Non-Network Time-Synchronized Applications

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February 21, 2013

Making Electric Power Safer, More Reliable, and More Economical®

Situational Awareness & Analytics

Time-Synchronized Measurements

PDC

PMU

Why not time
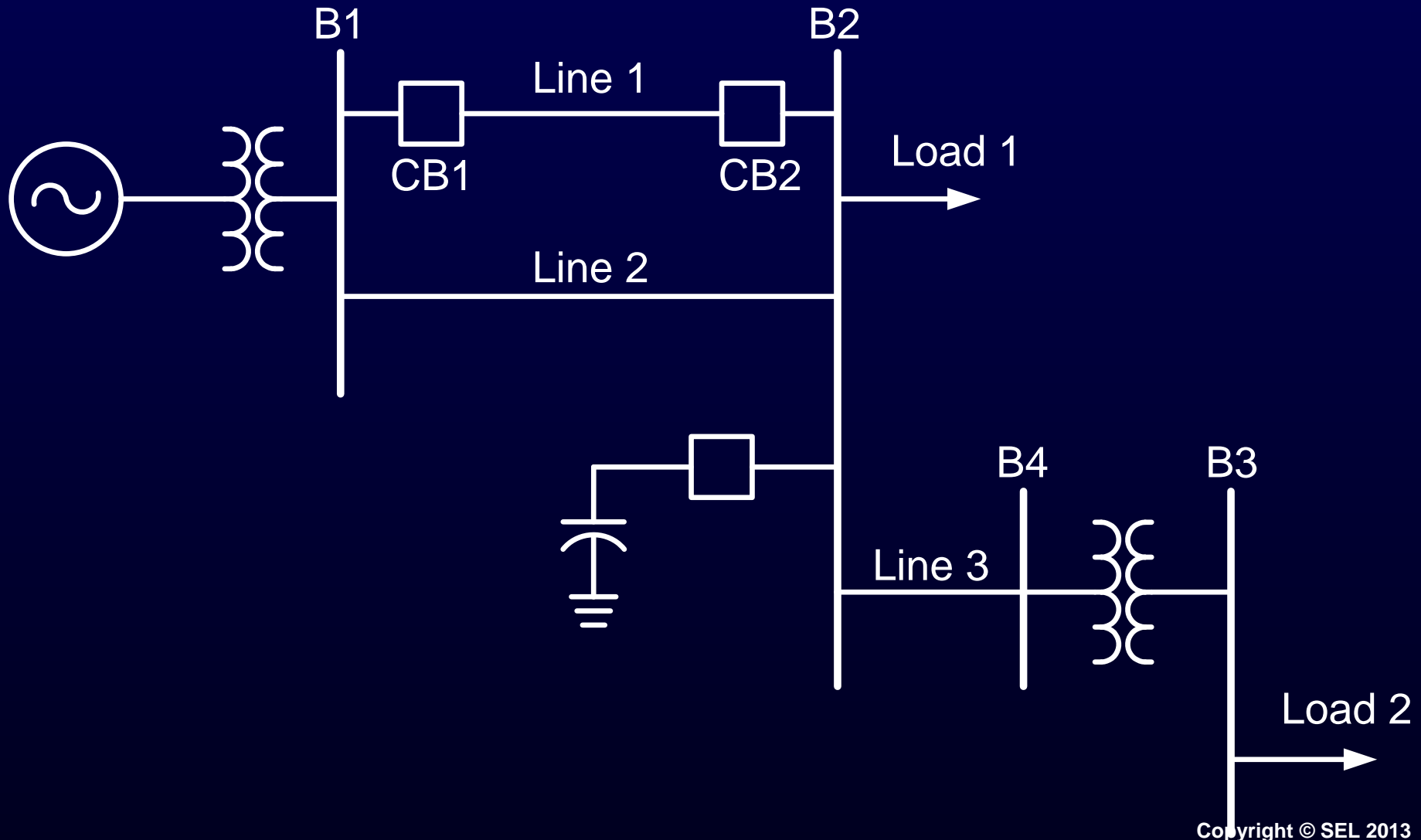synchronized control?

