Inductive Critical Currents in Nb/Mo bilayers

P.R. Broussard, J. Veldhorst

Covenant College, Lookout Mountain, GA 30750

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- Georgia Tech for thickness measurements
- Prof. C.B. Eom (Univ of Wisconsin-Madison) for XRD work

Talk Outline

- Introduction
- Sample Preparation
- Sample Characterization
- Inductive Critical Current Technique
- Transition Temperatures and Critical Currents
- Critical Currents in Low Magnetic Field
- Conclusions

Introduction

- Nb/Mo bilayers with varying d_{Nb} and d_{Mo}

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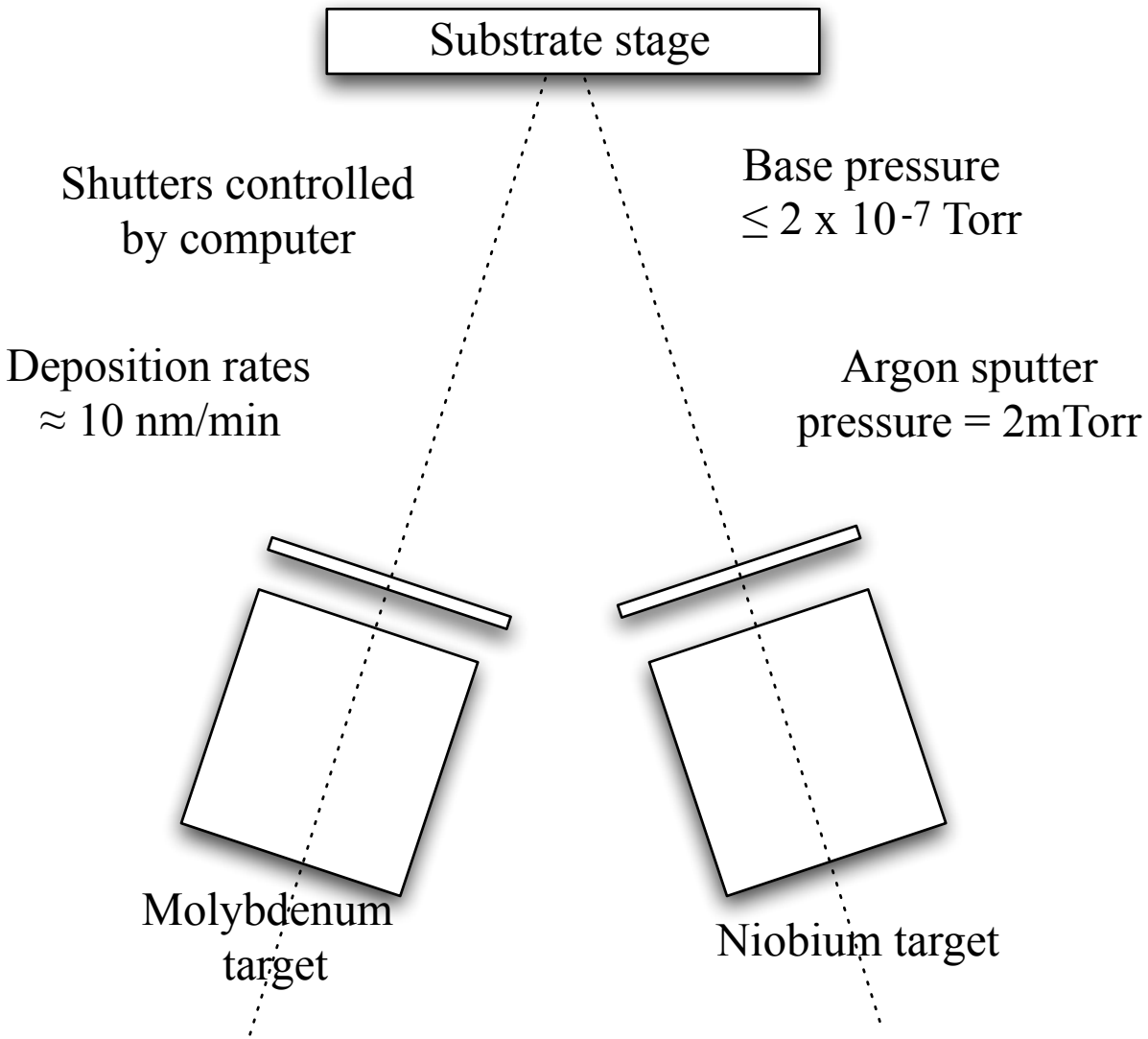
- Film production and characterization shown in poster by J. Veldhorst (LA 21)
- Here we look at the inductive critical currents.

