News from ESS

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ESS - BILBAO, THE SPANISH CONTRIBUTION TO EUROPEAN RESEARCH EXCELLENCE

ESS OVERVIEW

- *ESS-S and ESS-B have become **ESS** which now has **13 future member states***
  - ***Main site for facility in Lund** in Sweden*
  - ***Complementary R&D and user centre in Bilbao** in Spain*
- ***First neutrons for 2018** with full design specifications in 2023*
  - *Ambitious goals requires ambitious planning*
- *Build on **latest SC RF** R&D*
  - *Requires high reliability and low losses*
- *Maximize **synergies with other similar projects***
  - *Cost and time gains*
  - *Trained people are in short supply*
- *Very **challenging** task…*
  - *That is our job…*
  - *…and that is why we are here!*

FACILITY TECHNICAL OBJECTIVES

5 MW

Long pulse source

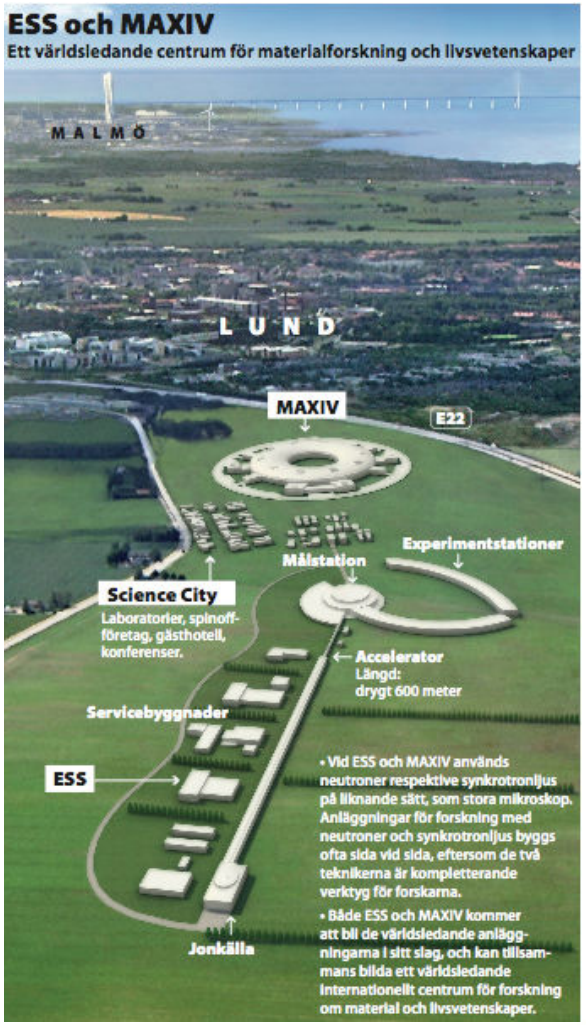
≤2 ms pulses

≤20 Hz

Protons (H+)

