








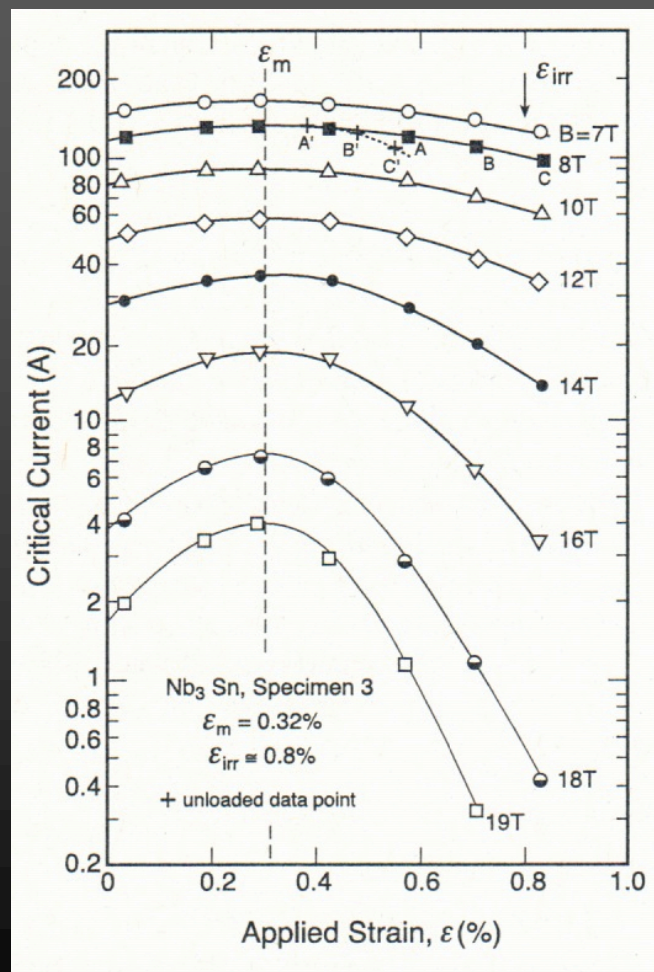
Reduced strain/stress sensitivity of the critical current of Nb₃Sn conductors

