Proposal for a CERN Virtual Visit Service

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12 Mar 2015

CERN-OPEN-2016-007
12/03/2015

Abstract

This note proposes the development of a CERN-wide Virtual Visit Service. Such a service would build upon the experience of the LHC Experiments, CERN DG EDU and DG COM, and the expertise of CERN IT CIS, to develop a world-leading communication and educational programme designed to serve the entire community in an effective and economical manner. Administration and Operation of the service would be modelled on the highly successful CERN Visits and Collaboration Services, and would extend the reach of Education, Outreach, and Communication to audiences around the globe, many of who might not have the opportunity to visit the laboratory in person.

1 Introduction

This past year, CERN, its member states, and its user community celebrated an historical landmark: 60 Years of Science for Peace [1]. The key theme emphasised throughout the celebration was that of collaboration among international scientists in the pursuit of fundamental research for peaceful purposes. CERN, founded in the wake of a horrible world war, has become a key centre of human cooperation, and now serves as a shining example to the world of what can be achieved by uniting people from around the globe to pursue endeavours of a common and fundamentally important objective: science.

Those of us involved in Outreach and Education, at CERN and our home institutes, spend significant time and effort communicating this very message, and it is always well-received by our diverse worldwide audiences. Even before recent successful efforts by the CERN Council and the Directorate to open CERN research to a sphere that extends beyond Europe, the community had developed international programmes designed to reach audiences – in particular, students – located around the globe. A typical example would be the International Masterclasses [2], developed by the International Particle Physics Outreach Group (IPPOG) [3], bringing LHC physics to classrooms everywhere.

This document proposes the development of a communication infrastructure at CERN designed to improve our ability to reach these worldwide audiences in an effective and more cost-efficient manner. It calls upon the experience we have gained in the development of global communication tools, and our expertise in addressing audiences from Kathmandu to Rio de Janeiro, Ghana, and the South Pole. The proposed service will facilitate current programmes and platforms developed by the major experiments, CERN DG EDU, DG COM, and supported by IT, by introducing a common infrastructure and a dedicated service.

2 Historical Perspective

CERN and the LHC Experiments have an important history in the usage of web-based video tools for global communication both internally to the collaborations and externally to worldwide public audiences. Important contributions to IP-based videoconferencing technology by the LHC community [4][5] helped CERN to be early adopters, thus serving the needs of the growing worldwide collaborations of the LHC [6]. In addition, the Education and Communication groups took advantage of the technology to serve growing public interest, through videoconferences to schools and remote events, as well as webcasts and video recordings that served larger audiences [7]. Periodic communications, such as the "Live from CERN" webcasts produced in 2000 and 2001 [8], pioneered usage of the medium to reach large global audiences for science education. Webcast and recording from the 4 July 2012 announcement of the Higgs boson discovery reached one billion people, according to media estimates [9].

Figure 1. Virtual Visit from Science Festival participants in New York City to the ATLAS Experiment at CERN.

Most recently, the LHC experiments have launched initiatives serving their Outreach and Education programmes, allowing them to extend and enhance their reach to remote audiences around the globe. The ATLAS Experiment launched a programme called ATLAS Virtual Visits [10][11] in 2010, combining equipment left over from the webcast of LHC First Physics with a standard videoconferencing unit, and a local encoding and recording server. This system allowed physicists in the ATLAS Control Room (and other remote locations, such as the cavern) to talk one-on-one with remote audiences. The videoconferences were publicly webcast and recorded, quickly becoming a popular success. ATLAS Virtual Visits won a Digital Communication Award in 2012 [12], was nominated for a European Excellence Award [13] in 2013, and to date has hosted visits from thousands of people covering all seven continents.

The CMS Experiment made important headway in communications in 2011 by implementing a Google Hangout [14] from the CMS cavern. Much like Virtual Visits, Hangouts provide direct video connections for discussion and also provide one-directional video and recordings embedded in the experiment's YouTube

site. Advantages include the usage of chat for discussion among those watching the video feed or recording. This successful pilot was followed up during the Outreach parallel session of ICHEP 2012 to a Google Hangout featuring experts from ATLAS, CMS and other experiments, explaining the Higgs discovery to a very large worldwide audience [15].

