



Status of between-shots TRANSP at KSTAR

H. H. Lee^a, L. Terzolo^a, F. Poli^b, S. Sabbagh^c, J. K. Lee^d, J. S. Park^a,
D. S. Lee^a, J. M. Kwon^a, B. H. Park^a, Y. K. Oh^a, H. Park^a and the KSTAR team

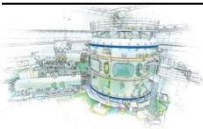
^a*National Fusion Research Institute, Korea*

^b*Princeton Plasma Physics Laboratory, USA*

^c*University of Columbia, USA*

^d*Korea University of Science and Technology, Korea*

jdfm@nfri.re.kr



Applications of TRANSP for KSTAR

1. Particle, heat and momentum transport analysis of the KSTAR experimental data (in between-shots)
2. Development of advanced discharge scenarios such as ITB, QH-mode, high- β_p , low-q discharges, etc.
3. Giving guideline for the KSTAR upgrade design
4. Development of long pulse discharge scenarios > 100 secs

Personnel involved in the project for implementing TRANSP in KSTAR

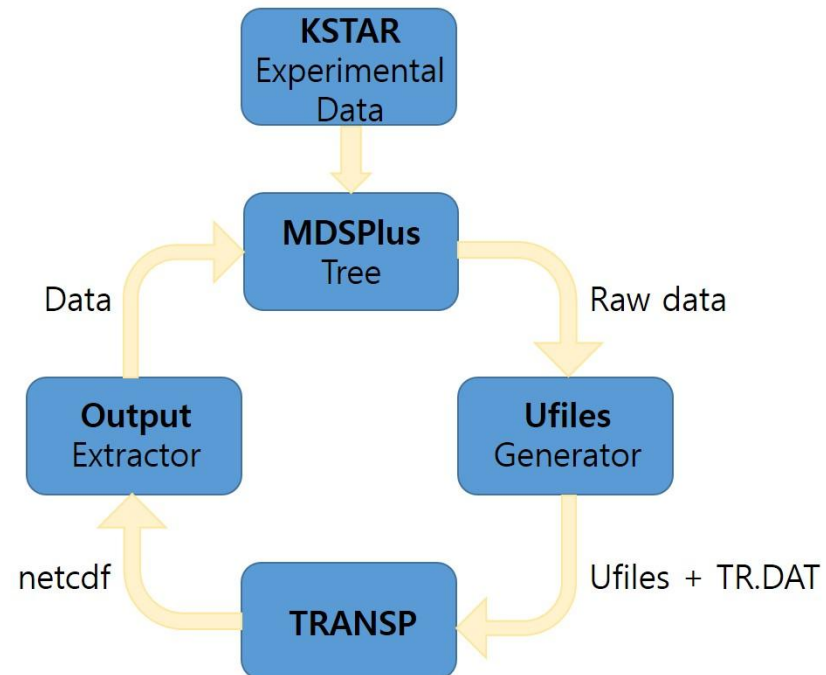
1. Project managers: H. Park, Y. K. Oh
2. Coordinators: H. H. Lee, J. M. Kwon, B. H. Park
3. TRANSP code/interfaces: L. Terzolo, S. Sabbagh (Univ. Columbia), J. K. Lee
4. Physics Validation: H. H. Lee, F. Poli (PPPL), L. Terzolo, H. S. Kim
5. For TRANSPgrid: M. Gorelenkova (PPPL), F. Poli (PPPL), K. Silber (PPPL)
6. IT and networks: D. S. Lee, J. S. Park



Recently, we have launched the project to develop the interfaces for automatic running of TRANSP for between-shots analysis of KSTAR experimental data

