

ESS bilbao

ESS-BILBAO ongoing activities

Consorcio ESS-BILBAO

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on behalf of ESS-BILBAO Team

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Introduction

Introduction

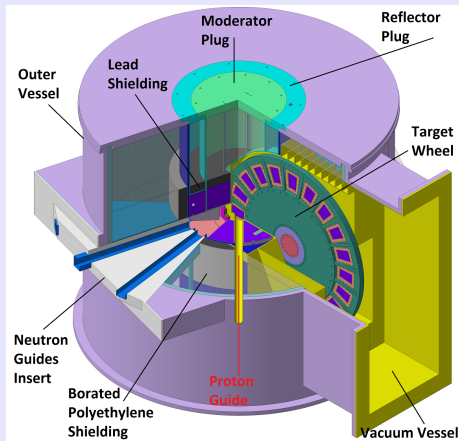
Role and functions

- The Spanish Government has taken the decision that ESS-BILBAO will be the only contractor from Spain to ESS project.
- On September 2009, ESS-BILBAO started the collaboration with ESS.
- On parallel to the ESS collaboration activities, from 2009 to 2013, ESS-BILBAO developed the design of a medium size neutron source based on a 50 MeV proton accelerator and beryllium target ($Be(p, n)$, $\sim 10^{15} \text{ ns}^{-1}$)

Introduction

The medium size neutron source project

- On September 2012, ESS-Bilbao review the source proposal with and scientific advisory panel. This panel recommended to continue with the local source project.
- On March 2013, both accelerator and target station reviewed the design with a Technical Advisory Committee.
- On August 2013, due to the spanish economical situation the source project was frozen and all the resurces of ESS-BILBAO will be focused on the in kind contribution to ESS
- However, the RFQ was close to manufacturing and it is needed for the ESS MBET testing so it will be completed.



Introduction

The in kind contribution to ESS

- The Spanish government has already approved the contribution to ESS with a 5% (~ 90 MeV).
- 80 % of this contribution will be in kind (~ 75 M€)
- Following the previous philosophy ESS-BILBAO will be the channel for this in kind contribution to ESS.

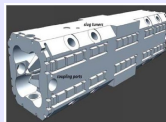
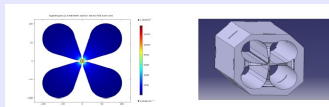
The RFQ project

The RFQ project

The remain activity from the medium size source project

As I was remarked in the introduction, the design activities related with the medium size source project was frozen on summer 2013. Nevertheless, the RFQ is useful for testing ESS accelerator components so, the ESS-Bilbao Steering committee authorized the completion of the project.

Once the ESS MBET testing is completed, ESS-BILBAO will have a 3 MeV proton source with high current ($\sim 50\text{-}60$ mA, 14 Hz, 1.8-2 ms)



The in kind contribution to ESS

The in kind contribution to ESS

ESS-Bilbao in kind contribution organization

Since October 2014, ESS-BILBAO team is working to organize the in kind contributions to ESS in the science project. Most of the workpackages from 2014 to 2015 has been already award.

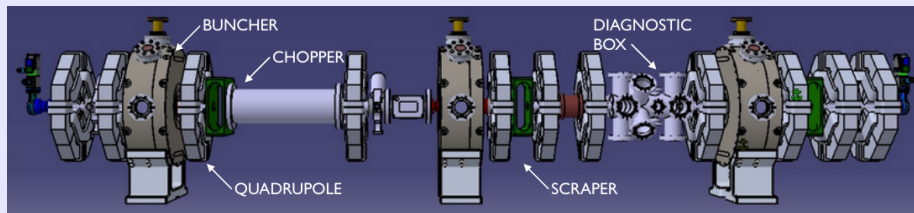
	Period	Expectation [M€]	Award [M€]
Accelerator	2015-2019	15	15
Target Station	2015-2019	20	17.5
Instruments	2018-2022	35	-

