U.S. ATLAS Project Manager's Review
1-2 April 2010

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10 May 2010

Executive Summary

The Detector and Computing Advisory Panels (DAP and CAP) reviewed the status and plans of the US-ATLAS Program at Brookhaven National Laboratory on April 1-2, 2010. The Panel was extremely pleased to hear of the highly successful commissioning of the ATLAS detector during early LHC collisions. The detector operated successfully, with no worse than 97% active channel count in any subsystem, from the start of collisions. There appears to be an excellent understanding of the detector performance via simulations. The BNL computing center has shown the highest performance among all of the international ATLAS Tier 1 centers. Tier 3 computing installations at various US-ATLAS institutions have received an important boost from ARRA funding, and another boost is anticipated shortly from an NSF MRI grant.

The US-ATLAS team is doing at least its share in all aspects of ATLAS maintenance, operations, software and computing, and upgrade R&D, and considerably more than its share in some aspects. In particular, the U.S. continues to fill a number of prominent leadership roles in the international collaboration. An extensive revision of the Program Management Plan for US-ATLAS holds the promise of enhancing involvement of the collaborating institutions in management appointments and strategic planning, and provides paths for improved delegation of responsibility from the Operations Program Manager (OPM) and Deputy OPM to Level 1 managers for M&O, S&C and upgrade R&D.

The Panel was also pleased to see very significant progress during the past year in the rate capability of the Cathode Strip Chamber readout drivers, although they have not yet quite met the ATLAS standard of 75 kHz operation. Other longstanding hardware vulnerabilities, especially in low-voltage power supplies (LVPS) for the Liquid Argon and Tile Calorimeters, in optical links for the LAr, and in silicon cooling systems, remain at reduced levels. The possible need for extensive replacements of some or all of these vulnerable systems during the scheduled 2012 long LHC shutdown requires that the Program maintain adequate Management Reserve funds for FY10 and FY11. The Panel judged the presently identified Management Reserve to be significantly too small.

The major concern expressed by the Panel involves planning to balance the many competing demands on the Program within anticipated tight budgets. These demands include: the US-ATLAS commitments to M&O and S&C; a suitably forward-looking detector R&D program geared to long-term ATLAS upgrades; U.S. participation in some attractive, modest shorter-term detector upgrades under consideration by the international collaboration; computing hardware investments beyond the U.S. pledge levels to international ATLAS, as well as other possible avenues to ensure a strong U.S. role in ATLAS physics analyses; allowance for replacement of vital components during the 2012 shutdown; and an enhanced role for SLAC physicists within US-ATLAS.

The Panel appreciates the challenge of planning in the face of rapidly shifting guidance from CERN on luminosity development and machine upgrade timelines, and from the funding agencies on detector upgrade timelines and budgets. Nonetheless, it considers it essential for the US-ATLAS management team to present to the agencies at least a baseline plan in which the above demands are clearly prioritized to fit within the presently anticipated Program budgets – which appear unlikely to grow even as fast as inflation from FY10 appropriated levels – with adequate Management Reserve maintained and without reliance on new construction funding for short-term upgrades. This will require difficult choices, presumably to be led by the new Management Board and Executive Committee, of those areas in which the U.S. team wants most to maintain or enhance its leadership within international ATLAS.

The Panel recommends that the US-ATLAS management be prepared to present such a baseline plan at the funding agency review in mid-May, 2010, together with the clearly delineated impacts of this baseline plan and an indication of how the impacts could be mitigated by funding above the baseline level. On this timeline, the baseline plan will have to rely on some guesses of likely international ATLAS decisions regarding shutdown and short-term upgrade plans. Any requests above the baseline, for new construction funding from DOE and NSF for modest short-term upgrades, will have to make a compelling case that the upgrades provide essential performance improvements that are needed before ATLAS reaches the integrated luminosity thresholds that had been previously presented as the justification for such upgrades. Even with compelling arguments, budget realities may make it difficult to obtain new U.S. construction funding before the planning and schedule for LHC machine upgrades is firm.

Specific Comments and Recommendations

1. LAr Calorimeter

Observations

The LAr Calorimeter and ATLAS as a whole performed extremely well during the recent physics run. In particular it benefitted from having time to work on streamlining calibrations and data taking software to greatly reduce latencies. Agreement with data simulations was excellent.

