ECFA Detector R&D Roadmap Panel

Phil Allport
University of Birmingham (30/9/20)

- **CERN (Open) Council Webcast at https://webcast.web.cern.ch/event/i924500 with documents: https://indico.cern.ch/event/924500/contributions/3884837/subcontributions/308163/attachments/2060582/3456333/CERN-ESU-013.pdf and "Deliberation Document" at https://indico.cern.ch/event/924500/contributions/3884837/subcontributions/308163/attachments/2060582/3456338/CERN-ESU-014.pdf**
- **Main report**: ***"Recent initiatives with a view towards strategic R&D on detectors are being taken by CERN's EP department and by the ECFA detector R&D panel*, supported by EU-funded programmes such as AIDA and ATTRACT. Coordination of R&D activities is critical to maximise the scientific outcomes of these activities and to make the most efficient use of resources; as such, there is a clear need to strengthen existing R&D collaborative structures, and to create new ones, to address future experimental challenges of the field beyond the HL-LHC. Organised by ECFA, a roadmap should be developed by the community to balance the detector R&D efforts in Europe, taking into account progress with emerging technologies in adjacent fields."***
- **Deliberation document**: ***"Detector R&D programmes and associated infrastructures should be supported at CERN, national institutes, laboratories and universities. Synergies between the needs of different scientific fields and industry should be identified and exploited to boost efficiency in the development process and increase opportunities for more technology transfer benefiting society at large. Collaborative platforms and consortia must be adequately supported to provide coherence in these R&D activities. The community should define a global detector R&D roadmap that should be used to support proposals at the European and national levels."***

