# STATUS REPORT ON THE CONTROL SYSTEM FOR THE MMF EXPERIMENTAL AREA

V.Gorbunov, M.Gratchev, V.Seleznev, V.Yabzhanov

Institute for Nuclear Research, Russian Academy of Science, Moscow, 117 3122, USSR

## Abstract

This paper presents the status of the Moscow Meson Factory first stage experimental area control system (CS). A brief list of beam transfer lines technological and diagnostic equipment and its interfacing to the process computers is given. The first results of the maintenance of constant current suppliers with multi drop bus interfacing are mentioned.

## Introduction

The main purpose of CS is to provide an efficient and flexible means for setting up the devices which affect the beam parameters and make appropriate corrections to the initial settings. Finally, the system must monitor the healthy of all components and automatically correct for inoperative devices, if it is possible, or at least notify the machine operators of a failure.

The CS's task is especially demanding because of a large number of devices that affect the beams and a large number of experimental facilities that utilize beams. Further, the CS must not only work flawlessly,but it must allow for the rapid development and testing of new or upgraded algorithms in order to maximize the experimental facilities performance. It is very important to reduce the failure rate of the CS for experimental area with beams of the actual intensity.

At this way we started to construct the CS from the choice of the interface between process computers and equipment. The requirements to the equipment are:

- the analog set points and actual monitored values would be transmitted in a digital form;
- the link to the equipment must be cheap as far as it is possible;
- the link must fulfill the requirements for the control of a simple equipment by command/response orders and have a transfer capability for driving intelligent subsystems by "message command";
- speed, minimum bit overhead for synchronization, low error characteristics;
- large common-mode rejection and matched coupling transformers;
- vendor support for protocol chips.

These are the reasons to choice the multi drop bus like MIL-1553B that is used widely nowadays for industrial applications and accelerator control.

## Multi Drop Bus Instrumentation and Control Application

The first operational installation of the multi drop bus at our Institute was made in 1989 to control large regulated current power suppliers for the quadrupole magnets field measurement set. Design and construction of this set served as test-bed for the final validation of the hardware implementation of the multi drop bus. Multi drop bus controller (BC) in CAMAC, and Remote Terminal Interface (RIT)build in power supply have been designed and produced by the INR equipment plant.

Two kinds of Protocol Cheaps have been tested and are now in use:

- 588VG3 Manchester Biphase encoder-decoder with serial input/output to the remote terminal logic;
- 588VG6 which provides in addition the main protocol handler and parallel input/output to the remote terminal logic.

The second multi drop BC was designed for IBM PC/XT/AT computer.

All designed and manufactured experimental area technological equipment have simplified slave only multi drop bus RTI units [2]. These are:

- various kinds regulated constant current power suppliers for magnets;
- custom exhaust units for vacuum system;
- residual gas spectrometers for vacuum control.

A serial crate controller in CAMAC has been designed to connect the remote beam diagnostic node to process computers. The bit rate is 1 Mbit/sec, and complete transaction time of about 65 μsec are achieved for 16-bit data transfers over cable up to 1000 feet long.

## Transfer Lines Beam Diagnostic

Transfer lines beam diagnostic of MMF experimental area consist of :

- 15 magnetic beam position and intensity monitors;
- 12 electrostatic pick-ups to provide the testing of proton beam position at initial low intensity beam transfer;
- 15 beam profile monitors;
- 20 ionization chambers to provide the beam losses measurement.

All these units, except beam profile monitors, have been designed and constructed.

There were difficulties to design the wide dynamic range radiation resistant beam profile monitor. A harp detector with ceramic board is designed now.

Magnetic and electrostatic pick-ups and harp detectors electronics are divided into to parts: front end electronics placed near detectors and standard CAMAC packaging of other partof data logging. The ionization chamber current is integrated on long interconnecting cable and processed by remote CAMAC.

## Power Suppliers Maintenance

The MMF experimental area magnets require about 200 power converters for supplying currents to various types of magnets: focusing/defocusing quadrupoles, correcting quadrupoles, etc. Their power ranges from 1kW to 200kW with current up to 1000 A at 230 V and down to a few Amperes at 50 Volts. 120 large current (1000 A at 220 V and 500 A at 115 V) power suppliers with multi drop bus interfacing have been manufactured. The same power suppliers are used at the magnets construction site for performing the field measurements of every experimental area magnet. Maintenance of these suppliers shows that the message fault is about 1/10 5.

## References

[1] M.Gratchev et al., "Experimental Area of Moscow Meson Factory", in Proceedings of the XIV International Conf. on High Energy Accelerators, Particle Accelerators, Vol. 27, pp. 51-58, 1990.

[2] M.V.Akopyan et al., "Magnet Power Suppliers and other Technological Equipment Control System for MMF Experimental Area", in Proceedings of The Second European Particle Accelerator Conference, Nice, 1990.