Scientific Brainstorming Session

Scientific Brainstorming Session

Everyone in the room
Various world-leading institutions

apart from Simon Hooker
University of Oxford

Order of play

- Brief review of outcome of each WG & comments on WG summaries
- Comparisons with US roadmaps
- Identification of common themes & synergies
- Next steps

Scientific bottleneck / challenge	Milestones			Comments	
	5 years	5 - 10 years	10 - 20 years		
femtosecond Injector >200MeV performance charge, dE/E, pointing stability			dQ/Q<2%, 100 pC, dE/E<2%, dE0/E0<1%, do<0.1 mrad (2/5)dQ/Q<2%, 100 pC, dE/E<2%, dE0/E0<1%, do<0.1 mrad (5/5)All parameters, structured pulse? Polarized?	Only for electrons; development needed for positrons, select injector technique	
Repetition rate (laser)	>10 Hz	>100 Hz	>1 kHz	Wakefield drive laser	
Repetition rate (experiment)	10 Hz	100 Hz	1 kHz		
Efficiency (laser)	>1%	>10%	50%		
Laser beam quality	>90% in design mode				
Scalable single stage	>10 cm, 0.1 GeV/cm	1 meter, 0.1 GeV/cm	1 meter, 0.1 GeV/cm	Capillary discharge, hollow channels, structure suitable for positrons	
Staging	~unity charge throughput and emittance preservation		Scalability (multi-staging)		
Positron acceleration	Identify and test injection method	Acceleration demonstration (low emittance and dE/E)	Parity with electrons		
Fluctuations and feedback control	chargex1, Ex2, E0x2, mradx2	Active control of multiple fluctuations	all factors 1.01		
Efficient beamloading (longitudinal bunch shaping)			ramped or multi-pulses		
Diagnostic resolution (bunch length and emittance)			fsec resolution, 0.1 mm-mrad normalizedenergy/phase correlation, single shot		
Diagnostic : plasma structure (single shot, high resolution)			Inline 1/2+1D1 parameter in feedback loopsingle shot 4D		
Multi-bunch acceleration	Generation and separation control	Acceleration			
electron/positron polarization					
Fully predictive simulations					
Availability of test facilities					
Collider parameter (re)definition	Preliminary design study	CDR	TDR		
BDS/FF design	Preliminary design study	CDR	TDR		
LWFA collider baseline design	Preliminary design study	CDR	TDR		

WG1: LWFA

- Suggests definition of LWFA baseline design, CDR, TDR
- Proposed collider definition parameter flow: physics → luminosity → BDS → linac → injector
- BDS and FF design study
- Defines target "injector" performance
- Milestones for control of fluctuations

Scientific bottleneck /	Milestones			Comments	
	5 years	5 - 10 years	10 - 20 years		
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Repetition rate (laser)	>10 Hz	>100 Hz	>1 kHz	Wakefield drive laser	
Repetition rate (experiment)	10 Hz	100 Hz	1 kHz		
Efficiency (laser)	>1%	>10%	50%		
Laser beam quality	>90% in design mode				
Scalable single stage	>10 cm, 0.1 GeV/cm	1 meter, 0.1 GeV/cm	1 meter, 0.1 GeV/cm	Capillary discharge, hollow	
Staging	~unity charge throughput and emittance preservation		Scalability (multi-staging)		
Positron acceleration	Identify and test injection method	Acceleration demonstration	Parity with electrons		
Fluctuations and feedback control	chargex1, Ex2, E0x2, mradx2	Active control of multiple	all factors 1.01		
Efficient beamloading (longitudinal bunch shaping)			ramped or multi-pulses		
Diagnostic resolution (bunch length and emittance)			fsec resolution, 0.1 mm-mrad		
Diagnostic : plasma structure (single shot, high resolution)			Inline 1/2+1D1 parameter in		
Multi-bunch acceleration	Generation and separation control	Acceleration			
electron/positron polarization					
Fully predictive simulations					
Availability of test facilities					
Collider parameter	Preliminary design study	CDR	TDR		
BDS/FF design	Preliminary design study	CDR	TDR		
LWFA collider baseline design	Preliminary design study	CDR	TDR		

Electron-driven

Scientific bottleneck / challenge	Facilities / capabilities needed		Milestones			Comments
	Experimental	**Computational**	**5 years**	**5 - 10 years**	**10 - 20 years**	
Collider Design		Start to End Simulations	Develop and maintain self-consistent parameters	Develop and maintain self-consistent parameters	CDR, TDR	R&D on concepts, including experiments and simulations. Will require engagement of larger accelerator & detector
Designing Experiments for Concept Validation at Test Facilities			Support for collaborations & University groups	Support for collaborations & University groups	Support for collaborations & University groups	Strongest collaborations involve University and National Labs
Optimized Beam Loading Scenarios			Self-consistant set for positrons			Develop self-consistant scenarios for beam loading (high-gradient, high-efficiency and emittance
Positrons	High-energy, High peak current, sub-ps positron beams & specialized plasma sources			Exploration of self-loaded regime, hollow channels, quasi non-linear reginmes	Plasma sources for e- & e+ beam production	
Beam quality preservation	Matched Injection, acceleration, extraction		Emittance preservation at 1μm level with % level dE/E			Transverse wakes, hosing, Ion motion, plasma source development with ramps, external injection
Development of low emittance PWFA based e- sources	Laser to e- beam spatial-temporal alignment (synchronization), specialized plasma sources, low emittance diagnostics		Emittance preservation at 1μm level	Emittance preservation at 100nm level (external injection)		
Transformer Ratio >1	Shaped beams with high peak current to drive non-linear wakes		Shaped beam experiments and demonstration of T > 2 (low E)	Shaped beam experiments and demonstration of T > 2 (high E)		Develop and demonstrate techniques for beam shaping
Beam Dynamics & Tolerances	Independent drive-witness beams with temporal & spatial alignment control. Diagnostics with sub-μm, fs	Development of analytic models, accelerator & plasma code integration, new physics packages		Parametric staging studies with independent drive-witness beam		Basic processes in addition to tolerance studies need to consider: Hosing, radiation loss, polarization
Plasma Sources	Tailored density ramps, differential pumping solutions, thermal management		Tailored density ramps, differential pumping solutions	Hollow (and quasi-hollow) channels development		Plasma profiles for emittance preservation at any Hz, refine to kHz rep rates with heat transport
Systems Integration				Drive-Main beam merging and extraction		Bunch compressors, drive beam format, delay, delivery, energy scaling, lareg dE/E beam dump for spent beam
Staging	Capability for multi-GeV with high capture efficiency			Studies with independent witness injector	Multi-stage demonstration in FFTBD	Optical design for multiple stages
Diagnostic development	Visualize wakes, EOS (bunch duration, synchronization & time-of-arrival), Novel plasma-based fs&μm spatiotemporal alignment (pioneered in E210), Emittance measurement, Selective driver/witness bunch measurement (charge, size, current profile), Plasma density tomography, Ultrafast bunch kickers (e.g. to separate driver and witness), High rep rate effects diagnostics , (Transverse) electron beam probing of wake					Single shot preferred
Simulation Development		Adaptive mesh refinement, Adaptive particle loading:Vary Npcell and/or particle merging and splitting, Dynamic load balancing, Adaptive 2d and 3d time steps, Intel Phi and GPUs, Radiation reaction (basic model is implemented) and QED effects based on OSIRIS 4.0 packages				Quasistatic codes are workhorse for beam driven (experimental planning, data interpretation, initial collider

