Bringing the LHC and ATLAS to a regional planetarium

R. Schwienhorst
Department of Physics and Astronomy, Michigan State University, East Lansing, USA

An outreach effort has started at Michigan State University to bring particle physics, the Large Hadron Collider, and the ATLAS experiment to a general audience at the Abrams planetarium on the MSU campus. A team of undergraduate students majoring in physics, communications arts & sciences, and journalism are putting together short clips about ATLAS and the LHC to be shown at the planetarium.

I. INTRODUCTION

The two general-purpose LHC experiments ATLAS [1] and CMS [2] have strong outreach programs that target audiences interested in particle physics and the LHC. An additional outreach tool not yet utilized by the LHC experiments is the planetarium. There are thousands of planetariums world-wide providing education and entertainment to a wide variety of target audiences, from elementary school groups to university classes and general audiences. The Abrams planetarium [3] on the campus of Michigan State University for example serves about 35,000 visitors annually, many of whom have expressed curiosity about how the LHC will address some of the important questions in astronomy and cosmology. An outreach program designed to bring the LHC and in particular the ATLAS experiment to the Abrams planetarium has been started at Michigan State University. The first result of this effort is a short planetarium clip about particle physics, the LHC and ATLAS and how MSU contributes which is shown in the planetarium.

II. ABRAMS PLANETARIUM

The Abrams planetarium is part of the Department of Physics & Astronomy at Michigan State University and serves as an astronomy and space science education resource, providing courses for MSU students, educational shows for area schools, and weekend shows for the general public. About 35,000 people visit the planetarium annually. The planetarium uses the Evans & Sutherland Digistar II projector system [4], consisting of a CRT and a lens to provide full-dome monochrome images. The CRT is controlled by a computer (Sun UNIX workstation) with a graphics processor that renders vector graphics. This computer is also connected to a LCD projector installed in the planetarium. The system is additionally connected to several slide projectors that can project on various areas of the dome, including full-dome images, as well as a video projector and several special-effects projectors. The Digistar II projector at its location in the planetarium as well as its control station are shown in Fig. 1.

![FIG. 1: Digistar II projector inside Abrams planetarium at Michigan State University and its control console.](image-url)
information, and even the Digistar II projector can show particle collisions and accelerator parts or detectors as line-drawings.

FIG. 2: All-sky image of the LHC accelerator and the detector sites, together with the surrounding mountains and countryside. This image is projected onto the planetarium dome, with the bottom of the image appearing in the front.

III. STUDENT INVOLVEMENT

Michigan State University has a graphics information program, a graphic design program, and various courses teaching undergraduate students about state-of-the-art animation, image creation, graphics processing, and audio production. Four undergraduate students from the College of Communication Arts & Sciences are working on creating animations and images about the ATLAS experiment, the LHC, and particle physics. Several of the students and their adviser traveled to CERN in December 2010 to see and experience first-hand what goes on at the LHC. The visit was very useful to the students and facilitated the production of the short planetarium clip. The students brought knowledge and material (images and videos) back with them, both of which are now being used.

At MSU, the animators and graphic designers are working together with an audio production student, two students from the professional writing program, as well as a physics graduate student and a physics undergrad. This team is responsible for creating planetarium show modules, from putting the initial script together to creating the animations and images and assembling the pieces into a coherent self-contained piece. The team works well together despite the very different backgrounds of the individuals involved. This creative experience
benefits all of the students. The main benefit to the physics students is much improved communication skills, while the main benefit for the graphic designers and animators is a better understanding of how science works and how to communicate it.

The students use commercial graphic design and animation software packages on dedicated high-end graphics workstations. The students are well-trained in the required software through their coursework and other projects. This includes 3D modeling and animation software, video editing and production programs, graphic design and image processing packages, and audio production programs.

While working mostly independently, the undergraduate students receive guidance from professors in the Information Graphics and in the Professional Writing programs at MSU. This connection, in addition to the support from Abrams planetarium staff, is useful to ensure that all aspects of the planetarium clip design process are covered and that the final result will be comprehensible to a general planetarium audience.