Findings

- The refurbishment of Front End Boards was completed in January 2009. A long list of smaller startup issues was resolved and operation was very smooth beginning with the 900 GeV beam. The following refers to two remaining issues, LVPS and fiber optic data links.

- LVPS: The system is operating with refurbished units from early 2009 and of these five units have failed. Though inaccessible, they are redundant, so the detector is operating normally. Meanwhile a new design has been commissioned and a contract is underway with Wiener for a completely new unit, which is under test. A full crate test will be performed at CERN. A complete replacement of these supplies is planned in 2012.

- One design change is needed on the ELMB (BNL) control board to provide proper grounding to the supplies when mounted in the detector system.

- Optical Transmitters: These units have been failing and a backup solution of a splitter and redundant fiber and link has been developed. The plan being considered is to replace all units during 2012.

- Noise Reduction: Work continues on grounding and shielding improvements to reduce electrical noise.

- M&O and RBT (Request Beyond Target budget allocations): RBT is requested for the ELMB upgrade and support for the optical transmitter development.

Recommendations

None.

2. TRT Barrel

Findings

- TRT Barrel and end cap are in data taking mode with 98% of the detector instrumented, aligned and operating well. Current ongoing work includes straw-by-straw alignment as well as better monitoring of efficiency and resolution on a chip by chip basis.

- An active gas "glitch" occurred but had minor ramifications.

- Budget request for 2011 and 2012 is of order $230K/year.

- Potential risks (calls on management reserve) in the coming year were identified to be of the order $30-60K and include the possibility of HV system spares and upgrades, a new facility to study aging, and potential upgrades of the active gas recovery system.

Comments

- TRT group had a good year – and their systems are working well

Recommendations

None

3. Tile Calorimeter

Observations

Subsystem manager Larry Price reported that the calorimeter performed superbly in recent collision data capture and analysis at CERN. A total of 3% of tiles are masked off due to various problems and compensation of energy based on neighboring cells is applied. The L1 trigger was exercised at up to 50kHz on cosmic rays.

Findings

- LVPS Supplies: Repairs have been developed over the past year involving additions of filters and improving robustness to failures during trips by slowing turn-off transients. These were implemented during the downtime last year. Currently 4-5 units out of 256 have failed during operations since November. The supplies have multiple voltages with no redundancy and are still considered a high risk; therefore an improved unit is under development at Argonne. Large parts of the core circuit are used in the new design.

Filters, bypass capacitors, protection and grounding for noise abatement are all being improved. Each drawer box contains 8 bricks and to date one brick has been extensively tested in December, while a box of 8 is currently being tested at CERN. Construction of 5 boxes of 40 bricks is underway. A pacing item is the fabrication of new transformers. There is a possibility of a brief access at Christmas 2010, during which some units may be replaced. However, the main goal is to be ready for a decision to replace all units in 2012. There is still a concern about the lack of redundancy and space constraints make an N+1 redundant design difficult if not impossible.

- Opto-Isolators: Opto-isolators have been found to latch up and one manufacturer suggested that the link would have to be physically disconnected to reset it. There is a suspicion it is happening during power supply trips. They eventually seem to recover. Since the manufacturer says that noise spikes lead to this problem, it is being addressed with the filters mentioned above.

- M&O for 2011 is $679K and for 2012 $915K

- RBT for 2011 is $320K in 2011 and $250K in 2012 (DOE +NSF)

- In 2011 a total of $160K is Priority 1 for the Calibration Test Facility and PMT spares purchases. Software support for another $160K is listed as Priority 2.

Recommendations

- Consider the advisability of discussing with lab power supply experts and manufacturers if an N+1 redundant LVPS design may be possible. This would need to be done soon since a new design would pose schedule and cost issues.

4. Endcap Muon System and Muon Upgrade R & D

Muon System

Observations

The system has performed remarkably well in first collision data capture and analysis. The success of the alignment system in helping calibrate positions of other subsystems, and in one case detecting a serious design error, is also noteworthy.

Findings

- A series of niggling issues were listed as concerns, none of them critical to the integrity of the system at present. However, the ROD data rate limit of 37 kHz is a threat which, if it cannot be solved via software, may ultimately require new RODs. There are also two dead planes that will have an impact on reconstruction.

