# F O R U M

## An Industrial Process Control Package for the use in experimental Physics

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## 1. ABSTRACT

The CAMAC based FORUM system was developed for large industrial process control systems. The extreme versatility permits the use of this system in many control applications in experimental physics facilities. As specific examples, we show the Radiation Effect Facility Control System (REFCOS) from Brookhaven National Laboratory and the beamline control system of the LINAC at Argonne National Laboratory.

## 2. FORUM

### 2.1. GENERAL DESCRIPTION

FORUM is a flexible distributed process control system based on the open architecture of CAMAC )[1] )[2] combined with the powerful **K-SCAN software.**
Process control applications requiring distributed I/O incorporate the KSC Serial Highway allowing up to 62 remote locations. Multiple Serial Highways allow I/O expansion that is virtually unlimited. Systems requiring redundant processors, remote processors, redundant data highways, or multiple operator stations for process control can be configured. The high scan speed and outstanding functionality of the software bring high speed process applications into focus. Both continuous and sequential batch control applications are handled with ease.
Engineers can configure the system and build custom monitoring displays for their own use from standard DIGITAL VT-100 compatible terminals. Through the use of standard modems, the engineer's terminal may be at any location.
The operator interface for FORUM was developed with simplicity in mind.

Bright color displays give process operators instant information on facility status. Custom graphics depict the process in operation and allow changes of discrete I/O status and PID control settings from the graphic page. The process operator input device is a sealed membrane keyboard that provides simple means to change setpoints, manual outputs, and controller status.

Real-time trending of system variables is available in multiple formats with excellent readability. Historical data storage and retrieval and database reporting capabilities allow review of past system events.

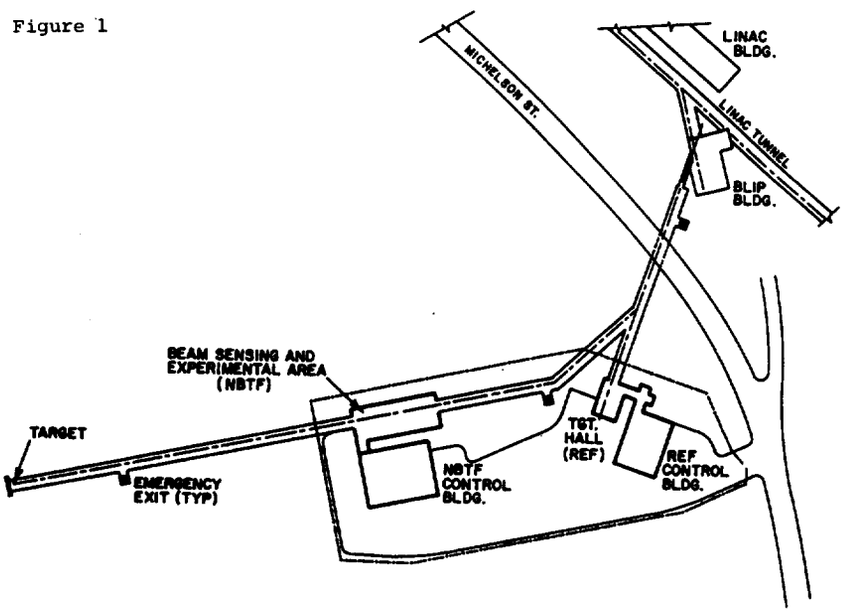
### 2.2. BASIC HARD- AND SOFTWARE ELEMENTS

2.2.1. HARDWARE ELEMENTS
- Devices
- Crates
- Modules

2.2.2. PROCESS ELEMENTS

- Analog Inputs
- Analog Outputs
- Digital Inputs
- Digital Outputs
- Digital Input Bits
- Digital Output Bits
- Module Control Operations (Non-scanned CNAFs)
- Incremental Devices
- Storage Elements-Intermediate (non I/O)
- Software Switches-Internal Memory Relays
- GPIB DEVICES

Figure 1



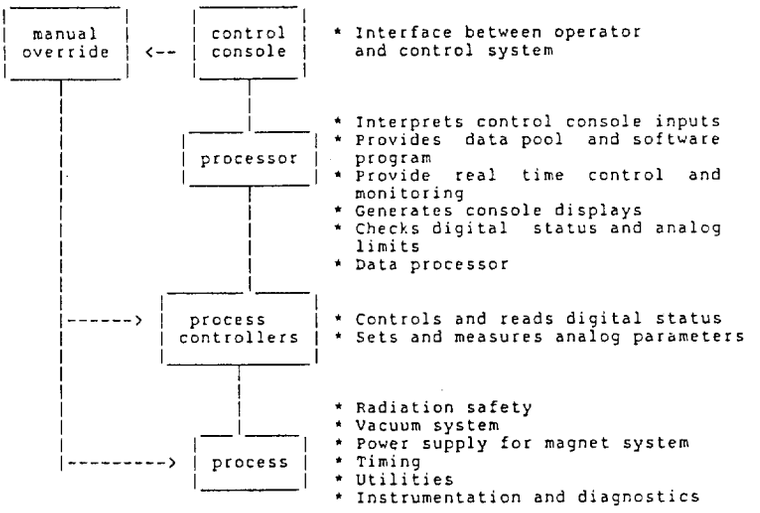



Figure 2 - RADIATION EFFECTS FACILITY CONTROL SYSTEM (REFCOS) HIERARCHY

### 2.2.3. CALCULATED FUNCTION ELEMENTS

- PID Loops
- ON/OFF Control Loops
- Ramping Functions
- Polynominal Conversions (conversions to Engineering Units)
- Mathematical Elements Relationships
- Logical Elements Relationships
- Lead/Lag Transfer Functions

## 3. REFCOS OVERVIEW

Radiation Effects Facility is built for damage studies on computer components and other materials. It utilizes the 200MeV negative hydrogen ion beam from the BNL Linac. This beam is focussed through different di- and quadrupol magnets to the target chamber (see figure 1). To perform this task 5 harps can be put in the beam to take the beam profile.
The largest part of the vacuum - and of the beam transport system (magnetic di- and quadrupols) are operated from CAMAC through the GPIB interface. The harps are read out directly by CAMAC ADC's.
Due to the computer overhead, created through the GPIB protocol up to now the response time of the GPIB devices is not satisfying. Nevertheless the introduction of an in-crate LSI-11 solves these problems.
The hierarchy of the control system is shown in figure 2.
The selftuning of the magnetic beam transport system and stabilisation of the magnetic fields through PID loops will be incorporated next.

## 4. ARGONNE BEAMLINE CONTROL

The beamline behind de 50 MeV LINAC at Argonne is used for studies on negatively charged H-minus beams. The beam intensity varies between 100µA and 1 mA. The system consists of 16 quadrupole magnets, 5 bending-and 6 stirring magnets. It has 6 movable colimeter jaws and 4 normal beamslits. An additional 16 faradaycups analyze the beam profile. The complete system, including vacuum and beam settings, is operated from the K-SCAN software. Here the selftuning of the beam, will also be incorporated next. We want to point out, that after only 6 weeks of installation the system was up and running.

## 5. CONCLUSION

The industrial process control package FORUM, which was designed to operate large industrial facilities has been proven to be a perfect tool for control applications in experimental physics. One of the advantages of using FORUM is the short time needed to implement a system.

## 6. ACKNOWLEDGEMENTS

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## 7. REFERENCES

1. ANSI/IEEE Standard 583 "CAMAC Instrumentation System"
2. ANSI/IEEE Standard 595 "CAMAC Serial Highway System"