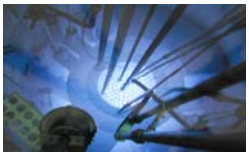


Study on Reactor Performance of Online Power Monitoring in PUSPATI TRIGA REACTOR (RTP)

Zareen Khan Abdul Jalil Khan[1], Ridzuan Abdul Mutalib[1], Mohd Sabri Minhat[1], Mohd Khairulezwan Abdul Manan[1]; Nurfarhana Ayuni Joha[1], Izhar Abu Hussin[1]

[1]Technology Reactor Division
Malaysia Nuclear Agency

Presentation Content

- Objective
- Introduction
  - Console System
  - Reactor Instrumentation signal interface with RPS
- REDICS Online Power Monitoring Data and Results
- Discussion

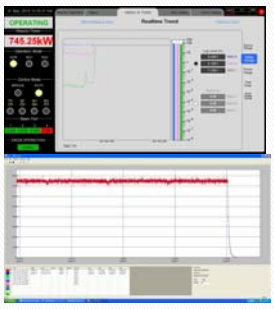
Objective

- To improves system performance & reliability
- To Identify problems in plant equipment and process
- Predict when equipment may fail

Introduction

- Nuclear reactor operators have to monitor the behavior of different nuclear parameters that vary in time so to ensure the safety operation of the reactor
- The operator workstation(OWS) has been utilized for online jobs of surveillance & monitoring
- This has resulted in improved safety and efficiency through reduced human errors and improved accuracy and reliability of process measurements

Different Console System

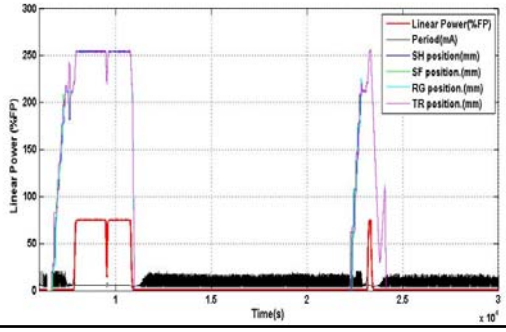


OLD CONSOLE | REDICS

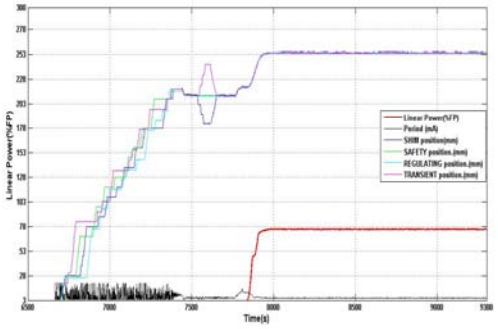
Reactor Instrumentation signal interface with RPS

Instrumentation	Signal
WR-NMS CHA- A	•Countrates
WR-NMS CHA- B	•Period
WR-NMS CHA- C	•Linear Power
Instrumented Fuel Element (IFE)	Fuel Temperature
Pool Level Transmitter(LT)	Pool level
RTD	Pool water Temperature

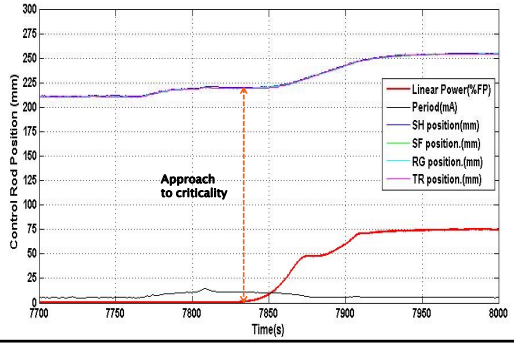
Linear power monitoring



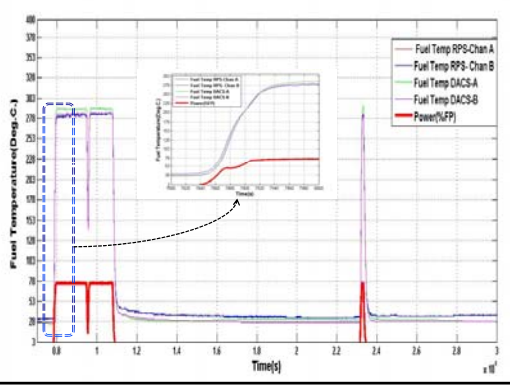
Power Raise Monitoring



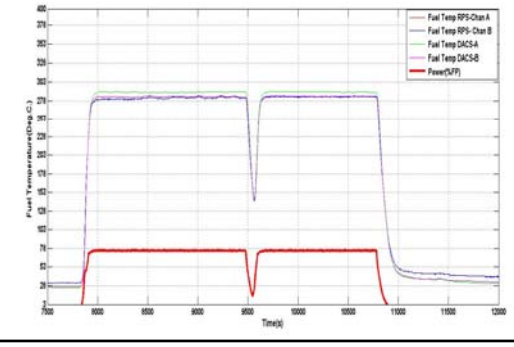
Approach to Criticality



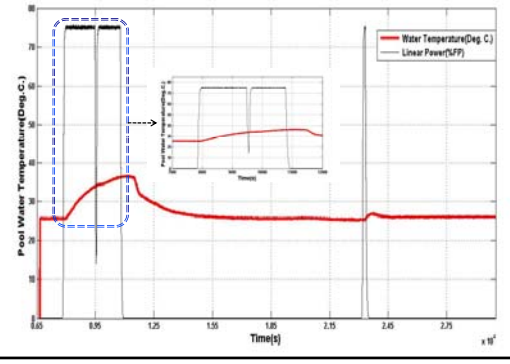
Fuel Temperature as a function of the power during the operation of the RTP