WG2: PWFA (electron driven)

- Collider design, S2E simulations, CDR, TDR
- Optimized beam loading
- Beam quality preservation
- Transformer ratio > 1
- Staging
- Diagnostics development

Scientific bottleneck / challenge	**Facilities / capabilities needed**		**Milestones**			**Comments**
	Experimental	**Computational**	**5 years**	**5 - 10 years**	**10 - 20 years**	
Collider Design		Start to End Simulations	Develop and maintain self-consistent	Develop and maintain self-consistent	CDR, TDR	R&D on concepts, including
Designing Experiments for Concept Validation at Test Facilities			Support for collaborations & University	Support for collaborations & University	Support for collaborations & University	Strongest collaborations involve
Optimized Beam Loading			Self-consistant set for positrons			Develop self-consistant scenarios for
Positrons	High-energy, High peak current, sub-ps positron beams & specialized plasma sources			Exploration of self-loaded regime,	Plasma sources for e- & e+ beam production	
Beam quality preservation	Matched Injection, acceleration, extraction		Emittance preservation at 1μm level with % level dE/E			Transverse wakes, hosing, Ion
Development of low emittance	Laser to e- beam spatial-temporal alignment (synchronization), specialized		Emittance preservation at 1μm level	Emittance preservation at 100nm level (external injection)		
Transformer Ratio >1	Shaped beams with high peak current to drive non-linear wakes		Shaped beam experiments and	Shaped beam experiments and demonstration of T > 2 (high E)		Develop and demonstrate techniques for
Beam Dynamics & Tolerances	Independent drive-witness beams with	Development of analytic models, accelerator & plasma code integration, new physics		Parametric staging studies with independent drive-witness beam		Basic processes in addition to
Plasma Sources	Tailored density ramps, differential pumping solutions, thermal management		Tailored density ramps,	Hollow (and quasi-hollow) channels development		Plasma profiles for emittance
Systems Integration				Drive-Main beam merging and extraction		Bunch compressors, drive beam
Staging	Capability for multi-GeV with high capture efficiency			Studies with independent witness	Multi-stage demonstration in FFTBD	Optical design for multiple
Diagnostic development	Visualize wakes, EOS (bunch duration, synchronization & time-of-arrival), Novel plasma-based fs&μm spatiotemporal alignment (pioneered in E210), Emittance measurement, Selective driver/witness bunch measurement (charge, size, current					Single shot preferred
Simulation Development		Adaptive mesh refinement, Adaptive particle loading:Vary Npcell and/or particle merging and splitting, Dynamic load balancing, Adaptive 2d and 3d time steps, Intel Phi and GPUs, Radiation				Quasistatic codes are workhorse for

Proton-driven

Scientific bottleneck / challenge	Facilities / capabilities needed		Milestones			Comments
	Experimental	Computational	5 years	5 - 10 years	10 - 20 years	
Demonstration/control of SMI of p+ buncn	Exist	Limited to 2D simulations/3D Quasi-static	Seeding, dependencie, maintaining high gradient			
Acceleration of externallyinjected e-, sample wakefields	Exist		GeV enery, finite energy spread (~10%), low trapped charge			
Acceleration of short e- bunch	Exist (?)	3D simulations, redudec and full PIC	Multi GeV, large charge capture	Multi-GeV, full charge capture, emittance<10mm-mrad (e-/p+ colider application)		
Development of scalable plasma source 5-10-100's m, high density uniformity (<1%)	New plasma source developemnt laboratory	Plasma simulations of helicon sources	4-10m	100m	100's m	Type of source not defined
Quick 3D simulation capabilities for optimization and comparison w experimental results						
Production of shorter p+ bunches (few cm)	Existing machine (SPS)		"Beam gymnastic in existing machine, longitudinal beam cooling			
Production of ultra-short p+ bunch (<1mm, TeV energy, 1e11p+)	New p+ bunch source? Compression after extraction?	Machine impedance simulation/understanding				
Production of low emittance p+ bunch			Transverse beam cooling			
Pre-modulation of p+ bunch (no plasma)	High frequency linac, dispersive section (SPS-AWAKE beam line)		Parameter studies			
Identify accelerator for fixed target studies, detectors calibartions, etc.	Facility including plasma-based accelerator of p+ bunch AND physics experiment(s)		Identify possible physics experiment	Design of suitable facility	Building facility	(10-100GeV)
Diagnostics for plasma wave/wakefields	Exist		Transverse diagnostics on existing source, shadowgraphy, etc.	Design of source with transverse and longitudinal acces to plasma, phton acceleration, shadowgraphy, spectral interferometry?		

WG2: PWFA (proton driven)

Scientific bottleneck / challenge	Facilities / capabilities needed		Milestones			Comments
	Experimental	Computational	5 years	5 - 10 years	10 - 20 years	
Demonstration/control of SMI of p+	Exist	Limited to 2D simulations/	Seeding, dependencie, maintaining high gradient			
Acceleration of externallyinj	Exist		GeV enery, finite energy spread (~10%), low trapped charge			
Acceleration of short e- bunch	Exist (?)	3D simulations, redudec	Multi GeV, large charge	Multi-GeV, full charge capture, emittance<10mm-mrad (e-/p+ colider application)		
Development of scalable	New plasma source	Plasma simulations of helicon	4-10m	100m	100's m	Type of source not defined
Quick 3D simulation capabilities for optimization and comparison w experimental results						
Production of shorter p+ bunches	Existing machine (SPS)		"Beam gymnastic in existing machine, longitudinal beam cooling			
Production of ultra-short p+	New p+ bunch source?	Machine impedance simulation/understanding				
Production of low emittance p+ bunch			Transverse beam cooling			
Pre-modulation of p+ bunch	High frequency linac, dispersive section (SPS-AWAKE beam line)		Parameter studies			
Identify accelerator for fixed	Facility including plasma-based accelerator of p+ bunch AND physics		Identify possible physics	Design of suitable facility	Building facility	(10-100GeV)
Diagnostics for plasma wave/	Exist		Transverse diagnostics on existing	Design of source with transverse and longitudinal acces to plasma, phton acceleration, shadowgraphy, spectral		

