ESS NAMING CONVENTION

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Abstract

The European Spallation Source is an intergovernmental project building a multidisciplinary research laboratory based upon thermal neutrons. The main facility will be built in Lund, Sweden. Construction is expected to start 2013 and the first neutrons will be produced in 2019. The ESS linac will deliver 5 MW of power to the target at 2.5 GeV, with a nominal current of 50 mA. The ESS Naming Convention is based on a standard, originally developed for the Super Superconducting Collider (SSC) and later adopted by other large research facilities, e.g. the Spallation Neutron Source (SNS), Facility for Rare Isotope Beams (FRIB), International Thermonuclear Experimental Reactor (ITER), and the Continuous Electron Beam Accelerator Facility (CEBAF). The ESS Naming Convention was agreed upon and approved at a very early stage of the ESS project in order to establish a standard before names started to evolve. The main scope was to standardise meaningful, yet short and mnemonic signal and device names. The present paper describes the naming convention, the site wide implementation at ESS and associated web based tools.

INTRODUCTION

The ESS Naming Convention [1] is mainly intended for the operational phase of ESS [2]. Given millions of signals to control and thousands of devices to operate, clear communication is essential among operators, physicists and engineers. Therefore the naming of the devices and signals must be mnemonic.

From the Integrated Controls Systems (ICS) perspective, all equipment is modelled as a device. Device is the basic unit of ICS granularity, i.e, it is the smallest part that stands alone and is loosely coupled to other parts of the ICS. Device is an abstraction that can represent either single pieces of equipment or higher-level entities of the ICS e.g., device models, subsystems or instruments. A device name follows the format:

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SSSS-BBBB:DDDD-III
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where the name components are shown in fig. 1. The signal names associated with a particular device are constructed by appending the signal components to the device name. The format does not specify minimum or maximum lengths of the name components. However, for practical reasons the length is limited to 32 characters in total.

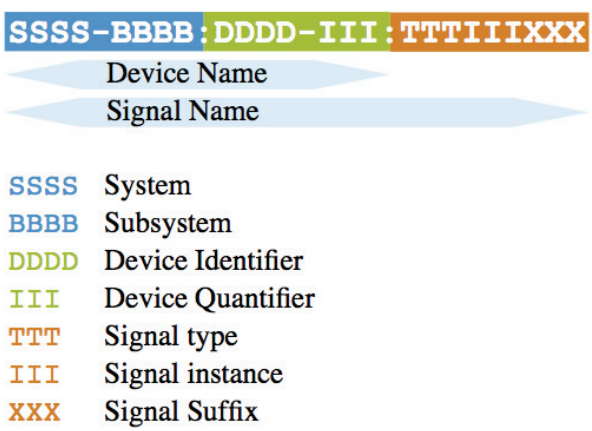

Figure 1: ESS Naming Convention

The format of device names can be used to name equipment in general, including for example cables.

A device can reside inside another device, as shown in fig. 2. Devices are however not organised hierarchically through the naming convention. The parent-child relation among devices can instead be found in other structures where the names are used.

Device names shall further not be confused with inventory identification since device names reflect where devices are installed and in which context these are used. In addition, when a device is replaced, the new device inherits the name.

In general, equipment at ESS will be assigned identification codes. Several identification codes will be associated with the equipment represented by each device, in for example work break down structure (WBS), project break down structure (PBS) or other project management systems, inventories as well as the BSAB 96 codes used by conventional facilities. To avoid confusion the device names have to be clearly distinguished from other identification codes of equipment:

1. Equipment identification codes other than device names must not be mnemonic, i.e. it shall not contain abbreviations or acronyms. Having parallel conventions for mnemonic names will inevitably cause confusion.

2. Equipment identification codes other than device names must not simulate the naming convention syntax.

Given the device name it shall be possible to look up the equipment in the inventory or similar systems. Furthermore the device names shall be used in these systems as attributes so that for example device names can be displayed on schematics and drawings.

