

PMI Workshop Epitome - Monday 5/4/2015

<https://www.burningplasma.org/activities/?article=Plasma-Materials%20Interactions>

Entrance at PPPL guard booth	8:00
Registration and badging in PPPL lobby	8:15
Refreshments - Melvin B. Gottlieb (MBG) Auditorium	8:30
Introduction Session – Auditorium (Chair: Maingi) *	
Prager, Foster - Welcome	9:00
R. Maingi/S. Zinkle – Goals, process, timeline, logistics	9:10
H. Guo/B. LaBombard – SOL and divertor physics – ReNeW Thrust 9	9:20
J.P. Allain/R. Doerner – Plasma-materials interactions – ReNeW Thrust 10	9:30
C. Kessel/D. Youchison – Engineering Innovations – ReNeW Thrust 11	9:40
A. Hubbard/T. Leonard – Core/edge integration issues – ReNeW Thrust 12	9:50
Coffee break	10:00
Plenary Session – Auditorium (Chair: Maingi) *	
G. de Temmermen – PWI Research Needs for ITER	10:30
I. Nunes – Experience with ILW in JET	11:00
Lunch break	11:30
Parallel Sessions: (Led by thrust leaders and deputies)	
Thrust 9: talks and structured discussion (B331 – Director’s Conference Room) ***	1:00
Thrust 10: talks and structured discussion (B318)	
Thrust 11: talks and structured discussion (B252) *	
Thrust 12: talks and structured discussion (A104 – Visualization Wall)	
Coffee break	3:00
Parallel Sessions: (Led by thrust leaders and deputies)	
Thrust 9: talks and structured discussion (B331 – Director’s Conference Room) ***	3:30
Thrust 10: talks and structured discussion (B318)	
Thrust 11: talks and structured discussion (B252) *	
Thrust 12: talks and structured discussion (A104 – Visualization Wall)	
Joint Panel Session – Auditorium (Chair: Zinkle) *	
D. Whyte - Achieving and exploring reactor-level PMI simulation in small-scale devices	5:30
R. Nygren - A New Vision for Materials, In-vessel Components and Diagnostics for the Plasma Edge	
J. Rapp - Integrated PMI R&D with a multi-device approach	
Adjourn	6:30
Working dinner: Cross-cutting group and sub-panel leads discussion (B318)	7:00

PMI Workshop Epitome - Tuesday 5/5/2015

Joint Parallel Sessions: (Chaired by cross-cutting group)	8:30
Thrust 9&12: talks and structured discussion (A104 – Visualization Wall) **	
Thrusts 10&11: talks and structured discussion (Auditorium) *	
Coffee break	10:30
Joint Parallel Sessions: (Chaired by cross-cutting group)	11:00
Thrusts 9&10: talks and structured discussion (Auditorium) **	
Thrusts 11&12: talks and structured discussion (A104 – Visualization Wall) *	
Working Lunch served in Auditorium	12:00
Parallel Sessions: (Led by thrust leaders and deputies)	1:30
Thrust 9: structured discussion (126 – Engineering Conference Room) **	
Thrust 10: structured discussion (Auditorium)	
Thrust 11: structured discussion (B252) *	
Thrust 12: structured discussion (A104– Visualization Wall)	
Coffee break	2:30
Parallel Sessions: (Led by thrust leaders and deputies)	3:00
Thrust 9: structured discussion (126 – Engineering Conference Room) **	
Thrust 10: structured discussion (Auditorium)	
Thrust 11: structured discussion (B252) *	
Thrust 12: structured discussion (A104 – Visualization Wall)	
Plenary Session – MBG (Chair: Maingi) *	6:00
Thrust 9, 10, 11, 12 PRD updates	
(If extra time is needed for preparation, this session or specific thrust reports will occur Wed. morning, 5/6, @ 8:30 AM)	
Adjourn	6:45
Group No-Host Dinner, Salt Creek Grill, Forrestal Village	7:00