- M&O: First priority is data taking; second is getting 50EE chambers ready for installation during the 2012 shutdown; third is installation with alignment system in 2012.

Recommendations

None.

Upgrade R & D

Findings

- Only 4 of 8 layers have been staged, since 4 was considered adequate for high luminosity However, higher than expected backgrounds will pose a risk. The collaboration is considering restoring the original scope.

- Improvements to the CSC detectors are proposed. US ATLAS will concentrate on the detectors. Candidate technologies are Micromegas, Thin Gap Chambers (TGC) and thinner drift tubes. Micromegas and TGC's are the most promising. Micromegas can give much higher performance than CSC's as a function of luminosity and radiation exposure. Micro-TPC operation could measure large angle tracks.

- The chambers will be 1x2 meters. There is a challenge in handling discharges. Spatial resolution can be improved with an increase in number of channels. Protection can be improved with resistive strips and 2-stage amplification. The electronics proposed is an on-chip ADC and 64-128 channels with 8-10 bits resolution and possibly on-detector track segment finding logic. Such a chip could serve a variety of detectors. A 64 channel ASIC has been developed and will be tested at CERN in summer 2010.

- RBT: The development budget request is $258K in 2010, $374K in 2011, and $412K in 2012.

Recommendations

None.

5. Silicon Subsystem

Findings

- The ATLAS silicon system is operational, performing well, with >98% operational channels, and taking data. Cooling problems remain, and compressor failures continue to complicate operations. Loss of a cooling loop has been the largest single point of failure in the system. Cooling is not a US responsibility.

- The cooling problems have required operation of some of the cooling loops at higher temperatures than anticipated. These higher temperatures will have an effect on the radiation-related lifetime of the detectors. The pixels operate between -5° C and -17° C. At these temperatures reverse annealing effects are substantially reduced and the lifetime should be close to initial predictions. The situation for the strips is less clear.

- The silicon subsystem has no requests "beyond the target" and has, in fact, considerably reduced their operating request due to the smooth commissioning and operation of the detector.

Comment: The silicon group should be complemented on the smooth commissioning and operation of the detector system.

Recommendations

None.

6. Trigger/DAQ

Findings

- The US ATLAS TDAQ subproject is a major and visible part of international ATLAS TDAQ and US members fill major management and operations roles in the ATLAS TDAQ system.
- The TDAQ system provided steady operations during 2009 for the detector readout and commissioning. Upgrades were performed where needed and the system as a whole was ready for data taking at the end of 2009. Some upgrades and computing additions will occur in 2010 with the first major high-level trigger (HLT) replacements planned for 2011.

- Many improvements and upgrades to the software, the software framework and infrastructure, hardware and operating system, and triggers were made in 2009 in preparation for the 2010 run and for the long-term maintenance of the systems.
- The TDAQ plan in 2010 will build out the system to an appropriate size for the upcoming data taking, will provide additional functionality and support for operations and provide the capabilities that ATLAS requires for successful monitoring, debugging, calibration, and cosmic and physics running, including heavy ion running.
- TDAQ has begun to participate in detector upgrade activities and has begun an investigation of potential modifications to the data flow architecture of the TDAQ system.

Comments

- The Trigger/DAQ (TDAQ) subsystem, under the leadership of Andy Lankford of UC Irvine and Reiner Hauser of Michigan State University , continues to make impressive progress in achieving the goals of the project and in meeting the needs of the ATLAS experiment for a robust and effective trigger and data-acquisition system. The architecture has proven to be effective and robust. A large number of accomplishments, both technical and managerial, were shown. ATLAS TDAQ was able to support all of the needs of the experiment in 2009, while performing necessary upgrades and preparations for the 2010-2011 running period.
- The US ATLAS operations targets for TDAQ in FY10 and the out-years recognize the importance of the system and the important role that US ATLAS plays in the TDAQ. US TDAQ should endeavor to maintain a strong presence in ATLAS TDAQ.

