

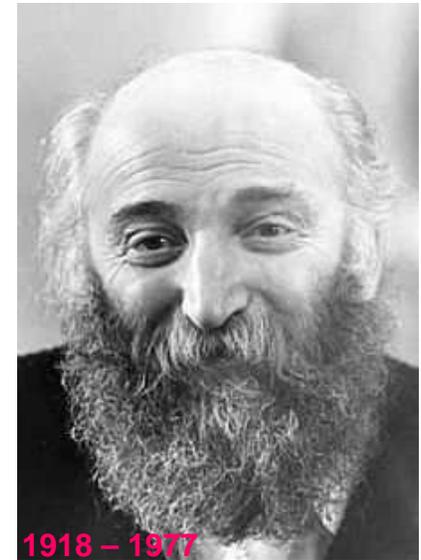


THE “Gersh Budker Prize” PRIZE FOR...THE SUCCESSFUL CONSTRUCTION AND COMMISSIONING OF THE SPALLATION NEUTRON SOURCE



1451 – 1506

EPAC08, Genoa (Italy)
26 June 2008



1918 – 1977

Norbert Holtkamp
Principal Deputy Director General, ITER

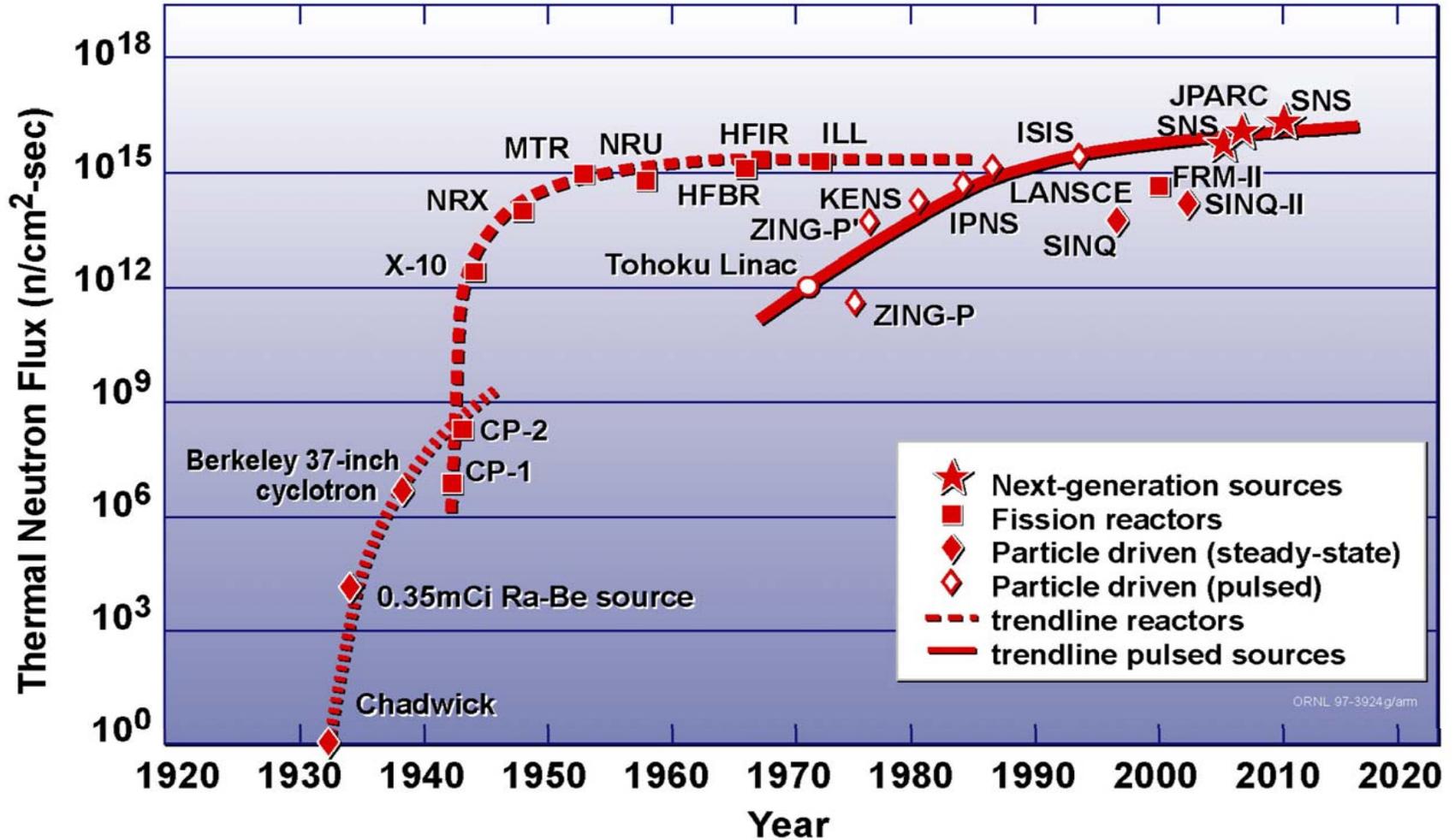


The Spallation Neutron Source

- SNS is funded through DOE-BES and has a Baseline Cost of 1.4 B\$
- 1.3 GeV facility designed & build to operate at 1 GeV to begin with
- SC linac
- Single ring capable to operate at 1.3 GeV
- One target station
- The peak neutron flux will be $\sim 20\text{--}100\times$ ILL
- SNS operates since May 2006



Reactors vs. Accelerator-Driven Sources



(Updated from *Neutron Scattering*, K. Skold and D. L. Price: eds., Academic Press, 1986)



The Citation

- “For the construction Successful commissioning of the linac-driven Spallation Neutron Source (SNS)
- On time and to budget,
- Within the constraints of a multi-laboratory collaboration.
- His inspirational leadership and outstanding management skills,
- Combined with a thorough understanding of the technical & scientific challenges,
- Were the essential components in successfully bringing together the highly effective SNS team.”
- ... SO: What are the elements of “Success”

- 
- An aerial photograph of a vast, dense forest. The trees are a mix of green and brown, suggesting a temperate forest. In the upper left quadrant, there is a distinct, roughly circular cleared area with a light brown, sandy or dirt-colored ground. A narrow, winding path or road is visible through the trees on the right side of the image. The overall scene is a high-angle view of a large natural area.
- FOR THE CONSTRUCTION

