The European Spallation Source Control System

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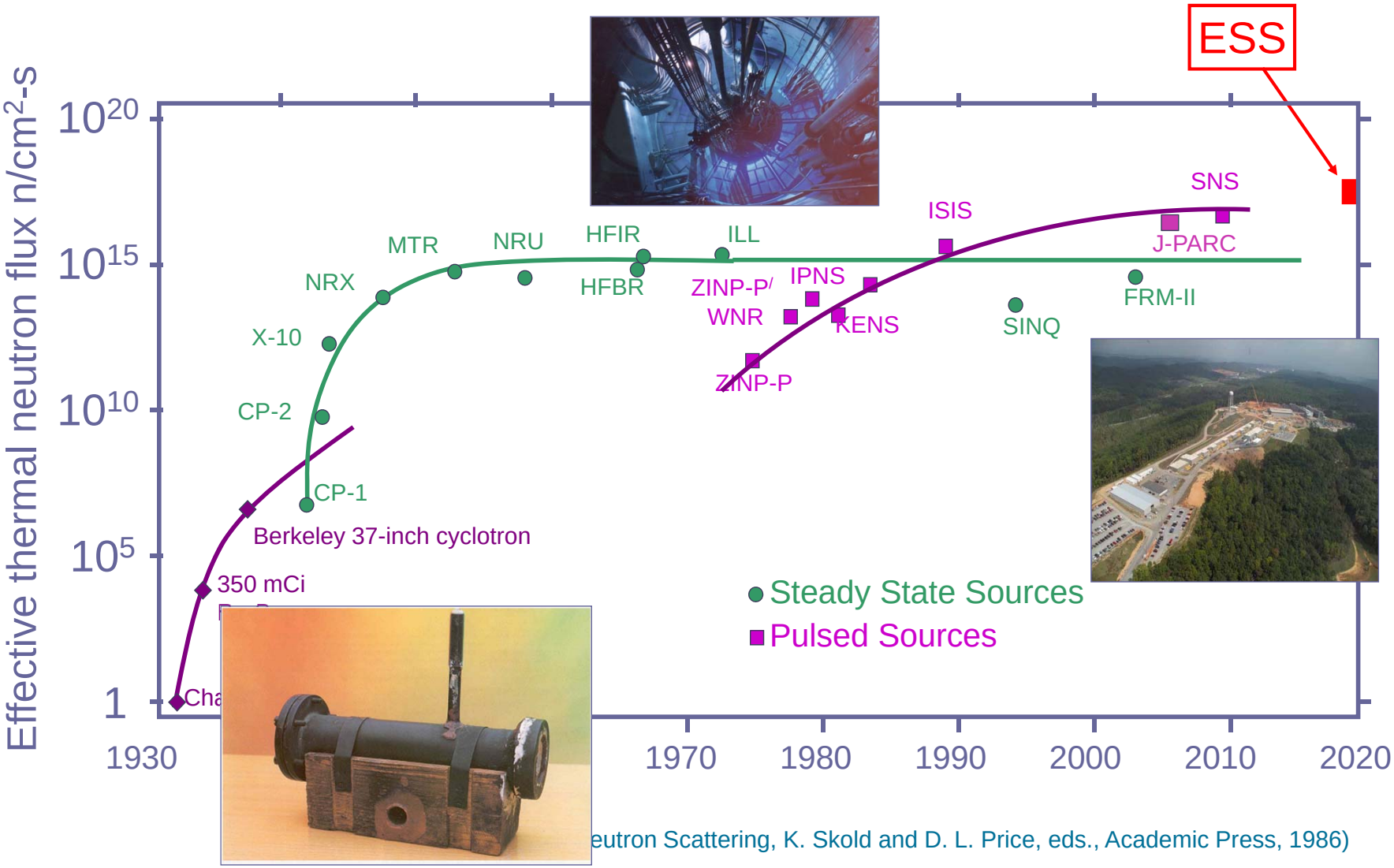
The ESS site is in Sweden !

