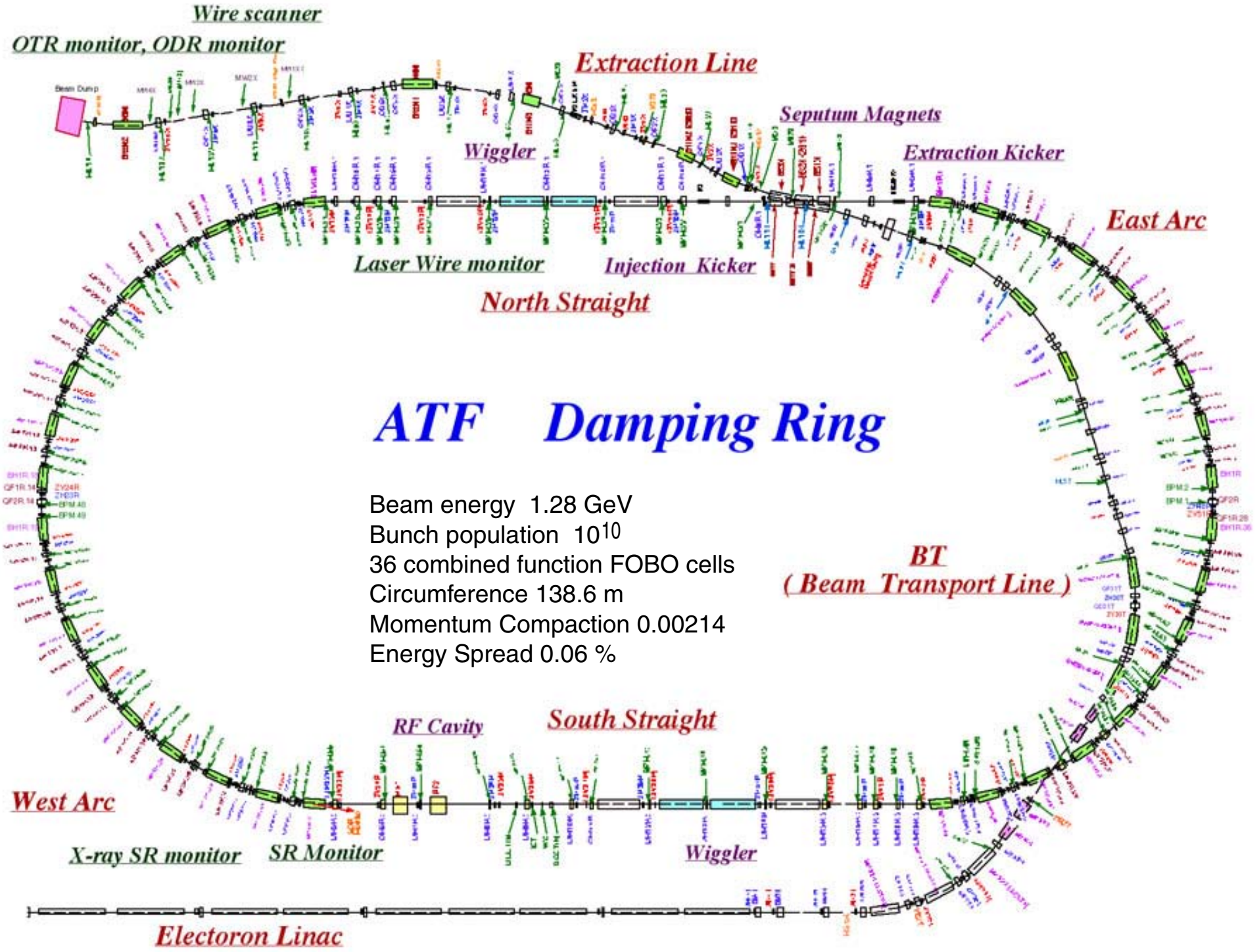
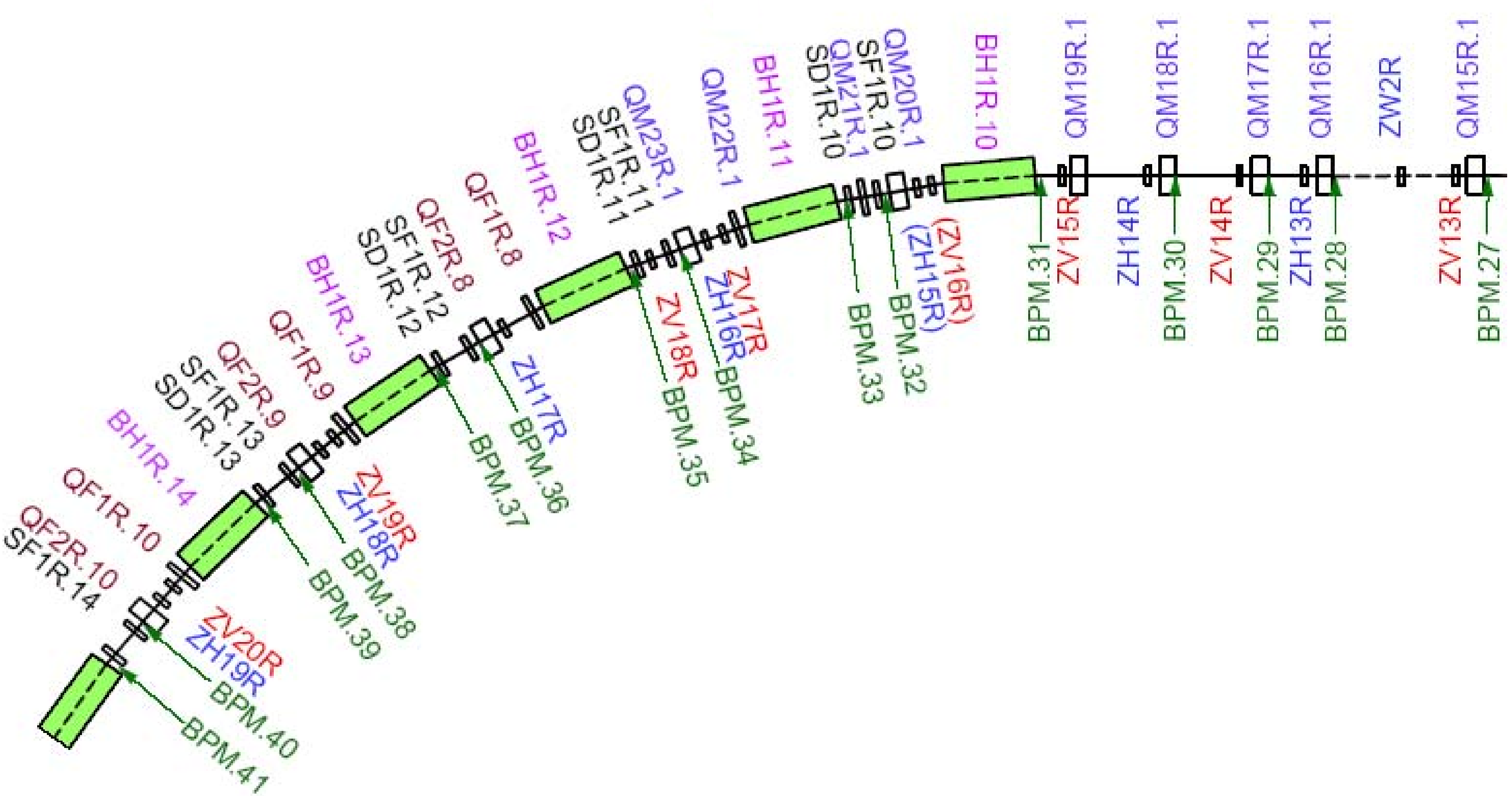
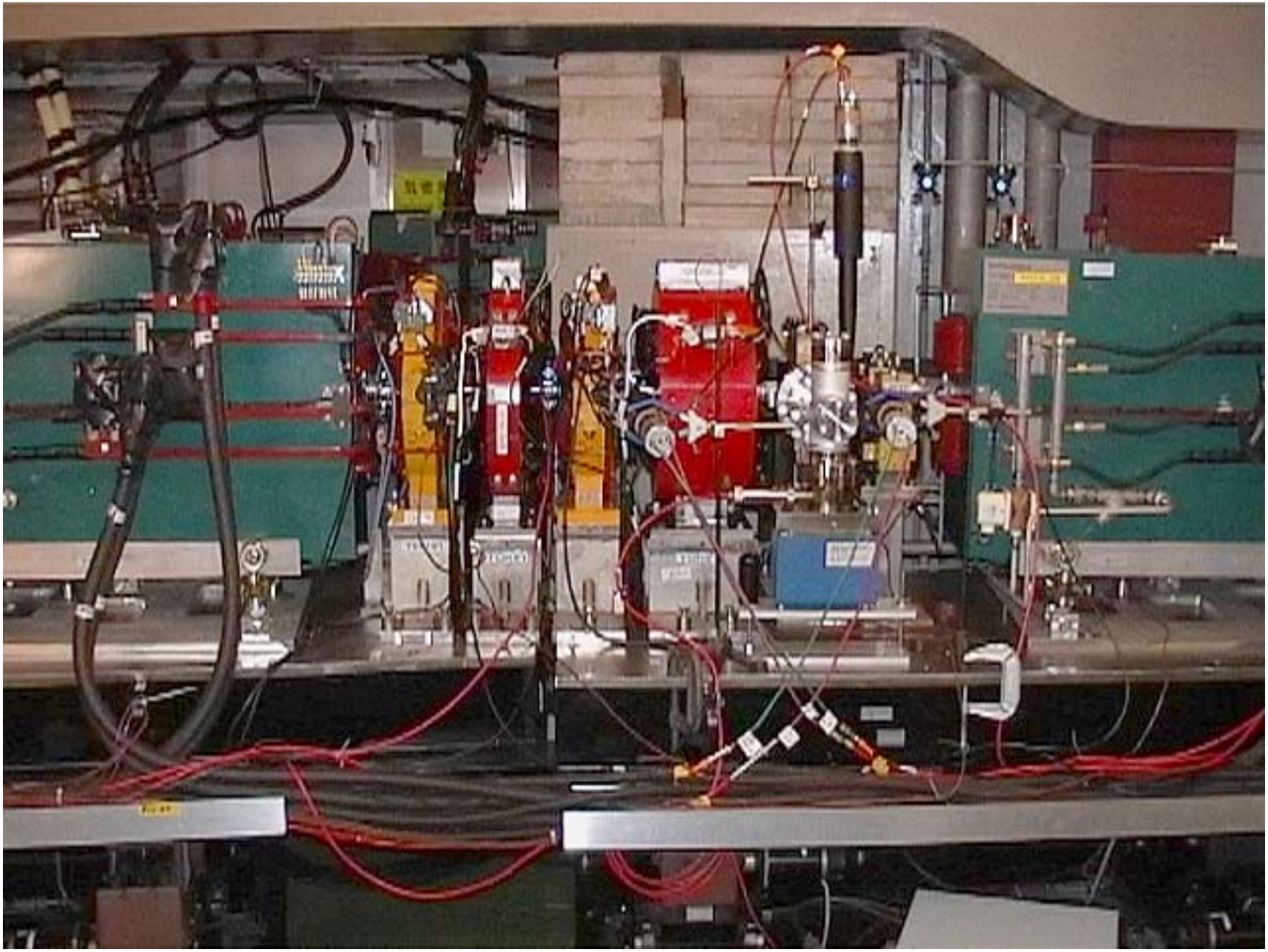
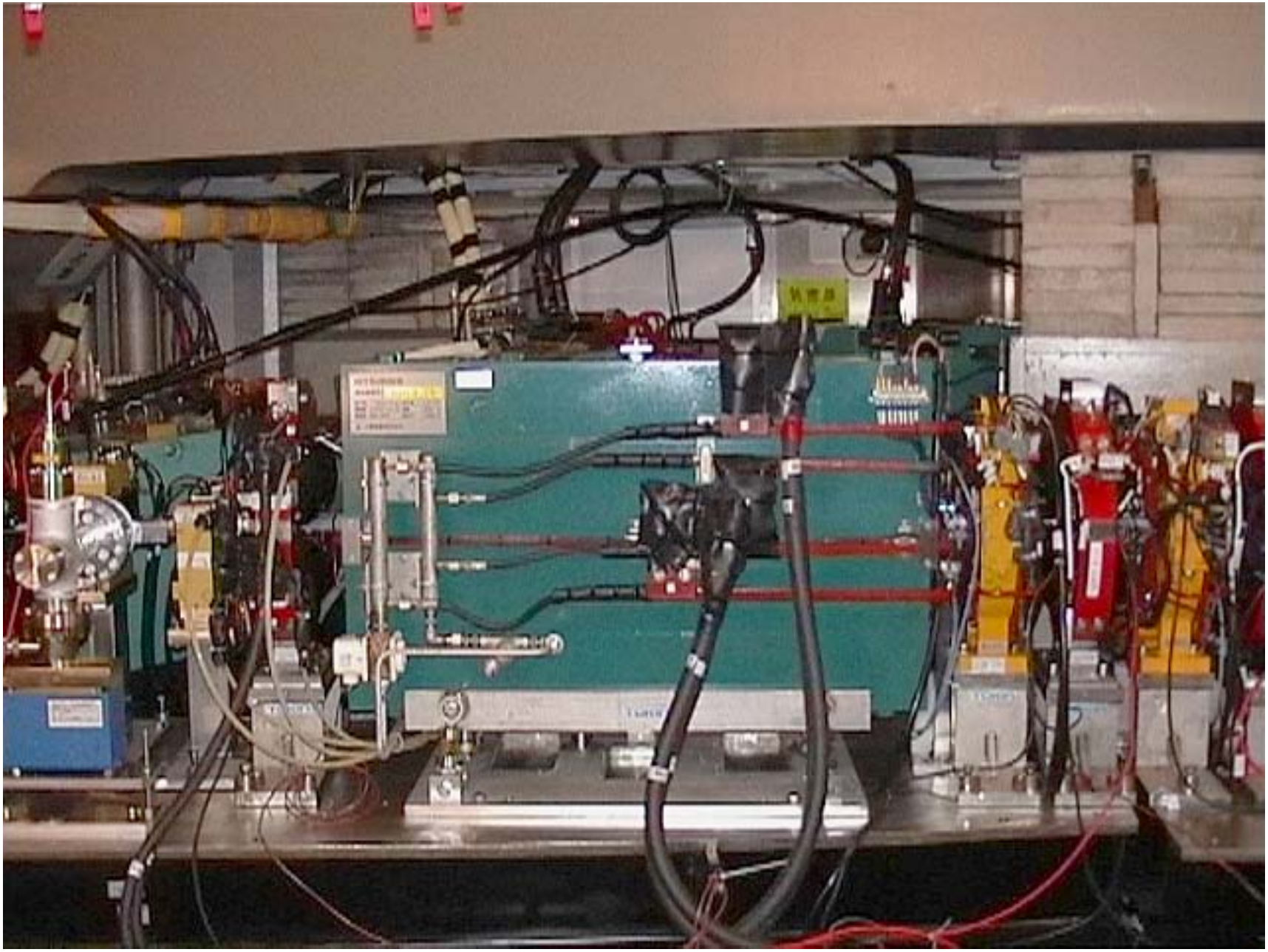

