



## PPOG International Masterclasses 2017

# The Video Conference

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22nd February 2017

# Moderators

- You are going to be the face of CERN to hundreds of students around the world!
- In pairs you will hold a video conference via Vidyo to a group of institutes who have all done the same masterclass exercise during their day.
- The video conference (VC) allows the students to come together to combine and discuss their results under your guidance in a light hearted and fun way.



# Aims of the Video Conference

- Convey the internationality of the event.
- Demonstrate how physicists work together internationally.
- Encourage students to exchange experiences between masterclasses.
- Demonstrate improvement in accuracy by combination of different data sets.
- Be a FUN end to a long day!

4-6 institutes  
participating in  
each session



# Things it should *not* do...

- Deepen the understanding of the physics.
- Teach English to the students.
- Contain a basic discussion of the measurement.
- Create a competition between the institutes.



# General Information

- Moderators Manual – has all the information you need for the VC!
  - [https://twiki.cern.ch/twiki/pub/Main/InternationalMasterclassesModeratorManual/manual\\_moderators\\_2016\\_02\\_03.pdf](https://twiki.cern.ch/twiki/pub/Main/InternationalMasterclassesModeratorManual/manual_moderators_2016_02_03.pdf)
- TWiki has quick links and information.
  - <https://twiki.cern.ch/twiki/bin/view/Main/InternationalMasterclassesModeratorManual>
  - Bookmarked on the ‘favourites’ bar of Internet Explorer in the VC rooms.

## Preparation for the video conference

Arrive 30 minutes before the start of your video conference and prepare/upload all the material, including:

- [masterclass map](#)
- [table/website](#) for combination of results
- [animated quiz](#)
- **NEW** for ATLAS Zpath - a great animation for the evolution of the [Higgs->gammagamma signal](#) and for the [Higgs->ZZ](#). These demonstrations can help with explaining to students who claim they have discovered the Higgs, that they probably will need more statistics.

Make sure you have downloaded what you need onto the desktop (quiz and map), you are able to access the tables and results, you know how to share these on vidyo, especially the animated quiz!

- Use Vidyo to setup the video conference.
  - Step by step instructions are in the Twiki.
  - Make sure you know how to use the shared desktop.
  - Mute any noisy participants if necessary!

New for 2017

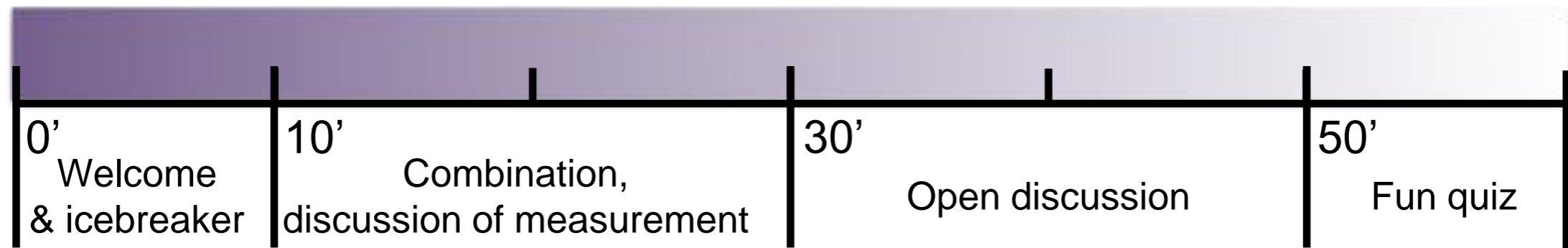


**PAY  
ATTENTION**

# New for 2017

- **NO MORE STUDENT REPORTS ON THEIR MEASUREMENT!**
  - Moderators bring up the results and combination and instead ask a question to each group about their result.
  - Ideas for questions can be found in the section “Combination and discussion of measurements” on the TWiki.
  - [https://twiki.cern.ch/twiki/bin/view/Main/InternationalMasterclassesModeratorManual#Combination\\_and\\_discussion\\_of\\_me](https://twiki.cern.ch/twiki/bin/view/Main/InternationalMasterclassesModeratorManual#Combination_and_discussion_of_me)
- **UPDATED QUIZ**
  - Same format as in previous years, but with several new questions.
  - New graphics.
  - Fewer clicks to advance through the questions.

# Video Conference Timeline



- One hour video conference (16h – 17h sharp) with 2-5 institutes.
- Arrive at the correct room at 15:30 to get everything setup and prepared.
- Three locations for the VC (check in advance which location you should be at!):

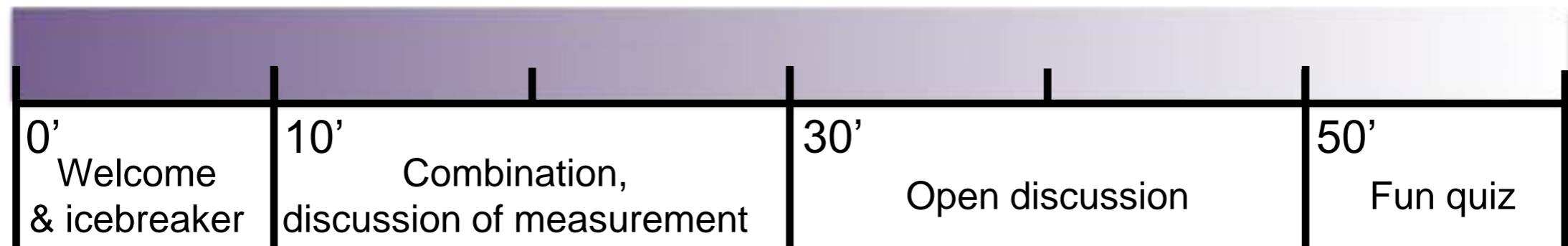
**VC1** - 33-R-016  
- Key will be left in an envelope addressed to “Masterclass” in the mailbox opposite the door – please replace it afterwards!!

