Investigations of wavelength-tunable nanosecond laser pulse compression characteristics by SBS technique

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Pulse compression techniques used in the ultrafast time regime cannot be applied to pulses with ns time duration. Outside of the optical resonator, pulse compression from several ns to sub-ns can be achieved only by utilizing nonlinear light-matter interactions such as the Stimulated Brillouin scattering (SBS).

We investigate pulse compression characteristics of moderate energy (~mJ), wavelength-tunable ns pulses from a Ti:Sapphire laser (15 Hz, 15 ~ 30 ns, 10 ~ 30 mJ, 680 – 1000 nm) operating in the gain-switching mode. Nanoseconds duration pulse compression devices could find applications in material processing, resonance Raman spectroscopy (RRS), etc.

In our previous report [1], we have described and demonstrated a variable length, compact (folded) SBS amplifier cell. In this report we will present and discuss first experimental results describing the pulse compression characteristics in different media (FC-72, FC-40 fluorinates) in terms of the energy conversion efficiency, pulse compression factor, and brightness enhancement using the new SBS amplifier cell.

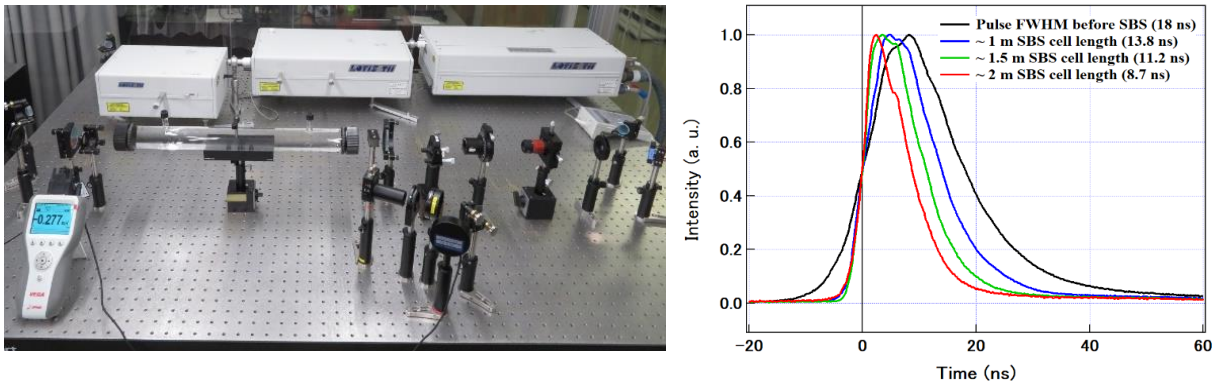

Fig. 1. (Left) Experimental setup of the pulse compressor; (Right) Pulse compression characteristics of the SBS compressor (FC72) at ~ 800 nm for 1, 1.5 and 2 m effective lengths of the SBS amplifier cell.

In Fig. 1, the experimental setup, and the pulse width dependence on the effective length of the SBS amplifier cell are presented. Although the pulses centered at 800 nm could be compressed from 18 to 8.7 ns, the SBS energy conversion efficiency has decreased to ~ 30%. Our analysis shows that the main reason for this could be the short coherence length (L_c) of the pump pulses (bandwidth ~ 15 GHz, L_c ~ 2 cm). Similar results were obtained also at 780 and 820 nm, respectively. In our forthcoming experiments, we will reduce the linewidth of the pulses by employing an etalon inside the resonator. We hope to increase the coherence length of the pulses and improve both the pulse compression factor and the energy conversion efficiency.

[1] H. Chosrowjan, et al. Presentation No.: 24p-P05-5 第 69 回応用物理学会春季学術講演会

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