GLAD analysis

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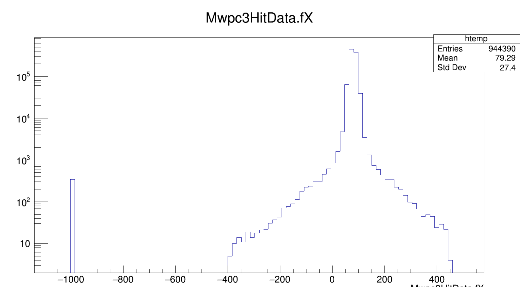
1 RUNS used for calibration = SWEEP RUNS without target

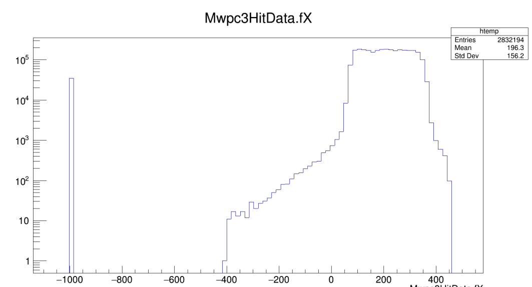
RUN	Beam ion	Beam Energy [AmeV]	GLAD current [A]	Comments
36	12C primary	400	1444	before broken motor, here we see that tof is about 5ns faster. So they probably changed the position of the TOFW afterwards
37	12C primary	400	1444	it has be seen that motor drive not working
38	12C primary	400	1444	tof is back with new gates *magnet sweep 1444A
39	12C primary	400	1498	
40	12C primary	400	1501	
41	12C primary	400	1501	stopped with 1558 A
42	12C primary	400	1558	
43	12C primary	400	1558	stopped with 1653 A
44	12C primary	400	1653	
45	12C primary	400	1653	stopped with 1748 A
46	12C primary	400	1748	
47	12C primary	400	1748	stopped with 1843 A
48	12C primary	400	1843	
49	12C primary	400	1843	stopped with 1938 A
51	12C primary	400	1938	
52	12C primary	400	1938	stopped with 1444 A
53	12C primary	400	1444	
54	12C primary	400	1444	stopped with 1349 A
55	12C primary	400	1349	
56	12C primary	400	1349	stopped with 1254 A
57	12C primary	400	1254	
58	12C primary	400	1254	stopped with 1159
59	12C primary	400	1159	
60	12C primary	400	1159	stopped with 1064
61	12C primary	400	1064	
62	12C primary	400	1064	stopped with 1444 A
123	12C primary	650	1748	stopped with 1957
124	12C primary	650	1957	

(red)	=	sweeping
(green)	=	stable GLAD current

Run 62 could not be used to compare with RUN 53 (1444A), as the GLAD current was sweeping continuously from 1064 to 1444 Ampere.



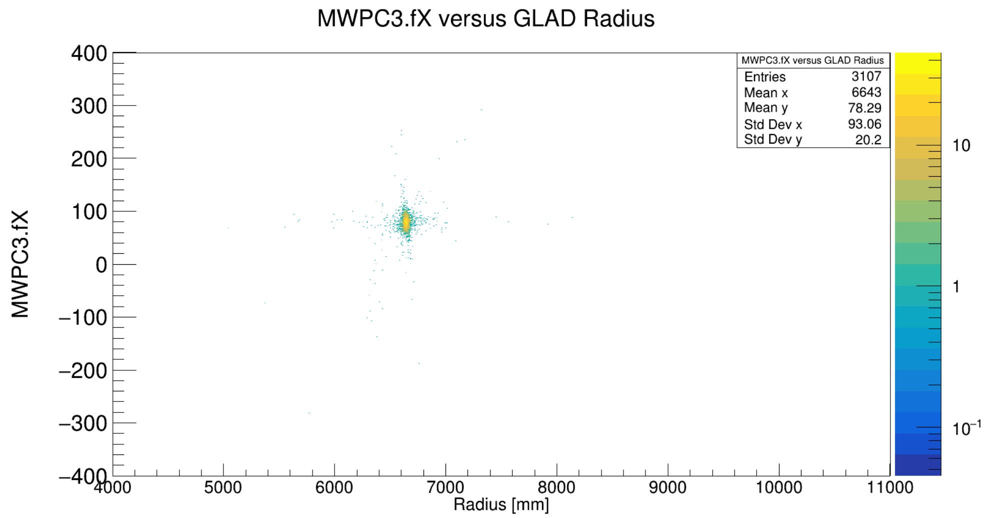
(a) "Event counts for MWPC3.fX in RUN 53 with GLAD current 1444A."



