The ESS

3 May, SHLiPP-2, Catania, 2012

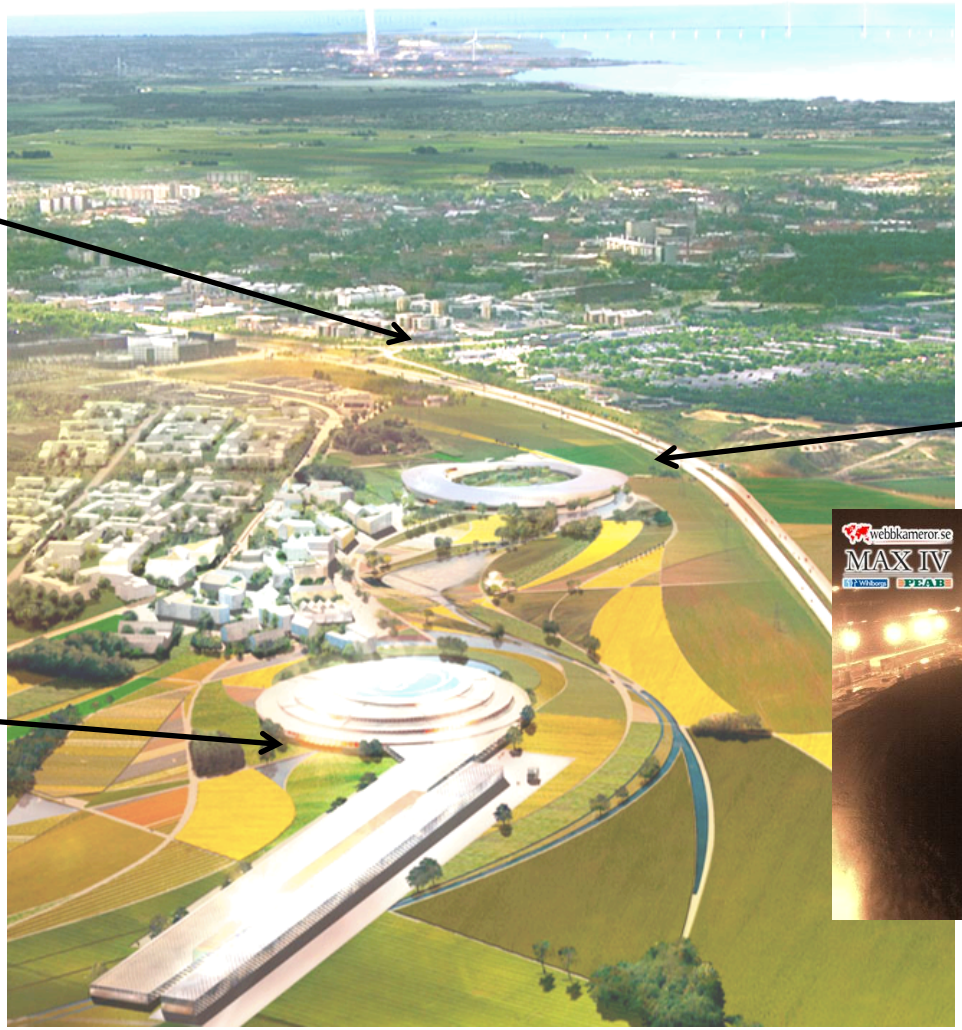
Mats Lindroos

Head of accelerator division and projects

EUROPEAN
SPALLATION
SOURCE

ESS , MAX-IV and Medicon Village

MEDICON VILLAGE



MAX-lab

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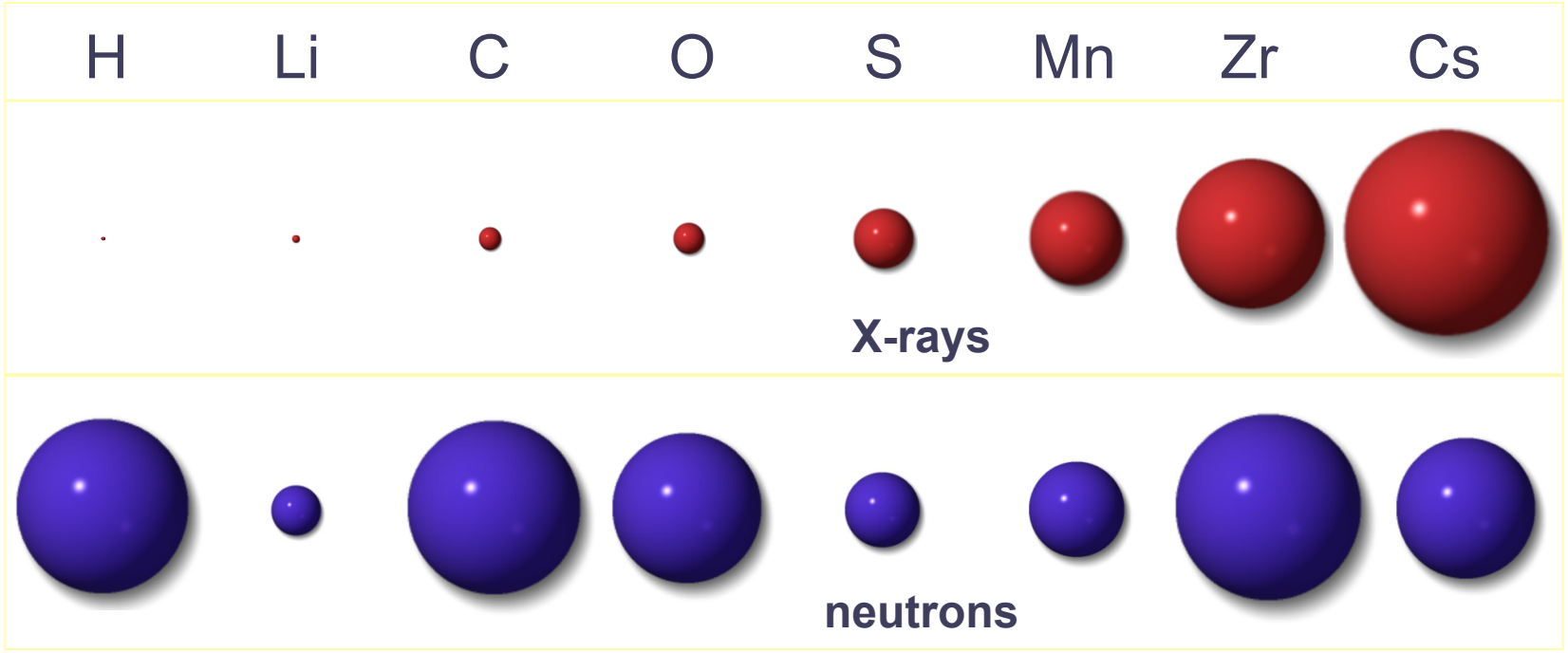
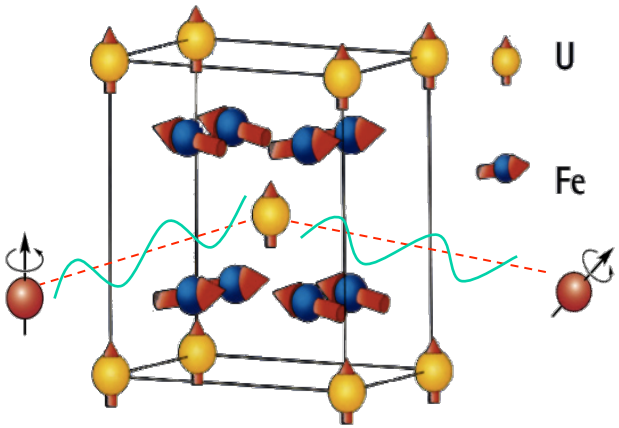
Neutrons see the nuclei..

