

# MDL0L02 Dipole Field Offset

August 12, 2016

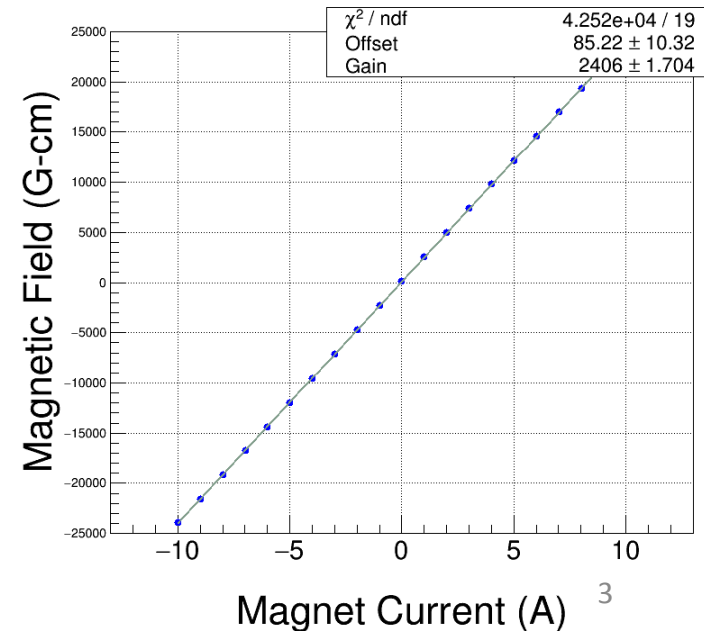
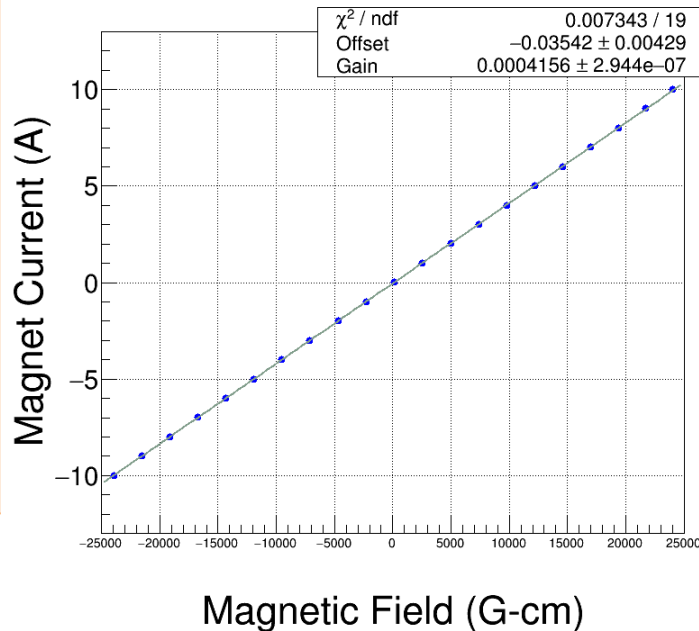
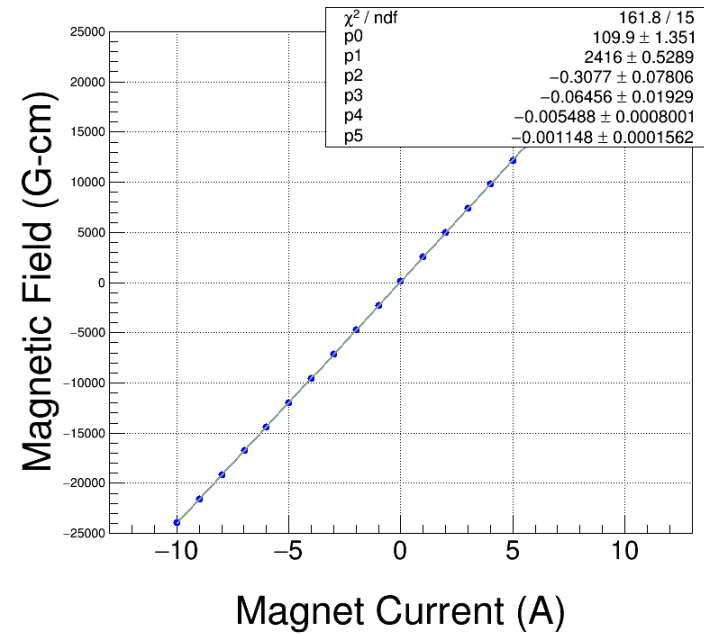
May 10, 2016

