

Coordinating Equipment Removal and Installation In Anticipation of EIC

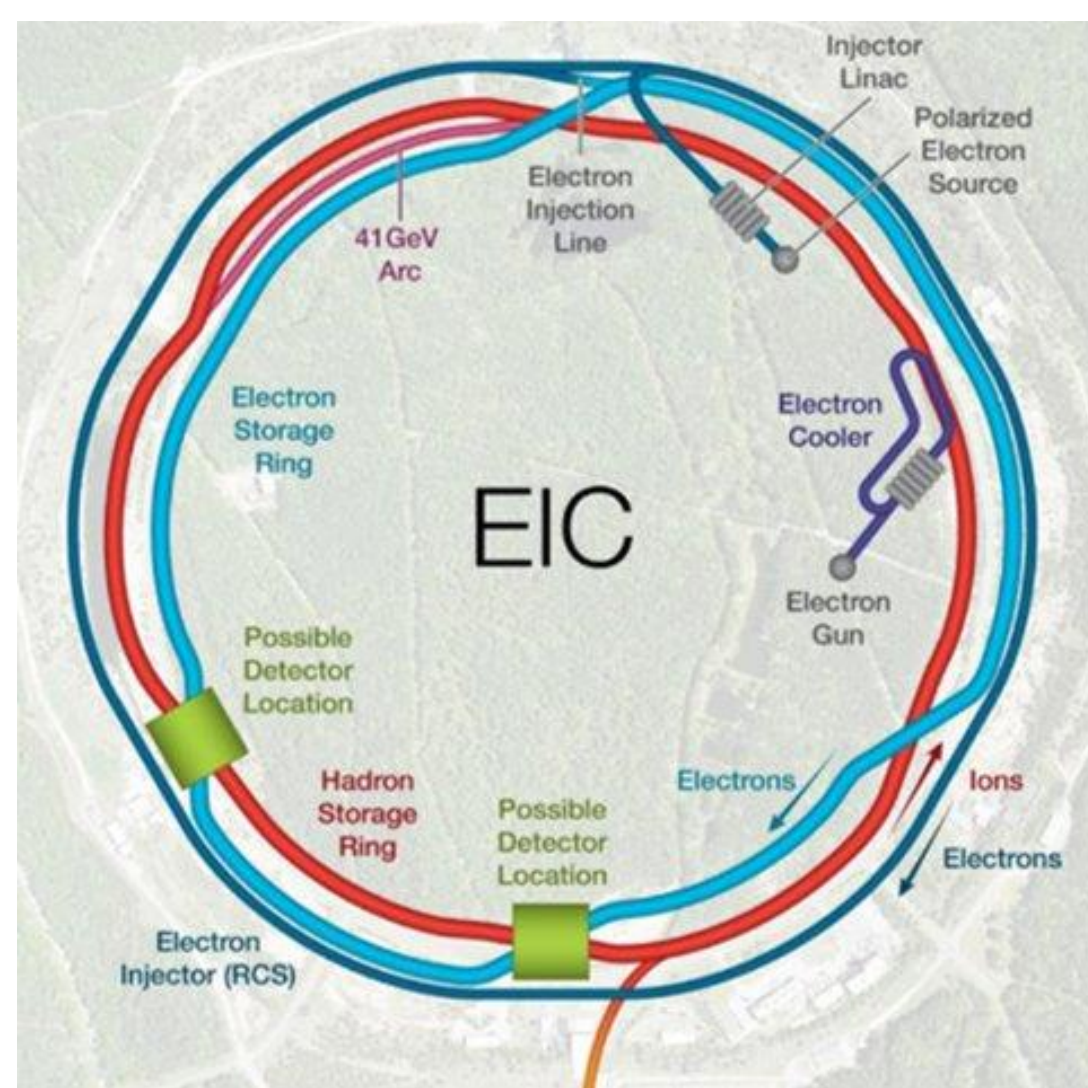
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Abstract

As accelerators become more complex over their lifespan it becomes increasingly important to document and plan for the removal of obsolete equipment as well as the installation of new components. The Electron Ion Collider at Brookhaven National Laboratory is no exception where coordinating the removal and installation must take place in the years prior to beam commissioning. This presentation will discuss the planning and consideration for these removals and installations in the coming years.

Introduction

The Electron-Ion Collider (EIC) is a new facility which will be built at Brookhaven National Laboratory. EIC will explore the most fundamental building blocks of all visible matter, specifically focusing on the inner workings of gluons which “glue” together quarks. The EIC will consist of two intersecting accelerators, one producing an intense beam of electrons and the other a high-energy beam of protons or heavier atomic nuclei which are steered into head-on collisions. The design utilizes some of the existing infrastructure including existing ion sources, pre-accelerator chain, one of the ion storage rings as well as other components of the Relativistic Heavy Ion Collider (RHIC). Additionally, a new electron source, accelerator and storage ring will be added inside the existing collider tunnel.



The scope of this project requires a detailed schedule for removing obsolete equipment along with the subsequent staging and installation of EIC equipment. There has been extensive documentation and planning for the removal and installation of equipment. A detailed explanation of this process to date will be discussed here.

