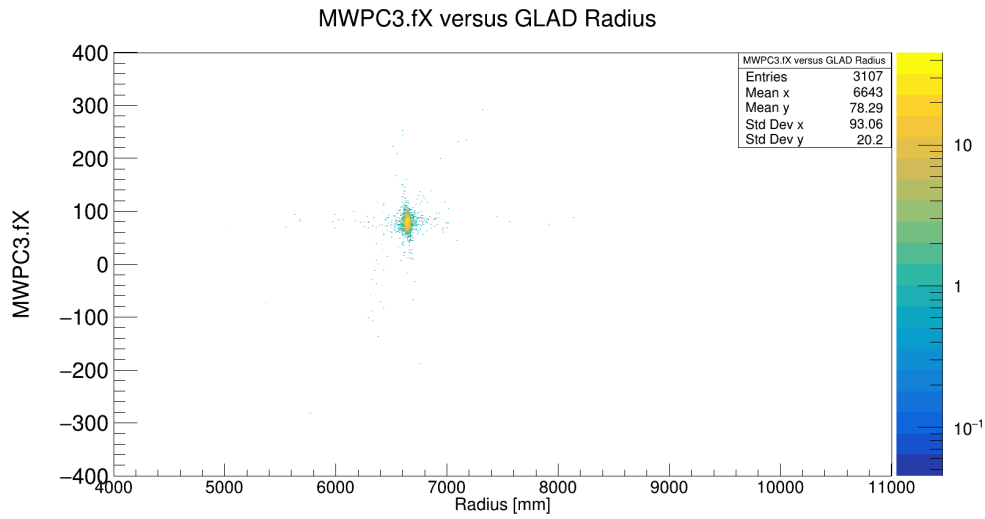
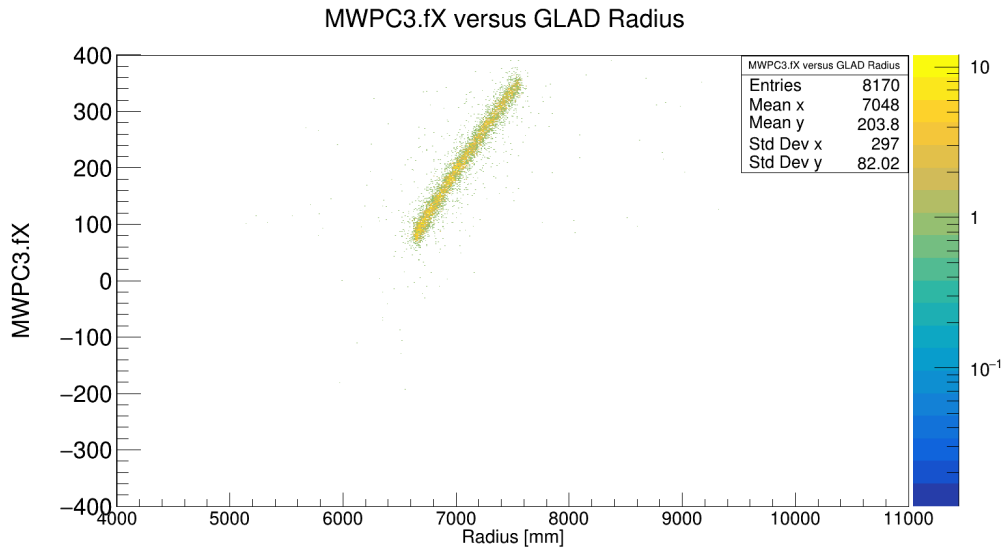


