



MREFC Education and Public Outreach (EPO) Strategy for US ATLAS

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Introduction



- The HL-LHC project provides unique opportunities for promoting our EPO objectives:
 - **Education:** student training, workforce development
 - **Public Outreach:** scientific literacy, awareness, societal value
- The success of these objectives is vital to the future strength and health of our field
- US ATLAS MREFC institutions are heavily involved in a variety of EPO programs that can leverage HL-LHC activities:
 - Programs spanning several institutions (e.g. REU, Quarknet)
 - Institution-specific programs



Context for EPO plan



Our EPO plan is broadly based upon the following considerations and constraints:

- Exploit the uniqueness of the HL-LHC project to promote objectives for broader impacts?
 - We have the opportunity for synchronising EPO with the design and construction phase for one of humanity's most ambitious endeavours for understanding the fundamental nature of our universe
 - This captures the imagination of a broad and diverse population – take advantage of this in creating the most feasible and impactful EPO plan
- MREFC funding can not be directed at EPO, but we can leverage the research supported by this funding to promote EPO objectives
 - Utilize and coordinate existing infrastructures, programs, and personnel

Our EPO plan includes (details in following slides):

- Workforce development strategy
- Evaluation plan for the effectiveness of our MREFC EPO
- Management plan
- Coordination with CMS



Existing US ATLAS efforts



- **REU:** Arizona, Chicago, Columbia, Michigan, Northern Illinois
 - REU does not include HL-LHC at this time so using this program would require an additional proposal
- **Quarknet:** Northern Illinois, UPenn, SMU
- Plus, many institutions have their own programs in place for involving and mentoring undergraduate and high-school students, many with a focus on under-represented groups
- Public outreach spans a broad spectrum of involvement
- The infrastructure and expertise that exists from these programs will be used to support our MREFC EPO plan



Examples of existing programs



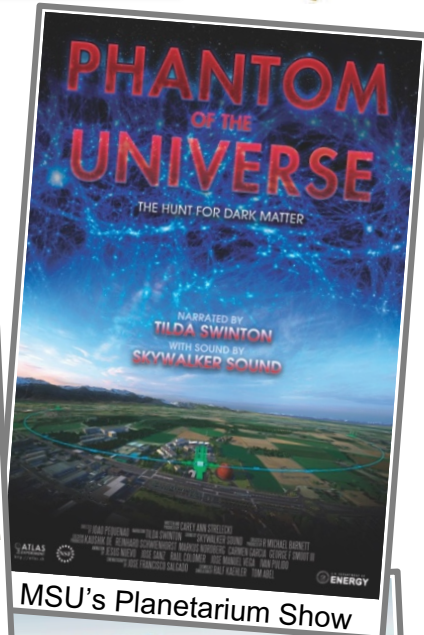
Michigan's 2016 REU students at CERN



NIU's 2017 Quarknet participants



Student from Michigan's "Semester Abroad" Program working on electronics at CERN



MSU's Planetarium Show



Oregon's Undergrad LHC Research Program



Pitt's High-School LHC Lecture Program



Michigan's 2017 REU students at CERN

Lots of engaged, diverse and happy students – our future!



Developing an HL-LHC EPO strategy



- Requires coordination between institutional activities and project areas
- Each L2 manager will describe the specific activities within their scope that will be used for workforce development
- Here, we will describe the following aspects of our plan
 1. Workforce development
 2. Evaluation
 3. Public Outreach
 4. Management and Resources



1. Workforce development

- Summary of expected undergraduate involvement (#/year)

FY20	FY21	FY22	FY23	FY24
10	20	30	10	5

- Work with the *US ATLAS committee on Diversity and Inclusion* on strategies for inspiring and mentoring under-represented groups
- Pipeline improvement:
 - Make recommendations for how to increase connections with minority physics chapters, colleges, HS's, etc.
- Improving sense of inclusion:
 - Informal weekly video/skype chats across different groups and institutions
 - Weekly UG presentations + regular reports at US ATLAS meetings
- Beyond technical training:
 - (bi)weekly meetings for career development, interviewing skills, etc.
 - Also important for grad students and postdocs on the project



1. Workforce development (cont.)



- Identification of projects
 - We need to employ people to get a detector built, but also need to carefully consider projects that will educate and train
 - Technical training, teaching, skills development, computational literacy, etc.
- Mentoring:
 - Each institution will identify their mentors for students
 - Biweekly meetings for mentors and PIs to discuss students, diversity issues, ideas for improvement, what is and isn't working, etc.
- Similar considerations for technical staff, graduate students, postdocs



