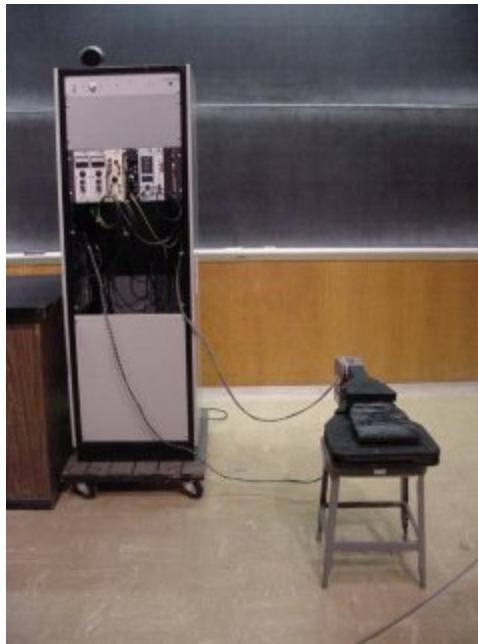
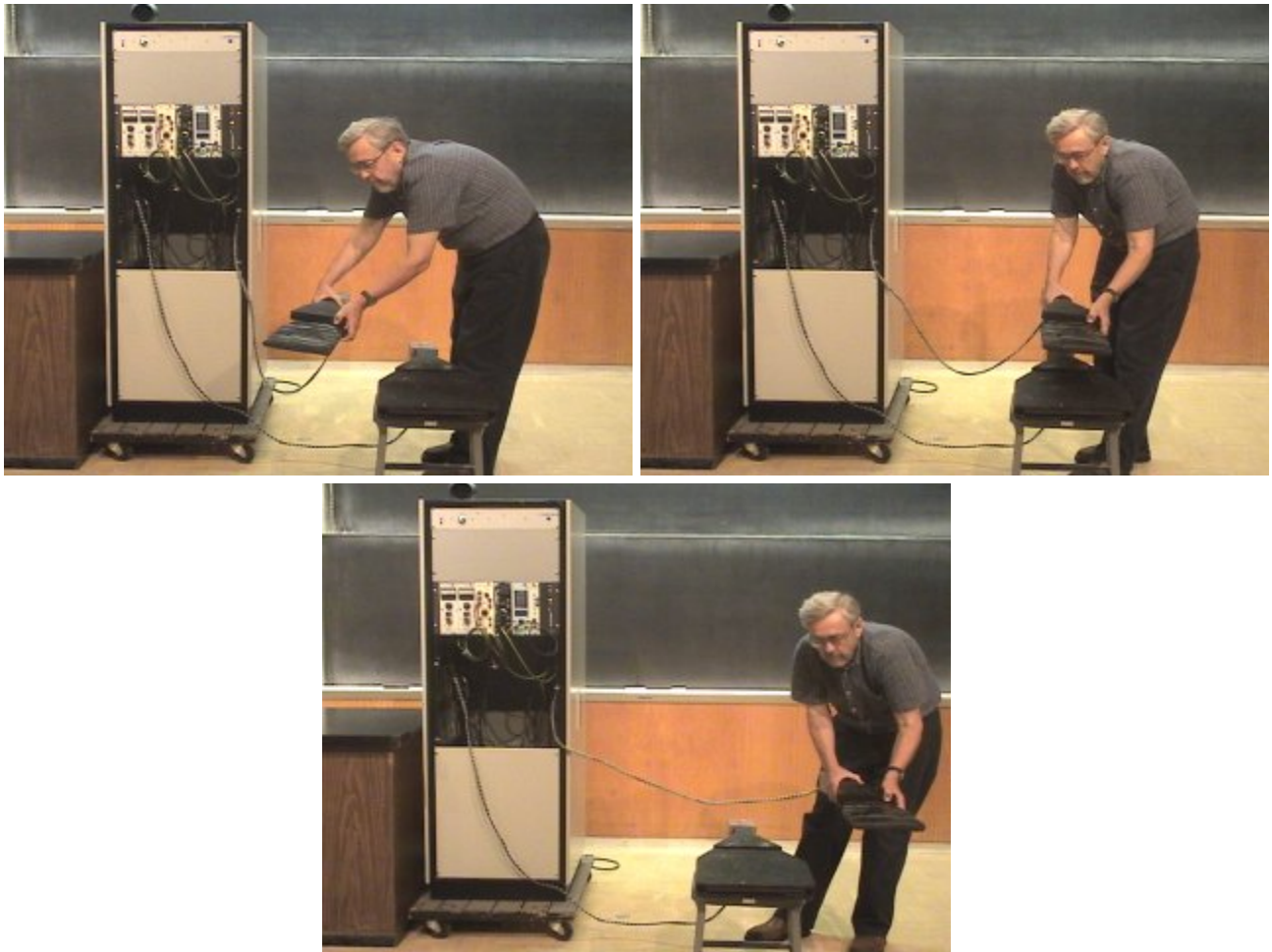


## Question #267

The experimental apparatus seen in the photograph at the left below is designed to demonstrate properties of cosmic rays. Each paddle detector has a large plate of scintillating material enclosed in a light-tight package. Cosmic rays may interact with the paddle or they may go through the paddle without interacting; only a small fraction of cosmic ray particles that pass through the paddles actually interact with either paddle. If a cosmic ray muon interacts with the scintillator in the paddle it produces a small light pulse that is converted into a click by the electronic apparatus in the rack. When a cosmic ray muon comes down from above, it may interact with either paddle A or paddle B, or it may interact with both paddles, creating a "coincidence" between the paddles. Click on the photograph at the right to hear cosmic rays that interact with paddle A, paddle B and both in coincidence. Because the two paddles are positioned one on top of the other, there is a significant possibility that a cosmic ray passing through and interacting with one of the paddles will pass through and interact with the other paddle, creating a coincidence.



The top paddle (A) can be raised about 30 cm above the lower paddle (B) and moved around to investigate where it must be located to produce the maximum rate of coincidence counts. Three possible positions are seen in the three photographs below.



We will now look at the number of cosmic ray coincidences with paddle A raised about 30 cm and moved back and forth above paddle B. Will the number of cosmic rays per second change as the position of paddle B changes? Or will it remain very nearly the same? One factoid that you may need to answer this question is that North (toward the North pole) is toward the left in these pictures. When the upper paddle is toward the left of the lower paddle in the picture, it has been moved toward the North. In addition, you might want to consider that these videos were made at about noon around the time of the summer solstice, where the sun is the highest in the sky.

The maximum rate of cosmic ray coincidences will be:

- (a) when the upper paddle is to the left (North) of the lower paddle.
- (b) when the upper paddle is to the right (South) of the lower paddle.
- (c) when the upper paddle is directly above the lower paddle.
- (d) the number of coincidences will be approximately the same for any position.

Click here for [Answer #267](#) after December 18, 2006.

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[Question of the Week](#)

[Outreach Index Page](#)

[Lecture-Demonstration Home Page](#)



For questions and comments regarding the *Question of the Week* contact [Dr. Richard E. Berg](#) by e-mail or using phone number or regular mail address given on the [Lecture-Demonstration Home Page](#).