



ESS – SPL Collaboration Meeting Infrastructure at ESS Report on WP3

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Work Package Description

Work Package Objectives



- *The overall objective of this Work Package is to perform the design and specification of all infrastructure facilities and services, including HVAC (Heating, Ventilation & Air Conditioning), cryogenics system, supply of cooling water, electricity, and networking.*
- *ESS will be a climate-neutral and sustainable facility and this Work Package will work closely with the ESS energy team.*
 - Design philosophy → innovative design choices to assure heat & energy recovery and efficiency
- *WP3 also creates a liaison between the LINAC machine and the Conventional Facilities Group*
- *Expected Outcomes:*
 - *Basic Design of the subsystems*
 - *Contribution to the LINAC TDR*
 - *WBS/PBS of the construction phase & cost estimates*

Work Package Description

Leader – Fundación TEKNIKER



- Founded in 1981 as a privately-owned, not-for-profit technology centre.

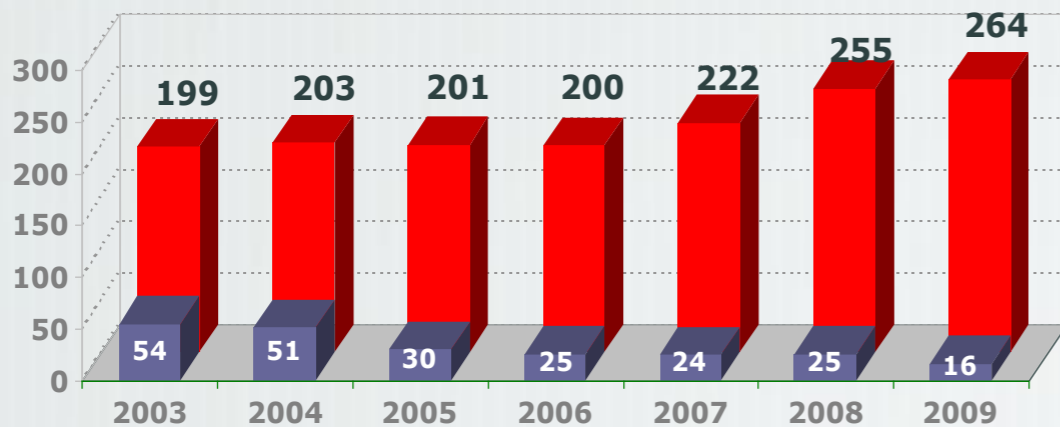
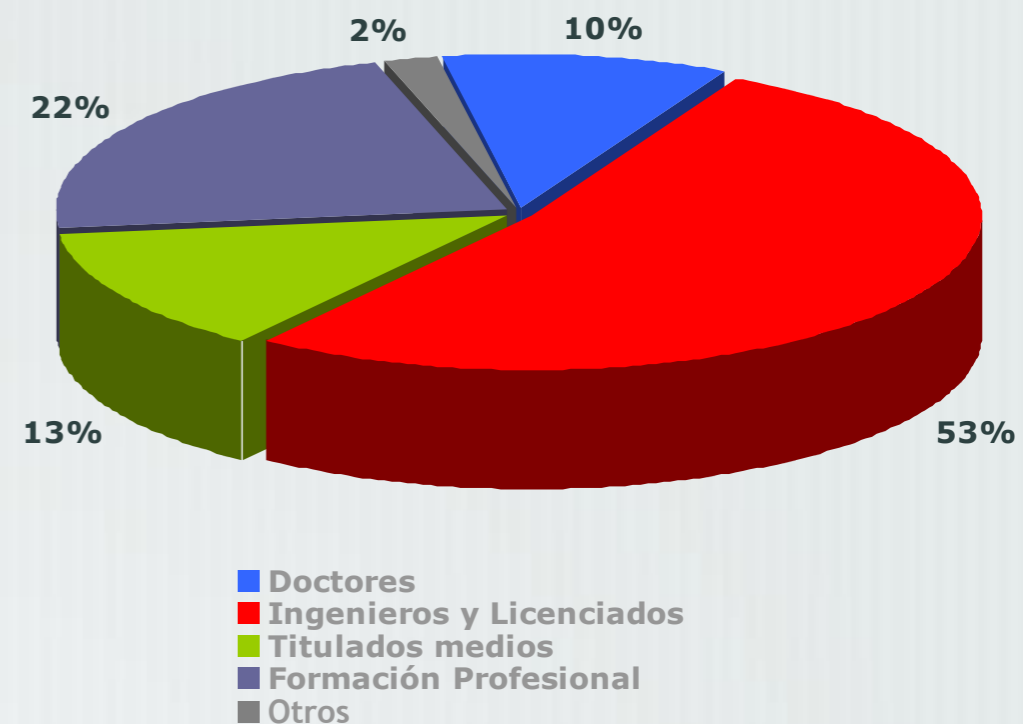
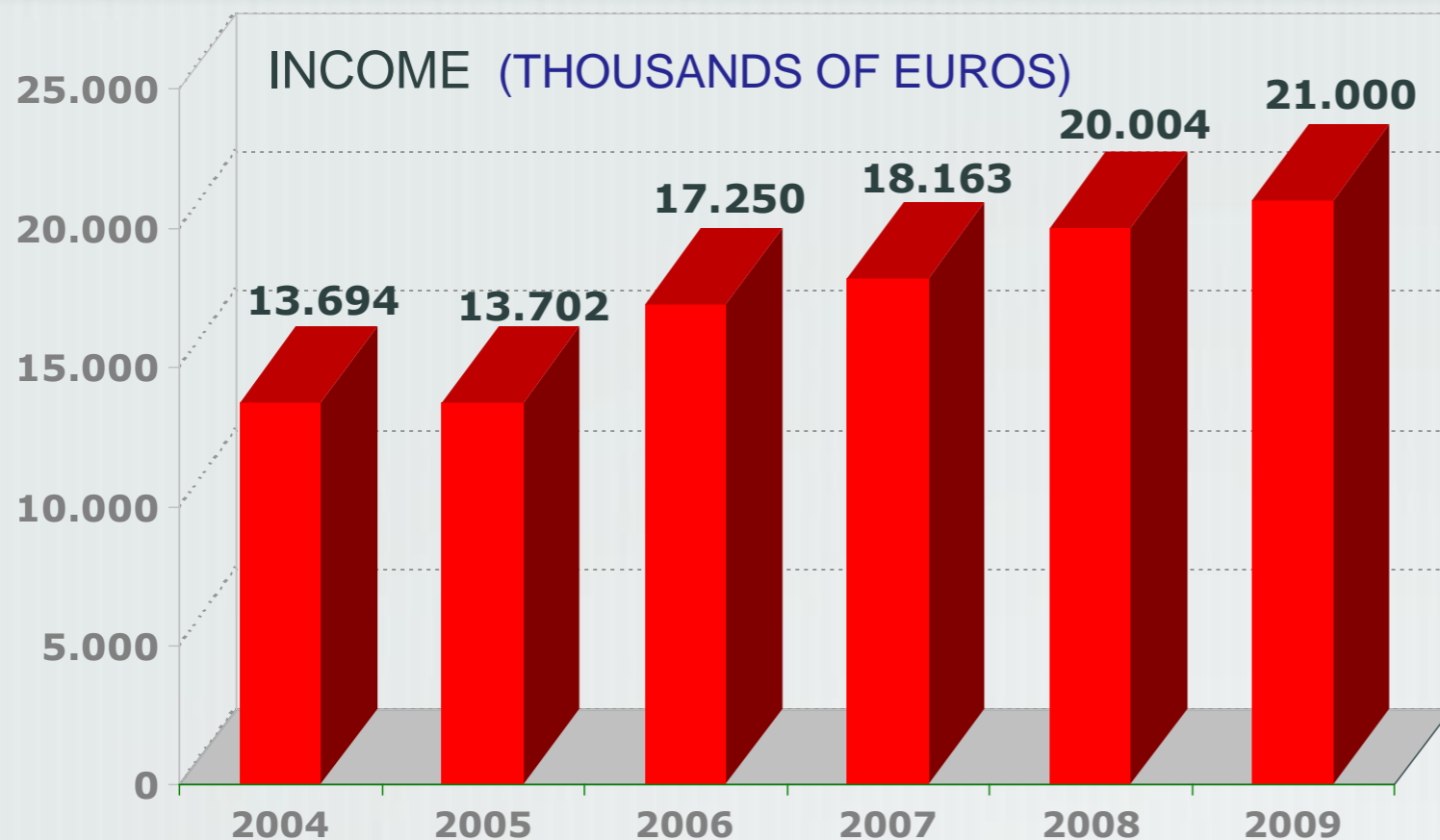
- Mission: **“TEKNIKER-IK4 is a technology centre staffed by people who are committed to promoting the ability to innovate on the part of our customers and increase their technological capital to help them become more competitive through the generation and application of scientific and technological knowledge.”**

