Status of TRANSP Code at ASIPP and the Future Plan

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On behalf of the TRANSP users at ASIPP

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# Outline

- **Status of TRANSP code at ASIPP**
  - **Hardware --- Shenma cluster**
  - **TRANSP code and TRANSP users**
- Application
- Future need and plan

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Local Cluster 'Shenma' is Recently Upgraded

- **129 computing nodes, 2688 cores, 80 TFlops theoretical computing capacity**
- **180 TB lustre parallel file storage system**
- **About 300 registered users and ~100 active users**
- **220,000 jobs and more than 10 million CPU-hours in 2016**
  - **In support of EAST, CFETR, …**
- **Scientific codes on SHENMA**
  - **TRANSP, IMFIT, GYRO, BOUT++, M3D, SOLPS, …**
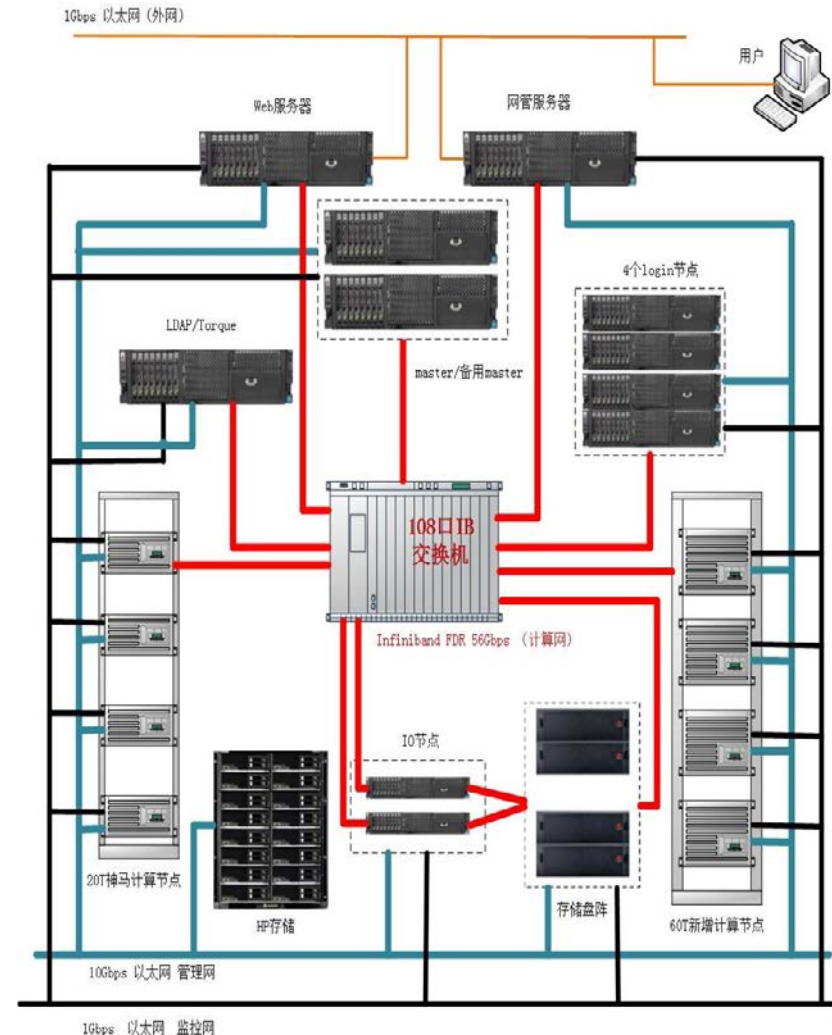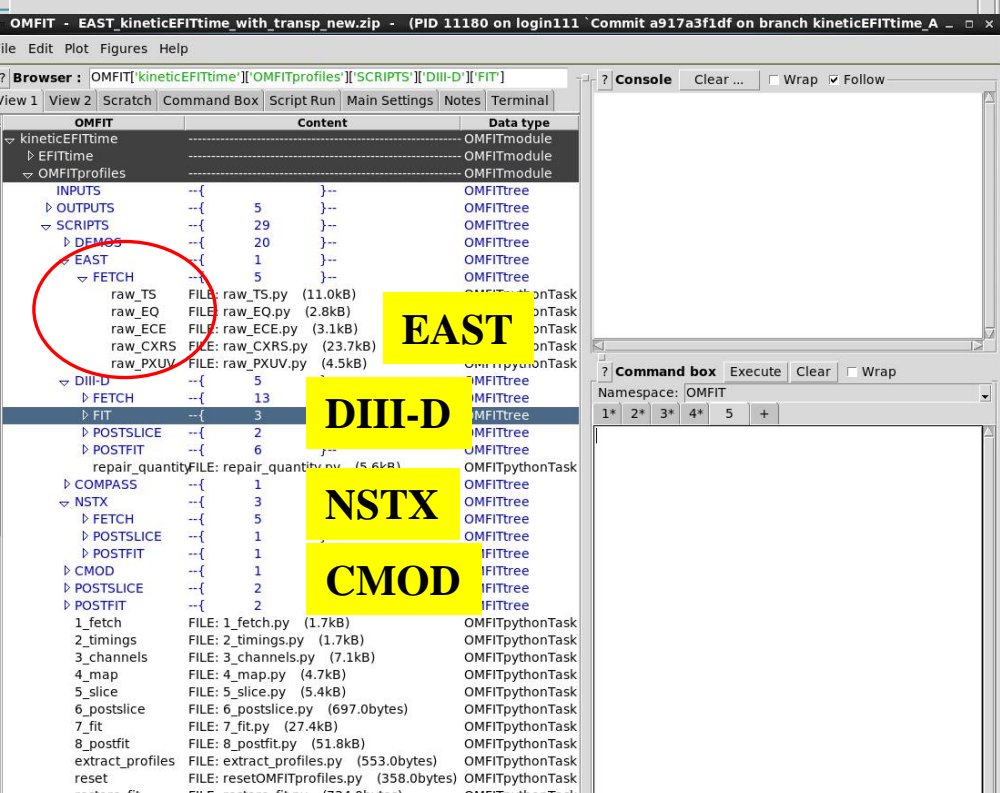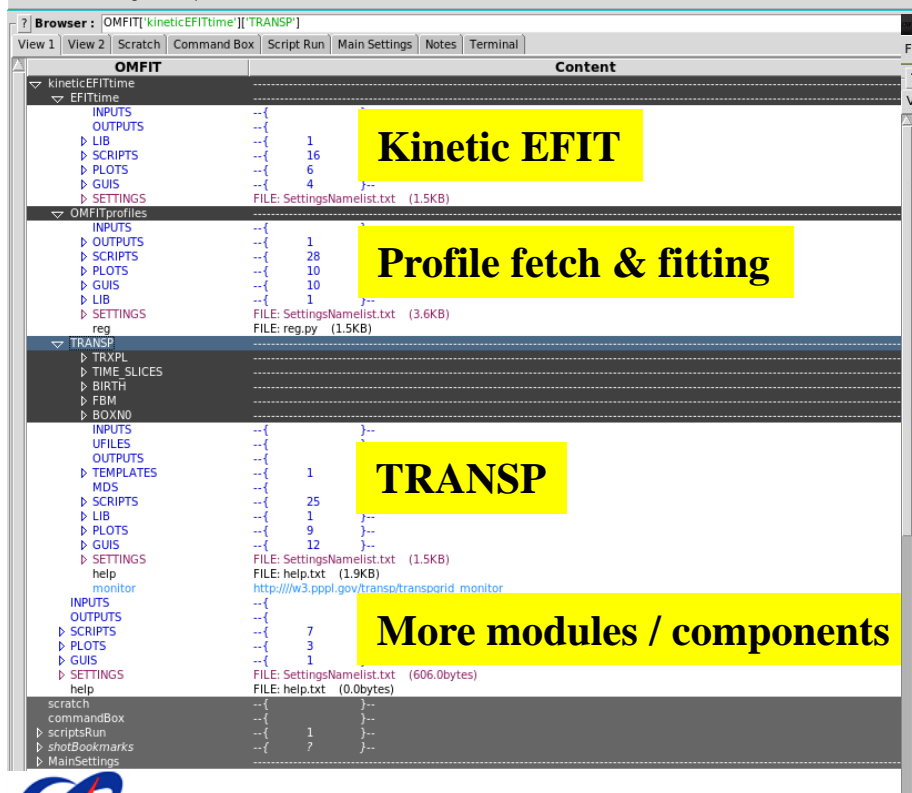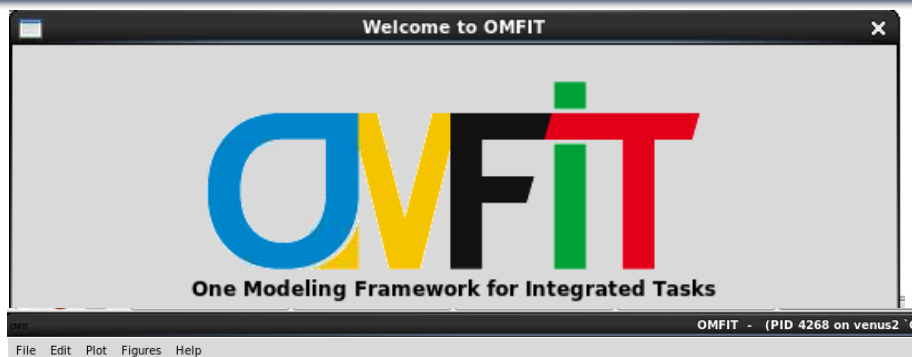
Status of TRANSP Code and Users on Shenma