- The replacements of hardware envisioned in the original plan for the TDAQ system are sensible and should be continued in future years to provide the necessary and increased capabilities that will be required for higher luminosity and enriched functionality. However, operational experience with hardware should be considered while planning for replacements. It may be possible to keep some equipment longer than the original planned lifetime. In addition, attention to the running schedule should be followed when purchasing additional CPU and other equipment to take advantage of better price performance, as has already been done based on the one year delay of running coming from the 2009 break in operations and the new 2010-2011 running schedule.

- It was refreshing to see that a serious documentation effort was made during 2009 and it is hoped that the documentation is kept up to date.

Recommendations

None.

7. Technical Coordination

Findings

- The US ATLAS subsystem manager for Technical Coordination, Venetios Polychronakos, outlined the accomplishments of this effort since the time of the last review in early 2009. ATLAS TC oversees Assembly and Integration, Commissioning, M&O Organization and Upgrade Project planning and coordination. US ATLAS contributions to Technical Coordination have been an important factor in the successful assembly of ATLAS.

- As ATLAS has transitioned from a construction project to an operating experiment, there has been an accompanying evolution in the focus of US ATLAS TC. By design, the budget has decreased from recent years. US ATLAS TC is carefully targeting its activities in order to operate with its leaner role.

- Two new Technical Coordination projects were described in some detail: first, the development of a collapsible scaffolding to provide access to the "fingers" of the TileCal; second, the development of a guide tube to facilitate the installation of the Insertable B-Layer (IBL).

- There were no budget requests beyond target.

Comment

- The activities that US ATLAS TC is undertaking seem well suited to current US ATLAS plans and they appropriately leverage existing engineering and technical expertise.

Recommendations

None.

8. Upgrades

There is now considerable uncertainty in the LHC schedule and the luminosity evolution of the machine. The original plan for a phase one upgrade in 2014 followed by a phase two upgrade in 2017 is no longer viable. This has not been replaced by a new plan. The resulting uncertainty has a strong impact on the ATLAS upgrade R&D program. Upgrades based purely on detector aging and coping with as many as 200 interactions per event are not likely to be needed as soon as initially thought. Other R&D items, which are intended to address deficiencies in the detector, are less uncertain. Many items are dependent on moderate to long (3 to 8 month) shutdowns to be installed and are thus strongly tied to the LHC running schedule.

Finding: A broad program of R&D for future upgrades of the ATLAS detector was presented. The contemplated upgrades and improvements include

- An Insertable B-layer (IBL) for improved IP resolution and radiation hardness
- A fast, level 1.5, track trigger (FTK).
- Completion of "CSC" muon coverage at high eta with new chambers
- Inner detector replacement. This is a large, multi-part project including development of staves, sensor, powering, electronics, readout …
- Forward calorimeter replacement to cope with high luminosity
- Fine-grained all digital readout of the liquid argon calorimeters to improve L1 trigger turn-on at high luminosity
- High speed optical link development
- Refurbishment/replacement of TileCal power supplies
- Replacement of TileCal electronics

Comment: A clear, reliable LHC plan will likely only emerge after experience running the LHC, studies by CERN of upgrade costs and machine plans, and understanding of requirements for machine protection. Many parts of the ATLAS detector upgrade were "sold" on the basis of high luminosities with >200 interactions per crossing. The case will have to be reformulated in the context of revised plans. A clear understanding and presentation of operational benefits, luminosity-independent physics benefits, and luminosity-dependent benefits of the various upgrades would help in formulating a strong case.

Finding: The collaboration states that a decision to go ahead with a liquid argon upgrade project for the forward calorimeters might be made in 2012 and such an upgrade could be available as early as 2017. The decision would be based on experience in the 7 TeV run. Upgrades to the full LAr readout to enable all cells to be incorporated into the trigger are also being studied and R&D is proceeding on optical links, front-end, and readout chips. The timescale for a decision on this part of the upgrade is less clear.

Comment: An important component of the case for the liquid argon upgrades will be the demonstration of the physics benefits, in particular demonstration that the new electronics recovers the sharp turn-on curve typical of low luminosities. These studies are not yet available for the readout upgrade.

Finding: Mel Shochet of the University of Chicago presented a plan for a FastTracKer (FTK) upgrade. It is a new proposal for a device that will allow the tracking at an earlier stage of the trigger. The architecture is based on the successful CDF SVT trigger. It has prospects to be an important and useful system at moderate to high luminosity and has been favorably reviewed by ATLAS. The upgrade is motivated by physics arguments, by better overall trigger performance - especially at high luminosity - and by experience from the CDF Silicon Vertex Trigger (SVT).

