University of Regina

Luminosity Study for the LD2 Target

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Lumi Scan Data Sets

- For Carbon &LD2

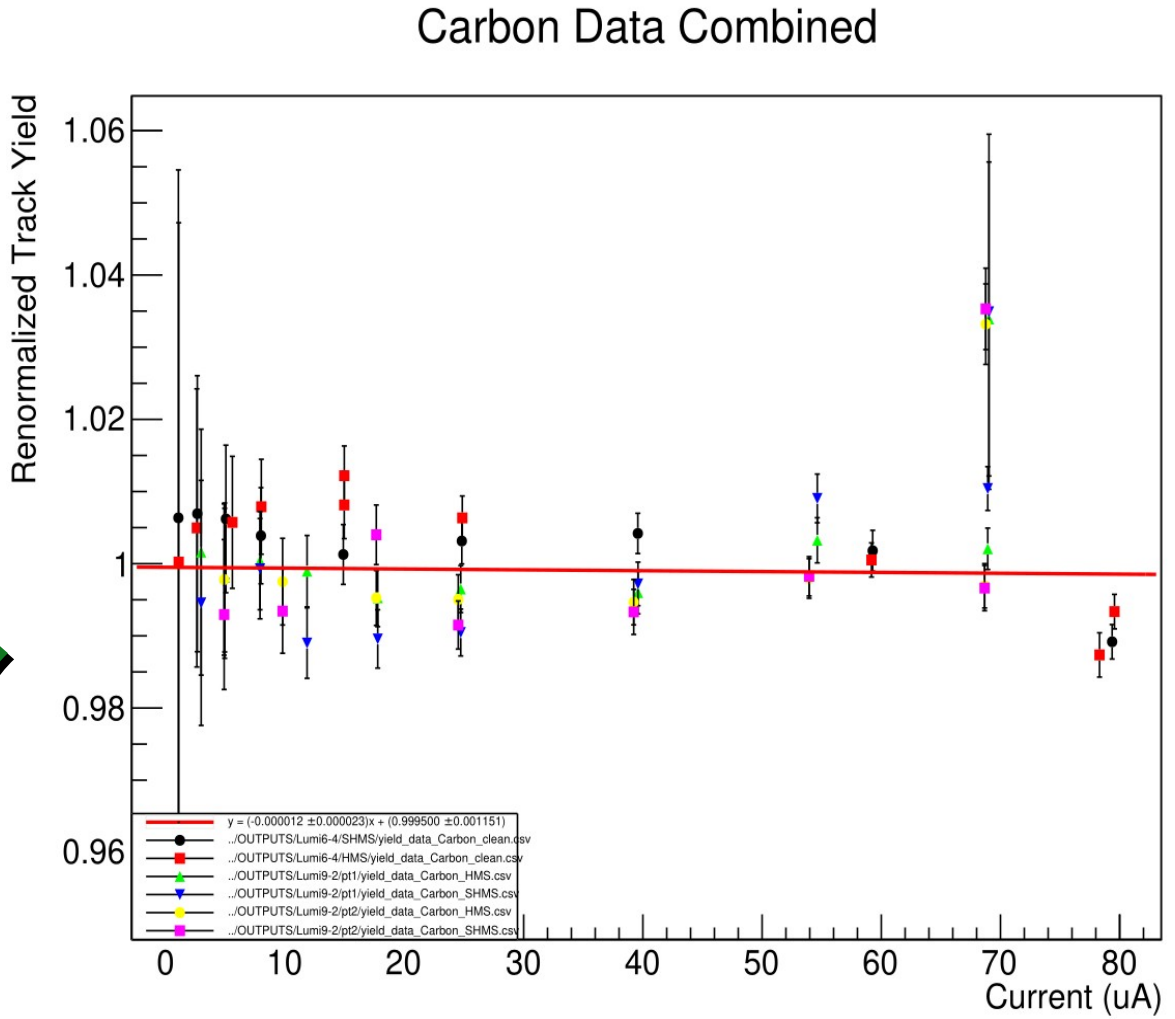
9.1 GeV #1	done
9.1 GeV #2	done
6.4 GeV	done
7.9 GeV	Not yet

- Using Nathen's script, combined the track Rel. Norm. yield for Carbon
- Combined the Scaler Rel. Norm. yield for LD2 (HMS, SHMS, both arms)
- Cobmined the Track Rel. Norm. yield for LD2 (HMS, SHMS, both arms) (Unstable)
- Scaler yield is more stable → Obtain the boiling correction factor