This task involves developments of

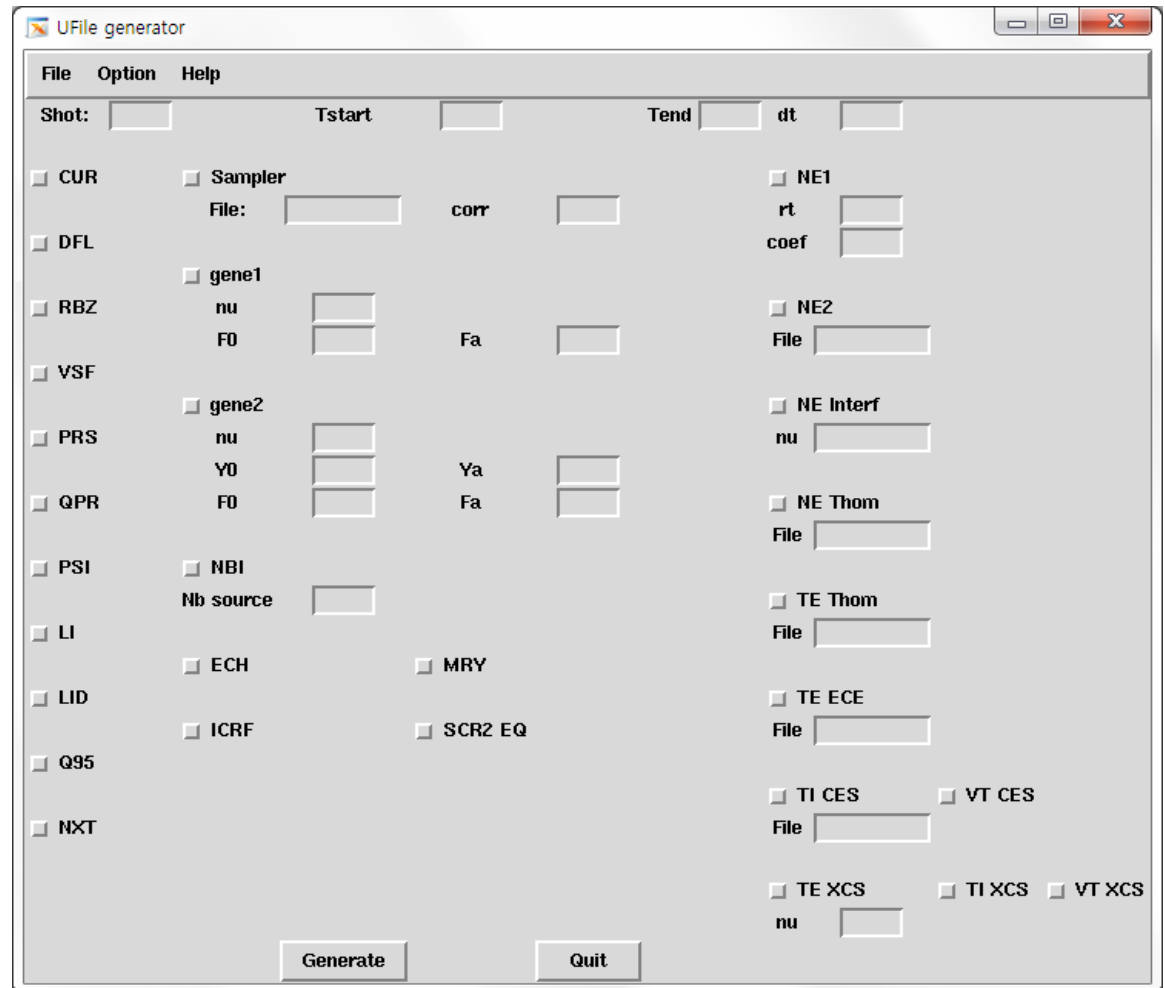
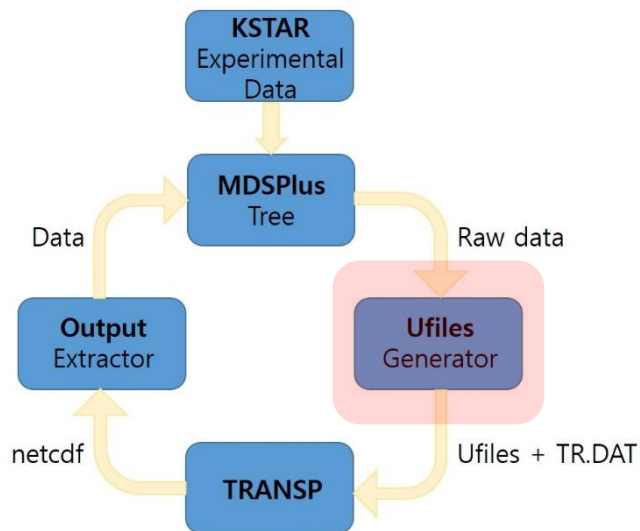
1. MDSplus data retrieving and UFILES and TR.DAT generator programs
2. a fitting or outliers removing program for improving profile data quality
3. an uploading program of the TRANSP calculation results to MDSplus
4. interfaces for integrating and automatic running of above programs

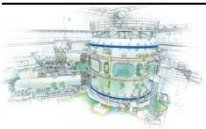




UFILES and TR.DAT generators

Previously, an automatic MDSplus data retrieving and UFILES and TR.DAT generating GUI interface was developed. Now, this interface can be automatically operated while monitoring the MDSplus data server and checking the heating scenario