Wire scanner
OTR monitor, ODR monitor
Extraction Line
Septum Magnets
Wiggler
Extraction Kicker
East Arc
Laser Wire monitor
Injection Kicker
North Straight
ATF Damping Ring
Beam energy 1.28 GeV
Bunch population 10^10
36 combined function FOBO cells
Circumference 138.6 m
Momentum Compaction 0.00214
Energy Spread 0.06 %
BT
(Beam Transport Line)
RF Cavity
South Straight
West Arc
X-ray SR monitor
SR Monitor
Wiggler
Electoron Linac

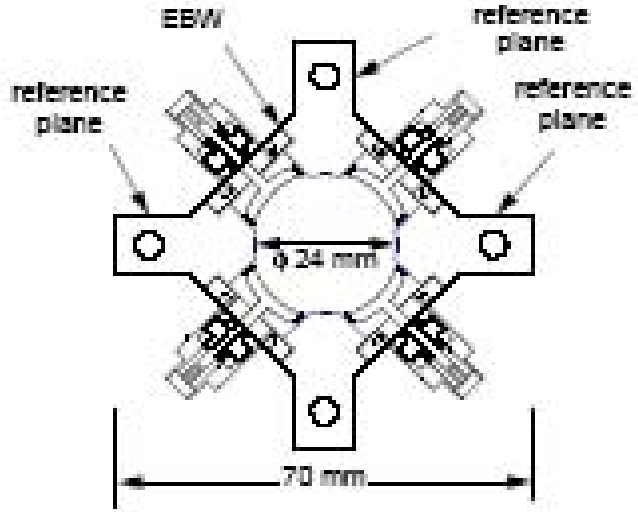


QM15R.1
ZW2R
QM16R.1
QM17R.1
QM18R.1
QM19R.1
BH1R.10
QM20R.1
SF1R.10
QM21R.1
SD1R.10
BH1R.11
QM22R.1
QM23R.1
SF1R.11
SD1R.11
BH1R.12
QF1R.8
QF2R.8
SF1R.12
SD1R.12
BH1R.13
QF1R.9
QF2R.9
SF1R.13
SD1R.13
BH1R.14
QF1R.10
QF2R.10
SF1R.14
BPM.27
ZV13R
BPM.28
ZH13R
BPM.29
ZV14R
BPM.30
ZH14R
ZV15R
BPM.31
(ZV16R)
(ZH15R)
BPM.32
BPM.33
ZV17R
ZH16R
BPM.34
ZV18R
BPM.35
ZH17R
BPM.36
BPM.37
ZV19R
ZH18R
BPM.38
BPM.39
ZV20R
ZH19R
BPM.40
BPM.41

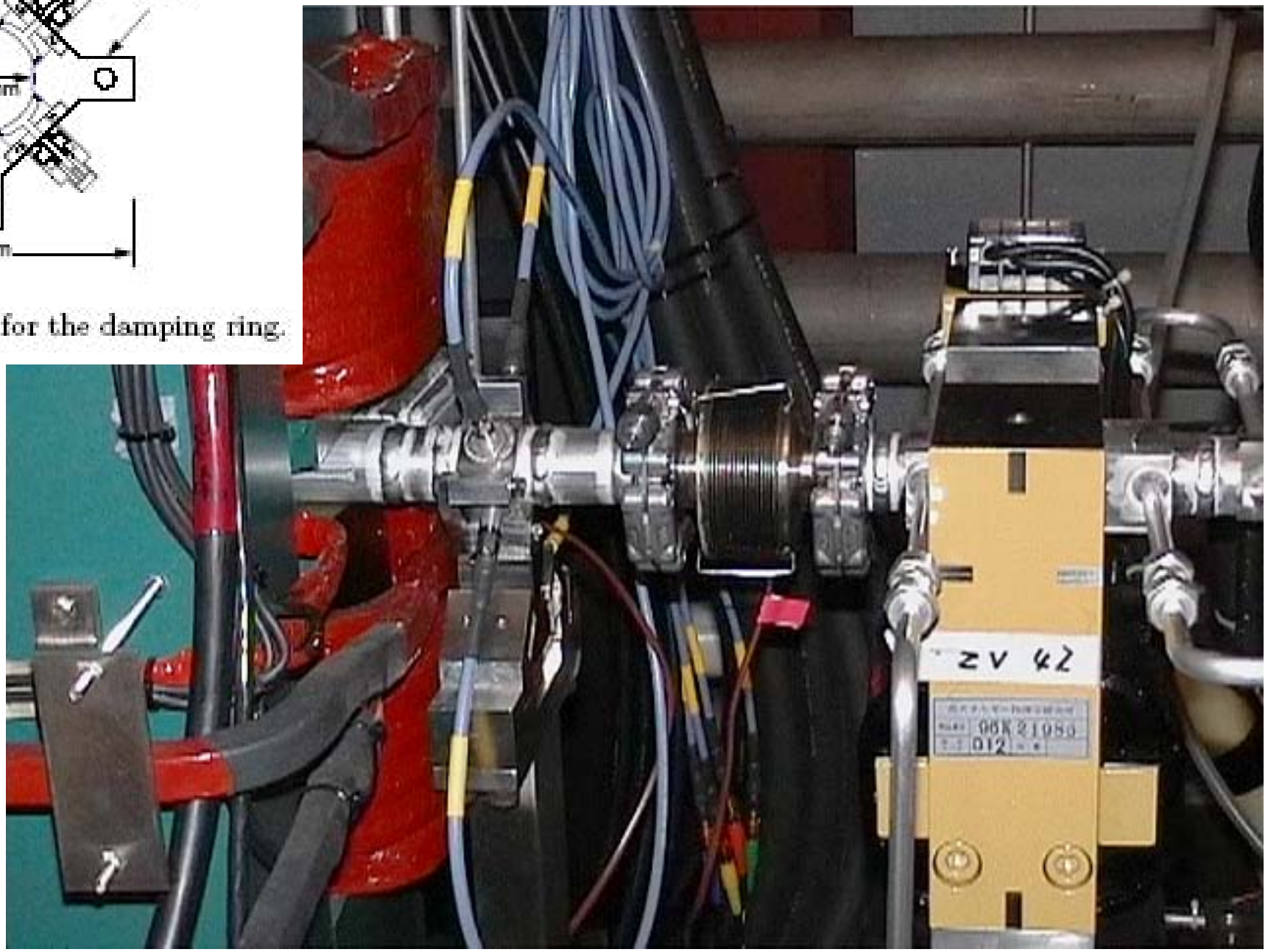


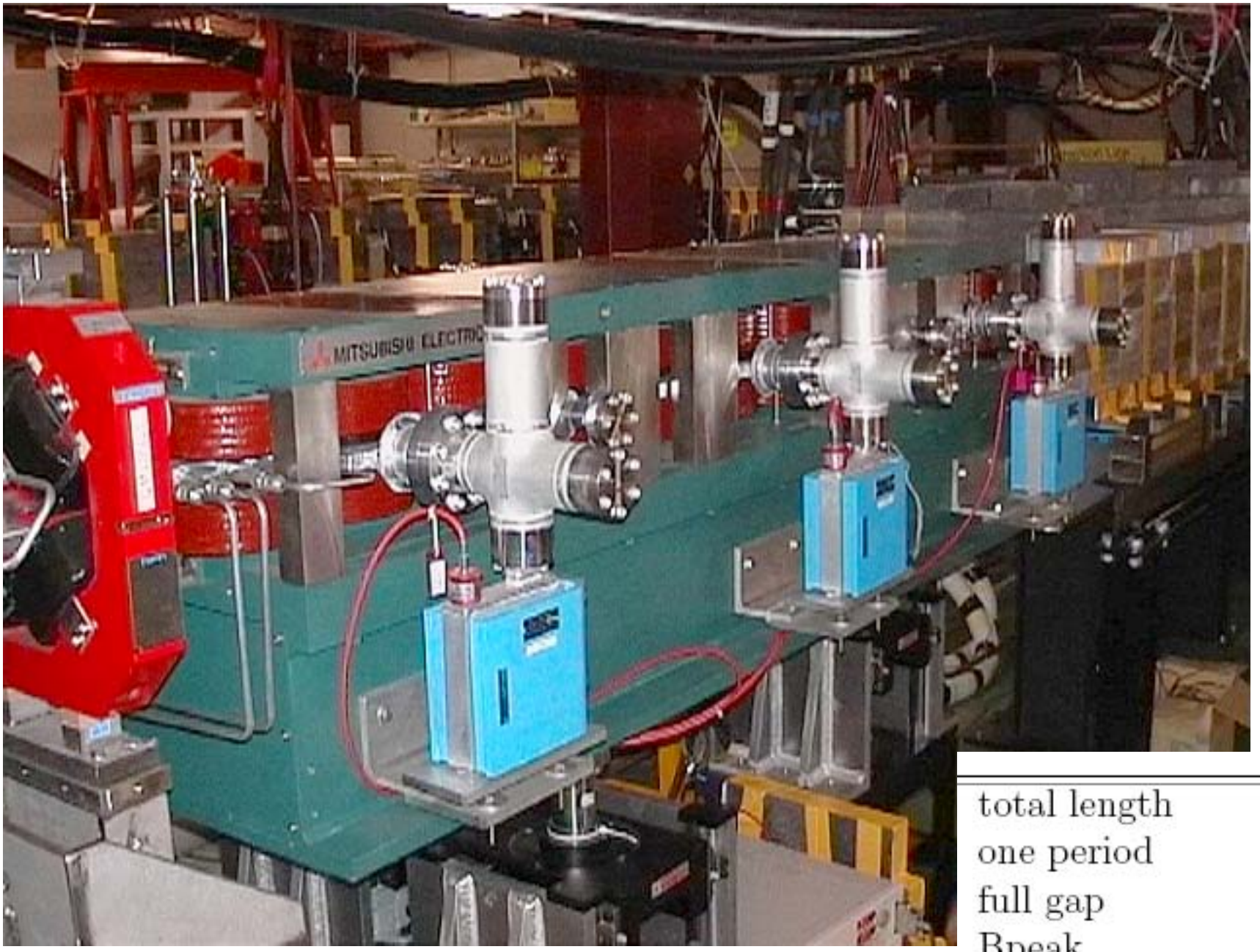



ZH·22
ZV·23



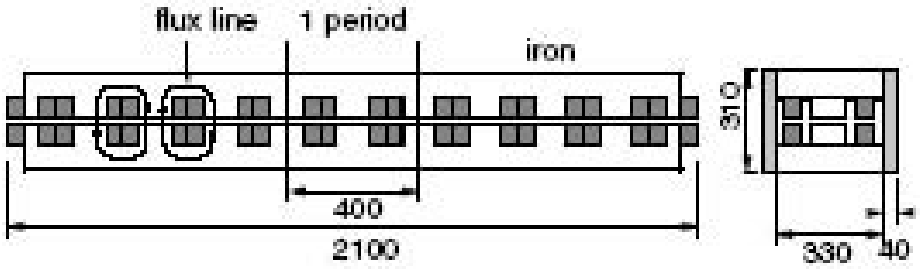
BPM block for the damping ring.