IV. SHORT CLIP

The creative team at MSU has spent the spring semester 2011 on creating a first five-minute long clip. This clip plays at the end of each public Abrams planetarium show. The current public show is on the topic of dark matter, and the five-minute clip describes how the LHC and ATLAS expect to identify dark matter and how MSU students and researchers contribute to this effort. An example all-sky image from the short clips is shown in Fig. 3.
shown in Fig. 2. All-sky images such as this one are projected onto the dome such that the bottom part of the image appears in the front, the top of the image appears at the back, and the center of the image is directly overhead. This particular image is combined with a Digistar animation of counter-circulating beams inside the LHC tunnel. The Digistar projector also shows stars in the night sky overhead.

Another example all-sky image is shown in Fig. 3. This image of the MSU campus with the planetarium and the physics building makes it easy for visitors to orient themselves and get a sense of where the researchers work.

Several other images and animations have been created in addition to the images shown in Figs. 2 and 3. All content is created locally at MSU by the students. This process not only results in content that the creative team and the audience can identify with, but it also builds a repository of MSU-specific content that can also be used elsewhere. It also gives future students the option and flexibility to build on previous work.

V. FEEDBACK

After each showing of the short clip, the physicist members of the creative team are available to the audience for questions. The feedback on the short clip collected in this way has been overwhelmingly positive and encouraging. Many planetarium visitors are interested in astronomy, astrophysics and cosmology. While they are aware of the existence of the LHC, they lack an understanding of specific questions that the LHC will address and how it will address them. The short clip is well suited to address these questions.

Additionally, feedback from MSU students and alumni on the connection between MSU and the LHC has also been very positive. Several people expressed surprise at how much individual students and researchers from a university like MSU are able to contribute to such a large and complex project.

VI. TOUCH SCREEN

The images and animations produced by the creative team can not only be shown inside the planetarium dome but will also be useful for other outreach projects. For example, a Dynics touch screen has been placed in the planetarium lobby with the intention to display particle physics and ATLAS outreach content. The display contains images, videos and background articles on ATLAS and the LHC. It also shows the live ATLAS event display web page. By converting the images, animations and other content developed for the planetarium into a format suitable for the touch screen we can deepen the viewers experience and reinforce the educational content. Curious visitors get an opportunity to learn more about ATLAS and the LHC and to explore on their own. It is typically the younger audience who members feel more comfortable to approach the touch screen and start exploring it, pushing the various on-screen buttons and interacting with the display. Combining general ATLAS-wide outreach material with MSU-specific content developed for the planetarium show makes the touch screen display an excellent outreach tool.

VII. CONCLUSIONS

A team of undergraduate students at Michigan State University has produced a short clip on particle physics, the LHC and the ATLAS experiment for the Abrams planetarium on the MSU campus. This five-minute clip has been a big success with planetarium audiences. The creative team is now working on a full planetarium show that will premiere as the feature show at the Abrams planetarium in Fall 2011. This show will be about 35 minutes long and cover the connection between the LHC and the ATLAS experiment on one side and cosmology and the big bang on the other, with a special emphasis on MSU’s involvement. It will feature the same mix of all-sky and slide images, animations and digistar programming also present in the short clip. Show modules and clips will also be made available to other planetariums that have a classic setup of slide and video projectors similar to Abrams planetarium.

Acknowledgments

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FIG. 4: Dynics touch screen in the Abrams planetarium lobby.

1. ATLAS experiment outreach web page [http://atlas.ch/](http://atlas.ch/)
2. CMS experiment outreach web page [http://cms.cern.ch/](http://cms.cern.ch/)
3. Talbert and Leota Abrams planetarium at Michigan State University, [http://www.pa.msu.edu/abrams/](http://www.pa.msu.edu/abrams/)
4. Evans & Sutherland Digistar II, [http://www.es.com/products/digital_theater/digistar2.asp](http://www.es.com/products/digital_theater/digistar2.asp)
5. Michigan State University College of Communication Arts & Sciences, [http://cas.msu.edu](http://cas.msu.edu)
6. A streaming video of the short clip showing at the end of each regular planetarium show is available on vimeo at [http://vimeo.com/23508145](http://vimeo.com/23508145)
7. DYNICS (Dynamic Industrial Computer Solutions), [http://www.dynics.com/](http://www.dynics.com/)
8. ATLAS live event displays, [http://atlas-live.cern.ch/](http://atlas-live.cern.ch/)
9. Relics of the Big Bang, Fall 2011 Show at Abrams planetarium, [http://www.pa.msu.edu/abrams/relics/](http://www.pa.msu.edu/abrams/relics/)