Spring 1999

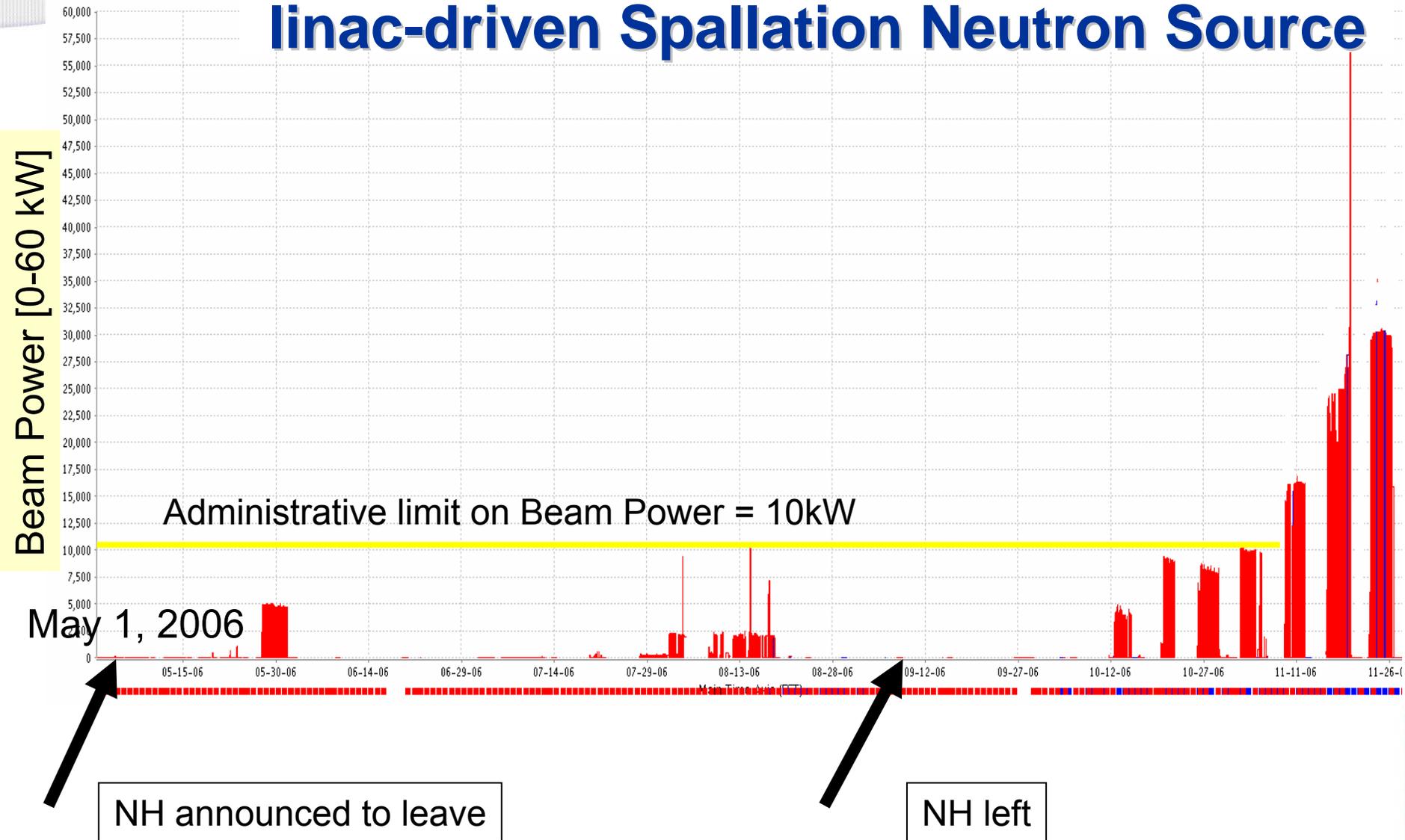


Spring 2006

FINISHED



- And successful commissioning of the linac-driven Spallation Neutron Source

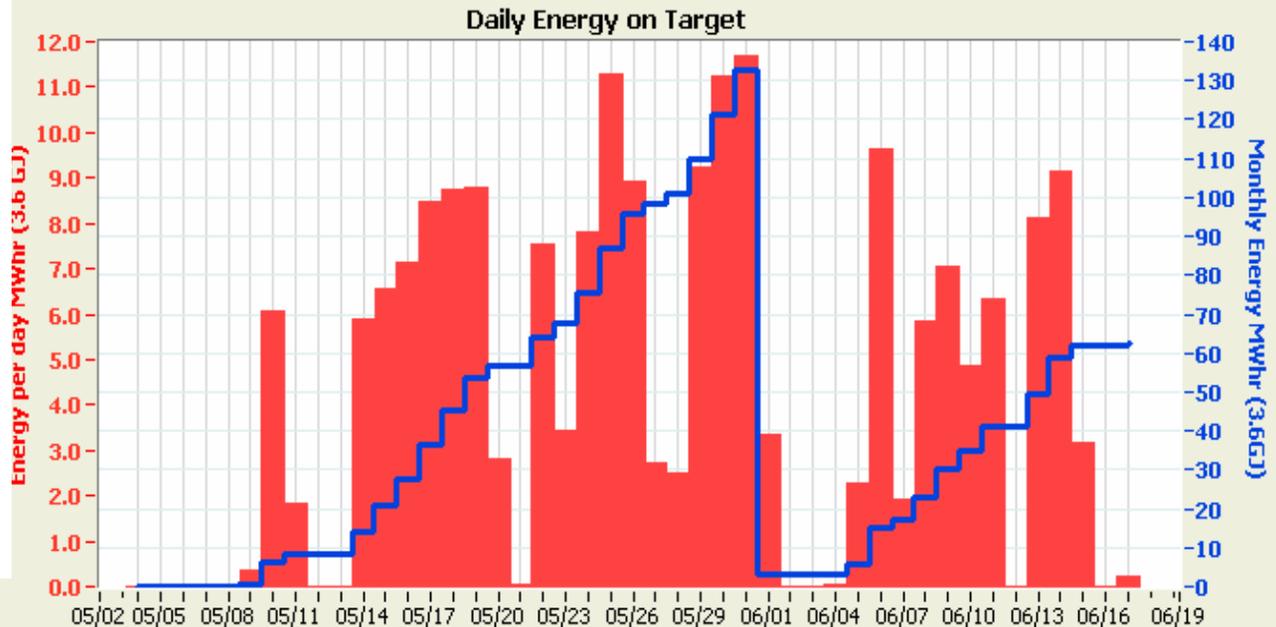
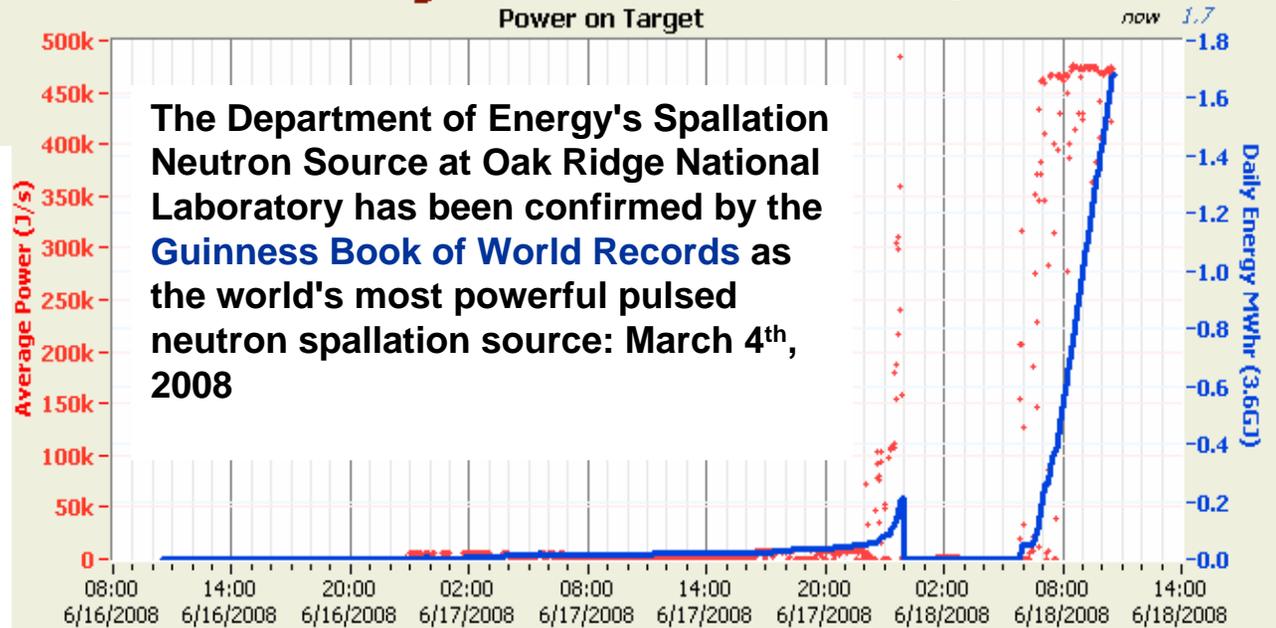




