Controlled Switching – suitability check for already installed HVAC circuit breakers

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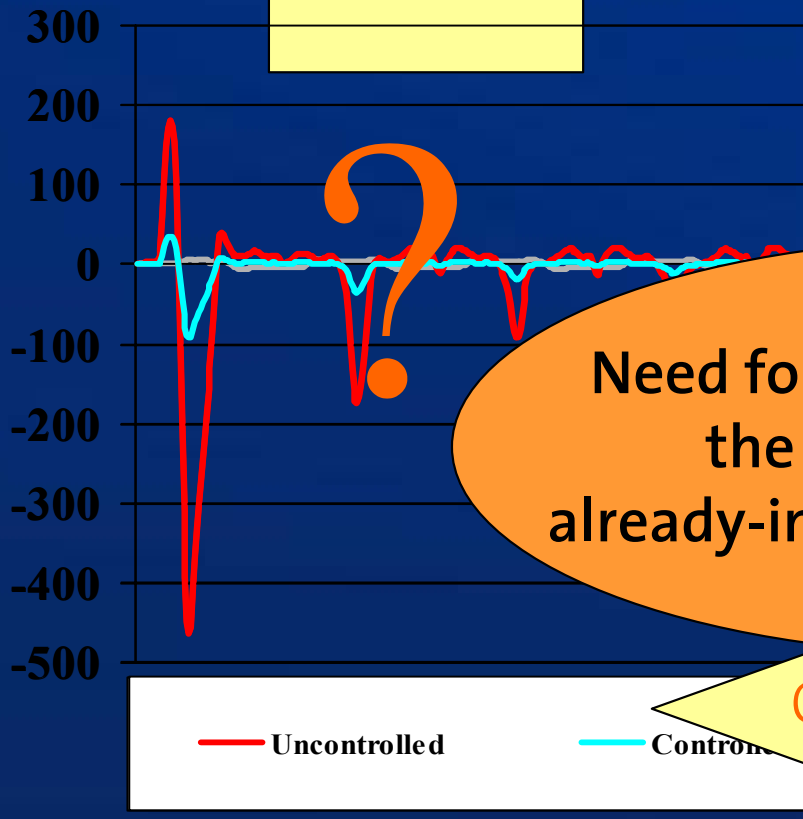
STRUCTURE

- INTRODUCTION
- IMPORTANT CHARACTERISTICS
- IDENTIFICATION OF RDDS
- CASE STUDY: CAPACITOR BANK
- QUESTIONS

INTRODUCTION

Reduction specifies the CB

Transformer inrush



Circuit breaker characteristics are often unknown

Need for methods to identify the characteristics of already-installed circuit breakers

CB specifies the reduction

Suitable or not?

- Depends on the switching case (reactor, capacitor bank, line, transformer, etc.)
- Defined by the power utility and/or its customers

-> a methodology to calculate the numbers as a base for the decision pro or contra controlled switching

IMPORTANT CHARACTERISTICS

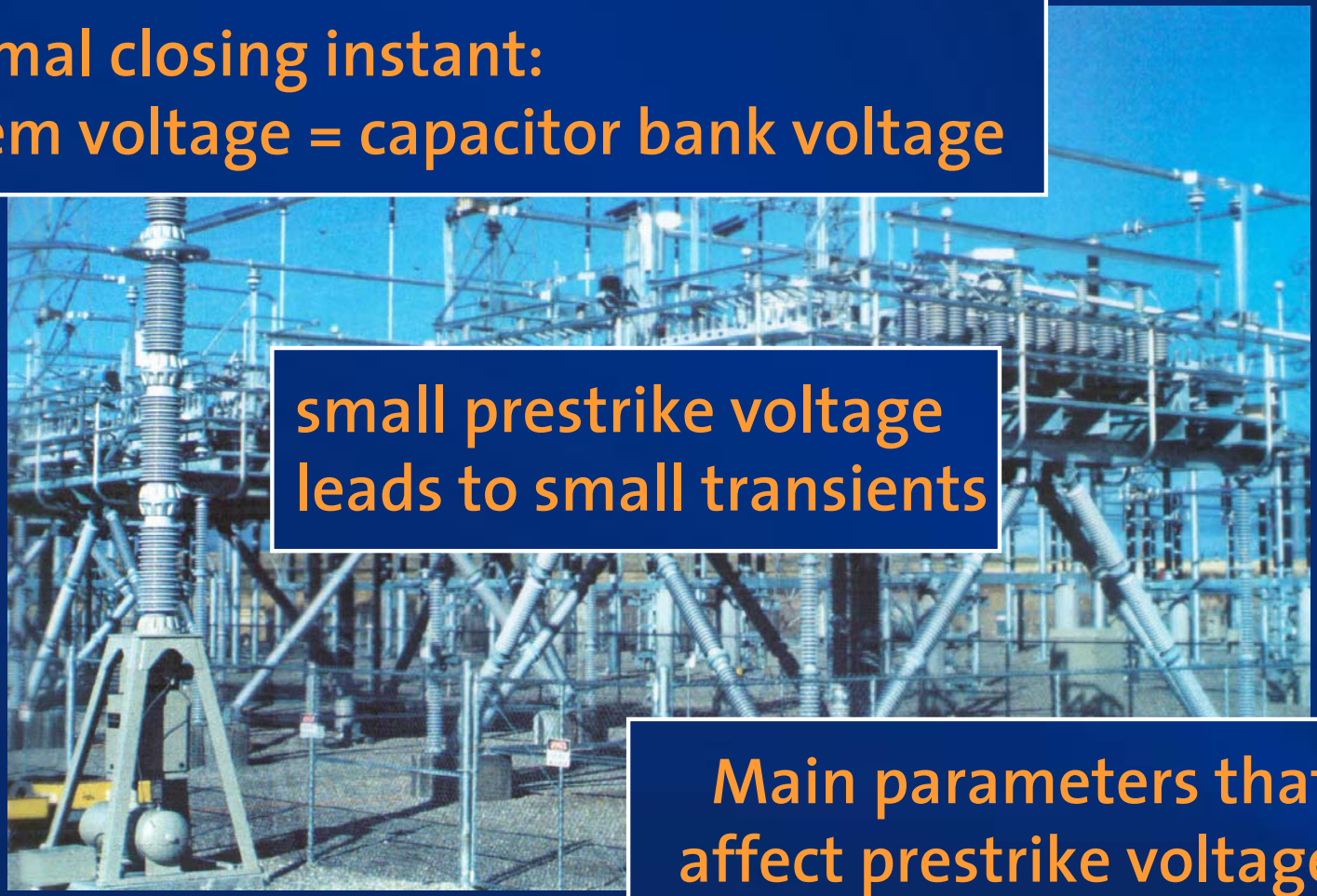
- Rate of decrease of dielectric strength RDDS
- Mechanical closing time in dependence of:
  - Idle time
  - Auxillary voltage
  - Temperature
  - Drive energy
- Scatter

