

PENGEMBANGAN SISTEM INSTRUMENTASI AKSELERATOR BERBASIS EPICS (EXPERIMENTAL PHYSICS AND INDUSTRIAL CONTROL SYSTEM)

oleh

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INTISARI

Experimental Physics and Industrial Control System (EPICS) adalah *framework* sumber terbuka untuk membangun sistem monitoring terdistribusi berbasis jaringan (*Distributed Control System, DCS*), yang telah banyak digunakan di fasilitas akselerator di seluruh dunia. Studi ini mengimplementasikan EPICS di Laboratorium Akselerator PRTA-BRIN untuk memfasilitasi pemantauan data serta mendukung operasi dan keamanan berbasis jaringan. Penelitian ini dimulai dengan menginstal EPICS menggunakan Linux Ubuntu pada komputer server berbasis Raspberry Pi, yang berperan sebagai *Input Output Controller (IOC)*. Data dari perangkat sistem vakum diproses di server dan ditampilkan pada komputer klien melalui jaringan menggunakan protokol *Channel Access*. Karena fasilitas *Linear Accelerator (LINAC)* masih dalam tahap perencanaan, maka uji coba dilakukan pada sistem vakum Siklotron DECY-13 yang memiliki karakteristik serupa. Sistem vakum DECY-13 dikendalikan oleh PLC, *Cerio*, dan *vacuum gauge controller* TPG-300. Program EPICS dikembangkan untuk membaca data tekanan vakum dari TPG-300 melalui jaringan, kemudian diuji menggunakan Wireshark untuk mengukur *round-trip time (RTT)*, *Throughput*, dan *Packet Loss*. Hasil pengujian menunjukkan RTT antara 0,045–0,15 ms, *throughput* 50–55 bit/s, dan *packet loss* 1,8%. Nilai-nilai ini memenuhi standar kinerja komunikasi untuk sistem kendali akselerator. Program EPICS yang selesai dibuat tersebut diuji-cobakan pada Siklotron CS-30 Serpong. Studi ini membuktikan efektivitas EPICS dalam integrasi sistem vakum akselerator dan berpotensi menjadi acuan pengembangan sistem monitoring vakum di laboratorium akselerator lainnya, terutama pada perencanaan laboratorium PRTA-ORTN-BRIN.

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**DEVELOPMENT OF AN EPICS-BASED ACCELERATOR
INSTRUMENTATION SYSTEM (EXPERIMENTAL PHYSICS AND
INDUSTRIAL CONTROL SYSTEM)**

by

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ABSTRACT

The Experimental Physics and Industrial Control System (EPICS) is an open-source framework for developing network-based distributed control systems (DCSs) that has been widely adopted by accelerator facilities around the world. This study implements EPICS at the PRTA-BRIN Accelerator Laboratory to enable real-time data monitoring and support network-based operational and safety systems. This research began with installing EPICS using Linux Ubuntu on a Raspberry Pi-based server computer., which serves as the input/output controller (IOC). The server processes data from vacuum devices and displays it on a client computer via the network using the Channel Access Protocol. Since the Linear Accelerator (LINAC) facility is still in the planning stage, experimental work was carried out on the DECY-13 cyclotron's vacuum system, as it exhibits similar operational characteristics. Currently, the DECY-13 vacuum system is controlled by a PLC, a Cerio, and a TPG-300 vacuum gauge controller. An EPICS application was developed to retrieve vacuum data from the TPG-300 over the network. Network performance was evaluated using Wireshark to measure round-trip time (RTT), throughput, and packet loss. The results showed RTT values between 0.045 and 0.15 milliseconds, stable throughput of 50–55 bits per second, and a packet loss rate of 1.8%. These values align with communication performance standards for accelerator control systems. The completed EPICS program was tested on the CS-30 Serpong Cyclotron. This study demonstrates the effectiveness of EPICS in integrating accelerator vacuum systems, and it could serve as a model for developing low-cost control systems in other accelerator laboratories, particularly for the PRTA-ORTN-BRIN laboratory.

Keywords: Accelerator, EPICS, communications analysis, Wireshark

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