- **Three versions**
  - **Public: daily use**
  - **Develop: receive update from PPPL**
  - **Backup: backup**
- **Support MPI and multiple-user jobs**
- **Update TRANSP source code via PPPL SVN**
- **Efforts on user promotion**
  - **User training + Q&A**
  - **TRANSP manual in Chinese**
- **47 registered users from domestic and international institutes / universities**
  - **From 33 users in 2015**
- **Total jobs / CPU-hours since 2015**
  - **2810 / 96212**
  - **30% higher**

TRANSP users in local cluster

Two Levels of Users Strategy

- **Common TRANSP user**
  - **In 'transp' group**
  - **Public version only**
  - **Full access of TRANSP computational capacity**
  - **No authorization of TRANSP source code access**
- **TRANSP administrator**
  - **In 'transpadmin' group, supreme to common user**
  - **Update and compile source code**
  - **Manage the three versions**
- **Data access**
  - **Users have their own $RESULTDIR**
  - **Each user can read results from all users**
  - **Each user can only write/delete his/her own results**

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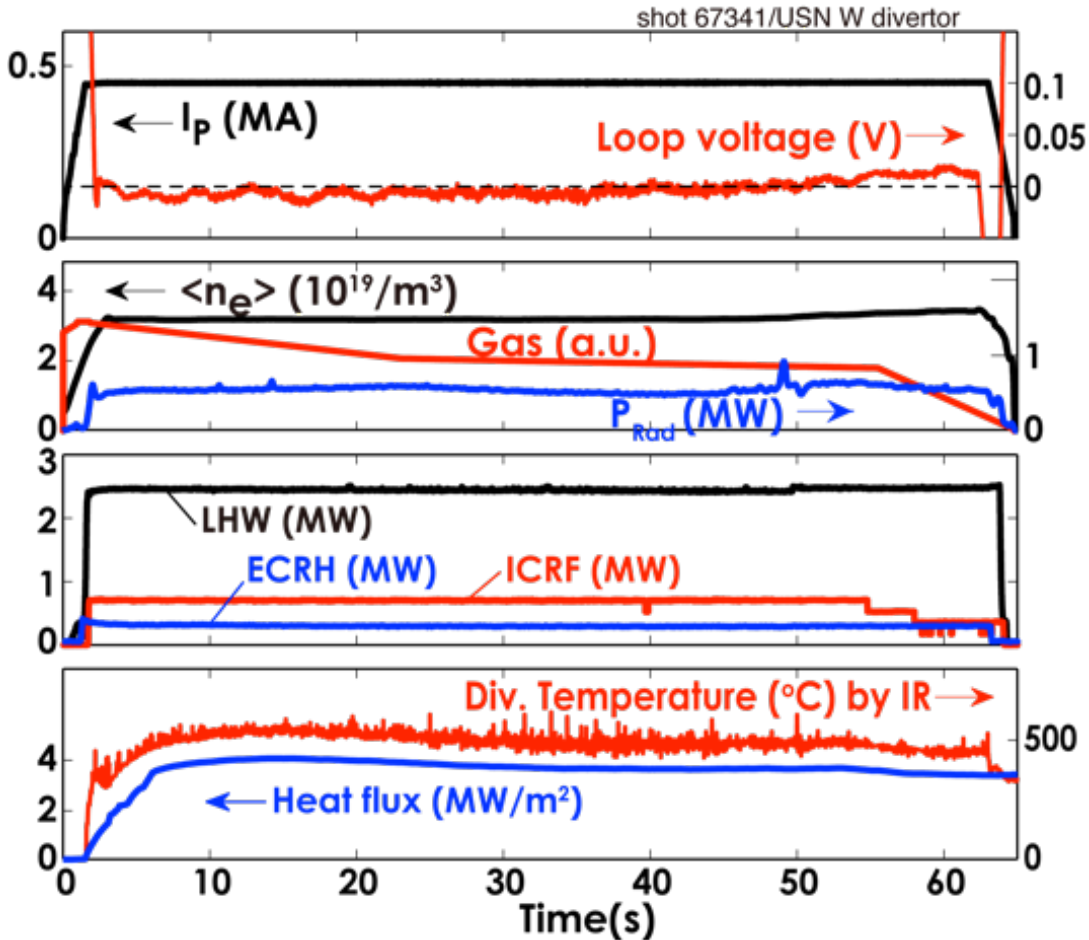# The OMFIT Project with TRANSP is Being Localized on Shenma for EAST

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Experiments on EAST Achieve First H-mode Operation >60 sec with ITER-like Actively Cooled Tungsten Divertor

shot 67341/USN W divertor

- **H-mode phase up to 61 sec**
- **Fully non-inductive operation**
- **Pure RF heating**
- **Good confinement**
  - $H_{98} \sim 1.1$
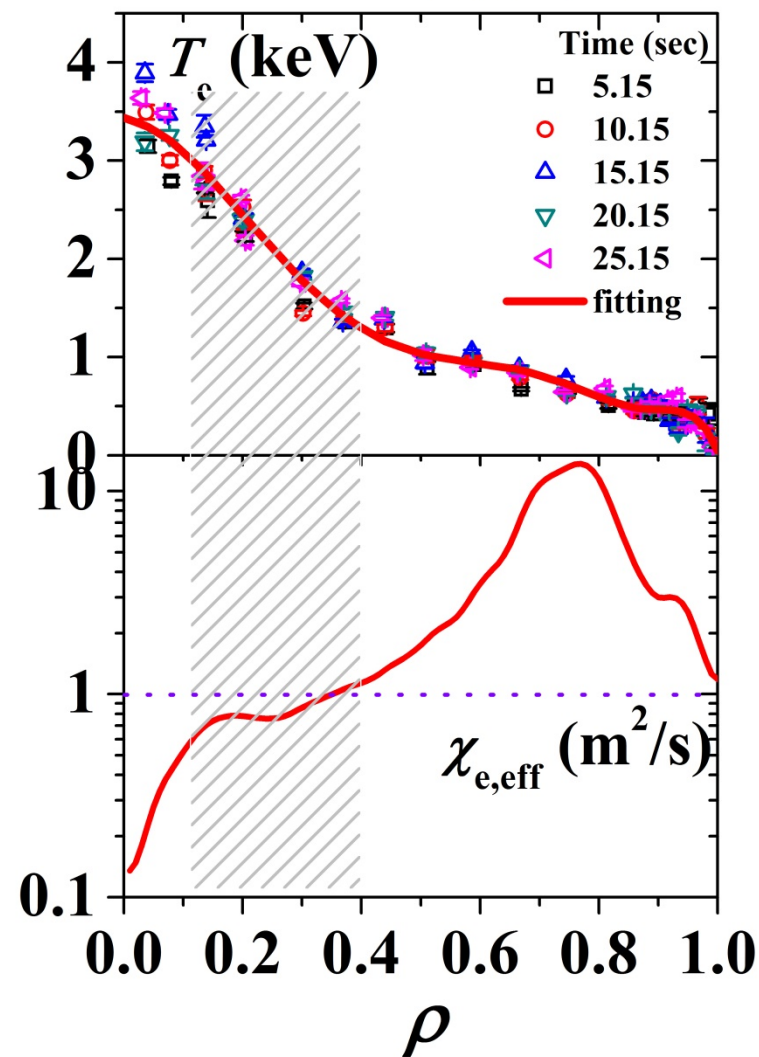

