

Longitudinal single-bunch stability in the NLC damping ring

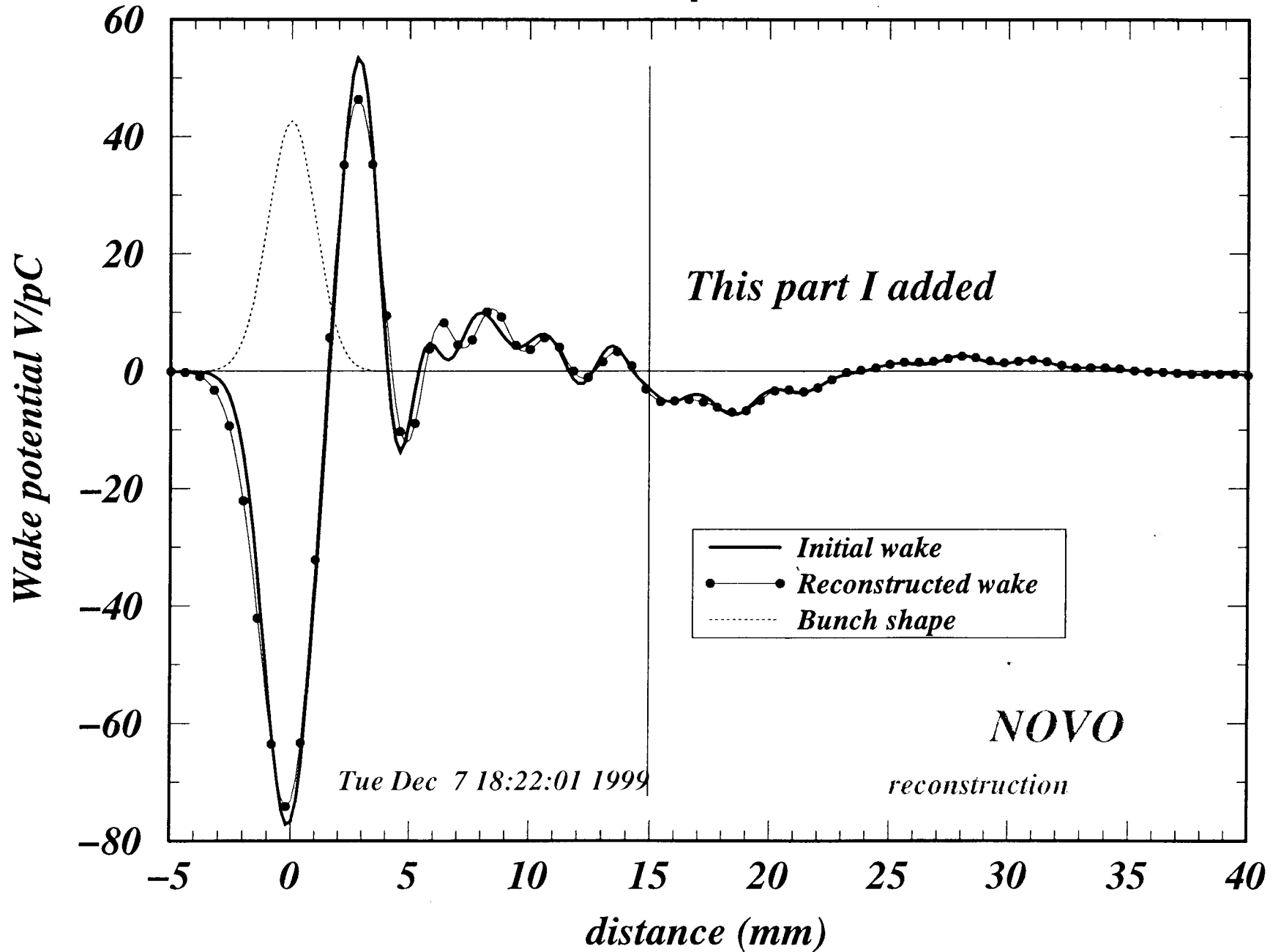
Dr. Alexandre Novokhatski
Technische Universität Darmstadt

February 25, 2000.

*Workshop on broadband impedance measurements and modeling
SLAC, Stanford, Ca
February 28 - March 2.*

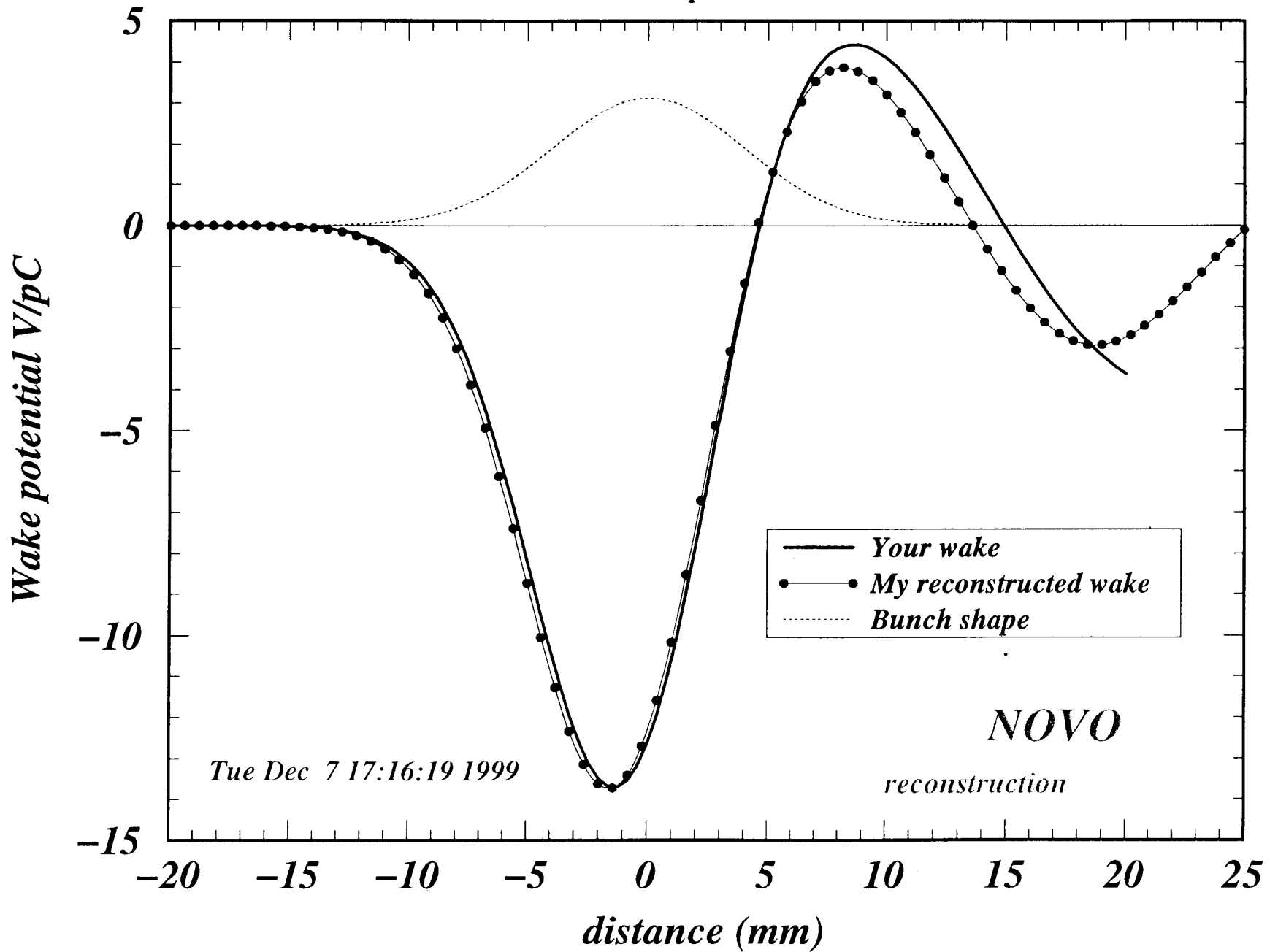
Wake ($\sigma=1\text{mm}$) by wake ($\sigma=1\text{mm}$)