Traditional Control to Isolate Line

Master Control

Bus 1

Bus 2

230 kV

204 kV

Tap Down

Close Cap

Time-Synchronized Control In Action

Traditional Method Causes Disturbances

Transmission Bus Voltage (Bus 2)

Distribution Bus Voltage (Bus 3)

Transformer Tap Changer Position

Line 1 Breakers Open

Phase A

Phase B

Phase C

Capacitor Bank Switched On
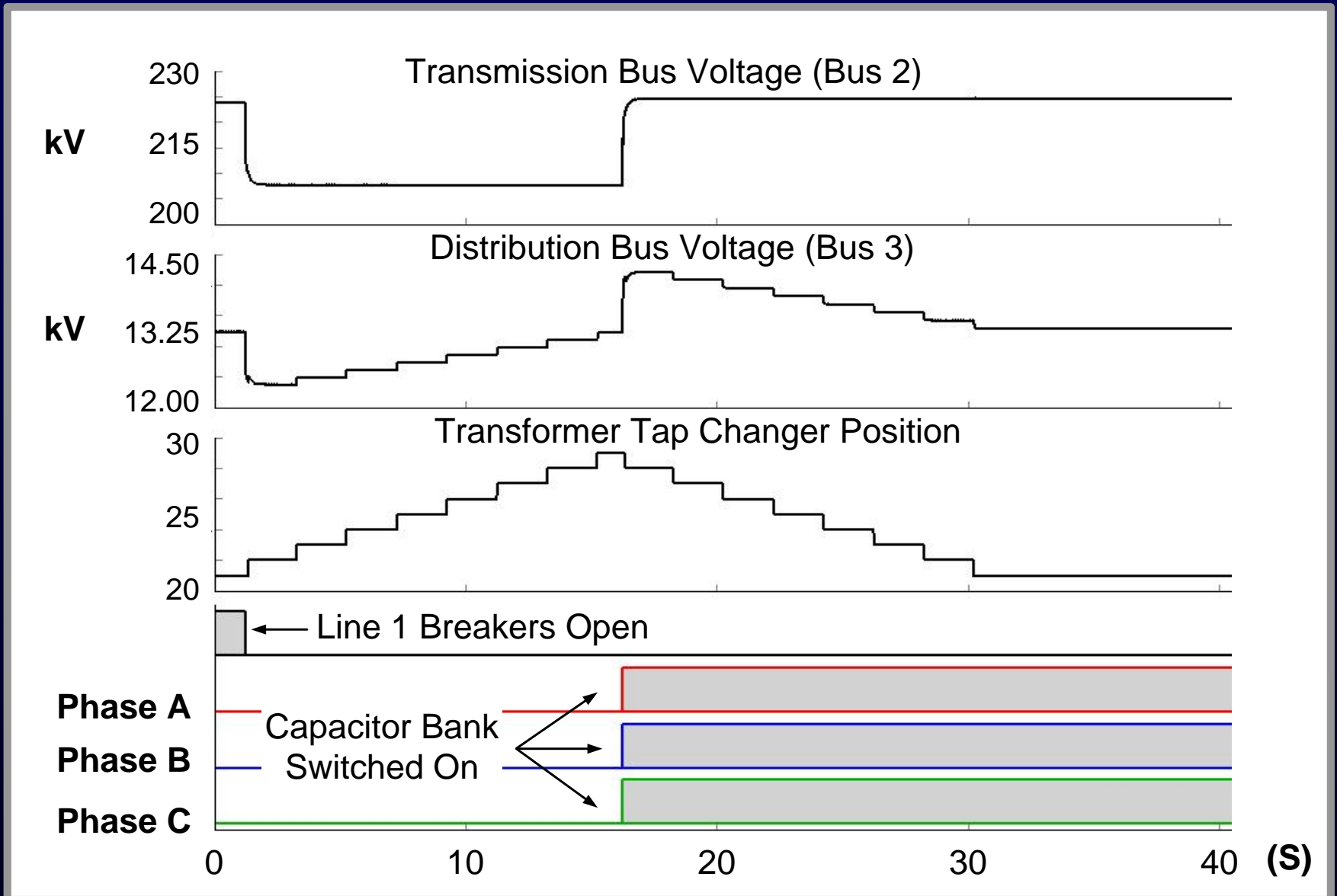
Synchronous Control to Isolate Line