**VC2** - 31-S-027 (for March 2, 6, 7, 9, 13, 14, 16, 20, 23, 27, 29, 30, April 1, 3, 5, 6, 11).  
- 600-R-002 (for March 3, 4, 8, 10, 17, 24, 31, April 7).  
- Both rooms have an electronic lock.  
- You need your CERN access card to open and close the lock.

- Details available on the [TWiki](#) and in the [Manual](#)



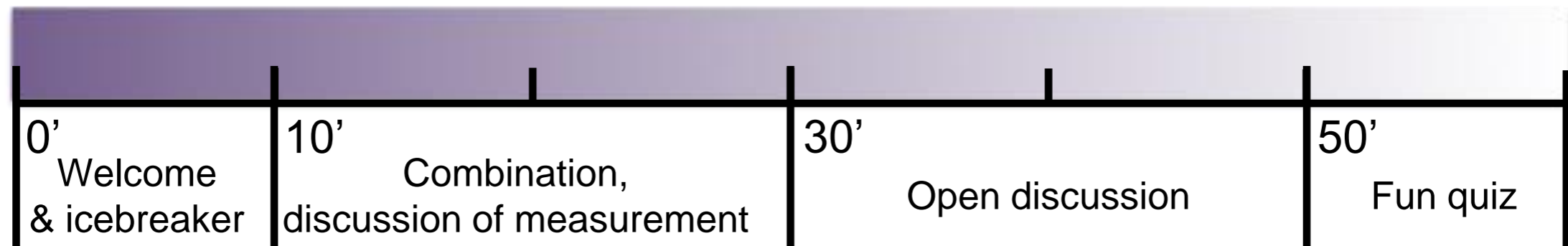
# Welcome & Icebreaker



**The welcome has to be on schedule, clear and interactive!**

- Students should immediately feel that this is a two-way conversation and they should actively take part in the VC.
- Introduce yourself, say a little about your research and explain where you are.
  - “Hello! My name’s Katharine and I work on the ATLAS detector. My research focuses on searching for new particles that can decay to two Higgs bosons.”
  - “Right now we are sitting at CERN. CERN is the largest centre for particle physics research in the world and *the* place to be for a particle physicist”
- Go through the VC timeline and explain what will be happening in the next hour.

