

# RF critical field of Nb<sub>3</sub>Sn and N-doped niobium

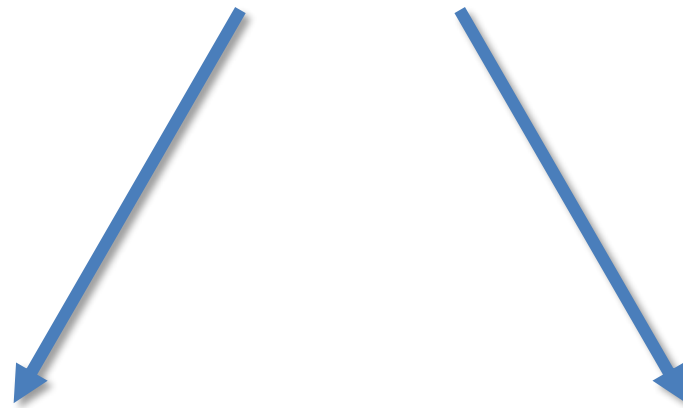
Sebastian Keckert

## ... and how to cope with thermal runaway?

short filling time

→ low  $Q_L$

→ high forward power



(single-cell) cavity

→ MW klystron

sample test cavity

→ different thermal design

→ solid-state amplifier

# The Quadrupole Resonator (QPR)

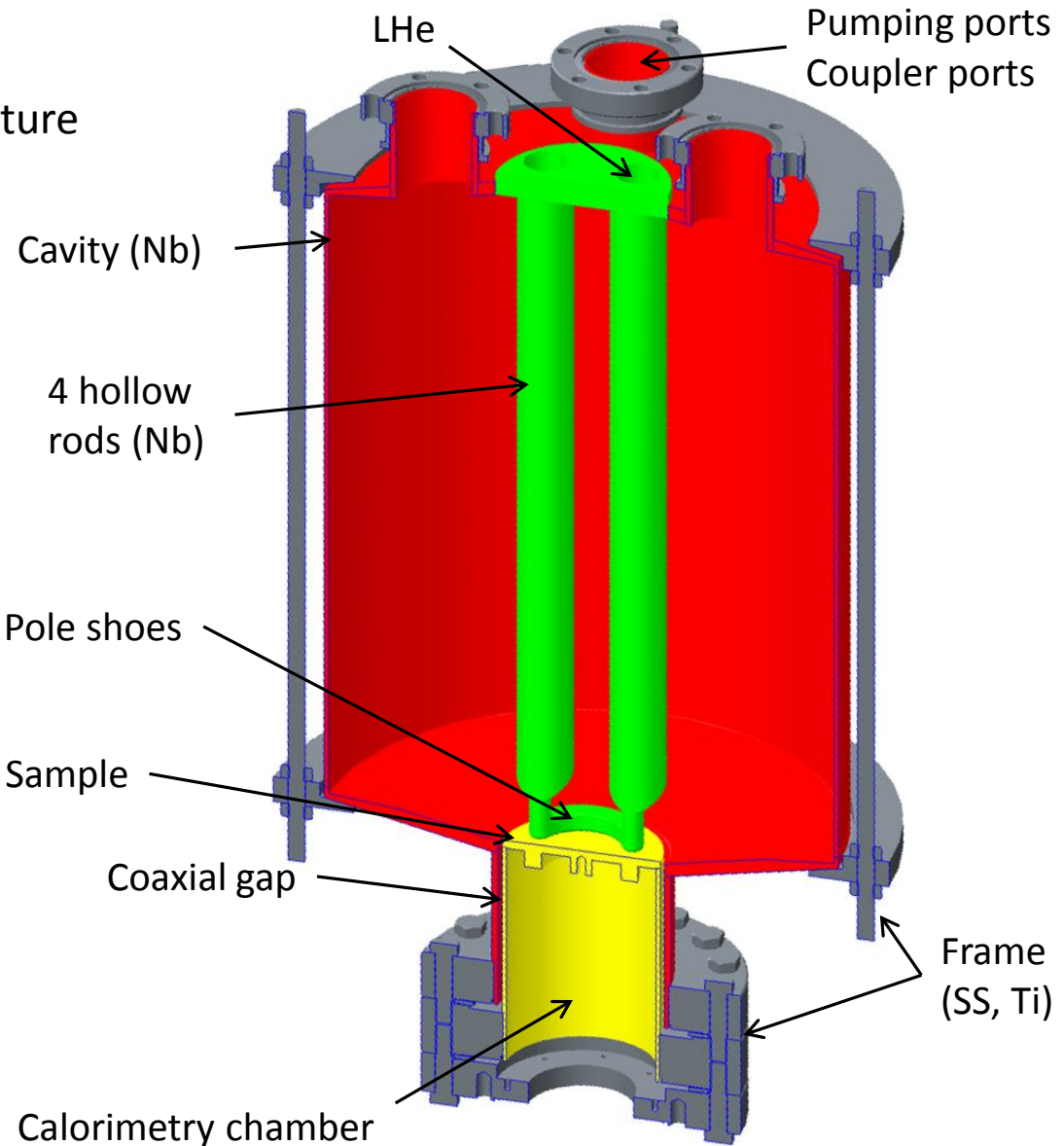
- Operated in VTS  
→ LHe bath at constant temperature

- Sample thermally decoupled from cavity and LHe bath

- Quadrupole modes at 420, 850, 1300 MHz

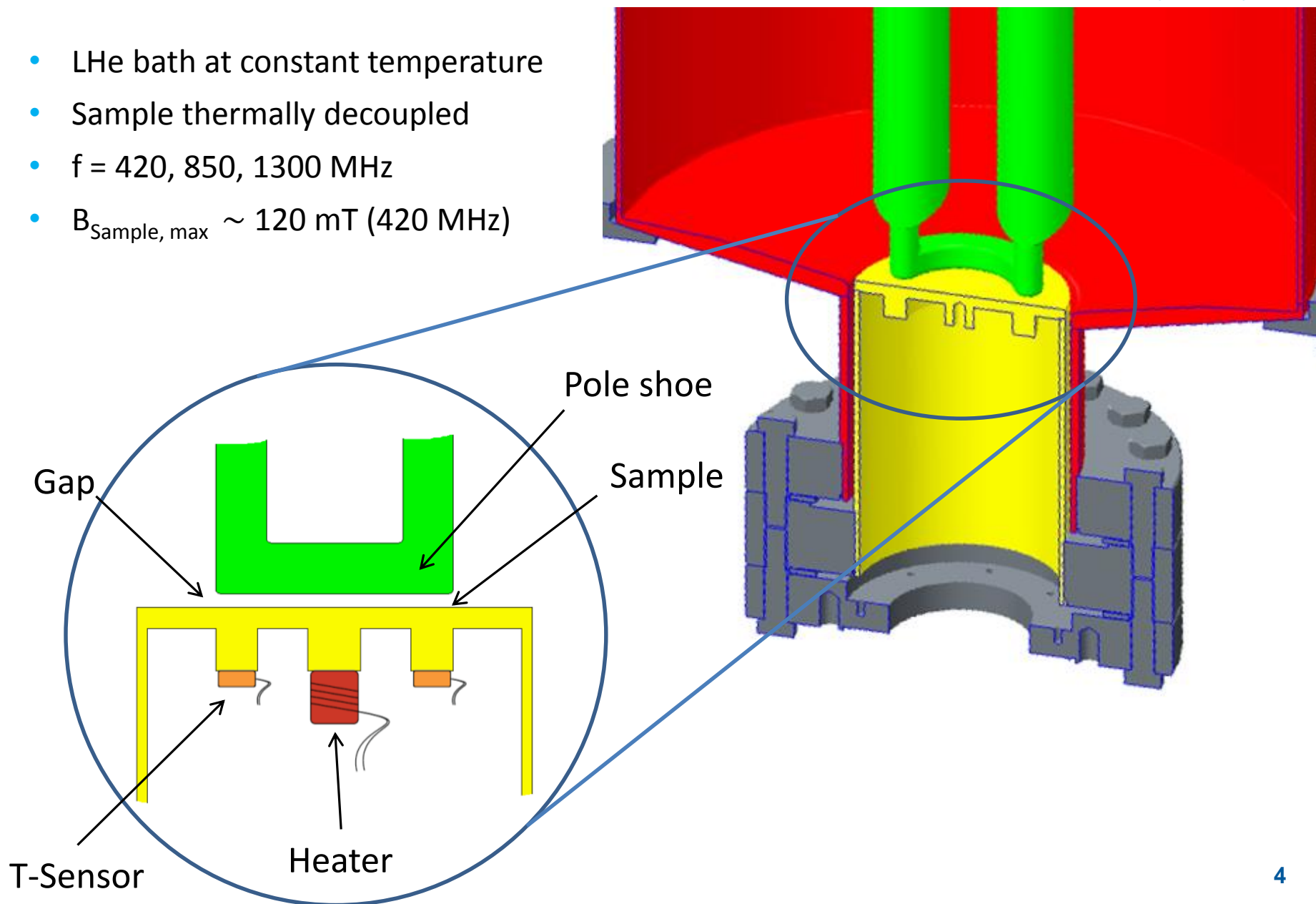
- $B_{\text{Sample, max}} \sim 120 \text{ mT (420 MHz)}$   
 $\sim 30 \text{ MV/m (TESLA)}$

