



**INDUSTRIAL & SYSTEMS
ENGINEERING**
TEXAS A&M UNIVERSITY

Human Factors Evaluation of the Texas A&M University AGN-201 Nuclear Reactor Control Console

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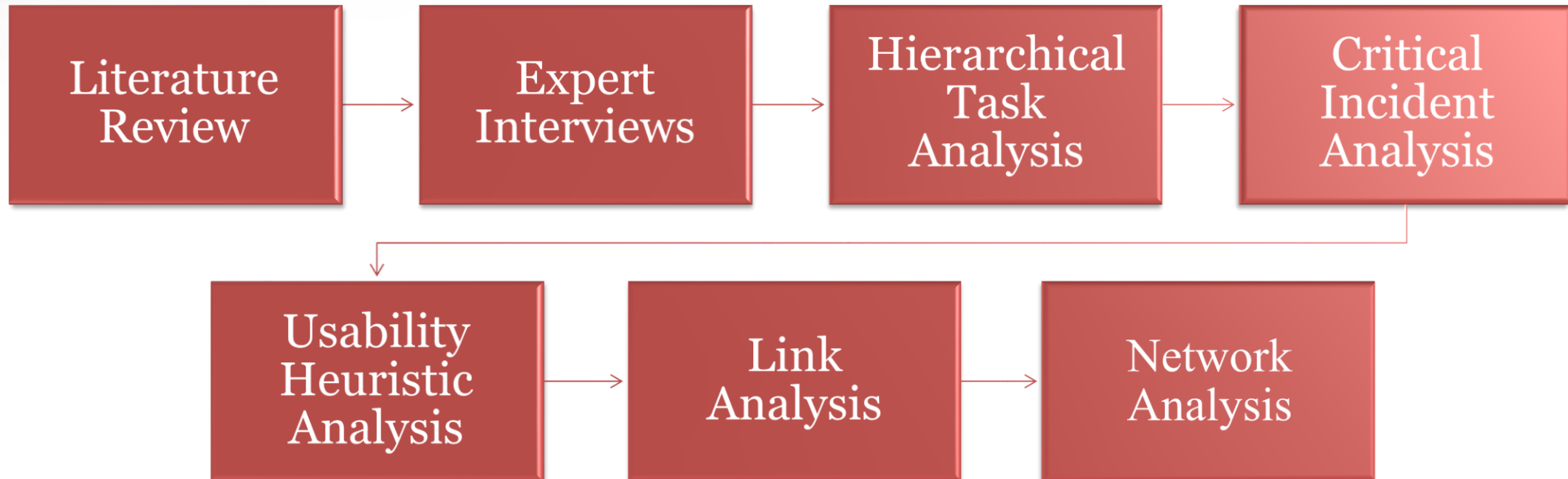
Department of Industrial and Systems Engineering

