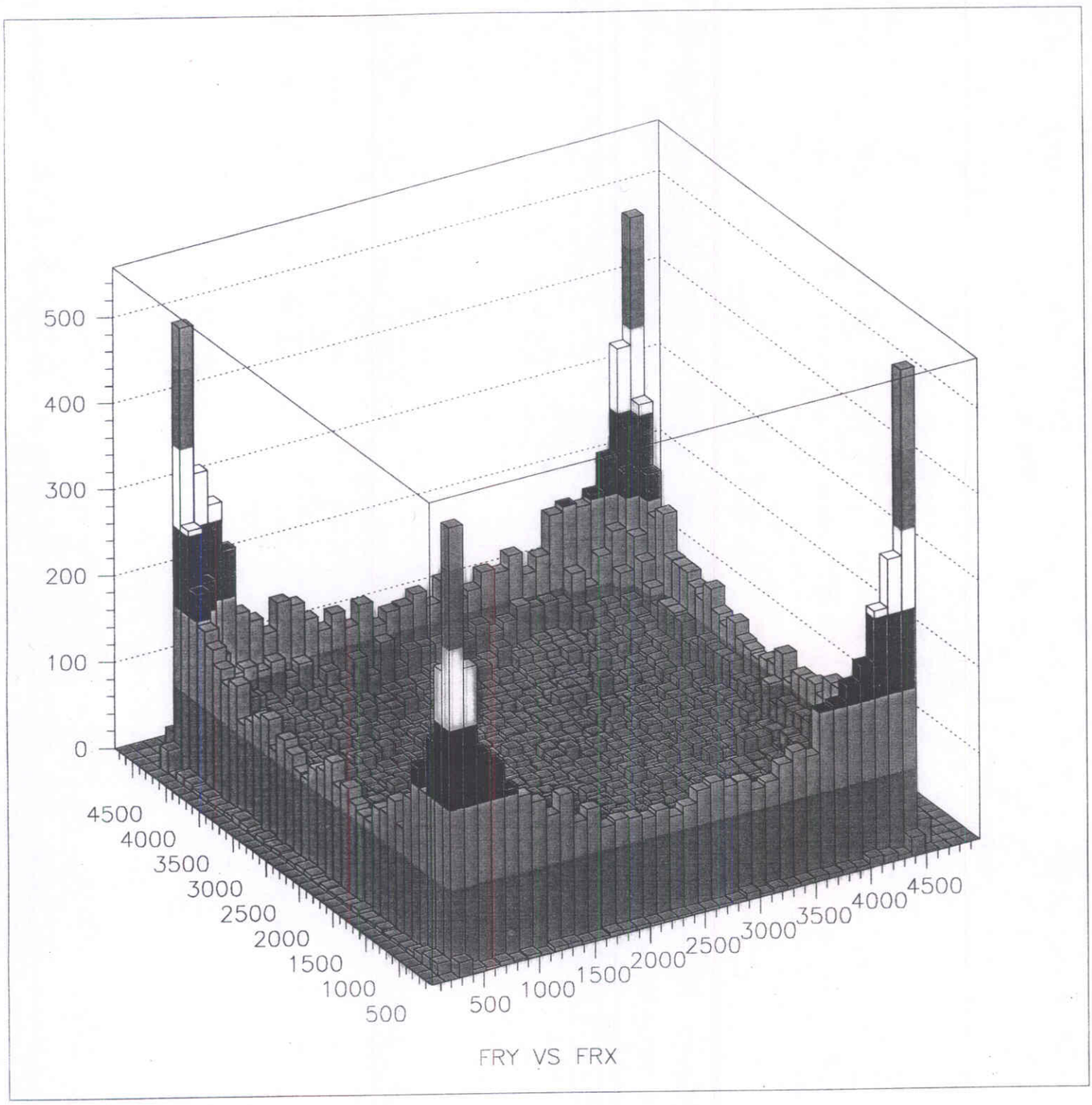
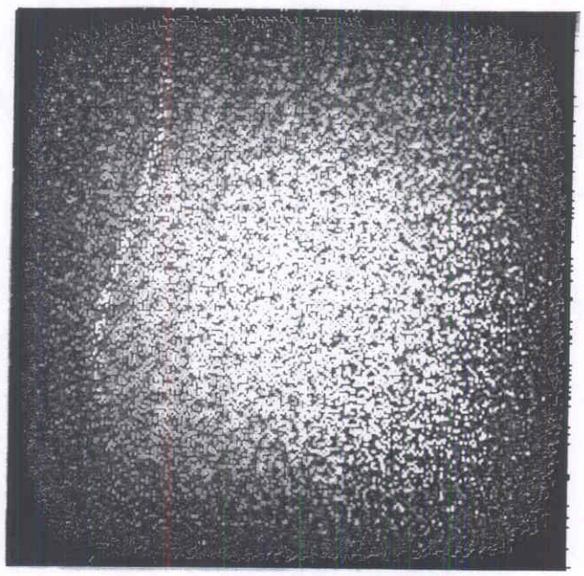
HALL C / G_0 TARGET RASTER SYSTEM (2003)

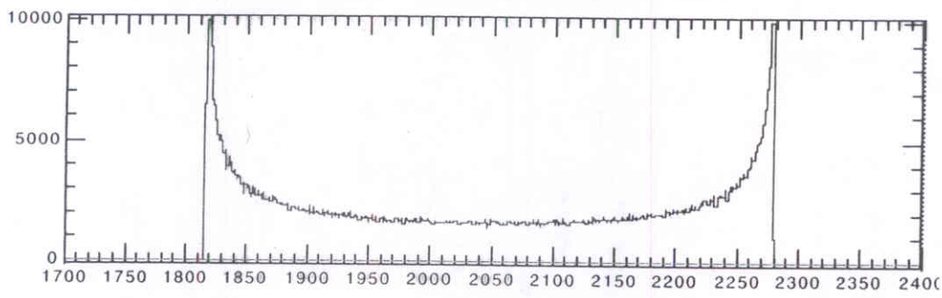
CHEN YAN

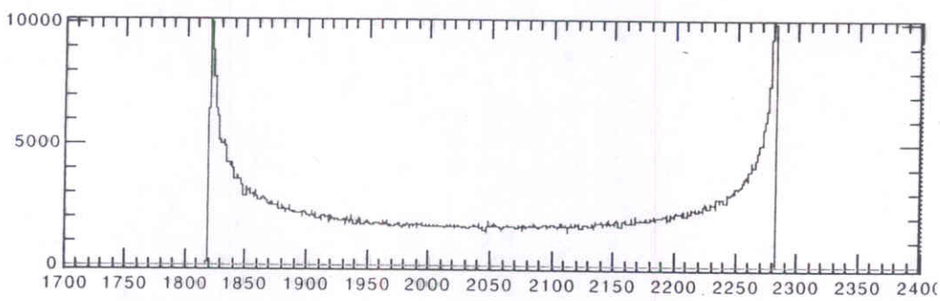
NIKOLAI SINKINE



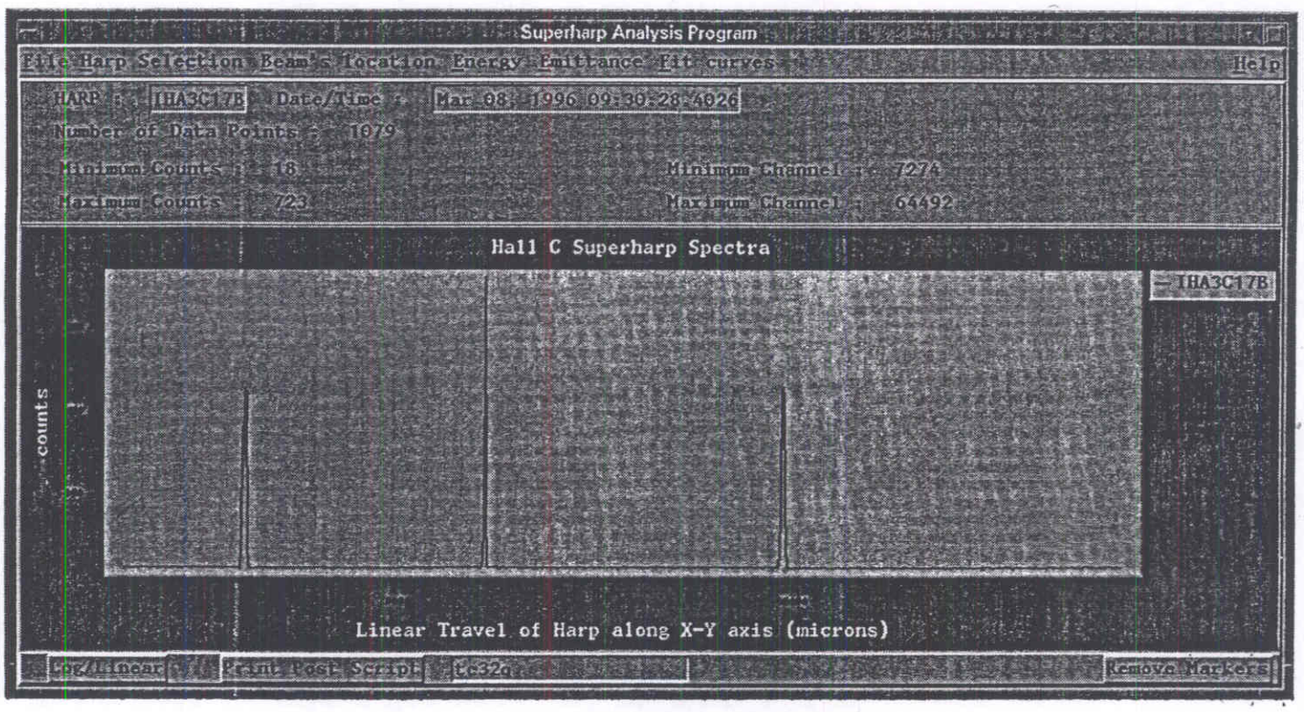
Density Histogram of Hall C Lissajous Raster Pattern (1994 – 2002)