- Talking about: “SUCCESSFUL”
- Congratulations to the SNS team....

473 kW on Target

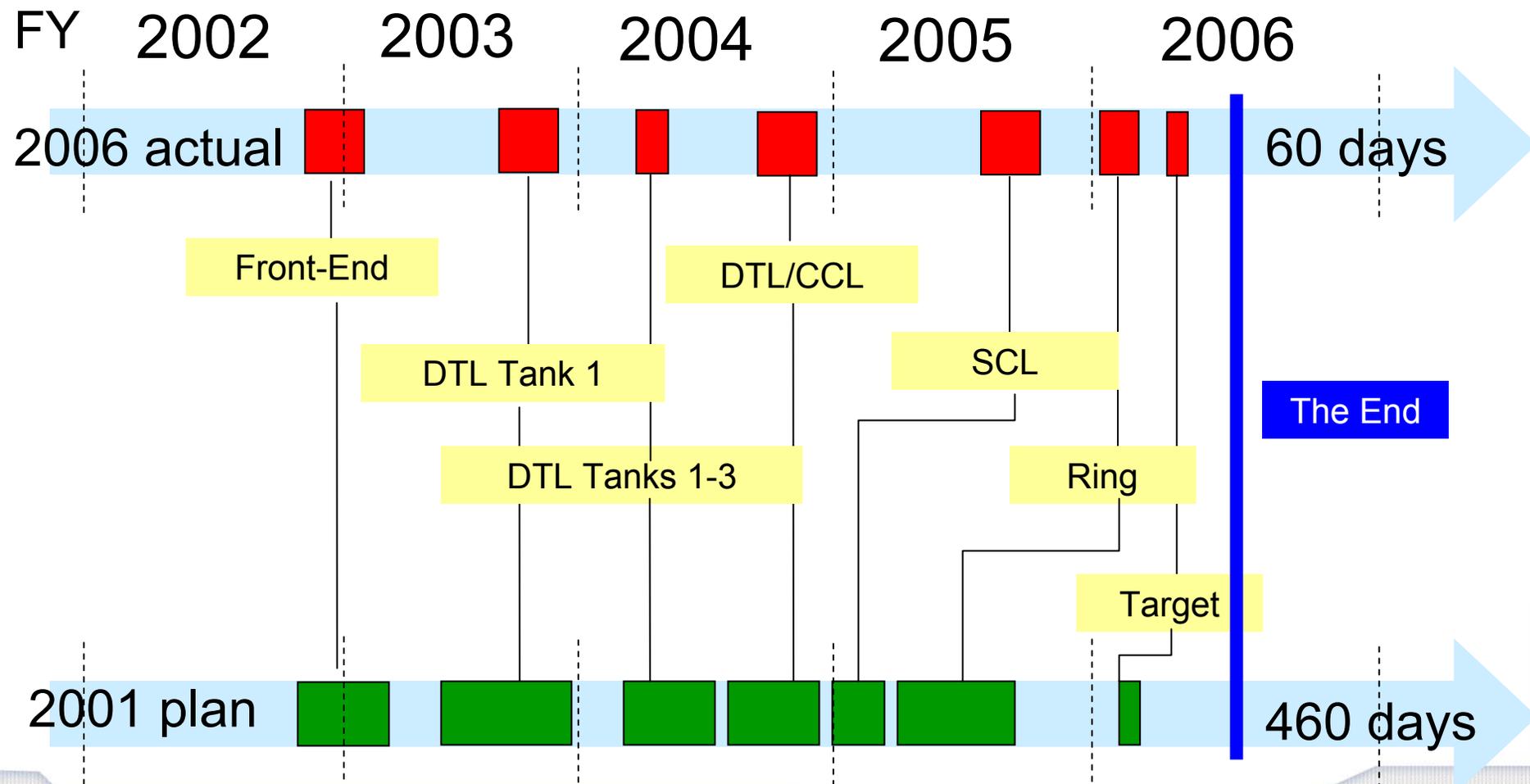
Beam to Target





• On Time

- Its always the first schedule that counts to measure how well a project is doing, not the last one.....





• And to budget

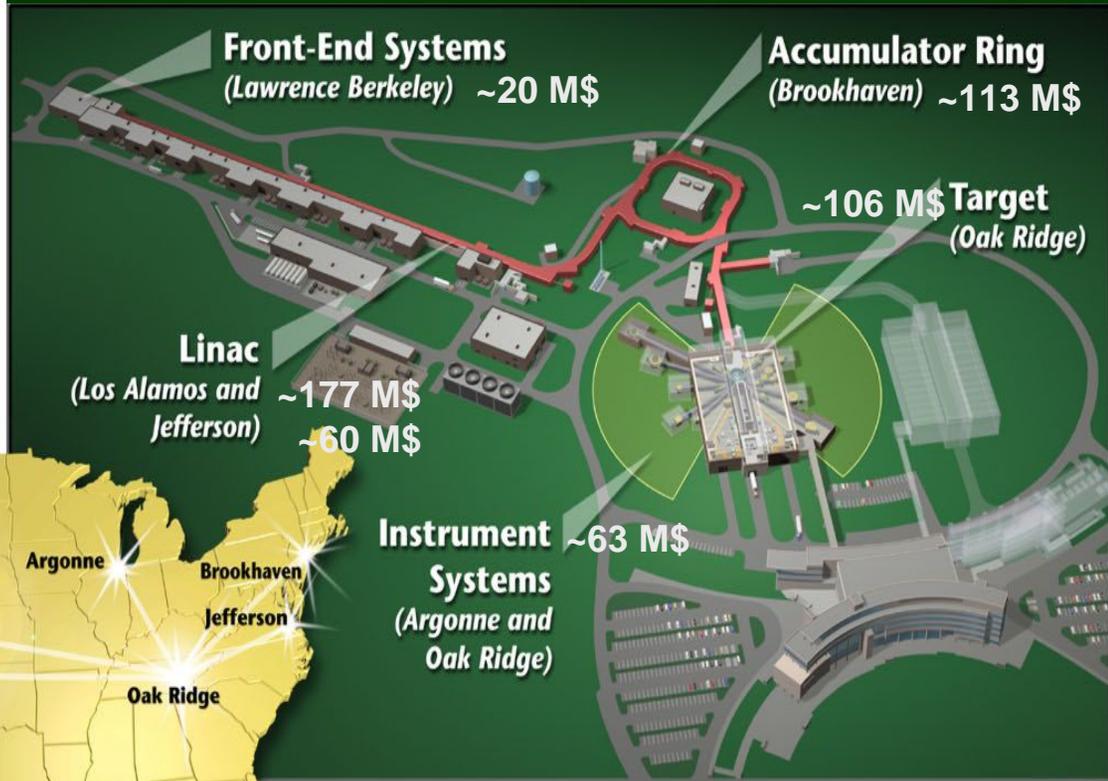
- Spend \$1.41 Billion dollars in 7 years with a peak of ~ 1 M\$/day during peak construction.
- ~ \$6.5 M contingency left at the end for scope additions

