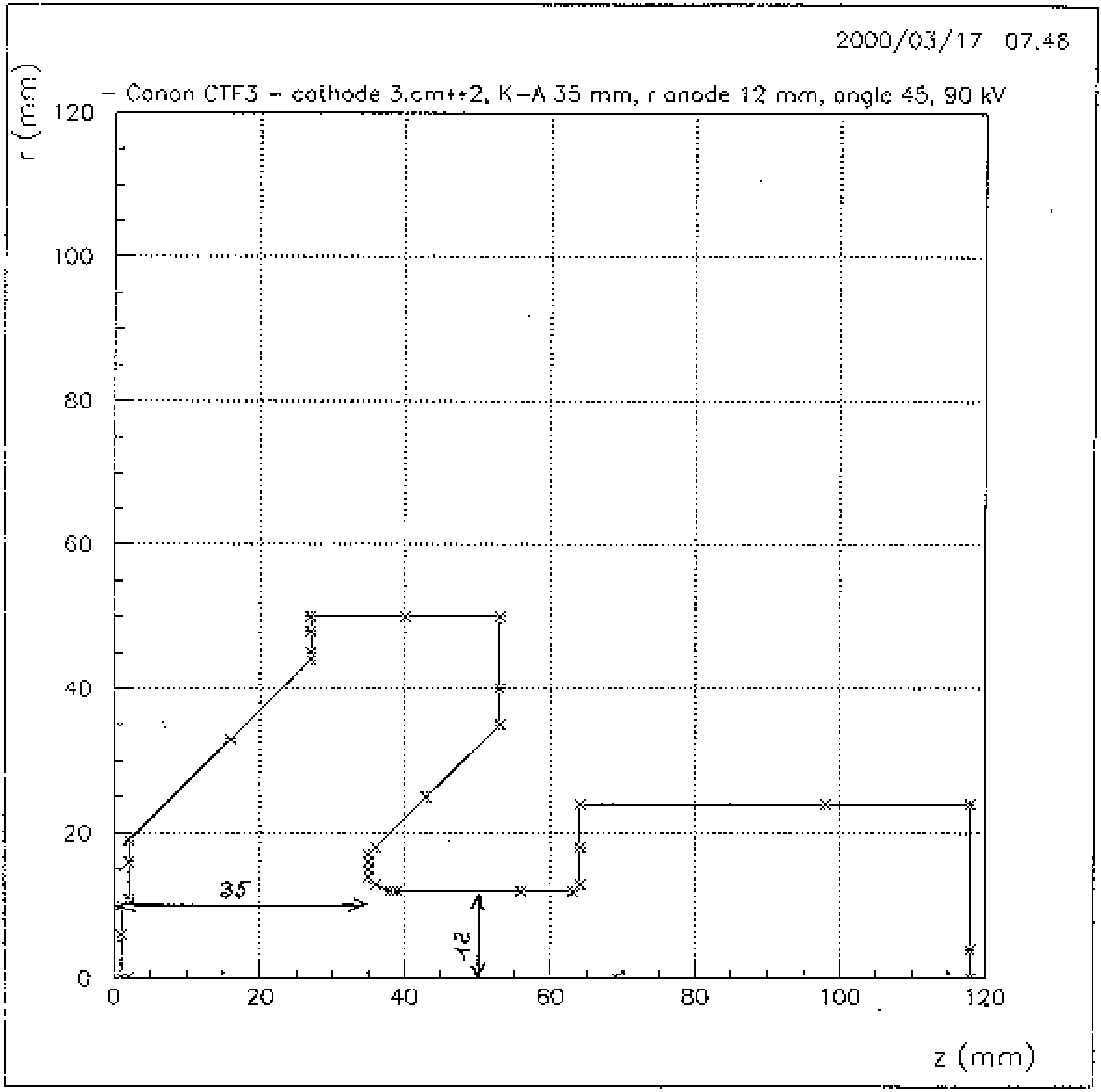
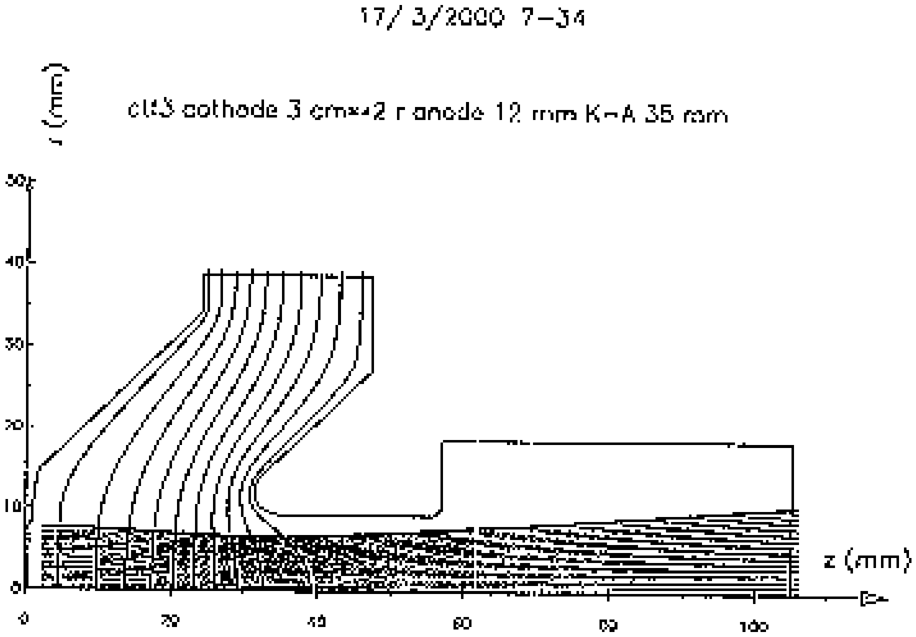
Table 1: Parameters for the CTF3 gun used for the Initial and Nominal stages

