MDL0L02 Dipole and Environmental Fields

August 16, 2016

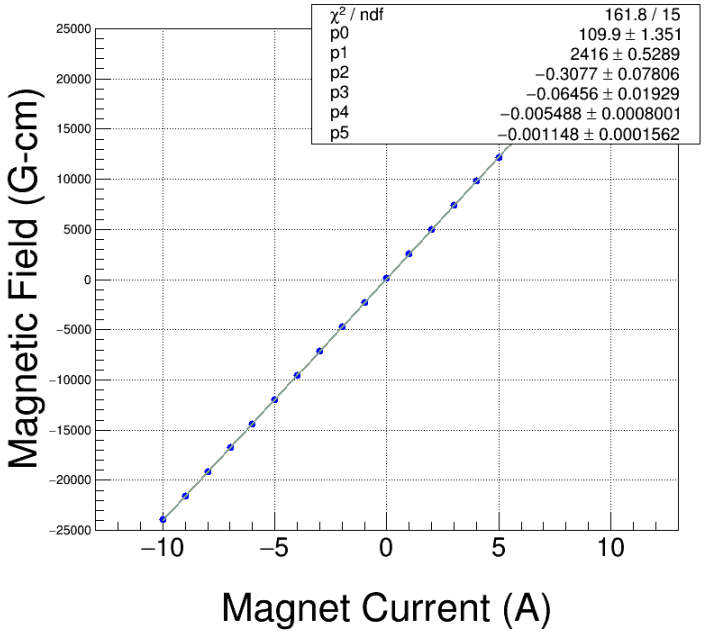
May 10, 2016

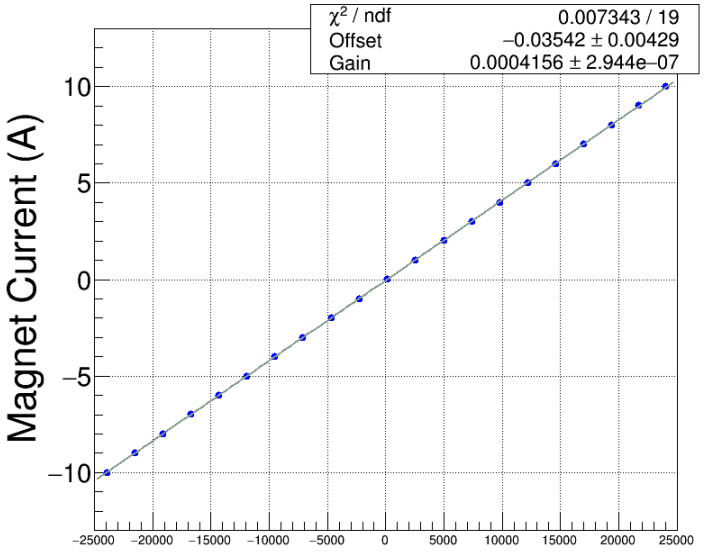
CEBAF DL MAGNET AT INJECTOR

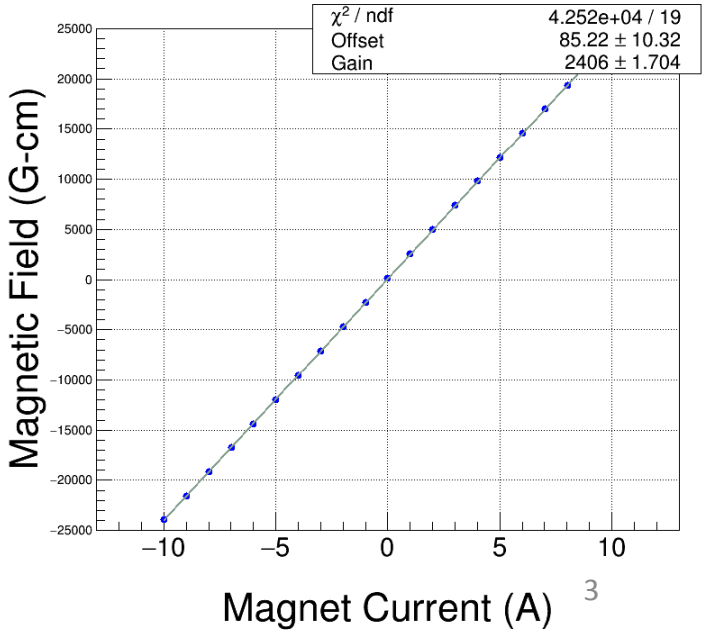
Field Map

Meas. Date: 8/29/2014
Coil used: Hall Probe Stepper

Current (A)	Strength (Gauss-cm)
-9.992	-23944.2
-8.996	-21569.6
-7.991	-19169.0
-6.990	-16769.5
-5.990	-14360.7
-4.993	-11954.6
-3.994	-9542.8
-2.989	-7116.1
-1.989	-4698.2
-0.990	-2283.6
0.003	126.0
1.009	2548.4
2.009	4960.8
3.009	7374.6
4.010	9785.8
5.010	12192.0
6.010	14589.8
7.011	16980.4
8.013	19360.4
9.015	21720.5
10.014	24038.1