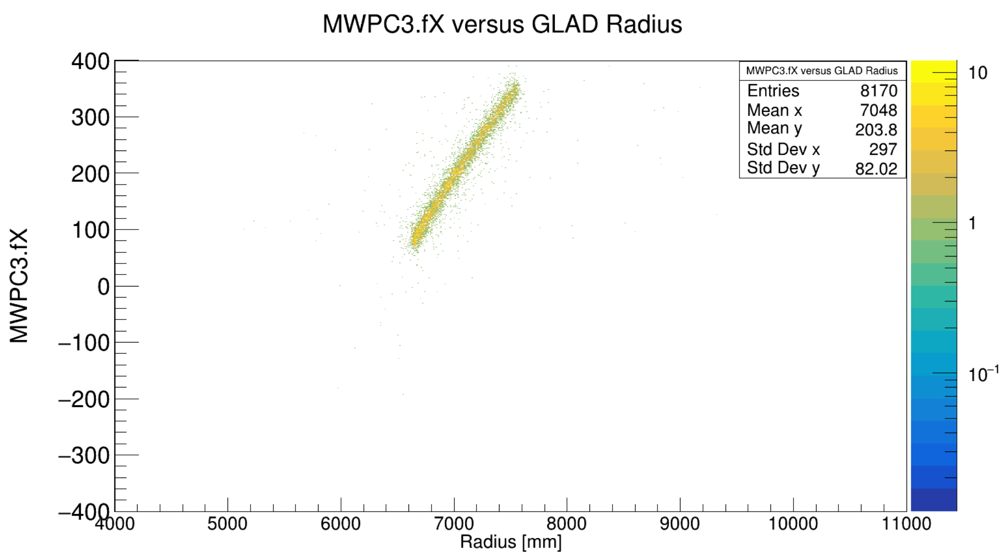
(b) "Event counts for MWPC3.fX in RUN 62 with sweeping GLAD current."

Taking sweep RUNS 39-61 we get following plot for B-Field versus Current (where the B-Field is calculated from given Brho divided by the calculated mean radius for given current):

As the GLAD current can just be tuned in multiple steps of 19A, the Current value for RUN



(a) "Radius vs MWPC3.fX for RUN 53 with GLAD current 1444A."



(b) "Radius vs MWPC3.fX for RUN 62 with sweeping GLAD current."