	Nov 2001 [\$M]	May 2006 [\$M]	Contingency
1.01 Research & Development	103.8	99.9	-3.8%
1.10 Operations	115.2	119.1	3.4%
Total OPC (Burdened, Escalated Dollars)	219.0	219.0	0.0%
1.02 Project Support	72.3	72.1	-0.3%
1.03 Front End Systems	19.3	20.8	7.9%
1.04 Linac Systems	272.4	311.0	14.2%
1.05 Ring & Transfer System	146.2	146.6	0.3%
1.06 Target Systems	95.3	114.9	20.5%
1.07 Instrument Systems	62.3	63.9	2.6%
1.08 Conventional Facilities	310.7	398.5	28.3%
1.09 Integrated Control Systems	58.6	58.5	-0.1%
Total	1037.0	1186.3	14.4%



- Within the constraints of a multi-laboratory collaboration ?

SNS-ORNL Accelerator systems: ~167 M\$



99-06976F/arb

At peak: ~500 People worked on the construction of the SNS accelerator



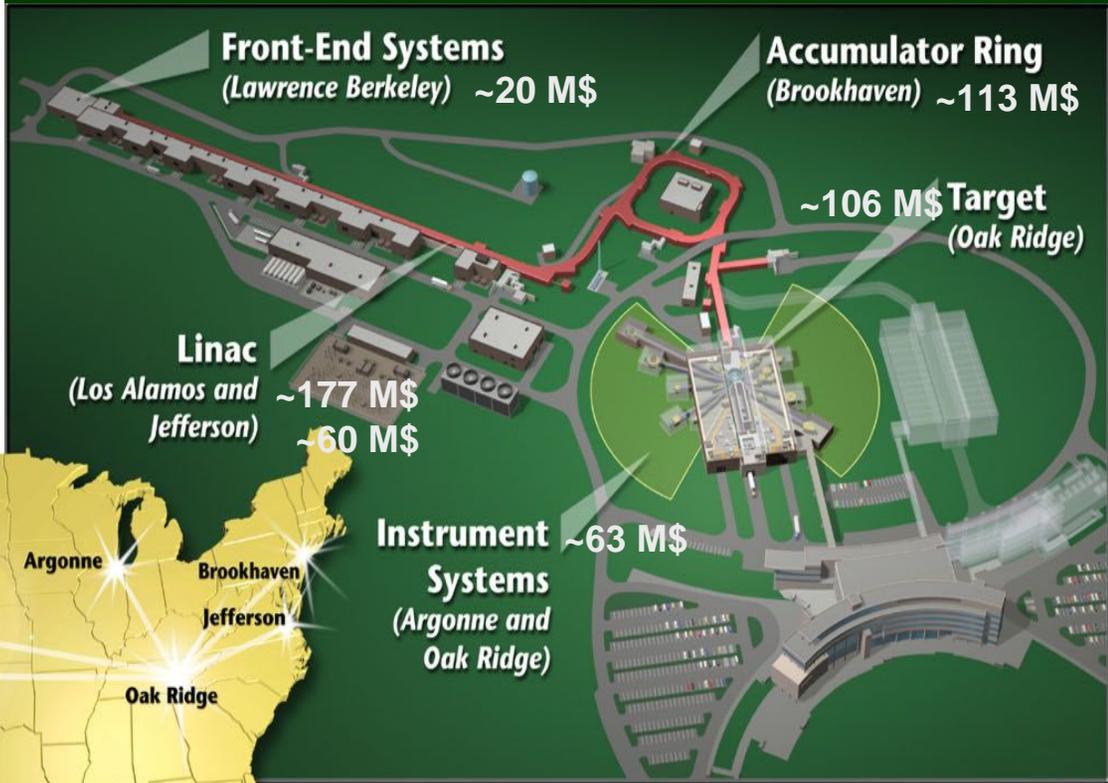
The partners developed and built – SNS/ORNL integrated, installed + operated



- Within the strength of a multi-laboratory collaboration ?