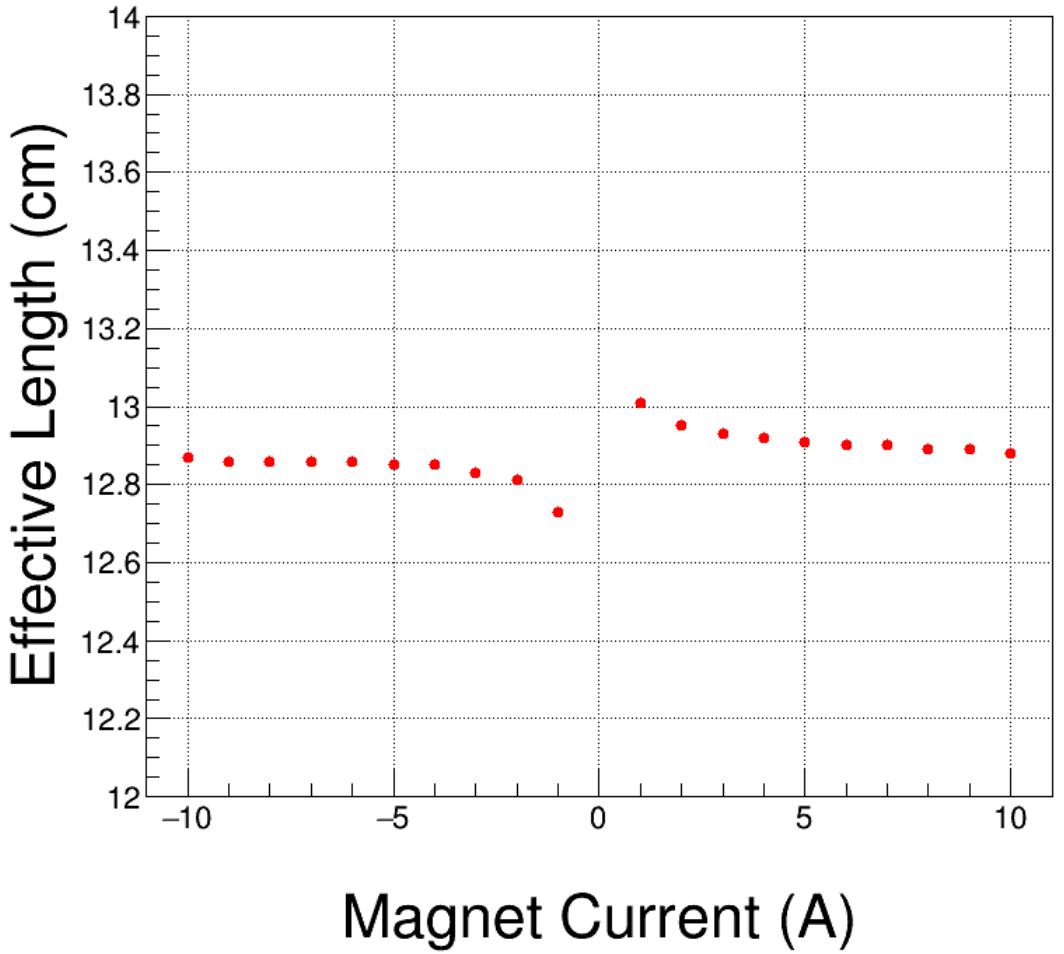




Field Map Effective Length

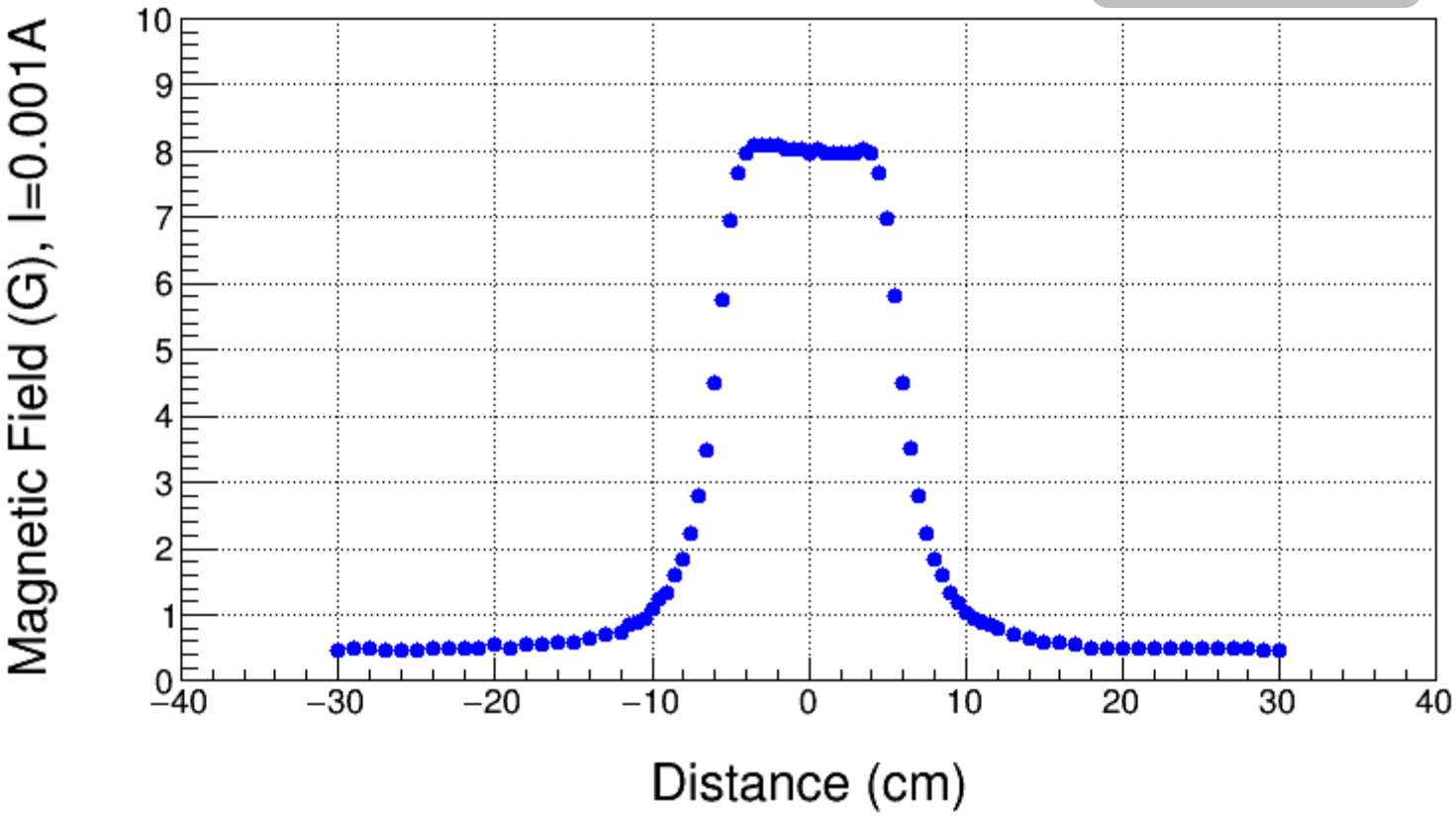
Meas. Date: 8/29/2014
Coil used: Hall Probe Stepper

Current (A)	Eff. L (cm)
10.00	12.88
9.00	12.89
8.00	12.89
7.00	12.90
6.00	12.90
5.00	12.91
4.00	12.92
3.00	12.93
2.00	12.95
1.00	13.01
0.00	16.39
-1.00	12.73
-2.00	12.81
-3.00	12.83
-4.00	12.85
-5.00	12.85
-6.00	12.86
-7.00	12.86
-8.00	12.86
-9.00	12.86
-10.00	12.87

