

Fig. 2 (color online) GUI of ELOG.

## 6 - 5 Preliminary Study in ms-level Range Verification of Carbon Therapy

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The well-defined carbon ion beam Bragg peak is the main advantage for using a carbon ion beam for precise particle therapy. However, this advantage cannot be fully exploited due to uncertainty in the particle distribution range. To solve this problem, we build a secondary particle intensity (SPI) monitor system, which is completed a CeBr<sub>3</sub> detector array, an integral ionisation chamber (IC), and a data acquisition (DAQ) system, as shown in Fig. 1(a). The range feedback of the SPI system is completed at the millisecond level. The probability distribution of the secondary particles produced by the primary carbon beam is different for different irradiation ranges. The intensity distribution of secondary particles obtained with the CeBr<sub>3</sub> array can be used to invert the irradiation depth of the carbon ion beam by establishing a mapping between the probability distribution of the secondary particles and the irradiation of the carbon ion beam. Currently, this SPI system is capable of feeding a range of carbon ions with an accuracy of  $0.57 \text{ mm} \pm 0.33 \text{ mm}$  and a maximum deviation of 1.048 mm for every 44 ms, as shown in Fig. 1(b).

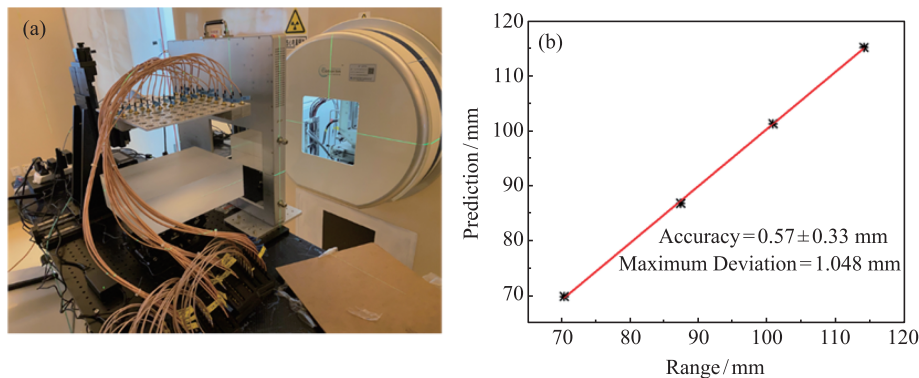


Fig. 1 (color online) (a) Diagram of the secondary particle intensity (SPI) monitor system, (b) Experimental range verification accuracy diagram of SPI system in every 44 ms.