Low losses

High reliability >95%



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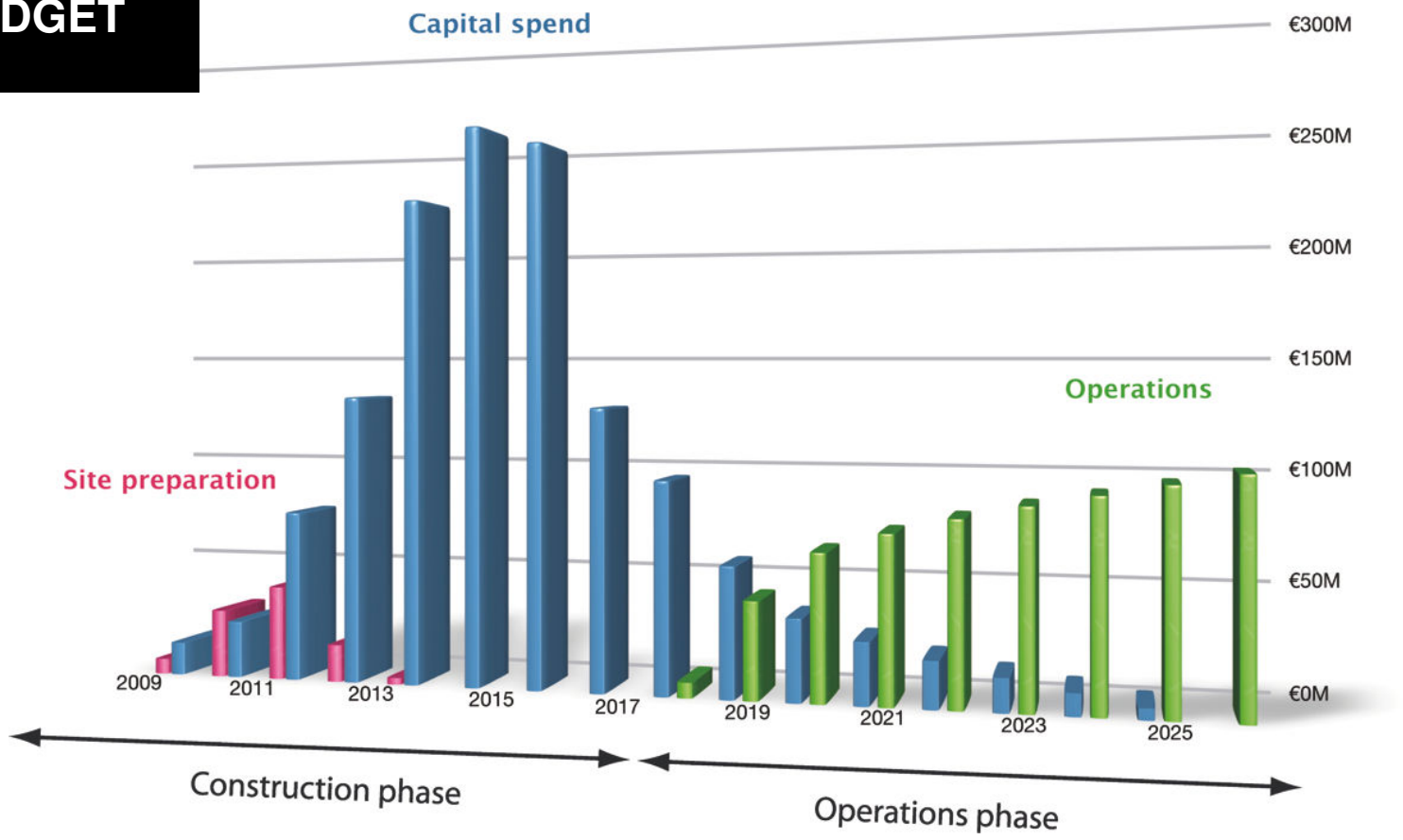
BUDGET



Facility investment: *1.377 M€$_{2008}$ with 22 instruments + 101 M€$_{2008}$ site specific cost*
Operational cost: *89 M€$_{2008}$ per year*
Decommissioning cost: *344 M€$_{2008}$*

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1st STEERING COMMITTEE

- *Held in Copenhagen **22-23 October** 2009*
- *Delegates from 13 countries: **Denmark, Estonia, France, Germany, Iceland, Italy, Latvia, Lithuania, Norway, Poland, Spain, Sweden, Switzerland***
- *Agenda:*
  - *governance of ESS*
  - *organisation of ESS*
  - *TAC & SAC*
  - ***ESS Design Update***
  - *administrative issues*

