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| **Motivation:**  Please explain why you would like to be considered for participation in the CSCS-USI Summer School 2014 (200 word limit) |
| My main study time is spent on data-analysis. Usually, the analysis code is run on very big amounts of data on the GRID, but very often one need to do a lot of smaller tests beforehand, which is not practical to send to the GRID, that’s why local computer resources are used. Basically the biggest part of the time is spent exactly to do these tests. The possibility to speed up this part by employing parallelism will increase the efficiency of my work dramatically and will free more time on actual physics analysis.  In addition, since I worked with tracking detectors I am really curious about the CUDA technology. I have seen presentations which showed incredible speed increase on the track reconstruction performance using GPUs instead of CPUs (up to 20x). The PANDA experiment already uses it, and they manage to reconstruct events online with thousands of tracks. That is really impressive and that’s why I believe GPU computations are the future for tracking. Therefore it would be crucial for me to know CUDA to be able to continue to do first class work in tracking.  I find this school such a good fit for my needs that I applied for – and got – a travel grant from the Lund University COMPUTE school to enable me to go. |

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| **Background:** |
| I am a PhD student in particle physics in my 3rd year. I am a member of the ATLAS collaboration and I am working primarily on two topics: data-analysis of big amounts of data and developing and supporting simulation and digitization codes for the Transition Radiation Tracker (TRT) which is sub-system of ATLAS tracking detector.  The first area of my work is is data-analysis of experimental data of proton-proton collisions. It requires me to run on huge amount of data, several times to calculate systematic uncertainties, and that is why it is really computing consuming. So far in my coding I am using openMPI on a basic level (splitting “for” loops) to speed up some elementary parts of the algorithms. But to implement parallelism in more complex cases I need a better understanding of it.  The second area of my work is the development of simulation and digitization code for the ATLAS tracking detector. This requires me to use C++ together with Python in a large framework, with several interdependencies. It is a requirement that new code should be compatible with current interfaces, so all code should be back-compatible. One of the most crucial thing is code performance, because it will be used for a few years to produce billions of physics events, using millions of cpu-hours of computing resources. The code therefore should meet tight CPU and memory restrictions but in the same time it should produce accurate enough results. My project is to implement the possibility of switching between different types of gases, used to detect particles, according to current detector condition and to introduce new gas-mixture. That is required to properly simulate all physics processes which occur when a particle penetrate sensitive volume of detector such as ionization of gas, electron drift to anode/cathode, collecting of charge, etc.  CERN are deeply concerned about efficiency of simulation codes and it is planned to improve existing analysis and simulation frameworks to use all advantages of multi core processors. And ATLAS simulation framework also will move this way and responsibility to make existing packages thread safe will be entrusted on their current developers.  As I said in the motivation part I am really interested in CUDA technology. I have finished an introductory course at Lund University about it. During the course we were trying to simulate electron-proton interaction and obtained the correct angular distribution of electron-proton scattering. This course was focused more on the physics part, and that is why I would like to learn more about CUDA from a programming point of view. Because it is highly possible, that CUDA will be used more and more to run track reconstruction algorithms in particle physics. |

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| **HPC Experience:** |
| - GRID infrastructure: was used mainly for data analysis, simulation and digitization of TRT detector. (2 years)  - Cluster at department (10 nodes, 16 cores each with hyper-threading support): data analysis and code testing. (6 months)  - CERN and DESY computing farms with batch systems: single-threaded jobs for physics data analysis. (4 years)  - Desktop with CUDA enabled GPU: was used during CUDA overview course at university. (2 months) |

Please give us the name of at least **1 reference**

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