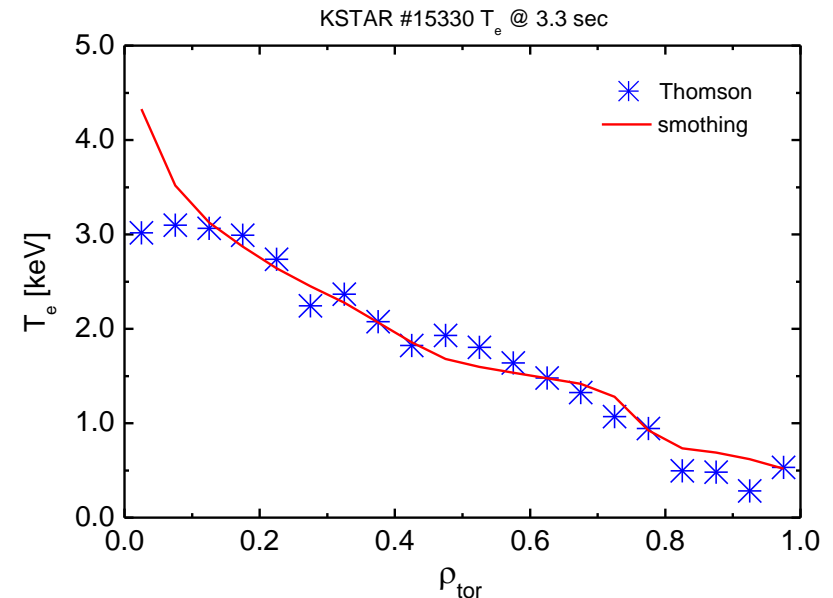
For the TRANSP run, we now use

1. EFIT data (CUR, RBZ, QPR, MMX, LIM, GRB, PRS, TRF, PLF, VSF)
2. Electron temperature profile from Thomson (default) or ECE
3. Electron density profile from Thomson (default) or prescribed profile
4. Ion temperature profile from Charge Exchange Spectroscopy
5. Toroidal rotation velocity profile from Charge Exchange Spectroscopy

Profile data is automatically fitted by **gsmoo2** (3-point average)

Now, time-dependent and automatic outliers removing and fitting code of Thomson data is being developed (in collaboration with S. Sabbagh).

Kinetic EFIT data will be also available soon (in collaboration with S. Sabbagh)



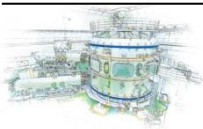


TR.DAT is automatically generated with default settings and NBI or other heating configurations

Example of 'in_fast_input.in'

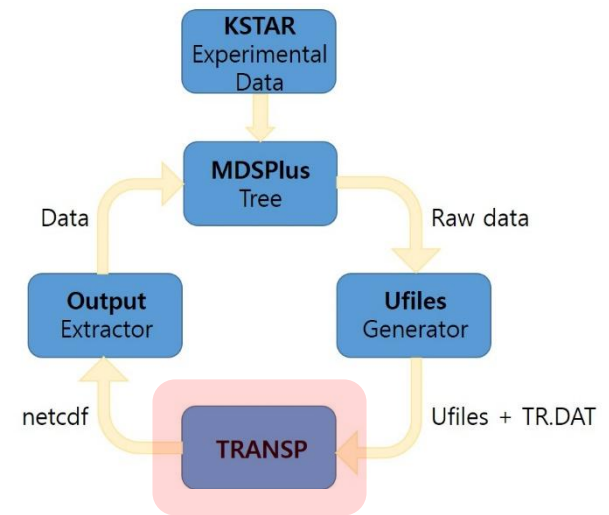
```
lterzolo@sophie:~/my-transp/fast — □ ×
INPUT_P
nshot=15330,      shot number
tstart=3.d0,     start of simulation
tend=7.d0,       end of simulation
dt=0.1,          sampling time for experimental data
epath='EFIT01',  EFIT branch in MDSPlus Tree
smooth=3,        smoothing parameter for gsmoo2
run=0,
1,1              Top
```

Now, from MDSplus data retrieving to TRANSP background job creation can be done automatically by 'one-command-execution'

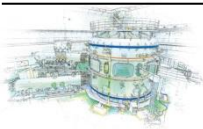


- At the moment, a local TRANSP of 2009 ver. is used for between-shots analysis
- Now, the local TRANSP is installed in a little-bit old (and very slow) cluster which had been used for MDSplus data access (jScope), EFITviewer, etc.
- We have realized that the TRANSP calculation time is mostly dominated by the NUBEAM calculation time (which can be controlled by 'DTBEAM' in TR.DAT).
- We found that, for 4 secs calculation (#15330),

