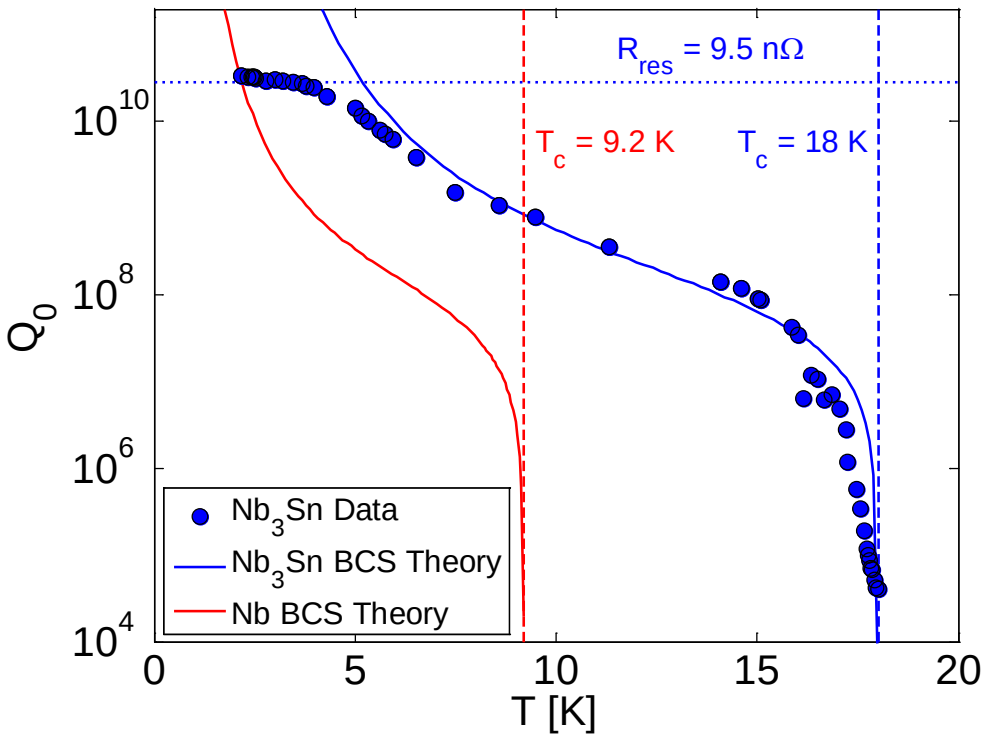
Nb_3Sn: New Development

- Nb_3Sn: alternative SRF material
  - T_c 18 K vs 9 K for niobium: much higher Q_0 at a given temperature **demonstrated**
  - H_{sh} of 400 mT vs 200 mT for niobium: **predicted** maximum E_{acc} up to twice that of niobium