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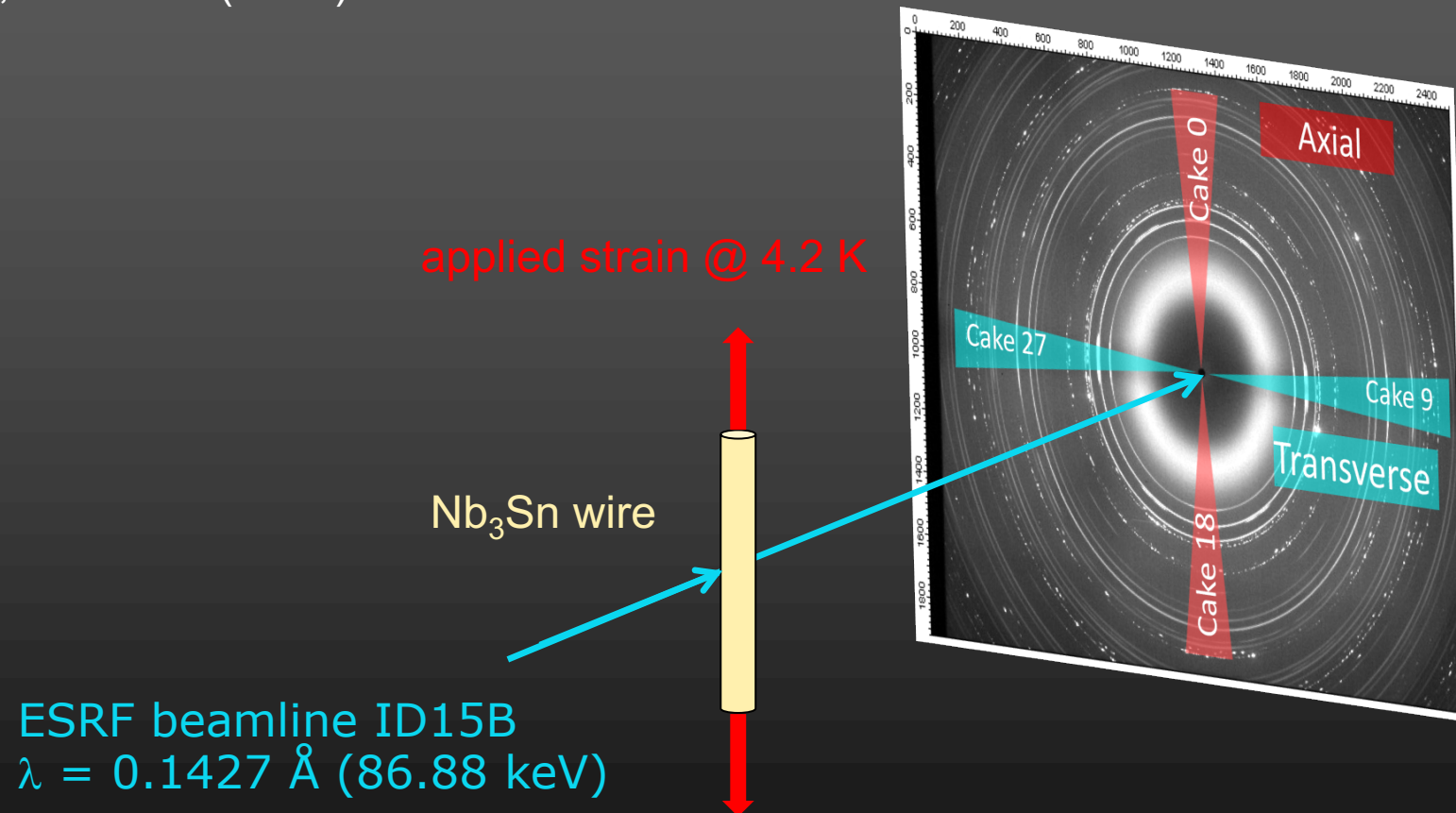
Nb₃Sn - I_c vs. strain