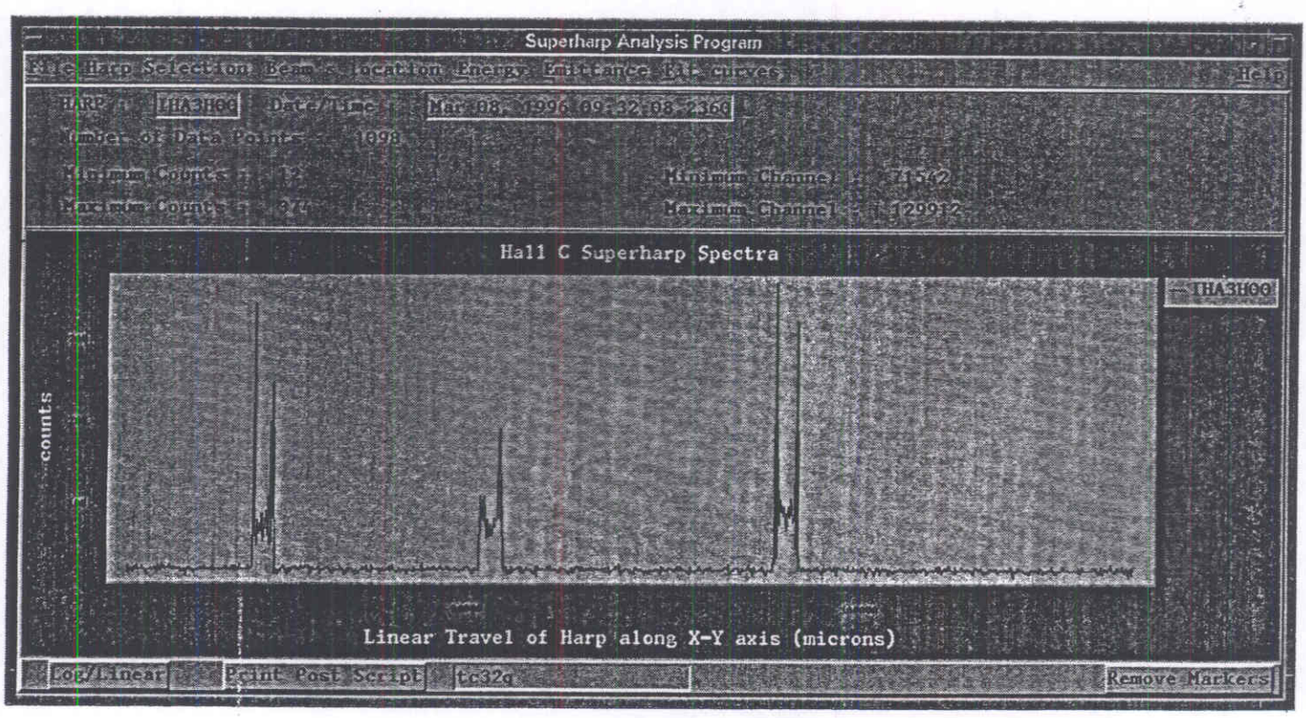


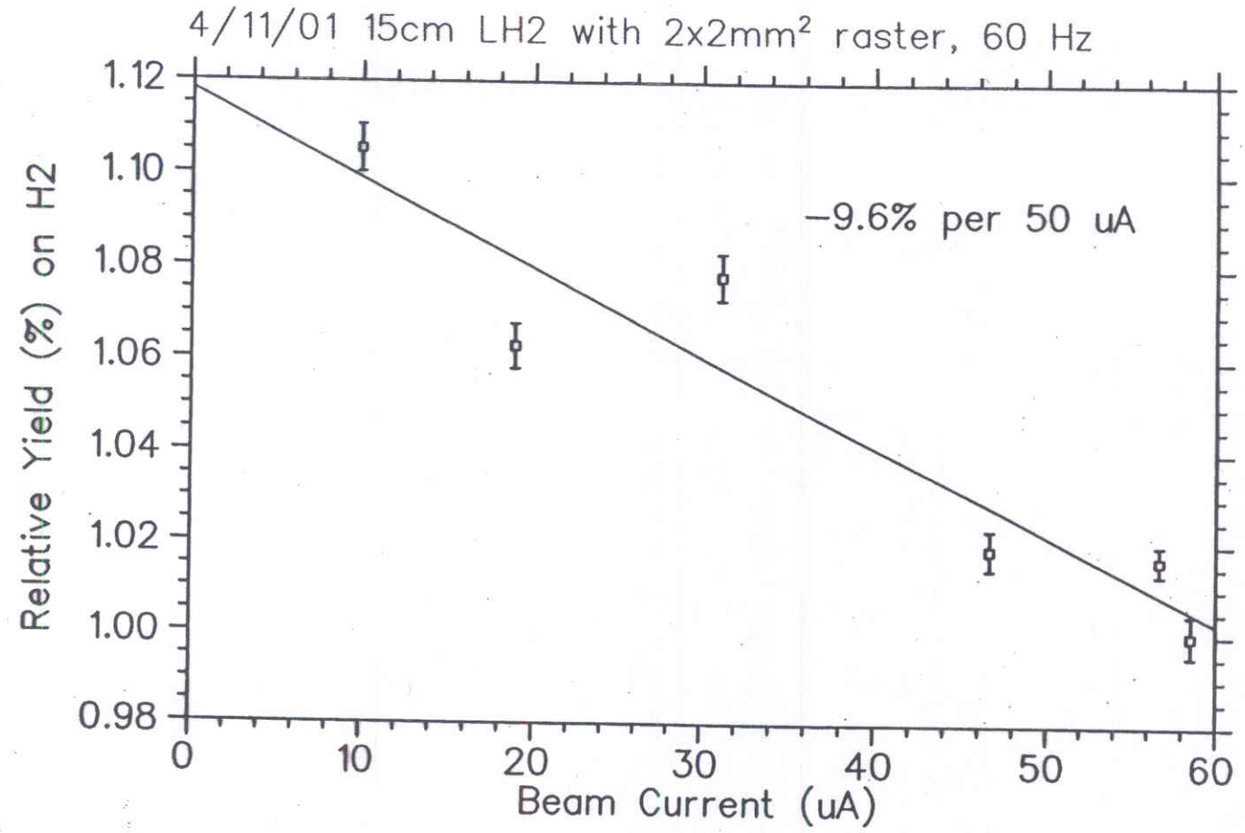


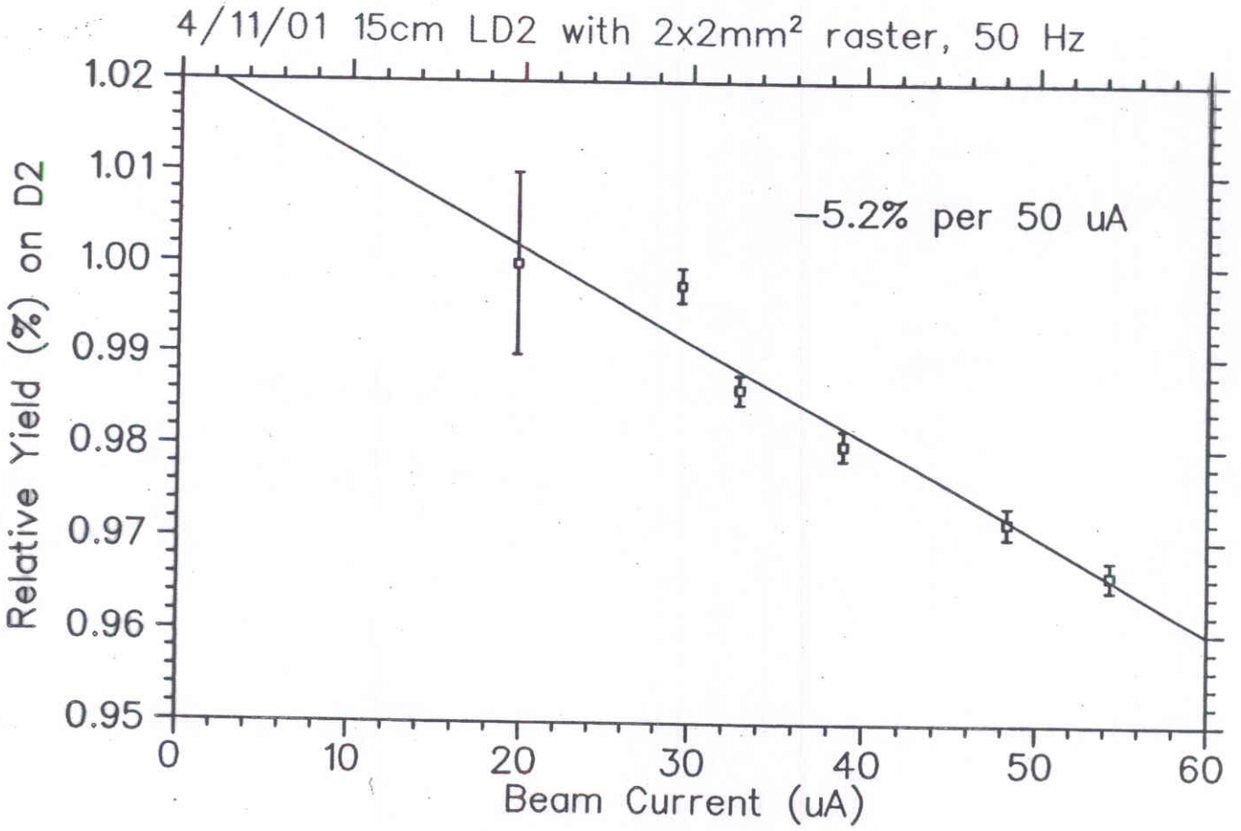


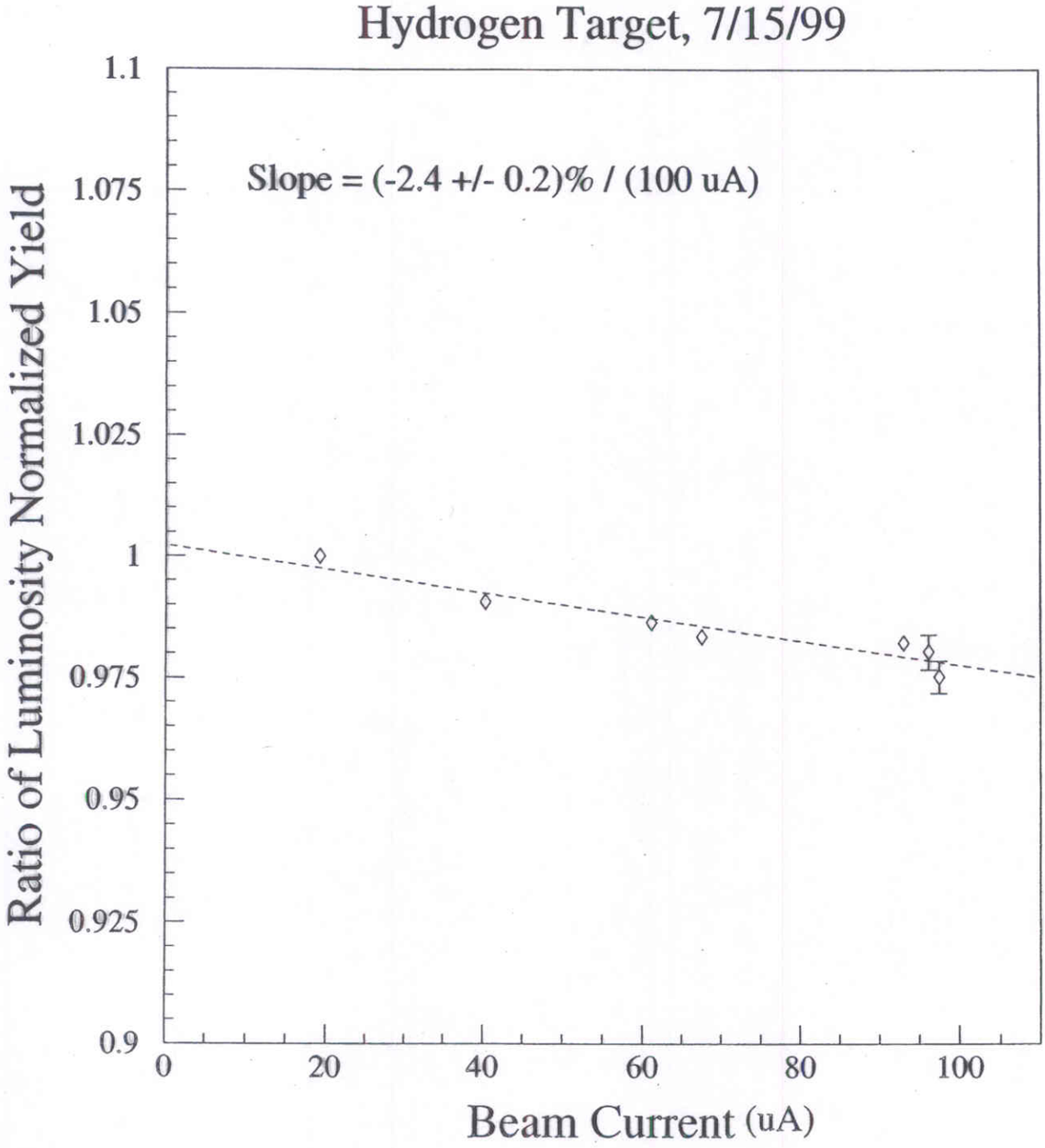
Profiles of Hall C Lissajous Raster Pattern (1994 – 2002)


Superharp Analysis Program
File Harp Selection Beam's Location Energy Emittance Fit curves Help
HARP : 1HA3C17B Date/Time : Mar 08, 1996 09:30:28.4026
Number of Data Points : 1079
Minimum Counts : 18
Maximum Counts : 723
Minimum Channel : 7274
Maximum Channel : 64492
Hall C Superharp Spectra
1HA3C17B
counts
Linear Travel of Harp along X-Y axis (microns)
Log/Linear
Print Post Script
tc32c
Remove Markers

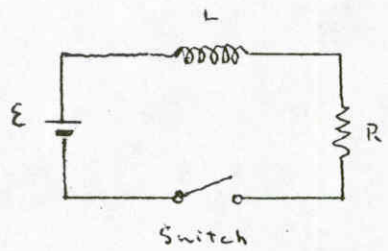

Superharp Analysis Program
File Harp Selection Beam's Location Energy Emittance Fit curves Help
HARP : 1HA3H00 Date/Time : Mar 08, 1996 09:32:08.2360
Number of Data Points : 1099
Minimum Counts : 12
Maximum Counts : 974
Minimum Channel : 71542
Maximum Channel : 129912
Hall C Superharp Spectra
1HA3H00
counts
Linear Travel of Harp along X-Y axis (microns)
Log/Linear
Print Post Script
tc32g
Remove Markers

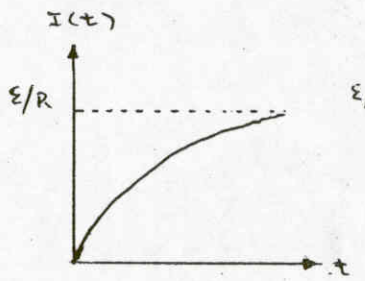

4/11/01 15cm LH2 with 2x2mm² raster, 60 Hz