University of Wuppertal, 1970s-1990s

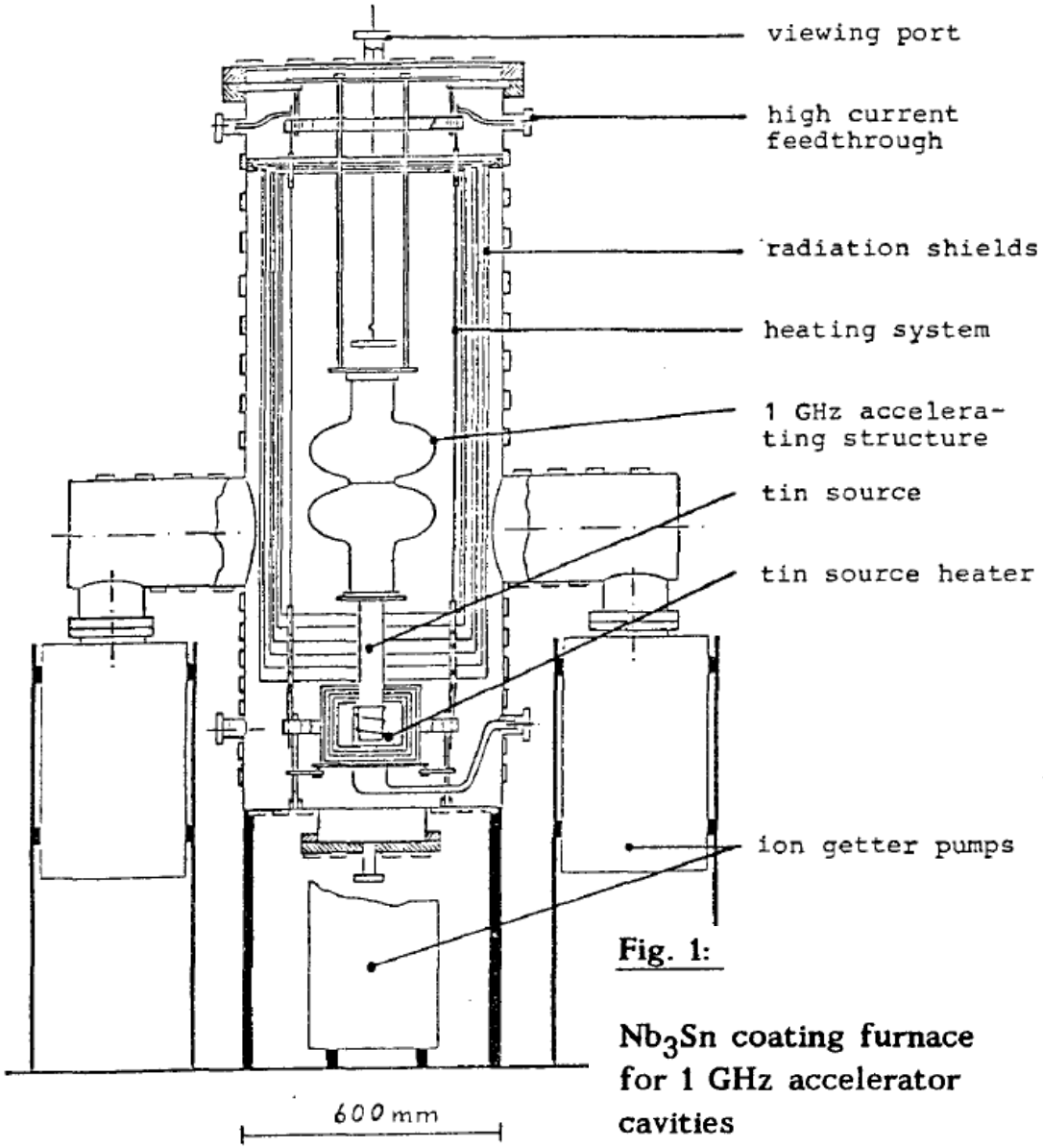
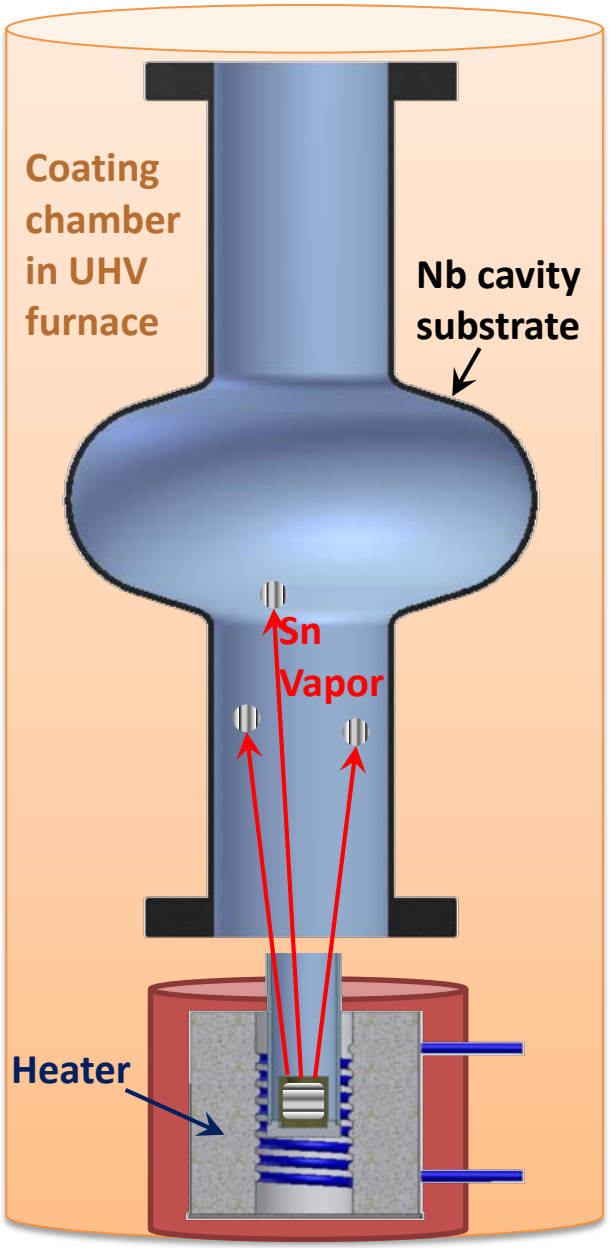
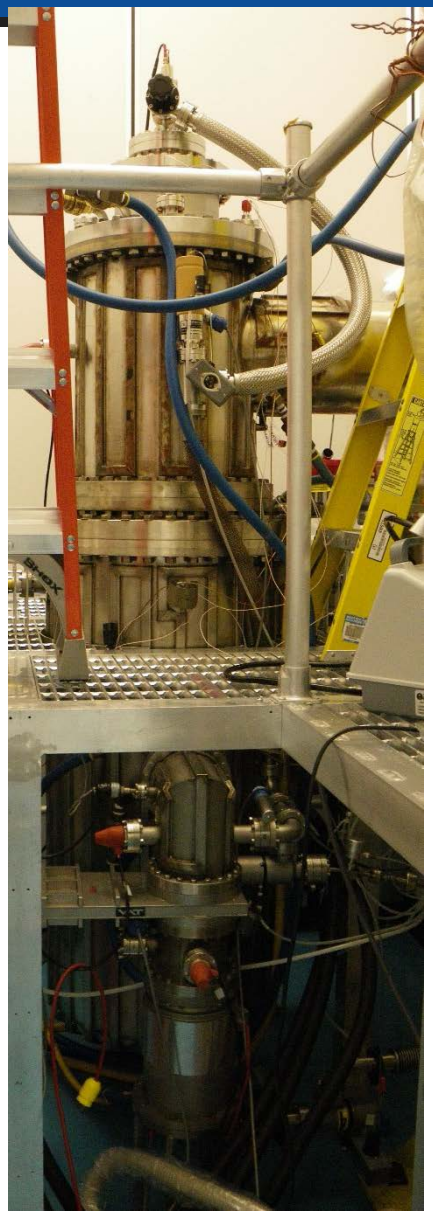
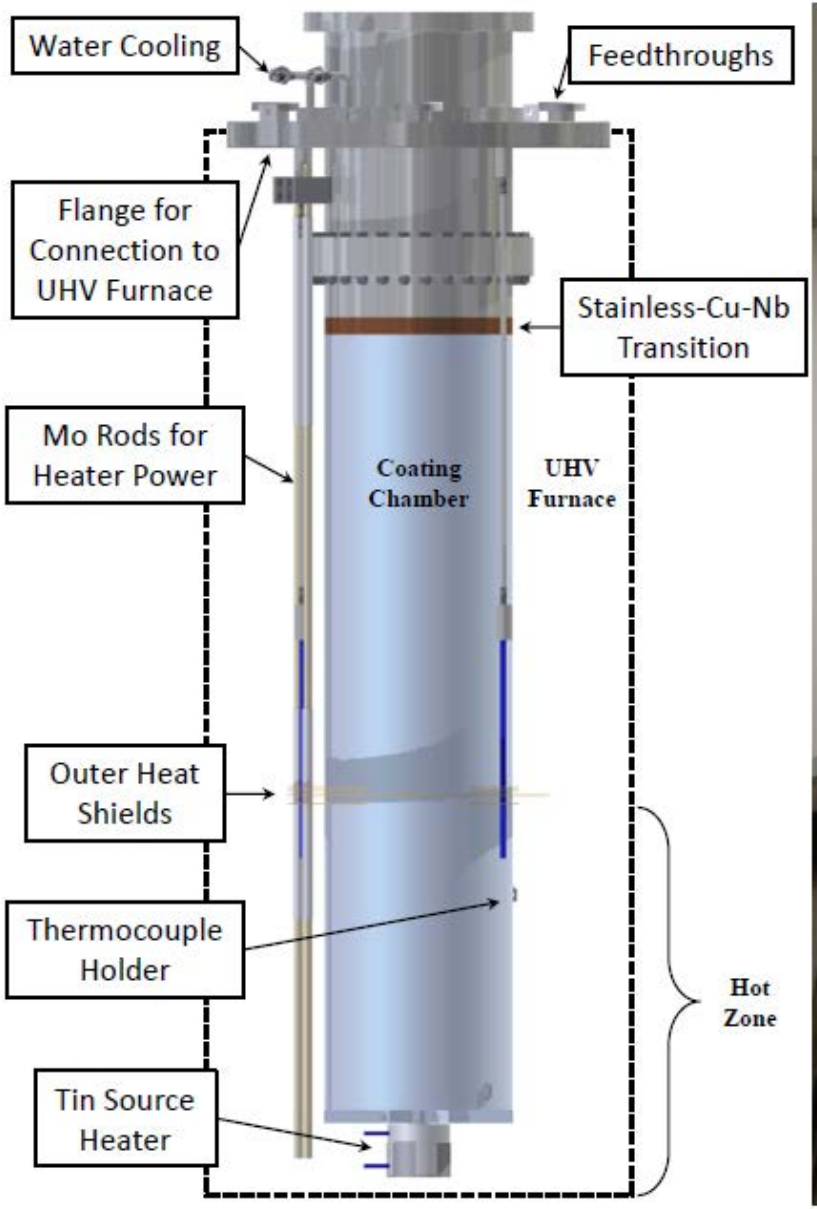


Fig. 1:

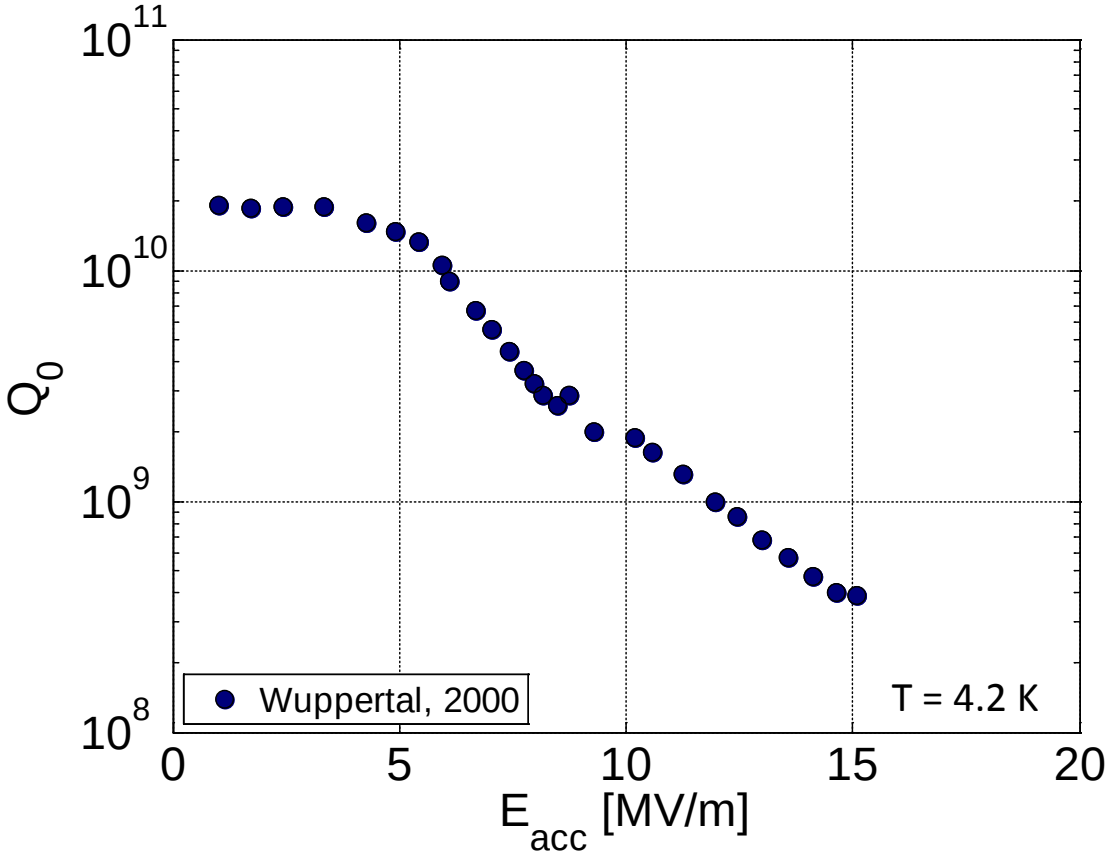
Nb_3Sn coating furnace for 1 GHz accelerator cavities