# **CEBAF DL MAGNET AT INJECTOR**

# Field Map

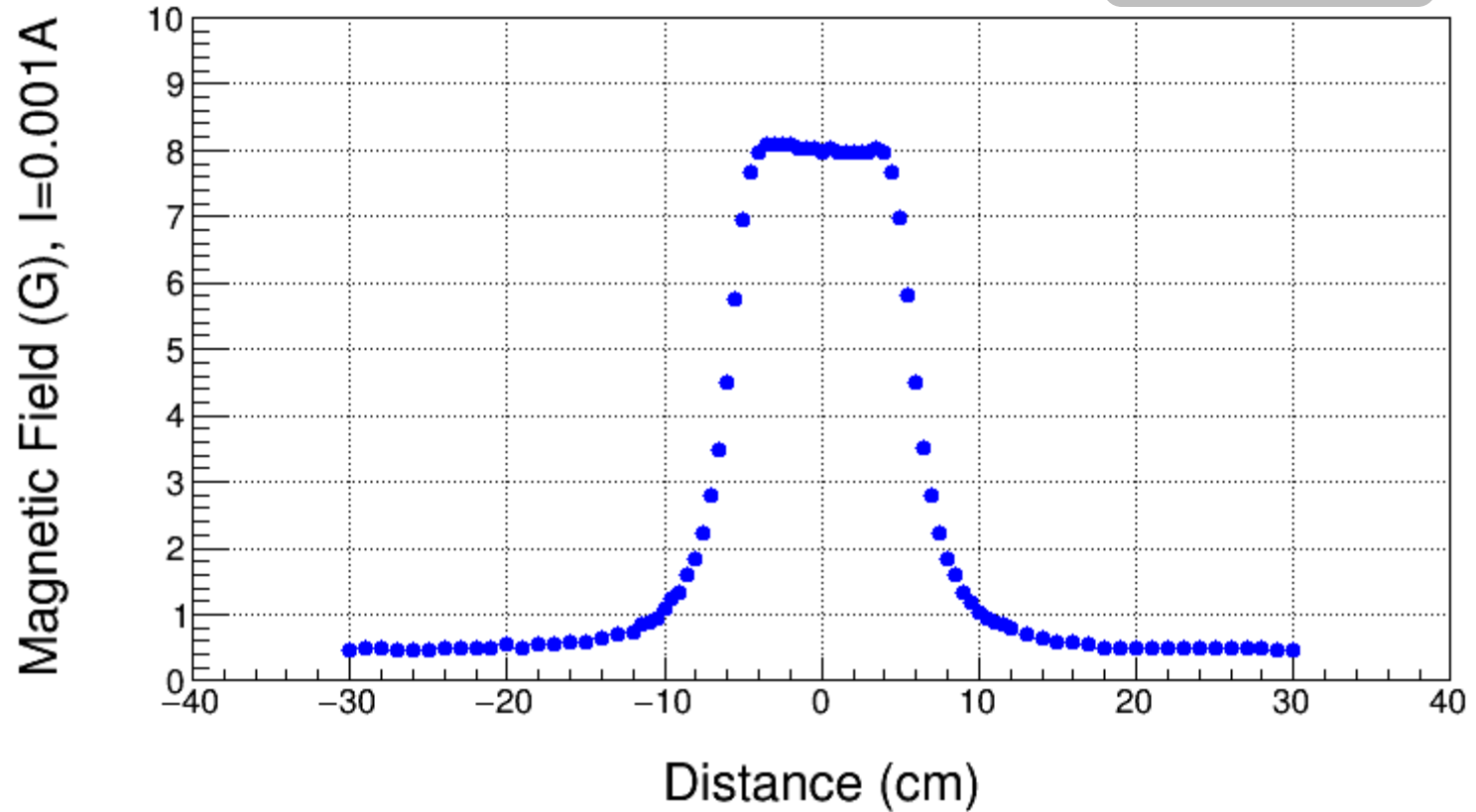
Meas. Date: 8/29/2014  
 Coil used: Hall Probe Stepper  
 Current (A) Strength (Gauss-cm)

|        |          |
|--------|----------|
| -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, $I=0.001A$