Film Growth

Nb/Mo bilayers grown by magnetron sputtering



Our system

- d_{Nb}=30 nm, d_{Mo} varied from 10-50 nm

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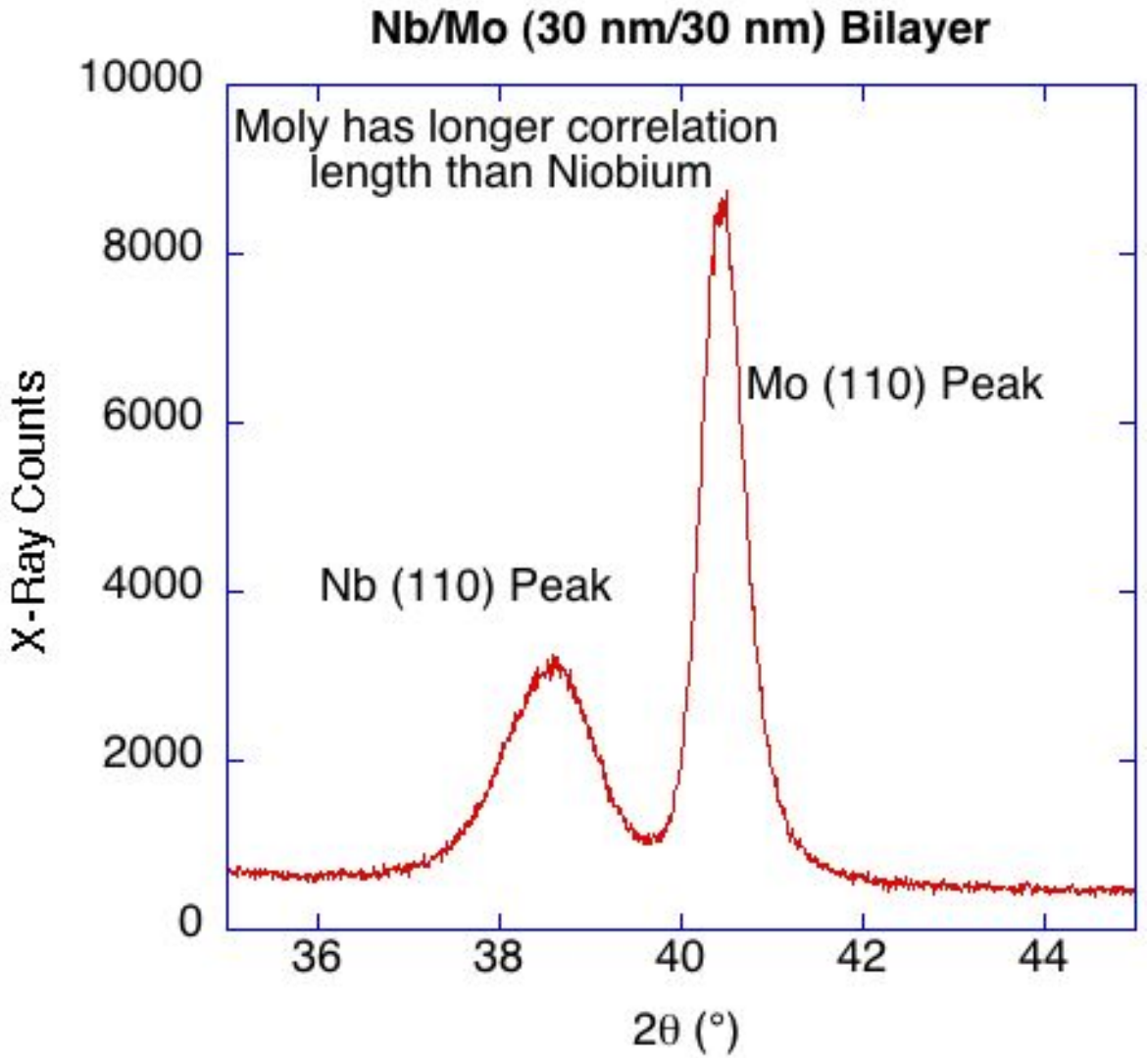
- d_{Nb}=30 nm, d_{Mo} varied from 10-50 nm
- d_{Mo}=20 nm, d_{Nb} varied from 30-90 nm