Given the success of the earlier programmes, the Outreach teams of ATLAS and CMS joined forces with CERN Communication to develop Hangout with CERN [16], a weekly online talk show giving the public a chance to discuss topical events and to visit CERN sites with physicists from the experiments and theorists specialising in the topics. In addition, CMS has developed an extensive Virtual Visit programme, similar to that of ATLAS, but with a greater emphasis on providing exclusive access to experimental locations not accessible to the general public [17][18]. The LHCb and ALICE experiments offer more modest and less frequent programmes of Virtual Visits, with the efforts only limited by infrastructure and resources.

Figure 2. Hangout with CERN episode featuring the CAST Experiment.

Simultaneous to the activities of the experiments, CERN DG EDU has continued to host videoconferences with classrooms and other public audiences in remote locations, often profiting from the facilities installed at the experiment sites. CERN IT COM has developed a high quality audio and video studio, used primarily for recording, but also with the capability of supporting videoconferencing and live streaming. Finally, CERN IT has continued to improve and expand its capability for IP-based videoconferencing, webcast streaming, and recording. Partnerships between all of these groups and the experiments have resulted in a rich and growing outreach and communication programme, capable of reaching large global audiences, but which could profit from streamlining and cross-departmental organisation.

3 What We Have Learned

The usage of video tools to connect to the public, especially students, with researchers at CERN is both popular and effective. Direct interaction between scientists and audience has always been the preferred means for communication, as it profits from the enthusiasm of personal conversation, and allows the scientists to respond accurately to the concerns and questions of the visitors. From our experience, student interest, in particular, is stimulated when the researcher is located in a place of action, such as a control room or underground next to a detector. The exact location is not too important. What counts is that the audience is being taken on a short "virtual journey" to a location where exciting things are happening. This spurs interest and sparks conversation.

Equally important has been the effect of the programmes on the recruitment of participants from within the collaborations and the laboratory. It is always a challenge to find active researchers willing to take time to describe their work to the public. Although scientists are trained to communicate progress to their colleagues through detailed publications, journal articles, conference presentations and papers, many find it difficult and perhaps extraneous to make the effort to distil the results into a form that is interesting and understandable to a general audience. Yet, communication benefits greatly when a variety of scientists, with differing perspectives, expertise, personalities, cultural and linguistic backgrounds, are engaged in the conversation. In addition, the communicators themselves benefit from their participation by developing a broader understanding of the scientific topics, when challenged by their peers and by public audiences to develop the "big picture" that incorporates their very specific contributions.

By reducing the burden on the scientists to that of simple conversation, the live video-based format, has attracted a significant number of new communicators. The Hangout with CERN programme brought together theorists and experimentalists from all over CERN to discuss a variety of physics topics with the public. The conversation was interesting, lively and stimulating to both the audience and the participants. It sparked in-depth conversation and developed relationships between scientists who might not have otherwise interacted in such a manner. The virtual visit programmes also engage a broader group of

scientists than those who typically volunteer for outreach activities, often due to requests from audiences located near their home institute or speaking their native language. In all cases, the scientists learn quickly how to engage an inquisitive public and profit from the narratives and explanations delivered by their peers.

Most importantly, these programmes have succeeded in making CERN accessible to a much larger audience, including many people who, for geographical, political, social, or economical reasons, would not normally have had the opportunity to make the trip to CERN. And they have done so in an effective manner that does not tax the already over-burdened Visits Service.

4 Existing Infrastructure and Services

Dedicated hardware configurations have been set up for the ATLAS and CMS locations, to better support Virtual Visits. The ATLAS system, for example, features remote wireless headsets and microphones integrated through an audio mixer to the videoconference and webcast encoding PCs. A pair of HD cameras, used to provide views from inside the ATLAS control room and visitor centre, are integrated via a video mixer, and the whole system is controlled through a Crestron® interface. On the simpler end of the technology spectrum, Hangouts and Virtual Visits can, and often are, executed using laptops with built-in microphones and cameras, although quality cannot always be assured in this manner.

The software applications employed for Virtual Visits, Hangouts, and other video-based external communication efforts, are primarily the same as those already installed for internal communication at CERN. They include Vidyo® [19] for videoconferencing and recording, Wowza™ [20] for webcast and recording, Indico [21] for the management of reservations and videoconference links, and CDS [22] for the video archives. Other IP-based systems, such as Google+ Hangouts [23] and Skype™ [24] are used with existing hardware systems or with laptops and other personal devices.

Administrative services required for the Virtual Visit programmes include: initial contact with clients, reservation of time slots, coordination of operators and guides, preparation of the webcast and recording interface, public advertisement of selected visits, testing of remote equipment, operation of the visit, editing and publishing of the recording, and subsequent advertisement, as requested. In addition, there is the recruitment and training of operators and guides from within the collaboration.