Master Control

Local Control

Local Control

Execute
Recipe
Simultaneously
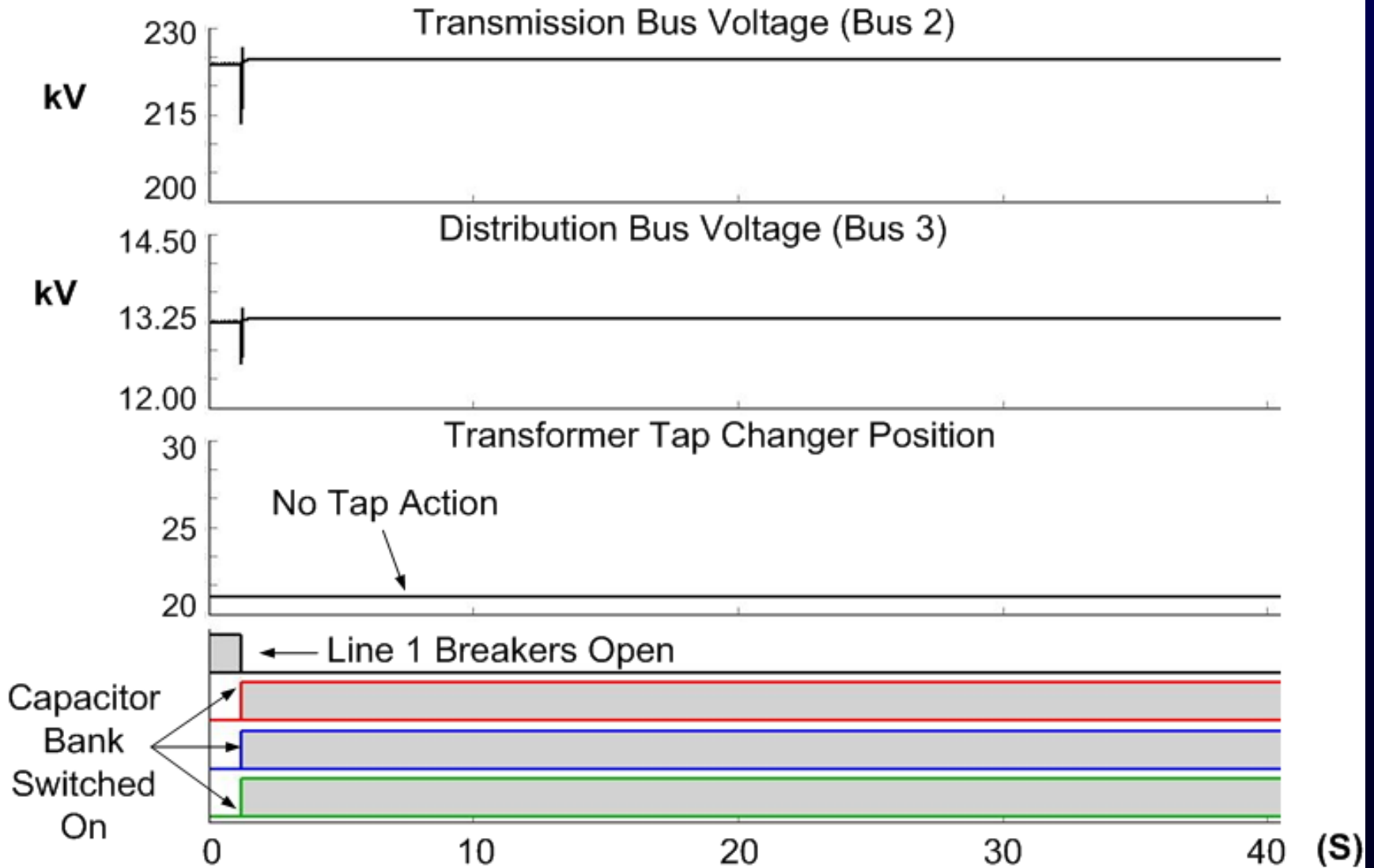
