

Where Has the Vision Gone?

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Edmund Burke, writing on conciliation with the American rebellious colonies [1] comments on unsolicited advice:

“ It generally argues some degree of natural impotence of mind, or some want of knowledge of the world, to hazard plans of government except from a seat of authority. Propositions are made, not only ineffectually, but somewhat disreputably, when the minds of men are not properly disposed for their reception.”

Given the importance to the future of American High Energy Physics, somebody should speak up about the recent decision to cancel the silicon upgrades to the CDF and D0 detectors [2].

I think this is a serious mistake, and will try to lay out the case why. The decision may well be irreversible, given the weight of distinguished committees and the long process behind it, but ultimately the future of the Lab rests with the Lab itself, and a new and bolder look at the alternatives by the Lab could produce a different answer, one with better physics for the Lab and the world HEP community. I argue here that a fresh look with different boundary conditions should be undertaken by the Lab in the form of a challenge to the two Collider collaborations.

When the Lab was first begun Bob Wilson took on a host of technical challenges with real panache, vision, and leadership. A key ingredient was his willingness, even eagerness, to take on technological innovation, and his deep faith in his staff to be able to do whatever needed to be done. Among many major decisions, the ones that impressed me most (I was a grad student just moving to UC from Berkeley, the proponent of the more conventional design) were the decision to bypass the expensive step of having the ring be on a foundation set into bedrock, separate from the surrounding tunnel, the decision to bypass the expensive construction of machined magnets with large-diameter threaded holes for bolting the segments together, instead welding punched laminae into a frame, the wire-septa for extraction and for splitting external beams, and the long-term vision of the superconducting ring in the same tunnel, to name just a few. Bob had the ability to define a vision, and to inspire all of the Lab with the importance of rapidly moving forward to those goals.

His technique depended on a clear and bright focus on making progress on the technical aspects; he had little patience for bureaucracy, long-range planning committees, and fiefdoms. This impatience to get results was a trademark of the field, as summarized by Lillian Hoddeson: *“Strong American laboratory leaders, such as Ernest Lawrence, Luis Alvarez, Edward Lofgren, Edwin McMillan, Wolfgang Panofsky, and Robert R. Wilson, ‘who imposed their rhythm on world science,’ shared a characteristic ‘pragmatic and utilitarian approach notable for its clear stress on ‘getting numbers out.’ ”* [3]. Similarly, *“Victor Weisskopf, CERN’s fourth director-general, a veteran of wartime Los Alamos, where time perhaps the most pressing constraint, reflected, ‘It is no good in this field to be excellent and always late.’ ”* [3]

The fundamental problem with the upgrades to the silicon that we have not been able to surmount was that a long shutdown ‘late’, i.e. close to or in LHC operation, is almost certainly a mistake; there is unlikely to be the resources or incentive to commission CDF and D0 at the same time one is commissioning Atlas and CMS- the advantage Fermilab will have at that time will be momentum and experience, and breaking those to shutdown almost certainly means never coming back on the air. Similarly, one doesn’t want a long shutdown ‘early’; the slippage in the Run II startup has made regaining the momentum of Run I to be critical, and breaking that momentum now is unthinkable.

So the problem is, I believe, the length of the shutdown, rather than the intrinsic merit of the upgrades. If the silicon detectors could be replaced **and commissioned** in a 3-to-4 month ‘summer’ shutdown, the picture looks entirely different.

Is this possible? I don’t know the answer, but rather than cancel the upgrades the question should be issued as a challenge to the Collaborations to make a credible proposal for installing and commissioning the new silicon detectors in a summer shutdown. It will require among other things a very different approach to commissioning: the new silicon will have to be debugged before being installed (this seems rational), and the alignment and calibration software will have to be in place at the outset. The SVT experience with CDF has shown that self-alignment and a rapid commissioning is possible with appropriate planning. What it would take to do the mechanical swap represents a formidable challenge, and yet Belle changes silicon often. In any case, rather than cancel the upgrades, offering a challenge to the collaborations to solve the key problem of a rapid upgrade without losing momentum would place the onus right where it belongs, with the proponents. If the Collaborations can’t meet the challenge, one knows the answer.