Public communication initiatives, such as the Hangout with CERN Programme, require significant effort for the planning and development of an interesting and informative programme of content. In addition, there is the organisation of personnel, including hosts, experts and guests, technical production, online direction, and social media advertisement. To be effective, they also require follow up tracking of target audiences and analysis of feedback for tuning content and otherwise improving the programme.

5 Issues to Resolve

Growing interest in the Virtual Visit programmes of ATLAS and CMS has brought increased demand on the number and frequency of visits to the two experiments. Unfortunately, while there is enthusiasm on both sides to increase the scope of their programmes, scaling can be a challenge, due to the burden of administration and operations. In addition, although other experiments at CERN have expressed interest in hosting visits, and there is interest on the part of the public to visit other sites at CERN, smaller collaborations do not have the resources required to support such programmes. In general, there is an abundance of enthusiasm to scale in both frequency and variety, and enough potential guides to do so easily, but the start-up threshold prevents this from happening.

The TOTEM experiment, for example, has been ramping up its participation in LHC outreach activities by joining forces with IPPOG to offer dedicated Masterclasses. The experiment would like to support and augment this effort through a Virtual Visit programme, which would allow TOTEM researchers to interact directly with students and educators, and to profit from participation of collaboration members at their home institutions. Lack of a suitable infrastructure at the experiment site and limited resources for maintenance and operation, if the infrastructure were to exist, hinder the development of the programme. The ALICE and LHCb experiments face similar issues. They do offer limited Virtual Visit programmes, but these are often coupled with events held by ATLAS or CMS, and are restricted in scope and functionality.

The Hangout with CERN programme (or any similar communication initiative) faces the challenge of reaching the level of quality expected from a world-renowned laboratory. The advantage of the most recent programme is that it is an initiative coming from the experiments and supported by the CERN DG COM team in a very positive and well-coordinated manner. As such, there has been no problem in the identification of high-quality content and enthusiastic participation by researchers from around the lab. By sticking to topical content, sharing personal experiences, and highlighting CERN's high-tech facilities, the team has found a recipe that resonates well with the public. Significant problems, however, lie with the burden of administration and with the limited equipment and technical capabilities of the production team.

The above issues threaten to stymie the development of important educational and communication programmes, each of which has already demonstrated a growing potential to bring CERN's message of peaceful scientific achievement to the world.

6 Proposal

6.1 Introduction

We propose the creation of a CERN-wide Virtual Visit Service. The goal of the service would be to develop, maintain, and operate the hardware infrastructure, software tools, and administrative activities required by the Virtual Visit programmes of the experiments. In addition, the service would serve major communication events (first collisions, high-energy records, etc.) and regular communication programmes, such as Hangout with CERN. We envision implementation of this programme based on a partnership between CERN IT CIS, CERN DG EDU, CERN DG COM, and the experiments, designed to support the worldwide education and communication goals of the physics community at CERN.

It is important to emphasize the nature of the partnership being proposed. The CERN Visits Service has already set precedent working closely with the experiments to provide a quality visit experience. Experiments help to develop and maintain visitor centres, provide guides, and handle reservations in coordination with CERN DG EDU. Similarly, the current videoconferencing programme is a good example of successful partnership between the experiments and CERN IT CIS. Experiments provide resources for facilities, as well as lines of communication [25] to aid in the development and maintenance of new and existing systems. This proposed service would build on the success of these existing partnerships and would integrate well with the existing programmes.

6.2 Infrastructure

The hardware and software infrastructure required for Virtual Visits is already well understood and tested. The new installation in the ATLAS Visitor Centre, for example, is based on the existing CERN videoconferencing and webcast facilities, and already much of the system can be operated remotely, in a similar manner. Simple modifications to the system will make it possible to serve other communication software, such as Google Hangouts and Skype, thus allowing it to serve the education and communication needs described above. As such, this system can act as a model for the development of other local installations at CERN, including experiments and control centres.

Enhancing the remote operation capabilities of the video systems will help to alleviate a significant burden from the experiments. Currently, volunteers from the experiments handle operations of the local video system, contacting the IT experts only when there are specific issues. These individuals are not experts in the field and often only perform the tasks intermittently, leading to undue errors and inefficiency. Moving operations to a central service will improve the effectiveness of the programme, much as it already has for the existing videoconference and webcast infrastructure.

