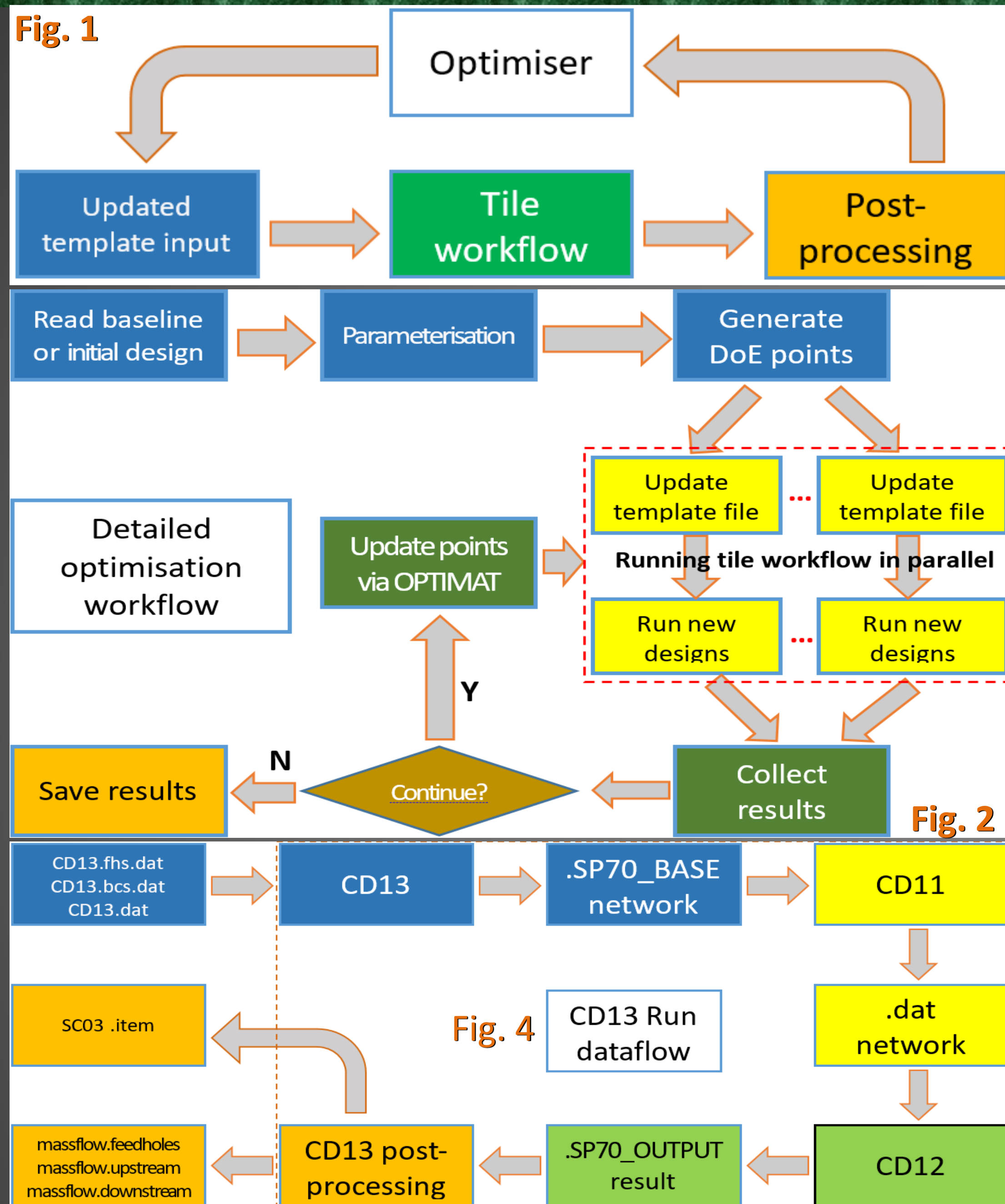# Pedestal Tile Feedhole Optimisation Package

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Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Tile Optimisation Package

