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ATLAS Virtual Visits: *Bringing the World into the ATLAS Control Room*

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Abstract. The newfound ability of Social Media to transform public communication back to a conversational nature provides HEP with a powerful tool for Outreach and Communication. By far, the most effective component of nearly any visit or public event is that fact that the students, teachers, media, and members of the public have a chance to meet and converse with real scientists.

While more than 30,000 visitors passed through the ATLAS Visitor Centre in 2011, nearly 7 billion did not have a chance to make the trip. Clearly this is not for lack of interest. Rather, the costs of travel, in terms of time and money, and limited parking, put that number somewhat out of reach. On the other hand, during the LHC "First Physics" event of 2010, more than 2 million visitors joined the experiment control rooms via webcast for the celebration.

This document presents a project developed for the ATLAS Experiment's Outreach and Education program that complements the webcast infrastructure with video conferencing and wireless sound systems, allowing the public to interact with hosts in the control room with minimal disturbance to the shifters. These "Virtual Visits" have included high school classes, LHC Masterclasses, conferences, expositions and other events in Europe, USA, Japan and Australia, to name a few. We discuss the technology used, potential pitfalls (and ways to avoid them), and our plans for the future.

1. Introduction

ATLAS Virtual Visits [1] is a project born of the need to provide tools promoting the interaction of LHC physicists with students, media and the general public. Communication experts agree that the best means of communication is through discussion and interaction between the involved parties. That such interaction can occur on a large scale and from remote locations has been proven in the past few decades with the development and proliferation of collaborative tools, such as video conferencing, as well as the explosion of the popularity of Web 2.0 tools and social media.

The primary aim of ATLAS Live is to integrate these tools in a manner that can support the communication goals of today's LHC experiments: to entice, inform and educated students, educators, decision makers, media and the general public of the goals and accomplishments of the LHC at CERN. This is achieved by employing a combination of web-based video conferencing, webcasting and non-invasive audio-video hardware to effectively bring groups of visitors inside the ATLAS Control Room, allowing them to hold a one-on-one conversation with a host representative of the collaboration. A short visit to the control room is concluded and highlighted by a question and answer session, which typically takes up the majority of the visit, allowing students and the general public to

satisfy their curiosity, and to share their thoughts, ideas and concerns with a researcher from the experiment.

Experience has shown that the vast majority of visitors to laboratories, such as CERN, leave with a greatly increased interest in the field of particle physics and with renewed support for the laboratory and the experiments. This interest can be qualitatively measured by tracking the career choices of young students who have made such visits. One example group, with which the author has personal experience, would be the US NSF-funded REU Summer Student Program [2], which sends 15 students to CERN each summer for eight weeks of research. Over the past decade, the percentage of these students continuing on to graduate studies in physics is around 90%, far above the typical average. Given that impact, it is hard to ignore any program or tool that can make it possible to bring exposure to a much larger audience, even for a limited period, even remotely.

2. How a Virtual Visit Works

The most common example of a Virtual Visit is that of a classroom of students, typically following the completion of an introduction and exercise, such as an LHC Masterclass [3]. The complete procedure from initial contact to publication of the recording is as follows:

- An organizer contacts info@atlas-live.ch to request a visit, negotiate a date/time, and determine guides, often based on relation to visiting institute or language.
- A web interface is designed, including a brief description of the event, photograph of the remote location, and an embedded viewer for watching the webcast.
- The Virtual Visit team requests access to the Control Room.
- A test session is organized by the Virtual Visit technical operator with a technician from the visiting site – this is primarily for testing hardware and connection, but can be used for organizing content presentation.
- On the day of the visit, run coordination, safety, and shifters in the ATLAS control room are automatically informed of the visit and of their right to remain out of camera view, if desired.
- Video conference, webcast and recording are started up to one hour before the visit, for last-minutes tests and preparations.
- An introduction of the visit is often made from the remote end or by sharing a screen from a laptop in the Control Room. This can include a short multimedia or slide presentation.
- The guide in Control Room gives a brief description of the LHC and ATLAS, primarily as a form of orientation, then describes the various shift desks, screens, responsibilities, etc. The camera operator follows the guide on this visit, switching between two camera views.
- A significant portion of the visit is reserved for questions and answers – this is typically about 50% of the visit (and can be more).
- Following the visit, the recording is processed and edited, then uploaded to a permanent archive on the CERN Document Server (CDS) [4], which is then embedded on the visit web interface, replacing the webcast viewer. The visitors are informed when the recording is published.

It is important that the guide keep in mind that interaction with the students is far more valuable than lecture time. The latter can occur in the classroom, anytime. The event, rather, is a unique chance for the students to have a conversation with someone who is involved with current, fundamental research.

There are several variations to the visit, as the video conferencing software allows multiple participants and the automatic sharing of content. One common addition is to add a video conference room located at Point 1, from which additional physicists (often from the same institute) talk about their research and perhaps share some images or video. During long shutdowns, ATLAS Guides could connect via a laptop or tablet, to talk directly from the experiment hall or other interesting locations around the CERN campus.