PMI Workshop Epitome - Wednesday 5/6/2015

Parallel Sessions: (Led by thrust leaders and deputies)	8:30
Thrust 9: structured discussion (126 – Engineering Conference Room) **	
Thrust 10: structured discussion (Auditorium)	
Thrust 11: structured discussion (B252) *	
Thrust 12: structured discussion (T169 – Theory Conference Room)	
Coffee break	10:30
Parallel Sessions: (Led by thrust leaders and deputies)	
Option: this session may be modified for additional cross-thrust discussions	11:00
Thrust 9: structured discussion (126 – Engineering Conference Room) **	
Thrust 10: structured discussion (Auditorium)	
Thrust 11: structured discussion (B252) *	
Thrust 12: structured discussion (T169 – Theory Conference Room)	
Working lunch served in Auditorium	12:00
Plenary Session: Status of each sub-panel: (Chair: Zinkle, Auditorium) *	
H. Guo/B. LaBombard – SOL and divertor physics – ReNeW Thrust 9	1:30
J.P. Allain/R. Doerner – Plasma-materials interactions – ReNeW Thrust 10	2:00
C. Kessel/D. Youchison – Engineering Innovations – ReNeW Thrust 11	2:30
A. Hubbard/T. Leonard – Core/edge integration issues – ReNeW Thrust 12	3:00
Break (no coffee)	3:30
Option for Parallel or Joint Sessions: (Led by thrust leaders and deputies)	4:00
Thrust 9: post-plenary discussion (B252) **	
Thrust 10: post-plenary discussion (T169)	
Thrust 11: TBD (B205 if needed) *	
Thrust 12: TBD	

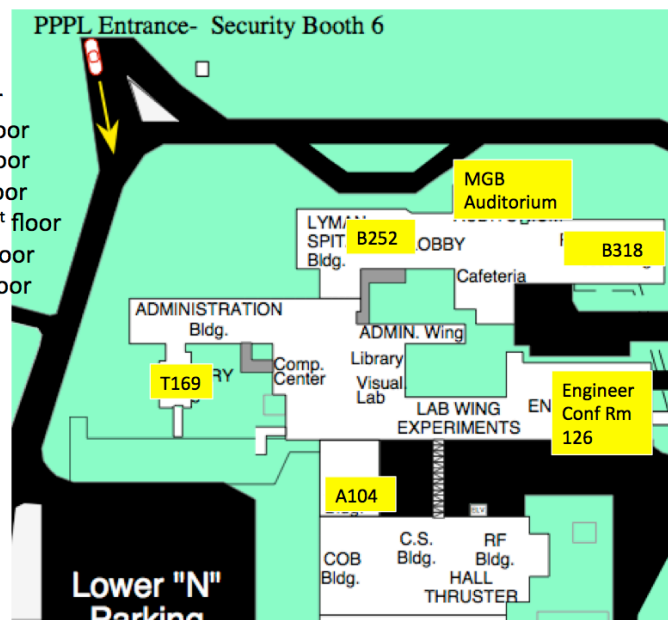
PMI Workshop Epitome - Thursday 5/7/2015 (*sub-panel members only*)

Plenary Session: Cross-cutting discussion (Chair: Hill/Neilson, B318) *	8:30
Coffee break	10:30
Parallel Sessions: (Led by thrust leaders and deputies)	11:00
Thrust 9: (B205) **	
Thrust 10: (B318)	
Thrust 11: (B252) *	
Thrust 12: (B331 – Director’s Conference Room)	
Adjourn	12:30

PMI Workshop Overview and Room Locations

Day/time	Thrust 9 Div/SOL	Thrust 10 PMI	Thrust 11 Engineering	Thrust 12 integration
Mon 9:00	Introduction session MBG Auditorium			
Mon 10:30	Plenary session MBG			
Mon 11:30	Lunch			
Mon 1:00	B331	B318	B252	A104
Mon 5:30	Joint Panel Session MBG			
Mon 7:00	Executive Committee working dinner B318			
Tues 8:30	Joint #9,#12 A104	Joint #10, #11 MBG	Joint #10, #11 MBG	Joint #9,#12 A104
Tues 11:00	Joint #9, #10 MBG	Joint #9, #10 MBG	Joint #11, #12 A104	Joint #11, #12 A104
Tues 12:00	Lunch			
Tues 1:30	EngConfRm	MBG	B252	A104
Tues 6:00	Plenary MBG			
Wed 8:30	EngConfRm	MBG	B252	T169
Wed 12:00	Working lunch in MBG			
Wed 1:30	Subpanel reports MBG			
Thurs 8:30	SP members-only B318			
Thurs 11:00	SP members only B205	SP members only B318	SP members only B252	SP members only B331
Thurs 12:30	Adjourn			

