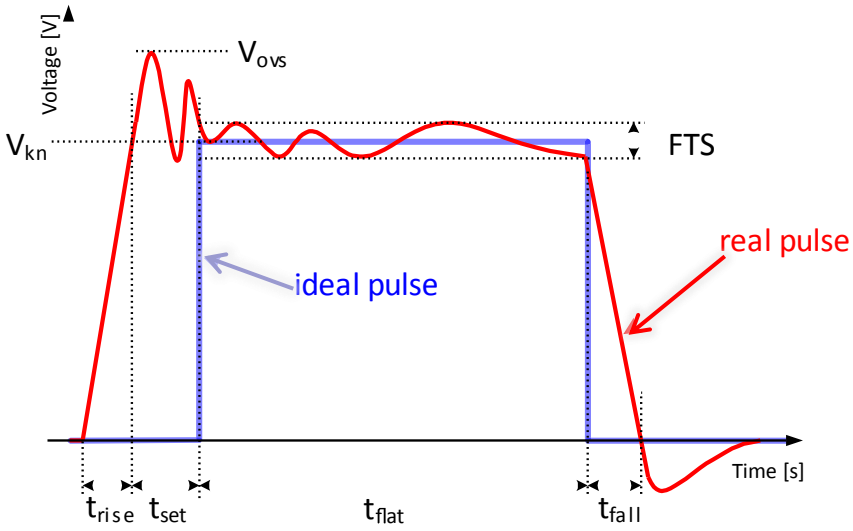
Outline

- Introduction
- Objectives
- R&D Status
  - Methodology
  - Topology Selection
  - Power & Droop Compensators
  - Monolithic Pulse Transformer
- Schedule

Introduction

- Pulse Requirements

Nominal pulse voltage	V_{kn}	150 - 180 KV
Nominal pulse current	I_{kn}	160 - 195 A
Rise & Fall Times	t_{rise}, t_{fall}	3 µs
Settling time	t_{set}	5 µs
Pulse Length	t_{flat}	140 µs
Repetition Rate	REPR	50 Hz
Voltage overshoot	V_{ovs}	1 %
Flat-top stability	FTS	0.85 %
Pulse to pulse repeatability	PPR	10 ppm
Pulse efficiency	η_{pulse}	95 %
PFS electrical efficiency	η_{pfs}	98 %
Modulator global efficiency	η_{mod_global}	90 %