B. Wan, OV/2-2, 26th IAEA FEC, 2016
A. M. Garofalo, EX/4-3, 26th IAEA FEC, 2016
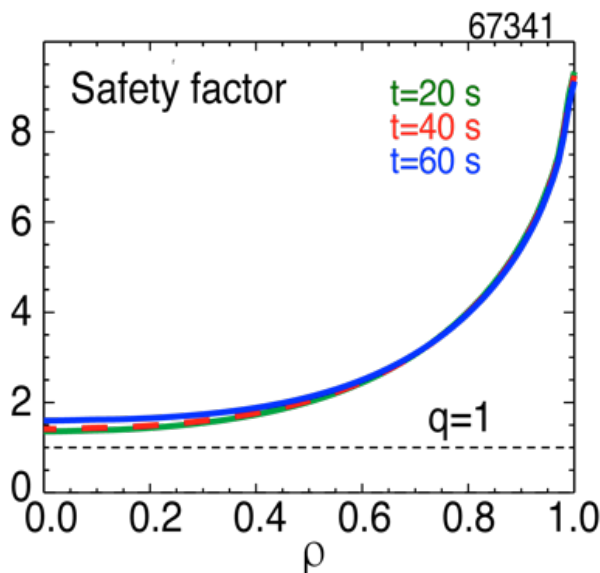S. Ding, invited, 58th APS, 2016

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Core Confinement Is Improved with ITB Feature in T_e Channel in the Fully Non-Inductive Long Pulse on EAST