Comments:

- A Fast Tracker has many attractive features, especially for heavy quark physics but also for the general physics program of ATLAS. As luminosity increases the ability to utilize hardware processing (FTK) provides increased capabilities of the overall trigger system. This upgrade is relatively straightforward and should be seriously considered for inclusion in the US ATLAS program. Studies and designs performed so far show good performance capabilities. A Technical Proposal exists and has been reviewed by ATLAS.
- This potential upgrade and other proposed upgrades and improvements to the detector will need to be considered as part of the overall improvement to the detector as the luminosity and energy increase. ATLAS, US ATLAS, US funding agencies and other relevant bodies will necessarily be involved in the decisions and prioritizations of the upgrades.
- Studies for the FTK will help inform possible inner tracker-trigger designs and a similar system is likely to be the basis of a next generation tracker.

Finding: The inner tracker replacement is the largest single component of the upgrade effort. Significant progress has been made in design and prototyping of the stave structure. Important progress has also been made on power delivery, chip development, and sensor qualification. The stave concept will be validated by working prototypes by the end of 2010.

Comments:

- Inner tracker R&D has progressed well, focusing on a short strip stave-based concept. The concept is well advanced, however given the long time before construction is likely to start, the collaboration should try to remain open to both incremental improvements and new concepts enabled by technical advances. The full inner tracker replacement is a major project and clearly cannot be funded within a fixed level of effort budget.

- The upgraded inner detector may well need to include some sort of track-based trigger, and there was some mention of adding triggering capability to the ABCN chip. This will not work well as an afterthought. Efficient trigger design depends on having a tracker geometry optimized for trigger connectivity. The stave geometry, which holds sensors ~2 mm apart would naturally accommodate a p_t-based track stub filter, but data transfer and connectivity issues may preclude utilizing a stave with the existing arrangement of chips.

Finding: The Insertable B Layer (IBL) has made significant progress in design and testing. A choice of sensor technology remains to be made. FEI-4 chip prototypes are ready to be submitted for production. The collaboration feels that a viable overall design has been developed. A draft TDR exists. Current planning has the detector available for installation in 2015.

Comment: Demonstration of good yield with a very large FEI-4 chip will be an important milestone. The demonstration will be important in understanding how future pixel detector readout chip yields scale. The IBL is similar in concept to D0 layer 0. In that program, emphasis on full scale mockups of the installation procedure, careful avoidance of ground loops through the detector, and careful grounding and shielding were all very important.

Finding: In FY11 work on the FTK and DC-DC conversion is "beyond the target" and is not currently funded. Parts of proposed work on IBL, muon electronics, Tile Cal front end electronics, and LAr control board replacement, are also currently beyond the target.

Comments:

- The upgrade program has properly focused on maintaining US intellectual leadership in areas where US groups have played a leading role. This effort has to be balanced with operational and physics needs. In a flat budget scenario it may be difficult to support all initiatives. If items are unfunded some personnel will not be supported and there will be delays in delivery of these items. In the longer term, US leadership and experience in some areas may be lost. The delay in the high energy and luminosity program alleviates some time pressure, but also complicates choices. Deferring these choices until the future is perfectly clear may neither be possible or optimal.

- There was no specific item-by-item discussion of the tradeoffs involved in funding decisions. In general funding allocations and priorities for the upgrade appear reasonable. For example DC-DC conversion R&D is being pursued by CMS, and that work in U.S. ATLAS was deferred into FY11. New initiatives, such as the FTK, are not yet funded. The current situation is different than the construction phase in the sense that future improvements are now in tension with operational needs and incremental improvements to the performance of the current detector.

- There have been recent indications that, given the long time scale for some of the upgrades, the DOE would like to move some of the R&D work into a "generic" program. It is difficult to understand how a complex multifaceted program with many experiment-specific components can be efficiently and successfully managed as a "generic" R&D program if placed outside of the US ATLAS context.