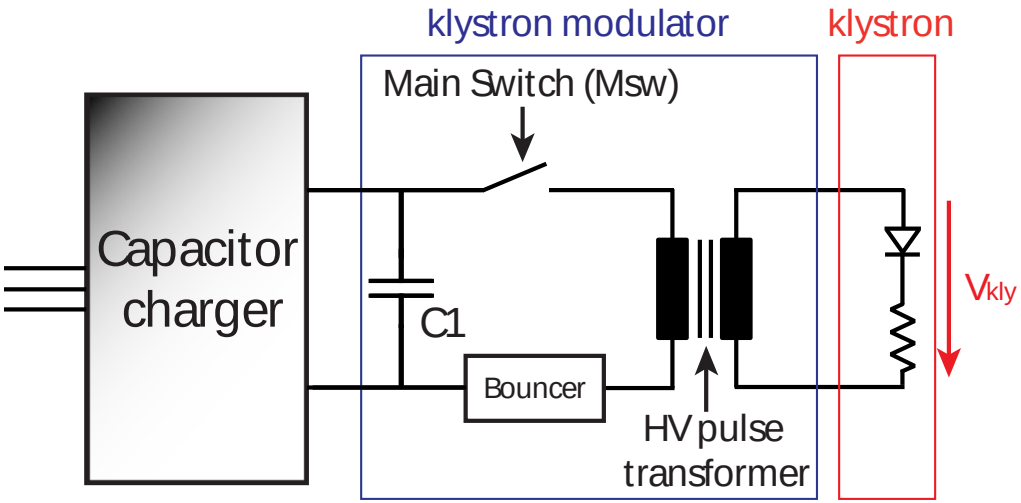
~1300 modulators of 29MW

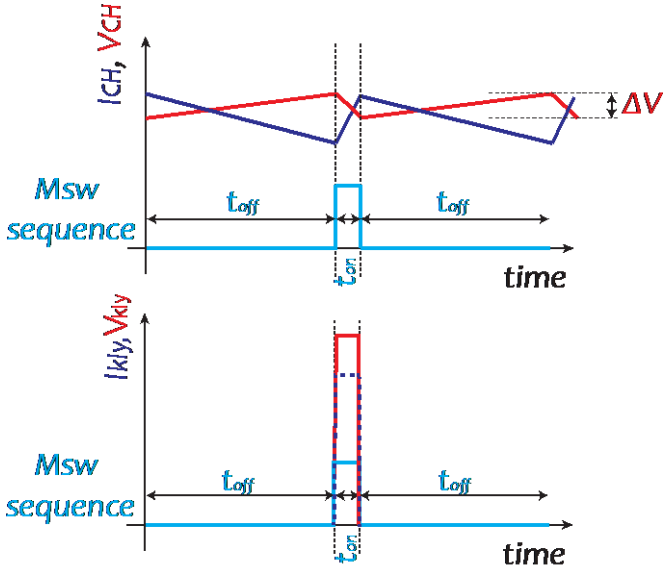
Total peak power: ~40 GW

Average power consumption: ~300 MW

Objectives

- Optimal Design of a Klystron Modulator for CLIC-DB, based on a monolithic transformer based topology, capable of:
  - Respecting the challenging pulse and efficiency specifications.
  - Operating at constant power consumption



