



ESS-Bilbao

Developments in Neutron and Accelerator
Science & Technology

**“Jornada Industria de la Ciencia - ICTS”
Abril 2022**

Mario Pérez, ESS-Bilbao
Madrid, 26 Abril 2022



Consortio ESS Bilbao

ESS Bilbao es un consorcio publico de los Gobiernos Central y Vasco que se establece como centro estratégico de referencia internacional en el desarrollo de Tecnologías Neutrónicas y de Aceleradores que aporta conocimiento y valor añadido a través de la contribución en especie al proyecto europeo

ESS ERIC, Suecia, Lund



47 employees
age average: 40



29% women



71% men



Qualification



Headquarters



Parque Tecnológico
Zamudio (Bilbao)

R&D Center



Parque Tecnológico
Zamudio (Bilbao)

AWF



Polígono Industrial Júndiz
Vitoria-Gasteiz

Madrid Satellite



Instituto de Fusión Nuclear
Madrid

European Spallation Source ESS, Lund

Total construction cost: 1.843 M€ (2013-2028)

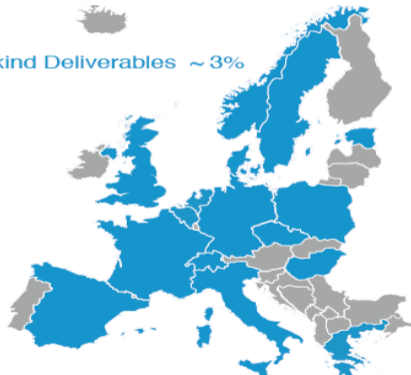
13 European countries and 100 Institutions

Host Countries Sweden and Denmark

Construction 47.5% Cash Investment ~ 97%; In-kind Deliverables ~ 3%
Operations 15%

Non Host Member Countries

Construction 52.5% In-kind Deliverables ~ 70%
Operations 85%



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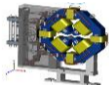
**ESS ERIC Construction -
Delivering on our commitment**



Mario Pérez, ESS-Bilbao
Madrid, 26 April 2022



MEBT



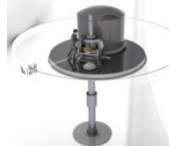
Accelerating element: complete subsystem that goes after the RFQ and integrates: design, manufacturing, diagnostics, control, assembly and testing.

RF Systems



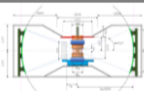
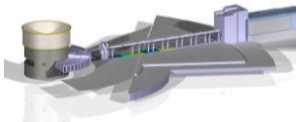
RF chains: 1 for RFQ and 5 for DTL. Composed by klystrons, modulators, loads, waveguides, interlocks and LLRF

TARGET



The spallation process takes place when the accelerated proton beam hits the Tungsten bricks of the 11-tonne target wheel. This will produce neutron brightness for scientific experiments across multiple disciplines.

MIRACLES INSTRUMENT



Time-of-Flight backscattering instrument for polymer science, energy materials, and magnetism studies.

Prime contractors: design, manufacturing, assembly & cold commissioning



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**ESS ERIC Initial Operations –
Future Opportunities**

Mario Pérez, ESS-Bilbao
Madrid, 26 April 2022



- ❖ The **Init. Ops. budget (810 M€₂₀₁₃)** and a detailed Initial Operations Plan was approved by Council
- ❖ Cost book for in-kind during initial operations and the ESS procedure for in-kind contribution management during initial operations phase was first presented at the IKRC (22 Oct 2020) – **currently under review**

Package	Definition	Preliminary Value (k€ ₂₀₀₅)
352 Klystron spares	2 spare 352 MHz Klystrons	1 230
Spares for Spoke RF stations	Replacement parts for spoke RF stations	1 272
Spare modulator	One complete spare modulator built to print	900
Modulator spare parts	Spare and replacement parts for modulators	1 168
Modulator oil and oil treatment	Spare oil and oil treatment for all modulators	769
Spare Medium Beta Cryomodule	Additional components and effort needed to build a spare cryomodule	500
Backup cryo compressor	Backup compressor and oils system for the accelerator cryo plant	3 600
Cryogenic Liquids	Approximately 26 600 liters of LHe	400
Spare LEBT	Spare LEBT, complete with diagnostics	331
Spare RFQ Copper	Spare copper material for an RFQ	285
Test stand 2 Operation ⁶	Manpower to operate test stand 2	550