J. Ekin, Cryogenics 20, 1980



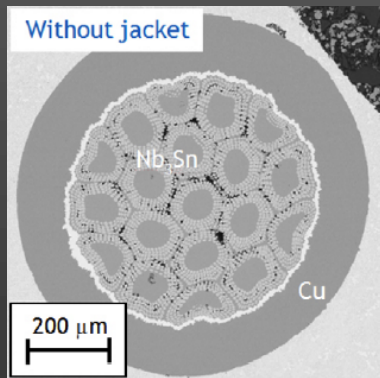
ESRF set-up

L. Muzzi et al., SUST 25 (2012)

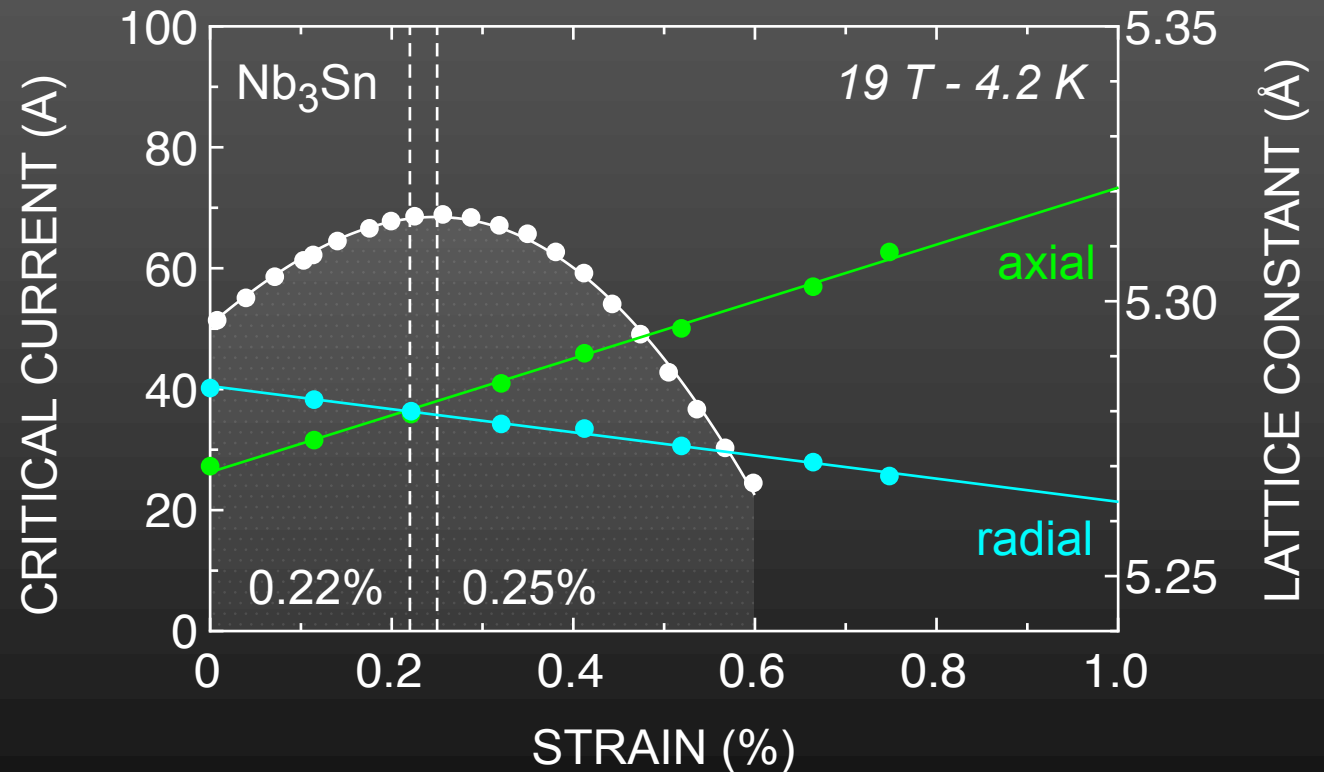