On Hysteresis



# 0 BdL

### MDL0L02 Dipole Power Supply

#### 5 MeV Dipole (MDL0L02)

| Line     | Current Mode             | Value (amps) |
|----------|--------------------------|--------------|
| 1. CEBAF | <input type="checkbox"/> | -0.0489      |
| 2. 2D    | <input type="checkbox"/> | -4.8966      |
| 3. 3D    | <input type="checkbox"/> | -1.6644      |
| 4. 5D    | <input type="checkbox"/> | 3.7128       |

#### Global Dipole Field

| BDL Mode                            | Value (G-cm) |
|-------------------------------------|--------------|
| <input type="checkbox"/>            | 0.000        |
| <input checked="" type="checkbox"/> | -11721.869   |
| <input type="checkbox"/>            | -3962.000    |
| <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**

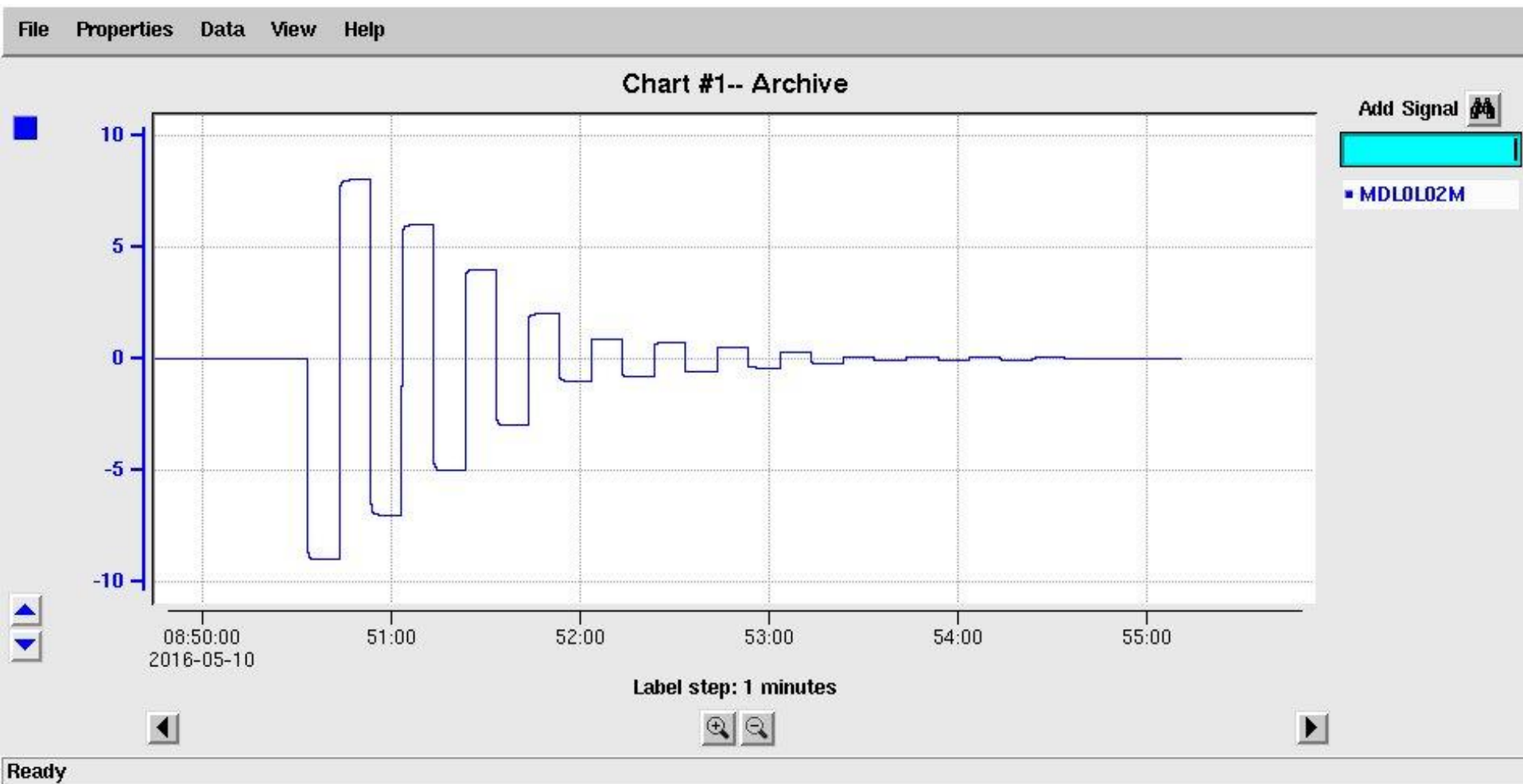
Window:  (0 - 65534)  **0.0**

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

