AGENDA: last updated: 26th June, 2012

2012 Summer School on 3D Microstructure Studies
Carnegie Mellon University
July 13-14, 2012

Summary of Summer School
The MSE department at CMU will host a workshop July 13-14, 2012 to introduce members of the technical community to the methods developed by the faculty in the MIMP group at CMU, together with colleagues at the US Air Force. The mission of the MIMP (Mesoscale Interface Mapping Project) is to understand the mechanistic origins of the grain boundary character distribution (GBCD), a five-dimensional materials specific quantity, and its influence on the macroscopic properties and performance of polycrystalline materials. Our integrated program of theory, experiment, and simulation leverages the skills of scientists and engineers from multiple disciplines.

The MIMP Workshop will focus on the characterization of 3D microstructures and grain boundary properties, quantifying and predicting microstructural evolution, and linking materials properties to microstructures. The school will combine lectures taught by the MIMP Faculty and hands-on analysis using software developed by CMU and the Air Force Research Lab. Two main topics will be addressed: 1) GBCD from Serial Sections and 3D Datasets and 2) Digital Microstructure Analysis Using DREAM.3D.

Computer and software needs:
For analysis of serial section data and synthetic microstructure generation, executables are available for both Mac and PC (see below) which means that no compilation is required. For analysis of grain boundary character (GBCD), one must be able to compile fortran programs. This means that a linux-like operating system such as Mac OS X or linux itself is easiest to use. Specifically on Macs, participants should ensure that they have Developer Tools installed (so that, e.g., XCode is available); to add fortran, we suggest obtaining a compiler from http://hpc.sourceforge.net. An alternative that may work better for some can be found here: http://r.research.att.com/tools/. Participants should also accustom themselves to using the Terminal app. On PCs, it is best to have a fortran compiler in the Visual Studio environment.

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Friday, July 13th
Rooms TBD
See brief descriptions of packages below the schedule.

Time	**Overview sessions**	
8am	Tony Rollett Overview of Microstructures in 3D ***Scaife Hall 219***	
9am	David Rowenhorst, Naval Research Lab. Combining micrographs with EBSD during serial sectioning ***Scaife Hall 219***	
Parallel sessions	**1: GBCD from Serial Sections (Greg Rohrer, Sukbin Lee, Tony Rollett)** ***Scaife Hall 219***	**2: Digital Microstructure Analysis Using DREAM.3D (Mike Groeber, Mike Jackson)** ***Scaife Hall 222***
10:30am	**Coffee break**	

10:45am	Stereological calculation of the GBCD and graphing results	Reconstruction, Clean-Up and Quantification of Microstructures using DREAM.3D
12:15pm	**Lunch**	
1:15pm	GBCD from serial section	Generating Synthetic Microstructures using DREAM.3D
2:45pm	**Break**	
3pm	Analyzing and sorting the data in the GBCD	Meshing and Smoothing Microstructures using DREAM.3D
4:30pm	**Q&A**	**Q&A**
5:15pm	**Happy Hour @ MSE Terrace (3300 Wean Hallway)**	

Saturday, July 14th

Time		
8:30am	Overview lecture: Overview of HEDM: Synchrotron-based Microstructure Mapping; **Bob Suter** ***Scaife Hall 219***	
	1: GBCD from 3D Datasets (Greg Rohrer, Sukbin Lee, Tony Rollett) ***Scaife Hall 219***	**2: Digital Microstructure Analysis Using DREAM.3D (Mike Groeber, Mike Jackson)** ***Scaife Hall 222***
9:30am	3D surface meshes, smoothing, visualization	Developing New Tools for DREAM.3D
10:30am	**Coffee break**	
10:45am	Advanced topics in 3D microstructures: topology, twins	Open Discussion of Areas for Advancement of DREAM.3D
12:15pm	**Lunch**	
1:30	**Help Session (practice with running codes, problem solving)**	**Help Session (practice with running codes, problem solving)**

Serial Section Data Sets
Converting serial section datasets into 3D images that can be analyzed, e.g. for GBCD, requires a number of processing steps. This school assumes that EBSD maps are available so that crystallographic orientation information can be used for alignment and analysis. The steps required to produce a 3D image, with orientations, will be explained in detail up to the point of generating a surface mesh.

Synthetic Microstructures
This means techniques for generating 3D microstructures, with orientations, that were not directly measured but, instead, are based on statistics of materials of interest. The main toolset is Dream.3D developed at the Air Force Research Laboratory (http://dream3d.bluequartz.net/).

GBCD = Grain Boundary Character Distribution
This means techniques for measuring the relative areas of grain boundaries as a function of all 5 degrees of (macroscopic) freedom, i.e. misorientation and normal. This can be done either from EBSD data using a stereological approach, or from 3D data. As mentioned above, the software for this analysis requires a fortran compiler.