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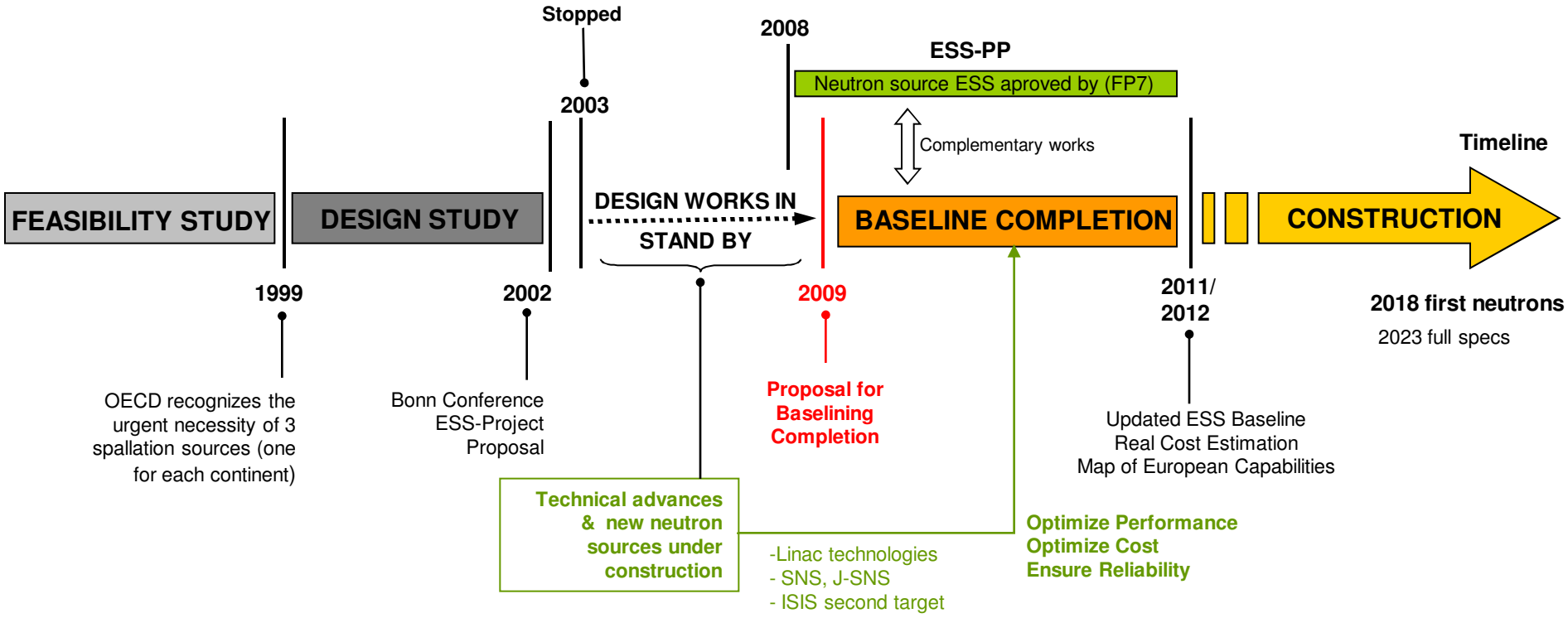
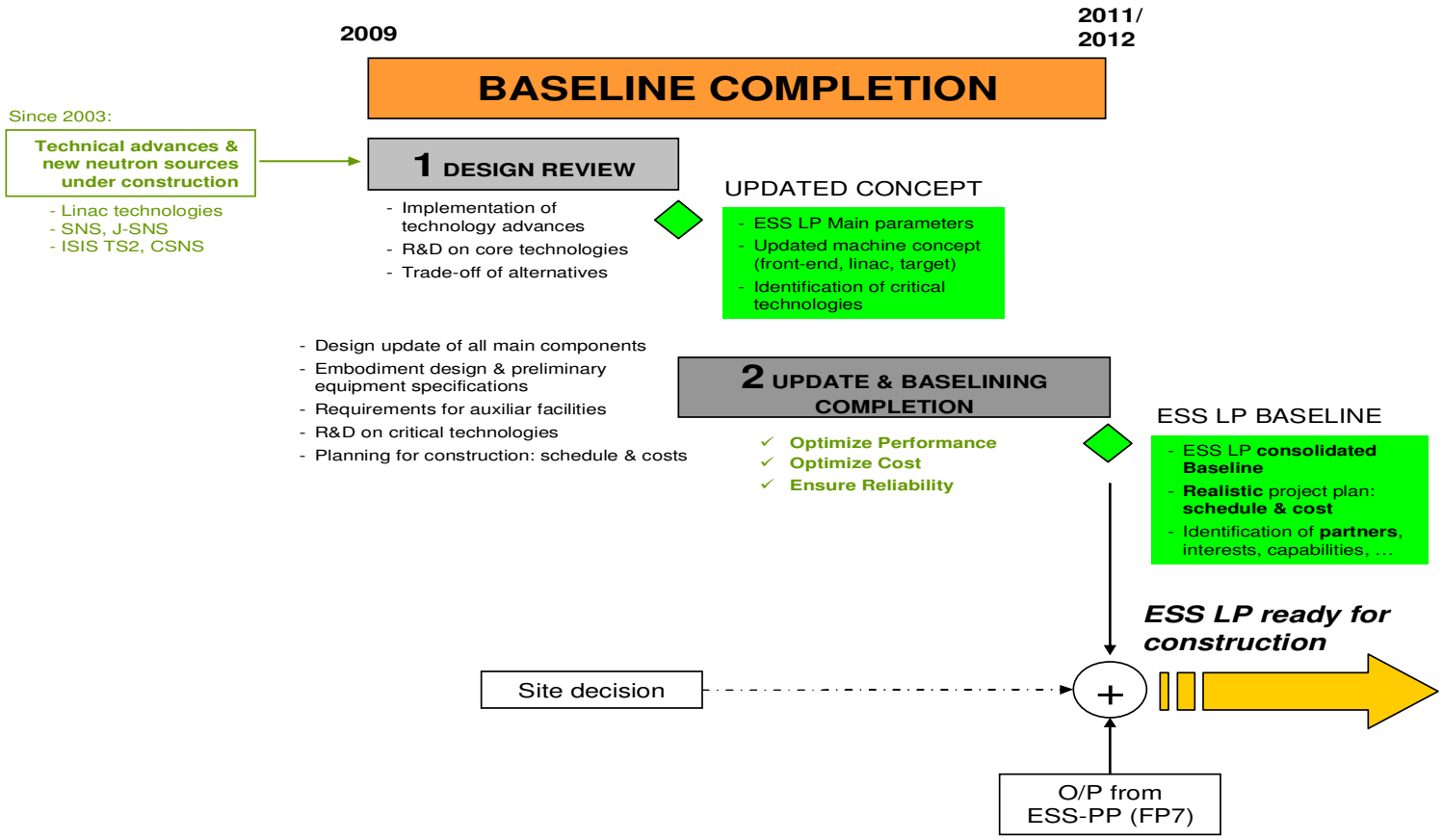
DESIGN UPDATE