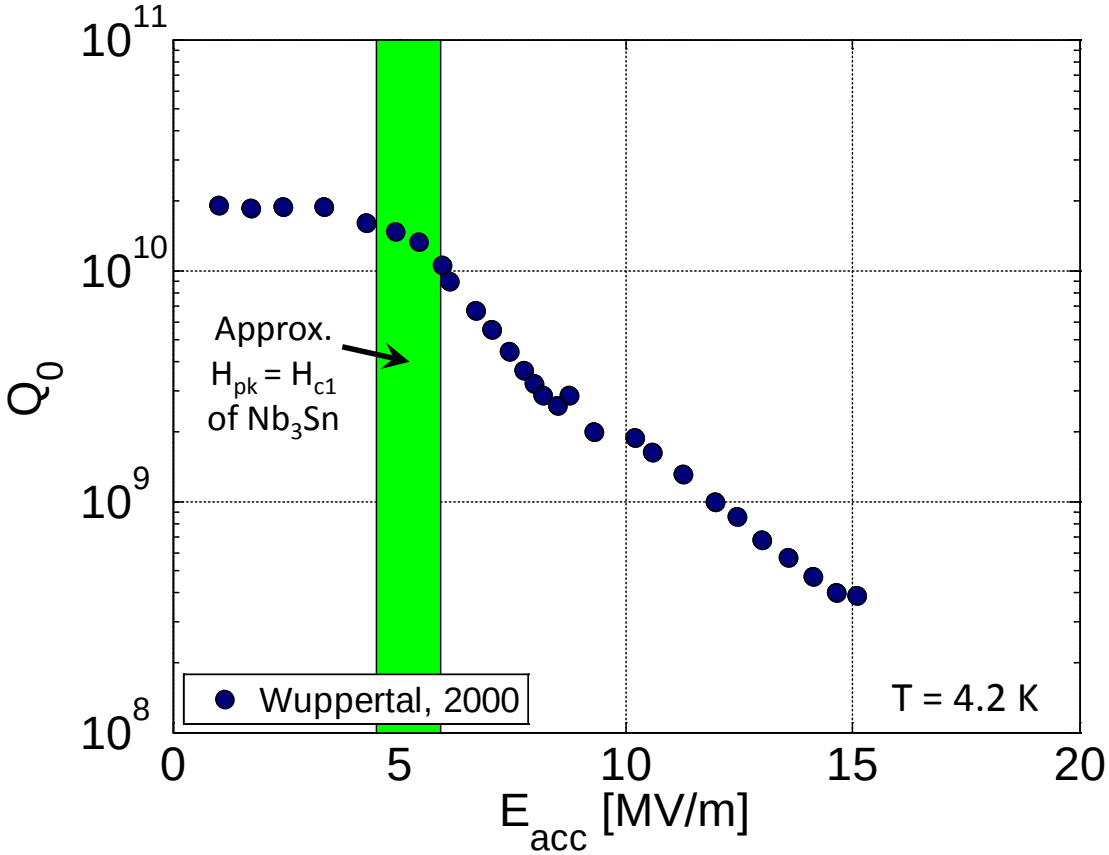



Water Cooling
Feedthroughs
Flange for Connection to UHV Furnace
Stainless-Cu-Nb Transition
Mo Rods for Heater Power
Coating Chamber
UHV Furnace
Outer Heat Shields
Thermocouple Holder
Hot Zone
Tin Source Heater