ESRF experiment

L. Muzzi et al., SUST 25 (2012)

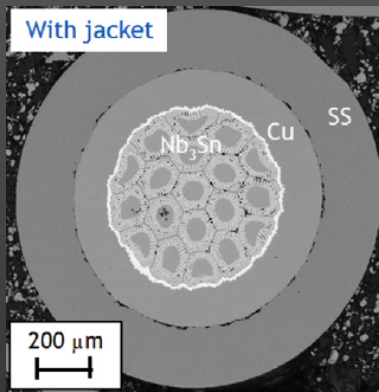


OST-I for ITER
(billet #7567)
OD = 0.81 mm
Ta barrier

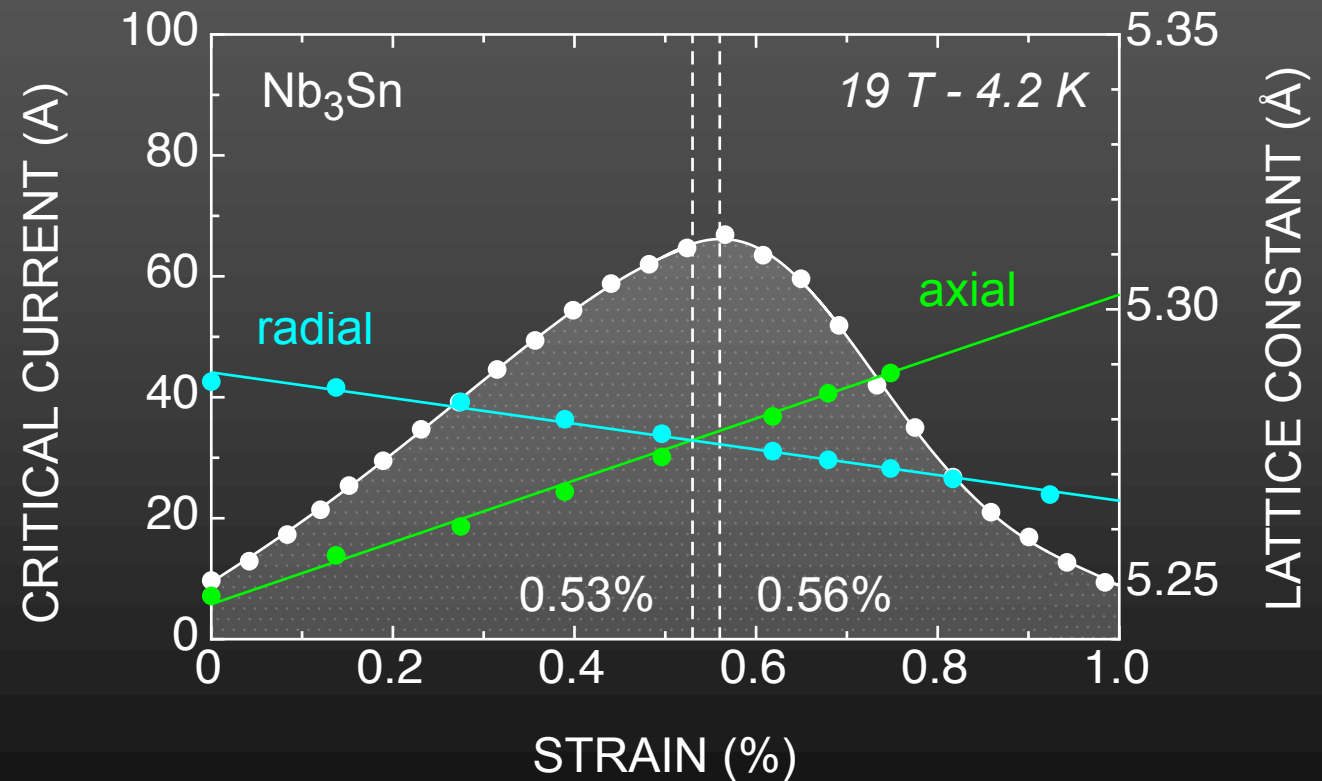