Comparison



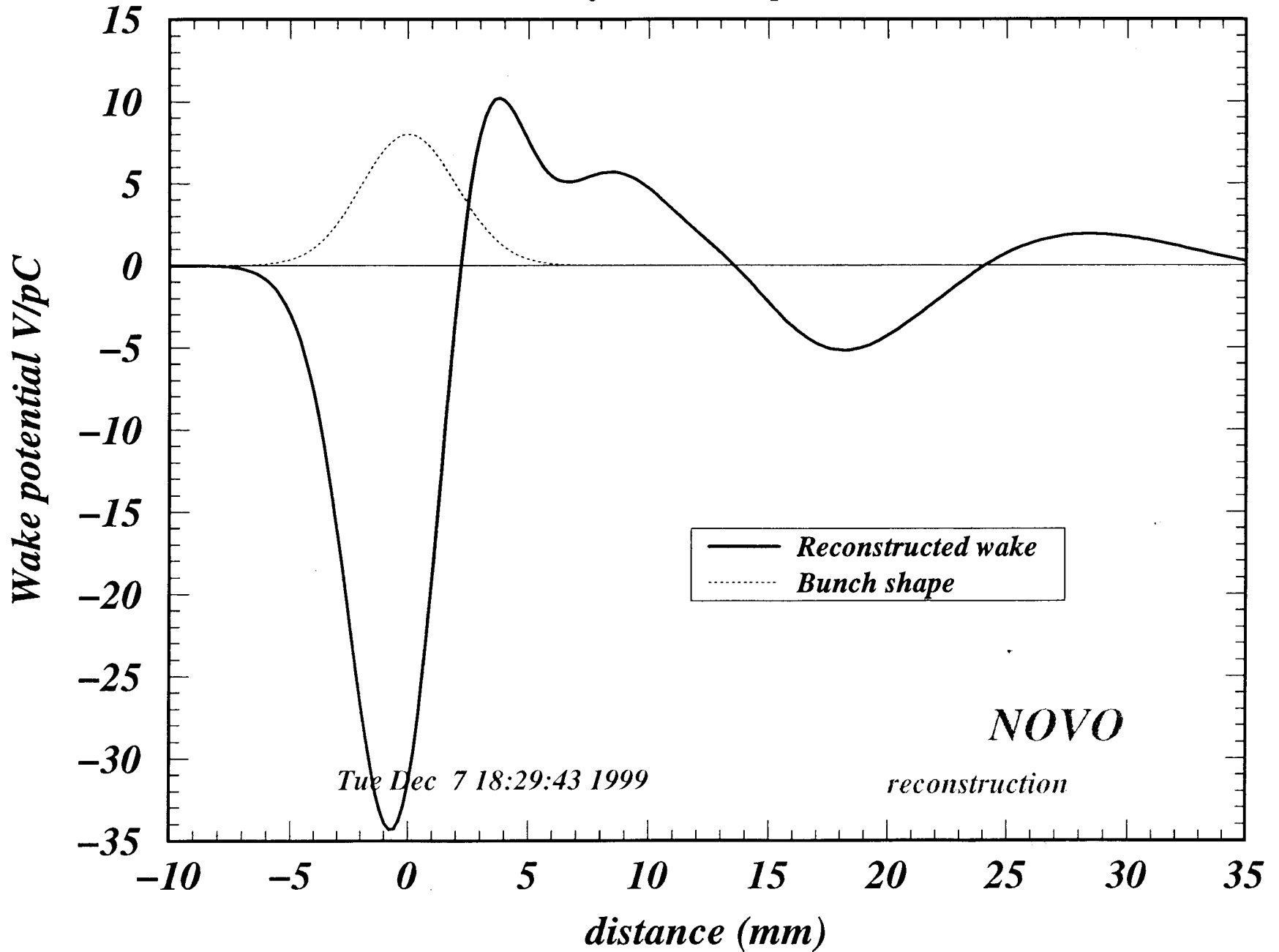
Wake ($\sigma=4\text{mm}$) by wake ($\sigma=1\text{mm}$)

Comparison



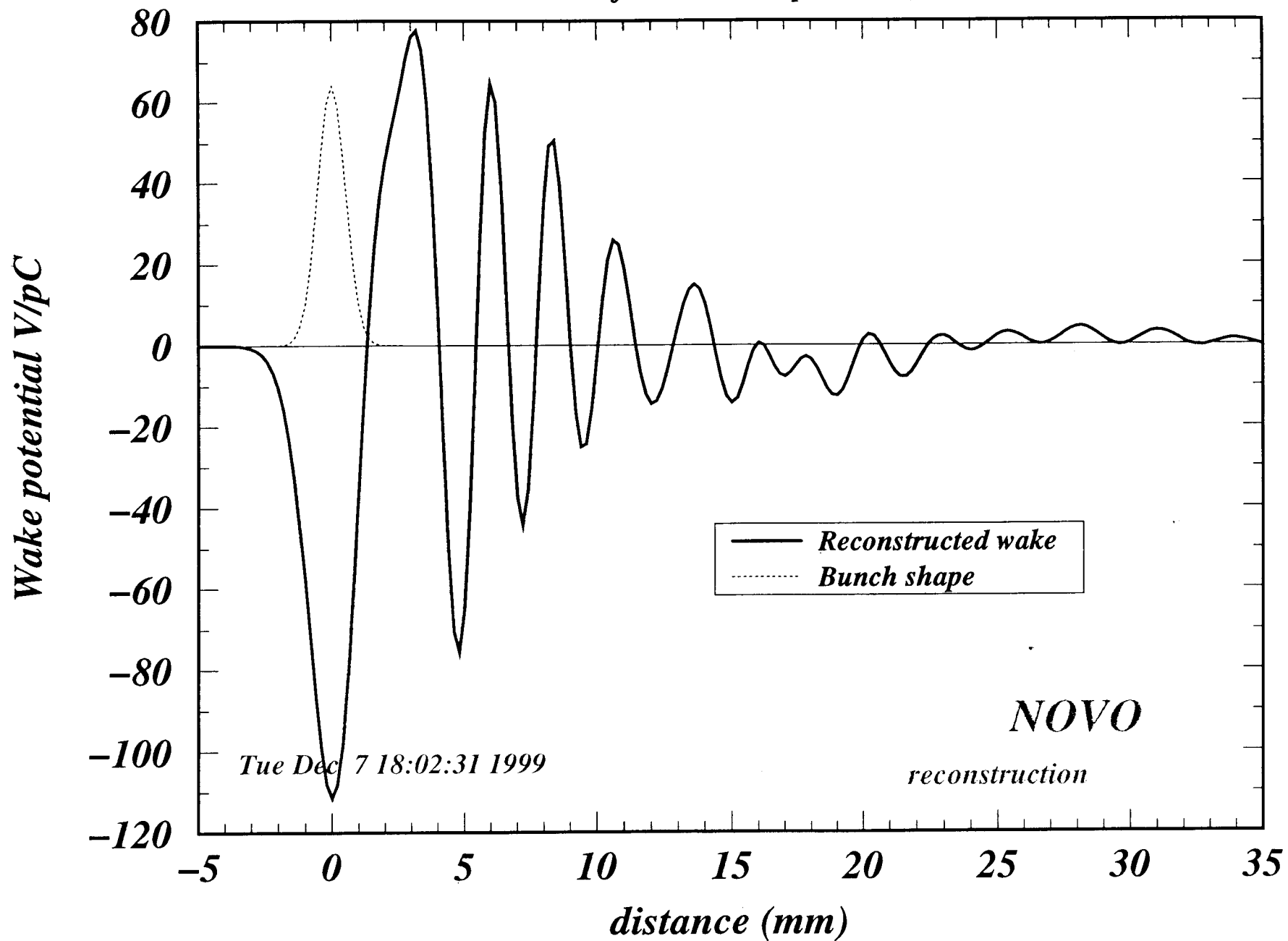
Wake Potential ($\sigma=2\text{mm}$)

reconstructed from the wake potential ($\sigma=1\text{mm}$)



