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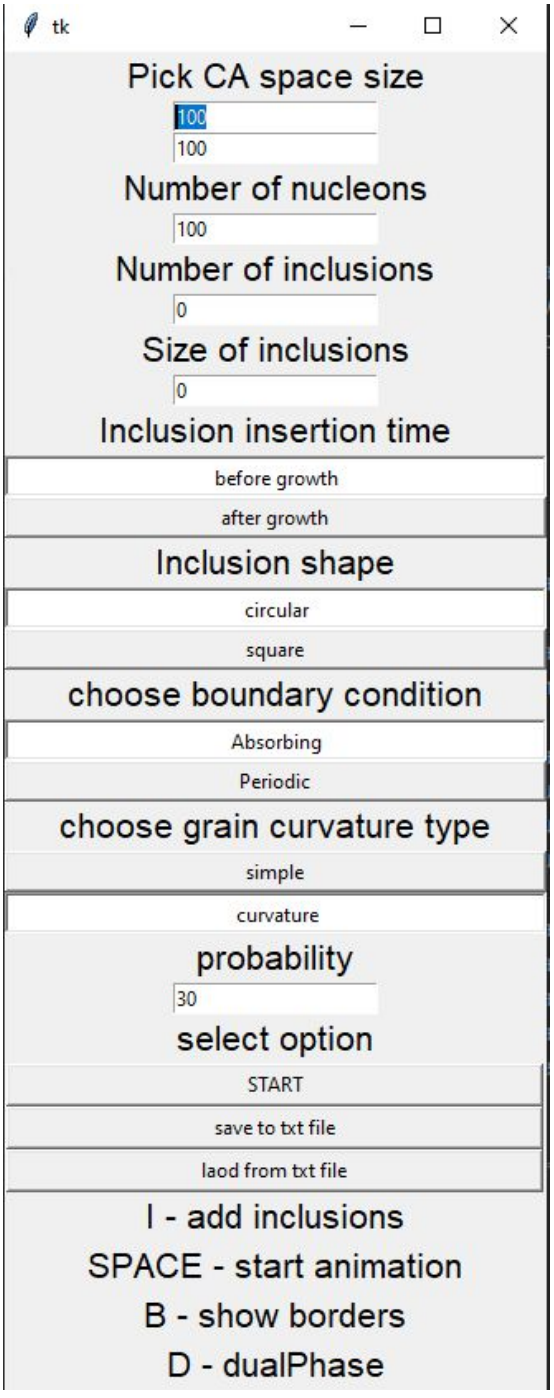
Report for multiscale modeling projects 2020/2021

GUI Explanation



From the top:

- Size x and size y of the CA space, these values will determine number of squares in the simulation(each square has 4x4px size for better visibility
- Number of randomly placed nucleons during the start of simulation
- Number of inclusions to put in the simulation(before or after, circular or square), optional
- Size of a single inclusion, diameter for circle, edge length for square
- Selection of the moment when the inclusions are placed. Before growth, inclusion are placed randomly, before the nucleons grow, after growth, they are placed on the grain borders
- inclusion shape determines whether they are squared or circular