Recommendation: A flexible long-term plan which can provide a plausible envelope for the necessary R&D within a fixed level of effort funding scenario should be developed and probabilities for funding currently unfunded projects should be understood. It does not appear that the full breadth of the program can be sustained within a flat funding scenario.

9. Software and Computing Facilities

Findings

- The US has done about 50% of the data reprocessing earlier this year, and serves about 50% of all data requests to ATLAS analysis jobs world-wide. Data were available for analysis at US Tier-2 centers within a few hours after initial reconstruction at CERN

- The BNL Tier 1 (T1) facility has shown world-leading performance. US ATLAS has deployed the full 2010 resources as pledged, and thus provides about 23% of the ATLAS T1 resource needs

- The procurement model now allows getting large disk installations on the T1 floor within a month or two.

- Tier-3 centers in ATLAS took off during 2009-10 and S&C helps with organizing these efforts. ATLAS has adopted the US ATLAS model of how to setup Tier-3 sites. There is a lot of activity around this area, and efforts are ongoing on to make running and using Tier-3 sites for physics easy.

Comments

- Software and computing are in good shape.

- The committee commends ATLAS for the good performance of computing and software systems for start of data taking. The US is certainly doing its share.

- The project organization is in good shape with a successful reorganization and a new management team. The US is also well represented in the overall ATLAS software and computing organizations.

- The T1 facility infrastructure is in good shape, the network is sufficient and will be extended with an additional 10Gbps link by ESnet to address increasing demands, and the facility deployment model is flexible and very successful.

- The Tier-2 program is very successful. The US ATLAS Tier-2s attract users to perform analysis, while also providing the brunt of MC processing power. The funding level is constant, but for the moment sufficient to support the required level of resources.

- The US provides strong contributions to ATLAS software and the US provides leadership in important areas. (See Section 9.)

- The performance improvement efforts seem very successful and should be commended.

- While the computing and software systems are performing very well, the data samples are still tiny compared to what is expected. Performance and throughputs have been successfully tested, but there are still large uncertainties when scaling to full operations, including the 6 order of magnitude increase in luminosity that lies ahead.

- Tier-2s are playing an increasing role in distributed analysis, and Tier-3 sites are coming into play. This will require more effort in the areas of distributed analysis support and user documentation.

- The agreements with Tier-2 sites are running out, and these agreements should be renegotiated. This process has started and should be continued.

- Recently ATLAS presented new estimates of computing resource needs, with significantly reduced requests for disk resources in 2011 and 2012. These reductions would mean that the US would no longer have a complete ESD sample, and would not even host a complete AOD sample.

- While within the envelope of the previous resource plans these functions were provided as part of the nominal Tier-1 functionality, and thus could be provided within the pledged resources, with the new lower ATLAS resource requests this may no longer be the case. The committee feels that not having full data samples on the level of ESD at BNL has large potential risks for US-based analysis and for the full functionality of US Tier-2 sites.

- While now BNL functions as an important analysis site, it is feared that with the new smaller resource request this function is at risk, as it is not part of the ATLAS Tier-1 role. However, a US-based analysis facility at BNL was part of the original project scope, and the Committee advises to seriously consider maintaining such a functionality at BNL as important for US-based analysis.

Recommendations

- Make sure that the distributed analysis support model, which is based on volunteers, is sustainable, e.g. by providing Cat-1 shift credit for participation in these efforts.

- Reduce the scope of the Tier-1 facility to providing the appropriate percentage (23%) of the total ATLAS resource requests, which will free significant funds for other uses.

- The proposal for providing enough disk space at BNL to store a complete ESD and AOD/dESD copy plus 0.5PB for specific RAW-based studies (at estimated costs of $880k/630k in FY10/11), should be included in the priority list of US ATLAS projects.

- Clarify and define the role of the BNL facility as a physics analysis facility, in terms of needed resources, size, scope, and how it interacts with the US community, the Tier-2 centers and the Tier-1 facility, so such a facility can be considered to be re-included in the baseline plan.

10. Physics Analysis Support and Software

Torre Wenaus, the US ATLAS subsystem manager for Physics Support and Computing, gave an overview of the activities in that area over the last year. Jim Cochran and Peter Loch provided details about Analysis Support activities and Software development and maintenance, respectively.