Work is in progress

No results can be presented for the time being

CAPACITORBANK ENERGIZATION

Optimal closing instant:
system voltage = capacitor bank voltage

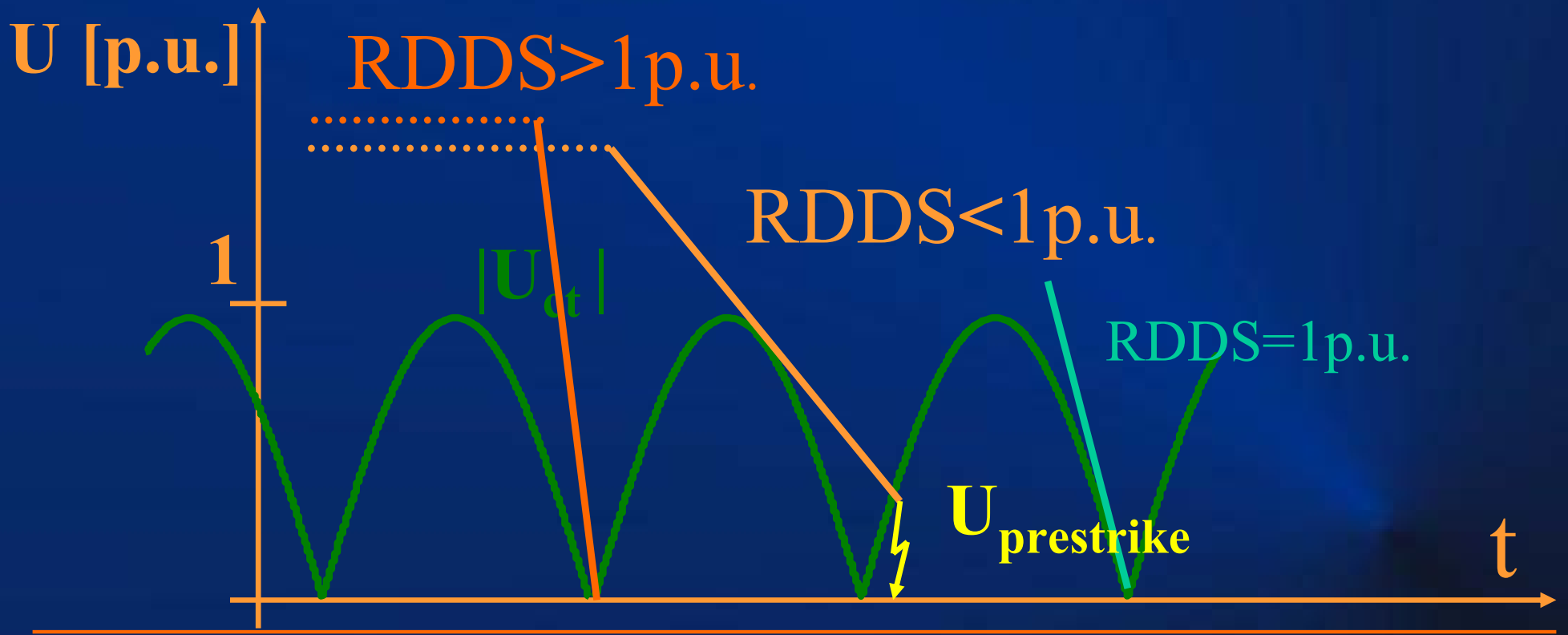


small prestrike voltage
leads to small transients

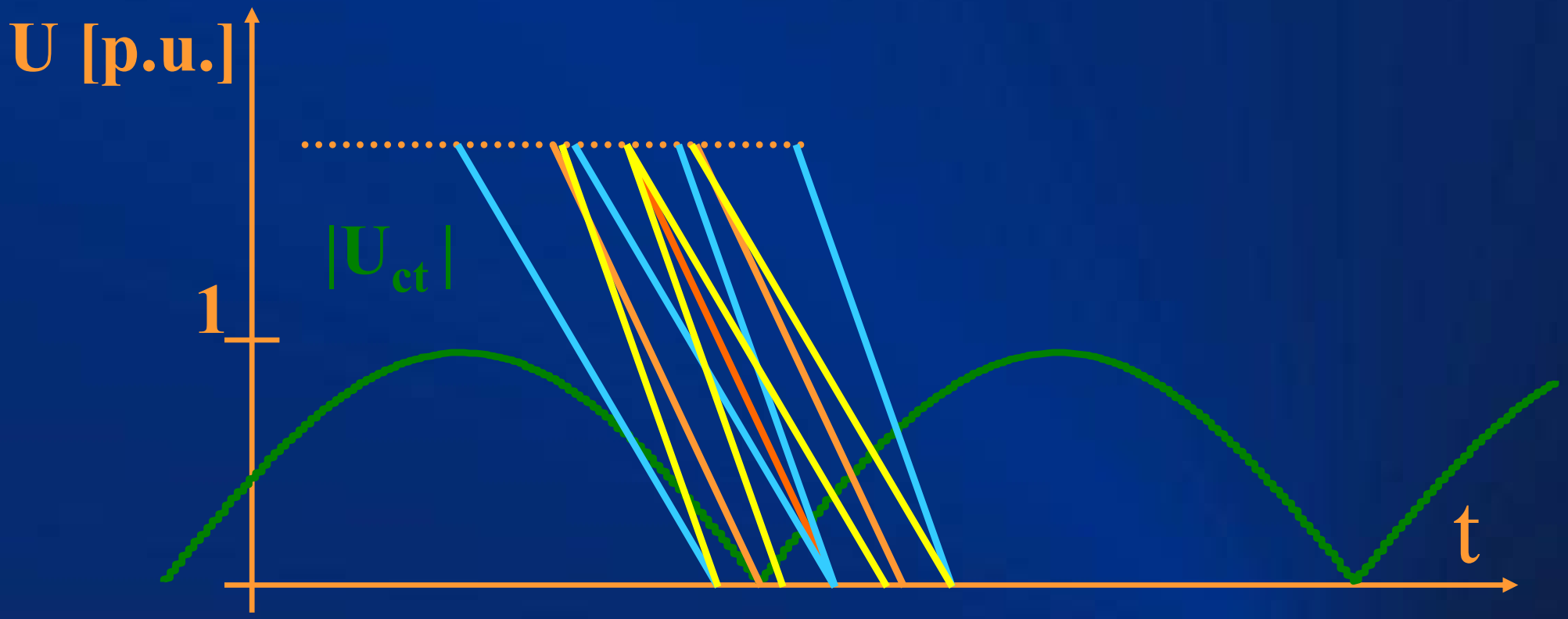
Main parameters that affect prestrike voltage?