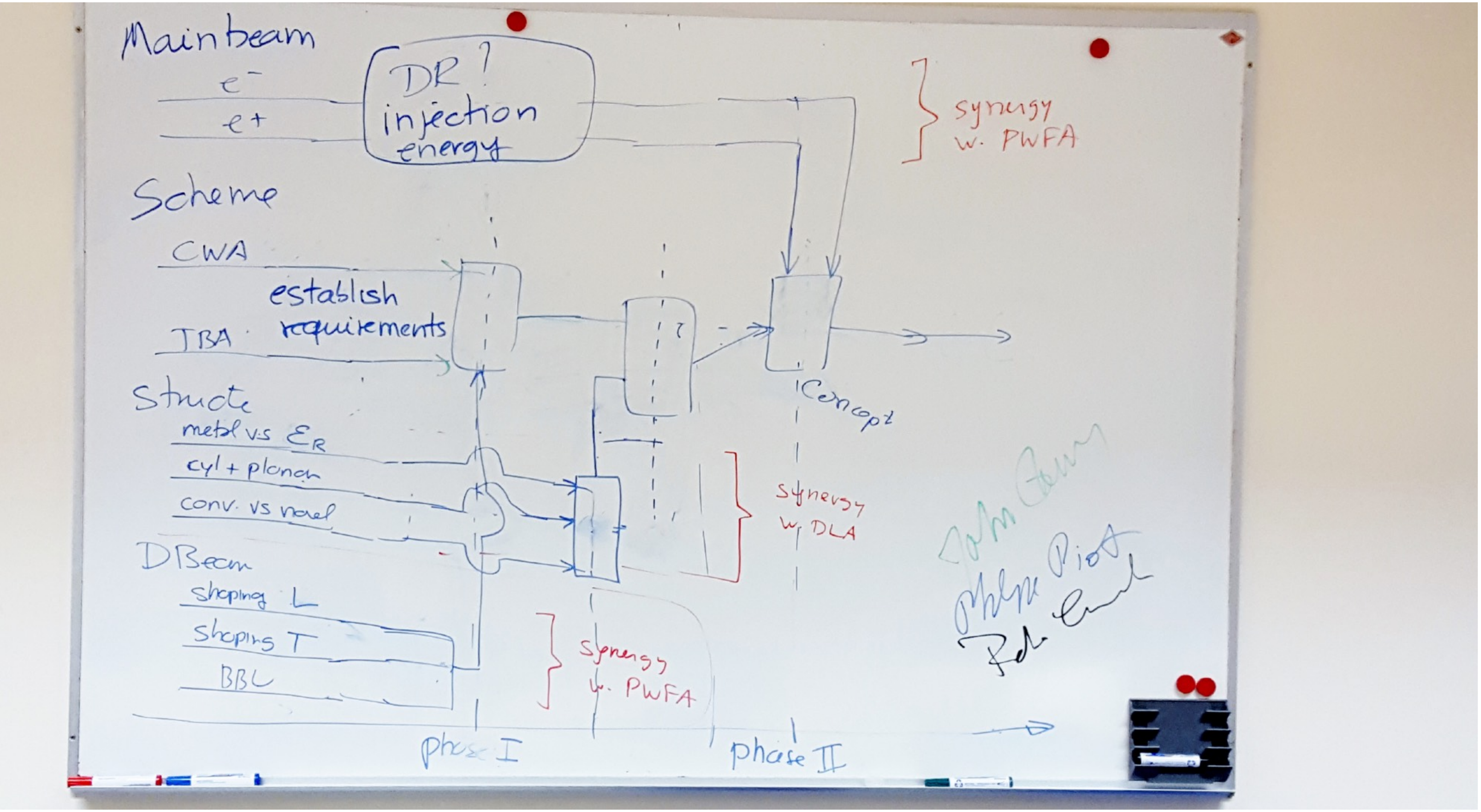
Scientific bottleneck / challenge	Facilities / capabilities needed		Milestones			Comments
	Experimental	Computational	5 years	5 - 10 years	10 - 20 years	
positron source for THz main beam	need to develop and demonstrate	need R&D	get $$$$$	get $$$$$$$$$		
BBU in THz drive beam	demonstrate test module with BBU control	no new code development needed but simulation needs to be done	cylindrical CWA BBU test planned; no planar test planned	establish BBU limit of planar and cylindrical and use these to optimize the LC		

WG3: DWA

- Refreshingly honest about need for $$$, €€€€, CHF
- Positron source
- Beam break up (BBU)

Scientific bottleneck / challenge	Facilities / capabilities needed		Milestones			Comments
	Experimental	Computational	5 years	5 - 10 years	10 - 20 years	
positron source for THz main beam	need to develop and demonstrate	need R&D	get $$$$$	get $$$$$$ $$$		
BBU in THz drive beam	demonstrate test module with BBU control	no new code development needed but simulation needs to be done	cylindrical CWA BBU test planned; no planar test planned	establish BBU limit of planar and cylindrical and use these to optimize the LC		

WG3: DWA


Main beam
e−
e+
DR ?
injection
energy
synergy
w. PWFA
Scheme
CWA
establish
requirements
TBA
Struct
metal vs ε_R
cyl + planar
conv. vs novel
DBeam
shaping L
shaping T
BBU
Concept
synergy
w. DLA
synergy
w. PWFA
phase I
phase II

