



UNC CHARLOTTE

The WILLIAM STATES LEE COLLEGE of ENGINEERING

Senior Design Project Description

Company Name	Areva	Date Submitted	11/28/2017
Project Title	Logarithmic Picoammeter (AREVA_PICO)	Planned Starting Semester	Spring 2018

Personnel

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project. 250 hours are expected per person.

Complete the following table if this information is known, otherwise the Senior Design Committee will develop based on the project scope:

Discipline	Number	Discipline	Number
Mechanical	1	Electrical	2
Computer	1	Systems	
Other ()			

Project Overview:

After a nuclear reactor refueling outage or an initial startup the reactor must be maneuvered into mode 2 (reactor critical), and perform Zero Power Physics Testing (ZPPT) as a prerequisite to increasing reactor power to mode 1 (producing electricity and syncing of the steam turbines and generator to the electrical grid). The purpose of ZPPT is to verify the reactor fuel performs consistent with the design, as demonstrated by measurements that are compared to predictions, through a set of predefined reactor control maneuvers. Average core temperature, boron concentration, as well as control and shutdown positions are all control elements that are maneuvered during ZPPT. All of this information is used to quickly assist plant engineers to reduce, visualize, and analyze this data to determine if each test acceptance criteria has “Passed” or “Failed”. The specific challenge is that the current (which indicates the power level) ranges from the picoamp to milliamp range during the power-up process, and thus many decades of precision measurement are required. A linear scale does not allow for the precision needed on the low end. Devices that perform these requirements do exist currently, but are bench-scale top grade equipment. The goal of this project will be to miniaturize this into a small, rugged, form factor device that is suitable for traveling and use for many years.

Project Requirements:

This Senior Design project is to develop a small, self-contained, rugged, logarithmic ammeter. The ammeter needs to be able to measure current from the picoamp to milliamp range and translate it into a logarithmic scale. This value will be transmitted over Ethernet as well as displayed on the ammeter itself. The entire device shall be programmable by USB. The ammeter shall be sized and durable enough that it can be transported and used for many years.

Expected Deliverables/Results:

Logarithmic Ammeter that:

- Measures an input current from the pico- to milli- amp range.



UNC CHARLOTTE

The WILLIAM STATES LEE COLLEGE of ENGINEERING

- Digitizes and translates that current into a logarithmic scale.
- Transmits the digital result over Ethernet.
- Displays the digital result on the ammeter itself.
- Is programmable over USB.
- Is packaged in a rigid form factor box.
- Is small and rugged enough for transportation and use for many years.

Disposition of Deliverables at the End of the Project:

Hardware and design will be kept as property of Areva and shall not be used commercially by anyone related to the project other than Areva.

List here any specific skills, requirements, knowledge needed or suggested:

- Basic understanding of currents
- Programming capability
- Mechanical and Electrical design skills to layout circuitry and hardware