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### Fiber optical current sensor (FOCS) for plasma current on EAST tokamak

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Plasma current is an essential parameter for tokamak operation. Precise measurement of the plasma current is critical to plasma control. Traditionally, plasma current is measured by Rogowski coil and integrator system, the output signal from Rogowski coil is sent to integrator [1]. However, the time-depend drift of integrator cannot be neglected when EAST demonstrating long-pulsed plasma operations. Fiber optic current sensor (FOCS), based on Faraday Effect [2], is one of good choice to measure the plasma current in steady-state discharge. The drift results of 100 s test of Rogowski coil and FOCS can be clearly shown in Fig.1, the drift of Rogowski coil is above 15 kA in 100 s, as for FOCS there is almost no time-depend drift.

A fiber optic current sensor (FOCS) has been successfully installed on EAST tokamak. The measuring range is 0-1 MA. The sensing optical fiber is installed inside EAST vacuum vessel, and the signal process system is outside the vacuum vessel. In order to guild the optical fiber out of EAST vacuum vessel, we have developed a novel flange, which has no effect on the optical fiber performance with leakage rate less than  $1 \times 10^{-10}$  Pa m<sup>3</sup>/s. The test work of sensing optical fiber has been implemented in different environments, such as high temperature, Electromagnetic Interference (EMI) and radiation (by neutron) tests. From the mess measure results of different range plasma current shots, FOCS is performing better than Rogowski coil.

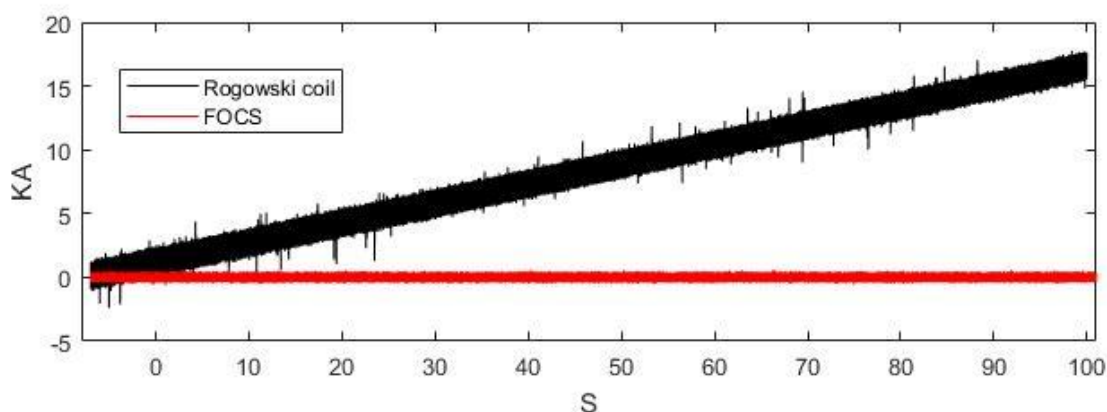


Figure 1 The result of 100 s test between Rogowski coil and FOCS

#### References

- [1] B. Shen, W. Xi, J. Qian, Y. Sun, H. Fan, The magnetic field configuration measurement on east tokamak, *Fusion Engineering and Design* 84 (1) (2009) 19 -23.
- [2] K. Bohnert, H. Brandle, M. G. Brunzel, P. Gabus, P. Guggenbach, Highly accurate fiber-optic dc current sensor for the electrowinning industry, *IEEE Transactions on Industry Applications* 43 (1) (2007) 180-187.

Figure 1

Note: Abstract should be in 1 page.