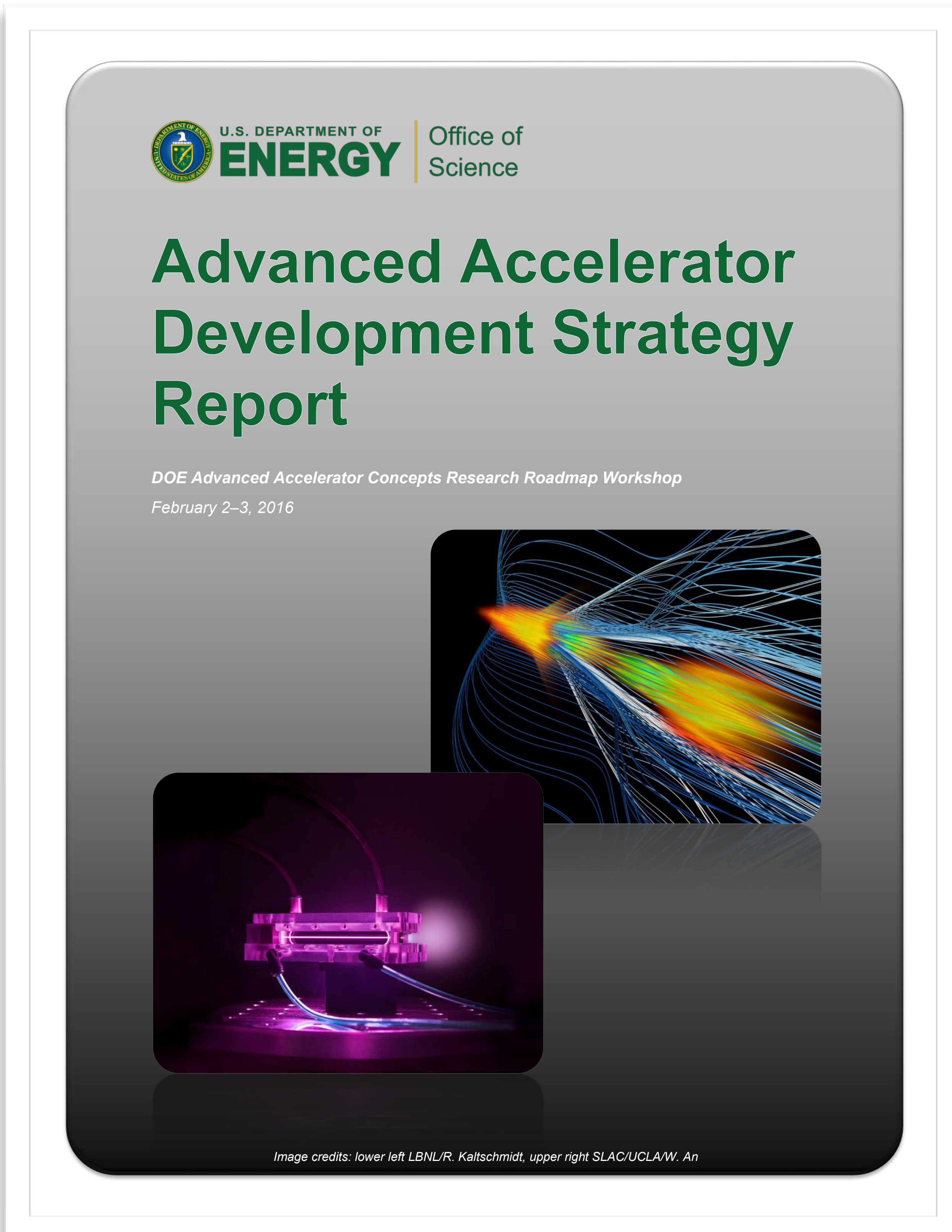
Scientific bottleneck / challenge (priority)	Facilities / capabilities needed		Milestones			Comments
	Experimental	**Computational**	**5 years**	**5 - 10 years**	**10 - 20 years**	
Achievable laser wall-plug efficiency (low)	N/A	N/A	N/A	N/A	N/A	Solid state lasers with 30% efficiency already available,
Laser to dielectric coupling efficiency (med)	N/A	N/A	N/A	N/A	N/A	On-chip highly efficient waveguides, splitters need to
Field to electron efficiency (med)	SwissFEL, DESY, ATF	Vsim, Ace3P	N/A	N/A	N/A	Theoretical studies have been done, experimental
Cost drivers and trends/ projections (med)	N/A	N/A	N/A	N/A	N/A	Total power consumption estimated below 500 MW
Requirements for final focus system (low)	N/A	N/A	N/A	N/A	N/A	Requirements possibly the same as for other novel (and
Luminosity, disruption, beamstrahlung (low)	N/A	N/A	N/A	N/A	N/A	Estimates indicate sufficient luminosity achievable
Requirements for dispersive microbunch	N/A	N/A	N/A	N/A	N/A	Likely to happen naturally in final focusing section
Electron Sources (Med)	FAU, UCLA, Stanford	N/A	N/A	N/A	N/A	Conventioal RF sources may produce adequate
Positron Sources (High)	N/A	N/A	Simulation and feasibility study	N/A	N/A	
Gamma-Gamma (Low)	N/A	N/A	N/A	N/A	N/A	Possible alternative application, laser
Choice of Laser Wavelength (Low-Med)	N/A	N/A	N/A	N/A	N/A	Larger wavelengths (than mid to near IR) ease electron
Laser Technical Requirements (Low)	N/A	N/A	N/A	N/A	N/A	Laser parameters for market lasers are near HEP
High-field damage mechanisms in dielectrics	N/A	N/A	N/A	N/A	N/A	Already demonstrated target gradients with available
SPM, Dispersion, and Raman Scattering (Med)	N/A	N/A	N/A	N/A	N/A	Kerr-effect has been experimentally observed,
Heat dissipation at high laser rep rate (Med)	N/A	N/A	N/A	N/A	N/A	Estimated heat dissipation for typical DLA ~1 W/cm^2 well
Periodic focusing for long-distance transport (high)	SwissFEL, FACET-II, FLASH, DESY, ATF-II	Elegant, GPT	Exp: First demonstration technique (concept) with	N/A	N/A	Need a long-distance focusing tracking study with
Radiation hardness and charging effects (High)	SwissFEL, FACET-II	N/A	Experimental tests at lower beam powers, Sim:	N/A	N/A	In addition to electrons depositing energy in material,
Wakefields - longitudinal and transverse -	N/A	Vsim, ACE3P, etc.	Simulation studes connected to those above	N/A	N/A	We must understand wall losses and the induced
BBU (High)	N/A	Vsim, ACE3P, etc.	Simulation studes connected to those above	N/A	N/A	Closely related to wakefields, loading
Start-to-end modelling (Med)	N/A	Vsim, ACE3P, etc.	Simulation studes connected to those above	N/A	N/A	Hasn't been done yet but is planned to occur as part of
Sub-micron coalignment and diagnostics over km	N/A	N/A	N/A	N/A	N/A	Active interferometric feedback is needed -- LIGO
Halo and beam collimation? (High)		New code needed	Simulation study	N/A	N/A	Nonlinear dielectric response may exacerbate beam halo.
Intrabeam scattering of the bunch particles (note low	N/A	N/A	N/A	N/A	N/A	Note that envelope equation not strictly valid here.
Combination of multiple parallel beams (Med)	N/A	N/A	N/A	N/A	N/A	Matrix accelerator may aid with achieving desired

WG4: DLA

- Identifies low / med / high priorities
- High-priority areas
  - Focusing & transport
  - Radiation hardness & charging
  - Wakefield and BBU
  - Beam halo & collimation
  - Compatible positron source
- Suggests gamma-gamma collider as alternative
- Sub-micron alignment over km distances - LIGO