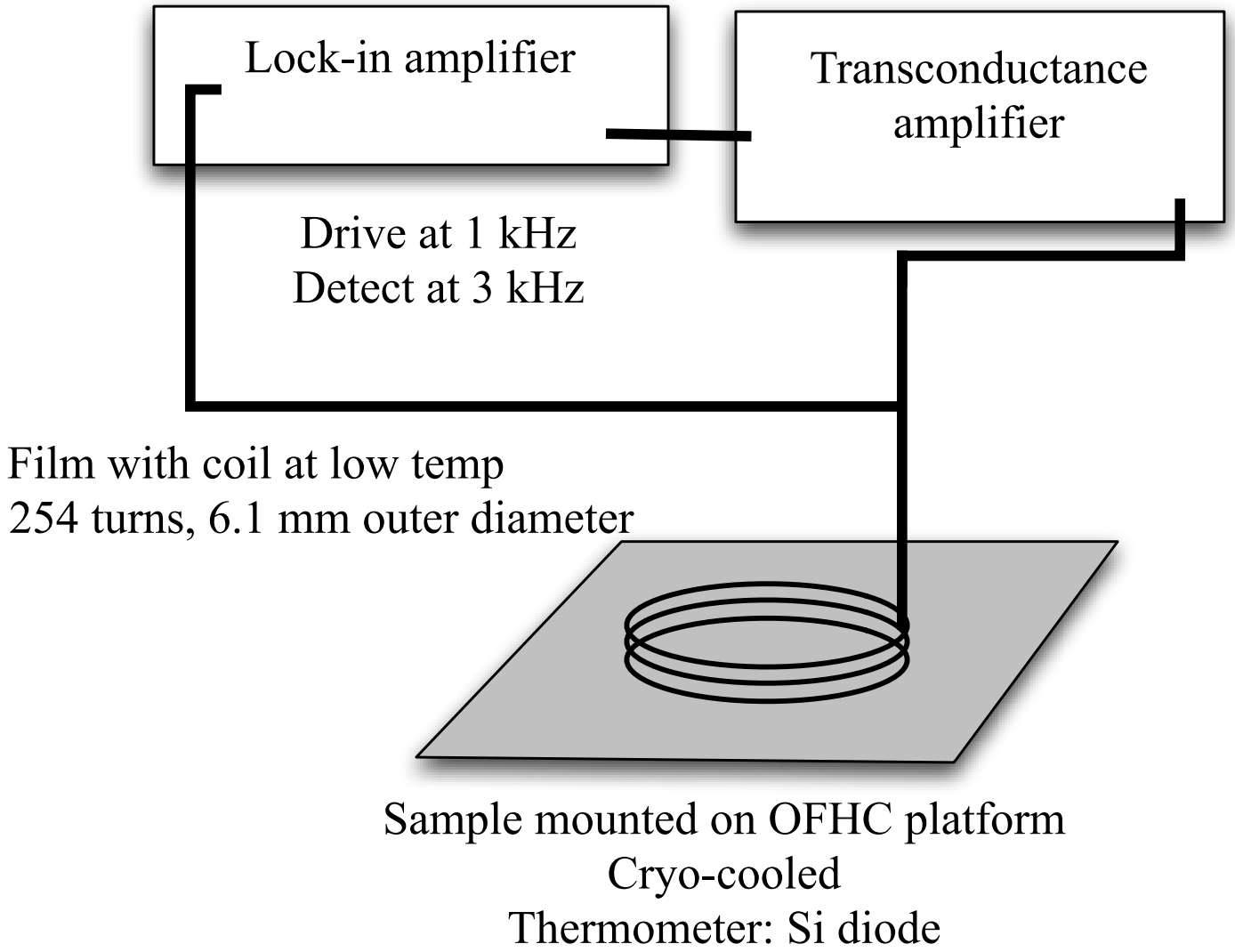
X-ray Characterization

Layers show close packed growth

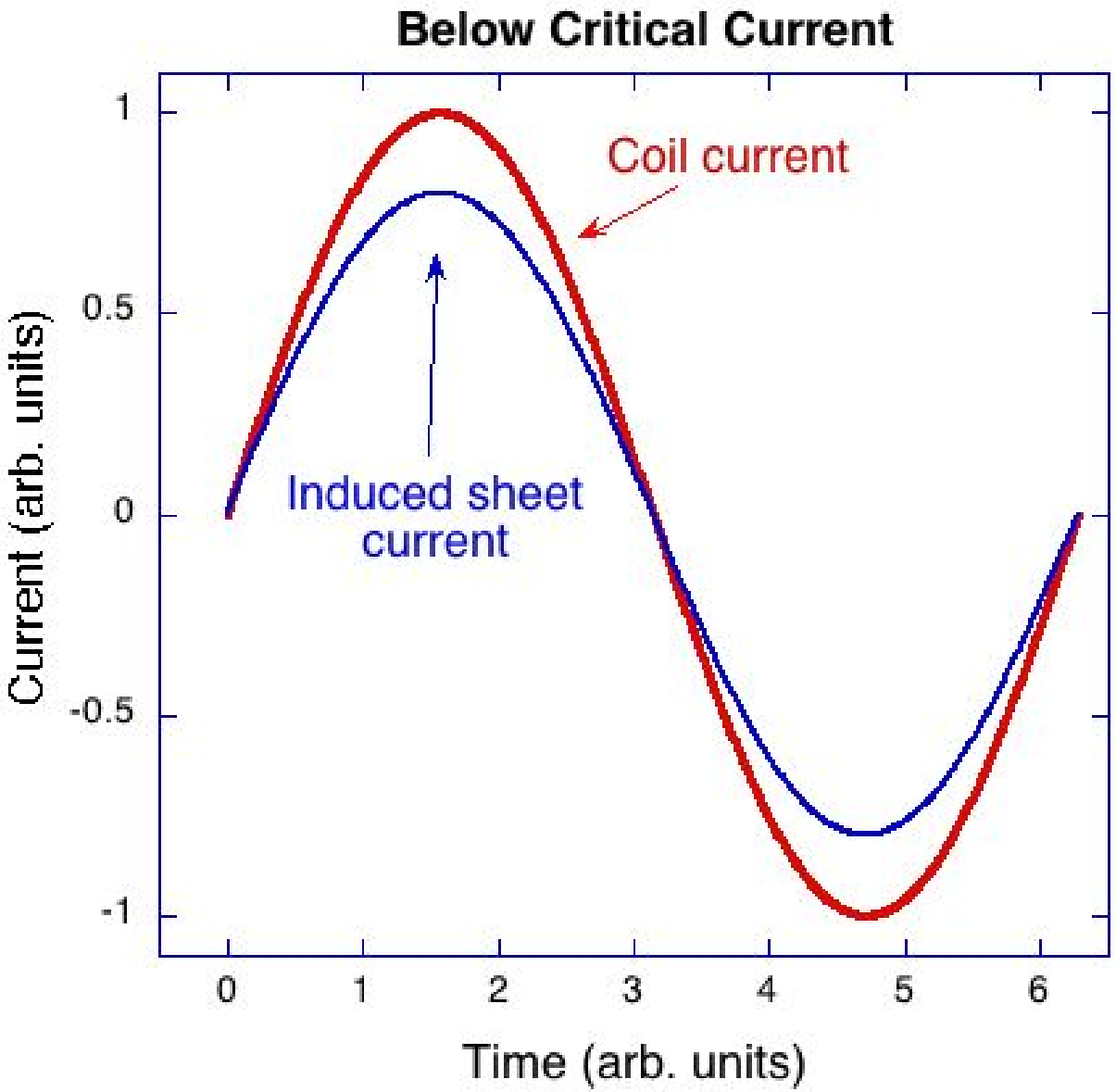


Inductive Critical Currents

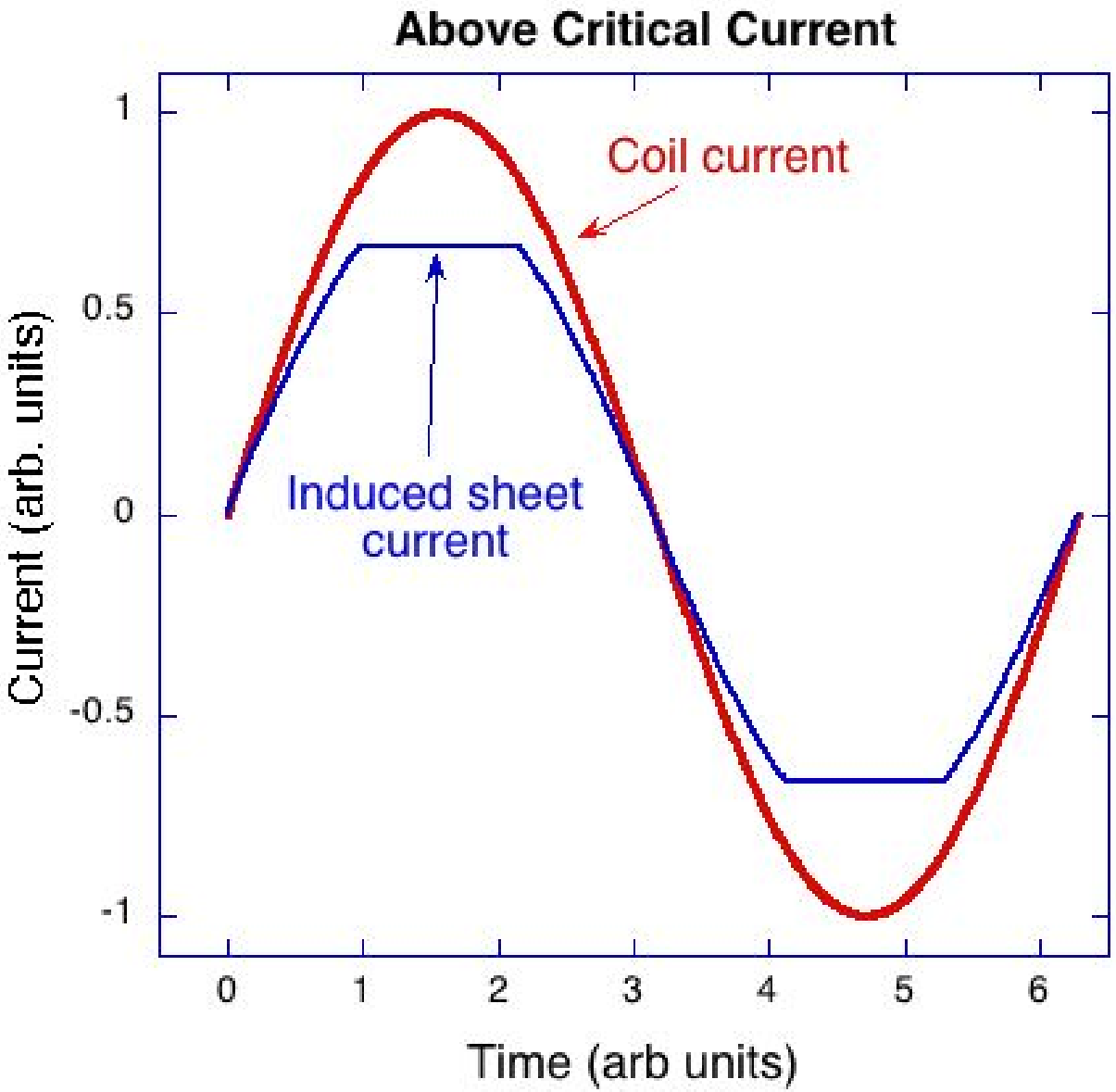
Based on work by Claassen *et al.*, RSI **62**, 996(1991)