Sweden, Denmark & Norway cover 50% of cost

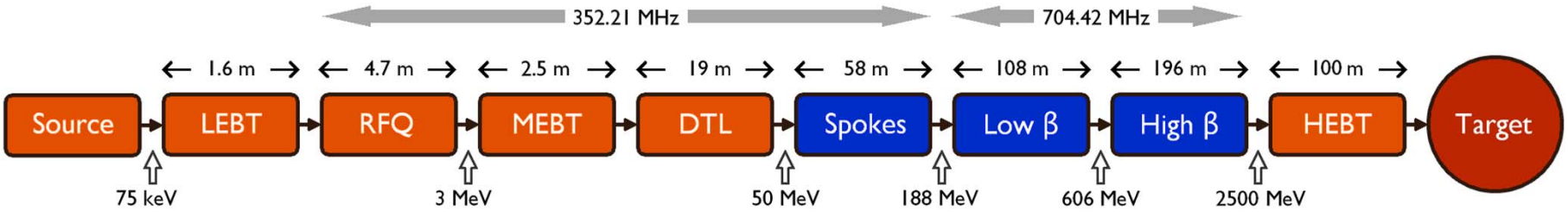
The other 14 member states covers the rest, with the European Investment Bank

Evolution of neutron sources



eutron Scattering, K. Skold and D. L. Price, eds., Academic Press, 1986)

Neutrons in 2019 !



5 MW	beam power
2.5 GeV	protons (H+)
2.9 ms	pulses
14 Hz	rep rate
50 mA	pulse current
704 MHz	RF frequency
< 1 W/m	beam losses
7.5 MW	upgradability?

