

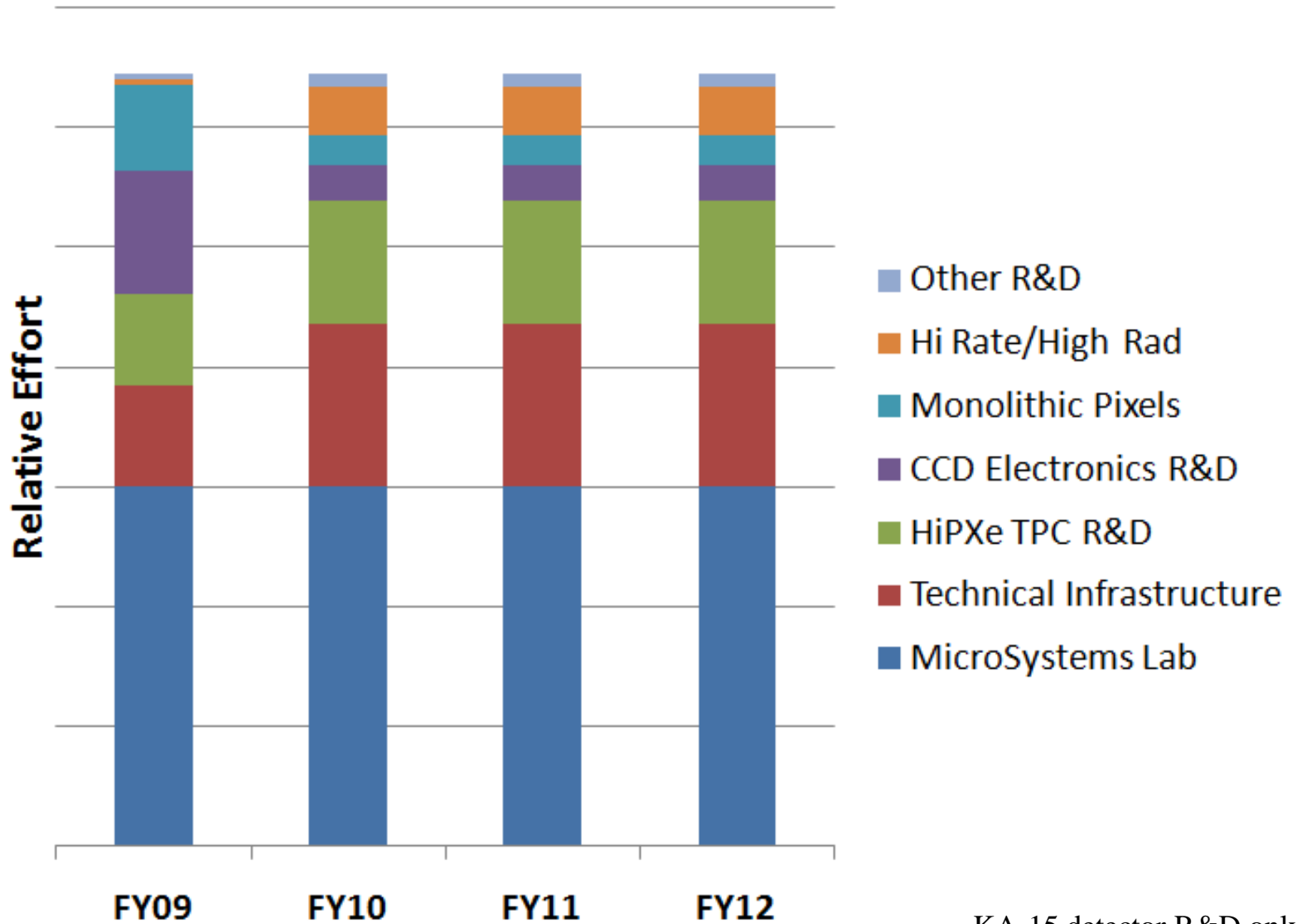
LBNL HEP Detector R&D Planning and Summary

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July 8, 2009

- **Primarily address planning and resources over next ~ 3 years**
- **Planning at TOTAL constant level of effort**
- **If more resources were available – where would we use them?**
- **Proposed areas for generic R&D with potential expanded collaborative involvement**
- **Resource information in backup and spreadsheets**

At Constant Level of Effort



KA-15 detector R&D only

- **Unique capabilities within DoE complex**
- **At TOTAL constant level of effort**
 - Outstanding program, maintain at constant level of effort
 - Assumes substantial project support(DES, BOSS, BigBOSS, JDEM) + strong connection to non-HEP applications
- **If more resources available**
 - Critical to enhance CCD testing infrastructure and personnel (engineer). Replace retiree. 1st priority.
 - Rely heavily on innovation in semiconductor device design. Postdoc? 2nd priority.
- **Generic R&D and community involvement**
 - Expand collaboration with FNAL(SiDet), Stage IV Dark Energy experiments
 - Continue collaboration on non – HEP applications