3. Technology Employed

Figure 1 presents a schematic diagram of the technology employed for Virtual Visits. Much of the equipment was installed in 2008, in preparation for LHC First Beam. A significant number of media were invited to the laboratory to cover the event and it was arranged to provide them with video and audio feeds from the various detector control rooms. Two HD cameras, with a remote control and video mixer were integrated with internal and remote microphones and an audio mixer through the Sony Anycast video production system.

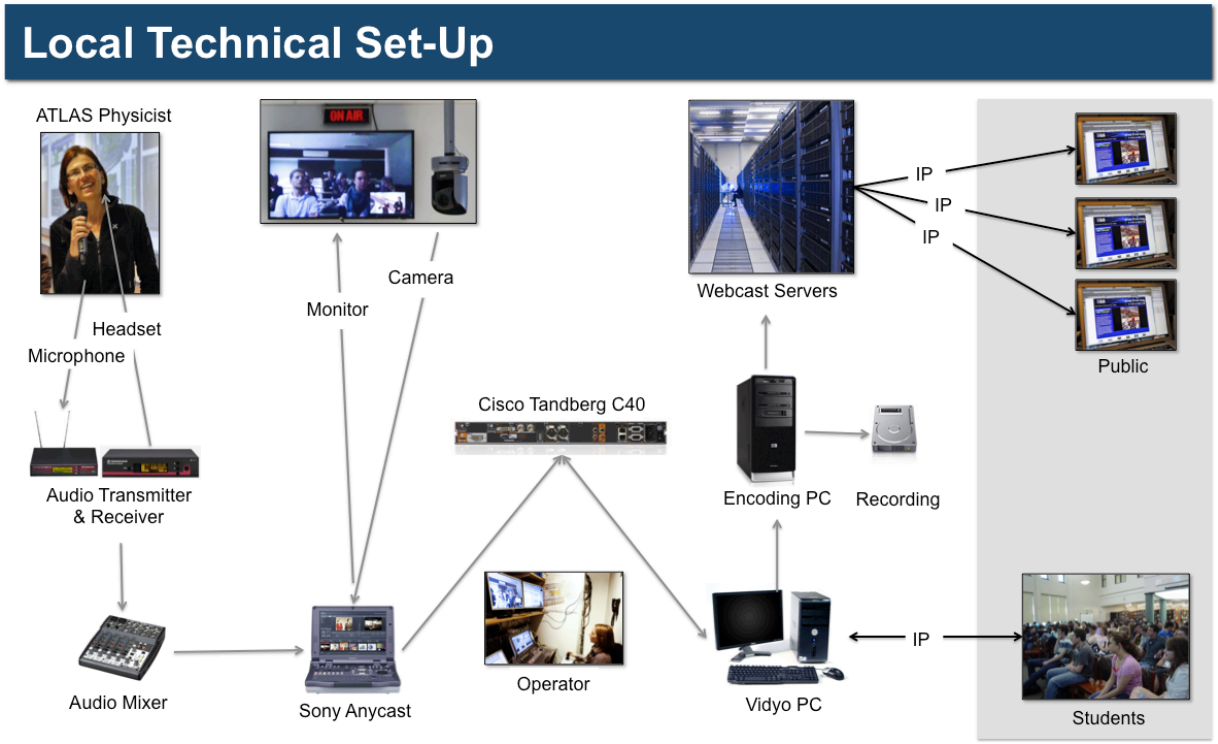

Figure 1. Schematic diagram of technology employed for a Virtual Visit located in the ATLAS Control Room.

The Anycast system provides the operator with controls for switching between and mixing various audio and video feeds, including cameras, microphones, video players and computers, allowing a great deal of flexibility. For a Virtual Visit, the audio and video outputs are sent directly to a Tandberg video conferencing system. It is also used to steer input from the Tandberg unit to a monitor in the control room, used by the guide.

In order to include webcast and recording capability, audio and video from the conference are sent to a local PC, which acts as a 3rd-party spy, running and watching the conference. Audio and Video from that PC are sent to an encoding PC, which sends a signal to the CERN webcast servers and to a recording program.

Active participants join the event either through a PC running the IP-based video conferencing software or via an H.323 device connected by the operator to the conference. Since late 2011, Vidyo [5] IP-based software has been used for nearly all of the Virtual Visits. No license is required by the remote participants, provided the conference is launched by ATLAS and, for most platforms, it is trivial to install and run. EVO [6] offers a similar flexibility and quality and has been used for earlier visits.

Passive participants view the event through the embedded webcast player on the Virtual Visit event web page. Audio and video are encoded on a local PC and sent to the CERN Webcast server. Streams optimized for high resolution or for small personal devices, such as mobile phones, can be viewed in the page or at full screen size. The embedded webcast player is replaced by an embedded recording shortly after the event and additional material from or about the event can be added to the page, as a permanent record. An example [7] can be seen for a Virtual Visit from a high school in Greece.