DTM 151

**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

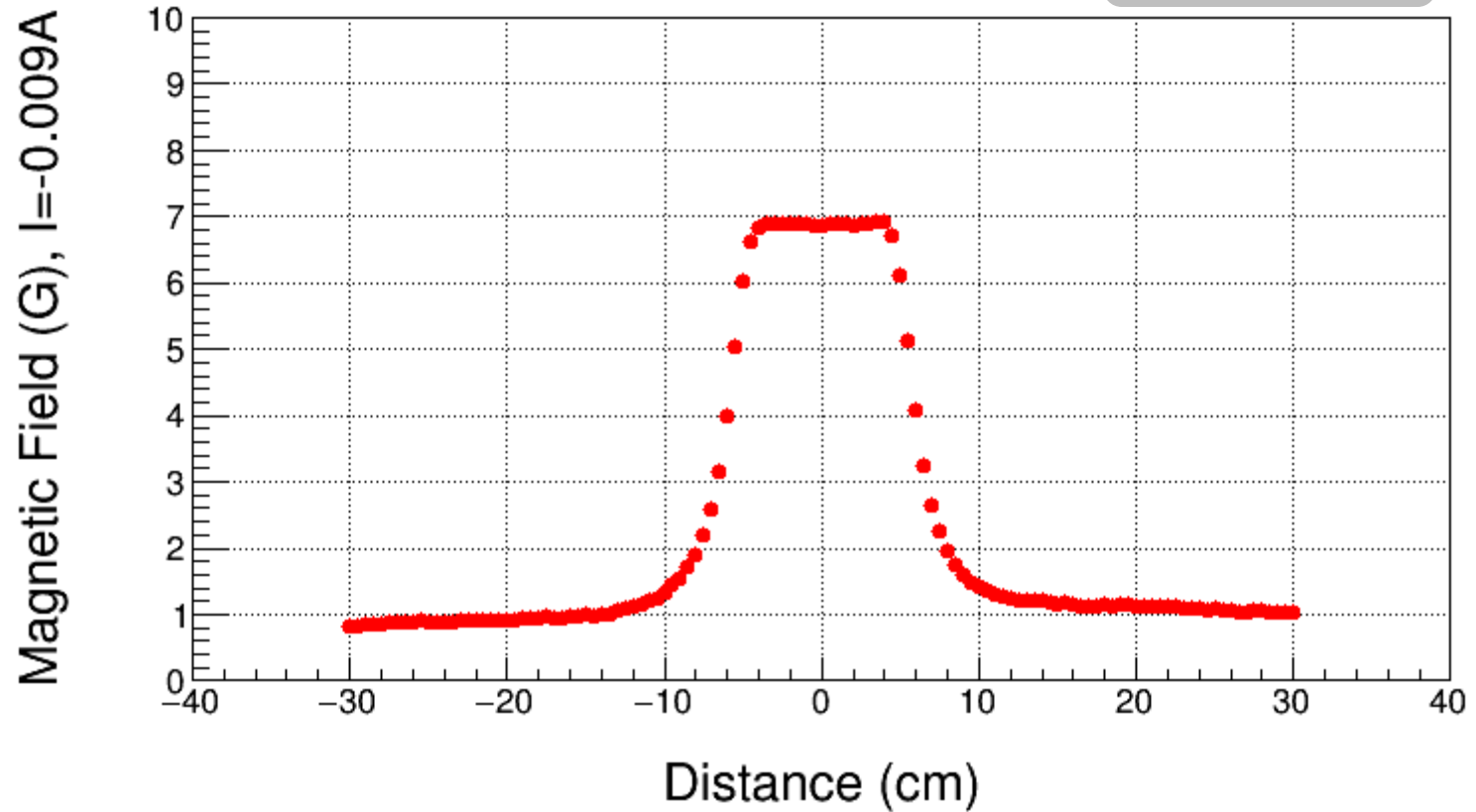
August 10, 2016

# **SPARE DL MAGNET AT MMF**



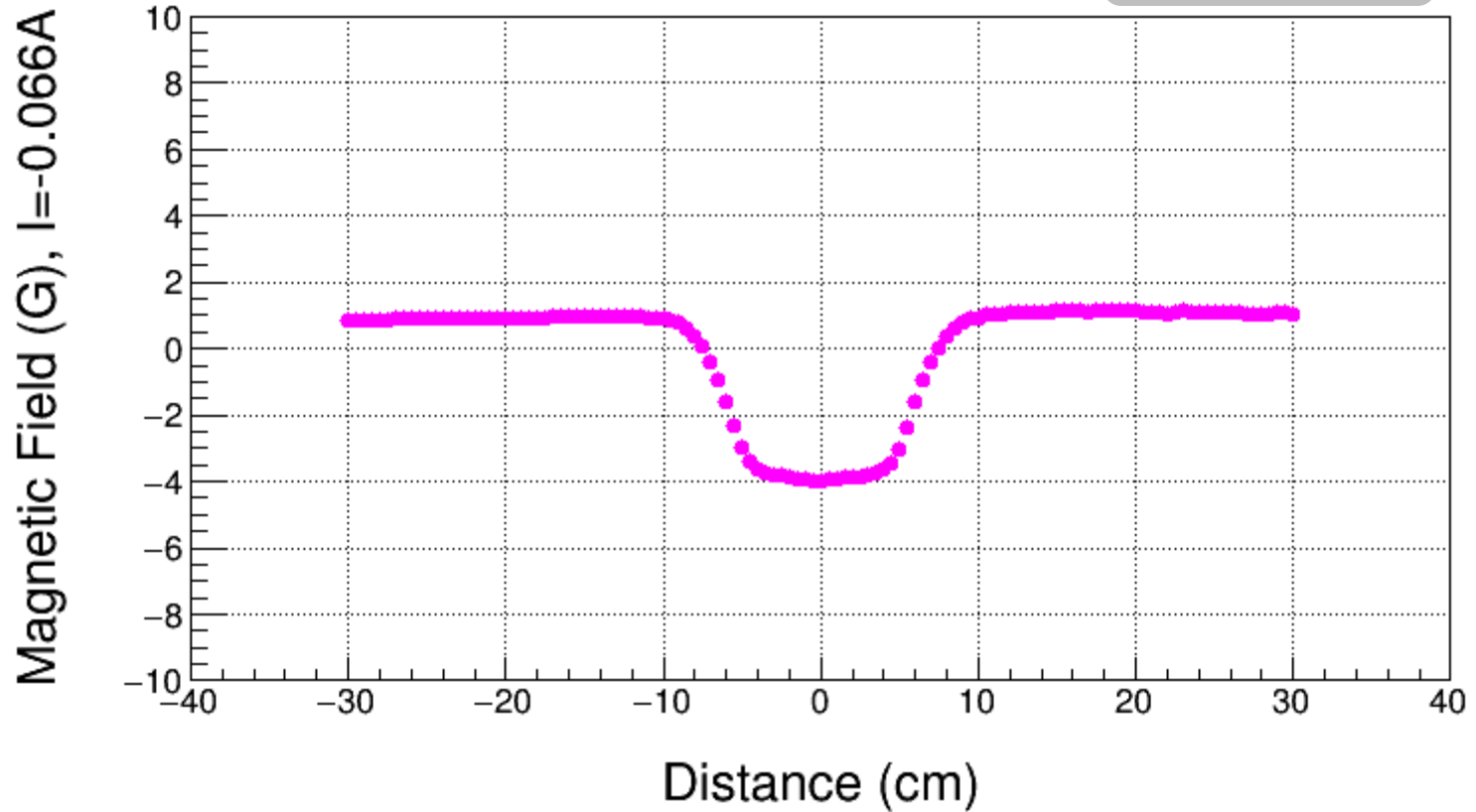
# Field Map, $I = -0.009\text{A}$

On Hysteresis



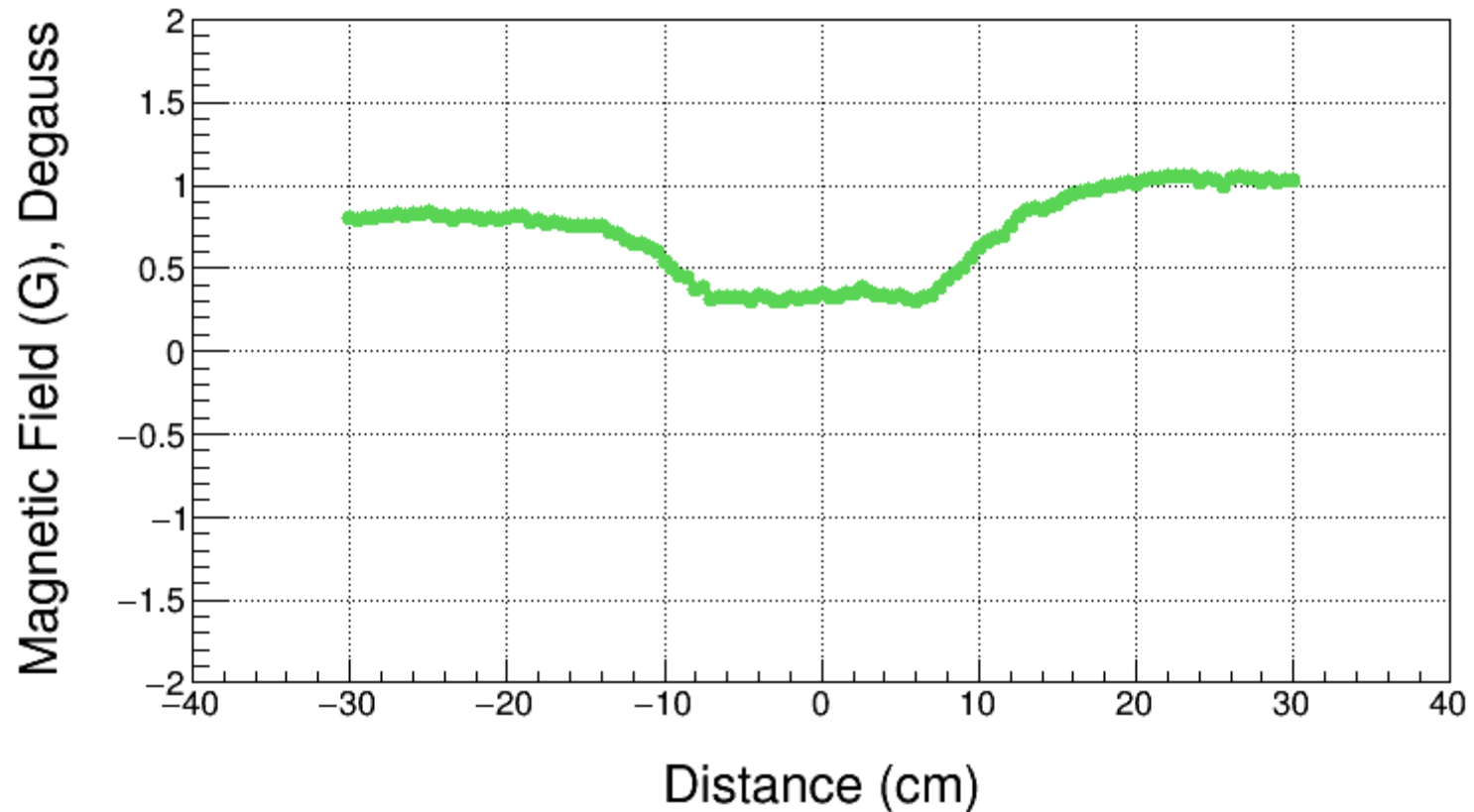
# 0 BdL, I=-0.066A

On Hysteresis



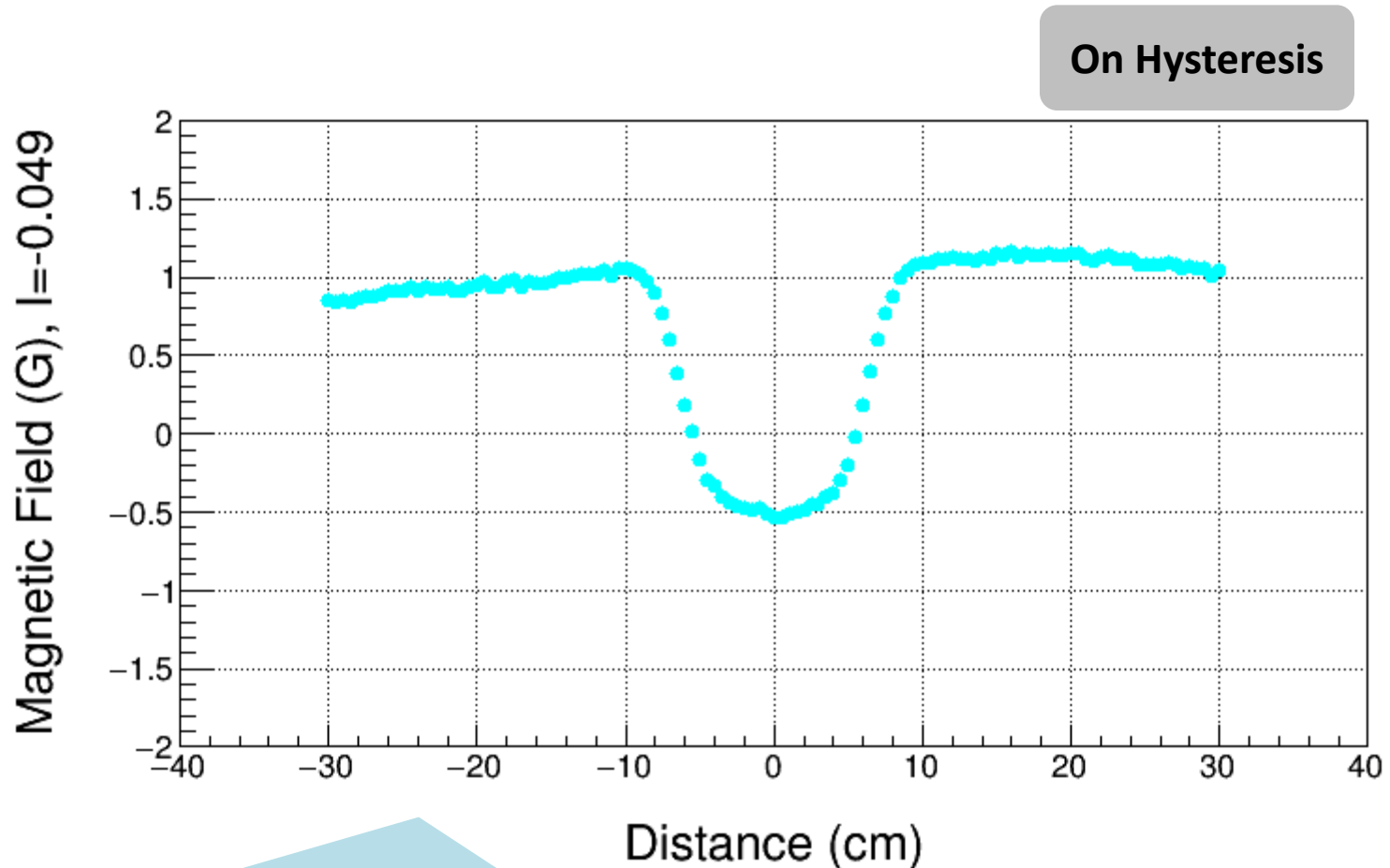
Used Field Map to find 0 BdL