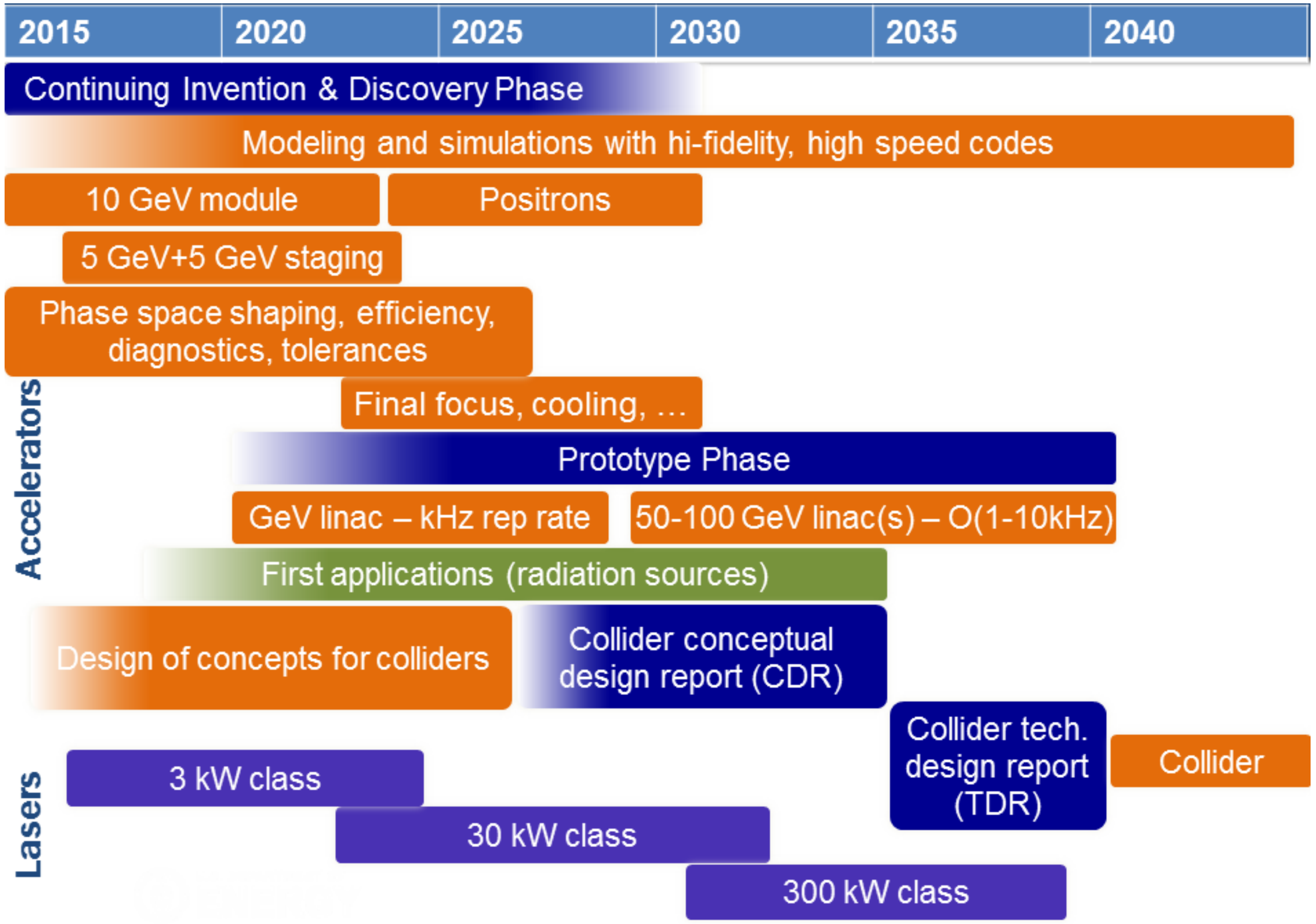
Scientific bottleneck /	Facilities / capabilities		Milestones			Comments
	Experimental	Computational	5 years	5 - 10 years	10 - 20 years	
Achievable laser wall-	N/A	N/A	N/A	N/A	N/A	Solid state lasers with
Laser to dielectric	N/A	N/A	N/A	N/A	N/A	On-chip highly efficient
Field to electron	SwissFEL, DESY, ATF	Vsim, Ace3P	N/A	N/A	N/A	Theoretical studies have
Cost drivers and trends/	N/A	N/A	N/A	N/A	N/A	Total power consumption
Requirements for final focus	N/A	N/A	N/A	N/A	N/A	Requirements possibly the
Luminosity, disruption,	N/A	N/A	N/A	N/A	N/A	Estimates indicate
Requirements for dispersive	N/A	N/A	N/A	N/A	N/A	Likely to happen
Electron Sources	FAU, UCLA, Stanford	N/A	N/A	N/A	N/A	Conventioal RF sources
Positron Sources	N/A	N/A	Simulation and feasibility	N/A	N/A	
Gamma-Gamma (Low)	N/A	N/A	N/A	N/A	N/A	Possible alternative
Choice of Laser	N/A	N/A	N/A	N/A	N/A	Larger wavelengths
Laser Technical	N/A	N/A	N/A	N/A	N/A	Laser parameters for
High-field damage	N/A	N/A	N/A	N/A	N/A	Already demonstrated
SPM, Dispersion,	N/A	N/A	N/A	N/A	N/A	Kerr-effect has been
Heat dissipation at	N/A	N/A	N/A	N/A	N/A	Estimated heat dissipation for
Periodic focusing for	SwissFEL, FACET-II,	Elegant, GPT	Exp: First demonstration	N/A	N/A	Need a long-distance
Radiation hardness and	SwissFEL, FACET-II	N/A	Experimental tests at lower	N/A	N/A	In addition to electrons
Wakefields - longitudinal	N/A	Vsim, ACE3P, etc.	Simulation studes	N/A	N/A	We must understand
BBU (High)	N/A	Vsim, ACE3P, etc.	Simulation studes	N/A	N/A	Closely related to wakefields.
Start-to-end modelling	N/A	Vsim, ACE3P, etc.	Simulation studes	N/A	N/A	Hasn't been done yet but is
Sub-micron coalignment	N/A	N/A	N/A	N/A	N/A	Active interferometric
Halo and beam		New code needed	Simulation study	N/A	N/A	Nonlinear dielectric
Intrabeam scattering of	N/A	N/A	N/A	N/A	N/A	Note that envelope
Combination of multiple	N/A	N/A	N/A	N/A	N/A	Matrix accelerator

Differences WRT US Roadmap



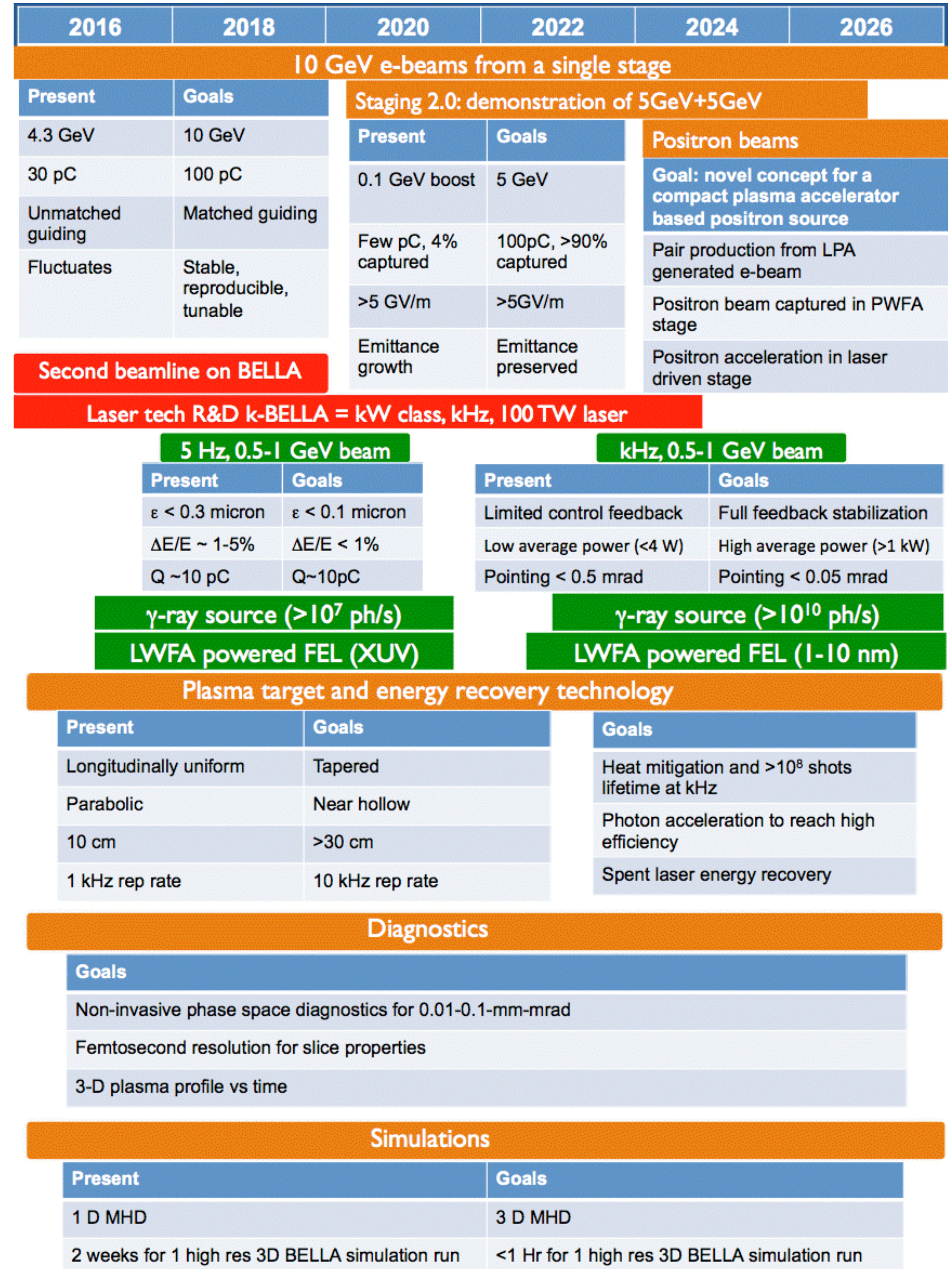
Comparison with US Roadmap: LWFA

- Defines time scales for 10 GeV module and > GeV staging
- Positron accel. mid 2020s
- kHz GeV linac < 2030
- kHz, 50 - 100 GeV ~ 2040