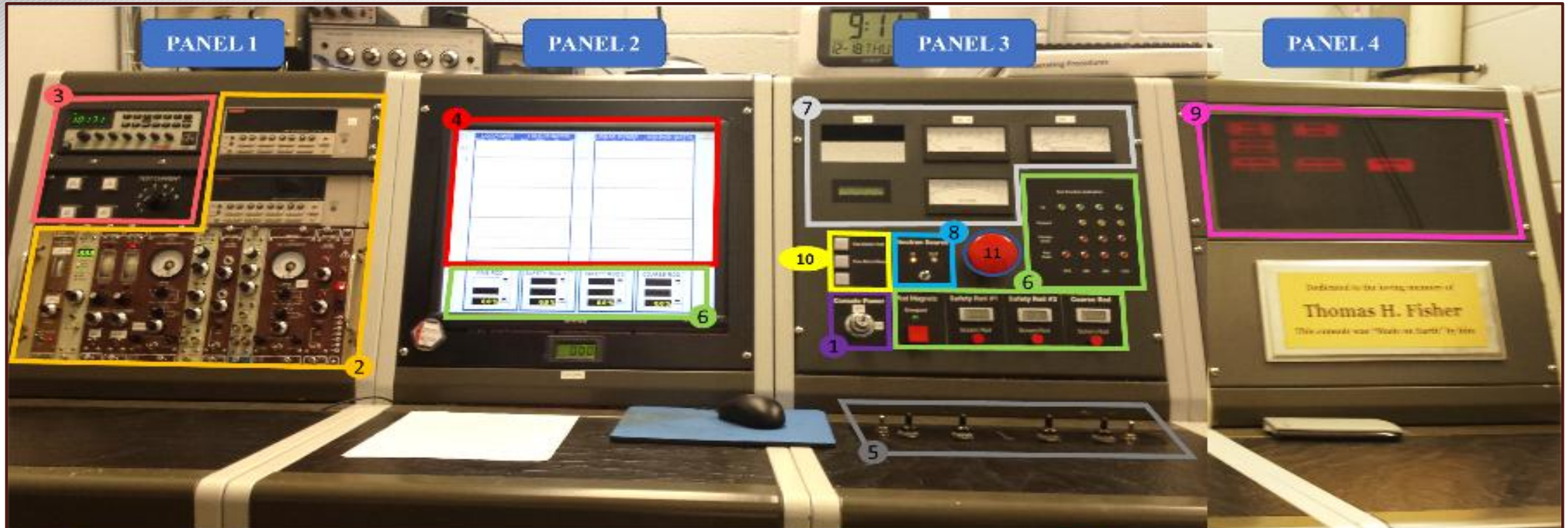
Texas A&M University

AGN 201: 5W Training and Research Reactor fro 1957

- An NRC report dated June 12, 2014, requested a human factors evaluation be conducted on the console restoration process in order to recertify the reactor.
- This study is a human factors evaluation of the Texas A&M University's AGN-201M reactor and is intended for use as documentation for the reactor's license renewal.
- National Regulatory Commission (NRC) guidelines NUREG 0700/ 0711/ 0800.







- ① Startup Control
- ② Calibration Panel
- ③ Testing Controls
- ④ Chart Recorder

- ⑤ Rod Movement Control
- ⑥ Rod Information Displays
- ⑦ System Status Meters
- ⑧ Neutron Source Panel

- ⑨ Alarm Panel
- ⑩ Pan Alarm Module
- ⑪ Manual Scram

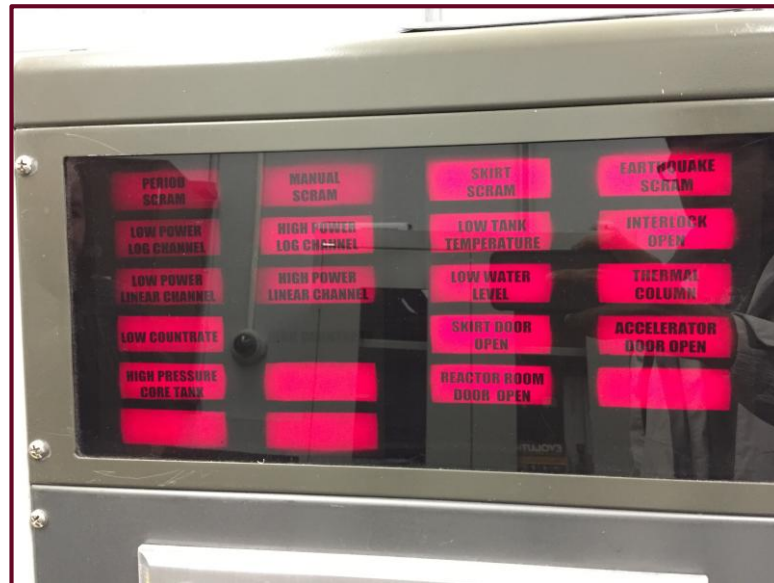
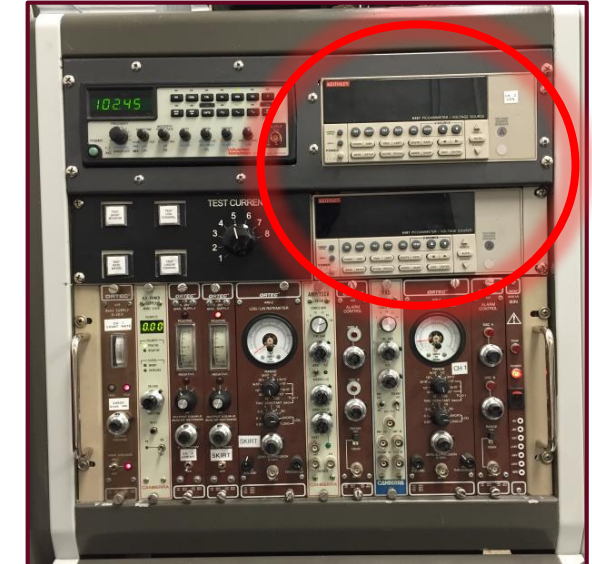