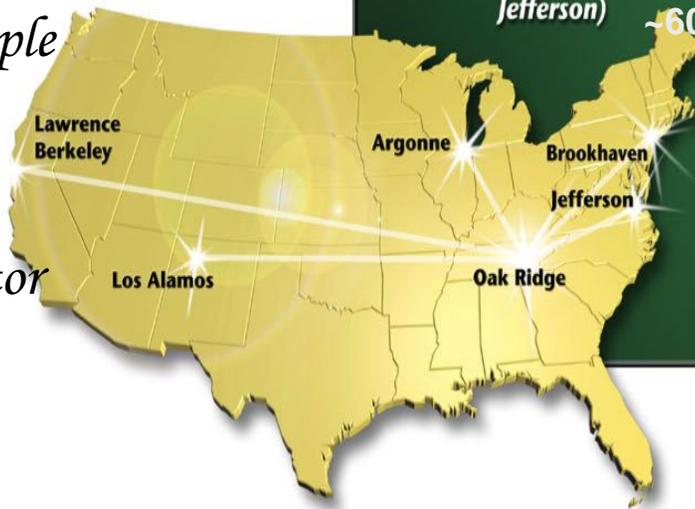


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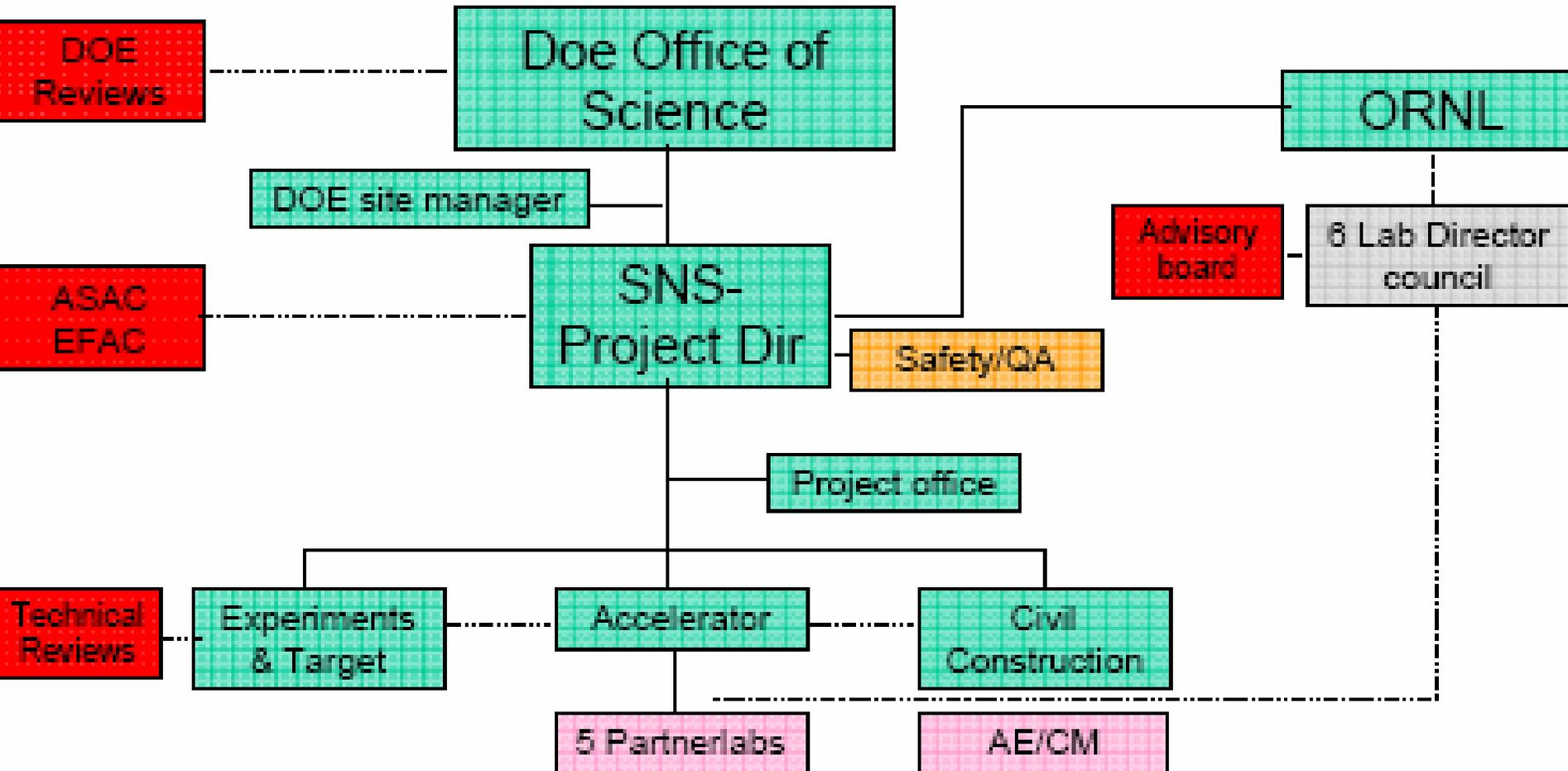
At peak: ~500 People worked on the construction of the SNS accelerator



The partners developed and built – SNS/ORNL integrated, installed + operated



- His inspirational leadership and outstanding management skills



- Technical reviews on all subsystem when necessary
- All other reviews every 6 month, plus some extra....



Combined with a thorough understanding of the technical & scientific challenges,

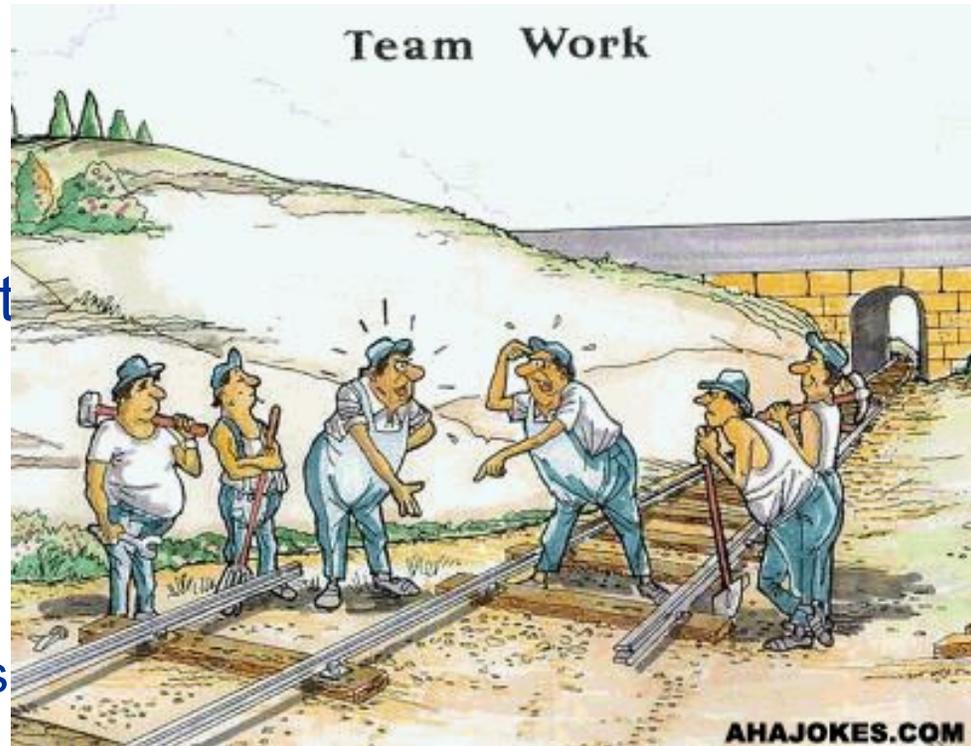
- High Intensity H- Ion source and low energy accelerator (LBNL)
- The 2nd largest rf installation in the US world and very compact high power, high voltage power supplies (LANL)
- A high energy superconducting H- linac (JLab)
- A high intensity proton storage ring (BNL)
- The first large scale laser based beam profile scanning system. (ORNL)

- The management role is to take the risk and to provide the resources.

- Good people solve these issues.

Were the essential components in successfully bringing together the highly effective SNS team

- To be effective:
 - Intelligence
 - Motivation
 - Good co-workers
- The greatest achievement was the assembly of the team
 - From all over the world
 - From all kinds of laboratories and industries
 - Local companies and unions





What happened to some of them...?

- Some get prizes
- Senior team leaders are off to bigger projects (J.Weil, C.Rode, D.Rej, R.Keller)
- T.Mason ->Lab director, I.Anderson ->director of SNS, S.Henderson ->div director for SNS
- I went to ITER.

- Is it worth it?



