Title
BEVATRON RESEARCH MEETING IV - BEVATRON TARGETS AND PROBES

Permalink
https://escholarship.org/uc/item/0789h8jh

Author
Chupp, Warren

Publication Date
2010-12-01
General Description of Beam Monitoring Equipment

Tangent Tank Allocations

**East Tangent Tank** -- The east tangent tank will house the inflector and one beam probe required for tune up. The inflector will be provided with two flip targets placed at the entrance and exit ends of the inflector. These targets can remain in place at all times except during actual beam injection. Their use will be confined to monitoring the over all performance of the inflector and inflector equipment. A probe will be located on the inside radius at the transition tank immediately following the inflector. Vertical aperture defining plates will be located at the north entrance to the east tangent tank.

**North Tangent Tank** -- Almost the entire volume of the north tangent tank will be utilized by the accelerator electrodes. Two probes will be located in the transition sections, one on the inner radius at the west side and another on the outside radius at the east side. Neither of these probes can be removed without loss of vacuum. They will be adjustable in radius and each will sweep slightly more than half of the aperture radius in the tank.

**West Tangent Tank** -- The west tangent tank has been allocated as the main target area. Air locks will be provided at the north side of the west tangent tank at inner and outer radius points. These will permit installation of targets without loss of vacuum and will provide a maximum volume of 12" x 6" x 6". Larger air locks may be provided in the future as the need develops.

**South Tangent Tank** -- The east end of the south tangent tank will house the induction electrodes which will be used for beam tracking. These will occupy approximately 8-feet of the 20-foot space. The west side of this tangent tank will be provided with air locks (as above) at inner and outer radius points.

**General Comments** -- The targets and probes will be introduced 6-inches below the median plane so that adequate mechanical support can be effectively utilized without reducing the aperture. Probe heads will be of such configuration as to allow monitoring of any desired vertical strip of the aperture. It is probable that some space will be available in the quadrants after first performance tests have been on the machine. No targets or probes will be located in that 1-foot x 4-foot aperture initially. Provision will be made for driving the inner radius targets on the west tangent tank into the aperture during acceleration. The drive mechanism will locate the target (within an adjustable radius) in 1/2 a second.

**Basic Probe Heads** -- Three types of probe heads will be provided. These include a direct monitoring, a phoscorphor flag, and a light pipe probe.

(1) **Direct Monitoring Probe** -- This will be provided with a cathode follower mounted at the electrode in the tank. This will be designed to deliver approximately 1 millivolt to the transmission line for 10^{-9}
ampères of beam. A bandwidth of 1 mc is planned. Provision will be made for rapid change of the input resistor of the cathode follower if greater sensitivity and less bandwidth is desired.

(2) **Phosphor Flag Heads** -- The phosphor flag can be attached to the end of the probes for visual location of the beam. This flag will be suitably wired so that it may double for direct beam indication and allow correlation of visual and electrical position of the beam.

(3) **Light Pipe Probe** -- A shielded Lucite rod will transmit the light from a phosphor to a photomultiplier located external to the vacuum liner. The cross section of the light pipe will be small - of the order of 1-inch. Probes of this type were found to be quite helpful in the initial tune up of the 1/4 scale Bevatron.

**Induction Electrodes**

Induction pick-up electrodes will be provided for monitoring the radial position of the beam. These will be provided with 1-foot guard rings so that quantitative measures of the beam intensity can be obtained. No verticle position electrodes are being planned at the moment. The induction electrodes can be easily modified as they are made of thin sheets of copper.

**Beam Targets**

**Neutral Beam Targets** -- Targets and suitable injecting mechanisms will be provided at turn on for ejection of neutral particle beams. The target will be located at approximately 20° from the south transition section of the west tank which should provide a beam of neutrons and neutral mesons of approximately 3° width with a beam sweep of approximately 1/16-inch at the target area. The rack and pinion drive mechanism will insert the target in approximately 1/2 second. The radial thrust of this target will be variable externally so that the target can be positioned at a fixed azimuth from 595 to 602 inch radius. The angular position of this target, though continuously variable, cannot be varied external to the vacuum envelope. Neutral particle beams as well as some π^- beams will come out of the southwest quadrant through a thin stainless steel window.

**Charged Particle Targets** -- The same mechanism used for neutral particle beams can be adapted for π^- meson beams in the 2 - 3 and 3 - 6 Bev energy range by suitable relocation of the target drive mechanism. These meson beams will leave the tank through the thin stainless steel window in the southwest quadrant. Forward π^- mesons below 2 Bev can be extracted from targets located near the south transition section of the west tangent tank. These beams will exit from the west tangent tank.

**General Comments** -- Because of the asymmetry in geometry of pole tip magnets with respect to the magnet yokes and the curvature of the quadrants, it will be difficult to remove positive charged meson beams. A re-entrant side plate on the inside radius of the west tangent tank is under study. While such a plate would provide a location for bending magnets and collimators for positive particles and would simplify the construction of some beam monitoring probes, its presence may introduce a first harmonic distortion in the magnet field of a prohibitive amplitude.
Target Configuration

Investigation has shown the lip target to be practicable. A 1/4-inch lip of copper will provide the necessary radial amplitude, for example, to cause the beam to strike the central target on the next revolution. Typical targets can weigh as much as five to eight pounds.

Expected Beam Configurations

The exit beam configuration depends on the method by which the internal beam is driven into a target. If the R-F is turned off and the magnetic field is allowed to walk the beam into the target, a beam of approximately 3 1/2 milliseconds length and of approximate constant amplitude can be expected. Pulse beams can be obtained by changing the field frequency relation in such a way that the beam spiral in all but the phase groups do not de-bunch appreciably.