Comparison with US Roadmap: LWFA

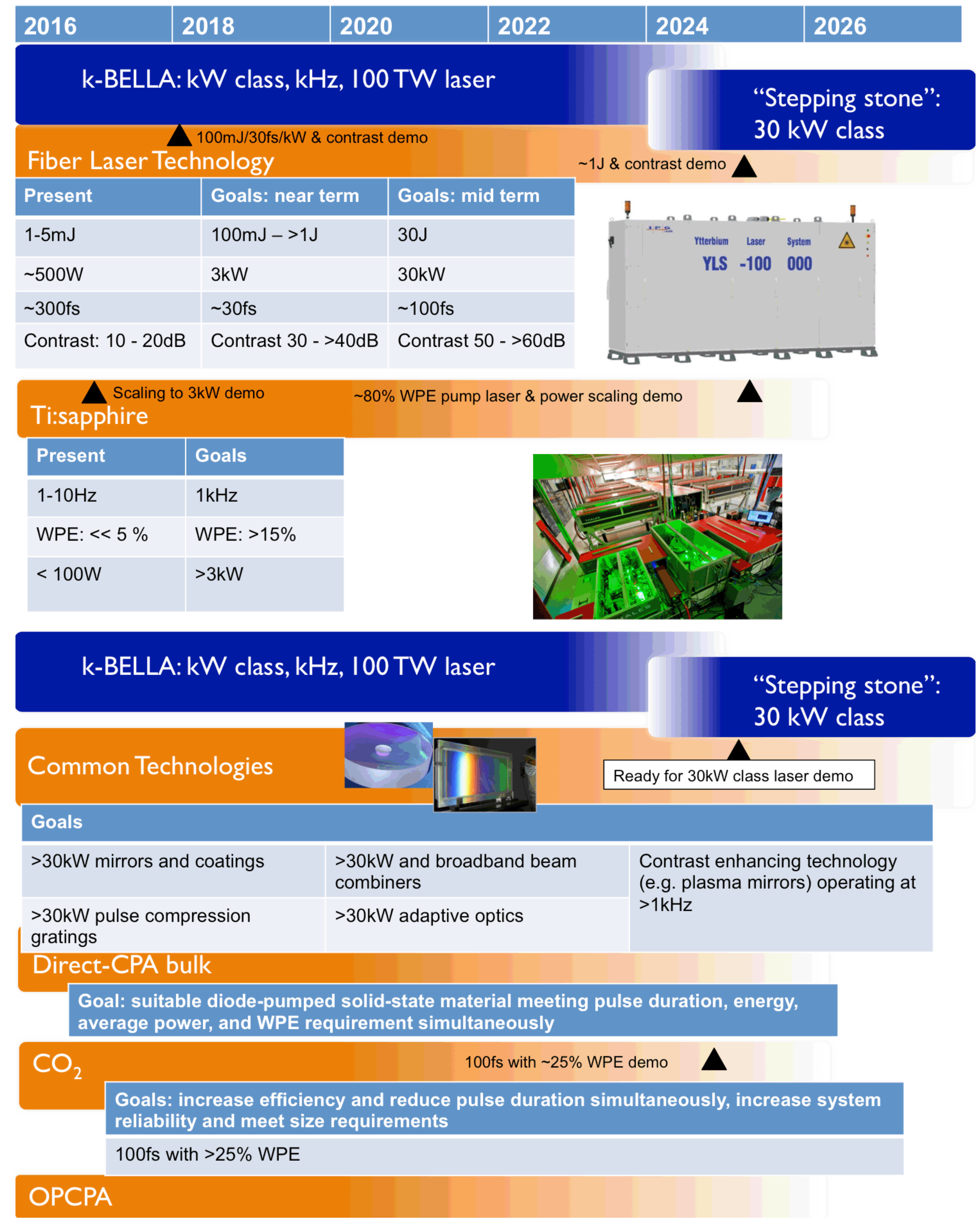
- Defines time scales for 10 GeV module and > GeV staging
- Positron accel. mid 2020s
- kHz GeV linac < 2030
- kHz, 50 - 100 GeV ~ 2040
- Detailed goals defined for next 10 years