INFLUENCE OF RDDS ON PRESTRIKE VOLTAGE

Rate of Decrease of Dielectric Strength=Slope

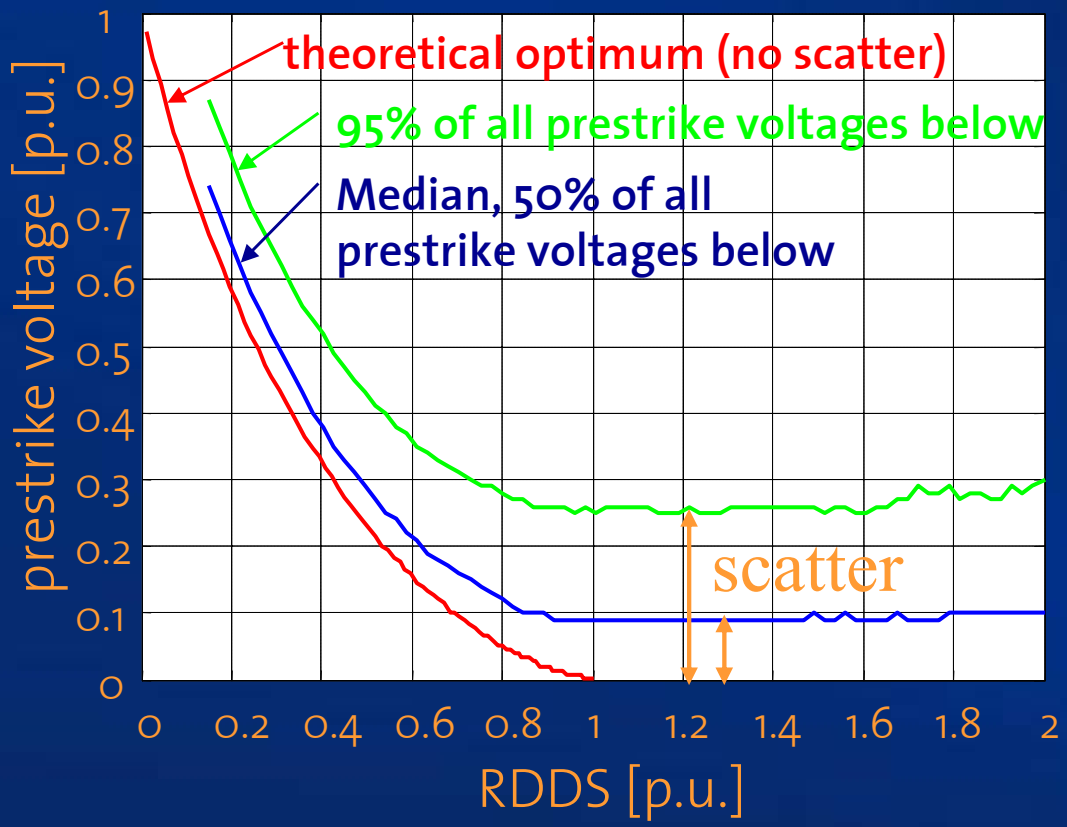


STATISTICAL MODEL OF THE DYNAMIC DIELECTRIC STRENGTH



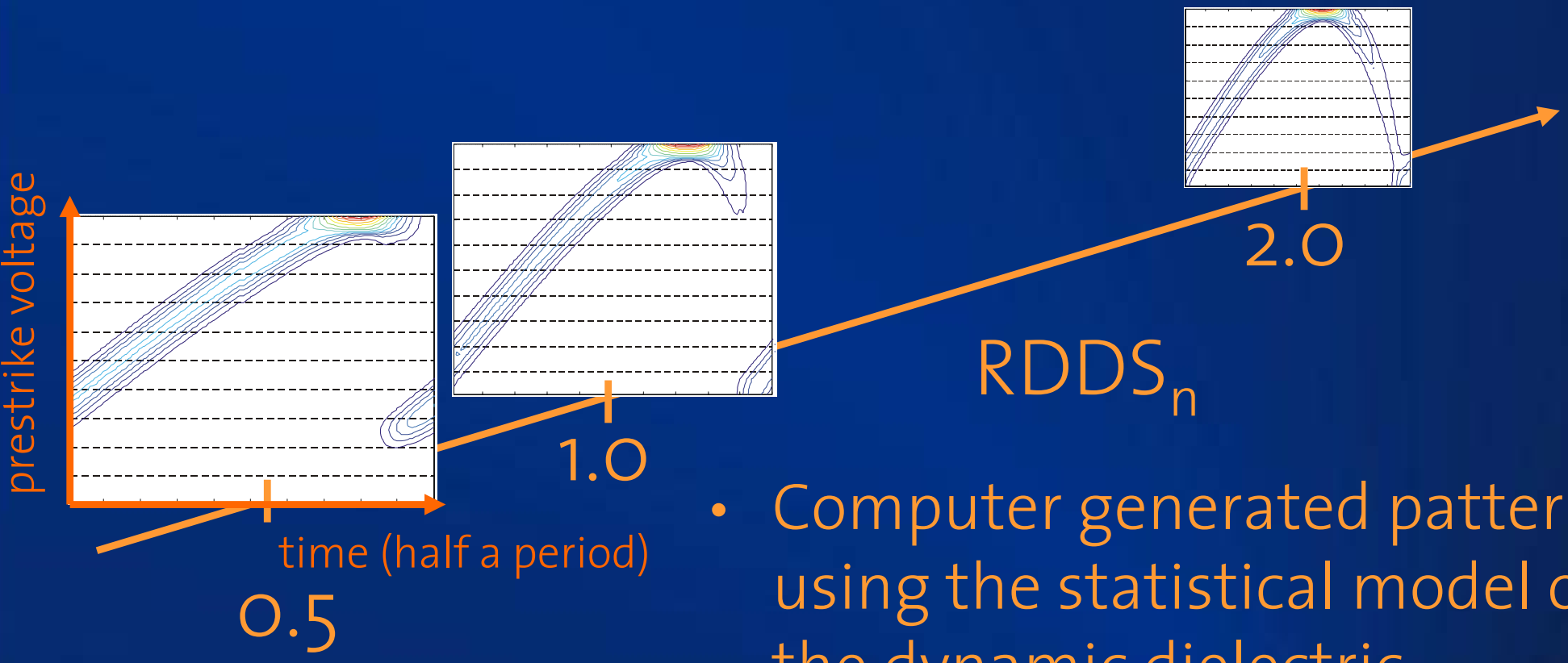
INFLUENCE OF RDDS ON PRESTRIKE VOLTAGE

zero voltage switching



Assumptions: 3σ Tb=1ms 3σ V=5% 3σ D=15%

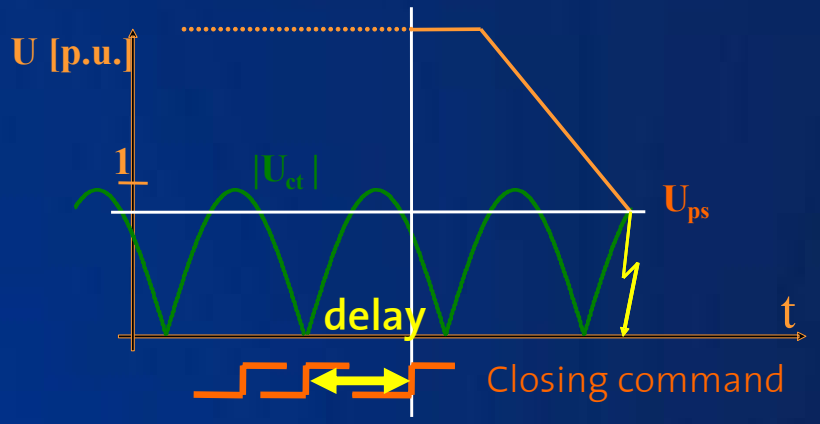
