

# Assembling, Installing and Integrating LRUs for SG-III Laser Facility

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**Abstract:** As National Ignition Facility (NIF) and Laser Mégajoule (LMJ), SG-III, which is an emblematical high-power laser facility, is constructed to create fusion conditions with controlled laboratory conditions. Its 351nm output of 48 beams is frequency converted to produce 0.18 MJ energy and physical experiments require the ability to precisely align and focus pulses with single-beam energy up to 3.75 KJ onto a millimeter-sized target with a precision of 30  $\mu\text{m}$  (RMS). Within the 48 beamlines of SG-III Laser Facility, there are over 1800 large (40 $\times$ 40 cm) optical components, including laser glass, mirrors, lenses, and polarizers. These optics are held in large opto-mechanical assemblies called line replaceable units (LRUs). Each LRU has strict specifications with respect to cleanliness, alignment and wavefront so that once activated, each SG-III beamline will meet its performance requirements. SG-III LRUs are assembled, tested, and refurbished in on-site cleanroom facilities. The assembled LRUs weigh up to 800 kilograms, and are about the size of a phone booth. They are transported in portable clean canisters and inserted into the SG-III beampath using robotic transporters. This plug and play design allows LRUs to be easily removed from the beampath for maintenance or upgrades. Commissioning of the first SG-III bundle (A6), an activity known as SG-III Early Light (SEL), has validated LRU designs and architecture, as well as demonstrated that LRUs can be assembled and installed as designed. Furthermore, it has served to develop key processes and tools forming the foundation for SG-III's long-term LRU production and maintenance strategy. As we look forward to building out the rest of SG-III, the challenge lies in scaling up the production rate while maintaining quality, implementing process improvements, and fully leveraging the learning and experience gained from SEL. This paper provides an overview of the facilities, equipment and processes used to assemble, install and integrate LRUs in SG-III.

**Keywords:** Large optical components, Line Replaceable Units, Assemble, Installation, Alignment