NRC Identified

- Restoration of log and linear channel power instrument channels to analog meters as compared to the current digital instrument
- Use of hardwired rod position indicators to verify rod position in case of an automatic shutdown

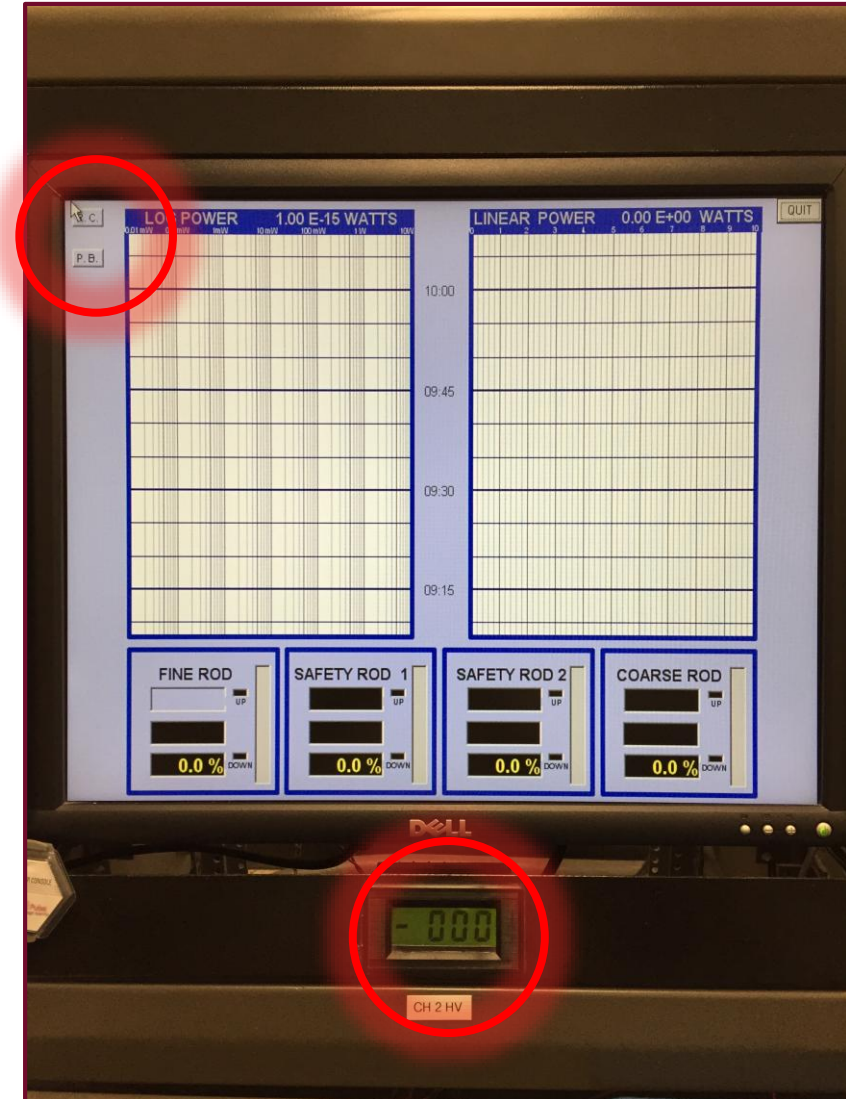
Human Factors Concerns

- Existence of additional/unused buttons and displays



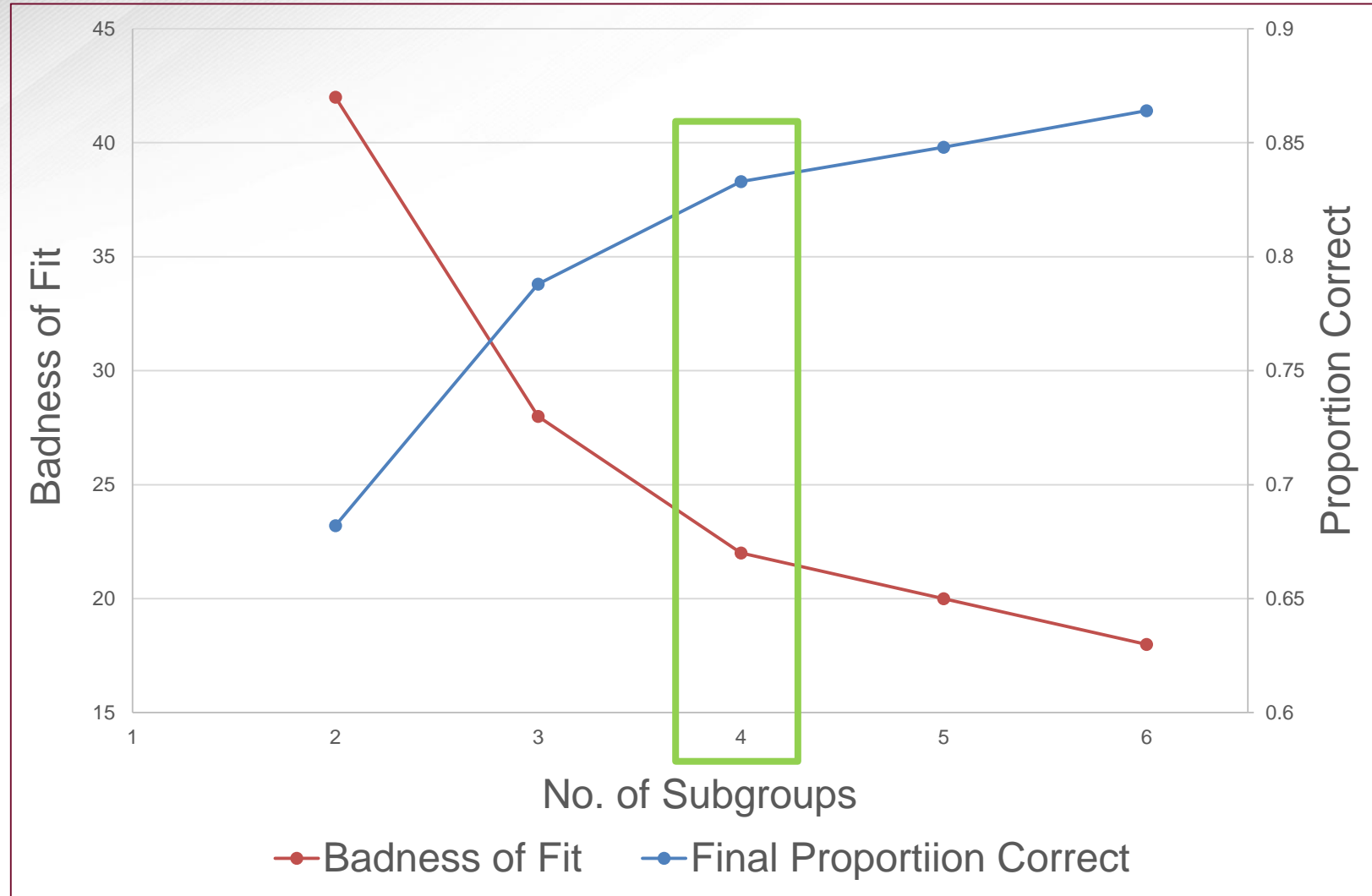
- No discrimination between Alarms and Warnings