The in kind to ESS Accelerator

The in kind to ESS Accelerator

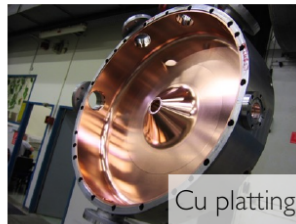
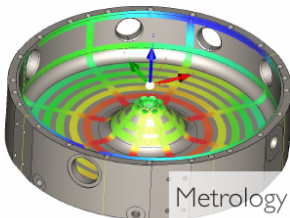
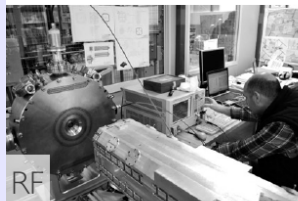
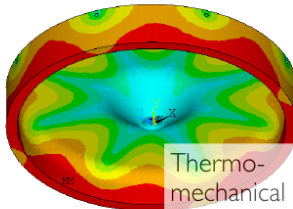
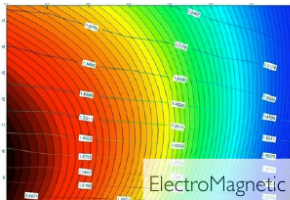
The medium beam energy transport

- 11 set of Quadrupoles (steerer embedded)
- 3 CCL type buncher cavities
- Chopping system
- Vacuum system
- Mechanical support.



The in kind to ESS Accelerator

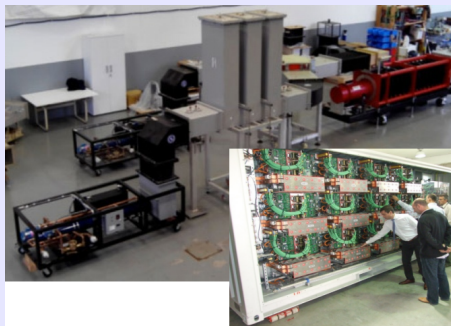
From base engineering to the testing&installation



The in kind to ESS Accelerator

RF power systems for ESS warm linac (RFQ and 5 DTL tanks)

- High Power Voltage Converters (Modulators): 3x 660 kVA (120kV, 100 A, 3.5 msec pulses, 14 Hz rep. rate
- High Power Amplifiers (klystrons, SSPAs): 6x 2.9 MWpk at 352.21 MHz
- RF Distribution (WR2300): Waveguide sections, Circulators, Directional Couplers, Power Splitters,...
- LLRF (Low Level RF Control): Cavity field amplitude and phase control, cavity frequency tuning, MTCA4
- Interlocks: Fast and Slow interlocks (<10 μ sec and >100 msec)



Target in kind contribution Summary

ESS-Bilbao Workpackages on ESS Target area

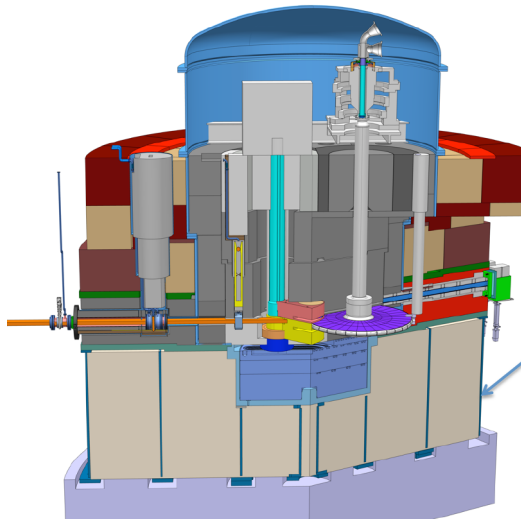
The total budget for ESS Accelerator is ~ 550 M€. ESS-BILBAO Consortium has been chosen as ESS partner for ~ 3 % of the Accelerator project.