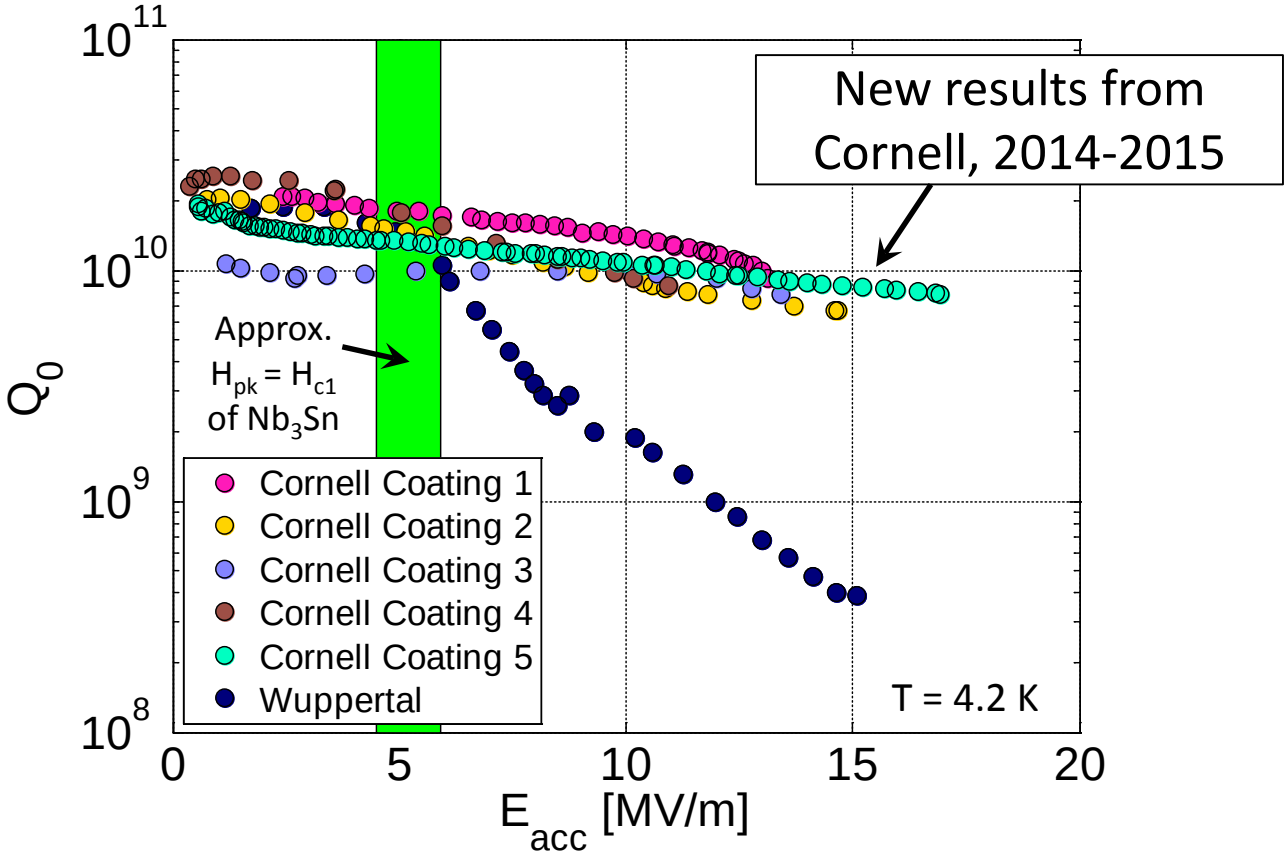
Nb_3Sn SRF History



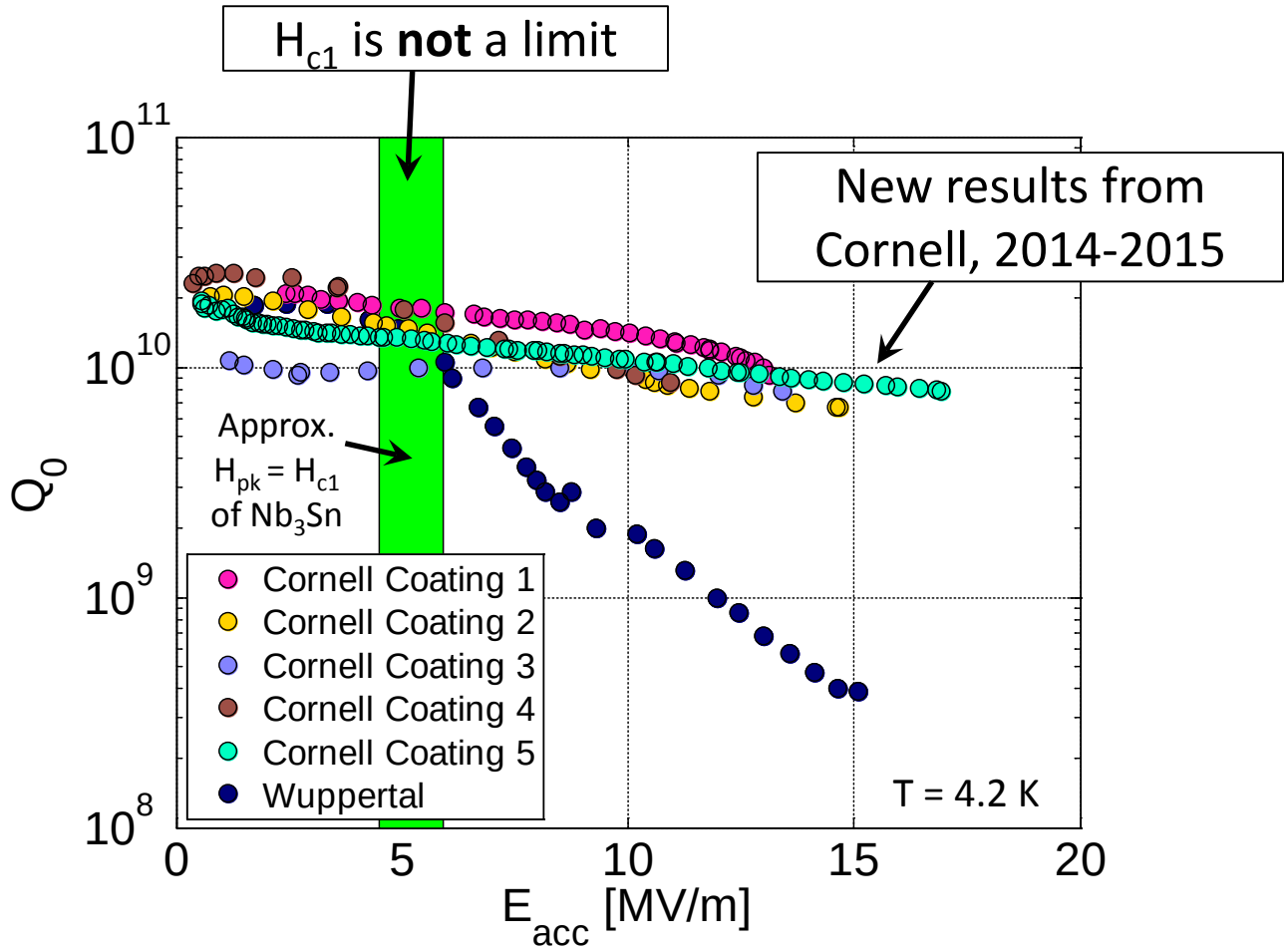
Nb_3Sn SRF History



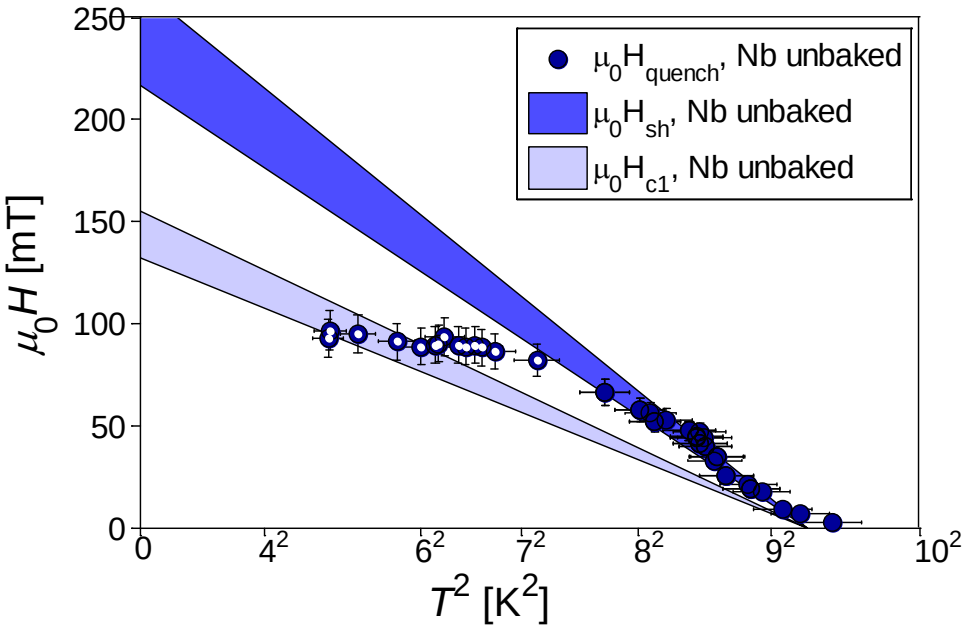
Nb_3Sn SRF History

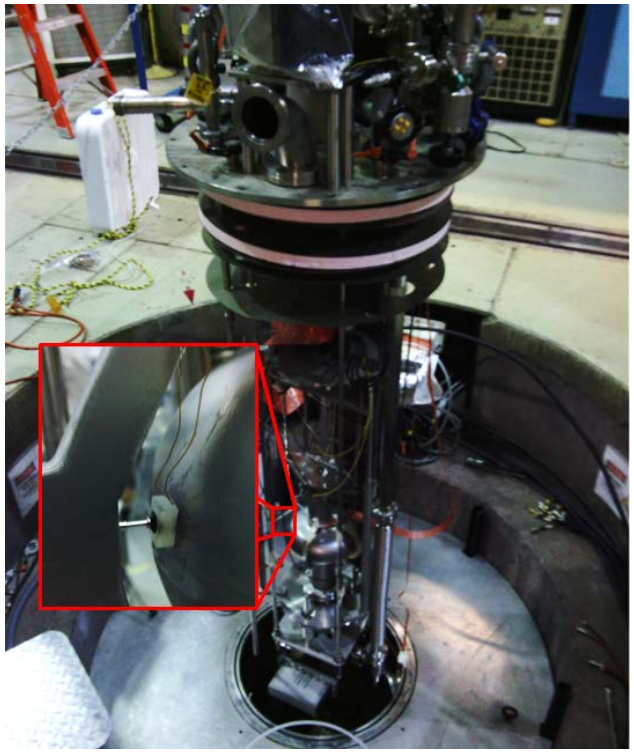


Nb_3Sn SRF History