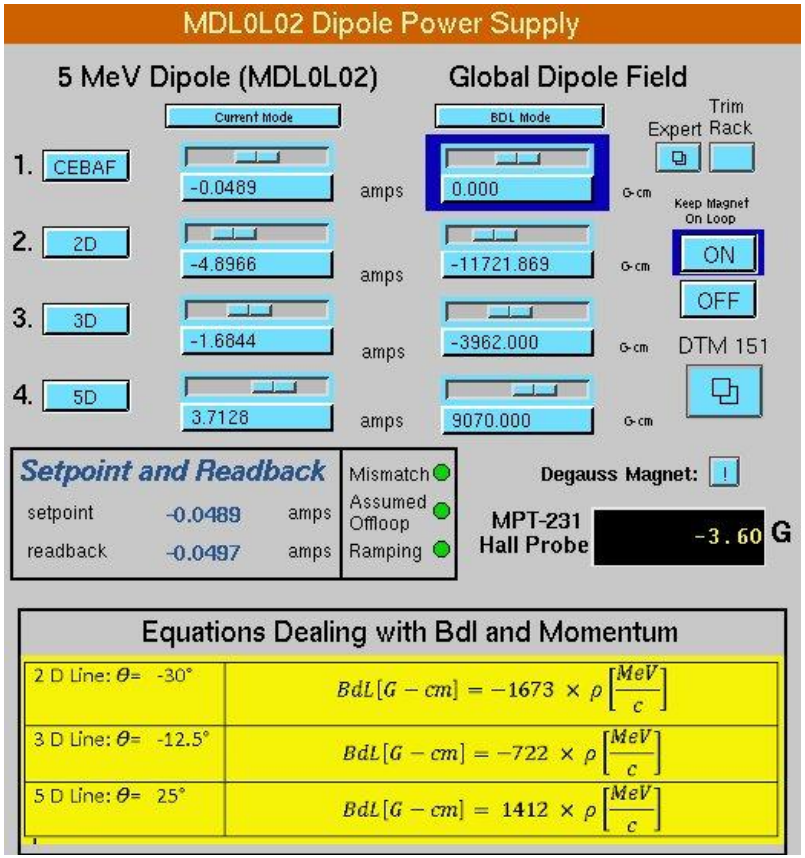


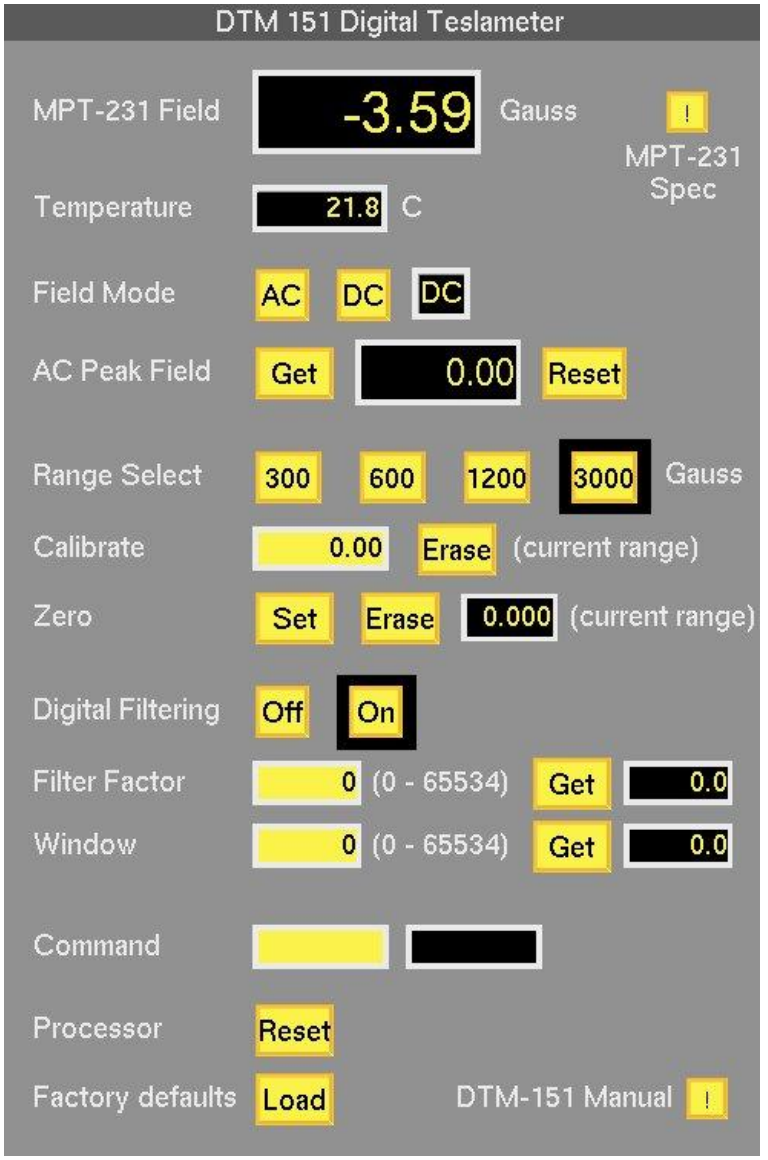
Field Map, I=0.001A

On Hysteresis

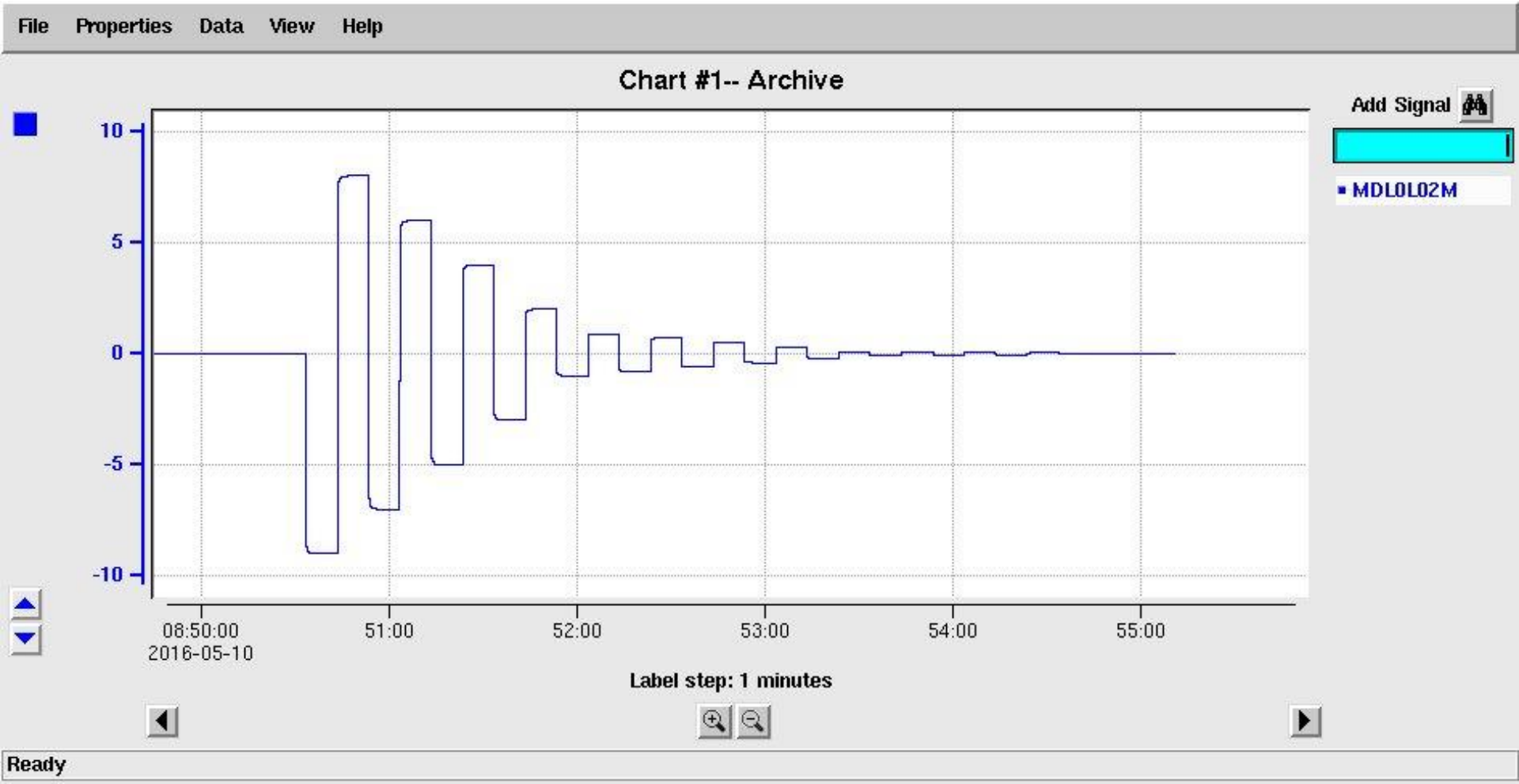


0 BdL

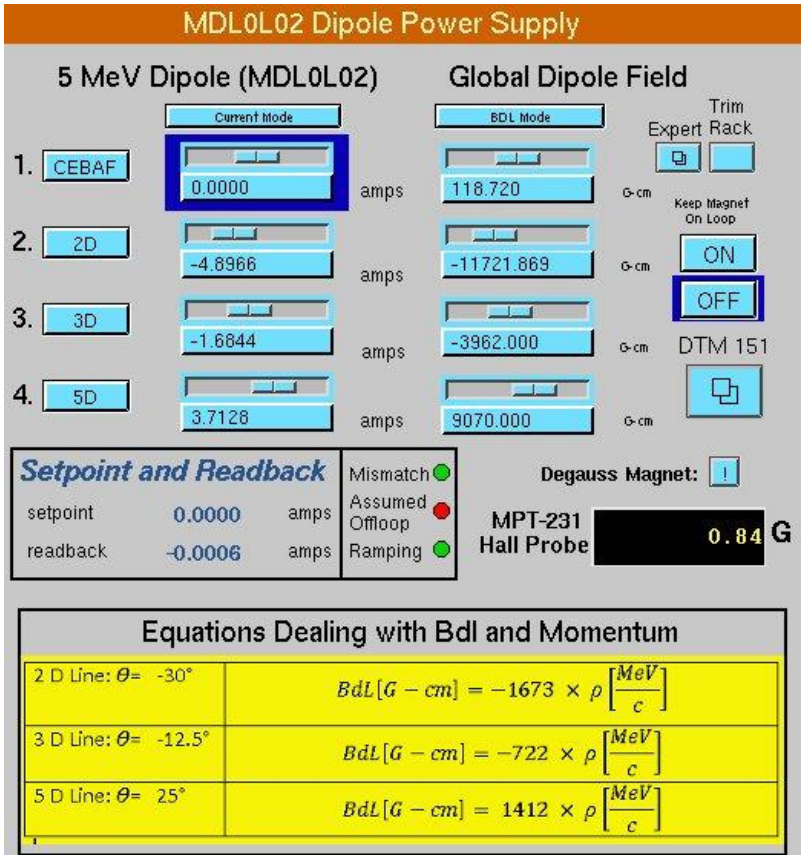

MDL0L02 Dipole Power Supply
5 MeV Dipole (MDL0L02)
Global Dipole Field
Current Mode
BDL Mode
Trim
Expert
Rack
1. CEBAF
-0.0489
amps
0.000
G-cm
2. 2D
-4.8966
amps
-11721.869
G-cm
Keep Magnet On Loop
ON
OFF
3. 3D
-1.6844
amps
-3962.000
G-cm
DTM 151
4. 5D
3.7128
amps
9070.000
G-cm
Setpoint and Readback
setpoint -0.0489 amps
readback -0.0497 amps
Mismatch
Assumed Offloop
Ramping
Degauss Magnet:
MPT-231 Hall Probe
-3.60 G
Equations Dealing with Bdl and Momentum
2 D Line: θ= -30°
$BdL[G-cm] = -1673 \times \rho\left[\frac{MeV}{c}\right]$
3 D Line: θ= -12.5°
$BdL[G-cm] = -722 \times \rho\left[\frac{MeV}{c}\right]$
5 D Line: θ= 25°
$BdL[G-cm] = 1412 \times \rho\left[\frac{MeV}{c}\right]$

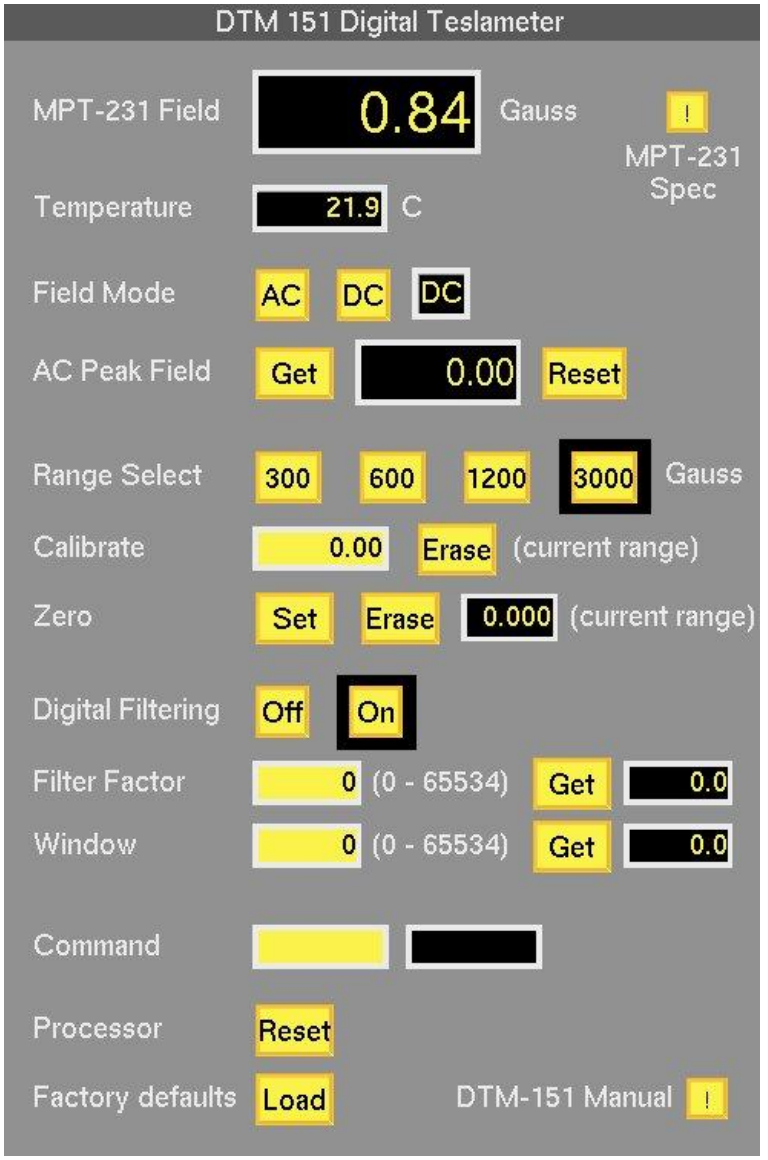

DTM 151 Digital Teslameter
MPT-231 Field
-3.59
Gauss
MPT-231 Spec
Temperature
21.8
C
Field Mode
AC
DC
DC
AC Peak Field
Get
0.00
Reset
Range Select
300
600
1200
3000