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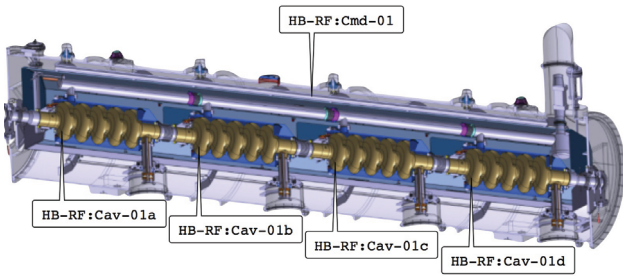

Figure 2: There are four cavities (Cav) inside a cryomodule (Cmd). The hierarchal structure cannot be resolved from the device names.

DEVICE CATEGORY STRUCTURE

Throughout the facility we can expect to have thousands of different kind of devices. Devices are therefore categorized on three levels:

Level 1. *Discipline*: Branch of knowledge that indicates the context in which a device is used, such as vacuum (Vac), water cooling (WtrC), proton beam instrumentation (PBI), etc.

Level 2. *Generic Device Type*: Two devices of the same generic type provide the same function, such as pumps, (Pmp), controlled valves (CV) or beam loss monitors (BLM).

Level 3. *Specific Device Type*: Two devices of the same specific type are identical from a controls perspective and among others have the same set of control signals.

Naming convention users prefer to use generic device type (level 2) as device identifier DDDD in the names. however users are still responsible for selecting the correct specific device type (Level 3), which is essential for configuration of the control system.

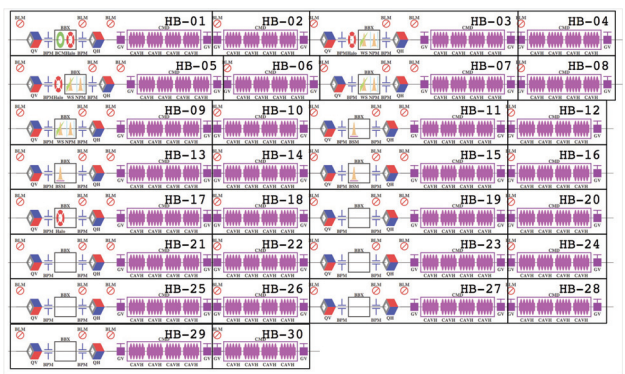

Figure 3: The high beta linac contains 120 super conducting elliptical cavities. The section is divided into 30 numbered subsections, each containing one cryomodule, one pair of quadrupoles as well as vacuum and beam diagnostics devices.

AREA BREAK DOWN STRUCTURE

From the operational point of view it is beneficial to have names mentally linked to physical location. This would help physicists, operators and engineers to orient themselves on the site relative to named technical systems. Devices are therefore sorted under a three level area break down structure:

Level 1. *Super Section*: High level zones and buildings such as Target Station, Accelerator, Neutron Science Instruments and Utilities.

Level 2. *Section*: Accelerator sections correspond to the accelerating structure used along the linac. For example the High Beta Linac (HB). Sections under Utilities are the Water Cooling plant (WCP), Cryo Plant (CrP) etc.

Level 3. *Subsection*: Each of the accelerator sections contains devices of a several disciplines in a repetitive pattern. Therefore the accelerator subsections are numbered, e.g., the first subsection of High Beta Linac (01) shown in figs. 3 and 4. The High Beta Water Substation (HBWS) is a subsection under the Water Cooling Plant.

The target division has a PBS organised in two levels which has been imported as section and subsection into the area break down structure.

The area break down structure is likely to need modification after the building design has been completed. Conventional facility will therefore use a numbering system as identifications for buildings, rooms and sections, which is independent on the ESS Naming Convention. They have however agreed to label structures with section-subsection names from the area breakdown structure.