Carbon Track Relative Normalized Yield vs Current

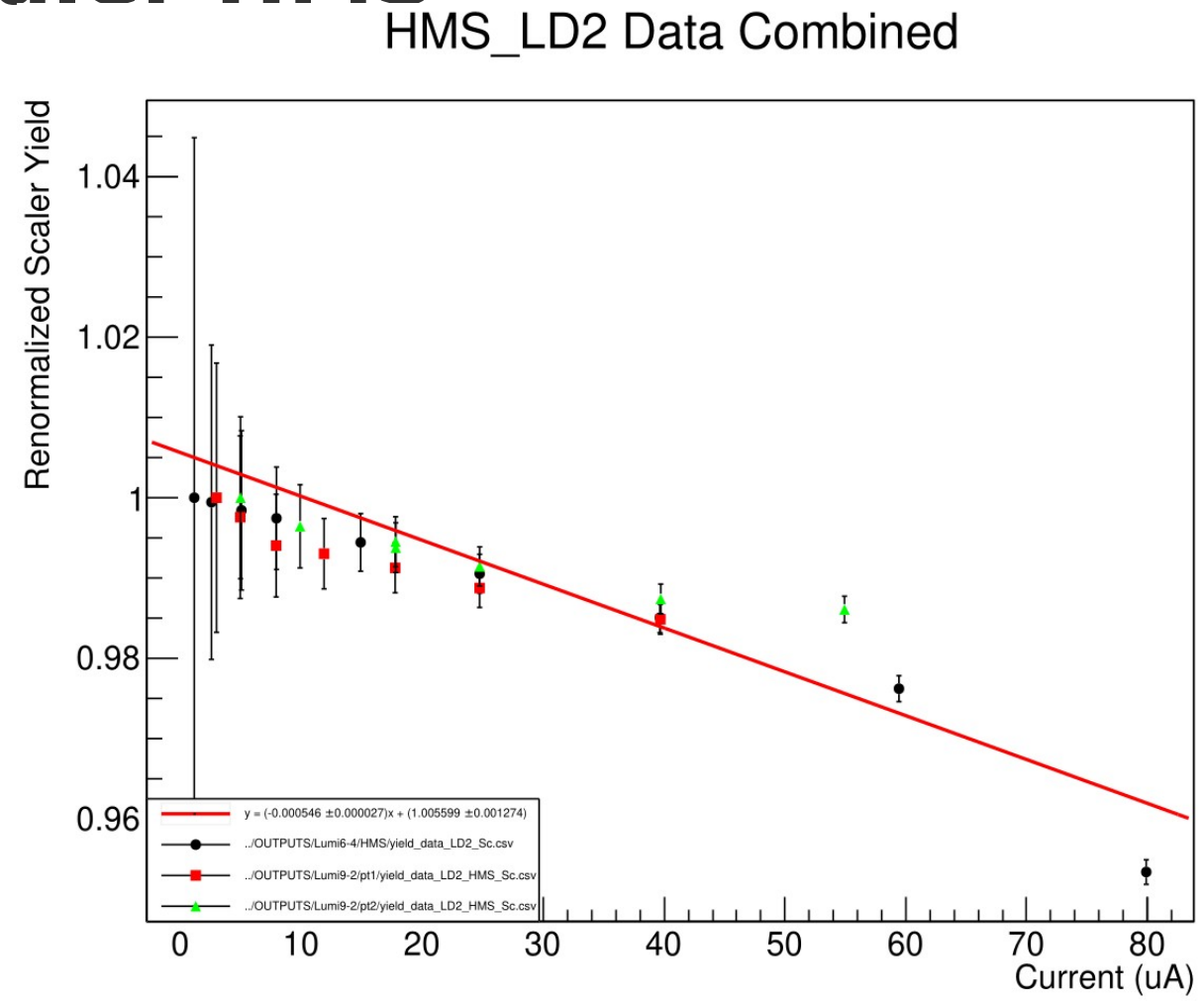
Slope:
$(-1.2 \pm 2.3)\times10^{-4}\ (\mu A)^{-1}$