Everyone in the room
World-leading institutions

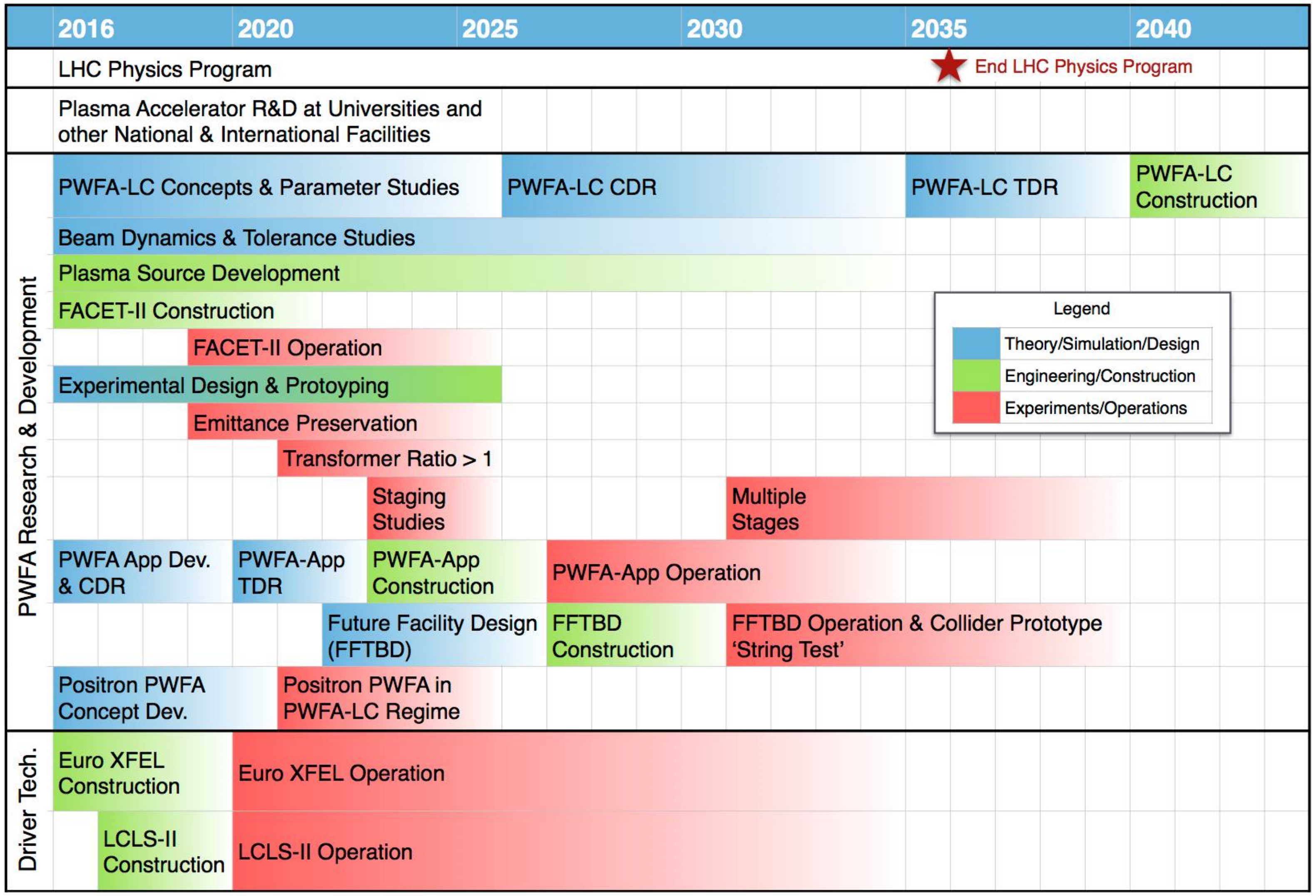
Comparison with US Roadmap: LWFA

- Defines time scales for 10 GeV module and > GeV staging
- Positron accel. mid 2020s
- kHz GeV linac < 2030
- kHz, 50 - 100 GeV ~ 2040
- Detailed goals defined for next 10 years
- Also roadmap for laser technology



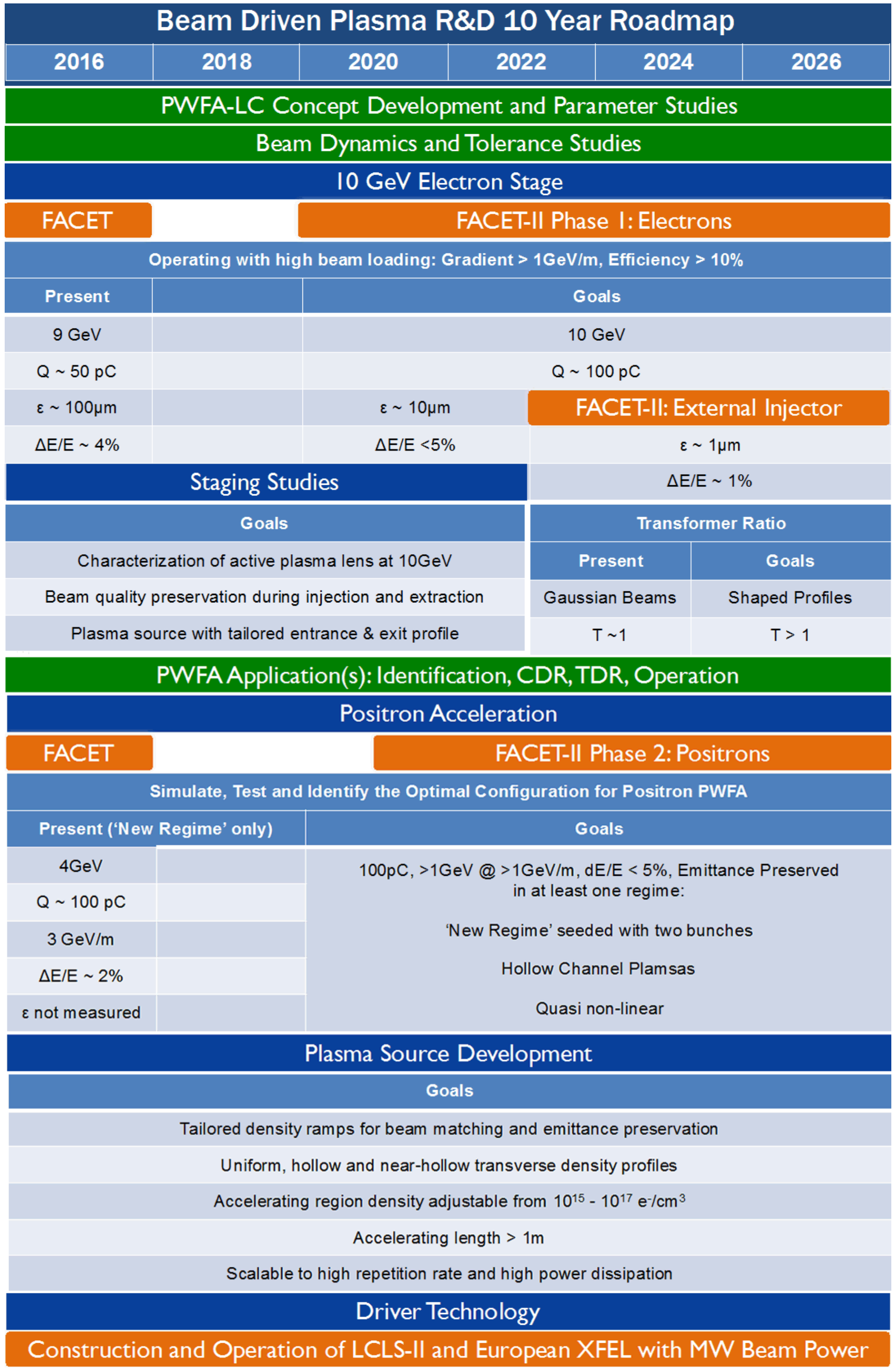
Comparison with US Roadmap: PWFA

- Also calls for collider design studies
- ANAR roadmap has more details / challenges?



Comparison with US Roadmap: PWFA - 10 years

- Also calls for collider design studies
- ANAR roadmap has more details / challenges?



Comparison with US Roadmap: DWA - 10 years

- Defines baseline design
- Sets goals for
  - 3 GeV facility
  - bunch shaping
  - efficiency
  - emittance
- US roadmap more detailed?

DWFA LC 10 YEAR PARAMETER TABLES

Baseline DWFA LC (potential multi-fold cost reduction)

Single Stage		High Fidelity Staging		Main Beam Source
Present	Goals	Present	Goals	Goals
100MV/m	300MV/m	1 accelerator per stage	2 accelerators per stage	X-band
0.5nC	0.5nC	50MV/m/ stage	200MV/m/stage	0.5nC/bunch
Beam partially characterized	Beam quality preservation demonstrated	0.5nC	0.5nC	Norm. emittance <1um
		Beam partially characterized	Beam quality preservation demonstrated	

