Progress of TRIUMF $\beta$-SRF Facility for Novel SRF Materials

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\section*{MOTIVATIONS}

**PUSHING ACCELERATING GRADIENT OF SRF CAVITY $\to$** Thin Film Approach

- **SS Bi-layer**
  - Low-T baked Nb, N-infused Nb
  - Higher-Tc superconductors (Nb$_3$Sn, MgB$_2$)

- **SIS Multilayer**

**MEASURE THIN LAYERS (LONDON PENETRATION DEPTH)** $\sim$ tens to hundreds of nanometers

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure1.png}
\caption{Measurements of penetrating field in the Meissner state with radioactive $^8\text{Li}$.}
\end{figure}

\section*{METHODS}

**LOCAL MAGNETIC FIELD MEASUREMENTS**

- Beta-decay asymmetry with muons/radioactive ion beam
- DEPTH RESOLVED SURFACE + INTERFACE STUDIES $\to$ e.g. Depth dependent London Pen. Depth
  - LE-$\mu$SR (PSI)
  - Low-energy radioactive $^8\text{Li} \to \beta$-NMR (TRIUMF)

**HIGH PARALLEL MAGNETIC FIELDS**

Not currently available $\to$ $\beta$-SRF (TRIUMF)

\section*{β-SRF PROJECT}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure2.png}
\caption{Current existing $\beta$-NMR beamline. Circled in red is the location of the $\beta$-SRF upgrade [G. Morris, 2014].}
\end{figure}

\section*{CURRENT UPGRADE}

**Phase-I: Optics & Diagnostics Modifications**

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

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure4.png}
\caption{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]).}
\end{figure}

\section*{FUTURE PLAN}

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

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure6.png}
\caption{The new 200 mT Helmholtz coil magnet and the support stands/bracket design.}
\end{figure}

\section*{CONCLUSIONS}

- $\beta$-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

\section*{Acknowledgement}

This work is funded by NSERC (Natural Sci. and Eng. Research Council) and NSERC/UBC IsoSim Program