Inductive Critical Currents



Inductive Critical Currents



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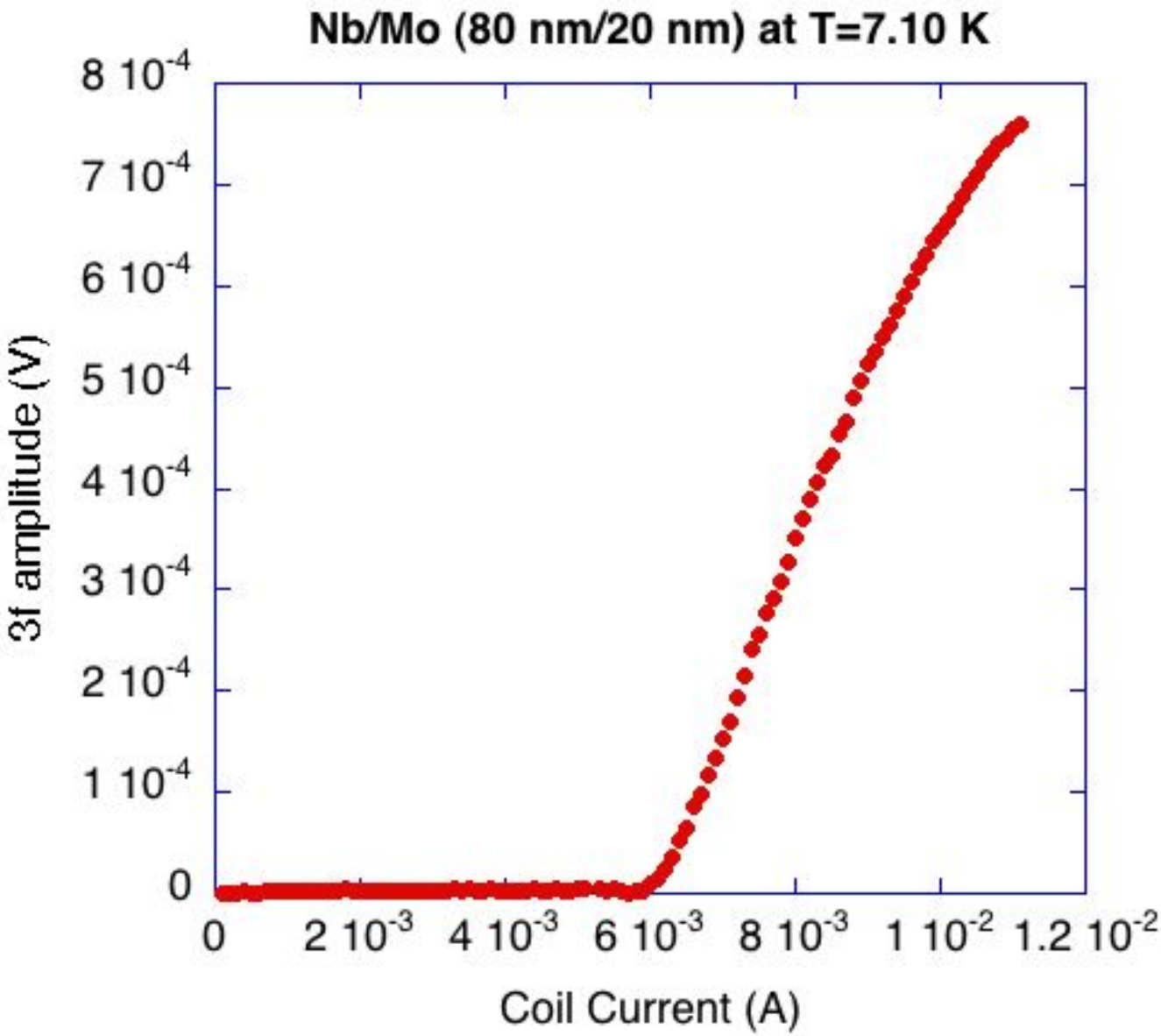
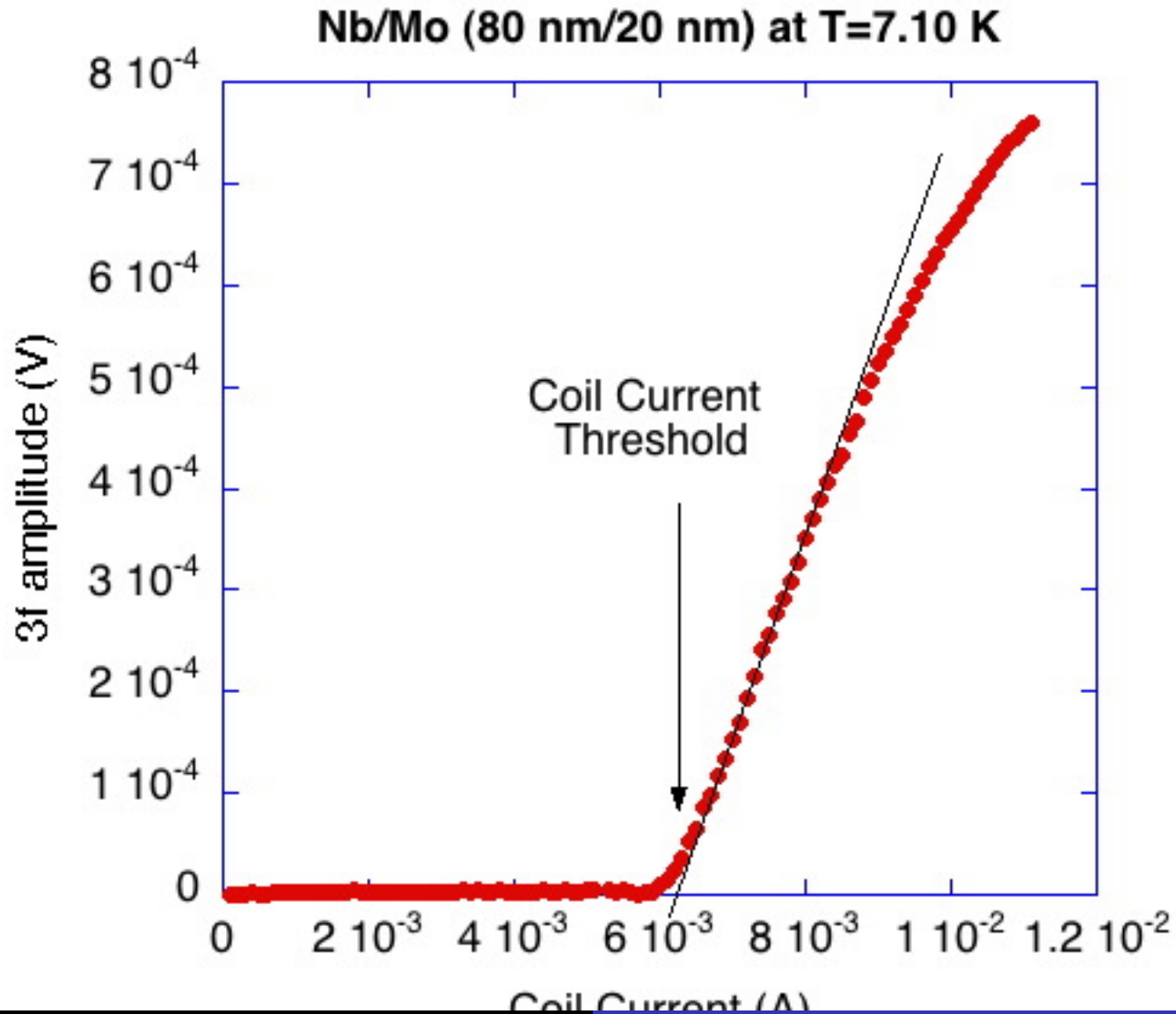