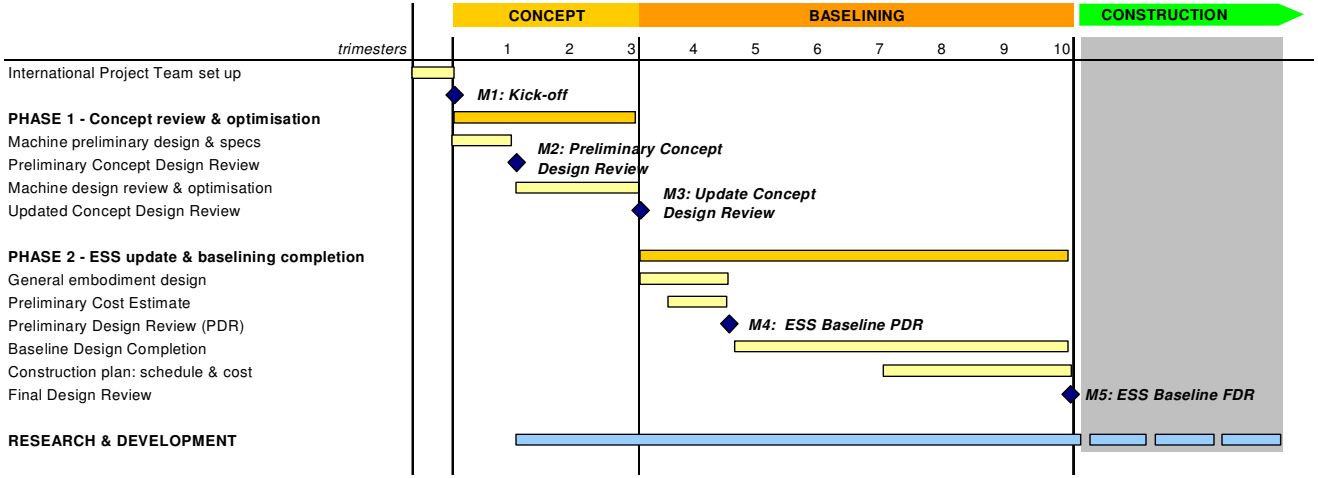
DESIGN UPDATE



LINAC DESIGN UPDATE

Objective**: To present a **Conceptual Design Report** with full cost (to completion) for the linac **by the end of 2012

- *Collaborations between institutes and universities in the ESS countries*
- *Agreement of main linac parameters with target and instrument teams*



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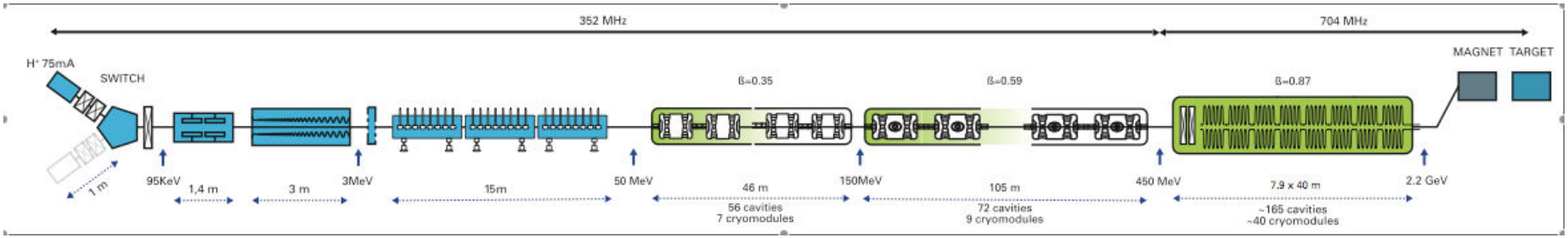
ESSB PREPARATORY WORK

ESS-Bilbao WORKSHOP CONCLUSSIONS



In comparison to the originally proposed design (5 MW, 1 GeV, 150 mA, 16.7 Hz) the parameters have been modified in order to ***simplify the linac design*** *and to* ***increase reliability****. In essence the current has been decreased and the final energy has been increased, keeping the footprint of the accelerator the same.*

