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Status of the Phase Reference Line for the European Spallation Source

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The required phase synchronization for the European Spallation Source proton linac LLRF and Beam Diagnostics systems is: 0.1° for short term (during 3.5 ms pulse), 0.1° for long term between adjacent outputs, and 2.0° for long term (hours to days) between any two points at both frequencies of 352 MHz and 704 MHz. The phase reference distribution system consists of a Phase Reference Line (PRL), which is a fully passive system based on a single 1-5/8" coaxial rigid line installed at the tunnel ceiling above the beamline and supporting systems installed in the ESS Klystron Gallery Hall. The PRL was designed to distribute both reference frequencies from a Master Oscillator to 56 tap points in the tunnel. Each tap point has several (3 or 6) signal outputs, giving 294 of the total output number. The length of the PRL is around 580 meters. The entire PRL is temperature stabilized (± 0.1 deg C) and includes an inner-line gas pressure stabilization to assure synchronization accuracy. This contribution covers the concept of the PRL, technical assumptions, the design, the status of installations, and current performance test results.

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