# Degaussed, Power Supply Off



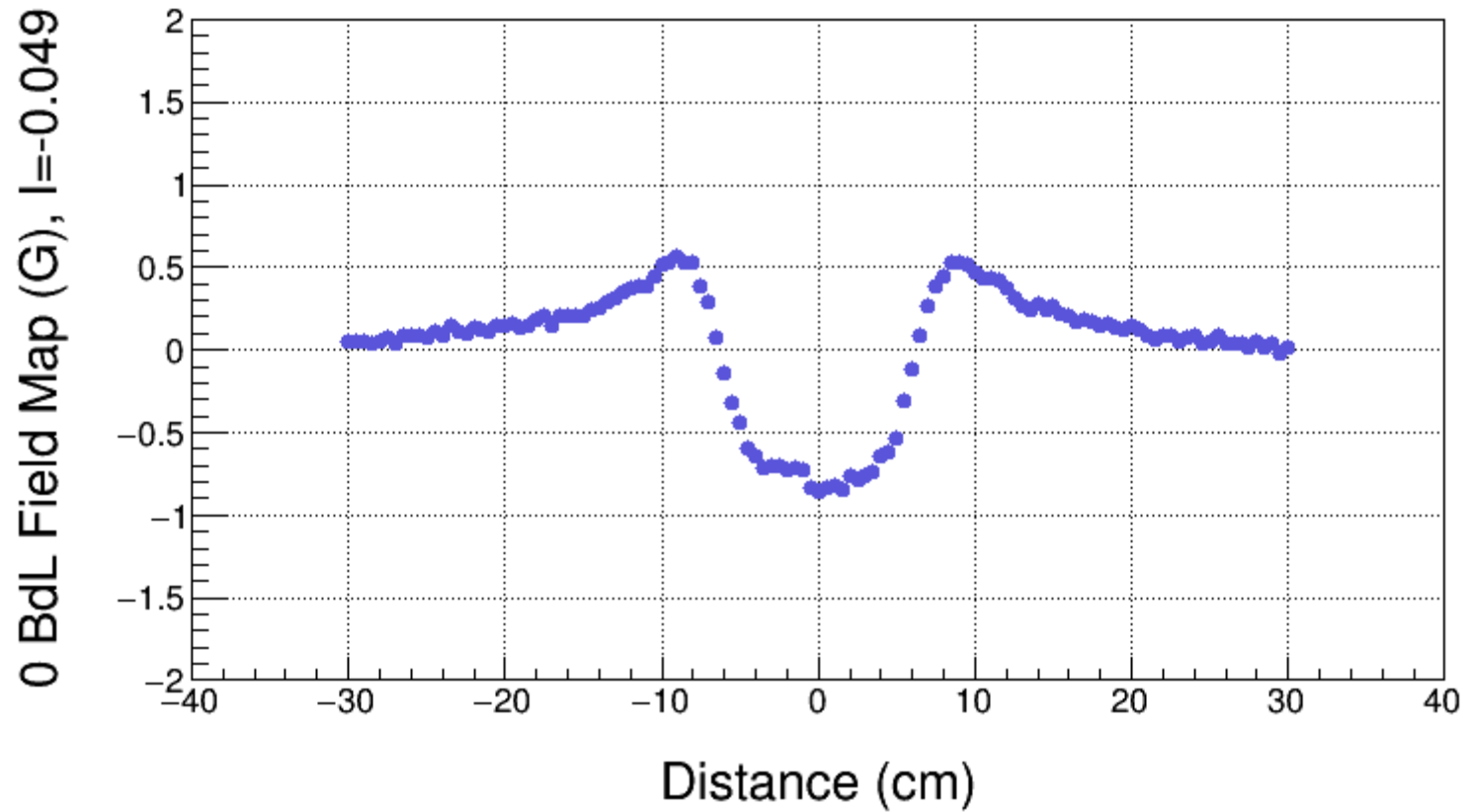
BdL = 42 G-cm, this is Field Map Offset

# 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

# Summary - I

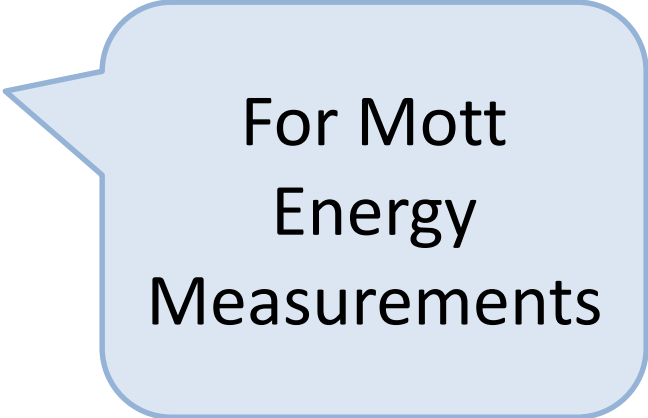
- I. Field Map Offset is found by mapping degaussed magnet with power supply off
- II. Field Map Offset of Spare DL magnet = 42 G-cm
- III. By comparing Spare magnet Field Map and Field Map of installed magnet, Offset of installed magnet is about  $20 \pm 5$  G-cm since:  
Environmental fields at MMF higher are today ( $\sim 1$  G) than during mapping of magnet installed in CEBAF ( $\sim 0.5$  G) in August 2014
- IV. Request to modify CEBAF Field Map: Subtract 20 G-cm
- V. When mapping environmental fields in CEBAF Injector, DL magnet must be degaussed first

# Summary - II

## VI. For Beam Energy Measurement:

- I. CEBAF :  $BdL \neq 0$  (due to field map error). Instead:  $BdL = -\text{Offset} \sim -20 \text{ G-cm}$  (treat as another horizontal corrector)
- II. Spectrometer Lines (2D, 3D, 5D): subtract 20 G-cm from Field Map

|  | <b>Error</b> |
|--|--------------|
| Trim Power Supply                                    | 2 mA         |
| Magnet Model<br>(to find momentum<br>from field map) | 0.1%         |
| Field Map Offset                                     | 5 G-cm       |



For Mott  
Energy  
Measurements