The aim of this project is to develop an automated working package to optimise a pedestal tile feedhole configuration to minimise the total mass flow while respecting ligament size and thermal temperature constraints. The package consists two parts: the optimisation package and the tile workflow package. The top-level view and the details of the optimisation package are shown in Fig. 1 and Fig. 2 respectively. The optimiser explores the design space by evaluating different feedhole configurations in parallel using the tile workflow that includes geometry run, CD13 run, and SC03 run (Fig. 3).
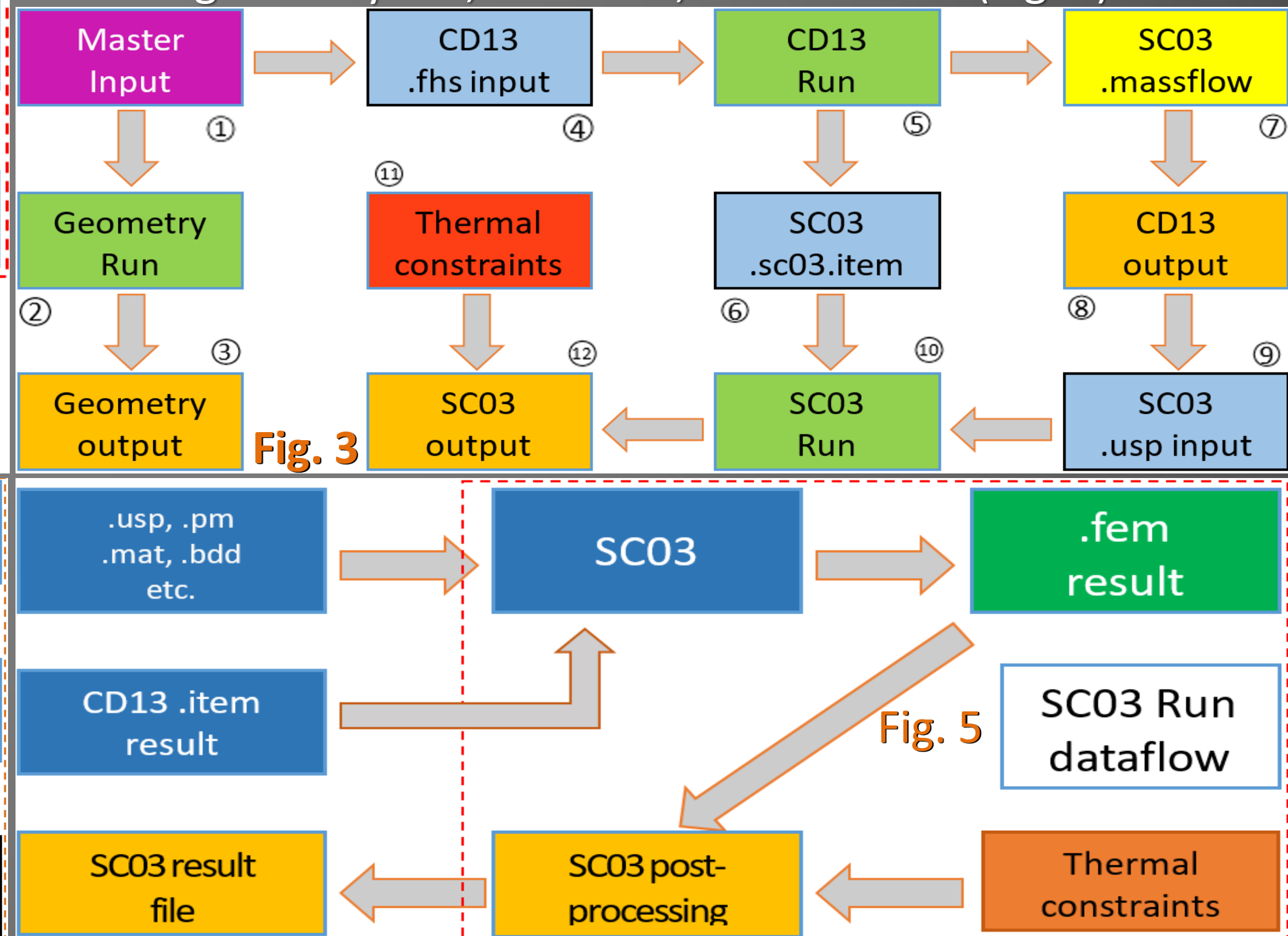
The Workflow

By providing the master input of feedhole definitions to the workflow (Fig. 6), the geometry information is calculated firstly. Then, the CD13 run (Fig. 4) generates and solves the Flownet network to populate boundary conditions for SC03 simulation (Fig. 5) that produces the tile mass flow and temperature maps for both the thermal barrier coating (TBC) and the tile surfaces (Fig. 7). Depending on the settings in the master input and the hardware resources, the SC03 jobs can be run locally, over an intranet, or on a cluster node (Fig. 8). The workflow is developed using standard Python and Windows batch file as well as other file formats that are specifically required by CD13 and SC03.

The Optimisation

OPTIMATv2, which is an optimisation suite developed by Southampton Rolls-Royce UTC, was used to carry out the optimisations for XWB inner bay 1 & 3. Better solutions have been found for both cases as shown in Fig. 9.

Future Works

- Different parameterisation methods
- Large-scale optimisation search
- Discrete manufacturable diameter change

Fig. 6

TBC temperature map

Tile temperature map

Tile massflow map

Fig. 7

Fig. 8

desktop machine
Peak mem: ~3.9Gbs
Min. mem: ~3.2Gbs

SC03 job on cluster updating files constantly

all files for SC03 job are copied to cluster nodes
node's run folder will be cleaned after running

Fig. 9

Improvements on the baselines of XWB IB1 and IB3

Case	$MaxT_{tile}$ (°C)	Total mass flow (Kg/s)
IB1 best design	↑ 0.99%*	↓ 35.31%
IB3 best design	↓ 0.59%	↓ 16.46%

*: the max tile temperature is still lower than the thermal constraint although it is higher than baseline

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