Gauss
Calibrate
0.00
Erase
(current range)
Zero
Set
Erase
0.000
(current range)
Digital Filtering
Off
On
Filter Factor
0
(0 - 65534)
Get
0.0
Window
0
(0 - 65534)
Get
0.0
Command
Processor
Reset
Factory defaults
Load
DTM-151 Manual

Degaussed


File
Properties
Data
View
Help
Chart #1-- Archive
Add Signal
MDL0L02M
10
5
0
-5
-10
08:50:00
2016-05-10
51:00
52:00
53:00
54:00
55:00
Label step: 1 minutes
Ready

Degaussed


MDL0L02 Dipole Power Supply
5 MeV Dipole (MDL0L02)
Global Dipole Field
Current Mode
BDL Mode
Trim
Expert
Rack
1. CEBAF
0.0000
amps
118.720
G-cm
2. 2D
-4.8966
amps
-11721.869
G-cm
Keep Magnet On Loop
ON
OFF
3. 3D
-1.6844
amps
-3962.000
G-cm
DTM 151
4. 5D
3.7128
amps
9070.000
G-cm
Setpoint and Readback
setpoint 0.0000 amps
readback -0.0006 amps
Mismatch
Assumed Offloop
Ramping
Degauss Magnet:
MPT-231 Hall Probe
0.84 G
Equations Dealing with Bdl and Momentum
2 D Line: θ= -30°
$BdL[G-cm] = -1673 \times \rho\left[\frac{MeV}{c}\right]$
3 D Line: θ= -12.5°
$BdL[G-cm] = -722 \times \rho\left[\frac{MeV}{c}\right]$
5 D Line: θ= 25°
$BdL[G-cm] = 1412 \times \rho\left[\frac{MeV}{c}\right]$