6.3 Administration

Many of the administrative aspects of the Virtual Visit programmes could also be handled more effectively through centralisation. In particular, we propose the development of a common reservation system similar to, and perhaps integrated with, the existing CERN Visits Service reservation system. An integrated interface hosted on the CERN web site would present potential visitors with the option of in-person visits or virtual

visits, and a choice of a wide variety of possible locations. It would also enhance the visibility of the Virtual Visit programmes, while balancing the load to the experiments in a fair and effective manner and potentially easing the demand for in-person visits.

Guides with relevant expertise would be trained and made available to serve at the various Virtual Visit locations in a manner similar to the current arrangement between the experiments and the CERN Visits Service. In most cases, these guides are already available and the training required would be minimal, as the technical aspects of the service would move primarily to central operators. As with current practice, researchers from the experiments and other Virtual Visit locations would retain the privilege of scheduling their own visits by coordinating local scheduling with the Virtual Visit Service.

6.4 Operations

Most of the technical operations required by Virtual Visits can be effectively centralised, as they involve activities similar to those already provided by CERN CIS for standard collaboration facilities: booking, running, and recording of videoconferences, webcast encoding and serving, testing and debugging of remote facilities, etc. Other activities, such as the editing, archiving and publishing of recordings can be handled by a central service or locally, depending on the level of service desired for the event.

There will still be a need for some local technical capabilities, due to specialisation of the various sites, but this is similar to the existing situation for the videoconferencing facilities, and can be controlled by the local organisation. Centralizing the common activities, however, is essential to improve efficiency and to ensure the quality of the programme, thus conveying a professional image to the worldwide audience. It will also reduce technical expertise requirements to the experiments and lower the barrier for entry into the programme.

Communication activities for major events and regular programmes would continue to be served by CERN DG COM and CERN IT CIS, in cooperation with the experiments, but would benefit from the improved infrastructure and central operations. In both cases, hosts could be located in an equipped, central home base, such as the AV Studio, with additional participants located at one or more of the other Virtual Visit centres, and/or remote locations. By putting operations for these events in the hands of the technical experts, participants from the experiments and from CERN DG COM or CERN DG EDU can focus on the delivery of quality content.

6.5 Research & Development

CERN’s reputation for world-leading research and development has always extended beyond the immediate needs of its physics programme. Researchers at the lab have made game-changing contributions to the fields of communication and education, exemplified by the development of the worldwide web, and continuing today, in the form of CERN-led projects and partnerships with its many participating institutions. One of the advantages of this proposal is the rich environment that would be provided by the cross-departmental programme for hosting further research and profiting from the ingenuity of its diverse participants.

One can envision projects yielding significant improvement in the integration and usage of the various communication and education tools through the development of the online Virtual Visit interface. As an example, components could be developed to allow communication and media sharing between the client audiences. Problems to solve include accommodation of heterogeneous platforms and operating systems, social media integration, instant language translation, and simplified access to CERN’s already rich educational media archive. Such an environment could allow science teachers from around the world to share lesson plans and content, while students share their experiences and newfound enthusiasm for science and the world of particle physics, all thanks to their common CERN experience. Such development would be a natural continuation of CERN’s most famous contribution to international communication, and would effectively support its current goals and strategy [26].

6.6 Resources

A significant amount of the resources required to install and run the new service are already being provided by the collaborations. This comes in the form of human resources offered by researchers and line items in

the outreach budgets of the larger experiments. These contributions are often matched with support from their CERN partners in IT CIS, DG COM, and DG EDU via existing agreements and good will. Some of these resources can be freed up simply through the consolidation of operations and reduction of redundancy in the organisation.

Additional resources, however, will be required from CERN IT CIS for the installation, maintenance and operation of new facilities, from CERN DG EDU for integration (or co-organisation) of the Virtual Visits Service with the existing Visits Service, and from both CERN DG EDU and DG COM for the development of the content and planning for regular programmes. As usual, such Research and Development would be funded by the interested parties, external partners, and other funding providers, as appropriate.

