

Custodian Synthetic LBW Dataset - August 2021

Dataset generated by Technical University of Wien and converted to compressed HDF5 format by AIMEN Technology Center.

This dataset contains synthetic data extracted from LBW numerical simulations. Since the output files from these simulations are very heavy and in complex format, some data from these simulations was extracted to HDF5 files. Data extracted are phase and temperature in the top plate and some process features. These data are intended to study the dynamics of the process and to find the theoretical image obtained by a perfect thermal imager (comparing these to real camera images could be used to find the function that transforms the image in real cameras).

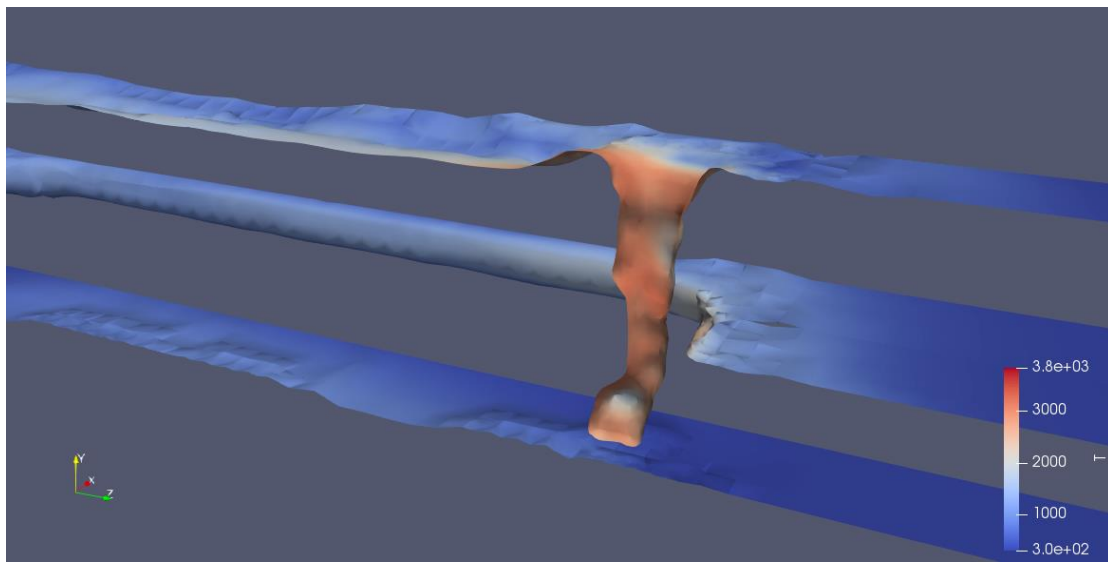


Fig.1 3D representation of the type of simulations used to generate this dataset.

The dataset contains 12 files where each file corresponds to one experiment with a unique combination of process parameters. Table 1 shows the different experiments in the dataset.

Table 1 Process parameters used for each experiment in the dataset.

Experiment Number	Input			
	Total power (sum of two beams) (kW)	Secondary Beam Width (mm)	Speed (mm/s)	Overlap gap between the two sheets (mm)
1	4.95	Step 0.7–2.2	100	0.1
2	Step 4-4.95	1.3		0.2
3	4.95	Step 0.7–2.2		0.4
4	Step 4-4.95	1.3		
5	4.95	Step 0.7–2.2		
6	Step 4-4.95	1.3		
7	6	Step 0.7–2.2	140	0.1
8	Step 5-6	1.3		0.2
9	6	Step 0.7–2.2		

10	Step 5-6	1.3	0.4
11	6	Step 0.7–2.2	
12	Step 5-6	1.3	

Some parameters in the experiments include steps used to study the dynamics and intensity of each parameter in the output data. The laser source is a main laser spot containing 80% of the power and a secondary beam containing 20% of power with square size with length 1.5mm y a width that depends on the experiment.

The structure of the hdf5 can be observed in Fig. 2. The content of the hdf5 file is the following:

- data0: contains a 2D table where rows are time instants and columns are different process parameters: meltpool_width (width of the liquid phase), meltpool_lenght (length of the liquid phase), x (x location in mm of the main laser spot), y (y location in mm of the main laser spot), process_status (1 when laser is on, 0 when laser is off) and timestamp (timestamp in seconds).
- image_data0: Temperature field (K) of the complete simulation area.
- image_data1: Phase field (Between 0 and 1.0, 0 being solid and 1 liquid) of the complete simulation area.
- image_data2: Meltpool width at all x in the simulation area.
- image_data3: Temperature field (K) of a small area centered around the laser spot location, simulating the view from a coaxial camera.
- image_data4: Phase field (Between 0 and 1.0, 0 being solid and 1 liquid) of a small area centered around the laser spot location, simulating the view from a coaxial camera. .
- data: link to data0, maintained for backwards compatibility reasons.
- image_data, link to image_data0, maintained for backwards compatibility reasons.