- ✓ ***Increase in energy*** *– With increased energy the average pulse current can be reduced by the same factor.*
- ✓ ***Increase of the cavity gradient*** *– By decreasing the current to 75 mA, the gradient can be raised to 15 MV/m, keeping the coupler power constant at 1.2 MW.*
- ✓ ***Increase of beam energy*** *- the final energy was increased from 1 to 2.2 GeV.*
- ✓ ***Repetition rate*** *- The originally proposed repetition rate of 16.67 Hz has been increased to 20 Hz.*
- ✓ ***Pulse length*** *- The originally proposed pulse length of 2 ms has been reduced to 1.5 ms*

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ESSS PREPARATORY WORK

Work with expert group (the ESSS linac reference group)

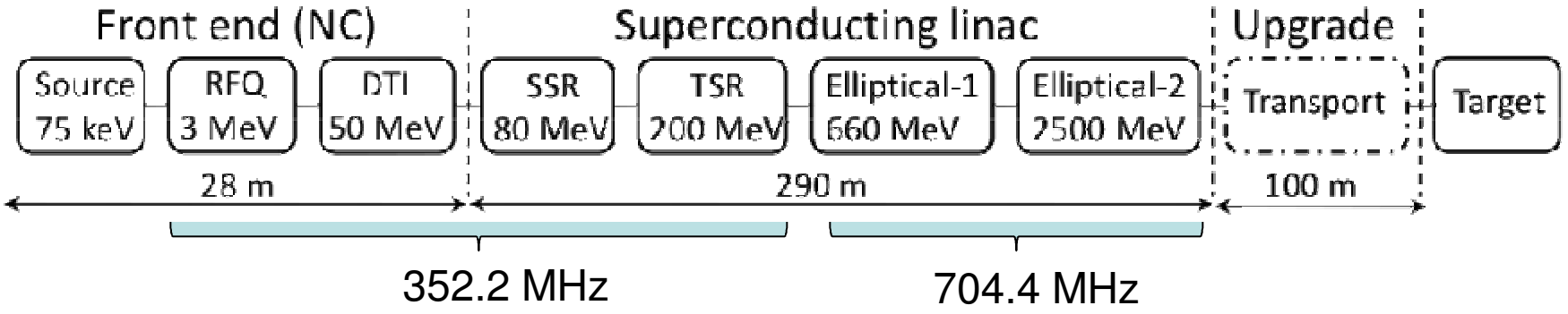


Table 1: Primary ESSS performance parameters in the long pulse conceptual design. There is no accumulator ring.

INPUT		**Nominal**	**Upgrade**
Average beam power	[MW]	5.0	7.5
Macro-pulse length	[ms]	2.0	2.0
Pulse repetition rate	[Hz]	20	20
Proton kinetic energy	[GeV]	2.5	2.5
Peak coupler power	[MW]	1.0	1.0
Beam loss rate	[W/m]	< 1.0	< 1.0
OUTPUT			
Duty factor		0.04	0.04
Ave. pulse current	[mA]	50	75
Ion source current	[mA]	60	90
Total linac length	[m]	418	418