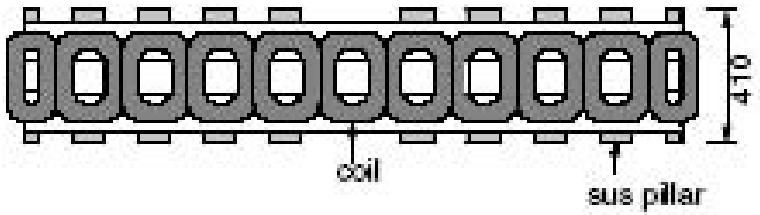


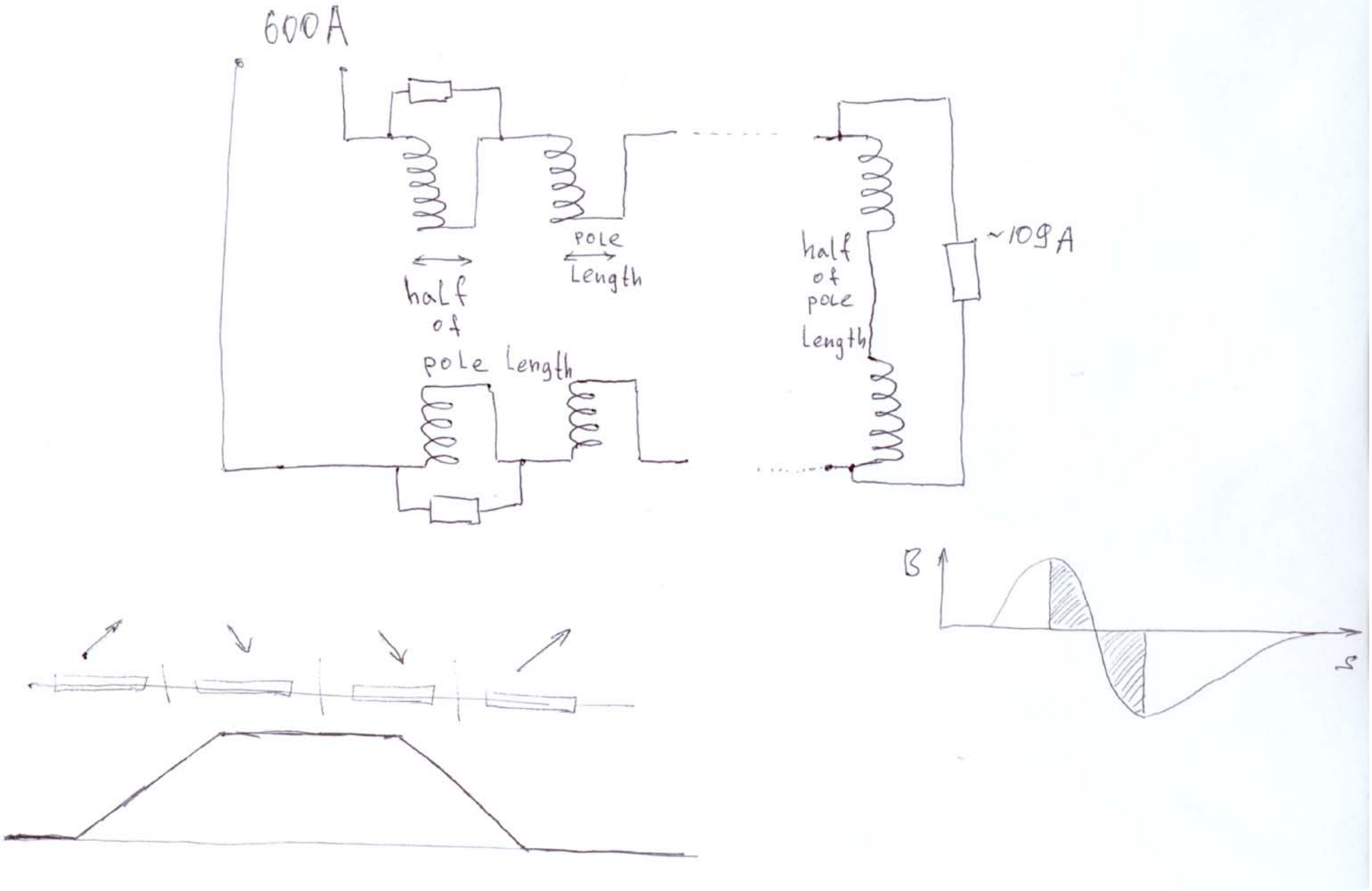


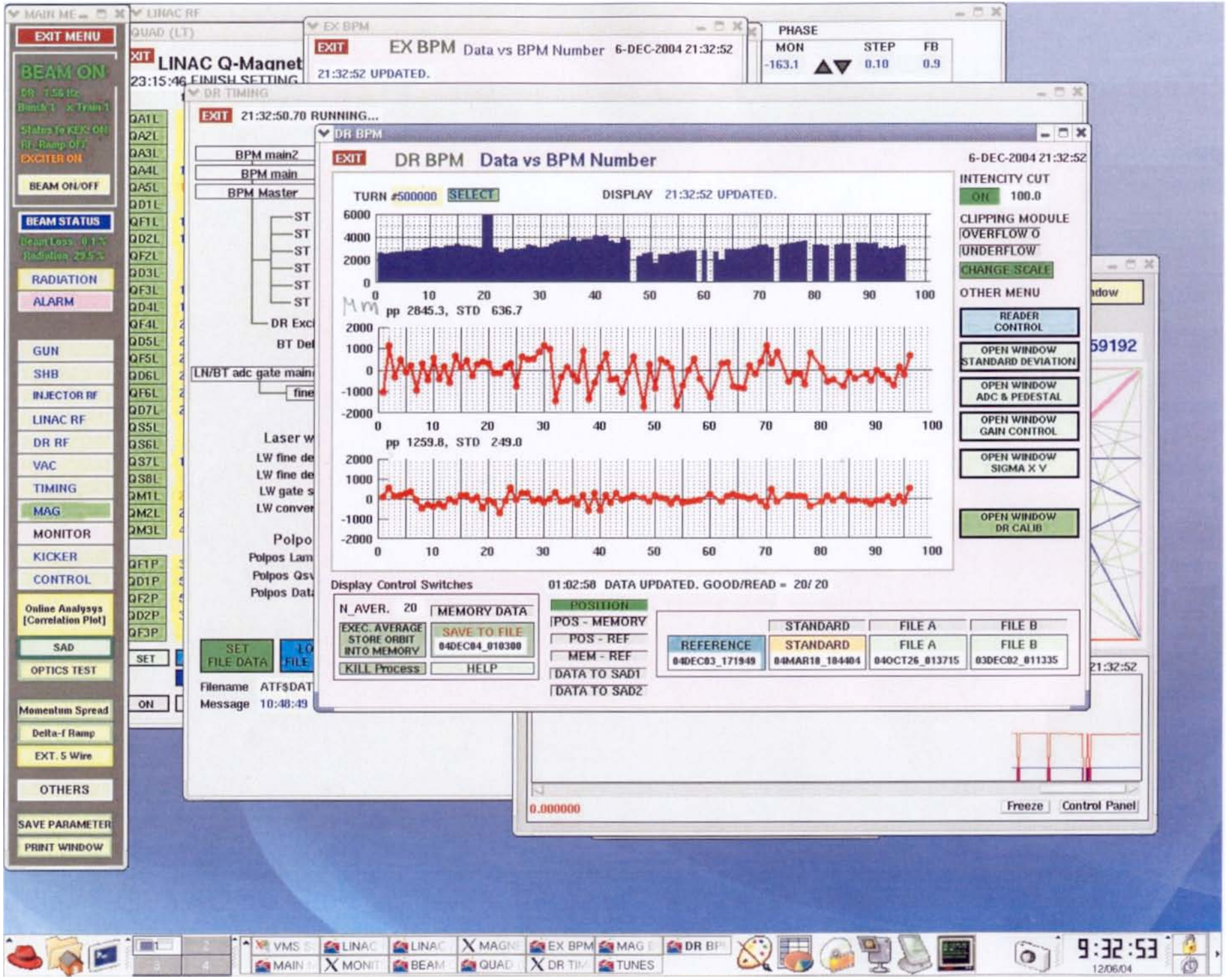
total length	2.1 m
one period	0.4 m
full gap	20 mm
Bpeak	1.6 T