Central Solenoid

ITER

Toroidal Field Coil

Poloidal Field Coil

The overall programmatic objective:

to demonstrate the s&t feasibility of fusion energy

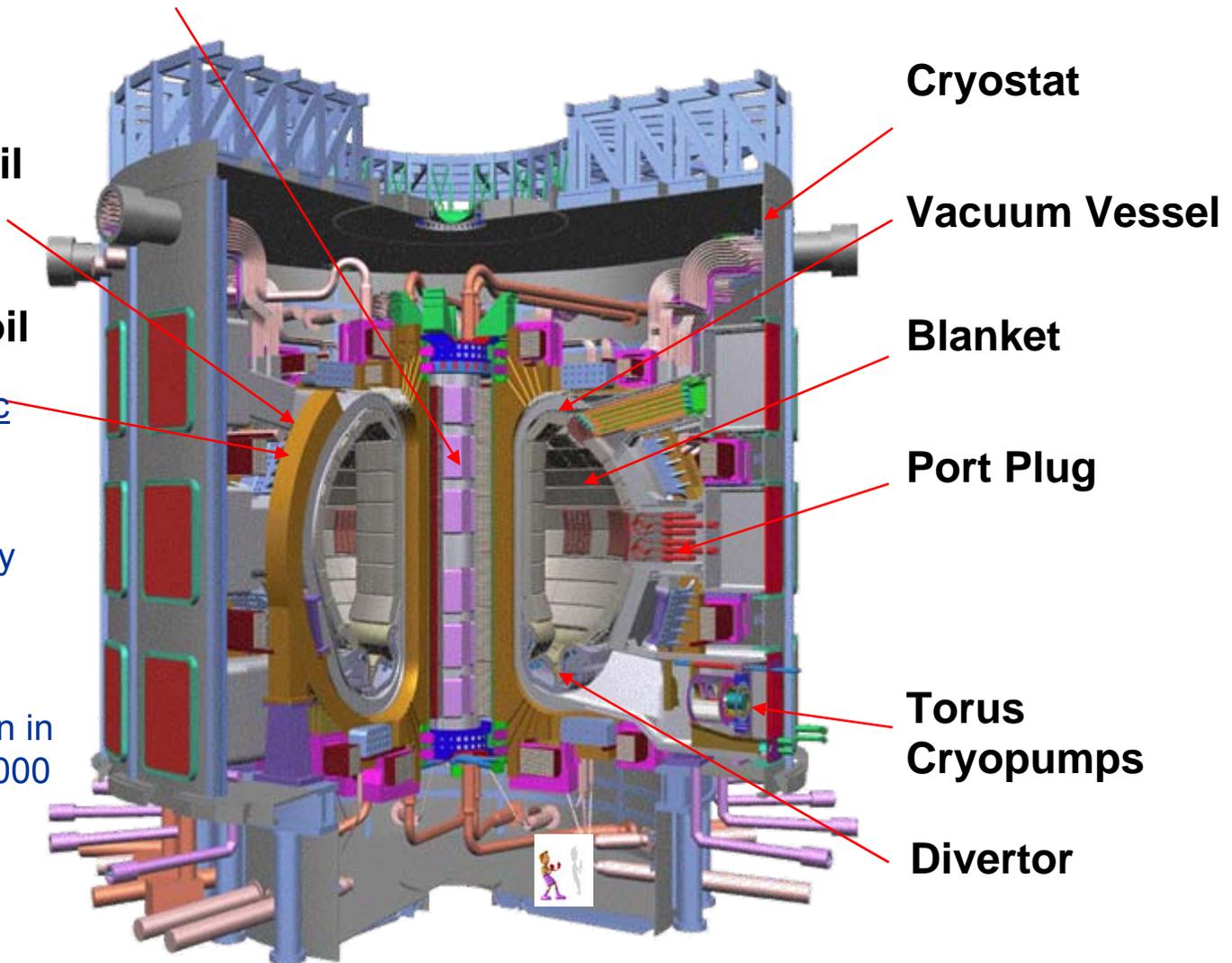
The principal goal:

to produce a significant fusion power amplification in long-pulse operation (~1000 sec) $Q \geq 10$

output power 500 MW

The execution:

~90% of the contributions are in kind.



Machine mass: 23350 t (cryostat + VV + magnets)

- shielding, divertor and manifolds: 7945 t + 1060 port plugs
- magnet systems: 10150 t; cryostat: 820 t

