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PARADIM machine learning model for assisted optical floating zone synthesis

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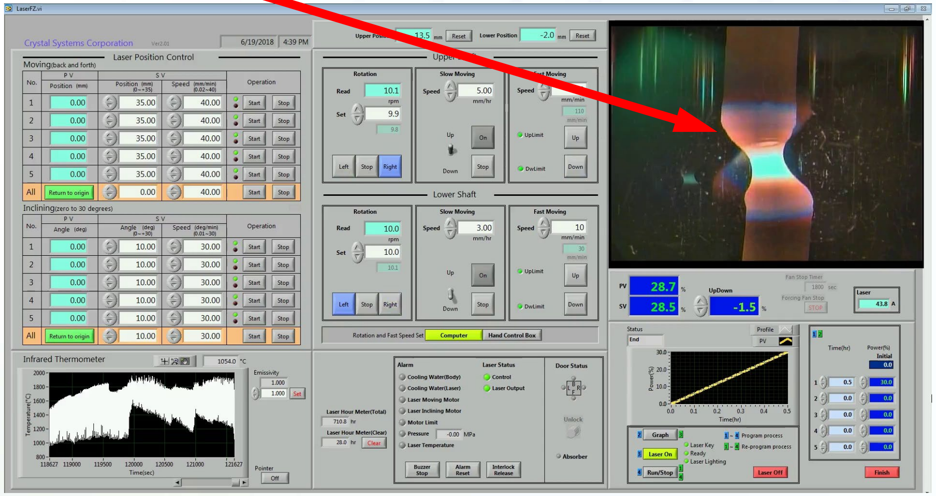
PARADIM has deployed the first deep learning model of crystal synthesis to assist facility users as they optimize synthesis conditions and accelerate the realization of their materials design plans.

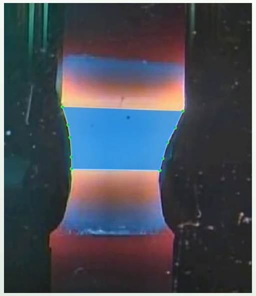
Optical floating zone furnaces are the backbone of single-crystal synthesis. PARADIM's deep learning model relates melt-zone geometry to the complex parameter space of the furnaces. Deployment of the model leverages PARADIM's prototype streaming data pipeline allowing real time feedback to users running on the laser diode furnace.

The PARADIM model combines image segmentation to capture melt zone geometry with extraction of furnace parameters from streaming video during synthesis. Parameters are streamed to a dedicated SQL database with extracted image frames stored as files in the PARADIM Data Collective. Stream processing triggers the learning model which inserts segmented images into the database.

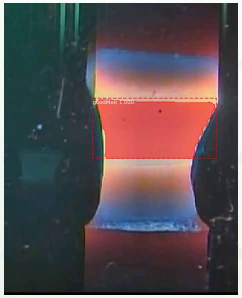
PARADIM Users receive feedback through JupyterLab dashboards for simple interactivity and flexible design.

Import growth parameters including laser power and inclination, upper rod rotation speed, direction, and feed rate, and lower rod rotation must be balanced to prevent melt-zone instabilities like that encountered here





Labeled for Training



Masked by ML

Image segmentation from the trained model rapidly identifies the melt zone (labeled in red) and classifies synthesis parameters to assist the user

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