Relative Yield (%) on H2
1.12
1.10
1.08
1.06
1.04
1.02
1.00
0.98
−9.6% per 50 uA
0
10
20
30
40
50
60
Beam Current (uA)


4/11/01 15cm LD2 with 2x2mm² raster, 50 Hz
Relative Yield (%) on D2
1.02
1.01
1.00
0.99
0.98
0.97
0.96
0.95
−5.2% per 50 uA
0
10
20
30
40
50
60
Beam Current (uA)


Hydrogen Target, 7/15/99
Slope = (-2.4 +/- 0.2)% / (100 uA)
Ratio of Luminosity Normalized Yield
Beam Current (uA)
1.1
1.075
1.05
1.025
1
0.975
0.95
0.925
0.9
0
20
40
60
80
100

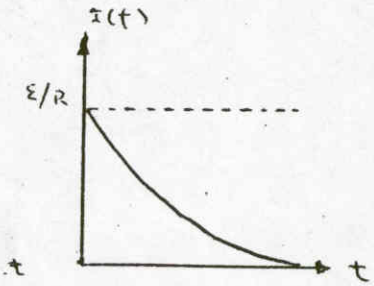
CLASSIC SWITCH





Switch "close"

$$I(t) = \frac{\varepsilon}{R}\left(1 - e^{-t/\tau}\right)$$



Switch "open"

$$I(\tau) = \frac{\varepsilon}{R} e^{-t/\tau}$$

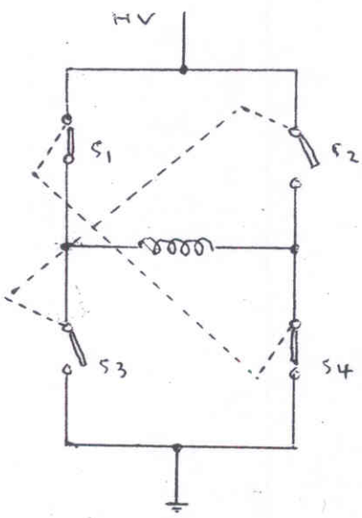
- $\tau = L/R$
- $R = R_0 + R_1$
- R_0 – magnet resistance
- R_1 – switch Internal Resistance

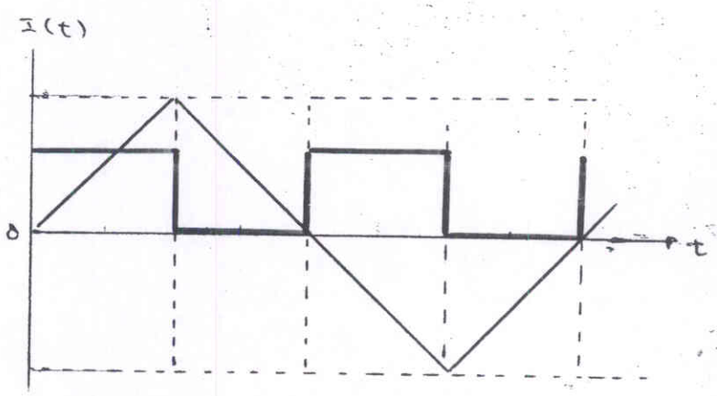
For FR coil, $L = 88\ \mu H$, $R_0 = 0.04\ \Omega$, $R_1 = 0.04\ \Omega \times 2$ } $\tau = 0.73$ ms

Assume switching frequency 25 kHz: $\frac{1}{2}T/\tau = 0.0274$ $\left(\frac{1}{2}T \ll \tau\right)$

$$\text{Linearity} = 1 - \frac{I(0) - I(\frac{1}{2}T)}{I(0)} = 1 - e^{-\frac{T}{2\tau}} = 1 - e^{-0.0274} \approx 0.973$$