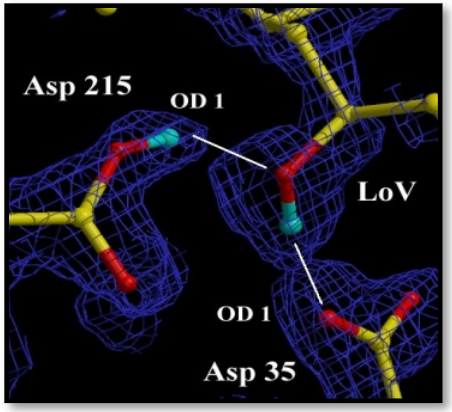


Neutrons and x-rays are complementary - neutrons…

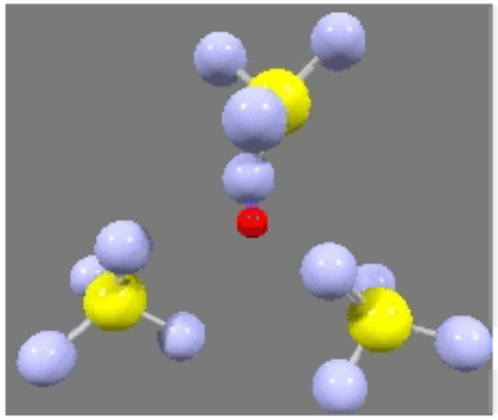


..see magnetic atoms

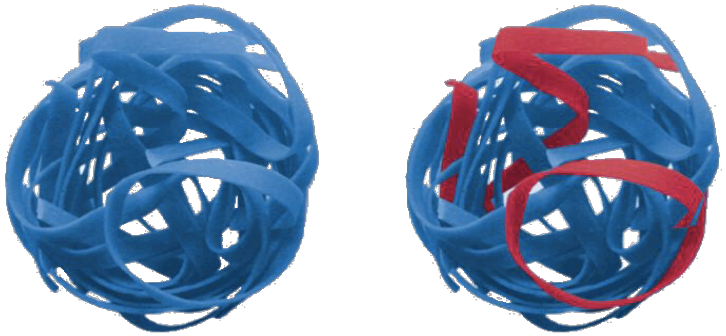
..see inside materials



..see light atoms



..see atoms move

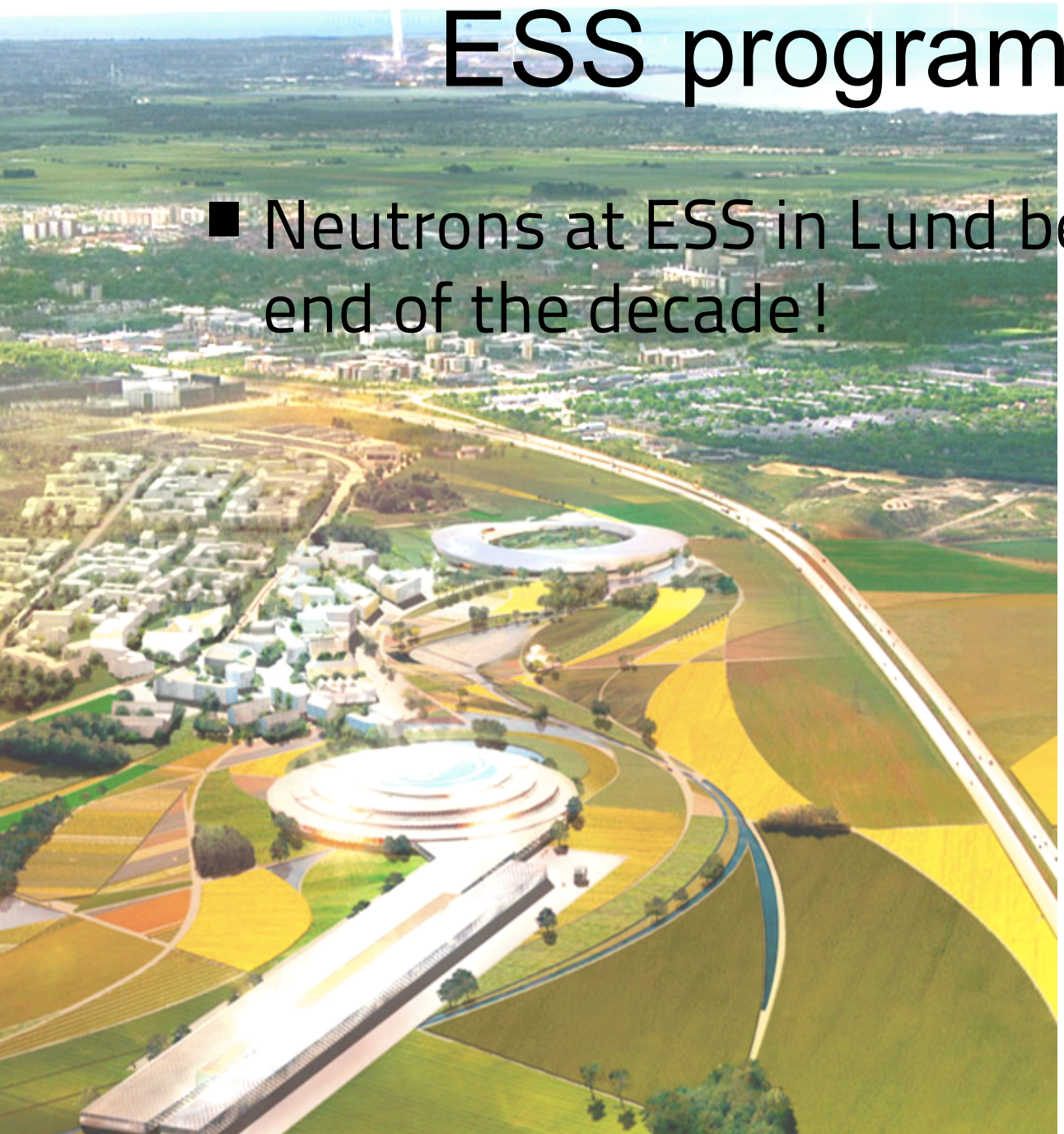


