

One-Bunch Mode Operation Of The Booster

Y. Y. Lee

December 1983

Collider Accelerator Department
Brookhaven National Laboratory

U.S. Department of Energy

USDOE Office of Science (SC)

Notice: This technical note has been authored by employees of Brookhaven Science Associates, LLC under Contract No.DE-AC02-76CH00016 with the U.S. Department of Energy. The publisher by accepting the technical note for publication acknowledges that the United States Government retains a non-exclusive, paid-up, irrevocable, world-wide license to publish or reproduce the published form of this technical note, or allow others to do so, for United States Government purposes.

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or any third party's use or the results of such use of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

ONE-BUNCH MODE OPERATION OF THE BOOSTER

Y.Y. LEE

(BNL, December 8, 1983)

ONE-BUNCH MODE OPERATION OF THE BOOSTER

Y.Y. LEE

(BNL, December 9, 1983)

8

One-bunch Mode Operation
of the Booster

Y. Y. Lee

BNL, Dec. 9, 1983

ACCUMULATOR/BOOSTER PARAMETERS

INJECTION ENERGY FOR PROTONS	T = 200 MeV
EJECTION ENERGY FOR PROTONS	T = 2.5 GeV
CIRCUMFERENCE	201.75 M
* FOCUSING CELLS	24
CELL LENGTH	8.4 M
PERIODICITY	12
STRAIGHT SECTIONS #/LENGTH	12/3.7
PHASE ADVANCE/CELL	100.5°
$v_x \sim v_y$	6.7
B_{MAX} / B_{MIN}	16/2 M
η_{MAX}	1.7 M
DIPOLES	
#	36
LENGTH	2.4 M
FIELD INJ/EJEC (PROTONS)	1.56/8 KG
(" HEAVY ION)	0.682 0.0682 A/Z/12 KG
QUADRUPOLES	
#	48
LENGTH	0.5
APERTURE	8"

*395 gauss for Au⁺³⁴
/ 336 Mex/amu*

Time / a.m.u.

500

27
Au

(15 MeV/a.m.u.
2000 injected)

400

(1 MeV/a.m.u.
2000 injected)