- $Q_L \sim 5 \cdot 10^5 \dots 5 \cdot 10^6$

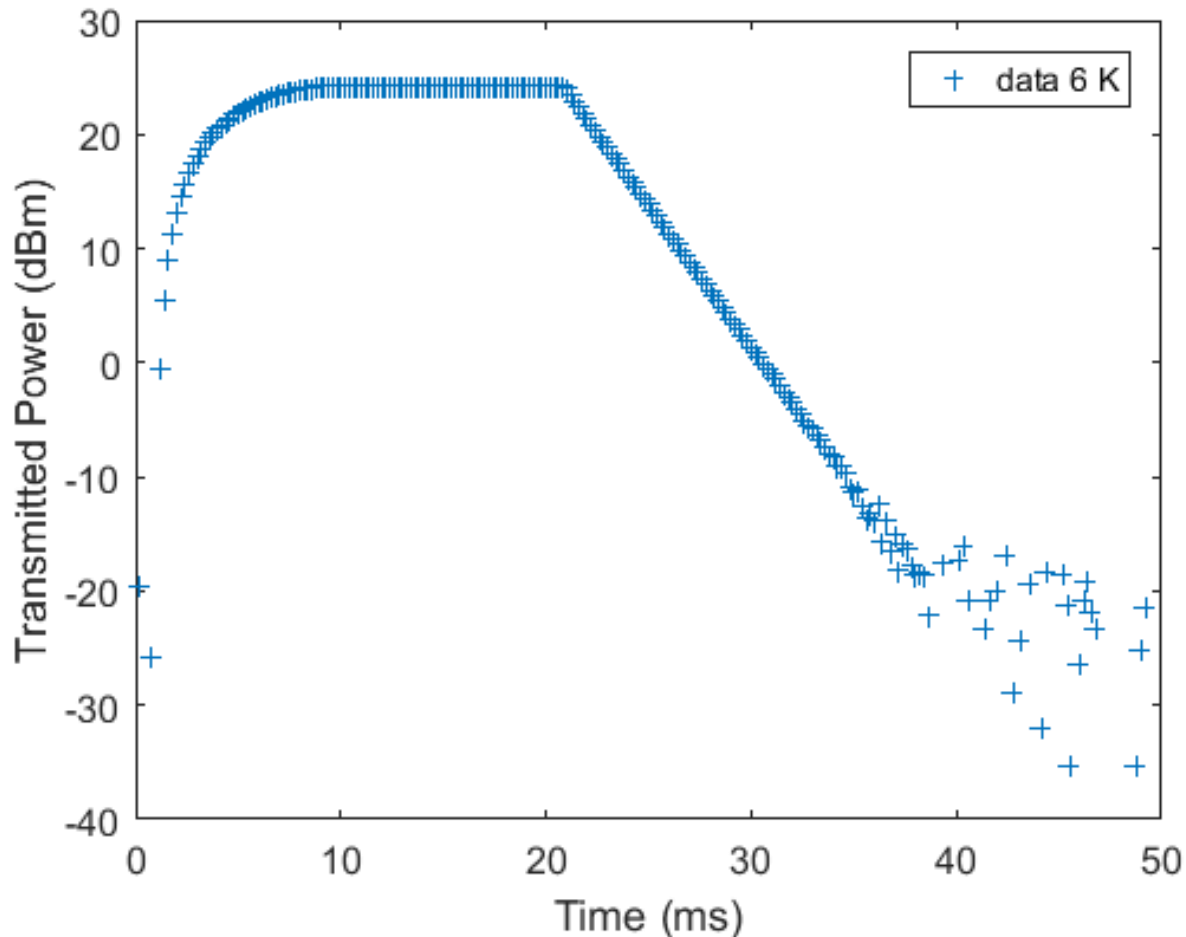


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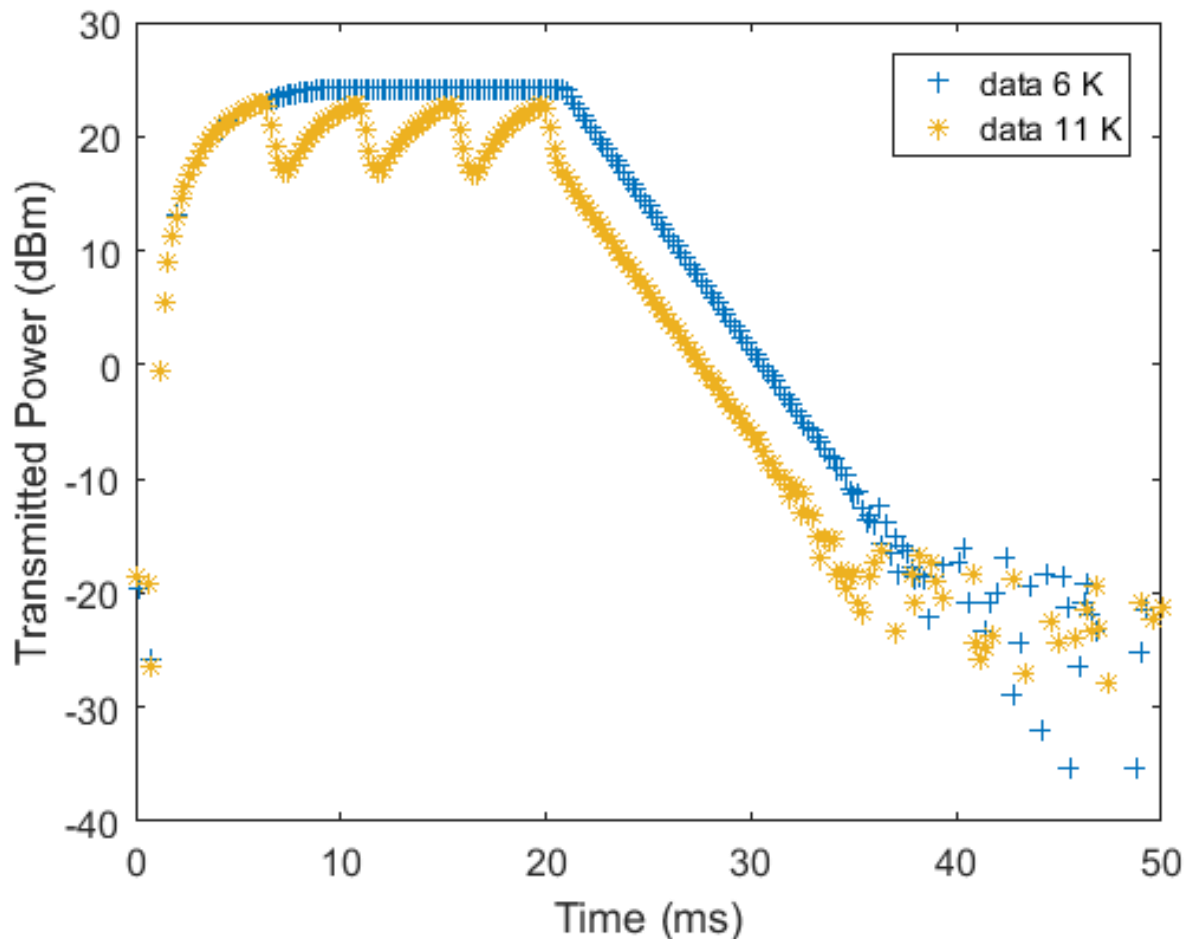
- LHe bath at constant temperature
- Sample thermally decoupled
- $f = 420, 850, 1300$  MHz
- $B_{\text{Sample, max}} \sim 120$  mT (420 MHz)