So why is canceling the silicon upgrades an exceptionally serious mistake? There are two strong reasons. The first arises in an assessment of risk. The second is more related to the issues of vision, momentum, and commitment, which translate into the quality and number of the young people entering the field and hence its future.

First, the question of risk. The success of HEP and the long support of its funding is due to a remarkable history of success, starting with the Manhattan Project, and carrying that pace, rhythm, and technological optimism into an every-increasingly larger set of labs and accelerators. Along the way remarkable new technologies have sprung up, and the impact on society of many of these, from the use of accelerators and large magnets in medicine and industry to the invention of the World Wide Web, have had an enormous societal payoff. More recently, the SSC was a highly-visible failure; we have recovered remarkably well, but it's not clear how many strikes one gets at bat in this game. We cannot afford a highly-visible failure at Fermilab. One way to avoid such is to lower expectations and 'go quietly into the night', moving the high-energy frontier to the LHC and focusing the Lab on other things. However it is still possible to have a highly visible failure; if CDF or D0, for example, loses its silicon detector to radiation (as could happen if the accelerator meets its more aggressive goals). The expenditure of 1% of the investment (e.g. 10 million dollars compared to the overall cost of 10 years of the Collider program) to have a backup solution in case of failure of the most vulnerable systems seems justifiable.

Second is the effect on morale and momentum, the intellectual attractiveness of the field to new students, and the opportunities for our present young folk. Many people have invested immense amounts of their time and intellect in the upgrades. Moreover, I can already see the impact of the cancellation on other aspects of the upgrade and on operations. By limiting the maximum luminosity that the detectors will be able to handle lowers the incentive to do well for the accelerator, which in turn lowers the relative importance of working on the present detectors relative to the upcoming LHC detectors, and so forth. There is a vibrant set of upgrades ongoing on the electronics, trigger, and DAQ systems of CDF (which I know best); I presume there are similar ones on D0. These present wonderful opportunities for students and post-docs to innovate, and have something that is truly their own. But already I am getting email from Upgrade Managers questioning the need for these, given that the luminosity will be essentially 'capped'. The message from the Lab is clear, and it's not one to inspire all-out efforts to greater capabilities. Shutting down the silicon upgrades has a much wider effect than the narrow interpretation.

The loss of the discovery vision will have major implications on staffing and resources at Fermilab. Is the Lab prepared for the migration of university folk [4] away from the Collider program earlier than would have happened before the cancellation? I've heard from many colleagues on CDF a disappointment with the Lab; the commitment to the Lab is no longer that deep. The operation of the detectors depends on graduate students and postdocs. We will have fewer of them given the loss of momentum and decreased morale at the Tevatron, and so will result in a shift away from present commitments by university groups to supporting subsystems; the Lab will have to pick up these tasks in order to maintain

a credible Collider program. Far better to maintain and increase the momentum until the LHC takes over, and then retire CDF and D0 cleanly, moving a vibrant energy-frontier program over to Atlas and CMS.

In summary, rather than wind down the Collider program prematurely, the Lab should challenge the two major collaborations to develop credible plans to replace the silicon detectors in a summer shutdown, move to a schedule with a single summer shutdown each year with steady running the rest of the year, and make every effort to accumulate meet the more aggressive goals it has publicized. If the collaborations meet the challenge, the Lab is then in a position to make a counter-proposal to the P5 Committee. Bob Wilson wouldn't have given up so easily, I would guess; the stakes are so high I don't see why we should either.

References

- [1] Edmund Burke, *Speech on Conciliation with America*, March 22, 1775, as reproduced in *Speeches and Letters on American Affairs*, J.M. Dent and Sons, Ltd, London, 1908.
- [2] Burke goes on to say “ *But when I saw that anger and violence prevailed every day more and more, and that things were hastening towards an incurable alienation of our colonies, I confess my caution gave way. I felt this as one of those few moments in which decorum yields to a higher duty. Public calamity is a might leveller, and there are occasions when any, even the slightest, chance of doing good, must be laid hold on even by the most inconsiderable person.*”. This is overdoing it in this present case, but we should not underestimate the effect of this decision on the field, and some of the analogies are interesting.
- [3] As quoted by Lillian Hoddeson.
- [4] In any case the Lab needs to study carefully the prospect of having to support increased maintenance of the detector operations as university groups move people and attention to the LHC detectors.