GLAD analysis

Tobias Jenegger



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



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

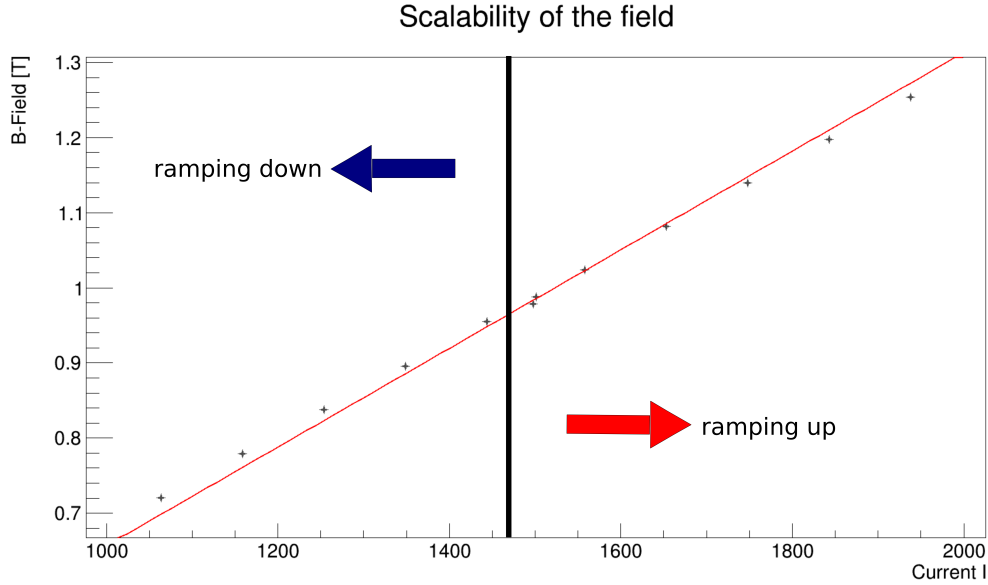


Figure 3: "Current vs B-Field using the E-Log Entry for RUN39, $I = 1498$."

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:

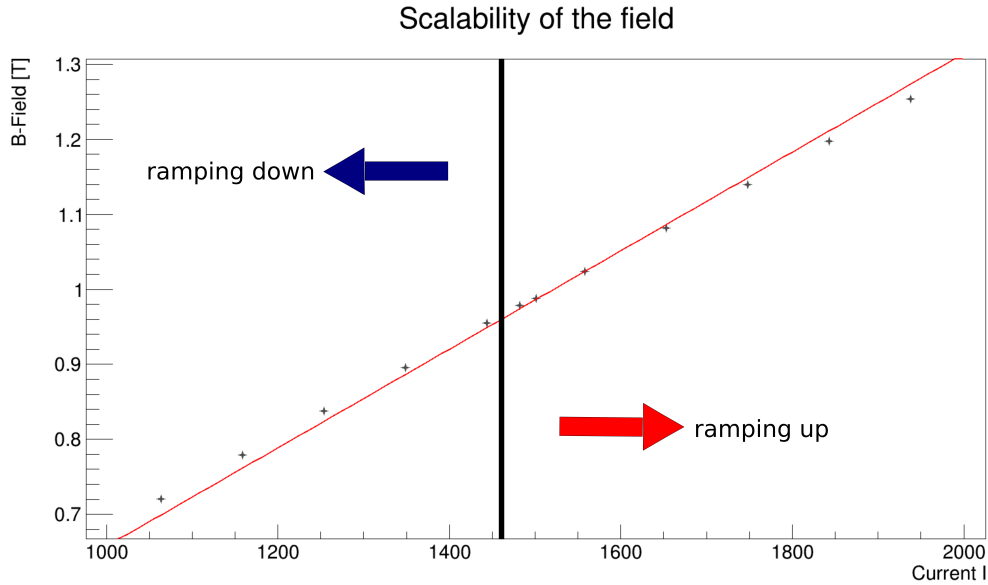


Figure 4: "Current vs B-Field, setting $I = 1482$ for RUN39."

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 $k = B_{\text{rho}}/(\rho \cdot \text{current})$ versus current we get the proportional factor k for each RUN:

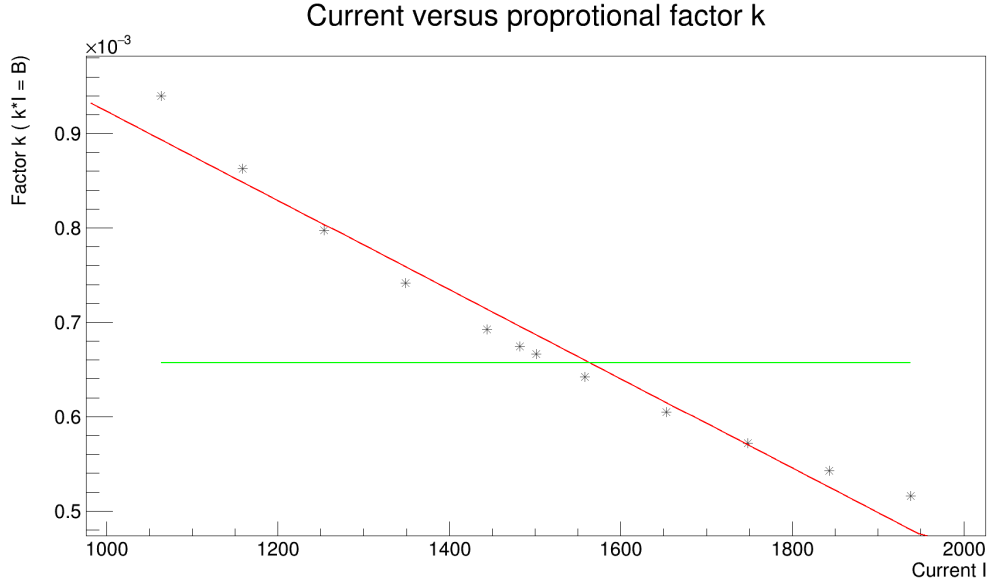


Figure 5: "Current vs proportional factor k for RUNs 39-61. Green line: k value from fit B vs I; red line: Fit $ax+b$ of k vs I"

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 (current).

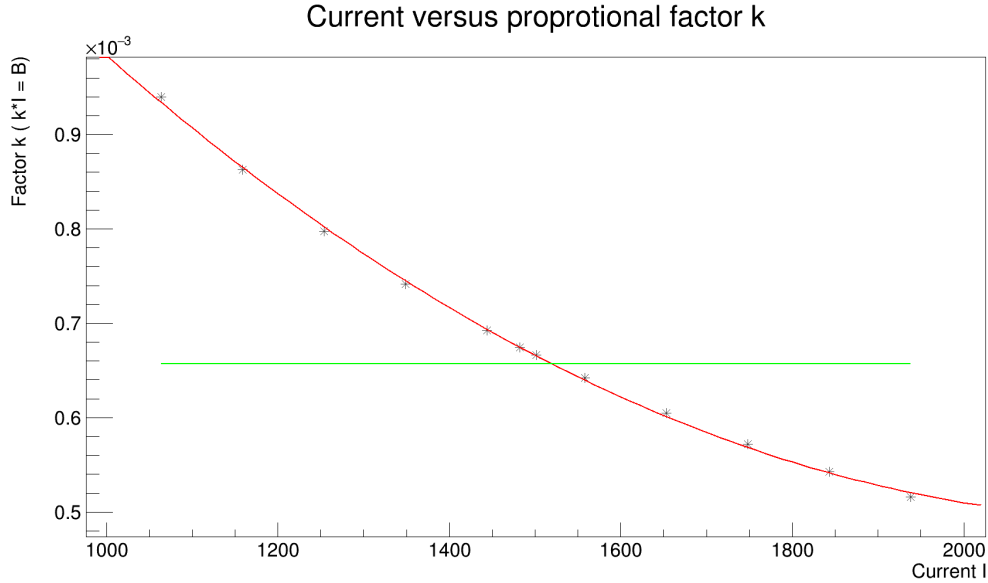


Figure 6: "Current vs proportional factor k for RUNs 39-61. Green line: k value from fit B vs I ; red line: Fit of k vs I with $ax^2 + bx + c$ "

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 ($a \cdot x + b \cdot x^2 + c \cdot x^3$).

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.