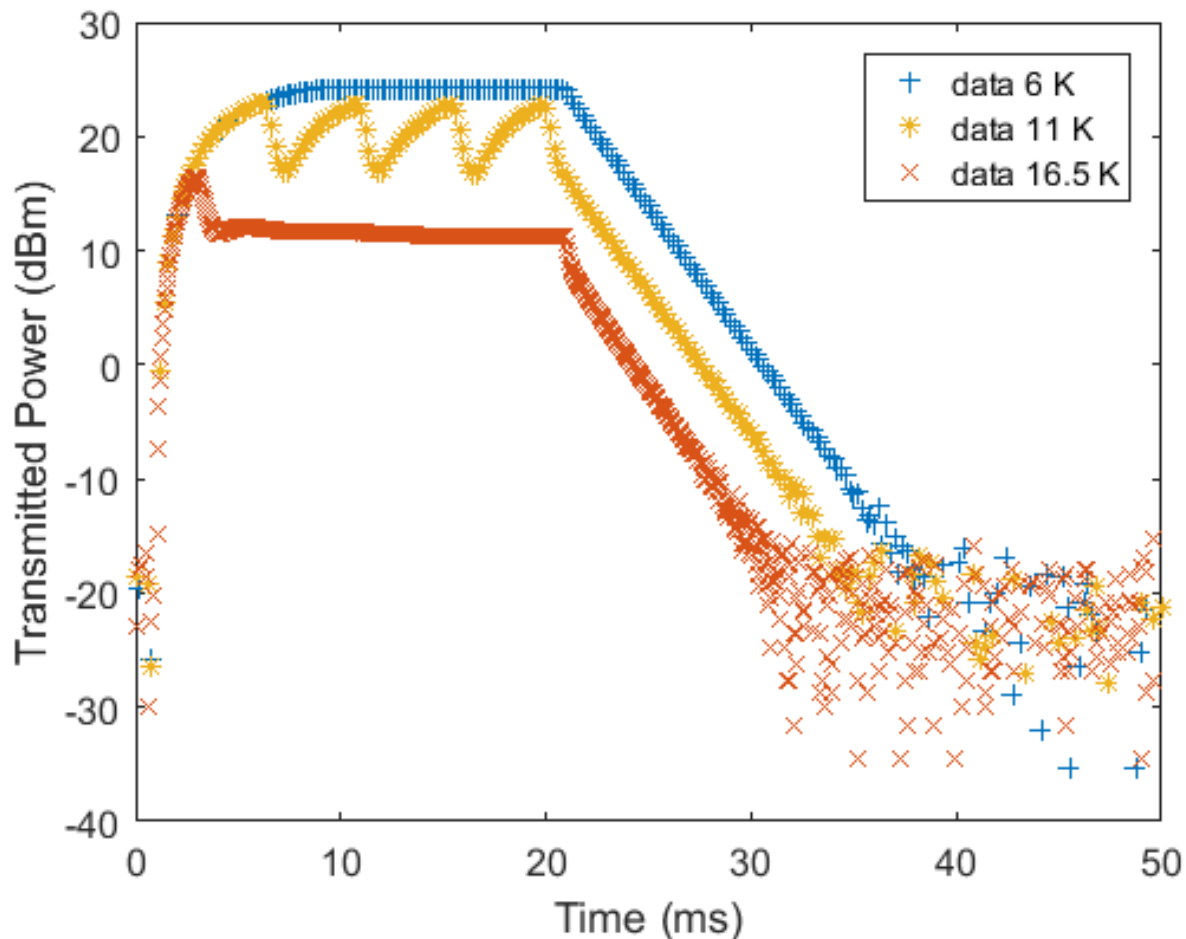
- Single short pulse of RF power → sample quenches
- $B_c(T) = B_{c,0} \cdot \left(1 - \left(\frac{T}{T_c}\right)^2\right)$
- Significant RF heating at lower temperatures



