

MDL0L02 Dipole Field Offset

August 12, 2016

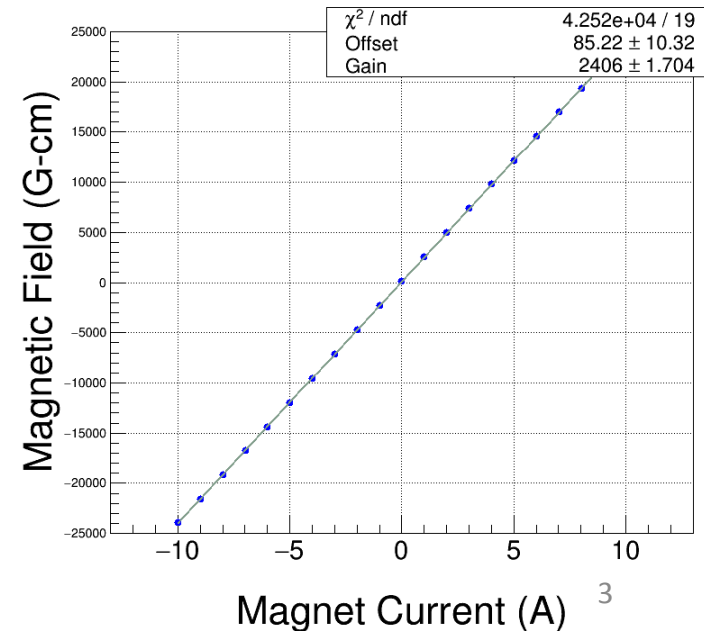
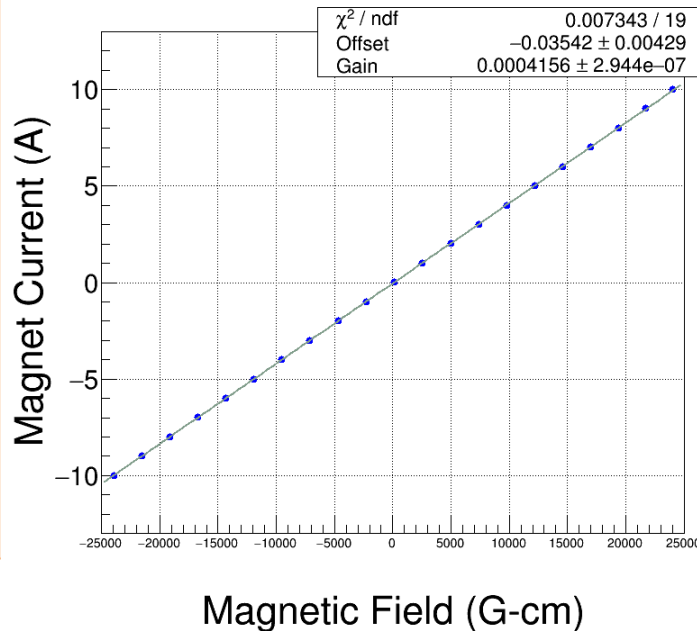
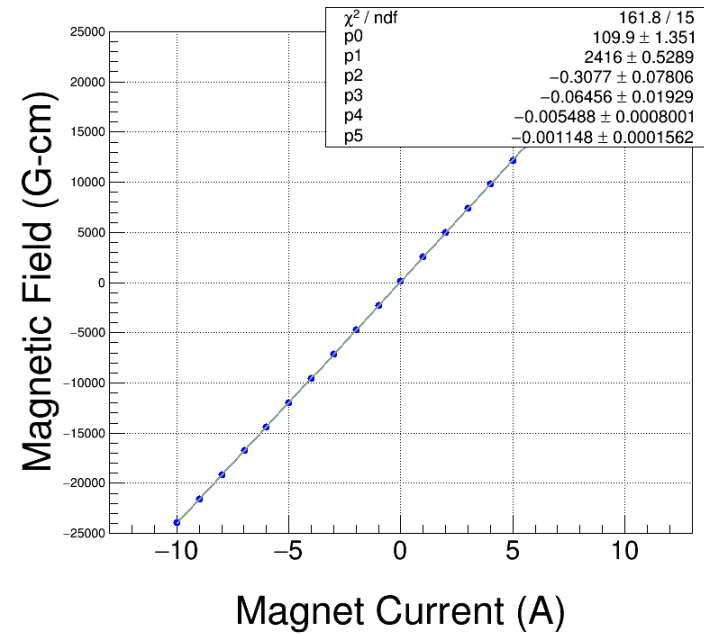
May 10, 2016

