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## Cascade Outreach Competitions for schools - an efficient way to introduce Particle Physics to many students

Peter Watkins , Lynne Long

*School of Physics and Astronomy  
University of Birmingham  
Birmingham  
B15 2TT  
United Kingdom*

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### Abstract

The Particle Physics group at the University of Birmingham has tried many different formats for Outreach competitions over recent years. We have found that a Cascade competition is a very efficient way to introduce Particle Physics concepts and experiments to a wide range of students. Small groups of students research, prepare and deliver a short presentation to other students. We will describe variations on the format of this type of competition and include some examples from our winning entries. All the material that we have used for these competitions is freely available on the web which we hope will make it easier for more groups to try similar competitions in the future.

The name Cascade emphasises that the competition aims to introduce and inform many students about Particle Physics. However relatively limited time is required from researchers and teachers to enable this. The students research the material themselves and give their presentations, which often include novel demonstrations well matched to the target age group, to younger students or students of their own age. The participants also gain valuable experience in teamwork from the challenge of producing and delivering a clear and interesting talk by all members of the team, as well as improving their own understanding of the subject during the process.

### *Keywords:*

Particle Physics Cascade Outreach Competition Birmingham

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### 1. Introduction

There are many different ways to get schoolchildren interested in science. In this talk we present a new outreach competition that we developed, tested and refined in the Particle Physics group in the School of Physics and Astronomy at the University of Birmingham UK over many years. We wanted to include the excitement and challenge of working in a team and so we asked small groups of students (16-17 years of age) to prepare and deliver a short presentation or video on a Particle Physics topic. We invited the most successful teams to a Finals day at the University where we chose the prize-winning teams. With this type of Cascade com-

petition we found that we were able to introduce many school children to new exciting science topics in a form that was appealing and accessible without requiring too much investment of time from teachers or researchers. The teams of presenters were inspiring many other students in their own school through their presentations. All the information that we used to run the competitions is freely available on the web and we are very keen to encourage and help other groups try their own version of this competition. Outreach colleagues in Slovakia have already been successfully running annual competitions for several years and we would like to help other countries try a Cascade competition in a form that works best for them.

## 2. Early ideas

In our first Cascade competition in 2006 we targeted schools in the Midlands region, relatively close to the University, so that we could visit and judge the entry from each school during their live presentation. We learned a lot about how to optimise the competition and the web resources that were needed. For example we decided to include the option of presentations to audiences of much younger children or children of the same age as the team. Our hope was that we would find that our young presenters would come up with novel ways of demonstrating or explaining some of the topics and this indeed worked very well in many cases. We tried to ensure that each team member made a significant contribution to the presentation and in the judging tried to balance the contributions of originality, presentational skill and knowledge of the topic. The very impressive winning team from this first competition, shown in Figure 1, were awarded support to help the team and their teacher visit CERN. They later produced an excellent short video about their CERN visit and we invited them to present this at the launch of our next Cascade competition.

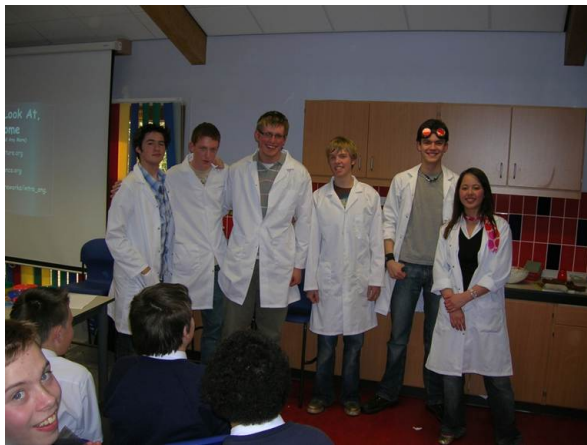


Figure 1: Winning team from our first Cascade competition

## 3. Cascade Live

We were keen to launch a national Cascade competition and so we needed some small adjustments to make this practical and more efficient. We decided to judge the entries on a video of the school presentation and the digital file that had been produced by the students rather than visiting each school. This meant we could have a small panel of judges to select the finalists and prize-winners with a mix of skills and backgrounds. The

panel usually included a few researchers, a teacher, a PhD student and someone without any specialist knowledge of Particle Physics. We typically invited 5-6 teams to the live final at the University where we made our final decisions on prize winners. Some pictures from Cascade Live finals events at the University of Birmingham are shown in Figure 2 and Figure 3.



Figure 2: Cascade Live final presentation at the University of Birmingham



Figure 3: Another Cascade Live final presentation at the University of Birmingham

As the teams often travelled a long distance to attend and had already attained a high standard to be invited to the final, we usually awarded a mixture of minor and major prizes to all our finalists. The map of the UK shown in Figure 4 illustrates that our Cascade competition reached schools in many parts of the UK. Around 150 students gave talks to over 1500 children in just one year of the competition.

We found that the majority of the teams produced



Figure 4: Map showing locations of schools entering Cascade competition

their presentations in their own time and proactively set up their team and then informed their teacher. In a few cases, teachers encouraged several teams from their class to enter and then allocated time in their science lessons to do some of the work. In most cases students learned many useful skills from entering the competition. These included team working experience, presentational skills, working to deadlines as well as increased understanding of new science topics. They also communicated their interest and knowledge of the subject to other children through their presentations in an accessible and interesting way.

