U.S. DEPARTMENT OF ENERGY | Office of Science

DOE HEP Accelerator R&D

HEPAP Meeting
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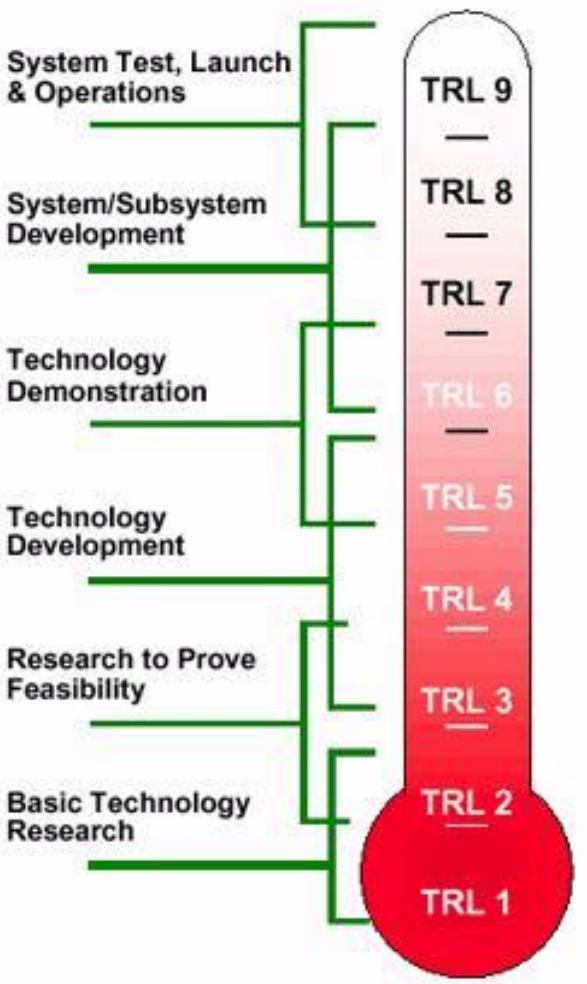
The DOE/SC Accelerator R&D Program

- SC supports a wide range of accelerator science and technology R&D primarily aimed at enabling a broad spectrum of discovery science.
- Accelerator R&D in SC is generally characterized/organized by*
  - What is the application? Or, Who is the customer?
  - What is the likely timescale for this effort to reach its desired goal(s)?
  - What is the current readiness level of the technology (TRL)?
- Answers to these questions generally determine which SC subprogram "owns" the effort.
  - Within a subprogram there may be several distinct activities or thrusts focused on particular technologies or classes of problems.
- Generally speaking, in SC all ***near- to mid-term*** accelerator R&D is owned by the ***customer*** (BES, NP, HEP) and all ***mid- to long-term*** accelerator R&D is owned by the ***HEP program***

**Since this is R&D, the development timescale is not always certain and the eventual application is not always known – so there is no shortage of grey areas.*

Technology Readiness Level

- A method of estimating technology maturity developed by DOD, NASA and others
- Widely used for complex science and technology projects
- Applies to individual technology elements. A project or activity may have multiple elements at different TRL stages
- Range is TRL 1-9 with larger number meaning more mature
  - In HEP we have tried to tailor management of R&D efforts to the approx. TRL level



HEP Accelerator R&D Program I

- HEP supports a wide range of accelerator science and technology R&D primarily aimed at enabling HEP discovery science.
- Near- to mid-term R&D is typically "owned" in Facility Operations
  - Incorporates generally known technologies (TRL 4+) that can be developed to the level of a full system prototype or full system test (TRL 7-8) in less than ~5 years
  - Priorities driven by customer/facility needs for science programs
  - Often takes the form of facility improvements that are installed and brought into operation over a few to several years
    - For example, PIP-I at Fermilab
  - Can also be incorporated into distinct Projects (e.g., LBNF, LCLS-II)
  - Individual components may be developed/provided by SBIR/STTR
  - Will not be discussed further here

