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One-Bunch Mode Operation Of The Booster

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ONE-BUNCH MODE OPERATION OF THE BOOSTER

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(BNL, December 8, 1983)

ONE-BUNCH MODE OPERATION OF THE BOOSTER

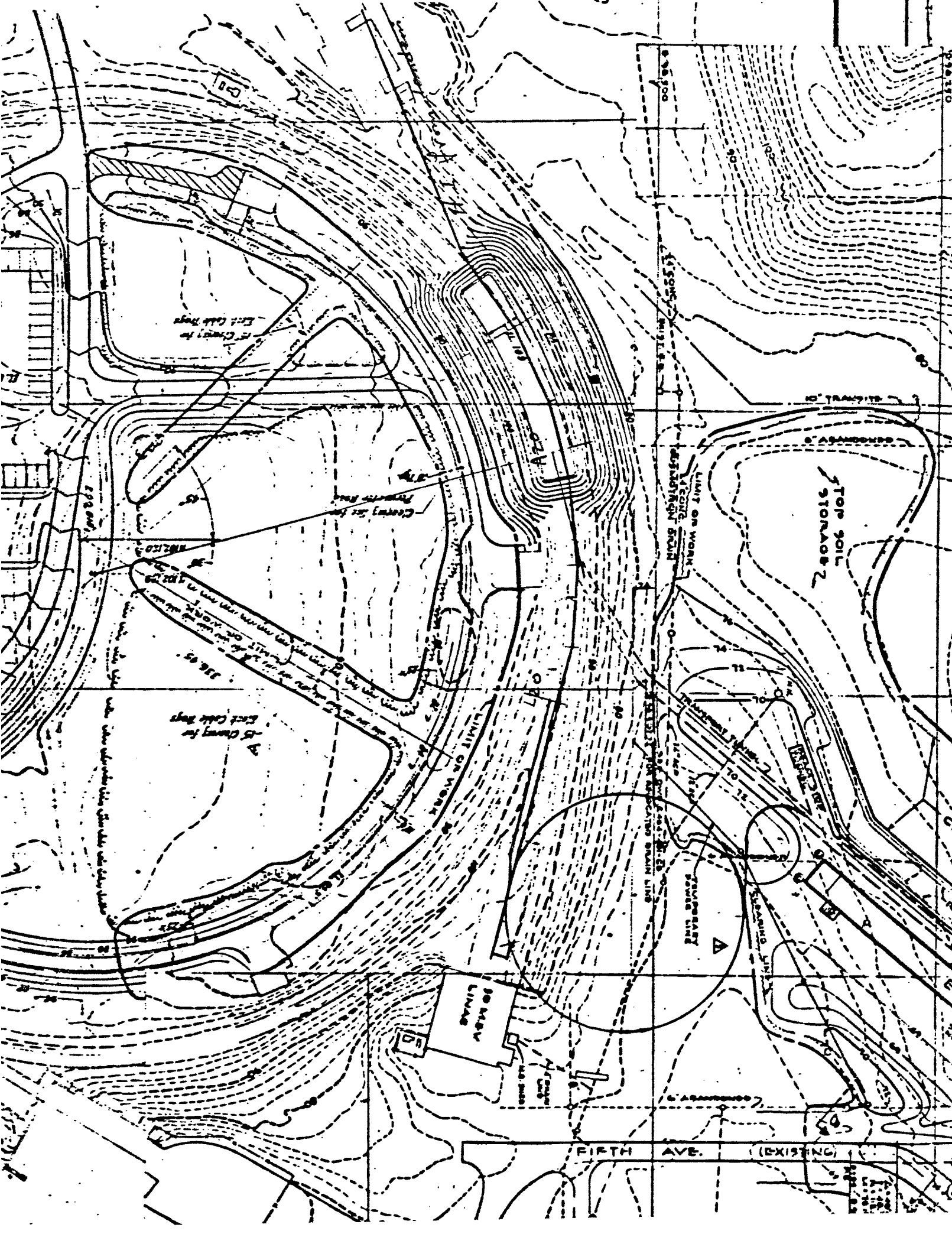
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One-bunch Mode Operation
of the Booster

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

$T(\text{MeV})/A \text{ m.u.}$

500

^{197}Au

$(15 \text{ MeV}/A \text{ m.u.})$
 $Q = 41 \text{ MeV}$

$(1 \text{ MeV}/A \text{ m.u.})$
 $Q = 34 \text{ MeV}$

α is equivalent to
 $4.37 \text{ MeV}/A \text{ m.u.}$ $\left(\frac{30}{70} = 0.4286 \right)$

Threshold

200

20

30

40

A

46 1320

K-E 10 X 10 TO 1/2 INCH 7 X 10 INCHES
 KALUFEL & BROWN CO. MADE IN U.S.A.

If Ignore inter 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	$(E_N)_{\text{required}} (10^{-6})$			# 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 $h=3$

$$\begin{aligned}
 J_{rr} \quad A &= 197 \\
 Q &= 34 \\
 T &= 1 \text{ MeV/amu.}
 \end{aligned}$$

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

$$h = 1$$

$$h = 3$$

Bunching V

$$1.8 \text{ KV}$$

$$5.3 \text{ KV}$$

T_s

$$3 \times 10^{-3}$$

$$1 \times 10^{-3}$$

A

$$.017 \text{ eV-sec/amu}$$

$$.006 \text{ eV-sec/amu/bunch}$$

At. 200 MeV/amu.

$$V = 30 \text{ KV}$$

$$\phi_s = 30^\circ$$

$$h = 3.$$

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

at AGS

$$336 \text{ MeV/amu}$$

$$280 \text{ KV}$$

$$h = 12$$

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