Bus 1

224 kV

224 kV

Bus 2

Tap Down

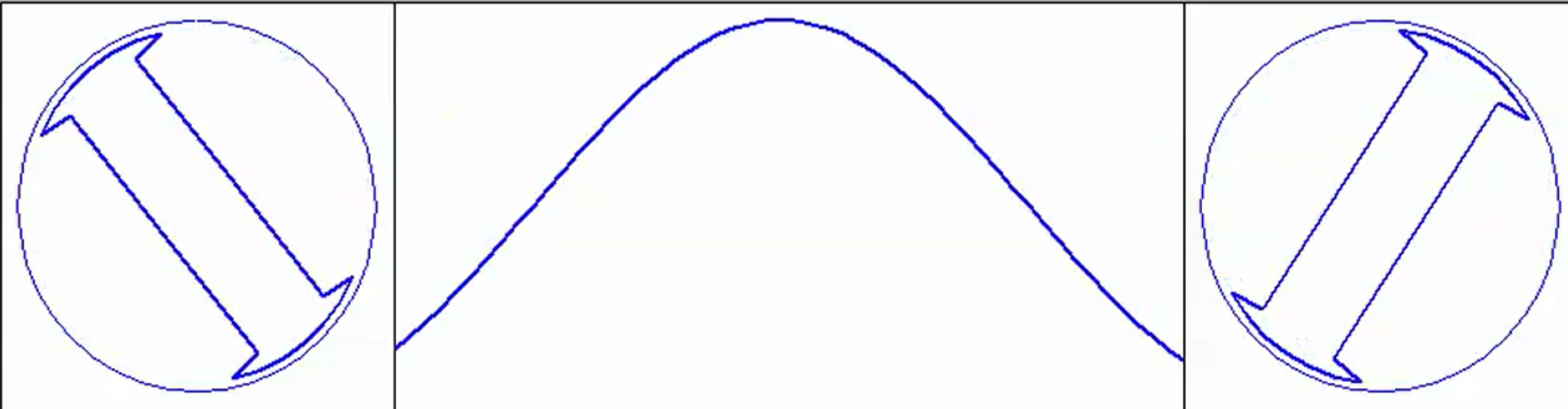Close Cap
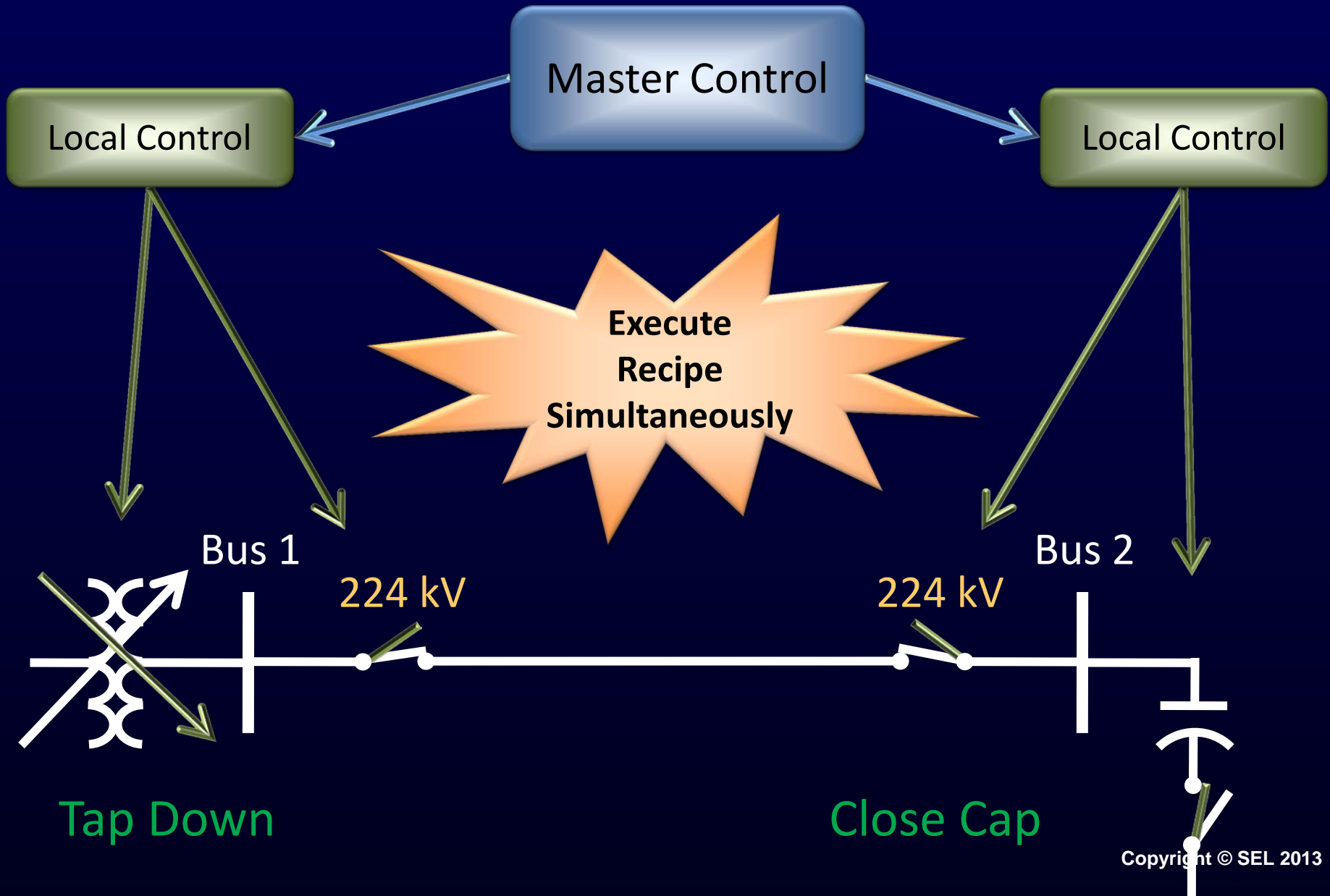
