Advanced and Novel Accelerators for High Energy Physics Roadmap Workshop 2017 April 25-28, 2017 at CERN

WG1: Laser wakefield accelerator (LWFA)

Conveners: Arnd Specka (CNRS) Dan Gordon (NRL) Carl Schroeder (LBNL)

Charge to the working groups

- Identify scientific and technological bottlenecks of each scheme and their possible solutions to produce a TeV lepton collider.
- > Detailed charge:
 - Identify parameters/elements necessary for the scheme
 - Determine to what extend they have been proved and demonstrated
 - Evaluate likelihood and timescales for testing/proving solutions
 - Identify key experiments to be performed
 - Identify existing or new facilities to perform key experiments
 - Identify realistic time scales
 - Identify panorama, what is in the making?

Deliverable (as of 18/04/2017)

«You already knowingly, willingly and happily agreed to write after the workshop:

shinny brochure: summarizes workshop and promotes the field to distribute to shakers and movers.»

Suggested sections:

- State of the art of the acceleration scheme relevant to HEP describe the main performance/parameters relevant to HEP that have been achieved
- Main challenges to be addressed in the next five(5) year describe which experiment/simulation/theory will or can/must be done in the next five(5) years (2018-2022) and which facility/resources are needed, emphasis on existing/planned facilities
- Main challenges to be addressed in the next ten(10) year: describe which experiment/simulation/theory will/can/must be done in the next ten(10) years (2018-2027) and which facility/resources are needed, emphasis on facilities that needs to be planned and built

Long term view for the acceleration scheme application to HEP:

describe intermediate steps (facility, etc.) that are needed to show relevance to HEP with emphasis on those that could already be of interest for HEP, e.g., beam test facilities, etc.

- Technologies that need to be developed to reach the goals above
 (e.g., high peak.average power lasers, super computer, simulation methods, etc.)
- Conclusions of the WG and outlook.

All this in five(5) pages maximum. Deadline May 28, 2017.

Parameter table

Electron Injector			
Conventional? Specify If in plasma specify injection			
mechanism			
Parameters:			
Energy (MeV)			N/A
Energy (MeV) Relative energy spread (%) Charge per bunch (nC)			N/A N/A
Population x 1e9 (# e-)	0		ily A
Normalized emittance (mm- mrad)			N/A
Summary of electron injector			N/A
Electron damping ring			Yes
Positron Injector			
Specify Source (brehmastarhlung, plasma, etc.)			
Parameters:			
5 B 4-3-0			N/A
Energy (MeV) Relative energy spread (%) Charge per bunch (nC) Population x 1e9 (# e-)			N/A
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Normalized emittance (mm- mrad)			N/A
Summary of positron injector			N/A N/A
Positron damping ring			Yes
Accelerator section			
Plasma (PWFA, LWFA)			
Type: Laser ionized			Yes
Gas or alkaly (H, He, Ar, Li, Rb, etc)			
Capillary discharge Glass capillary			Yes Yes
Other			Yes
Parameters:			N/A
Length of single plasma (cm) Density (x1e16/cc) Accelerating gradient (GV/m)			N/A
Accelerating gradient (GV/m) Relative density niformity (%)			N/A N/A
Relative density niformity (%) Longitudinal profile (ramp, gradient, etc.)			N/A
Hollow plasma channel			N/A
Hollow gas channel Summary of accelerator section			N/A N/A
Dielectric (DWA, DLA) Structure geometry (cylindrical,			
planar, etc.) Dielectric constant			N/A N/A
Operating frequency Inner diameter (microns)			N/A
Outer diameter (microns)			N/A N/A
Clading (none, metallic, layer, etc.)			N/A
Accelerating gradient (GeV/m)			N/A
Drive beam			
Parameters: Type (electrons, laser, other?)			
Pulse/bunch length (microns) Transverse size at focus			N/A
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(microns)			N/A
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WG1: schedule (25/04)

14:30-16:00	1:30	LWFA electron Acceleration			
	0:10	Conveners	Charge to to the WG		
	0:15	Alban Mosnier	Electron acceleration - Introductory Overview		
	0:10	Arie Irman	Recent result in ionization induced injection		
	0:10	Masaki Kando	Improvement in beam pointing stability		
	0:10	Oznur Mete-Apsimon	Witness beam scattering by plasma ions and electrons"		
	0:35	discussion	State of the art of the acceleration scheme relevant to HEP		
			Identify parameters/elements necessary for the scheme		
16:30-18:00	1:30	:30 Alternative and Novel Acceleration Schemes (electrons and positrons)			
	0:10	Simon Hooker	Excitation and control of plasma wakefields by trains of laser pulses".		
	0:10 Alexander Debus		Traveling-Wave Electron Acceleration (TWEAC) Electron		
			acceleration		
	0:10	Andreas Döpp	PWFA with LWFA generated electrons		
1:00		discussion	State of the art of the acceleration scheme relevant to HEP		
			Determine to what extend they have been proved and		
			demonstrated		
			Identify key experiments to be performed		

WG1: schedule (26/04)

S2C	26-avr	09:00-10:30	1:20	Injection / Positron pr	oduction
			0:05	Vladimir Andreev	external injection strategy of an electron bunch to minimize the
					energy spread of accelerated electrons
			0:05	Igor Pogorelsky	positron prodution?
			0:10	Mike Downer	Compton x-rays, gamma-rays from self-aligned combination of LWFA
					and plasma mirror
			1:00	discussion	electron and positron sources
					cross-fertilization with XFEL application of LWFA
					Identify realistic time scales?
S2D	26-avr	11:00-12:30	1:30	Modeling and testing	of concepts
			0:20	David Bruhwiler	Simulation Codes - Introductory Overview
			0:05	Mike Downer	Single-shot diagnostics of LWFA structures: holography,
					shadowgraphy, streak camera, tomography, Faraday rotation
			0:05	Christina Swinson	10 um laser-wakefield mapping using an electron beam probe.
			0:05	Wim Leemans	Bella
			0:55	discussion	Identify existing or new facilities to perform key experiments
S2E	26-avr	14:00-16:00	2:00	Work session on parar	neter ranges, technologies, interfaces, strategies,
					laser parameters
					plasma source developments
					Identify panorama, what is in the making?
					fill in the spreadsheet table?
S2F	26-avr	16:30-18:00	1:30	synthesis	
					State of the art LWFA
					Main challenges 5y
					Main challenges 10y
					Long term view for HEP: