

Accelerator Frontier 6: Advanced Accelerator Concepts

AF6 “goal”:

- Assess potential for new accelerator technologies to revolutionize cost and capability of future accelerators for frontier High Energy Physics
- Capacity for orders of magnitude higher acceleration gradient than conventional systems enabling new types of high energy colliders including energies at and beyond TeV.
- Consistent with collider luminosity and efficiency requirements
- Generation of beams with unprecedented parameters (ultrahigh brightness), enabling novel intermediate applications
- Identify challenges and capability gaps that new acceleration methods could address

AF6 Conveners



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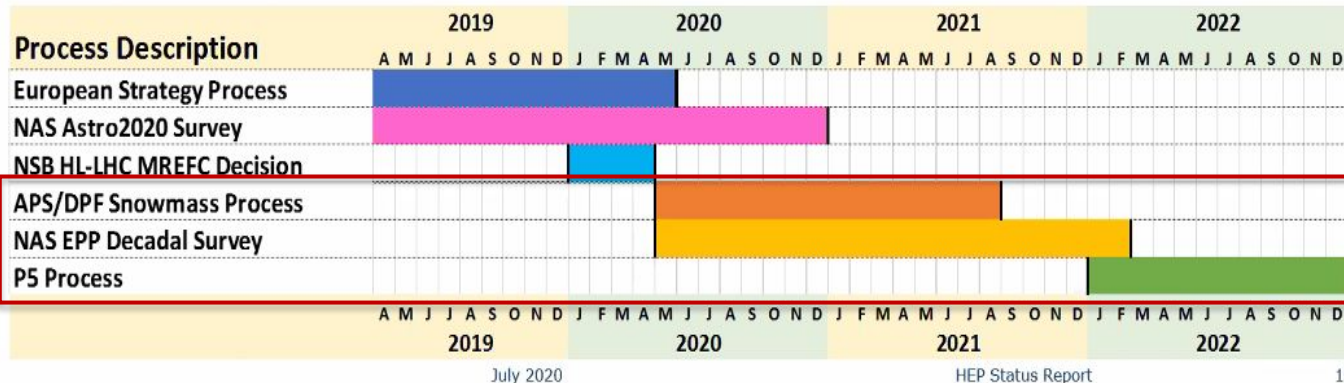
Snowmass Timeline

Jim Siegrist's presentation (2020-07-09)

Young-Kee Kim (U.Chicago), July 2020 HEPAP presentation

Strategic Planning Timeline

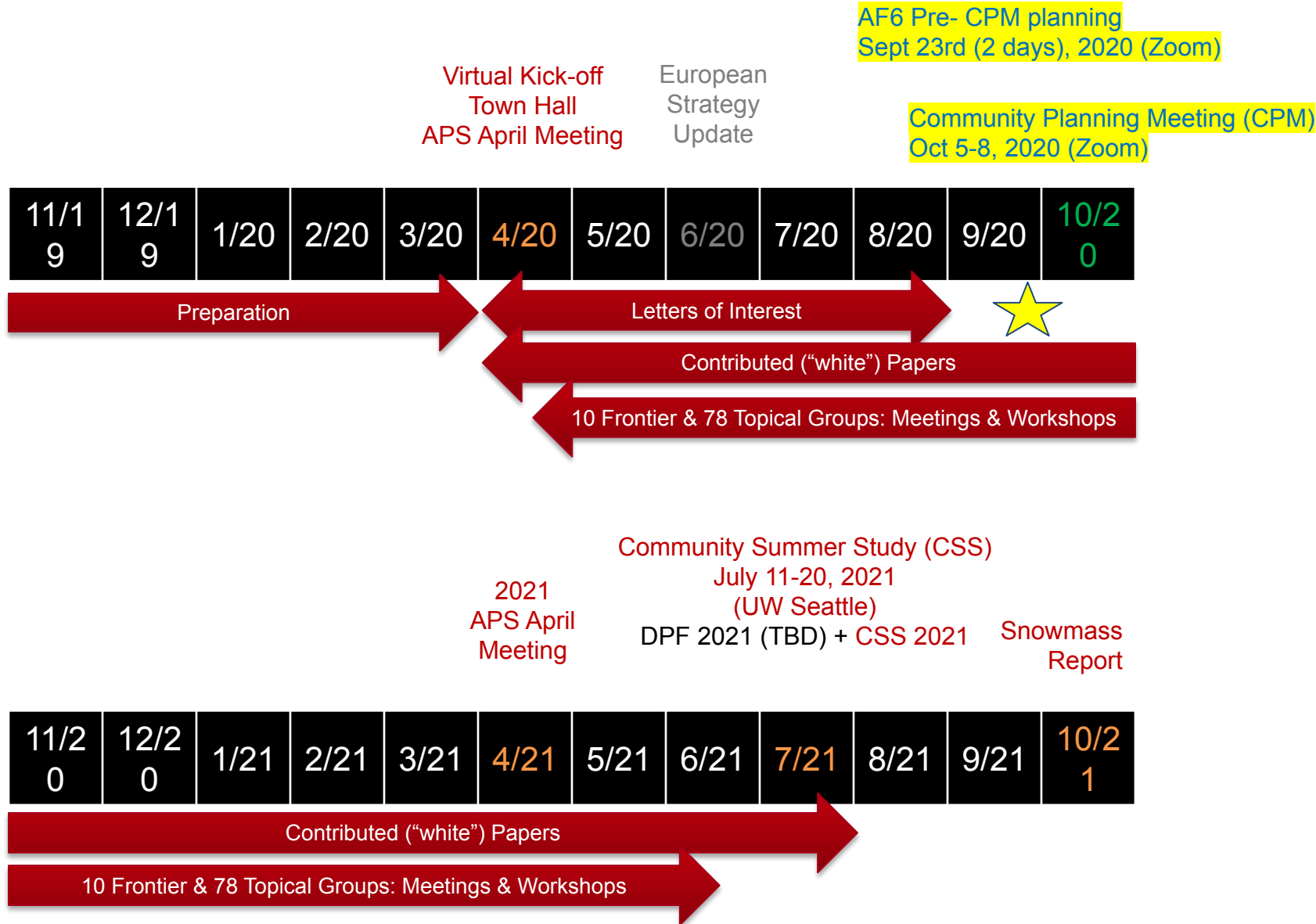
- ▶ To provide timely input to the FY25 budget formulation, the next P5 report will be required by March 2023
- ▶ U.S. Community Snowmass process is underway with major meeting occurring in summer 2021
- ▶ Potential timeline for the next NAS EPP Decadal Survey could be mid-2020 through early-2022
 - ▶ Overlap with Snowmass could enable synergy with Snowmass processes and delivery of report as P5 process begins



