GARD Beam Test Facilities

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Five beam test facilities, supported by GARD* in support of SC mission:

- **Accelerator Test Facility (ATF), BNL**
- **Argonne Wakefield Accelerator (AWA), ANL**
- **Berkeley Laboratory Laser Accelerator Center (BELLA), LBL**
- **Facility for Advanced Accelerator Experimental Tests II (FACET-II), SLAC**
- **Fermilab Accelerator Science and Technology facility (FAST), FNAL**

provide access to a suite of complementary and diverse capabilities for a broad community of scientists representing universities, industry and National laboratories to:

- Advance accelerator technologies for the next generation of SC research facilities;
- Basic research in accelerator and beam physics;
- Education and training for future scientists and engineers

*ATF has been funded by GARD prior to 2013 and Accelerator Stewardship after 2013. It will move to SC-24.2 (ARDAP) in FY21.

Complementary and diverse

Capabilities:	ATF	AWA	BELLA	FACET-II	FAST
Operation model:					
National User Facility	✓			✓	
Accelerator Stewardship	✓				
Collaboration models		✓	✓		✓
Beams and accelerators:					
~100 MeV electrons	✓	✓			✓
10 GeV electron beams				✓	
10 GeV positron beams				planned	
High charge electron bunches		✓			
Proton beams					planned
NC S-band and X-band	✓			✓	
NC L-Band		✓			
SC L-Band linac					✓
Storage ring					✓
Lasers:					
TW class 0.8 μm laser (Ti:Sapphire)	✓		✓	✓	
PW class 0.8 μm laser (Ti:Sapphire)			✓		
TW class 10 μm laser (CO_2)	✓				
Plasmas:					
Plasma capillaries	✓ (2 cm)	✓ (2 cm)	✓ (10 cm)		
Gas Jets	✓		✓	✓	
Heat pipe oven				✓	
Hollow channel		✓		✓	

Complementary and diverse

Research goals:	ATF	AWA	BELLA	FACET-II	FAST
Advanced Acceleration Methods:					
Laser driven Wake Field Acceleration (LWFA)	✓(MeV)		✓(GeV)		
Beam driven Wake Field Acceleration (PWFA)	✓(MeV)	✓(MeV)		✓(GeV)	
Structure Wake Field Acceleration (DWFA)	✓(MeV)	✓(MeV)		✓(GeV)	
Inverse Free Electron Laser Acceleration (IFEL)	✓				
Studies of staging	✓	✓	✓		
Acceleration of positrons				✓(GeV)	
Source development:					
High brightness electron beams from plasmas		✓	✓	✓	
Ion acceleration with lasers	✓		✓		
Compton backscattering	✓		✓	✓	
Gamma rays from filamentation				✓	
Coherent X ray source using plasmas			✓	✓	
Beams Physics:					
Cooling R&D		✓			✓
Single Electron and Cristal-like beams					✓
Integrable Nonlinear Optics					✓
Physics of extreme compression (collective effects)				✓	
Diagnostics and beam control:					
Novel diagnostics	✓	✓	✓	✓	✓
ML/AI to characterize intense bunches, improve efficiency		✓		✓	
Beam-current shaping	✓	✓		✓	
Emittance exchange		✓			

V. Yakimenko, Oct. 6, 2020

Evolution of supported capabilities

- Roadmaps for Advanced Concepts were developed following the previous P5 and are outlined in the 2016 DOE Advanced Accelerator Development Strategy Report

- These roadmaps highlight the key R&D challenges in an order of phased complexity in line with the expected availability of experimental facilities

- An effort to re-examine priorities, developing updated roadmaps for R&D and identifying needs for demonstration and beam test facilities is expected following upcoming P5

- As advanced acceleration techniques continue to mature, as first applications will be brought online and as concepts move to the conceptual and technical design level

The capabilities at each facility were developed with the focus on specific aspects of the HEP mission. Upgrade plans will be developed and coordinated to address needs of the community