

Snowmass at Argonne Exercise

ANL HEP
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Challenges for HEP

■ Challenges facing HEP

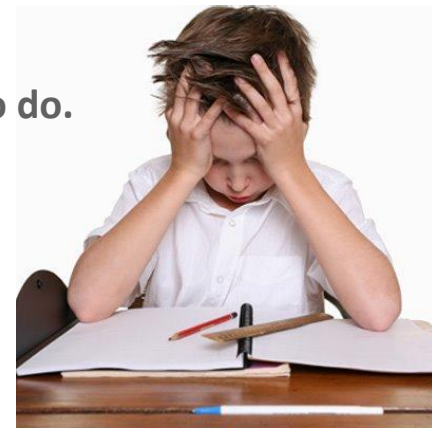
- The resources available for HEP research in the US is limited.
- We want to do many (expensive) things.
- We know that we will not be able to do all of the things we want to do.
- How do we decide what to do?

■ The Snowmass process

- The Snowmass process + P5 process is supposed to answer this.
- But the Snowmass process is big and complicated.
- So far no opportunity for us to think about the big picture.
- The Big Picture will only be discussed (if at all) in the 3-4 days in Minnesota in August.

■ The proposal:

- Do the proposed “Snowmass at Argonne” exercise!



Snowmass at Argonne

- To plan the future HEP experimental program: one can imagine a two step process.
 1. Figure out the scientific priorities of the various experimental opportunities on the table.
 2. Then add to that other constraints: programmatic (nation, laboratory, community), financial, diplomatic... etc.
- The proposal is to (attempt) to do STEP 1 between now and Minnesota.
 - Start with big scientific questions we ask in HEP
 - Try to figure out a strategy to answer these questions from the experimental opportunities on the table.
- Remember however:
 - This will be difficult!
 - There will be subjectivity.
- Can we do it? Can we come to a consensus?
- Can we come up with reasonable ways to decide between alternatives?
- Even if the answer is no, we will learn a lot!



Benefits

- ANL HEP is unique in that we are a small enough division so that a discussion such as this can be handled relatively easily, while large enough to be working in almost all of the relevant experimental areas. We believe we benefit from this exercise in the following way:
- Provides an opportunity to discuss these matters in a more extensive and open way than is otherwise possible.
- ANL HEP division members will gain a clearer view of the existing opportunities and their context than is otherwise possible.
- Prepares us for the discussions at the real Snowmass meeting.
- Will result in (probably) a unique input into the US HEP planning process.



Ground Rules and Initial Input

Ground Rules

- We will evaluate the experimental opportunities in terms of very general physics questions.
- We will evaluate the scientific merit of the experimental opportunities. In the merit we will consider:
 - The measurements and their quality to be made at this experimental opportunity
 - Rough measure of effort (manpower and expense) associated with this opportunity
 - Rough expectation of the timeline of this opportunity.

Initial Input

- The primary input will be the Physic Briefing Book (http://europeanstrategygroup.web.cern.ch/europeanstrategygroup/Briefing_book.pdf) used by the European Strategy meeting. We may add supplementary material where appropriate.
- **Is this the right thing? We need a relatively compact and well defined input.**

Questions are taken from Quantum Universe

Questions

- The basic physics questions that are to be the bases of discussion are taken from “The Quantum Universe”:
 - Are there undiscovered principles of nature: new symmetries, new physical laws?
 - How can we solve the mystery of dark energy?
 - Are there extra dimensions of space?
 - Do all the forces become one?
 - Why are there so many kinds of particles?
 - What is dark matter? How can we make it in the laboratory?
 - What are neutrinos telling us?
 - How did the universe come to be?
 - What happened to antimatter?
- In addition, there are three further questions for detector and accelerator R&D
 - What are likely new revolutionary developments in detector or accelerator technologies that could be expected in the next 10-20 years.
 - What are the salient characteristics of such developments in terms of performance and cost.
 - What are the timescales for such developments. Could they be speeded up with more effort?

Are these the right questions? Add Computing?

The Process

- Assign each of the 9 physics questions to a group of 3-4 physicists who will make:
 - A set of more specific sub-questions (no more than 5) where appropriate
 - A list of relevant experimental opportunities.
 - A considered strategy of how to proceed with the experimental opportunities in order to begin to answer the question.
- The three R&D questions are assigned to two groups (one for accelerator and one for detector) of 3-4 physicists each to be answered.
- The conclusion of each group is written up in a ~10 page document.
- The finding of each of the 11 groups is presented to the division, followed by general discussion.
- Rewriting of the documents in light of the discussion.
- A committee is formed to edit together the 11 separate documents. In addition, an attempt is made to answer the following questions for the concluding section of the overall document.
 - Can we set overall priorities from the opportunities listed in the 9 physics documents?
 - Can we make statements about the proper balance between direct physics research and R&D efforts.
- The overall document, particularly the concluding section, is presented to the division and discussed.
- Revise the final document according to the outcome of the discussion.



Next Step

- Define the steps and their timescale better. Aim is to finish mid-July!
- Ask people to identify which working group(s) they would like to join in the next few days.
 - We want people to go across “frontiers”
 - We want the younger people to participate and drive this process
 - We want theoretical input in each of the groups.
- Form the group and identify chairs next week.
- An organizational meeting of the chairs to make sure we work at the same level and to synchronize.
- We’re off!