Wake Potential ($\sigma=0.5\text{mm}$)

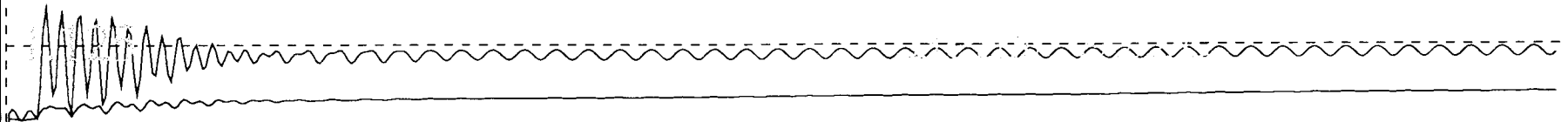
reconstructed from the wake potential ($\sigma=1\text{mm}$)



DNLC

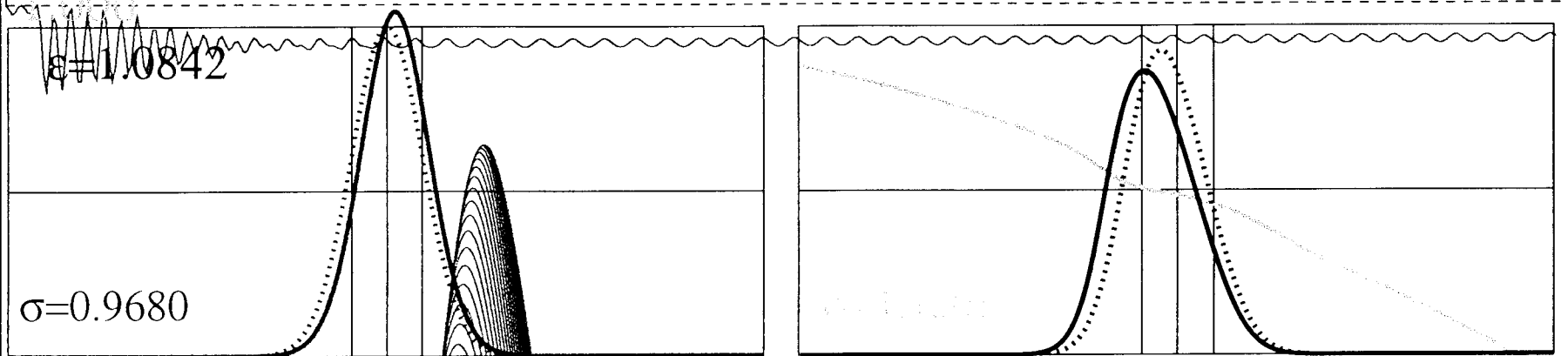
Quasi Green file -DNLC.gre

Emittance



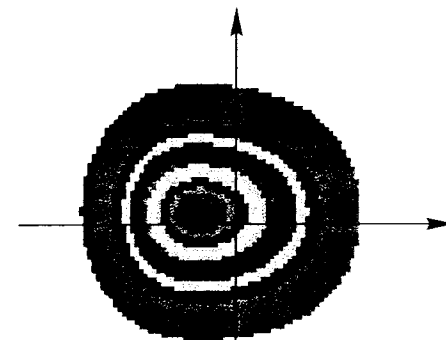
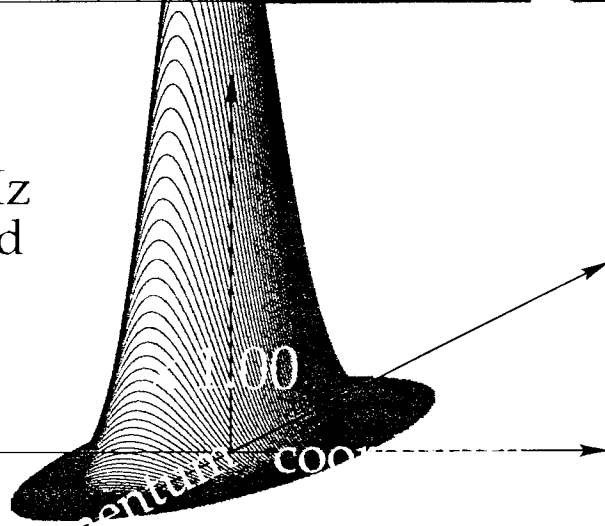
Momentum spread

Time-> 50.00



$\sigma_0 = 3.8 \text{ mm}$
 $q = 5.2 \text{ nC}$
 Volt. = 1.50 MV
 Freq. = 714.0 MHz
 Phase = 32.0 grad
 Stune = 0.0068
 modu = 0.0000
 Damp = 1000.0

NxN = 400x400
 N/sigma = 19.00
 TET = 0.0010
 Konto = 0.9990



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Sun Dec 12 13:13:05 1999

DNLC

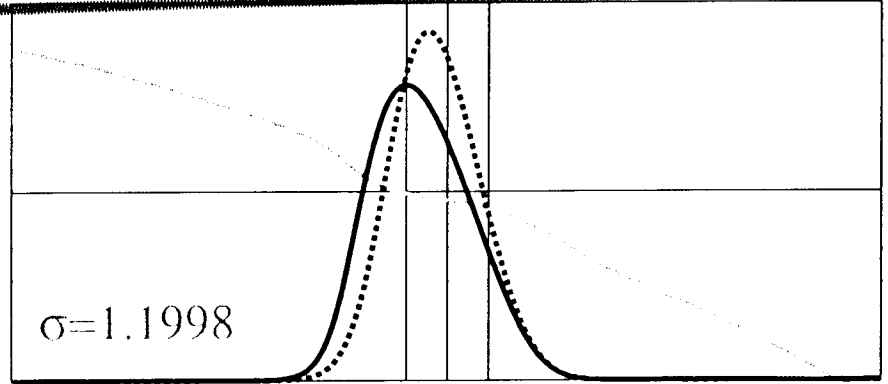
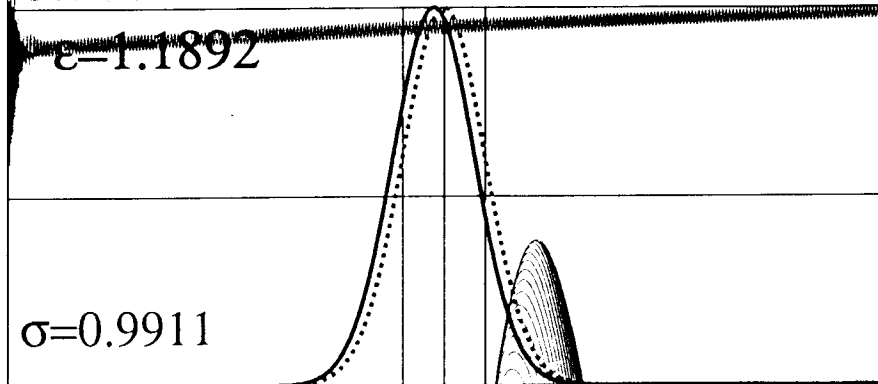
Quasi Green file -DNLC.gre