DTBEAM (s)	TRANSP run time
0.005	3 hrs
0.1	36 mins
0.2	20 mins

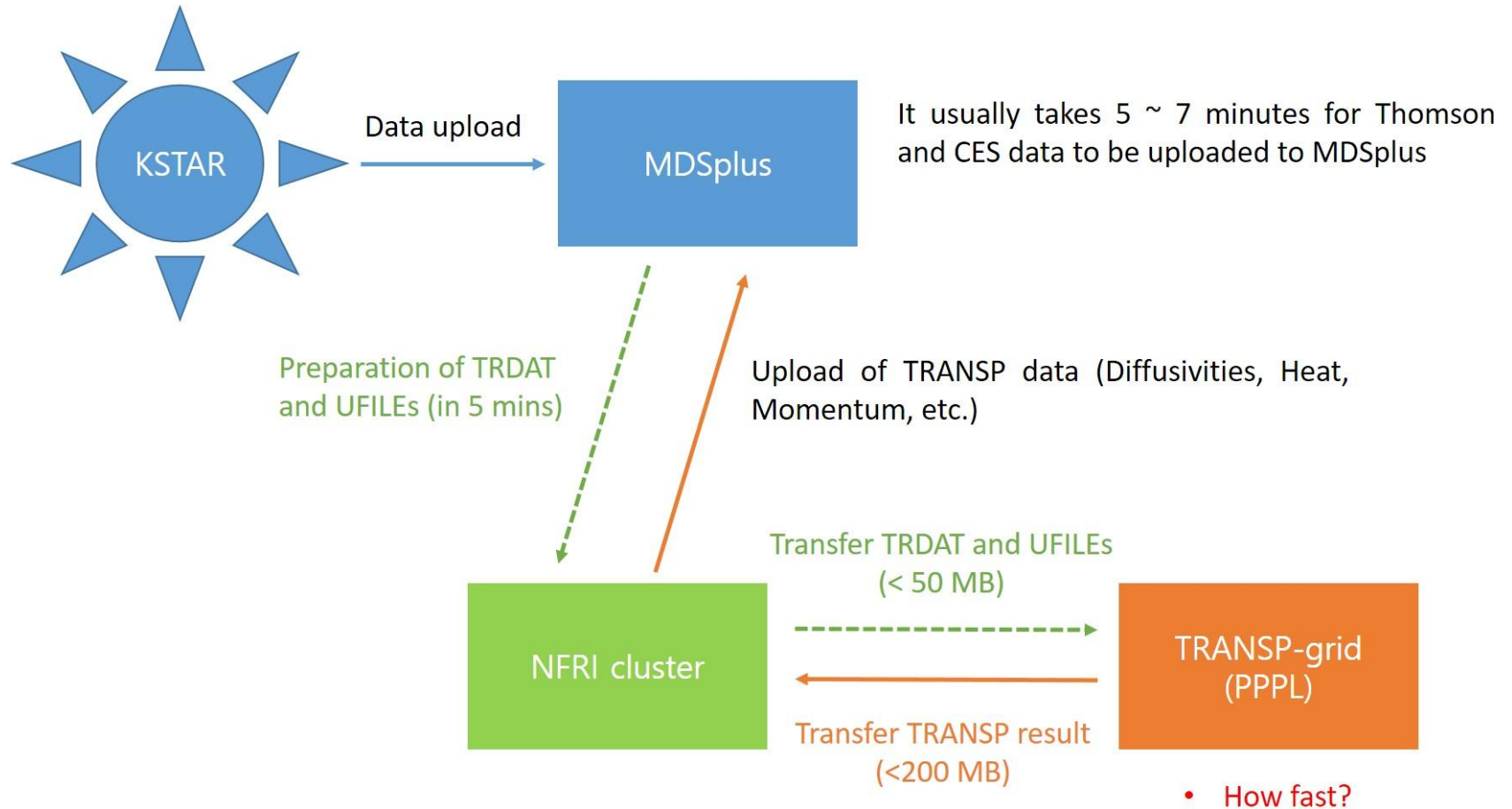


- ✓ For the purpose of between-shots analysis, DTBEAM should be in the order of 0.1 sec.
- ✓ Or, we need to upgrade the cluster for between-shots TRANSP
- ✓ Can TRANSPgrid be an another option for KSTAR?