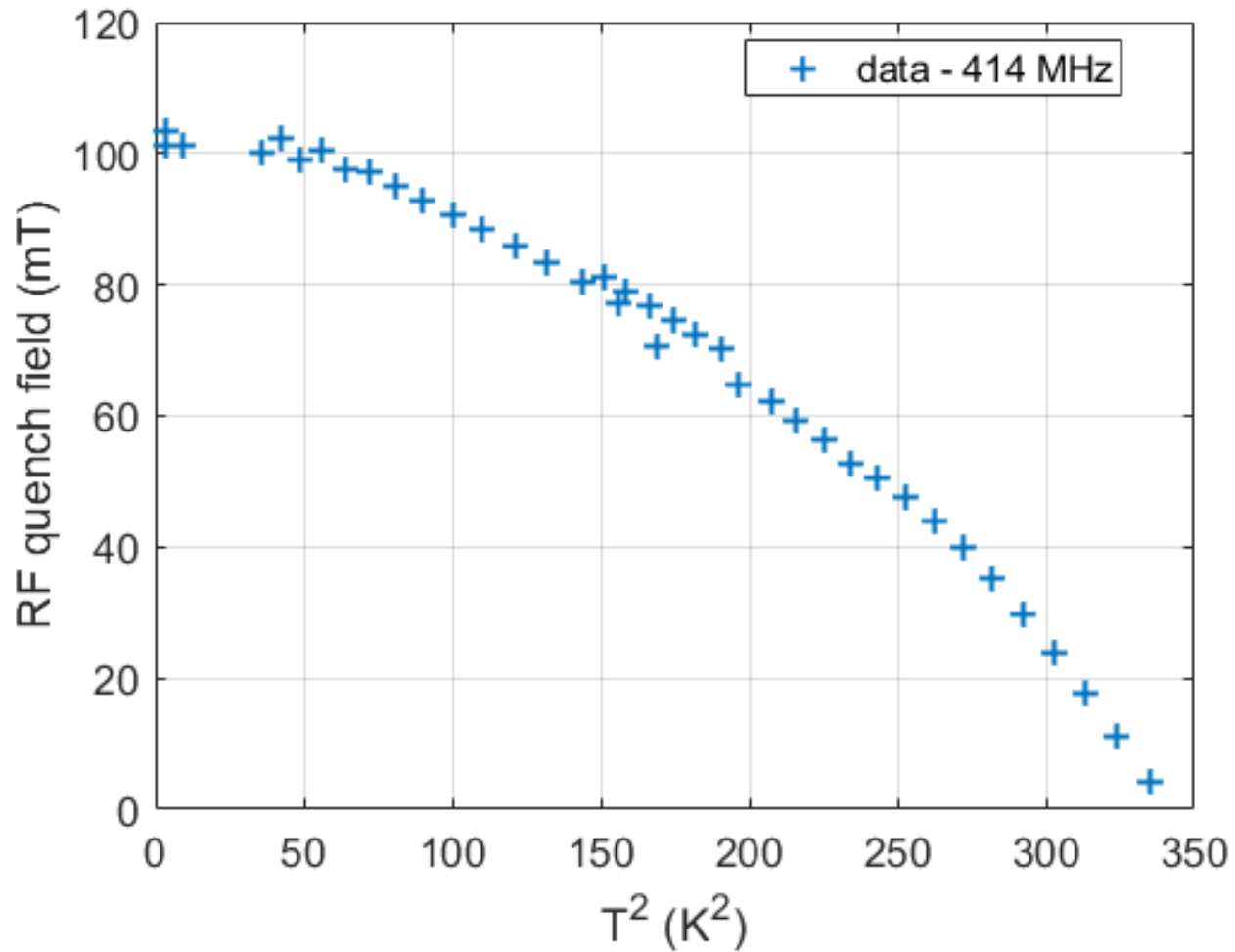
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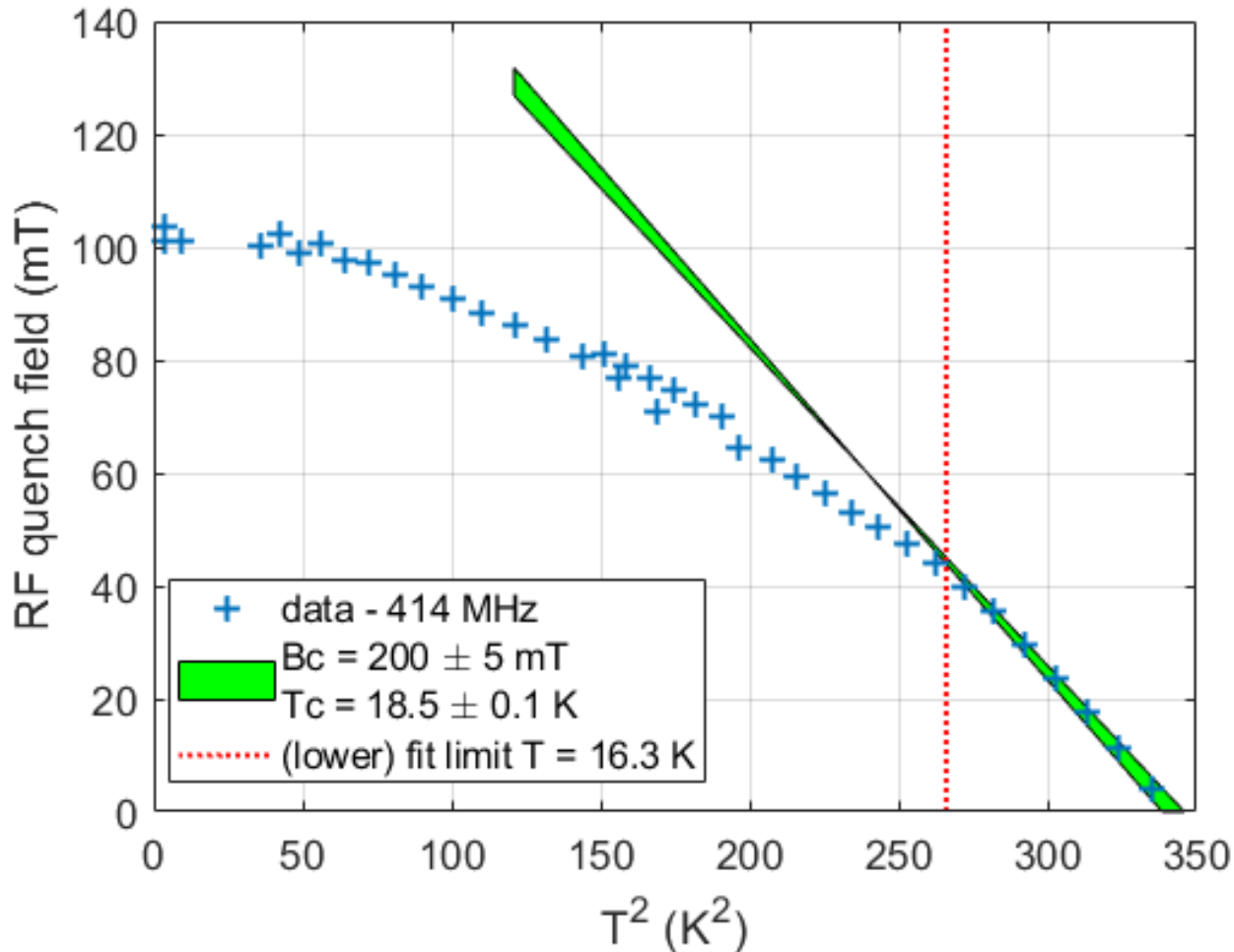
- Sample coated by Daniel Hall (Cornell)