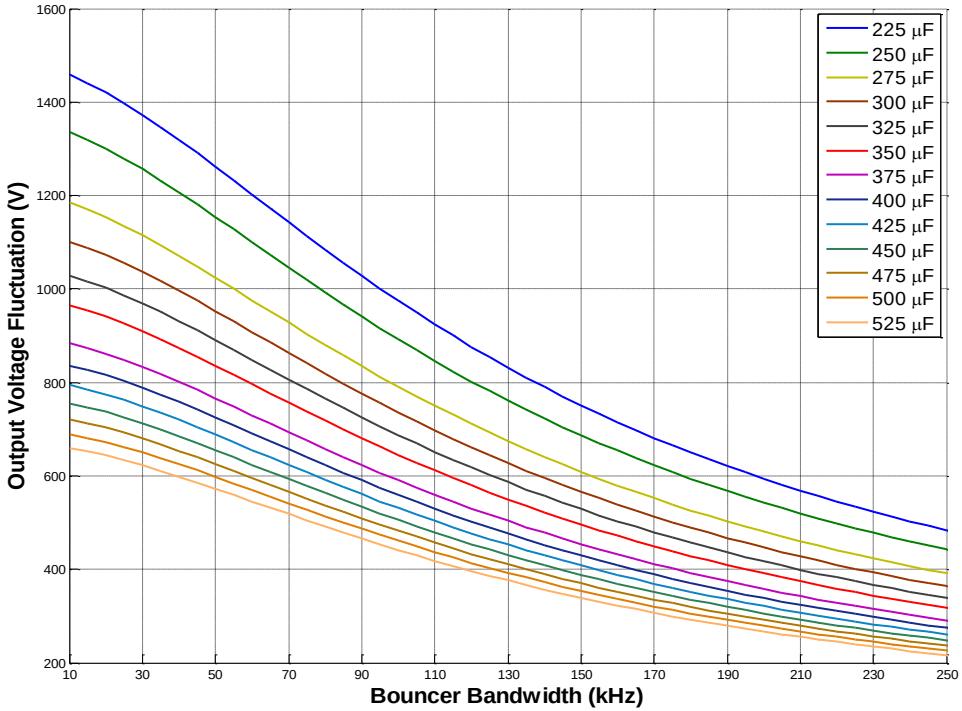


R&D Status

- Influence of several modulator parameters on active bouncer requirements

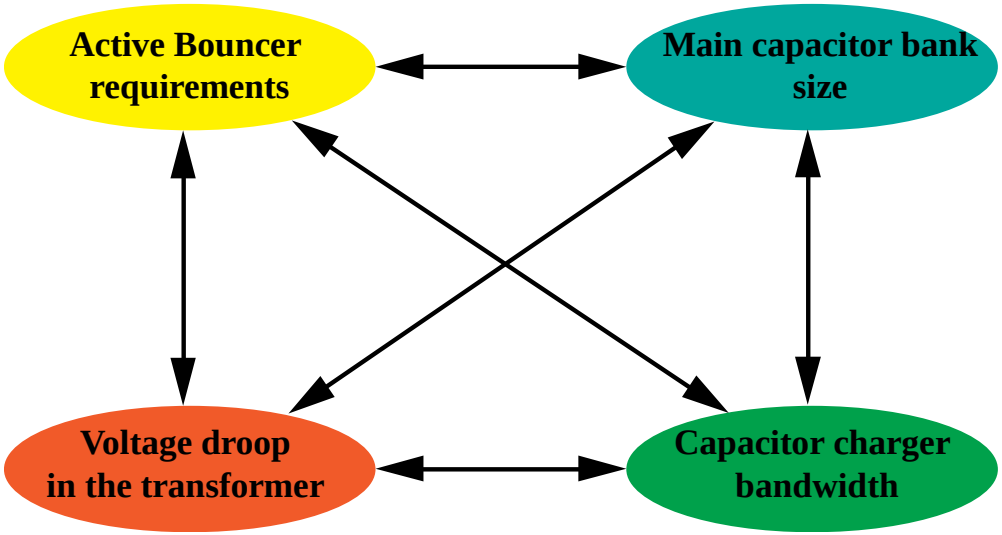
Examples:

- HV charger bandwidth
- Transformer droop
- Main capacitor bank size



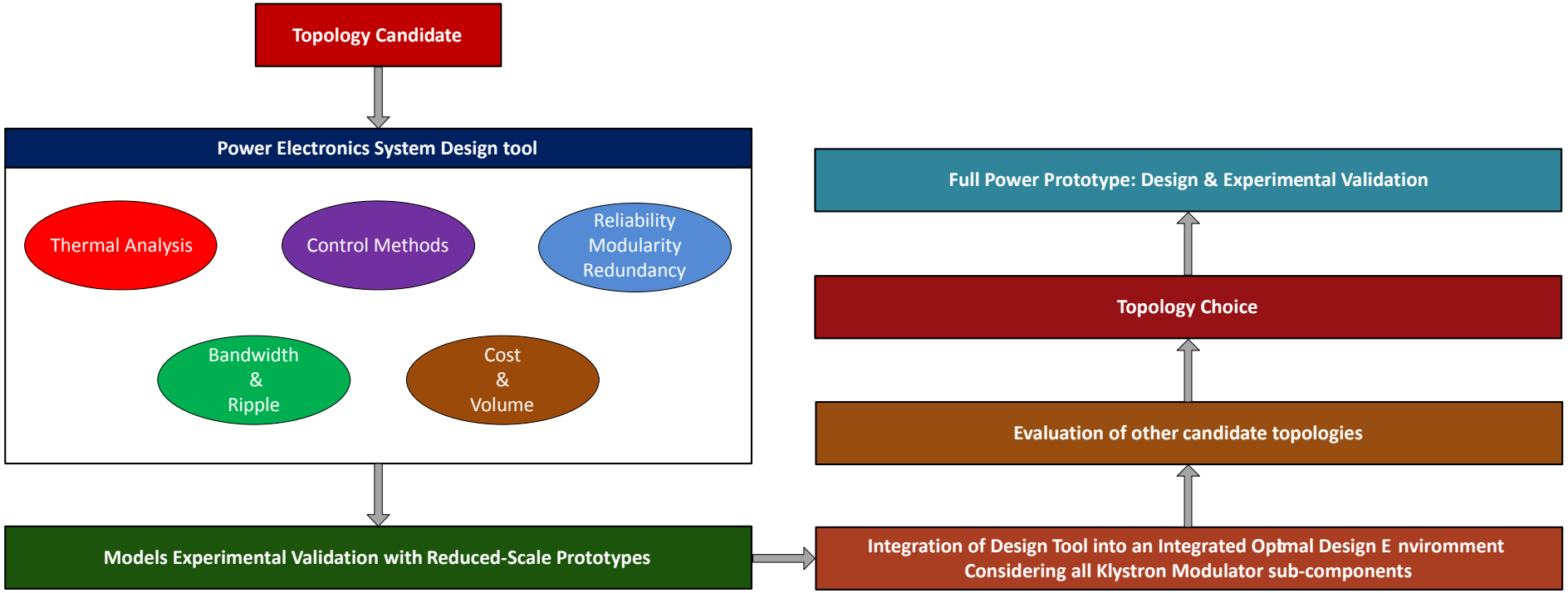
R&D Status

- Influence of several modulator parameters on active bouncer requirements
  - Need for an integrated system approach
  - Constrained nonlinear optimization