Emittance

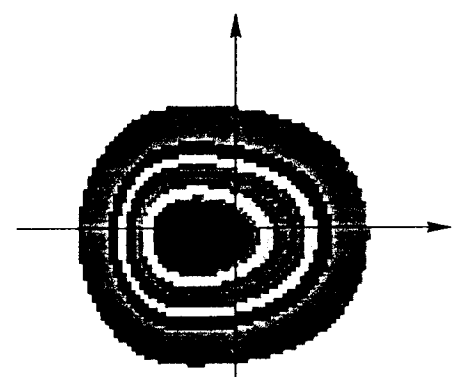
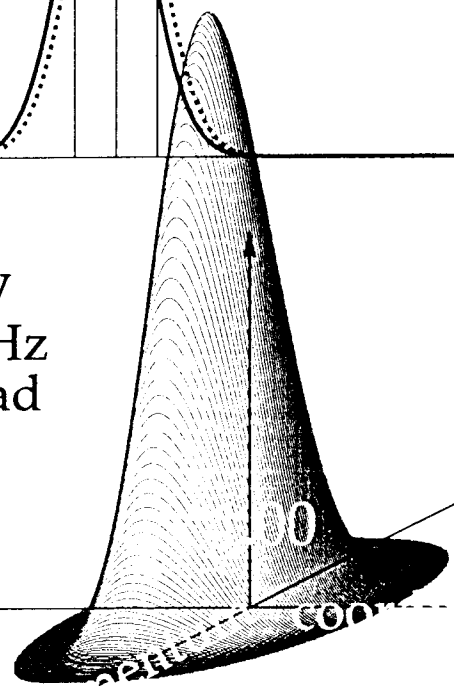
Beam size

Momentum spread

Time-> 538.00



$\sigma_0 = 3.8 \mu\text{m}$
 $q = 7.8 \text{ nC}$
 Volt. = 1.50 MV
 Freq. = 714.0 MHz
 Phase = 32.0 grad
 Stune = 0.0068
 modu = 0.0000
 Damp = 1000.0
 NxN = 400x400
 N/sigma = 19.00
 TET = 0.0010
 Konto = 0.9894

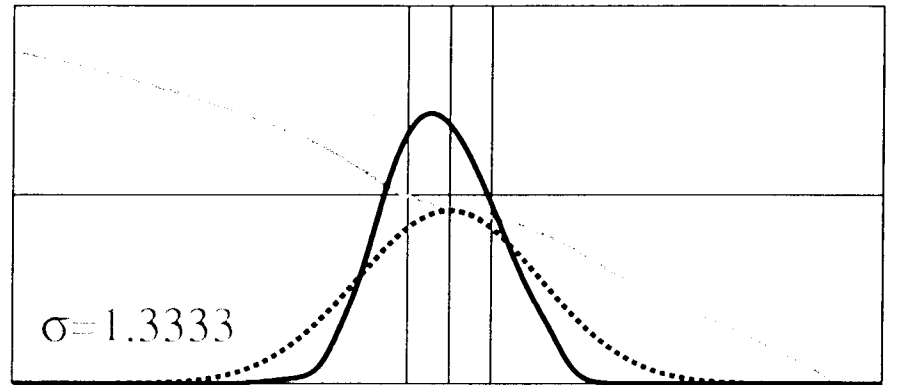
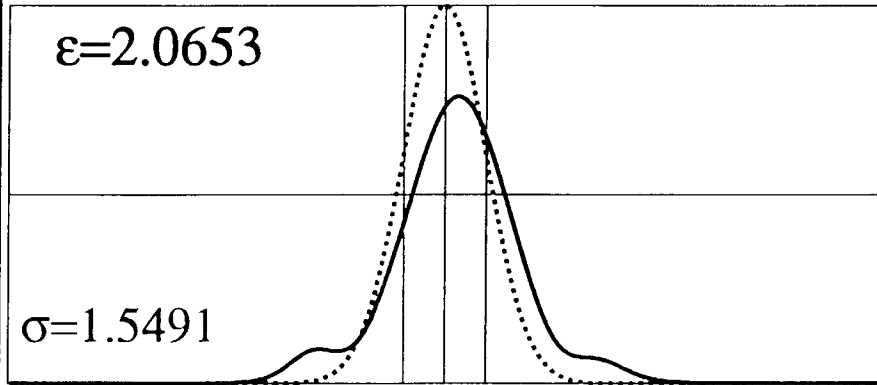
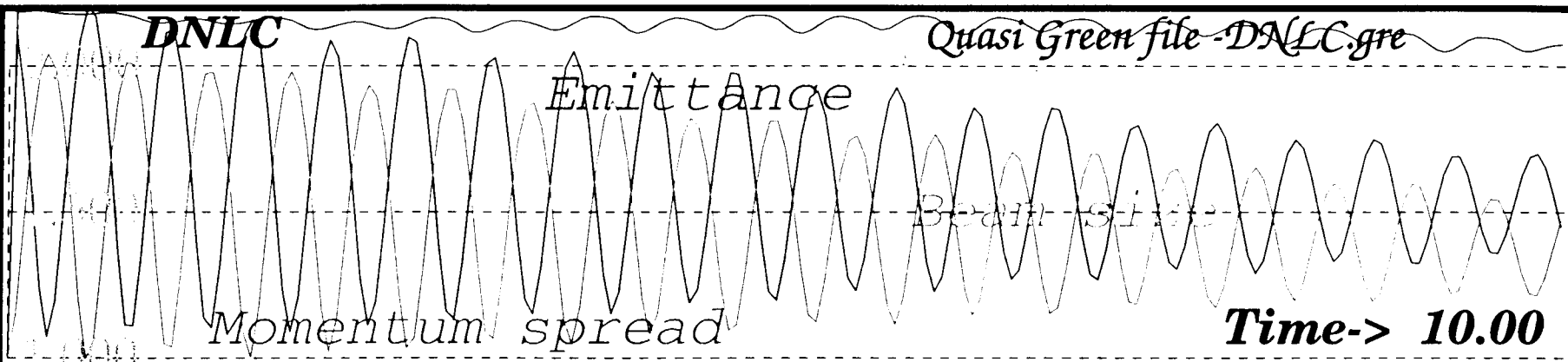


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Mon Dec 13 09:22:23 1999 /

DNLC

Quasi Green file -DNLC.gre



$\sigma_0 = 3.8 \mu\text{m} (8.3)$

$q = 7.8 \text{ nC}$

Volt.= 1.50 MV

Freq.=714.0MHz

Phase= 32.0grad

Stune= 0.0068

modu= 0.0000

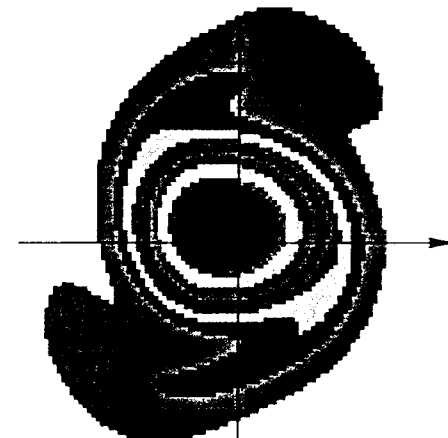
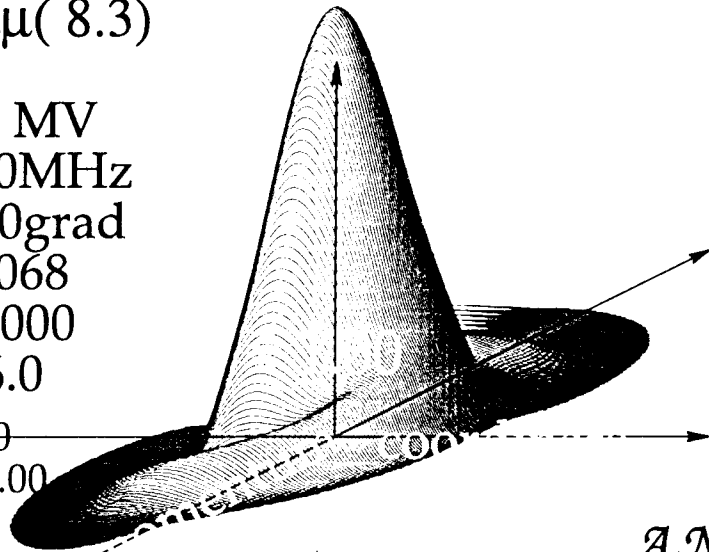
Damp= 36.0