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



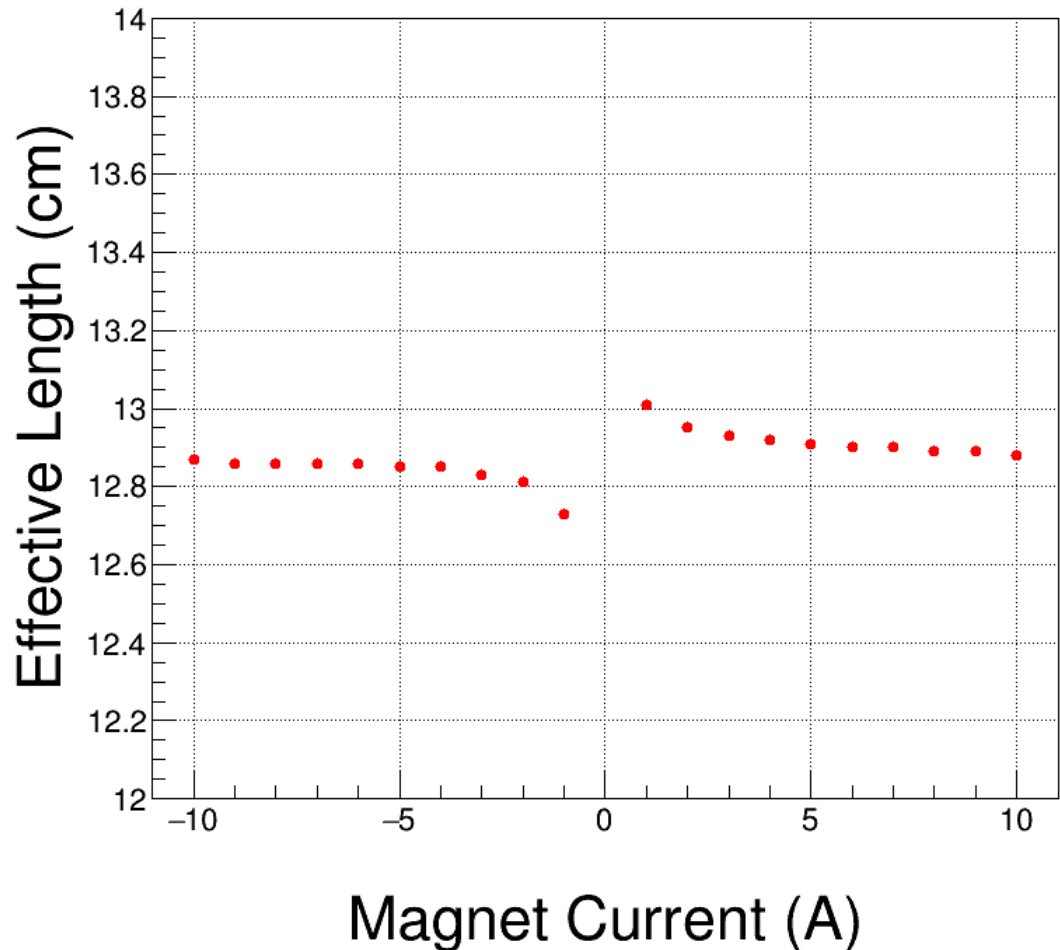
Field Map Effective Length

Meas. Date: 8/29/2014

Coil used: Hall Probe Stepper

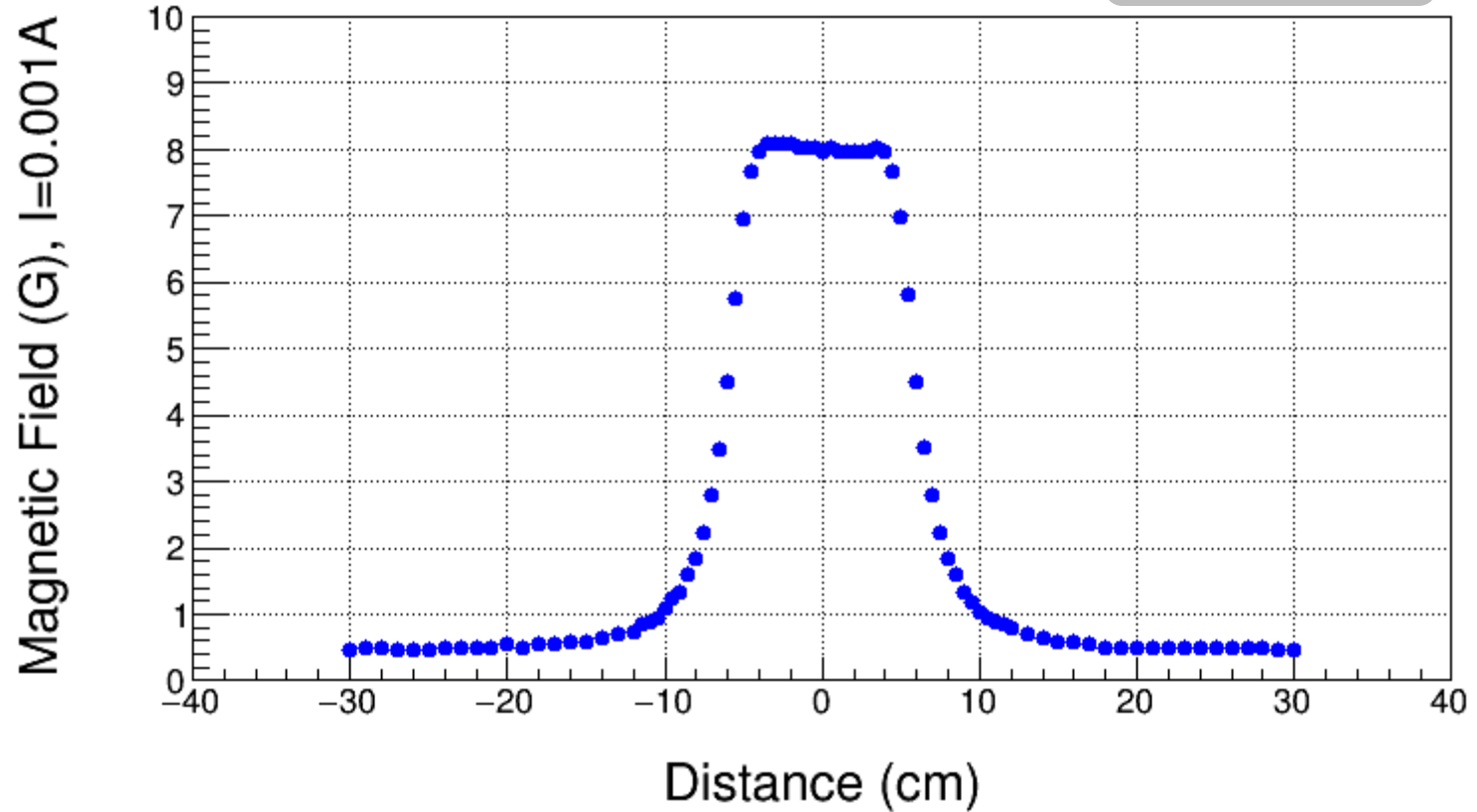
Current (A) Eff. L (cm)

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	amps	BdL Mode	G-cm
1. CEBAF	<input type="checkbox"/>	-0.0489	<input checked="" type="checkbox"/>	0.000
2. 2D	<input type="checkbox"/>	-4.8966	<input type="checkbox"/>	-11721.869
3. 3D	<input type="checkbox"/>	-1.6644	<input type="checkbox"/>	-3962.000
4. 5D	<input type="checkbox"/>	3.7128	<input type="checkbox"/>	9070.000

Trim Expert Rack

Keep Magnet On Loop ON OFF

Degauss Magnet:

MPT-231 Hall Probe **-3.60 G**

Setpoint and Readback

setpoint	-0.0489	amps
readback	-0.0497	amps

Mismatch Assumed Offloop Ramping

Equations Dealing with BdL and Momentum

2 D Line: $\theta = -30^\circ$	$BdL[G - cm] = -1673 \times \rho \left[\frac{MeV}{c} \right]$
3 D Line: $\theta = -12.5^\circ$	$BdL[G - cm] = -722 \times \rho \left[\frac{MeV}{c} \right]$
5 D Line: $\theta = 25^\circ$	$BdL[G - cm] = 1412 \times \rho \left[\frac{MeV}{c} \right]$

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 **0.00**

Range Select Gauss

Calibrate (current range)

Zero (current range)

Digital Filtering

Filter Factor (0 - 65534) **0.0**

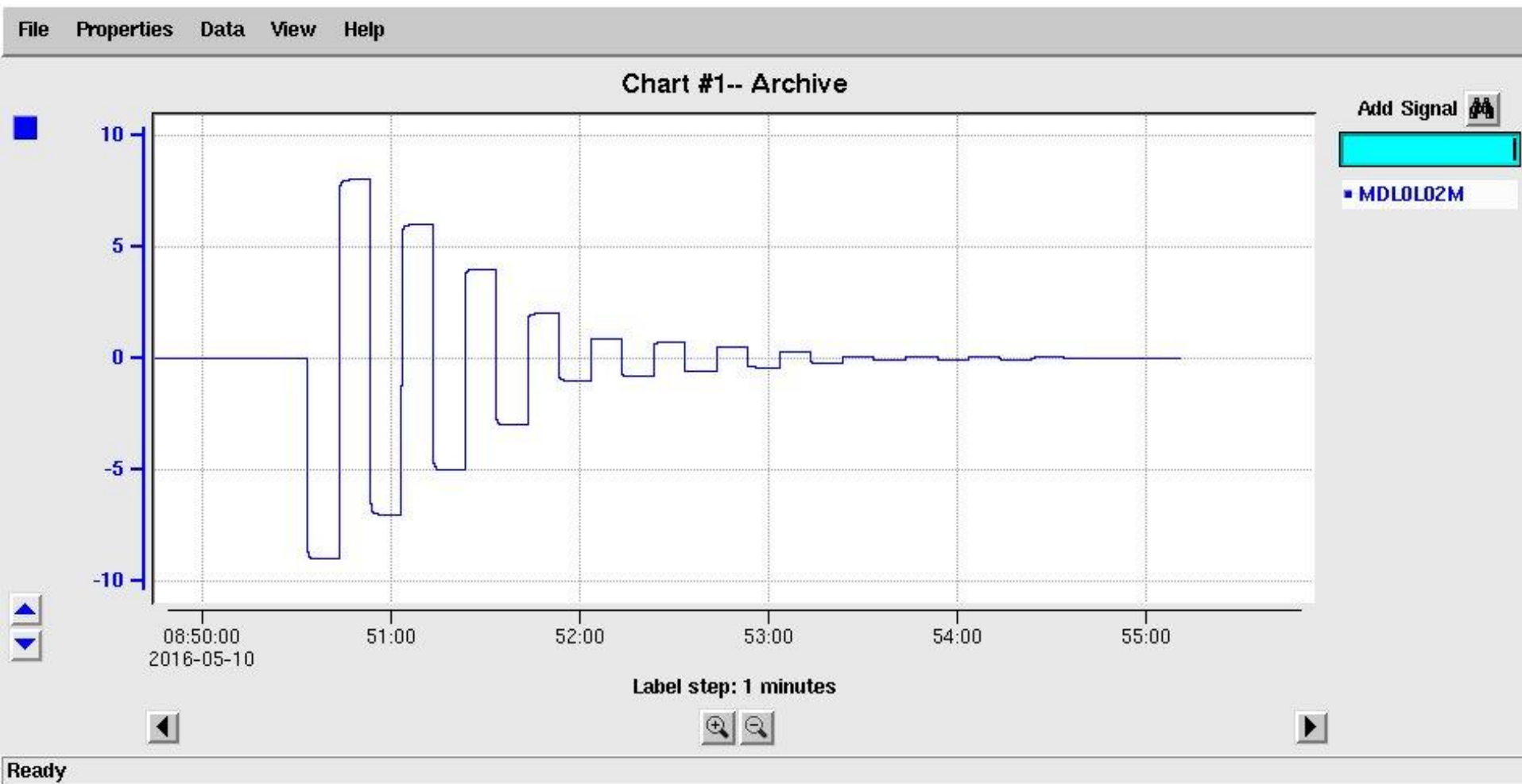
Window (0 - 65534) **0.0**

Command

Processor

Factory defaults

Degaussed



Degaussed

MDL0L02 Dipole Power Supply

5 MeV Dipole (MDL0L02) **Global Dipole Field**

Current Mode BDL Mode

1. **CEBAF** 0.0000 amps 118.720 G-cm

2. **2D** -4.8966 amps -11721.869 G-cm

3. **3D** -1.6644 amps -3962.000 G-cm

4. **5D** 3.7128 amps 9070.000 G-cm

Trim Expert Rack Keep Magnet On Loop

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: $\theta = -30^\circ$	$BdL [G - cm] = -1673 \times \rho \left[\frac{MeV}{c} \right]$
3 D Line: $\theta = -12.5^\circ$	$BdL [G - cm] = -722 \times \rho \left[\frac{MeV}{c} \right]$
5 D Line: $\theta = 25^\circ$	$BdL [G - cm] = 1412 \times \rho \left[\frac{MeV}{c} \right]$