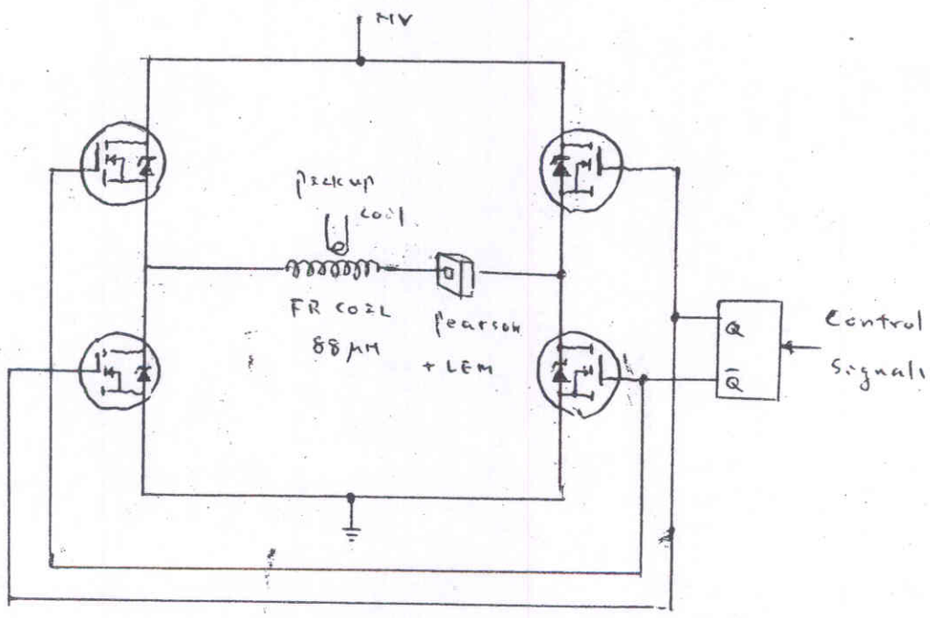
H - BRIDGE SWITCH

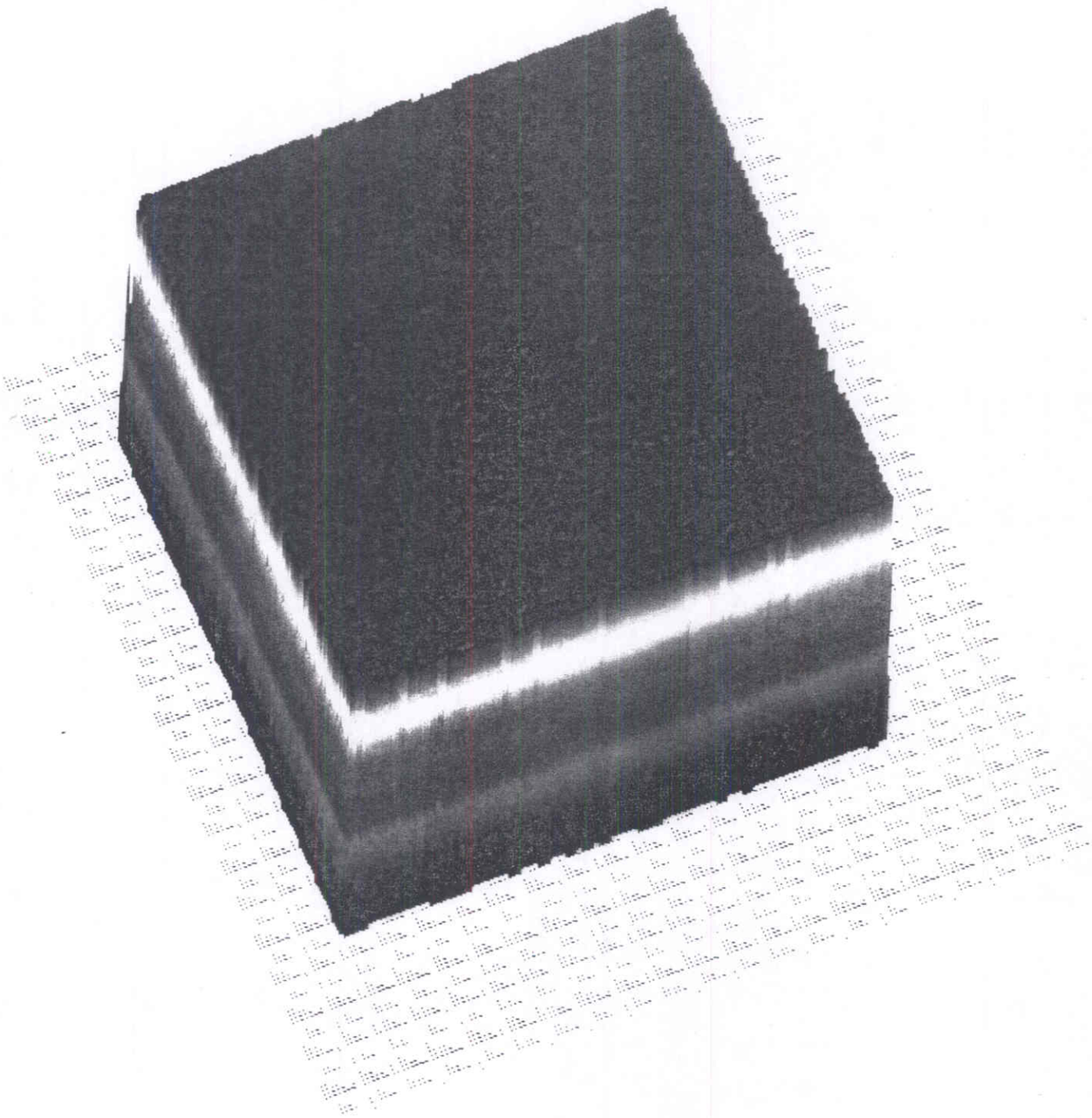




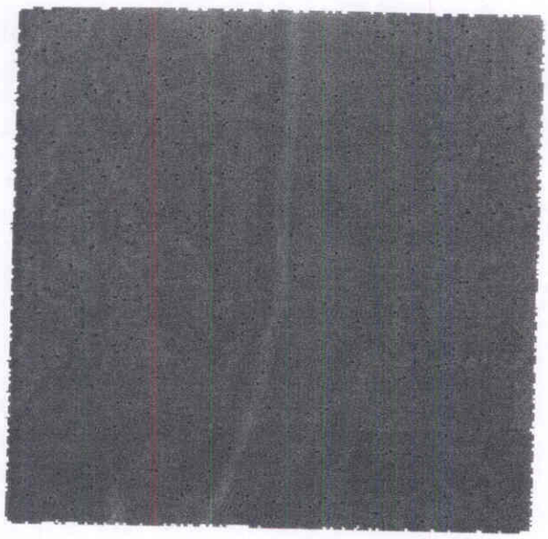
S1, S2, S3, S4 = FAST SASOLC

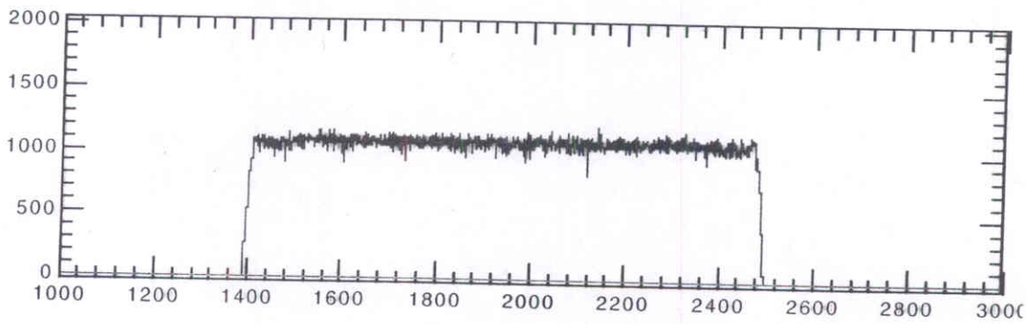
HEXFET MODULES H - BRIDGE

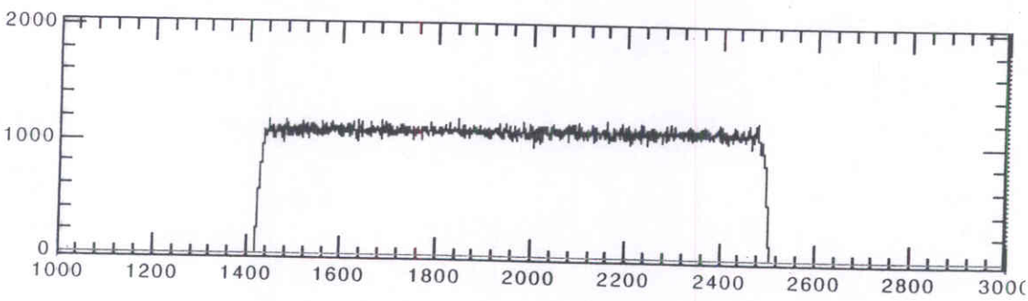




Density Histogram of Hall C Linear Raster (2002 -)







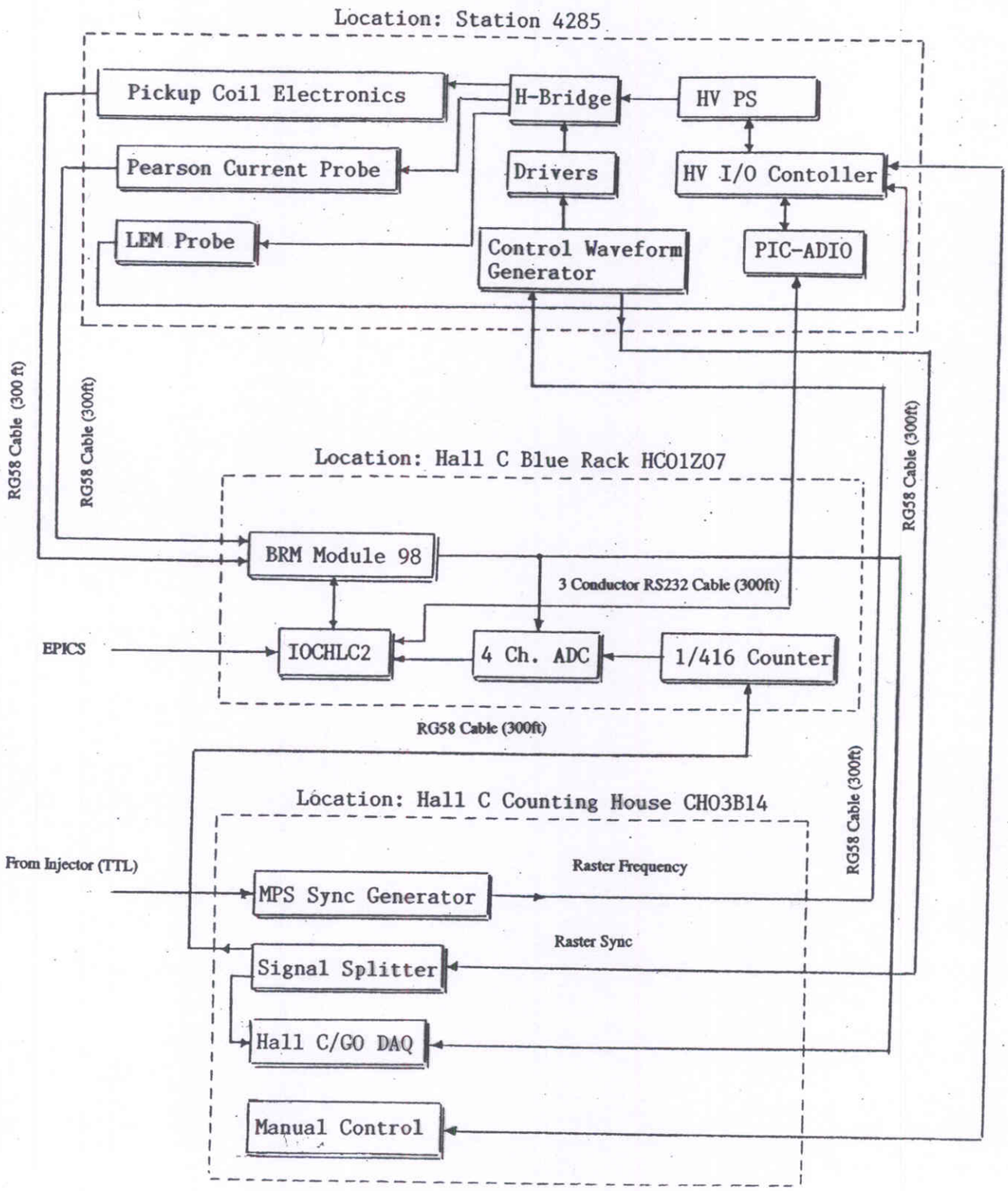
Profiles of Density Distribution of Hall C Linear Raster Pattern (2002 -)