TRANSP calculation

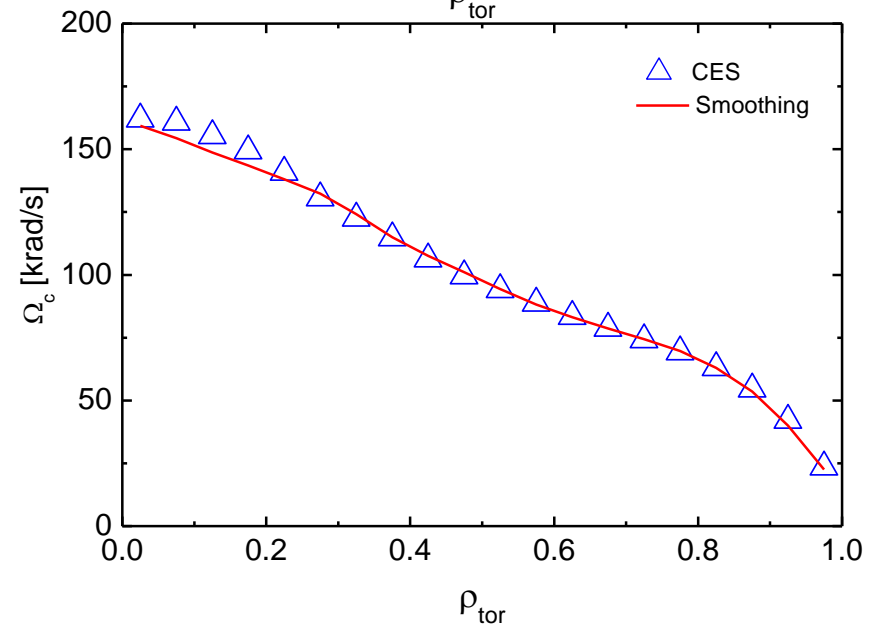
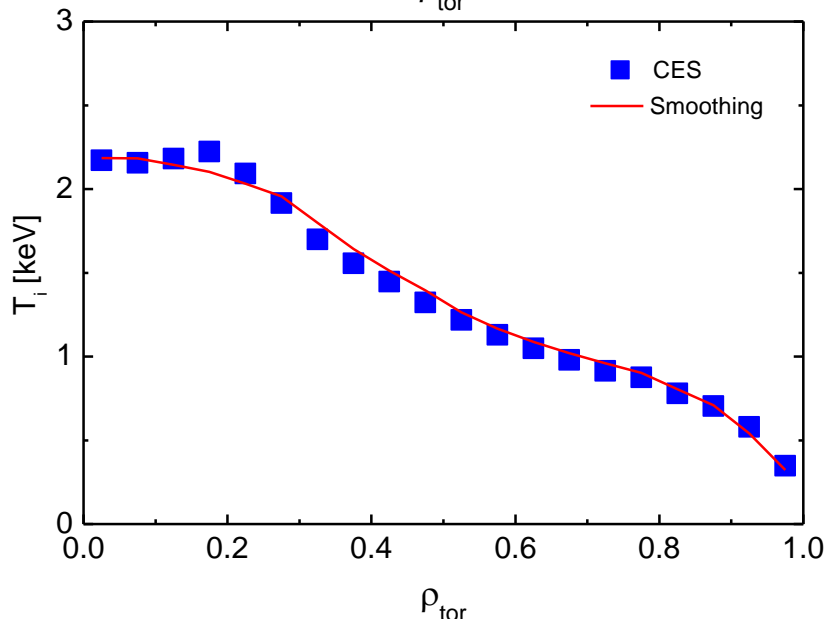
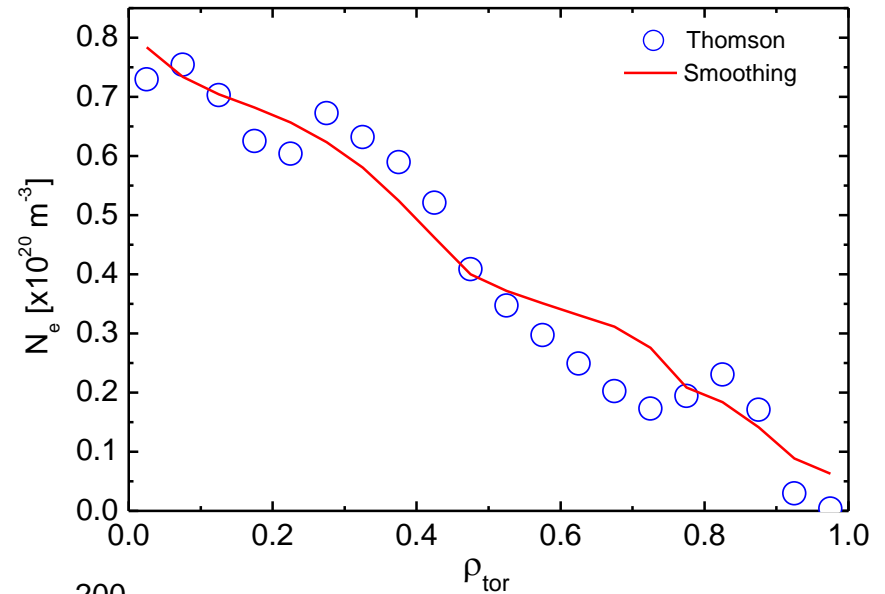
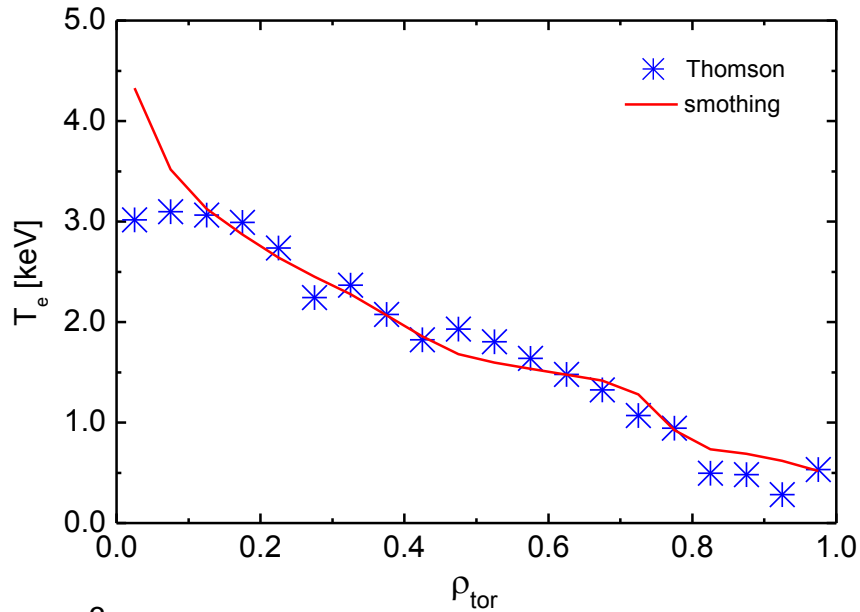
If TRANSPgrid can be applied for KSTAR between-shots analysis,