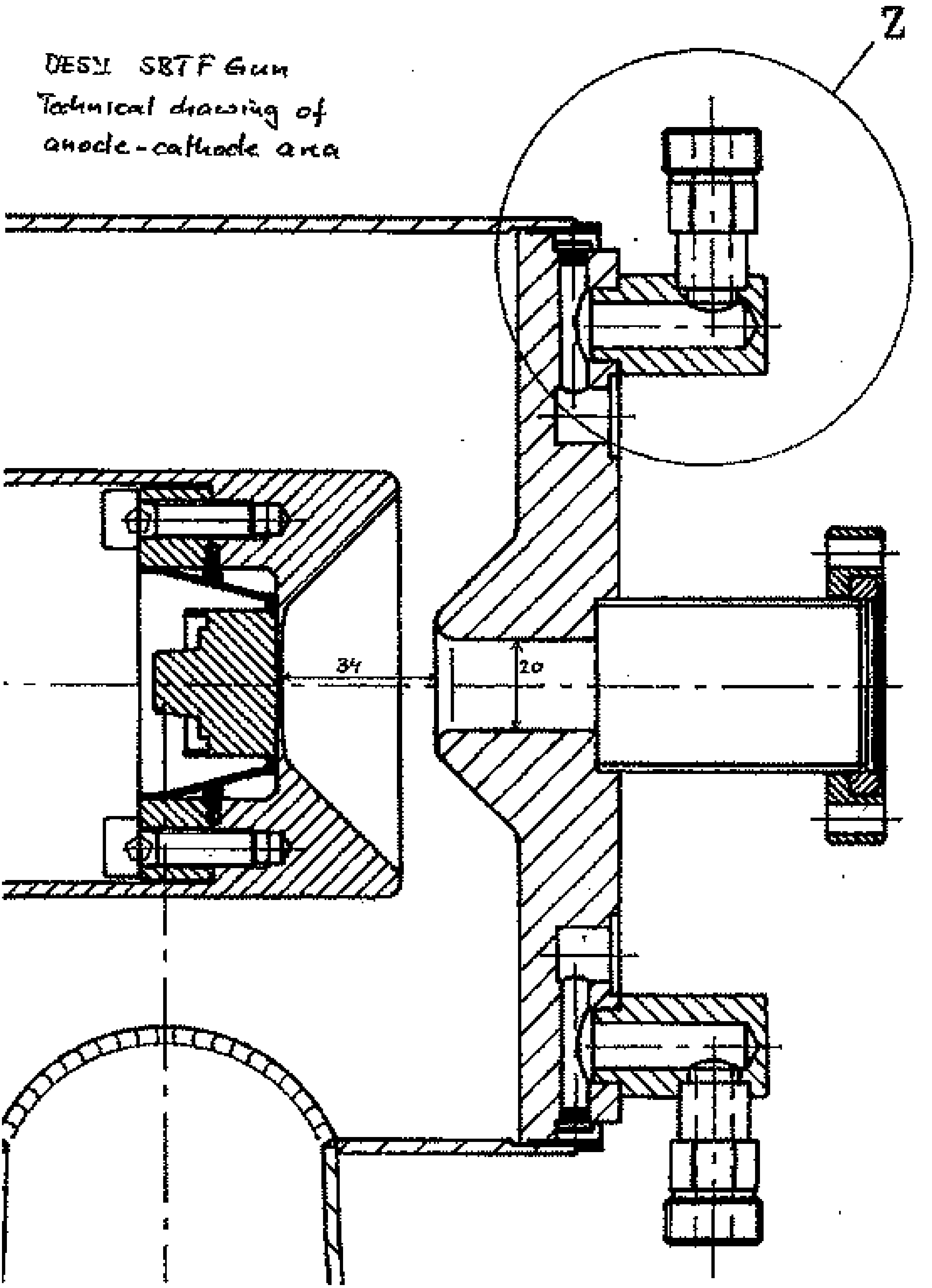
Parameters	Unit	Initial and Nominal
Voltage	kV	150 (*)
Pulse length	µs	1.6
Gun current	A	7
Charge per pulse	µC	11
Rise/ Fall time	ns	≤ 10
Voltage stability ΔV/V	%	≤ 0.1
Charge flatness on flat top	%	≤ 0.1
Emittance (norm., rms)	mm.mrad	≤ 10
Repetition rate	Hz	5