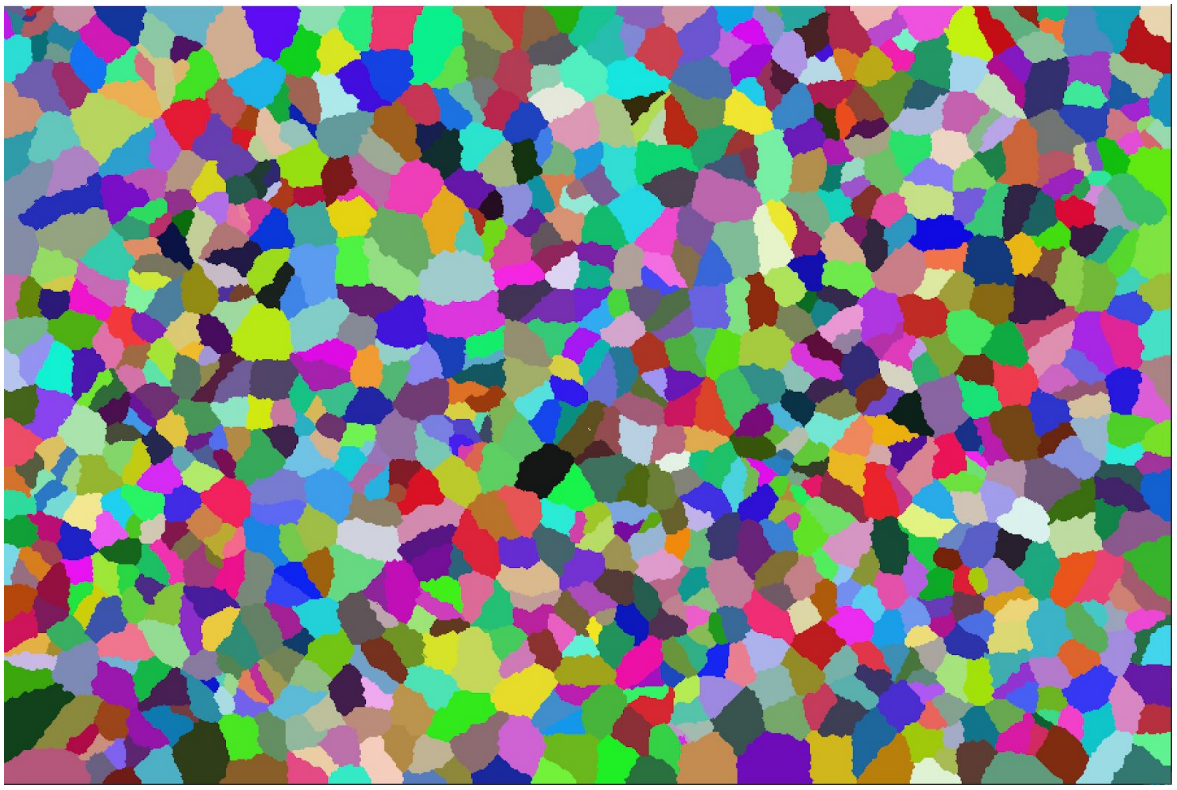
- Boundary condition determines whether borders of the ca space are absorbing or if they let the grains pass through and appear on the other edge
- grain curvature chooses between simple moore neighbourhood growth or the 4 rule growth with probability to better show grain curvature
- Probability option allows to set probability for the 4 rule algorithm used for curvature option

- Start the simulation and save/import to file options

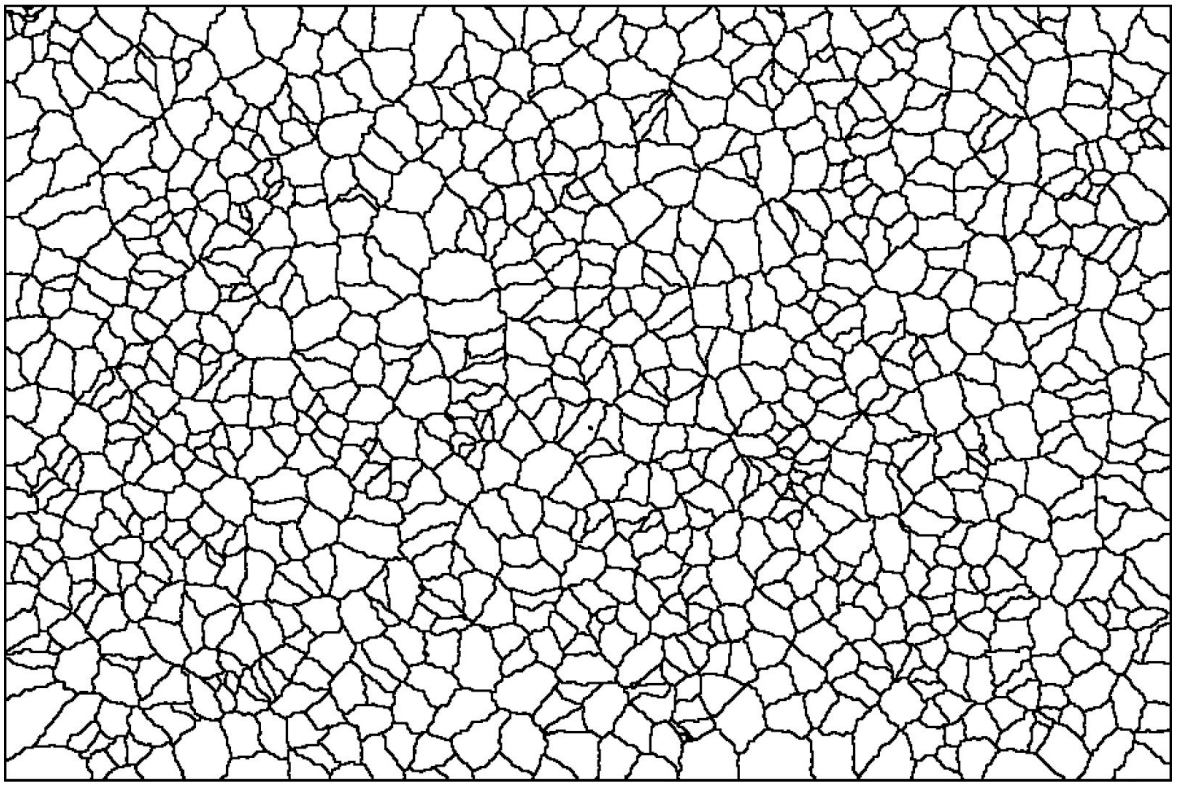
- Buttons to press to control the simulatio