6.7 Strategy

The current scheduling strategies for Virtual Visits have been developed independently by the experiments, and in a relatively ad-hoc manner. Virtual Visits are commonly used to support other outreach programmes, such as LHC Masterclasses, or public events, such as European Researcher Night or CERN's 60th Anniversary celebration. In some cases, collaboration members request visits, in support of outreach activities in their home institutes or countries and, on (more and more frequent) occasion, the experiments are contacted via their public web interfaces by previously unknown teachers or students. In many cases, the Virtual Visits are simply replacements for physical visits, allowing researchers to talk to audiences without one or the other having to schedule expensive or inconvenient travel. But, for the most part, there is no unique overall strategy concerning the scheduling of visits to specific countries or target audiences for well-defined goals.

Lack of a unique strategy, other than outreach support, is not worrisome; the success of the projects, as measured in audience reach and reaction, has been clear and measurable. However, the organisers agree that more can be done to reach the full potential of the programme. Toward this direction, recent discussions have been held under the umbrella of IPPOG to seek common strategy for the scheduling of outreach activities, such as Masterclasses and Virtual Visits. Recently, Rüdiger Voss, CERN's Head of International Relations, addressed the group, and possible common approaches, aligning the goals of these programmes with CERN's strategy for broadening international scope, were identified. Certainly, a key component of any CERN-wide service would be the development of policy supporting such a strategy to the benefit of all participants.

7 Conclusion

CERN and the LHC Experiments have partnered to develop a virtual communication and education programme over that past several years that has matured and grown in popularity. The various activities have been successful in reaching large worldwide audiences and in recruiting researchers to contribute to their outreach programmes. Yet, organisational limitations and a relatively high resource threshold prevent the programme from expanding its scope to include all interested parties at CERN, reaching out to a broader range of potential audiences and, in general, growing to its full potential. We believe these issues can be addressed by the creation of a CERN-wide Virtual Visit Service that includes participation by the experiments in partnership with CERN IT CIS, CERN DG EDU and CERN DG COM. This programme would not only facilitate development in a more efficient and economical manner, but could serve as a key component of CERN's long-term international strategy.

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Appendix I – Infrastructure, Operation, and Maintenance Costs

The cost of equipping a site at CERN to handle Virtual Visits, Virtual Visits with Webcasting (for external viewers), and Virtual Visits with Webcasting and Fibre Connection (for major events) is included in the table below. For each category, a minimal set of options is provided alongside a more complete set of options. The more complete configuration is what has been installed and tested at LHC Point 1 for ATLAS Virtual Visits and events.

