

Working Group 8

Novel Source Concepts

Working Group Conveners:

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Charge to the Working Group

- Identify promising R&D areas that may be high risk but offer high value and could have significant impact on future light source designs,
- Connect R&D areas to future applications by developing machine concepts based on best estimates of potential performance,
- Develop a description of each concept, enumerating its probable performance, cost, and the R&D necessary to bring the concept to practice.

Charge to the Working Group

Speakers were asked to prepare talks that included the following:

- 1) Overview of the technology
- 2) What is the likely performance in terms of limiting brightness, limiting average power, and temporal properties (pulse duration, rep rate, coherence, spectral purity)?
- 3) What is the present state of the R&D?
- 4) Nominal strawman design of a 500-eV source consistent with a 5 year horizon.
(Use the attached spreadsheet as a starting point)
- 5) Nominal strawman design of a 50-keV source consistent with a 10 year horizon (Use the attached spreadsheet as a starting point) For describing a nominal design, please include:
 - a. Rough estimate of cost and size of such a facility
 - b. Quantified special source properties and advantages over existing and proposed light sources
 - c. Key technical issues requiring further R&D can be identified and a roadmap sketched
 - d. Synergy of the R&D effort with other areas (e.g. HEP, Laser Science, etc.) to be identified

Strawman Designs at 500 eV & 50 keV

- We will put together strawman designs based on the Novel Source Concepts presented.
- The desired outcome is to understand the role of novel concepts from a system-level perspective, and to identify the highest-priority R&D questions.

Novel Light Source Parameter Worksheet					
Parameter	Unit	LCLS		Strawman Design 500 eV	Strawman Design 50 keV
		Long Wavelength	Short Wavelength		
Source Parameters					
Source Type		rf gun	rf gun		
Injection Energy	MeV	6.0	6.0		
Bunch Charge	nC	1.0	1.0		
Emittance (Norm)	mm-mr	1.0	1.0		
Energy Spread	%	1.5	1.5		
Bunch Length (FWHM)	micron	3000.0	3000.0		
Peak Current	Amp	100.0	100.0		
# Bunches per Train		1.0	1.0		
Bunch spacing	micron				
Train Rep Rate	Hz	120.0	120.0		
Accelerator Parameters					
Accelerator Type		s-band rf	s-band rf		
Beam Manipulations		2 BC, 1 XBL	2 BC, 1 XBL		
Final Energy	GeV	4.3	13.6		
Gradient	MeV/m	19.0	19.0		
Active Length (Not total length)	m	227.0	717.9		
Final Energy	GeV	4.3	13.6		
Final Energy Spread	%	0.1	0.0		
Final Bunch Length	micron	41.0	22.0		
Peak Current	Amp	1920.0	3400.0		
Average Current	microAmp	0.1	0.1		
Final Emittance (Norm)	mm-mr	3.0	2.0		
Wall Plug Power (accel only)	MW	6.8	21.5		
Radiator Parameters					
Radiation Process		FEL	FEL		
radiator period (if FEL)	mm	30.0	30.0		
rho parameter (if FEL)		8.50E-04	4.20E-04		
Quantum Efficiency	phot/elec	4.42E+03	6.90E+02		
Laser Power (if ICS)	W				
Laser Wavelength (if ICS)	micron				
Light Source Parameters					
Center Wavelength	Angstrom	15.0	1.5	24.8	0.2
Center Wavelength	eV	830.0	8300.0	500.0	50000.0
Peak Photons/sec	phot/s	31.0	5.8		
Average Photons/sec	10 ¹² phot/s	1729.8	173.0		
BC = Bunch Compressor XBL = X-Band Linearizer					

Working Group 8 Schedule

Monday, March 1

Session I: WG8 Charge and Needs of Future Light Sources

Session II: Plasma-Wakefield Based Concepts

Tuesday, March 2

Session III: Scattering-Based Light Sources

Session IV: Other Accelerator Technologies for Light Sources

Wednesday, March 3

Excursion; no WG sessions.