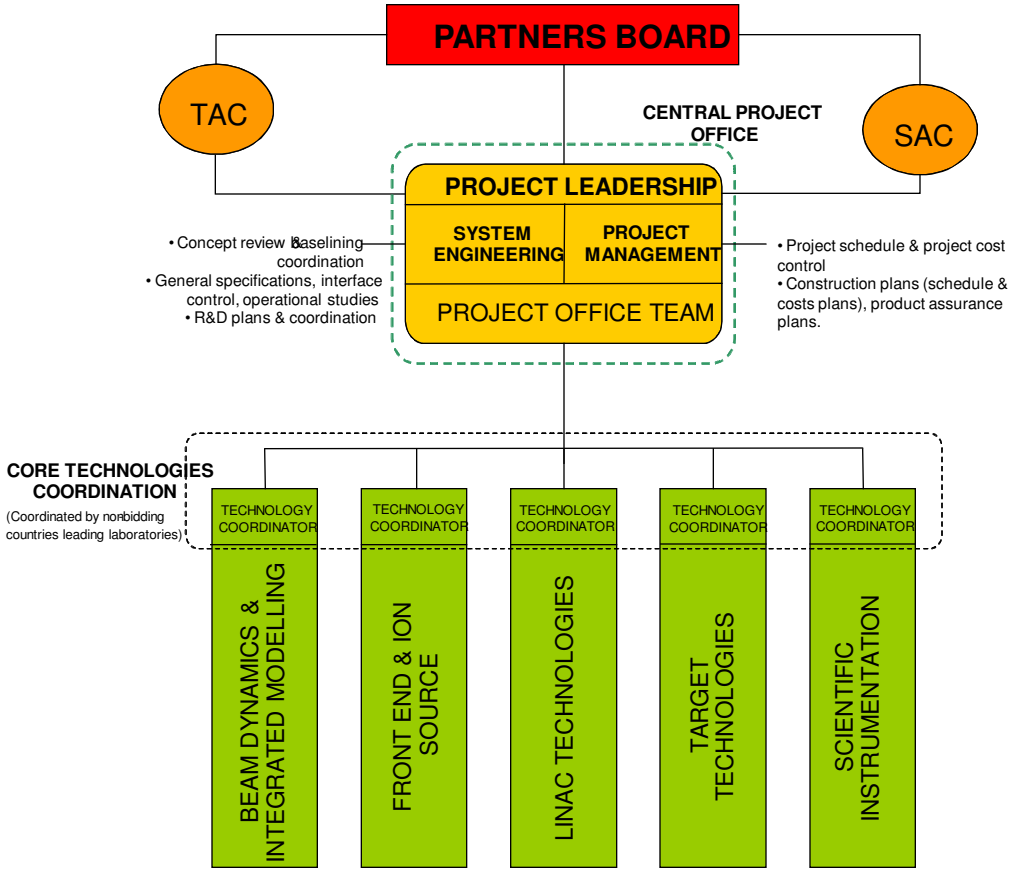
DESIGN UPDATE: SOME ISSUES

Question for future users and ESS technical teams:

- *Using the best SCRF technology, what is the **optimum design** of the linac with given objectives?*
- *How long is the **ideal "long pulse"** and what is the **ideal repetition rate**?*
- *Can we confirm that the number of **neutron at the instruments** is proportional to the proton-Joules delivered at target for **energies up to 3 GeV** or more?*
- *What flexibility can be left in the design for **future upgrades** without compromising construction time, schedule and budget?*

COLABORATION MODEL FOR LINAC DESIGN

- *A strong **coordination team** in Lund – responsible for project integration*
- *A **collaboration board** – to assure good coordination*
- *Adoption of **common standards***
- *Regular **reviews***
- *Basis for **collaboration during construction phase***
- *Share of technical resources with **XFEL, SPL, Project X, eRHIC….***



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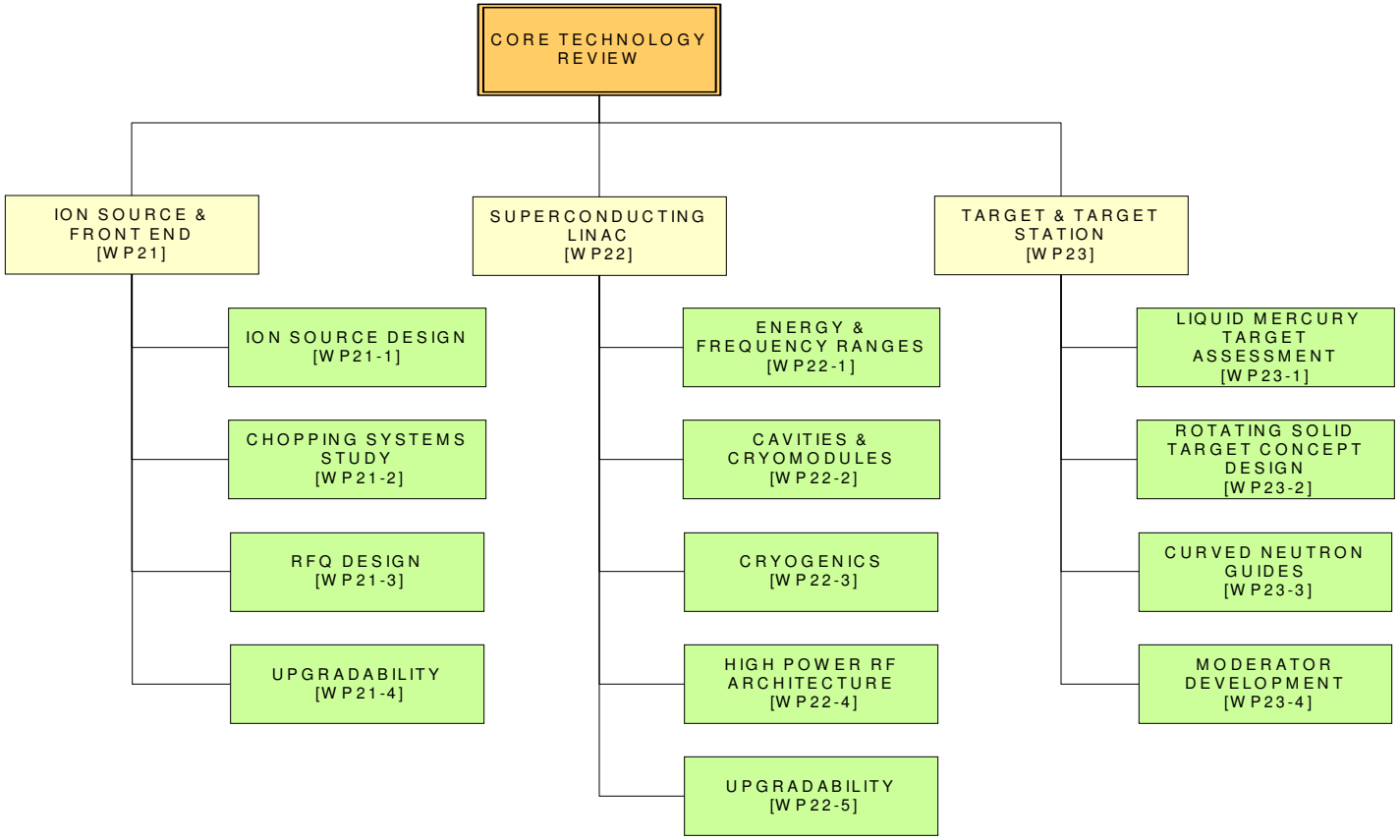
CORE TECHNOLOGY REVIEW