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**

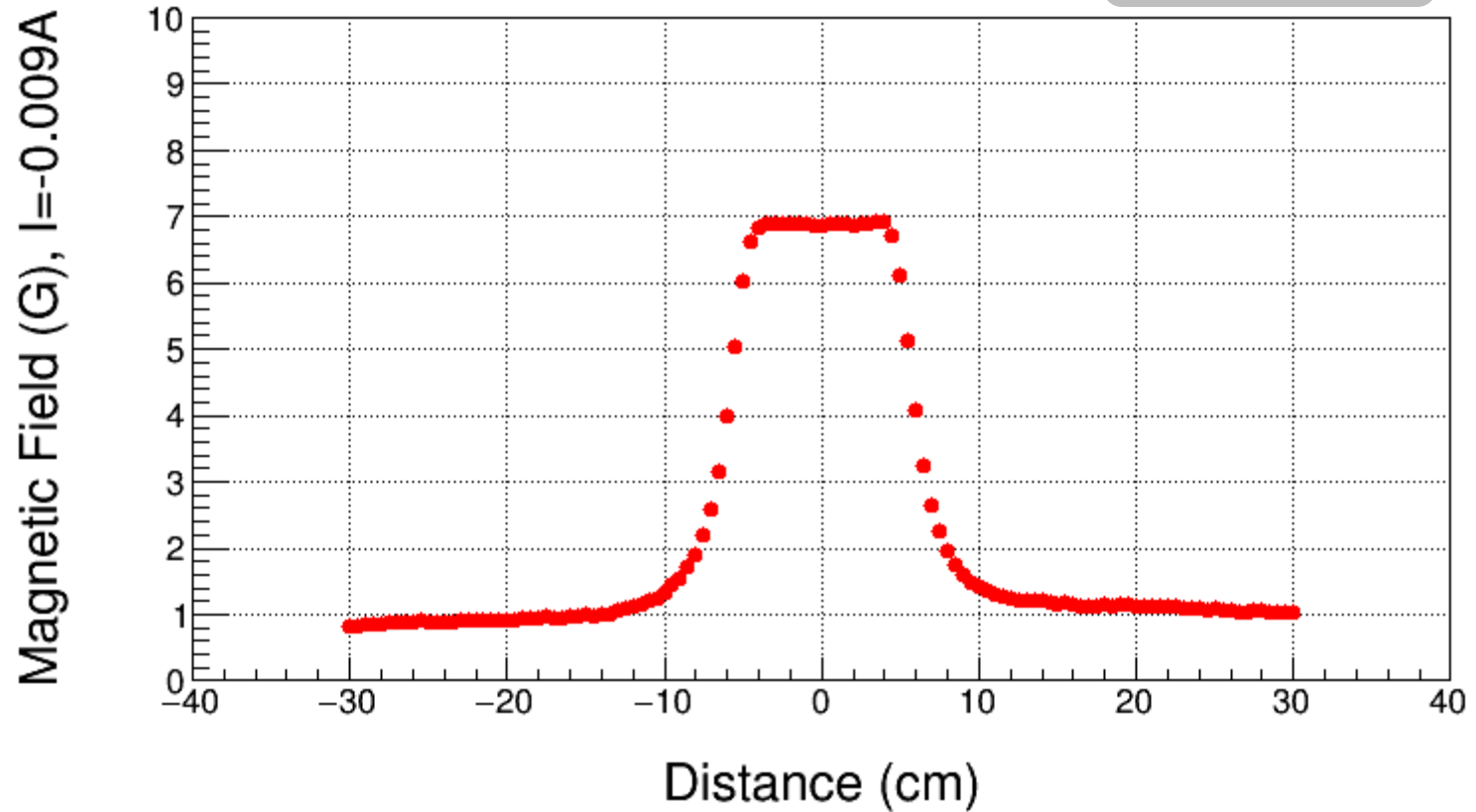
Factory defaults **Load** DTM-151 Manual

