The advanced methods and surfaces needed for next-generation SRF cavities that enable game-changing reduction of cooling power, higher temperature operation, and higher accelerating fields for lower cryogenic system costs, energy sustainability, and simpler refrigeration.

### TARGET DATES

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<th>OBJECTIVES</th>
<th>DELIVERABLES</th>
<th>APPLICATIONS</th>
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<td><strong>Advanced SRF materials growth:</strong> Develop improved growth methods and understand the impact of realistic (non-ideal) surfaces on performance</td>
<td><strong>New and improved growth methods and alternative materials for increased cavity efficiency and operating temperature</strong></td>
<td><img src="image" alt="SEM image of a high-quality Nb$_3$Sn film, showing individual grains." /></td>
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<td><strong>Multi-layers and inhomogeneous layers:</strong> Increasing RF performance via surfaces by design</td>
<td><strong>Optimized inhomogeneous surface layers for increased cavity efficiency and increased accelerating fields</strong></td>
<td><img src="image" alt="Multilayer surface with 100nm ALD NbTIN layer on niobium substrate." /></td>
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<td><strong>Higher efficiency and higher fields:</strong> Demonstrate higher RF performance in proof-of-principle SRF cavities and study RF superconductivity under extreme conditions</td>
<td><strong>Surfaces from non-Nb at 20 MV/m with cooling power &lt;1.5 kW/(active meter), corresponding to a 10x reduction</strong></td>
<td><img src="image" alt="Compact Nb$_3$Sn coated SRF cavity with conduction cooling for stand-alone operation." /></td>
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<td><strong>Surfaces capable of sustaining higher accelerating field with ultra-high efficiencies, and surfaces approaching 400 mT.</strong></td>
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