

# ARGONNE SYNERGIES WITH A LINEAR COLLIDER



**JOHN BYRD**

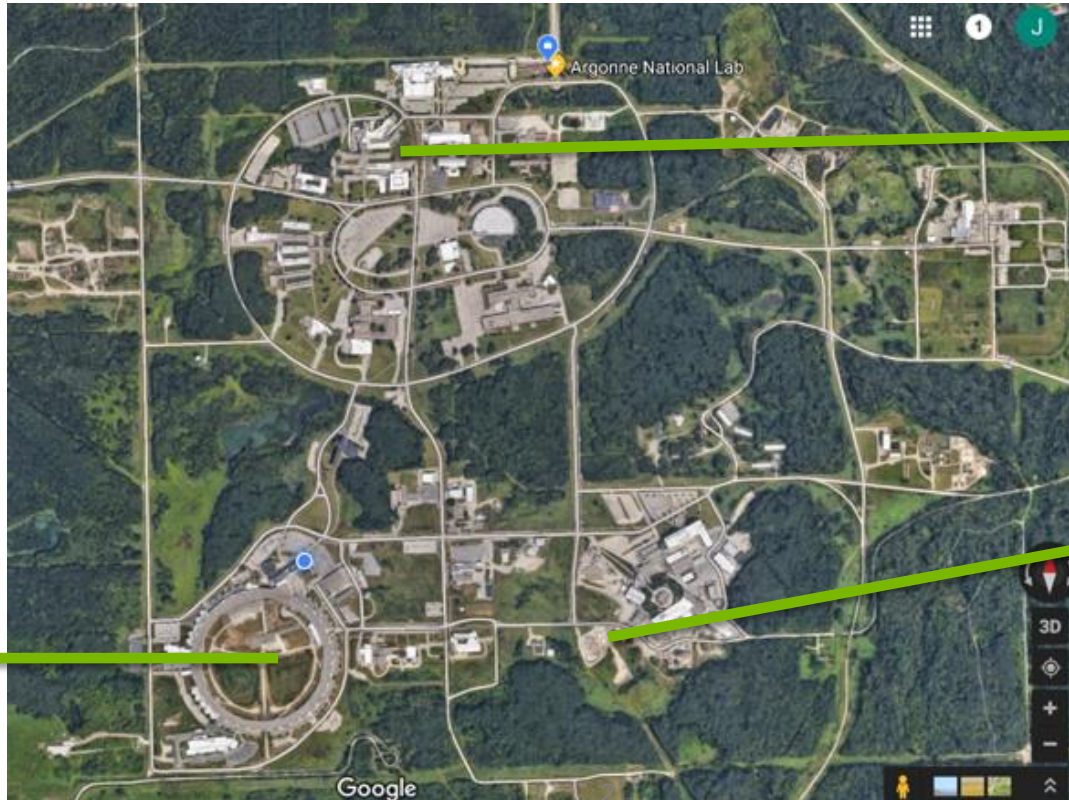
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# ARGONNE OPERATES THREE MAJOR ACCELERATOR FACILITIES

A broad range of accelerator R&D and engineering capabilities

The APS is a leading 7 GeV storage ring source of hard x-rays. Major upgrade underway with strong similarity to ILCDRs.



ATLAS operates a SC linac for heavy ion beams. Strong SRF R&D capability.

Argonne Wakefield Accelerator (AWA) is an R&D testbed for high gradient acceleration of electrons.

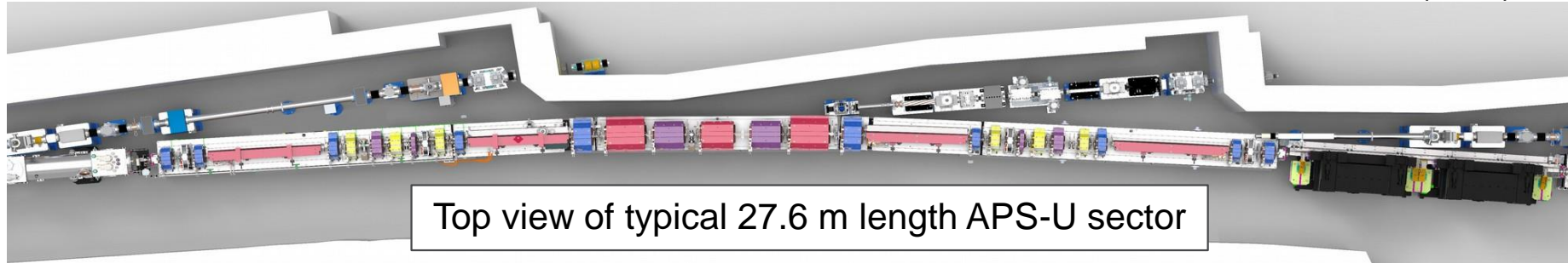
# THE APS UPGRADE IS SIMILAR TO ILC DAMPING RINGS