August 10, 2016

SPARE DL MAGNET AT MMF

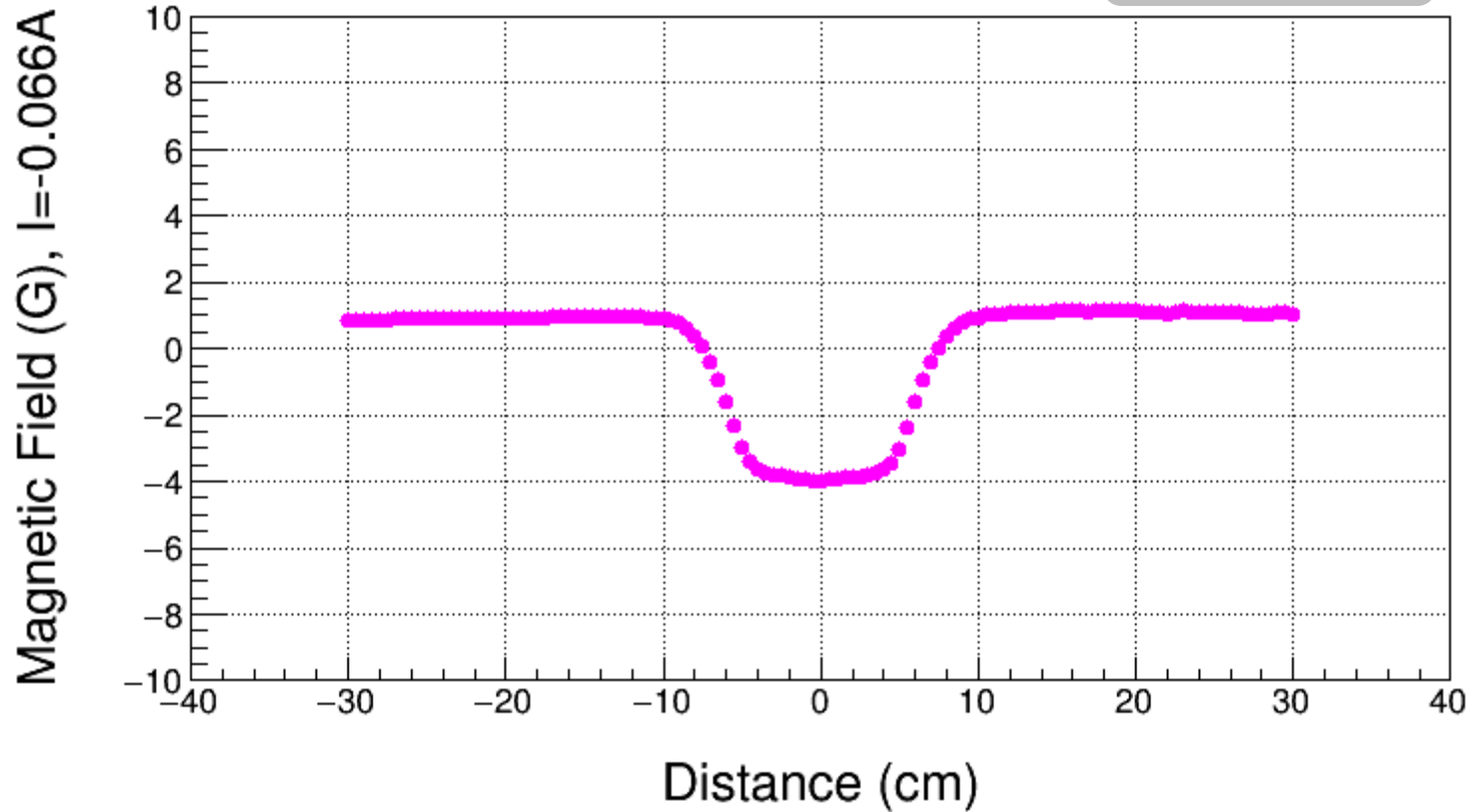
Field Map, $I = -0.009\text{A}$

On Hysteresis



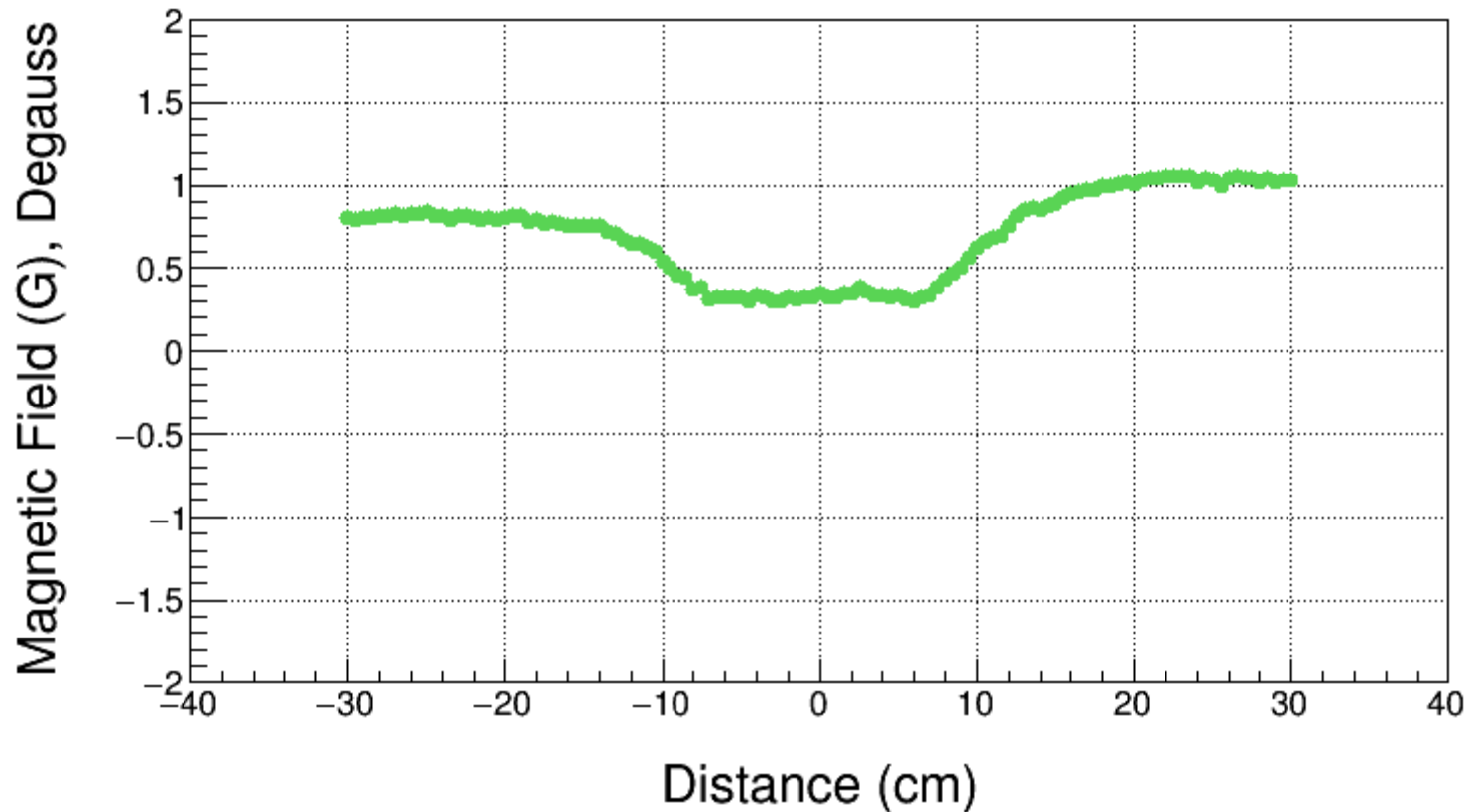
0 BdL, I=-0.066A

On Hysteresis



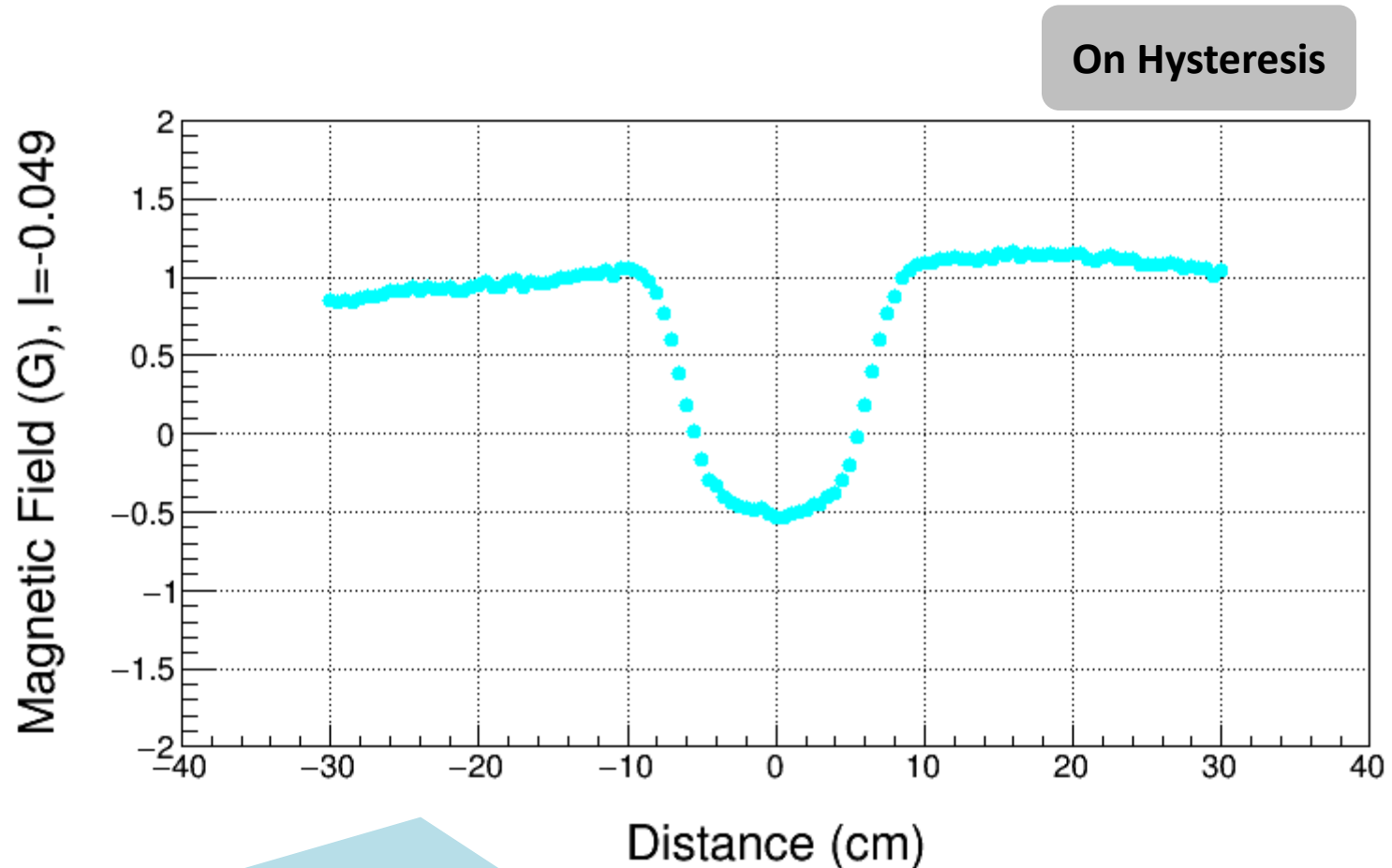