(*) Preliminary value which may be reduced in the course of the injector design study.


2000/03/17 07.46
- Canon CTF3 - cathode 3.cm**2, K-A 35 mm, r anode 12 mm, angle 45, 90 kV
r (mm)
120
100
80
60
40
20
0
35
12
0
20
40
60
80
100
120
z (mm)


17/ 3/2000 7-34
cl43 cathode 3 cm**2 r anode 12 mm K-A 35 mm
r (mm)
50
40
30
20
10
0
0
20
40
60
80
100
z (mm)

DESY SBTF Gun
Technical drawing of
anode-cathode area



Numerical simulation of the bunching systems

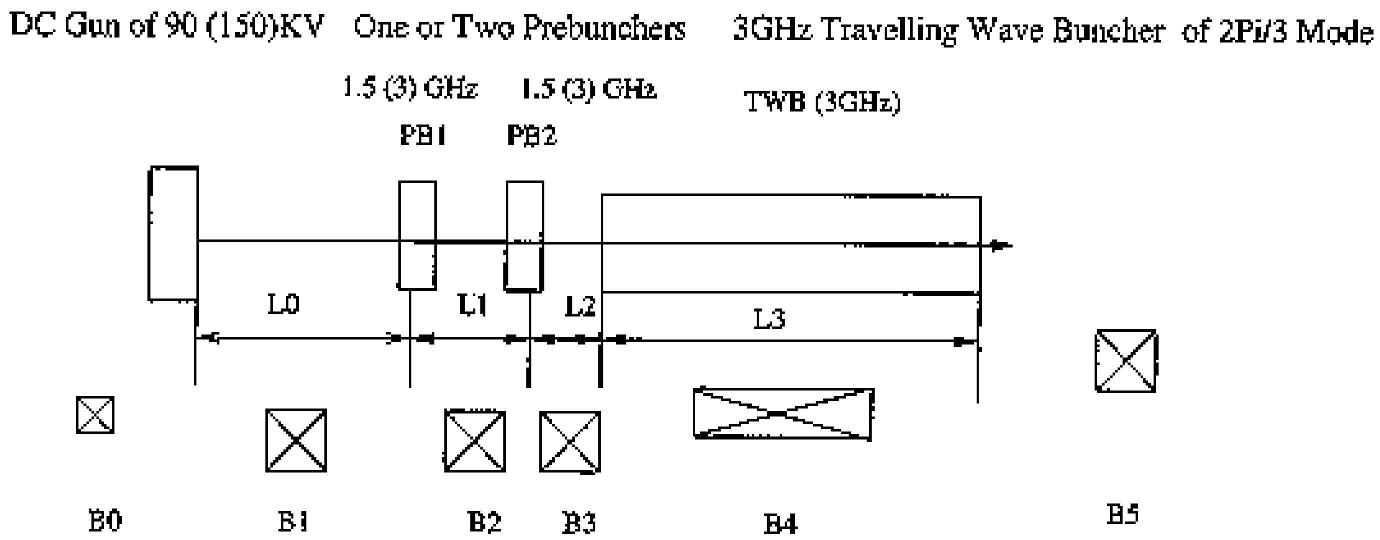
The design goal [8][9] of CTF3 is listed below:

CTF3 Design Goal

Beam energy at the exit of the injector	~26 MeV
Pulse length	1.6 us
Beam current per pulse	3.5 A
Charge per pulse	1.17-2.33 nC
Bunch spacing	10-20 cm
Bunch length (FWHH and rms)	<12 ps and 5 ps
Normalized emittance	<100 mm.mrad
Single bunch uncorrelated energy spread (rms)	<0.5 MeV
Pulse repetition frequency	5 Hz
Allowed charge in satallite	< 5%

Figure 2: The injector design goal.

Bunching Systems Proposed for CFT3



TWB: 3 cells of phase velocity =0.75c and 21 cells of phase velocity =c

E0=10MV/m (at the input coupler of TW buncher), L3=0.8m

For two 3 GHz prebunchers case: L0=50 cm, L1=15 cm, and L2=10 cm

For one 1.5 GHz and one 3 GHz prebuncher case: L0=50 cm, L1=15 cm, and L2=10 cm

For one 1.5 GHz prebuncher case: the prebuncher is located at L0=50 cm and L1+L2=25 cm

For two 1.5 GHz prebunchers case: L0=50 cm, L1=22 cm, and L2=3 cm

Summary of the PARMELA simulations (90 kV)

Ngood 427

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Ez0 (MV/m)	W (MeV)	dW (MeV)	En (mm.mrad)	dPhi (degree)	N/N0
10	3.94	0.034	53.5	5.11	304/500
20	7.3	0.28	52.6	3.47	345/500
30	8.99	0.474	93.5	2.84	304/500

window 20°

Table 2: The case of two 3 GHz prebunchers and one TW buncher.

10 4.1 0.08 51 4.1 352/500 → 150 kV

Ez0 (MV/m)	W (MeV)	dW (MeV)	En (mm.mrad)	dPhi (degree)	N/N0
10	4.2	0.032	49	5.38	208/500

Table 3: The case of one 1.5 GHz prebuncher, one 3 GHz prebuncher, and one TW buncher. The satellite charge is 21.9%

Ez0 (MV/m)	W (MeV)	dW (MeV)	En (mm.mrad)	dPhi (degree)	N/N0
10	4.12	0.040	37.5	4.7	244/500

Table 4: The case of one 1.5 GHz prebuncher, and one TW buncher. The satellite charge is 13.3%

Ez0 (MV/m)	W (MeV)	dW (MeV)	En (mm.mrad)	dPhi (degree)	N/N0
10	4.07	0.035	44	5.63	222/500

Table 5: The case of two 1.5 GHz prebuncher, and one TW buncher. The satellite charge is 10.3%

Figure 4: Two 3GHz prebuncher case with DC gun of 90 KV.