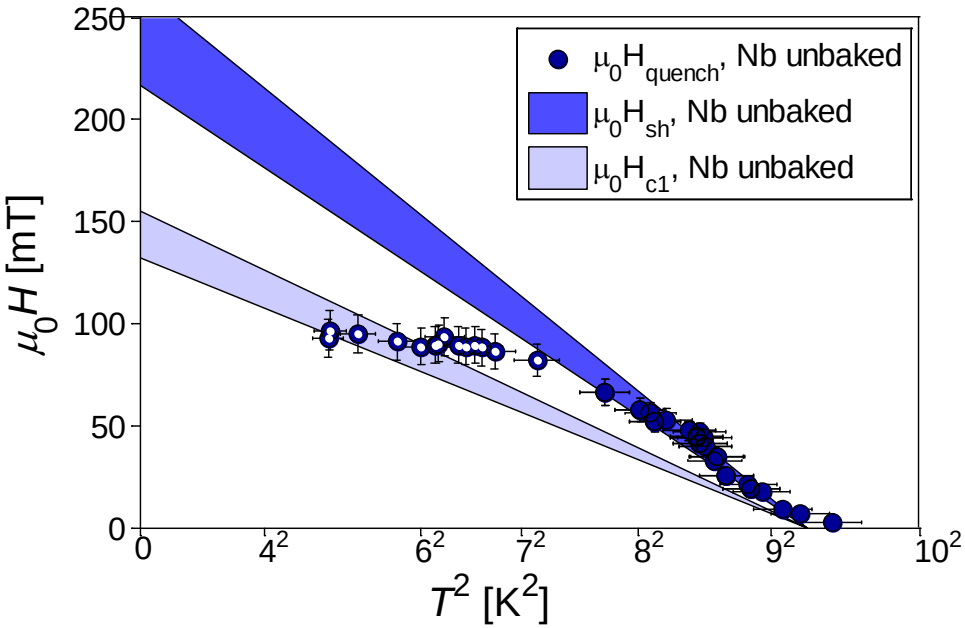
Next Step: Push Quench Field

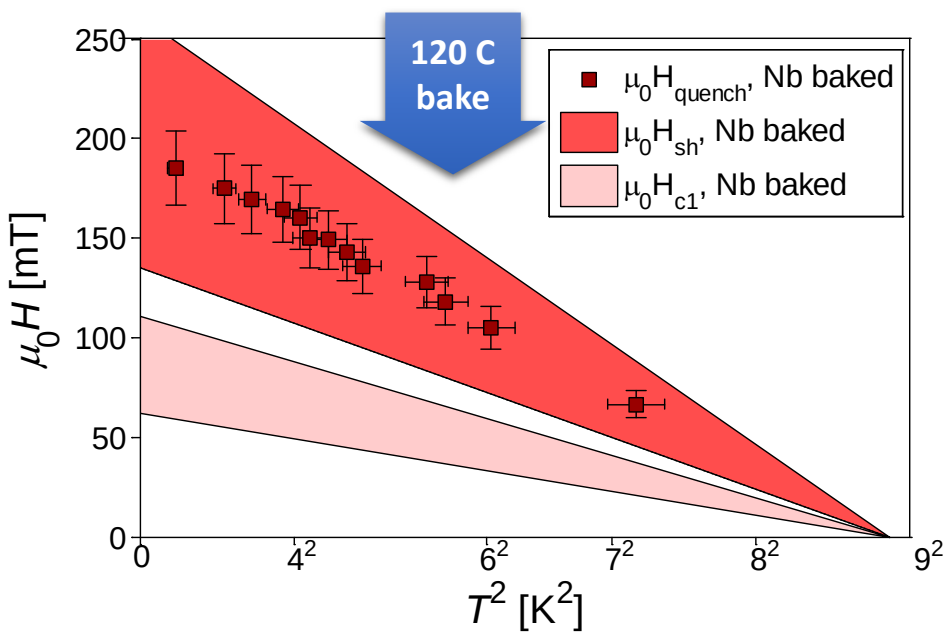


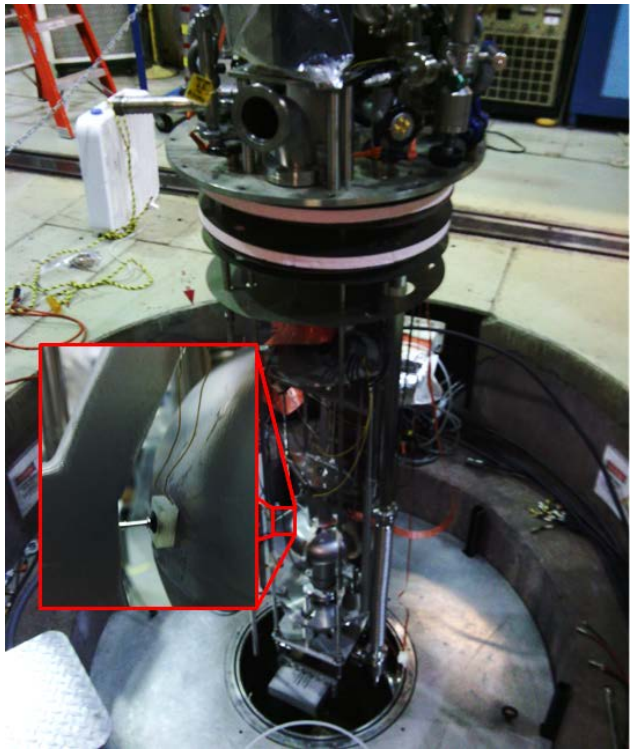


S. Posen, N. Valles, and M. Liepe,
***Phys. Rev. Lett.*, 115, 047001 (2015).**

Fermilab Next Step: Push Quench Field