- Sample coated by Daniel Hall (Cornell)
- Fit yields  $T_c$  and  $B_c(0K)$

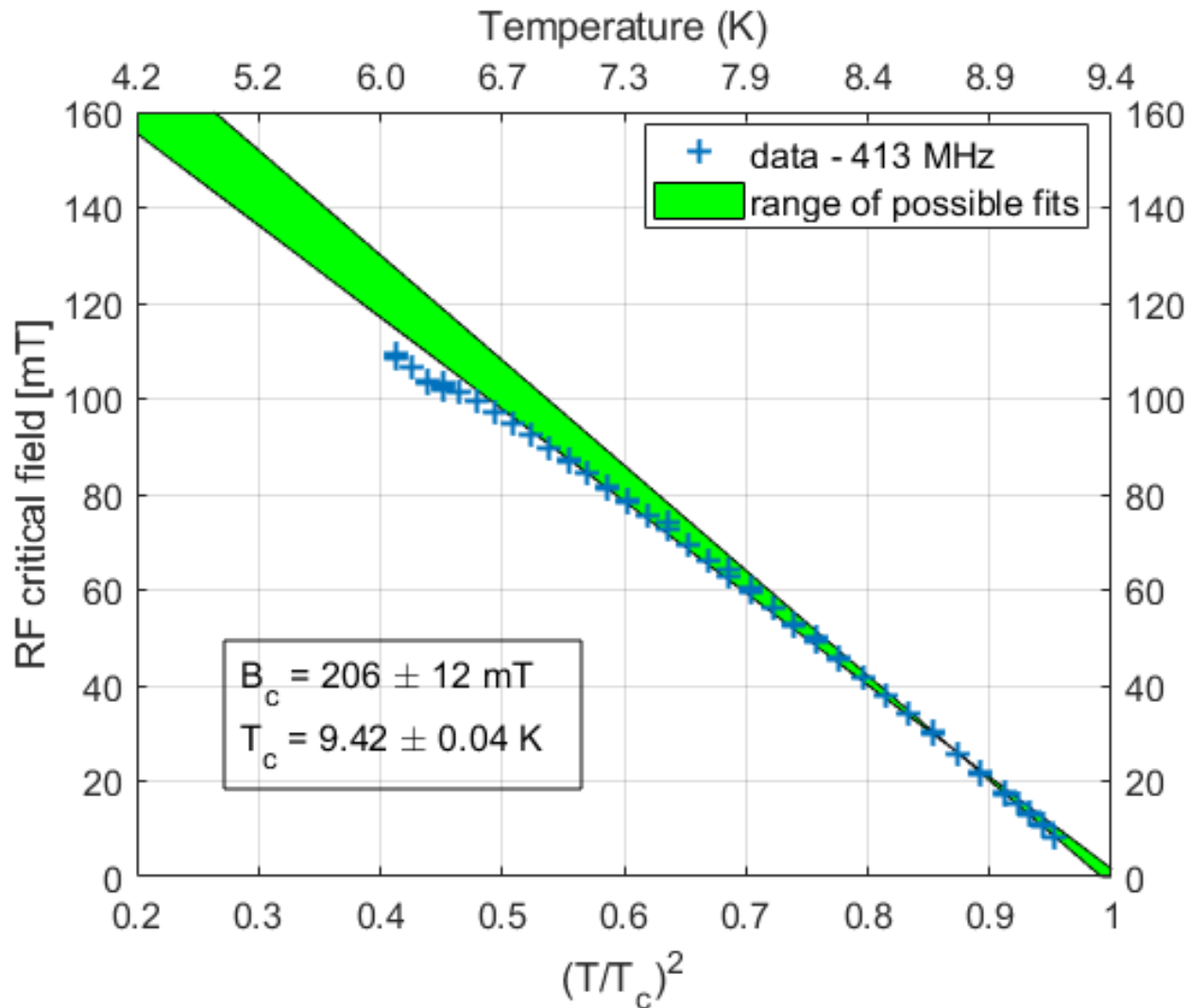
$$B_c(T) = B_{c,0} \cdot \left(1 - \left(\frac{T}{T_c}\right)^2\right)$$