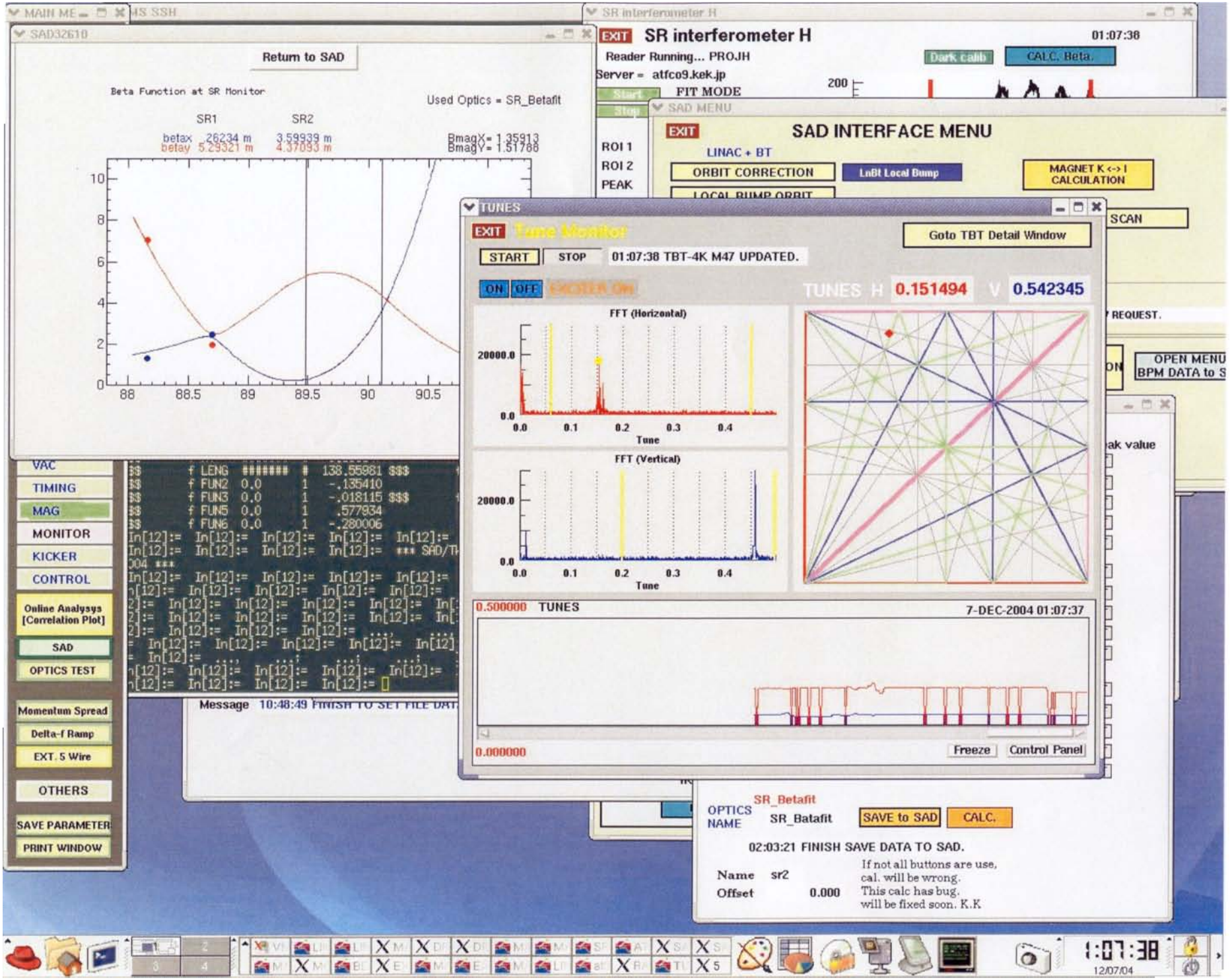

Damping Ring

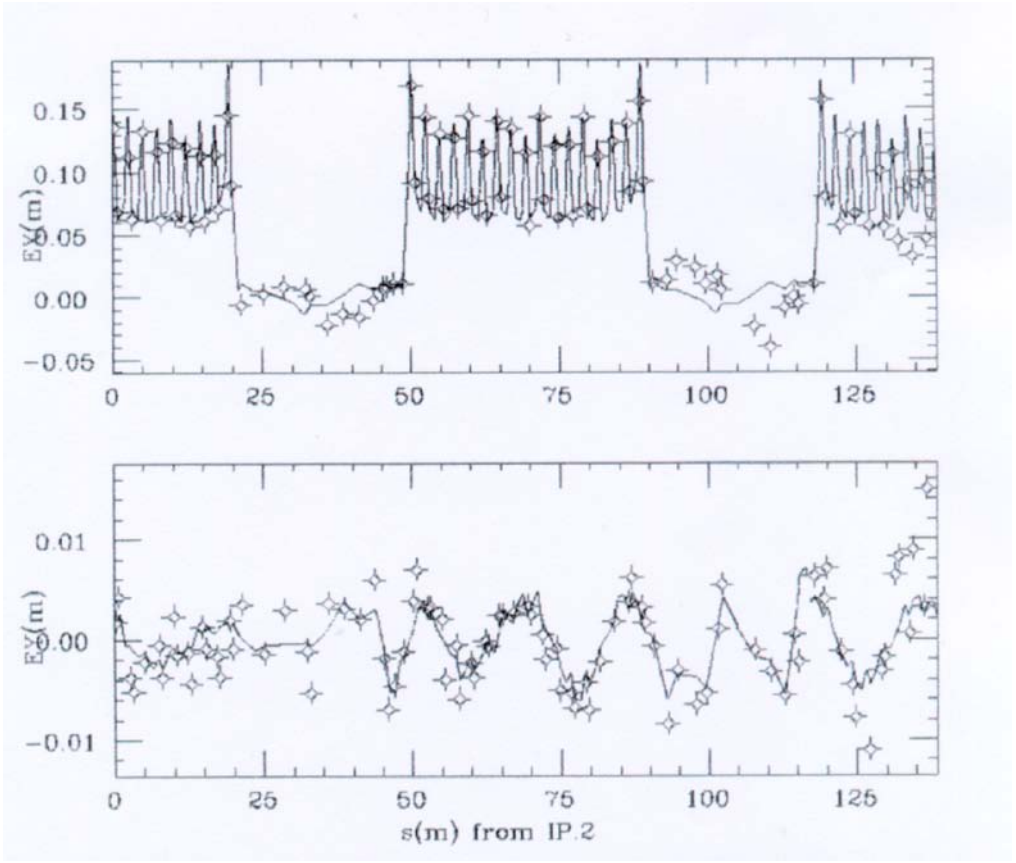

flux line
1 period
iron
400
2100
310
330
40

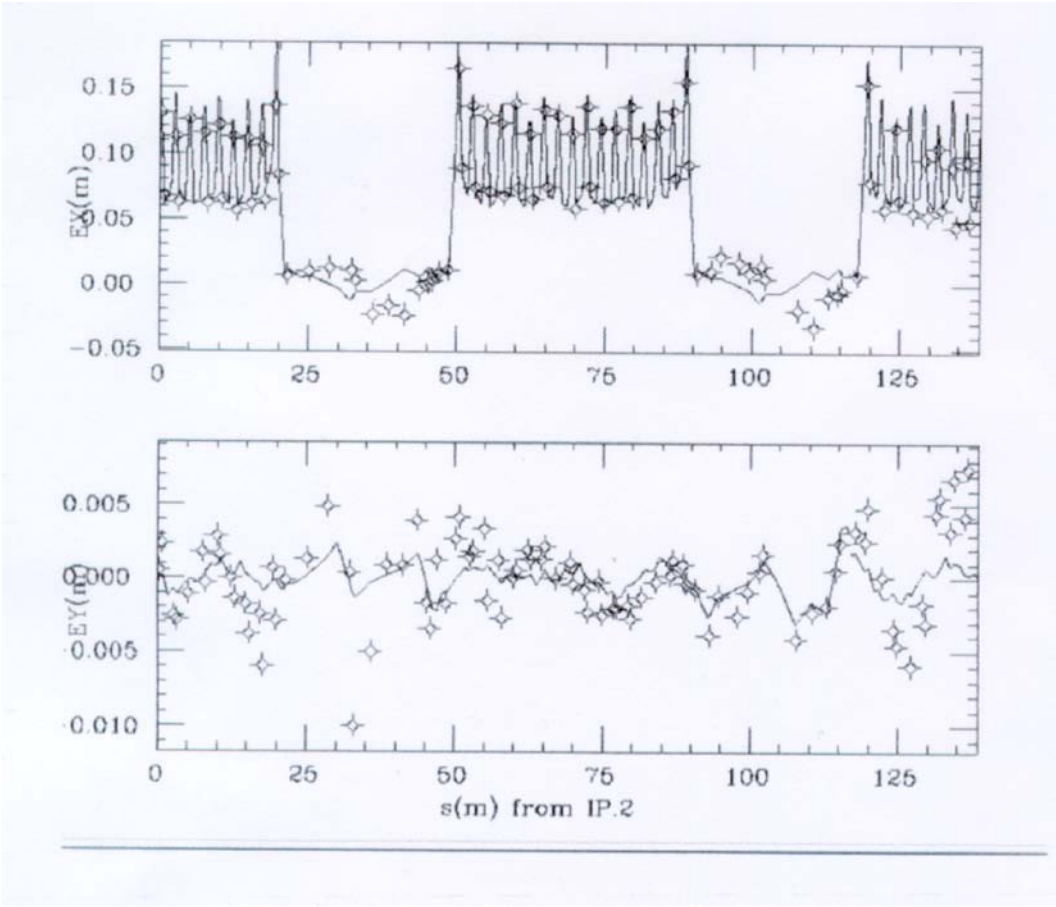

410
coil
sus pillar

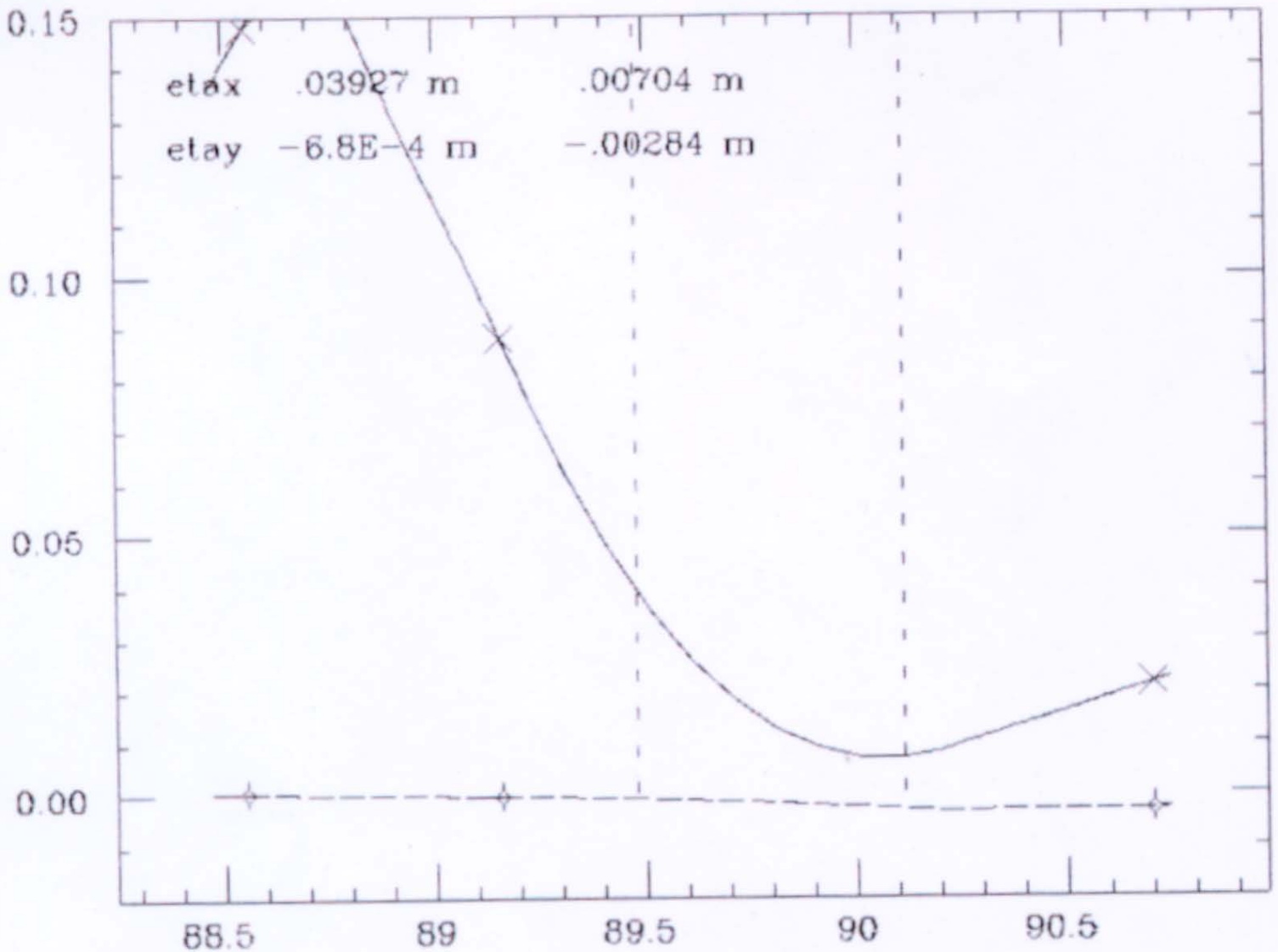

600A
half of pole Length
pole Length
half of pole Length
~109A
B
z

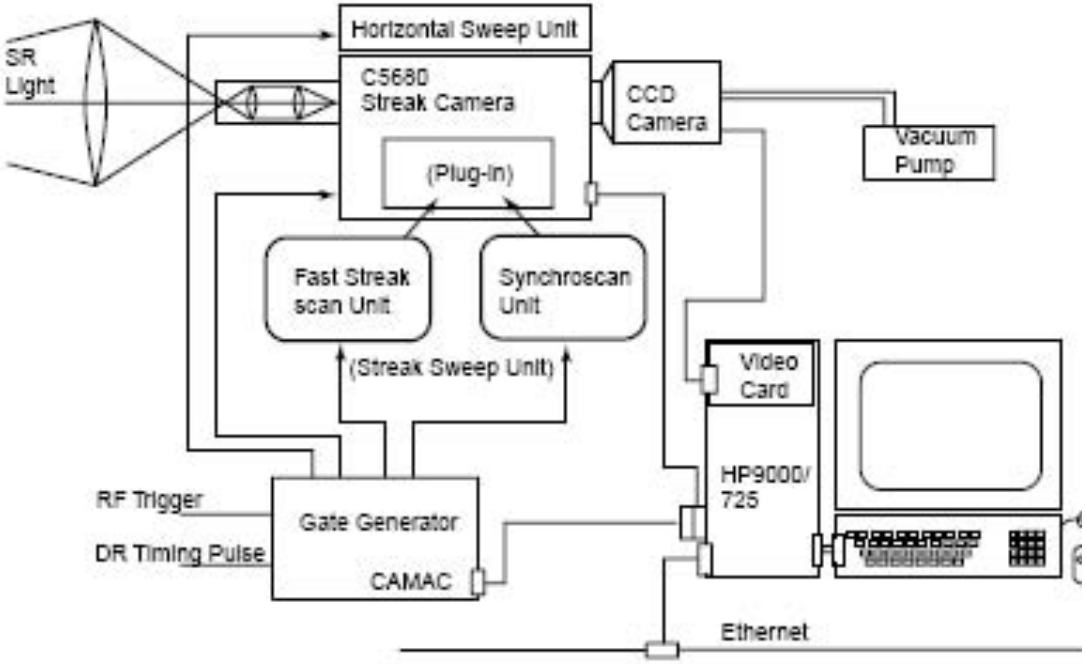

EXIT MENU
BEAM ON
BEAM ON/OFF
BEAM STATUS
RADIATION
ALARM
GUN
SHB
INJECTOR RF
LINAC RF
DR RF
VAC
TIMING
MAG
MONITOR
KICKER
CONTROL
Online Analysys [Correlation Plot]
SAD
OPTICS TEST
Momentum Spread
Delta-f Ramp
EXT. 5 Wire
OTHERS
SAVE PARAMETER
PRINT WINDOW
LINAC Q-Magnet
EX BPM
EX BPM Data vs BPM Number 6-DEC-2004 21:32:52
21:32:52 UPDATED.
PHASE
MON
STEP
FB
-163.1
0.10
0.9
DR TIMING
21:32:50.70 RUNNING...
BPM main2
BPM main
BPM Master
DR BPM
DR BPM Data vs BPM Number
6-DEC-2004 21:32:52
TURN #500000
SELECT
DISPLAY 21:32:52 UPDATED.
INTENCITY CUT
ON
100.0
CLIPPING MODULE
OVERFLOW 0
UNDERFLOW
CHANGE SCALE
OTHER MENU
READER CONTROL
OPEN WINDOW STANDARD DEVIATION
OPEN WINDOW ADC & PEDESTAL
OPEN WINDOW GAIN CONTROL
OPEN WINDOW SIGMA X Y
OPEN WINDOW DR CALIB
pp 2845.3, STD 636.7
pp 1259.8, STD 249.0
Display Control Switches
N_AVER. 20
MEMORY DATA
EXEC. AVERAGE STORE ORBIT INTO MEMORY
SAVE TO FILE
04DEC04_010300
KILL Process
HELP
01:02:58 DATA UPDATED. GOOD/READ = 20/ 20
POSITION
POS - MEMORY
POS - REF
MEM - REF
DATA TO SAD1
DATA TO SAD2
STANDARD
FILE A
FILE B
REFERENCE
04DEC03_171949
STANDARD
04MAR18_184404
FILE A
04OCT26_013715
FILE B
03DEC02_011335
SET FILE DATA
Filename ATF$DAT
Message 10:48:49
0.000000
Freeze
Control Panel
9:32:53
12/06/04


SAD32610
Return to SAD
Beta Function at SR Monitor
Used Optics = SR_Betafit
SR1
SR2
betax 26234 m
betay 5.29321 m
3.59939 m
4.37093 m
BmagX= 1.35913
BmagY= 1.51766
SR interferometer H
EXIT
SR interferometer H
01:07:38
Reader Running... PROJH
Server = atfco9.kek.jp
Dark calib
CALC. Beta.
FIT MODE
SAD MENU
SAD INTERFACE MENU
LINAC + BT
ORBIT CORRECTION
LnBt Local Bump
MAGNET K <-> I CALCULATION
ROI 1
ROI 2
PEAK
SCAN
TUNES
Tune Monitor
Goto TBT Detail Window
START
STOP
01:07:38 TBT-4K M47 UPDATED.
ON
OFF
TUNES H 0.151494 V 0.542345
FFT (Horizontal)
FFT (Vertical)
Tune
VAC
TIMING
MAG
MONITOR
KICKER
CONTROL
Online Analysys [Correlation Plot]
SAD
OPTICS TEST
Momentum Spread
Delta-f Ramp
EXT. 5 Wire
OTHERS
SAVE PARAMETER
PRINT WINDOW
Message
0.500000 TUNES
7-DEC-2004 01:07:37
0.000000
Freeze
Control Panel
OPTICS NAME
SR_Betafit
SR_Batafit
SAVE to SAD
CALC.
02:03:21 FINISH SAVE DATA TO SAD.
Name sr2
Offset 0.000
If not all buttons are use, cal. will be wrong.
This calc has bug. will be fixed soon. K.K
OPEN MENU
BPM DATA to S
REQUEST.
peak value
1:07:38
12/07/04

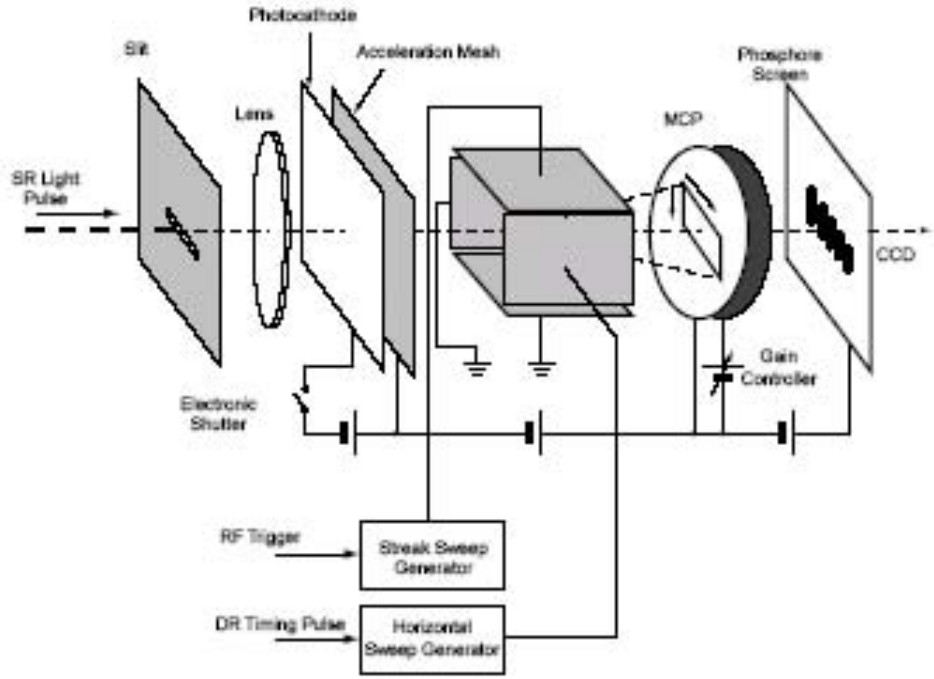

EX(m)
0.15
0.10
0.05
0.00
−0.05
0
25
50
75
100
125
EY(m)
0.01
0.00
−0.01
s(m) from IP.2


EX(m)
0.15
0.10
0.05
0.00
−0.05
0
25
50
75
100
125
EY(m)
0.005
0.000
0.005
0.010
s(m) from IP.2