R&D Status

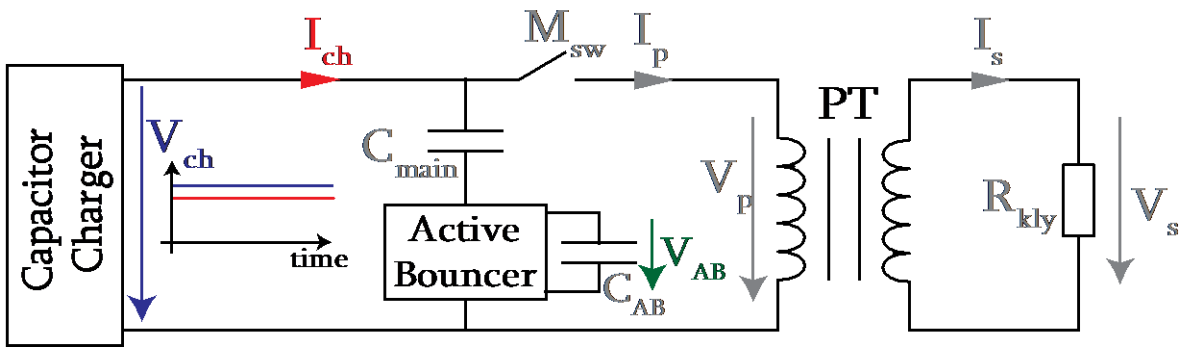
- Methodology



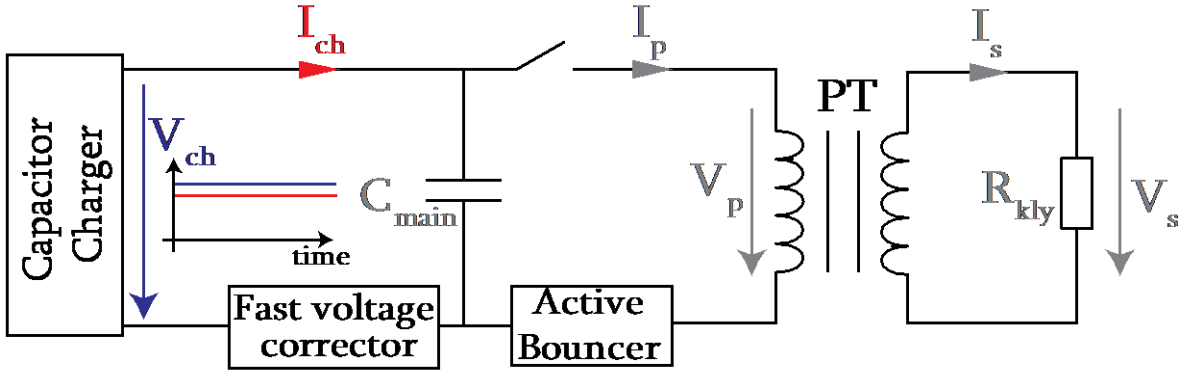
R&D Status

- Topology Selection

a)



b)