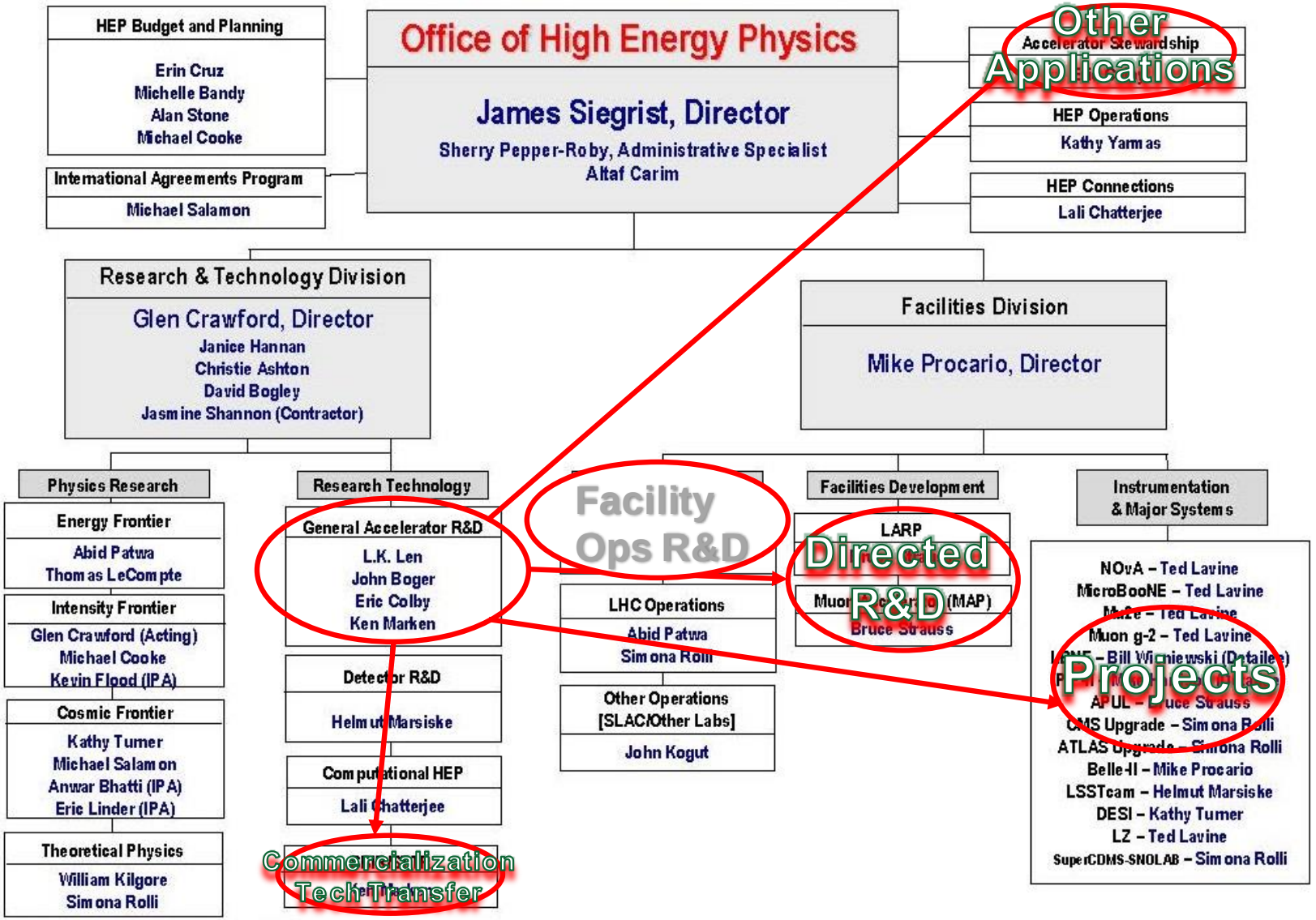
HEP Accelerator R&D Program II

- Mid- to long-term R&D is "owned" in three separate HEP subprograms:
  - General Accelerator R&D (GARD): ***HEP-owned early-stage R&D***
  - Accelerator Stewardship: ***Non-HEP-owned early stage R&D***
  - Directed Accelerator R&D***: HEP-owned mid-stage R&D***
- Will focus on the first of these today (other 2 tomorrow AM).
- GARD: ***HEP-owned early-stage R&D***
  - Focuses on basic accelerator science and related R&D.
  - Accelerator science component (TRL 0-1) : physics of beams
  - R&D thrusts (TRL 1-3) can be developed to the level of proof-of-concept or component demonstration (TRL 3-5) in ~5-10 years
    - Technology "roadmaps" developed by the community. Will hear about several of these efforts today
  - Priorities driven primarily by long-term goals of HEP program
  - Too early to be incorporated into Projects (technology not ready)
  - Individual components may be developed/provided by SBIR/STTR