***https://ecfa-dp.desy.de/members/**

See also plenary ECFA presentations at https://indico.cern.ch/event/933318

Presentations from ECFA Chair

ECFA
European Committee for Future Accelerators

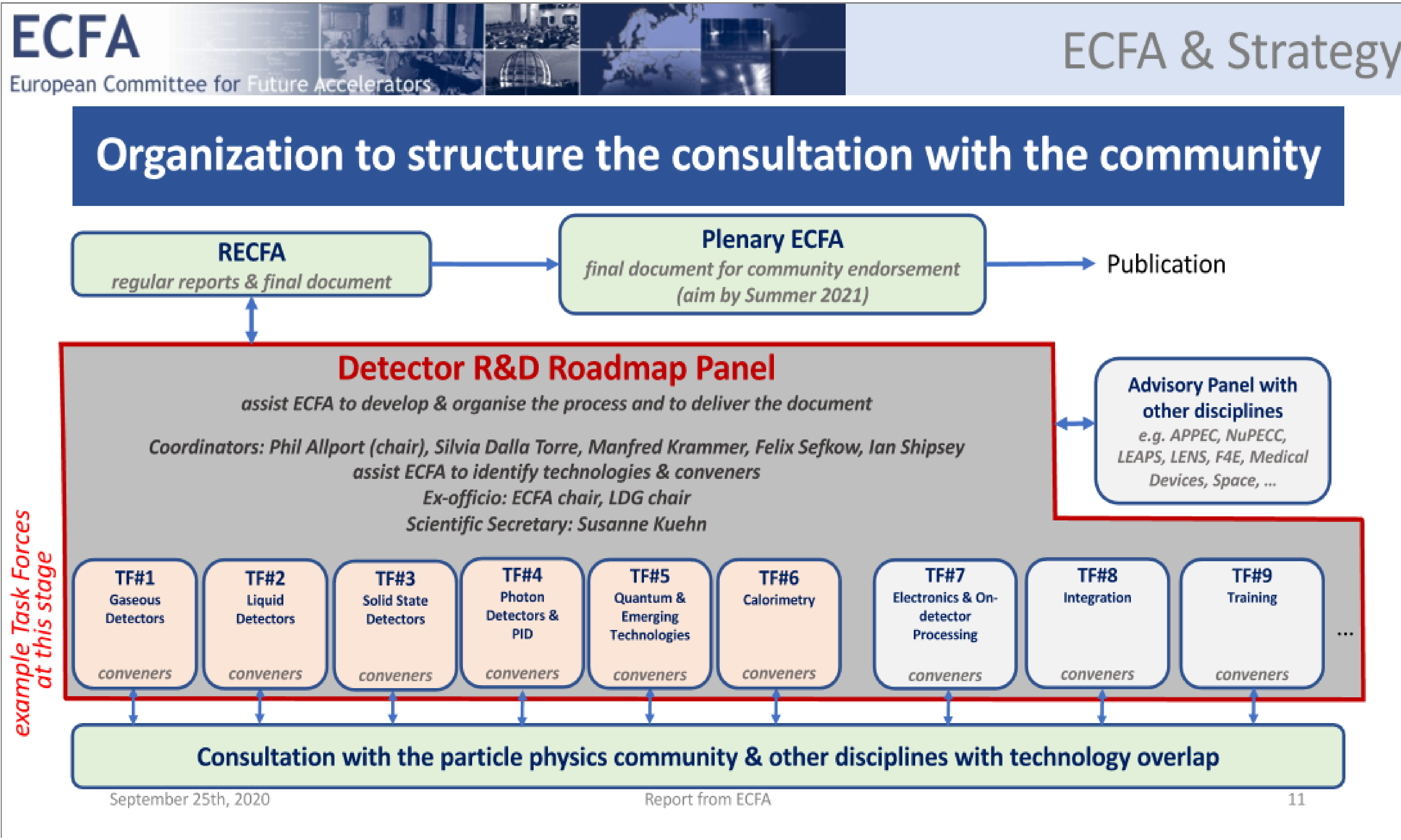
ECFA & Strategy

2

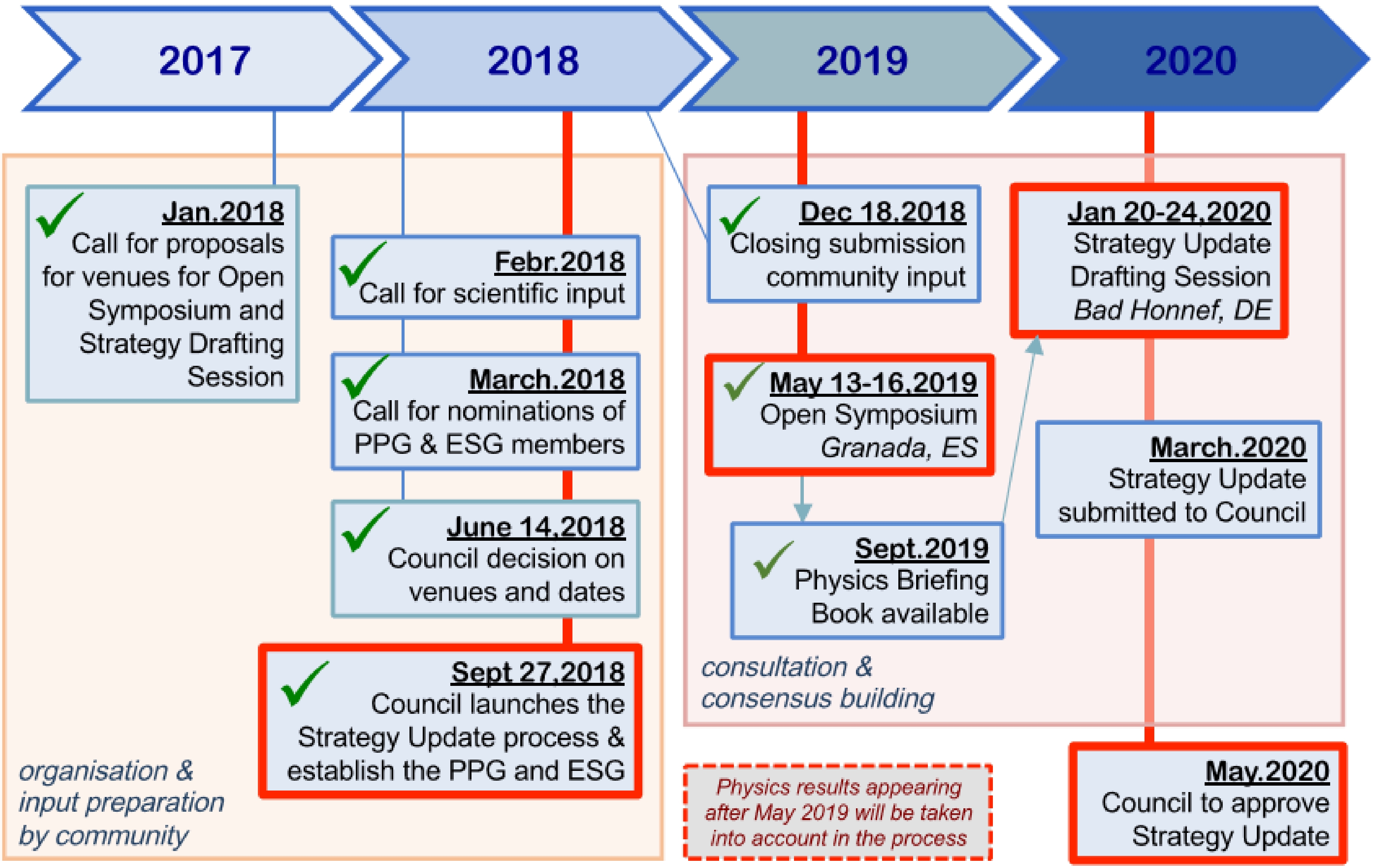
Timeline within ECFA

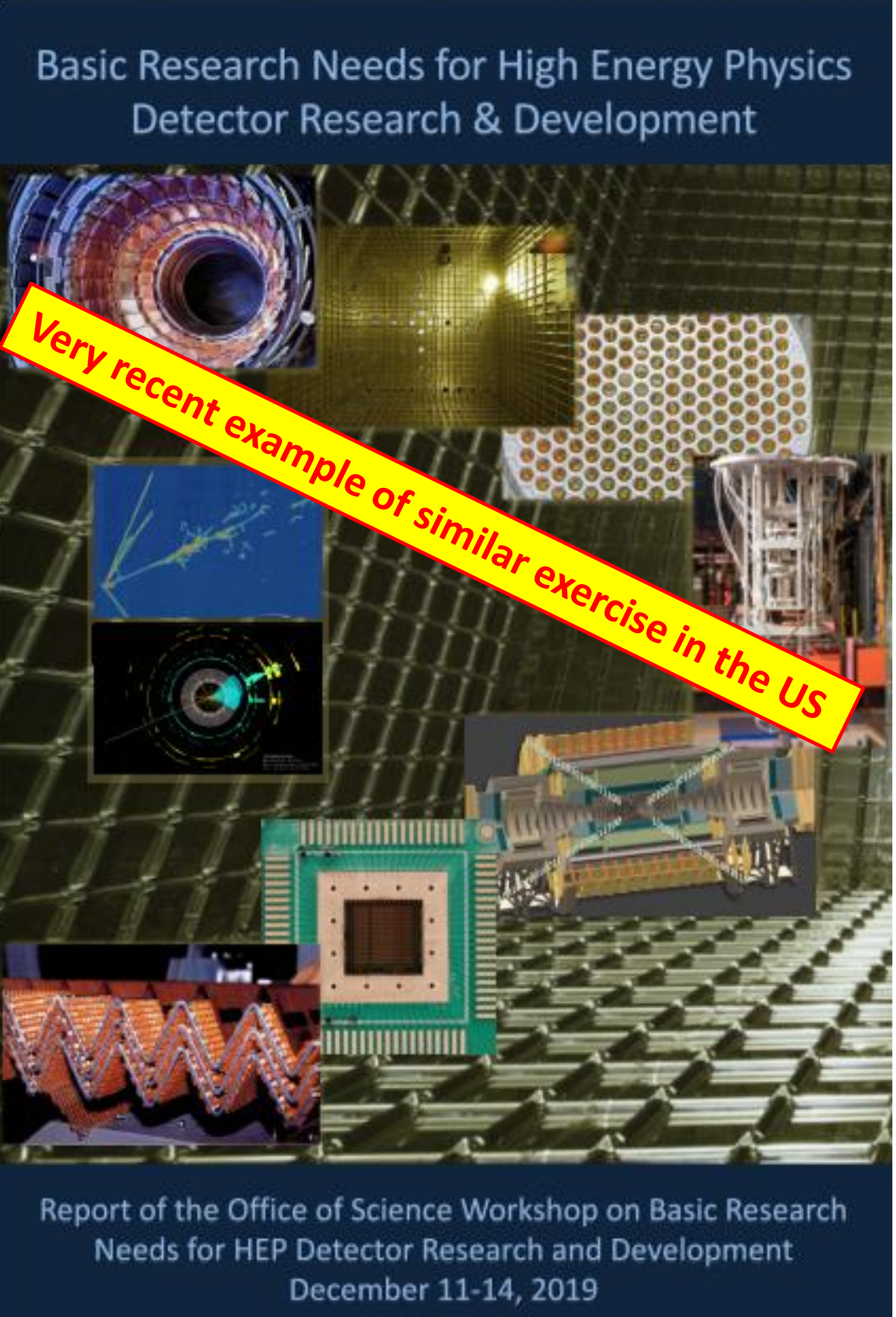
- *The topic was first discussed in Restricted ECFA during its meeting on 17 April*
- *On the basis of this discussion, and profound consultations with amongst others the ECFA Detector Panel, CERN DG, President of Council and LDG chair, a strawman proposal for the organisational structure was presented for discussion to Restricted ECFA on 10 July*
- *The above mentioned consultation provided initial names for the membership of the Detector R&D Roadmap Panel that will assist ECFA to develop and organise the process, i.e. the coordinators*
- *Names were presented as an initial proposal to Restricted ECFA on 10 July, and with few changes both the organisational structure and the coordinators were agreed to be presented to Plenary ECFA*
- *On 10 July, the organisational structure and the coordinators were presented to Plenary ECFA for discussion after which they were endorsed*
- *A call for nominations for additional Panel members, i.e. conveners, was mentioned to Plenary ECFA and communicated in written to all ECFA members on 11 August (and a reminder early Sept)*
- *The list of nominations for conveners is now in the hands of the Panel for further considerations*
- *In consultation with the CERN EP department head, a scientific secretary was added to assist the Panel*

