Progress of TRIUMF β-SRF Facility for Novel SRF Materials

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MOTIVATIONS

PUSHING ACCELERATING GRADIENT OF SRF CAVITY →

Thin Film Approach

- SS Bi-layer
  Low-T baked Nb, N-infused Nb
  Higher-Tc superconductors (Nb_3Sn, MgB_2)
- SIS Multilayer

MEASURE THIN LAYERS (LONDON PENETRATION DEPTH)
~ tens to hundreds of nanometers

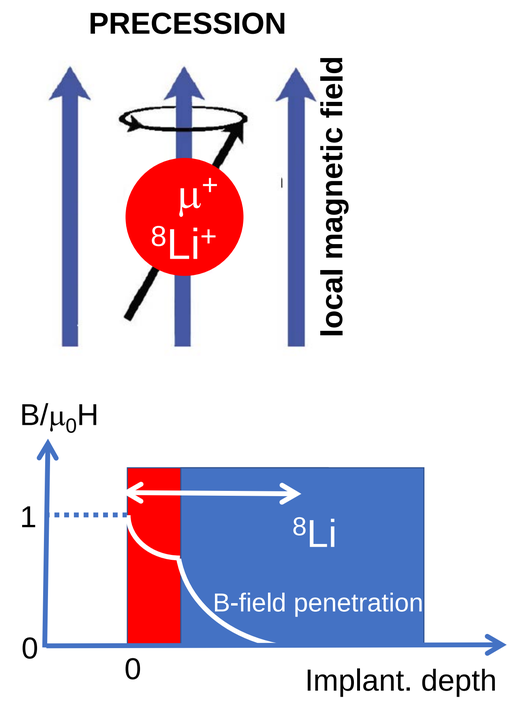


Fig.1. Measurements of penetrating field in the Meissner state with radioactive ^8Li

METHODS

✓ **LOCAL MAGNETIC FIELD MEASUREMENTS**
Beta-decay asymmetry with muons/radioactive ion beam

✓ **DEPTH RESOLVED SURFACE + INTERFACE STUDIES → e.g. Depth dependent London Pen. Depth**
LE-μSR (PSI)
Low-energy radioactive ^8Li → β-NMR (TRIUMF)

× **HIGH PARALLEL MAGNETIC FIELDS**
Not currently available → β-SRF (TRIUMF)

β-SRF PROJECT

LAYOUT OF CURRENT β-NMR BEAMLINE

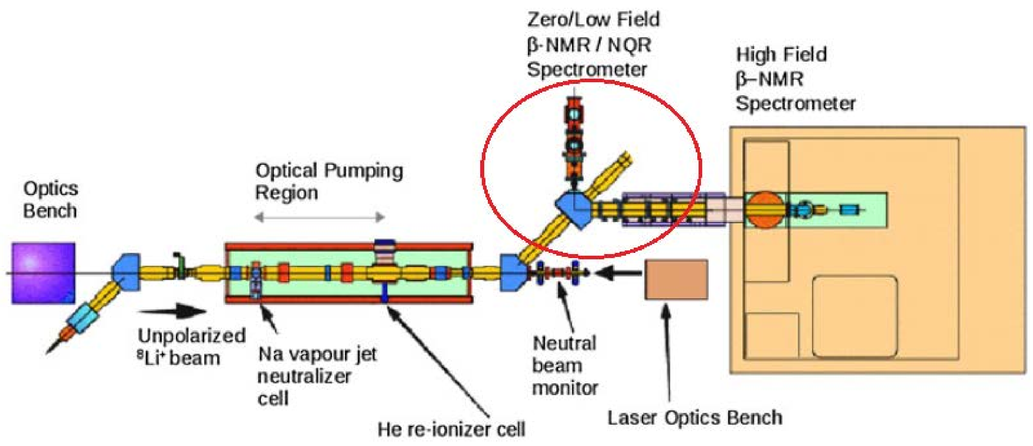


Fig.2. Current existing β-NMR beamline. Circled in red is the location of the β-SRF upgrade [G. Morris, 2014]