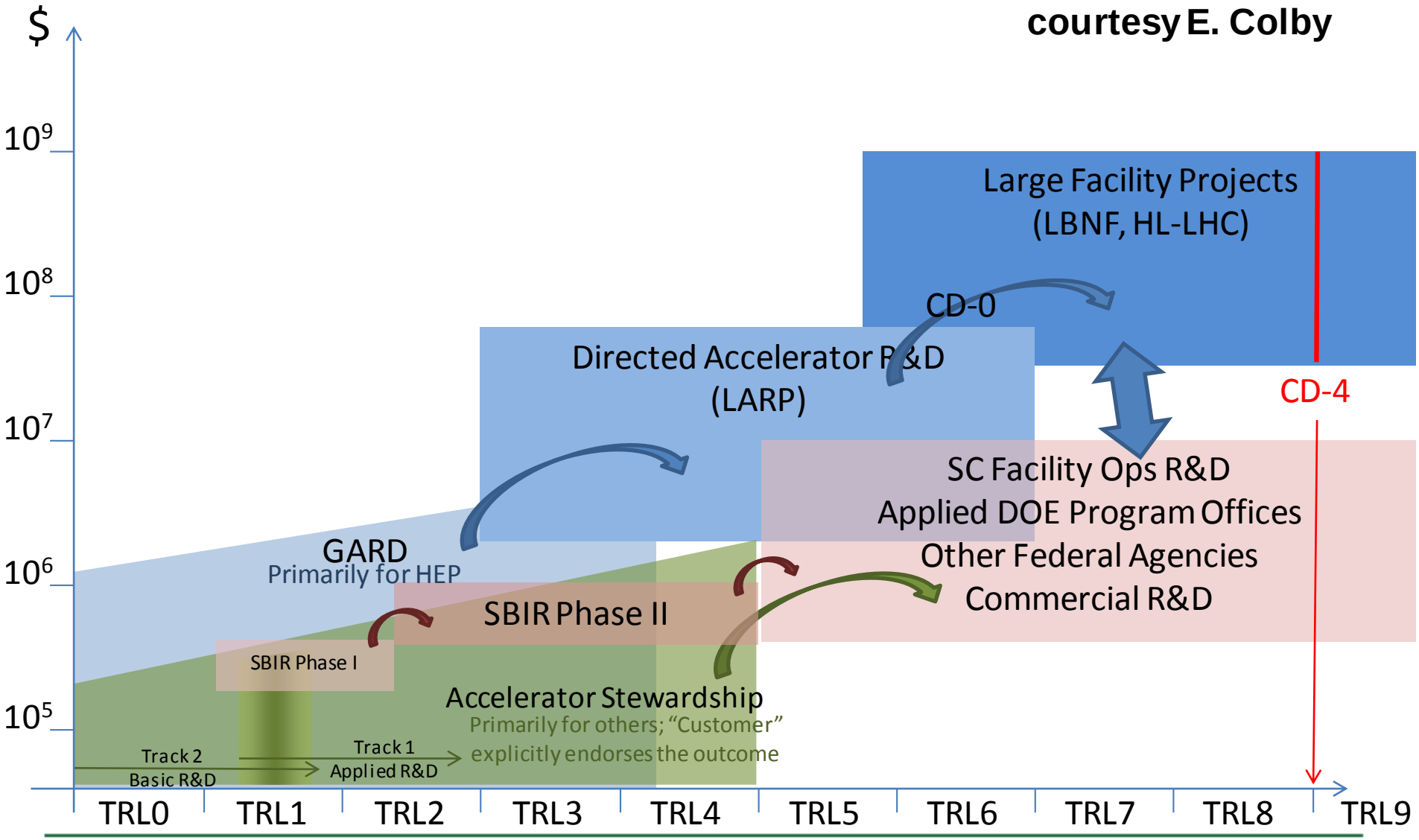
HEP Accelerator R&D III

- Accelerator Stewardship: ***Non-HEP-owned early stage R&D***
  - Has many of the same general characteristics as GARD but is concerned with customers other than HEP
  - Priorities driven primarily by mid- or long-term goals of the customer, and the ability to make significant technical progress in 3-5 years
  - Multi-partner collaboration is important (labs, university, industry)
- Directed Accelerator R&D: ***HEP-owned mid-stage R&D***
  - Selected R&D areas past the proof-of-concept level (TRL 3-4+) which are directed towards ***specific future facilities*** to demonstrate project readiness (TRL 6-7)
    - ***E.g., HL-LHC (LARP), ILC***
  - Actual implementation may be 10+ years away
  - Priorities driven by HEP long-term goals
  - Individual components may be developed/provided by SBIR/STTR

Where these live on HEP Org Chart



Funding Trajectories of GARD, Stewardship, and SBIR



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GARD = "General Accelerator R&D"