ESRF experiment

L. Muzzi et al., SUST 25 (2012)



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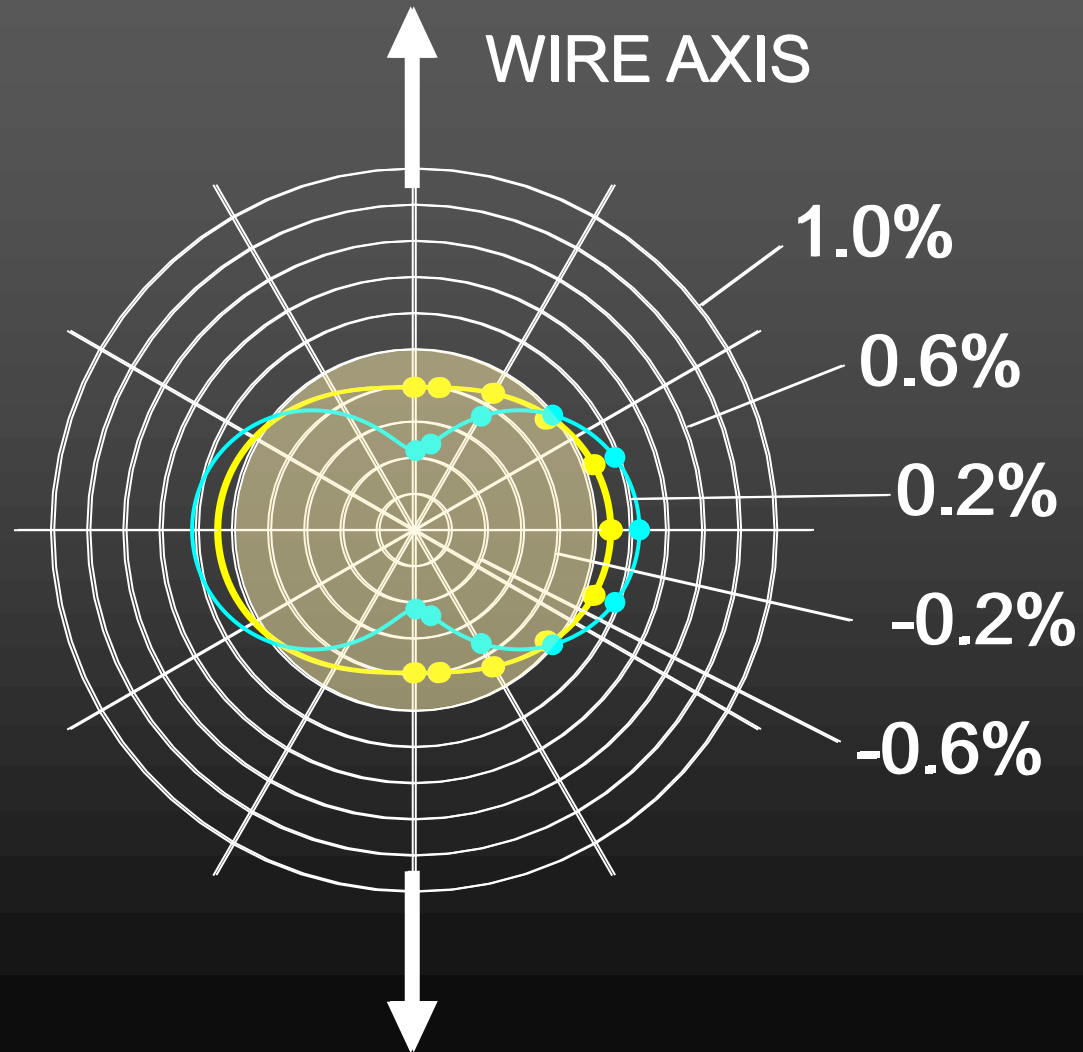