Used Field Map to find 0 BdL

Degaussed, Power Supply Off



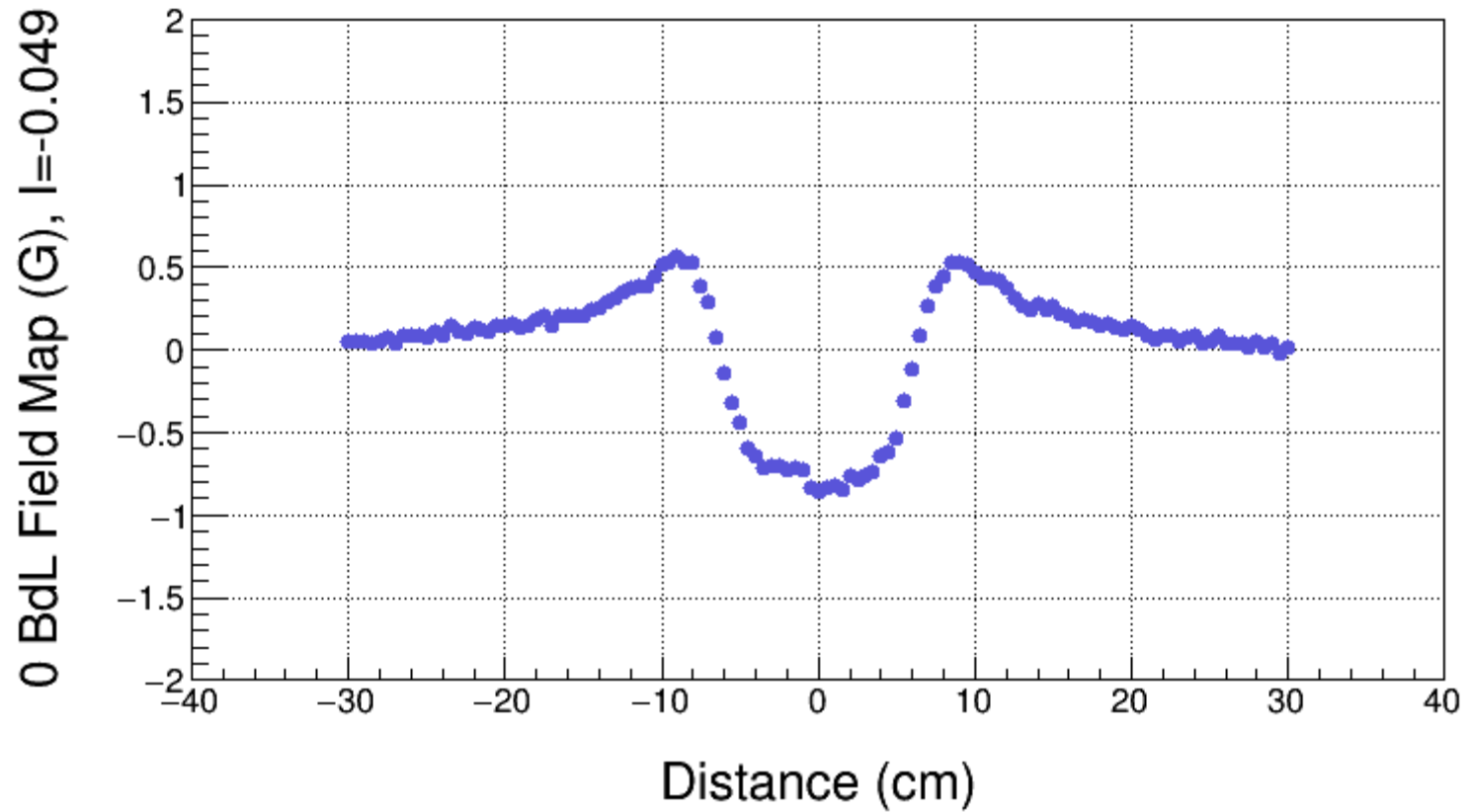
BdL = 42 G-cm, this is Field Map Offset

0 BdL, $I = -0.049\text{A}$ (with no Offset)



Used Field Map with offset subtracted
to find 0 BdL