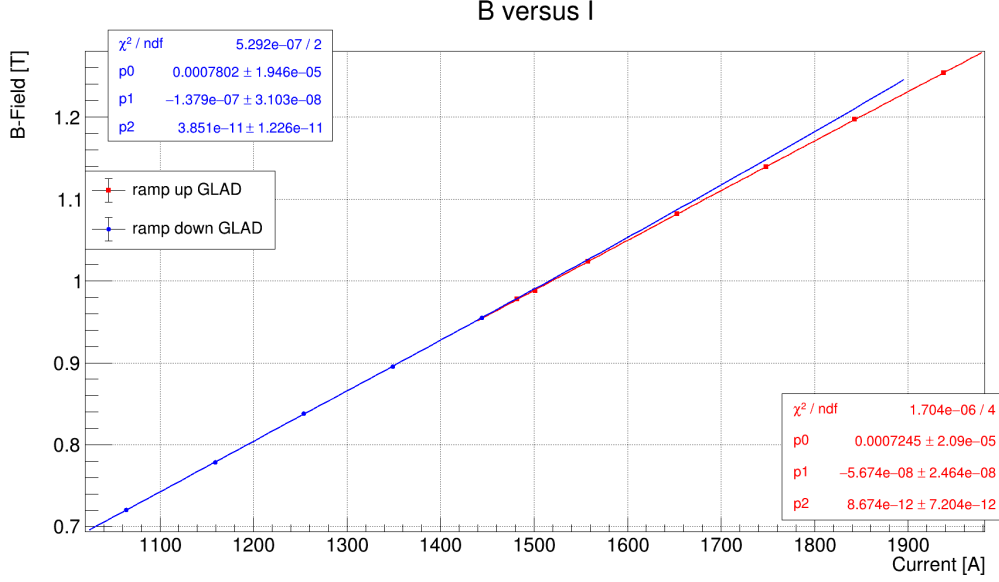


Figure 7: "B-Field versus current for both ramp up and down phase."

2 Plots with errors in B (= 6.3472/radius) plotting and fitting ramp up and down together

Therefore σ_B (coming from the error in the radius computation) has to be extracted to get the standard error of the mean (SEM).

Runnr.	B-mean	σ_B	No. of Events	SEM
39	9.78004e-01	3.44246e-03	132919	9.44E-06
40	9.87929e-01	1.83828e-03	521841	2.54E-06
42	1.02352e+00	1.86227e-03	545163	2.52E-06
44	1.08146e+00	1.86080e-03	551870	2.5E-06
46	1.13943e+00	1.82158e-03	507216	2.56E-06
48	1.19737e+00	1.81473e-03	517491	2.52E-06
51	1.25391e+00	1.82867e-03	245708	3.69E-06
53	9.54908e-01	1.82927e-03	442614	2.75E-06
55	8.95591e-01	1.93142e-03	377027	3.15E-06
57	8.37859e-01	1.83791e-03	435326	2.79E-06
59	7.78625e-01	1.83557e-03	447905	2.74E-06
61	7.20417e-01	1.88449e-03	381069	3.05E-06

In figure ?? the calculated B-Field is plotted against the current and fitted with a polynomial function . The error bars cannot be visualized, as the SEM is five magnitudes smaller than the value of the B-Field. This causes also the large chi-square values. Nevertheless the fit seems to coincide quite well with the data point. The linear part dominates with an offset of about 0.05.

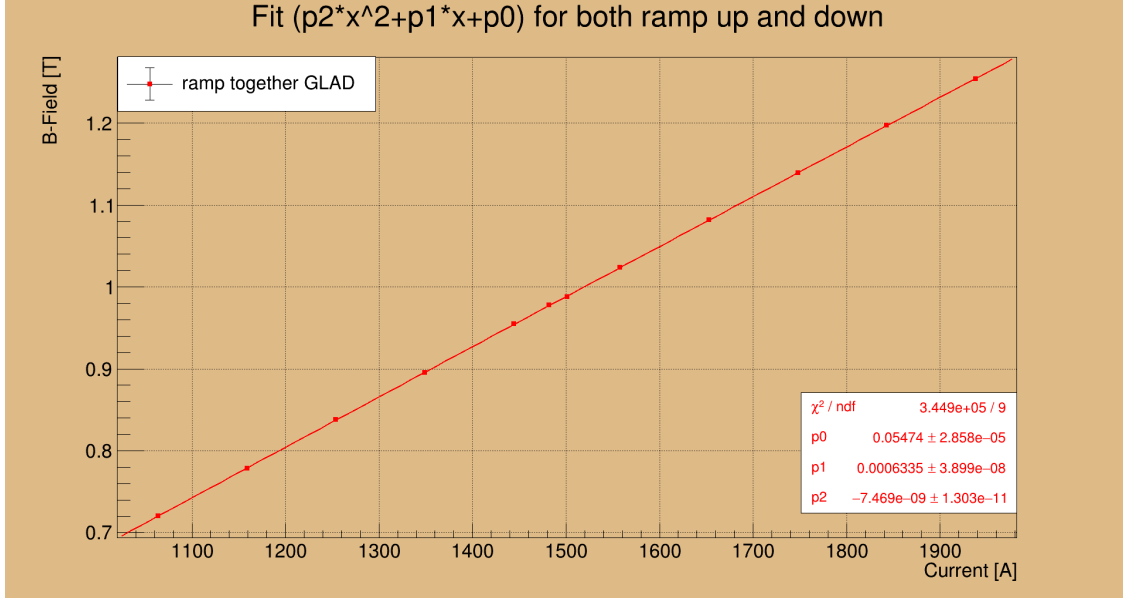


Figure 8: "B-Field versus current for both ramp up and down phase."

