

Final Syllabus – 2106 Scientific Computing Bootcamp
Woodruff Scientific, Inc., 4000 Aurora Ave. N, Seattle, WA 98103
 September 19-23, 2016

Monday	Tuesday	Wednesday	Thursday	Friday
networking & light breakfast				
SCBC1	SCBC3	SCBC5	SCBC7	SCBC9
SCBC2a				
networking & lunch				
SCBC2b	SCBC4	SCBC6	SCBC8	closing
informal chats				

SCBC1 – Introduction: Grand Challenges in Computational Plasma Physics

- (a) Computation as third pillar of science
- (b) Multi-physics and multi-scales for nuclear fusion simulations
- (c) OFES HPC (initiatives, centers, SciDac), NERSC
- (d) Current research directions globally, nationally, and locally

Duration: 2 hours lecture

SCBC2a – Some Computer Science Considerations

- (a) Modeling & simulation, and why
- (b) Overall process of computational simulation
- (c) Some sources of approximation *
- (d) Algorithmic (in)stability
- (e) Accuracy versus precision

Duration: 1 hour lecture (can be partially hands-on)*

SCBC2b – Using UNIX

- (a) Introduction to UNIX and the UNIX command line
- (b) Introduction to make

Duration: 4 hours interactive hands-on

SCBC3 – Introduction to R&D Codes

- (a) Introduction of some codes we use and why
- (b) Single particle and ideal MHD codes, including NIMROD
- (c) FORTRAN syntax
- (d) Compiling and debugging

Duration: 3 hours lecture + hands-on

SCBC4 – High Performance Computing

- (a) Parallel computing, scalability
- (b) Schedulers, jobs, batching, queue handling
- (c) Hands-on: running an R&D code at NERSC, retrieving data
→ *local facility tour (2016, 2015: Hyak@UW; 2014: Hutch)*

Duration: 3 hours lecture + hands-on + tour

SCBC5 – Post-Processing

- (a) ParaView introduction, tutorial, application to SCBC4 generated data
- (b) VisIt introduction with respect to same SCBC4 generated data

Duration: 2 hours lecture + hands-on

SCBC6 – Verification and Validation in Scientific Computing

- (a) Verification & validation
- (b) Predictive capabilities, restrictions
- (c) Reproducibility of results

Duration: 2 hours

SCBC7 – Solving PDEs Numerically with Finite Elements

- (a) Finite Element Method in 100 lines of code
- (b) Pre-processing, demonstration of Fluxgrid
- (c) CUBIT hands-on

Duration: 4 hours lecture (can be hands-on)*

SCBC8 – Contemporary Issues in Plasma Physics and Nuclear Fusion

Anticipated but not limited to:

- (a) Multi-fluid modeling (mixed neutral-plasma models)
- (b) Multi-physics (Fokker-Plank coupling to MHD)
- (c) Adaptive solvers
- (d) Flux-source expression of dominant equations

Duration: 3-4 hours (anticipated 6-8 presentations)

SCBC9 – Future of Scientific Computing

(a) Exascale roadmap

(b) Hardware/software, architecture/algorithms gap

(c) Algorithmic considerations, adaptations, and foresight for extreme scale

Duration: 2 hours