Confirms → No Boiling



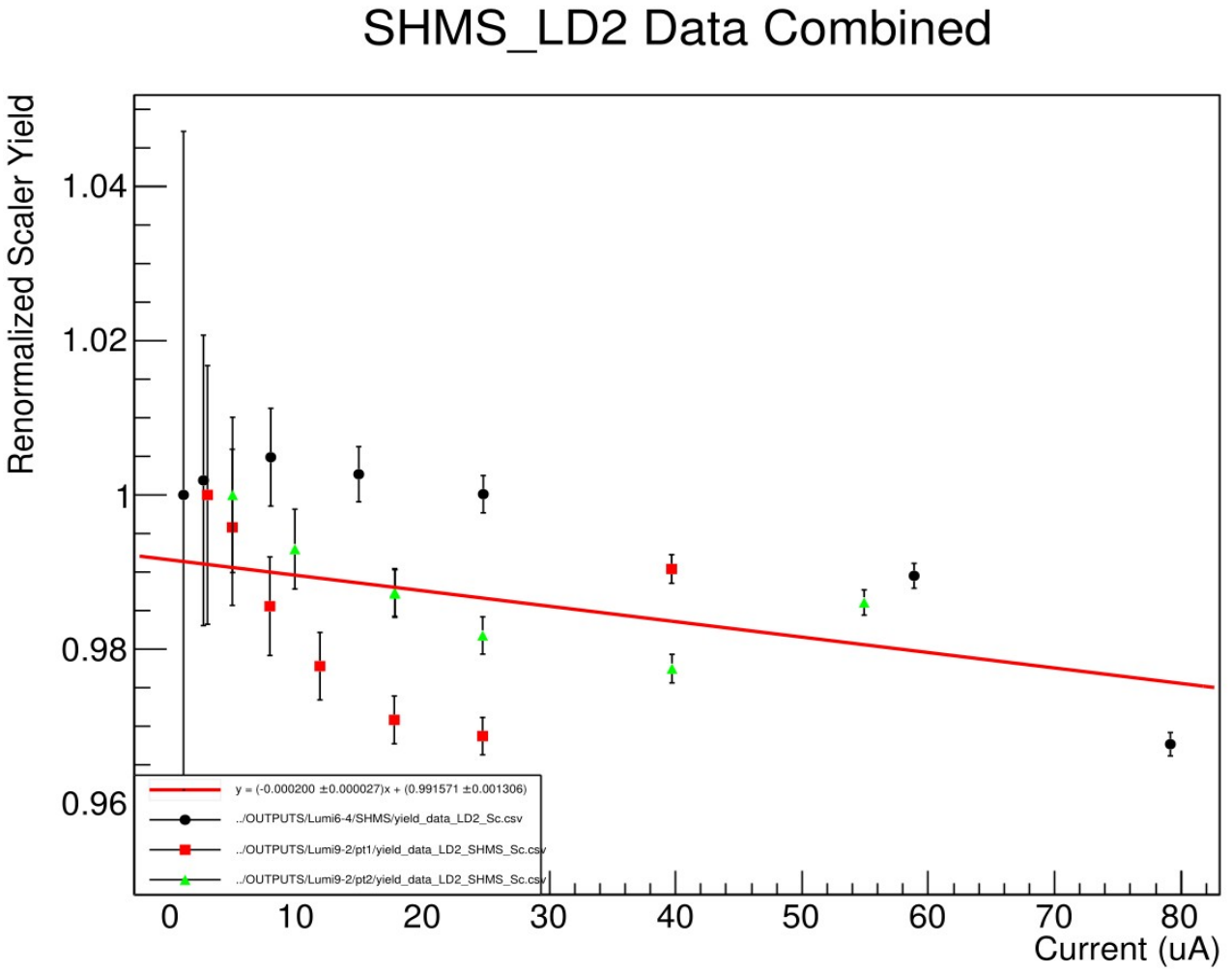
LD2: Scaler HMS

Slope:
$(-5.46 \pm 0.27) \times 10^{-4}$ $(\mu A)^{-1}$



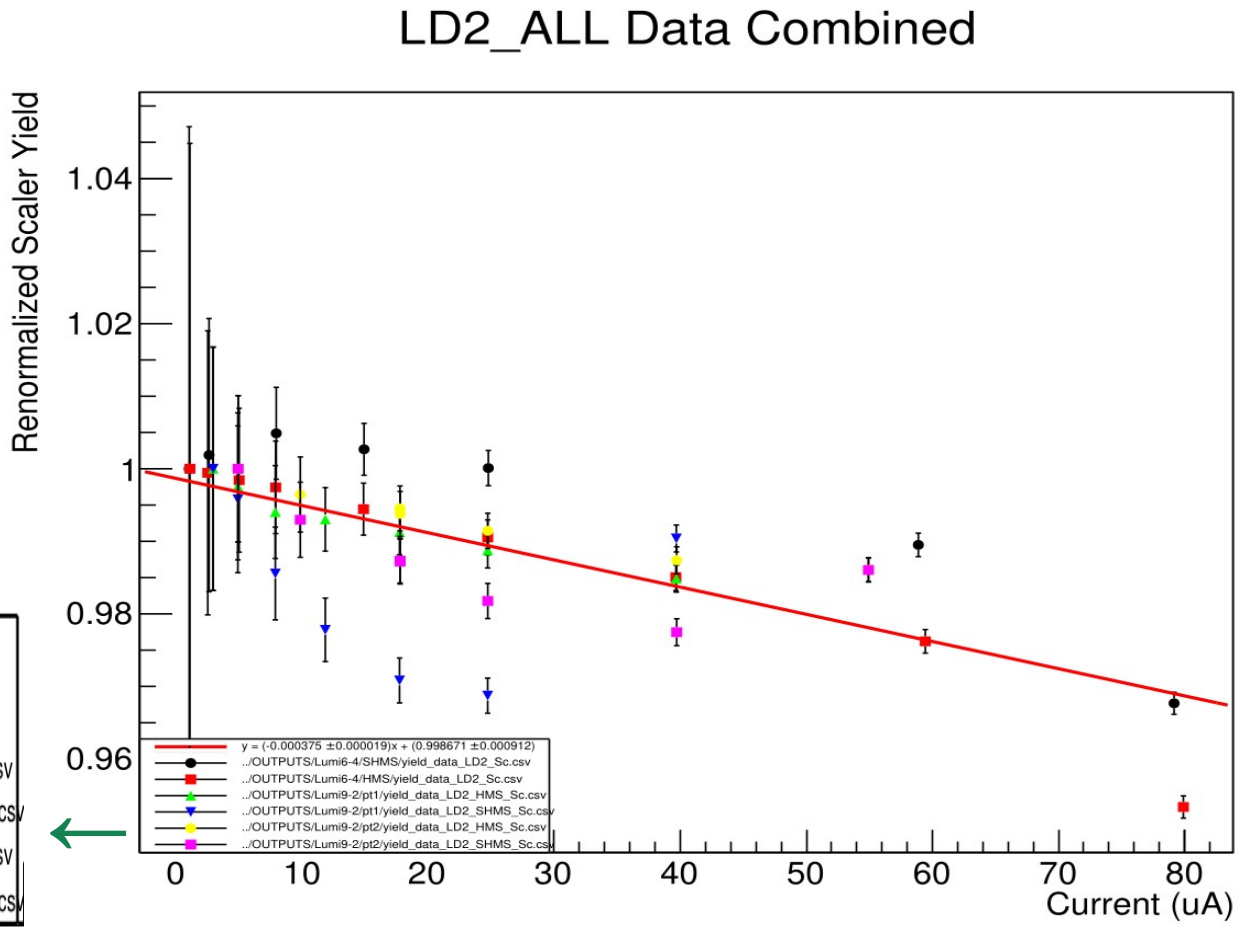
LD2: Scaler SHMS

Slope:
$(-2.00 \pm 0.27) \times 10^{-4}$
$(\mu A)^{-1}$



LD2: Scaler (HMS&SHMS)