Findings

Torre Wenaus and Stephane Willocq have taken over leadership of Physics Support and Computing from Jim Shank and Srini Rajagopalan, who have moved on to positions in international ATLAS.

- With the advent of real data (both cosmic and collisions) this has been an understandably active period of time for this effort in US ATLAS and there have been many noteworthy accomplishments. PanDA has become the ATLAS standard framework for distributed analysis. The processing of data and the distribution of those results to Tier-2 sites was very successful. There is an effort to institute a "feedback loop", in which real-world experience with software and data analysis is reviewed, and the lessons learned are applied to design a variety of improvements.

- In total, the US ATLAS Tier-3 sites anticipate having over 500 people analyzing data. A dozen workshops were held over the last year in order to educate some of these users in the use of the US ATLAS physics analysis software. Various metrics have been examined in order to gauge the effectiveness of the Analysis Support effort.

- The US ATLAS Software effort is significant in scope, with a large variety of activities ranging up and down the software stack. The existing software has achieved a useful degree of functionality. The ongoing effort is aimed at building on that. There are efforts aimed at making more efficient use of hardware (e.g., the multicore investigations), more effective use of the computing model (e.g., the Tier-3 VM work), and to make the software a more effective tool for physicists (e.g, event selection service).

- There were no budget requests beyond target

Comments

- The data replication from CERN to the BNL Tier-1 was very successful. The US ATLAS Tier-1 performance is a clear stand-out among the ATLAS Tier-1 sites.
- The successful use of PanDA across ATLAS is a development for which the US ATLAS computing effort should be commended.

- The deployment of a caching front-end to the conditions database was also a significant success, forestalling a potential bottleneck involving a central database. It was, in addition, a demonstration of coordination between US ATLAS and US CMS computing.
- The fact that real physics results are being produced by physicists using this software ecosystem is a long and eagerly awaited development and is commendable.

Recommendations

- In arguing for the needs of Physics Support and Computing, recast those arguments to emphasize the degree to which particular elements enable the leadership of US ATLAS physicists.

- A more defensible assessment of contribution of US ATLAS Software (WBS 2.2) to the overall ATLAS effort should be developed.

11. Project Management

Findings

- ATLAS and US ATLAS had a very successful year. The detector and offline systems are working very well and the collaboration is shifting to commissioning, operations and physics analysis.
- ATLAS experienced its first collisions in late 2009 and had its first physics publication a few months later.
- A re-written program management plan (PMP) and new organization has been established that will provide a mechanism for collaborative input regarding appointments and strategy
- The budget in FY 11 and 12 is of order $37M/year. There is currently about $1M in management reserve and calls for about $3M in requests "beyond the target".

Comments

- We should be basking in the glory of first 3.5 TeV on 3.5 TeV collisions, a superb detecting instrument and first physics results just around the corner. It is unfortunate in the light of these successes to have to worry about how to plan for the future, given the current and expected constraints on science funding.

- The PMP is an important step in achieving more collaboration input and consensus as US ATLAS makes decisions regarding its leaders, as well as in developing a long term strategy for where it wants to maintain or increase its current scientific and technical leadership.

- The management reserve at the moment is too low for this stage of the project and potential known and unknown problems that may be awaiting it.

- DOE is now struggling with the issue of detector upgrades. With the change of the LHC Machine operating plans, the motivations for some of these upgrades have changed. Nevertheless, these upgrades are still needed. The arguments for building them need to be reframed in terms of insurance policies, enhancements, and achieving TDR specifications, not in terms of occupancy and radiation damage.

Recommendations

- Try to control/curb spending this year and next such that the management reserve can be built back to a level ~10% of the overall budget for the start of FY12.

- Establish a concrete proposal for an upgrade plan – without too many options. In the short term, these upgrades should be relatively modest in cost and scope and installable within a "typical" downtime.

- Go through the exercise of dealing with an M&O budget that is flat+2% growth for the next 5 years. What would US ATLAS do? Include your thoughts on how to fund the above upgrades within those constraints. What would US ATLAS want to retain in terms of its scientific and technical leadership and what areas is US ATLAS willing to give up? Based on the above financial plan, write down a series of impact statements describing what is lost (or being given up) as a result of this flat funding scenario so that the funding agencies understand what they are potentially losing..