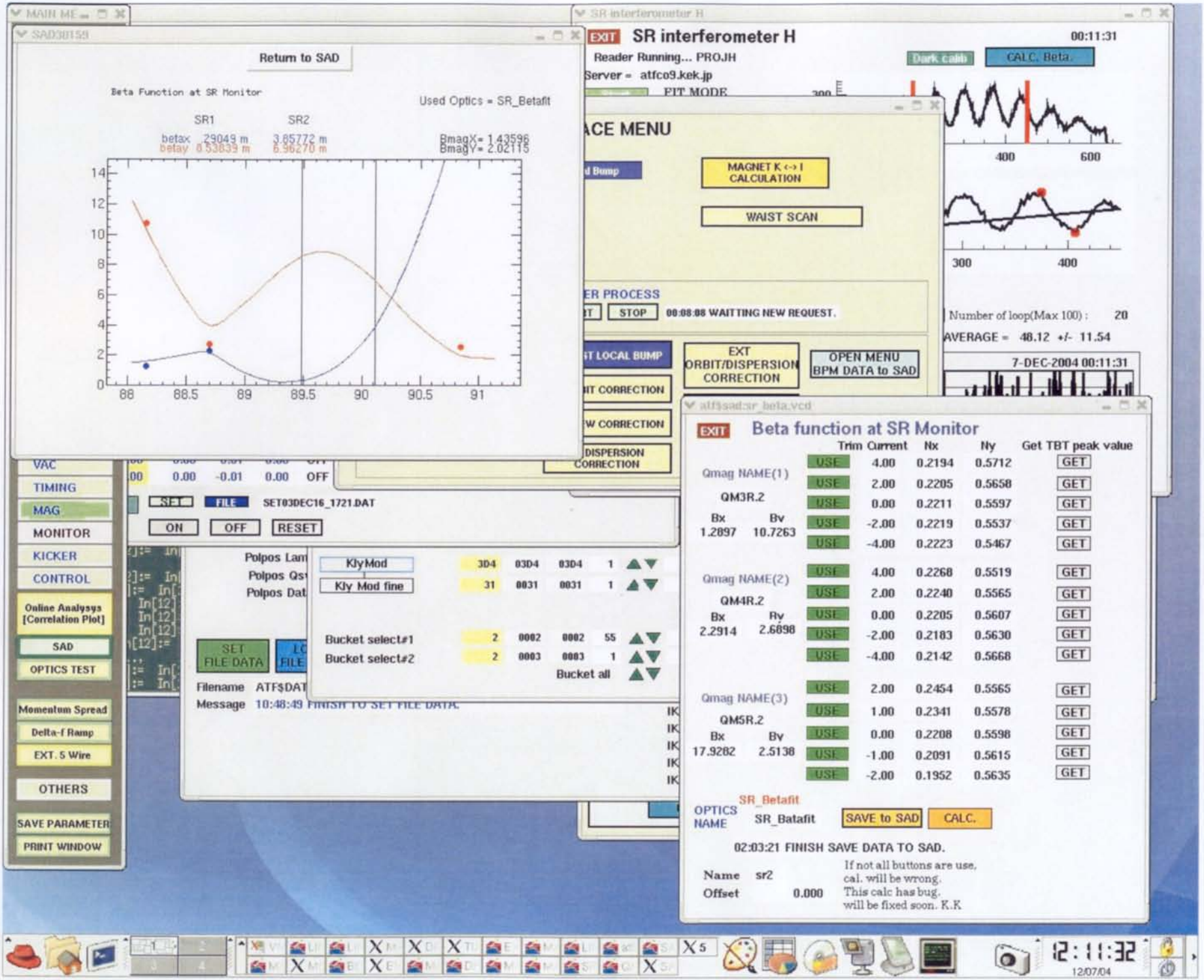

0.15
0.10
0.05
0.00
etax .03927 m .00704 m
etay -6.8E-4 m -.00284 m
88.5
89
89.5
90
90.5

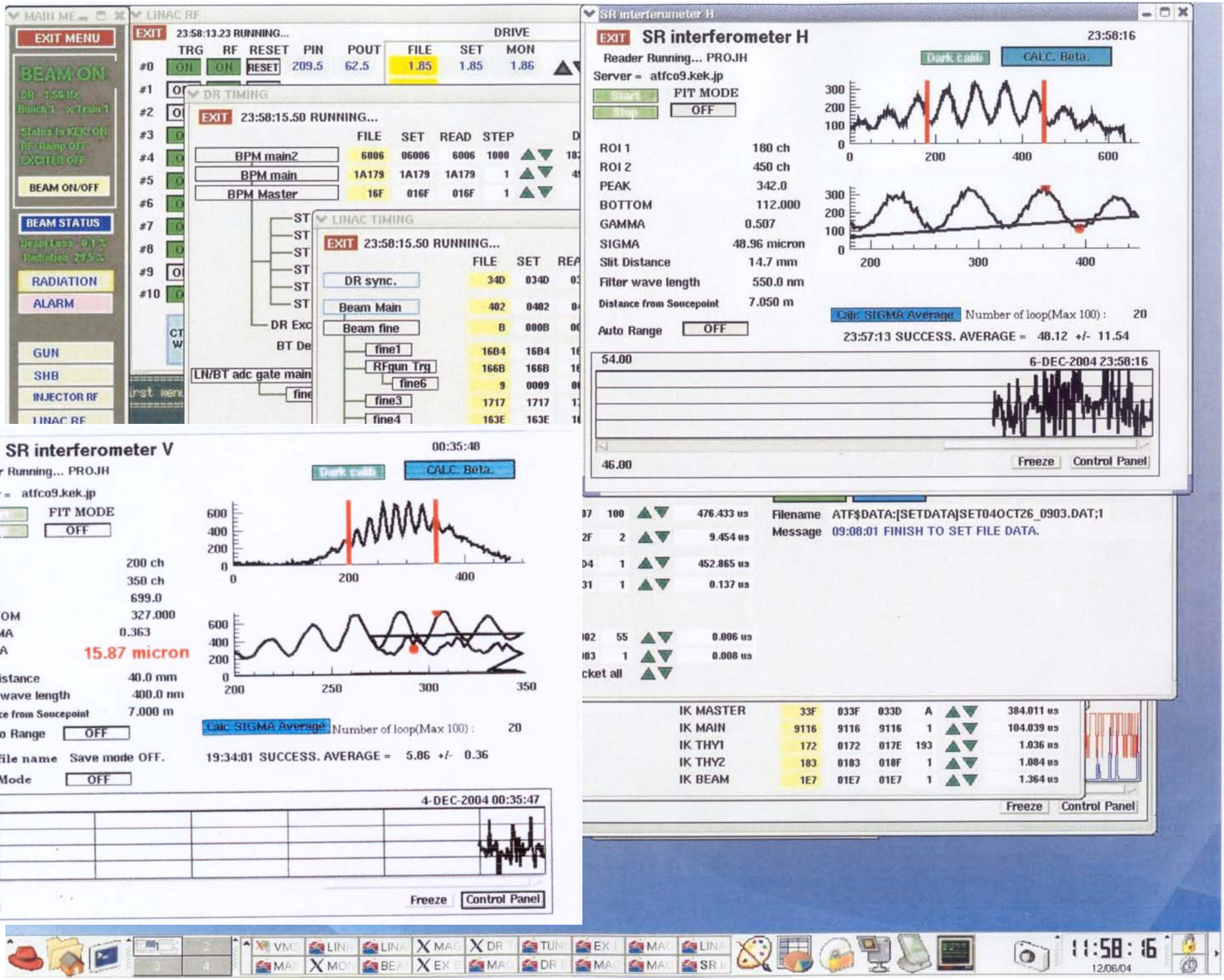


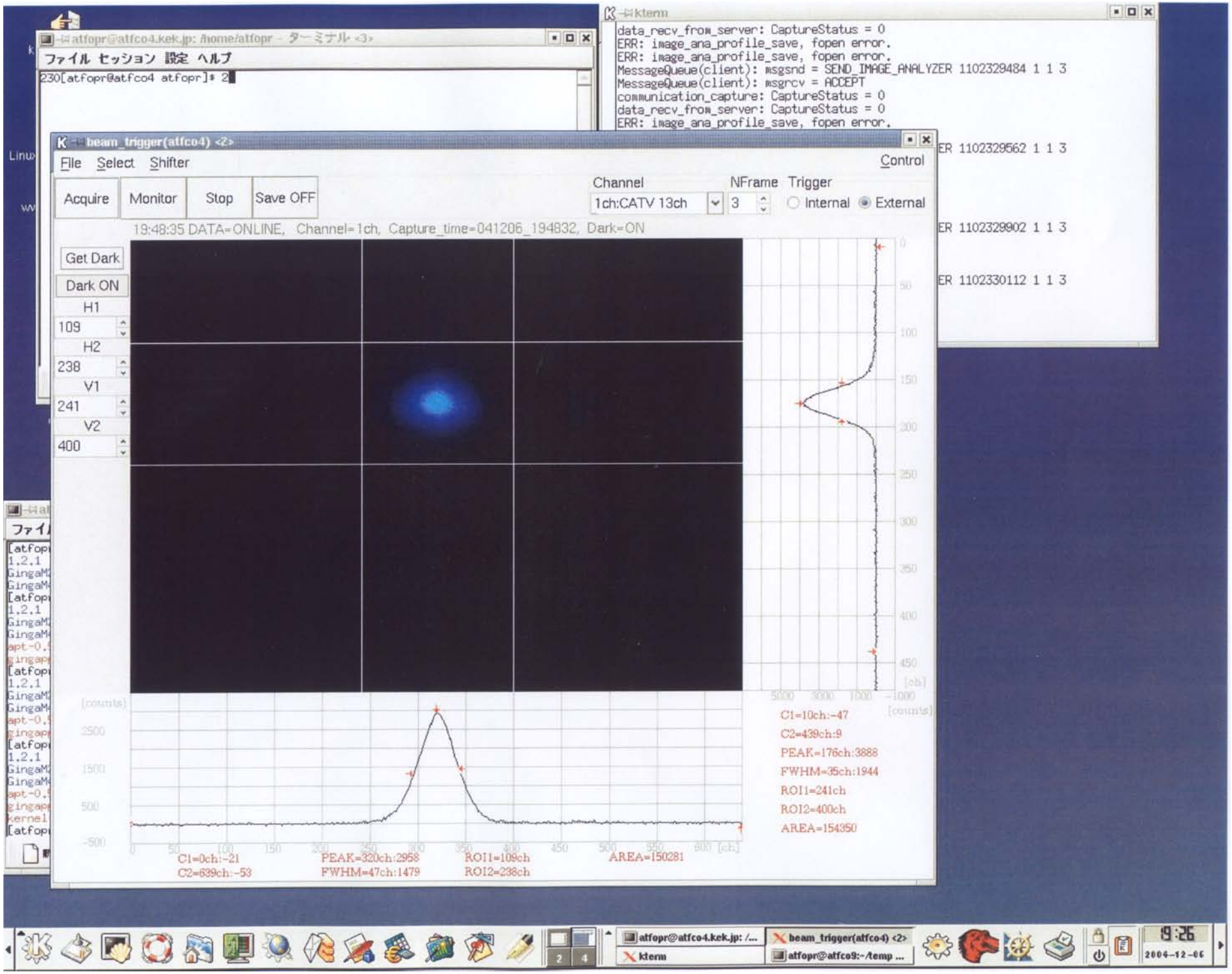
Block diagram of the system configuration for the bunch-length measurement.