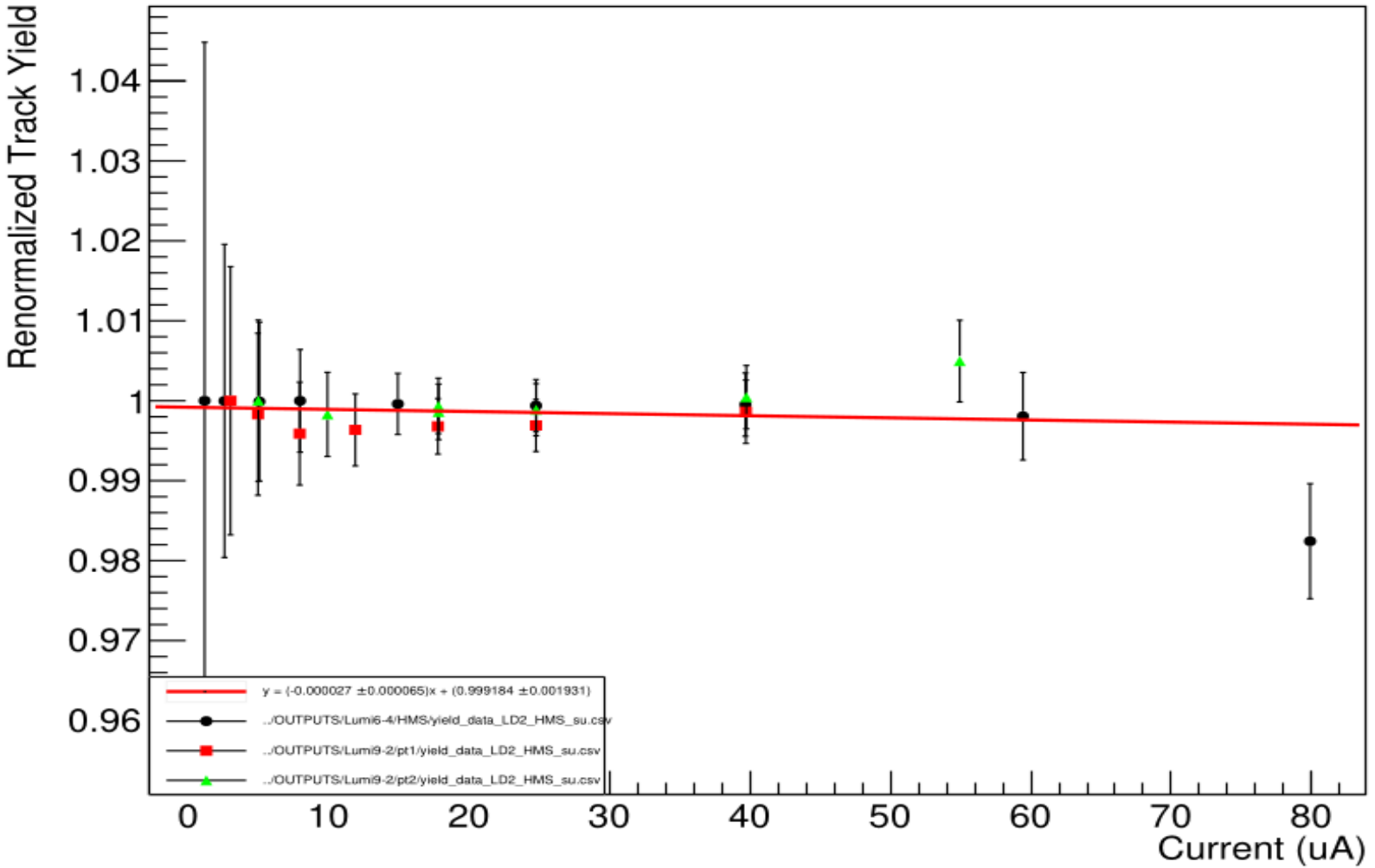
Slope:
$(-3.75 \pm 0.19) \times 10^{-4}\ (\mu A)^{-1}$