$N \times N = 400 \times 400$

$N/\sigma = 19.00$

TET=0.0010

Konto=1.0002



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Fri Feb 25 19:25:30 2000

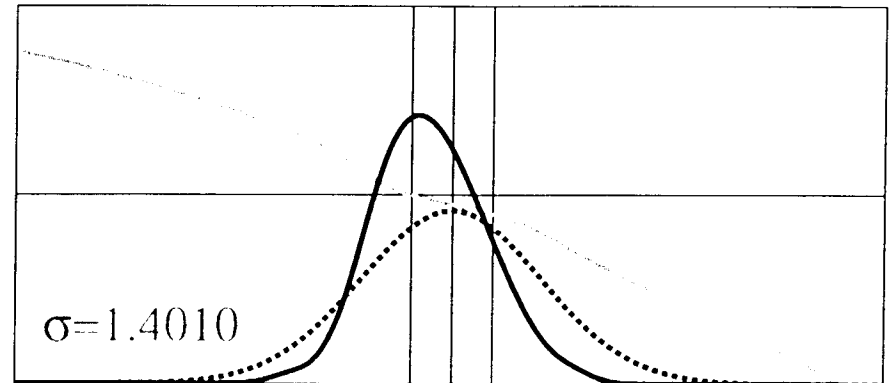
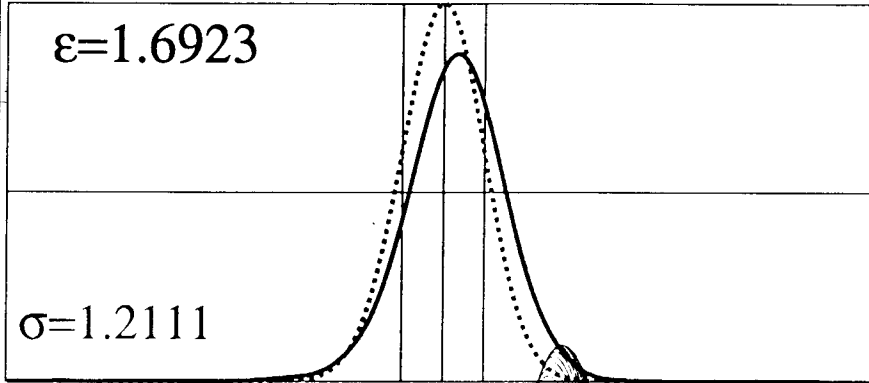
BNLC

Quasi Green file -DNLC.gre

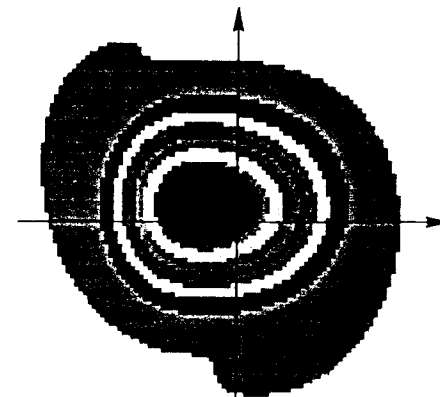
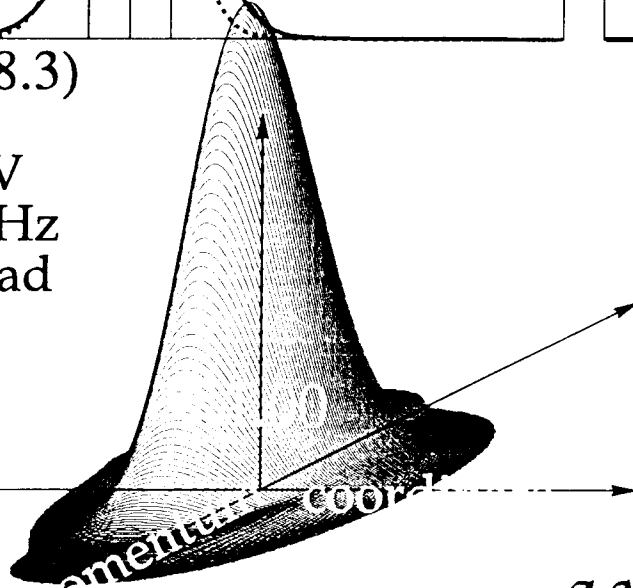
Emittance

Momentum spread

Time-> 20.00



$\sigma_0 = 3.8 \mu\mu (8.3)$
 $q = 7.8 \text{ nC}$
 Volt.= 1.50 MV
 Freq.=714.0MHz
 Phase= 32.0grad
 Stune= 0.0068
 modu= 0.0000
 Damp= 36.0
 NxN=400x400
 N/sigma= 19.00
 TET=0.0010
 Konto=1.0004



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Fri Feb 25 19:32:57 2000

DNLC

Quasi Green file -DNLC.gre

Emittance

Beam size

Momentum spread

Time-> 40.00

$\epsilon=1.0629$

$\sigma=0.9968$

$\sigma=1.0662$

$\sigma_0 = 3.8 \mu\mu$ (scribble)

$q = 2.6 \text{ nC}$

Volt.= 1.50 MV

Freq.=714.0MHz

Phase= 32.0grad

Stune= 0.0068

modu= 0.0000

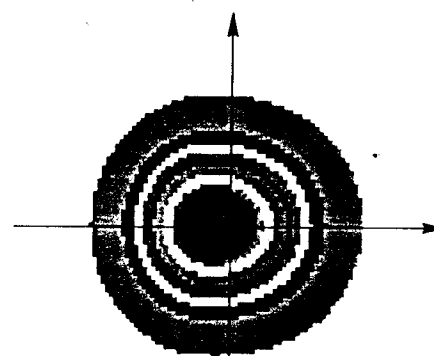
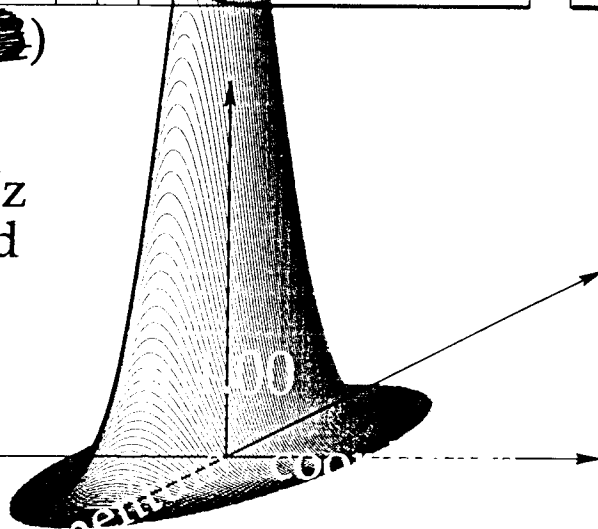
Damp=1000.0