January 5, 2003

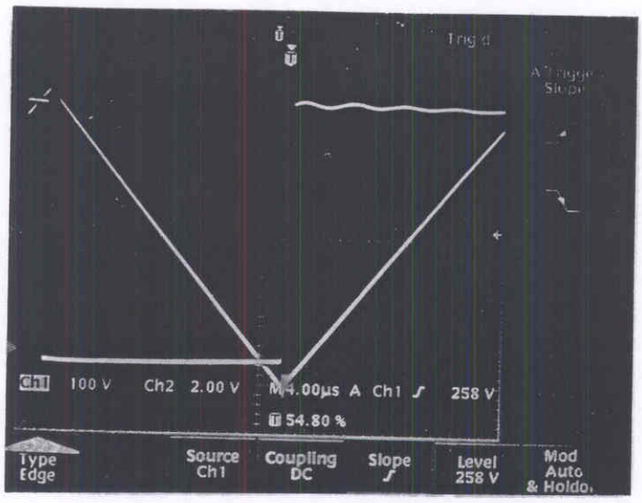
Major Specification

Raster frequencies (kHz)	*24.96/ 25.08*	
Max. I pp (A)	*82*	
Max. Rigidity (GeV/c)	*20/(Δx1/2 [mm])* *35/(Δx1/2 [mm])*	*Hall C geometry* *G0 geometry*
Max. bending power (mr)	*0.97/p[GeV/c]* *1.70/p[GeV/c]*	*Hall C geometry* *G0 geometry*
Shape of raster pattern	*Rectangular*	
Shape of raster trace	*Triangular*	
Dwelling time at vertex (ns)	*50*	
Dwelling/half period	*0.25%*	
Trace linearity (%)	*97*	
Density uniformity (%)	*95*	
Pattern stability (%)	*0.01*	
Operational mode	*Free run (correlated/ non-correlated)* *Helicity (MPS) synchronization* *Line synchronization*	
Analog on-line display	*current probe/field pickup in 2D or 3D*	
Commissioning period	*08/2002 – 01/2003*	

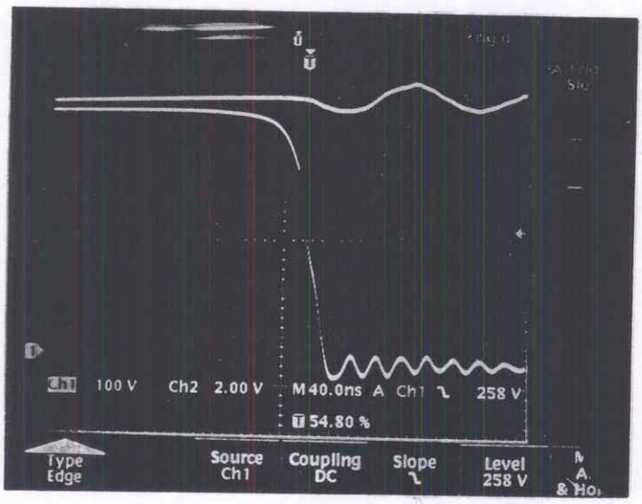
System Block Diagram for Single Module of Hall C Raster



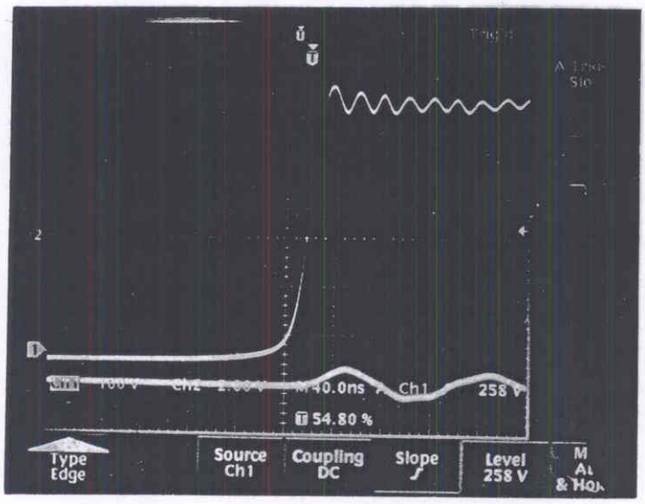
H-Bridge Switching Performance



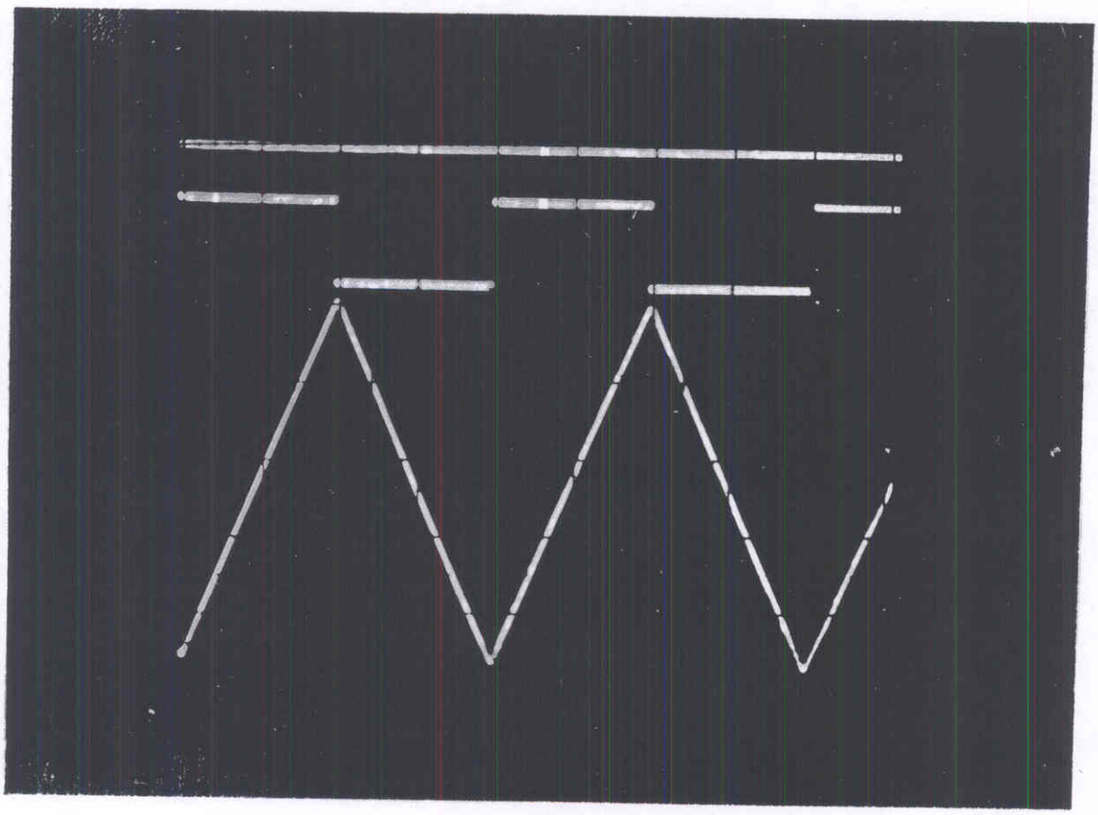
Return time of triangular current ~ HV switch time



