

## BEAM INTENSITY IN THE AGS

A. van Steenbergen

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Collider Accelerator Department  
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Accelerator Department  
BROOKHAVEN NATIONAL LABORATORY  
Associated Universities, Inc.  
Upton, New York

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A. van Steenberg  
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Since turn-on after the recent shutdown, sufficiently improved multi-turn (horizontal only) stacking efficiencies have been observed\* that it seemed worthwhile to update and expand on Technical Note No. 90 (J.C. Herrera, "Beam Intensity in the AGS", January 20, 1972). However, in addition to stating here the "injection" and "capture" efficiency numbers, as defined in Technical Note 90, more relevant figures of merit for the transverse stacking and injection performance, i.e., the circulating beam current to linac current ratio, and the absolute value of circulating beam current immediately after multiturn injection completion, are given. This is listed in the following table, where the first two columns are a repeat from Tech. Note 90, expanded with  $I_c(1)$  values and  $[I_c(1)/I_L]$  ratios. The additional columns reflect more recent performance figures using "horizontal stacking only" injection.

\*Due to inflector system improvements, better beam matching control, enlargement of the horizontal acceptance (10 to 15%) due to reduction of horizontal closed orbit errors and some reduction of the 200 MeV emittance associated with improved linac performance.

[Note: Since  $\eta(1)$  depends on  $t_L$  (see definitions in the table), which may or may not be set up to verlap the acceptance (time) aperture generously, and also, since the "per turn acceptance" varies strongly during the  $t_L$  duration,  $\eta(1)$ , as defined, is a poor criterion of injection tune-up and performance. As an example, the following numbers are cited, using recent observations:

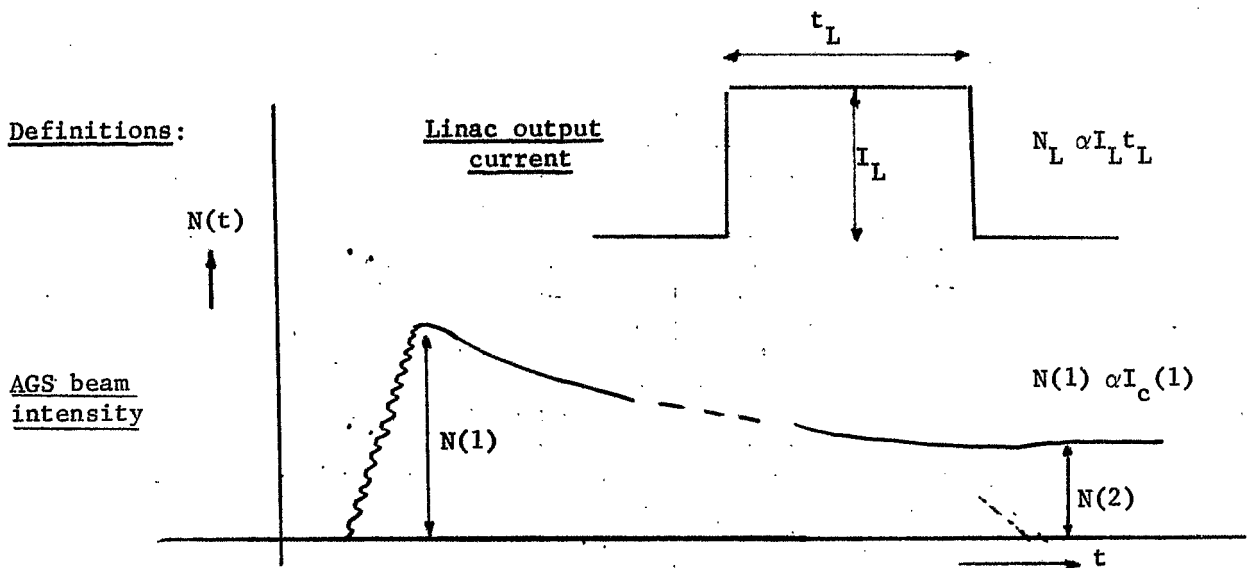
$t_L$ ( $\mu$ sec)	$I_L$ (mA)	N(1) (ppp)	N(2) (ppp)	$\eta(1)$	[ $\eta(2)$ ]	[ $\eta(1)\eta(2)$ ]
56	35	$8 \cdot 10^{12}$	$3.5 \cdot 10^{12}$	62%	44%	27%
100	35	$12 \cdot 10^{12}$	$4.0 \cdot 10^{12}$	48%	33%	16%

These numbers were obtained with only a change in linac pulse length. No injection conditions or parameters were changed.

For this reason, in addition to using N(2) (measured immediately before transition) and N(1) or  $I_c(1)$ , immediately after stacking, the guiding figures of merit to indicate status of optimization of transverse stacking and longitudinal capture (and linac performance!) which are presently being used are  $(I_c(1)/I_L)$  and  $\eta(2)$ .]

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	50 MeV Injection	200 MeV 1/18/72		3/25/72	Peak N(2) Before Shutdown		10/22/72	1/10/73
$I_L$ (mA)	40	40		38	54		40	41
$t_L$ ( $\mu$ sec)	86	48		57	57		100	120
turns	10	10		12	12		21	25
pr/mA turn	$5 \cdot 10^{10}$	$3 \cdot 10^{10}$		$3 \cdot 10^{10}$	$3 \cdot 10^{10}$		$3 \cdot 10^{10}$	$3 \cdot 10^{10}$
$N_L$	$20 \cdot 10^{12}$	$12 \cdot 10^{12}$		$13.7 \cdot 10^{12}$	$19.0 \cdot 10^{12}$		$25 \cdot 10^{12}$	$30 \cdot 10^{12}$
N(1)	$10 \cdot 10^{12}$	$7.2 \cdot 10^{12}$		$7.0 \cdot 10^{12}$	$9.6 \cdot 10^{12}$		$14 \cdot 10^{12}$	$12.8 \cdot 10^{12}$
N(2)	$3 \cdot 10^{12}$	$2.6 \cdot 10^{12}$		$4.5 \cdot 10^{12}$	$5.8 \cdot 10^{12}$		$4 \cdot 10^{12}$	$7 \cdot 10^{12}$
$N(1)/N_L = \eta(1)$	50%	60%		51%	50%		56%	42%
$N(2)/N(1) = \eta(2)$	30%	36%		64%	60%		28%	54%
$\eta(1)\eta(2)$	15%	22%		33%	30%		16%	23%
$I_c(1)$ (mA)	336	242		235	<u>322</u>		<u>470</u>	430
$(I_c(1)/I_L)$	5.0*	6.0		6.2	<u>6.0</u>		<u>11.7</u>	10.5



\* Corrected for  $(\beta_{50}/\beta_{200})$  ratio.

time (1) , transverse capture complete  
 " (2) , total capture process complete