Definition of Critical Current

Define via linear offset (Claassen, 1991)



Extraction of Results

- Conversion of coil current to critical current ($K = 7 \times 10^4$ m^{-1}.

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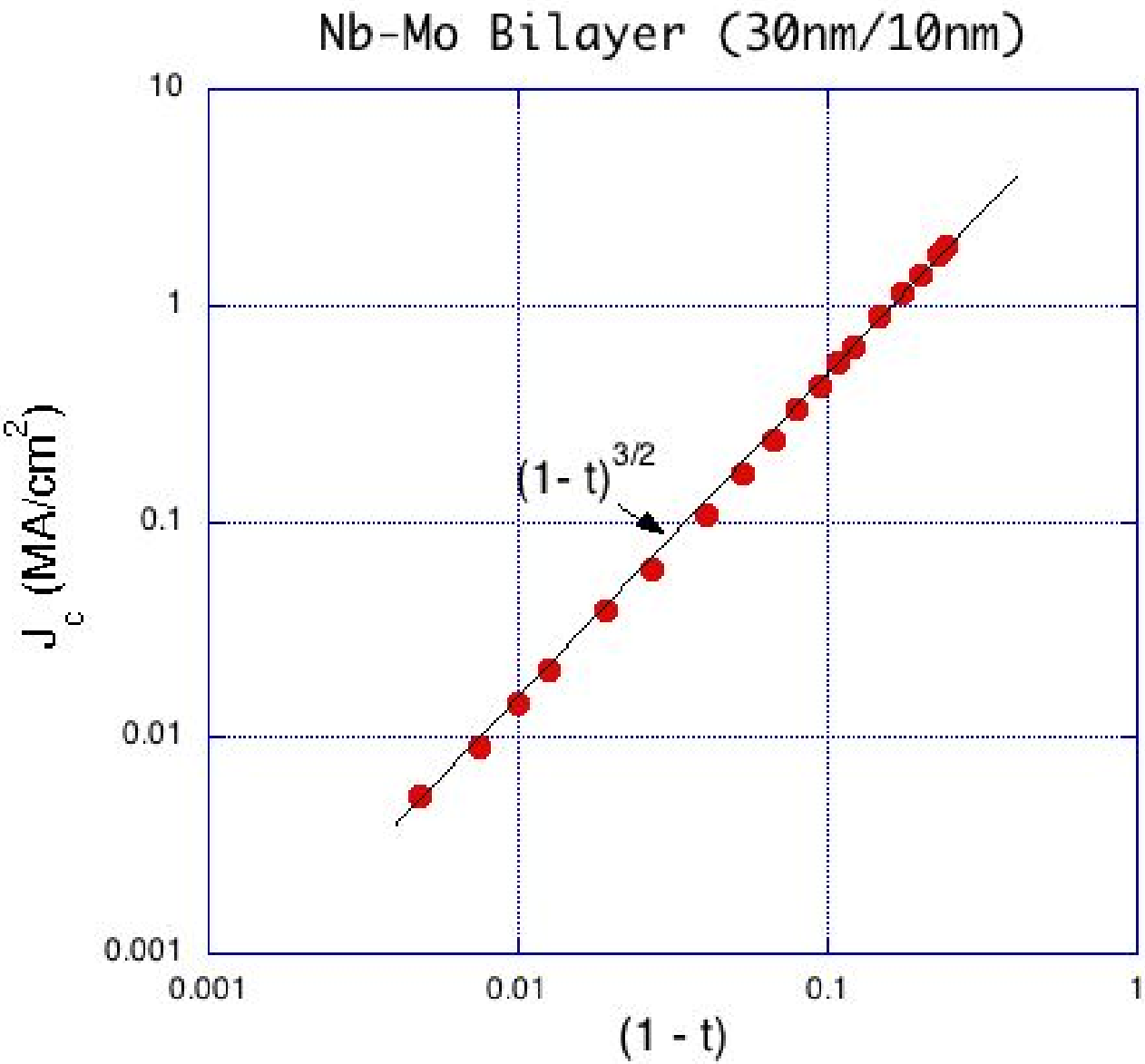
- Fitting J_c vs. T indicates Ginzburg-Landau behavior