- **Supports and maintains Physics Division programs, laboratory operation and maintenance. Only element of LBNL non-project technical support.**
- **At TOTAL constant level of effort**
 - **Restore some mechanical engineering/technical capability(<1 FTE) and equipment maintenance to support all efforts. Otherwise constant effort.**
- **If more resources available**
 - **Advance hire of technician in FY12 to have greater overlap in anticipation of retirement**
- **Generic R&D and community involvement**
 - **Supports broad range of experiments and R&D**

- **Excellent record of accomplishments**
- **Close connection to sensor development outside HEP, rapidly growing area**
- **At TOTAL constant level of effort**
 - Reduce from FY09 level (Battaglia moving to UC Santa Cruz, will continue to collaborate) and then maintain.
 - Highly leverage emerging non-HEP support.
- **If more resources available**
 - Additional IC design
- **Generic R&D and community involvement**
 - How does OHEP detector R&D in this area connect to BES and other agency detector R&D?

- **Initial development coming to successful conclusion**
- **Close connection to sensor development outside HEP**
- **At TOTAL constant level of effort**
 - Reduce from FY09 level and then maintain
 - Expect HEP project support and non-HEP support, focus on critical generic R&D at minimal level
- **If more resources available**
 - Increase IC design support, new challenges.
- **Generic R&D and community involvement**
 - Needed for Stage IV Dark Energy experiments
 - Close connection with MSL and with non-HEP work

- **Critical to understand limits of IC technology at ~ 1 GRad and beyond**
- **LBL has been world-leader in this area but current (FY09) level is very small**
- **At TOTAL constant level of effort**
 - Increase to level of ~ 0.5 FTE IC design + testing
- **If more resources available**
 - Increased IC design (go faster), more testing support (students), see below
- **Generic R&D and community involvement**
 - Propose a ~ 3 year generic R&D program involving labs(LBNL, Fermilab, perhaps others) + key universities(Santa Cruz, Penn, perhaps others)

- **Silicon-based detectors will continue to be critical elements of HEP experiments.**
- **How to add intelligence for triggering or other applications**
- **At TOTAL constant level of effort**
 - Cannot support R&D in this area
- **If more resources available**
 - See below
- **Generic R&D and community involvement**
 - Propose to help understand community interest by holding workshop in early 2010. 3+ year program?
 - Preliminary indications of very broad interest => lead to multi-institution proposal?

High Pressure Xenon TPC R&D



- **Potential new capability for very low rate detection and imaging**
- **At TOTAL constant level of effort**
 - Increase in engineering design, but not sufficient to build instrument
- **If more resources available**
 - Have requested FY09 supplement to begin ramp up to begin instrument construction.
 - See below
- **Generic R&D and community involvement**
 - Organizing workshop for mid-November in Bay Area to bring together interested US parties, with international involvement => coordinated US work and proposal

- **Non-silicon(MCP, gas detector) readout using pixel ICs**
- **Nanowire carpets to reduce pixel detector cost**
- **Powering R&D(DC-DC) to reduce cable plant/material**
- **MCP development for large area detectors(SSL expertise)**
- **Scintillator R&D for hadronic calorimetry(Life Sciences expertise)**
- **At TOTAL constant level of effort**
 - **Life-support level(pixel IC readout, nanowires). Proposal to Homeland Security for pixel IC readout of TPC for neutron detection.**
 - **Powering R&D part of high radiation effort at minimal level**
 - **MCP and scintillator – if external funds arrive**
- **If more resources available**
 - **Would increase work on powering R&D and pixel IC readout, partly by involving students**
- **Generic R&D and community involvement**
 - **Collaborate as possible**

- $0\nu\beta\beta$ and dark matter detector collaborations in contact with LBNL regarding R&D
- Extensive experience at LBNL on germanium detectors for Nuclear Physics experiments and other applications. R&D for Majorana, GEO DM,....
- Interactions with liquid Xenon proponents. Generic R&D needs for fundamental properties in addition to issues of larger scale. Applications to LZ20, etc
- How to respond in context of DUSEL....in progress

- **1st priority – enable design/construction of HiPXe TPC demonstrator**
 - Have requested FY09 supplement(\$250K)
- **2nd priority – increase IC design support**
 - Have requested FY09 supplement(\$250K)
- **3rd priority - test engineering for MSL**
- **4th priority – start work on “intelligent” silicon**