2. Evaluation



- Ongoing evaluation of impact on EPO objectives allows us to determine what is working and what needs improving, and to adjust accordingly
- For the workforce development component of the HL-LHC EPO plan, we are coordinating with CMS on a uniform survey-based approach
 - Will allow for common evaluation data for analysis and comparisons
 - Surveys will be administered and coordinated locally
 - We (via CMS) have secured help from a STEM education professional, Prof. Natasha Holmes (Cornell), who has helped us with developing surveys and will assist with the analysis and interpretation of data (with the help of summer students/interns)
 - Will allow more quantitative statements regarding impact on workforce development
 - In addition to the surveys we will conduct interviews with a subset of participants to make sure we have a consistent picture of their experiences
 - Filling out the surveys will be part of the “job description”
 - Survey drafts included in the back-up of these slides



3. Public Outreach



- We will encourage and make recommendations for highlighting MREFC activities in existing public outreach activities and programs at US ATLAS institutions. This includes (but not limited to):
 - LHC Masterclasses
 - Public talks and events
 - Middle/High school visits
- For the public outreach component of the HL-LHC plan, metrics for evaluating impact on objectives such as scientific literacy, public awareness/interest/support, etc. are more difficult to define and interpret
 - However, we are investigating existing resources we may benefit from, and
 - investigating possible connections with assessment “professionals” in other programs (e.g. OERL, DEVISE, INCLUDES) and connected with our institutions
 - We will also consider proposals to other programs to develop strategies



4. Management



- Both US ATLAS and US CMS have EPO coordinators (physicists from US LHC institutions) who oversee projects funded by their respective entities
- The US ATLAS EPO coordinator position has been redefined to oversee the HL-LHC EPO program and its evaluation, and to ensure EPO objectives are being met
- Each institution will have an EPO contact who will coordinate activities locally (including meetings, events, surveys, etc.)
- The local EPO contacts will also coordinate training on diversity, best practices, etc. (most institutions already have these resources available)



Resources



- The baseline EPO plan involves no new resources or personnel
 - The only additional resource needed is the summer intern for the evaluation plan that we plan to fund within the existing US ATLAS EPO budget
- However, many other NSF programs exist through which we can develop new initiatives or programs with additional resources.
- We will explore such opportunities for extending our baseline EPO



Summary



- We have developed an MREFC EPO strategy to use US ATLAS institutional HL-LHC activities to promote our EPO objectives
- We use existing programs and infrastructure that can leverage MREFC funded projects
- Some details are still being worked on, but the structure is now taking shape, thanks to a lot of input and help from experts in STEM education and outreach
- We are coordinating closely with US CMS



Back up



Surveys: further details



- We are working closely with CMS to formulate a consistent EPO assessment plan and evaluation metrics
- As part of this plan, we have created surveys for project participants, as a means to evaluate the effectiveness of our workforce training and diversity efforts
- These surveys include:
 - Entry survey: administered before starting research experience
 - Exit survey: administered immediately after research experience
 - Follow-up survey: administered at least 1 year after research experience
- Surveys will be administered by local project leaders and overseen by the appropriate L2 manager
- We have identified the additional personnel needed to analyse and interpret the data from these surveys
- The following slides provide drafts of the survey questions (as developed in coordination with STEM education specialist ...)



Entry survey

HL-LHC project: Entry survey

In order to gauge the effectiveness of our HL-LHC educational efforts we would greatly appreciate your time in filling out this short survey. All responses will be kept anonymous.

PART 1: Regarding your upcoming research experience

1. University or Lab at which you will work:

2. Is this your first LHC research experience?

Yes No

3. Start date (MM/YY): _____ End date (MM/YY): _____

4. What is your *main* reason for participating in this research project? (select one)

- To determine if this is a field I might be interested in pursuing
- To fulfill a research requirement for my degree
- To gain experience in research methods and/or data analysis
- This was my only offer for a research experience
- My other research options appealed to me less
- Other: _____

Please rate the following:

5a. Your understanding of what your project entails is:

poor excellent

5b. Your excitement regarding particle physics at the Large Hadron Collider is:

low high

5c. Your desire to pursue a career in physics or a related field is:

low high not applicable

Regarding physics as your major or intended major:

6a. Are you a physics major, or intend to be a physics major?

Yes No not applicable

6b. Are you a physics minor, or intend to be a physics minor?

Yes No not applicable

Please turn over...

Part 2: Demographic Information

1. Current position and institution (e.g. Year 2 undergrad at University of X):

2. Preferred pronouns:

- He/him/his
- She/her/hers
- They/them/theirs
- Other: _____
- Prefer not to answer

3. Ethnicity to which you identify:

- Asian
- Black/African
- Hispanic/Latino
- Native American
- Pacific Islander
- White/Caucasian
- Other: _____
- Prefer not to answer

4. Are you the first generation in your family to attend an undergraduate institution?

Yes No not applicable

5. Please feel free to make any further comments and/or suggestions regarding your upcoming research project:

Thanks for your time in filling out this survey.



Exit survey



HL-LHC project: Exit survey

In order to gauge the effectiveness of our HL-LHC educational efforts we would greatly appreciate your time in filling out this short survey. All responses will be kept anonymous.