Work Package	KO meeting	Delivering date
MEBT	4.5	4.5
RF	10.5	10.5
TOTAL	15 M€	

The in kind to ESS Target Station

The in kind to ESS Target Station

ESS-Bilbao Workpackages on ESS Target Station

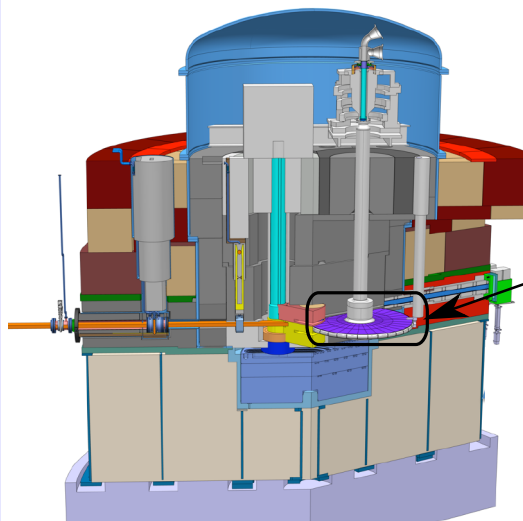


ESS-Bilbao in-kind Contribution:

- * Base Design
 - * Detail Engineering
 - * Manufacturing
 - * QA Control
 - * Testing
- * Support for the Installation

ESS Target Wheel

ESS Target Wheel



ESS Target Station
Monolith

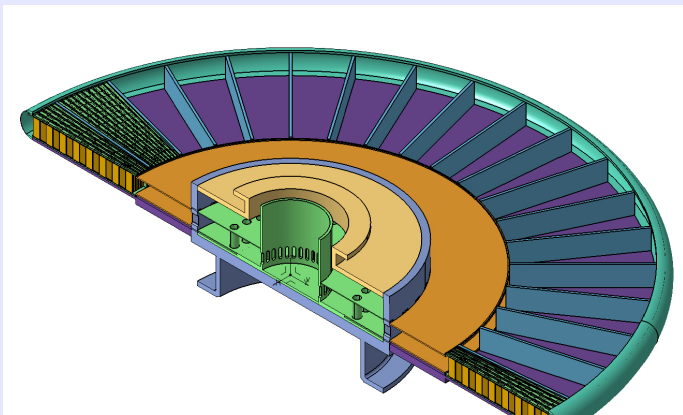
Target Wheel

ESS Target Wheel: Target Vessel

Target Vessel

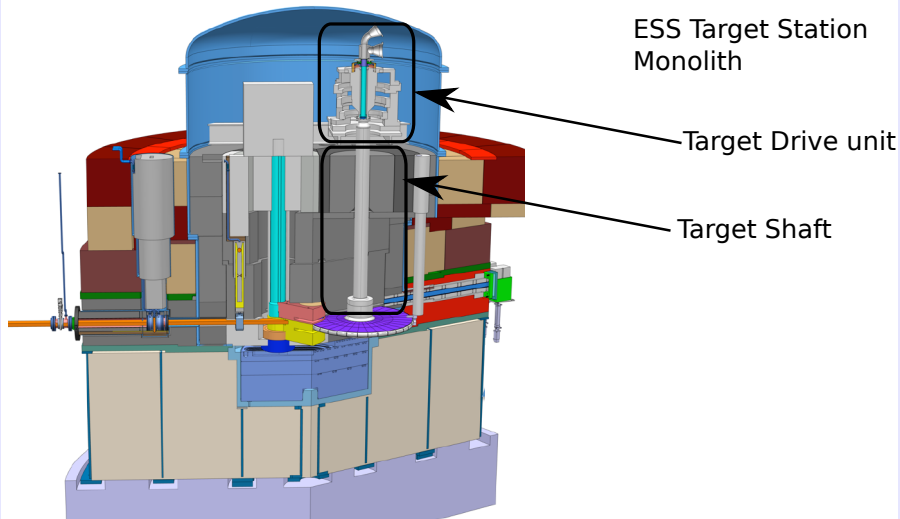
On the basis of the proposed helium flow path, an alternative configuration for the vessel is proposed.