CHARACTERISTIC PATTERN



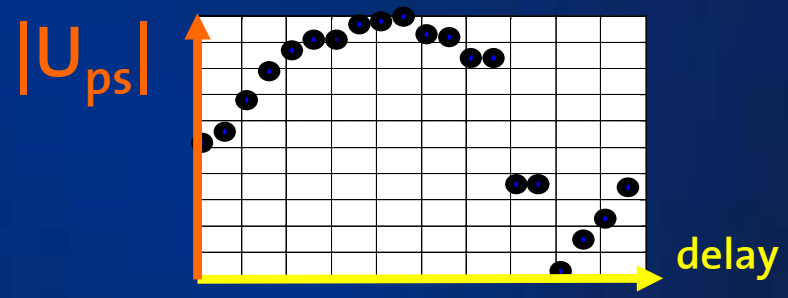
- Computer generated patterns using the statistical model of the dynamic dielectric strength of a circuit breaker
- 100 patterns are available for identification

IDENTIFICATION ALGORITHM

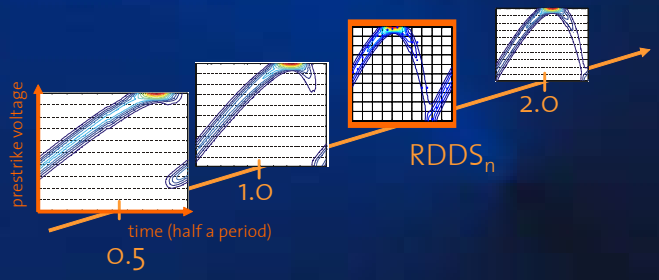
- Closing command is synchronized and delayed in 20 steps over one half-cycle