Fall edge Δt~50 ns

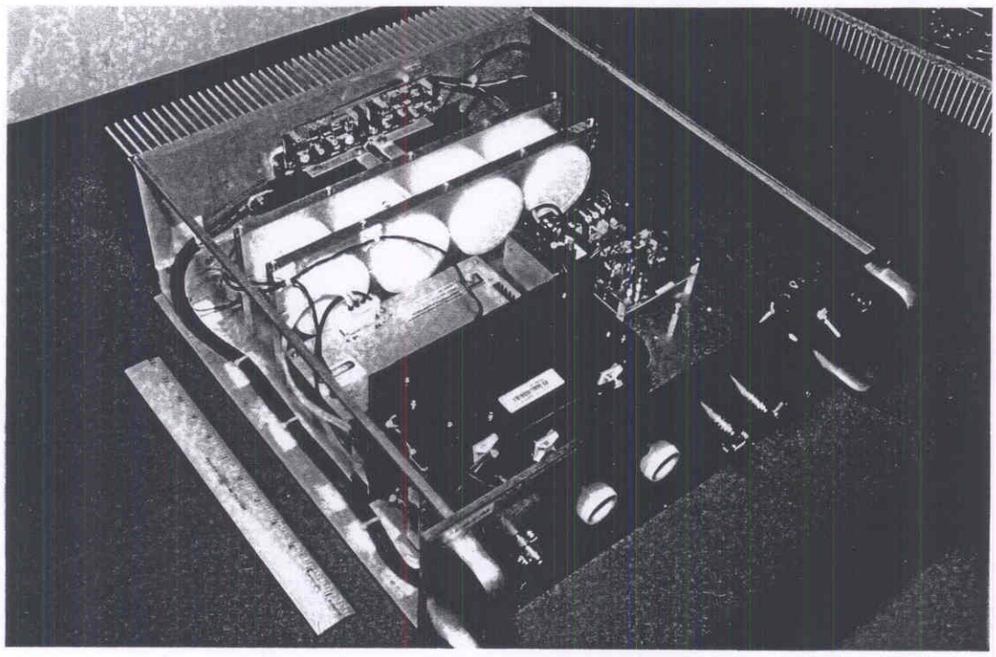


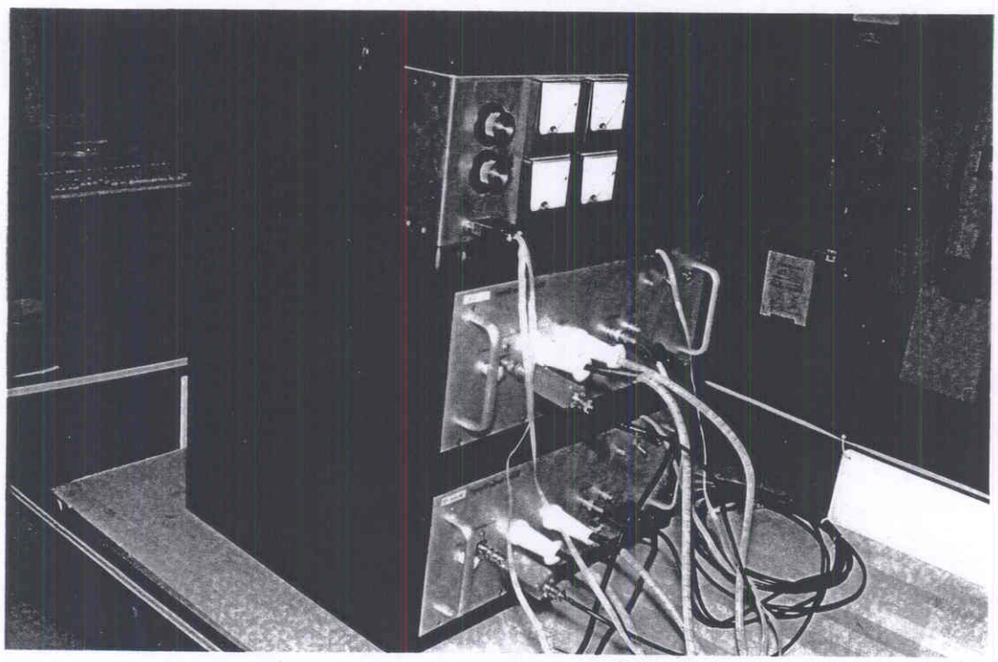
Leading edge Δt~50 ns

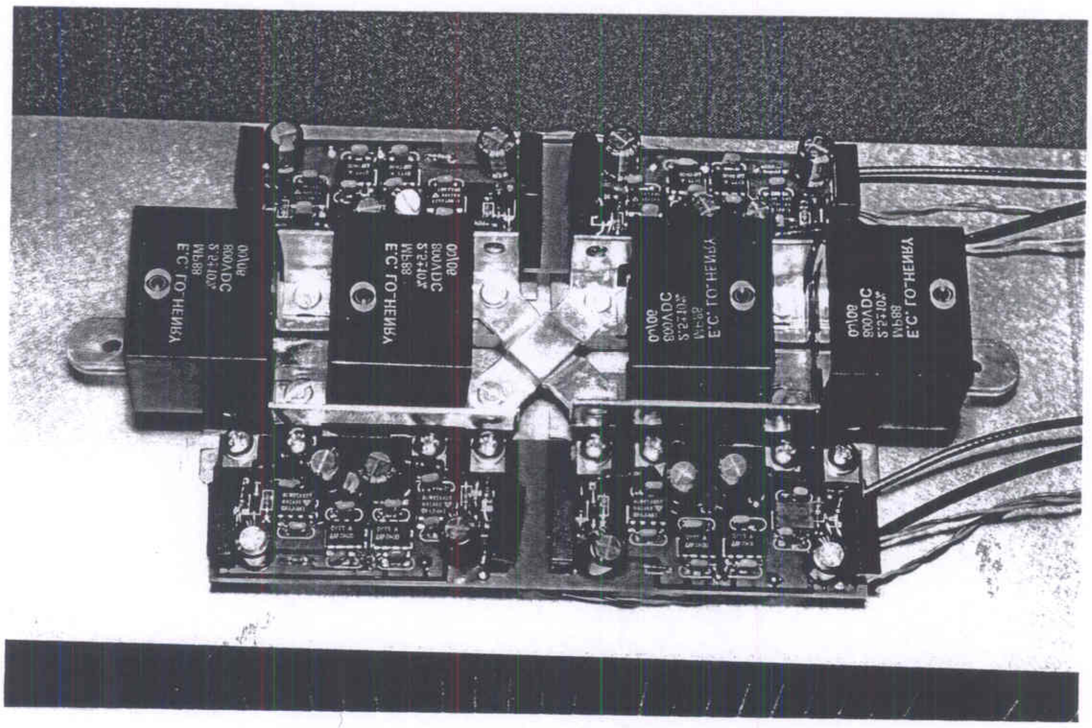


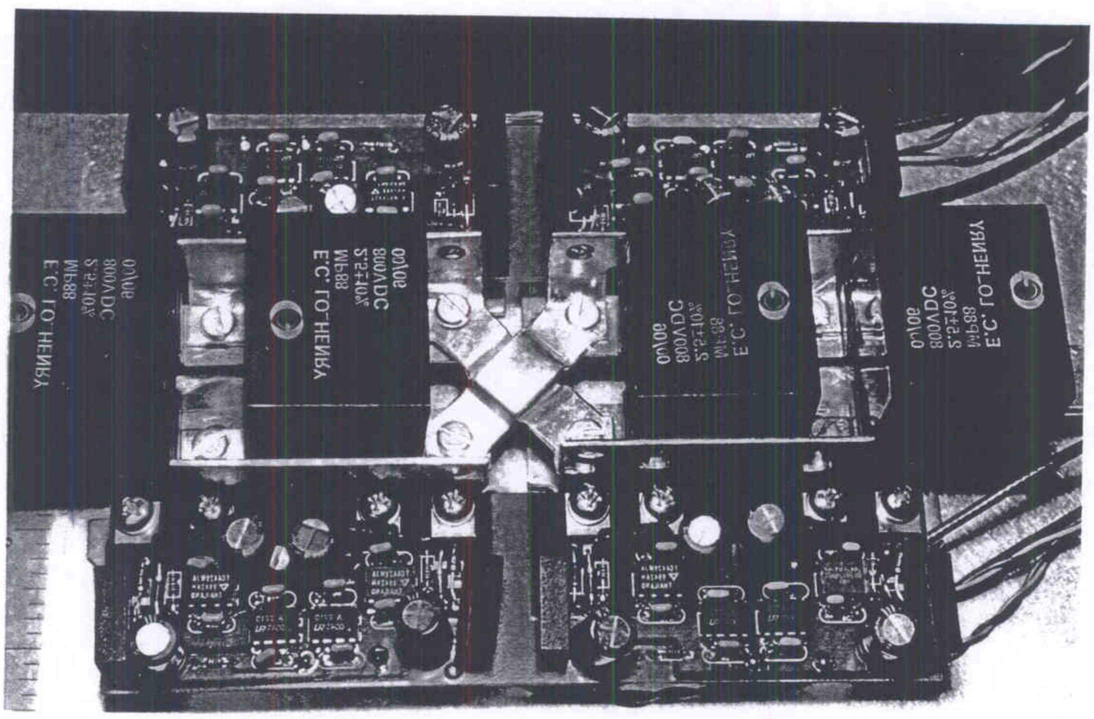
Helicity (MPS) Synchronization

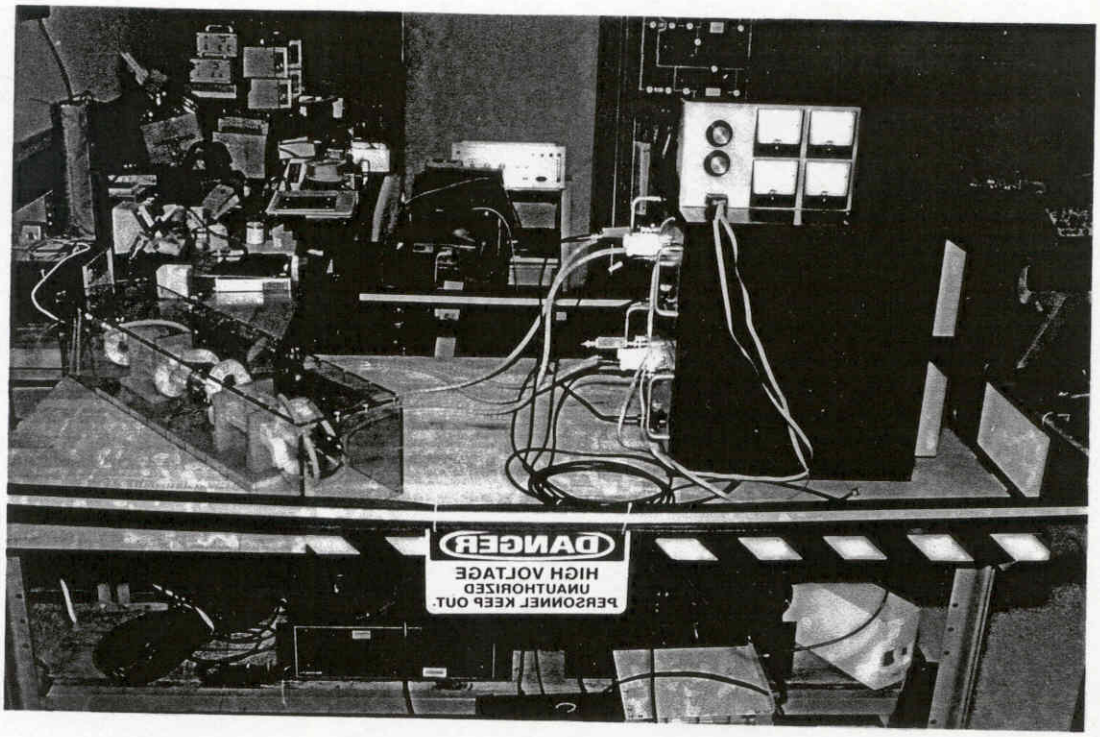
Upper trace - MPS with T_{settle} = 250 μs and T_{stable} = 33.3333 ms
Middle trace – raster sync output in TTL level
Lower trace – magnet current swing

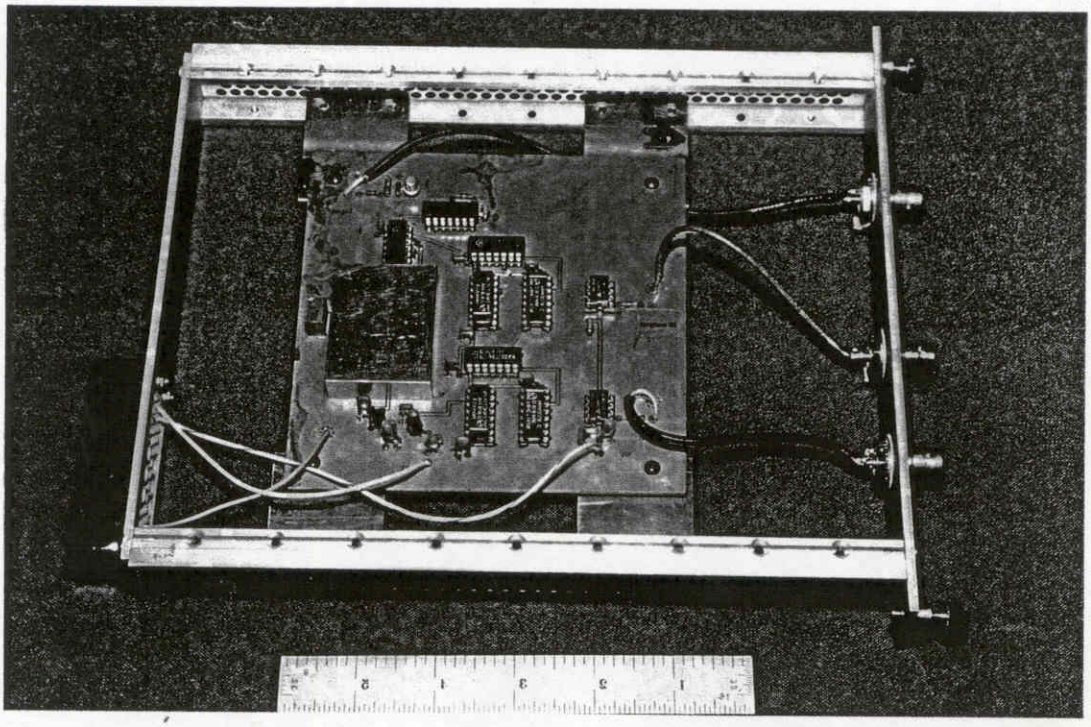


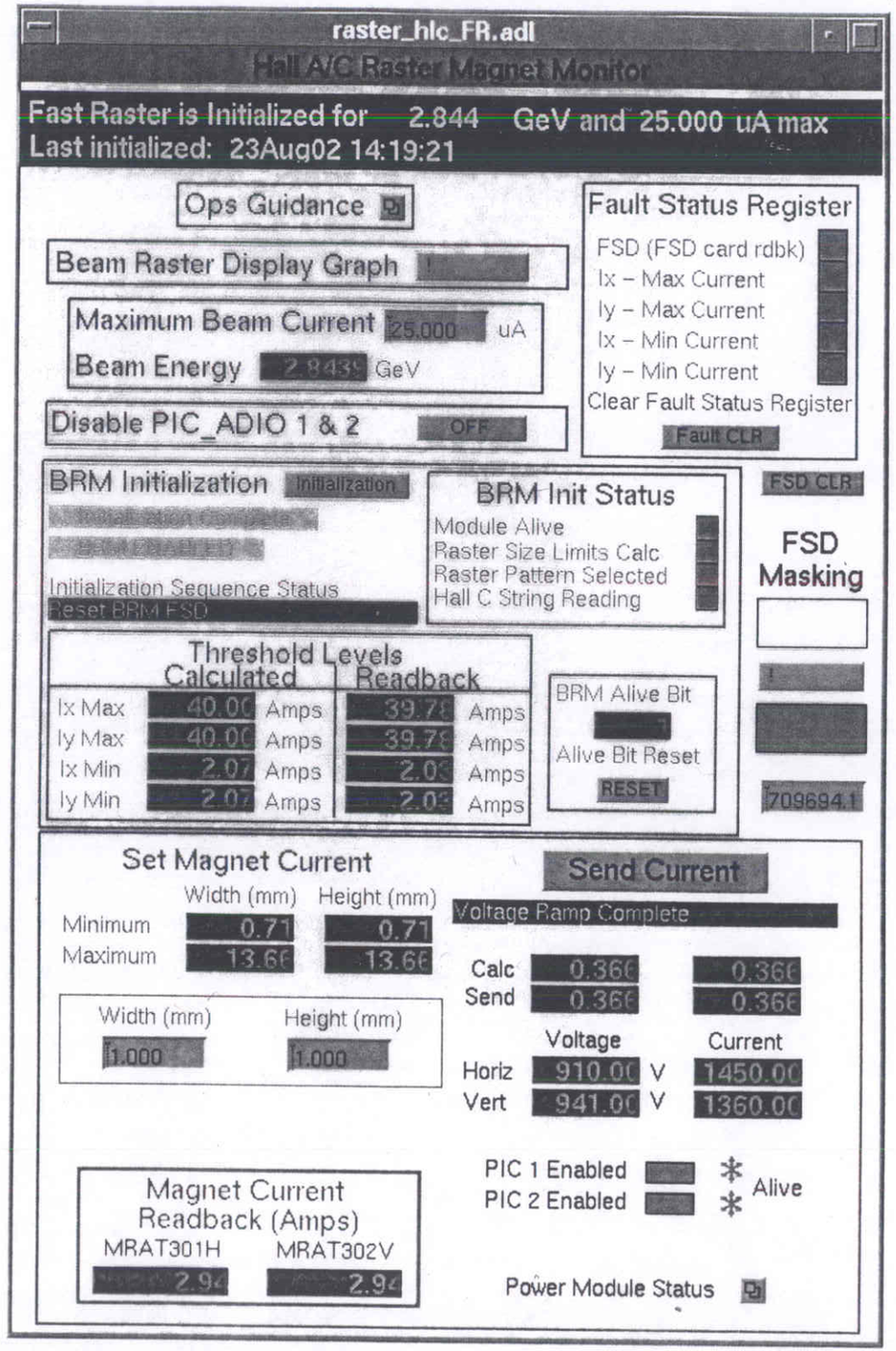


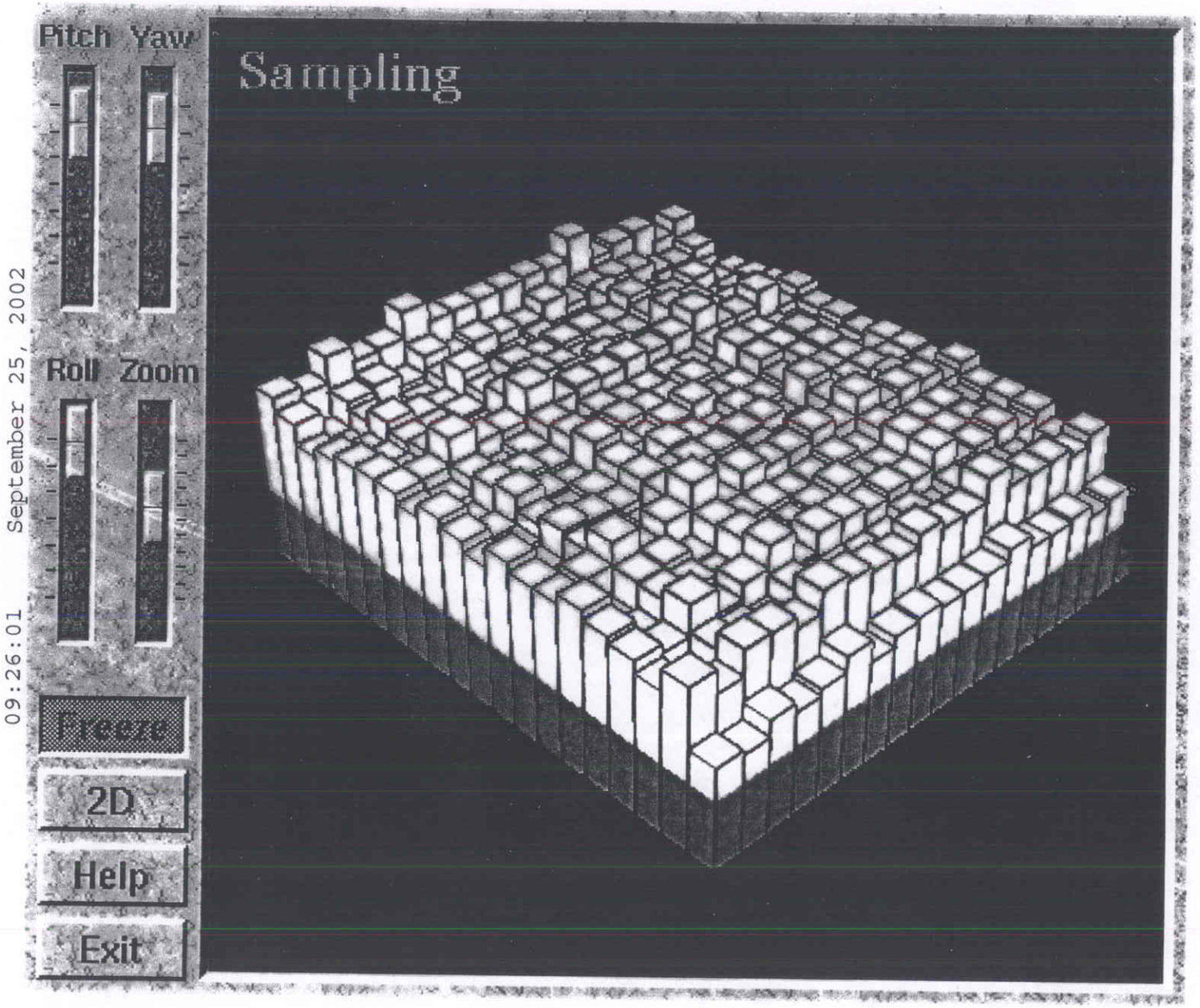




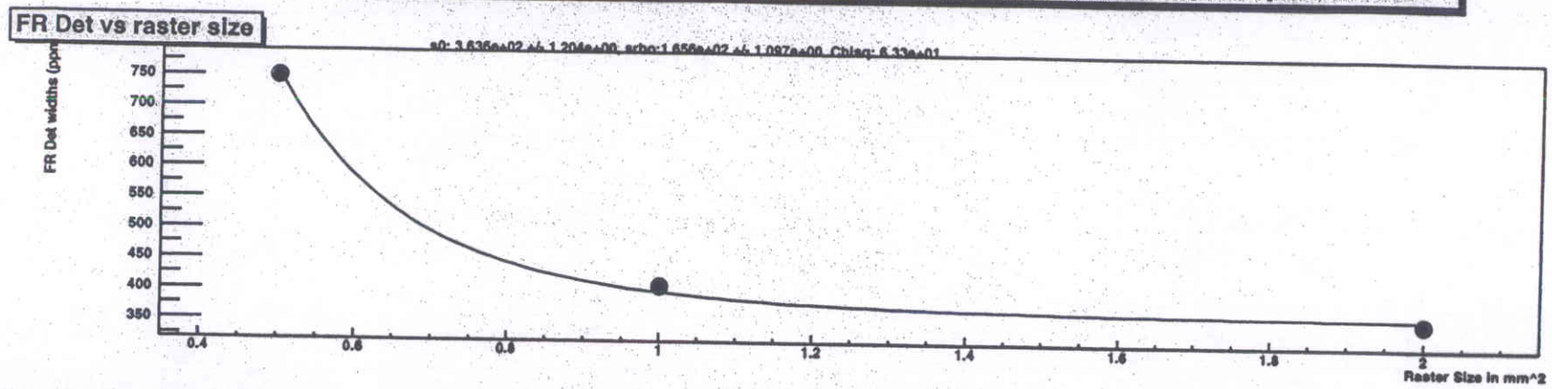

DANGER
HIGH VOLTAGE
UNAUTHORIZED
PERSONNEL KEEP OUT.

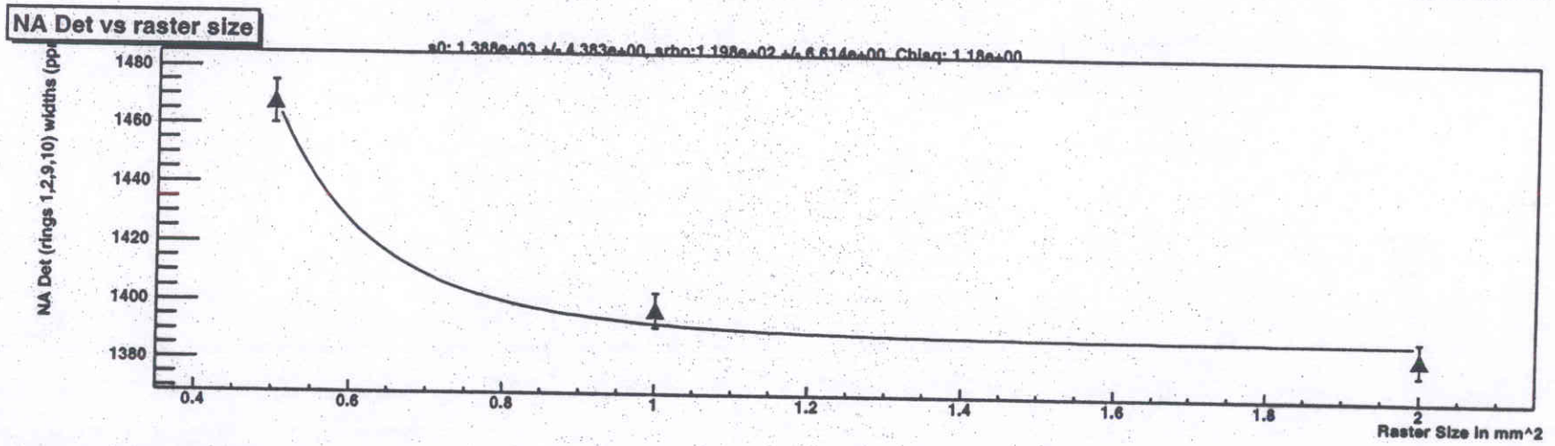


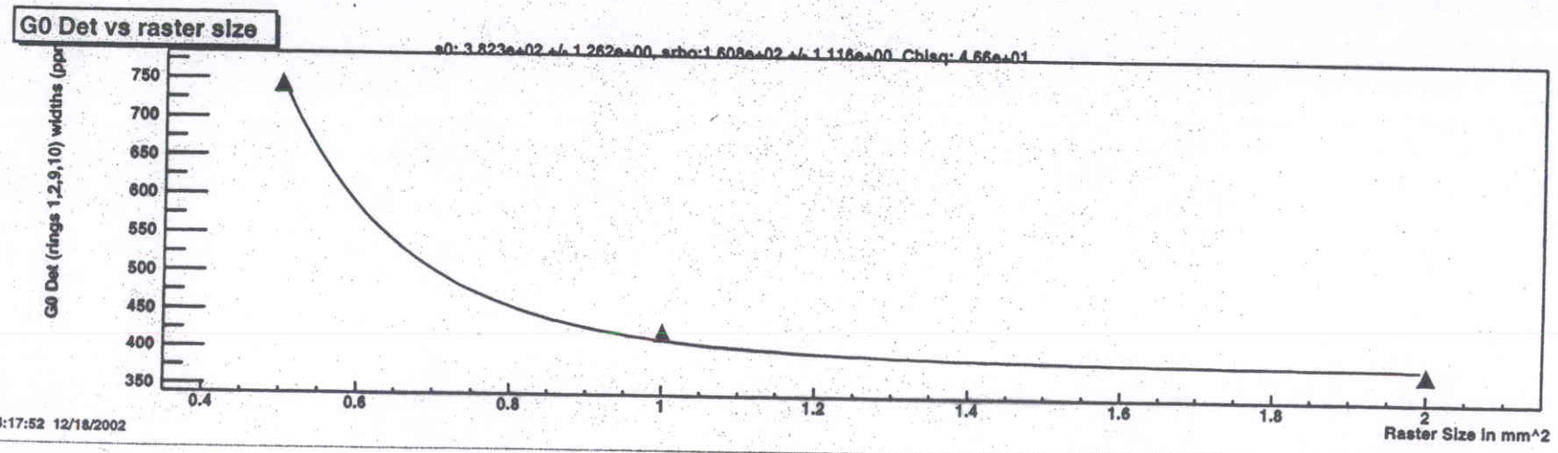

raster_hlc_FR.adl
Hall A/C Raster Magnet Monitor
Fast Raster is Initialized for 2.844 GeV and 25.000 uA max
Last initialized: 23Aug02 14:19:21
Ops Guidance
Beam Raster Display Graph
Maximum Beam Current 25.000 uA
Beam Energy 2.8439 GeV
Disable PIC_ADIO 1 & 2 OFF
Fault Status Register
FSD (FSD card rdbk)
Ix – Max Current
Iy – Max Current
Ix – Min Current
Iy – Min Current
Clear Fault Status Register
Fault CLR
BRM Initialization
Initialization
Initialization Sequence Status
Reset BRM FSD
BRM Init Status
Module Alive
Raster Size Limits Calc
Raster Pattern Selected
Hall C String Reading
FSD CLR
FSD Masking
Threshold Levels
Calculated
Readback
Ix Max 40.00 Amps 39.78 Amps
Iy Max 40.00 Amps 39.78 Amps
Ix Min 2.07 Amps 2.09 Amps
Iy Min 2.07 Amps 2.03 Amps
BRM Alive Bit
Alive Bit Reset
RESET
709694.1
Set Magnet Current
Send Current
Width (mm) Height (mm)
Minimum 0.71 0.71
Maximum 13.66 13.66
Voltage Ramp Complete
Calc 0.366 0.366
Send 0.366 0.366
Width (mm) Height (mm)
1.000 1.000
Voltage Current
Horiz 910.00 V 1450.00