Selection process



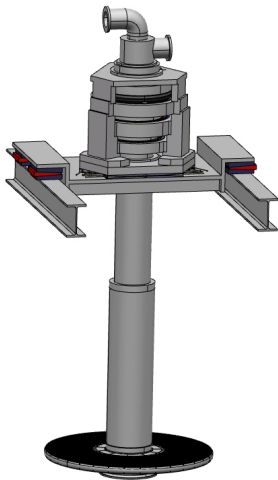
ESS Target Station

Target Drive Unit



ESS Target

ESS Target Unit

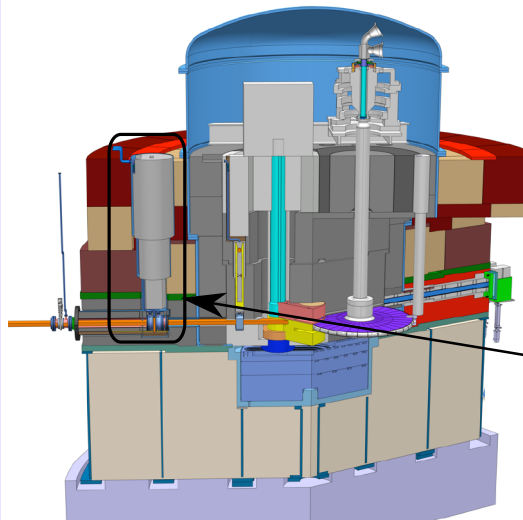


Key Design parameters

- Material: Hot Rolled W, SS-316L
- Beam Power: 5 MW
- Max Proton Energy: 2 GeV
- Life Time: 5 years
- Coolant: helium
- Helium Pressure: 10 bar
- Helium flow mas: 3 kg s^{-1}
- RCC-MRx: Class 2

ESS Target Station

Proton beam entrance window

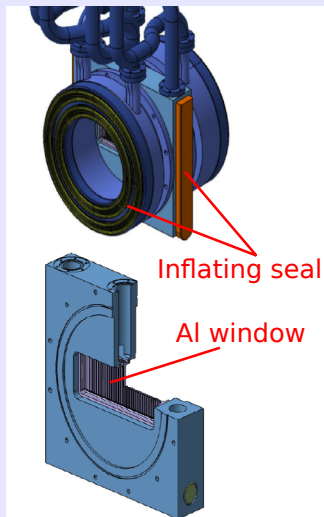


ESS Target Station
Monolith

Proton Beam
Entrance Window

ESS Target Station

Proton beam entrance window

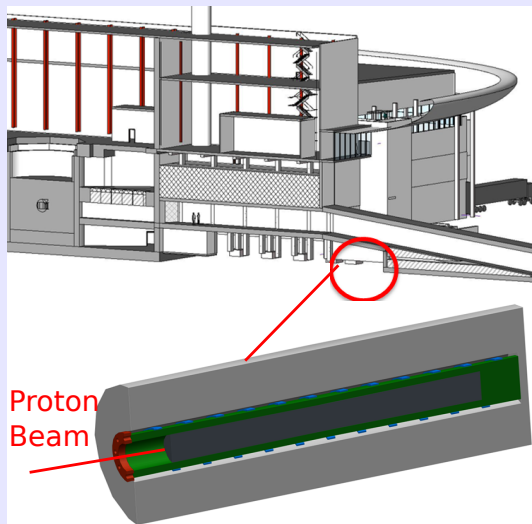


Key Design parameters

- Material: Al-6061-T6, A5083 or Al3Mg
- Life Time: 4-6 months
- Differential pressure: 1 bar
- Coolant: helium or water
- Inflating seal for remote handling operation
- RCC-MRx: Class 3

ESS Target Station

Tunning Beam Dump

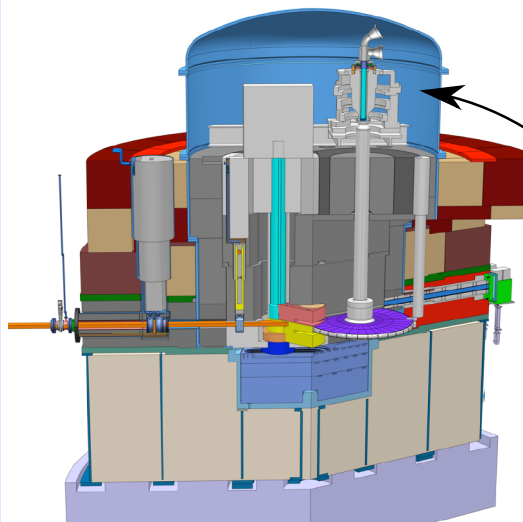


Key Design parameters

- Material: Copper & Graphite
- Max Power: 6 kW
- Max Proton Energy: 2 GeV
- Life Time: 40 years
- Coolant: Passive cooling
- Scope: Beam dump, shielding and instrumentation
- RCC-MRx: Class 3