Green field site

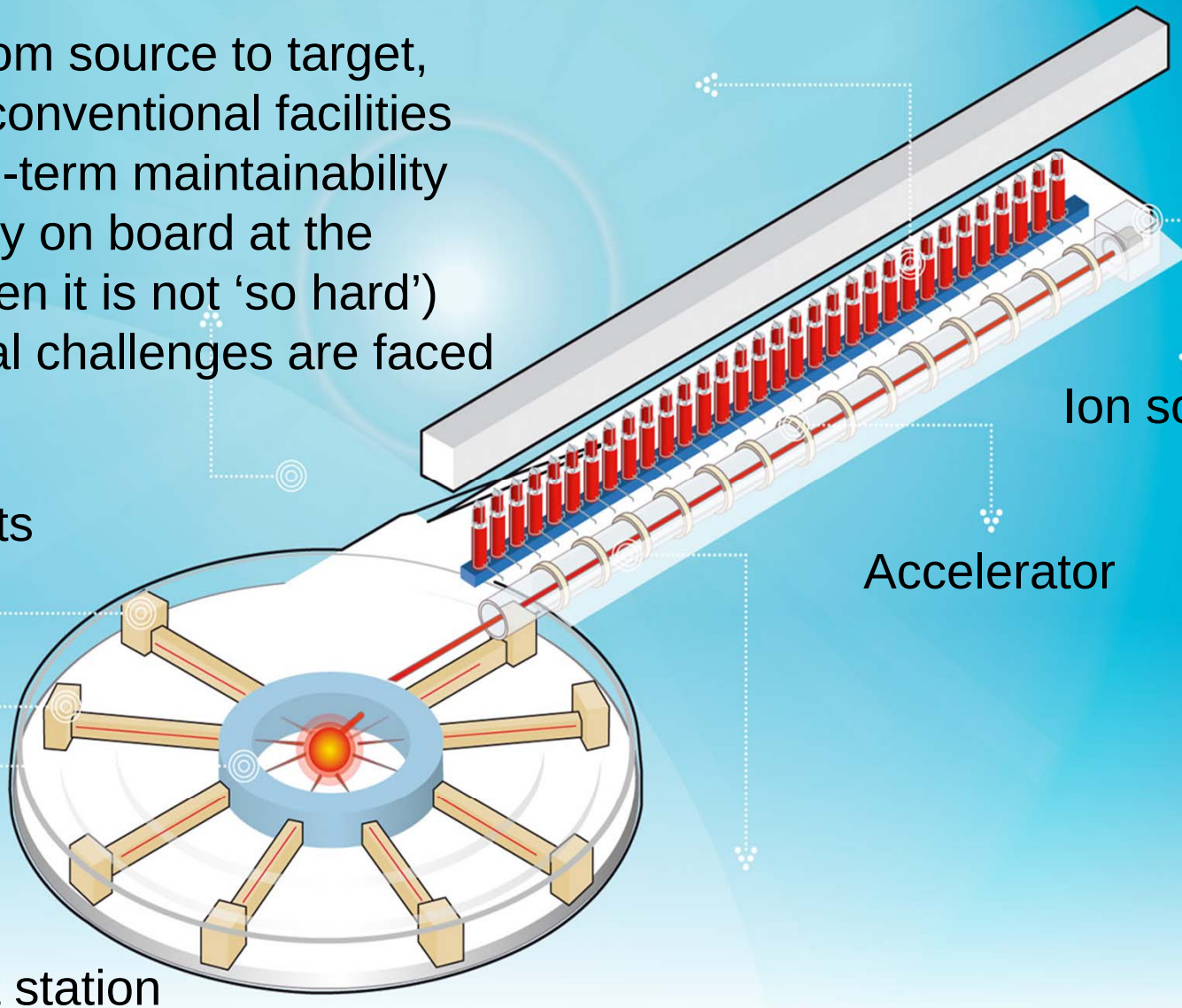
No H- injection,

No accumulator/compressor ring !

