A laser range finder (LRF) is one of the most reliable and commonly used sensors for the localization of a mobile robot. Many studies have shown that localization schemes using LRFs satisfy practical requirements. However, it is still a challenging problem to employ LRF-based localization schemes in environments surrounded by transparent or reflective objects such as glass walls or mirrors. Because the LRF is an optical sensor, range measurements are affected by various phenomena at the glass wall, such as diffuse reflection, specular reflection, and penetration. Hence, LRF measurements are erroneous in environments surrounded by glass walls. This paper proposes a new strategy for localization using the LRF in a glass-walled indoor environment. Based on the reflective characteristics of a laser beam, we designed a novel scan matching algorithm under the consideration of all candidate distances that can be measured in the direction of the glass wall. Experimental results show that the proposed method can significantly improve the local tracking performance of a mobile robot in glass-walled environments.