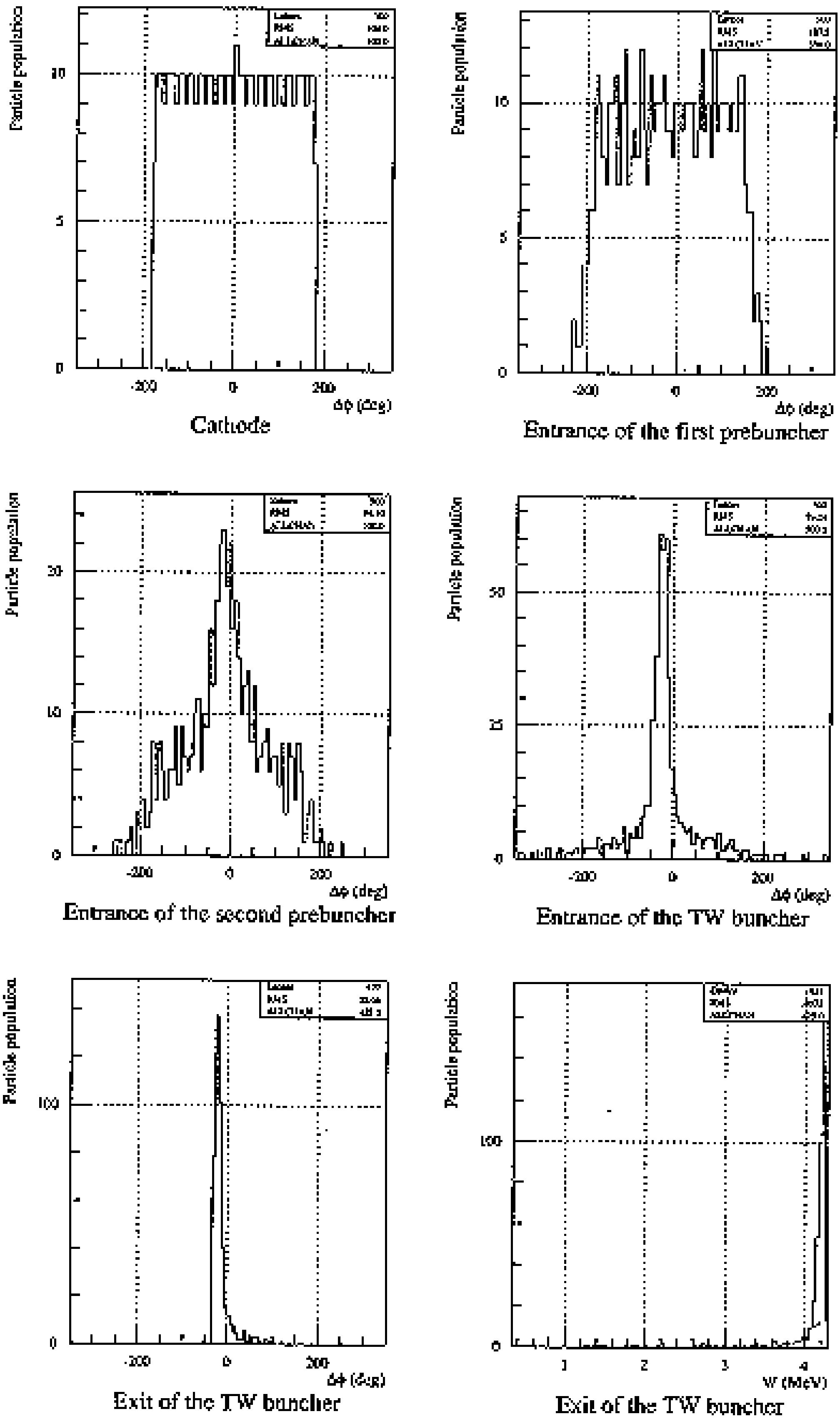
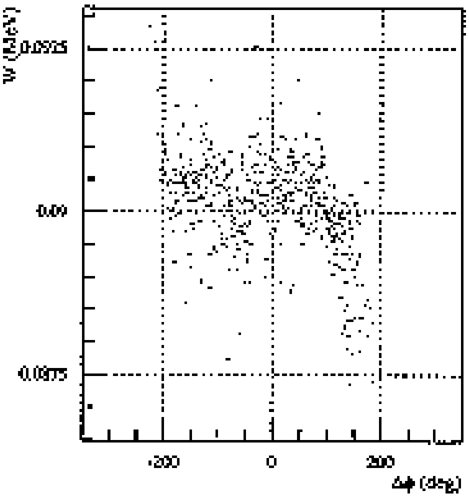
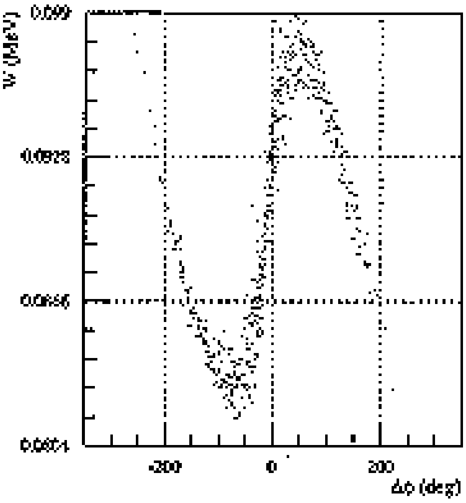


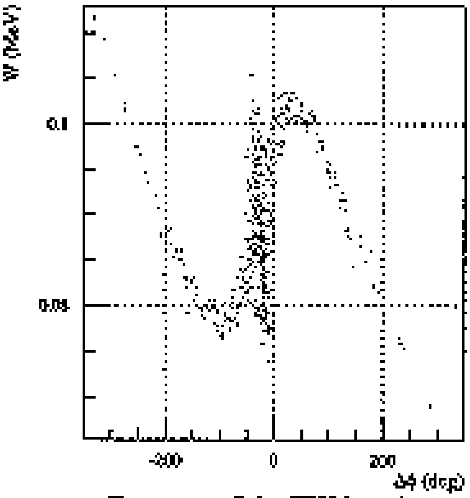
Figure 5: Two 3GHz prebuncher case with DC gun of 90 KV.