Between-shots TRANSP result

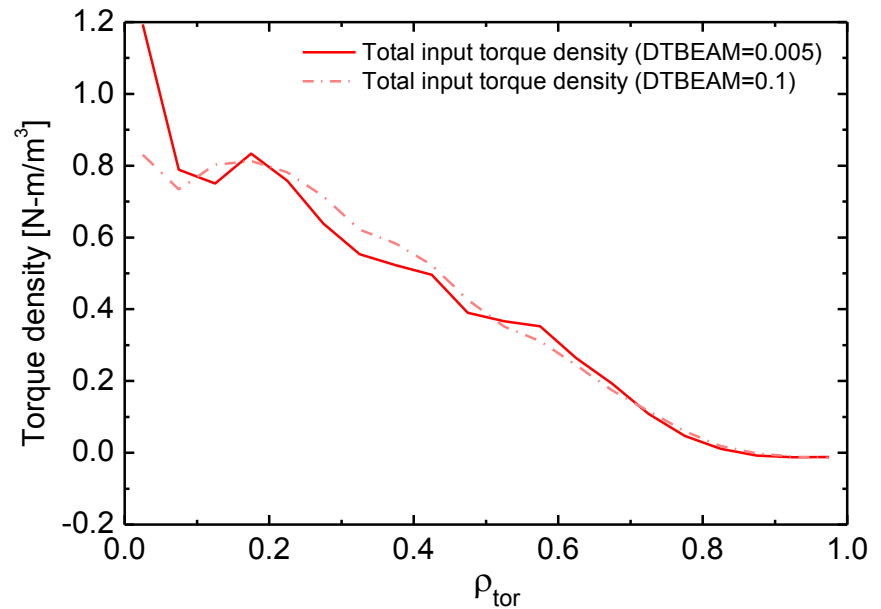
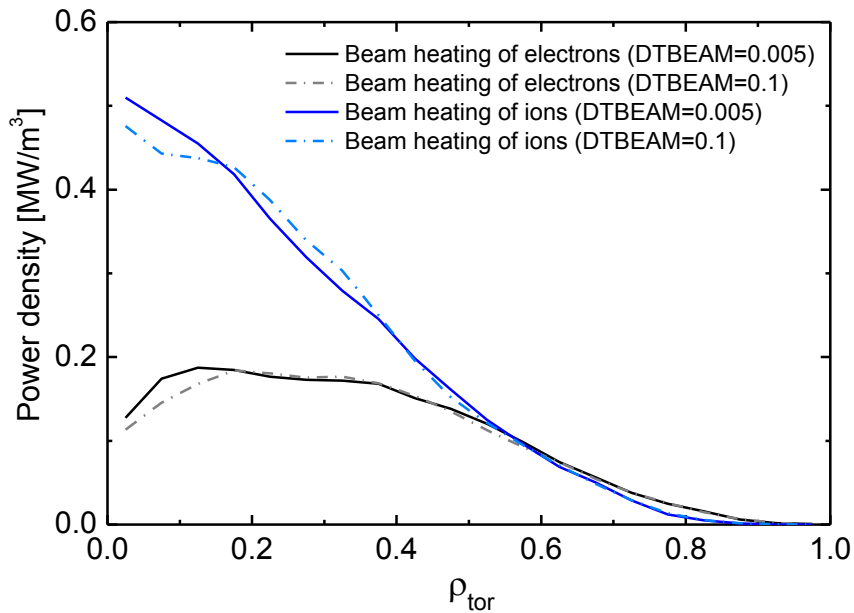
Input profile data (H-mode, #15330@3.3 s, comparison between raw and smoothed)