All of the material required to launch a Cascade competition is available at [1]. We are pleased to answer any questions about these resources and provide additional advice where necessary. The resources include advertising material and web pages, suggestions of topics for the talks, breakdown of the percentage of marks awarded for different aspects of the performance and examples of some prizewinning performances.

#### 4. Cascade in Slovakia

The International Particle Physics Outreach Group (IPPOG) [2] is a very useful forum for sharing and discussing new outreach ideas that have been developed in various countries. We presented our experience in the UK with Cascade competitions at an IPPOG meeting in 2008 and Ivan Melo decided to try a similar approach in Slovakia starting an annual competition. He was looking for a way that students could follow up on the one day International Masterclass experience if they wanted to find out more about Particle Physics. The number of teams submitting entries has increased steadily each

year in Slovakia where they appoint a mentor to each team from the Particle Physics community in contrast to the email/web based support that we provided to teams in the UK. Some pictures from the Grand finals held in Kosice in 2011 are shown in Figure 5.



Figure 5: Pictures from Finals of Cascade competition in Slovakia

Many more details about these events is available at [3]. Ivan Melo comments that the format works very well as most students love to work in teams and present things. There were no shortage of mentors with students, postdocs and distinguished scientists volunteering to help. The best presentations had solid scientific content, fresh and entertaining presentation which is a treat to watch.

#### 5. Cascade Video

The Cascade Live competitions work very well for students who are interested in Particle Physics and also confident about making presentations. Whilst we were experimenting with different competitions we tried to find an alternative format that would also interest students who enjoyed working in a team but were less confident about contributing to a 20 minute presentation. We decided to ask small teams of students to produce a 4 minute video on a Particle Physics related topic aimed at children of a similar age. There are many similarities between this Cascade Video and the Cascade Live competition and the resources that we used to run this type of competition can be found in [4].

Figure 6 shows the home web page we produced for one of our later competitions where we included pictures from some of the prize-winning entries from earlier competitions.

We have experience from running a number of Cascade Video competitions. In these events we still invite



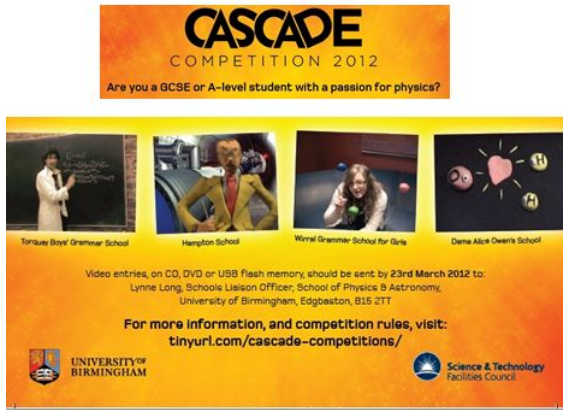


Figure 6: Prize winning entries on Cascade Video competition web site

the prize-winning teams to the University to meet members of the Particle Physics group but use a different format for the day instead of a live final. We have been very impressed by the quality and the variety of presentational ideas used in these short videos. Figure 7 shows members of the prize-winning teams from one of our Cascade Video competitions.



Figure 7: Picture of finalists in Cascade Video competition

Pictures from two of the prize-winning entries are shown in Figure 8 to illustrate the variety of styles submitted in this video competition.

## 6. Conclusions

We have described outreach competition formats that we have found work well for students and referenced many of the resources that we have used to make it easier for others to experiment with them. These competi-

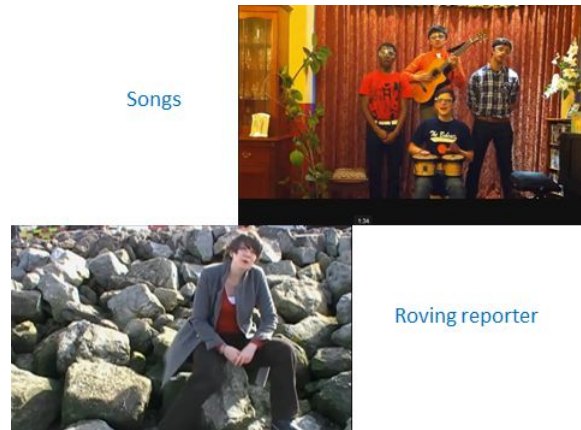


Figure 8: Pictures from two prize winning entries in Cascade Video competition

tions provide the opportunity for many students to enjoy learning about Particle Physics without requiring their teachers or researchers to invest too much of their time.

## 7. Acknowledgements

We would like to acknowledge the support of many colleagues in the School of Physics and Astronomy at the University of Birmingham who have helped us in the running of these competitions. We would also like to thank Ivan Melo for his valuable input and feedback. Finally we thank the Science and Technology Facilities Council for supporting these events and the prizes through a number of Outreach awards.

## References

- [1] [http://www.hep.ph.bham.ac.uk/cascade/index.php?p=\\_Downloads](http://www.hep.ph.bham.ac.uk/cascade/index.php?p=_Downloads).
- [2] <http://ippog.web.cern.ch/>.
- [3] <http://ippog.web.cern.ch/resources/2011/cascade-projects-slovakia>.
- [4] <http://www.ep.ph.bham.ac.uk/general/outreach/VideoAnimationCompetition/Welcome.html>.