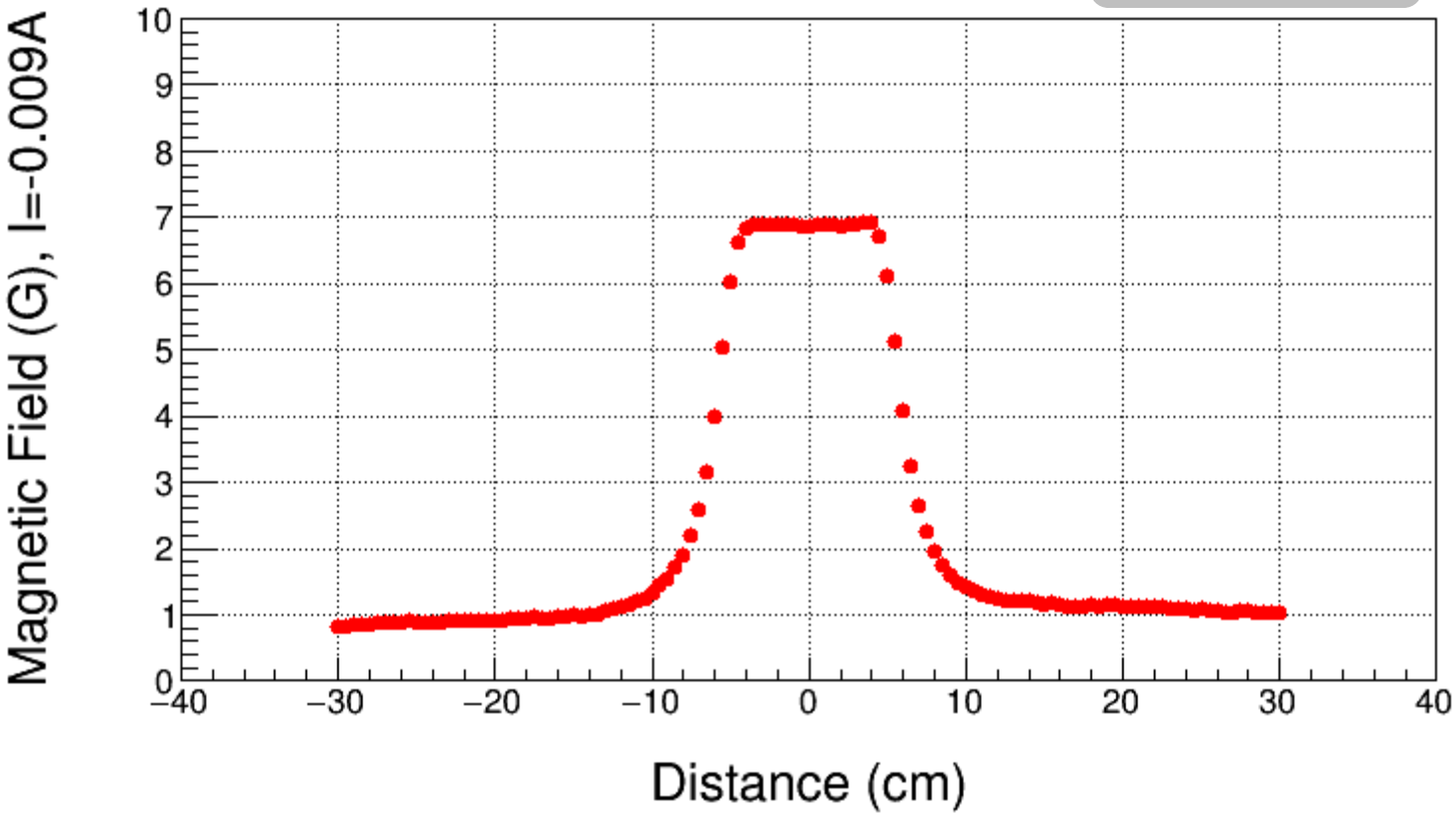

DTM 151 Digital Teslameter
MPT-231 Field
0.84
Gauss
MPT-231 Spec
Temperature
21.9
C
Field Mode
AC
DC
DC
AC Peak Field
Get
0.00
Reset
Range Select
300
600
1200
3000
Gauss
Calibrate
0.00
Erase
(current range)
Zero
Set
Erase
0.000
(current range)
Digital Filtering
Off
On
Filter Factor
0
(0 - 65534)
Get
0.0
Window
0
(0 - 65534)
Get
0.0
Command
Processor
Reset
Factory defaults
Load
DTM-151 Manual