UPGRADE

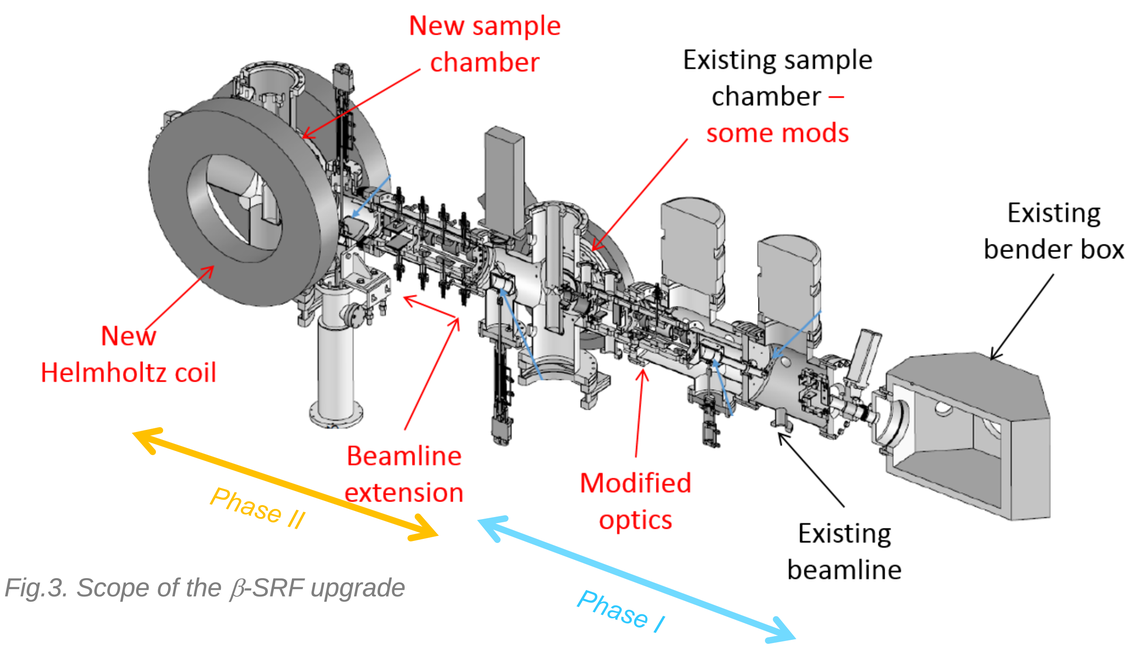


Fig.3. Scope of the β-SRF upgrade

CURRENT UPGRADE

Phase-I: Optics & Diagnostics Modifications

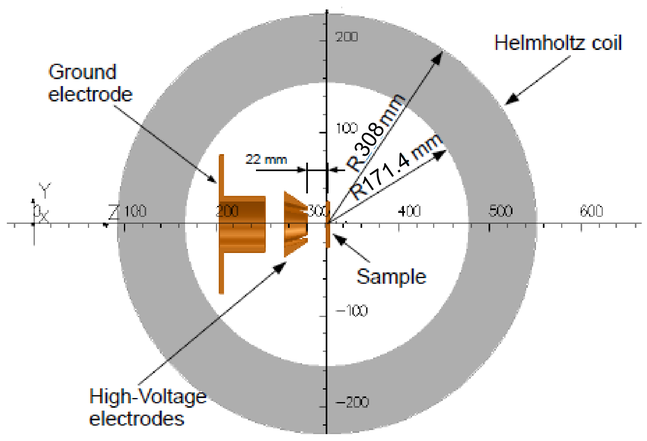


Fig.4. The modified optics and a new four-electrode segmented decelerator used for compensation of the higher magnetic field and deceleration of beam (modified from [S. Saminathan, 2015])

Beamtime with Phase-I modified optics

Beam proposal for depth profile of dirty layer in Niobium approved → ellipsoid samples + in-house heat treatment (induction furnace)

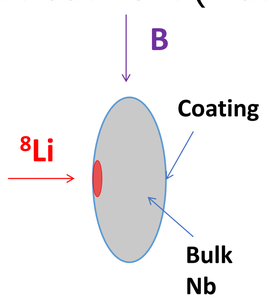
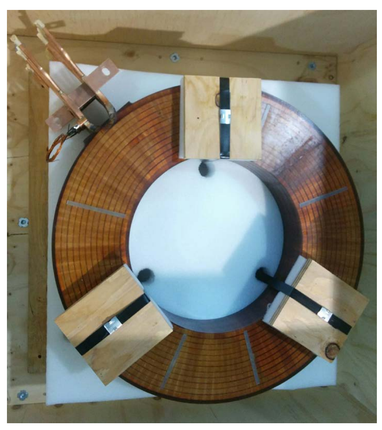


Fig.5. Ellipsoid samples for incoming beamtime with modified zero/low-field β-NMR spectrometer

FUTURE PLAN

Phase-II: Beamline Extension + Higher Fields (200 mT)



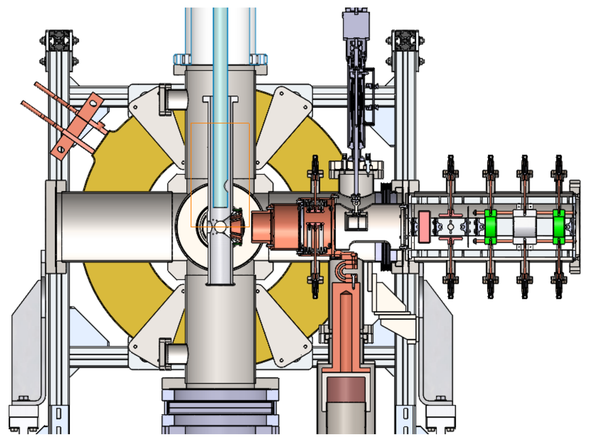


Fig.6. The new 200 mT Helmholtz coil magnet and the support stands/bracket design

CONCLUSIONS

- β-SRF project designed to meet high-parallel field (up to 200 mT) and depth-resolved London penetration depth studies.
- Scope divided into two phases: phase-I upgrade currently ongoing, phase-II continues until June 2020.
- Incoming beamtime for preliminary measurements with ellipsoid SRF samples

Acknowledgement

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