- Snowmass 2021
- NAS EPP 2022
- P5 2023

Today: A step along the way. Brief presentation on process followed by discussion, Q&A, and then >50 short presentations on AF6 LOIs (please help us keep on

Snowmass Timeline



Goals For Today

- Provide a public forum for all AF6 LOIs to be heard
- Chance for Q&A and to refine why each topic is important for High Energy Physics
- Begin to explore connections and consideration for coordination of multiple LOIs into strong contributed papers
- Opportunity for AF6 convenors to encourage participation in October planning meeting (please register)
- Communication of current agenda and cross-cutting sessions relevant to AF6

<https://snowmass2021.org>

Snowmass Structure & AAC linkages

Snowmass Frontiers

ENERGY FRONTIER

NEUTRINO PHYSICS FRONTIER

RARE PROCESSES AND PRECISION

COSMIC FRONTIER

THEORY FRONTIER

ACCELERATOR FRONTIER

INSTRUMENTATION FRONTIER

COMPUTATIONAL FRONTIER

UNDERGROUND FACILITIES

COMMUNITY ENGAGEMENT FRONTIER

- EF01: EW Physics: Higgs Boson properties and couplings
- EF02: EW Physics: Higgs Boson as a portal to new physics
- EF03: EW Physics: Heavy flavor and top quark physics
- EF04: EW Precision Physics and constraining new physics
- EF05: QCD and strong interactions: Precision QCD
- EF06: QCD and strong interactions: Hadronic structure and forward QCD
- EF07: QCD and strong interactions: Heavy Ions
- EF08 - BSM: Model specific explorations
- EF09 - BSM: More general explorations
- EF10: BSM: Dark Matter at colliders

- AF1: Beam Physics and Accelerator Education
- AF2: Accelerators for Neutrinos
- AF3: Accelerators for EW/Higgs
- AF4: Multi-TeV Colliders
- AF5: Accelerators for PBC and Rare Processes
- AF6: Advanced Accelerator Concepts
- AF7: Accelerator Technology R&D

- CommF1: Applications & Industry
- CommF2: Career Pipeline & Development
- CommF3: Diversity & Inclusion
- CommF4: Physics Education
- CommF5: Public Education & Outreach
- CommF6: Public Policy and Government Engagement

Agenda for Community Planning Meeting October 5-8, 2020

Please Register Now: <https://indico.fnal.gov/event/44870/>

Monday is high level plenary sessions

Welcome	<i>Nigel Lockyer</i>
<i>Virtual</i>	11:00 - 11:05
Goals of the CPM and Snowmass Timeline	<i>Young-Kee Kim Kim</i>
<i>Virtual</i>	11:05 - 11:15
CPM Logistics	<i>Bo Jayatilaka et al.</i>
<i>Virtual</i>	11:15 - 11:20
Exciting Physics Before Us	<i>JoAnne Hewett</i>
<i>Virtual</i>	11:20 - 11:40
Q&A with plenary speakers	
<i>Virtual</i>	11:40 - 11:45
Strategies and Plans in Other Regions: Europe and Russia	<i>Jorgen D'Hondt</i>
<i>Virtual</i>	11:45 - 12:05
Strategies and Plans in Other Regions: Asia and Pacific	<i>Geoffrey Taylor</i>
<i>Virtual</i>	12:05 - 12:25
Strategies and Plans in Other Regions: Canada	<i>Brigitte Vachon</i>
<i>Virtual</i>	12:25 - 12:35
Strategies and Plans in Other Regions: Latin America	<i>Rogério Rosenfeld</i>
<i>Virtual</i>	12:35 - 12:45
Strategies and Plans in Other Regions: Africa and Middle East	<i>Shaaban Khalil</i>
<i>Virtual</i>	12:45 - 12:55

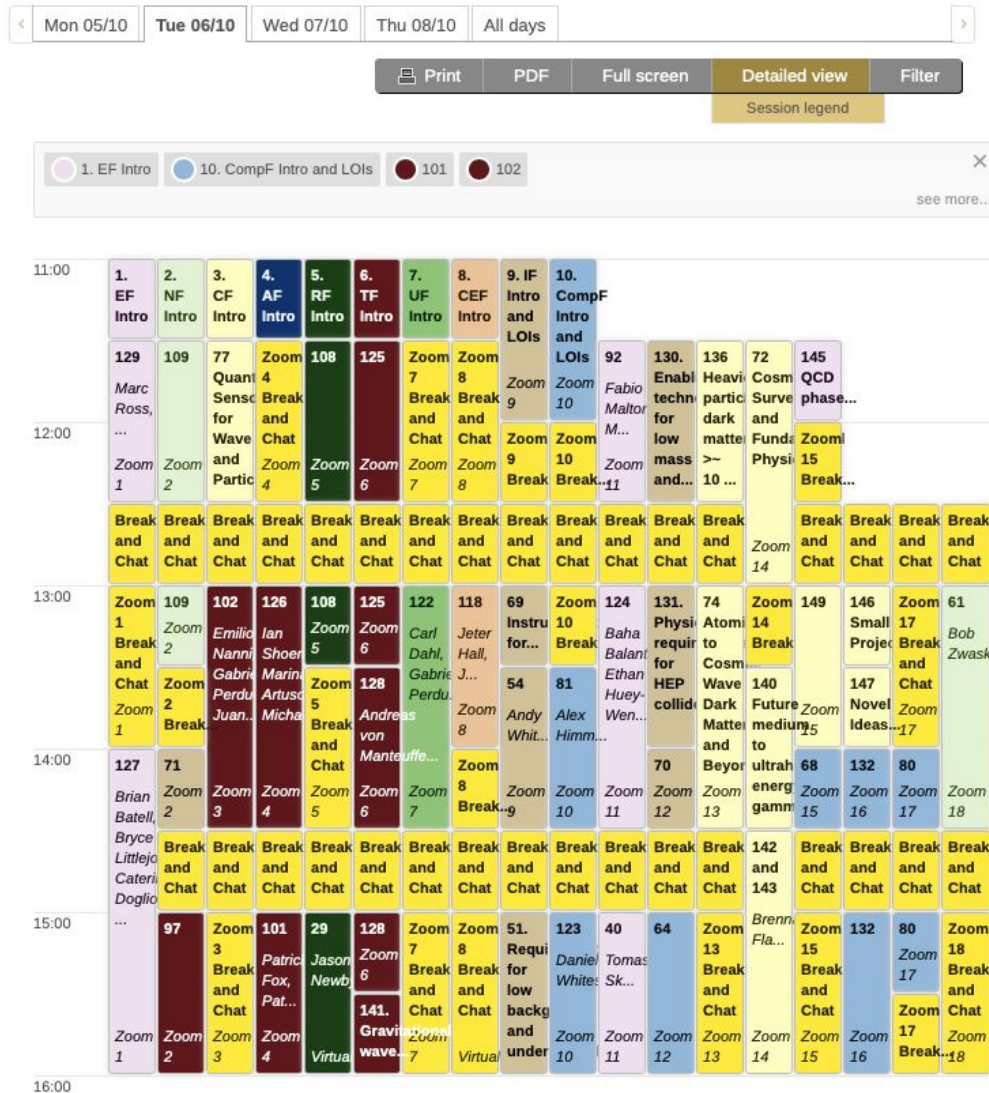
Q&A with plenary speakers	
<i>Virtual</i>	12:55 - 13:10
Break and chat	
<i>Virtual</i>	13:10 - 13:25
Strategies and Plans in Related Fields: Astrophysics	<i>Fiona Harrison</i>
<i>Zoom Webinar</i>	13:25 - 13:40
Strategies and Plans in Related Fields: Nuclear Physics	<i>Kate Scholberg</i>
<i>Zoom Webinar</i>	13:40 - 13:55
Remarks from Funding Agencies to the Snowmass Process: DOE	<i>Jim Siegrist</i>
<i>Zoom Webinar</i>	13:55 - 14:05
Remarks from Funding Agencies to the Snowmass Process: NSF	<i>Saul Gonzalez</i>
<i>Zoom Webinar</i>	14:05 - 14:15
Q&A with plenary speakers	
<i>Zoom Webinar</i>	14:15 - 14:30
Break and chat	
<i>Virtual</i>	14:30 - 14:45
Town Hall: Voices from the community	
<i>Joel Butler</i>	
<i>Zoom Webinar</i>	14:45 - 16:00

Thursday features reports from the 10 Frontiers + Panel

Agenda for Community Planning Meeting

October 5-8, 2020

Tuesday & Wednesday – grab your seatbelts!



Agenda for Community Planning Meeting

October 5-8, 2020

Purpose is not to come up with all of the answers, but...

- Make connections (physics – technologies, e.g. EF – AF)
- Define the work that needs to be done before Snowmass in June 2021 (documented in Contributed Papers)

ID	Frontiers	Inter Frontier Theme	Topical Groups
26	EF, IF, TF, AF	Energy Frontier discovery machines (> 1 TeV)	EF, AF4, AF6, TF07, TF08, IF, AF7r
44	AF, RF	new accelerator concepts for muon transitions	rf3, rf5 with AF5
54	IF, AF - focus on muon CommF	Machine Detector Interface with AF	IF03, IF04, IF05, IF06, IF07, AF3, AF4, AF6
57	IF, CommF, AF	Connection with industry and manufacturing	IF01, IF02, IF03, IF04, IF07, CommF1, AF1, AF7, AF6
61	AF, NF (same as #112)	Energy and Power and Time structure goals for Neutrino Frontier	AF2, AF7, NF
64	AF, CompF	Computation Frontier requirements from AF	CompF2-F7 (F2 to F7), AF1, AF6, AF7
102	TF, CompF, IF, AF,RF	The roles of QIS in HEP	TF10, TF01, TF03, TF05; CompF6, RF03, CF02, AF05, AF07, IF01,...
108	RF, TF, CF, EF, NF	Light dark matter (keV-GeV)	EF09,EF10, EF4, CF1, RF6, TF11, TF09, NF02, NF03, NF05, NF09, AF6
119	All Frontiers + Early Careers	Education, Outreach, & Diversity: HEP Workforce Staffing and Tra	CommF4,CommF3, CommF2, all other Frontiers + early careers, , CompF1
123	IF, CompF, RF (#55 + #86 --> #1	Data Handling and AI/ML	IF04, IF07, CompF3, CompF4, RF, AF1
127	TF, AF, EF, RF (#43 + #91 --> #1	Searches for different dark particles	TF07, TF08, TF09, TF10; EF09, EF10, NF03, RF06, CF1, AF03, AF05 ...
129	EF, TF, AF	Higgs factories	EF, AF3, AF4, AF6, TF06, TF07, TF08, AF7r

Middle two days (above) are both cross-frontier and ...