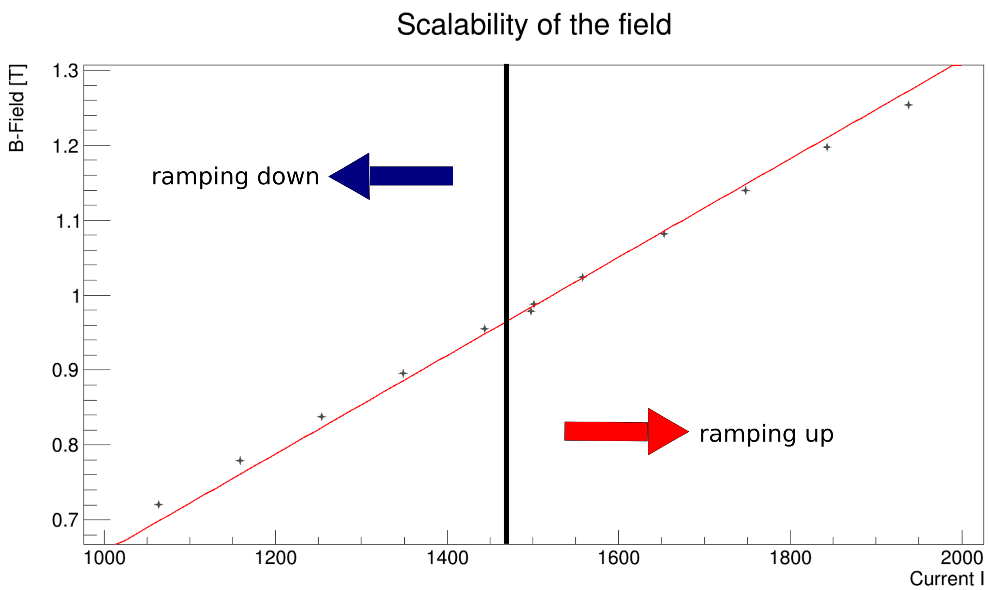


Figure 3: "Current vs B-Field using the E-Log Entry for RUN39, I = 1498."

39 falls out of the range. Most probably that was a typo. Making same plot but changing the Current number of RUN 39 to 1482 Ampere we get:

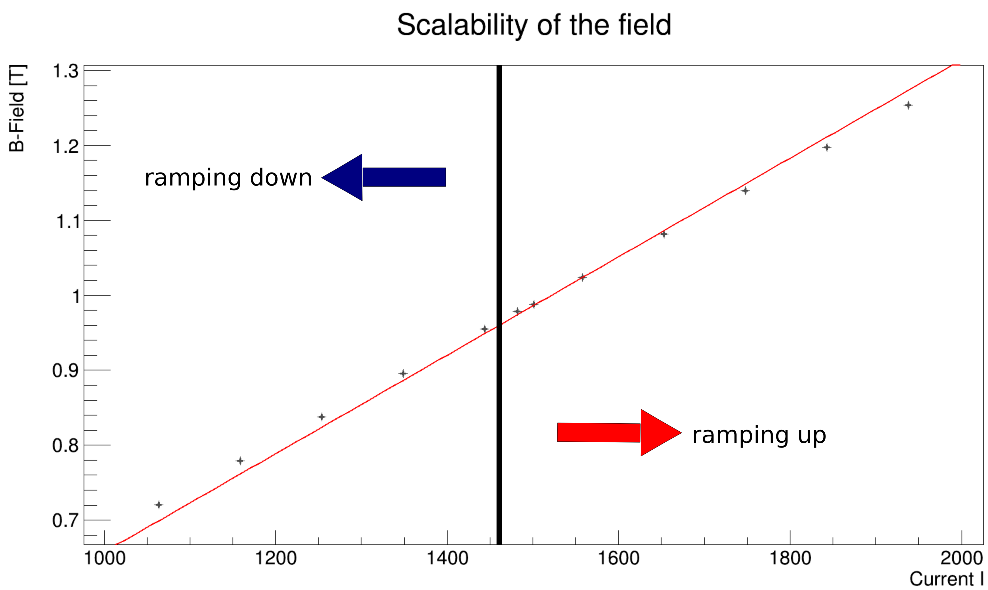


Figure 4: "Current vs B-Field, setting I = 1482 for RUN39."