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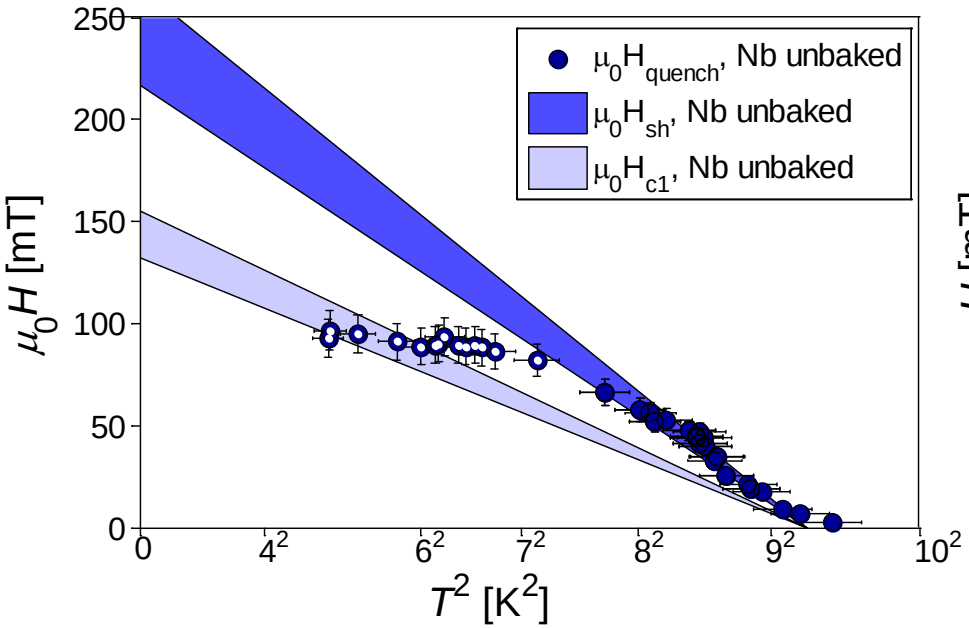
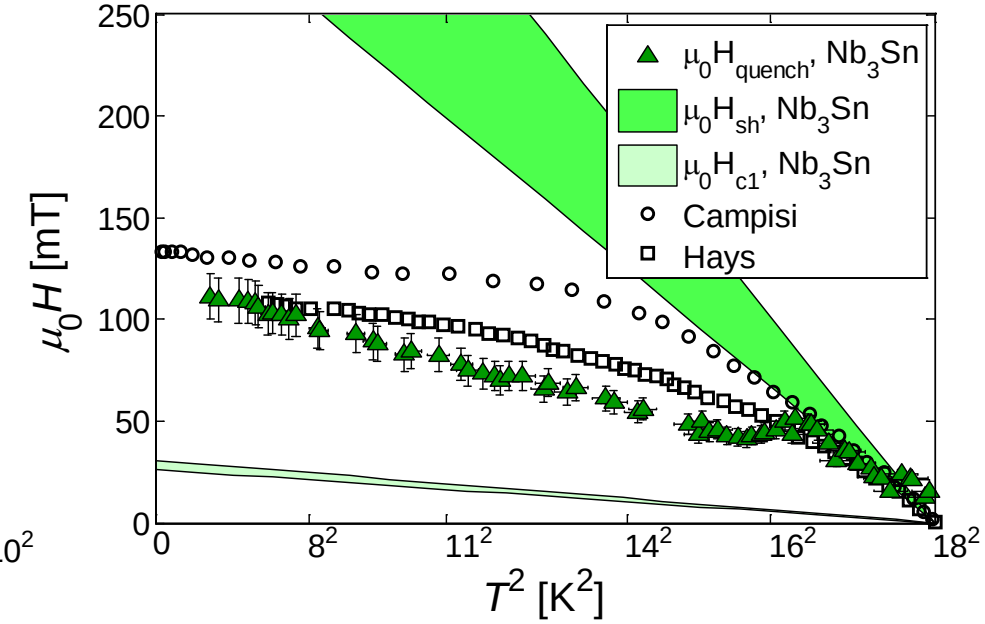
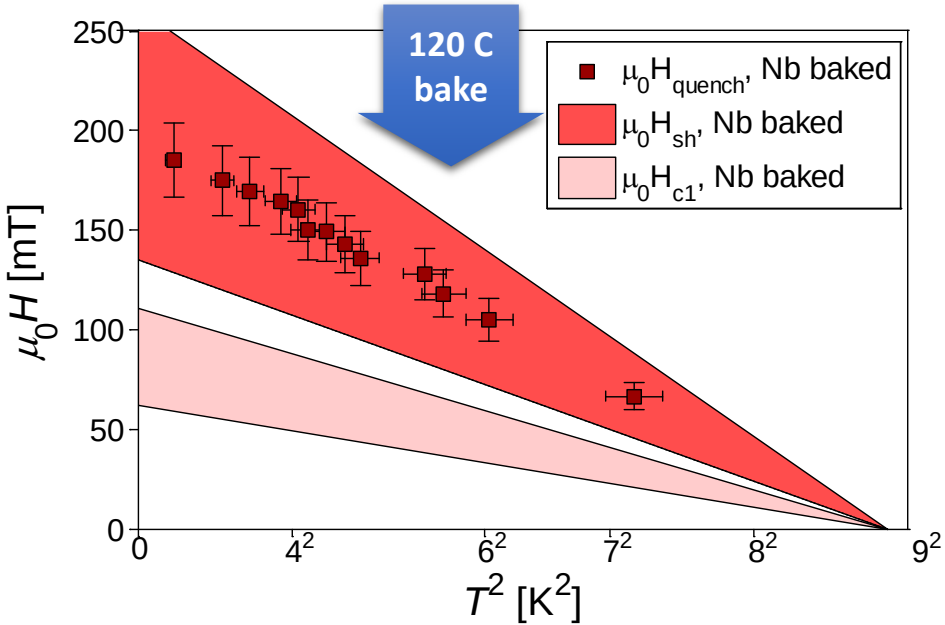
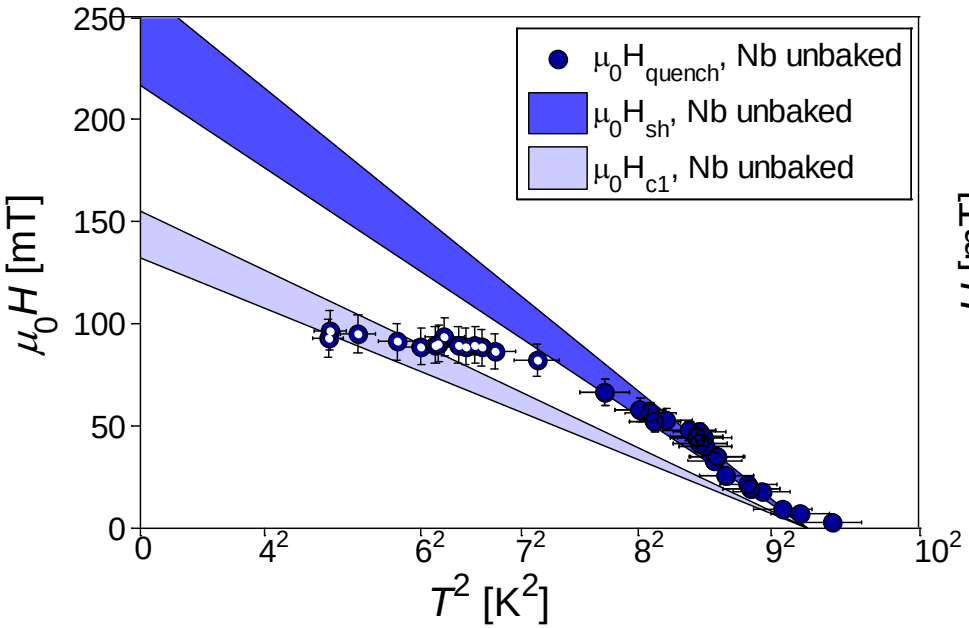