$N \times N = 400 \times 400$

$N/\sigma = 19.00$

TET=0.0010

Konto=0.9992



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Fri Feb 25 20:54:19 2000

DNLC

Quasi Green file -DNLC.gre

Emittance

Momentum spread

Time-> 72.00

$\epsilon=1.2277$

$\sigma=1.0074$

$\sigma=1.2187$

$\sigma_0 = 3.8 \mu\mu(8.3)$

$q = 7.8 \text{ nC}$

Volt.= 1.50 MV

Freq.=714.0MHz

Phase= 32.0grad

Stune= 0.0068

modu= 0.0000

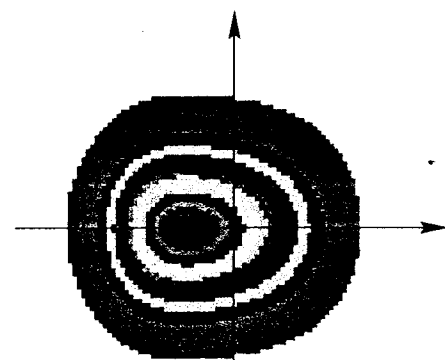
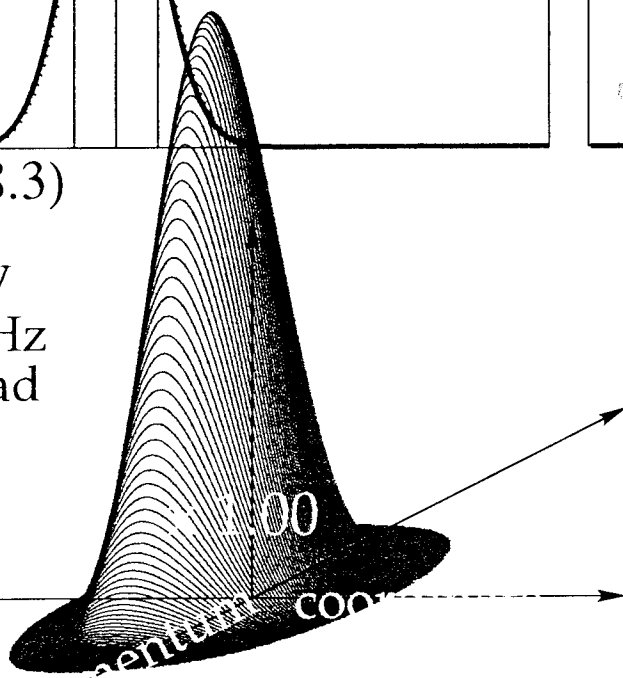
Damp= 36.0

NxN=400x400

N/sigma= 19.00

TET=0.0010

Konto=1.0014



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Mon Dec 13 12:09:45 1999

DNLC

Quasi Green file -DNLC.gre

Emittance

Beam size

Momentum spread

Time-> 110.00

$\epsilon=1.2134$

$\sigma=1.0015$

$\sigma=1.2116$

$\sigma_0 = 3.8 \mu\text{m} (8.3)$

$q = 7.8 \text{ nC}$

Volt. = 1.50 MV

Freq. = 714.0 MHz

Phase = 32.0 grad

Stune = 0.0068

modu = 0.0000

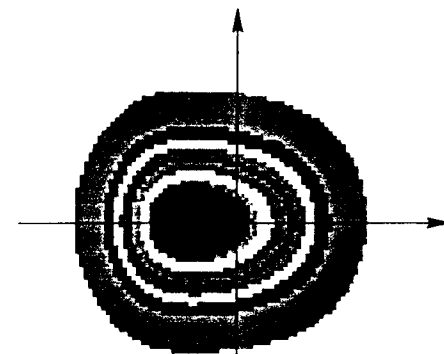
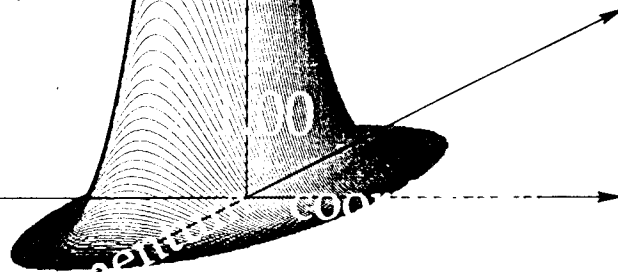
Damp = 36.0

NxN = 400x400

N/sigma = 19.00

TET = 0.0010

Konto = 1.0000



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Mon Dec 13 15:15:54 1999

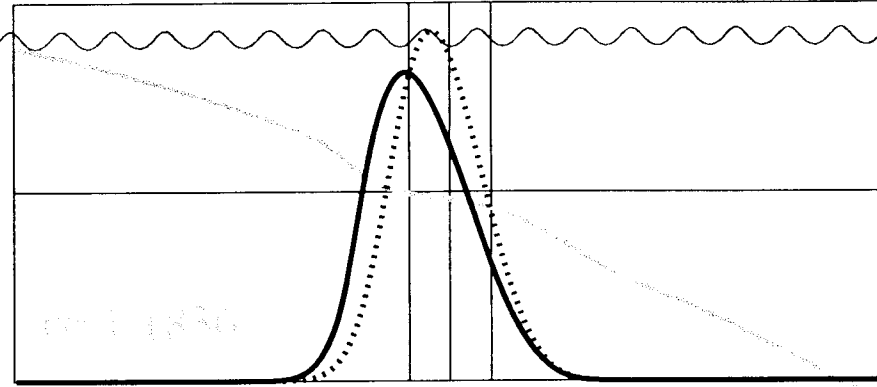
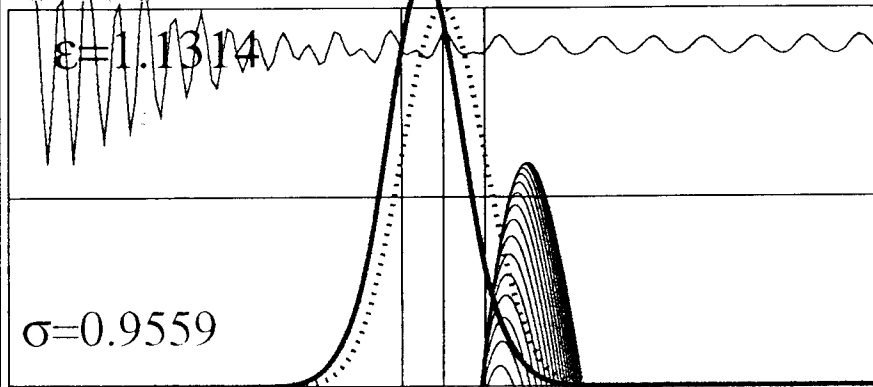
DNLC

Quasi Green file -DNLC.gre

Emittance

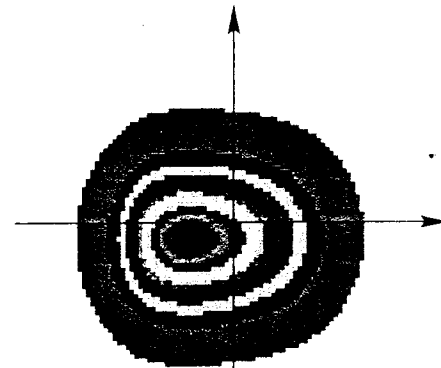
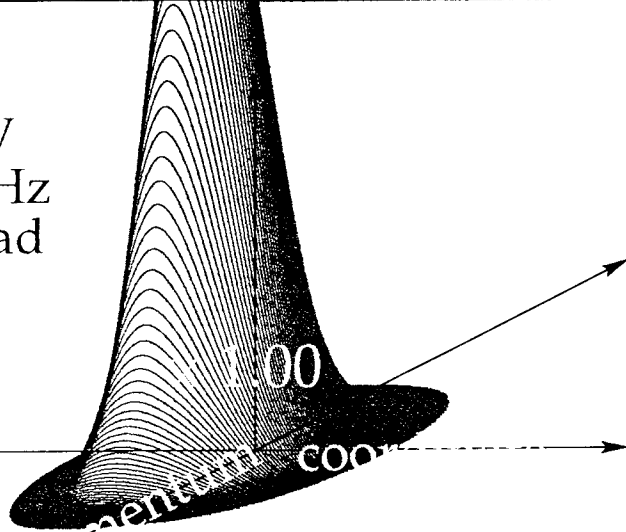
Momentum spread