Temperature Dependence



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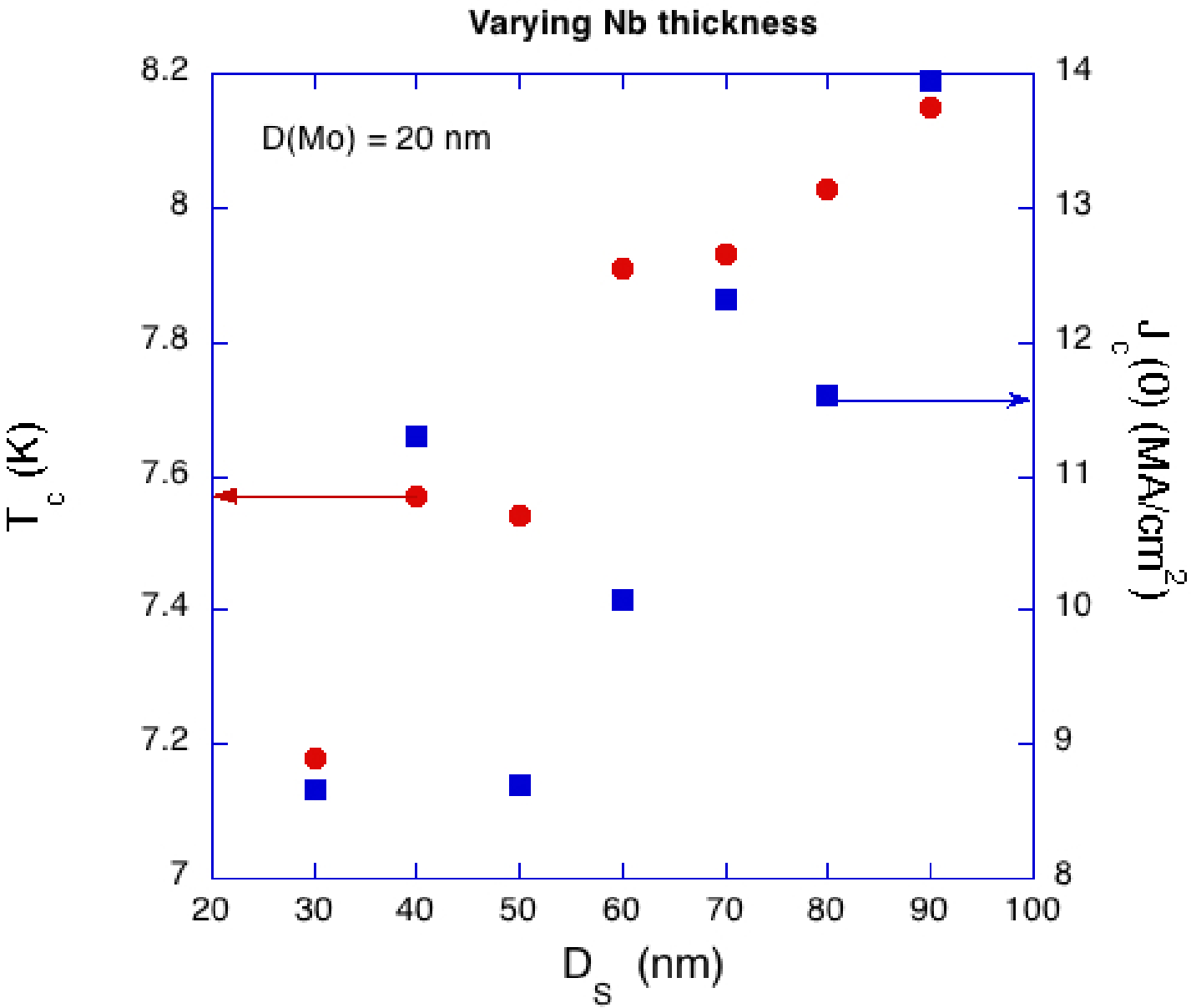
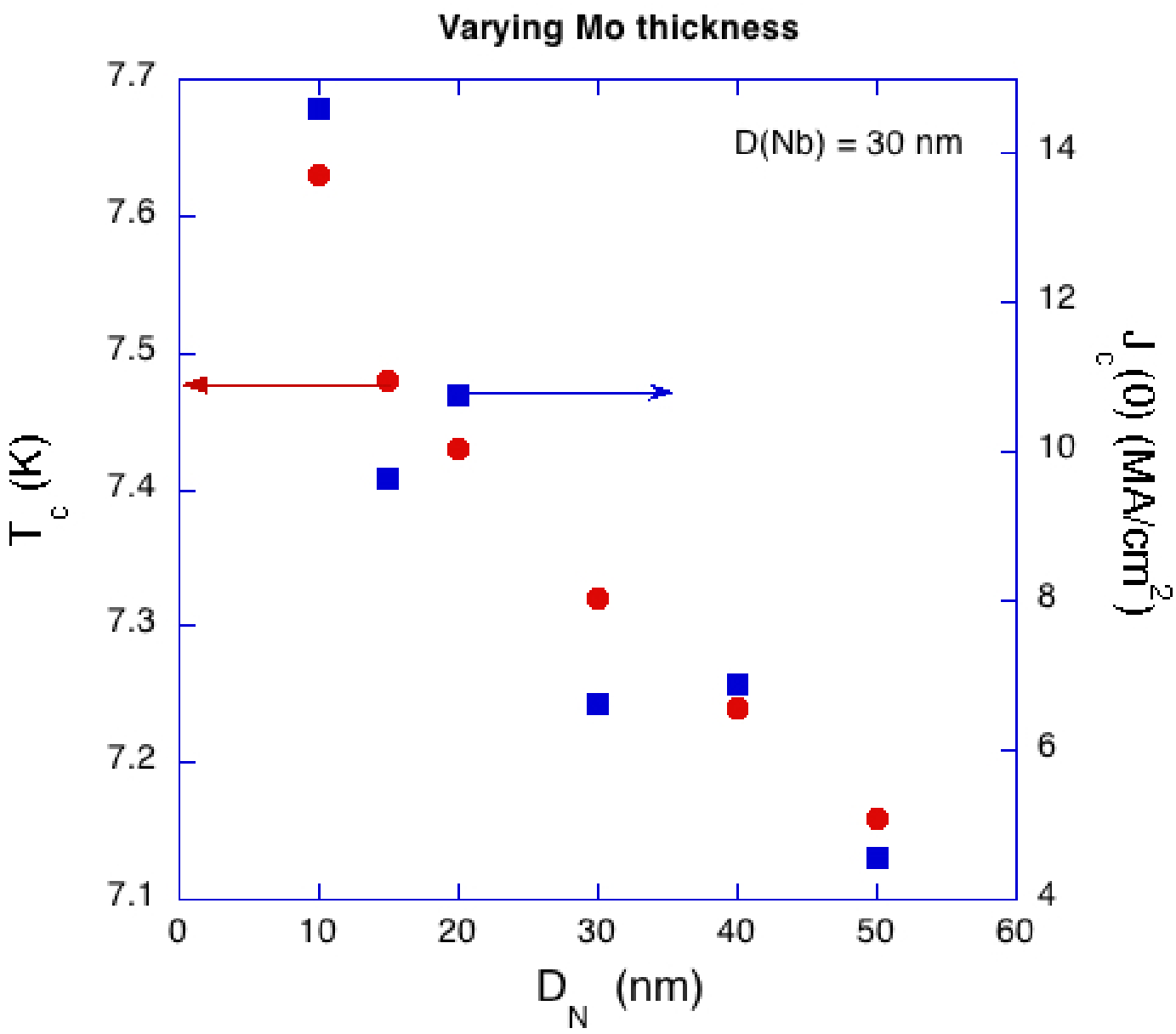
- Conversion of coil current to critical current ($K = 7 \times 10^4$ m^{-1}).
- Fitting J_c vs. T indicates Ginzburg-Landau behavior
- Fitting with $J_c(0)(1-t)^{3/2}$ and extract both T_c and $J_c(0)$
- Look at results for varying both d_{Nb} and d_{Mo}