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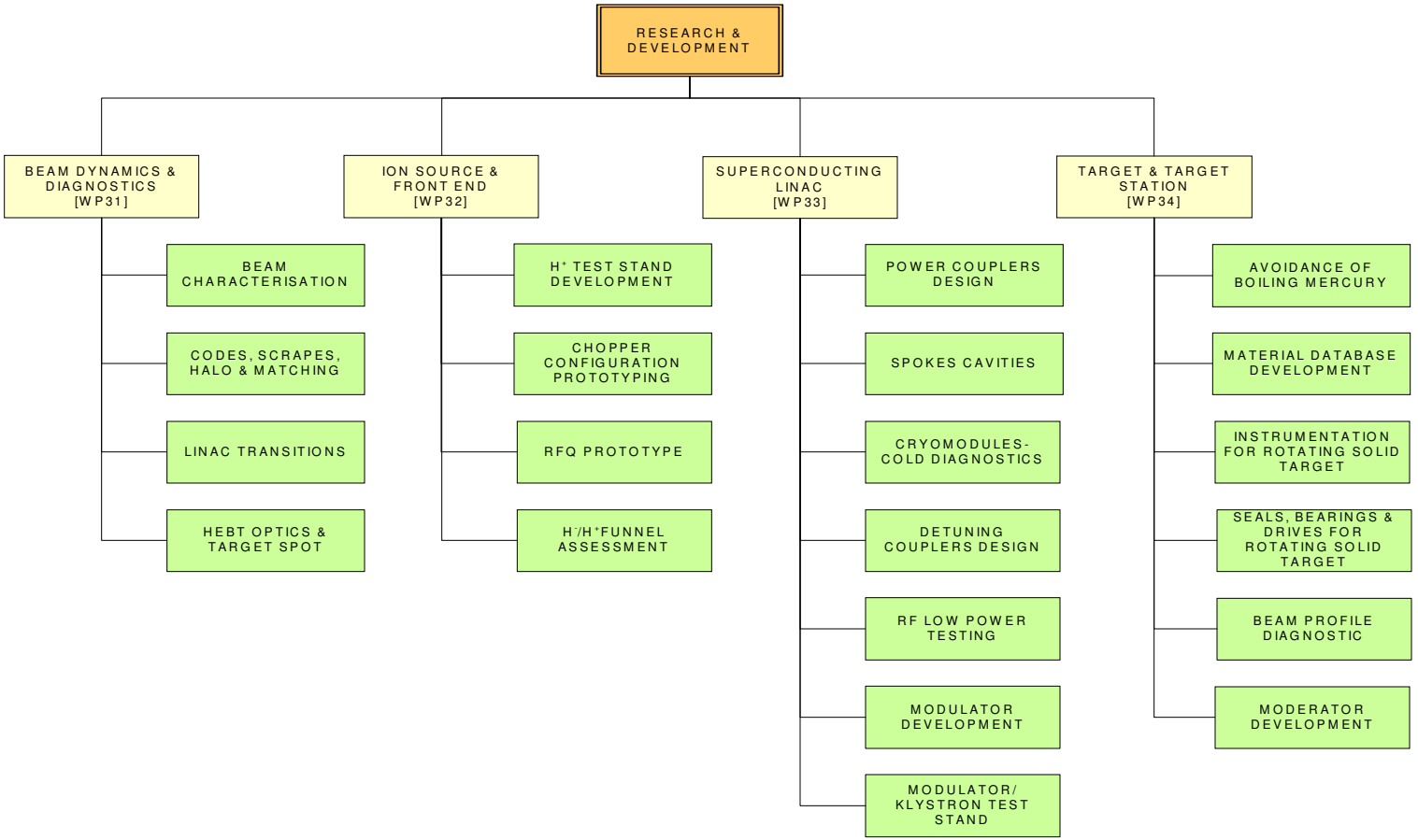
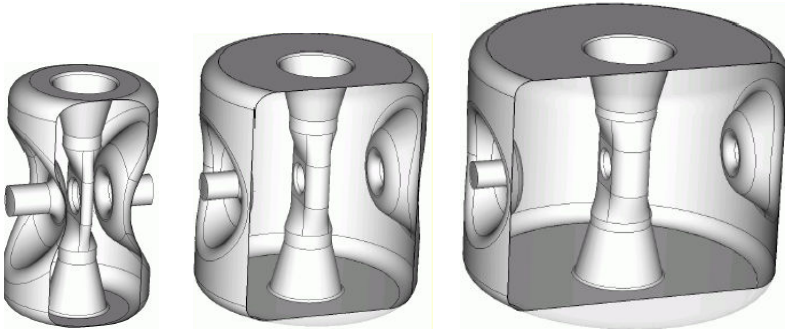
R&D FOR DESIGN PHASE