Traditional Method Causes Disturbances
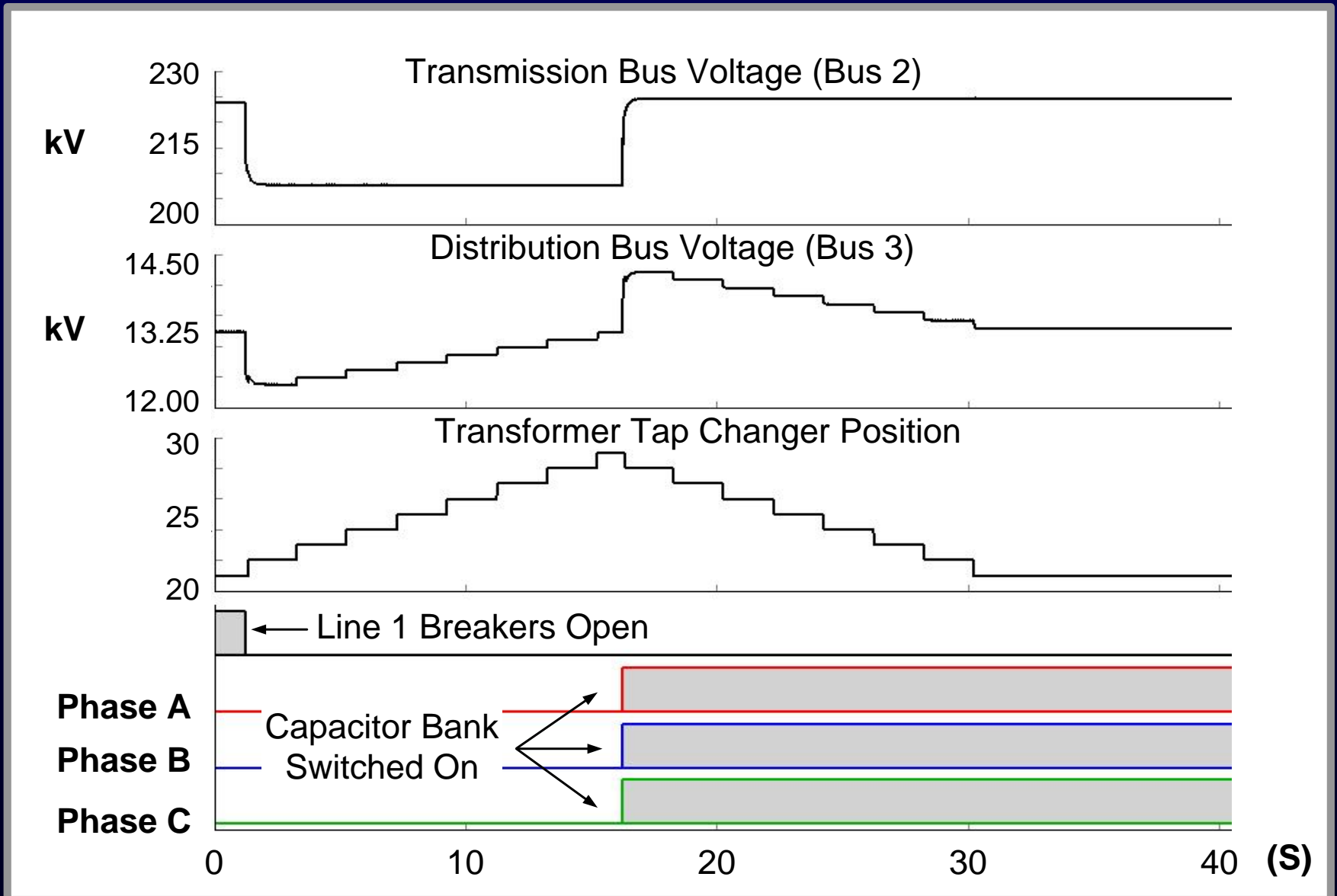
RECIPE Method Minimizes Impact