Between-shots TRANSP result

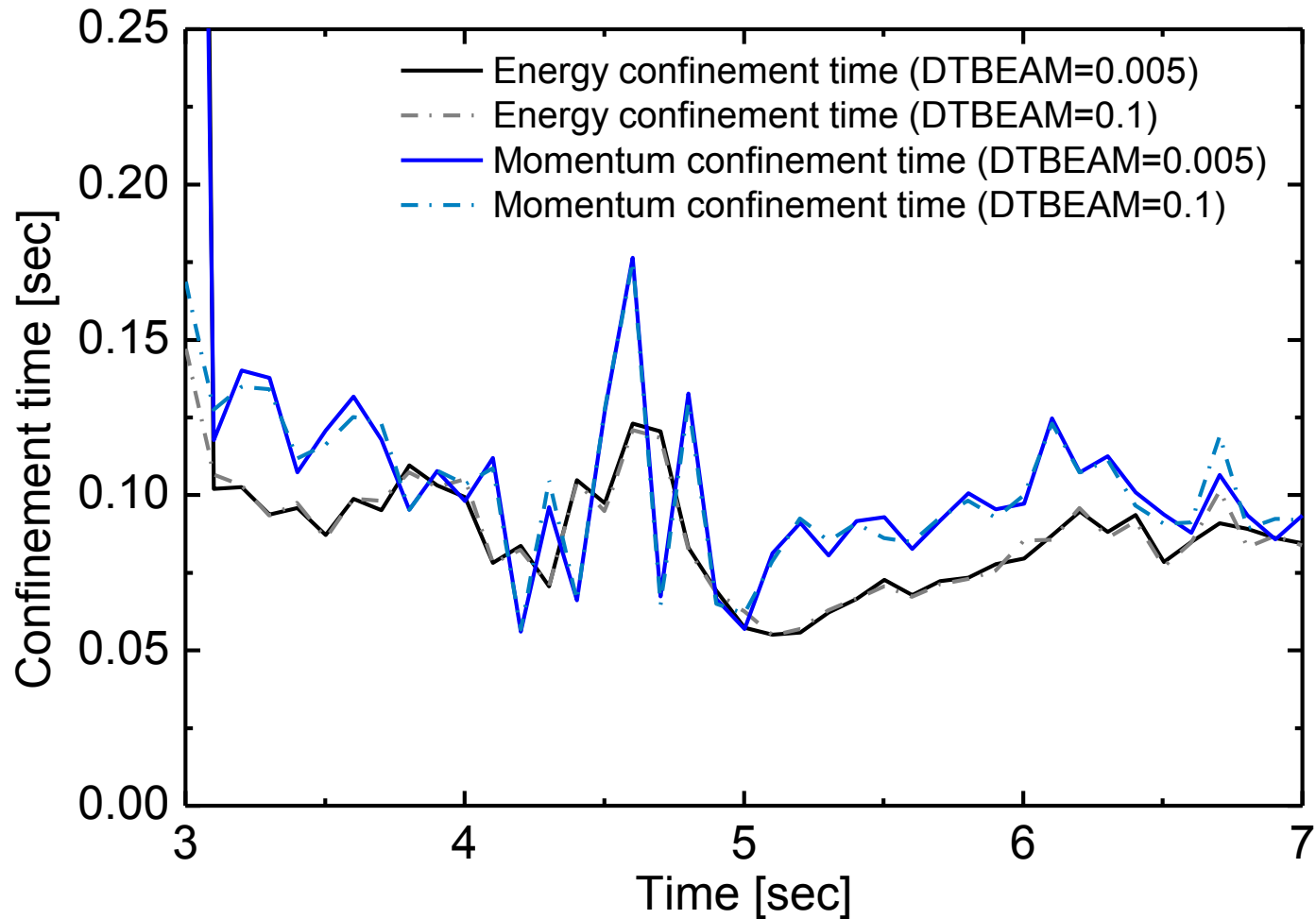
NBI profiles – Power and Torque density (with smoothed input profiles)





Between-shots TRANSP result

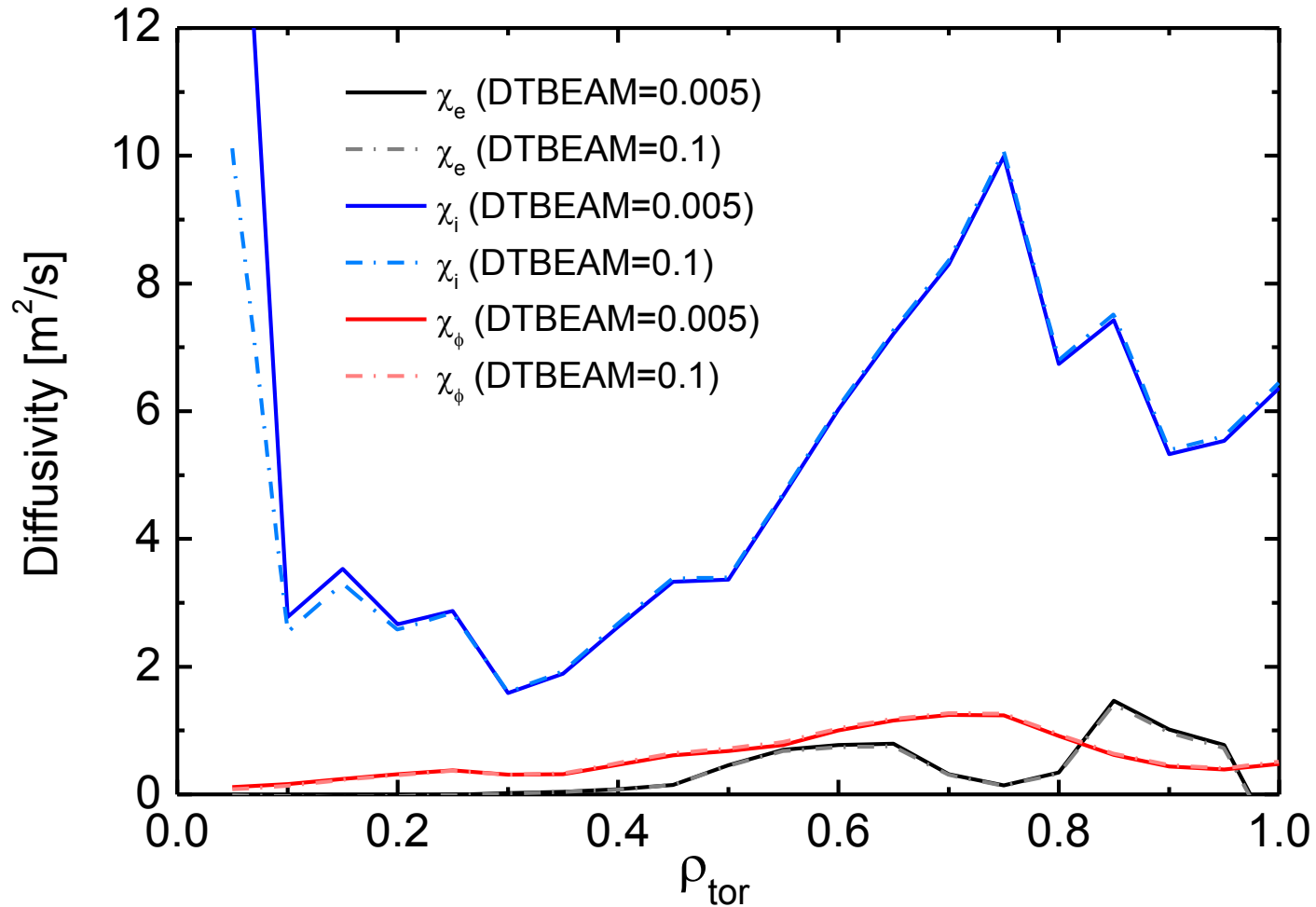
Confinement times – Energy and momentum (with smoothed input profiles)