ITEM	QTY	UNIT PRICE EUROS	TOTAL PRICE EUROS	FUNCTION	Minimal Option Virtual Visit	Full Option Virtual Visit	Minimal Option Virtual Visit + Webcast	Full Option Virtual Visit + Webcast	Minimal Option Virtual Visit + Webcast + Fibre	Full Option Virtual Visit + Webcast + Fibre
CAMERA HE120	2	6 500	13000	Visual signal	NOT REQUIRED	REQUIRED	NOT REQUIRED	REQUIRED	NOT REQUIRED	REQUIRED
CAMERA HE60	1	3 000	3000	Visual signal	REQUIRED	NOT REQUIRED	REQUIRED	NOT REQUIRED	REQUIRED	NOT REQUIRED
REMOTE CAMERA	1	1 850	1850	Camera control	NOT REQUIRED	REQUIRED	NOT REQUIRED	REQUIRED	NOT REQUIRED	REQUIRED
VIDEO MIXER (up to 3 cameras)	1	1 500	1500	Clean camera switching	NOT REQUIRED	REQUIRED	NOT REQUIRED	REQUIRED	NOT REQUIRED	REQUIRED
HDMI MATRIX 8x8	1	3 100	3100	Routing of video sources	NOT REQUIRED	REQUIRED	NOT REQUIRED	REQUIRED	REQUIRED	REQUIRED
HDMI MATRIX 4x4	1	2 050	2050	Routing of video sources	NOT REQUIRED	NOT REQUIRED	REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED
COMPUTER	1	600	600	Softwares Management	REQUIRED	REQUIRED	REQUIRED	REQUIRED	REQUIRED	REQUIRED
HDMI INPUT CARD	1	500	500	Video Acquisition	REQUIRED	REQUIRED	REQUIRED	REQUIRED	REQUIRED	REQUIRED
VIDEO MONITORING 24''	3	170	510	Technical Monitoring	REQUIRED	REQUIRED	REQUIRED	REQUIRED	REQUIRED	REQUIRED
VIDEO MONITORING 24''	1	170	170	Technical Monitoring	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED
MONITOR 55" and Wall Mount	1	1 800	1800	Speaker Monitoring	NOT REQUIRED	REQUIRED	NOT REQUIRED	REQUIRED	NOT REQUIRED	REQUIRED
MONITOR 42 " and Wall Mount	1	1 000	1000	Speaker Monitoring	REQUIRED	NOT REQUIRED	REQUIRED	NOT REQUIRED	REQUIRED	NOT REQUIRED
VIDEOCONFERENCE CODEC	1	8 000	8000	Videoconference	NOT REQUIRED	REQUIRED	NOT REQUIRED	REQUIRED	NOT REQUIRED	REQUIRED
PACK HF MICROPHONE (*Madonna)*	1	1 000	1000	Audio signal	NOT REQUIRED	REQUIRED	NOT REQUIRED	REQUIRED	NOT REQUIRED	REQUIRED
PACK HF MICROPHONE (*Hand)*	1	900	900	Audio signal	REQUIRED	REQUIRED	REQUIRED	REQUIRED	REQUIRED	REQUIRED
PACK IN EAR MONITOR	2	900	1800	Audio signal	NOT REQUIRED	REQUIRED	NOT REQUIRED	REQUIRED	NOT REQUIRED	REQUIRED
MONITORING AUDIO	1	120	120	Technical Monitoring	NOT REQUIRED	REQUIRED	NOT REQUIRED	REQUIRED	NOT REQUIRED	REQUIRED
MONITORING AUDIO	1	120	120	Speaker Monitoring	REQUIRED	REQUIRED	REQUIRED	REQUIRED	REQUIRED	REQUIRED
AUDIO MIXER (12 in, 8 out)	1	1 200	1200	Audio Mixing	NOT REQUIRED	REQUIRED	NOT REQUIRED	REQUIRED	NOT REQUIRED	REQUIRED
AUDIO MIXER (6 in, 4 out)	1	740	740	Audio Mixing	REQUIRED	NOT REQUIRED	REQUIRED	NOT REQUIRED	REQUIRED	NOT REQUIRED
AUTOMATION WITH WIRELESS TOUCH SCREEN PANEL	1	5 000	5000	System Operation	NOT REQUIRED	REQUIRED	NOT REQUIRED	REQUIRED	NOT REQUIRED	REQUIRED
AUDIO SYMETRISER	2	300	600	Infrastructure	REQUIRED	REQUIRED	REQUIRED	REQUIRED	REQUIRED	REQUIRED
ETHERNET SWITCH	1	60	60	Infrastructure	REQUIRED	REQUIRED	REQUIRED	REQUIRED	REQUIRED	REQUIRED
CABLE PACKAGE	1	600	600	Infrastructure	NOT REQUIRED	REQUIRED	NOT REQUIRED	REQUIRED	NOT REQUIRED	REQUIRED
CABLE PACKAGE	1	300	300	Infrastructure	REQUIRED	REQUIRED	REQUIRED	REQUIRED	REQUIRED	REQUIRED
TECHNICAL RACK	1	600	600	Infrastructure	REQUIRED	REQUIRED	REQUIRED	REQUIRED	REQUIRED	REQUIRED
ON AIR SIGN	1	300	300	Infrastructure	REQUIRED	REQUIRED	REQUIRED	REQUIRED	REQUIRED	REQUIRED
VIDEO SCALING	2	750	1500	Infrastructure	NOT REQUIRED	NOT REQUIRED	REQUIRED	REQUIRED	REQUIRED	REQUIRED
DUPLEX FIBRE CONNEXION	1	5 000	5000	Infrastructure	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	REQUIRED	REQUIRED
WEBCAST	1	1 600	1600	Webcast	NOT REQUIRED	NOT REQUIRED	REQUIRED	REQUIRED	REQUIRED	REQUIRED
				TOTALS	**9230**	**43460**	**14380**	**46560**	**20430**	**51560**

Figure 3. Estimated cost of equipping one CERN site to support Virtual Visits with Webcasting options.

Human resources required to operate and maintain the infrastructure, support visit administration, and coordinate the programme are estimated to be 2.0 FTE. This includes one technical person hired full-time to work within the IT CIS group for installation, maintenance and operation of the infrastructure; one half-time administrative person working within the DG EDU group to handle booking and distribution of the visits; and one half-time person coordinating the planning, development, and coordination of the overall programme. The coordinator could be attached to DG EDU, DG COM or PH, and is most likely a senior researcher capable of overseeing the development of content, determining prioritisation, and acting as liaison to the experiments.