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Measure FEB Extraction Efficiency, Calibrate Transformers

J. Balsamo

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Collider Accelerator Department

Brookhaven National Laboratory

U.S. Department of Energy

USDOE Office of Science (SC)

DISCLAIMER

Blumberg
NO. 41

FEB BEAM COMMISSIONING STUDY. WED. OCT. 3, THURS. OCT. 4, 1973

Balsamo, Bennett, Blumberg, Glasmann, Guthy, Keane, Williams

SCHEDULED 1800 (10/3) → 0800 (10/4). ACTUAL: 1900 → 0800

OBJECTIVES: CALIBRATE INSULATED PLATES, CURRENT TRANSFORMERS AND PICK-UP ELECTRODE SUMS VS. POLY FOIL AT LOW AND HIGH INTENSITY. MEASURE EXTRACTION EFFICIENCY. MEASURE "HALO" AT U273.

1. SET UP "USUAL" FULL EXTR. AT P_{FEB} = 28.7 GeV/c (GAUSS CLOCK [illegible]) AND CBM ~ $1.5\,10^{12}$. NOTED $\frac{1}{2}$" BEAM POSITION FLUCTUATIONS AT U115. THESE CORRELATED WITH SPOT MOVEMENT AT H10 INTERNAL TARGET. HENCE H10 EJECT. MAGNET IS NOT CAUSE. PROBLEM IS RADIAL FLUCTUATION OF 2 mm OF CIRCULATING BEAM, WHICH CORRELATES WITH CHANGES IN CBM OF ABOUT 50%. WE COULD NOT STABILIZE RADIUS BY GAIN CHANGE IN RADIAL SERVO LOOP OR USE OF HIS PUE.
2. WENT TO CBM = $6.3\,10^{12}$ p/p. RADIAL AND VERTICAL SPOT SIZES INCREASE MARKEDLY. VERTICAL SIZE AT H10 FLAG → $\frac{3}{4}$" FROM USUAL ~ $\frac{1}{4}$" AND SHOWS VERTICAL COLLIMATION, PROBABLY FROM .687" E10 APERTURE. WITH OUTER EDGE OF BEAM AS CLOSE AS POSSIBLE TO E10 SEPTUM, WE DO NOT HAVE ENOUGH KICK AT C15 KICKER (EVEN WITH INCREASE OF C15 BANK VOLTAGE FROM 30 KV TO 36 KV) TO EXTRACT BUNCHES CLEANLY, AS EVIDENCED BY HIS PUE SIGNAL AND U165 CURR. TRANS. PICTURE. EXTRACTION EFFICIENCY = 51% BY POLY FOIL. ALSO EXPOSED ARRAY OF POLY RODS FOR "HALO". INTENSITY AT $1\frac{7}{16}$" FROM SPOT CENTER IS ~ 3×10^{-4} OF CENTER INTENSITY. HALO DECREASES BY FACTOR OF 7 GOING FROM 1" TO 3" FROM CENTER. CENTER FOIL COUNT ALSO GIVES ~51% EXTR. EFF. AUTO RADIOGRAPH OF FOIL SHOWS ~ $\frac{1}{2}$" DIAMETER SPOT, WHEREAS ON U273 FLAG IT LOOKED ~ 2"×1". IP'S, PUE'S AND CT'S ALSO CALIBRATED IN ABOVE RUNS. AGS RADIUS STABLE TO ~.2 mm AT HIGH intensity
3. WENT BACK TO CBM ~ $1.5\,10^{12}$. EXPOSED POLY FOIL. EXTR. EFF. = 45%. LOW VALUE POSSIBLY CAUSED BY RADIAL JITTER NOTED ABOVE. EXTERNAL DETECTORS ALSO CALIBRATED AT THIS LOW INTENSITY
4. CHECKED PERFORMANCE OF U5 VERTICAL COLLIMATOR. IT LIMITS VERTICAL SIZE OF U273 SPOT AS CALCULATED. (NOTED THAT U5 COLLIMATOR WAS OPEN TO ONLY $\frac{3}{8}$" GAP IN ABOVE RUNS. THIS MAY ALSO EXPLAIN LOW EFFICIENCY.)
5. CHECKED MOMENTUM RECOMBINATION AT U273. INCREASED 4 $\frac{1}{4}$° BEND BY 1% AND NOTED ~ $\frac{1}{8}$" MOVEMENT TO INSIDE AT U273 (3000" AWAY). SO WE ARE NEAR ACHROMAT. SPOT AT U165 MOVED ~1".
6. ALL POWER SUPPLIES STAYED ON FOR 13 HOURS WITHOUT FAULT. RECORD!