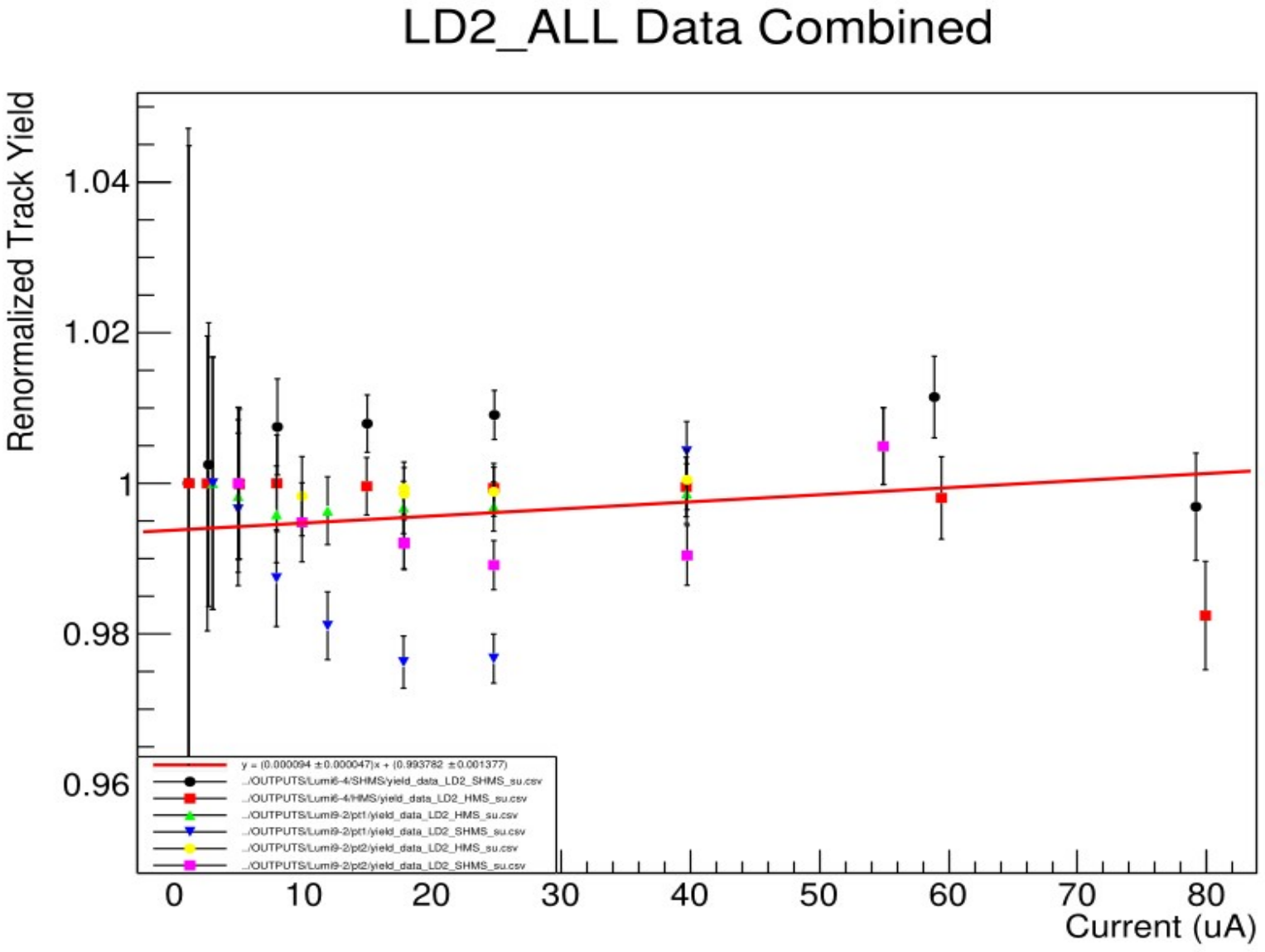
Boiling Factor

- Equation: $\epsilon = 1 - m_{boil} I_{avg}$
- m_{boil} = (3.75 ± 0.19)x10⁻⁴ (μA)⁻¹ ± systematic Uncertainty: 0.69x10⁻⁴ (μA)⁻¹
- Uncertainty $\delta\epsilon = I_{avg}\,\delta m_{boil}$
- Apply for each run
- **To DO Next → include the 7.9 GeV set & run coin LD2 data**