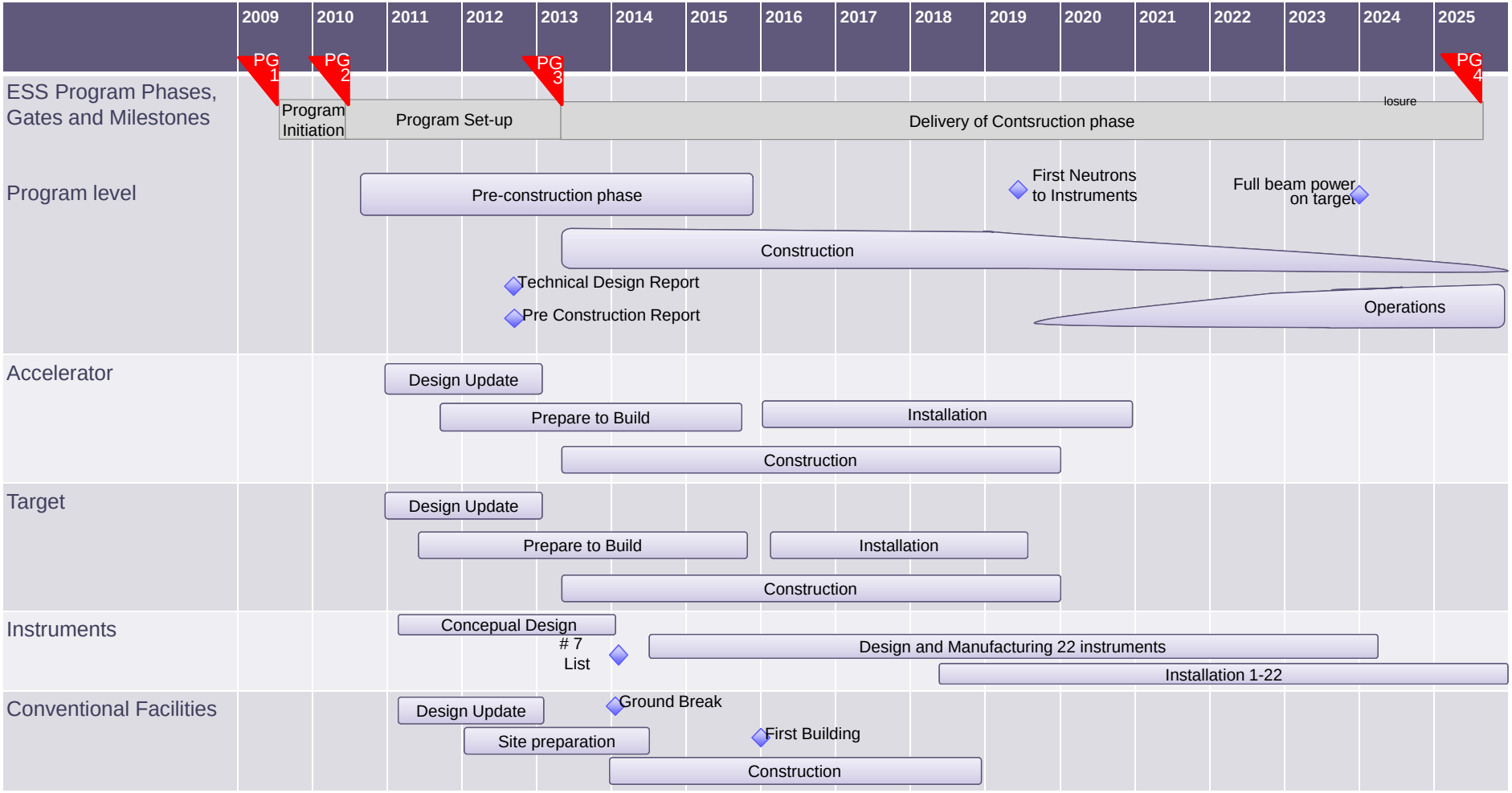
Scope of integrated control system

Everything from source to target, cryogenics & conventional facilities

- Good for long-term maintainability
- Get everybody on board at the beginning (when it is not ‘so hard’)
- Organizational challenges are faced head-on