Appendix A

Charge to the Reviewers

Dear Review Panel Member,

I would like to thank you in advance for your willingness to participate in the annual U.S. ATLAS Research Program Manager's Review scheduled for April 1-2, 2010 at BNL. Below, I provide the charge for this review, which is tailored to address most of the issues that are likely also to be covered in a May review of the U.S. LHC programs carried out by the DOE and NSF.

The primary purpose of the review at BNL is to assess the quality of management of the U.S. ATLAS program, the status of U.S. contributions to ATLAS in detector operations and commissioning, software and computing, support of detector performance and physics analysis, and planning for upgrades over the next several years. Toward that end, I would like you to address the following specific issues, and to advise me regarding any recommendations for improvement:

1) Assess the quality of U.S. ATLAS management decisions about allocation of resources among collaborating institutions, and among detector, computing and upgrade R&D needs.
2) Does management have the tools, strategies and organizational structure in place to monitor subsystem progress, track program scope, prioritize activities and respond to unforeseen technical or funding challenges? Are management reserve funds sufficient for this purpose?
3) Are the U.S. technical contributions to ATLAS performing at a level suitable for the planned 2010-11 LHC run? Are areas of potential vulnerability being addressed in timely and cost-effective ways?
4) Is the investment in, and progress on, ATLAS upgrade R&D projects suitably matched to LHC's evolving upgrade plans and to the DOE/NSF outlook toward U.S. participation in upgrade construction projects?
5) Are the costs of managing and administering the U.S. ATLAS program reasonable?
6) Are there sufficiently well developed plans for providing tools and access to LHC data for the U.S. collaborating institutions to perform efficient data analysis? In particular, is the performance and support of the U.S. Tier 1 and Tier 2 computing centers sufficient to meet anticipated demands?
7) Are the metrics provided by U.S. ATLAS sufficient to determine the effectiveness of the Analysis Support effort? Is the support effort achieving the goal of empowering U.S. physicists to fully participate in the LHC physics program?
8) Assess the U.S. planning to meet personnel needs during the early years of LHC operation, within a budget outlook that is likely to support no more than constant levels of effort.

9) Given the current LHC schedule (a long run in 2010-11, and a yearlong shutdown in 2012), assess the impact on computing hardware needs, and on maintenance needs in 2012

I look forward to seeing you all in early April at BNL, and to receiving your advice on U.S. ATLAS progress and management.

Best regards,
Steve Vigdor

Appendix B

Agenda

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08:30	Executive Session (30')	
09:00	Overview of U.S. ATLAS (40') (Slides)	Mike Tuts
09:45	U.S. ATLAS Management: Resources, Planning, and Priorities (20') (Slides)	Howard Gordon
10:05	Overview of M&O (25') (Slides)	Frank Taylor
10:35	Coffee Break	
10:50	Silicon M&O (25') (Slides)	Alex Grillo
11:20	TileCal M&O (20') (Slides)	Larry Price
11:40	TRT M&O (20') (Slides)	Harold Ogren
12:00	Muon M&O (25') (Slides ; movie)	Jim Bensinger
12:30	Lunch	
13:45	Trigger/DAQ M&O (30') (Slides)	Andy Lankford/Reiner Hauser
14:15	Technical Coordination (20') (Slides)	Ven Polychronakos
14:35	Overview of Upgrade R&D and Construction Projects (55') (Slides)	Abe Seiden
15:35	Insertable B-Layer (IBL) (35') (Slides)	Maurice Garcia-Sciveres
16:15	Coffee Break	
16:30	Forward Muon Upgrade R&D (25') (Slides)	Ven Polychronakos
17:00	Fast TracKer (FTK) (25') (Slides)	Mel Shochet
17:30	Executive Session (1h30')	

19:00	Dinner	

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09:00	Liquid Argon M&O (30') (Slides)	Ryszard Stroynowski
09:30	Overview of Physics Support and Computing (40') (Slides)	Torre Wenaus
10:15	Analysis Support (40') (Slides)	Jim Cochran
11:00	Coffee Break	
11:15	Facilities and Distributed Computing (45') (Slides)	Michael Ernst
12:10	Software (30') (Slides)	Peter Loch
12:45	Lunch	
14:00	Executive Session (1h30')	
15:30	Closeout (20')	