Agenda for Community Planning Meeting

October 5-8, 2020

ID	Frontiers	Inter Frontier Theme
A01	AF01	AF1 organization with contributors
A02	AF02	AF2 organization with contributors
A03	AF03	AF3 organization with contributors
A04	AF04	AF4 organization with contributors
A05	AF05	AF5 organization with contributors
A06	AF06	AF6 organization with contributors
A07	AF07m	AF7m (magnets) organization with contributors
A08	AF07r	AF7r (rf) organization with contributors
A09	AF07t	AF7t (target/sources) organization with contributors
A10	AF1/AF4/AF6	Physics limits of Ultimate Beams (colliders: e+/e-, mu/mu, p/p, p drivers, etc)
A12	AF1/AF3/AF4/AF6	Research centers and test facilities
A14	AF2/AF5	High power proton beams for rare searches
A16	AF3/AF4	Common goals/technology at the energy frontier
A18	AF3/AF4/AF6	Intermediate lepton collision energies between 500 GeV and 3 TeV
A20	AF1/AF2/AF4/AF5/AF7t	Sources and targets for high power beams
A22	AF3/AF4/AF7m/AF7r	SRF and magnets for the higgs
A24	AF5/AF7	Technology for rare searches (magnets, RF)
A26	AF6/AF7	Energy and power limits for plasma accelerators
A28	AF6/RF/Dark Sector	Plasma acc for fixed target experiments
A30	AF6/MDI	MDI with plasma lens and plasma acc
A32	AF6/CommF	Near-term applications of plasma accelerators
A34	AF6/TF	High field (Schwinger limit) physics

...and inter-frontier. Detailed scheduling still in progress

Goals for Community Planning Meeting

Oct 5-8, 2020

- Focused on cross-frontier coordination
- Workshop: opportunity to lay out goals and plans for the next 8 months leading to Snowmass
- Make needs of other Frontiers clear, e.g.
 - Expect that AF4 will want magnet dev. plan from AF7
 - Expect that AF4 & AF6 will want energy limits from AF1
 - Expect that AF3, AF4, & AF6 will want luminosity/energy requirements from Energy Frontier
 - Expect that AF5 will want suggestions for experiments from Rare Processes Frontier
 - Expect that AF2 will want goals from the Neutrino Frontier

Snowmass Goals and Relationship to AF6

- Define the most important questions for the field of particle physics
- Identify promising opportunities to address them
- Information is provided to P5 to develop a strategy for US HEP
- Accelerator Frontier : Each Working group will address the overall questions:
 1. What is needed to advance the physics?
 - AF6: Enable new capabilities
 2. What is currently available (state of the art) around the world?
 - AF6: progress in techniques, collider concepts and path
 3. What new accelerator facilities could be available on the next decade (or next next decade)?
 - AF6: Will be test facilities, with coordinated plan to impact collider path
 - AF6: Intermediate applications and how they contribute to collider path
 4. What R&D would enable these future opportunities?
 5. What are the time and cost scales of the R&D and associated test facilities as well as the time and cost scale of the facility?

AF6 Specific Goals - Address HEP Impact

- Impact on High Energy Physics is the motivation
 - Drive from Luminosity at IP to collider IP parameters such as bunch length and focusing to accelerator charge/bunch, rate, efficiency...
- AAC are longer term technologies
- Path from current studies to realistic colliders needs to be clear
 - Includes intermediate applications
 - Coordinated AF6 community message is essential
- 2016 DOE Advanced Accelerator Development Strategy Report was a key step in defining a collider path for some AAC technologies
 1. Show the impressive AAC progress along the defined path
 2. Incorporate and assess new results and techniques, and their impact
 3. Articulate strategy of experimental tests, theory and modeling, facilities
 4. Plan towards integrated design studies of more mature technologies
- Roadmaps similarly needed for other new technologies, at varying levels

AF-EF Coordination Sets Parameters

- Coordination with Energy Frontier and Collider Parameters will be key input to AF6 goals
 - **Energy frontier targets for high energy systems have increased since last Snowmass** - several key categories identified as of interest
 - **Higgs factories** at fraction of a TeV - conventional technology options exist, e.g. ILC
 - Easy to justify, high priority per EF discussions and European strategy
 - AF6 roles may include afterburners/upgrades from 0.25-> 0.5TeV or in luminosity (accelerator structures and advanced focusing/cooling/etc. could be included)
 - AF6 designs can directly address this but focus on conventional options
 - Options: polarization interesting but not core, e-p possible but not mainstream
 - **Few TeV** lepton or gamma-gamma colliders
 - Near LHC in parton energy - some EF discussions indicate less interest now. Alternatively some indications this range could still be of interest
 - Clearly not the main/only thrust as it was in past years
 - **10-30 TeV** lepton or gamma-gamma colliders
 - Beyond LHC in parton energy by factor of a few desired -> 10 TeV or above
 - Conventional options feasible but expensive, luminosity requirement increases
 - Articulate AF6 path to build much cheaper - includes gradient, unique beam regimes, efficiency, focusing methods, and more. Show R&D strategy to realize.
 - Energy limits include: cost (AF6 has potential to address) luminosity per power (AF6 short/round beams and/or advanced focusing and cooling could help)
 - muon colliders - AF6 technologies can contribute to multiple components or full machine
 - Area of renewed interest

AF-EF Coordination Sets Parameters

- Coordination with Energy Frontier and Collider Parameters will be key input to AF6 goals (cont.)
 - Physics studies - physics not strongly affected. No specific studies identified to date
 - Detector considerations? Beamstrahlung? Time structure may differ. Events are rare, wait seconds for triggers, sonot a big deal
 - **Need a strong strategy for AF6 mid term** 10-20 year impact and plan
 - EF issue: AAC is long term and physics may be a moving target. So far away that by then physics goals may be different, colliders might be less critical.
 - Need to create medium term reality at 15 year scale and range of options to address range of physics possibilities to best justify a strong program
 - Coordinated **Advanced Accelerator Development Strategy Report** of 2016 documents strong advancement by AF6 technologies since last P5 and AF6 impact/plan
 - Resource limited, approved program for 15-20 years of R&D, potential for CDRs in 2035 compatible with goals above. **Re-visiting and updating this plan and incorporating new goals is a priority and a guide to focus LOIs to Papers**
 - **Coordinated plan of test facilities** and advancement towards integrated design studies.
 - Target Integrated Design Studies in next 5-10 years: believable concept and can do calculations with focusing and staging, costing (not TDR). Will be cheaper because X. Much of this is in the Accelerator Development Strategy Report and needs to be pushed forward
 - **First applications** could be light sources, then possibly a Higgs factory or upgrade setting up technology towards multi-TeV
 - Further input welcome

Lols and White Papers

Letters of Interest (submission : April 1, 2020 – August 31, 2020)

- Informal documents intended to be useful in the first stages of the Snowmass study
- Help conveners to prepare the Snowmass Community Planning Meeting (Oct. 2020)
- Submission instructions: <https://snowmass21.org/loi>
- Lol authors are welcome to make a full writeup as a contributed paper (not required)

Contributed (“white”) Papers (submission : April 1, 2020 – July 31, 2021)

- Scientific or technical articles on relevant physics / technical topics, and reasoned expressions of physics priorities, including those related to community engagement.
- Part of Snowmass proceedings (permanent record of Snowmass 2021)
- Submission instructions: <https://snowmass21.org/submissions/>
- Lols are not required in order to submit contributed papers
- Note that the submission date is after the workshop to allow for final revisions, but AF6 requests complete drafts should be submitted before the workshop to support discussion.

