

Kansas Advanced Semiconductor Project: Final Report

P. Baringer^(b), A Bean^(b), T. Bolton^(a), G. Horton-Smith^(a), Y. Maravin^(a), B. Ratra^(a), N. Stanton^(a),
E. von Toerne^(a), and G. Wilson^(b)

(a) Kansas State University, Manhattan, KS

(b) University of Kansas, Lawrence, KS

Overview

KASP (Kansas Advanced Semiconductor Project) completed the new Layer 0 upgrade for D0, assumed key electronics projects for the US CMS project, finished important new physics measurements with the D0 experiment at Fermilab, made substantial contributions to detector studies for the proposed e^+e^- international linear collider (ILC), and advanced key initiatives in non-accelerator-based neutrino physics.

In brief:

- Under the leadership of co-project manager A. Bean of Kansas University (KU), the D0 Layer 0 (L0) upgrade project was completed. The L0 upgrade was financed by an NSF Major Research Instrumentation grant led by PI Bean, with Bolton as co-PI, and by Fermilab funds transferred to KSU and KU under memoranda of understanding (MOUs). Approximately 300K dollars of work was performed in Kansas.
- KSU and KU expanded technical projects for the silicon tracking system of the CMS experiment now under construction at CERN, Geneva, Switzerland. These projects were supported by CMS projects funds under MOUs (approximately 90K for each institution) with the US-CMS program at Fermilab.
- KU and K-State launched their planned expansion of R&D in energy flow measurement for the DOE's highest ranked intermediate term HEP project, a TeV-scale linear collider. This program received approximately 35K of US-DOE linear collider R&D funding.
- With Tevatron luminosity reaching record levels and the D0 detector operating at top efficiency, KSU and KU contributed decisively to a number of physics analyses of Run II data nearing publication. Bolton was appointed co-convenor of the D0 electroweak physics group.
- Assistant professor G. Horton-Smith led a productive program involving physics studies using neutrinos produced by nuclear reactors. A new initiative to utilize measured neutrino interaction rates for nuclear security applications was launched.
- B. Ratra and KASP post-doc T. Kahniashvili developed new tests of the cosmological dark energy hypothesis and set constraints on cosmological magnetic fields.
- KU and K-State continued to successfully incorporate Kansas undergraduates into their research programs. K-State utilized KASP to continue its QuarkNet project, which involves twenty-two secondary school science teachers from underserved rural areas of the state.
- In February 2006 Alice Bean launched the *Quarked!*¹ educational website. A major goal of *Quarked!* is to familiarize kids with the names of the quarks and some basic particle physics concepts. In addition to the web site, a pilot episode for a possible half-hour TV series is being developed. Three short 3D animations were produced that can be viewed from the web site. By the end of this summer, these programs will

¹ See www.quarked.org.

have reached over 1300 kids. Bean received a grant from the Kauffman Foundation that will allow expansion of the website; and discussions are under way with PBS Television regarding a half hour animated series about quarks.

- In recognition of her accomplishments and visibility in the field, made possible in part by the EPSCoR program, Bean was appointed to HEPAP, the chief scientific advisory committee for high energy physics at DOE.

Summary of KASP Human Resources Development

In its last year, the DOE EPSCoR grant with KTEC support has allowed the KU and KSU high energy groups to support at least in part: four junior faculty members (Horton-Smith, Maravin, von Toerne, Wilson), six postdoctoral researchers (Christofek, Hentsel, Kahniashvili, Moulik, Onoprienko, and Tang), 6 graduate students (Bryant, Chen, Clutter, Foster, Samushia, and Smith), 17 undergraduate students (Batson, Brockman, Cameron, Flores, Harness, Kats, Koester, Martin, Smith, Stone, Sterling, Thompson, Van Eenwyk, Vehlewald, Wilson, and Wright), and two technicians (Robbins, Worth). EPSCoR funds also support engineering for the D0 L0 upgrade and CMS tracker through J. Ledford at the Instrumentation Design Lab at KU and T. Sobering and D. Huddleston at the KSU Electronics Design Laboratory.

New faculty members Horton-Smith, Maravin, von Toerne, and Wilson submitted four independent funding proposals between them. Horton-Smith was awarded a DOE Outstanding Junior Investigator Award, a three year grant for providing approximately 190K of support. Von-Toerne and Wilson received approximately 35K in funding for linear collider R&D.

Mentoring for junior faculty was provided by Baringer, Bean, Bolton, Ratra, and Stanton, making all together nine faculty members engaged in this project.

Final Summary

We believe the KASP project represents a successful use of EPSCoR funds. Capable, but under-funded and under-equipped physics groups at the University of Kansas and Kansas State University were able to make permanent improvements in their human resources and physics infrastructure. These improvements have resulted in larger levels of stable base funding and in widespread recognition of high energy physics in Kansas.