Presentations from ECFA Chair



Reminder of Steps In EPPSU Process





https://science.osti.gov/hep/Community-Resources/Reports

DOE Basic Research Needs Study on High Energy Physics Detector Research and Development

Contents

"Transformative discovery in science is driven by innovation in technology. Our boldest undertakings in particle physics have at their foundation precision instrumentation."

"To reveal the profound connections underlying everything we see from the smallest scales to the largest distances in the Universe, to understand its fundamental constituents, and to reveal what is still unknown, we must invent, develop, and deploy advanced instrumentation."

Four Grand Challenges encompass this Instrumentation revolution

- **Advancing HEP detectors to new regimes of sensitivity**: *To make the unmeasurable measurable will require the development of sensors with exquisite sensitivity with the ability to distinguish signal from noise…. Research will be needed to develop these sensors with maximal coupling to the quanta to be sensed and push their sensitivities to ultimate limits.*
- **Using Integration to enable scalability for HEP sensors**: *Future HEP detectors for certain classes of experiments will require massive increases in scalability to search for and study rare phenomena ... A key enabler of scalability is integration of many functions on, and extraction of multidimensional information from, these innovative sensors.*
- **Building next-generation HEP detectors with novel materials & advanced techniques**: *Future HEP detectors will have requirements beyond what is possible with the materials and techniques which we know. This requires identifying novel materials … that provide new properties or capabilities and adapting them & exploiting advanced techniques for design & manufacturing.*
- **Mastering extreme environments and data rates in HEP experiments**: *Future HEP detectors will involve extreme environments and exponential increases in data rates to explore elusive phenomena. ... To do so requires the intimate integration of intelligent computing with sensor technology.*

Panelists

Co-Chairs
Bonnie Fleming, Yale
Ian Shipsey, Oxford

Cross-Cut Panel
Marcel Demarteau, ORNL
James Fast, JLab
Sunil Golwala, CalTech
Young-Kee Kim, Chicago
Abraham Seiden, UCSC

Physics Panels

Energy Frontier
James Hirschauer, Fermilab (Lead)
Gabriella Sciolla, Brandeis (Lead)
Michael Begel, Brookhaven
Meenakshi Narain, Brown