Note:
 1st number
 denotes floor
 A104 1st floor
 T169 1st floor
 ECR 126 1st floor
 B252 2nd floor
 B318 3rd floor



Thrust Evaluation sub-panels, based on ReNeW Thrusts - Background

The list of participants for each evaluation, based on thrusts from the 2009 ReNeW report, is show below.

Scrape-off layer (SOL) & divertor physics (ReNeW Thrust #9):

Leader/Deputy: H.Y. Guo (GA), B. LaBombard (MIT)
Panelists: R. Goldston (PPPL), I. Hutchinson (MIT), S. Krashenninikov (UCSD), J. Myra (Lodestar), V. Soukhanovskii (LLNL), P. Stangeby (U. Toronto), P. Valanju (U. Texas), X. Xu (LLNL)

Advancing the Plasma-Material Interface Science and Innovation (ReNeW Thrusts #10, and part of #14):

Leader/Deputy: J.P. Allain (UIUC), R. Doerner (UCSD)
Panelists: M. Jaworski (PPPL), R. Kolasinski (SNLL), R. Kurtz (PNNL), J. Rapp (ORNL), B. Wirth (UT-K)

Engineering innovations for plasma exhaust challenges (ReNeW Thrust #11)

Leader/Deputy: C. Kessel (PPPL), D. Youchison (SNLA)
Panelists: J. Blanchard (UW-M), R. Callis (GA), R. Ellis (PPPL), R. Majeski (PPPL), N. Morley (UCLA), D. Ruzic (UI-UC), M. Tillack (UCSD), S. Wukitch (MIT), M. Yoda (GIT)

Core-edge integration (ReNeW Thrust #12)

Leader/Deputy: A. Hubbard (MIT), T. Leonard (GA)
Panelists: J. Canik (ORNL), M. Kotschenreuther (UT-A), R. Majeski (PPPL), P. Snyder (GA), J. Terry (MIT), Z. Unterberg (ORNL), R. Wilson (PPPL)

Also, there is a **cross-cutting group** for overlaps amongst thrust issues and proposals:
R. Maingi (PPPL), S. Zinkle (UT-K), D. Hill (LLNL), D. Hillis (ORNL), J. Menard (PPPL), H. Neilson (PPPL), D. Whyte (MIT)

Thrust 9 Parallel Sessions - Agenda Monday (5/4/15)

Guidance: Nominal 20 minute time slots – 12 minutes for talk + 8 for questions

Session I (B331 – Director’s Conference Room)

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|------|---------------------|---|
| 1:00 | Guo, LaBombard | Organization of subpanel 9 sessions |
| 1:20 | C.S. Chang | Importance of SOL plasma kinetic information for more reliable PMI data |
| 1:40 | J.M. Canik | Model validation needs in boundary physics |
| 2:00 | J.R. Myra | Understanding the SOL: Fundamental Physics Challenges |
| 2:20 | A. Anders | Unipolar arcs on the first wall: gaining deeper understanding of arc ignition conditions and development of arc-prevention strategies |
| 2:40 | V.A. Soukhanovskii | Snowflake divertor |
| 3:00 | <i>Coffee Break</i> | |

Session II (B331 – Director’s Conference Room)

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|------|-----------------------|------------------------------------|
| 3:30 | S.I. Krasheninnikov | Detachment 101 |
| 3:50 | V.A. Soukhanovski | Control of divertor and detachment |
| 4:10 | Structured Discussion | |
| 5:30 | Plenary Session | |
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Tuesday (5/5/15) - Subpanel 9 Parallel Sessions