AF6 plan:

- Discuss LOIs in September (today) then incorporate feedback from the October Snowmass community workshop
- Work together to coordinate contributions (for example, merging similar submissions) and generate a compelling and coherent vision for our field and its impact on High Energy Physics.

Roadmaps Developed for Wakefield Acceleration



Advanced Accelerator Development Strategy Report

DOE Advanced Accelerator Concepts Research Roadmap Workshop
February 2–3, 2016

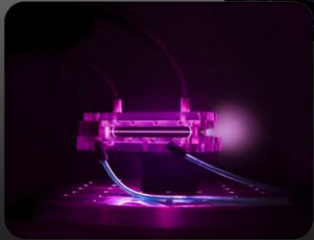
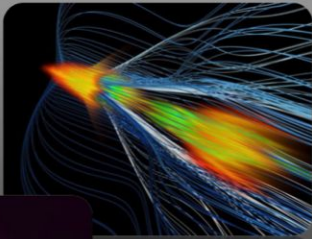
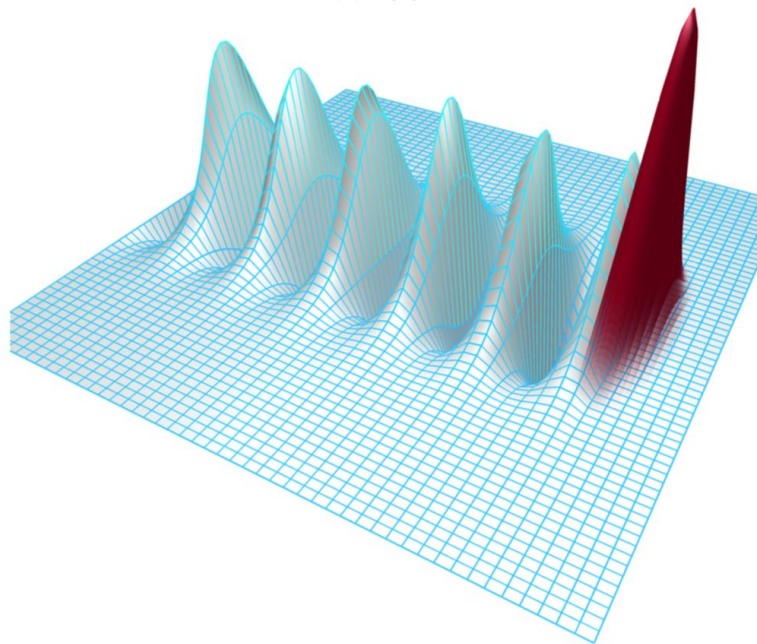


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Plasma Wakefield Accelerator Research 2019–2040

A community-driven UK roadmap compiled by the
Plasma Wakefield Accelerator Steering Committee (PWASC)

March 2019



Related:
European
roadmapping
and
(concurrent) ALEGRO



Other techniques continue to emerge: balance continuing to advance 'mature' concepts towards collider designs with new concepts that continue to offer new capabilities

More than acceleration: also beam manipulation, focusing etc.

Both: colliders based on AF6 technologies and technologies for other colliders (e.g. focusing, cooling etc.)

Snowmass Focus: Planning for the Next Decade

For this workshop we have organized the LOIs around the following themes:

- Integrated collider design studies for plasma and structure wakefield technologies, building on the 2016 strategy towards executable collider designs
- New acceleration concepts continue to redefine what is possible
- Computational and Control methods and studies to define what can be done
- Particle sources supporting AF6 and also other types of colliders. For example: bright muons or ions?
- Interaction point physics regimes supporting increased performance, such as short beams and tight focusing
- Wakefield acceleration methods for efficient, high gradient and high quality beam
- Beam manipulation supporting AF6 and also other types of colliders. For example: plasma lenses, rapid cooling
- Laser drivers required developments for LWFA-LC
- Near term applications Supporting the path to the challenging requirements of colliders
- Test facilities and Community coordination to realize progress towards collider needs

Workshop Agenda for Today & Tomorrow

08:00	1 - Introduction 08:00 - 08:30
09:00	2 - Collider Concepts <i>Dr Cameron Geddes</i> 08:30 - 10:50
11:00	3 - New Acceleration Concepts <i>Pietro Musumeci</i> 11:00 - 12:00
12:00	4 - Computation & Control <i>Pietro Musumeci</i> 12:00 - 13:00
13:00	
14:00	5 - Particle Sources <i>Cameron Geddes</i> 13:30 - 14:30
15:00	6 - Interaction Point <i>Cameron Geddes</i> 14:30 - 15:30

08:00	1 - Introduction 08:00 - 08:30
09:00	7 - Wakefield Acceleration <i>Mark Hogan</i> 08:30 - 09:45
10:00	8 - Beam Manipulation <i>Pietro Musumeci</i> 09:45 - 10:30
11:00	9 - Laser Drivers 10:45 - 11:15
12:00	10 - Near Term Applications <i>Pietro Musumeci</i> 11:15 - 12:00
13:00	11 - Test Facilities & Community <i>Mark Hogan</i> 12:30 - 13:45
14:00	12 - Discussion 13:45 - 14:15

AF6 to date

Liaisons with other Frontiers

Energy - D. Denisov and M. Narain

Computation - J. L. Vay

Community Outreach - TBA

Coordination with Energy Frontier

AF/EF meetings June 24th/July 1st. Especially 2nd day was relevant to AF6
slides can be found here [Joint AF-EF Meeting on future colliders: Day 2](#)

Invitations to mailing lists of conferences:

- o EAAC, EuroNNAC, ICFA ANA lists
- o Contacted major Advanced Accelerator groups/organizations. ALEGRO, ACHIP, LaserNetUS, AWAKE, EUPRAXIA, INFN
- o **! To be replaced with AF6 mailing list. To sign up email to listserv@fnal.gov with a blank subject and with the body of the message consisting of the text:
SUBSCRIBE SNOWMASS-AF-06-AAC firstname lastname**

Questions?