..see isotopes

Courtesy of Ian S. Anderson

ESS program Goal

- Neutrons at ESS in Lund before the end of the decade!



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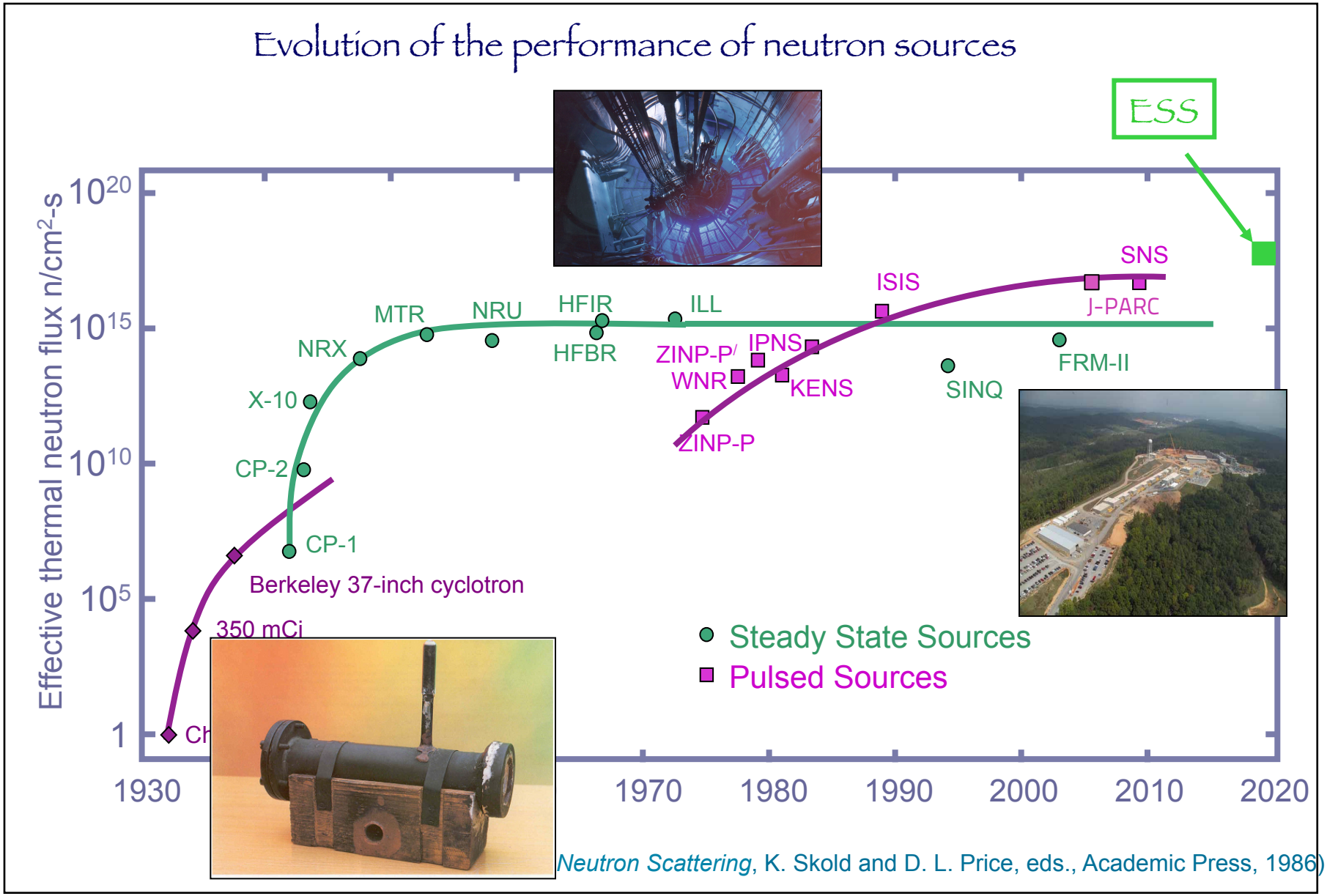
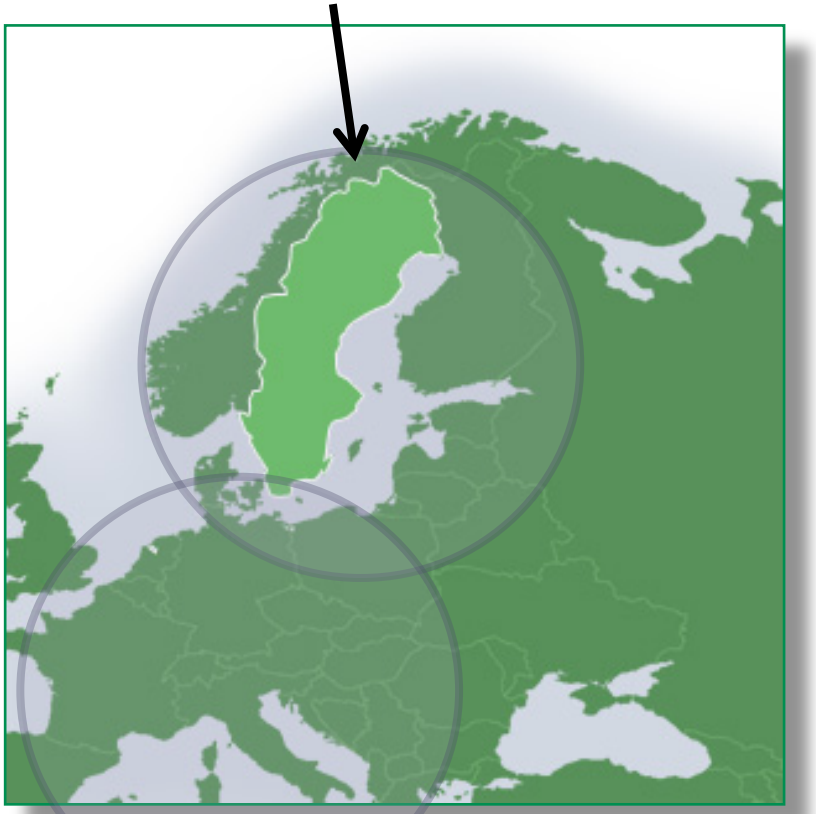
Why ESS? - High time average and peak flux