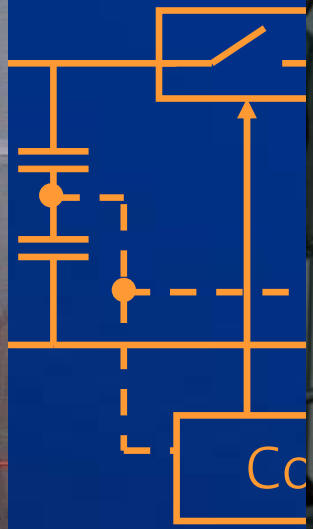
- Prestrike voltages are measured



- The algorithm evaluates the best pattern



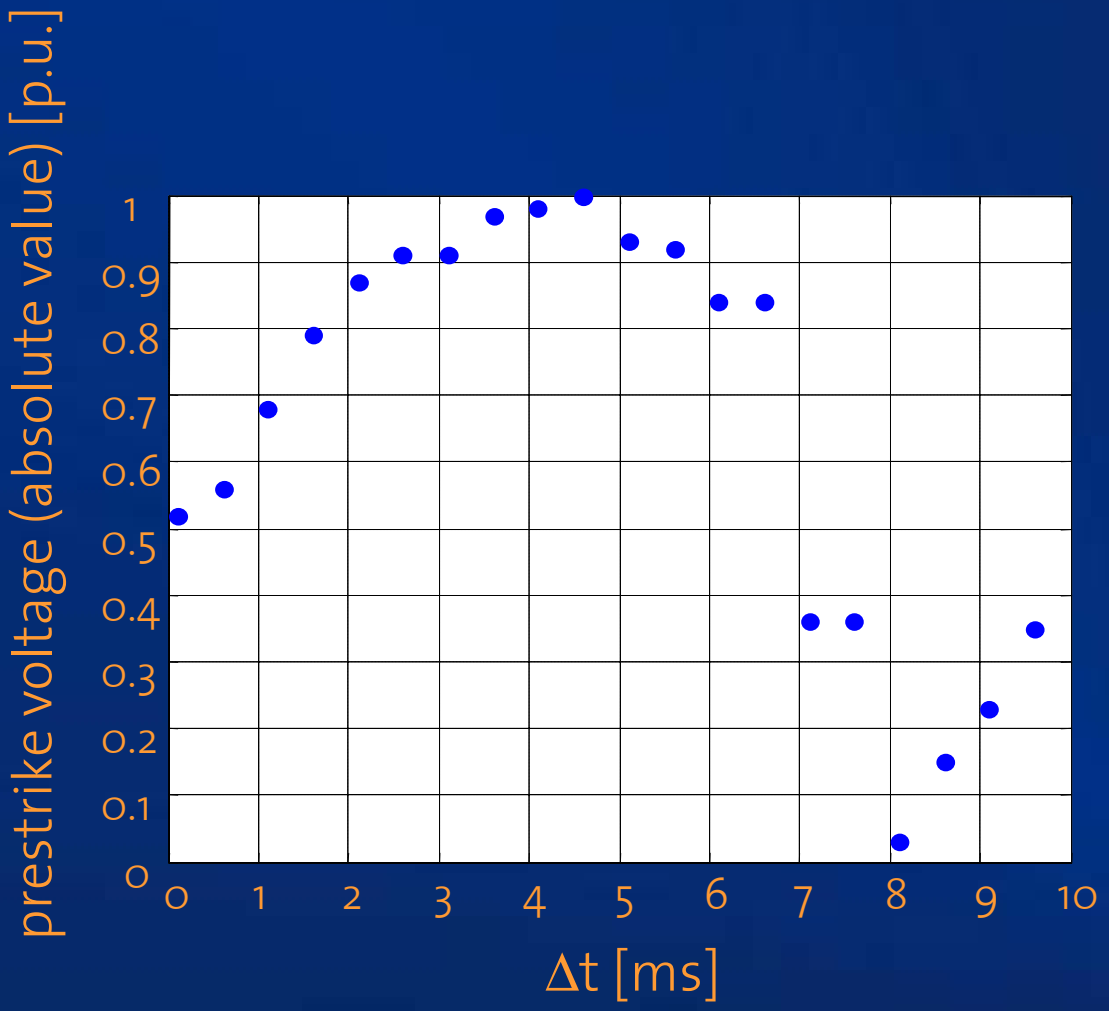
TEST SETUP



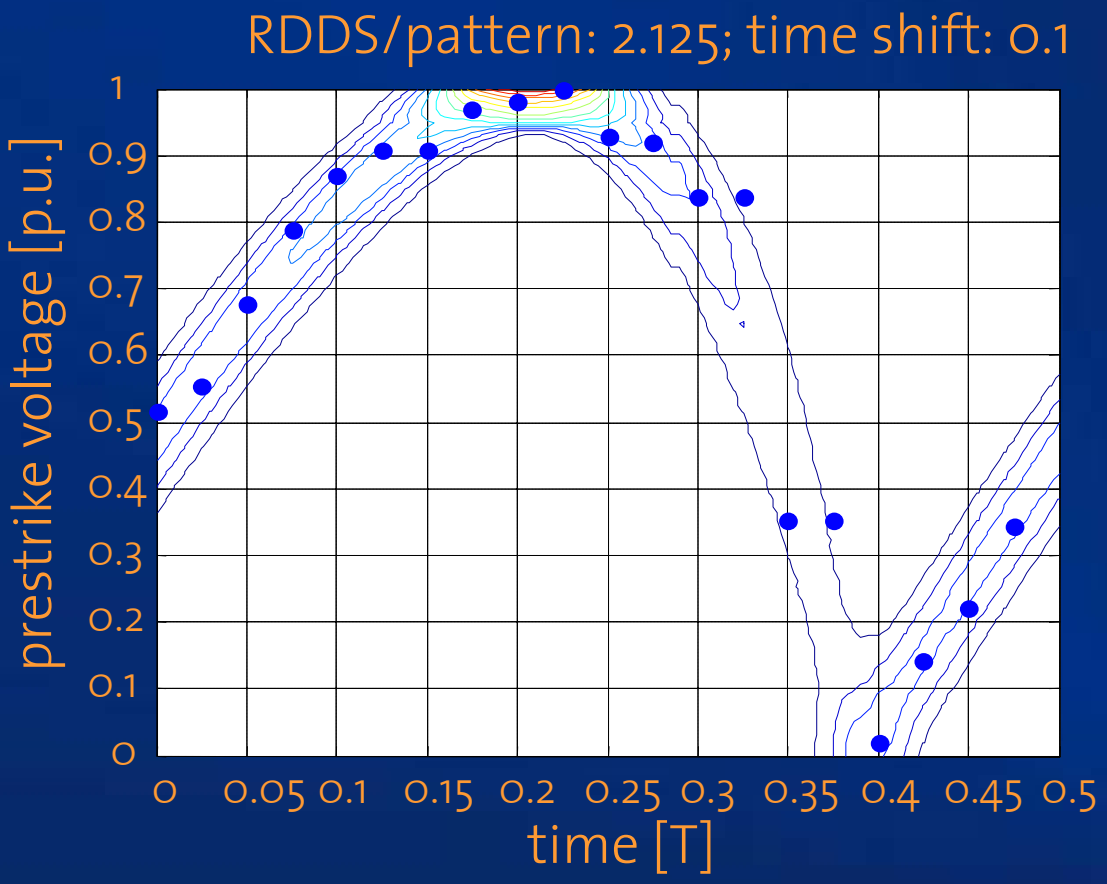
age

- the close command with the system voltage
- mmand in 20 steps over half a period

