Queen Mary
University of London
Science and Engineering

Radiation Detectors (SPA 6309)

Lecture 11

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What is this lecture about?

- The major assessment for this module.
- Deadline for submission is 14 April 2020

Information Sources (reminder)

Make good use of Web of Science https://wok.mimas.ac.uk/ .

Can be quicker/better to use a highly relevant journal directly (e.g. *IEEE Trans Nuc Sci* or *Nucl. Instrum Meth. A*).

arXiv, https://arxiv.org/, does not contain everything! Mostly you will be looking for preprints in the **hep-ex** category.

Don't forget the CERN document server http://cdsweb.cern.ch/

Look to see if there is a high quality review article (see especially the journal *Rep. Prog. Phys.*).

Assessment

Assessment Title: Reconstructing the Z boson from its decay to leptons in an experiment at a collider facility.

Weighting: 70%

Brief Description of the assessment:

Students will write a short review of the experimental details of a named experiment in which an unstable fundamental particle is reconstructed from its decays in to final state particles, in this case leptons.

The review will concentrate on the detection principles, operation and performance of sub-systems used to identify the final state particles and also those which may be used primarily to reduce the backgrounds from other final state particles unconnected with the primary event or which come from additional particles produced from the primary interaction or secondary particles associated with it.

Assessment – really important note:

Please note that this review is **not** intended to contain a discussion of the underlying fundamental particle physics of the production and decay of the Z boson.

$e^+e^- \rightarrow Z^0 \rightarrow l^+ l^-$ where l (lepton) is a muon or an electron (ignore τ)

p+p or p+ p-bar $\rightarrow Z^0 + X \rightarrow l^+ l^-$ where l (lepton) is a muon or an electron (ignore τ) and X is anything else (probably a hadronic jet)

Marking criteria

Write a concise report in appropriate scientific language (format and length details below).

Explain the basic particle detection principles of the key subsystems that are used to reconstruct the Z boson via its decays to leptons.

Provide, with appropriate references, information about the key performance parameters of the sub-systems relevant to this study.

Use appropriate figures (with references) to illustrate the performance of the sub-systems.

Format of the report

One cover sheet with your title and student ID number on it (please don't put your name as I wish to ensure anonymous marking). Your title should be something like:

Reconstructing the Z boson from decays to electrons using the XYZ detector at ABC.

Up to a **maximum of eight (8)** pages of text/figures/references. Any pages beyond the eighth page of text will **not be marked!**

Font size of 12pt for text and 10pt for figure captions and references. PDF format file.

DEADLINE: 14 April 2020

Assessment – indicative marking scheme

Indicative Marking Scheme

Criteria assessed	Contribution to overall mark
Clearly explained principles of detector subsystems used to identify and characterise the particles used in the Z boson reconstruction.	20%
Critical review of the performance of the detector subsystems described.	40%
Use of scientific writing style, numerical referencing and informative captions for figures and tables.	20%
Appropriately chosen references to published literature.	20%

Assessment – what is my experiment?

A spreadsheet with your name/ID will be up on QM+ before the end of today. It will be in the same place as the assessment pro-forma.

Assessment – any questions?

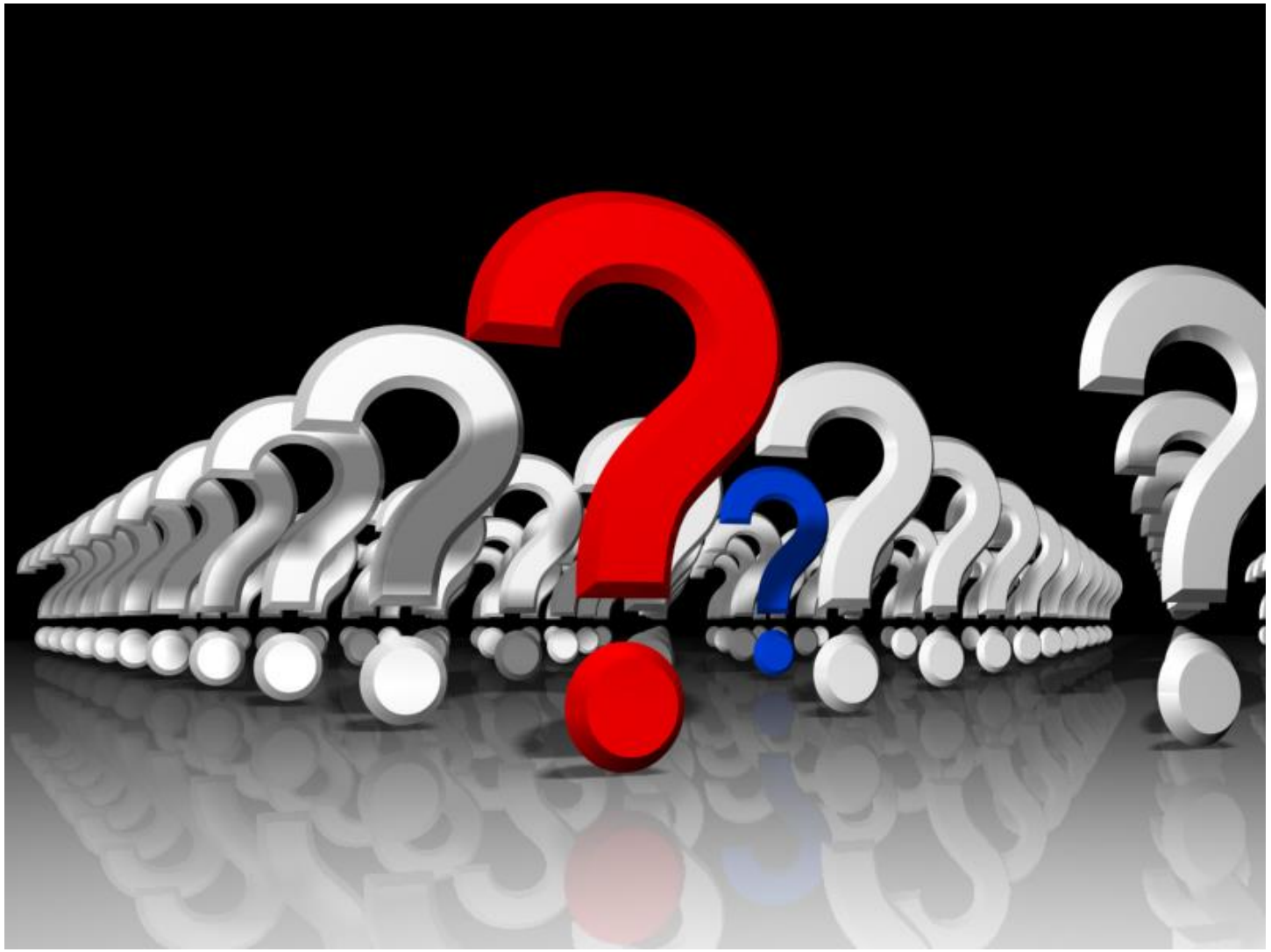

Photo by Chris Baker from FreeImages

Now it is your turn, what's wrong/missing with this paragraph?

The energy and position of the particles was measured using a high precision calorimeter based on scintillating crystals. The excellent energy resolution is critical for reconstructing the Higgs boson from its two-photon final state. The crystals and their photodetector readout have the required speed and radiation tolerance to operate in an experiment within the harsh radiation environment of the Large Hadron Collider, Hobson 2009 [1]

[1] P R Hobson et al, *Journal of Imaginary Detectors* **23** (2009) 123-145