Session III (126 – Engineering Conference Room)

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|------|-----------------------|--|
| 1:30 | Structured Discussion | |
| 2:30 | <i>Coffee Break</i> | |

Session IV (126 – Engineering Conference Room)

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|------|-----------------------|--|
| 3:00 | Structured Discussion | |
|------|-----------------------|--|

Plenary Session (Auditorium)

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|------|--|--|
| 6:00 | Thrust 9, 10, 11, 12 PRD updates | |
| 6:45 | Adjourn | |
| 7:00 | <i>Group No-Host Dinner, Salt Creek Grill, Forrestal Village</i> | |
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Wednesday (5/6/15) - Subpanel 9 Parallel Sessions

Session V (126 – Engineering Conference Room)

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|-------|-----------------------|--|
| 8:30 | Structured Discussion | |
| 10:30 | <i>Coffee Break</i> | |

Session VI (126) -- if not replaced by cross-cutting discussion

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|-------|-----------------------------------|--|
| 11:00 | Structured Discussion | |
| 12:00 | <i>Working Lunch (Auditorium)</i> | |

Plenary Session (Auditorium)

- | | | |
|------|---|--|
| 1:30 | Thrust 9, 10, 11, 12 PRD updates | |
| 3:30 | Adjourn | |

Thrust 10 Parallel Sessions –Agenda for Talks

Guidance: Nominal 15 minute time slots – 10 minutes for talk + 5 for questions

Session I - Facilities Monday 5/4 1:00 PM

S.H. Glenzer	Stanford	Opportunities for fusion material science studies at LCLS Extreme Materials (XMAT) Beam Line for In Situ Examination of Radiation Damage
M.J. Pellin	ANL	
R. Majeski	PPPL	Test stands for liquid metal PFC development
R.H. Goulding	ORNL	A multiply-heated RF plasma source for a novel linear divertor simulator
Y. Katoh	ORNL	Impact of Neutron Irradiation on Plasma-Materials Interactions

Session II - Diagnostics Monday 5/4 3:30 PM

T.M. Biewer	ORNL	PMI Diagnostic Development Needs
Z.S.Hartwig (Wright)	MIT	The necessity to advance diagnostics for plasma-facing component surfaces
C.M. Parish	ORNL	Qualifying materials' response to plasma-materials interaction
E. Scime	WVU	Two Photon Absorption Laser Induced Fluorescence Measurements of Neutral Hydrogen in the Tokamak Edge

Session III - Modeling Tuesday 5/5 1:30 PM

C.H. Skinner	PPPL	Coordinated experimental-modeling approach to low-risk PFCs for FNSF/DEMO
B.D. Wirth	UT-K	Status of Modeling Plasma - Materials Interactions: Unresolved Issues & Future Opportunities
D. Curreli	UIUC	Challenges and strategies to experimental validation of multi-scale nuclear fusion PMI computational modeling
P. Krstic	SUNY	Integrated, Multi-Scale Plasma-Material Interface Simulation

Thrust 11 Parallel Session –Agenda for Talks

Guidance: Nominal 20 minute time slots – 12 minutes for talk + 8 for questions

Session I Monday 5/4 1:00 PM

- A. Lumsdaine Engineering Enhanced Heat Transfer Materials
- L. Garrison Development of advanced tungsten and alternative materials through advanced manufacturing
- D.G. Whyte Plasma-facing engineering solutions enabled by modularity & demountable coils
- F. Volpe Feedback Stabilization of Flowing, Electromagnetically Restrained Liquid Metal Walls
- D. Andruczyk Liquid Metal's Role to Improve Power Handling through Engineering Innovation

Session II Monday 5/4 3:30 PM – structured discussion

Session III Tuesday 5/5 1:30 PM

- J. Singh Fabrication of Net-shaped Functional Graded Nano-dispersion Strengthened Tungsten Alloys for Structural Applications in Fusion Energy

All subsequent parallel sessions – structured discussion

Thrust 12 Parallel Sessions – Agenda for Talks

Guidance: Nominal 20 minute time slots – 12 minutes for talk + 8 for questions

Parallel Session 1 Monday 5/4 1:00 PM:

- 1:00 Hubbard + Leonard Scope of panel, intended output (if needed after am session)
- 1:20 Jon Menard Potential challenges, research needs, and solutions for core-edge integration
- 1:40 Jim Terry Challenges for integrating power-handling constraints and those of a high-performance core
- 2:00 Dick Majeski Low recycling walls and confinement
- 2:20 C. S. Chang Importance of kinetic physics in core-edge integration
- 3:00 Coffee Break

3:30 Parallel Session II: Structured Discussion

Possible topics:

Priority Research Topics. Do we have the right set? What is missing?

Metrics: Can/should we quantify some of these issues, to serve as template for assessing initiatives?

Initiatives: Considering whole set of white papers (including those not in talks), do we have all bases covered? If not (and perhaps ahead of meeting), assign people to summarize options in other realms on Tuesday.

All subsequent parallel sessions – structured discussion

Joint Parallel Sessions on Tuesday 5/5 –Agenda for Talks

Thrusts 9 & 12: Joint Parallel Session Tuesday 5/5 8:30 AM

Guidance: Nominal 20 minute time slots – 12 minutes for talk + 8 for questions

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|--------------------|--|
| B. LaBombard | ADX: a high field, high power density, advanced divertor and RF tokamak |
| X.Q. Xu | Develop a Validated Predictive Modeling Capability for Localized Transient Events under Detached Divertor Operations |
| R. Nygren | Smart Tiles and MEMS-based sensors - new age of wall/edge diagnostic |
| M. Kotschenreuther | Cumulative sensitivity of high Q operation on ITER and burning plasmas to issues of integrated operation |

Thrusts 10 & 11: Joint Parallel Session Tuesday 5/5 8:30 AM

Guidance: Nominal 15 minute time slots – 10 minutes for talk + 5 for questions

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|--------------------|---|
| R. Nygren | Advanced Manufacturing and Engineered Materials – A New Vision for Materials and PFC Development |
| M. Kotschenreuther | Implications of Recent SOL Projections, and Tungsten Sputtering, on Tolerable ELM size: SOL physics, and plate design |
| Y. Wang | Controlled He Release Through Nanocomposite Materials Design |
| G. Wright | Operation of a Tokamak with a Hot Wall |
| M. Shimada | Tritium and Nuclear Sciences Initiative for Burning Plasma Long Pulse PMI |
| R. Goldston | An Example Opportunity for Divertor Innovations: The Lithium Vapor-Box Divertor |
| B. Koel | Liquid Metals as Plasma-Facing Materials for Fusion Energy Systems |
| J. Caughman | Reliable Long Pulse Plasma Heating and Current Drive using ICRF |

Joint Parallel Sessions on Tuesday 5/5 – Agenda for Talks

Thrusts 9 & 10: Joint Parallel Session Tuesday 5/5 11 AM - Noon

Guidance: Nominal 15 minute time slots – 10 minutes for talk + 5 for questions

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|---------------------|---|
| G. Tynan | Addressing PMI Challenges with Complementary Linear Device and Confinement Device Studies |
| D. Buchenauer | Neutral H sensor for C-X H flux on wall and divertor |
| I. Hutchinson | Divertor Detachment Basic Physics |
| T. Schenkel(Anders) | Multi-scale and time-resolved studies of point defect dynamics in materials, to further the understanding of PMI for fusion |

Thrusts 11 & 12: Joint Parallel Session Tuesday 5/5 11 AM - Noon

Guidance: Nominal 15 minute time slots – 10 minutes for talk + 5 for questions

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|-------------|---|
| S. Wukitch | PMI Challenges and Path towards RF Sustainment of Steady State Fusion Reactor Plasmas |
| R. Nygren | Understanding Design Integration to Confirm the Credibility of Liquid Surface PFCs |
| R. Majeski | Lithium walls for fusion |
| L. Zakharov | Flowing Liquid Lithium (24/7FLiLi): the technology step to burning plasma regimes |