## Uses multiple technologies envisioned for ILC DR

- Entirely new 6-GeV, 200-mA ring, including
  - Advanced multi-bend-achromat lattice-42 pm
  - 1104 m of vacuum systems
  - On-axis injection with fast stripline kickers
  - 1320+ high-strength conventional magnets
  - Superconducting 4th Harmonic Cavity for BLS
  - Orbit correction system with 1 kHz bandwidth
- Will exceed capabilities of today's storage ring light sources by 2 to 3 orders of magnitude



Advanced Photon Source (APS)



Top view of typical 27.6 m length APS-U sector

# ARGONNE IS THE HOME OF THE elegant CODE

**Code of choice for modeling storage rings and linacs. Continuously updated with new physics and algorithms. Many new features added for design of APS-U.**

- Advanced design optimization targeting key performance metrics
- Benchmarked simulation tools – against current APS data
- Combined single and multi-bunch modeling
- Detailed machine error simulations
- Direct simulation of different beam loss mechanisms including swapout injection.
- Coupled vacuum & physics modeling. New module includes comprehensive ion modeling.
- SR masking modeling for high-current electron rings
- Automated machine commissioning<sup>4</sup> simulation → AI / ML



# SRF@ANL - Design to Operation



Assembly of ANL-designed ATLAS Intensity Upgrade 72 MHz Quarter-Wave Resonator Cryomodule (2014)



Superconducting cavity processing at the ANL facility jointly funded and staffed by Argonne and Fermilab. Four full time staff (2 ANL, 2 FNAL)



Cavity and accelerator systems testing (ADTF)

# Argonne Wakefield Accelerator-AWA

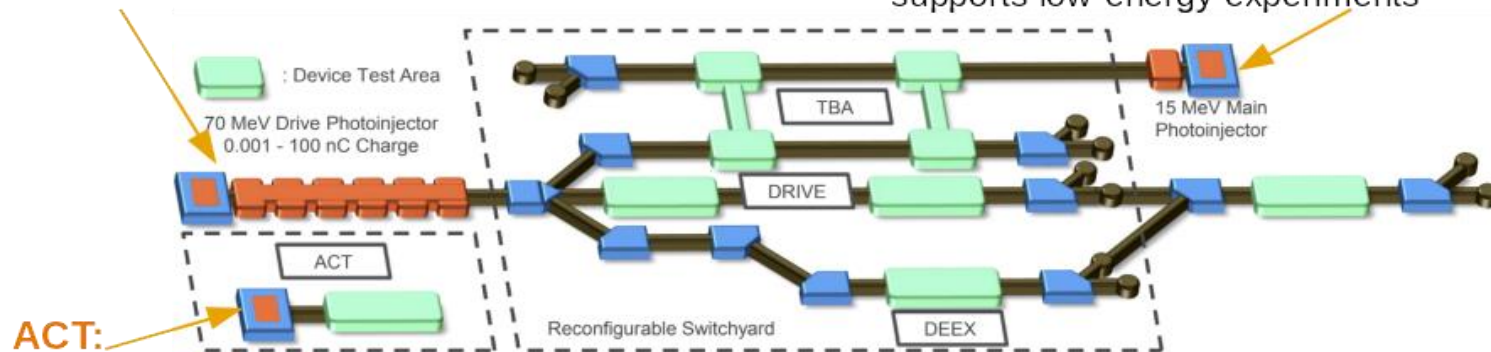
A Versatile Electron Accelerator Test Facility open to outside users.

## Drive beam:

- backbone accelerator
- <70-MeV bright or high-charge beams

## Witness beam:

- ultimately produces bright beam for TBA or CWA applications
- supports low-energy experiments



## ACT:

- cathode research
- physics of breakdown
- low-energy diagnostics tests

- Zoned vacuum-isolated sections for fast beamline reconfiguration
- >100 nC electron bunch available
- Multiple independent electron sources
- Precise phase-space-shaping beamline

# SUMMARY

- Argonne has a strong interest and capability to contribute to a Linear Collider with a broad program of accelerator R&D, engineering and fabrication over several DOE offices (HEP, BES, NP.)
- The most sophisticated electron storage ring in the world (APS-U) is being built and will be installed and commissioned in 2022-2023.
  - Numerous leading-edge developments in accelerator technology and beam physics with strong similarities to the ILC DRs.
- Argonne has complete SRF design and testing capabilities with an excellent record of delivering for other projects.
- The AWA continues to contribute to studies of high gradient acceleration and has a variety of capabilities of interest for ILC R&D.