Thursday, March 4

Session V: Novel Radiation-Generation Technologies I

Session VI: Novel Radiation-Generation Technologies II

Session VII: Working Session: Analysis of Strawman Designs

Session VIII: Working Session: Summary Discussion and Writeup

Friday, March 5

Workshop Summary Reports

Monday March 1

Day : 1. Monday (10)

3/1/2010 1:30 PM	4:00pm	SESSION I: WG8 Charge and Needs of Future Lights Sources	
3/1/2010 1:30 PM	2:00pm	Discussion of WG8 Schedule and Goals	Colby/Carlsten
3/1/2010 2:00 PM	2:30pm	Future Parameters and Needs for 1 keV-Class Soft Xray Sources	Bill Schlotter
3/1/2010 2:30 PM	3:00pm	Discussion of SXR Needs	ALL
3/1/2010 3:00 PM	3:30pm	Future Parameters and Needs for 50 keV-Class Hard Xray Sources	Cris Barnes
3/1/2010 3:30 PM	4:00pm	Discussion of HXR Needs	ALL
3/1/2010 4:30 PM	6:00pm	SESSION II: Plasma-Wakefield Based Concepts	
3/1/2010 4:30 PM	5:10pm	Prospects for Laser-Driven PWFA-Based Light Sources	Wim Leemans
3/1/2010 5:10 PM	5:50pm	Prospects for Beam-Driven PWFA-Based Light Sources	Mark Hogan
3/1/2010 5:50 PM	6:00pm	Discussion of PWFA-Based Sources	ALL

Tuesday March 2

Day : 2. Tuesday (11)

3/2/2010 1:30 PM	4:00pm	SESSION III: Scattering-Based Light Sources	
3/2/2010 1:30 PM	2:10pm	Overview of Compton Scattering Light Sources & Applications	Fred Hartemann
3/2/2010 2:10 PM	2:50pm	Inverse Compton Scattering Sources	Bill Graves
3/2/2010 2:50 PM	3:30pm	Experience with Intersecting Storage Ring-Based Compton Scattering Light Sources	Ron Ruth
3/2/2010 3:30 PM	3:50pm	Demonstration of single shot phase contrast imaging and single shot diffraction	Vitaly Yakimenko
3/2/2010 3:50 PM	4:00pm	Discussion of Scattering Light Sources	ALL
3/2/2010 4:30 PM	6:00pm	SESSION IV: Other Accelerator Technologies for Light Sources	
3/2/2010 4:30 PM	5:00pm	Dielectric-Based Laser Accelerators	Eric Colby
3/2/2010 5:00 PM	5:30pm	The Laser-Driven MAP Structure	Gil Travish
3/2/2010 5:30 PM	6:00pm	Conceptual Design of a Beam-Drive DWFA-Based Light Source	James Rosenzweig
3/2/2010 6:00 PM	6:15pm	Discussion of Dielectric Based Accelerators	ALL

Thursday March 4

Day : 4. Thursday (10)

3/4/2010 9:00 AM	10:30am	SESSION V: Novel Radiation-Generation Technologies I	
3/4/2010 9:00 AM	9:30am	Extremely high gain FEL amplifiers	Vladimir Litvenenko
3/4/2010 9:30 AM	10:00am	Free electron laser simulations without the slowly-varying envelope approximation	Svet Bajlekov
3/4/2010 10:00 AM	10:30am	Laser-driven soft-X-ray undulator source	Matthias Fuchs
3/4/2010 11:00 AM	12:30pm	SESSION VI: Novel Radiation Generation Technologies II	
3/4/2010 11:00 AM	11:30am	Optics-free X-ray FEL oscillator	Vladimir Litvenenko
3/4/2010 11:30 AM	12:00pm	Some Applications of Laser-Compton Scattering X-rays from intermediate Energy Electron beams	Khalid Chouffani
3/4/2010 12:00 PM	12:30pm	Open Slot for Last-Minute Contributions	<open slot>
3/4/2010 1:30 PM	4:00pm	Discussion and Analysis of 500eV and 50keV Strawman Designs	ALL
3/4/2010 4:30 PM	6:00pm	Summary Discussion and Writeup	ALL

Proceedings

Our goals for the proceedings will be to assemble

- All abstracts for plenary talks
 - All presentation materials from plenary sessions and working groups
 - Abstracts from breakout session speakers
 - Four-page minimum summaries from the conveners - no specified maximum
 - Written reports of plenary and breakout presentations from those participants willing to write them
 - Overall closing summary of workshop from the 3 of us
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- Please e-mail talks to ecolby@slac.stanford.edu for upload to the WG8 website.
 - Thursday afternoon **we** will draft the final WG8 report.