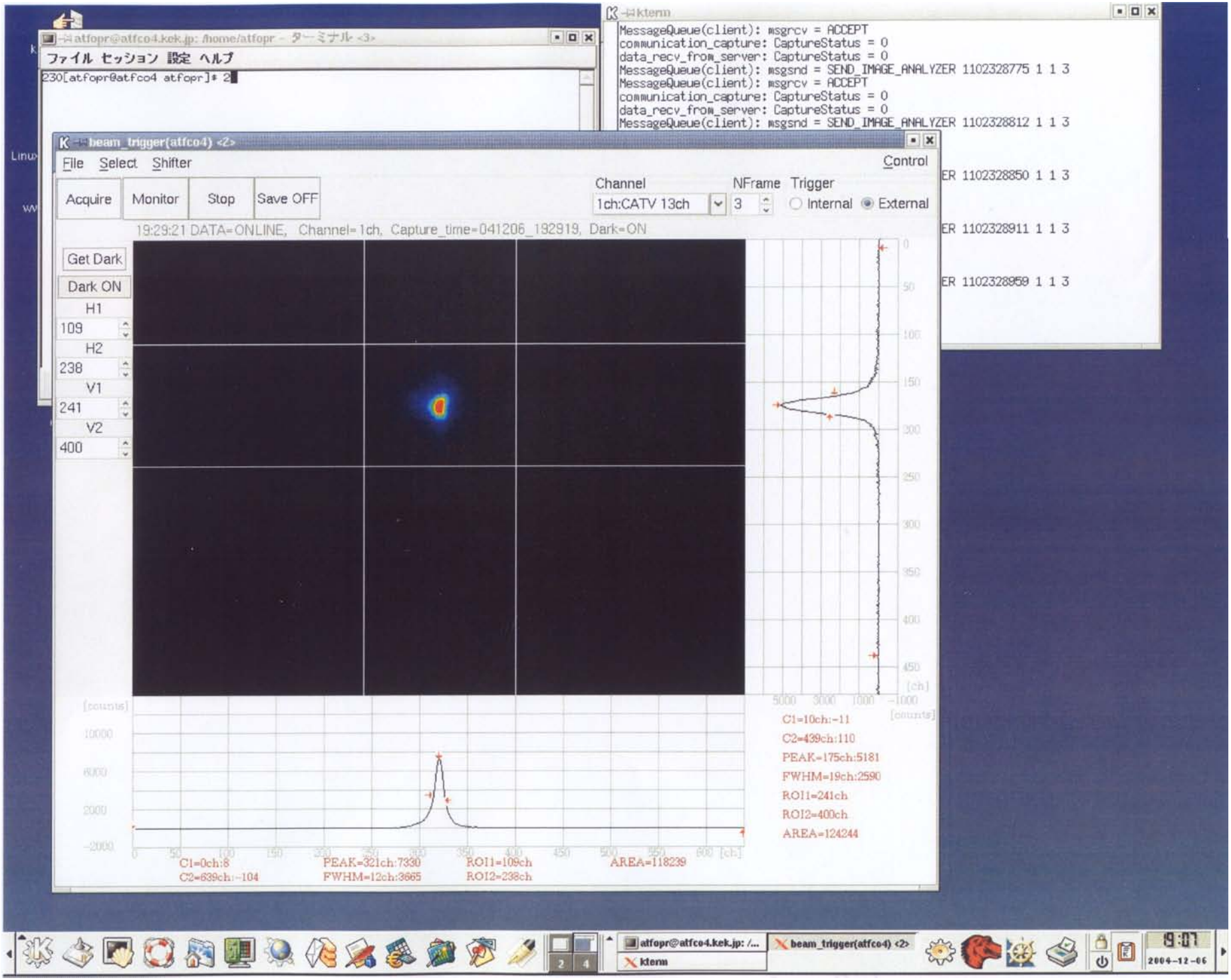


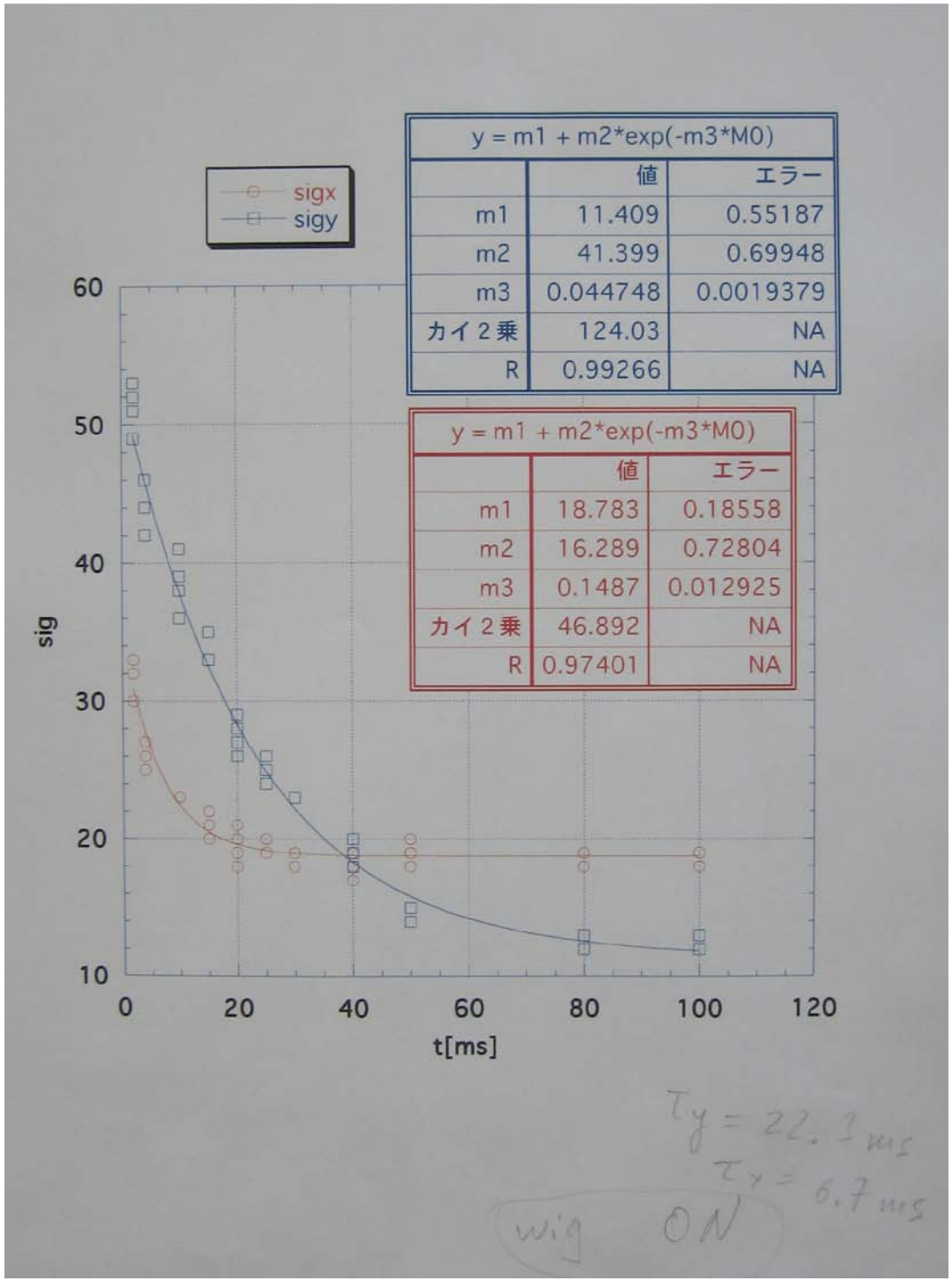
Conceptual diagram of the double-sweep streak camera.

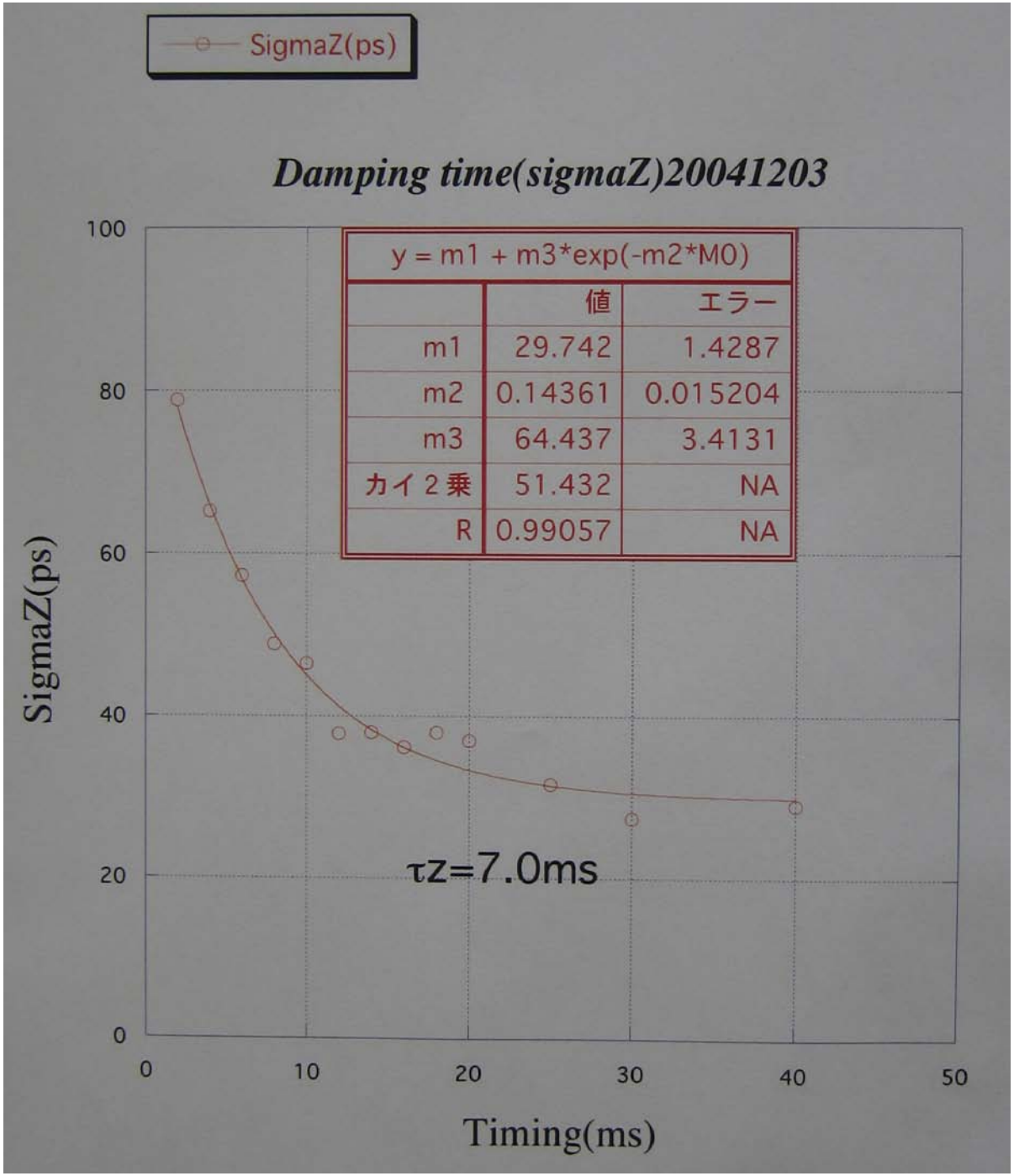

Return to SAD
Beta Function at SR Monitor
Used Optics = SR_Betafit
SR1
SR2
betax 29049 m 3.85772 m
betay 0.53839 m 6.96270 m
BmagX= 1.43596
BmagY= 2.02115
SR interferometer H
Reader Running... PROJH
Server = atfco9.kek.jp
00:11:31
Dark calib
CALC. Beta.
MAGNET K <-> I CALCULATION
WAIST SCAN
STOP
00:08:08 WAITTING NEW REQUEST.
EXT ORBIT/DISPERSION CORRECTION
OPEN MENU BPM DATA to SAD
Number of loop(Max 100) : 20
AVERAGE = 48.12 +/- 11.54
7-DEC-2004 00:11:31
VAC
TIMING
MAG
MONITOR
KICKER
CONTROL
Online Analysys [Correlation Plot]
SAD
OPTICS TEST
Momentum Spread
Delta-f Ramp
EXT. 5 Wire
OTHERS
SAVE PARAMETER
PRINT WINDOW
SET
FILE
SET03DEC16_1721.DAT
ON
OFF
RESET
KlyMod
Kly Mod fine
Bucket select#1
Bucket select#2
Bucket all
SET FILE DATA
Filename ATF$DAT
Message 10:48:49 FINISH TO SET FILE DATA.
Beta function at SR Monitor
Trim Current
Nx
Ny
Get TBT peak value
Qmag NAME(1)
QM3R.2
Bx 1.2897
By 10.7263
Qmag NAME(2)
QM4R.2
Bx 2.2914
By 2.6898
Qmag NAME(3)
QM5R.2
Bx 17.9282
By 2.5138
OPTICS NAME
SR_Betafit
SAVE to SAD
CALC.
02:03:21 FINISH SAVE DATA TO SAD.
Name sr2
Offset 0.000
If not all buttons are use, cal. will be wrong.
This calc has bug.
will be fixed soon. K.K
12:11:32
12/07/04


MAIN ME
EXIT MENU
BEAM ON
BEAM ON/OFF
BEAM STATUS
RADIATION
ALARM
GUN
SHB
INJECTOR RF
LINAC RF
EXIT
23:58:13.23 RUNNING...
DRIVE
TRG RF RESET PIN POUT FILE SET MON
#0 ON ON RESET 209.5 62.5 1.85 1.85 1.86
DR TIMING
EXIT 23:58:15.50 RUNNING...
FILE SET READ STEP
BPM main2 6006 06006 6006 1000
BPM main 1A179 1A179 1A179 1
BPM Master 16F 016F 016F 1
LINAC TIMING
EXIT 23:58:15.50 RUNNING...
DR sync. 34D 034D
Beam Main 402 0402
Beam fine B 000B
fine1 16B4 16B4
RFgun Trg 166B 166B
fine6 9 0009
fine3 1717 1717
fine4 163E 163E
LN/BT adc gate main
SR interferometer H
EXIT SR interferometer H
23:58:16
Reader Running... PROJH
Server = atfco9.kek.jp
Start
Stop
FIT MODE
OFF
Dark calib
CALC. Beta.
ROI 1 180 ch
ROI 2 450 ch
PEAK 342.0
BOTTOM 112.000
GAMMA 0.507
SIGMA 48.96 micron
Slit Distance 14.7 mm
Filter wave length 550.0 nm
Distance from Soucepoint 7.050 m
Auto Range OFF
Calc SIGMA Average
Number of loop(Max 100) : 20
23:57:13 SUCCESS. AVERAGE = 48.12 +/- 11.54
54.00
6-DEC-2004 23:58:16
46.00
Freeze
Control Panel
SR interferometer V
00:35:48
Reader Running... PROJH
Server = atfco9.kek.jp
FIT MODE
OFF
ROI 1 200 ch
ROI 2 350 ch
PEAK 699.0
BOTTOM 327.000
GAMMA 0.363
SIGMA 15.87 micron
Slit Distance 40.0 mm
Filter wave length 400.0 nm
Distance from Soucepoint 7.000 m
Auto Range OFF
Save file name Save mode OFF.
Save Mode OFF
Calc SIGMA Average
Number of loop(Max 100) : 20
19:34:01 SUCCESS. AVERAGE = 5.86 +/- 0.36
20.00
4-DEC-2004 00:35:47
12.00
Freeze
Control Panel
Filename ATF$DATA:[SETDATA]SET04OCT26_0903.DAT;1
Message 09:08:01 FINISH TO SET FILE DATA.
476.433 us
9.454 us
452.865 us
0.137 us
0.006 us
0.008 us
IK MASTER 33F 033F 033D A 384.011 us
IK MAIN 9116 9116 9116 1 104.039 us
IK THY1 172 0172 017E 193 1.036 us
IK THY2 183 0183 018F 1 1.084 us
IK BEAM 1E7 01E7 01E7 1 1.364 us
Freeze
Control Panel
11:58:16
12/06/04


atfopr@atfco4.kek.jp: /home/atfopr - ターミナル <3>
ファイル セッション 設定 ヘルプ
230[atfopr@atfco4 atfopr]$ 2
kterm
data_recv_from_server: CaptureStatus = 0
ERR: image_ana_profile_save, fopen error.
ERR: image_ana_profile_save, fopen error.
MessageQueue(client): msgsnd = SEND_IMAGE_ANALYZER 1102329484 1 1 3
MessageQueue(client): msgrcv = ACCEPT
communication_capture: CaptureStatus = 0
data_recv_from_server: CaptureStatus = 0
ERR: image_ana_profile_save, fopen error.
ER 1102329562 1 1 3
ER 1102329902 1 1 3
ER 1102330112 1 1 3
beam_trigger(atfco4) <2>
File Select Shifter
Control
Acquire
Monitor
Stop
Save OFF
Channel
1ch:CATV 13ch
NFrame
3
Trigger
Internal
External
19:48:35 DATA=ONLINE, Channel=1ch, Capture_time=041206_194832, Dark=ON
Get Dark
Dark ON
H1
109
H2
238
V1
241
V2
400
C1=0ch:-21
C2=639ch:-53
PEAK=320ch:2958
FWHM=47ch:1479
ROI1=109ch
ROI2=238ch
AREA=150281
C1=10ch:-47
C2=439ch:9
PEAK=176ch:3888
FWHM=35ch:1944
ROI1=241ch
ROI2=400ch
AREA=154350
atfopr@atfco4.kek.jp: /...
kterm
beam_trigger(atfco4) <2>
atfopr@atfco9:~/temp ...
9:26
2004-12-06


atfopr@atfco4.kek.jp: /home/atfopr - ターミナル <3>
ファイル セッション 設定 ヘルプ
230[atfopr@atfco4 atfopr]$ 2
kterm
MessageQueue(client): msgrcv = ACCEPT
communication_capture: CaptureStatus = 0
data_recv_from_server: CaptureStatus = 0
MessageQueue(client): msgsnd = SEND_IMAGE_ANALYZER 1102328775 1 1 3
MessageQueue(client): msgrcv = ACCEPT
communication_capture: CaptureStatus = 0
data_recv_from_server: CaptureStatus = 0
MessageQueue(client): msgsnd = SEND_IMAGE_ANALYZER 1102328812 1 1 3
ER 1102328850 1 1 3
ER 1102328911 1 1 3
ER 1102328959 1 1 3
beam_trigger(atfco4) <2>
File Select Shifter
Control
Acquire
Monitor
Stop
Save OFF
Channel
1ch:CATV 13ch
NFrame
3
Trigger
Internal
External
19:29:21 DATA=ONLINE, Channel=1ch, Capture_time=041206_192919, Dark=ON
Get Dark
Dark ON
H1
109
H2
238
V1
241
V2
400
C1=0ch:8
C2=639ch:-104
PEAK=321ch:7330
FWHM=12ch:3665
ROI1=109ch
ROI2=238ch
AREA=118239
C1=10ch:-11
C2=439ch:110
PEAK=175ch:5181
FWHM=19ch:2590
ROI1=241ch
ROI2=400ch
AREA=124244
atfopr@atfco4.kek.jp: /...
kterm
beam_trigger(atfco4) <2>
19:07
2004-12-06


sigx
sigy
y = m1 + m2*exp(-m3*M0)
値 エラー
m1 11.409 0.55187
m2 41.399 0.69948
m3 0.044748 0.0019379
カイ２乗 124.03 NA
R 0.99266 NA
y = m1 + m2*exp(-m3*M0)
値 エラー
m1 18.783 0.18558
m2 16.289 0.72804
m3 0.1487 0.012925
カイ２乗 46.892 NA
R 0.97401 NA
sig
t[ms]
60
50
40
30
20
10
0
20
40
60
80
100
120
τy = 22.1 ms
τx = 6.7 ms
wig ON