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

International collaboration

Sweden, Denmark and Norway
covers 50% of cost



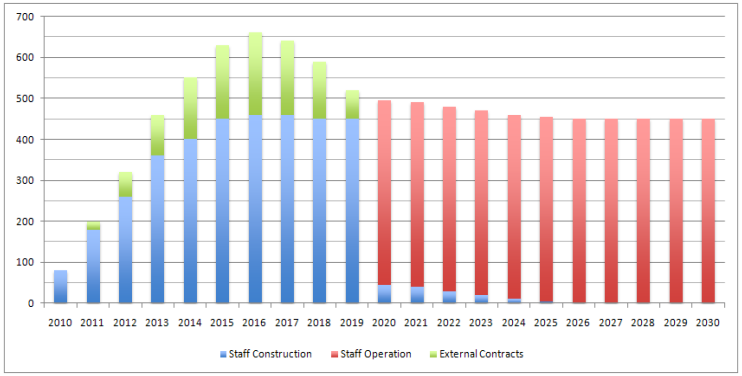
The remaining ESS members states covers the rest!

17 Partners today

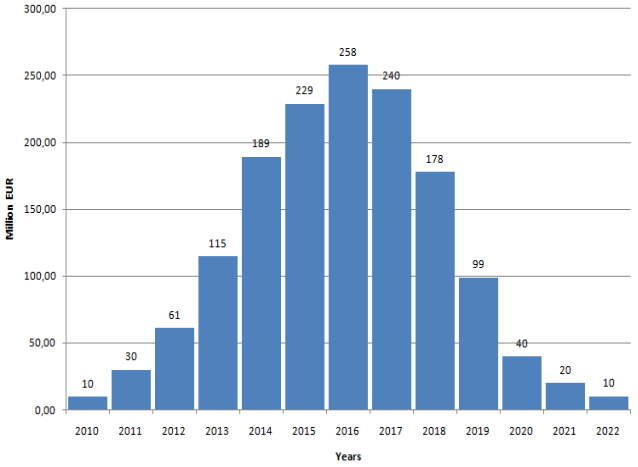
ESS construction cost estimates

Investment: 1478 M€ / ~10y
Operations: 106 M€ / y
Decomm. : 346 M€
(Prices per 2008-01-01)

Personel:



Investment:



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ESS Programme Organisation

ESS AB Board

Steering Comm (STC)