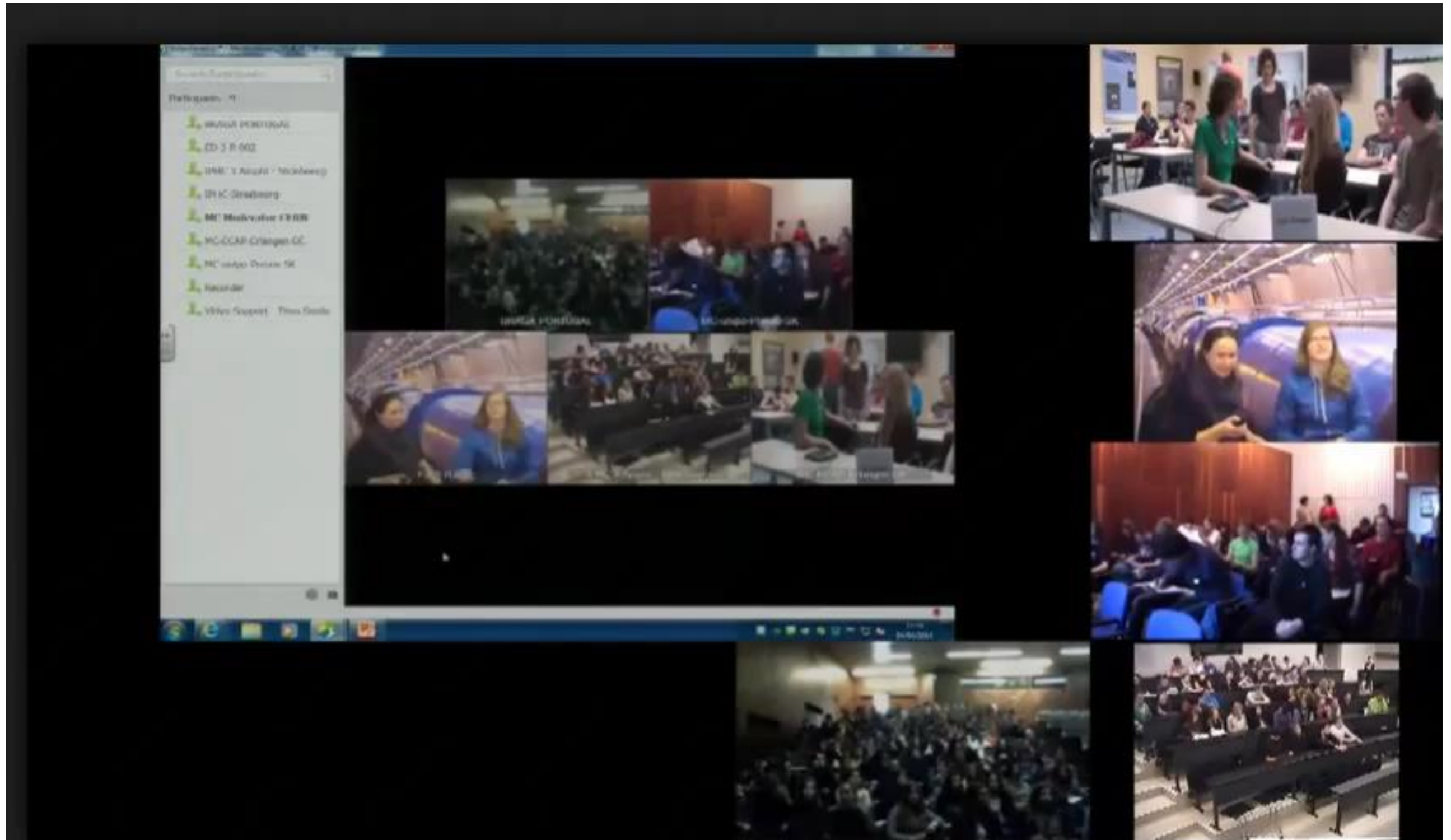
# Welcome & Icebreaker



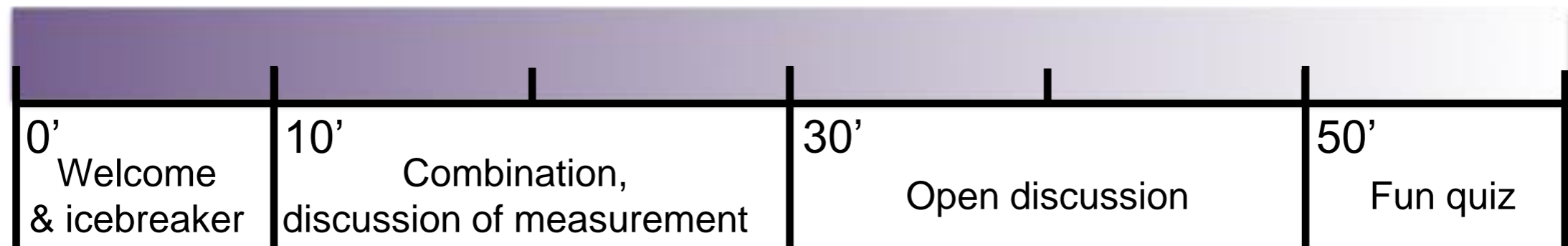
- Share a map showing all the connected sites.
  - Use to explain to the institutes in which order they will be addressed (e.g. north to south).
- Ask one short, friendly question to each institute (sometimes suggested by the local organisers).
  - “Barcelona, how did you find the exercises today?”
  - “Vienna, have you seen the VERA accelerator?”
  - More ideas for questions [here](#) (and linked from the [TWiki](#)).



# Welcome & Icebreaker



# Discussion of Measurements & Combination



## **NEW FOR 2017!**

No more student presentations of their measurements!

Instead, ask each group **ONE** question about their measurement.

# Discussion of Measurements & Combination

0'	10'	30'	50'
Welcome & icebreaker	Combination, discussion of measurement	Open discussion	Fun quiz

- Ask each group questions about their measurement.
- Questions have been pre-agreed by the authors of each measurement.
- Examples include:
  - Have you discovered the  $Z'$  boson? If you think so, what is the  $Z'$  boson's mass?
  - Is there anything interesting in the 120-130 GeV range? What is it?
- See the TWiki for list of questions for each measurement.
  - <https://twiki.cern.ch/twiki/bin/view/Main/InternationalMasterclassesModeratorManual#C>



# Discussion of Measurements & Combination

### Analysis

Total $n$	$W \rightarrow \mu\mu + \nu\nu$				Background	WW
	$e^+e^-$	$e^+e^+$	$\mu^+\mu^-$	$\mu^+\mu^+$		
Hruga	89	51	60	38	740	41
Erlangen	58	56	75	55	525	34
Presov	109	97	109	89	531	79
Strasbourg2	31	22	25	27	306	24
<b>Total</b>	<b>287</b>	<b>256</b>	<b>269</b>	<b>209</b>	<b>2102</b>	<b>178</b>
$\Sigma W^+ / \Sigma W^-$	$ W^+ $	356	$ W^- $	435	$ W^+  +  W^- $	991
Ratio	$ W^+ / W^- $		1.28	+		0.08

Comparison with results of the ATLAS collaboration (Hiro 2011):  
*Measurement of the  $W \rightarrow \mu\mu$  and  $Z \rightarrow \mu\mu$  production cross sections in proton-proton collisions at  $\sqrt{s} = 7$  TeV with the ATLAS detector and search for the Standard Model Higgs boson in the  $H \rightarrow WW(\mu\mu) \rightarrow 4\mu$  decay*

Cot

Aims/Tasks

Identifying pa





Identifying  $\mu\nu$

Measurement

Analysis

Free students

Supporting

# Discussion of Measurements & Combination

0'	10'	30'	50'
Welcome & icebreaker	Combination, discussion of measurement	Open discussion	Fun quiz