- **From the guidelines for this review**
 1. Be more proactive in identifying outstanding detector related problems in the field and then
 2. Help the community address those problem in which a concerted effort might improve the physics reach and/or substantially reduce the cost of future detectors
- **There are four areas of generic R&D in which we believe LBNL has or can have a leading role**
 - Continued R&D on instrumentation for Dark Energy science – already underway, we believe, with LBNL leadership
 - Exploration of technologies to meet the future ultra high rate/high radiation challenge for tracking detectors. Three year Lab/university program, then reassess situation.
 - High pressure Xenon TPC R&D for combined high precision energy measurement and track imaging. Proof-of-concept over next ~ 3 years.
 - Intelligent silicon. Likely a three year Lab/university program, proposal needed.
- **Also can lead in connections with non – HEP detector R&D**

Conclusions



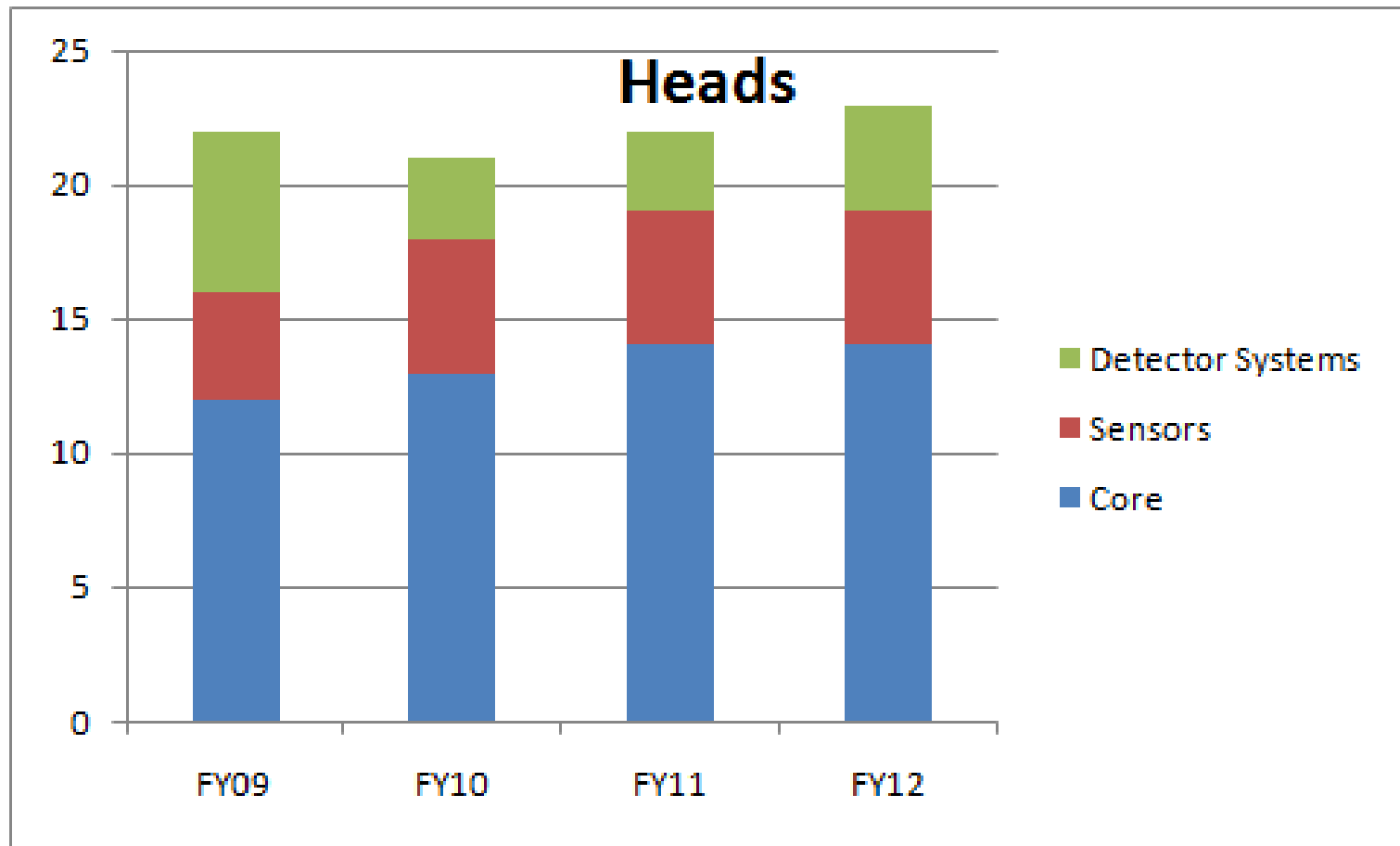
- **Outstanding record of detector R&D for High Energy Physics.**
- **Planning in place to address critical R&D needs and opportunities in next three years.**
- **Specific proposals for generic R&D with community involvement**

Backup

KA-15 Supported Heads



- Assumes constant level of effort(including M&S)
- Includes 4 heads for computing support(Core)



KA-15 Supported FTEs



- Assumes constant level of effort(including M&S)
- Includes 2.8 FTE for computing support(Core)

