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Challenges and Constraints in Designing a High Gain Single-Pass Amplifier for Optical Stochastic Cooling[1] MATTHEW ANDORF, Northern Illinois University, VALERI LEBEDEV, Fermi National Accelerator Laboratory, PHILIPPE PIOT, Northern Illinois University And Fermi National Accelerator Laboratory, JINHAO RUAN, Fermi National Accelerator Laboratory — Optical Stochastic Cooling (OSC) is a proposed method to reduce the equilibrium energy spread and emittance of the beam in a particle accelerator. In OSC light generated in a pickup undulator is amplified and transported downstream to an identical kicker undulator. A magnetic bypass chicane between the pickup and kicker adjust the arrival time of each particle with its own radiation in such a way as to provide a corrective kick. The bypass chicane can only provide a few millimeters of optical delay for the amplification system and thus puts a strict constraint on the design. Fermilab is currently working towards a proof-of-principle OSC experiment with electrons at the Integrable Optics Test Accelerator (IOTA) that includes a passive test of OSC (no amplification) and an active test with an amplifier of 7 dB. For OSC to work in a hadron collider the amplifier gain must be increased to 20-30 dB, operate at a relatively large duty cycle of $\sim$ 1-10% and amplify pulses on the order of a few ns. Here we consider the challenges of reaching such high gains in a single pass amplifier with the above constraints.

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