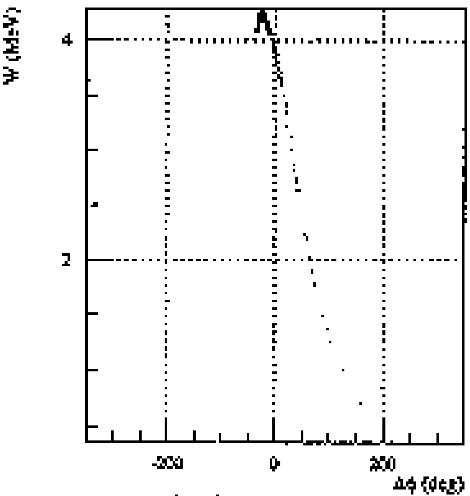
Entrance of the first prebuncher



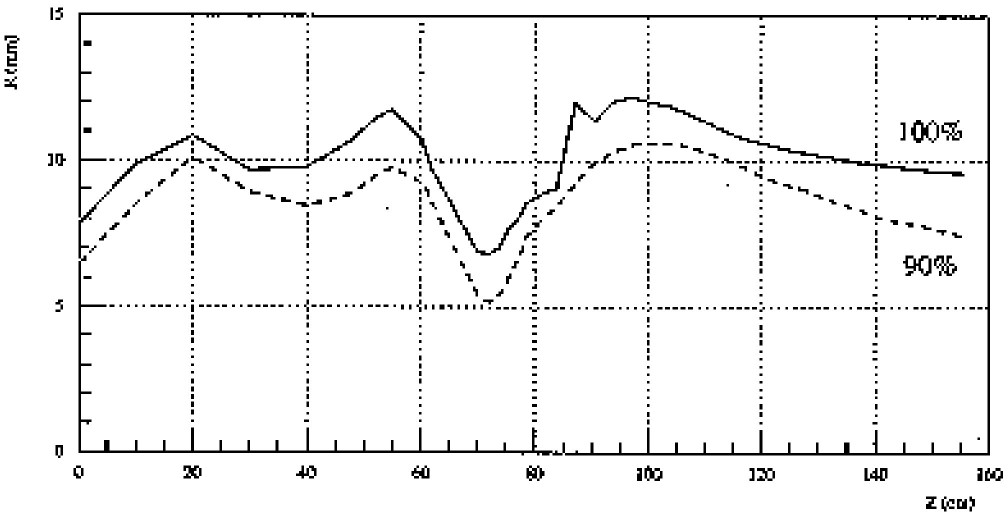
Entrance of the second prebuncher



Entrance of the TW buncher



Exit of the TW buncher



Beam envelope

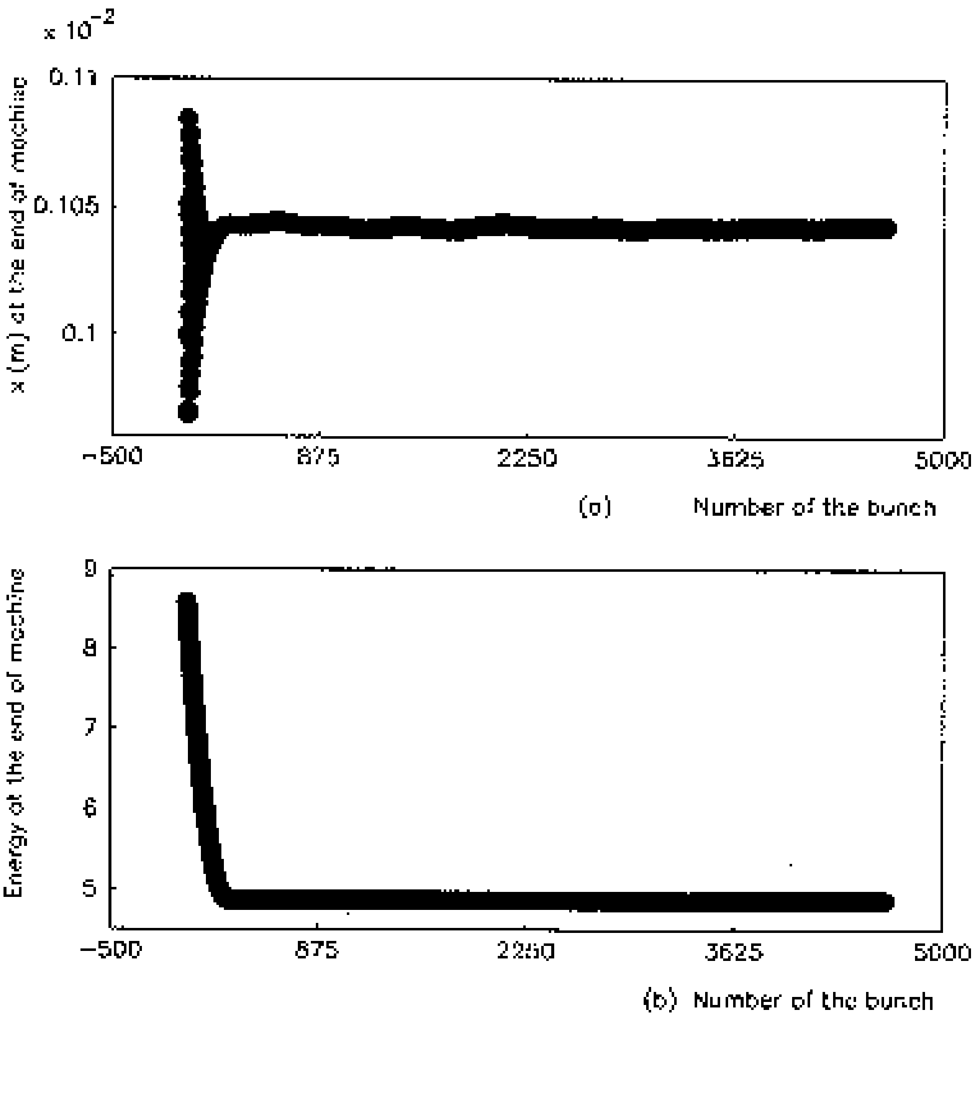


Figure 26: The bunch separation is 10 cm, and the TW buncher is not damped. (a) The transverse motion of a bunch train with an initial offset of 1 mm. (b) The energy gain of the bunch train.

