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Transmission through LEBT and Tank #1

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The object of the study period was to improve the beam transmission through the low energy beam transport system and Tank #1. The amplifiers from the 200 MeV emittance unit were required for this study so this unit was removed from the injection area, and renovated prior to the study period. The computer programs written in FOCAL for the twiss PDP8L were retrieved and used for data analysis. Four consecutive 8 hour study periods were manned for the beam studies. The first 4 hours of the first 8 hour period was taken up with initial equipment turn on and with trouble shooting of the data taking equipment and the associated software. This was necessary since it had not been possible to run the emittance equipment with beam on prior to the study period. During the next 4 hours qualitative emittance data was taken using the manually operated AGS OPS unit connected to VB#1 emittance unit to determine the best operating conditions for the source magnet, anode pulser and extractor with the quadrupole set to theoretical settings obtained from ray tracing calculations. None of the source parameters had a large effect on

[illegible] emittance [illegible] for a 150 mA beam current at VB#1. The only parameter that appears to affect the emittance in any way was the extractor voltage which was finally set to 40 KV compared with ~ 30 KV used prior to this study period. The source parameters used for the remainder of the study period were as follows:-

Cockcroft Walton High Voltage	=	764 KV.
Extractor Voltage	=	40 KV
Source filament current	=	40 A
Source discharge magnet	=	1.3 A
Source anode pulser	=	320 V
Beam current in VB#1	=	150 mA.
LEBT Quadrupoles Q1 and Q3	=	255 A
LEBT Quadrupole Q2	=	265 A.

During the second 8 hour period the LEBT steering was adjusted to centre the beam at VB#4 with the LEBT apertures out. With the beam centred at VB#4 it was off centre in VB#5 (immediately in front of Tank #1) suggesting that there is some misalignment in the later part of the LEBT line. Tank #1 was then turned on and a 60 mA beam current obtained for 100 mA at the input to the Tank with only Buncher #2 on. This was achieved by setting LEBT quadrupoles to give a matched beam at the input to the Tank as calculated and reported in Conference papers. At this point a fault occurred in Anode Pulser #1 so the second Anode pulser was brought into operation after running the gas pressure to zero. This operation caused a movement of

position which necessitated readjustment of the beam steering. The next shift used to answer from the lift of the beam by readjusting the above steps but were unsuccessful. They then recorded emittances at VB#1, 4, 5 and 10 MeV for the previously determined setting until the matched input beam and with buncher #2 energised.

The next shift put the LEBT aperture in and adjusted the quadrupole triplet upstream of the aperture to improve beam transmission through the aperture. This did not affect the beam position at VB#4 or 5 but the transmission through Tank #1 was improved as 58 mA of 10 MeV beam current was obtained for 80 mA at the input.

Then buncher #1 was turned on and a 10 MeV beam current of 60 mA obtained for 75 mA at the input to the Tank.

Emittances were recorded at VB4, 5 and 10 MeV for LEBT aperture in and one and two bunchers energised. The data is summarised in the following table which gives best 10 MeV emittance of 6 cm mrad un-normalised. a specimen set of the measurements with the AESOPS unit for future reference purposes.

80% EMITTANCES AT LOCATIONS GIVEN IN cm mR

VB1H		VB1V		VB4H		VB4V		VB5H		VB5V		10MeVH		10MeVV		BEAM CURRENT IN mA.				LEBT AP. STATUS	BUNCHER #1 STATUS	BUNCHER #2 STATUS
E	NE	E	NE	E	NE	E	NE	E	NE	E	NE	E	NE	E	NE	VB1	VB4	VB5	10MeV			
12.8	0.79	24.3	0.97	8.6	0.55	11.0	0.56	13.1	0.53	13.3	0.53	7.5	1.13	5.1	0.76	140	125	100	60	OUT	OFF	ON
21.8	0.63	26.1	1.05	9.4	0.38	11.1	0.45	13.9	0.56	13.5	0.54	6.80	1.02	5.90	0.88	150	85	85	58	IN	OFF	ON
—	—	—	—	7.0	0.28	10.0	0.40	12.6	0.51	15.2	0.61	6.00	0.90	5.60	0.87	140	75	75	60	IN	ON	ON

* INCLUDES ALL BEAMS AT VB4 LOCATION.