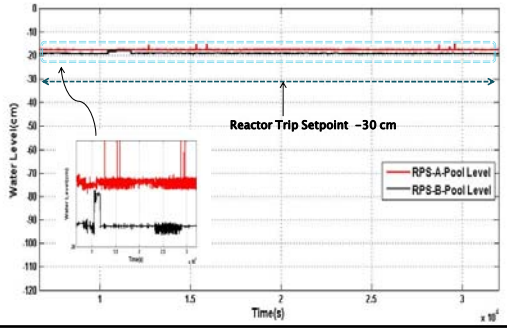
Temperatures patterns in the reactor pool at 750 kW thermal power



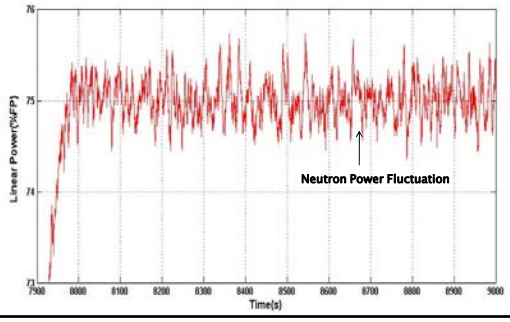
Pool water Temperature Versus Time



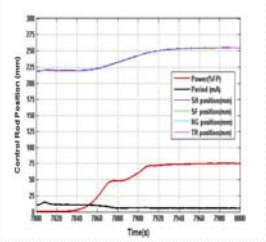
Water level as a function reactor protection system(RPS)



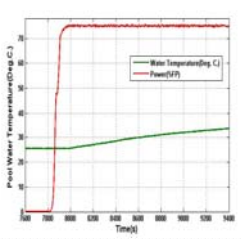
Neutron Power Fluctuation



Most important parameter monitored while stable power operation

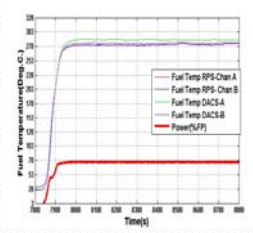


Control rod position during stable reactor power

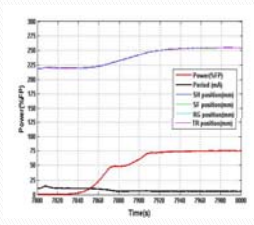


Pool Water Temperature during stable reactor power

Most important parameter monitored while stable power operation



Change in Fuel Temperature as a function of reactor power during operation

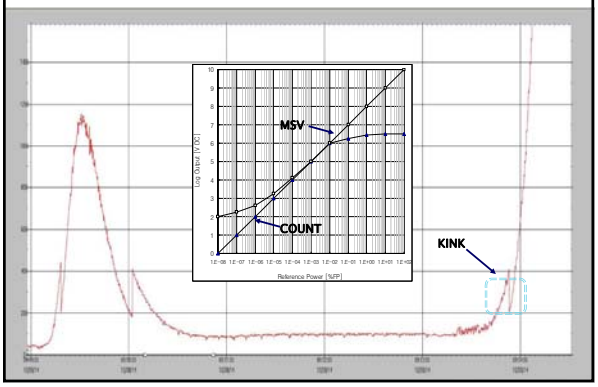


Change in reactor power during withdrawal of control rod

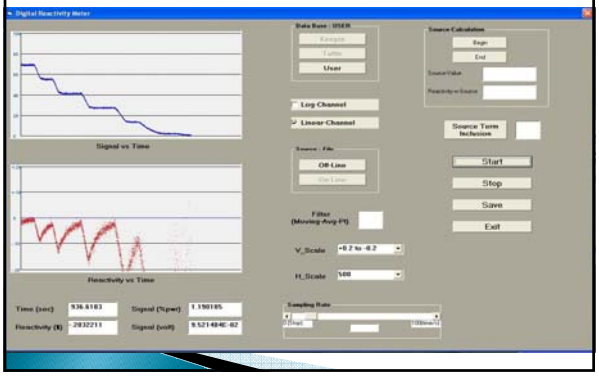
Campbell Technique for Wide-Range Log Power

- COUNT Mode from 10^{-8} to $3x10^{-3}$ %F.P
- MSV Mode from 10^{-3} to 200 %F.P
- Automatic crossover from COUNT to MSV around $3x10^{-3}$%FP
- For a typical neutron flux monitoring system, the switch over from the COUNT mode to MSV mode occurs at 5.6 V which is equivalent to $3x10^{-3}$ %FP (about 1.0 KW)

Linearity characteristics of the Log power signal is the major for accurate reactor power control



Online Reactivity Meter



Online Reactivity Control

- The reactivity control is one of the most important items that must be performed to ensure the safe and efficient operation of a nuclear research reactor. The reactor operators need to know, in real-time, the basic reactor behavior in order to understand and safely operate a nuclear reactor

Discussion

- Power monitoring channels play a major role in retaining a safe reliable operation of nuclear reactors
- Operating parameters for the RTP research reactor were monitored and indicated in real-time by the operator workstation(OWS), with all the data being stored in a hard drive in the OWS
- In future project will more focus on early detection of faults in NIS Channels and Online Computation of Core Physics and Safety Parameters

Thank you for your Attentions!

22