Adm Financial Comm

CEO C. Carlile

Administration Director

Collaboration Partners

Programme Director

Machine Director

Science Director

Technology Adv. Comm

Science Adv. Comm

Programmme Office

Accelerator

Target

Conventional Facilities

Instruments

Neutron Science

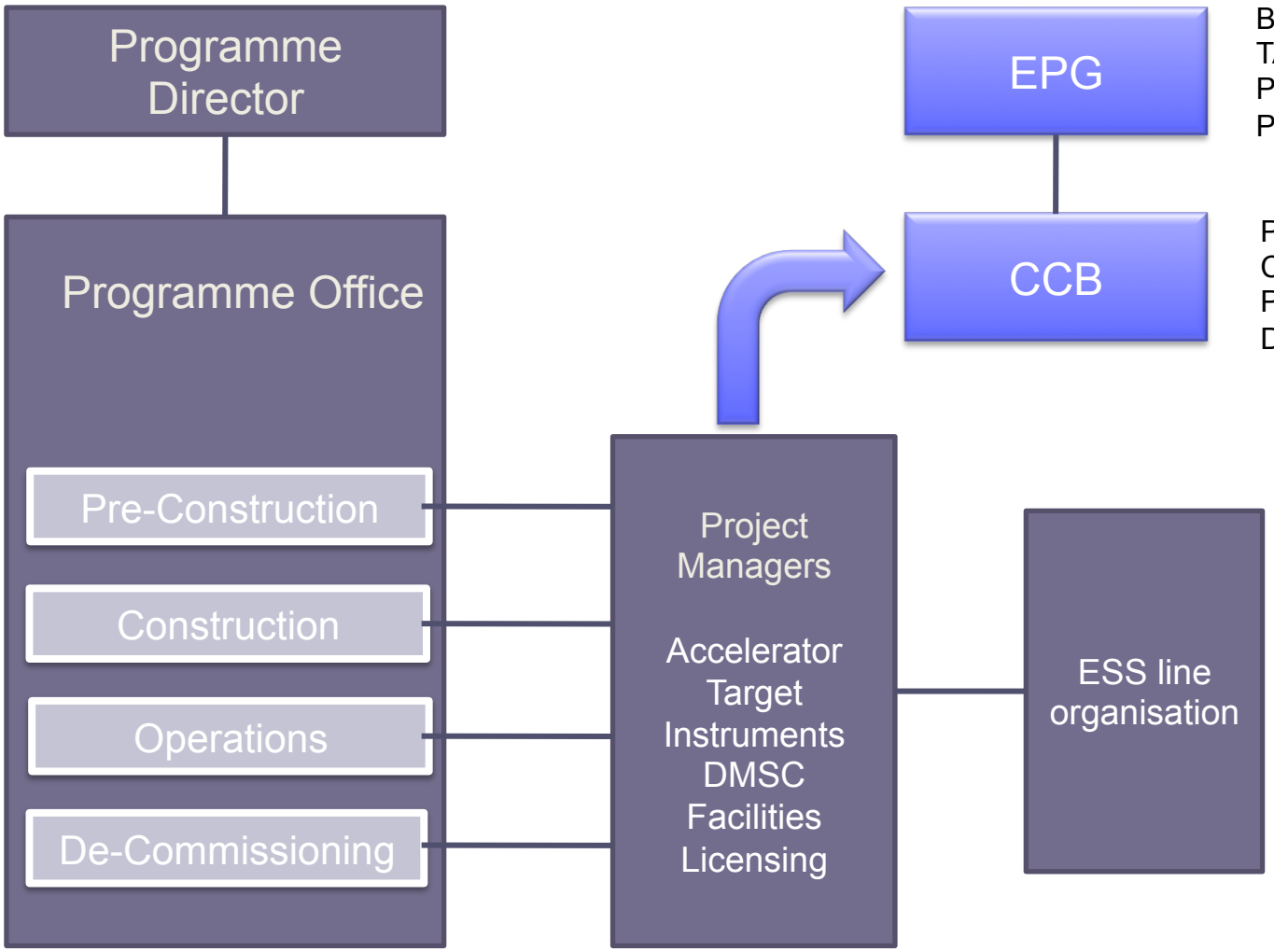
Data Management

Preconstruction

Construction

Operation Phase

Programme Committees



Board, ,STC, AFC, SAC,
TAC Programme Decisions
Programme Reviews
Programme Budget

Programme Planning
Configuration control
Preparation of EPG Decisions
Definition of deliverables

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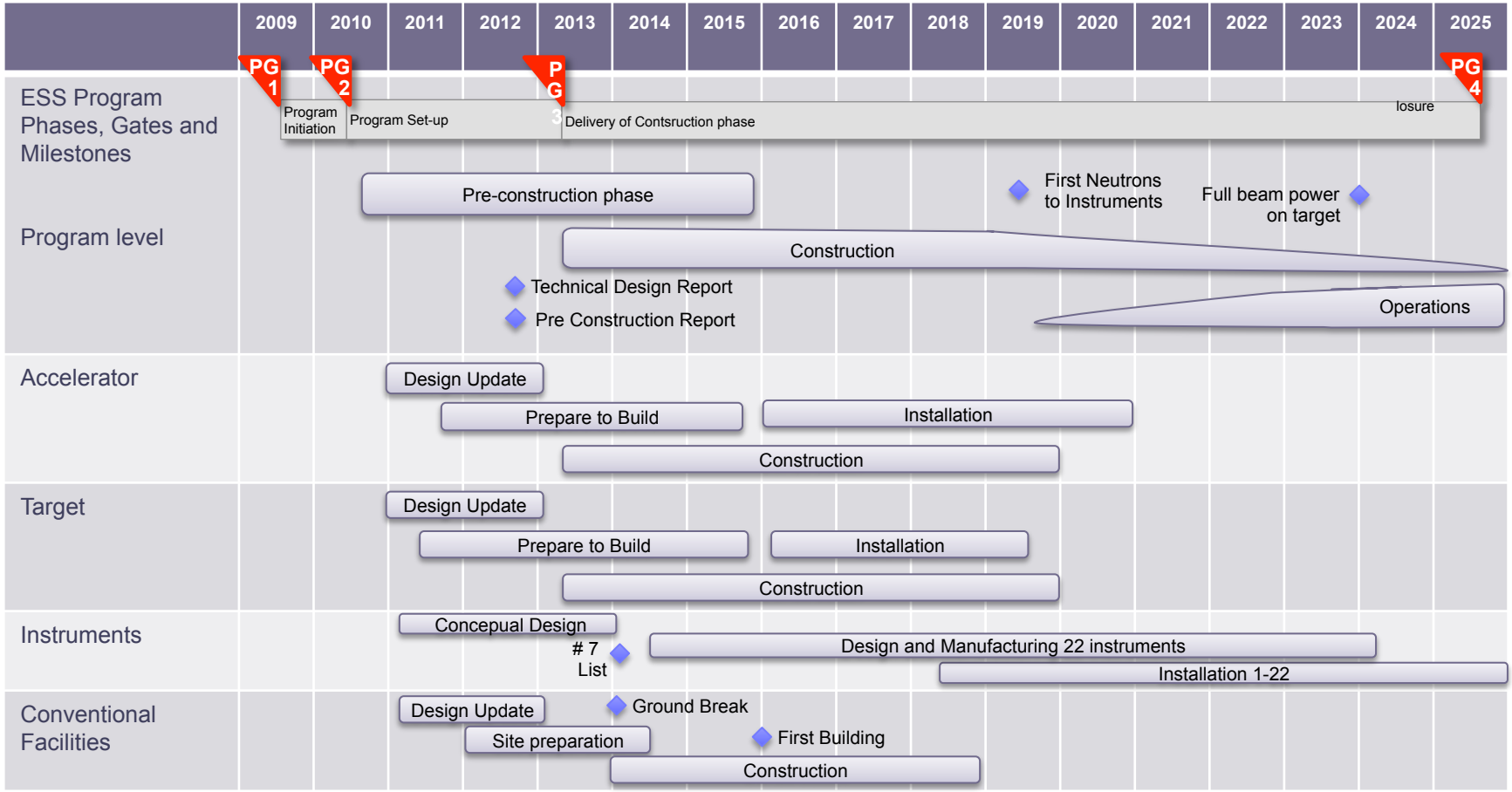
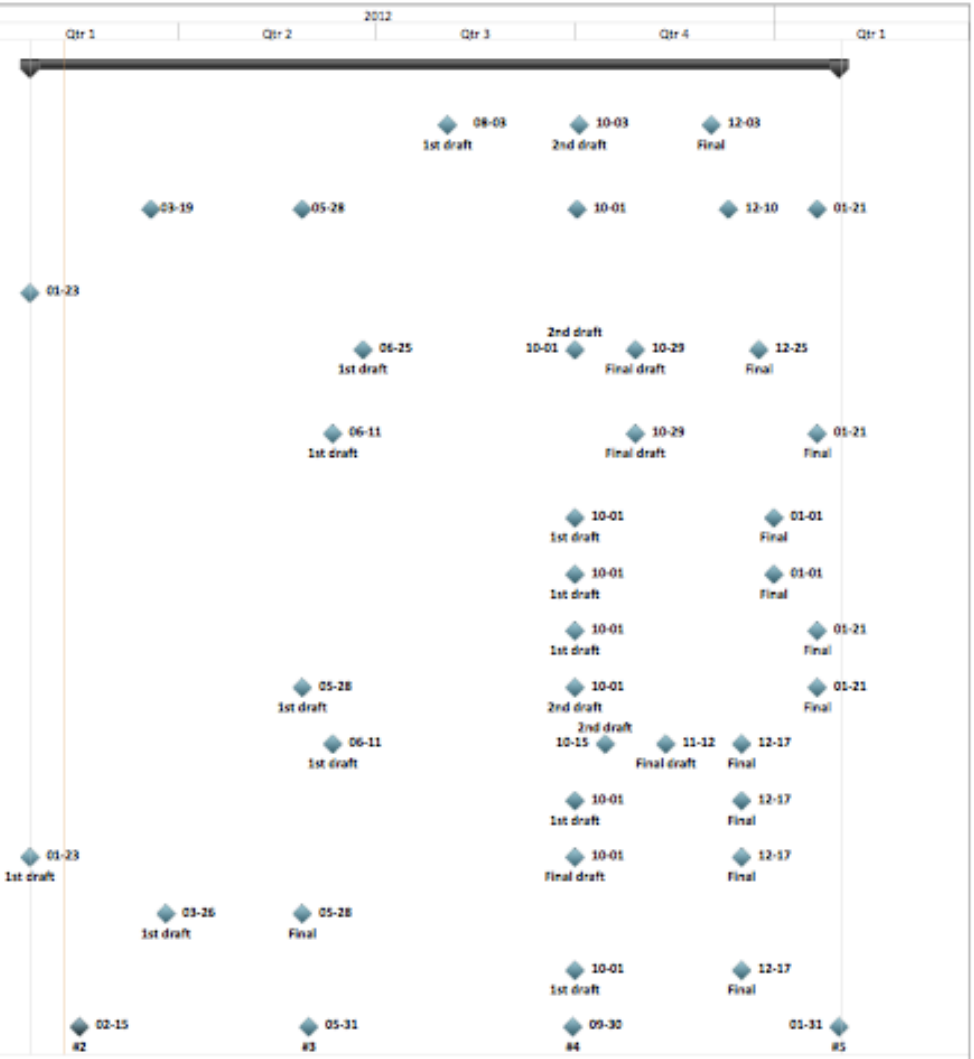
ESS Master Programme Schedule