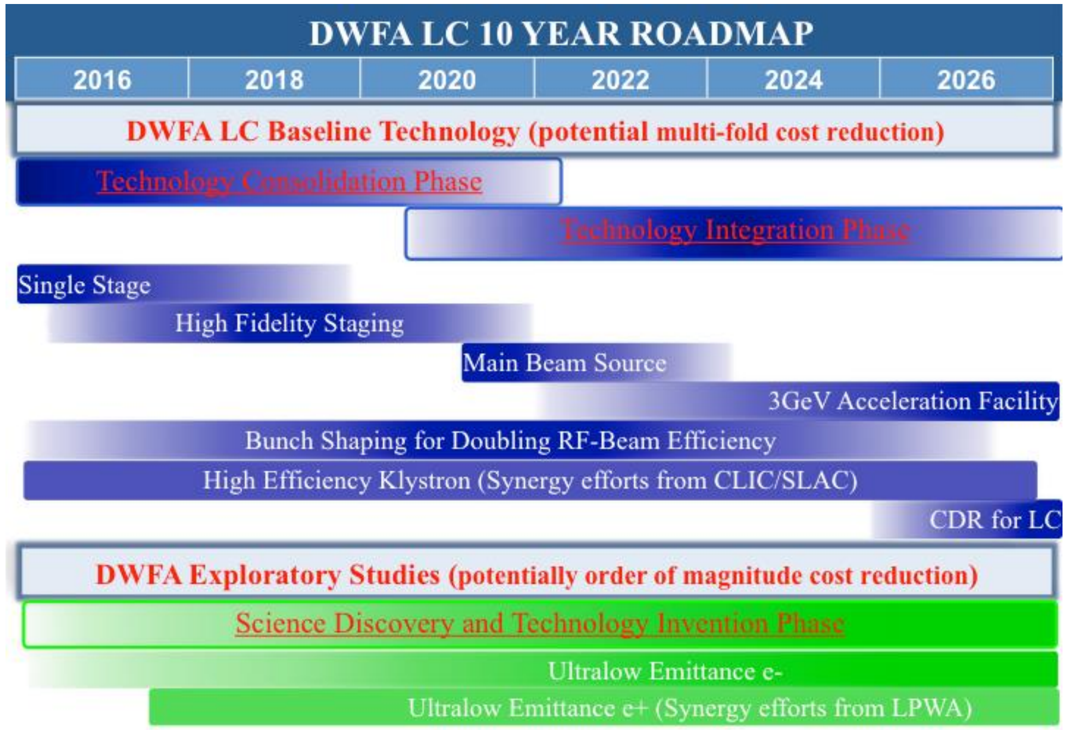
3GeV Acceleration Facility
Goals
15m in length, 0.75 fill factor
200MeV/m effective gradient
0.5nC/bunch, 6.5A current in pulse
Beam quality preserved

Bunch Shaping
Goals
0.1% level energy spread
~50% beamloading

High Efficiency Klystron
Goals
~90% efficiency klystron, efforts from CLIC/SLAC

DWFA Exploratory Studies (potentially order of magnitude cost reduction)

Ultralow Emittance e-	Ultralow Emittance e+
Aiming for	Aiming for
~1nm vertical emittance level at IP	No damping ring e+ source, by efforts from LPWA



Comparison with US Roadmap: DLA

- No US roadmap for DLA …

Identification of common themes & synergies

- Define collider design
  - Several designs or one?
- Development of BDS and FF systems tailored to novel accelerators

- Development of positron sources
- Development of polarized sources

- Multiple staging
  - Preservation of beam quality
  - Mitigation of emittance growth

- Efficient energy transfer from accelerating field to bunch

- Positron acceleration, especially in nonlinear wakefields

Identification of common themes & synergies

- Can BDS and FF systems be tailored to novel accelerators … or must we meet their (stringent) requirements?

- Code development,
  - Especially for many stages / long distances
  - Enterface between plasma codes and accelerator codes
  - Adaption to / us of Exascale capabilities

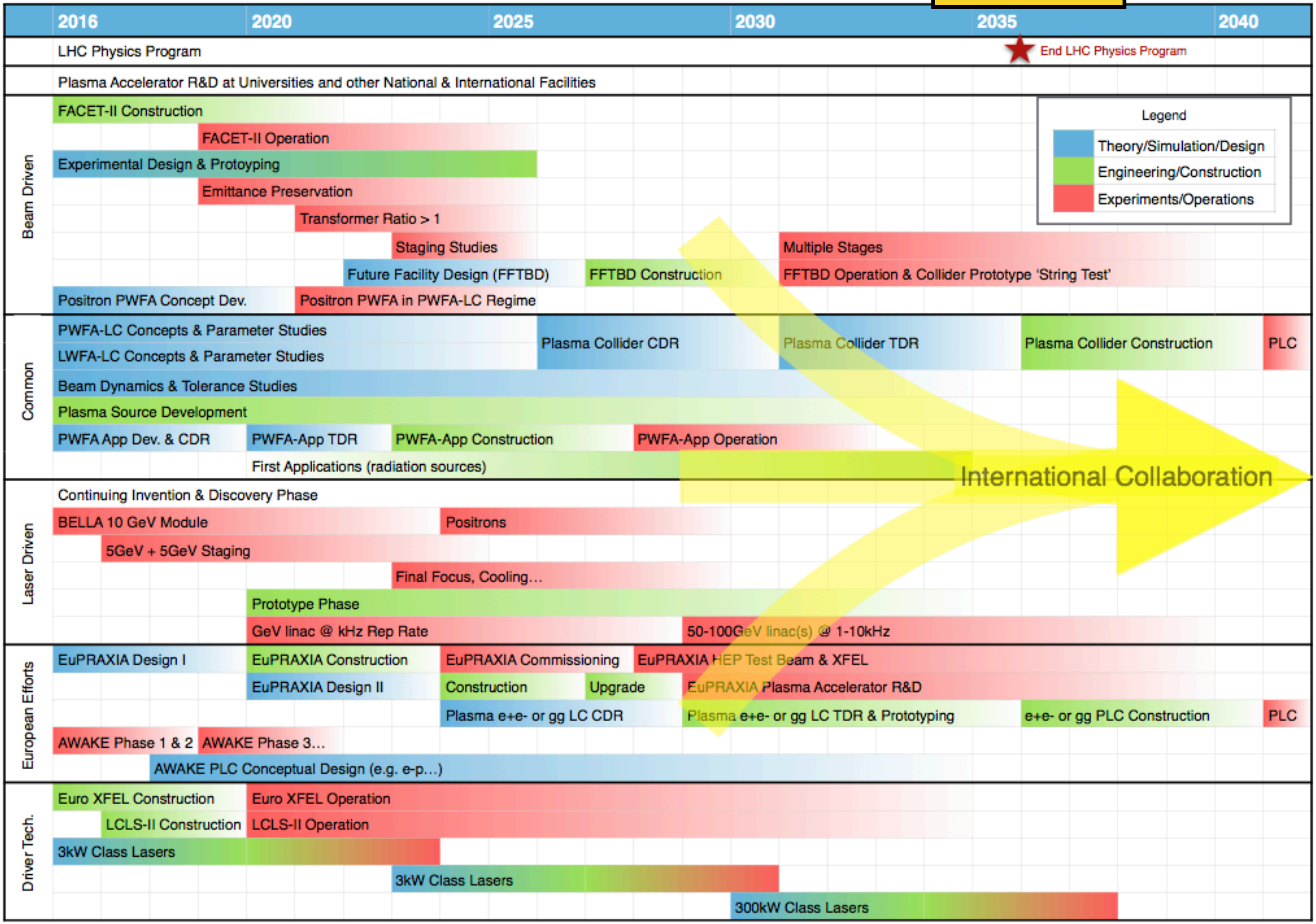
- Synergies with nearer term applications?

- Development of test facilities?

- Development of agreed ways to describe beam parameters?

Global Plasma Accelerator Roadmap

Mark Hogan



Next steps

- The different WGs took different approaches. If we made second drafts, would we want to enforce a uniform style / approach?
- Others?
- Lunch?