Time-> 35.00



$\sigma_0 = 3.8 \mu\mu$
 $q = 7.8 \text{ nC}$
 Volt. = 1.50 MV
 Freq. = 714.0 MHz
 Phase = 32.0 grad
 Stune = 0.0068
 modu = 0.0000
 Damp = 1000.0

$N \times N = 400 \times 400$
 $N / \sigma = 19.00$
 TET = 0.0010
 Konto = 0.9993



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Sun Dec 12 14:46:05 1999

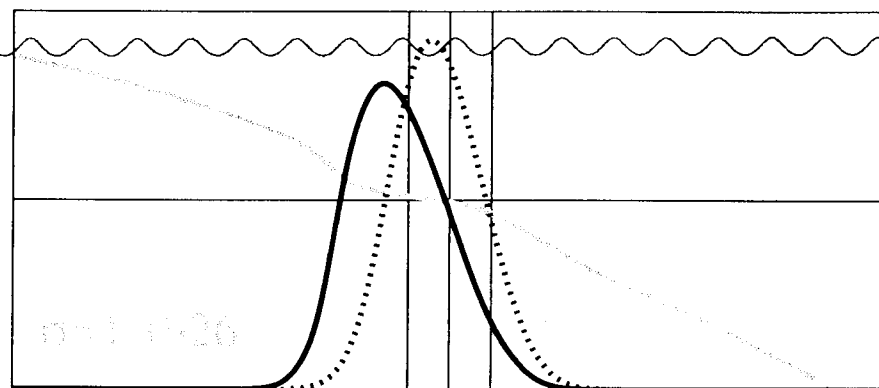
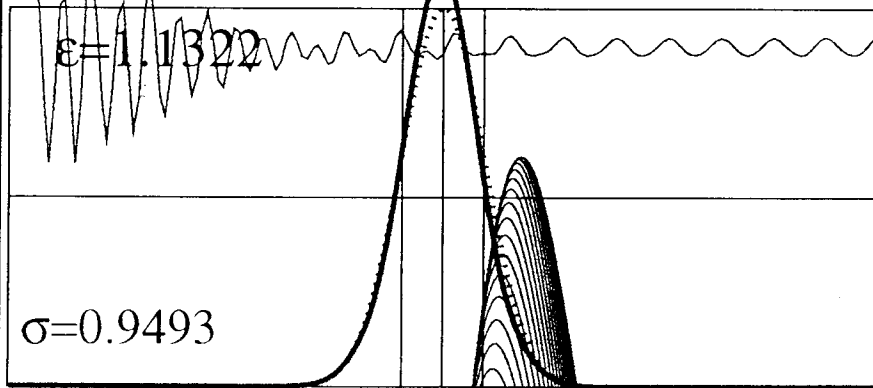
DNLC

Quasi Green file -DNLC.gre

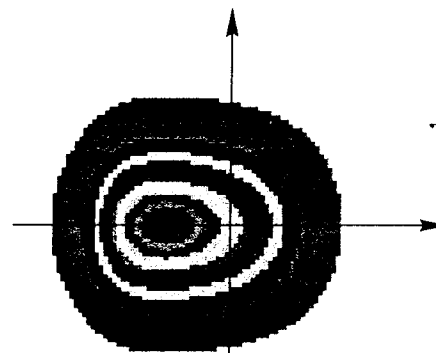
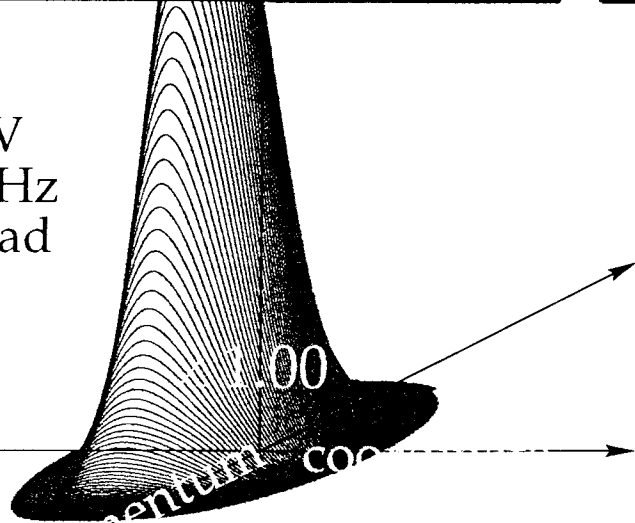
Emittance

Momentum spread

Time-> 34.25



$\sigma_0 = 3.8 \mu\text{m}$
 $q = 7.8 \text{ nC}$
 Volt.= 1.50 MV
 Freq.=714.0MHz
 Phase= 32.0grad
 Stune= 0.0068
 modu= 0.0000
 Damp=1000.0
 NxN=400x400
 N/sigma= 19.00
 TET=0.0010
 Konto=0.9993



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Sun Dec 12 14:41:47 1999

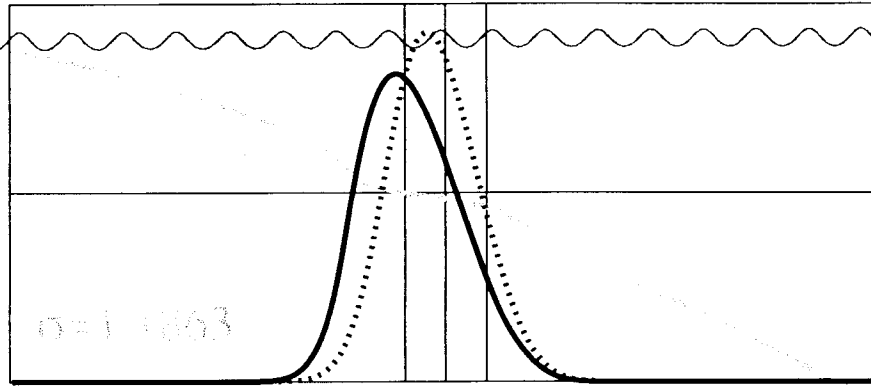
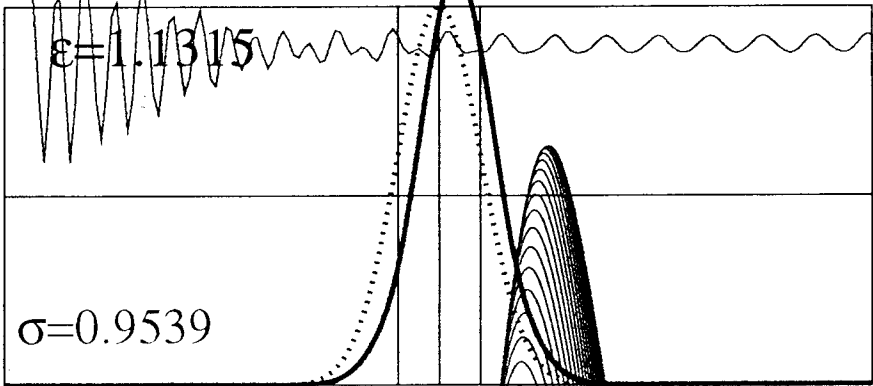
DNLC