Backup material

This meeting: based on Lols

- Organized around the LOIs and the Advanced Accelerator Development Strategy Report and other planning documents
- Discuss the submitted LOIs and identify additional material needed
- Begin coordination of input







Community Planning Meeting: Oct 5-8, 2020

CPM 2020				
Day 1	Plenary (1.5 hrs)	Introduction	30'	About Snowmass, About CPM
		Community Engagement	60'	
	Breakout Sessions (~2.5 hrs)	Focus on inter-frontier discussions and establish cross working group connections. Establish new areas to focus Identify further input needed to achieve Snowmass goals		
Day 2	Breakout Sessions (~4 hrs)	Focus on inter-frontier discussions and establish cross working group connections. Establish new areas to focus Identify gaps and further input needed to achieve Snowmass goals		
Day 3	Plenary (~4 hrs)	Input from Funding Agencies (30')	15'	Questions for the community from DOE
			15'	Questions for the community from NSF
		Particle Physics in Other Regions (80')	25'	Europe
			25'	Asia/Pacific
			10'	Canada
			10'	Latin America
			10'	Africa/Middle East
		Plans in Related Fields (30')	15'	Astro2020 Decadal Survey
			15'	Long Range Plan for Nuclear Science
		Laboratory Corner (45')	45'	Panel Discussion with lab leaders
Community Voices (60')	60'	Town Hall		
Day 4	Plenary (~4 hrs)	Frontiers: Ongoing Activities, Summaries of Breakout Sessions, and Next Steps (250')	25'	Energy
			25'	Neutrino
			25'	Rare Processes & Precision Measurements
			25'	Cosmic Frontier
			25'	Theory
			25'	Accelerator
			25'	Instrumentation
			25'	Computing
			25'	Underground Facilities and Infrastructure
			25'	Community Engagement
Closing Remarks (5')	5'			

LOI planning to date - invitation to collaborate

LOI # if sub.	Planned LOI Topic or submitted LOI title	Frontier	Contact for LOI
	Multiple technologies		
	Accelerator Test Facilities in the US	AF6	TBD
	Plasma acceleration theory and simulation needs	AF1, AF6, CompF2	Carl Schroeder
AF6-011	ALIC studies through ALEGRO (ICFA)	AF6	TBD
	Underdense Thin Plasma Lens as a Tool for Future Colliders	AF6	Christopher Doss
	Proposed EuPRAXIA facility in Europe	AF6	
	PWFA		
	The path towards a plasma collider	AF6	Spencer Gessner
	Short-bunch Colliders	AF1 & AF3 & AF4	Vitaly Yakimenko
	PWFA Program at FACET-II and Beyond	AF6	Chan Joshi
	High brightness injectors based on PWFA	AF6	Bernhard Hidding, Xinlu Xu
	Plasma lenses	AF6	Mike Litos
	Proton Driven Plasma Wakefield Acceleration and plans for AWAKE	AF6, AF4	Patric Muggli (tentative)
	Attosecond electron and photon beams	AF6	Ckaudio Emma
	Plasma Instability Driven Gamma-ray Source	AF6	Frederico Fiuza
	PWFA High-Energy Injector for rings like CEPC	AF6	TBD
	LWFA		
	Laser-plasma accelerator linear collider	AF6, EF	Carl Schroeder
	Interaction point effects, QED and short bunches	AF6	Stepan Bulanov
	LPA Program at BELLA	AF6	Eric Esarey
	High brightness injectors based on LWFA	AF6	
	High gradient focusing	AF6	Sam Barber
	Photon sources and near term applications of LWFA	AF6	Jeroen van Tilborg
	Precision high average power lasers & plasma accelerators	AF6, CF	Leily Kiani, Tong Zhou
	Spatiotemporal control of lasers	AF6	John Palastro
	Polarized beams from LWFA	AF6	M. Büscher
	SWFA		
	Continuous and Coordinated Efforts of Structure Wakefield Acceleration (SWFA) Development for an Energy Frontier Machine		John Power
	Beam Physics Challenges & Research Opportunities for Structure-based Wakefield Accelerators		
	SWFA demonstrators with integrated technologies for future large-scale machines		
	Research and Educational Opportunities at the Argonne Wakefield Accelerator (AWA) Facility		
	Short-pulse wakefield structure R&D for high gradient and high efficiency acceleration in future large-scale machines		
	Argonne Flexible Linear Collider (AFLC)–Beyond Concept: A 3-TeV Linear Collider Using Short rf Pulse (~20ns) Two-Beam A		
	Dielectric Wakefield Accelerators	AF6	Brendan C. Saha
	Other		
	ACHIP	AF6	Joel England
AF6-005	Ultimate Acceleration in Crystals and Nanostructures	AF6	T. Tajima
AF6-006	Nanostructure Accelerators	AF6	A. Sahai

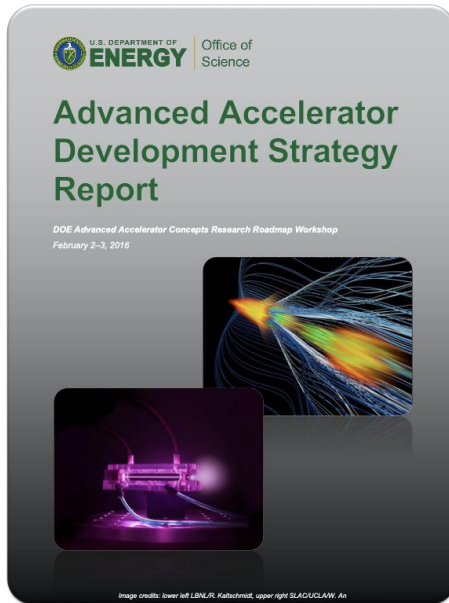
Example
Cross-links:

- ATF's 
- Colliders 
- IP physics 
- Focusing 
- Injectors 
- Near term 

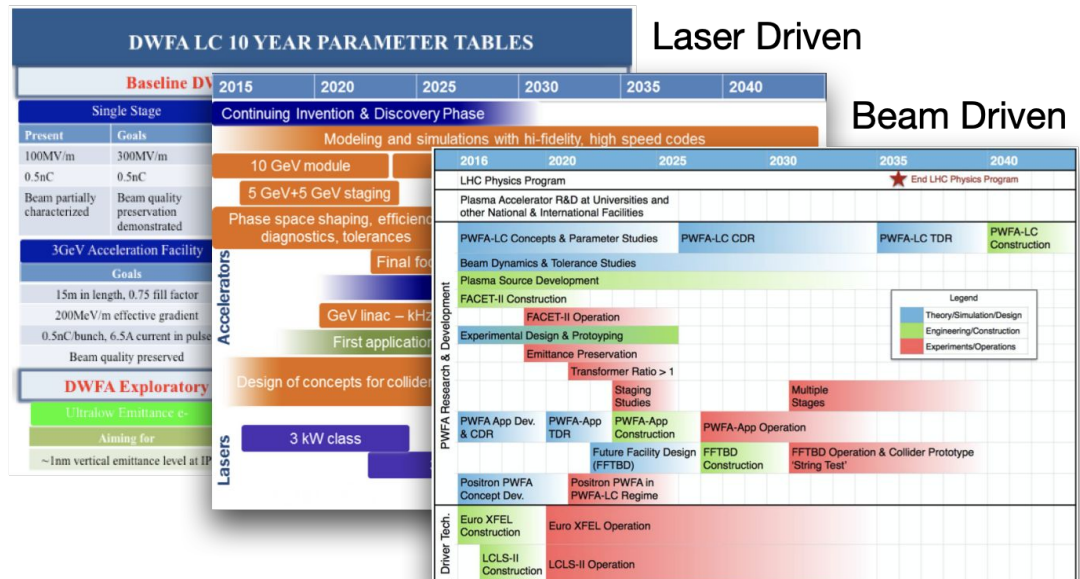
Collaboration and linkages will be beneficial
Please contact us with additional ideas
Please reach out to contacts for collaboration

Collaboration Across LOIs for Coherent Message

- Initial philosophy – let a thousand flowers bloom and get all the ideas on the table
- Following recent meetings and discussions we realized it's possible to get a more coherent message that (importantly) is also strongly aligned with HEP Roadmaps
- Roadmaps followed Snowmass 2013 and ensuing HEPAP sub-panel
- Community representatives organized workshops and worked with DOE HEP to define roadmaps for three AAC technologies: DWFA, LWFA, and PWFA
- Will be revisited as part of Snowmass 2021