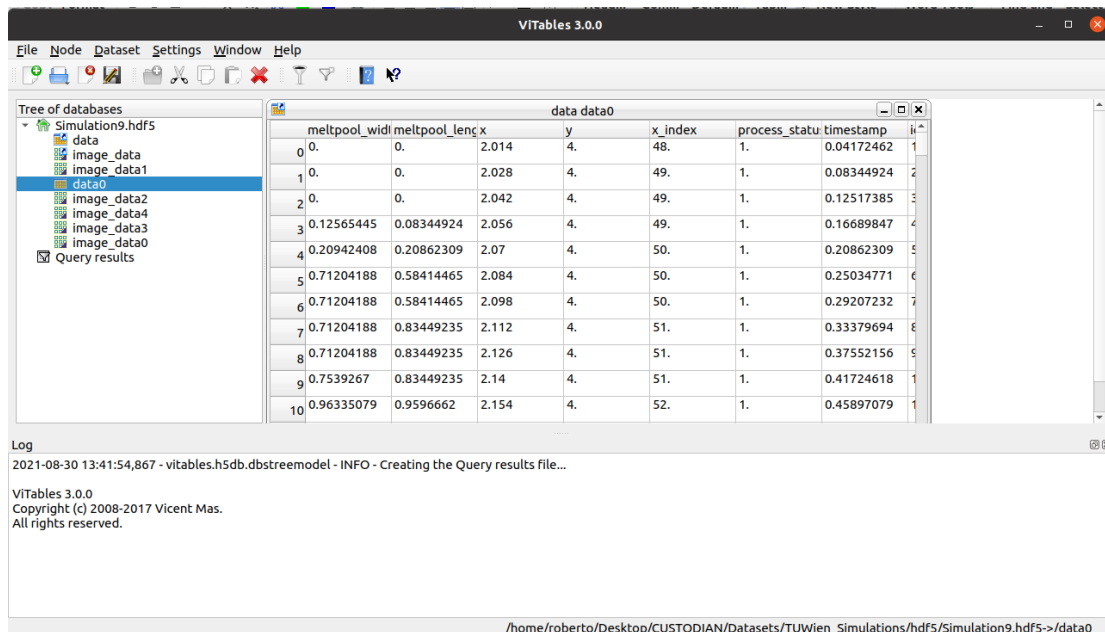


Fig.2 HDF5 file of Experiment 9 open with Vitables.

Hdf5 files can be open with:

- standard hdf5 viewers (like hdf5view or pytables) but these do not let you explore the images.

- AIMEN Visualizer program (see Fig. 3): Attached with the dataset is an executable for an HDF5 program called Visualizer from AIMEN technology center that lets you open the hdf5 files, visualize image and scalar data and export data to other formats (csv, png, etc.). This executable is for Windows.
- Finally, for those who want to use the dataset for research a small Python program is also included to read data from files using Python3.

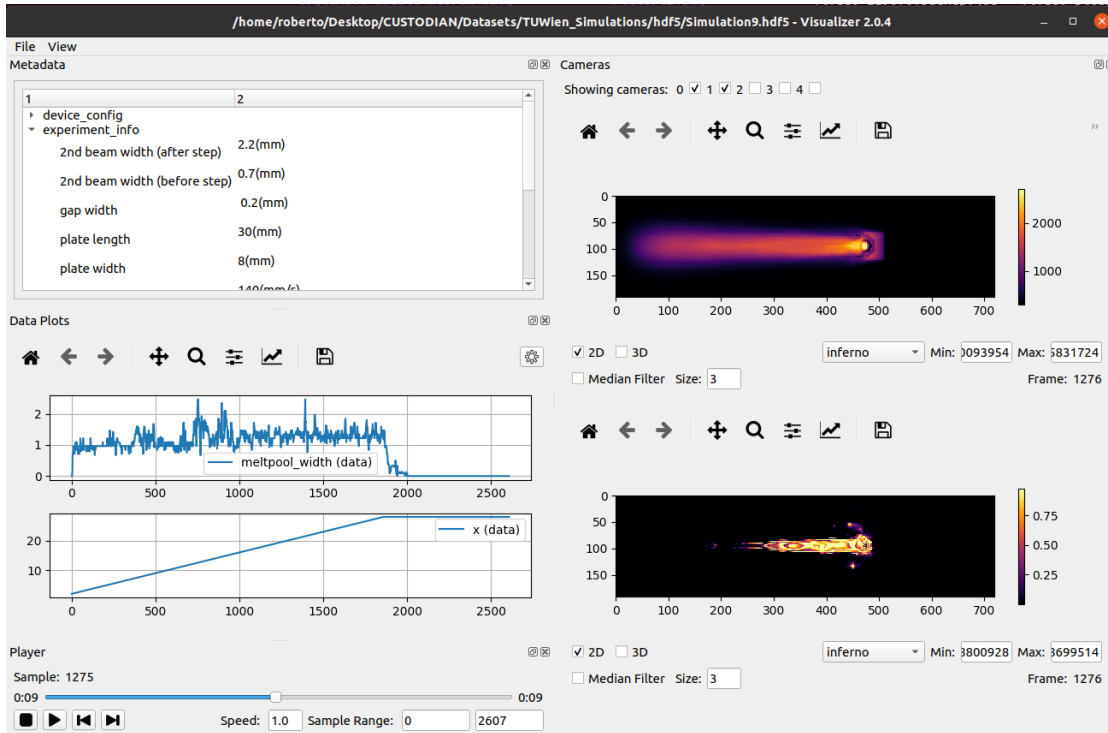


Fig.3 HDF5 file of Experiment 9 open with AIMEN Visualizer.