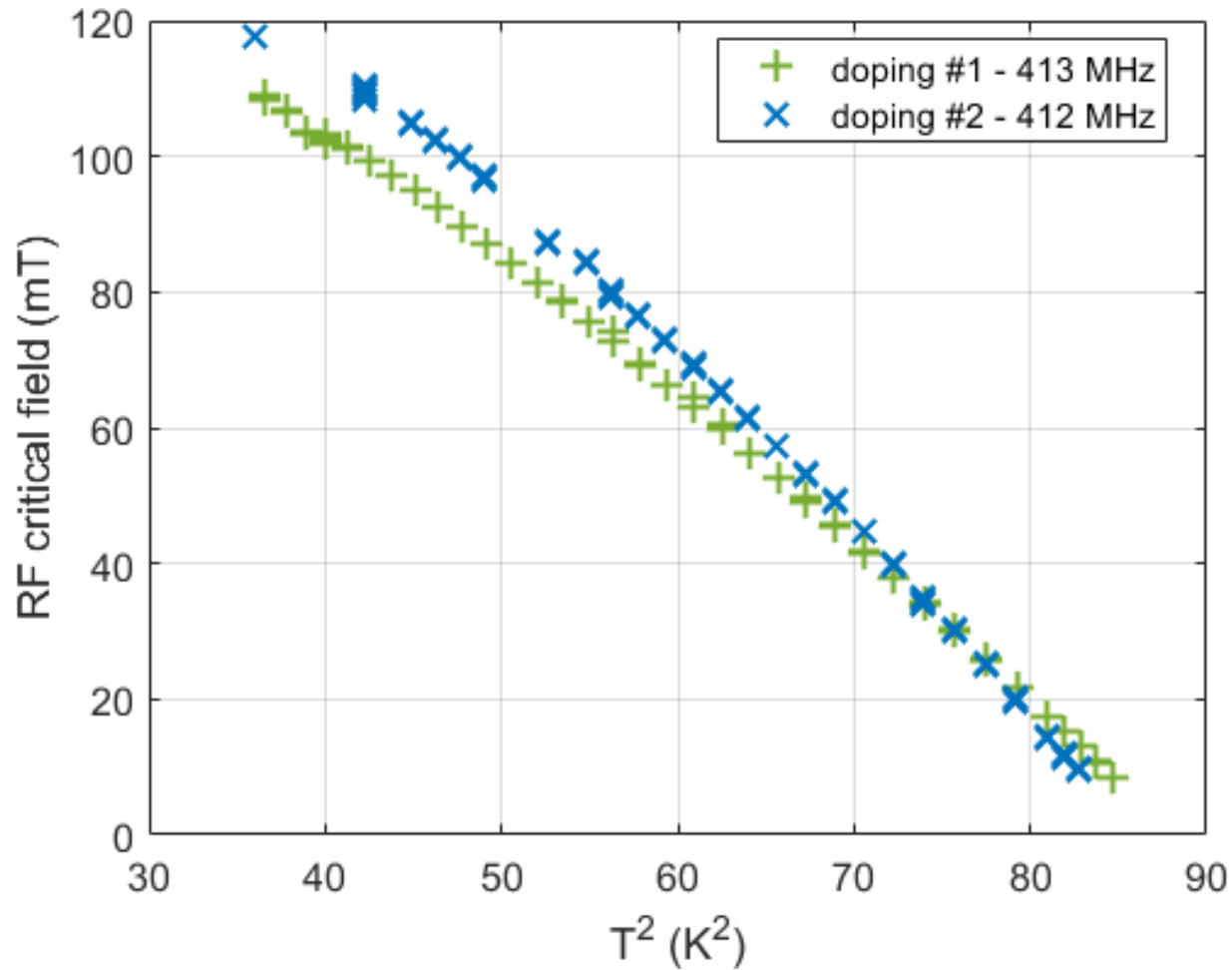
$$B_{c1} = 25 \text{ mT}$$

$$B_{sh} \sim 400 \text{ mT}$$

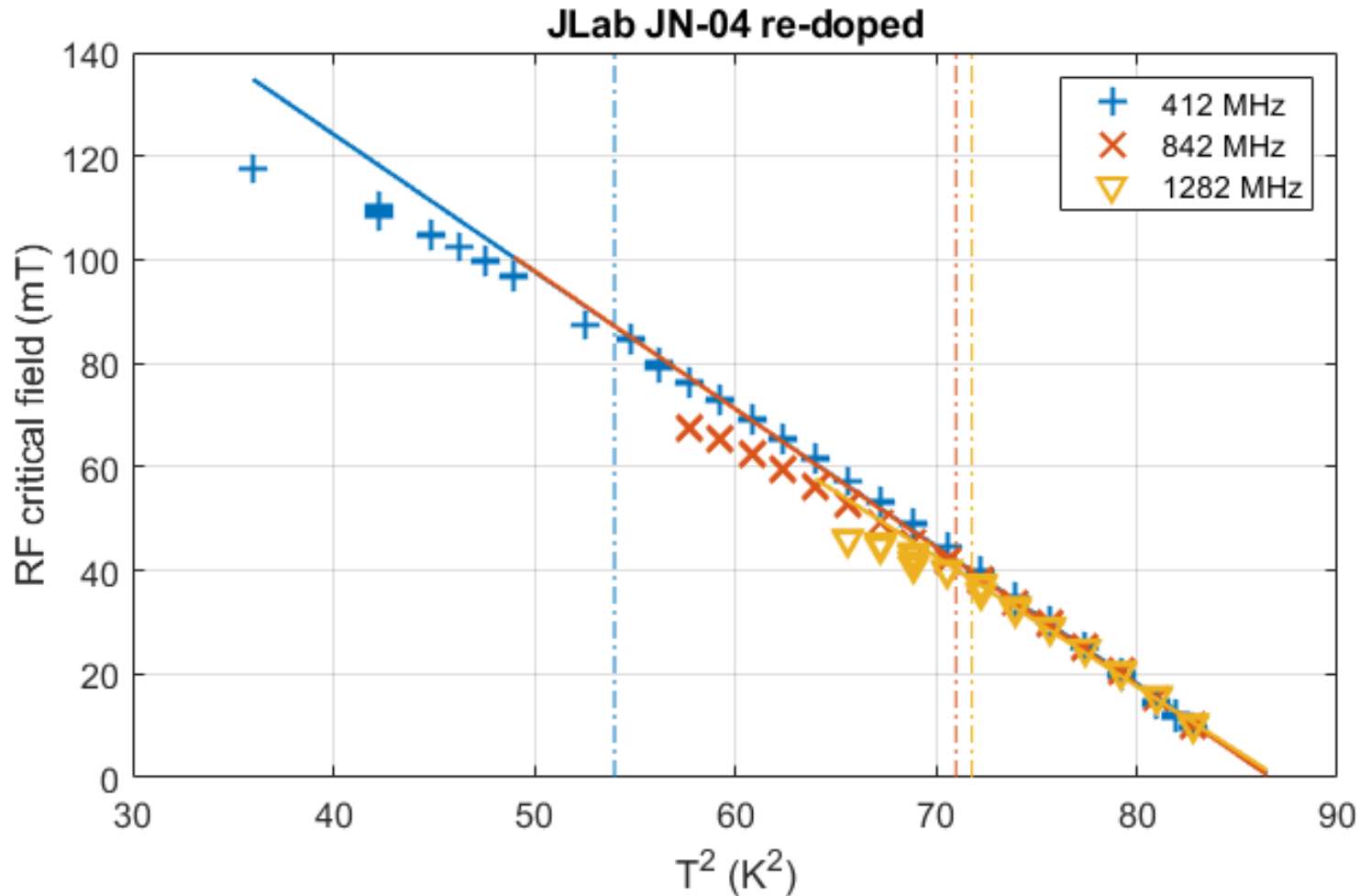
- Sample prepared by Ari Palczewski (JLab)



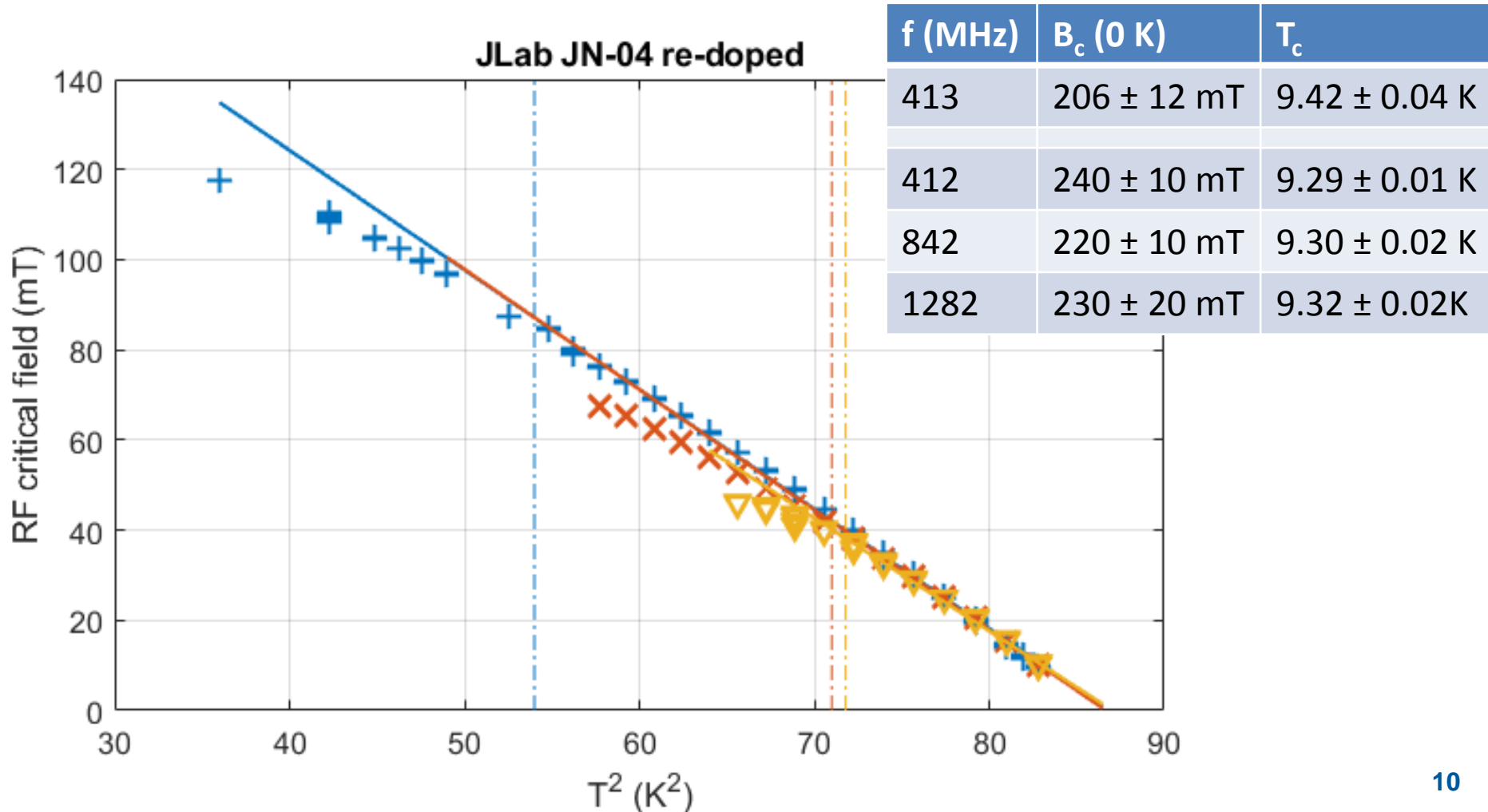
- 2nd run after 150 $\mu$ m EP and re-doping