Package	Definition	Preliminary Value (k€ ₂₀₁₃)
Mark-2 Target Wheel	Technical development of the Mark-2 Target Wheel unit, provisionally including the delivery of the actual hardware item for mitigation of the risk of Mark-1 TW infant mortality.	4 500
Mark-2 MR	Technical development of the Mark-2 MR, i.e. of the BF-1 type, including timely delivery of the actual hardware item as required.	2 750
Mark-2 and Mark-3 PBW	Two replacement items of the PBW, including moderate technical development and timely delivery of the actual hardware items as required.	1 000
ACF supplier support	As described above	To be costed
Casks Assembly – manufacture, testing and commissioning	Seven (minimum) shielded handling and transfer casks and one maintenance and decontamination station.	7 000

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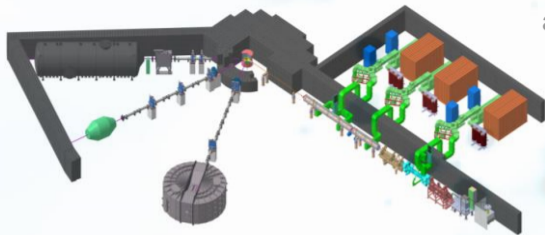
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**ARGITU,
A unique and versatile Low Energy (30 MeV)
accelerator-based Neutron source**

Mario Pérez, ESS-Bilbao
Madrid, 26 April 2022



ARGITU, a unique and versatile Low Energy (30 MeV) accelerator-based Neutron source



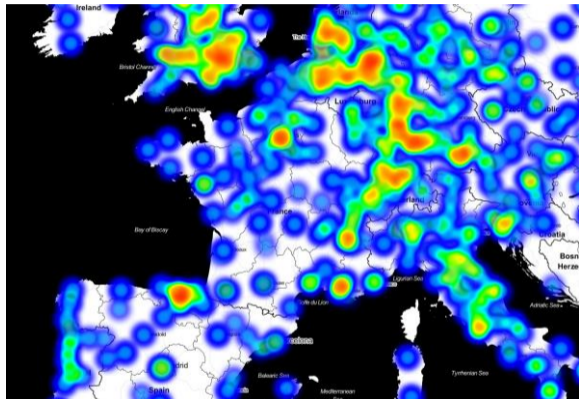
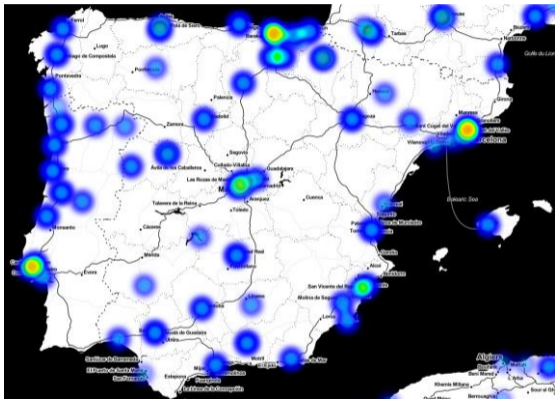
PARAMETER

VALUES

PARAMETER	VALUES
Specimen	H+
Beam Pulse (ms)	1.5
Rep Rate (Hz)	30
Beam Current (mA)	32
Beam Energy (MeV)	31.47
Duty	4.5
Peak Power (KW)	1,007.15

- Provides easy access to neutrons at a much lower running cost than a high flux neutron source.
- Allows proof-of-concept and proof-of-principle investigations of materials that, if satisfactory, will be analyzed more in detail in a high-flux neutron source, complementing a currently lacking link between lab-based research and expensive high-flux neutron source experiments.
- Increases the efficiency of the neutron scattering experiments, providing more opportunities to incubate new ideas, pioneering works and epoch-making breakthrough experiments.
- Enables cheaper and faster proof-of-concept experiment sources for industrial partners with fast access needs.
- Represent a strong opportunity for a cost-effective training of scientists on the use of neutron scattering experiments and to use them in hands-on experiences on seasonal neutron scattering schools.
- Allows cost-effective instrumentation developments.

Fostering Neutronic R&D ecosystem...



Heat maps of neutron scientists, in terms of their **scientific productivity**, as a function of their home institutions in Spain (left) and in western Europe (right), denoting a **leading role of Basque scientists** in the use of neutron scattering tools for research and development activities.

IKUR estrategia



EUSKO JAURLARITZA



GOBIERNO VASCO

HEZKUNTZA SAILA

DEPARTAMENTO DE EDUCACIÓN



High Performance Computing e Inteligencia Artificial

Garantizar y extender las prestaciones de una **Infraestructura referente de supercomputación**
Impulsar un **uso intensivo de la inteligencia artificial**...