Dependence on d_{Nb}



Dependence on d_{Mo}



Variation in $J_c(0)$?

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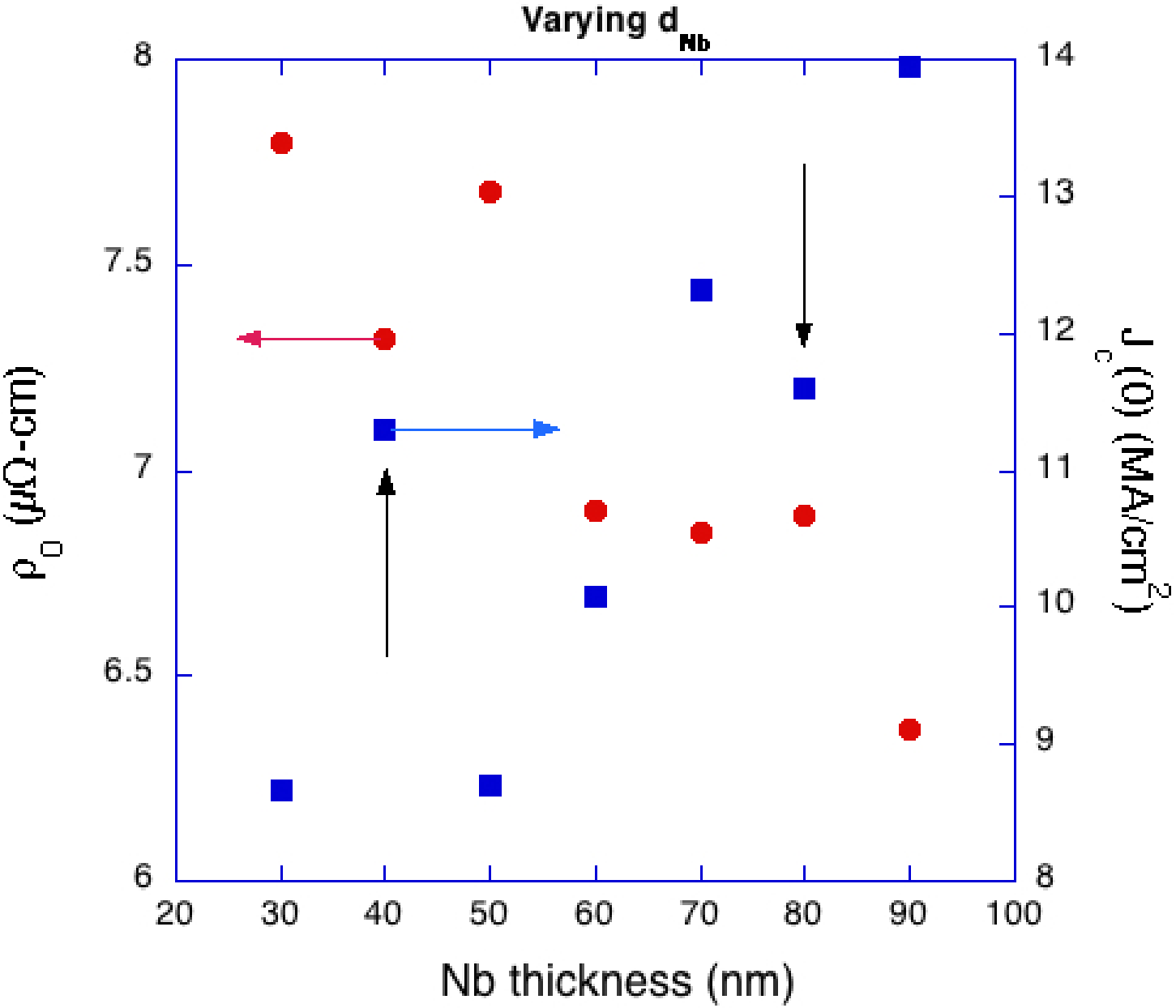
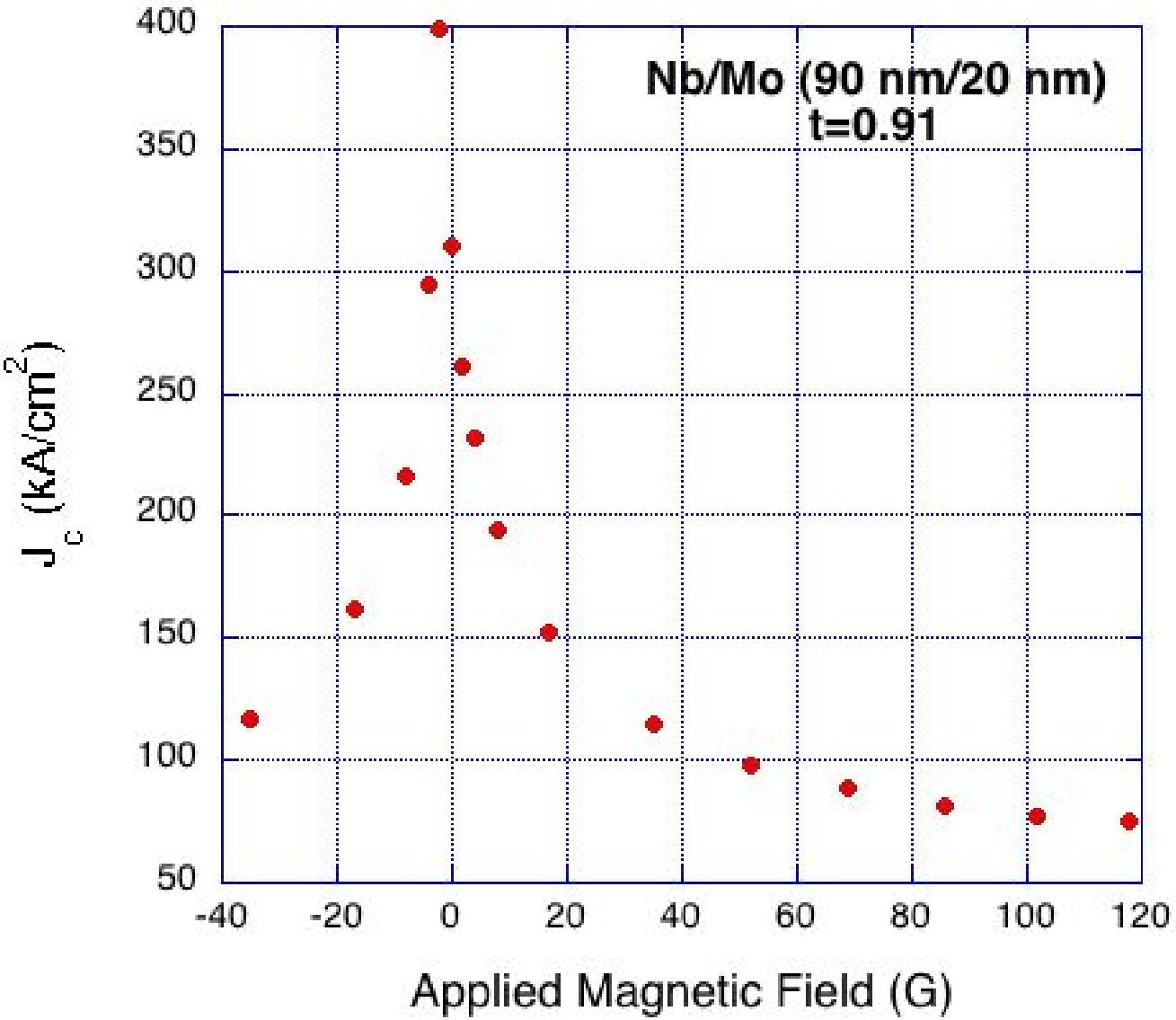
- $J_c(0) \propto (\rho_0)^{-1/2}$ (Geers *et al.* Phys. Rev. B **64**, 094506 (2001)