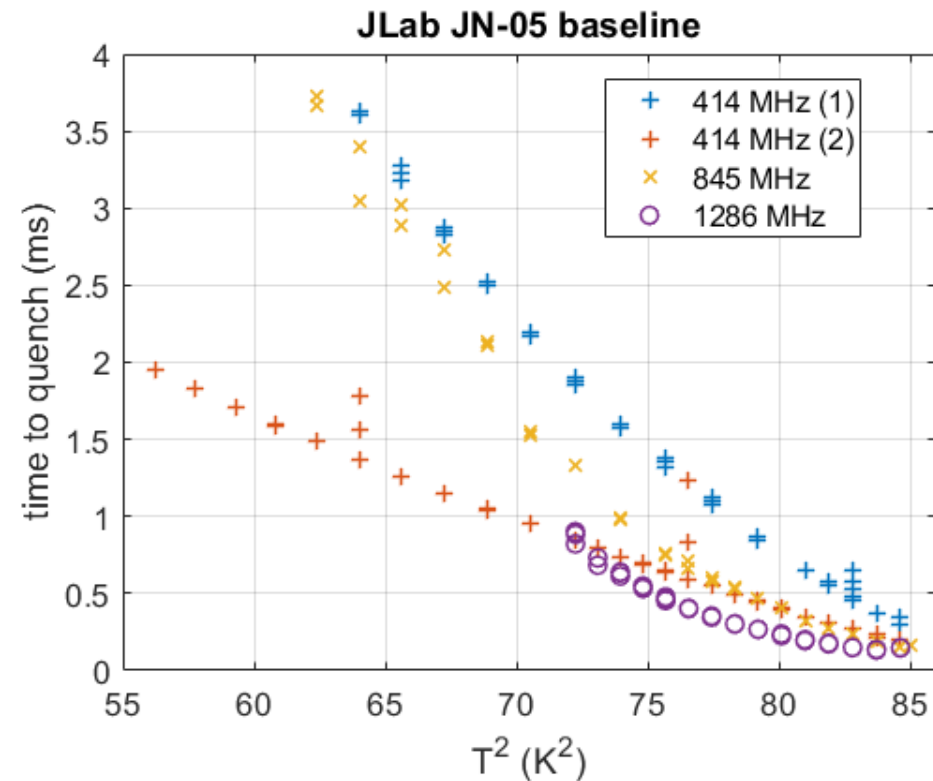
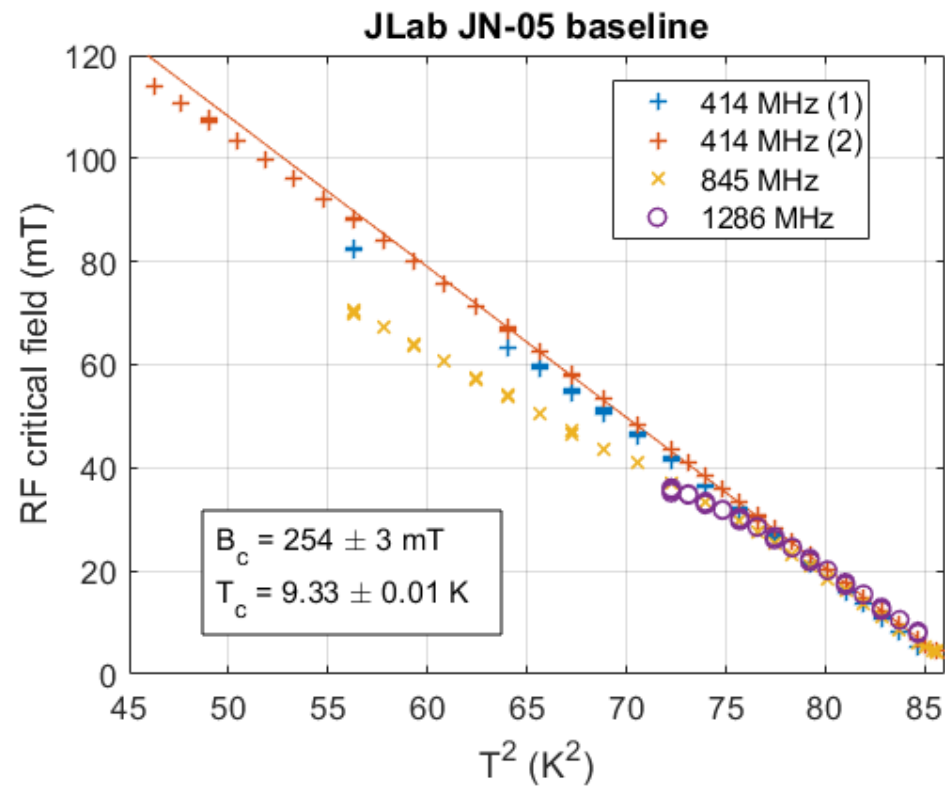
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- now: measurements at all 3 frequencies possible



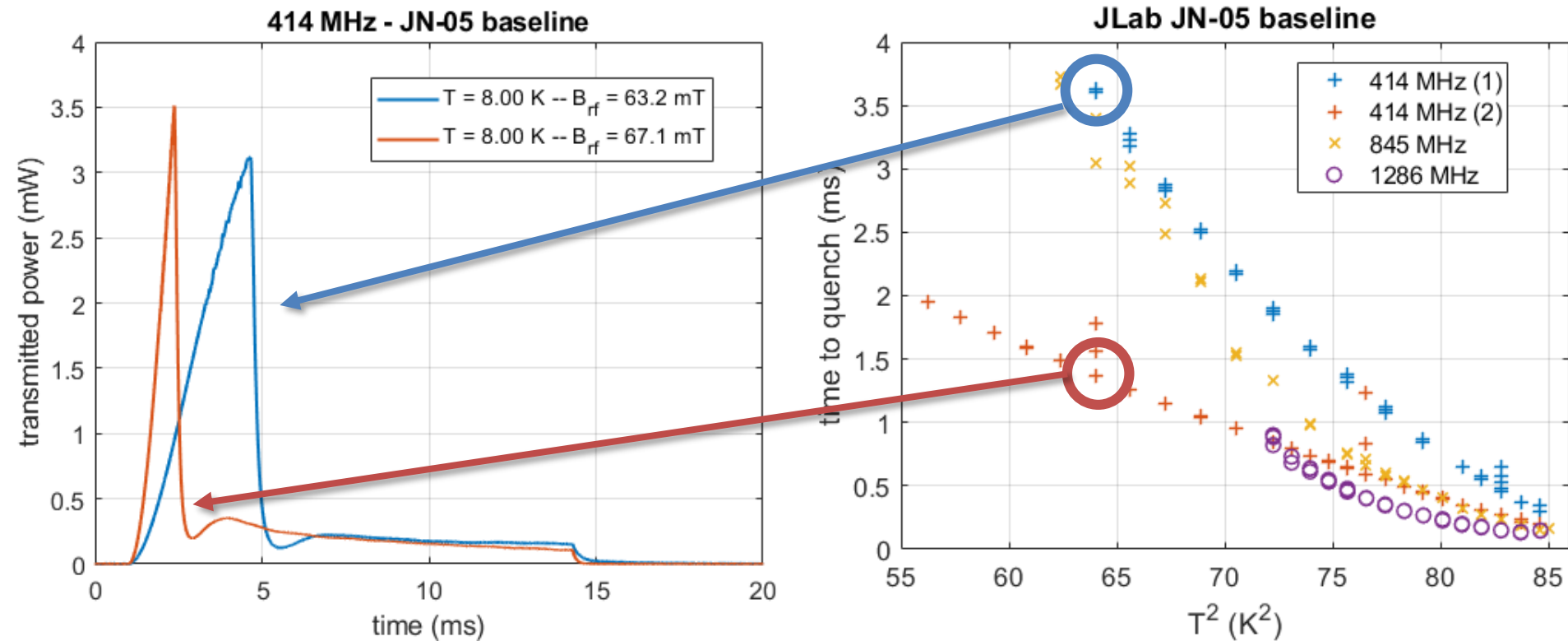
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- Measurements at all three QPR modes possible
- RF parameters improved to decrease rise time (coupling unchanged!)