300

5 equivalents to
4.37 MeV/a.m.u. $\left(\frac{30}{7} \right)$

threshold

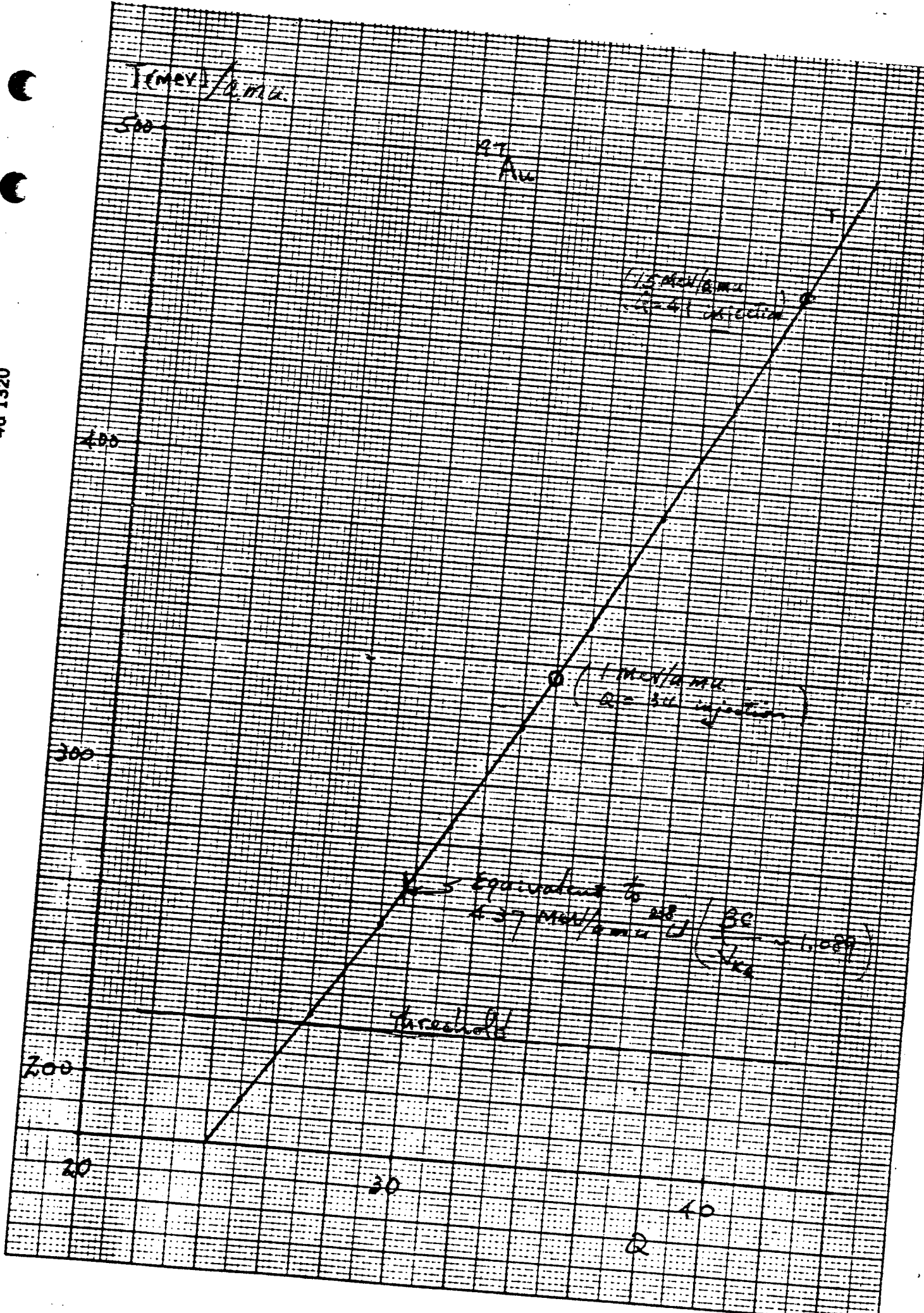
200

20

30

10

2



If I ignore intra beam scattering and

I we can take large space charge tune shift

$$1 \sim 3 \times 10^9 \text{ / bunch}$$

If the other hand one only can have say

$$6 \times 10^8 \text{ / bunch in the collider}$$

the we can work backward

$$\rightarrow 1.2 \times 10^9 \text{ / bunch in the Booster}$$

Let's compare several schemes

6×10^8 / Bunch in collider

option	# required	# turn inj	(E_N) required (10^{-6})			# Bunch in Collider
			$\Delta V = .1$	$\Delta V = .2$	$\Delta V = .4$	
Booster	3.6×10^9	10	$4\pi \cdot 10^{-6}$	2π	1π	57
Booster w. Linac	3.6×10^9	22	$1.8\pi (3.4\pi)$	$.9 (3.4\pi)$	$.5\pi (3.4\pi)$	57
Booster*	1.2×10^9	3	1.3π	$.7$	$.3\pi$	$57 \times n$ $n=1, 2, \dots$

Assume; $4 \mu A$ beam with $E = 1.5\pi \times 10^{-6}$ from Tandem or linac

* Bunch and accelerate to 200 MeV/amu in $h=1$
Transfer to $h=3$

$J_{rr} \quad A = 197$
 $Q = 34$
 $T = 1 \text{ MeV/AMU.}$

If keep $\frac{\Delta P}{P} < .01$

	$h = 1$	$h = 3$
Bunching V	1.8 KV	5.3 KV
T_s	3×10^{-3}	1×10^{-3}
A	.017 eV-sec/AMU	.006 eV-sec/AMU/bunch

At. 200 MeV/amu.

$V = 30 \text{ KV}$

$\phi_s = 30^\circ$

$h = 3.$

$A_{30} = .075 \text{ eV-sec/amu/bunch.}$

at AGS

336 MeV/amu

280 KV

$h = 12$

$A_{30^\circ} = .244 \text{ eV-sec/amu/bunch}$