Vert 941.00 V 1360.00
Magnet Current Readback (Amps)
MRAT301H MRAT302V
2.94 2.94
PIC 1 Enabled
PIC 2 Enabled
Alive
Power Module Status


Pitch
Yaw
Roll
Zoom
Freeze
2D
Help
Exit
Sampling
09:26:01
September 25, 2002

Target boiling studies, beam 40 uA, G0 detector, pump at 30 Hz







User name silviu

Log entry time 12:11:29 on December 19,2002

Entry number 54917

keyword=target boiling studies

Results from the two shots at target boiling studies could be found at

www.krl.caltech.edu/g0/target/beam_studies

For the nominal running point (30 Hz and 40 uA) the width of the asymmetry for the FR detector (from SDMCH data) is around 364 ppm and the contribution to the width from target density fluctuations (uncorrected for beam parameters) is 41 ppm for a raster 2x2 mm^2. The density reduction at this point due to boiling (again this is uncorrected for beam stuff) is of the order of 4.1x10e-5 relative effect. The density reduction decreases to 3.8x10-5 if the pump speed is increased to 42 Hz, and increases to 1.4x10-4 if the speed is dropped to 19 Hz (all at 40 uA beam). The target seems to have negligible density reduction due to boiling at 30 Hz and 40 uA for this experiment. These results are still preliminary until we'll be able to develop a robust correction procedure and regress the beam related fluctuations.