$$\text{BdL} = 43 \text{ G-cm} - \text{Offset} \sim 0$$



True 0 BdL Field Map

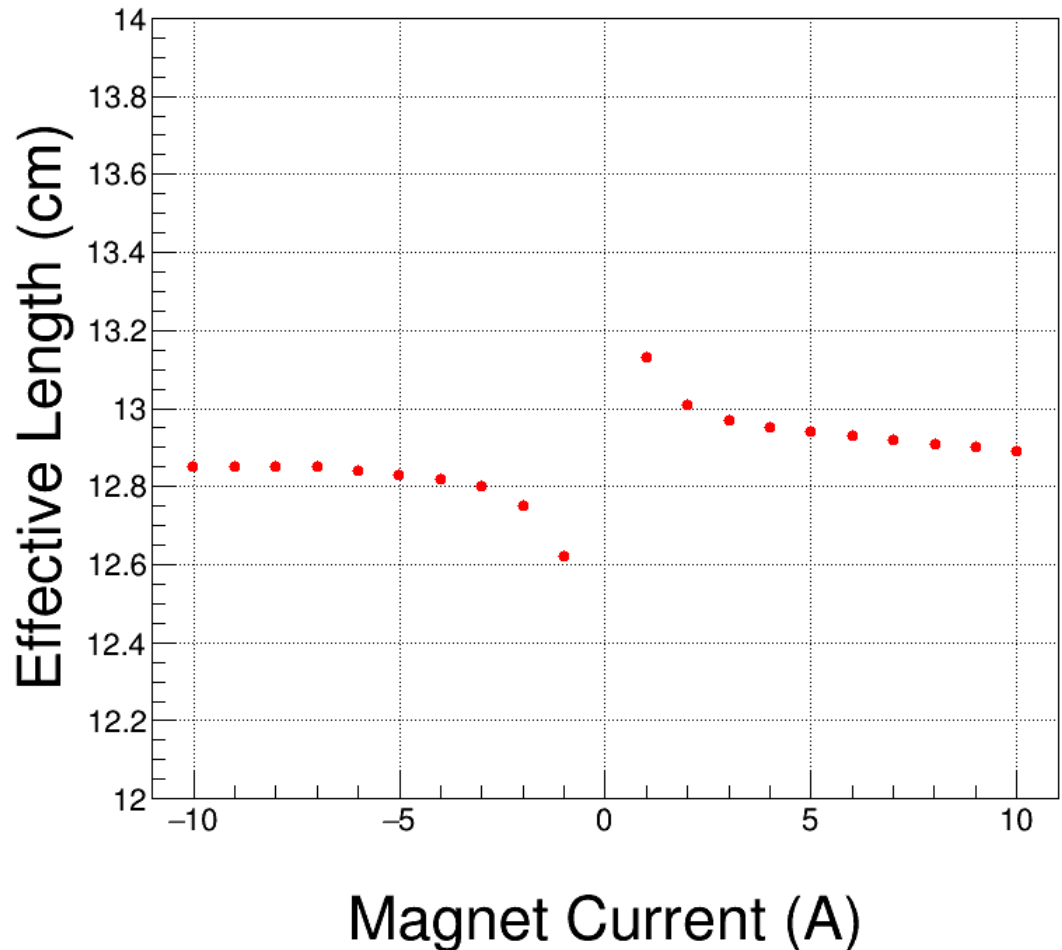
Field Map Effective Length

Meas. Date: 8/10/2016

Coil used: Hall Probe Stepper

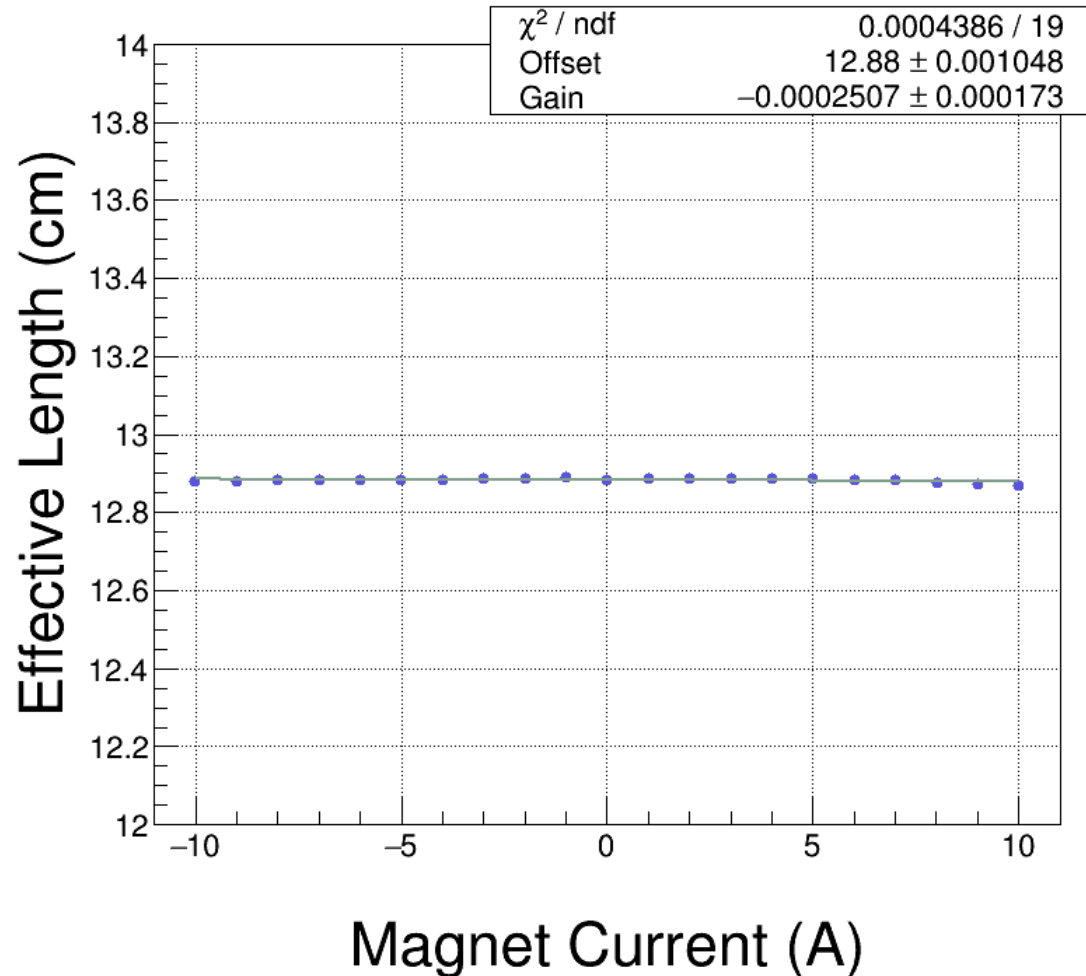
Current (A) Eff. L (cm)

