Question 1

- It is understood that the variance analysis is not yet being posted to IPD. It would, however, be useful to see what you have collected thus far (in any convenient format)
  - The June CPR is the first one for which we are writing variance reports
  - These initial reports have not been reviewed by the PO yet, and for many, this is the first one
  - ➡ It is premature, and not helpful, to share these outside the project team
  - However, here are the variance drivers:
    - LAr FEE: submission of ADC pre-prototype 3 is delayed
      - if submission happens in August, FDR date likely to be maintained, so no significant impact
    - LAr BEE: delay in engineer hire (person will start on August 19) at SBU, extra time being spent on specifications
      - extra effort planned in next few months to recover

Question 1, ct'd

- Tile Main Board: no report required, but SV driven by test fixture fabrication, already recovering
- Muon sMDT: Precision jigging for module 0 construction has not been arrived yet
- Trigger HTT SV: Effort on the RTM was delayed due to deadlines on other projects, and the RTM/TFM work was deemed acceptable to delay short term
  - Effort will be available in the near future to compensate and recover the schedule.

Question 2

- The June monthly report says that the EV report has bugs. Please explain the origin of the problem. Is it e.g., related to the tool being used or the data.
    - The use of bug may have been too strong. It was intended to reflect the fact that it is still early days as we exercise the system and there may be issues yet to be resolved. One recently discovered issue was that two institutions were exchanged when recording the accrual data, introducing an error, which can now be fixed.
    - I.e. some of the historical actuals from FY17-18 were not captured correctly in the May CPR. This was fixed in the June CPR

Question 3

- The EAC reported in the June report is not same as the BAC. What is the primary reason for this?
  - The BAC reflects the current “baseline” cost, i.e. the planned cost for the RLS against which we report
  - The EAC is the BAC + cost variance + impact of escalation (due to schedule variance)

Question 4

- In the subsystem presentations two contingency numbers were usually given, for 70% CL and for 90% CL. When adding up the contingency for the total project which of these CL's were used?
  - We simulate the project, typically for 1000 “runs”, and integrate the expected project cost distribution to extract the xx% CL TPC
  - In Brooijmans’ talk, sl 32, the 70% and 90% CL cost contingency numbers are given ($16.1 and $22.0M)
  - In Brooijmans’ talk, sl 33, the 90% CL cost contingency numbers are given for each deliverable
  - The available contingency, given a $75M TPC, is $20.1M
    - This corresponds to the 85% CL
    - In other words, according to the simulation we will complete the planned scope within $75M at 85% CL
      - We also have 15% scope contingency, bringing the CL to ~100%

Question 5

- A possible one year slippage of the overall ATLAS upgrade schedule was mentioned as a possibility. This might cause a standing army cost increase. Even though the US responsibility is defined as delivery of subsystems, and thus insensitive to standing army costs, a delayed overall schedule might delay the completion of US deliverables due to delays of prerequisite parts from overseas collaborators. How has this possibility taken into account in the contingency estimation?
  - [will write tomorrow]

Question 6

- The HTT project builds on FTK is key ways. Please reflect on the aspects of FTK that were successful and aspects that were less than successful. Which lessons are appropriate to HTT? How will these lessons help you manage risk to cost and schedule in HTT?
  - Next two slides

Lessons learned from FTK

- Simplify the hardware
  - FTK has 7 board types; HTT has 3
  - Data transfer is simpler (from DAQ rather than directly from detector)
- Integration of multiple board types should be started early
  - Integration tests of HTT are in the RLS including joint demonstrator tests of the TP and TFM, and slice tests at CERN with all prototype board types.
- Start writing firmware long before final FPGA decision is made; in FTK some of the FPGA resources turned out to be marginally sufficient.
  - HTT: Two prototype rounds with a substantial period of firmware development/optimization prior to the final FPGA decision.

Lessons learned from FTK

- Have professional oversight of scientific personnel writing the functional firmware.
  - HTT: There will be firmware engineers at each of the firmware writing institutions. They will set the overall structure of the firmware, write some of the most challenging functions (I/O, memory access, etc.), and oversee the work of the scientists.
- There should be system-wide oversight of the firmware
  - There is an HTT firmware coordinator whose responsibilities include system verification procedures.
  - All HTT board reviews will include reviews of the firmware.
- When testing with simulated data, include dropped data and data errors.
  - A comprehensive test suite which includes data corruption is part of the RLS.
  - QA/QC specifically includes inserting data with errors.

Question 7

- The key to the proposed change management plan is the CCB. Please explain how this committee functions, e.g., by consensus, majority vote, unanimity? How are conflicts of interest among its members managed/mitigated?
  - [Jon]

Question 8

- The core management team has used the US-ATLAS Phase-1 upgrade project cost and scheduling data to inform your expectations for the MREFC HL-LHC project. Could you make available to us any documentation you have on "lessons learned in Phase 1"?
  - The CD-3 Lessons Learned write-up is posted on the indico page under the Tuesday homework response entry

Question 9

- Provide a pointer to NSF project milestones that are linked to international milestones and indicate how this is tracked in the RLS
  - The majority of these are labeled with “EX” in the task name (there are many)
  - They include the ATLAS reviews (SVR, PDR, FDR, PRR), needed at CERN dates, as well as required deliveries from international collaborators (but there are not so many of these in NSF scope)
  - In our RLS these milestones are tracked as all other tasks and milestones
    - We plan to emphasize the need to status their expected dates, not just completion
    - Expected information is obtained from regular ATLAS working meetings, as well as the International ATLAS schedules (which are statused quarterly)

Question 10

- Top level talks emphasized the difficulty of controlling the risks of international contributions to the US project. We would like to a specific list of those contributions, if any, and the plans for mitigating these risks (where possible). Integration aspects such as power, cooling, space (rack and cable), and common projects such as lpGBT or bPOL are of particular interest
  - In phase-I international contributions generated the majority of cost and schedule contingency draws, but the international schedules were coarse and essentially not revised or statused after the MoUs were finalized
  - The risk register identifies the impacts of delays in lpGBT, ELMB2, … availability
  - Power and cooling density specs are already set; the question is rather whether we can meet these specs
  - Similarly, rack space has been assigned
  - (One unknown is when exactly USA15 - the counting room - will be available for installation, but that only affects us in the I&C phase)