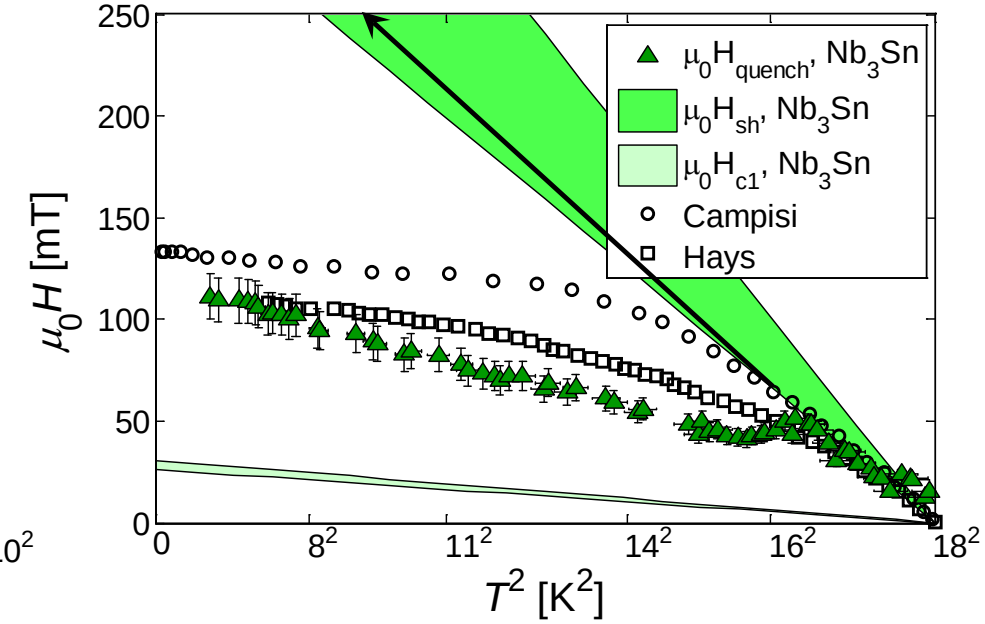


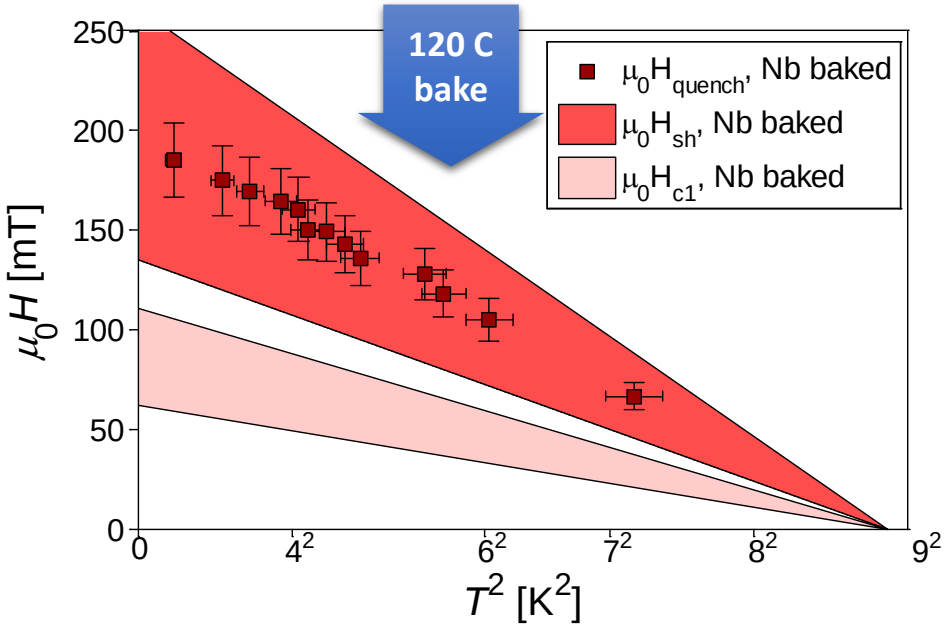


S. Posen, N. Valles, and M. Liepe, *Phys. Rev. Lett.*, 115, 047001 (2015).

Fermilab Next Step: Push Quench Field

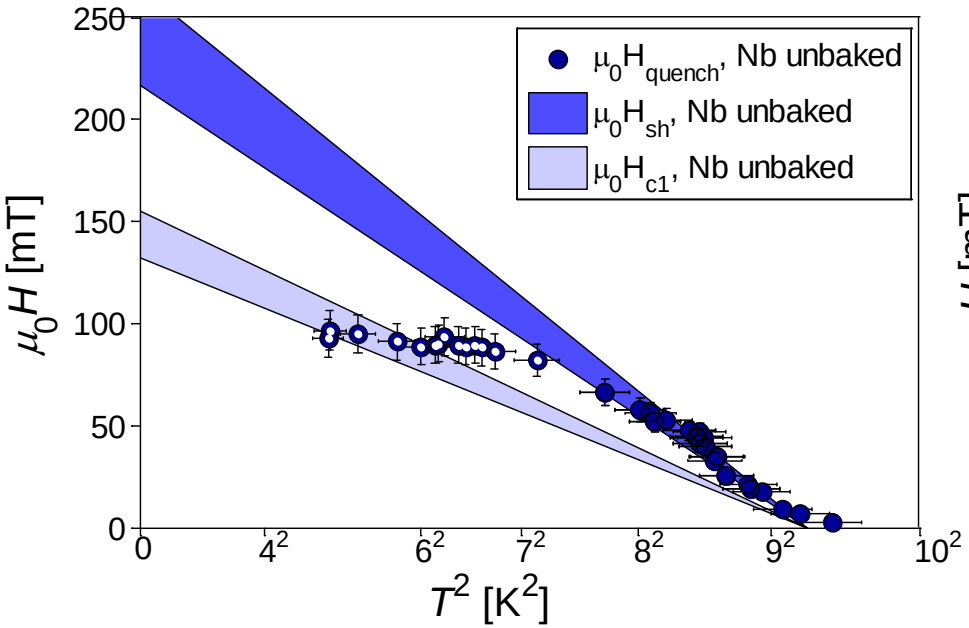


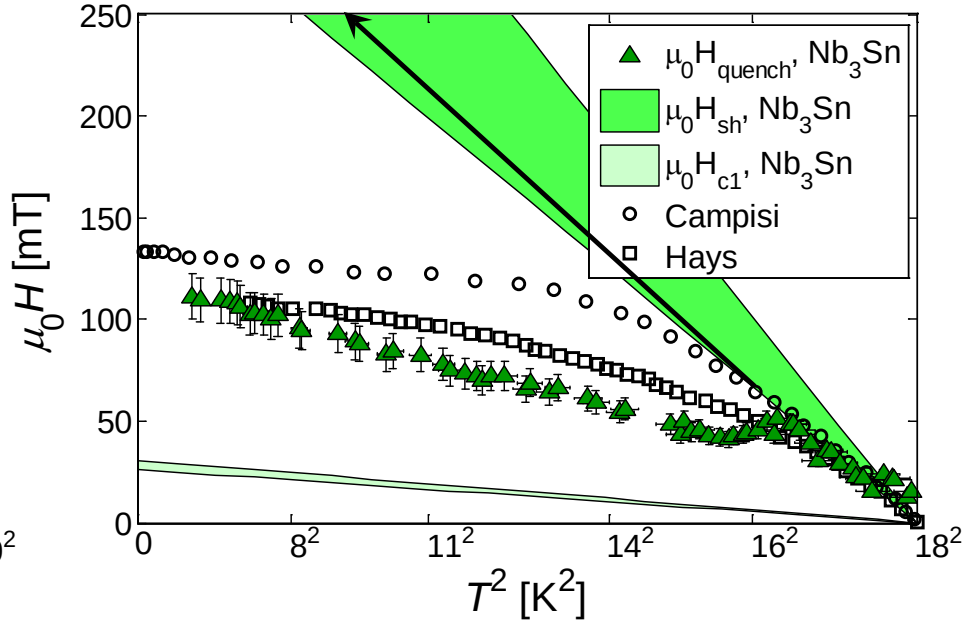


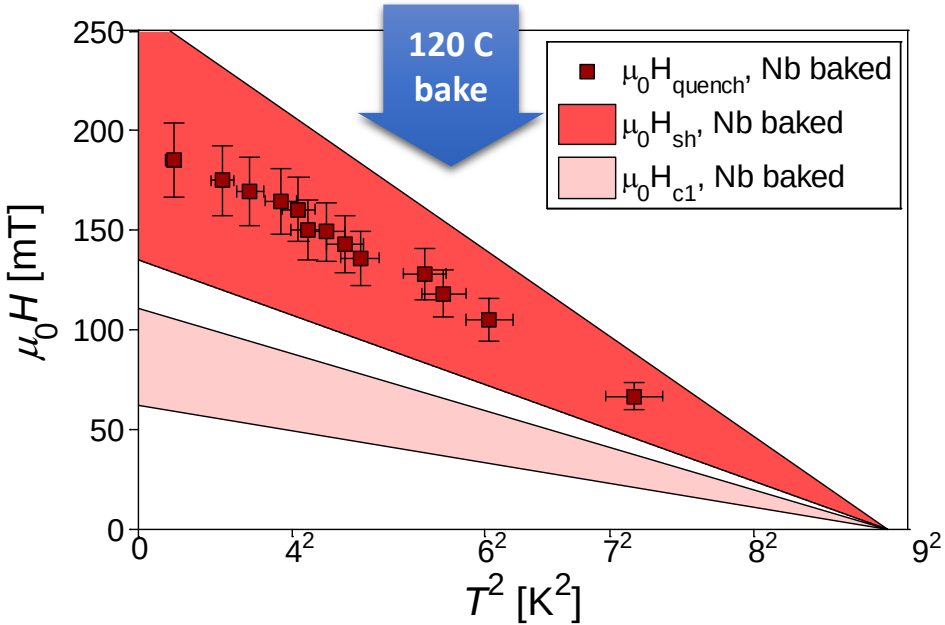


S. Posen, N. Valles, and M. Liepe, *Phys. Rev. Lett.*, 115, 047001 (2015).

Fermilab Next Step: Push Quench Field





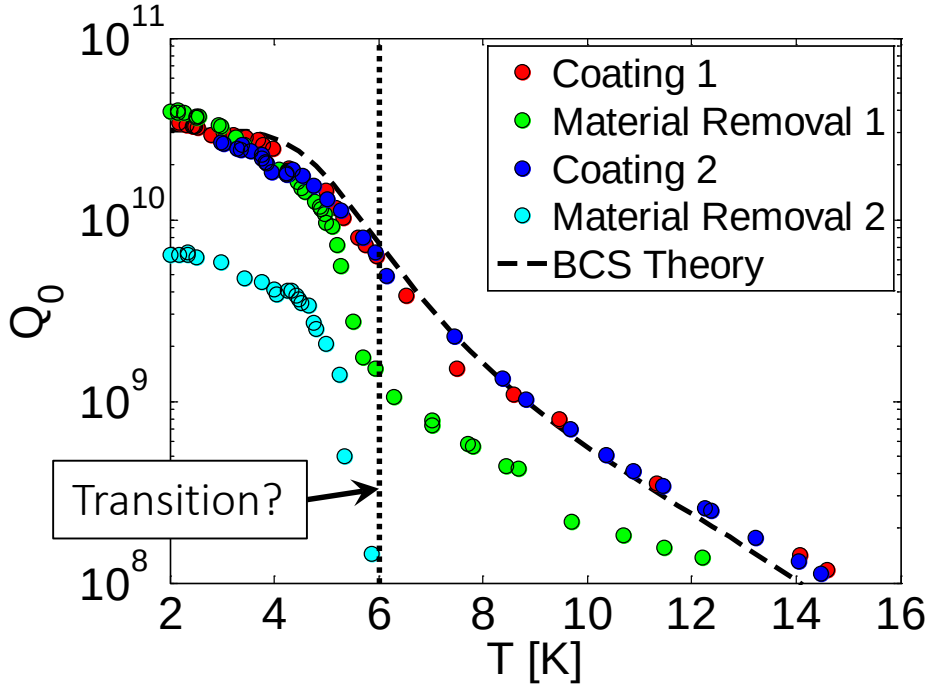


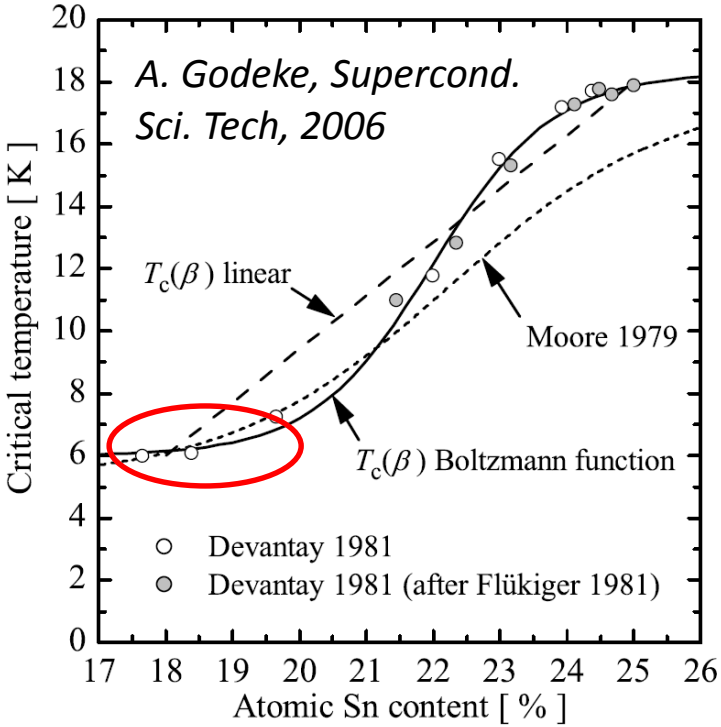
?