ESS Target Station

Monolith Vessel



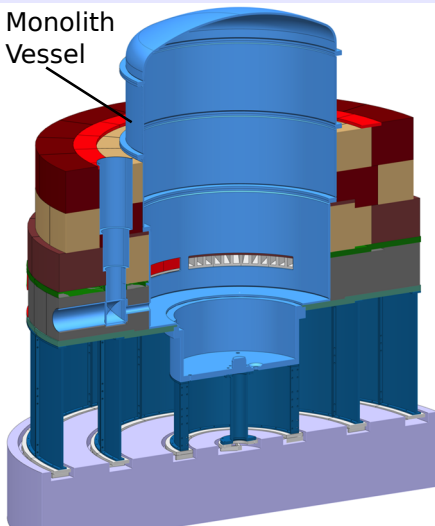
ESS Target Station
Monolith

Monolith Vessel

ESS Target Station

Monolith Vessel

Monolith Vessel



Key Design parameters

- Material: Stainless steel (SS-316L or SS-304)
- Life Time: 40 years
- Scope: Vessel, top vessel head, PBW shaft and Dover
- RCC-MRx: Class 3
- Diameter: 8 m
- Weight: 75 Tons
- RCC-MRx: Class 3

Target in kind contribution Summary

ESS-Bilbao Workpackages on ESS Target area

The total budget for ESS Target station is ~ 150 M€. ESS-BILBAO Consortium has been chosen as ESS partner for ~ 12 % of the Target Station project.

Work Package	KO meeting	Delivering date
Target Wheel & Shaft & Drive Unit	January-2015	April-2019
Proton beam entrance window	April-2015	Feb-2018
Tuning beam dump	April-2015	Feb-2018
Monolith vessel	June-2015	May-2017
Beam Instrumentation plug	—	Oct-2018
Target instrumentation plug (proposal)	—	Oct-2018
TOTAL	17.4 M€	

The in kind to instruments

ESS instruments

Contribution to instruments (LOKI)

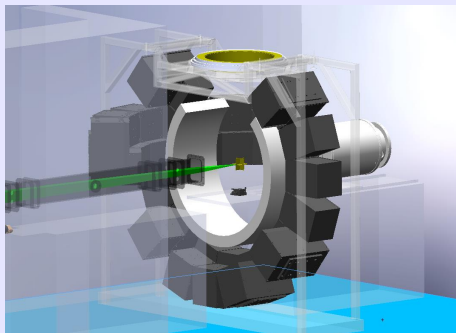
- Procurement, fabrication, delivery and installation of technical components.
- Man power for mechanical engineering, assisting the design, manufacturing and integration of technical components.



ESS instruments

Contribution to instruments (EXPRESO)

- ESPRESSO: Diffractometer for very high pressure scienc.
- Instrument Budget around 17-20 M€. ESS Bilbao has the ambition to coordinate this instrument project in close collaboration to ESS.



Target in kind contribution Summary

ESS-Bilbao Workpackages on ESS Target area

The total budget for ESS instruments is ~ 350 M€. ESS-BILBAO Consortium has been chosen as ESS partner for ~ 10 % of the instruments project.

Work Package	KO meeting	Delivering date
LOKI	-	-
Expreso	-	-
Miracles	-	-
MAGIC	-	-
TOTAL	35 M€	

Summary and conclusions

Summary

Challenges and opportunities

- ESS-BILBAO will complete along 2016 the RFQ project and a 3 MeV proton beam will be available after the testing of ESS MBET.
- ESS-BILBAO has been chosen for several in kind contribution workpackages specially challenging (Target & MBET)
- ESS-BILBAO will be focus on ESS in kind contribution for the next couple of years until the end of the ESS construction phase.
- Based on that, we will take the opportunity of ESS in kind contribution to improve our in house technical capacities and we hope to be ready for the future...