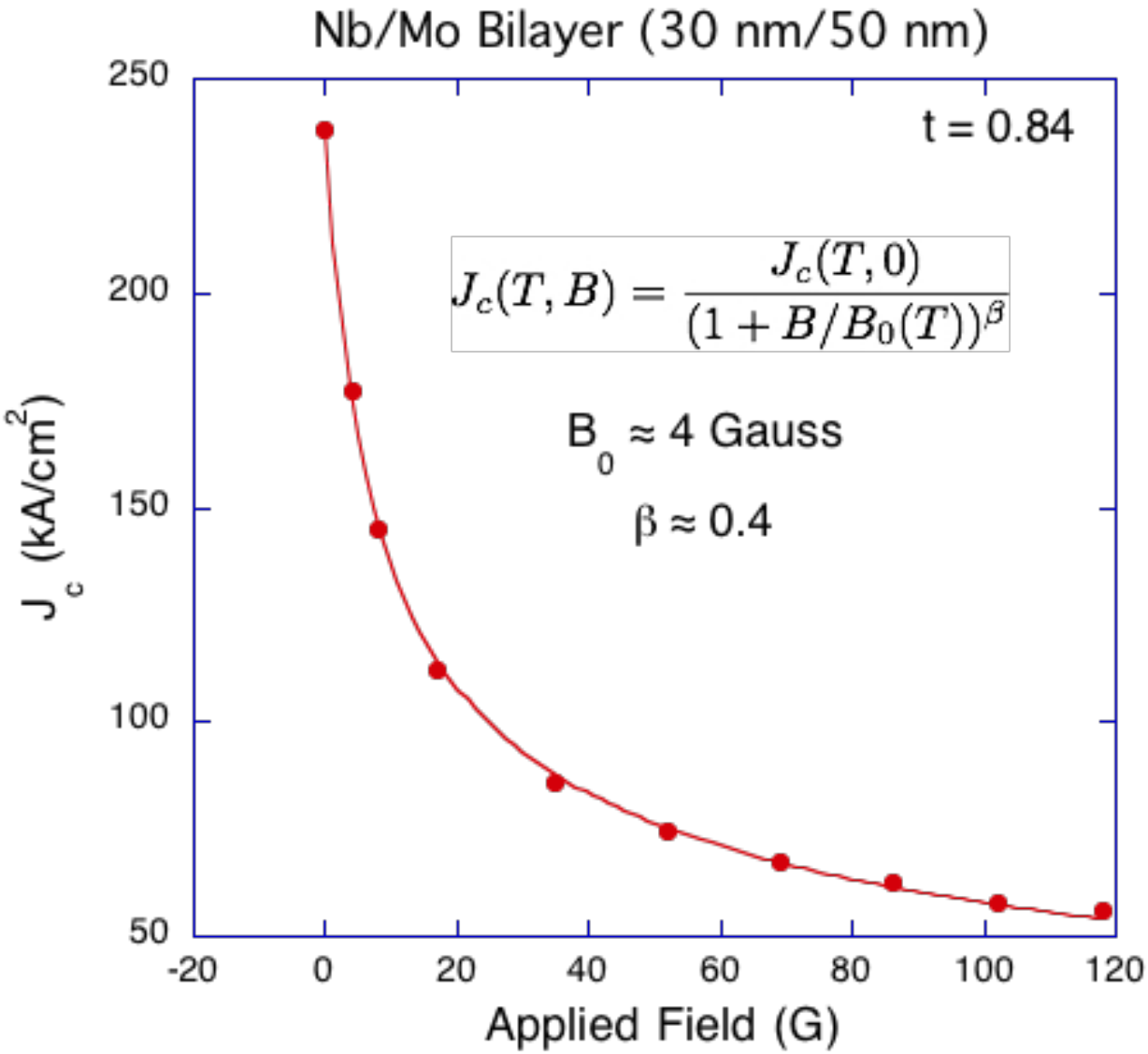

Varying d Nb
8
7.5
7
6.5
6
14
13
12
11
10
9
8
20
30
40
50
60
70
80
90
100
Nb thickness (nm)
ρ0 (μΩ-cm)
Jc(0) (MA/cm2)

Field Dependence

Field applied $\perp$ to layers



Weak link dependence?



Conclusions

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- Future work: Film quality