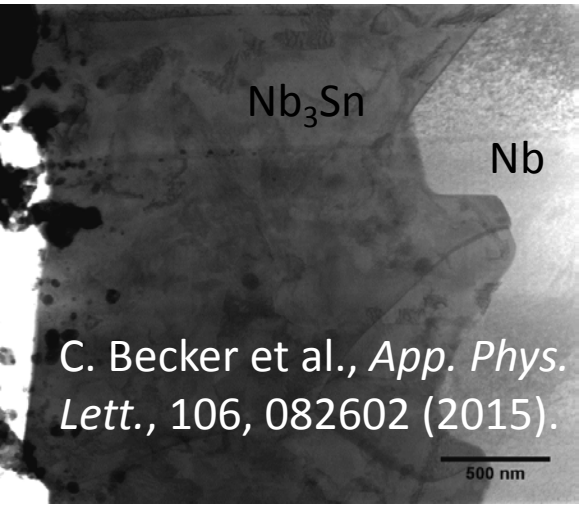
350 mT - 80 MV/m?

S. Posen, N. Valles, and M. Liepe, *Phys. Rev. Lett.*, 115, 047001 (2015).

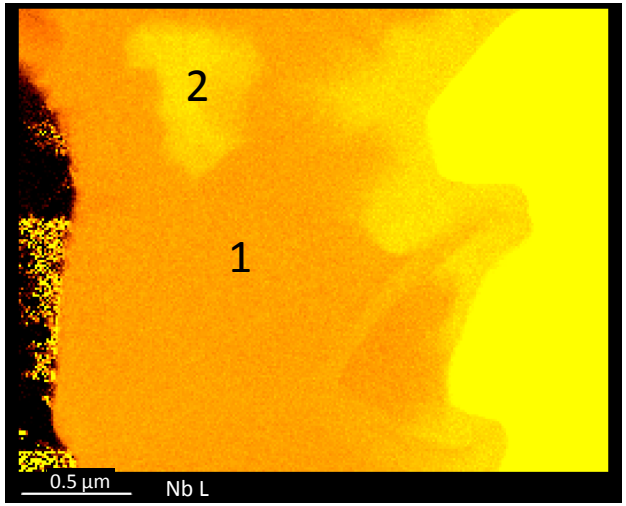
Low Tin Content Regions

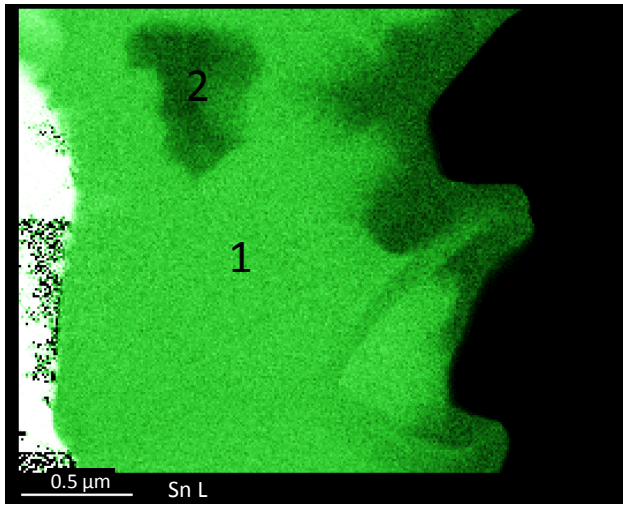


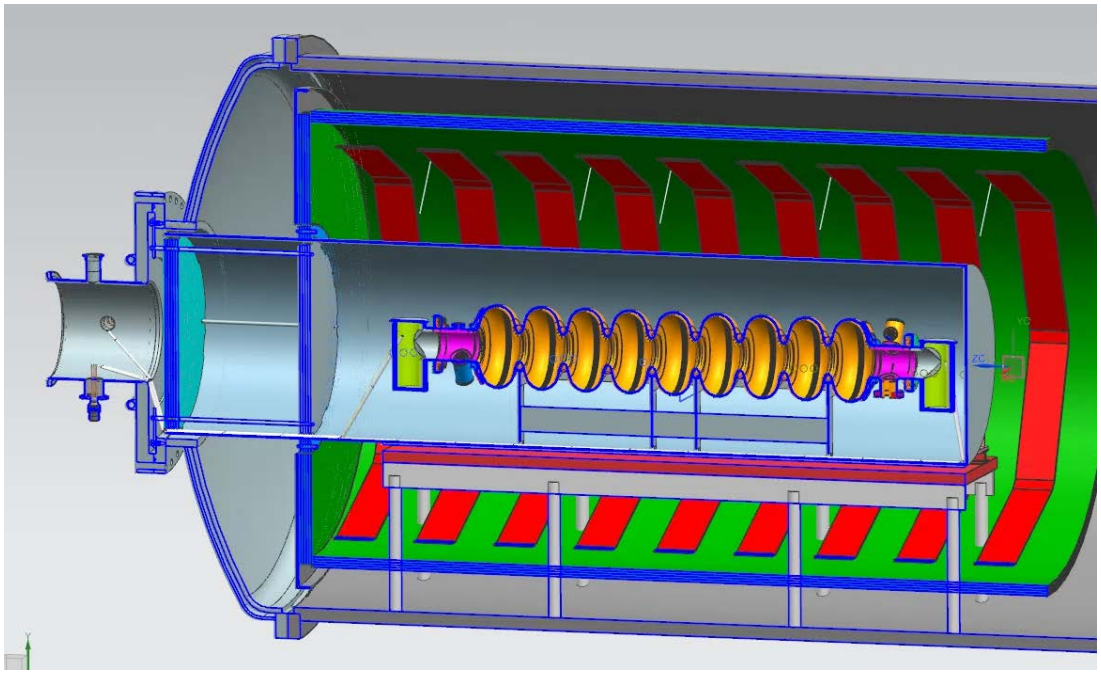
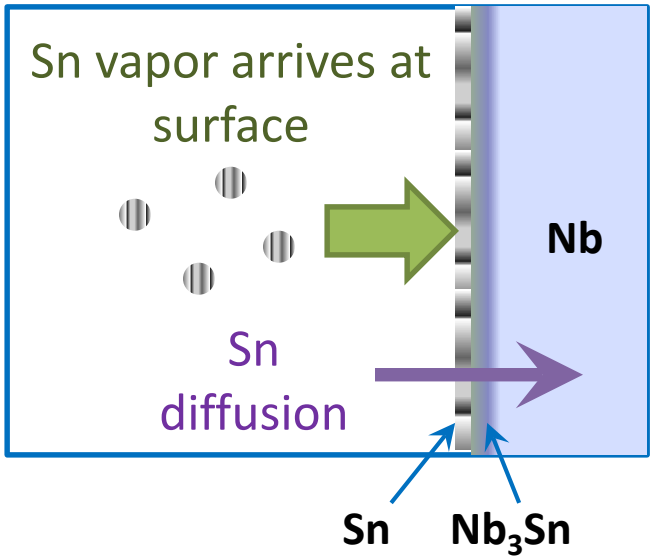




C. Becker et al., *App. Phys. Lett.*, 106, 082602 (2015).





Fabrication Technique

- Evaporate tin in UHV furnace with Nb cavity
  - Can coat single cell cavities at Cornell, Jlab
  - Soon, 9-cells at Fermilab (20” diam, 65” long chamber)
- Similar to Nb prep – still start with niobium cavity, still HPR after coating
- Great potential for future applications