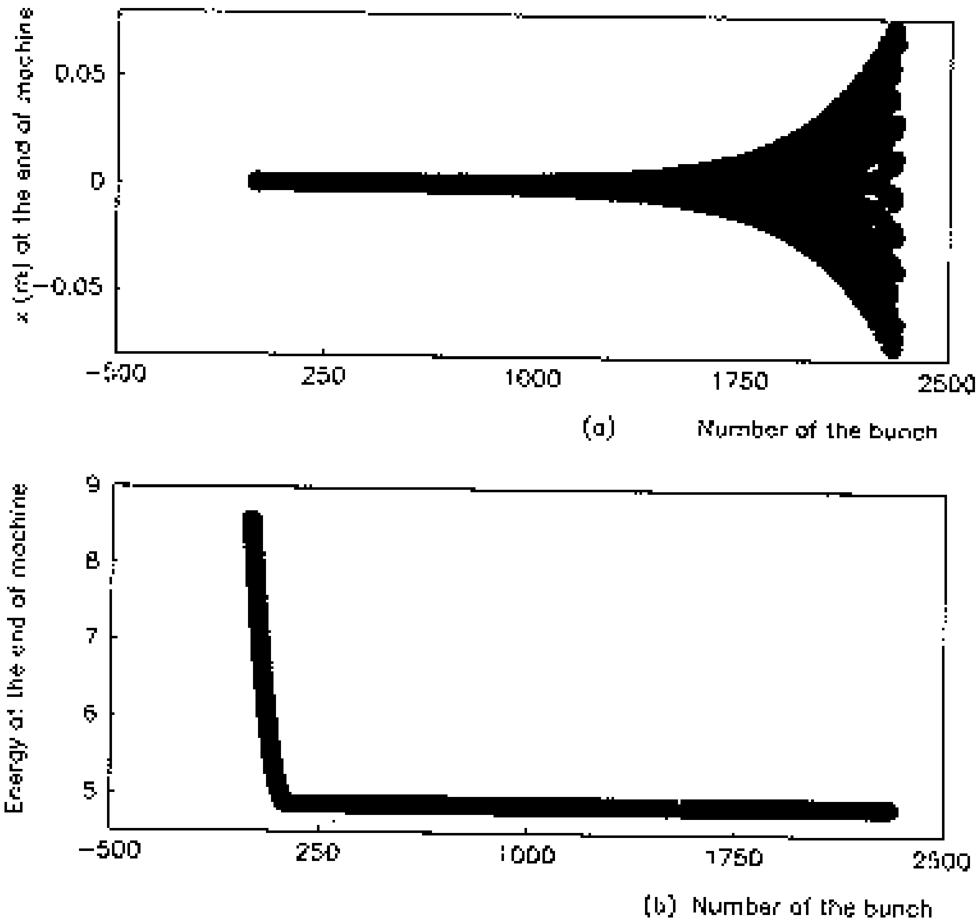


Figure 27: The bunch separation is 20 cm, and the TW buncher is damped with $Q_{L,110} = 93$. (a) The transverse motion of a bunch train with an initial offset of 1 mm. (b) The energy gain of the bunch train.