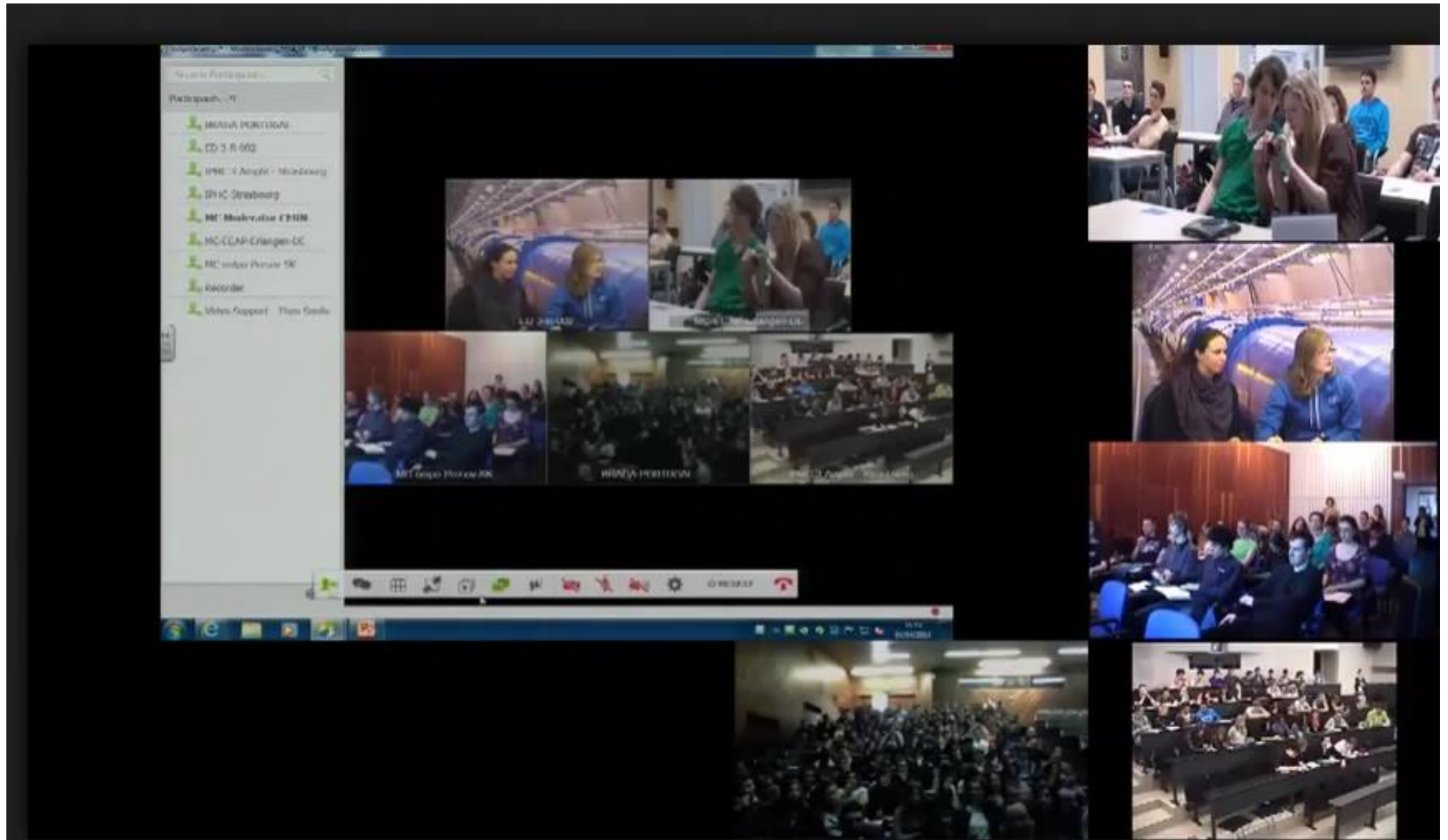
- Combine the results in the table.
- Summarise and comment on the combination.
  - Note that all groups in the VC have done the same measurement, but using different datasets.
- Compare to the theory/experimental results.
- Stress why using different data from different sources is beneficial (stats and reduces bias).
- Questions from students about the measurements.

	3	4	5	6	Sum	
place 3	0	0	0	0	0	0
place 4	0	0	0	0	0	0
place 5	12	21	33	4	53	24
place 6	0	0	0	0	0	0
Sum	58.0	58.0	71.0	30.0	113.0	27.0
W+ & W-	number of W+		number of W-		88.0	
W+/W-	1.47		=		0.20	

\*) Authors: The ATLAS Collaboration (Submitted on 5 Dec 2011): <http://arxiv.org/abs/1109.3341.pdf>  
 \*\*) Authors: The ATLAS Collaboration (24 Aug 2011): ATLAS-CONF-2011-134

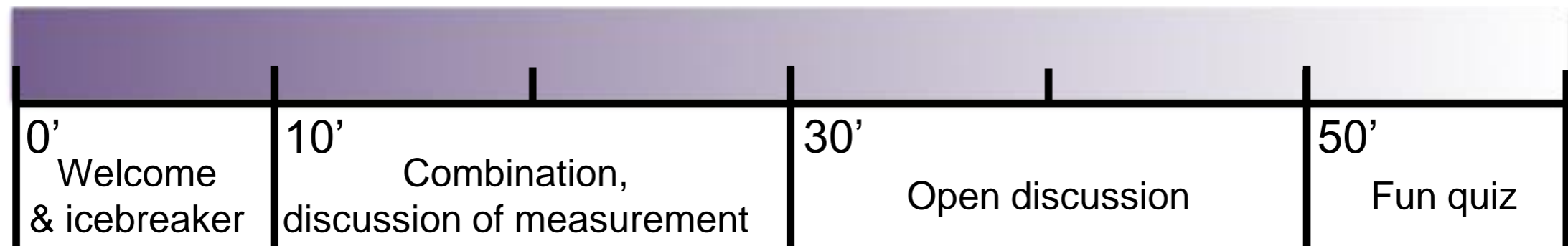
	W + ... + ν				Background	WW+γγ cont.
	positron	electron	antimuon	muon		
Total	77885	52856	84514	55254.0	21930.0	400
Total W+&W-	number of W+		number of W-			
W+/W-	1.50		=		0.01	