Lattice strain of Nb₃Sn

Zero applied strain

Without stainless steel jacket

With stainless steel jacket

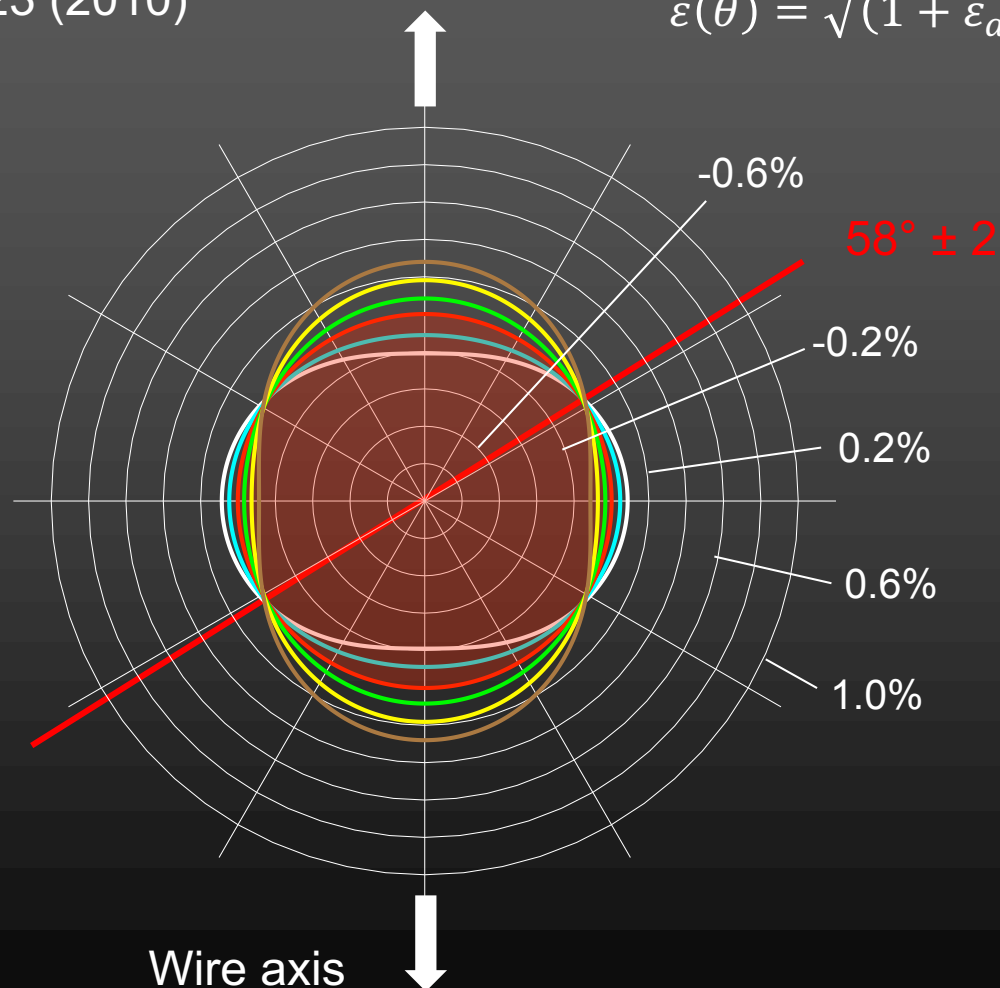


Lattice strain of Nb₃Sn

Modelling: S. Awaji et al. SUST 23 (2010)

$$\varepsilon(\theta) = \sqrt{(1 + \varepsilon_{ax0})^2 \sin^2 \theta + (1 + \varepsilon_{rad0})^2 \cos^2 \theta} - 1$$

Without stainless steel jacket



Applied tensile strain

- $\varepsilon = \text{zero}$
- $\varepsilon = 0.10\%$
- $\varepsilon = 0.22\%$
- $\varepsilon = 0.3\%$
- $\varepsilon = 0.4\%$
- $\varepsilon = 0.5\%$