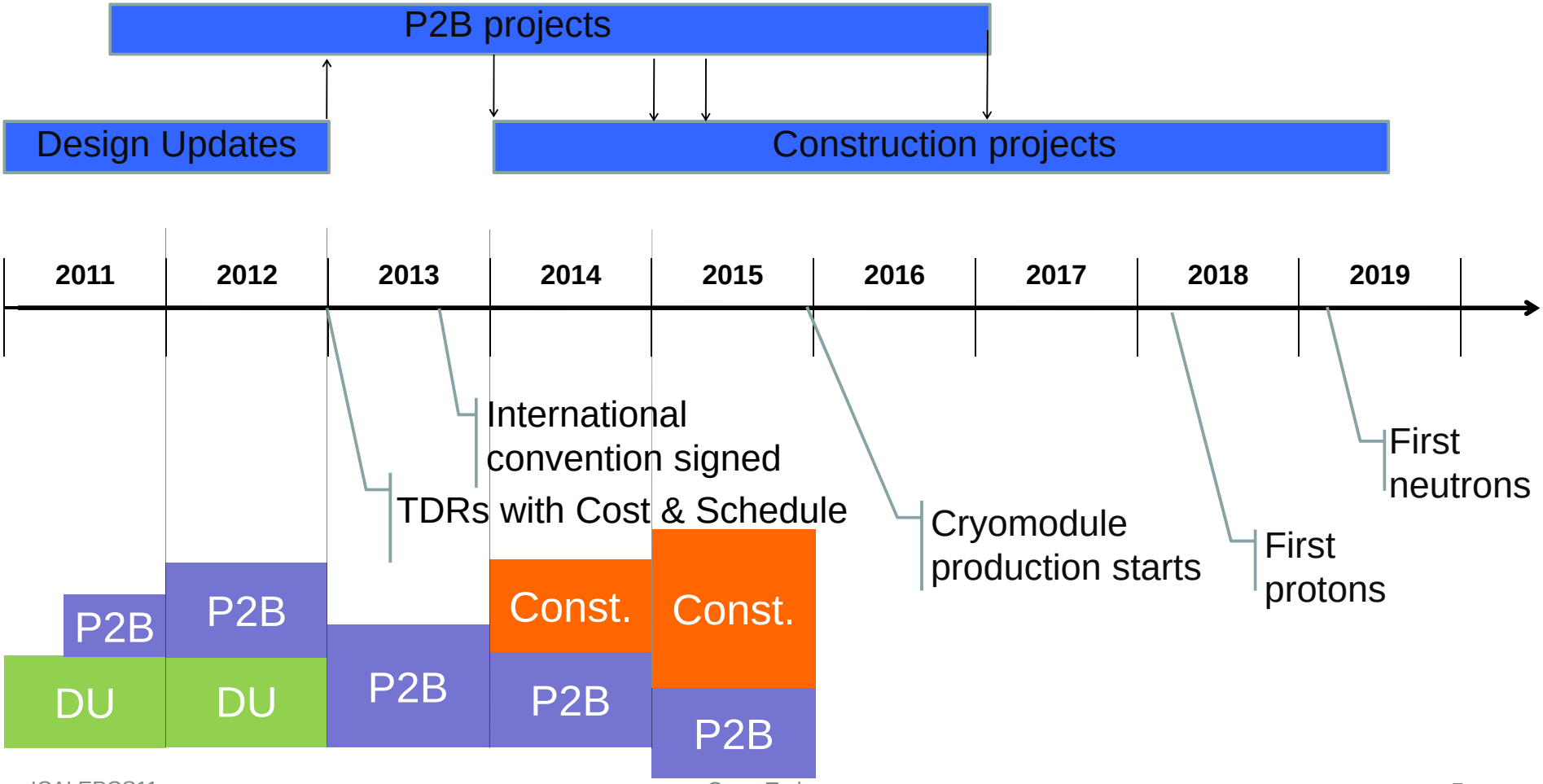


ESS Master Programme Schedule



Current activities

Prepare-to-Build (P2B) provides 1) Prototyping & 2) Engineering Design Reports, in smooth transition from design to construction.



Projects to model on in terms of controls

- SNS
  - Similar in functionality to ESS
  - Real-life experience from SNS control system

- ITER
  - multi-lab and multi-nation project just like the ESS
  - A very large EPICS installation
  - ITER timeframe
    - First subsystems integrated: 2013
    - Commissioning: 2018
    - Operation: 2019

Some architectural, design and organizational decisions

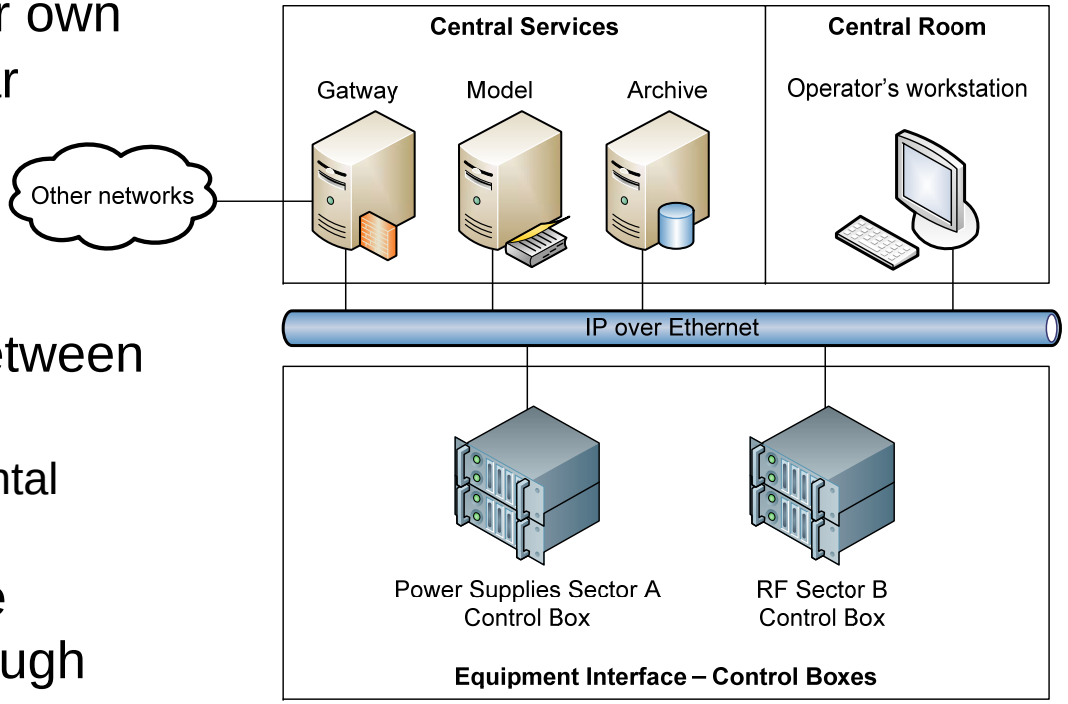
- ESS will use the EPICS control system.

- Linux will be the operating system in the ESS controls service tier.