Time-Synchronized Rotor Angles

One Possible Implementation

Power
System

Optical
Pickup

V, I

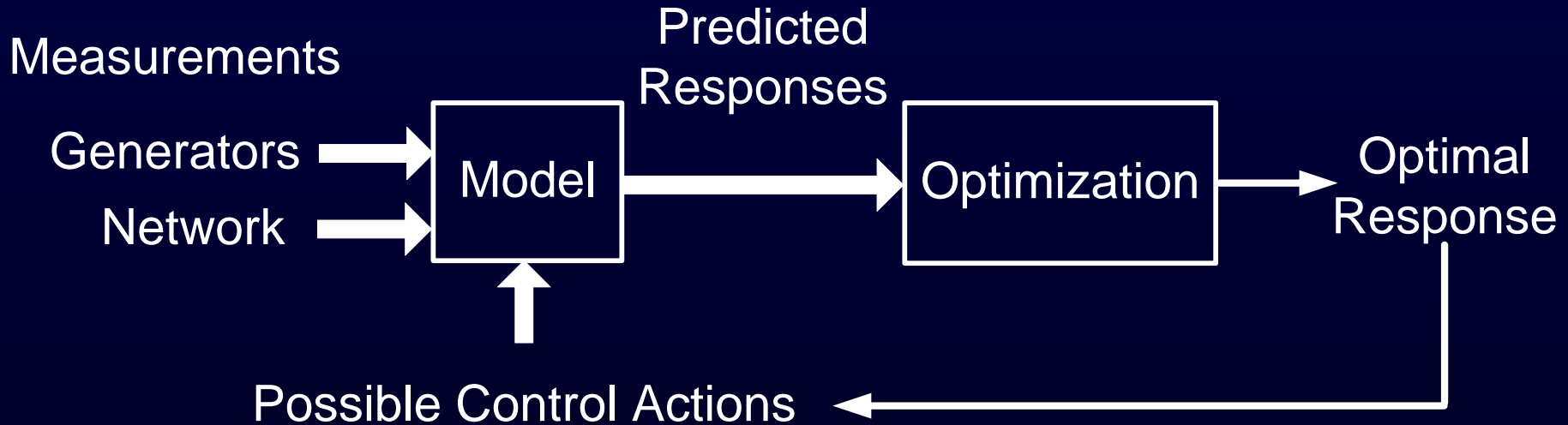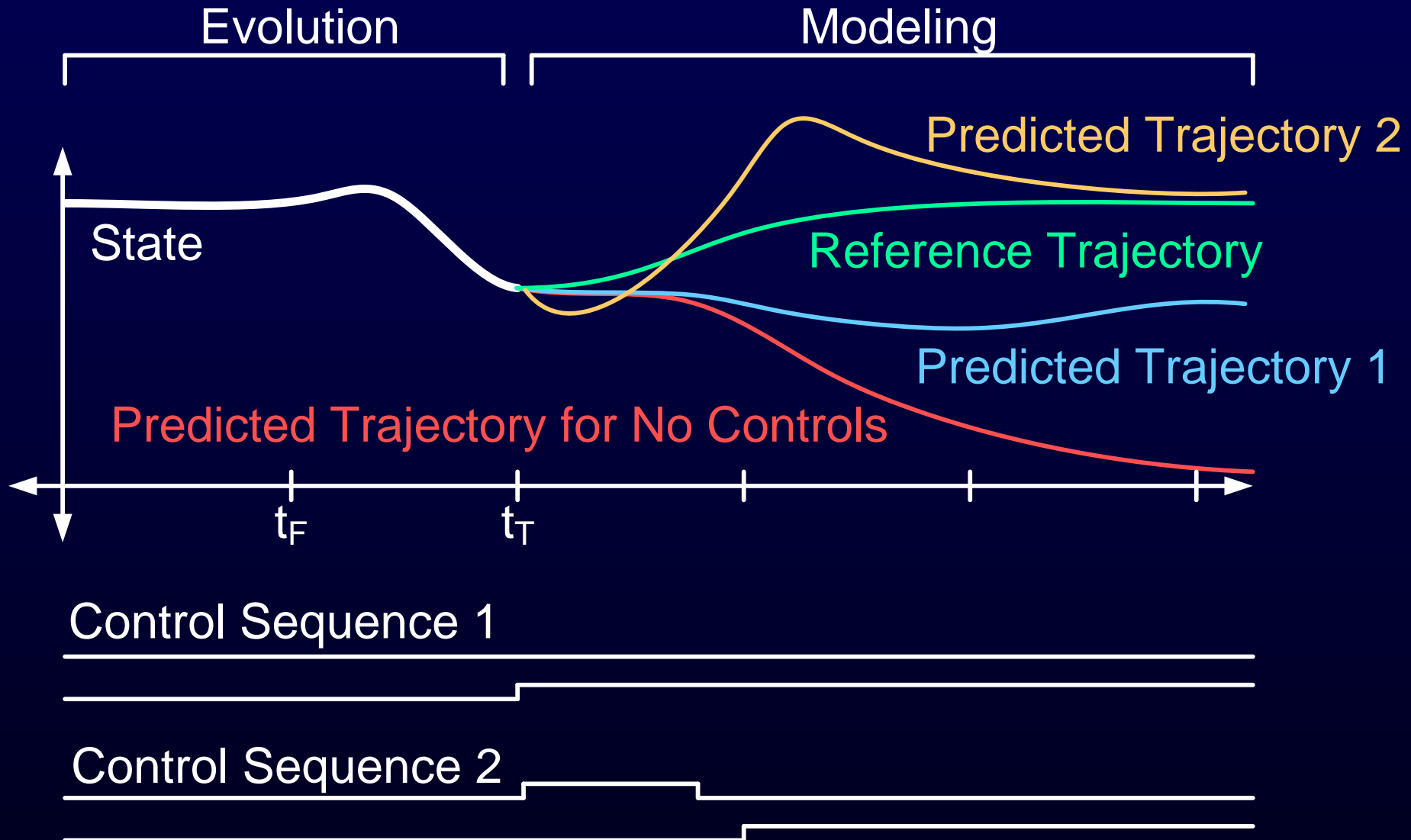Relay