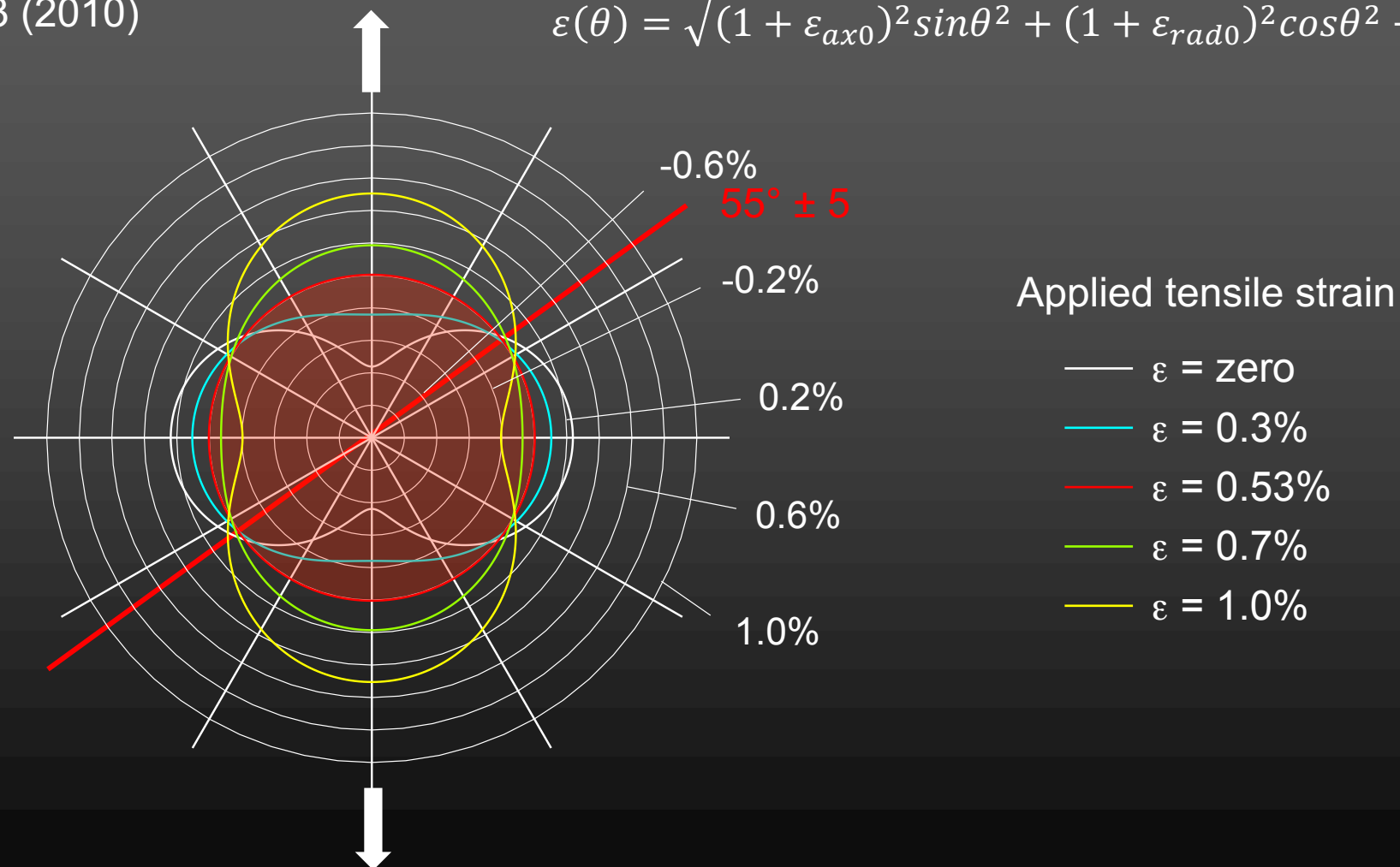


Lattice strain of Nb₃Sn

Modelling: S. Awaji et al. SUST 23 (2010)

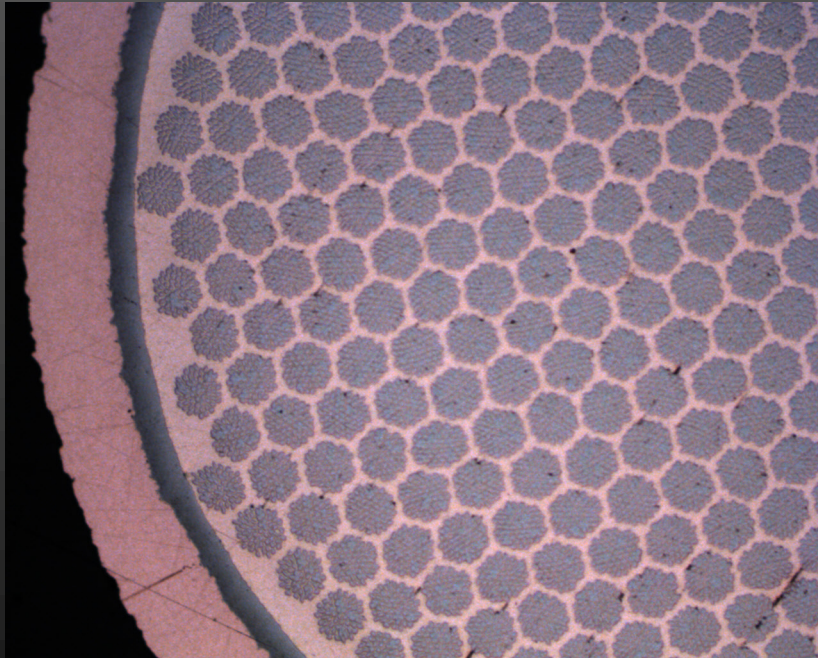
$$\varepsilon(\theta) = \sqrt{(1 + \varepsilon_{ax0})^2 \sin^2 \theta + (1 + \varepsilon_{rad0})^2 \cos^2 \theta} - 1$$

