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Fri-Af-Po.08-05: Investigation of the relationship between RRR degradation from Rutherford cabling and facet dimensions at the edge of a cable by cross-sectional metallography

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Superconducting wires undergo large plastic deformation during manufacturing of Rutherford cables, especially at the cable edges. Previous studies on Restack Rod Process (RRP) Nb_3Sn wires have shown that the position of the strands in the cable and the orientation of the subelement stack, with respect to the main rolling direction during cabling, are affecting the amount of plastic deformation to which individual subelements are subjected. Subelements with damaged niobium diffusion barriers lead to tin diffusion into the copper matrix during heat treatment and a reduction of the residual resistivity ratio (RRR). For the High-Luminosity Upgrade of the Large Hadron Collider, more than one hundred Rutherford cables were manufactured at Lawrence Berkeley National Laboratory. In-line imaging of all four sides of the cables were acquired to assess cabling deformation and more by measuring the dimensions of all facets on the minor and major edges. RRR measurements at the cable-edge kinks and the straight sections of individual extracted strands were also performed to assess cabling-induced performance degradation. This study is building on this historical data to advance our understanding of the relationship between facet size and RRR degradation in Nb_3Sn RRP wires during cabling. Cross-sectional metallography at the kink of extracted strands is used to study differences in microstructures after heat treatment for wires with different RRR values and facet sizes.

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