



Office of High Energy Physics Detector R&D Program

CPAD Meeting at FNAL

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Detector R&D Program

- Support research leading to fundamental advances in the science of particle detection, and develop the next generation of instrumentation for HEP
 - “Generic” R&D that has potential for wide applicability and/or high payoff ← “high-risk/high-impact” as opposed to incremental advances
 - “Out-innovate” rather than out-spend the international competition
 - Focus on areas where U.S. can have leadership
- Provide graduate and post-doctoral research training in instrumentation ← next generation of detector experts
- Support “infrastructure”—technical personnel, equipment, “facilities”, and test beams—required for experimental detector R&D and fabrication



Program Funding and Effort

- **Total funding ~\$29M in FY2014 for research as well as detector facilities/test beam operations**
 - **85-90% of funding to national labs**
- **Supports efforts at 5 national labs (~80 FTEs at ANL, BNL, FNAL, LBNL, SLAC) and ~30 universities (~25 FTEs)**
- **National labs: annual budget briefings, field work proposals (FWPs), and lab comparative review (last in 2012)**
- **Universities: annual funding opportunity announcement (FOA) and university comparative review (since 2012)**
- **Special solicitations for Advanced Detector R&D and Collider Detector R&D in the past (last in 2011)**

P5 Recommendations

- **Recommendation 27: Focus resources toward directed instrumentation R&D in the near-term for high-priority projects. As the technical challenges of current high-priority projects are met, restore to the extent possible a balanced mix of short-term and long-term R&D.**
 - ← **Flavor of R&D is changing: less generic, more project-oriented**
 - Total R&D funding shrinking because of other, higher-priority initiatives**
- **Recommendation 28: Strengthen university-national laboratory partnerships in instrumentation R&D through investment in instrumentation at universities. Encourage graduate programs with a focus on instrumentation education at HEP-supported universities and laboratories, and fully exploit the unique capabilities and facilities offered at each.**
 - ← **Find appropriate laboratory/university balance to optimize overall productivity; find mechanisms to foster university instrumentation programs**



R&D Efforts by Frontier

- **Energy Frontier**
 - **LHC phase-II (HL-LHC)**
 - Partially supported by LHC operations program
 - **ILC further off into the future**
- **Intensity Frontier**
 - **LBNF**
 - Liquid Argon TPC, etc
- **Cosmic Frontier**
 - **Cosmic Microwave Background (CMB-S4)**
 - **Dark Matter (DM-G3)**
- **“Instrumentation” Frontier**
 - **LAPPD**
 - **Others?**



Need Ideas for “How to Do More with Less”

- **More science**
 - Also from other fields
- **More generic/high-risk/high potential for impact R&D**
 - Strategic areas? Grand Challenges?
- **More university involvement**
 - Large under-utilized intellectual potential
- **More young people**
 - Future instrumentation leaders
- **More communication/interaction**
 - Workshops/conferences
- **More cost-effective**
 - E.g., more sharing of resources; better execution
 - Non-HEP funding sources: other SC, other agencies, SBIR, etc.



Summary

- **Innovation in instrumentation historical strength of HEP**
 - Need to preserve and invigorate this core competency
- **Near-term priority is to support P5 research priorities**
 - LHC phase-II upgrades
 - Neutrino program
 - Dark matter and CMB
- **Stewardship of instrumentation efforts has historically rested with national labs and (some) university groups**
 - Need to establish new, collaborative models to do more with less
 - Need to examine raison d'être of existing detector facilities within the (changing) national HEP program
- **Community plays key role in identifying scientific and technological opportunities and in making them happen**
 - Would welcome white paper/report on CPAD's ideas



Backup



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