Neutrinos
Ornella Palamara, Fermilab (Lead)
Kate Scholberg, Duke (Lead)
Daniel Dwyer, Berkeley Lab
Amy Connolly, OSU

Dark Matter
Jodi Cooley, SMU (Lead)
Dan McKinsey, Berkeley (Lead)
Andrew Sonnenschein, Fermilab
Reyco Henning, UNC

Cosmic Acceleration
Clarence Chang, Argonne (Lead)
Brenna Flaugher, Fermilab (Lead)
Kyle Dawson, Utah
Laura Newburgh, Yale

Explore the Unknown
Sarah Demers, Yale (Lead)
Monica Pepe-Altarelli, CERN, EONR (Lead)
Matthew Reece, Harvard
Nicola Serra, Universität Zürich

Technology Panels

Calorimetry
Francesco Lanni, Brookhaven (Lead)
Roger Rusack, Minnesota (Lead)
Nural Akchurin, Texas Tech
Sarah Eno, UMD
Paolo Rumerio, Alabama
Ren-Yuan Zhu, CalTech

Noble Liquids
Roxanne Guenette, Harvard (Lead)
Jocelyn Monroe, U London (Lead)
Jennifer Raaf, Fermilab
Andrea Pocar, UMass
Jonathan Asaadi, UT, Arlington
Hugh Lippincott, UCSB

Photodetectors
Lindley Winslow, MIT (Lead)
Peter Krivzan, ULJ / JSI (Lead)
Graham Giovanetti, Williams College
Adriana Lita, NIST
Felix Sefkow, DESY

Quantum Sensors
Andrew Geraci, Northwestern (Lead)
Kent Irwin, Stanford (Lead)
Gretchen Campbell, JQI/UMD
Alexander Sushkov, BU
Ronald Walsworth, Harvard
Anna Grassellino, Fermilab

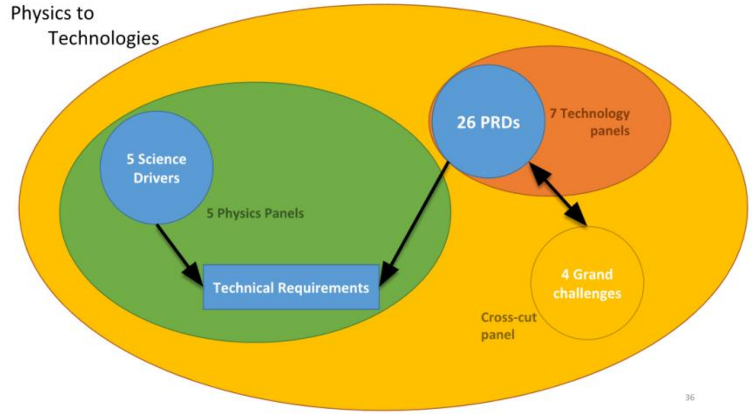
Readout & ASICS
Gabriella Carini, Brookhaven (Lead)
Mitch Newcomer, Penn (Lead)
Angelo Dragone, SLAC
Maurice Garcia-Sciveres, Berkeley Lab
Terri Shaw, Fermilab
Julia Thom-Levy, Cornell

Solid State & Tracking
Marina Artuso, Syracuse (Lead)
Carl Haber, Berkeley Lab (Lead)
Alessandro Tricoli, Brookhaven
Petra Merkel, Fermilab

TDAQ
Darin Acosta, Florida (Lead)
Tulika Bose, UW, Madison (Lead)
Wesley Ketchum, Fermilab
Jinlong Zhang, Argonne
Paul O'Connor, Brookhaven
Georgia Karagiorgi, Columbia