- The Period Bypass is a digital control in the AGN Program, which may cause an accidental deactivation of the period scram
- Dependence on Digital Reading from the Chart Recorder
- Redundant Plateau Voltage Meter on Panel 2



- Label absent for the Manual Scram button
- Low Proximity Compatibility







Network Analysis: Factions

Group Assignments:

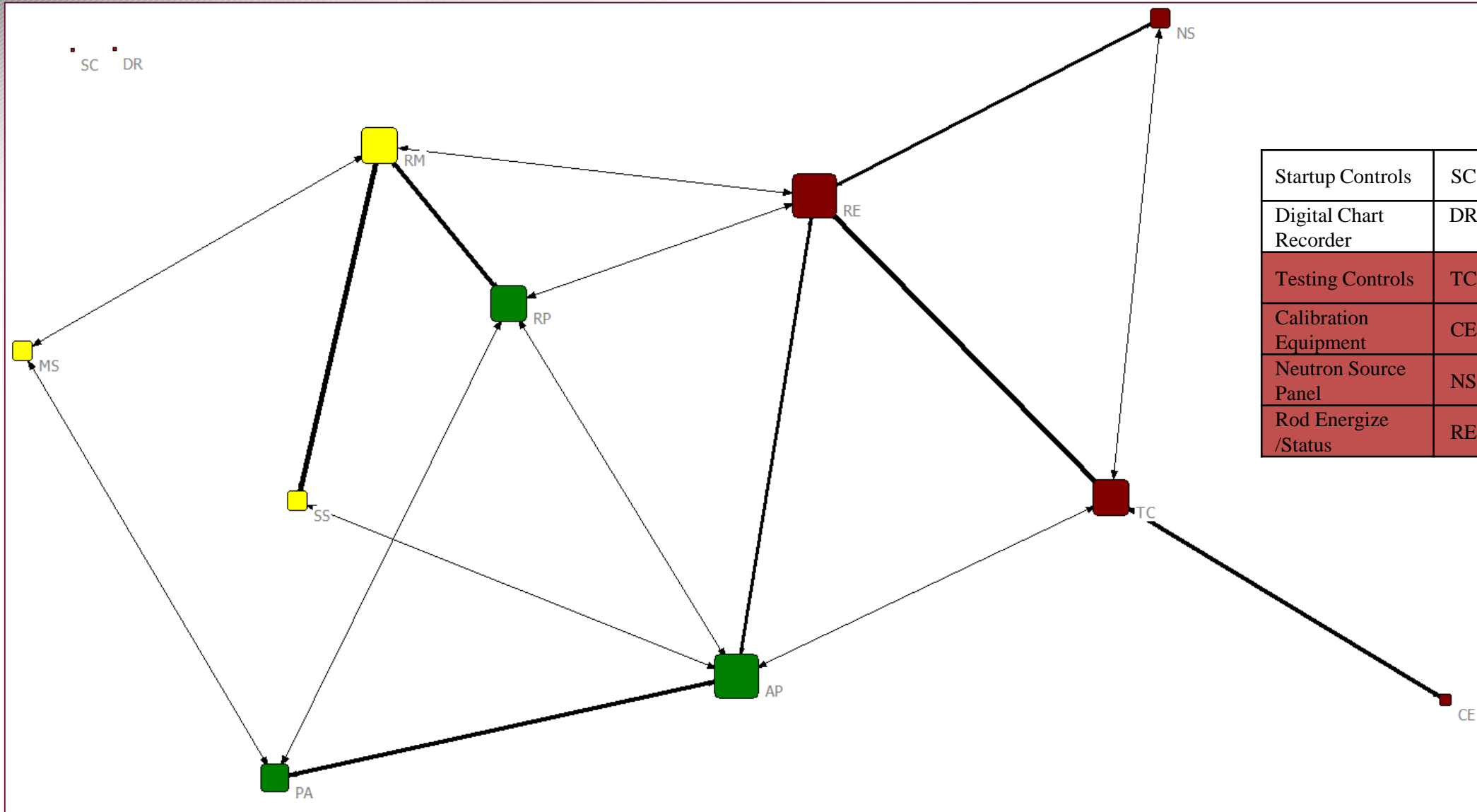
- 1: CE TC RE NS
- 2: RM SS MS
- 3: RP AP PA
- 4: SC DR