3 Other Empty Target RUNS at 400 AMeV, 1444 A

- RUN 74 (quite long before set to $I = 1444\text{A}$, but RUN 73 has dispersed beam, rollover open)
- RUN 178 (RUN 176 was at $I = 2223\text{ A}$, 800 AMeV; RUN 177 was used to tune, for 21 mins)
- RUN 187 (RUN 185 was at $I = 1444\text{ A}$, 400 AMeV; RUN 186 was used to tune, for 10 mins)
- RUN 202 (RUN 201 with target CH2, 12 mm at $I = 1444\text{ A}$, 400 AMeV)

Runnr.	R mean	σ_R	rel. Res Radius $\frac{\sigma_R}{R_{mean}}$	No. of Events
74	6.66339e+03	1.24510e+01	0.00187	500889
178	6.64599e+03	1.30616e+01	0.00197	672316
187	6.64609e+03	1.28225e+01	0.00193	1497967
202	6.65009e+03	1.85012e+01	0.00278	143775

Runnr.	B-mean	σ_B	No. of Events	SEM
74	9.52524e-01	1.72958e-03	500889	2.444e-06
178	9.55041e-01	1.71365e-03	672316	2.09e-06
187	9.54994e-01	1.68231e-03	1497967	1.374e-06
202	9.54329e-01	2.24965e-03	143775	5.933e-06

Figure ?? shows graphically the calculated B-Field values for the empty target RUNS with $I = 1444\text{A}$.

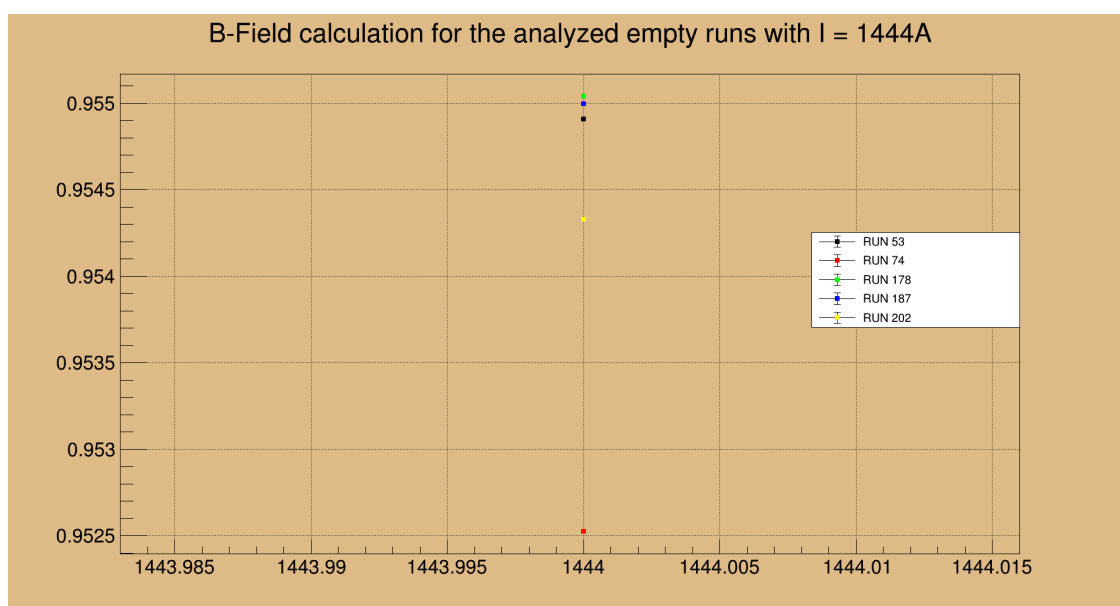


Figure 9: "B-Field versus current for empty runs with $I = 1444\text{ A.}$ "