SigmaZ(ps)
Damping time(sigmaZ)20041203
y = m1 + m3*exp(-m2*M0)
値
エラー
m1 29.742 1.4287
m2 0.14361 0.015204
m3 64.437 3.4131
カイ２乗 51.432 NA
R 0.99057 NA
τz=7.0ms
SigmaZ(ps)
Timing(ms)
0
20
40
60
80
100
0
10
20
30
40
50

1.28 GeV, RF voltage 110 kV, wiggler field 1.8 T

MAD

$$\sigma_x = 48.96\ \mu m \qquad \sigma_y = 15.87\ \mu m$$

$$\beta_x = 3.85\ m \qquad \beta_y = 6.96\ m$$

$$\eta_x = 0.007\ m \qquad \eta_y = -0.0028\ m$$

$$\epsilon_x = \frac{\sigma_x^2 - (\eta_x \sigma_p)^2}{\beta_x} = \frac{(48.96 \times 10^{-6})^2 - (7 \times 10^{-3} 5.6 \times 10^{-4})^2}{3.85}$$

$$\epsilon_x = 0.618\ nm$$

$$\epsilon_x = 1.15\ nm$$

$$\tau_x = 6.72 \pm 0.58\ ms \qquad \tau_x = 14\ ms$$

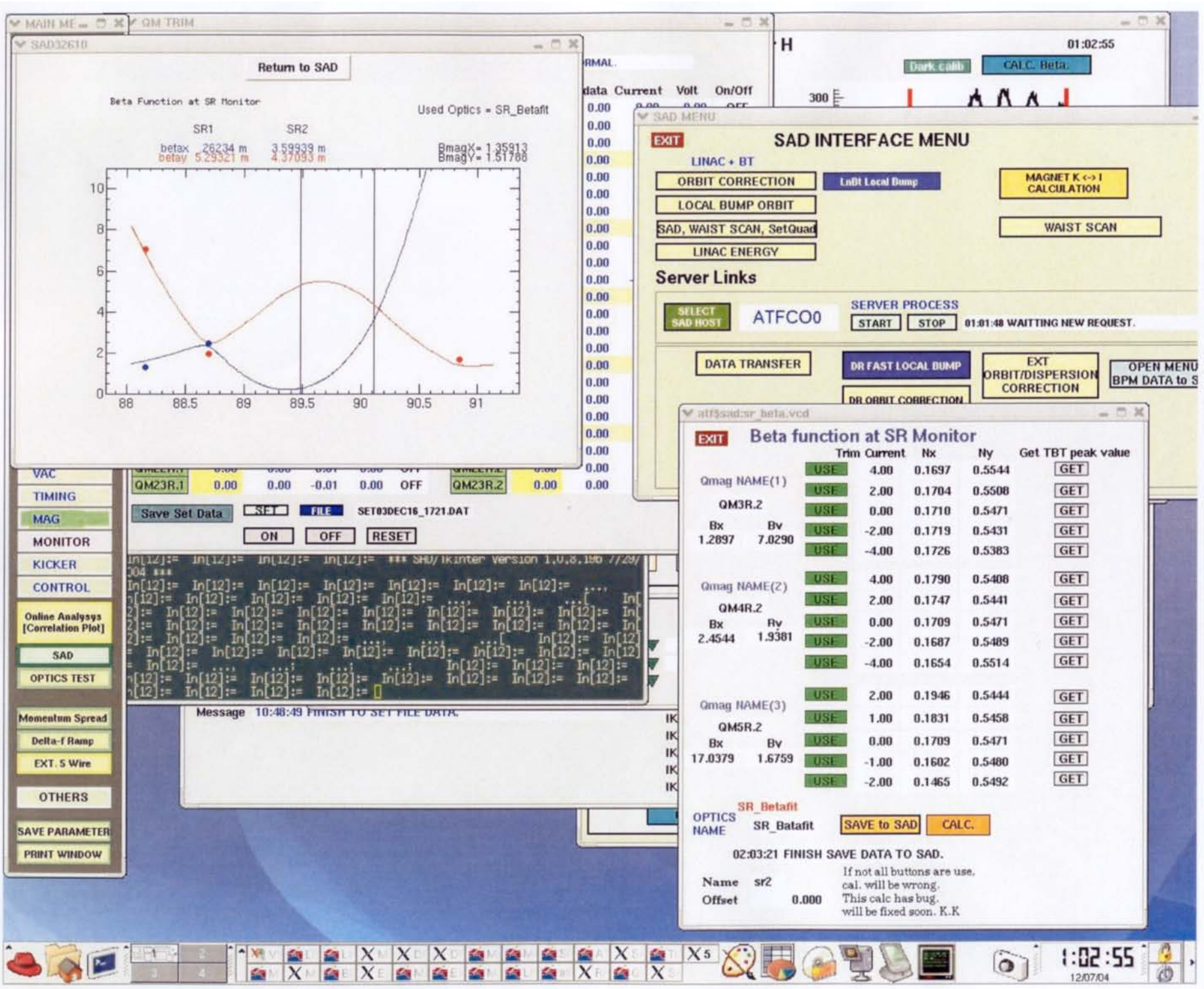
$$\tau_y = 22.3 \pm 0.96\ ms \qquad \tau_y = 20\ ms$$

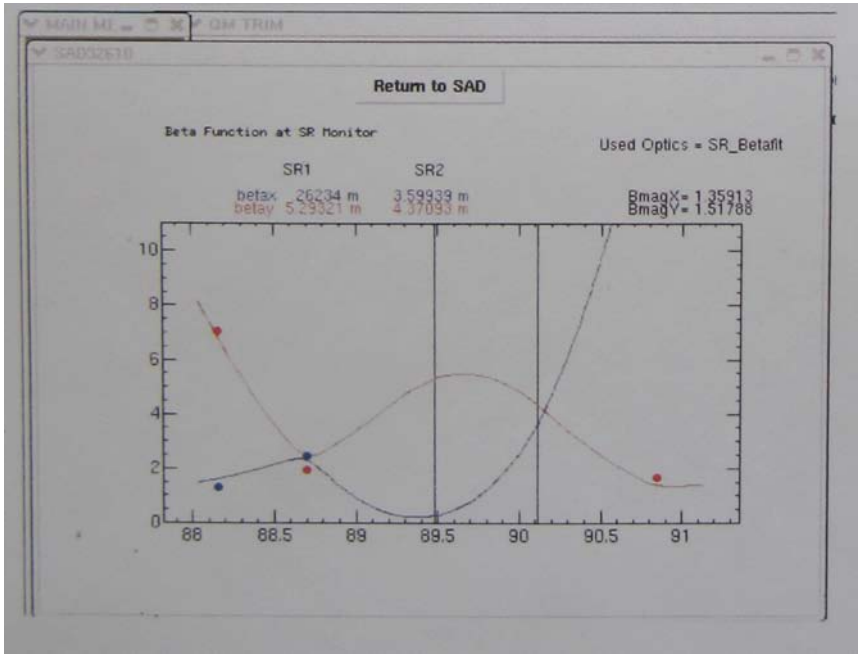
$$\tau_z = 7.0 \pm 0.75\ ms \qquad \tau_z = 12.6\ ms$$

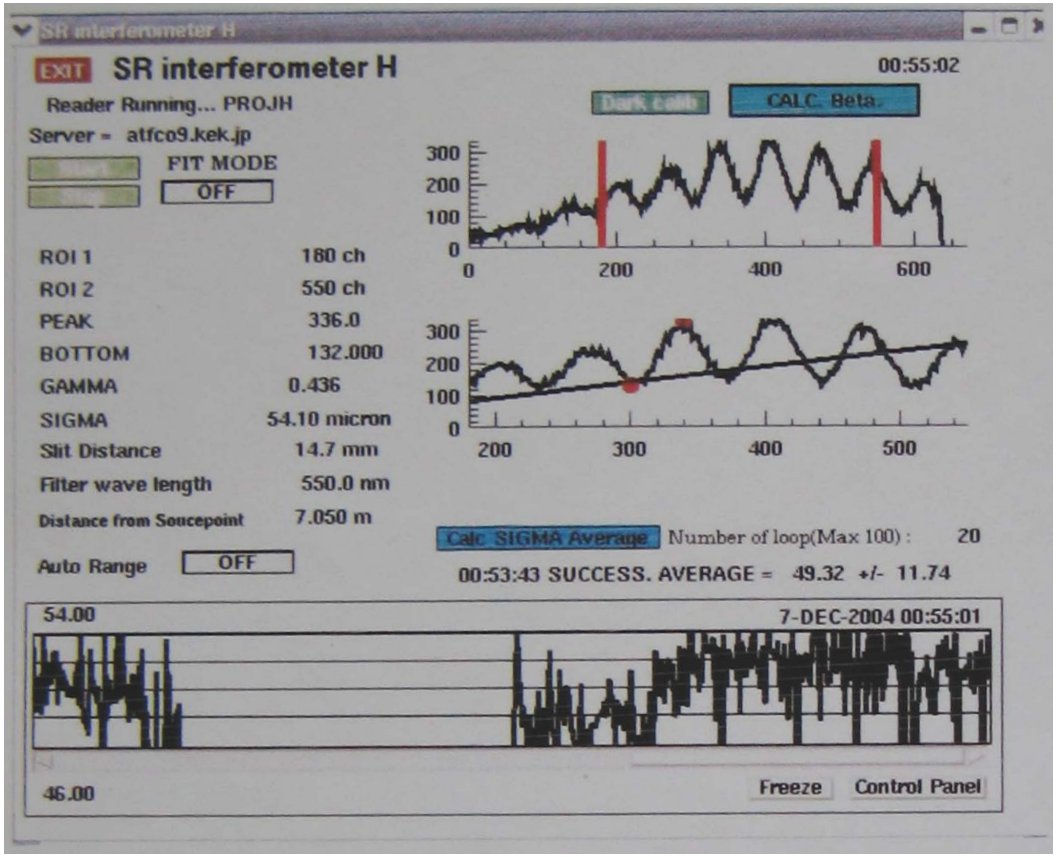
$$\sigma_z = 9.2 \pm 0.6\ mm \qquad \sigma_z = 9\ mm$$

$$\epsilon_y = \frac{\sigma_y^2 - (\eta_y \sigma_p)^2}{\beta_y} = \frac{(15.87 \times 10^{-6})^2 - (-2.8 \times 10^{-3} 5.6 \times 10^{-4})^2}{6.96}$$

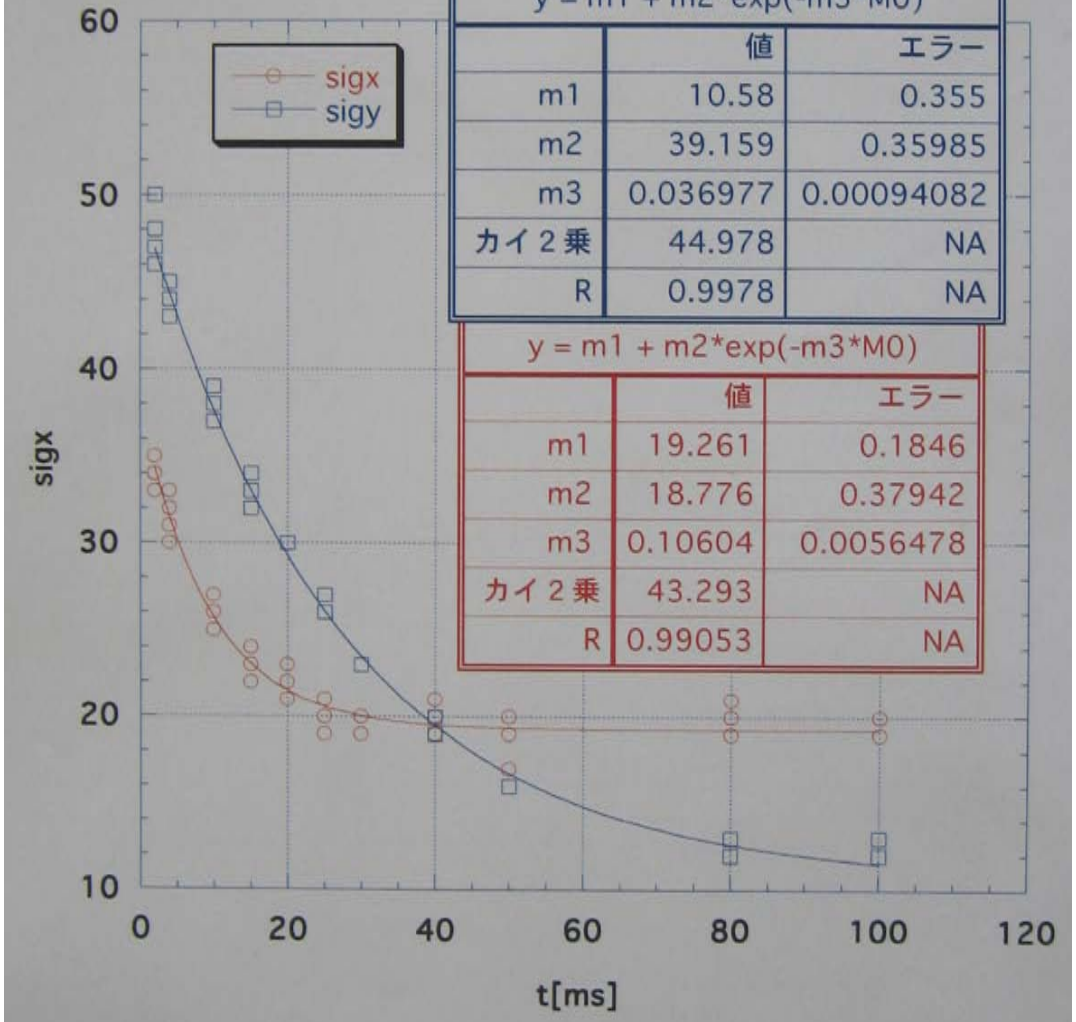
$$\epsilon_y = 3.58 \times 10^{-11}\ m$$