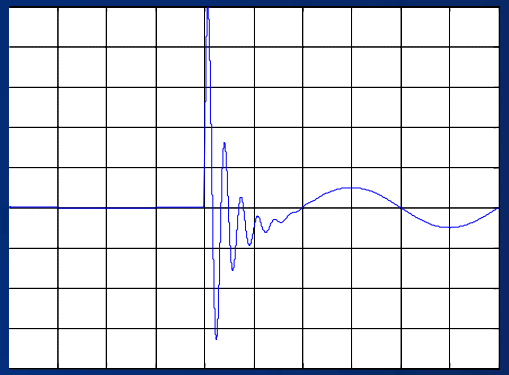
MEASUREMENTS

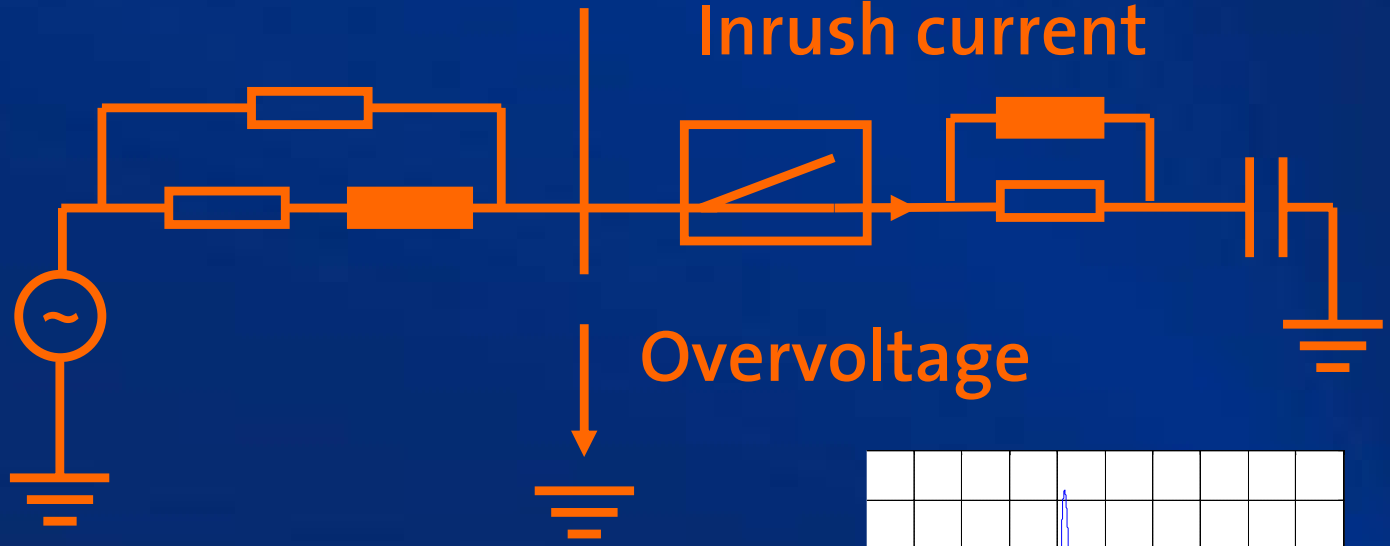


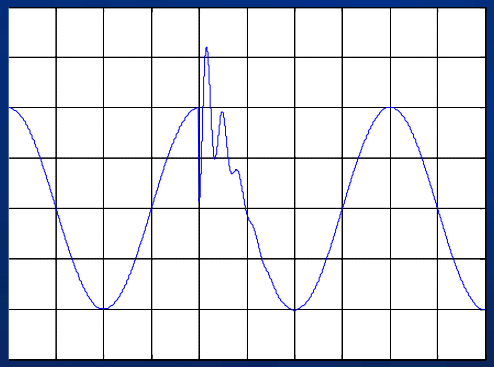
VISUALIZED RESULT



CASE I

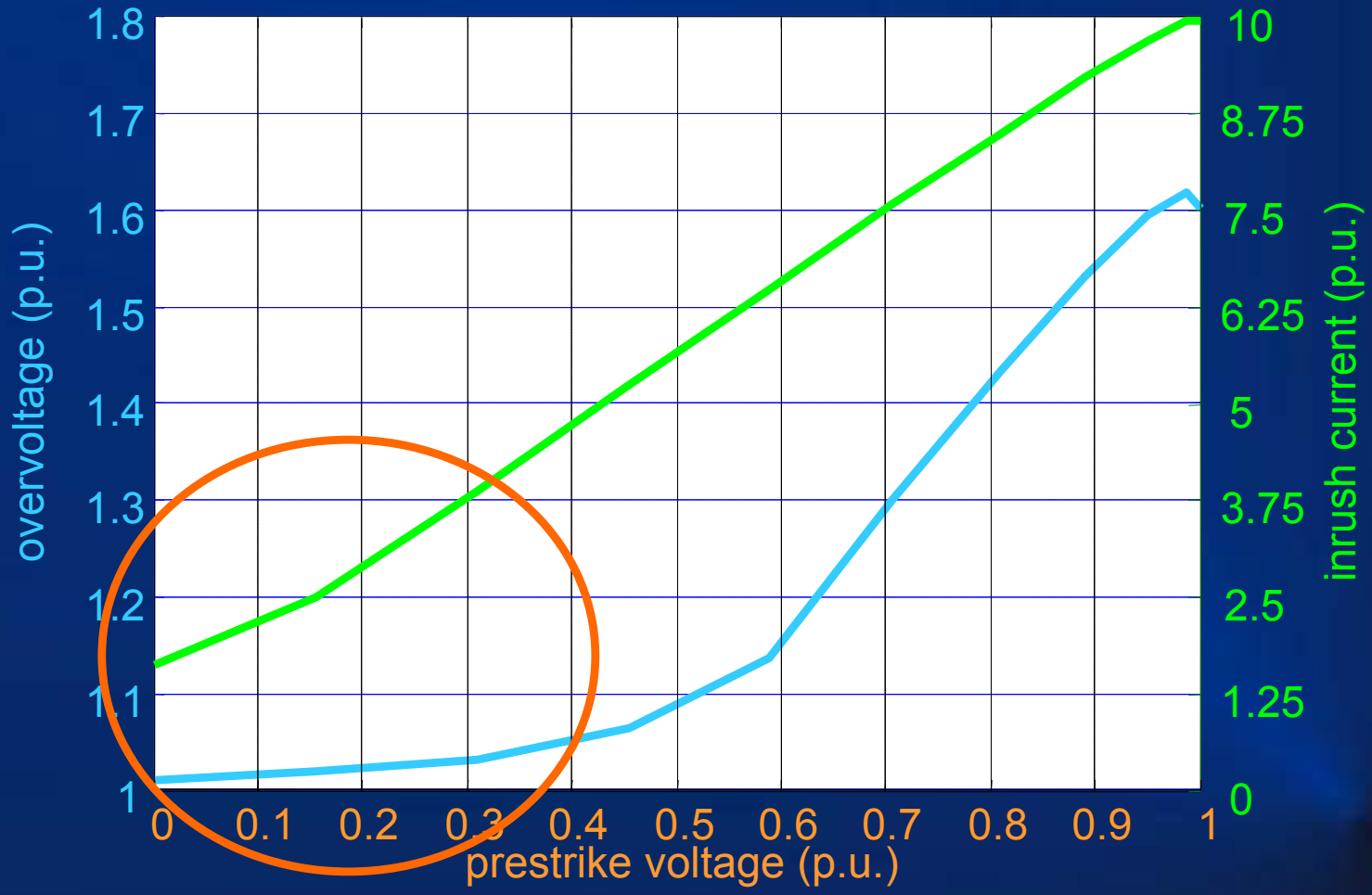






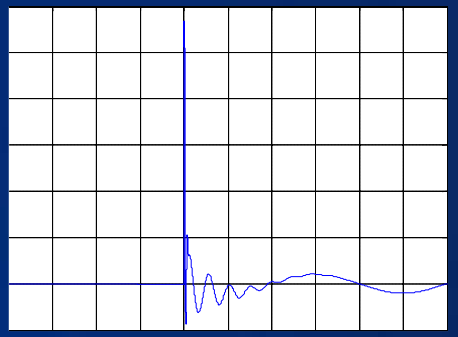
SUITABILITY CHECK