Clock
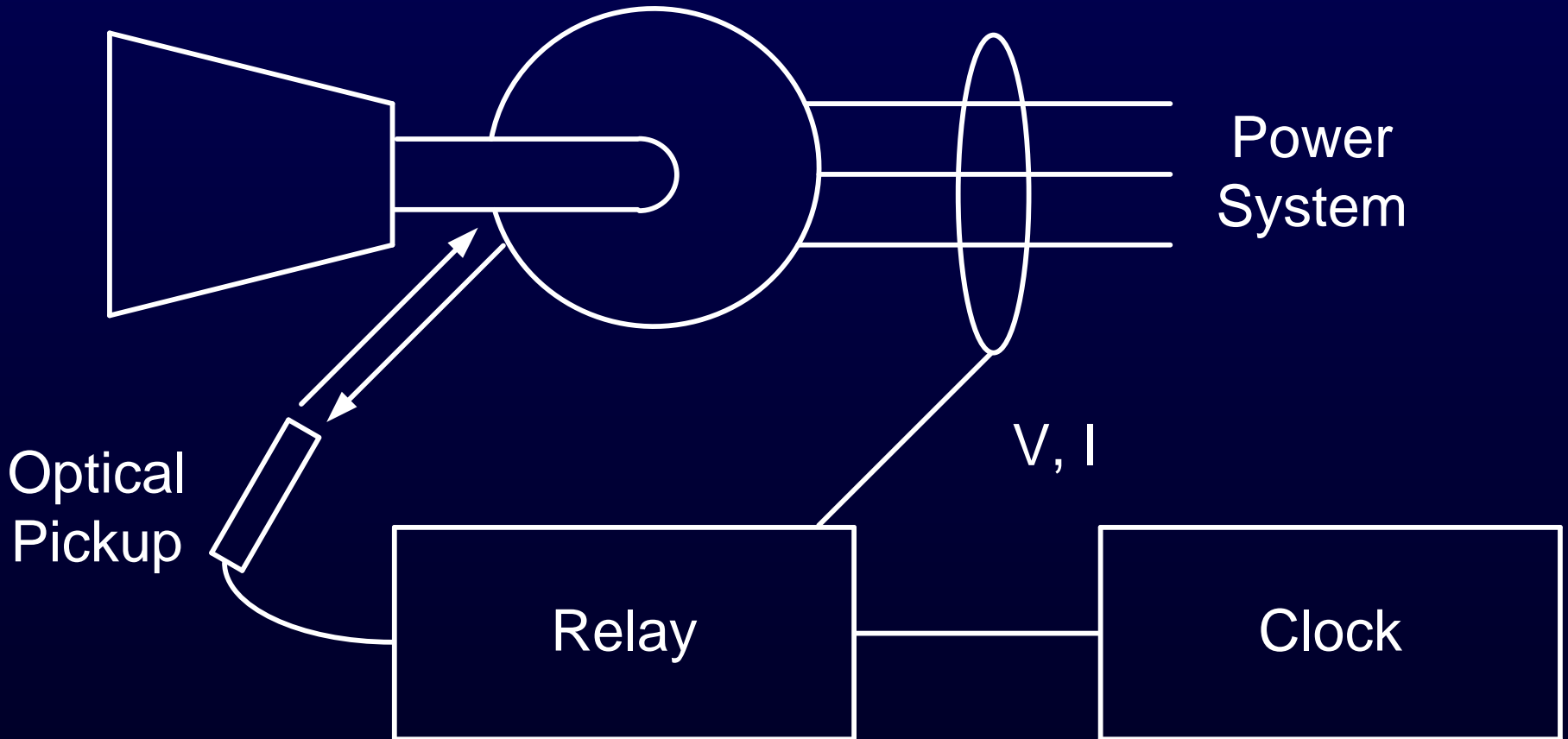
What Are Some Applications?

- Network state measured (synchrophasors)

- Machine states measured (rotor, excitation…)

Measurements

Generators → **Model**

Network → **Model**

Model → Predicted Responses → **Optimization** → Optimal Response

Possible Control Actions ← Optimal Response

Control Application Iteratively

G. Zweigle and V. Venkatasubramanian, "Wide-area Optimal Control of Electric Power Systems with Application to Transient Stability for Higher Order Contingencies", *IEEE Trans. Power Systems*, 2013.

Questions