Removal Documentation

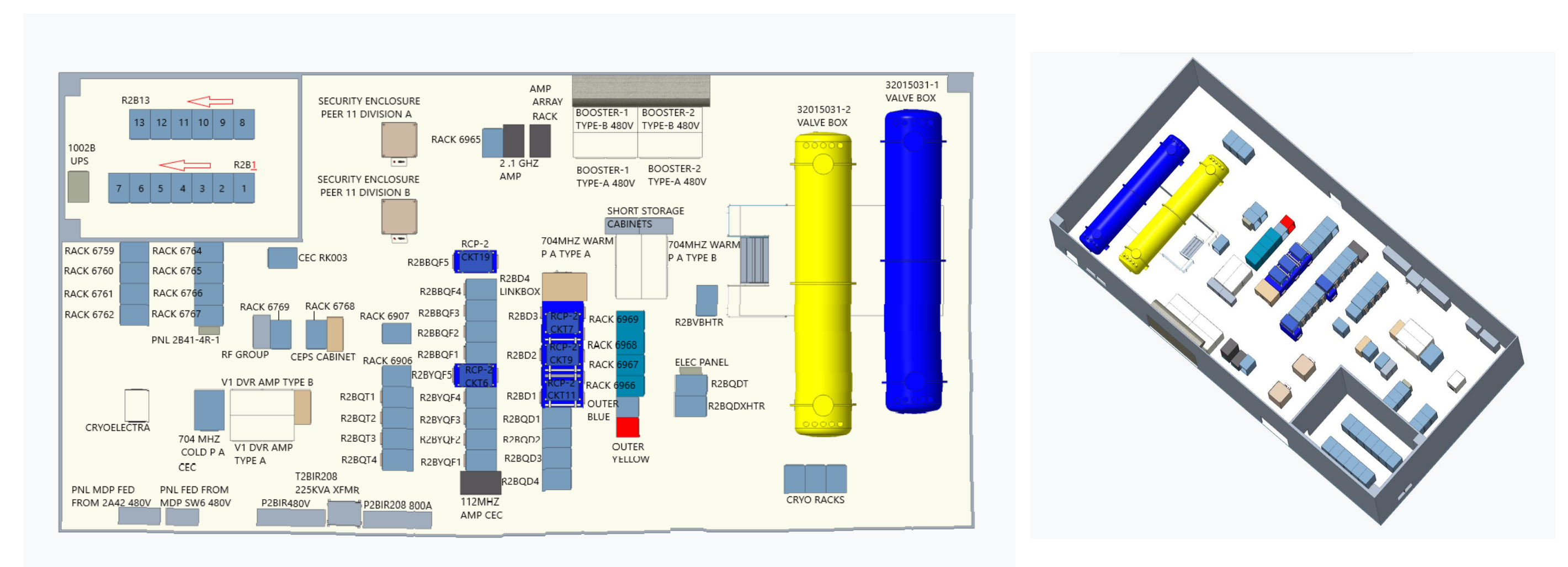
Due to the nature of the design, there is a significant amount of infrastructure which will remain in the RHIC tunnel and support buildings. Conversely, there is a substantial amount of equipment which will become obsolete once RHIC program concludes in 2025. With the limited amount of space available, and since new equipment cannot be installed until obsolete equipment is removed, careful planning beforehand is paramount. The first step in accomplishing this task is to identify available space which can be utilized for new equipment or components which are being relocated. One way this is being detailed is through rack space within the alcoves in the RHIC tunnel and support buildings.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |
|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |

Documentation has been created and details all the elements which are counterparts to the tunnel equipment. The rack documentation details the rack name, contents within the rack, rack dimensions, and the intentions for the listed equipment. These intentions are defined in a work breakdown structure description that goes by arc sextant and fall under four categories: stay, move, repurpose, or remove. Equipment that is denoted with a ‘stay’ designation is intended to be used in the Hadron Storage Ring (HSR) and will remain in place. Those with the ‘move’ designation are for components which are still expected to be used but will be re-assigned to a new location in the ring. Equipment labelled for ‘repurpose’ are for components that can be reused as spares and will be removed and set to storage. Components no longer deemed useful for EIC will be ‘removed’ and sent for disposal.