HMS_LD2 Data Combined

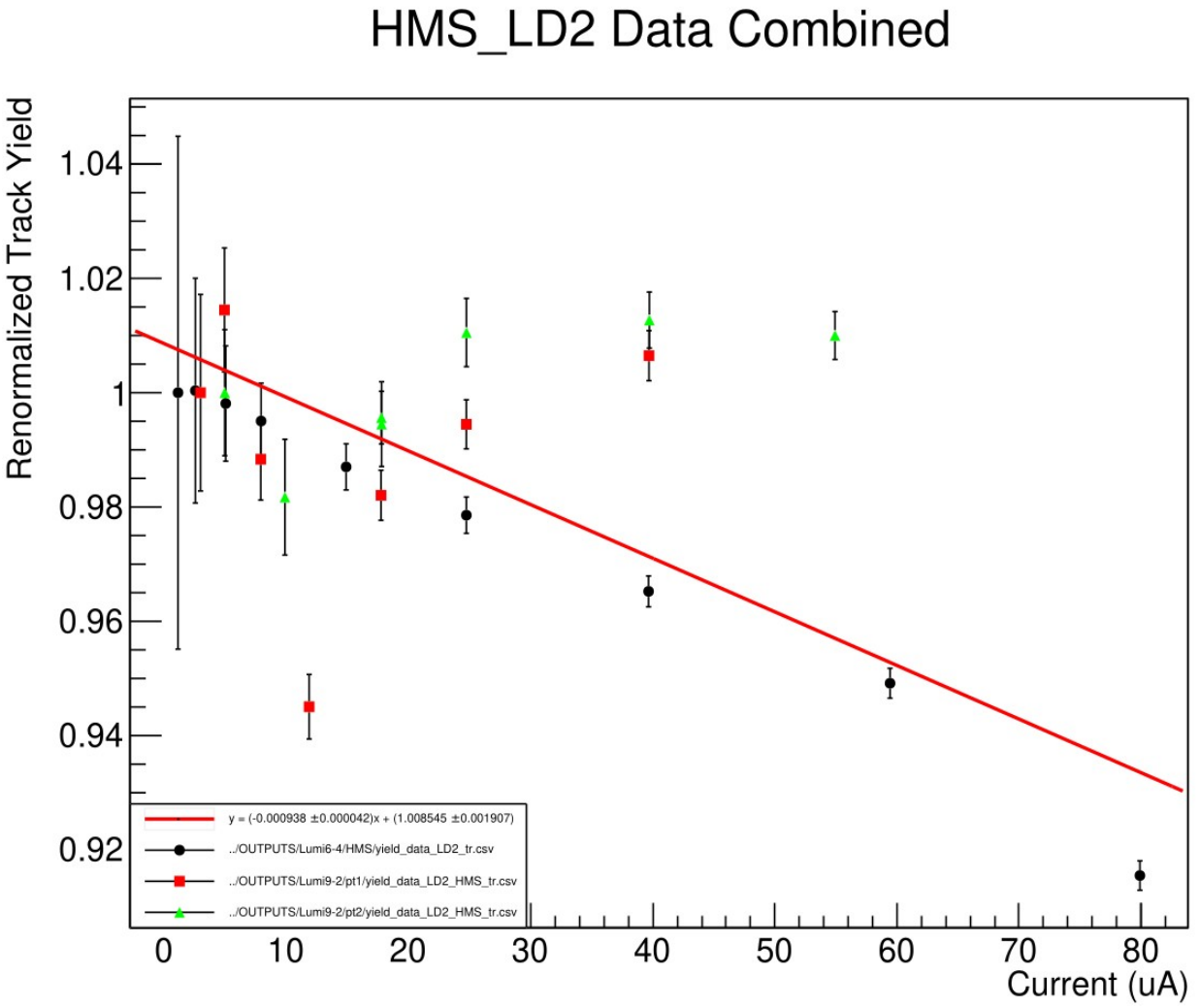


After Boiling Correction

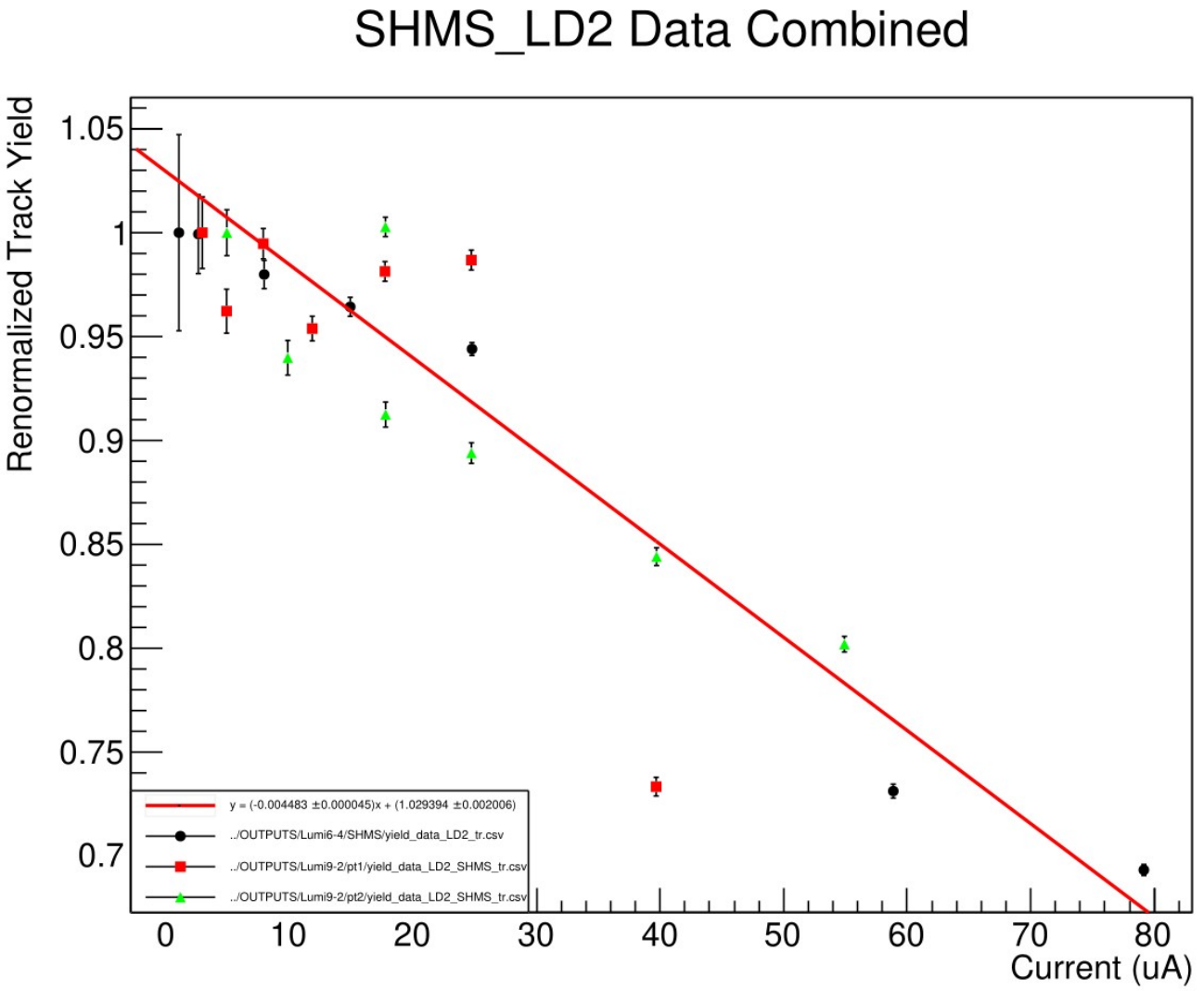


After Boiling Correction

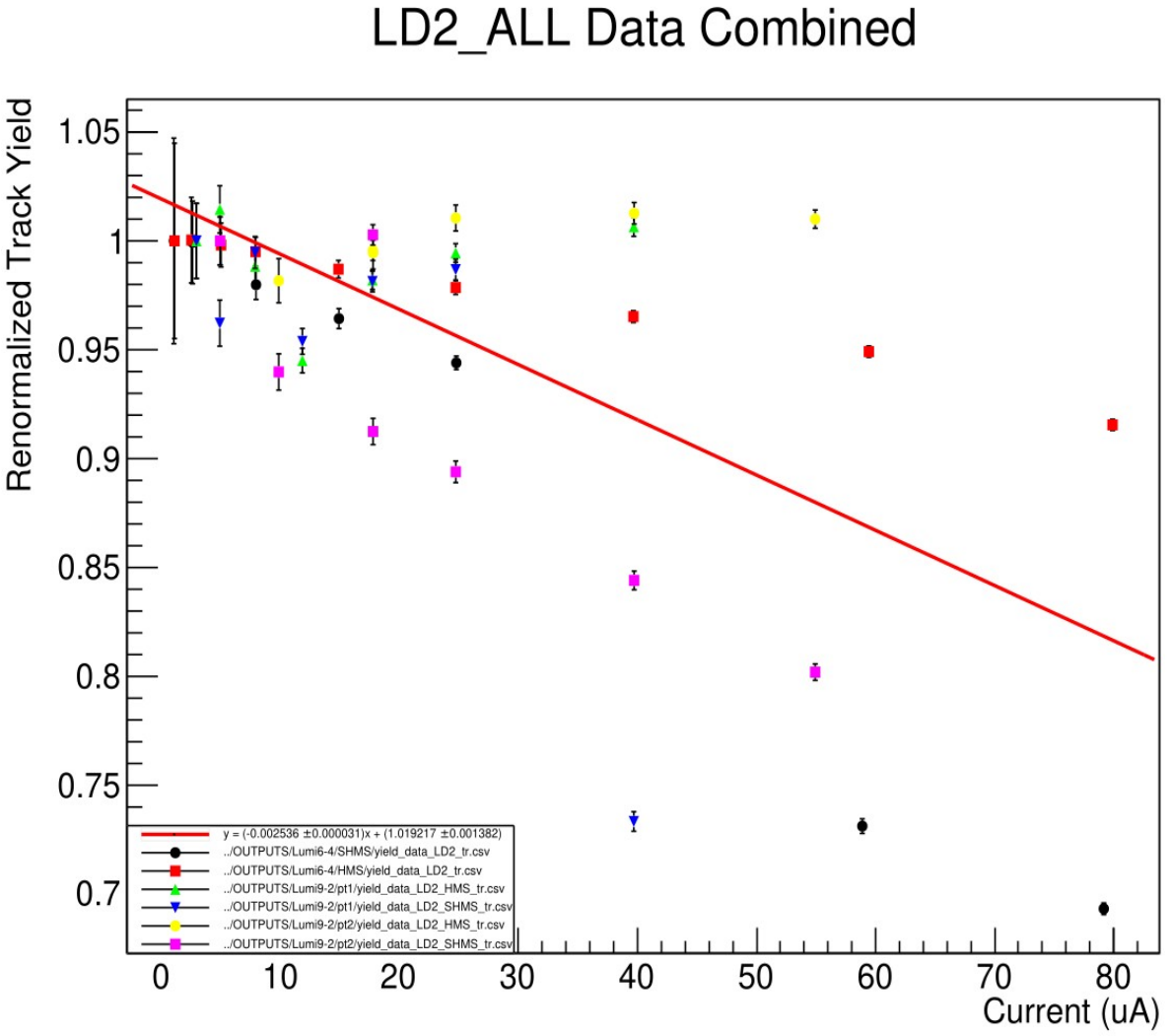
Track HMS

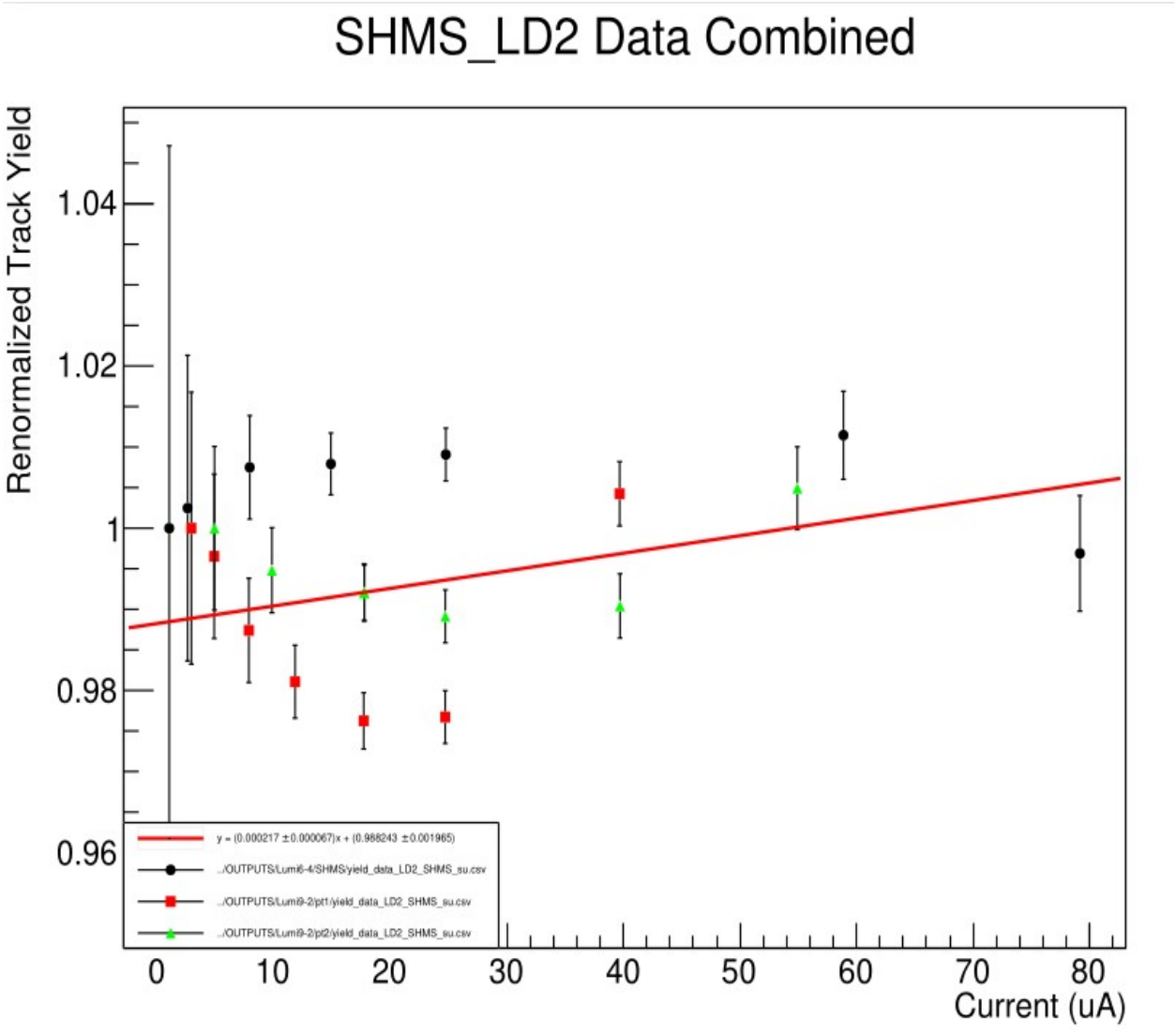

HMS_LD2 Data Combined
Renormalized Track Yield
1.04
1.02
1
0.98
0.96
0.94
0.92
0
10
20
30
40
50
60
70
80
Current (uA)
y = (-0.000938 ±0.000042)x + (1.008545 ±0.001907)
../OUTPUTS/Lumi6-4/HMS/yield_data_LD2_tr.csv
../OUTPUTS/Lumi9-2/pt1/yield_data_LD2_HMS_tr.csv
../OUTPUTS/Lumi9-2/pt2/yield_data_LD2_HMS_tr.csv