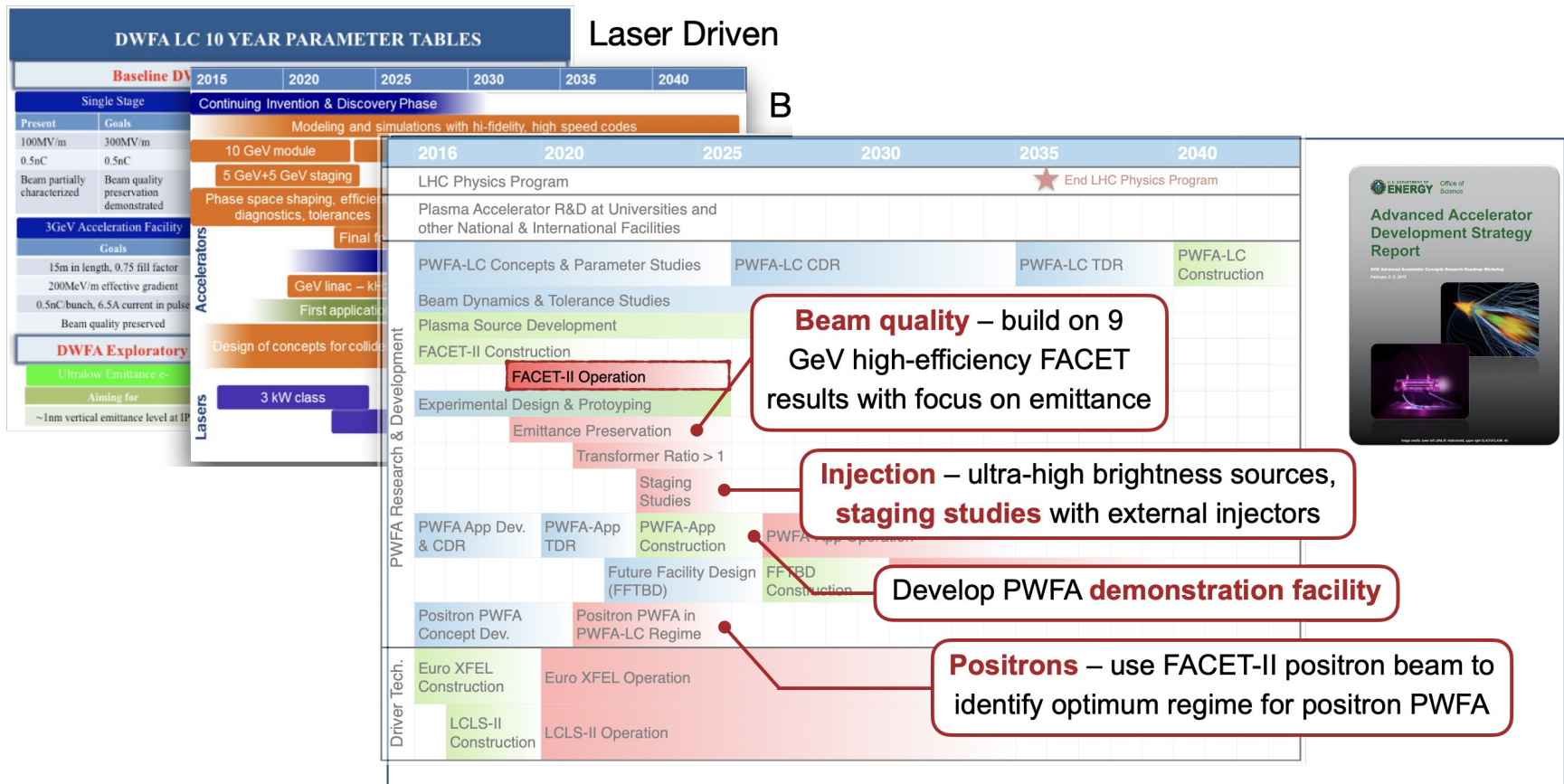
Dielectric Structures



Example of LOI Coordination

- Roadmaps outline expected progress in the next decade (in broad themes and more specific detail) - similar roadmaps for PWFA, LWFA, structures
- Beneficial if LOIs (and Contributed Papers) align to roadmaps and guidance from EF community about latest thinking (e.g. a few TeV vs. Higgs factory + 10TeV)

Dielectric Structures



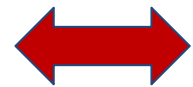
Example of PWFA Collaboration LOIs Aligned with HEP Roadmap

- Goal to target a single LOI & contributed paper towards each roadmap theme (bold) that combines individual LOIs currently in progress –
- GoogleDoc already shows there is an opportunity for broader collaboration
- This should be revisited as we head to October planning workshop
- PWFA, DWFA & LWFA are conducting similar coordination including across techniques

Organized by Technology/Physics

LOI # if sub.	Planned LOI Topic or submitted LOI title	Frontier	Contact for LOI
	Multiple technologies		
	Accelerator Test Facilities in the US	← AF6	TBD
	Plasma acceleration theory and simulation needs	AF1, AF6, CompF2	Carl Schroeder
	ALIC studies through ALEGRO (ICFA)	AF6	TBD
AF6-011	Underdense Thin Plasma Lens as a Tool for Future Colliders	AF6	Christopher Doss ←
	PWFA		
	The path towards a plasma collider	AF6	Spencer Gessner
	Short-bunch Colliders	AF1 & AF3 & AF4	Vitaly Yakimenko ←
	PWFA Program at FACET-II and Beyond	← AF6	Chan Joshi
	High brightness injectors based on PWFA	AF6	Bernhard Hidding, Xinlu Xu →
	Plasma lenses	AF6	Mike Litos ←
	Proton Driven Plasma Wakefield Acceleration and plans for AWAKE	AF6, AF4	Patric Muggli (tentative)
	Attosecond electron and photon beams	AF6	Ckudio Emma →
	Plasma Instability Driven Gamma-ray Source	AF6	Frederico Flua →
	PWFA High-Energy Injector for rings like CEPC	AF6	TBD
	LWFA		
	Laser-plasma accelerator linear collider	AF6, EF	Carl Schroeder ←
	Interaction point effects, QED and short bunches	AF6	Stepan Bulanov
	LPA Program at BELLA	← AF6	Eric Esarey
	High brightness injectors based on LWFA	AF6	→
	High gradient focusing	AF6	Sam Barber ←
	Photon sources and near term applications of LWFA	AF6	Jeroen van Tilborg →
	Precision high average power lasers & plasma accelerators	AF6, CF	Lelly Kiani, Tong Zhou
	Spatiotemporal control of lasers	AF6	John Palastro →
	SWFA		
	Continuous and Coordinated Efforts of Structure Wakefield Acceleration (SWFA) Development for an Energy Frontier Machine		John Power
	Beam Physics Challenges & Research Opportunities for Structure-based Wakefield Accelerators		
	SWFA demonstrators with integrated technologies for future large-scale machines		
	Research and Educational Opportunities at the Argonne Wakefield Accelerator (AWA) Facility	←	
	Short-pulse wakefield structure R&D for high gradient and high efficiency acceleration in future large-scale machines		
	Argonne Flexible Linear Collider (AFLC)–Beyond Concept: A 3-TeV Linear Collider Using Short rf Pulse (~20ns) Two–Beam Accelerator		
	Dielectric Wakefield Accelerators	AF6	Brendan O'Shea
	Other		
	ACHIP	AF6	Joel England
AF6-005	Ultimate Acceleration in Crystals and Nanostructures	AF6	T. Tajima
AF6-006	Nanostructure Accelerators	AF6	A. Saha

Example Cross-links:
 ATF's ←
 Focusing ←
 IP physics ←
 Injectors →
 Near term →



Organized by Roadmap Themes

PWFA Topics Grouped By Roadmap Theme
Beam Quality
PWFA Program at FACET-II and Beyond
Injection & Staging Studies
High brightness injectors based on PWFA
Plasma lenses
Demonstration Facility
The path towards a plasma collider
Short-bunch Colliders
PWFA Injector for High Energy Rings
Plasma Instability Driven Gamma-ray Source
Attosecond electron and photon beams
Positrons
Positron Acceleration in Plasma

International Input is Invited

- High energy physics today is a successful global endeavor with work share across countries and continents. This makes it a role model for a changing world... Accelerator research and development is embedded in this global research landscape. Many links exist, enabling sharing of ideas, concepts and infrastructures → faster progress.
- US has been the driving force for advanced accelerators since more than four decades and is still a leader in this field.
- International studies or projects with US links reinforce international approach and exchange (see ACHIP, AWAKE, ELI-beamlines, ALEGRO, EuPRAXIA).
- Europe and Asia are rapidly building up their own research capabilities and already set the theme in some aspects of advanced accelerators. National projects in Europe (SPARClab, Apollon/CILEX, LUNEX, Lund facility, ATHENA, HZDR facilities, FLASHForward, LUX, KALDERA, JuSPARC, CALA, FELIX, Strathclyde facilities) and Asia (KEK, SPRING-8, Korea, Tsinghua, Shanghai) push progress on many fronts.
- The recognition of importance of advanced accelerators for our future is still growing. E.g. European strategy for Particle Physics explicitly mentions plasma accelerators for the first time and requests follow-up in coordination of R&D.
- Snowmass is a US driven effort. **International actors are explicitly invited so submit LOI's and join this process. It will help to strengthen our field and progress world-wide!**