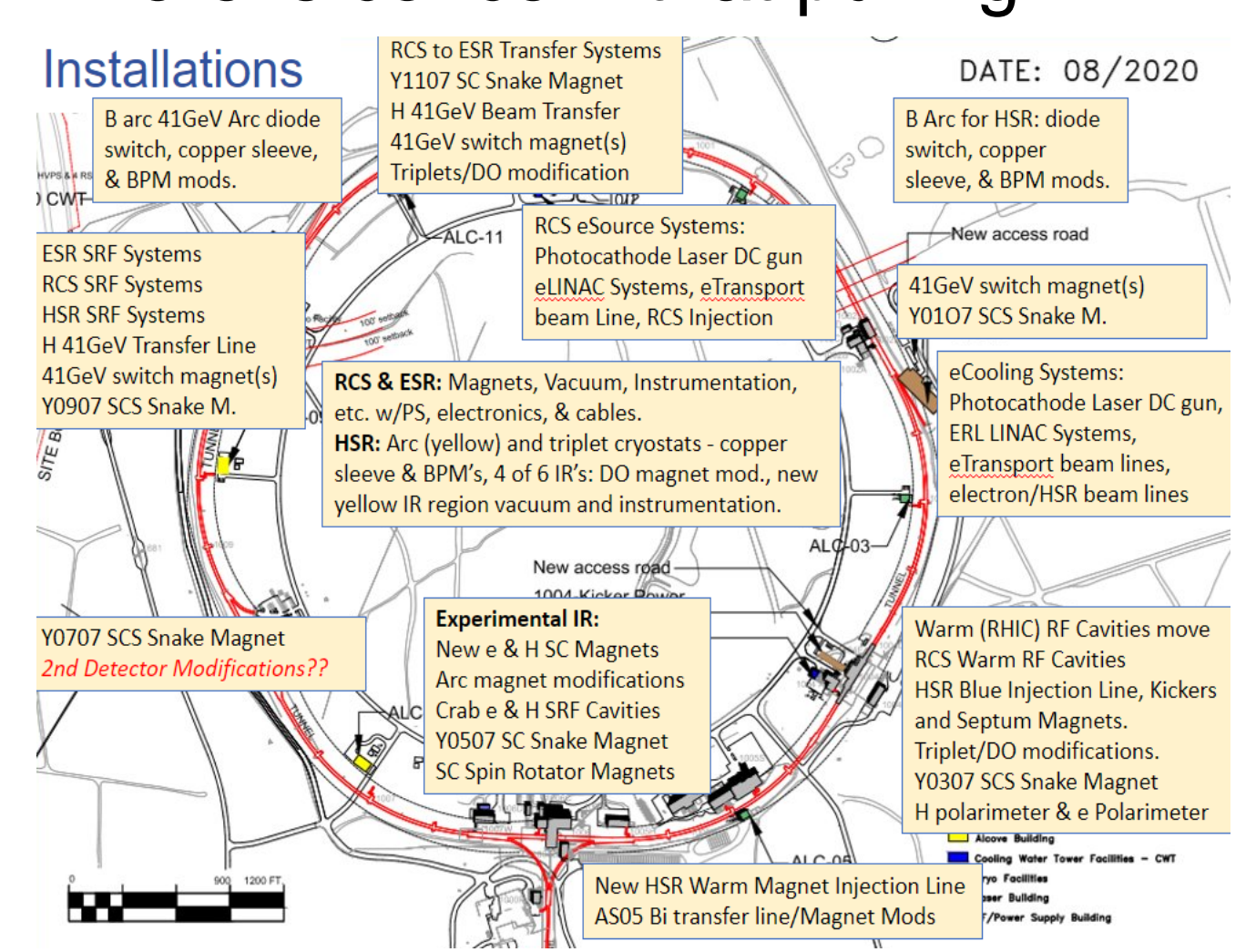
Service Building Modeling

Another element of the removal and installation documentation is to quantify the amount of available floor space once obsolete equipment is removed. Part of the process is to document the size of support buildings (square feet) and additionally detail the orientation for these buildings, including the layouts of racks, valve boxes, etc. This can serve as a functional space blueprint either in the form of rack space or for new/moving equipment. The goal is to maximize this real estate and alleviate the demand on new support buildings. Current layouts are being modeled for all of the current support buildings. Subsequently, these will later be used for the installation blueprints to detail where repurposed equipment and new racks will be established.



Looking Ahead and Installation

While we are years away from the installation process, it is important to consider what lies ahead for planning purposes. This allows time to consider pitfalls in the planning process and consider ideas to mitigate these issues. One of these arose while documenting cables which traverse between the tunnel and the support buildings. It would seem easy enough to simply remove all cabling for obsolete equipment to allow space in cable trays for incoming components. However, as RHIC evolved, the cable trays became increasingly full with layers of old and new cable becoming intermingled. There is concern that pulling cable may damage the cable that is needed to stay. It was proposed that some of the obsolete cable be reused for new equipment being installed which could save both time and cost. This task will most likely be implemented for components such as instrumentation, vacuum, etc. but is still being considered for power supplies as specific magnet requirements are still being defined.



Summary

The EIC will be a unique and exciting new accelerator complex, bringing about new challenges. Due to the nature of its design in utilizing both new and pre-existing infrastructure, EIC will bring about complicated issues: both in continuing running the RHIC program up to 2025 and installing the EIC machine. By preparing all the steps in detail we hope to minimize the complexity of these issues and seamlessly transition to the next chapter of accelerator science at Brookhaven National Laboratory. Thus far, detailed lists of equipment and their subcomponents have been generated to identify available rack space which will be intended for new equipment installation. Additionally, building modeling is utilized to specify floor space which can be used for additional racks or equipment. Moving forward this will be useful in planning for the installation phase.