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Precision by design: The eight-piece quadrupole method for high-precision pole tip placement

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The 8-piece quadrupole method, developed and patented by the Advanced Photon Source (APS) for APS-Upgrade magnets, is a manufacturing and assembly technique in which magnet pole tips and core quarters are machined separately to standard machining tolerances and bolted together during assembly. The APS-U was able to avoid traditional methods of high precision machining to achieve high positional accuracy, which is costly, difficult and time consuming. By using standard machining tolerances and the 8-piece quadrupole method, magnets were assembled to precise mechanical tolerances, ensuring the resulting magnetic field met specification. This approach allowed mechanical assembly, rather than precise machining, to drive the magnetic field performance. The modular design allowed for fine adjustments, ensuring the pole tip and core could be manipulated to achieve the prescribed tolerance. As a result, APS-U production using the 8-piece method met the required quality standards.

Footnotes

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