Pre-construction deliverables (1/2)

ID	Task Name	Text2
1	**ESS Doc Deliveries**	
2	Executive Report	KM
6	Programme Plan	JL
12	Conceptual Design Report	SP
13	Technical Design Report	SP
18	Project specification	ML, FM, KA, KH, TP, JB, GL
22	Prel Project spec Operations	DA
25	Prel Proj spec Decommissioning	PJ
28	Collaboration plan	KM
31	Transition plan to operations	PC
35	Budget and Cost Report	JB
40	Funding Scenario	DA
43	Risk management plans	ÖL
47	Proposal org structure	CC
50	A Signature-ready agreement	(TBD)
53	4-monthly report	JB



Pre-construction deliverables (2/2)

ID	Task Name	Text2	2012 Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1
1	**Supporting activities**						
2	**ESS framework project**					10-01	01-01
5						09-28	
6	Project Management	JB		03-31	06-30	12-31	01-21
12						09-28	
13	Engineering processes	RD		03-31	06-30	12-31	01-21
19						09-28	
20	Acquisition management	TW		03-31	06-30	12-31	01-21
26						09-28	
27	IT and Information Management	HB		03-31	06-30	12-31	01-21
33						09-28	
34	Governance and organisation	CC		03-31	06-30	12-31	01-21
40	"Light" review	(TBD)			06-29		
41	**Governance Meetings**						
42	STC	CC	01-12	05-10/11		09-13/14	12-17/18
47				03-20	06-04	10-24	
51	ESS board	CC		04-24	08-14	11-16	
59	**Project Milestones**						
60	Target cooling concept	FM			08-01		
61	Number of beam ports defined	PC				10-01	
62	Baseline Ancillary system agreed	ML				11-15	
63	Draft Concept Design Linac & Target foundation	KH			06-01		
64	Choice of Architects	ÖL			08-31		
65	Conventional Facilities conceptual design for Accelerator	KH				12-17	

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ESS accelerator design

High level objectives

ESS **accelerator** high-level technical objectives:

5 MW long pulse source
- -2.86 ms pulses
- -50 mA pulse current
- -14 Hz
- -Protons (H+)
- -Low losses
- -High reliability, >95%
- -Low heat loss cryostats for minimum energy consumption
- -Flexible design for a future power upgrade

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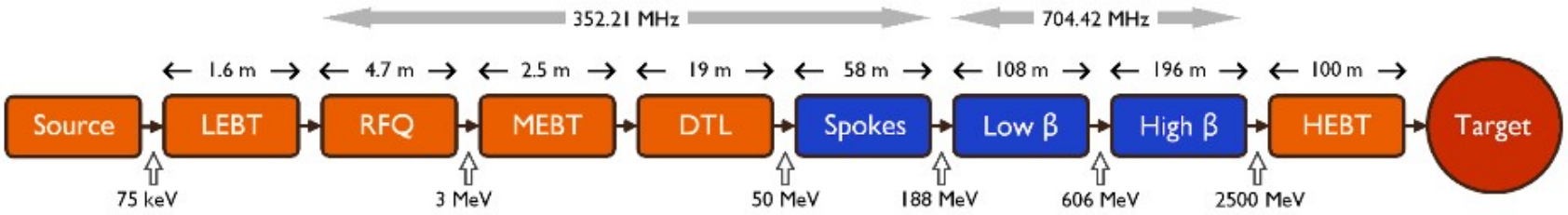
LINAC layout