Return to SAD
Beta Function at SR Monitor
Used Optics = SR_Betafit
SR1
SR2
betax 26234 m
betay 5.29321 m
3.59939 m
4.37093 m
BmagX= 1.35913
BmagY= 1.51768
SAD INTERFACE MENU
EXIT
LINAC + BT
ORBIT CORRECTION
LnBt Local Bump
MAGNET K <-> I CALCULATION
LOCAL BUMP ORBIT
SAD, WAIST SCAN, SetQuad
WAIST SCAN
LINAC ENERGY
Server Links
SELECT SAD HOST
ATFCO0
SERVER PROCESS
START
STOP
01:01:48 WAITTING NEW REQUEST.
DATA TRANSFER
DR FAST LOCAL BUMP
EXT ORBIT/DISPERSION CORRECTION
OPEN MENU
BPM DATA to S
DR ORBIT CORRECTION
Beta function at SR Monitor
Trim Current
Nx
Ny
Get TBT peak value
Qmag NAME(1)
QM3R.2
Bx 1.2897
By 7.0290
Qmag NAME(2)
QM4R.2
Bx 2.4544
By 1.9381
Qmag NAME(3)
QM5R.2
Bx 17.0379
By 1.6759
OPTICS NAME
SR_Betafit
SAVE to SAD
CALC.
02:03:21 FINISH SAVE DATA TO SAD.
Name sr2
Offset 0.000
If not all buttons are use, cal. will be wrong.
This calc has bug, will be fixed soon. K.K
Dark calib
CALC. Beta
01:02:55
Save Set Data
SET
FILE
SET03DEC16_1721.DAT
ON
OFF
RESET
VAC
TIMING
MAG
MONITOR
KICKER
CONTROL
Online Analysys [Correlation Plot]
SAD
OPTICS TEST
Momentum Spread
Delta-f Ramp
EXT. S Wire
OTHERS
SAVE PARAMETER
PRINT WINDOW
Message 10:48:49 FINISH TO SET FILE DATA.
1:02:55
12/07/04


Return to SAD
Beta Function at SR Monitor
Used Optics = SR_Betafit
SR1
SR2
betax 26234 m
betay 5.29321 m
3.59939 m
4.37093 m
BmagX= 1.35913
BmagY= 1.51788
10
8
6
4
2
0
88
88.5
89
89.5
90
90.5
91


SR interferometer H
EXIT
SR interferometer H
00:55:02
Reader Running... PROJH
Server = atfco9.kek.jp
FIT MODE
OFF
Dark Calib
CALC. Beta
ROI 1 180 ch
ROI 2 550 ch
PEAK 336.0
BOTTOM 132.000
GAMMA 0.436
SIGMA 54.10 micron
Slit Distance 14.7 mm
Filter wave length 550.0 nm
Distance from Soucepoint 7.050 m
Auto Range OFF
300
200
100
0
0
200
400
600
200
300
400
500
Calc SIGMA Average
Number of loop(Max 100) : 20
00:53:43 SUCCESS. AVERAGE = 49.32 +/- 11.74
54.00
7-DEC-2004 00:55:01
46.00
Freeze
Control Panel

Beam Size(Wiggler OFF)

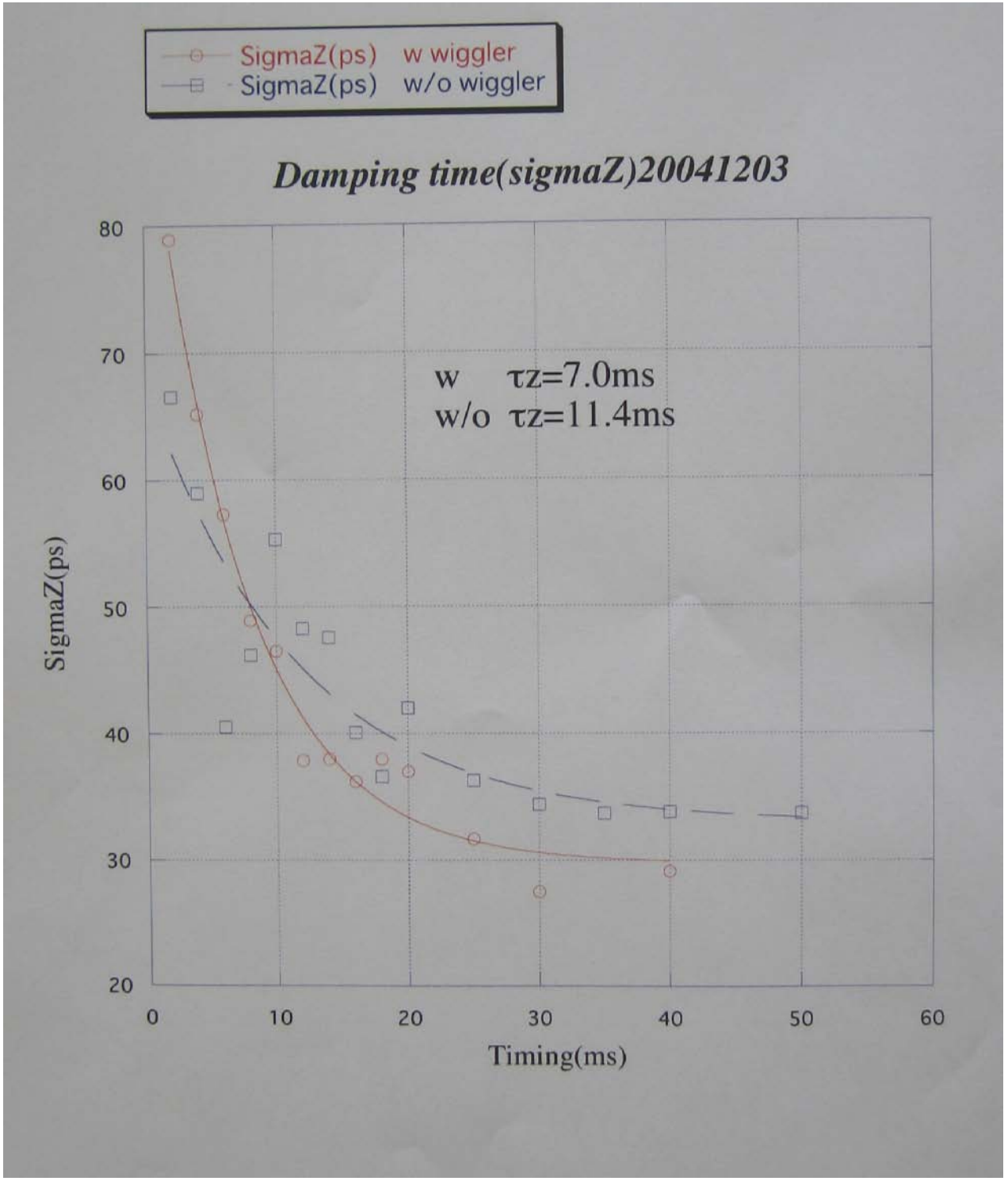


y = m1 + m2*exp(-m3*M0)		
	値	エラー
m1	10.58	0.355
m2	39.159	0.35985
m3	0.036977	0.00094082
カイ２乗	44.978	NA
R	0.9978	NA

y = m1 + m2*exp(-m3*M0)		
	値	エラー
m1	19.261	0.1846
m2	18.776	0.37942
m3	0.10604	0.0056478
カイ２乗	43.293	NA
R	0.99053	NA

$\tau_y = 27$ ms

$\tau_x = 9.43$ ms


SigmaZ(ps) w wiggler
SigmaZ(ps) w/o wiggler
Damping time(sigmaZ)20041203
w τz=7.0ms
w/o τz=11.4ms
SigmaZ(ps)
Timing(ms)
80
70
60
50
40
30
20
0
10
20
30
40
50
60

1.28 GeV, RF voltage 80 kV, wiggler field off

$$\sigma_x = 49.32\ \mu m$$

$$\beta_x = 3.6\ m$$

$$\eta_x = 0.007\ m$$

$$\epsilon_x = \frac{\sigma_x^2 - (\eta_x \sigma_p)^2}{\beta_x} = \frac{(49.32 \times 10^{-6})^2 - (7 \times 10^{-3} 5.6 \times 10^{-4})^2}{3.6}$$

$$\epsilon_x = 0.675\ nm$$

$$\tau_x = 9.43 \pm 0.5\ ms$$

$$\tau_y = 27.0 \pm 0.65\ ms$$

$$\tau_z = 11.4\ ms$$

$$\sigma_z = 10 \pm 0.6\ mm$$

MAD

$$\epsilon_x = 1.06\ nm$$

$$\tau_x = 18\ ms$$

$$\tau_y = 28.5\ ms$$

$$\tau_z = 20.4\ ms$$

$$\sigma_z = 10.2\ mm$$

Table 1: List of ILC damping ring parameters based on TME5.1 version (KEK)

Parameter	**TME5.1**	**with NLC wig**	**modified by me**
Ring energy [GeV]	5.0	5.0	5.0
Ring circumference [m]	3223.8	3223.8	3223.8
No. of bunch trains stored	60	60	60
No. of bunches/trains stored	43	43	43
Train spacing [ns]	61	61	61
Bunch spacing [ns]	2.8	2.8	2.8
Bunch population	1.4×10^{10}	1.4×10^{10}	2.0×10^{10}
Horizontal emittance (norm) [nm]	3892	2841	2030(2200)
rms energy spread [%]	0.136	0.15	0.151
rms bunch length [mm]	7.37	9.94	9.6
Damping time x/y/z [msec]	12.1/12.1/6.08	8.1/8.1/4.05	8.12/8.12/4.6
Betatron tune x/y	45.36/24.55	45.36/24.78	48.85/27.19
Number of cells	60	60	76
Field of bending magnet [T]	0.194	0.194	0.153
Length of bending magnet [m]	9	9	9
Number of wigglers	80	80	80
Wiggler period [cm]	40	27	27
Field of wiggler [T]	1.8	2.15	2.15
Energy loss per turn [MeV]	8.85	13.28	13.15
RF frequency [MHz]	714	714	714
Effective RF voltage [MV]	16	16	16

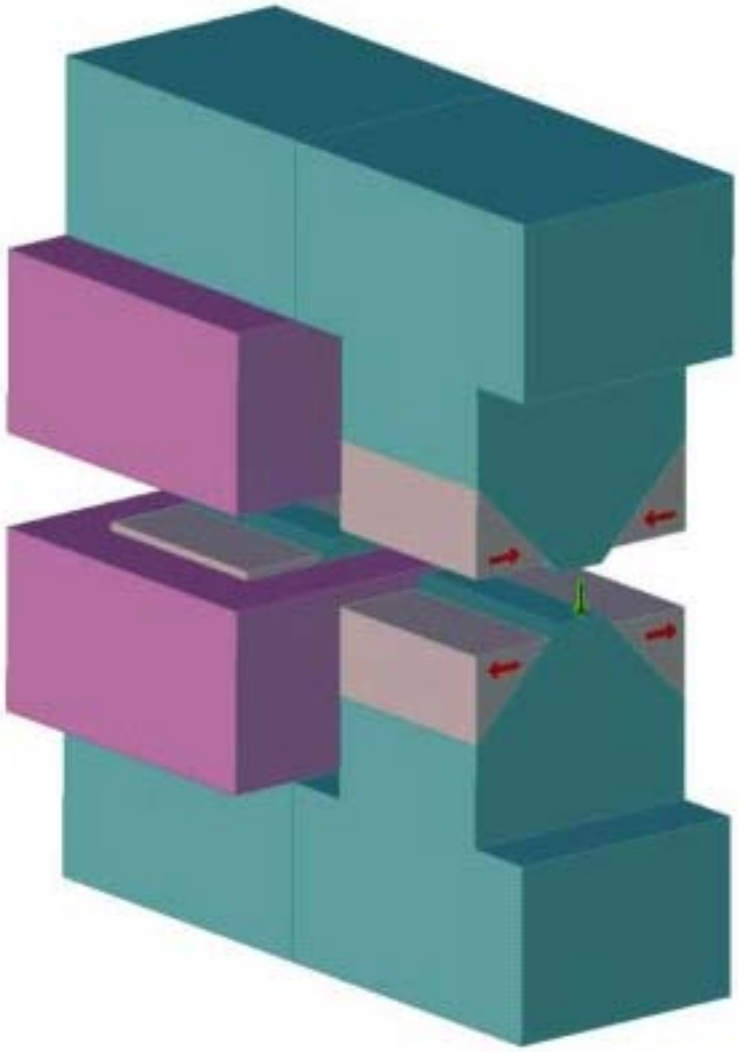
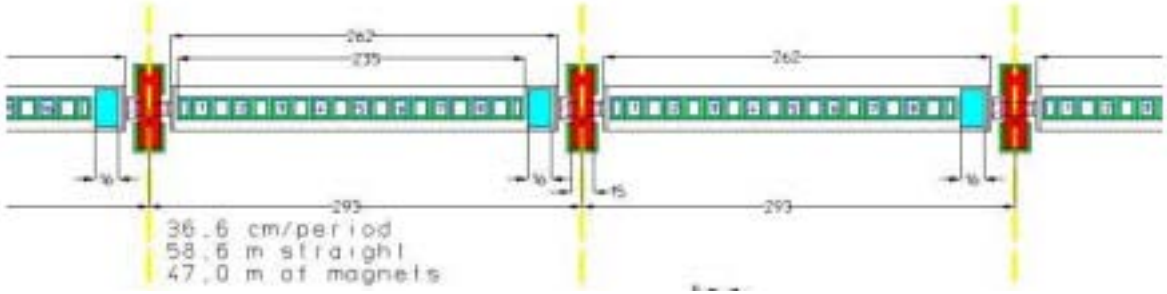


Figure 1. Electromagnet wiggler, one period.

8 periods -> length 2.16 m



- B_w = 2.15 T (sinusoidal field)
- λ_w = 0.27 m
- magnet gap, g = 2.0 cm