Neurobiociencias

Impulsar la excelencia investigadora del País Vasco en neuro- y biociencias
Infraestructuras experimentales singulares en caracterización e imagen, supercomputación e inteligencia artificial



Tecnologías Cuánticas

Polo de tecnologías cuánticas
Desarrollo de una **Internet Cuántica**
'Quantum computing as a service' para finanzas o sector aeroespacial



Neutriónica

Investigación en **neutrinos** con alto **potencial de descubrimiento científico** y de aplicaciones de **transferencia de tecnología** en el ámbito biomédico,...
Potenciar el liderazgo científico del País Vasco en **ciencia de neutrones** aplicado a la caracterización y estudio de materiales (ESS Lund – ESS Bilbao)

IKUR
100 M€

Grandes Infraestructuras Singulares

30M€

Atracción de personal investigador de excelencia

30M€

Participación en proyectos internacionales

10 M€

Impulso Colaboración Redes de Conocimiento

30 M€

IKUR

100M€
Hezkuntza Saila

IKUR

+282M€

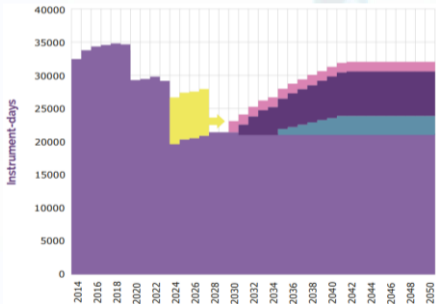
- EJ Hezkuntza Saila: 100M€
- Enpresak: +139M€
- Administrazioak: +18M€
- Nazioartea: +25M€



...a trend in Europe as well (ELENA)

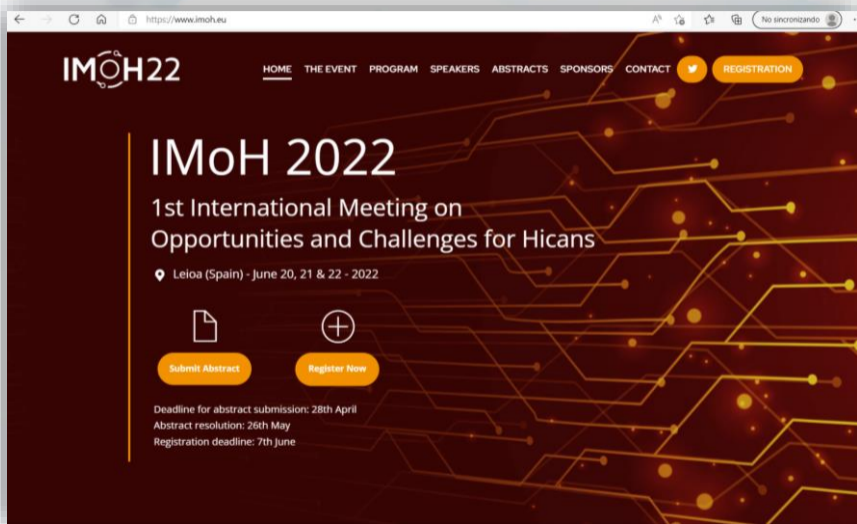
European Low Energy accelerator-based Neutron facility Association

- ❖ Closing the gap, opening in Europe by the ongoing shutdown of research reactors, by joining forces in the promotion of such facilities



- ESS, ISIS, MLZ/FRMII, SINQ operate through the entire period at current level, ILL to the end of the current Convention and the remaining small facilities according to current planning
Operation Costs: 300 ME/year
- ILL continues to operate beyond 2023 until 2030
Operation Costs: 95 ME/year
- New Small Regional Source
Investment Costs: 2-500 ME
Operation Costs: 10-20 ME/year
- ESS, MLZ/FRMII, SINQ upgrade to full capacity
Investment Costs: 375 ME
Additional Operational Costs: 46 ME/year
- ISIS upgrade - 0.5 MW and 3rd TS
Investment Costs: 755 ME
Additional Operational Cost: 19 ME/year





The screenshot shows the homepage of the IMoH 2022 website. The browser address bar displays 'https://www.imoh.eu'. The navigation menu includes 'HOME', 'THE EVENT', 'PROGRAM', 'SPEAKERS', 'ABSTRACTS', 'SPONSORS', 'CONTACT', and a 'REGISTRATION' button. The main content area features the event title 'IMoH 2022' and subtitle '1st International Meeting on Opportunities and Challenges for Hicans'. The location and dates are listed as 'Leioa (Spain) - June 20, 21 & 22 - 2022'. Two primary call-to-action buttons are present: 'Submit Abstract' (with a document icon) and 'Register Now' (with a plus icon). Below these, the following deadlines are specified: 'Deadline for abstract submission: 28th April', 'Abstract resolution: 26th May', and 'Registration deadline: 7th June'.



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Mario Pérez
Executive Director
ESS BILBAO

Parque Tecnológico de Zamudio.
Laida Bidea, edif 207B, semisótano-2
48160 Derio
Phone +34 946 076 622, mobile +34 648 580 253
e-mail: mperez@essbilbao.org