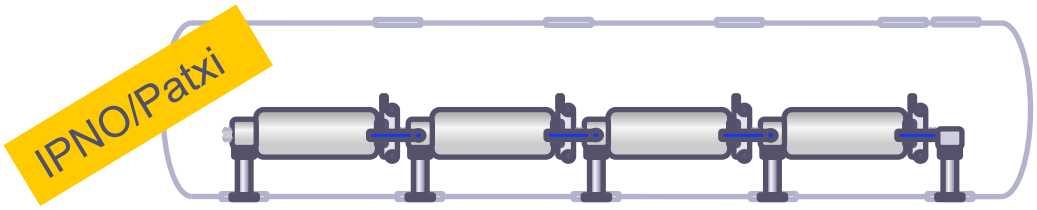


	Length (m)	Input Energy (MeV)	Frequency (MHz)	Geometric β	# of Sections	Temp (K)
RFQ	4.7	75×10^{-3}	352.2	--	1	≈ 300
DTL	19	3	352.2	--	3	≈ 300
Spoke	58	50	352.2	0.57	14 (2c)	≈ 2
Low Beta	108	188	704.4	0.70	16 (4c)	≈ 2
High Beta	196	606	704.4	0.90	15 (8c)	≈ 2
HEBT	100	2500	--	--	--	--

H. Danared, M. Eshraqi, A. Ponton, ESS

Cryomodules

- **Decision** at ESS to use a segmented design
- **Desig and construction** of ESS Spoke cavity CM at IPNO
  - Talks by H. Saugnac and Y. Rutambhara (test in Uppsala)
- **Design and construction** of a 4 cavity CM with SPL study at CERN on-going
  - Talks by P. Duthil and R. Bonomi
- **Agreement** with CEA and IPNO on design and prototyping (EDD) of 4 cavity CM for elliptical cavities at ESS. Work has started.
  - Talk by C. Darve
- **Study** of pros and cons of using a single 4 cavity CM design for all elliptical cavities at ESS
  - Schedule constrained construction
  - Pros and cons under study by C. Darve at ESS AB



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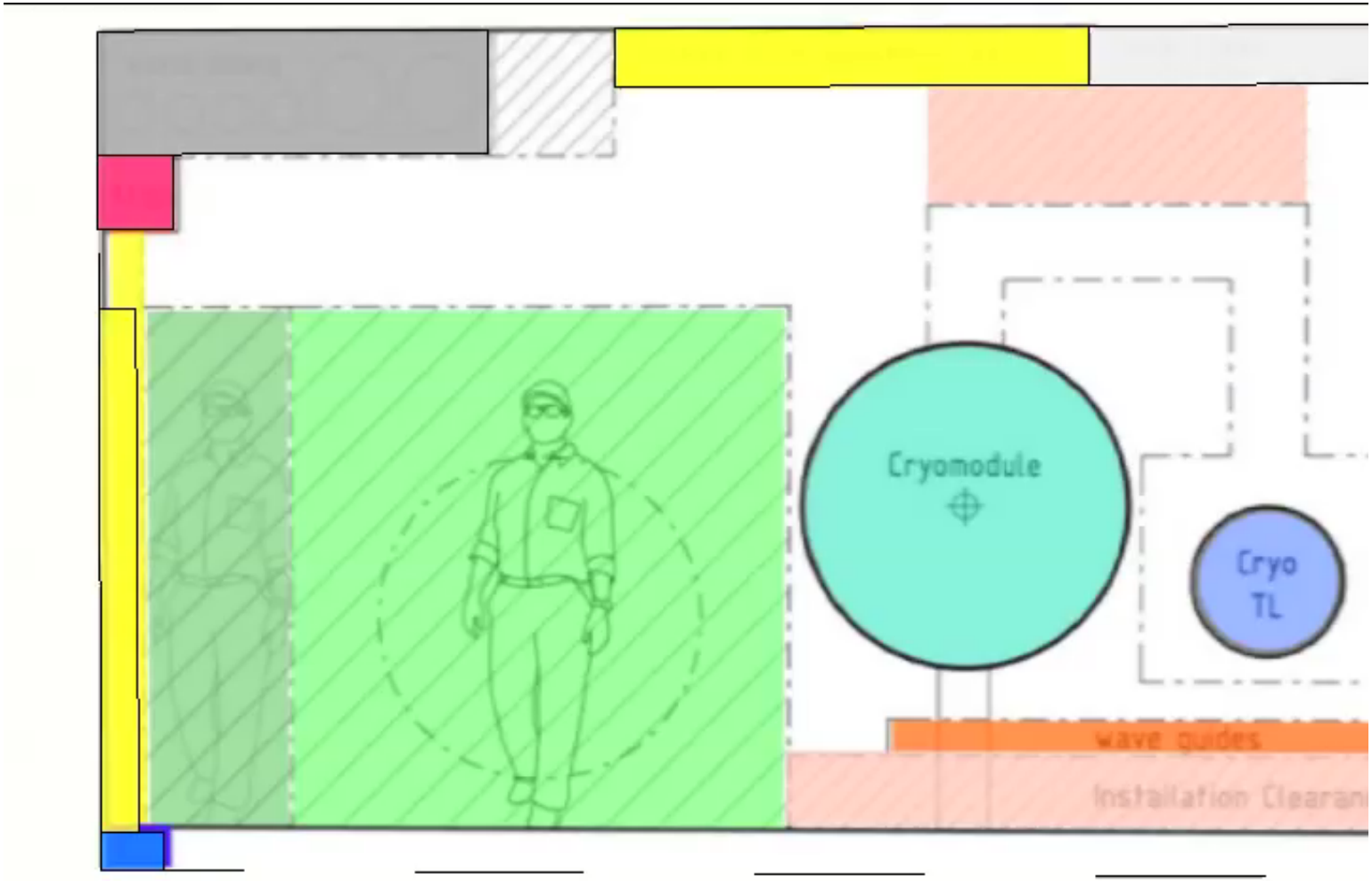
Tunnel cross section



Courtesy of Wolfgang Hess, ESS AB

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Reflection on future operations