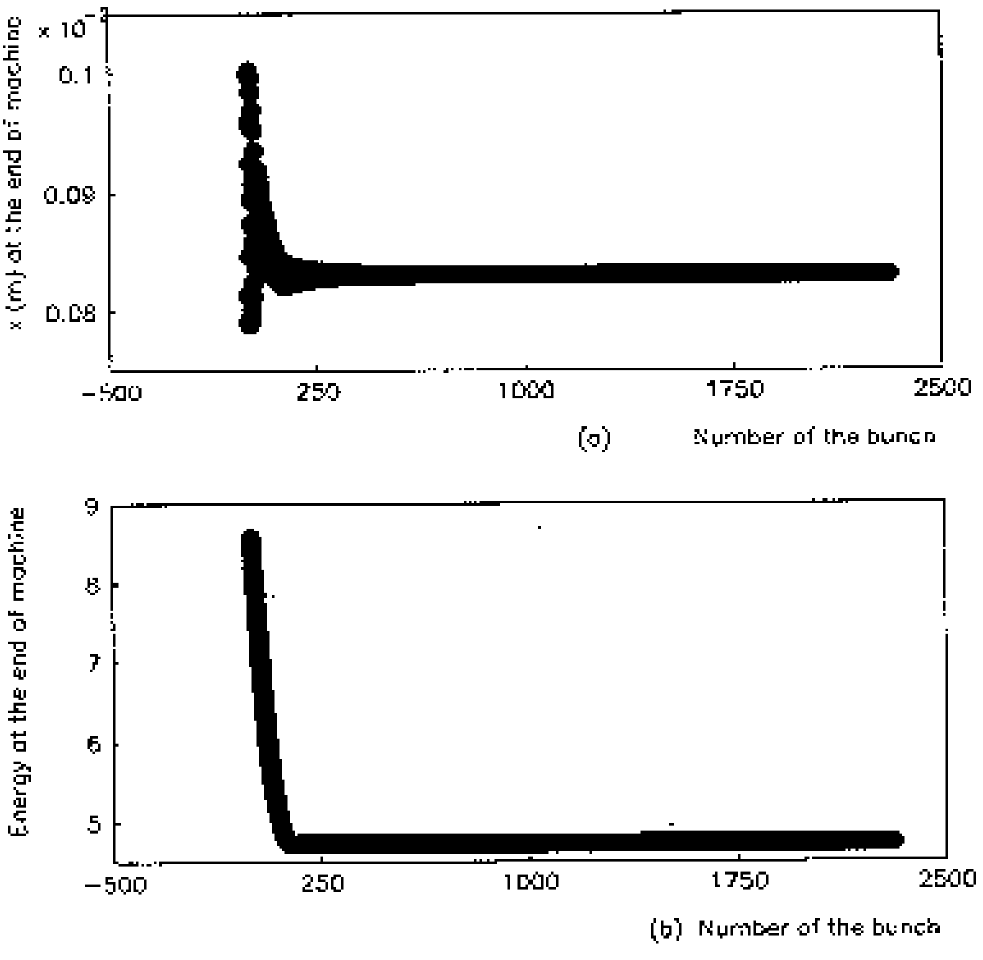


Figure 28: The bunch separation is 20 cm, and the TW buncher is damped with $Q_{L,110} = 80$. (a) The transverse motion of a bunch train with an initial offset of 1 mm. (b) The energy gain of the bunch train.