Using as current 1482 for RUN 39 we get from the linear fit going through (0,0) as slope $k = 0.000657193$ (with B $= k \cdot I$). From the proportional fitting line we see that for ramp-

ing up the data points lie slightly below the fitting line but then for ramping down slowly above the line. This indicated pattern could be due to the supposed underlying magnetic remanence which adds a positive offset when ramping down.
Plotting k = Brho/(rho$\cdot$ current) versus current we get the proportional factor k for each RUN:

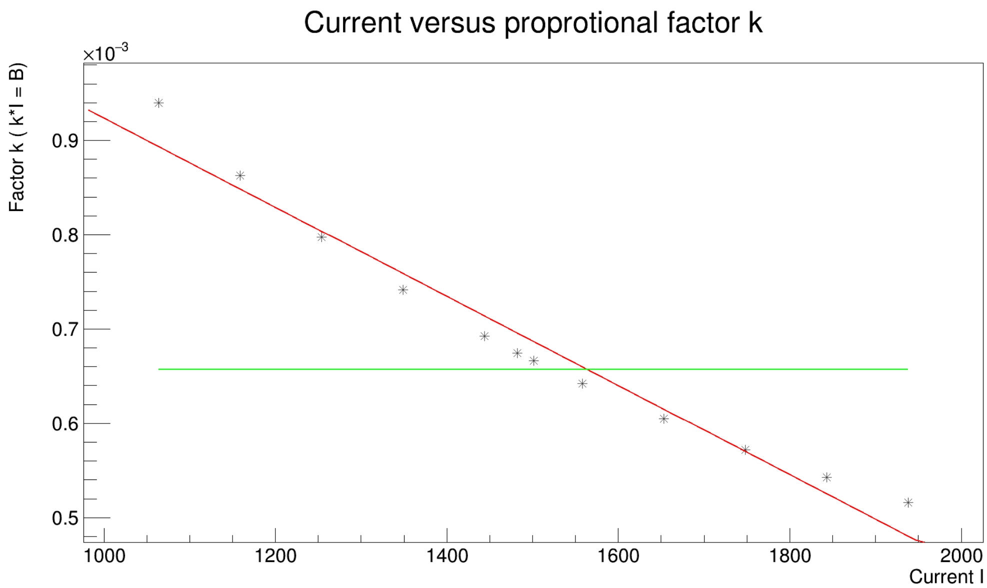


Figure 5: "Current vs proportional factor k for RUNs 39-61.Green line: k value from fit B vs I; red line: Fit ax+b of k vs I"

The plot in figure 5 shows decreasing k values for increasing current. The green line in figure 5 shows the k value retrieved from the proportional fit of B-Field versus current. The red line in figure 5 is a linear fit (ax+b) of the values in the plot.
From the fit we get follwing values for a and b:

- a $= -4.72574e - 07$
- b $= 0.00139628$
- $\chi/NDf = 6.03242e - 09/10$

As it can be seen the data points deviate noticeable from the straight fitting line. That means not just second order terms, but third and higher terms need to be considered when describing the B-Field by the current.
From figure 5 it can also be read off the value of the slope for the respective current. As k (i.e. the slope) decreases with increasing current, the curve flattens out for higher current values. This is also the case in a hysteresis curve.

When fitting the datapoints of k with a polynomial of second order ($ax^2 + bx + c$) we get the fitting curve shown in figure 6 with the parameters:

- a $= 3.22629e - 10$
- b $= -1.44161e - 06$
- c $= 0.00210266$
- $\chi/NDf = 1.3088e - 10/9$

It can be clearly seen that the fit in figure 6 is much better than in figure 5 (see also the χ/NDf values). Hence the B-Field can be described well by third order terms in I (curent).