Track SHMS


SHMS_LD2 Data Combined
Renormalized Track Yield
1.05
1
0.95
0.9
0.85
0.8
0.75
0.7
0
10
20
30
40
50
60
70
80
Current (uA)
y = (-0.004483 ±0.000045)x + (1.029394 ±0.002006)
../OUTPUTS/Lumi6-4/SHMS/yield_data_LD2_tr.csv
../OUTPUTS/Lumi9-2/pt1/yield_data_LD2_SHMS_tr.csv
../OUTPUTS/Lumi9-2/pt2/yield_data_LD2_SHMS_tr.csv

LD2 Track


LD2_ALL Data Combined
Renormalized Track Yield
Current (uA)
1.05
1
0.95
0.9
0.85
0.8
0.75
0.7
0
10
20
30
40
50
60
70
80
y = (-0.002536 ±0.000031)x + (1.019217 ±0.001382)
../OUTPUTS/Lumi6-4/SHMS/yield_data_LD2_tr.csv
../OUTPUTS/Lumi6-4/HMS/yield_data_LD2_tr.csv
../OUTPUTS/Lumi9-2/pt1/yield_data_LD2_HMS_tr.csv
../OUTPUTS/Lumi9-2/pt1/yield_data_LD2_SHMS_tr.csv
../OUTPUTS/Lumi9-2/pt2/yield_data_LD2_HMS_tr.csv
../OUTPUTS/Lumi9-2/pt2/yield_data_LD2_SHMS_tr.csv


SHMS_LD2 Data Combined
Renormalized Track Yield
1.04
1.02
1
0.98
0.96
0
10
20
30
40
50
60
70
80
Current (uA)
y = (0.000217 ±0.000067)x + (0.988243 ±0.001965)
../OUTPUTS/Lumi6-4/SHMS/yield_data_LD2_SHMS_su.csv
../OUTPUTS/Lumi9-2/pt1/yield_data_LD2_SHMS_su.csv
../OUTPUTS/Lumi9-2/pt2/yield_data_LD2_SHMS_su.csv