AccelNet-Implementation: HSF-India - Research Software Networks in Physics

HSF-India is a US National Science Foundation (NSF) funded project that began October 1, 2022. HSF-India works to connect collaborative networks in India to networks in the U.S. and Europe in order to build the international research software collaborations required to reach the science goals of next-generation particle, nuclear and astroparticle physics experiments including the high-luminosity Large Hadron Collider at CERN, the Deep Underground Neutrino Experiment at Fermilab, the Electron Ion Collider at Brookhaven National Laboratory, and the Laser Interferometer Gravitational-Wave Observatory (LIGO). To fully realize their discovery potential a new generation of software algorithms and approaches is required. Building these research software collaborations is challenging and inherently international matching the international nature of the experimental undertakings themselves. HSF-India provides students, postdocs and early career personnel significant experience in international team science through engagement in a diverse research community.

HSF-India activities include:

1. **Training events** that build upon the curriculum being actively developed and used today by the HSF and IRIS-HEP. This includes an introduction to the current analysis, deep learning and data science ecosystem, software development/engineering skills, and best practices for collaborative work. We have engaged over 4000 students so far and have funds to assist with instructor travel costs and networking events. Our project includes funding for instructor travel and a network building event during each training .
2. **Research Hackathons** that match researchers and students in short small group projects having specific goals. The idea is to bring together several international researchers with a research group or set of groups to collaborate on a research project of mutual interest. The goal is to build new collaborations, work together as teams and to grow familiarity with research topics related to the software used in experimental research.
3. **Fellowship programs** for students that have participated in our training programs, or have equivalent experience. Fellows arel be based at their home institute (or elsewhere as convenient) and interact remotely with their mentors on software projects. Projects nominally have two mentors, both for practical reasons (holidays, busy schedules, etc), and to bring different perspectives, from different networks, to the problem. We also aim for projects where two Fellows from different countries work together under the same mentors on a project. We aim to support approximately 10 students per year for a three month fellowship in a fashion similar to the Google Summer of Code program.
4. **Researcher exchanges** organized and funded between the U.S. and India. While short in-person visits for training events, workshops and conferences can reduce barriers to communication, longer visits are critical to building and sustaining durable longer-term relationships. We aim to provide travel support for 10 early-career researchers per year

to participate in a researcher exchanges. Like the fellowship program, this program is be open to researchers in both India and U.S.

HSF-India started with three three broad research themes: **Analysis Systems** including tools and techniques enabling next-generation analysis approaches to realize the maximum scientific potential of the data in the least time; **novel simulation techniques** including critical tools for the increasingly complex questions being asked by current and planned experiments; and **Tools for Open Science** that ensure that researchers benefit from, and contribute to, the innovation of the broader data science community. We continue to broaden this scope as we identify topics of mutual interest across collaborative networks.

HSF-India will continue to focus on opportunities for early-career researchers and establish mentoring and co-mentoring relationships with more senior researchers across the networks. By engaging with the data-science, artificial intelligence and broader computer science communities the projectl fosters bottom-up alliances around research software, for physics and beyond. HSF-India aims to establish an environment where researchers with diverse backgrounds, skill sets and interests can come together and build innovative collaborations that sustain novel tools and techniques while bridging research gaps to enable future scientific facilities.

HSF-India is an National Science Foundation (USA) funded project lead in the U.S. by David Lange (Princeton University), Peter Elmer (Princeton University), Rafael Coelho Lopes de Sa (University of Massachusetts, Amherst), and Verena Martinez Outschoorn (University of Massachusetts, Amherst).