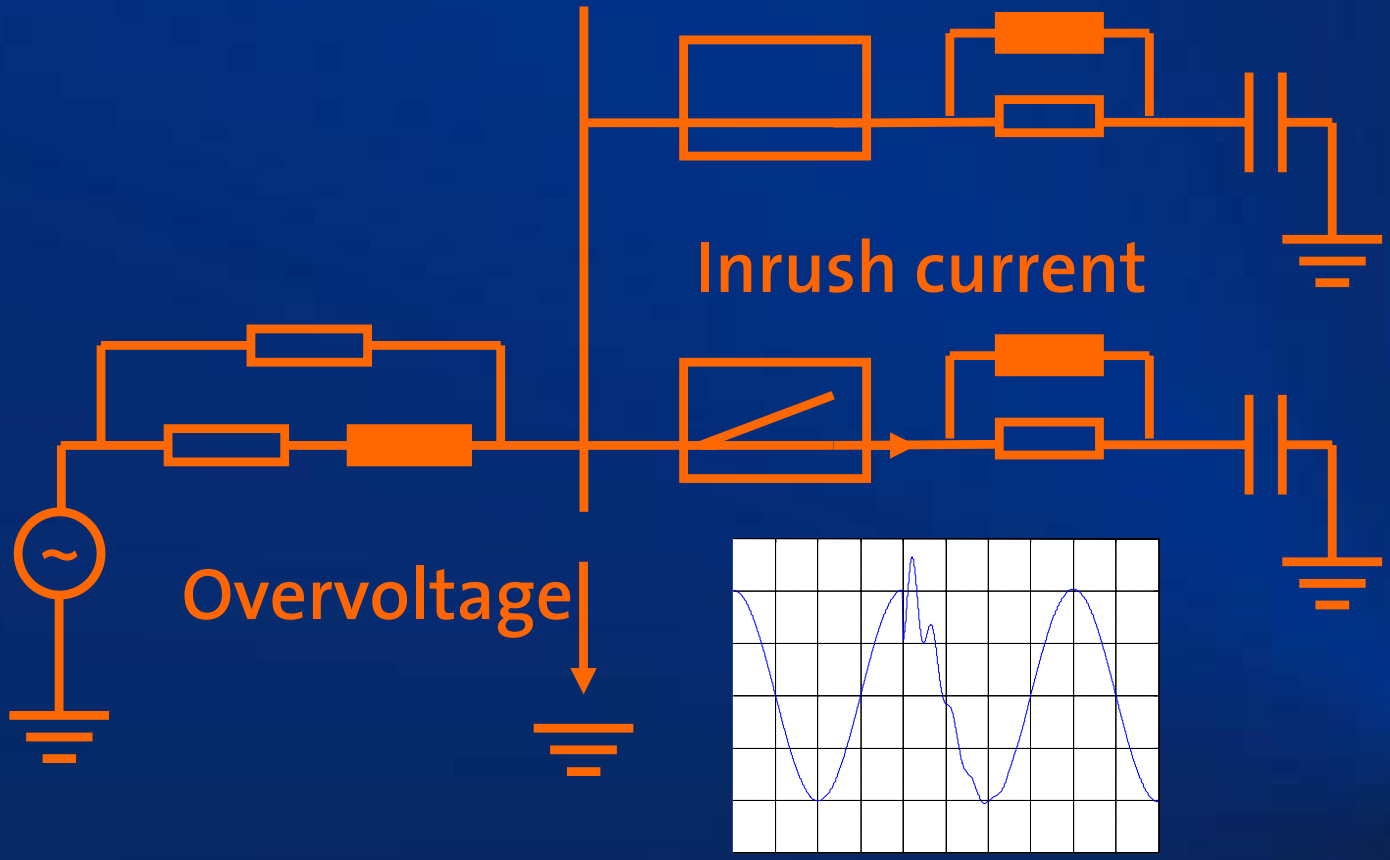
Single capacitor bank



CASE II

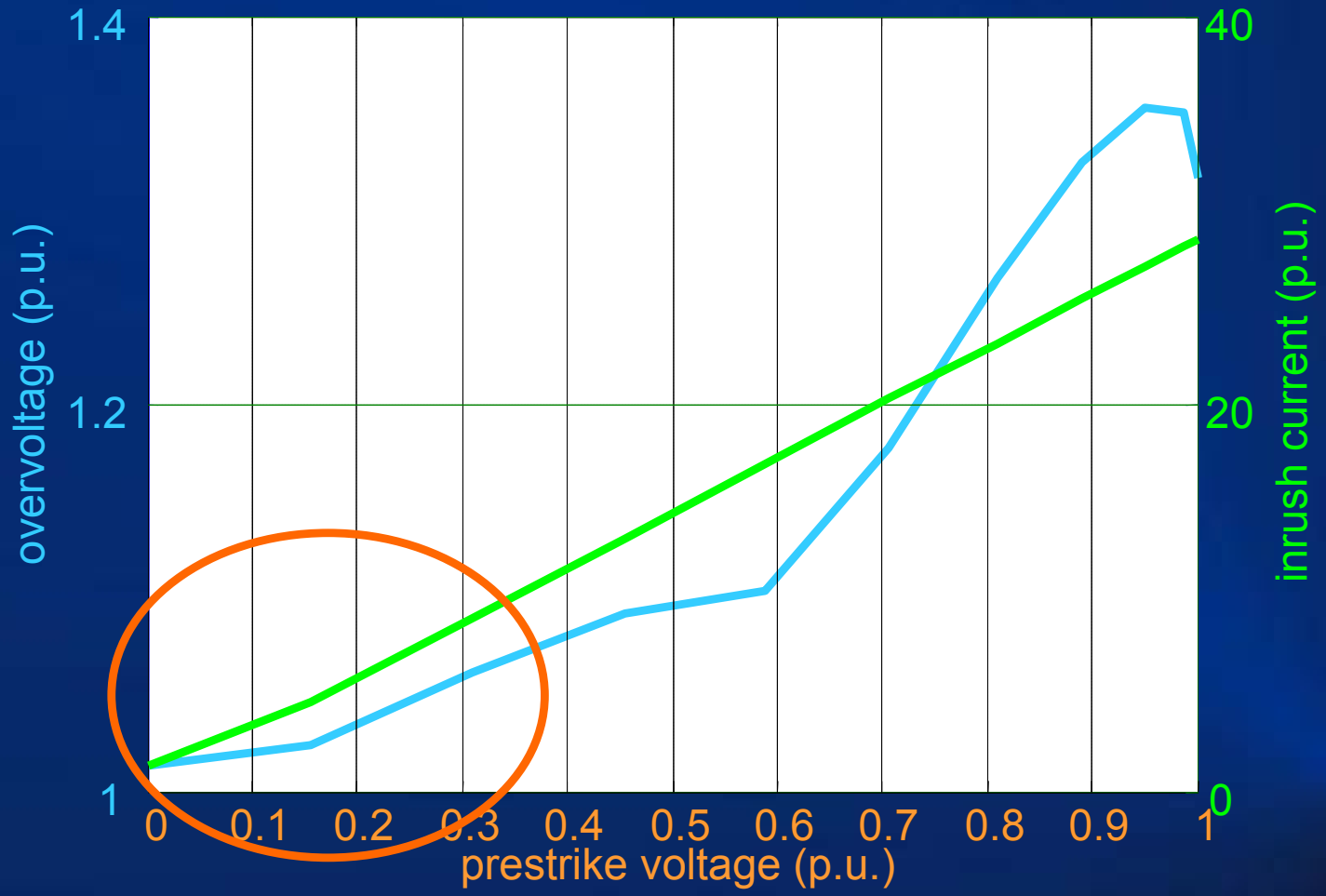
Simple back-to-back situation:





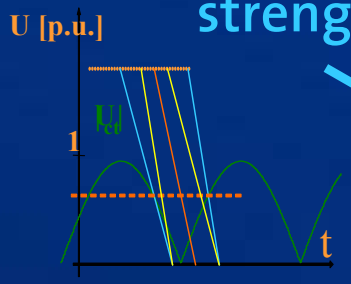
SUITABILITY CHECK

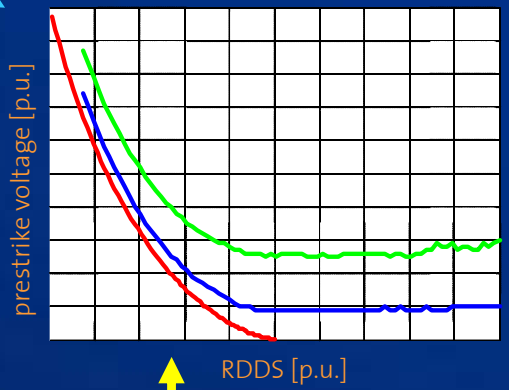
Back-to-back