EAST SN# 66740

- **Peaked T_e profile and improved confinement are stationary**
- **Power balance analysis by TRANSP shows a significantly reduced χ_e in plasma core region**
- **Core T_e profile meets the ITB criterion**
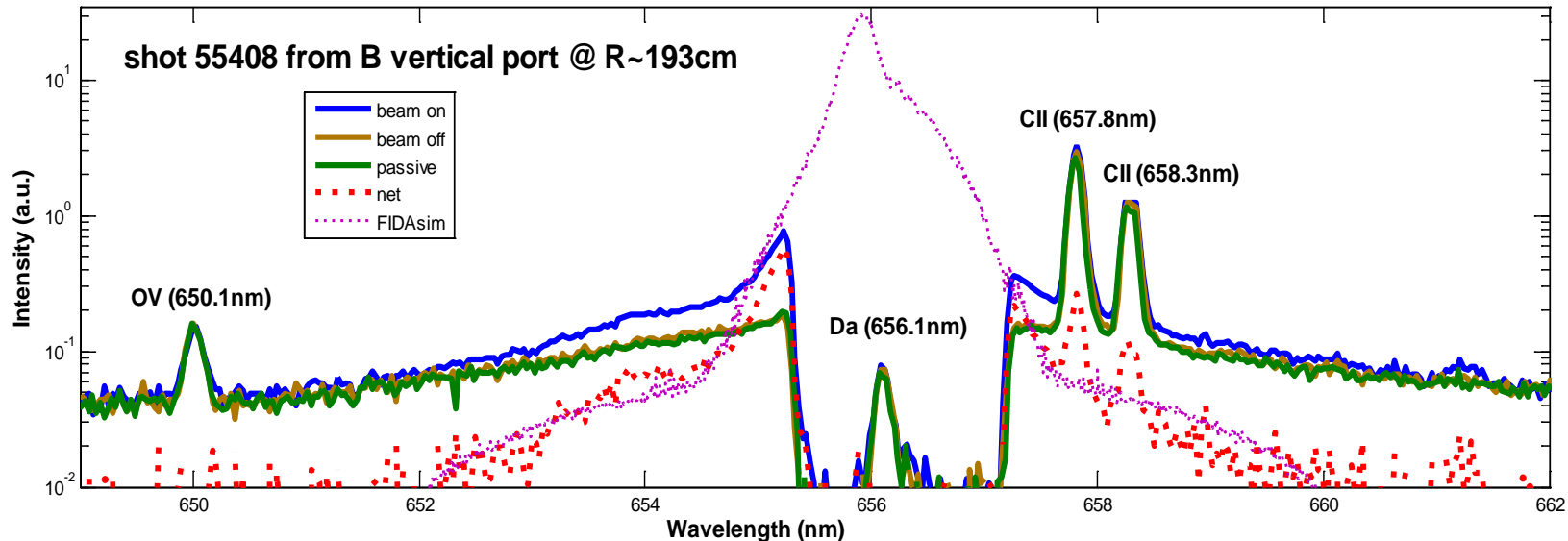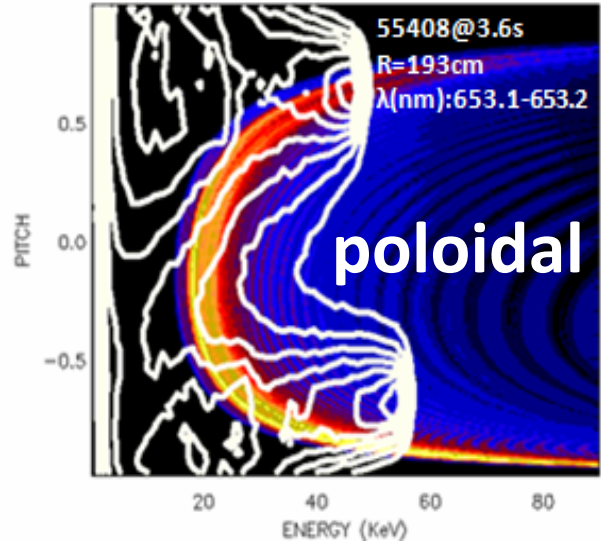 - $\rho_{Te}^*(max)=0.02>\rho_{ITB}^*\sim0.014$

G. Tresset, Nucl. Fusion, 42(2002)520

Broaden q-profile to expand ITB radius and increase confinement

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Validation of FIDA Measurements during EAST Neutral-Beam Heated Plasmas

- **New s-FIDA system is validated in a MHD-quiescent plasmas**
  - Beam ions are neoclassical
  - Beam modulation: 100 ms with 10% duty cycle
- **Kinetic equilibrium at 3.6 sec are used in TRANSP and FIDAsim**
- **TRANSP produces the fast ion distribution functions**
- **The simulated spectrums calculated in FIDAsim are consistent with the measurement**

Fast-ion Distribution Function (F) & Weight Function (W)

55408@3.6s
R=193cm
λ(nm):653.1-653.2

poloidal

shot 55408 from B vertical port @ R~193cm

Legend:
- beam on
- beam off
- passive
- net
- FIDAsim

OV (650.1nm), Da (656.1nm), CII (657.8nm), CII (658.3nm)

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Future Need and Plan

- **The capability of LHCD simulation in dual-antenna dual-frequency scenario (Crucial !)**
  - **LSC → GENRAY+CQL3D**
- **The interaction between RF and neutral beam induced fast ions**
- **OMFIT project with TRANSP for EAST**
- **Control algorithms for EAST**
  - **EAST colleague Dr. Yong Guo may be involved**
- **Between-shot analysis (BEAST)**

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Summary

- **TRANSP provides good opportunity for EAST colleagues to study H&CD, transport, EP, etc.**

- **Numbers of TRANSP users and TRANSP usage is kept growing in EAST**

- **The request of improving LHCD simulation capability is urgent**

- **Further collaboration may happen in two aspects**
  - **Control algorithms**
  - **Between-shot analysis**

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Thank you !