

PROGRESS REPORT  
ON  
THE FAST EJECTION SYSTEM FOR CHANNEL A  
OF THE  
SERPUKHOV 70 GEV PROTON SYNCHROTRON

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of the CERN/Serpukhov collaboration to be held at CERN, April 71.

## 1. GENERAL

Since the issue of the last progress report<sup>1)</sup> the detailed design of the major parts of the equipment has been completed. Production and delivery thereof are almost completed and the assembly is in an advanced stage. Tests have commenced in January of this year and these are being extended as more equipment is delivered, until complete linkup of all ejection equipment will be achieved.

In order to simulate as closely as possible the situation in Serpukhov, all heavy equipment with their local controls will be assembled in Cesar-hall and linked up with the electronics which will be collected in a separate mockup control room.

In parallel, life tests of prototypes are continuing. Their results have been fed back into the design work and give valuable advance information about the performance and required tuning of the final equipment.

Design and production of auxiliary equipment, such as beam diagnostics and components necessary for installation, are still in progress.

Six collaborators from IHEP are now well integrated in the ejection team and are getting actively acquainted with the various equipment. One more collaborator is urgently needed in the electronics field. A software specialist must join the ejection team soon, in order to get familiar with the computer program for beam diagnostic data handling.

## 2. BEAM OPTICS

On the basis of measurements of accelerator performance IHEP has formulated preliminary plans<sup>2)</sup> for combined operation of fast and slow ejection, on which rough agreement has been obtained.

As the date of installation and first operation draws nearer it becomes necessary to have a final written statement on the expected accelerator performance in particular on beam geometry, orbit stability and deformations and reproducibility of the magnet cycle.

## 3. CONTROL PHILOSOPHY

After CERN has finalized its recommendations on the control philosophy<sup>3)</sup>, i.e. the interplay and hierarchy between the two control rooms, the central control desk and the ejection systems controls, IHEP has formulated preliminary plans for the organization of the local control room at a technical meeting in December 1970. Preliminary agreement has been reached.

CERN now awaits a full written statement on this organization and in particular on some facilities convenient for operation of the fast ejection, i.e. means for closed orbit corrections and programmable local orbit bumps.

#### 4. KICKER MAGNET

Design and manufacture of the full aperture "Janus" kicker magnet have been completed, assembly is well underway and two completed kicker magnet modules are under vacuum in their final tank. Assembly of their terminating resistors is underway.

Design and manufacture of the ten delay line pulse generators for excitation of the kicker magnet have been completed, and assembly is well underway. Two delay line pulsers are presently being tested together with the master gap trigger system. It is hoped to link them up to the two kicker magnet modules early in May.

The high voltage charging supplies have been delivered at the end of 1970 and have been successfully tested.

Construction of some auxiliary equipment such as the air pressure system for the sparkgaps and the temperature regulation of the electrolytic resistors are continuing.

The prototype kicker magnet module, made with the final ferrite, has now undergone 10 millions pulses without a flaw. Data on the preliminary magnetic measurements 4) have been transmitted to IHEP.

The prototype delay line pulser has undergone an equal number of pulses and has yielded valuable data on sparkgaps electrode erosion. These runs are being continued.

#### 5. Septum magnets

Following requests of IHEP the septum magnet apertures have been increased to cope with larger beam diameters and achieve compatibility with the slow ejection system planned by IHEP. The increased magnetic forces on the septums have caused some difficulties and some time has been lost. Although manufacture of some parts of the final magnets is underway, design of some other parts is still continuing.

Design, manufacture and assembly of the final pulse generators for the two septum magnets have been completed and start of tests is imminent.

At the request of IHEP a small magnetic pulse of inverse polarity will be provided in septum magnet SM26 for more convenient operation of channel B.

Manufacture of the high voltage pulse transmission cables has been completed and the cables have been shipped to IHEP.

The high voltage charging supplies for the capacitor banks in the pulse generators have been delivered at the end of 1970 and have since been successfully tested.

In parallel with the construction of the final magnets the programme for finding the precision field corrections is well underway on prototypes with the final magnetic circuit but of reduced length. Provisions have been made in the design of the final septum magnet so that the found corrections may be incorporated in the form of shims after delivery of the magnets.

#### 6. Vacuum

Design and manufacture of the 3 large vacuum tanks for the ejection magnets have been completed, two tanks have been delivered and one tank, for the kicker magnet, has been completely assembled with the final pumping system and controls and two kicker magnet modules in it. It reached a vacuum of  $3 \times 10^{-6}$  mm Hg after a few days pumping. The third tank is due for delivery in one week.

All pumping systems and small vacuum material have been delivered and are partially assembled.

The three supports for the three vacuum tanks have been delivered and assembled.

#### 7. ACTUATOR

Design, manufacture and assembly of the hydraulic actuator and the precision guiding system supporting the mobile septum magnet have been completed and start of tests on the test bench is imminent.

Manufacture, assembly and test of the hydraulic pumping station have been completed at the factory and the station has been delivered as a whole at the end of 1970. Tests with the final actuator are to start soon.

The prototype actuator, now installed in straight section 13 of the CPS and moving a second "bare kicker magnet" for ejection into the ISR, has given entire satisfaction in routine operation.

#### 8. ELECTRONICS

Production, installation in the mockup control room and testing of the programming and timing system have been completed.

Substantial parts of the beam diagnostic system have been produced. A partial linkup of the prototype electrostatic pickups and the final beam transformer in the CPS proton beam with their final electronics is to start early in May.

The small computer to be used for handling the beam diagnostic data has been delivered. A first version of the computer programme has been working.

Substantial parts of the interface and readout hardware have been delivered and are presently being installed in the mockup control room.

REFERENCES

- 1) B. Kuiper, Progress report on the fast ejection system for channel A of the Serpukhov 70 GeV proton synchrotron. CERN/PS/FES/70-2.
- 2) K.P. Myznikov, V.M. Tatarenko, Yu.C. Fedotov  
Simultaneous operation of the proton slow and fast ejection system at the IHEP 70 GeV accelerator. IHEP-70-79.
- 3) B. Kuiper  
CONTROL PHILOSOPHY II . CERN/PS/FES/TN-174. 28.8.70.
- 4) A. Messina  
Preliminary results on the performance of final prototype of Janus kicker magnet . CERN/PS/FES/TN-224. 13.1.1971.

Manufacture of controls and interlocks of the vacuum system is well advanced, around half of it is delivered. One unit is in operation with the kicker magnet vacuum tank.

Construction of the multiplexed precision voltage regulation of the septum magnets and the regulation for the kicker magnets is well advanced.

Manufacture of the monitoring system is in progress.

#### 9. BUILDING AND INSTALLATION

Agreement has been reached on the foundation of the vacuum tanks and hydraulic actuator in the accelerator ring tunnel. Equally for the layout of the local control room.

The detailed layout of the ejection equipment room and the pump station and the detailed cable plan with wire number lists and layout of the cable terminals are presently being finalized.

The filters for the shielding walls for ejection and beam transport are being manufactured.

A number of smaller items such as water, compressed air and transformer oil pipings, power connections to CERN equipment, simple supports for television cameras and possibly other equipment remain to be manufactured by IHEP at short notice, as the CERN drawings become available.

#### 10. TRANSPORT

Modalities of transport of the ejection equipment to Serpukhov have been investigated. The total volume will be  $\sim 250 \text{ m}^3$  and the weight  $\sim 120$  tons. Typically, complete transport by truck would take 4-6 weeks.