# Discussion of Measurements & Combination





# Open Discussion

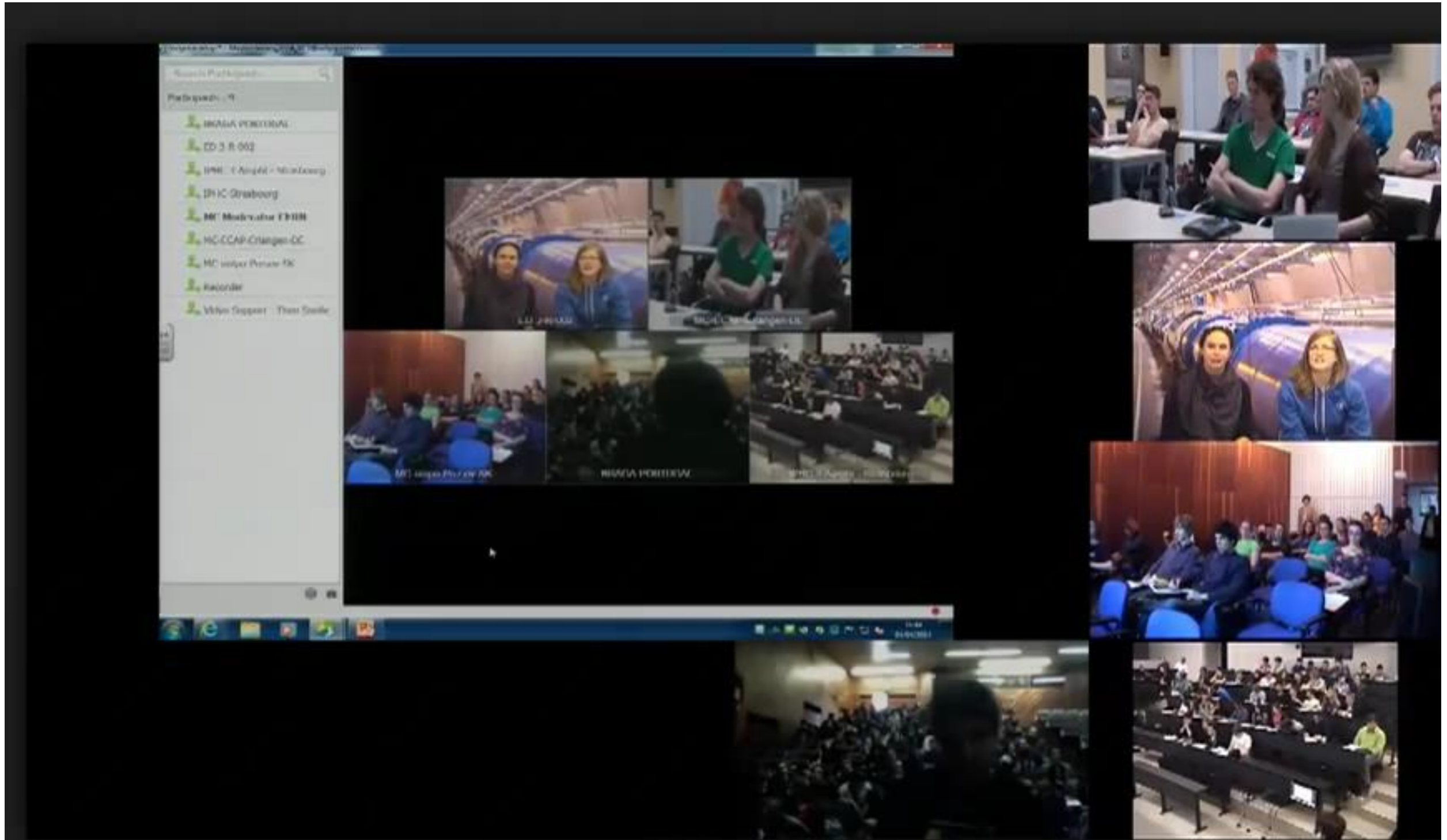


- Discussion can expand to more open and general questions. They can be on anything from...
  - Life at CERN.
  - LHC, size, magnets, cost, power consumption.
  - Detectors & experiments.
  - The Universe, the Big Bang, dark matter, black holes, time travel...
  - How to become a particle physicist.
  - Are we really sitting in the LHC tunnel?



**Give concise, interesting answers!**

# Open Discussion



# Quiz

0'	10'	30'	50'
Welcome & icebreaker	Combination, discussion of measurement	Open discussion	Fun quiz

**“Who Wants To Be A Millionaire” style quiz.**

**Re-designed for 2017!**

- Moderators show English version on shared desktop.
- Local-language version may be shown locally in parallel.
- Seven multiple-choice questions.
- Correct answer revealed after each question.
- Each student plays alone and does their own scoring.
- No comparisons, no prizes.

Quiz Answersheet

1	A. <input type="radio"/>	B. <input type="radio"/>	<p>Your score</p> <p>Tick off one energy step for each correctly answered question, starting at the bottom</p> <p><input type="radio"/> 7 TeV Full beam energy of the LHC</p> <p><input type="radio"/> 172.9 GeV Mass of the top quark</p> <p><input type="radio"/> 91.2 GeV Mass of the Z boson</p> <p><input type="radio"/> 938.3 MeV Mass of the proton</p> <p><input type="radio"/> 105.7 MeV Mass of the muon</p> <p><input type="radio"/> 2.5 MeV Mass of the up quark</p> <p><input type="radio"/> 0.511 MeV Mass of the electron</p>
	C. <input type="radio"/>	D. <input type="radio"/>	
2	A. <input type="radio"/>	B. <input type="radio"/>	
	C. <input type="radio"/>	D. <input type="radio"/>	
3	A. <input type="radio"/>	B. <input type="radio"/>	
	C. <input type="radio"/>	D. <input type="radio"/>	
4	A. <input type="radio"/>	B. <input type="radio"/>	
	C. <input type="radio"/>	D. <input type="radio"/>	
5	A. <input type="radio"/>	B. <input type="radio"/>	
	C. <input type="radio"/>	D. <input type="radio"/>	
6	A. <input type="radio"/>	B. <input type="radio"/>	
	C. <input type="radio"/>	D. <input type="radio"/>	
7	A. <input type="radio"/>	B. <input type="radio"/>	
	C. <input type="radio"/>	D. <input type="radio"/>	

# Rules of the Game

7 questions, each with 4 answers to choose from (A, B, C, D).