- Provide a standardized “Control Box” platform to ESS partner institutions, with first prototype delivery in the design phase.
    - Release Control Box software and hardware in (approximately) yearly cycles

Control System Architecture – Control Box

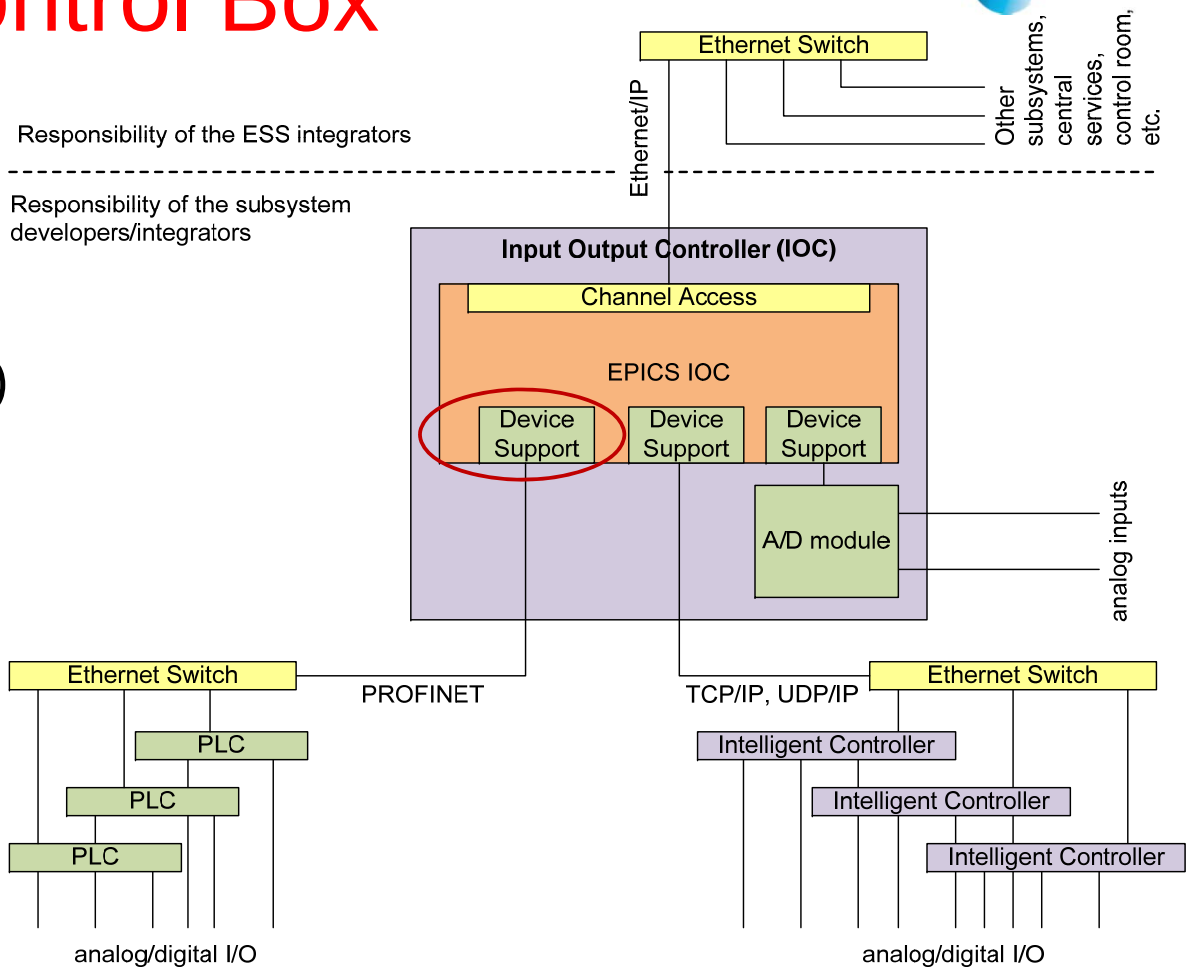
- Control Box
  - Provide a standardized solution before teams develop their own
  - A cornerstone in the 3 year design update phase
- Benefits
  - Encourage consistency between sub-systems
    - including target, experimental stations, cryogenics & CF
  - Enable factory acceptance testing of subsystems through control system,
  - Validate technology decisions,
  - Minimize throw-away hardware and software development