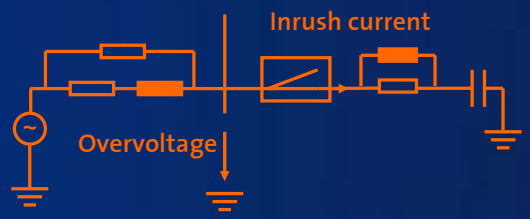
SUMMARY

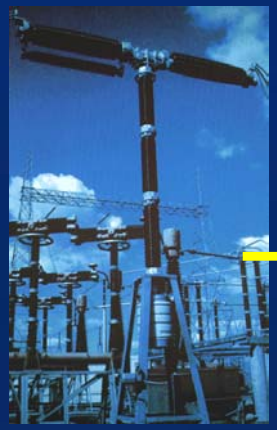
Statistical model of dynamic dielectric strength



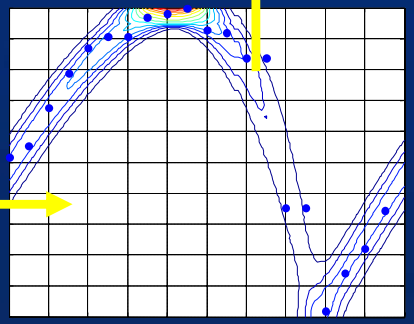


Case Study

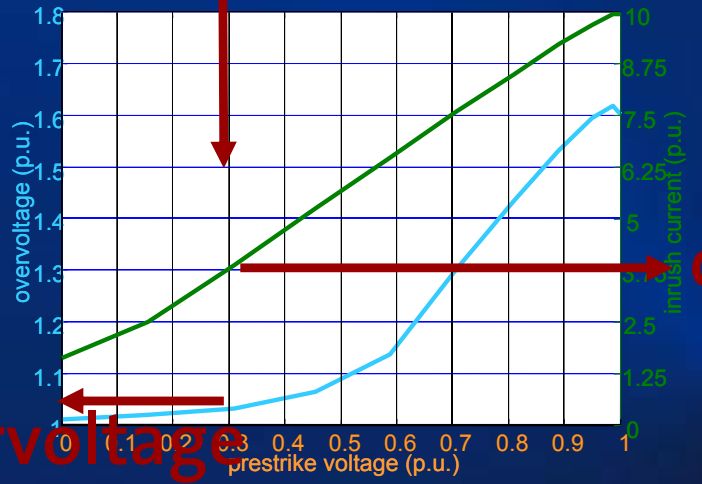




RDDS



Identification



Overvoltage

Inrush current