- Specialisation:

- **Precision engineering and mechatronics.**
- **Surface engineering.**
- **Production engineering and automation.**
- **Manufacturing technologies.**

Work Package Description

Leader – Fundación TEKNIKER

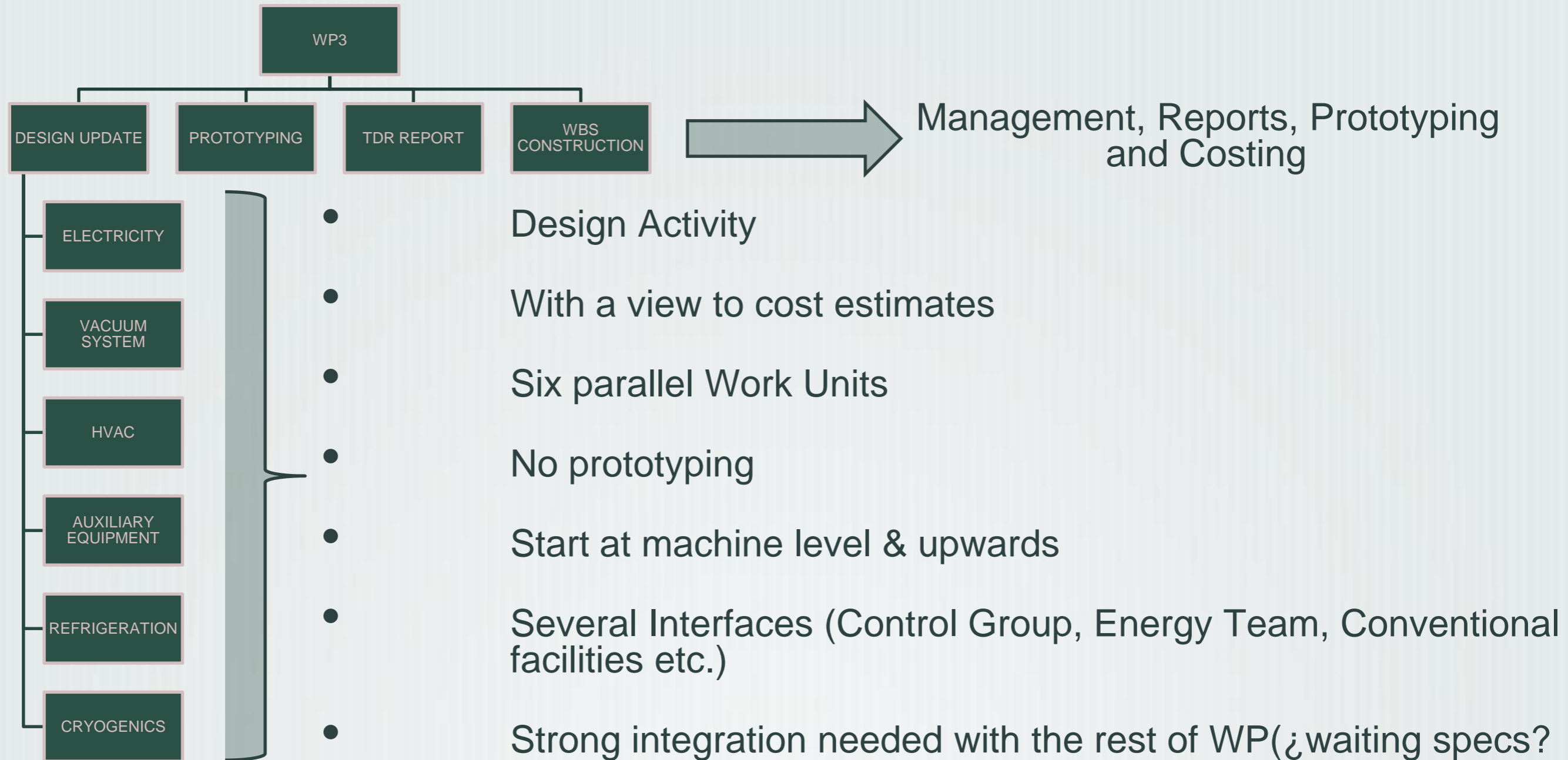


WORKFORCE

■ TRAINEE ■ TOTAL

Work Package Description

Work Breakdown Structure



Work Package Description

A word about prototypes



- Two mock – up of the LINAC are planned
 - A virtual Prototype
 - A scaled model of the LINAC
- Seeking:
 - Integration and operation of all the subsystems (also for other WPs)
 - Image & Dissemination and Communication
 - Help for Conventional Facilities Group

Scientific & Technical Challenges

Work Units



- **WU2: Electrical System**

Outline definition of the electrical system necessary for the LINAC, with the objective of supplying energy in the amount, quality and requested, to the systems that request it (RF, magnets etc. via equipment racks).