Between-shots TRANSP result

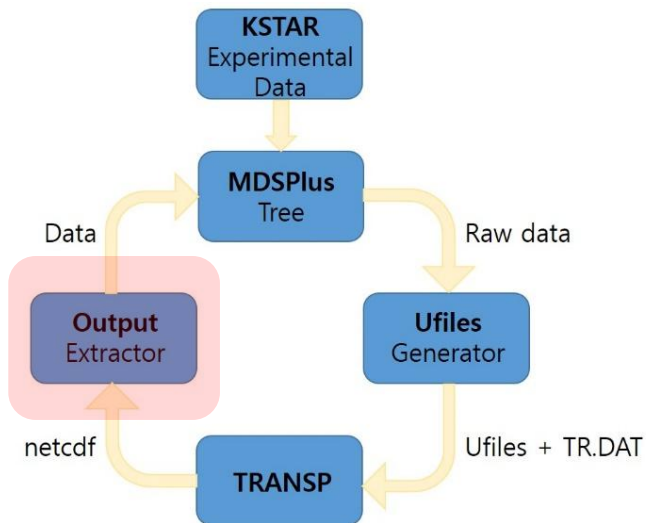
Diffusivity profiles – Electron heat, ion heat and angular momentum diffusivities





Data upload

- A program to extract specific result from .cdf file is ready
- MDSplus data uploading module will be integrated into the program soon
- For KSTAR users, several TRANSP result will be served via MDSplus server (can be updated by request)



	Node Name	Description
1D	tr_IPBE	Integrated beam heating power of electrons
	tr_IPBI	Integrated beam heating power of ions
	tr_ITQ	Integrated beam torque
	tr_TEE	Electron energy confinement time
	tr_TEI	Ion energy confinement time
	tr_TAUE	Energy confinement time
	tr_TAUPHI	Angular momentum confinement time
2D profile	tr_Rho01~50	Toroidal rho
	tr_CONDE01~50	Electron heat diffusivity profile
	tr_NCCONDE01~50	Neoclassical electron heat diffusivity profile
	tr_CONDI01~50	Ion heat diffusivity profile
	tr_NCCONDI01~50	Neoclassical ion heat diffusivity profile
	tr_CHPHI01~50	Angular momentum diffusivity profile
	tr_NE01~50	TRANSP electron density profile
	tr_TE01~50	TRANSP electron temperature profile
	tr_NI01~50	TRANSP ion density profile
	tr_TI01~50	TRANSP ion temperature profile
	tr_PBE01~50	Beam heating power of electrons profile
	tr_PBI01~50	Beam heating power of ions profile
	tr_TQ01~50	Beam torque density profile



- We hope a new cluster for between-shots TRANSP can be available soon
- The connection between NFRI cluster and transp-grid will be established under the support of M. Gorelenkova, F. Poli in PPPL
- PPPL collaborators will be provided with the direct access to NFRI cluster in order to effectively resolve some issues
- Predictive modeling by TRANSP is being prepared in collaboration with F. Poli
- TRANSP user group for KSTAR will be organized and promoted soon