August 10, 2016

SPARE DL MAGNET AT MMF

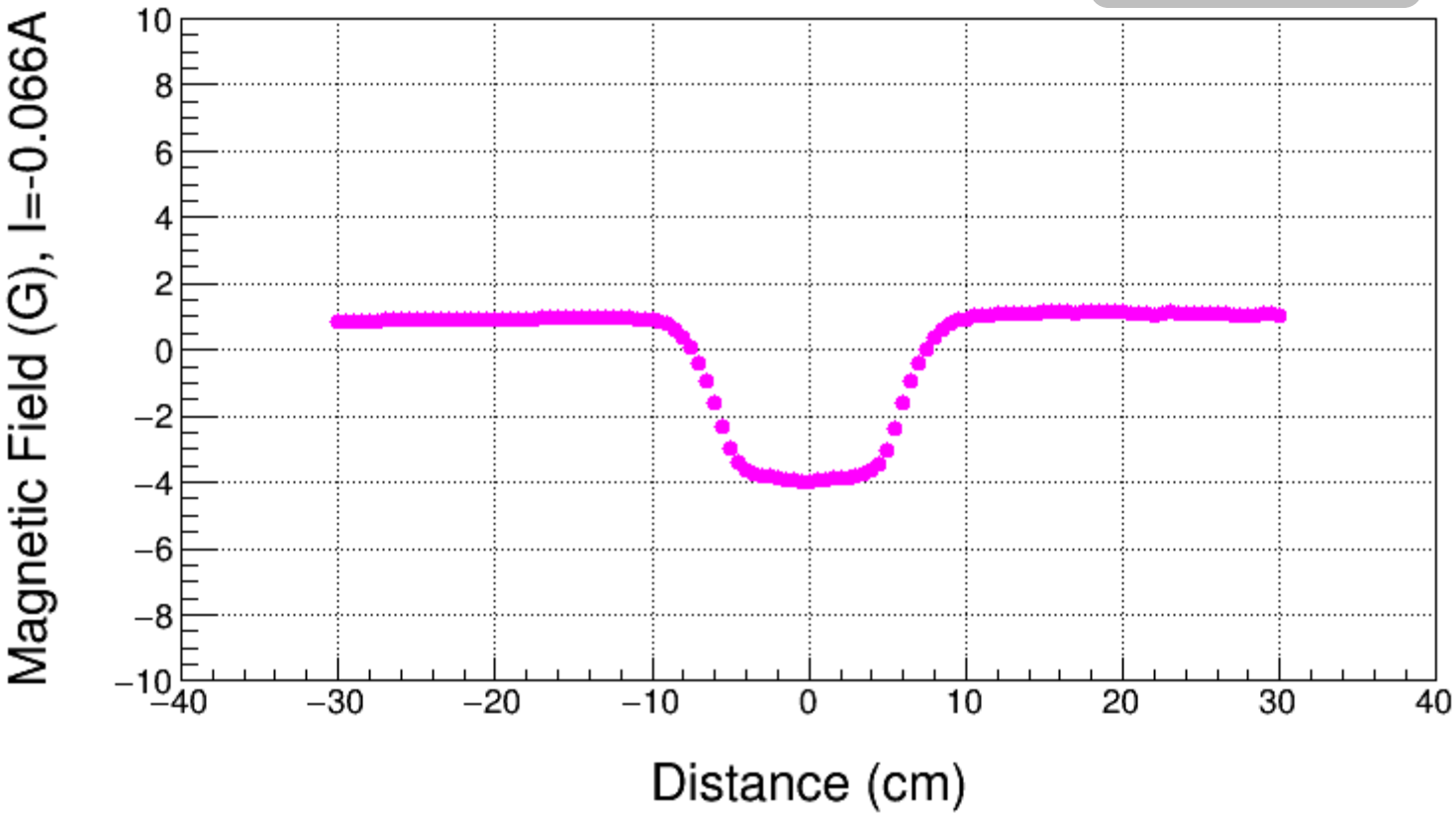
Field Map, I=-0.009A

On Hysteresis



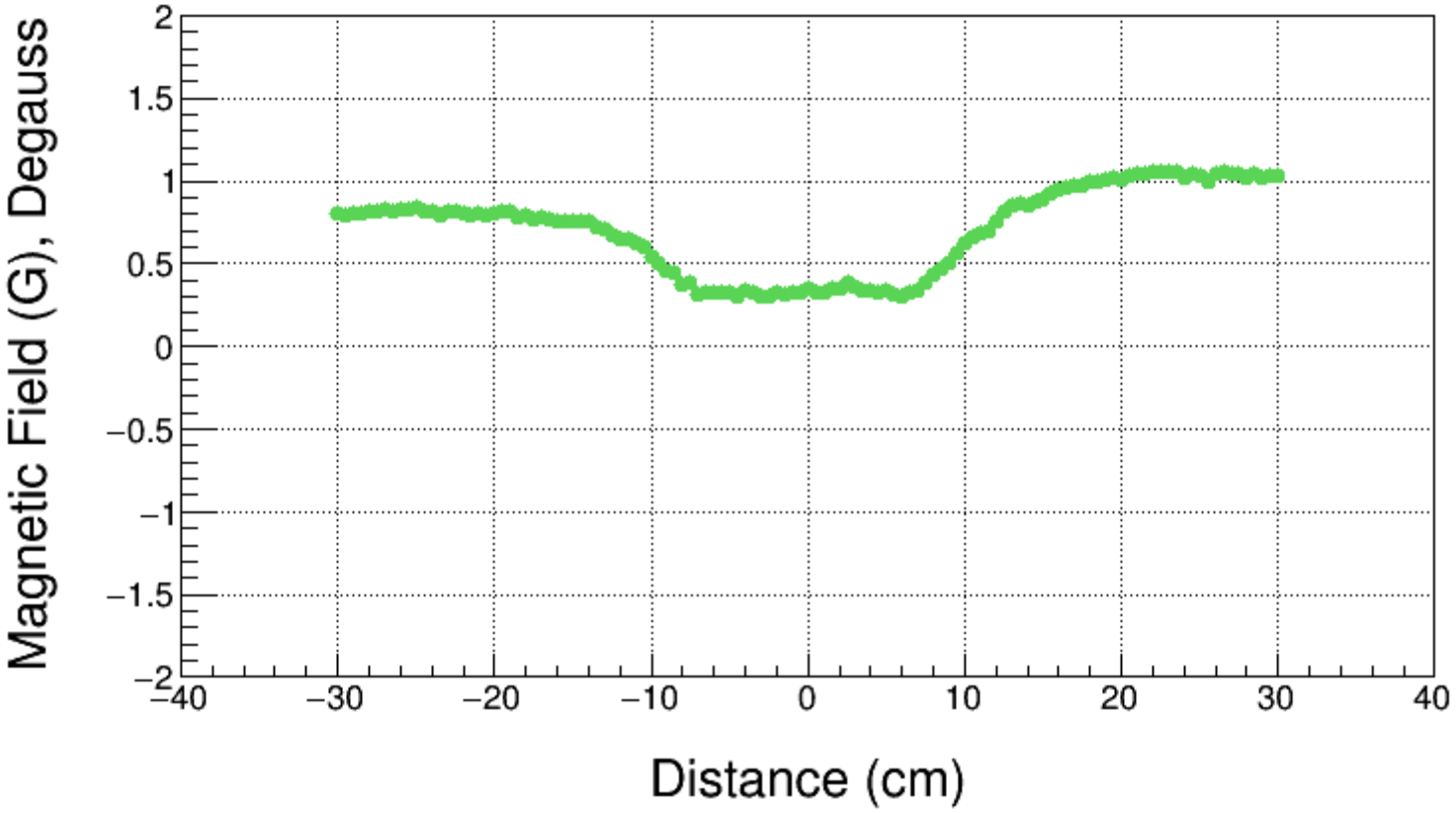
0 BdL, I=-0.066A

On Hysteresis



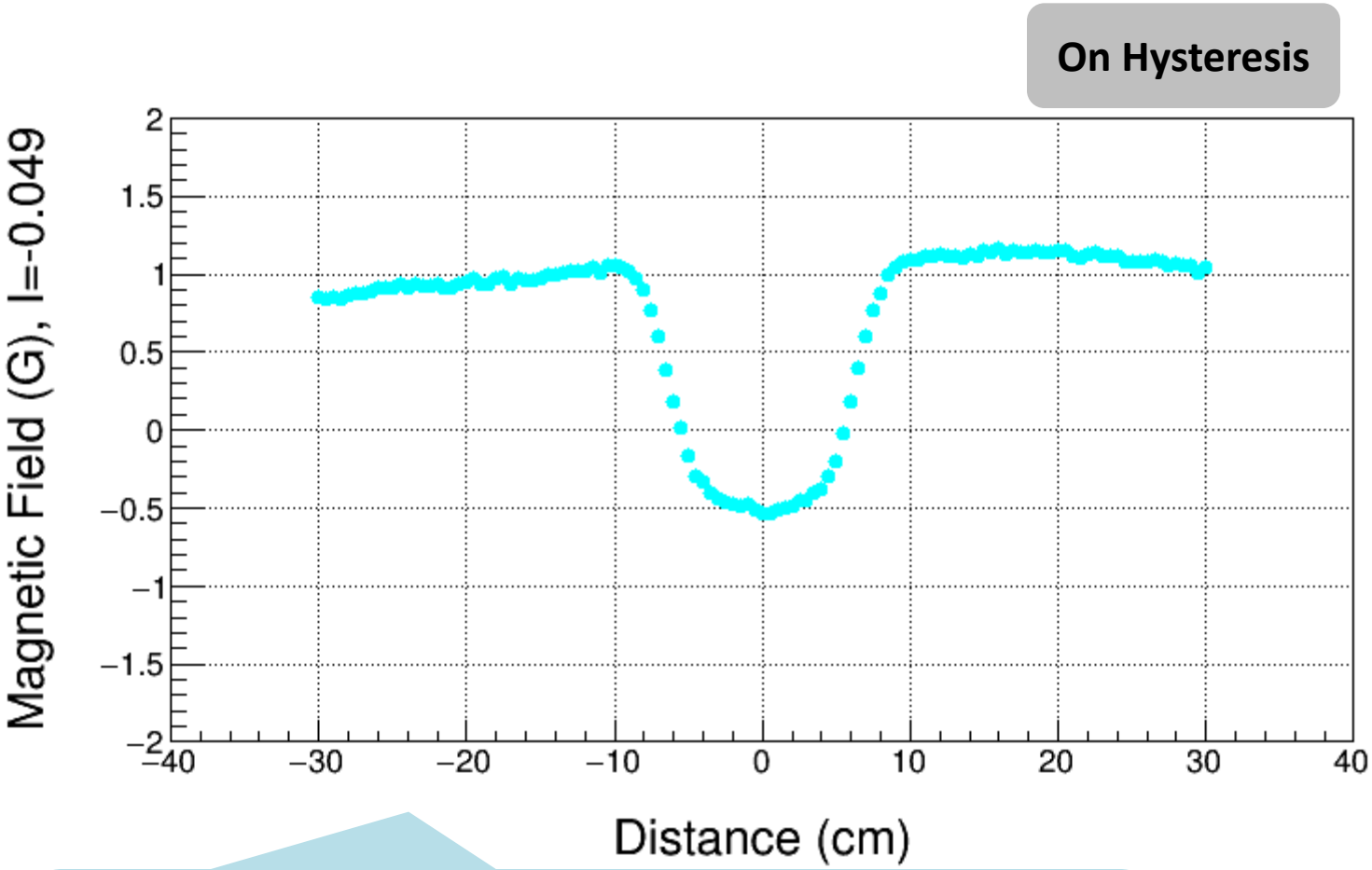
Used Field Map to find 0 BdL

Degaussed, Power Supply Off



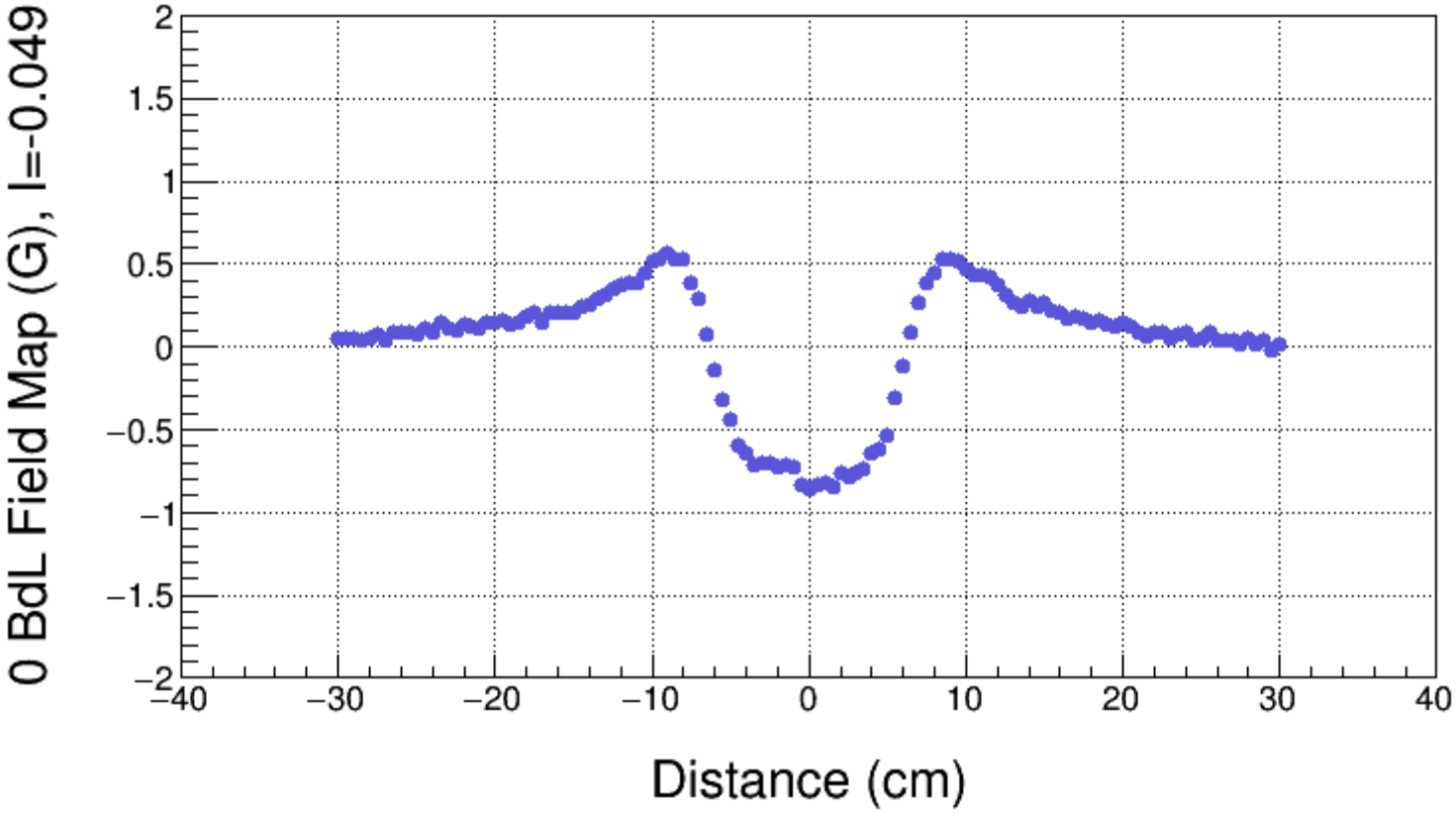
BdL = 42 G-cm, this is Field Map Offset

0 BdL, I=-0.049A (with no Offset)



Used Field Map with offset subtracted to find 0 BdL

BdL = 43 G-cm – Offset ~ 0

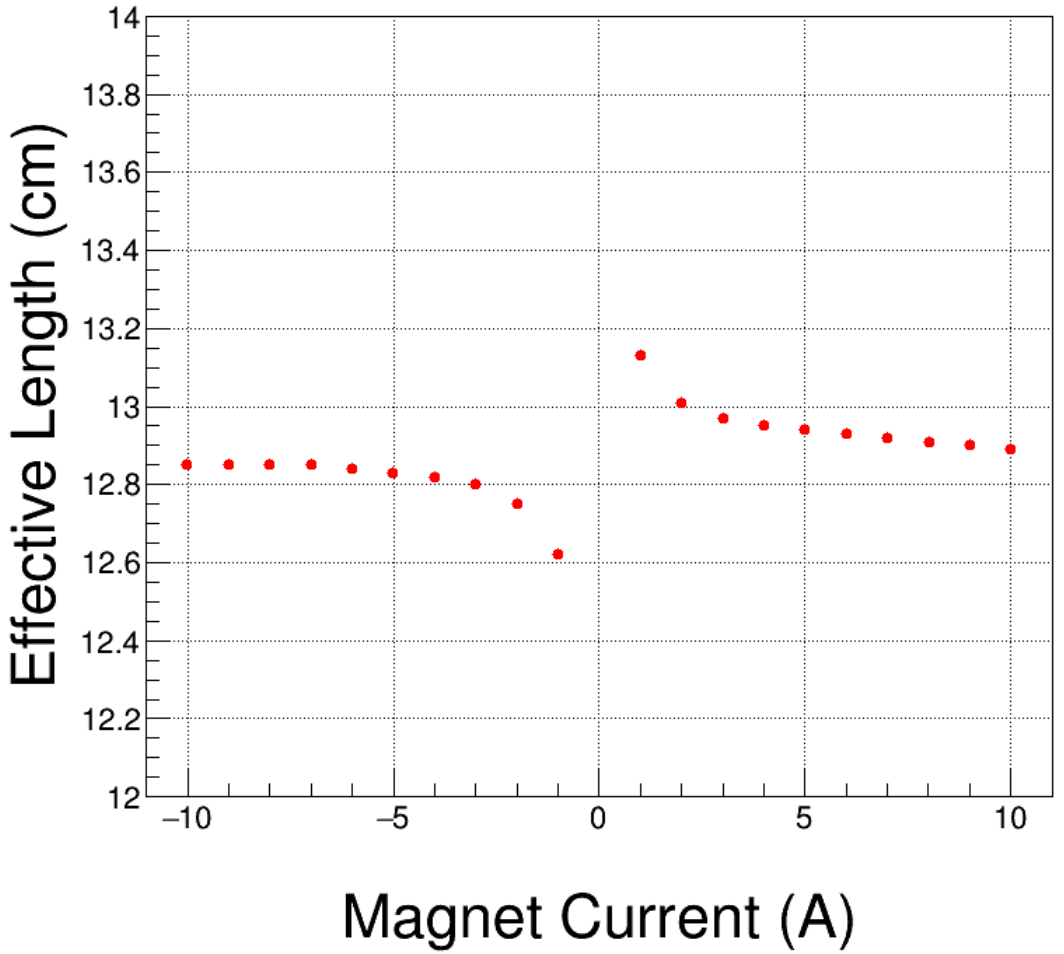


True 0 BdL Field Map

Field Map Effective Length

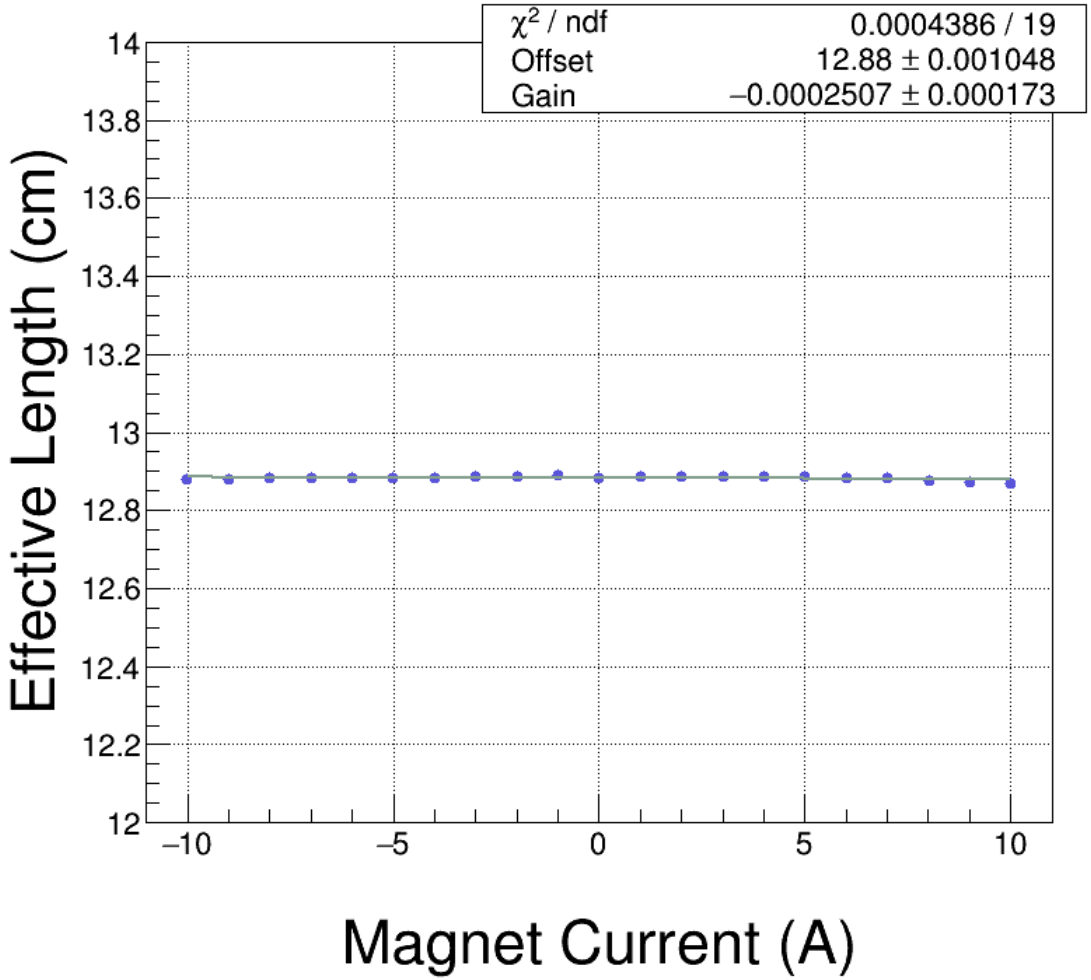
Meas. Date: 8/10/2016
Coil used: Hall Probe Stepper

Current (A)	Eff. L (cm)
10.007	12.89
9.007	12.90
8.006	12.91
7.003	12.92