A shared design work is planned, with strong contributions and links with the local (Lund) and other relevant governing bodies, not least the Energy Team of ESS

A down-to-top approach shall be followed, starting from the machine level and upwards towards the power supplies. The electrical supply definition of the cryoplant will be covered in the work unit related to cryogenics and, thus, remains out of the reach of this task.

- **WU3: Vacuum system**

To develop the vacuum generation system for the whole LINAC of ESS. With a view to lowering beam – gas interaction and supplying the requested environment at the requested places, this work unit will perform the general design and the detail component selection of the vacuum system, detailed enough for an accurate cost estimate and an efficient stock-up of components during construction phase.

Support and coordinate the creation of a vacuum team in Lund to oversee, define and control the construction, operation and maintenance of the vacuum system during construction phase, and take the lead in the commissioning.

Scientific & Technical Challenges

Work Units



- **WU4: Heating, Ventilation and Air-conditioning**

The definition of the heating systems and ventilation necessary for human comfort will be performed in this work unit. Special requirements dealing with air conditioned areas (be it assembly points, metrology areas etc.) will be identified and dealt with.

Safety considerations (action in case of fire, evacuation pathways, procedures to handle contaminated air, segmentation of ambient etc.) will also impact and determine the baseline design of the HVAC system, which will be performed in this work unit.

- **WU5: Auxiliary Equipment**

Follow-up and definition of auxiliary equipment of moderate/high importance that shall be needed at the ESS LINAC. This task will not only plan “in-operation” needs, but it will also detail the infrastructure and services that will be needed during the construction.

Modularity, maintenance philosophy, physical configuration of items, pits and escape routes, the alignment of accelerating structures, modules and magnets with respect to previous structures; overall configuration of LINAC tunnel to avoid interferences and colliding elements; cranes, rail systems and so forth.

Scientific & Technical Challenges

Work Units



- **WU6: Refrigeration & Cooling**

Foresee and plan the refrigeration system that will evacuate heat when needed and in the amount needed.

In accordance to the overall design philosophy of ESS, the excess heat will be reused (when dissipation temperatures make it possible) to feed the heating systems both at ESS and Lund itself.

- **WU7: Cryogenics**

This will perform the outline design of the cryogenic systems that will feed the ESS LINAC in its superconducting parts, activity which will be divided in two: 1) The Central Cryoplant and 2) The Fluid Distribution System for the cryomodules.

The Central Helium Liquifier System will be calculated and designed with the inputs on heat loads from the responsible partners of the superconducting linac, based on the cryomodule performances and estimation from static and dynamic performances. Alongside with the calculations, fluid cycles, liquefaction systems and necessary equipment will be defined, with the help of vendors and stakeholders. With an overall design of the distribution system, fluid requirements (both He and N) will be defined, and the related dewar systems, containers, intermediate buffers etc. A preliminary study of the operation mode of the cryoplant.

the liquid helium distribution system will also be planned. A general layout of the piping will be generated with ancillary systems and equipment, specially cryovalves and flow-meters. Solutions for thermal deformations (lumped vs. distributed) will be planned in advance.

Support and coordinate the creation of a strong cryogenic team in Lund to oversee, define and control the construction, operation and maintenance of the cryoplant and the cryo-distribution system during construction phase, and take the lead in the commissioning.

Scientific Collaboration



- Partners with a great overall vision of facilities are needed, and expertise in designing, but also building, commissioning and operating COMPLETE facilities
- Nevertheless, cryo & vacuum do require specific capabilities and know-how.
- Several different engineering problems to be solved by personnel in the same lab/institute
- A possible collaboratorative group based on:
 - **1 major scientific facility to assist in most of the tasks.**
 - **1 institute with proven expertise in cryo for LINACS.**
 - **1 major scientific facility acting as a “internal customer”.**
 - **Vendors, industry, engineering services.**

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Thank you for your attention !!!