Operations	Source ON	Machine Studies	User Service Mode	Source ON	Machine Studies	User Service Mode
	days/year	days/year	days/year	%	%	%
ILL	200	0	200	100%	0%	100%
ESRF	289	56	233	100%	19%	81%
SNS	244	27	217	100%	11%	89%
ESS	260	30	230	100%	12%	88%

Accelerator Design Update

Romuald Duperrier
(30 years ago)

Steve Peggs

Cristina Oyon

David McGinnis

Work Package (work areas)

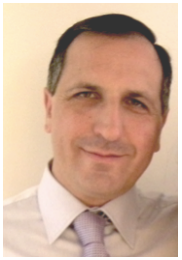
1. Management Coordination – ESS AB (Mats Lindroos)
2. Accelerator Science – ESS AB (Steve Peggs)
(3. Infrastructure Services – now ESS AB!)
4. SCRF Spoke cavities – IPN, Orsay (Sebastien Bousson)
5. SCRF Elliptical cavities – CEA, Saclay (Guillaume Devanz)
6. Front End and NC linac – INFN, Catania (Santo Gammino)
7. Beam transport, NC magnets and Power Supplies – Århus University (Søren Pape-Møller)
8. RF Systems – ESS AB (Dave McGinnis)
19. P2B: Test stands – Uppsala University (Roger Ruber)

Mats Lindroos

Guillaume Devanz

Roger Ruber

Søren Pape Møller



Santo Gammino

Sebastien Bousson

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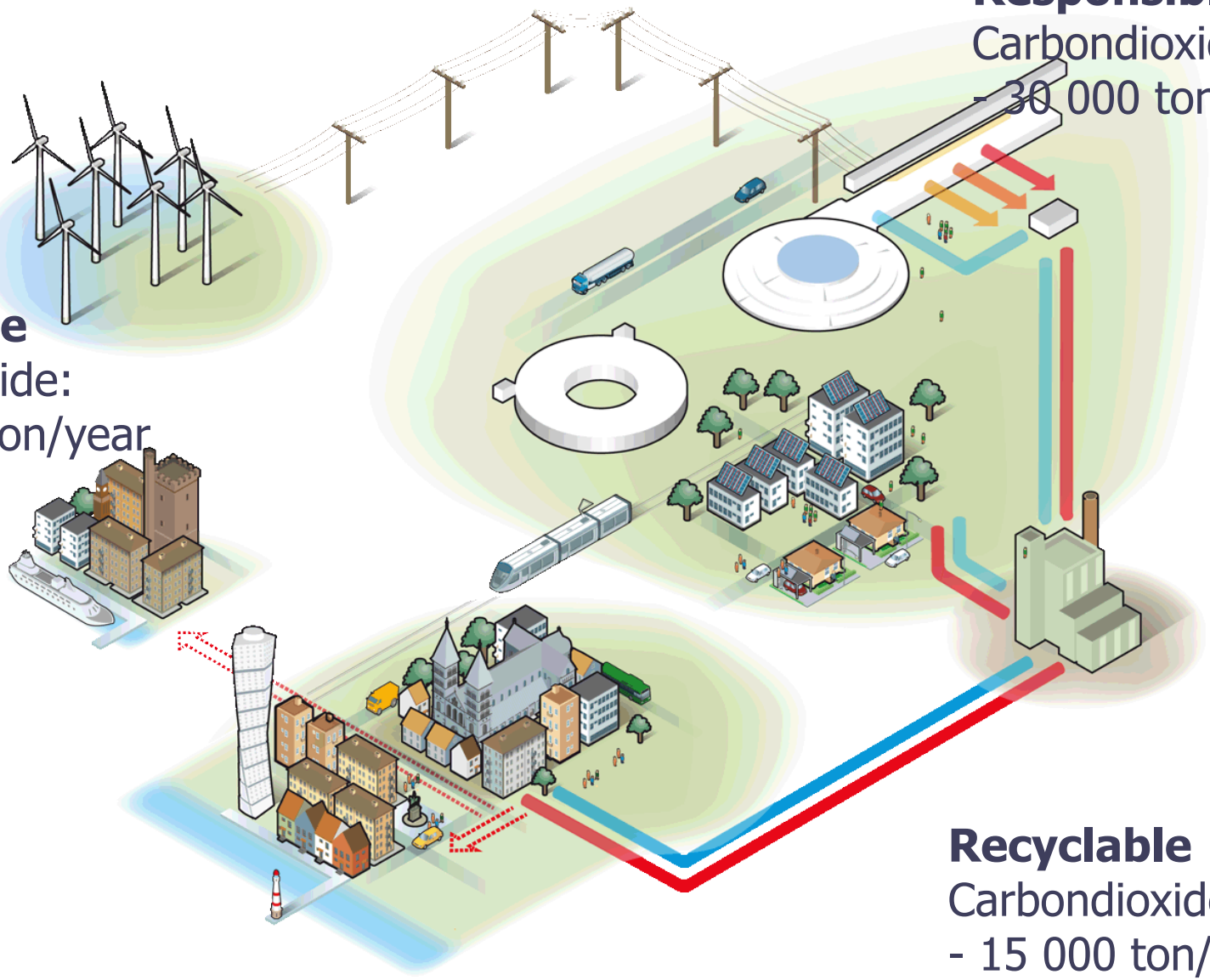
A sustainable research facility

Responsible
Carbondioxide:
- 30 000 ton/year



Renewable
Carbondioxide:
- 120 000 ton/year

Recyclable
Carbondioxide:
- 15 000 ton/year

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Upgrades

- **The mandate is to build a 5 MW long pulse source!**
- The presently favored upgrade scenario is a **power upgrade to higher power with maintained time structure** (Max. 3.5 Gev and/or 100 mA)
- Renewed interest recently in a 5 MW 100 microsecond pulse source
  - Extraction from a ring of a train of ≈1 microsecond bunches over 100 microsceonds
- We will study how this can be prepared within the present 5 MW baseline
  - The additional cost should be understood and made apparent in the costing of the 5 MW baseline
  - First technical studies and financial estimates for the upgrade itself should be done as part of the ADU project

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Summary

- The European Spallation Source will be built in Lund
- The Design will permit a long life with many upgrades
- The accelerator design, prototyping and construction are done in a collaboration

- Good progress – general comment at the last TAC meeting was:
  - You are really going to build it!

- We are looking forward to your feed-back and input!

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Frozen accelerator design Falsterbo December 2011