Control Box

Control Box consists of

- Hardware
- Software (IOC, OPI)
- Procedures



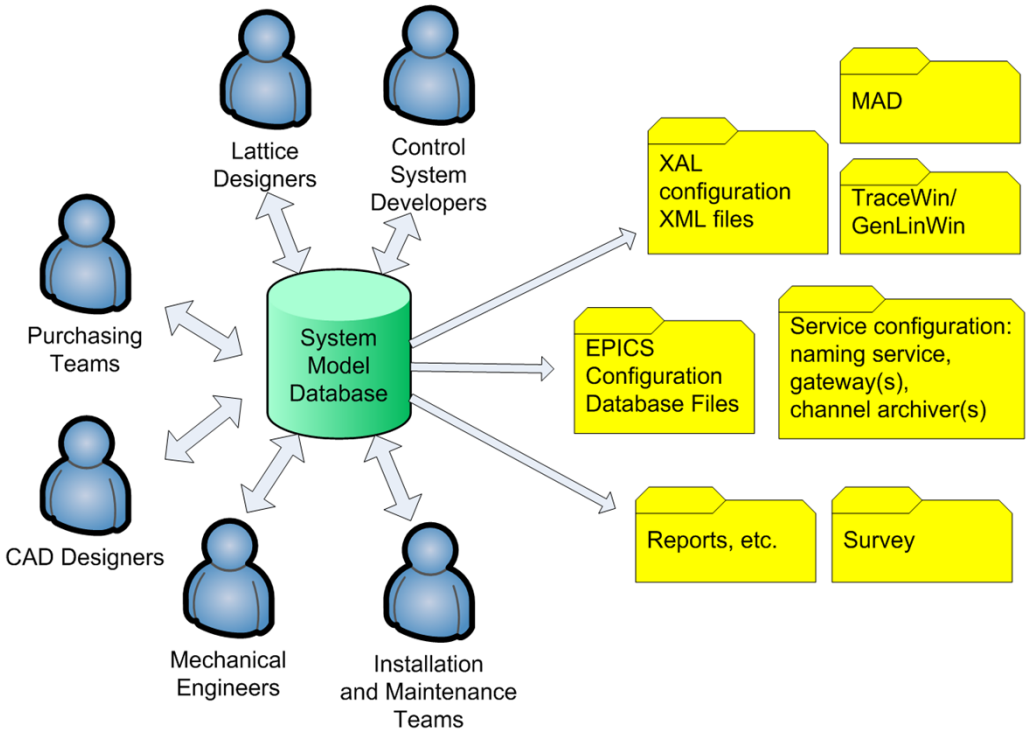
Provides a clear split of responsibility among

- Control system developers
- Subsystem integrators

Beam line elements database (BLED)

- Automatically generate as much of the control system's components as possible
- Principal input: a high-level description of the system (e.g., the accelerator's lattice)

- Use of system engineering tools and model-driven architecture
- The database(s) contain:
  - inventory information (equipment and its location, reference to manuals, reference to purchasing information, …)
  - cabling, connectivity and topology information
  - control system process variables, processing rules, …



Hardware platform selection

- How to select the hardware platform, main criteria
  - Usability
  - Longevity
  - NOT “top performance” or coolness factor

  Acceptance by majority in the industry.

- Selection process:
  - Stakeholders: controls, beam instrumentation, RF, …
  - First prototype decision on October 3: cPCI
  - Decision revised through prototyping and comparing notes
    - Early prototype – learn from mistakes
    - Different groups – different experiences

  - Objective approach: unified table for all platforms, arguments agreed upon by all groups

Current status

- Development environment
  - ITER's CODAC is taken as basis
  - 8 service servers hosting bug tracking, version control, continuous integration …
  - Scientific Linux user development virtual machines
    - Cross platform: Windows, Mac OS, Linux
- Timing, MPS: gathering requirements
  - Single source clock will be used
- Naming convention finalized
- End of 2012: First major deliverables
  - Technical Design Report
  - Vertical prototype with Control Box (and manual)

… complement each other.

Summary

The European Spallation Source will be built in Lund.

- The design of the CS should ensure a long life with many upgrades.
- The accelerator design, prototyping & construction is being performed in a collaboration.

Use code and best practices from similar projects as much as possible

- Collaboration with SNS and ITER

Provide a working control system from the onset

- Control Box, released in yearly cycles