NAME CONSTRUCTION

All information needed to construct device names, except for the quantifier III used to distinguish identical device identifiers DDDD (device instances) of the same system-subsystem SSSS-BBBB, are contained in the device category and area breakdown structures. Names will be constructed differently depending on the section a devices belongs to. This is due to the fact that target and accelerator, which both are complex systems, are very different. Accelerator sections have many devices of several disciplines in a repetitive pattern while the target, which has considerably fewer devices, has a large fraction of unique equipment. Both divisions agree to use the section names as systems names SSSS and the generic device type as device identifier DDDD. However, as subsystem BBBB the target division uses the subsection convention name while accelerator division uses the discipline convention name. As quantifier III the accelerator division uses the subsection number in combination with letters as quantifier as shown in fig. 4

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Therefore, systems SSSS (sections) are assigned either as accelerator-type (A) or target-type (T) with different methods to construct names:

System SSSS

Section convention name from level 2 in the area break down structure

Subsystem BBBB

T: Subsection convention name from level 3 in the area break down structure

A: Discipline convention name from level 1 in device category structure

Device Identifier DDDD

Generic device type convention name from level 2 in device category structure

Device Quantifier III

T: Alphanumeric characters to differentiate devices of the same generic type within the same subsection.

A: Subsection convention name (a number) from level 3 in the area break down structure immediately followed by alphabetic numbering (a, b, c or d etc.).

Having managed to consistently name devices for both target and accelerator we are confident that other parts of the facility can be named using the same underlying structures and tools.

TOOLS

Web-based tools are under development to support the process of naming devices. Use-cases are being studied to collect requirements, e.g., filtering and sorting capabilities, as well as automated name generation. The tool shall also enforce the syntax and ensure a set of rules to be fulfilled. The naming tools will be part of ICS's central data management system BLED (beam line element databases) [2].

To assure integrity of names the naming convention users will be asked to select discipline and device type from device category structure as well as section and subsection from area break down structure. Users should not have to be informed in detail on definitions of section, subsection, discipline or the distinction between generic and specific device types. Neither should they have to keep track of whether a device name is generated as A or T-type. The user will instead be asked to select device from the device category structure displayed in a three level menu type list. Likewise, users will be asked to select section and subsection by answering the question "Which part of the facility does the device provide service to?". The naming tool will automatically generate the names and ensure a set of rules:

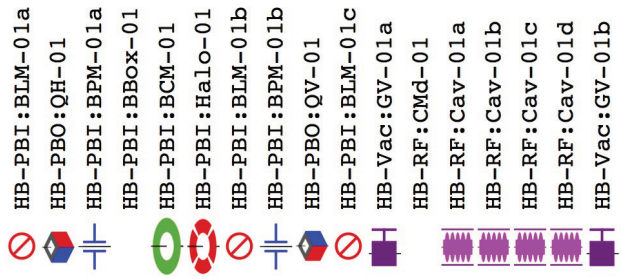

Figure 4: Layout of the first High Beta subsection (HB-01) with devices from the disciplines Radio Frequency (RF), Proton Beam Instrumentation (PBI), Proton Beam Optics (PBO) and Vacuum (Vac).

1. Convention names for section, subsection, discipline, generic device type and signal part of names shall be alphanumeric.
2. First character of convention names for section, T-type subsection, discipline, generic device type and signal part of names as well as quantifier for A-type devices shall be alphabetic.
3. Convention name for A-type subsection shall be numeric.
4. Convention names for section, discipline, device name and signal name shall be unique irrespective of
   (a) Letter case
   (b) Letters I, l and number 1
   (c) Letter O and number 0
   (d) Letters V and W
   (e) Leading zeros, i.e., number 0 immediately following a non-numerical character
5. Convention names for subsection and generic device type shall be unique according to rule number 4, however only within the same section and discipline, respectively.
6. Leading zeros shall be used to ensure that all numbers have the same number of digits.

REFERENCES

[1] G. Trahern, M. Rescic and K.Rathsman, "ESS Naming Convention", http://eval.esss.lu.se/cgi-bin/public/DocDB/ShowDocument?docid=4

[2] S. Peggs ed., "ESS Technical Design Report", https://dl.dropboxusercontent.com/u/24187786/ess/TDR_final_130423_blue.pdf

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