Revised Run 10 Plan
(Nov. 25, 2009)

At the RHIC Planning Meeting on Nov. 24, 2009 we had a good discussion of priorities for the start of a low-energy scan in Run 10. This discussion was prompted by two new facts revealed in the preceding weeks: (1) we received an FY10 RHIC budget from the Office of Nuclear Physics that will support at least 25 cryo-weeks of operation in FY10, with a possible extension to 27 weeks if the BNL overhead rate is not raised from its present level (a possible increase is under consideration at the lab); (2) a reanalysis of PHENIX data taken during the $\sqrt{s_{NN}}$ = 9.2 GeV Au+Au test run at the end of Run 8 has revealed that PHENIX can indeed trigger successfully and reconstruct events at energies below the RHIC transition energy, without the addition of new trigger detectors. The latter information renders invalid the premise (namely, that PHENIX could participate at the lowest energies only in Run 11 or beyond) of the tentative run plan I proposed last summer.

The highest priorities for Run 10, as set down by the PAC in June 2009, remain 10 physics production weeks at $\sqrt{s_{NN}}$ = 200 GeV and an additional 4 physics production weeks at $\sqrt{s_{NN}}$ = 62.4 GeV Au+Au, while the Hadron Blind Detector remains installed in PHENIX. (Its removal to permit installation of the VTX upgrade is planned for Summer 2010.) Allowing for overheads of 2.0 weeks cooldown, 2.0 weeks collision commissioning at 200 GeV, 0.5 weeks cumulative for subsequent energy changes and 0.5 weeks for warmup, we will have a total of 6.0 weeks remaining for a start on the energy scan in a 25-cryoweek run, growing to 8.0 weeks in a 27-cryoweek run. Of these, I would like to devote 0.5 weeks to machine studies important to RHIC's future program: a test of beam stability near a betatron tune of 0.67, as needed for improved polarization transmission to 250 GeV in subsequent pp runs, and in the wake of improvements made to the main magnet power supply during the shutdown just ending; a first test of feasibility of providing Au+Au collisions at $\sqrt{s_{NN}}$ as low as 5 GeV.

The remaining 5.5-7.5 weeks is insufficient to complete an energy scan. Thus, the question at hand is what aspects of the energy scan to emphasize in this first run, with the understanding that additional low energies can be part of a Run 11 plan. The plan I propose below has the advantage that it provides the opportunity to have significant impact and publications from Run 10 at both the low-energy end of the scan, where STAR is focused on searching for the QCD critical endpoint, and at the intermediate energies, where PHENIX hopes to find clear evidence for the onset of jet quenching and other phenomena associated with the QGP transition. Thus, 4 weeks will be devoted toward the end of the running period to Au+Au collisions at $\sqrt{s_{NN}}$ = 7.7 GeV. While PHENIX estimates that they would accumulate only around 0.5M events during this run, there no longer seems to be any reason to anticipate that this situation will improve by waiting a year. Low-energy electron cooling of the RHIC beams, which would improve the luminosity at the lowest energies, is at least five years off and only worth considering for a second-generation low-energy scan. The beam top-off mode that had been discussed at the June PAC meeting is hard to reconcile with safety considerations at the low energies, where beam is lost at an elevated rate. And the addition of the PHENIX

VTX detector is unlikely to increase the PHENIX event rate significantly at the low energies, given that it will require much tighter vertex cuts out of a large diamond size. Furthermore, C-AD accelerator physicists are confident that 7.7 GeV is a sufficiently small step down from the already demonstrated 9.2 GeV that there is a high probability of successful RHIC operation in this first attempt at 7.7 GeV.

We will devote 1.5 weeks to a run at $\sqrt{s_{NN}}$ = 39 GeV, providing sufficient statistics for PHENIX to see if there is a sharp onset of jet quenching between 22.4 and 62.4 GeV, and more than enough statistics for STAR to compare observables to those at other energies in the scan. The 39 and 7.7 GeV runs will be included in a 25-cryoweek run. If the run can be extended by two weeks, my best guess (informed by PAC advice) of the largest potential impact of those extra weeks is to devote them to Au+Au collisions at 11.5 GeV, even though collisions can be provided to only one detector at a time at this energy. Since STAR has the much larger acceptance at the low energies, the collisions would be arranged at STAR. The remaining energies from the PAC-recommended scan -- $\sqrt{s_{NN}}$ = 27 and 18 GeV – could then be scheduled in Run 11, although that plan can certainly be amended by results revealed during Run 10.

In summary, the table below shows the revised plan for 25 or 27 cryo-weeks:

	Physics production or beam studies weeks	
$\sqrt{s_{NN}}$ (GeV)	**25-cryoweek run**	**27-cryoweek run**
200	10	10
62.4	4	4
39	1.5	1.5
27	0	0
18	0	0
11.5 @ STAR	0	2
7.7	4	4
Beam studies @ 5 GeV and @ $\nu \approx 0.67$	0.5	0.5