2 co-Chairs, 24 panel leads, 35 panel members, 5 cross cutters= 66

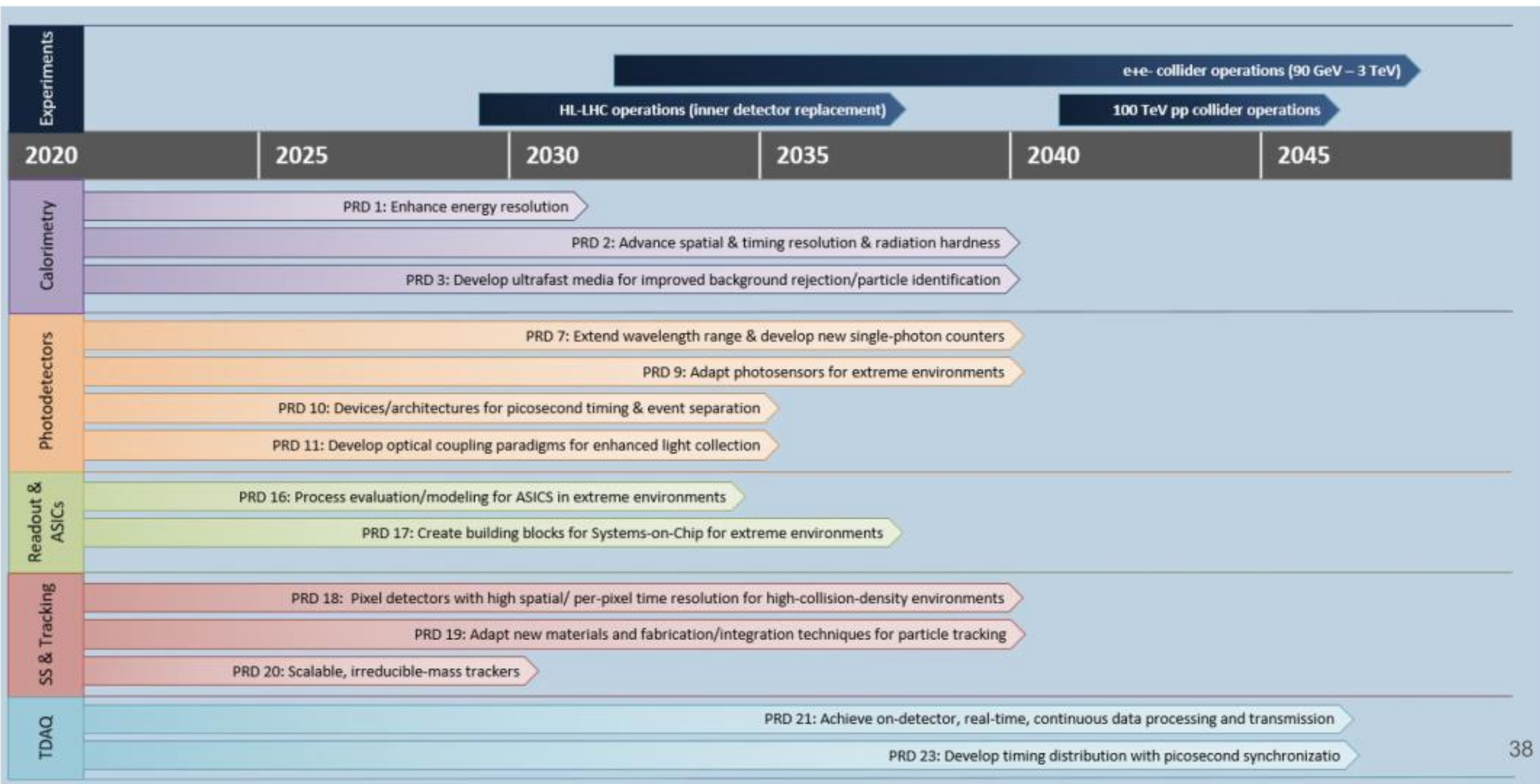
https://www.dropbox.com/s/0rml2hxooobxlv9/DOE%20BRN%20HEPAP-Fleming-Shipsey.pdf?dl=0



Example from DOE Basic Research Needs Study

https://science.osti.gov/-/media/hep/pdf/Reports/2020/DOE_Basic_Research_Needs_Study_on_High_Energy_Physics.pdf?la=en&hash=A5C00A96314706A0379368466710593A1A5C4482

Timeline: Higgs → Technologies to Discovery



https://www.dropbox.com/s/0rml2hxooobxlv9/DOE%20BRN%20HEPAP-Fleming-Shipsey.pdf?dl=0