Mark your answer on your answer sheet before the timer ends.

We will then reveal the correct answer.

If you have answered correctly you may tick off the next energy level.

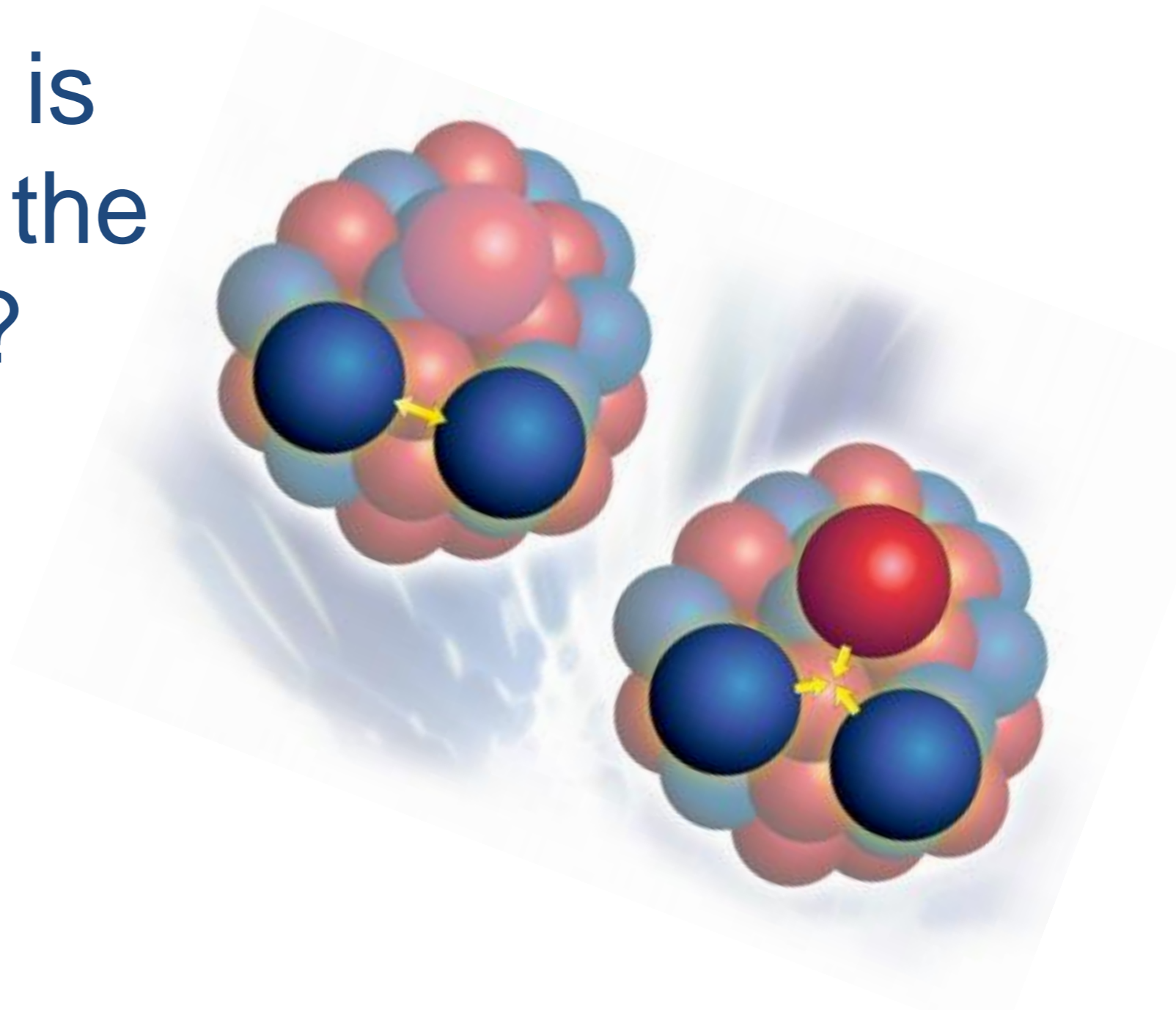
Quiz Answersheet

Question	Options	Energy Level	Description
1	A. <input checked="" type="radio"/> B. <input type="radio"/> C. <input type="radio"/> D. <input type="radio"/>	7 TeV	Full beam energy of the LHC
2	A. <input type="radio"/> B. <input type="radio"/> C. <input type="radio"/> D. <input type="radio"/>	172.9 GeV	Mass of the top quark
3	A. <input type="radio"/> B. <input type="radio"/> C. <input type="radio"/> D. <input type="radio"/>	91.2 GeV	Mass of the Z boson
4	A. <input type="radio"/> B. <input type="radio"/> C. <input type="radio"/> D. <input type="radio"/>	938.3 MeV	Mass of the proton
5	A. <input type="radio"/> B. <input type="radio"/> C. <input type="radio"/> D. <input type="radio"/>	105.7 MeV	Mass of the muon
6	A. <input type="radio"/> B. <input type="radio"/> C. <input type="radio"/> D. <input type="radio"/>	2.5 MeV	Mass of the up quark
7	A. <input type="radio"/> B. <input type="radio"/> C. <input type="radio"/> D. <input type="radio"/>	0.511 MeV	Mass of the electron

Let's see which energy level you can reach!