Results

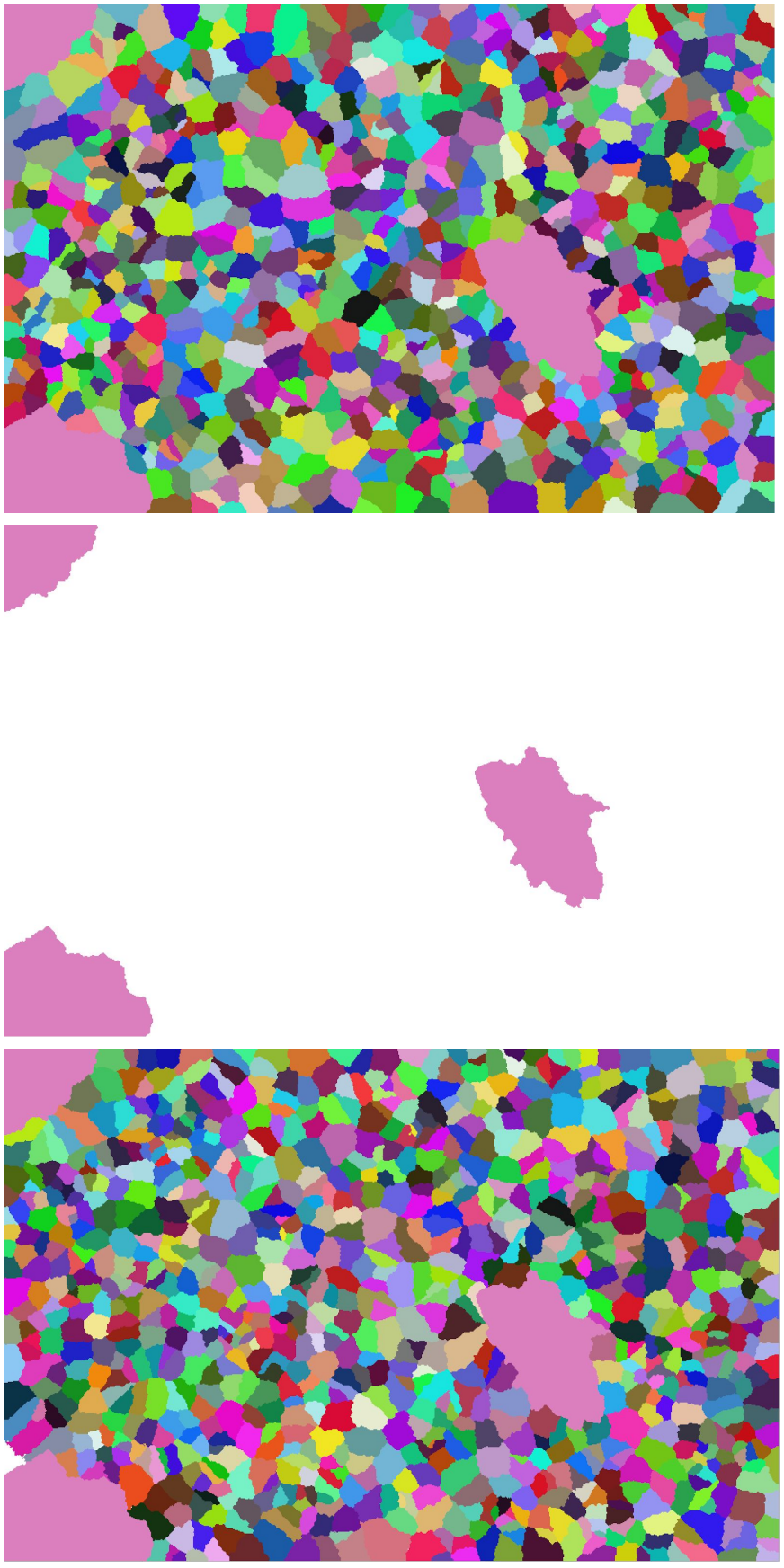
CA space 900x600, 1000 nucleons, cuvred grain boundries