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

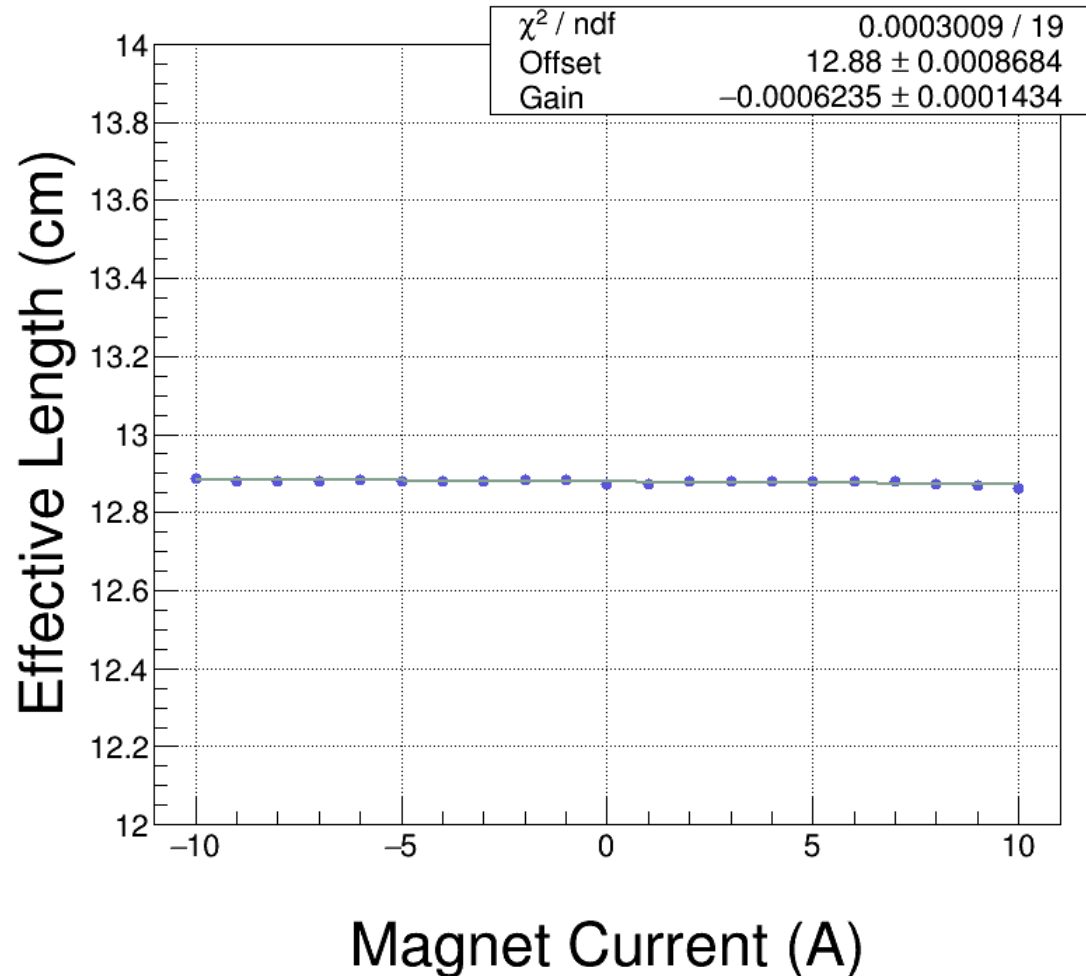


Summary - I

- 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

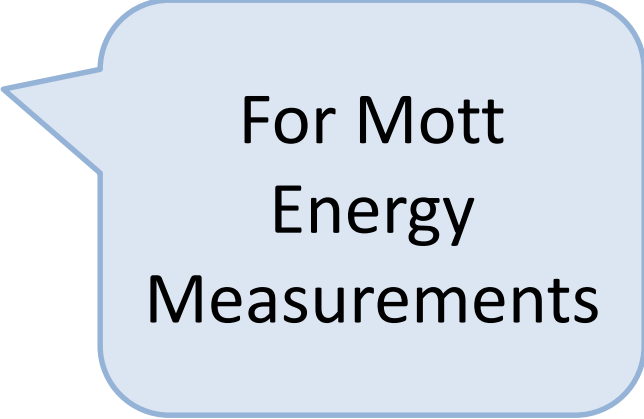


Summary - II

VI. For Beam Energy Measurement:

- I. CEBAF : $BdL \neq 0$ (due to field map error). Instead: $BdL = -\text{Offset} \sim -27 \text{ G-cm}$ (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