Resoody?

Which particle is the mediator of the strong force?



1

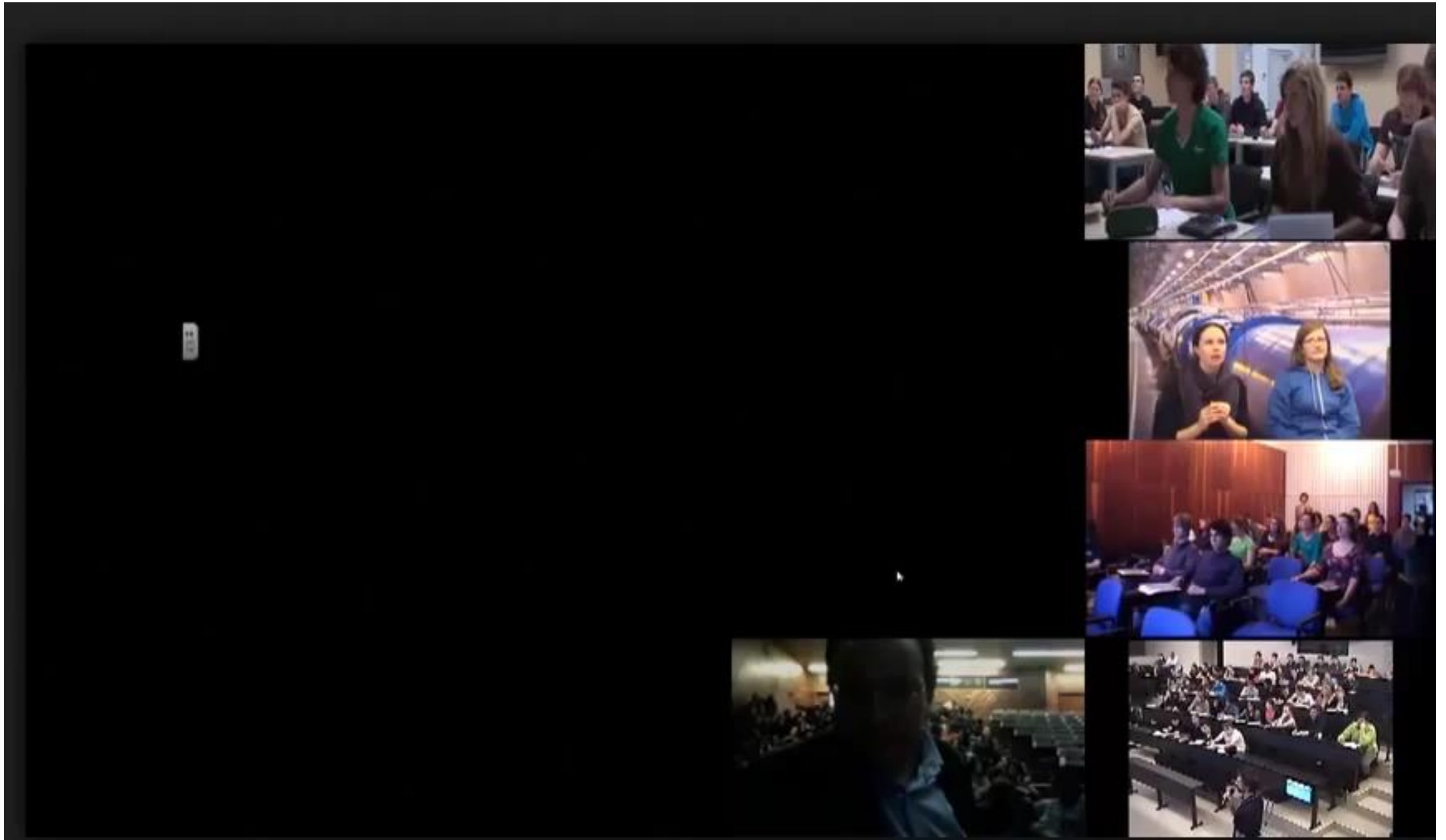
A. Neutralino

B. Z boson

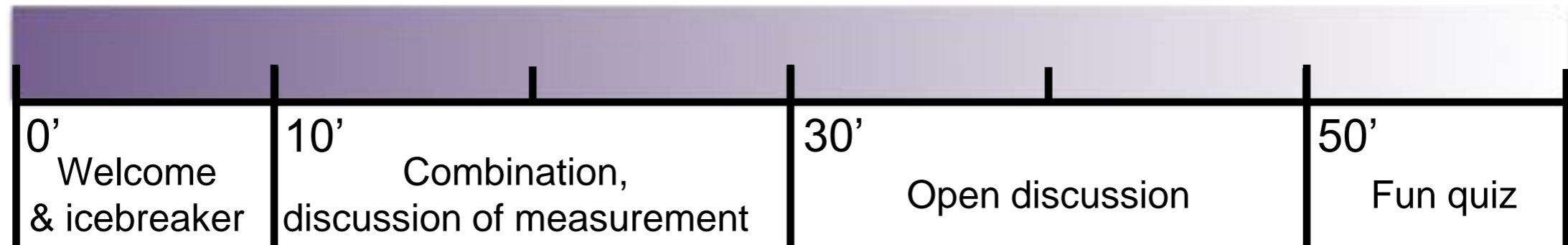
C. Gluon

D. Quark

# Quiz



# Goodbye



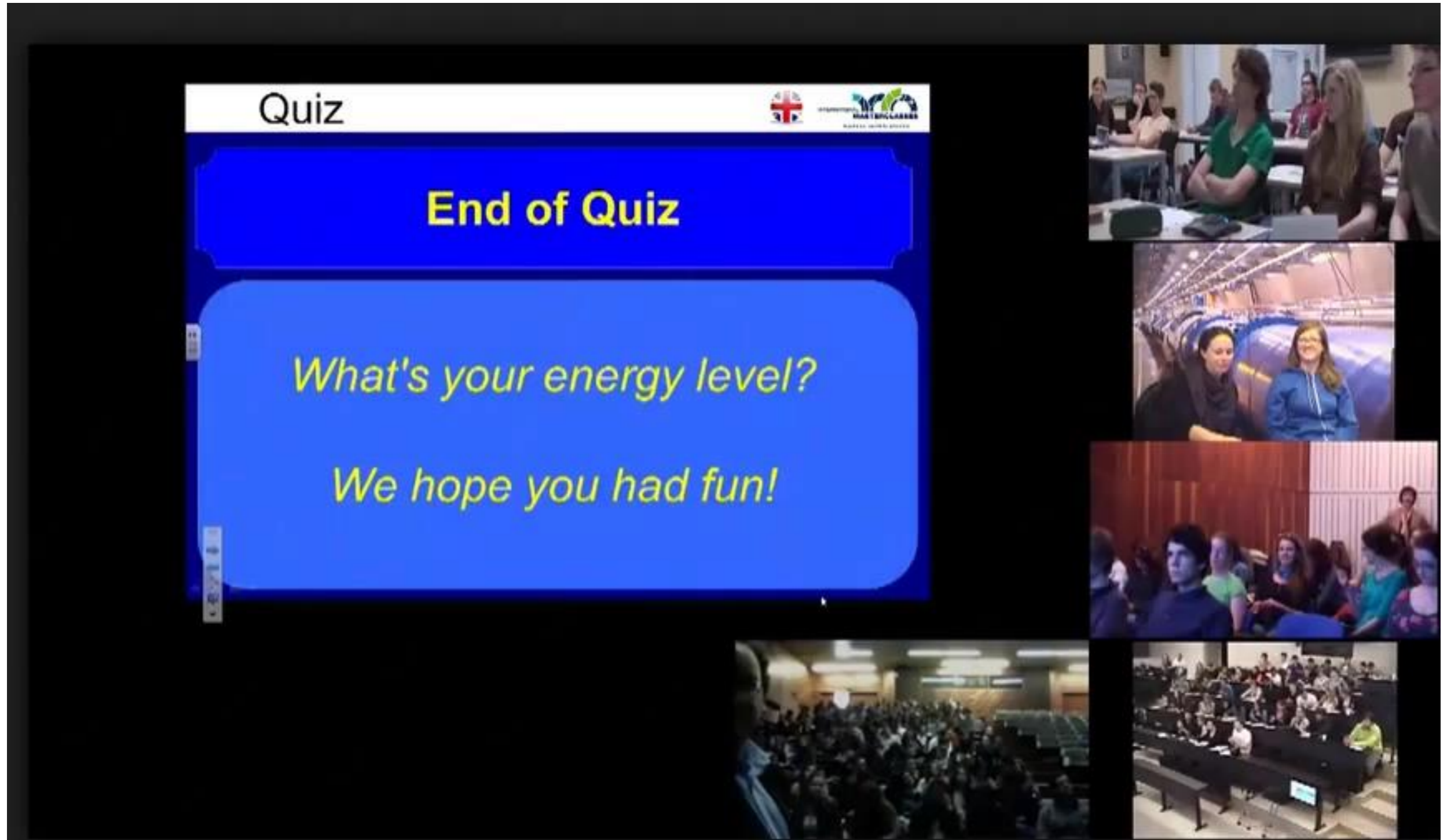
**There must be a clear and common end to the VC after one hour.**

- Say goodbye to everyone and thank them for taking part.
- Do not keep discussion going even if the students are still asking questions.
  - If they and you want some discussion can continue after the goodbye on a voluntary basis.





# Goodbye



# Summary

- Arrive 30 minutes before the start of the VC.
- Set up the Vidyo conference following the step by step instructions on the TWiki (instructions also in the manual).
- The quiz should already be downloaded on the desktop of the PC (if not it can be downloaded from the TWiki).
  - Check that you can open the quiz as a slide show and share it.
- Download the map - this must be done each time.
- Have the link to the tables for the combination already open.
- Follow the suggested timeline where possible, but use some common sense too.
  - e.g. if there are few institutes joining and the students don't have lots of questions then you may finish a bit early - that's fine!

- All the info you need is on the TWiki and in the manual
  - <https://twiki.cern.ch/twiki/bin/view/Main/InternationalMasterclassesModeratorManual>
  - [https://twiki.cern.ch/twiki/pub/Main/InternationalMasterclassesModeratorManual/manual\\_moderators\\_2016\\_02\\_03.pdf](https://twiki.cern.ch/twiki/pub/Main/InternationalMasterclassesModeratorManual/manual_moderators_2016_02_03.pdf)

# Social Media

- Feel free to post on the [facebook page!](#)

- Interesting questions you were asked.
- Anything unusual or interesting with the combination.
- Any interesting questions you were asked.
- Links you wish to share.

- Twitter

- #LHCIMC17
- @physicsIMC



# And Finally...

Smile, initiate two-way conversations with the students, and have FUN!