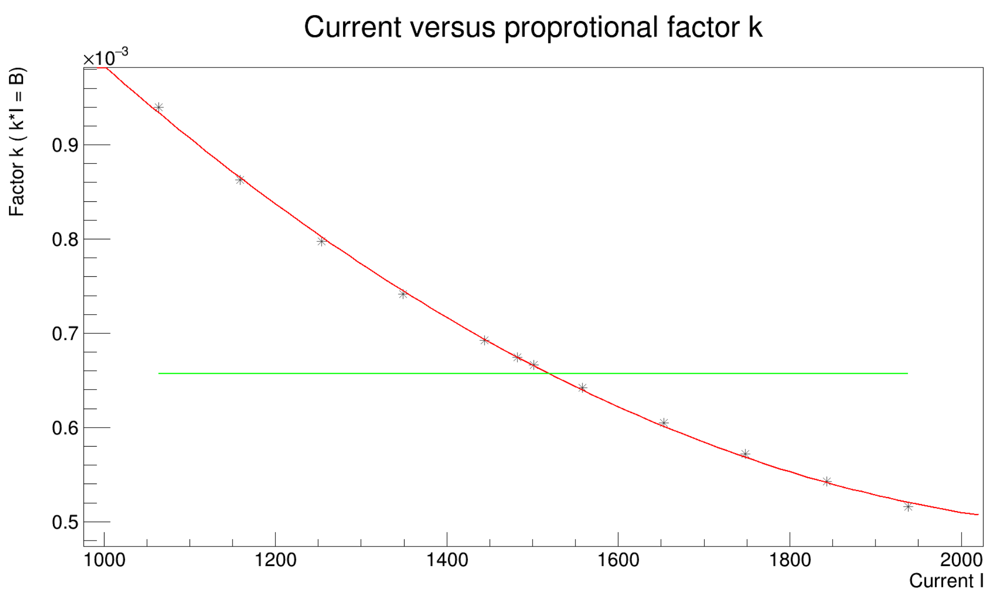


Figure 6: "Current vs proportional factor k for RUNs 39-61.Green line: k value from fit B vs I; red line: Fit of k vs I with $ax^2 + bx + c$ "

1.1 Plotting ramp up and ramp down separately

In figure 7 the datapoints for the ramp up (from 1482 Ampere to 1938 Ampere) and ramp down (from 1444 Ampere to 1064) are plotted separately and both fitted with a 3rd order polynomial (a·x +b·x^2 + c·x^3).

From figure 7 we can see that the slope of the fit for the ramping down phase is steeper as in the ramping up phase. As the current ranges for the two phases don't overlap we cannot derive any other information from the plot.

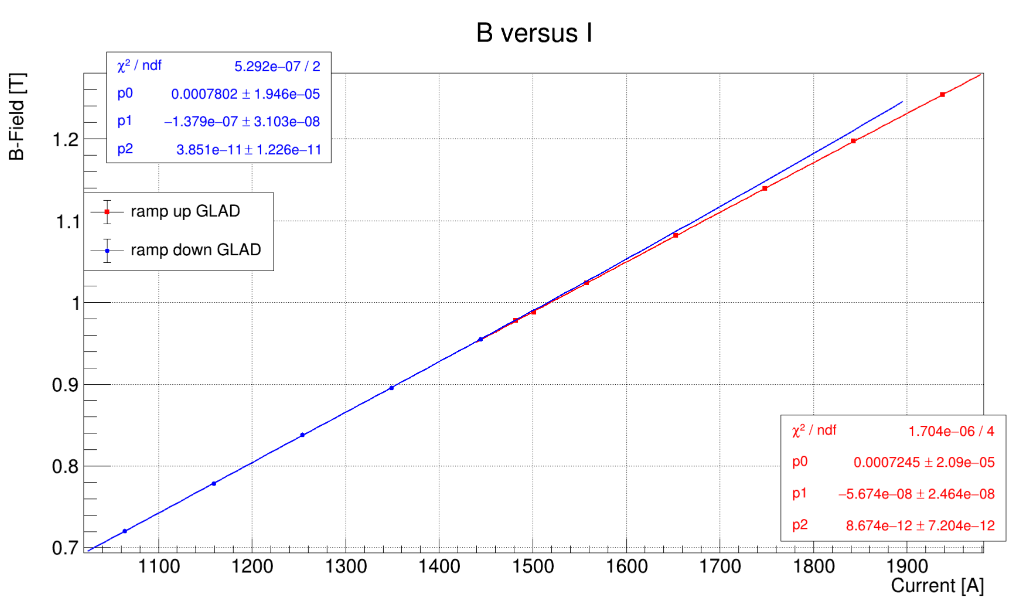


Figure 7: "B-Field versus current for both ramp up and down phase."