A detailed progress report

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Abstract

This is a progress report detailing my research work as a graduate student at the Physics Department of Virginia Tech and the Belle CP Violation Experiment located at the international High Energy Physics Laboratory [KEK] in Japan. This covers completion of my academic requirements in Virginia Tech starting Aug 2001, selection, proposal and qualification of the thesis problem in the PhD preliminary examination in Jan 2004, major breakthroughs in a uniquely important and uniquely difficult experimental problem between Nov 2005 - Nov 2006, presentation of research results from the collaboration to the international physical societies in December 2006 as an invited speaker, further progress in analysis in 2007, completion of a first draft of thesis in October 2007, career development process and formulating future research interest in 2007 and other important research and service contributions during 2002-2007.

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- Aug 09, 2001: Joined Virginia Tech, Masters in Physics from India
- Fall 2001[TA], Spring 2001[RA]: Completed course requirements, cummulative GPA > 3.0
- For above two semesters I passed the exam of three courses in addition to five full courses I took.
- Special Note: Throughout my PhD program I have reported the progress of my research regularly over video link between Japan and USA. [slides at http://www.phys.vt.edu/ dash] Some slides have not been uploaded but have been archived. After significant progress into thesis was made by me these video conferences were stopped. Neverthless I presented my status inside collaboration meetings up untill 2007 april and these involved major progress reports.[slides available] Apart from the presentation slides thousands of emails have been exchanged by me with several key researchers who were closely involved with my analysis. All progress todate have been reported to thesis advisor over email and all slides, technical issues and status have been forwarded to him. My program involved significant amount of travel time between Japan and USA, huge amount of paperwork [tax, immigration, travel, banking] because of five month rule for F1 Visa and yearly Japanese Visa procedures and many other paperworks that were required for my long term stay in Japan.
- Summer 2002 - Fall 2003[RA]: Joined Belle Collaboration and stationed in Japan for 14 months.

  During this period of 14 months till Fall 2003:

  - Learned software programing,
  - Learned Belle software framework for data-analysis [High scale computing]
  - Developed my own software modules for data-analysis.
  - Contributed extensively towards service, maintenance of detector and trouble-shooting of experimental data collection.
  - Presented status of progress every wednessday over to VT, over video link[slides available]
  - Chose a thesis problem. Did extensive diagnosis studies and evaluated the problem.
  - By the end of the 14 month period I had preliminary signal in some decay channels.
- Fall 2003 - Summer 2004: Returned to VT for this period
  - Prepared for preliminary exam, problem solving for oral exam, presentation material for thesis proposal
  - At the end of Fall 2003 presented the proposal for thesis [Presentation slides available], successfully qualified the exam.
  - Spring 2004[TA+RA]: Read and discussed 10 major publications related to my study with thesis advisor. As TA taught a class of twenty, helped them with problem solving.

  - Summer 2004 returned to Japan

- Made notable progress with thesis. Involved further understanding of thesis, detector and data-analysis at Japan [reported in slides] and major development of software codes and data analysis techniques. Simulation studies of the detector and my analysis produced consistent results. This is a major progress.

- In april 2005 attended American Physical Society's annual conference in Florida

- From Jan 2005 to November 2005: Further remarkable progress made. Good quality results were obtained in experimental data, which so far had been obtained only for test purposes.

- Towards the end of 2005 I had achieved a major breakthrough in my analysis.

  - My analysis was a unique problem from various angles
  - The detector didn't give sufficient information for part of the analysis
  - The problem was experimentally difficult to measure
  - The expectaion of having a good signal in some of the channels were very small. The previous work carried out by others had produced feeble signal and their work was stalled due to daunting experimental issues, before I had joined VT.
  - Due to my special approach to the problem, unique algorithms I developed over two years and persistent effort I obtained very high quality signal and reduced noise level noteciably. [can be compared to a voice that is hardly understandable over international long distance telephone calls and a voice thats almost like next door] This was termed as a miracle by the most experienced Physics leaders of the group. This was related to something called a K_L [read K-long] meson that is very hard to measure at the detector. Other studies involving its measurement by others had never produced such a good signal.

- In Jan 2006 I attended an international conference and workshop in India

- From Feb 2006 to November 2006:

  - I continued making rapid progress in my analysis.
  - I added very important steps to the analysis that were not carried out in previous study.
  - I worked on difficult technical problems, diagnosis and consistency checks.
  - I expected to present my results to the international community by summer 2006 as an ambitious plan from collaboration leaders. But we decided to carry the measurement further and present in winter 2006 instead.
  - By November 2006 my results were almost ready but since this would be a first time, precise result expected to create a major sensation we decided to continue the measurement till we are completely confident that we did not make a mistake.

  - During the last two months I carried out simulation studies to investigate the cause of noise that mimics the signal. This is a major study as this would make my study far more reliable and accurate than the previous study.
  - I drafted a technical note describing the methods of my analysis.
  - By this time I had become familiar with others work in the collaboration.
  - In November 2006 I presented Belle Collaboration results carried out by others in an international conference in Hawaii that was jointly held by American and Japanese Physical Societies. I gave a similar talk in a conference of the American Physical Society in College of William and Marry, Virginia
  - These were summary of several analysis results and I was an invited speaker to these conference. Both of these were an honor for a graduate student.

- From December 2006 to feb 2007 I had a three months hiatus

- When I came back I presented the status of my work to the collaboration from VT over video link.

- In april 2007 my thesis advisor wrote a very positive report on my progress.

- During april to now I have been involved in finding a suitable postdoctoral research career. I had a trip to Japan in July for a week where I attended collaboration meeting. I had appointments with collaborators for fellowships in research career. I have drafted curriculum vitae, research interest letters and cover letters for my job search for a career in Experimental Physics research.

- Recently I drafted the first copy of my thesis and submitted to my thesis advisor in September. I am expanding the technical note I had written in November 2006.

- Most recently I have sorted out and arranged archived research logs according to date and content so that I can write my thesis consitently and without loss of content.

- I have to finish my analysis. My analysis will go through internal review of the collaboration [two weeks !!] and few more status and prgress reports. I have to complete the technical note so that the collaboration can read and review it. After that this will be released for publication in Journal. Once my analysis is complete, I will present and publish my results in international conferences.

- Writing of thesis should not take long time once the analysis is complete, because the description of detector which constitute almost fifty percent is already in hand. The methods and results of analysis will quickly go into the thesis and that will be the final draft of the thesis. Then its a matter of review by thesis advisor. After that I will defend my thesis to the graduate committee.

- I need 5/6 months of quality time to finish everything. Travel to Japan is crucial as all the high speed computation is directly accessible instead of internet connection and also technical issues are immediately solvable as most of the collaborators from around the world are present in KEK at anytime and in VT I am the only person working on this

kind of analysis. Once the results are allowed to be presented out of the collaboration I need funds to travel to the conference venue to present my results.

- In the present scenario with full support I expect to defend by may 2008.
- In the Belle collaboration I have also contributed thousands of hours as service in terms of trouble-shooting of experimental data collection, operation of the detector and its components, outreach experience and community and cultural experience in Japan, from summer 2002 - summer 2007.