4. Recent Visits

Virtual Visits in 2011 and 2012 are listed on the web portal [1] under *Past Visits*. As submission date, this has already included a very broad geographical spread from Australia to the Pacific West Coast of the USA, from South Africa to Scandinavia. A partial list of Virtual Visitors include:

- Kobe University, Japan
- University of Birmingham, UK
- World Science Fair, NY USA
- University of Melbourne, Australia
- SciTech 2011, London UK
- Kurukshetra, Anna University, Chennai, India
- Parkside Middle School, Jackson MI, USA
- Al-Quds University, Abu Dis, Palestine
- High Schools of Pelopio and Lala, Greece
- Birzeit University, West Bank, Palestine
- Festival of Science, Main Square, Cracow, Poland
- William Floyd High School, Long Island NY, USA

Figure 2. Clockwise from top-left: Visit from Birzeit University, Palestine; Visit from World Science Fair, New York City; CERN Director General attending Festival of Science in Cracow, Poland; ATLAS members from Cracow hosting Virtual Visit in ATLAS Control Room.

No specific strategy has been devised to recruit visits, as the current number of requests is already reaching the limits of the existing human resources. However, an emphasis has been placed on giving priority to visits from locations that would be challenged to organize physical visits to CERN. This includes institutes with limited resources and those located far from Geneva. Events involving ATLAS institutes or associated to events organized by those institutes are also given a high priority, as are events that promise to reach wide audiences, such as science fairs or museum shows.

Figure 3. Virtual Visit webcast and recording interface.

Whenever possible, new hosts (called Virtual Guides) are recruited from within the collaboration, in order to increase the diversity of the presentations and to handle the cultural and lingual variations of the audiences. This has the dual aspect of increasing participation of the collaboration in the core activities of the Education and Outreach programme.

5. Conclusions and Future Plans

The ATLAS Virtual Visit project presents an effective integration of existing communication tools to create a new platform to reach the public. Although no new technology has been involved in the project, its methods capitalize on the usage of interactive communication to reach large audiences and to create new opportunities to reach our Education and Outreach goals. Positive comments from visits and ever-increasing demand indicate that the tool is both effective and popular.

Potential limits to the growth of the project include:

1. Limited human resources for operation;
2. Limited time slots in the ATLAS Control Room;
3. Inadequate equipment or resources at the remote location;

Given our goal of reaching 7 billion visitors, these limitations will need to be addressed. The first point requires resources and training. Currently, the operator is in charge of the camera, audio/video equipment, web interface development, and organisational aspects of the project. These tasks could be divided, if necessary, but the skill set can be obtained primarily through on-the-job training.

The second point is important, as the safety and efficiency of operations in the ATLAS Control Room take the highest priority. Usage of a variety of different locations, including visits to the experiment's cavern, the LHC control room, or other interesting locations at CERN, can help to both diversify the visit experience and lighten the load in the Control Room.

Point 3 is one of the more difficult of the problems to solve. Several early visits nearly had to be aborted, due to sound problems, such as echo. It is impossible to give an effective presentation and discussion when hearing one's voice echoed back after a short delay. In addition, remote locations often underestimate the effect of crowds on the background noise level and outside exhibition events can result in visits during which the participants cannot follow discussion, due to lack of amplification. Finally, classrooms often have old equipment, including computers that might not be able to handle the load of recent audio and video codecs. One early visit was only rescued because a student happened to have his own more powerful laptop on hand.

To address Point 3, we have defined a set of equipment for the remote location that is minimal for an effective visit. For schools and other potential visitors without access to that equipment, we suggest the creation of a program that could subsidize the donation or lending of Virtual Visit kits to schools or school districts in need. Our next steps will include an effort to identify resources to support a wide-scale, Virtual Visit campaign, targeting locations that could most benefit from exposure to the excitement of the LHC physics program, but that currently cannot afford to make the virtual trip.

Figure 4. So long and thank you for taking this virtual trip (visitors from Cracow, Poland)!

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References

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[2] University of Michigan Research Experience for Undergraduates Summer Student Program at CERN, funded by the US National Science Foundation http://www.um-cern-reu.org/index.php.
[3] International Masterclasses challenge high school students with the analysis of real LHC collision data http://cern.ch/kjende/en/index.htm.
[4] The CERN Document Server provides access to both public and CERN protected documents and multi-media content http://cds.cern.ch.
[5] Information on Vidyo IP-based video conferencing software is found at http://www.vidyo.com.
[6] Information on EVO IP-based video conferencing software is found at http://evo.caltech.edu.
[7] Recording of Virtual Visit from Pelopio and Lala high schools in Greece: http://cern.ch/atlas-live-virtual-visit/2012/Lala-2012.html.