Humboldt Highway II: computer cluster on renewable energies

Aims

- Discuss possibilities to build a computer cluster which runs fully on renewable energies to support the scientific exchange program between scientists in Cuba and in Europe.

- THINK BIG – aim for a full scale computer cluster located in Cuba for scientists in the Caribbean fully on renewable energies

- Project can be part of the Science4Peace idea of CERN and DESY – enable and encourage international collaboration and cooperation
  - against digital and scientific divide

- International Year of Basic Sciences for Sustainable Development 2022/2023 encourages such projects

Ideas

- Define the long term goal – in 5-10 years
  - Full Scale Computer center on renewables
- Intermediate goal – 2-5 years
  - Computer cluster at InSTEC on renewables with up-to-date CPUs etc
- Short term goal – 1-2 years
  - small cluster existing – back up with PV system to ensure stable operation even in power-cut situations
    - on-site applications of Monte Carlo simulations in the field of elementary particle physics.
    - cluster can serve as a testing field under real conditions for operating a computer cluster based on the availability of energy

Concrete plans

- Short term
  - Computer cluster fully on renewable energies
    - design PV system to run current cluster and charging battery
    - which PV system is suitable – requirements
    - design should be scalable
  - Investigate options from new CPUs
    - Cluster using low energy consumption devices
      - ARM CPUs ?
        - does software run on ARM – experience with Mac M1 !
      - Can we use laptops for a simple cluster ?
      - Export issues
        - can new CPUs be exported to Cuba

- Exchange visits of IT experts for training – both ways
  - cluster at DESY
  - running under difficult conditions

How to proceed – short term

- Continue scientific cooperation by visits and exchange programs for students and scientists DESY – Cuba.

- Need for short term funding
  - DESY - Cuba cooperation agreement
  - can something like this be achieved also with CERN ?

- DAAD application still in pipe-line

  Apply for new funding for medium term projects:
  - new DAAD Sachmittel application for support of first step PV system etc

How to proceed – Medium term goals

- Exchange project in computing – operation of computer cluster under different conditions

- Common projects in the field of high energy physics between InSTEC, DESY and CERN:
  - Theoretical and phenomenological calculations can be performed at the computer cluster on renewable energies at InSTEC.
  - Scientists at DESY offer voluntary partnerships to students and scientists at InSTEC to support experimental analyses with theoretical and phenomenological calculations. The calculations should be directly connected to the experimental analysis.
    - For introduction, the student comes for a visit of 3 months to DESY to learn the basic requirements of the experimental analysis
    - A senior scientist or postdoc at DESY supervises together with a senior scientist at InSTEC the theory calculations
    - The partnership with InSTEC could result in a CMS association with the scientists involved (to be clarified with CMS)

This cooperation with InSTEC would allow to develop a phenomenology group for particle physics at InSTEC, exchange IT knowledge and would allow to perform PhD theses in particle physics and Computing Science at Havana University.

How to proceed – longer term

- Apply for longer term funding – ERC grant (European Research Council)
  - deadline for Synergy Grant is Nov 2023 (… too early, but next round)
  - Synergy Grant – A group of two to maximum four Principal Investigators (PIs) working together and bringing different skills and resources to tackle ambitious research problems.
    - Proposals are evaluated on the sole criterion of scientific excellence which takes on the additional meaning of outstanding intrinsic synergetic effect.
  - 3 Pillars:
    - Renewable energy supply: PV system etc
    - Computer cluster operation depending on availability of energy: low energy CPUs, operation of cluster etc, including network etc
    - Physics applications in QCD: Code optimization for least CPU time consumption