6.001	12.93
5.001	12.94
4.000	12.95
2.999	12.97
1.998	13.01
0.998	13.13
-0.009	20.02
-1.002	12.62
-2.002	12.75
-3.002	12.80
-4.008	12.82
-5.007	12.83
-6.005	12.84
-7.005	12.85
-8.007	12.85
-9.013	12.85
-10.010	12.85



New Effective Length

New Effective Length calculated with Offset of 49.0 G-cm



Summary - I

I. Field Map Offset is found by mapping degaussed magnet with power supply off

II. Field Map Offset of Spare DL magnet = 42 G-cm from mapping degaussed magnet or Offset = 49 G-cm from Effective Length

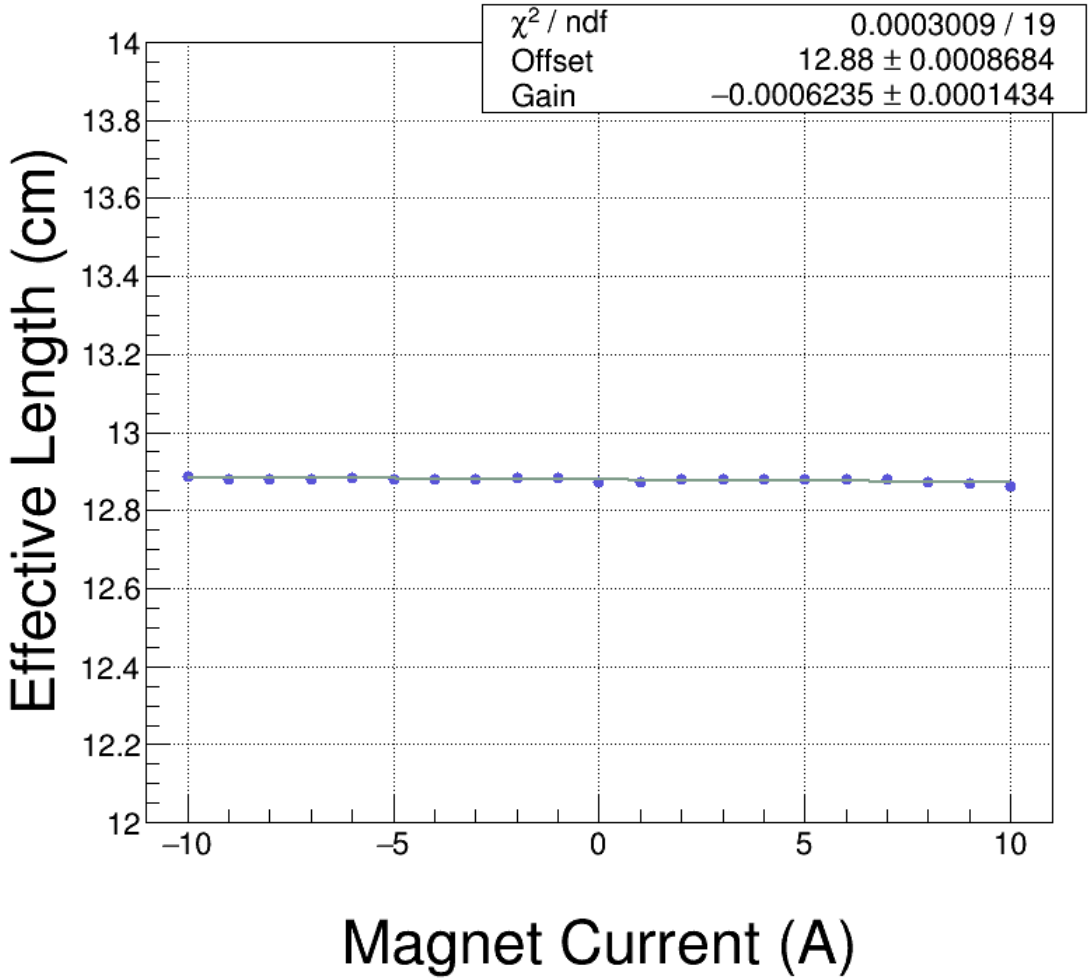
III. By comparing Spare magnet Field Map and Field Map of installed magnet, Offset of installed magnet is about 27±7 G-cm since:
    I. Environmental fields at MMF higher are today (∼1 G) than during mapping of CEBAF magnet (∼0.5 G) in August 2014
    II. New Effective Length is now independent of magnet current

IV. Request to modify CEBAF Field Map: Subtract 27 G-cm

V. When mapping environmental fields in CEBAF, DL magnet must be degaussed. Length occupied by magnet must be mapped too.

New Effective Length

New Effective Length calculated with Offset of 27.0 G-cm



Summary - II

VI. For Beam Energy Measurement:

I. CEBAF : BdL ≠ 0 (due to field map error). Instead: BdL = -Offset ~ -27 G-cm (treat as another horizontal corrector)

II. Spectrometer Lines (2D, 3D, 5D): subtract 27 G-cm from Field Map

	Error
Trim Power Supply	2 mA
Magnet Model (to find momentum from field map)	0.1%
Field Map Offset	7 G-cm

For Mott Energy Measurements