

The linewidth of individual longitudinal modes in Fig. 8 have been investigated using both a delayed self-heterodyne interferometer (DSHI) [16] and a scanning Fabry-Perot resonator with a full spectrum range of 402.5 MHz. The resolution of the DSHI is of the order of 100 KHz while that of the Fabry-Perot resonator is of the order of 1 MHz. In both cases, we were unable to resolve the linewidth under the above limitation. Using the theoretical model derived in Ref [17], we calculated that the linewidth of individual laser modes are close to that of the fiber laser. A precise measurement will be conducted in the future using a different heterodyne measurement approach [18] which involves a second frequency stable tunable laser source.

4. Conclusion

In summary, we have described a MOPA configuration macropulse laser system that provides MW peak power at 355 nm. The seed laser is based on a direct modulation of a single frequency light from a fiber laser with 5 KHz linewidth. Using an adaptive bias control, the seed laser is capable of generating transform-limited picosecond pulses with high contrast ratio, flexible pulse width, and small timing jitter. The Continuum customized multi-stage burst mode laser amplifier enables high gain, effective ASE suppression, and uniform macropulse shaping with tunable macropulse durations and repetition rates. The laser demonstrated 66-ps/402.5-MHz output pulses with 1.08 MW peak power at 355 nm for the 5- μ s/10-Hz macropulse setting. The laser output has a very stable spectrum with the individual mode linewidth below 100 KHz. The mode-hopping free narrow linewidth light is critical for the beam recycling optical cavity designed for mitigation of the average laser power requirement [19]. Although the laser parameters are optimized for the application of laser-assisted H⁺ beam stripping at the Spallation Neutron Source, the designed system has a broad flexibility in terms of pulse width and repetition rate (of both macropulses and micropulses) and therefore can be used in many other applications.

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