WORK PACKAGES

1. *Management Coordination*
2. *Beam Physics*
3. *Infrastructure Services*
4. *SCRF Spoke cavities*
5. *SCRF Elliptical cavities*
6. *Front End and NC linac*
7. *Beam transport, NC magnets and Power Supplies*
8. *RF Systems*

4TH LINAC REFERENCE GROUP MEETING



- *Held in **Aarhus, Denmark** the **9th October***
- *Focus on the low energy part of the linac, in particular the **low beta SC part***
- *~30 experts attended from: **FNAL, INFN, TSL, CERN, MSL, JLAB, SNS, SOLTAN, ANL, BNL,AU,CEA,UU, ESS***
- ***Talks:***
    - *low beta structures – Duperrier (CEA/IRFU)*
    - *low beta NC linac design philosophy – Stovall*
    - *SPES pulsed linac – Pisent (INFN)*
    - *JLAB experience on SC low beta structures – Delayen (JLAB)*
    - *The all SC linac, ANL view – Ostroumov (ANL)*
    - *EURISOL spoke cavity development – Bousson (CEA)*
    - *An optimised spoke option for ESS in 50-160 MeV range – Eshraqi (ESS)*

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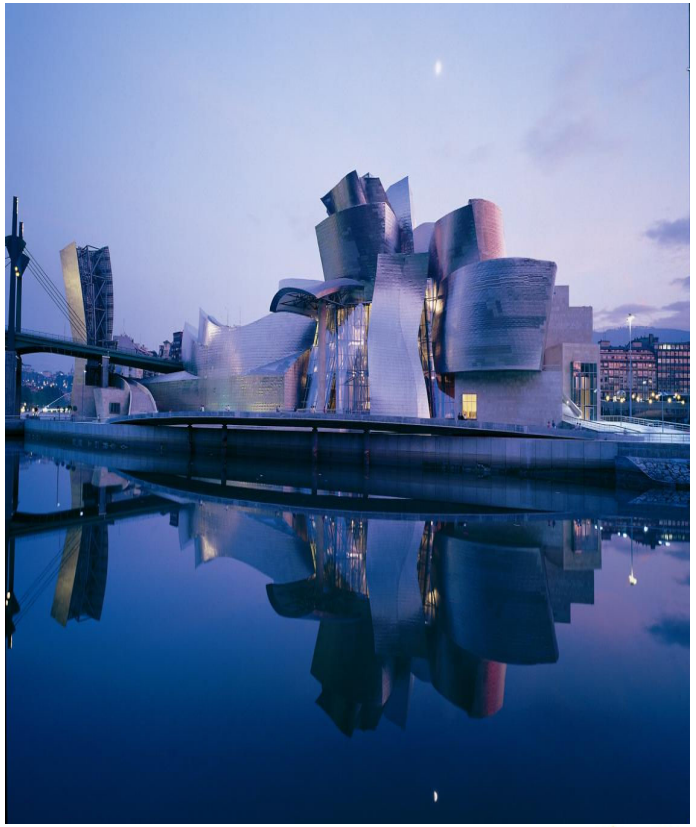
5TH LINAC REFERENCE GROUP MEETING

- *To be held in **Bilbao** on the **23rd November***

-*Focus on **beam losses & operational simulations***

-*Goal: to identify key operational scenarios and beam dynamic issues that permit **low beam losses, rapid commissioning and high reliability***

- *Outcome expected: **connections** between these 3 issues outlined in **work programmes** for ESS design update*



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