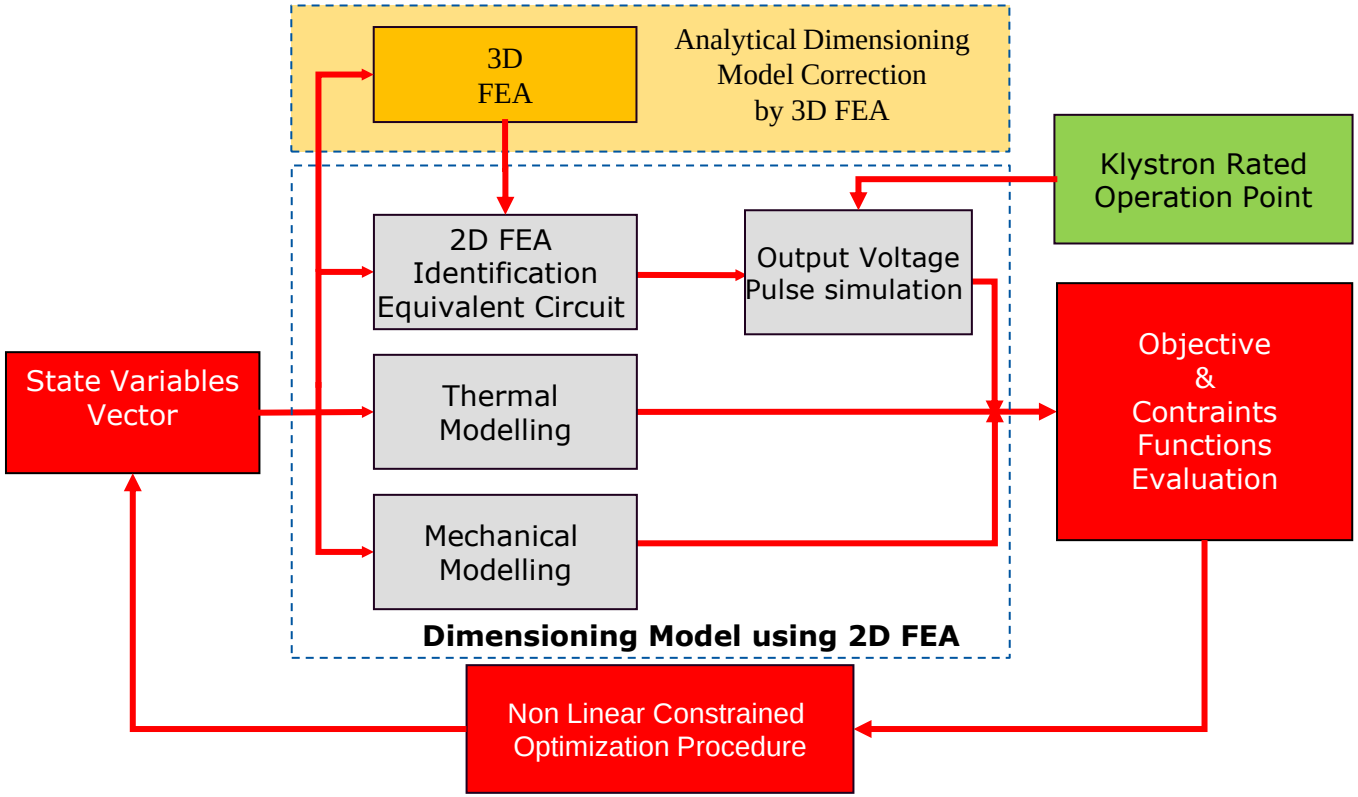
R&D Status

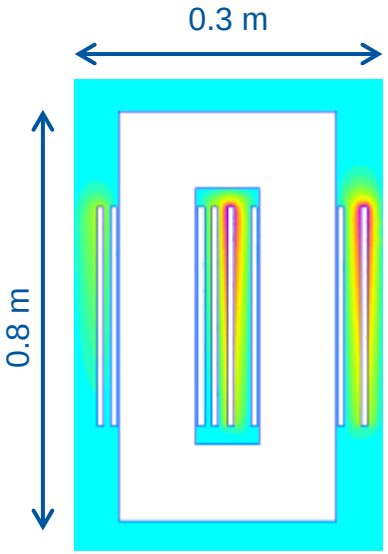
- Power & Droop Compensators:
  - 300 kW prototype (1kV, 300A).

Validation & Correction of Mathematical Models and Control Strategies

R&D Status

- Monolithic Pulse Transformer

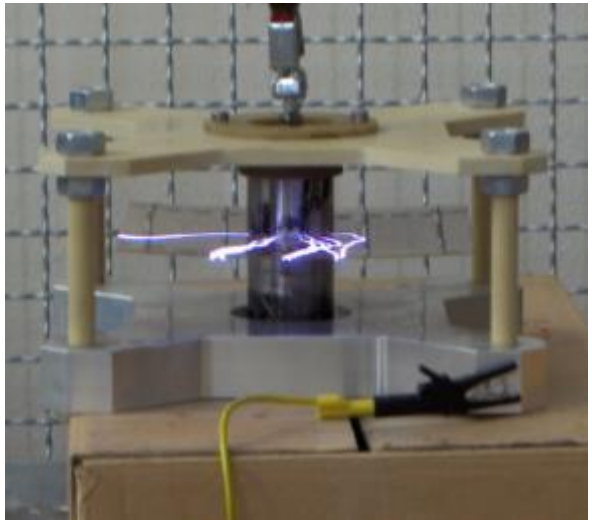




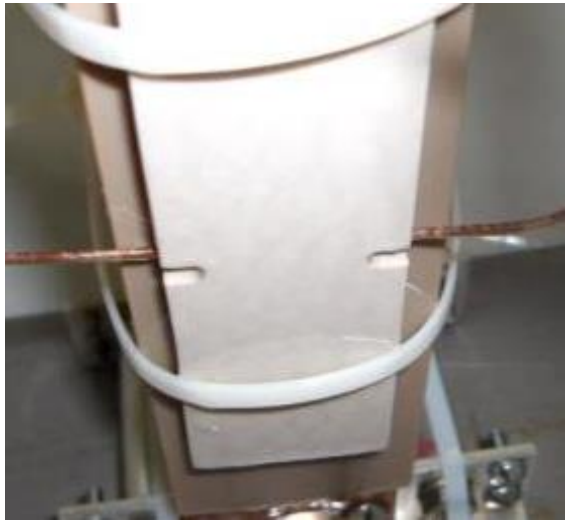
R&D Status

- Monolithic Pulse Transformer
  - HV Tests: Determination of expert coefficients

MIDEL & Silicon Oil tests



PEEK test



Insulation system test

Schedule

- 2014:

	February - July	August	September - December
Theoretical Studies			
Protype Testing			
Compensator Final Design			
Transformer Final Design			
Specification & Purchasing of Conmponents			

- Beginning of full scale construction: December 2014
- Full Power Testing & Validation: 2015

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