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## Innovative neutron guide replacement at the Institut Laue Langevin: The H24 (thermal) and H15 & H16 (cold) neutron guides.

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High-performance instrumentation projects rely on high-performance neutron guide infrastructure. During the extended reactor outage (2021 –2023) we have replaced the H1-H2 beam-tube, in-pile optics and three new guides with innovative geometries to provide intense neutron beams to new or upgraded instrumentation. The upgraded IN5 (2019) time-of-flight spectrometer and its new elliptically focussing H16 cold-neutron guide demonstrates the best-use of phase-space and boasts huge gains in intensity, in particular at shorter wavelengths, while focussing onto much smaller samples.

The new H24 thermal-guide uses a rather elegant concept of a common-curved-trumpet exploiting two radii of curvature to naturally diverge and expand the guide to be split into two distinct branches with four dedicated end-of-guide positions for instrumentation.

The new H15 cold- guide has a rather complex opposing-curved expanding section, referred to as ‘the trumpet’ serving two important purposes: The first is to spatially expand the neutron guide allowing the guide to be split into multiple individual guide branches and dedicated end-of-guide beam positions. The second is that the opposing curve leaves a ‘fingerprint’ correlation between the divergence profile and spatial position at the end of the trumpet. Importantly, this allows guide branches to be more widely separated in angle therefore allowing space for substantially more instrumentation down-stream.

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