# Optimization of laser-driven monoenergetic ion acceleration using Au-mounted on large-area suspended graphene

16pB111-12

N. Tamaki [A], T. Minami [A, B], S. Suzuki [A], T. Taguchi [A], F. Nikaido [A], R. Kitamura [A], K. Sakai [C], Y. Abe [A, D], C. M. Chu [E], Y. T. Liao [E], W. Y. Woon [E], L. N. K. Döhl [F, G], N. Woolsey [G], Y. Arikawa [H], A. Yogo [D], A. Morace [D], Y. Sakawa [D], H. Habara [A, D], M. Kanasaki [H], A. Tokiyasu [I], H. Kohri [J], S. Kodaira [K], T. Hayakawa [B], Y. Fukuda [B], Y. Kuramitsu [A, B, D]

## Background

- Laser-driven quasi-monoenergetic high-energy ion beams can be used for various applications such as cancer therapy and laser fusion.
    - A thinner target generates energetic ions more efficiently.
    - A double-layer target combining high-Z and low-Z materials enhances the monoenergeticity of ion beams.
- We have developed a nm-scale double-layer target combining Au and large-area suspended graphene (LSG).

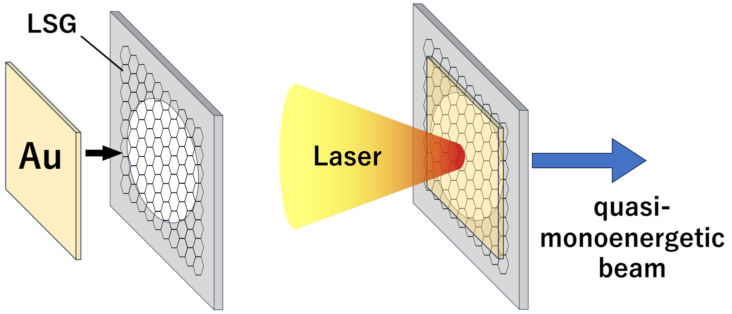


Fig 1. Au-mounted LSG target

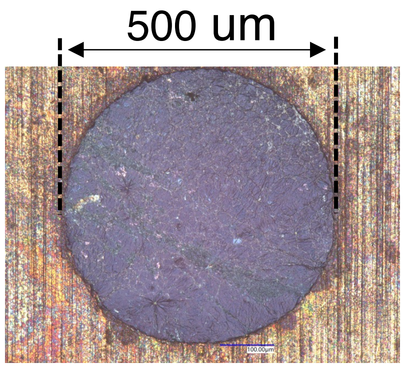


Fig 2. A microscope image of 5 nm Au + 4L-LSG

## Research result

- Using PIC simulations, we optimize Au thickness, LSG thickness, and the laser irradiation surface (Au side or LSG side) based on proton energy and monoenergeticity.
- Under optimal conditions, the proton beam has an energy spread $\Delta E$ of 4.28 MeV and an average energy $E_{\mathrm{peak}}$ of 106 MeV.
    - Optimal Au thickness increases proton energy.
    - Thinner LSG and laser irradiation from the LSG side improve monoenergeticity.

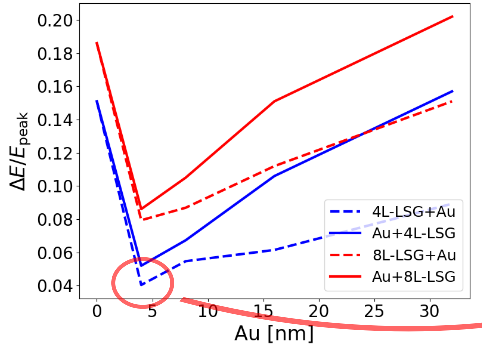


Fig 3. $\Delta E/E_{\mathrm{peak}}$ vs. Au thickness (The left material in the legend is the laser irradiation surface.)

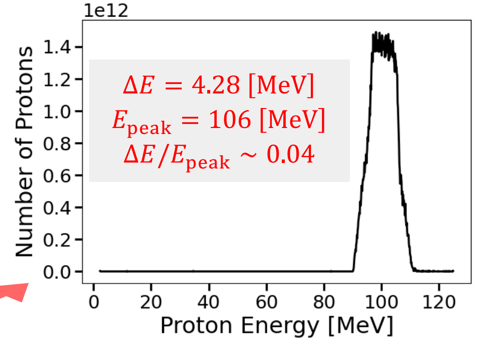


Fig4. Proton energy spectrum at 4L-LSG + 4 nm Au