INTER-UNIVERSITY RESEARCH INSTITUTE CORPORATION
HIGH ENERGY ACCELERATOR RESEARCH ORGANIZATION

THPS038

STUDY ON A NOVEL LASER ABORT SYSTEM FOR SuperKEKB

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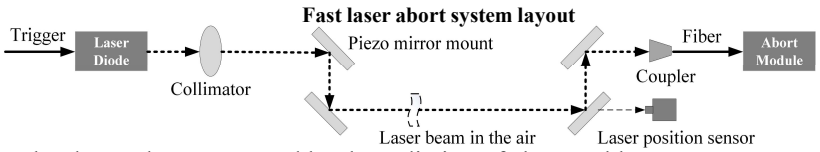
INTRODUCTION

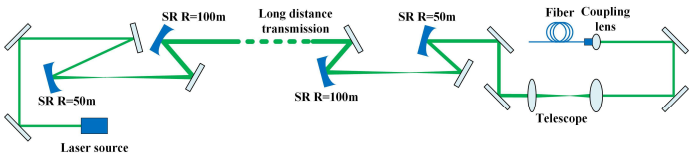
- To ensure stable and continuous commissioning of SuperKEKB, the machine protection system (MPS) plays a crucial role in safeguarding the accelerator's hardware from damage caused by beam loss.

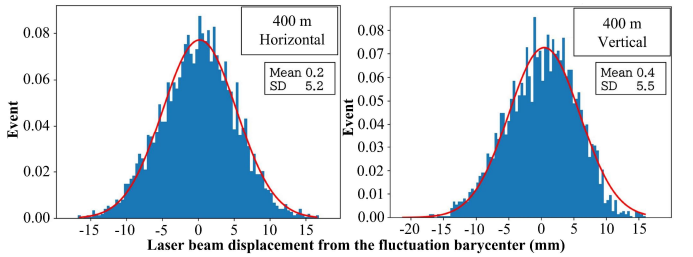


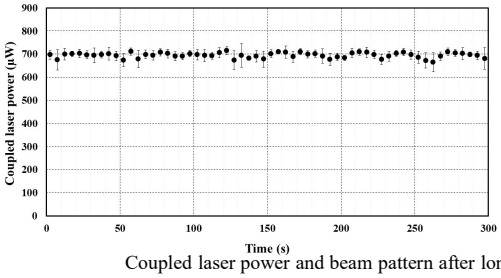
- The response time of the MPS is a critical factor in mitigating hardware damage caused by the radiation of abnormal beams.
- A novel laser abort system is investigated for the SuperKEKB accelerator to reduce the response time of the beam abort trigger by using a laser as trigger signal transmission through free space
- Compared to the traditional method, the transmission speed is 1.5 times faster than that in optical fiber.

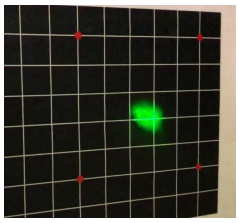
EXPERIMENTAL SETUP AND RESULTS

Spherical Mirror Telescope Setup





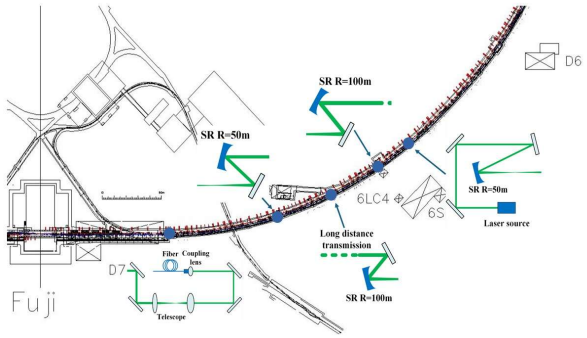


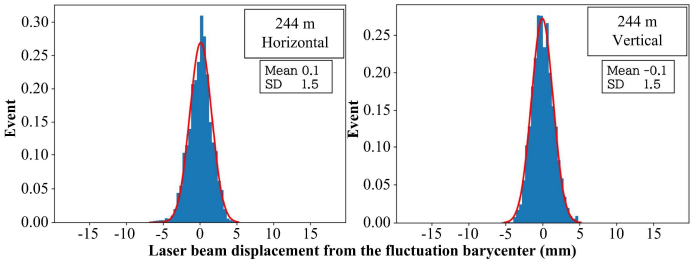


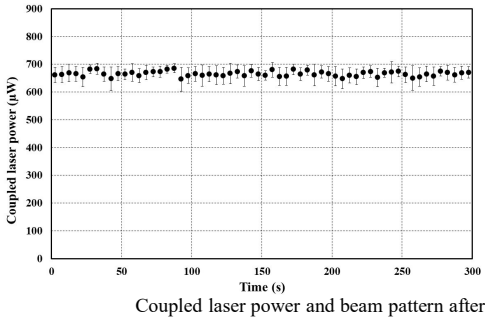
Coupled laser power and beam pattern after long distance transmission

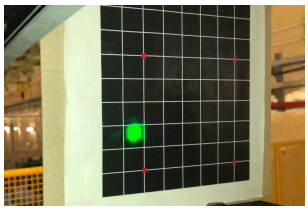
- ~700 μW laser power is coupling after 400 m transmission via air by two sets of telescope with spherical mirrors
- Due to air turbulence and temperature instability in the Linac klystron gallery, the beam stability perfect but the laser beam pattern is improved
- Compared to the previous design, the long-distance laser path adjustment is much easier, so this configuration has been decided to be used in the KEKB tunnel experiment

244 m Transmission at KEKB Tunnel



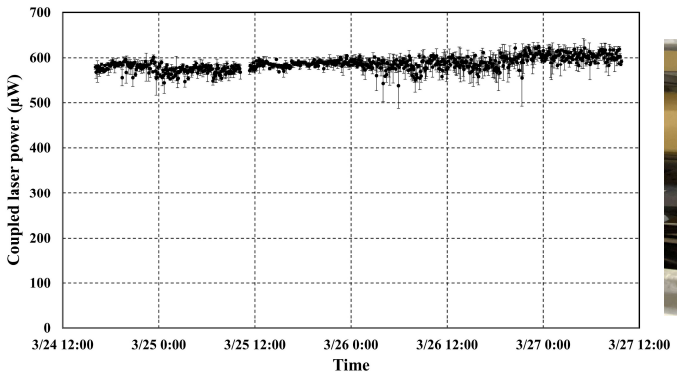






Coupled laser power and beam pattern after long distance transmission

- ~680 μW laser power is coupling after 244 m transmission via air by two sets of telescope with spherical mirrors
- Thanks to the better temperature stability in KEKB tunnel, the laser pointing stability is much better than the results tested in Linac gallery. Laser beam pattern is good enough for simple laser coupling
- Due to the circular layout of the SuperKEKB accelerator, spherical reflective mirrors can be used as both lenses and reflectors simultaneously for controlling the laser beam size and adjusting the laser transmission path. This configuration reduces transmission loss with fewer optical components
- This novel design achieves trigger signal transmission that is ~420 ns faster than the current abort system structure



The 64-hour laser power history was recorded in the ground power supply building