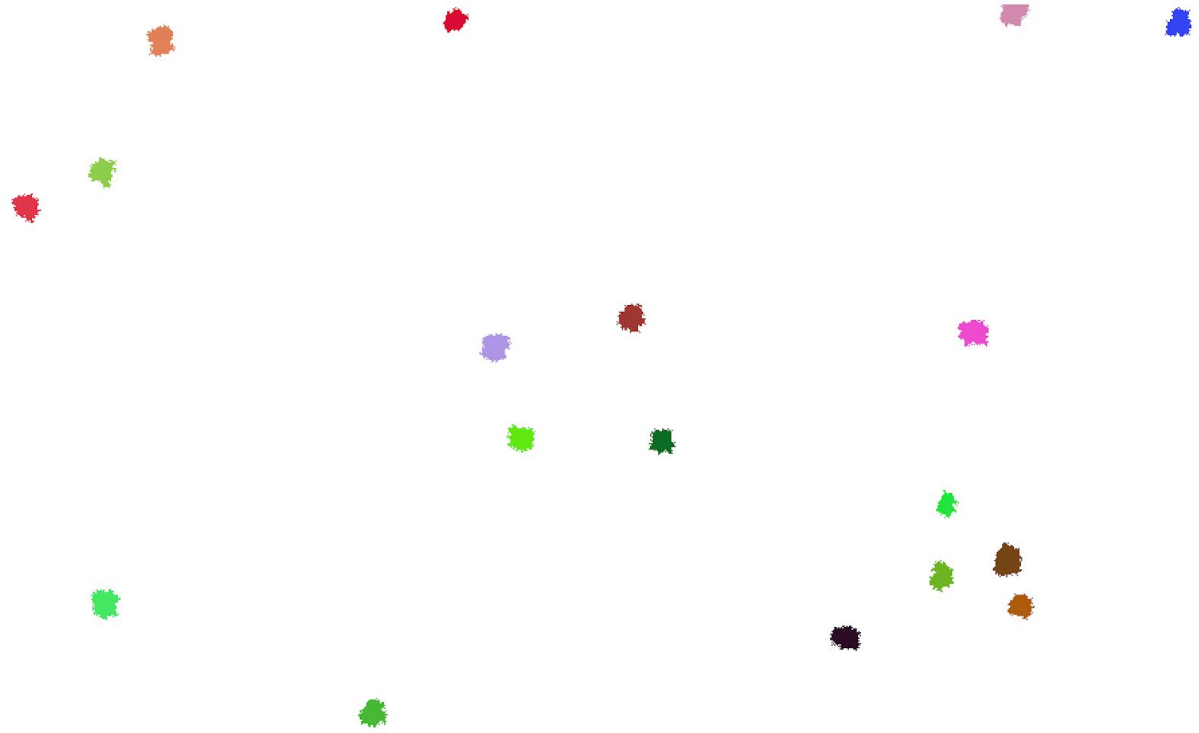
Boundries of the microsctructure



Dual Phase Example on Above microsctructure

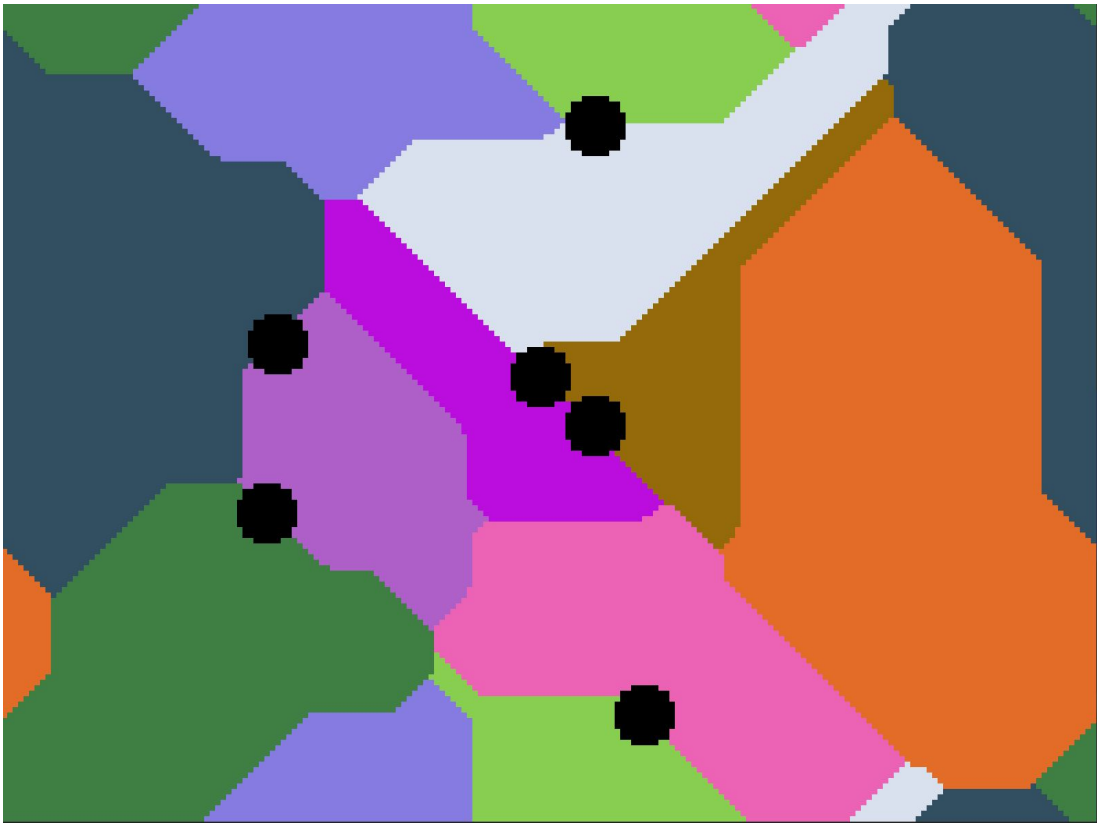


Grain curvature growth

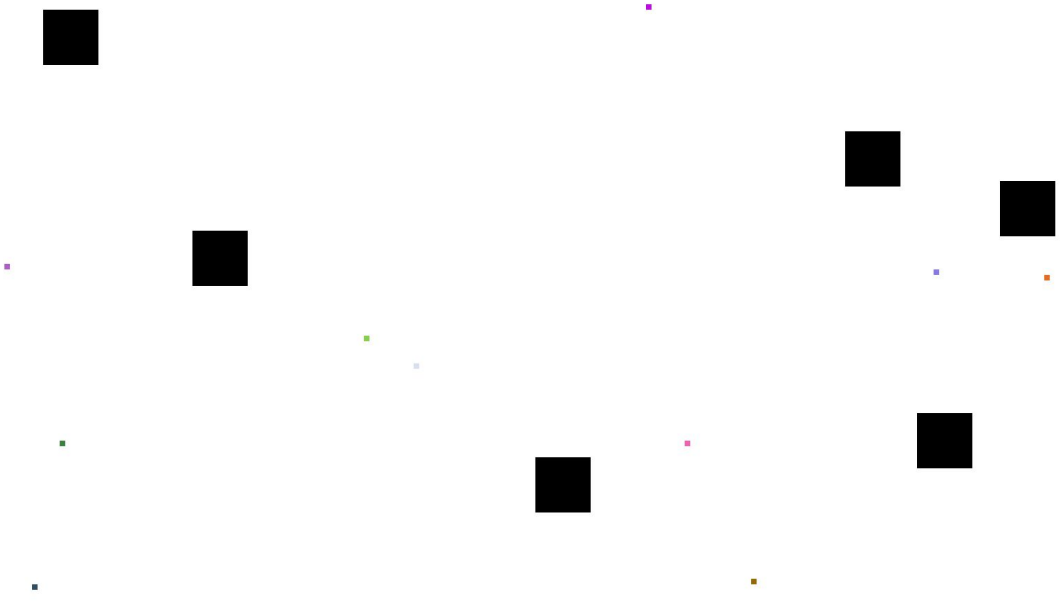


Fully grown

Inclusions on grain boundaries, smaller space, magnified pixel for better visibility
Circular after grain growth



Squared before before grain growth



Conclusion

Results are close to real microstructures, the output is similar to EBSD microstructures. Algorithm performance is good for the 300x300 CA space. It can also calculate bigger structures(900x600 in report) but it takes few minutes to compute. To achieve higher performance, some code would need to be rewritten to e. g. c++ to support multithreading.