With stainless steel jacket



Nb₃Sn samples

Bruker EAS Nb₃Sn bronze wire (NSTT28105Nb23) - OD = 1.45mm - Nb barrier



Courtesy of M. Alessandrini

Different twist pitch lengths:

- no twist
- 50 mm (4.5°)
- 5 mm (38°)



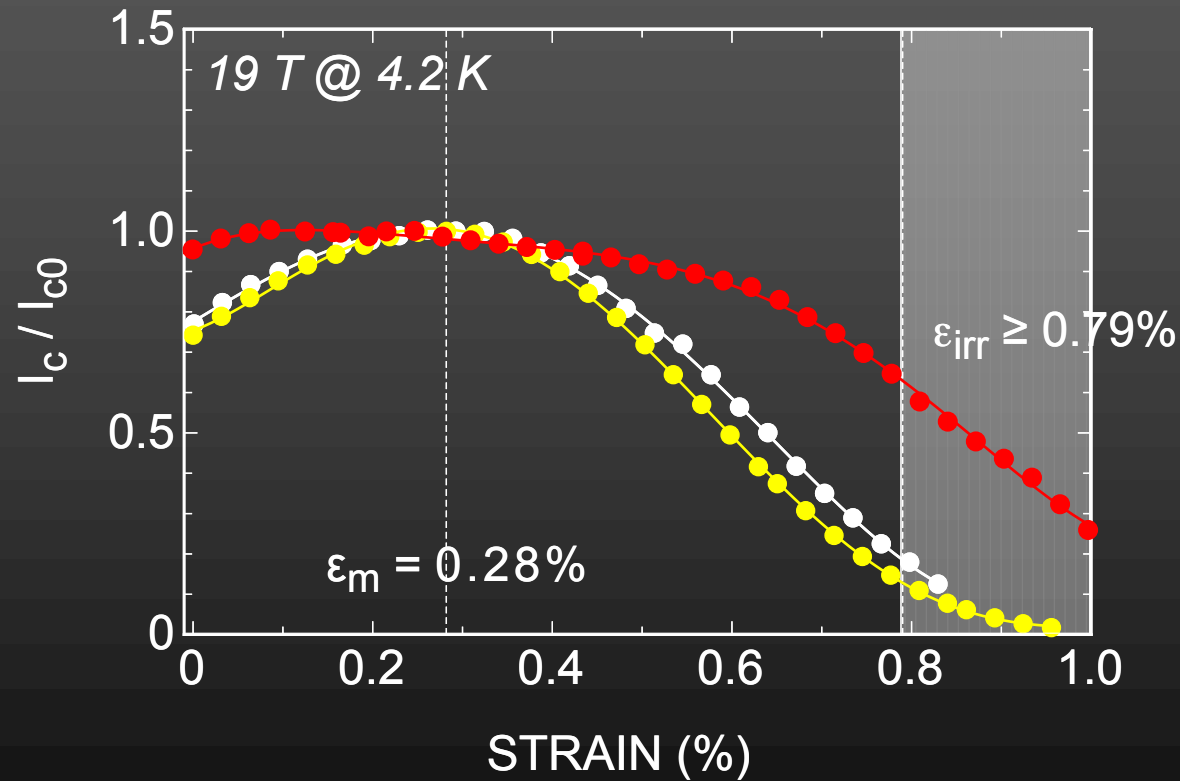
I_c vs. strain measurements

Nb_3Sn bronze wire Bruker EAS NSTT28105Nb23

twist pitch = zero

twist pitch = 50 mm

twist pitch = 5 mm



- I_c maximum for a cubic (not distorted) Nb_3Sn unit cell
- Cubic Nb_3Sn unit cell is independent of axial strain at $\sim 58^\circ$
- Strain dependence of the critical current goes to zero for filaments at $\sim 58^\circ$
- Idem for cables where strain is applied to filaments under an angle of $\sim 58^\circ$