PART 1: Regarding your completed research experience

1. University or Lab at which you worked:

2. Was this your first LHC research experience?

Yes No

3. Start date (MM/YY): _____ End date (MM/YY): _____

4. What was your *main* reason for participating in this research project? (select one)

- To determine if this is a field I might be interested in pursuing
- To fulfill a research requirement for my degree
- To gain experience in research methods and/or data analysis
- This was my only offer for a research experience
- My other research options appealed to me less
- Other: _____

Please rate the following:

5a. Your preparation/knowledge before starting your project was:

poor excellent

5b. During your project the instruction and mentorship provided was:

poor excellent

5c. During your project you were excited by the work you were doing:

never always

5d. During your project you felt included and respected by your colleagues:

never always

5e. Your excitement regarding particle physics at the Large Hadron Collider is:

low high

5f. If applicable, your desire to pursue a career in physics or a related field is:

low high

Part 1 continued next page...

Please rate the following regarding what you gained from your research experience:

1a. A better understanding of the limitations of research methods:

no gain great gain not applicable

1b. A better understanding of the research and development required for the LHC:

no gain great gain not applicable

1c. Problem solving in general:

no gain great gain not applicable

1d. Comfort in working collaboratively with others:

no gain great gain not applicable

1e. Confidence in my ability to contribute to science:

no gain great gain not applicable

1f. Understanding what everyday research work is like:

no gain great gain not applicable

1g. Anything else you would like to mention that you gained from your project?

2. Please comment on the effect of this research experience on your plans for pursuing a career in physics or a related field:

Regarding physics as your major or intended major:

3a. Are you a physics major, or intend to be a physics major?

Yes No not applicable

3b. Are you a physics minor, or intend to be a physics minor?

Yes No not applicable

Please turn over...

Part 2: Demographic information

1. Current position and institution (e.g. Year 2 undergrad at University of X)

2. Preferred pronouns:

- He/him/his
- She/her/hers
- They/them/theirs
- Other: _____
- Prefer not to answer

3. Ethnicity to which you identify:

- Asian
- Black/African
- Hispanic/Latino
- Native American
- Pacific Islander
- White/Caucasian
- Other: _____
- Prefer not to answer

4. Are you the first generation in your family to attend an undergraduate institution?

Yes No not applicable

Please feel free to make any further comments and/or suggestions regarding your research project:

Thanks for your time in filling out this survey.



Follow-up survey



HL-LHC project: Follow-up survey

In order to gauge the effectiveness of our HL-LHC educational efforts we would greatly appreciate your time in filling out this short survey. All responses will be kept anonymous.

PART 1: Research experience and outcomes

1. University or Lab at which you conducted your research project:

2. Was this your first LHC research experience?

Yes No

3. Project start date (MM/YY): _____ End date (MM/YY): _____

4. Today's date (MM/YY): _____

Please rate the following from your recollection of your research experience:

5a. During your project the instruction and mentorship provided was:

poor excellent

5b. During your project you were excited by the work you were doing:

never always

5c. During your project you felt included and respected by your colleagues:

never always

5d. Your excitement regarding particle physics at the Large Hadron Collider was:

low high

Please rate the following regarding the impact of your research experience:

6a. Do you feel your LHC research experience assisted you in your career path?

Not at all To a large degree

6b. Your excitement regarding particle physics at the Large Hadron Collider is:

low high

Part 1 continued next page...

Please rate the following regarding what you gained from your research experience:

1a. A better understanding of the limitations of research methods:

no gain great gain not applicable

1b. A better understanding of the research and development required for the LHC:

no gain great gain not applicable

1c. Problem solving in general:

no gain great gain not applicable

1d. Comfort in working collaboratively with others:

no gain great gain not applicable

1e. Confidence in my ability to contribute to science:

no gain great gain not applicable

1f. Understanding what everyday research work is like:

no gain great gain not applicable

1g. Anything else you would like to mention that you gained from your project?

Please feel free to make any further comments regarding your LHC research experience:

Please turn over...

Part 2: Demographic Information

1. Position and institution at time of research experience (e.g. Year 2 undergrad at University of X)

2. How would you best characterize your current position:

- Graduate Student in Physics
- Graduate Student in another discipline. Please specify: _____
- Postdoctoral researcher. Please specify area: _____
- Technical position at an academic institution
- Technical position outside of academia
- Nontechnical position outside of academia
- Other: _____
- Prefer not to answer

3. Preferred pronouns:

- He/him/his
- She/her/hers
- They/them/theirs
- Other: _____
- Prefer not to answer

4. Ethnicity to which you identify:

- Asian
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- Other: _____
- Prefer not to answer

5. Are you the first generation in your family to attend an undergraduate institution?

Yes No not applicable

Thanks for your time in filling out this survey.