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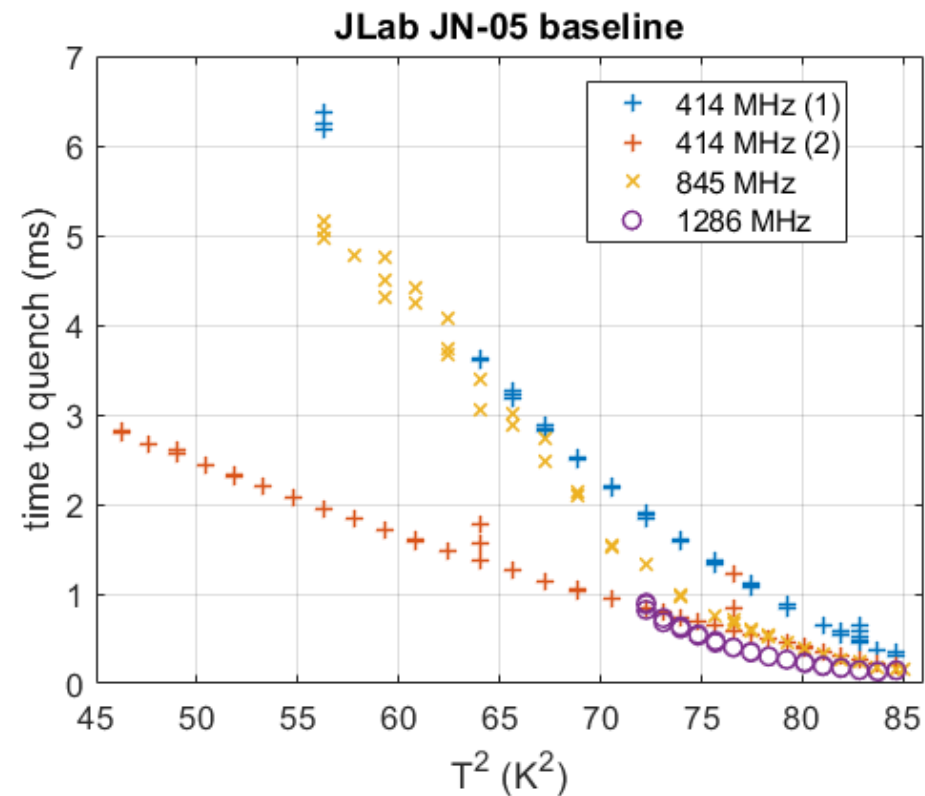
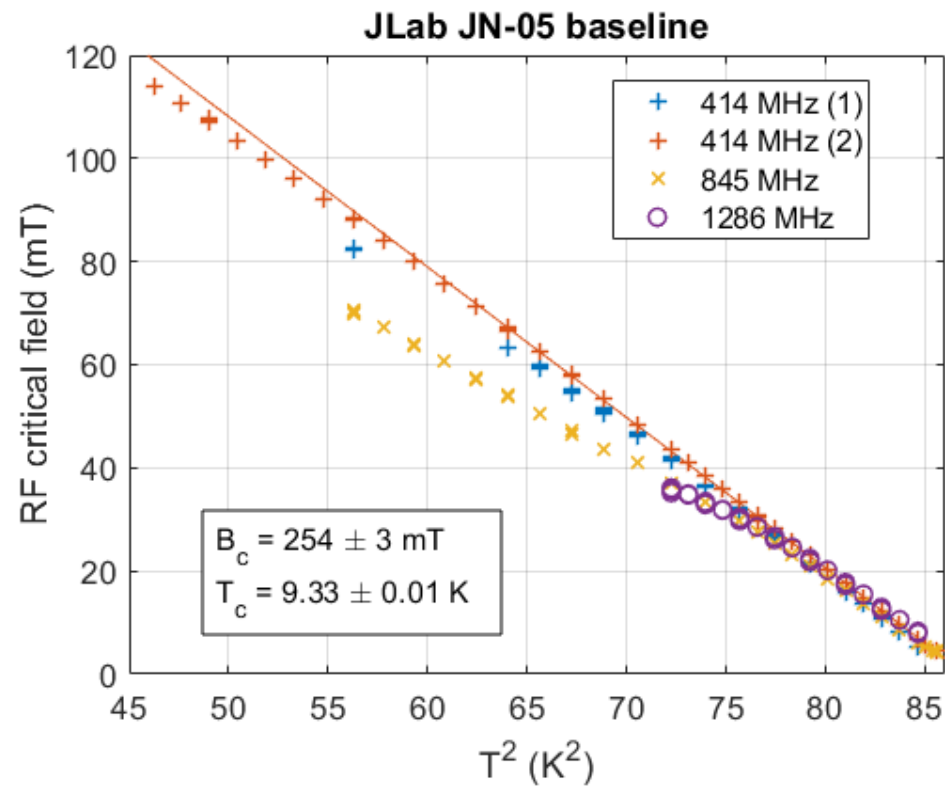
Thank you for your attention !



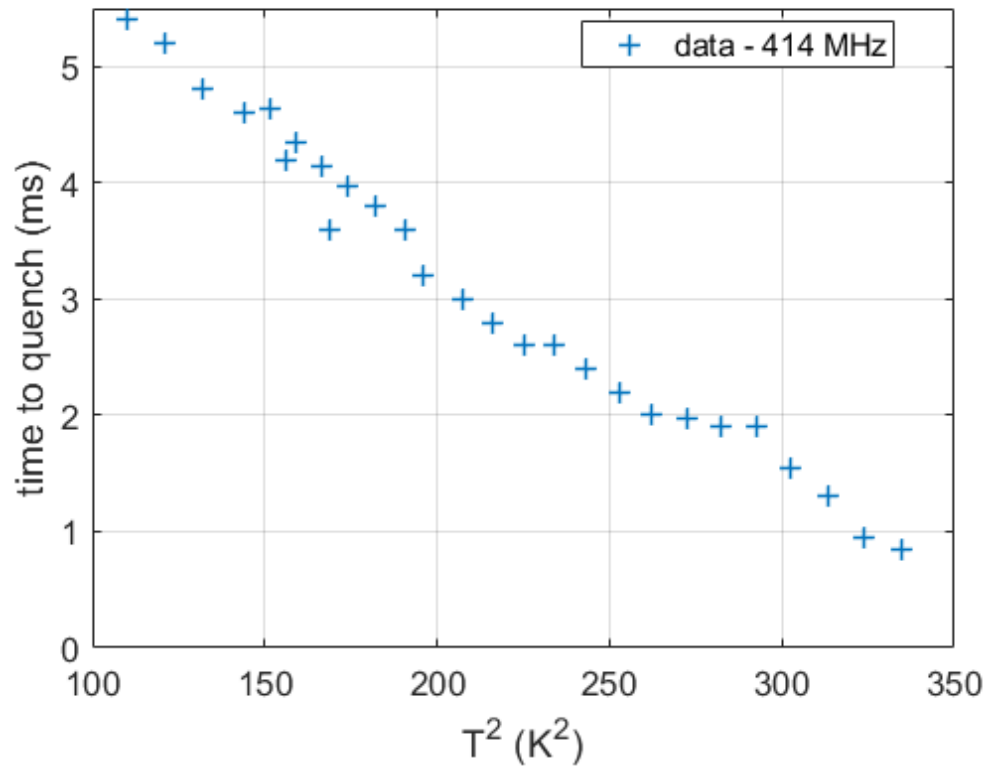
EuCARD-2 is co-funded by the partners  
and the European Commission under  
Capacities 7th Framework Programme,  
Grant Agreement 312453



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### Nb<sub>3</sub>Sn



### JLab JN-05 baseline