Quasi Green file -DNLC.gre

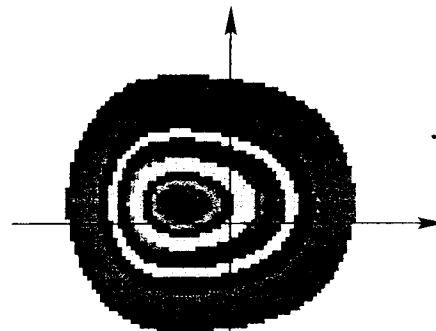
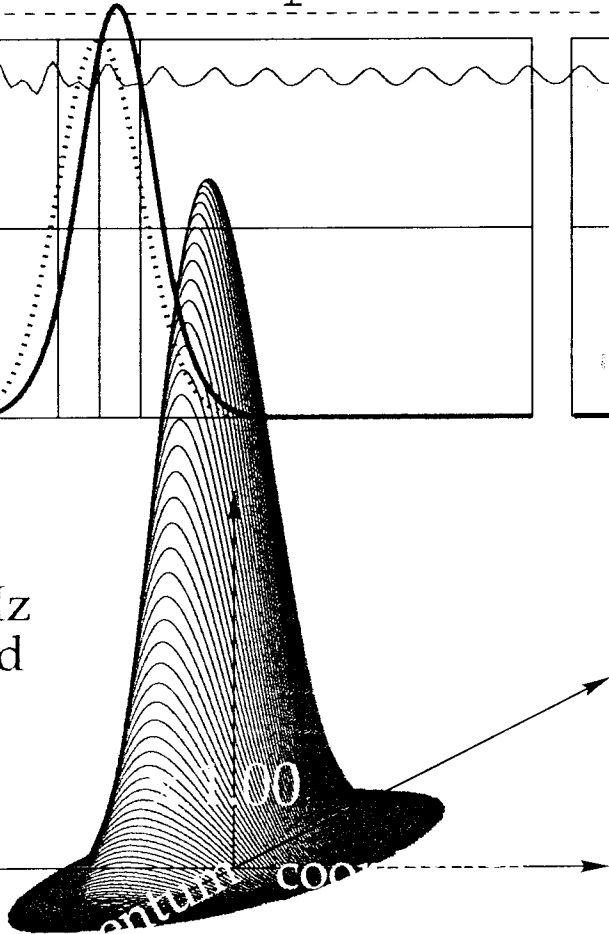
Emittance

Momentum spread

Time-> 34.50



$\sigma_0 = 3.8 \mu\text{m}$
 $q = 7.8 \text{ nC}$
 Volt. = 1.50 MV
 Freq. = 714.0 MHz
 Phase = 32.0 grad
 Stune = 0.0068
 modu = 0.0000
 Damp = 1000.0
 NxN = 400x400
 N/sigma = 19.00
 TET = 0.0010
 Konto = 0.9993



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Sun Dec 12 14:43:51 1999

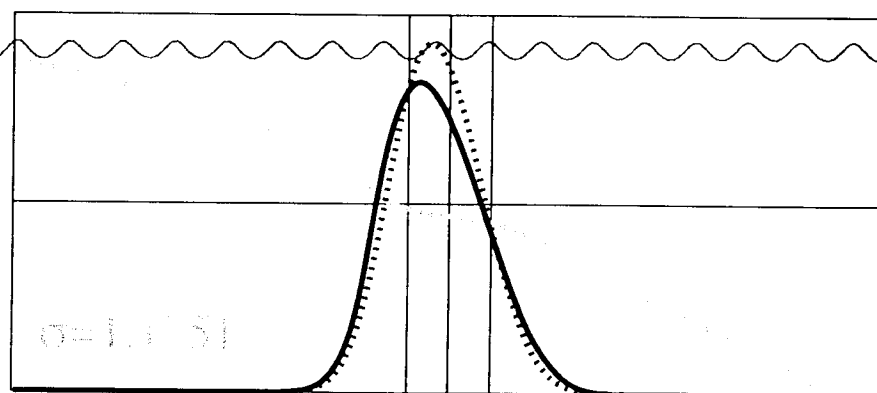
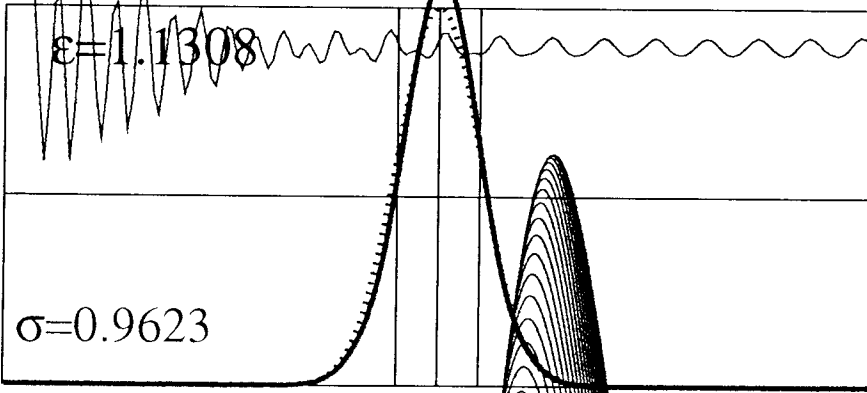
DNLC

Quasi Green file -DNLC.gre

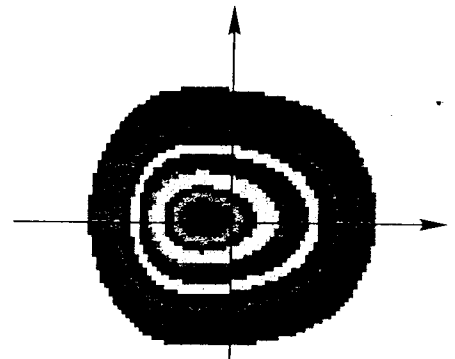
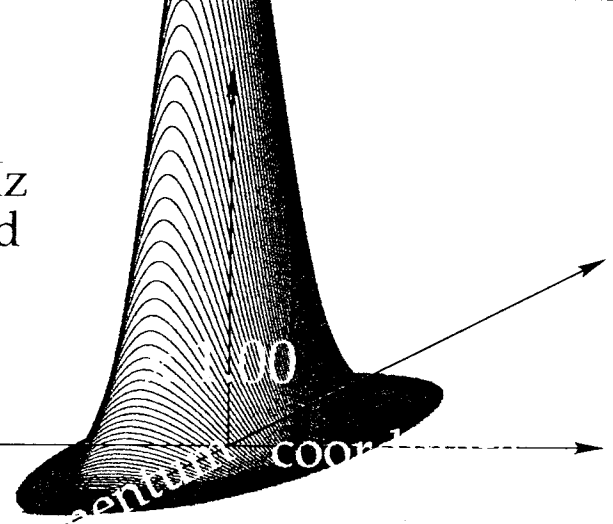
Emittance

Momentum spread

Time-> 34.75



$\sigma_0 = 3.8 \mu\mu$
 $q = 7.8 \text{ nC}$
 Volt.= 1.50 MV
 Freq.=714.0MHz
 Phase= 32.0grad
 Stune= 0.0068
 modu= 0.0000
 Damp=1000.0
 NxN=400x400
 N/sigma= 19.00
 TET=0.0010
 Konto=0.9993



A.Novokhatski TEMF TU Darmstadt

Sun Dec 12 14:44:43 1999

1 Some results for the longitudinal dynamics in the NLC damping ring.

Simulation is done on the solution of Fokker-Planck equation with the wake field.

Wake potential was calculated by Cho Ng.

It is reconstructed by using the quasi Green function.

The parameters for the machine are taken from J. Corlett talk at LC'99.

For nominal bunch charge we have only potential well distortion, bunchlengthening is 6.3 %

RF instability appears at the bunch charge of two times large, but with very small increment.

More clearly this instability can be seen at the bunch charge of three times large and without radiation damping.

Fortunately the radiation damping cancel partially this instability. The bunch length is changing from initial 8.3 mm to 4.6 mm in ~~the~~ three damping times.