Grouped Adjacency Matrix

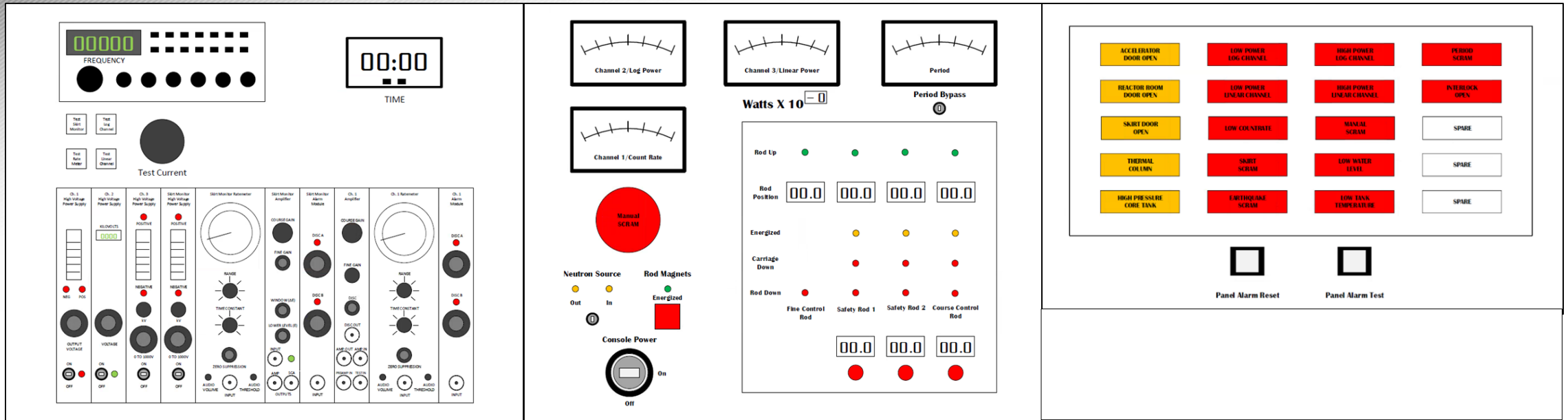
		2	3	6	9	5	8	12	7	10	11	1	4
		CE	TC	RE	NS	RM	SS	MS	RP	AP	PA	SC	DR
2	CE		8										
3	TC	8		11	2					2			
6	RE		11		5	2			2	6			
9	NS		2	5									
5	RM			2			10	2	9				
8	SS					10				1			
12	MS					2					1		
7	RP			2		9				1	1		
10	AP		2	6			1		1		8		
11	PA							1	1	8			
1	SC												
4	DR												

Startup Controls	SC	Rod Position Indicators	RP
Calibration Equipment	CE	System Status Panel	SS
Testing Controls	TC	Neutron Source Panel	NS
Digital Chart Recorder	DR	Alarm Panel	AP
Rod Movement Controls	RM	Pan Alarm Module	PA
Rod Energize /Status	RE	Manual Scram	MS

Network Diagram



Startup Controls	SC	Manual Scram	MS
Digital Chart Recorder	DR	System Status Panel	SS
Testing Controls	TC	Rod Movement Controls	RM
Calibration Equipment	CE	Alarm Panel	AP
Neutron Source Panel	NS	Pan Alarm Module	PA
Rod Energize /Status	RE	Startup Controls	SC



- Use of Analog Displays and Controls for log and linear power
- Rod position indicator provides digital numeric value as compared to an additive display
- Move Chart Recorder Panel to the Panel 1 position
- Improved Proximity Compatibility
- Omission of unused buttons and displays
- Alarm Panel Color Coded to differentiate between warnings and alarms



Thank you

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