Model of the ITER Site

Magnet power
convertors buildings

Cryoplant
buildings

Tokamak
building

Tritium
building

Hot
cell

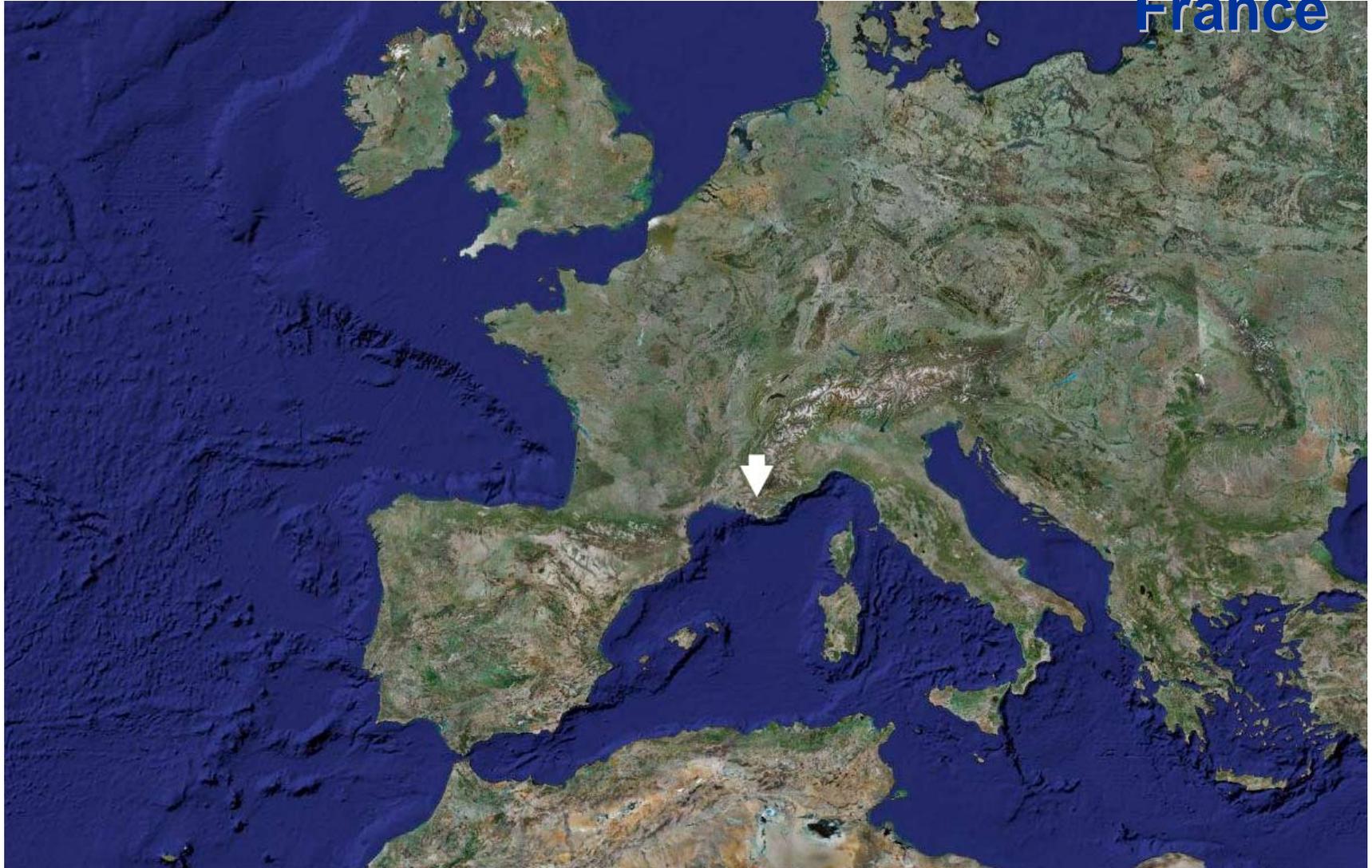


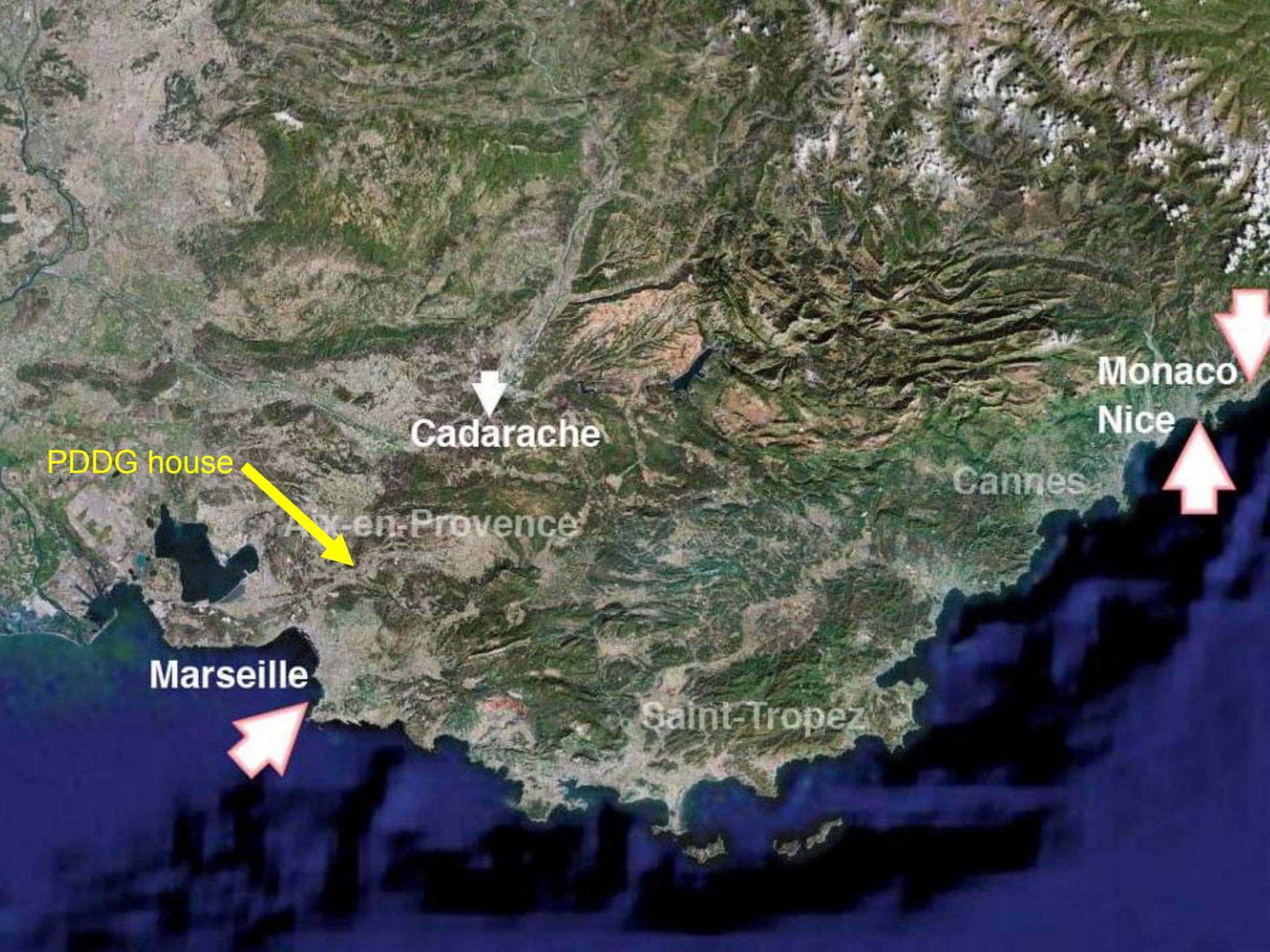
- Will cover an area of about 60 ha
- Large buildings up to 170 m long
- Large number of systems

Cooling
towers



...based in Cadarache, Southern France





Cadarache

Monaco
Nice

PDDG house

Aix-en-Provence

Cannes

Marseille

Saint-Tropez



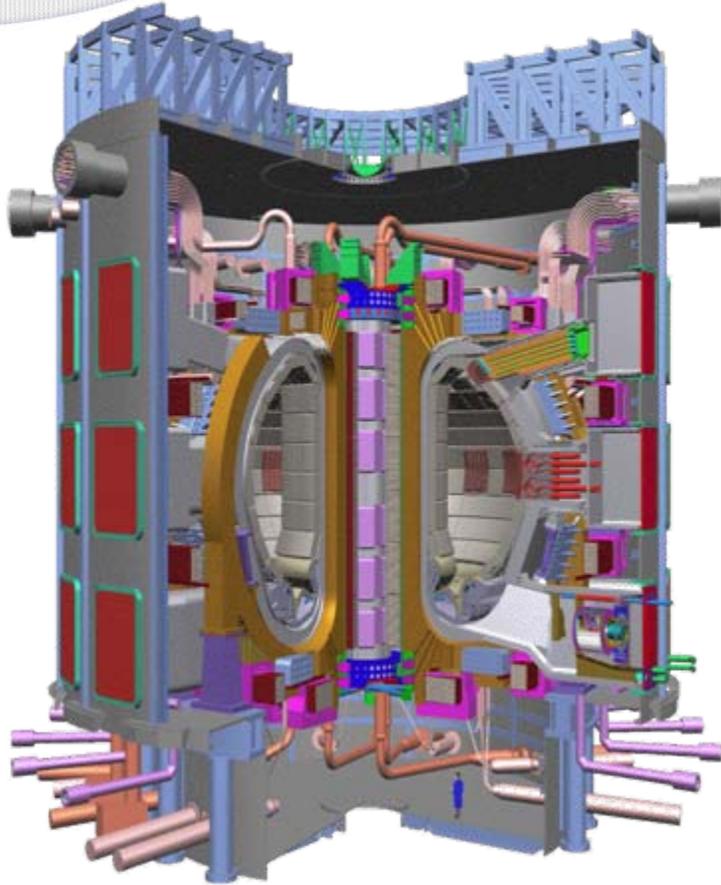
Pictures



Courtesy AIF



ITER Tokamak - Mass Comparison



ITER Machine mass:

~23000 t

28 m diameter x 29 m tall

Charles de Gaulle mass:

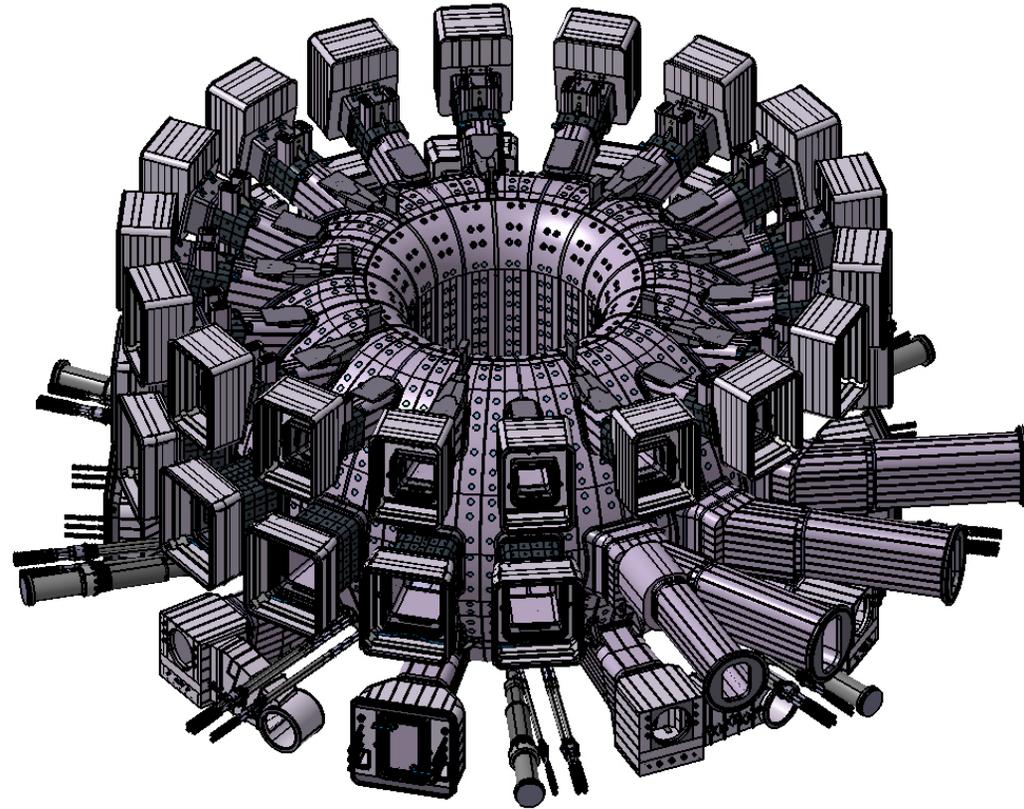
~38000 t (empty)

856 ft (261 m) long

(Commissioned 2001)



Vacuum Vessel Mass Comparison



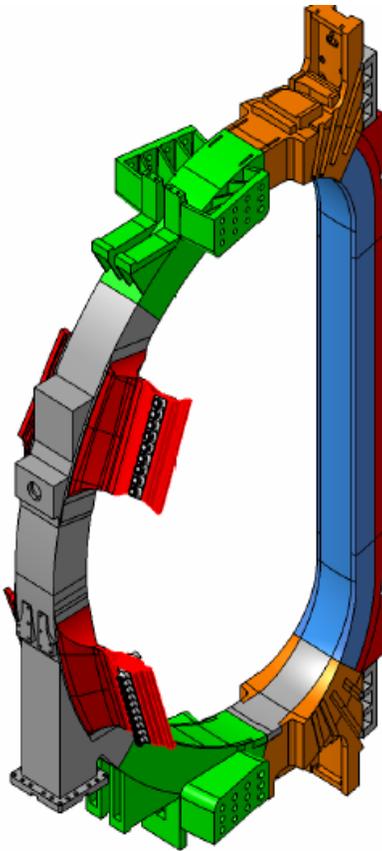
VV & In-vessel components mass: ~8000 t
19.4 m outside diameter x 11.3 m tall



Eiffel Tower mass: ~7300 t
324 m tall
(Completed 1889)



TF Coil – Mass Comparison



Mass of (1) TF Coil:

~360 t

16 m Tall x 9 m Wide

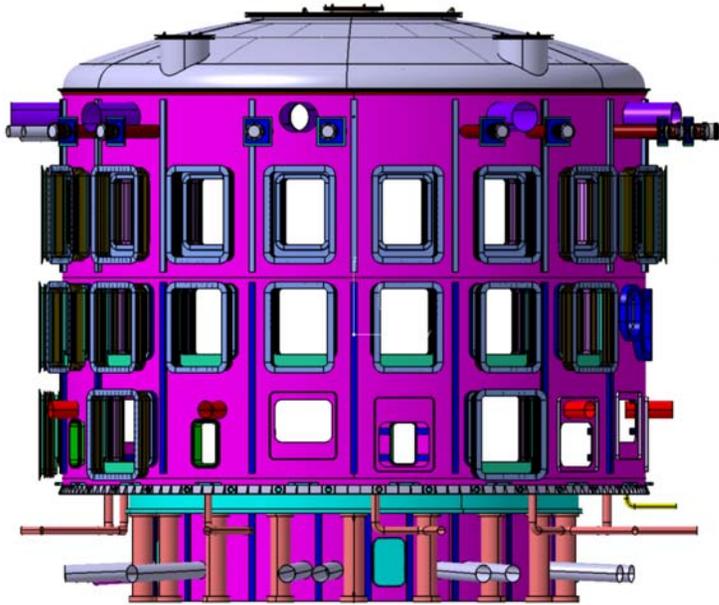


D8 Caterpillar Bulldozer

~35 t



Cryostat Size Comparison



ITER Cryostat
~28 m Tall x
29 m Wide

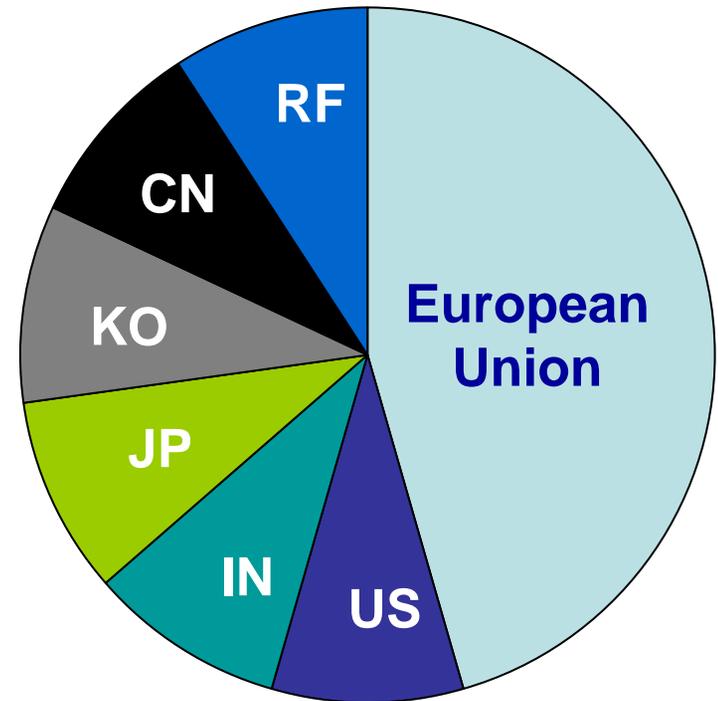


Jefferson Memorial
(Washington DC)
~29 m Tall (floor to top of dome)



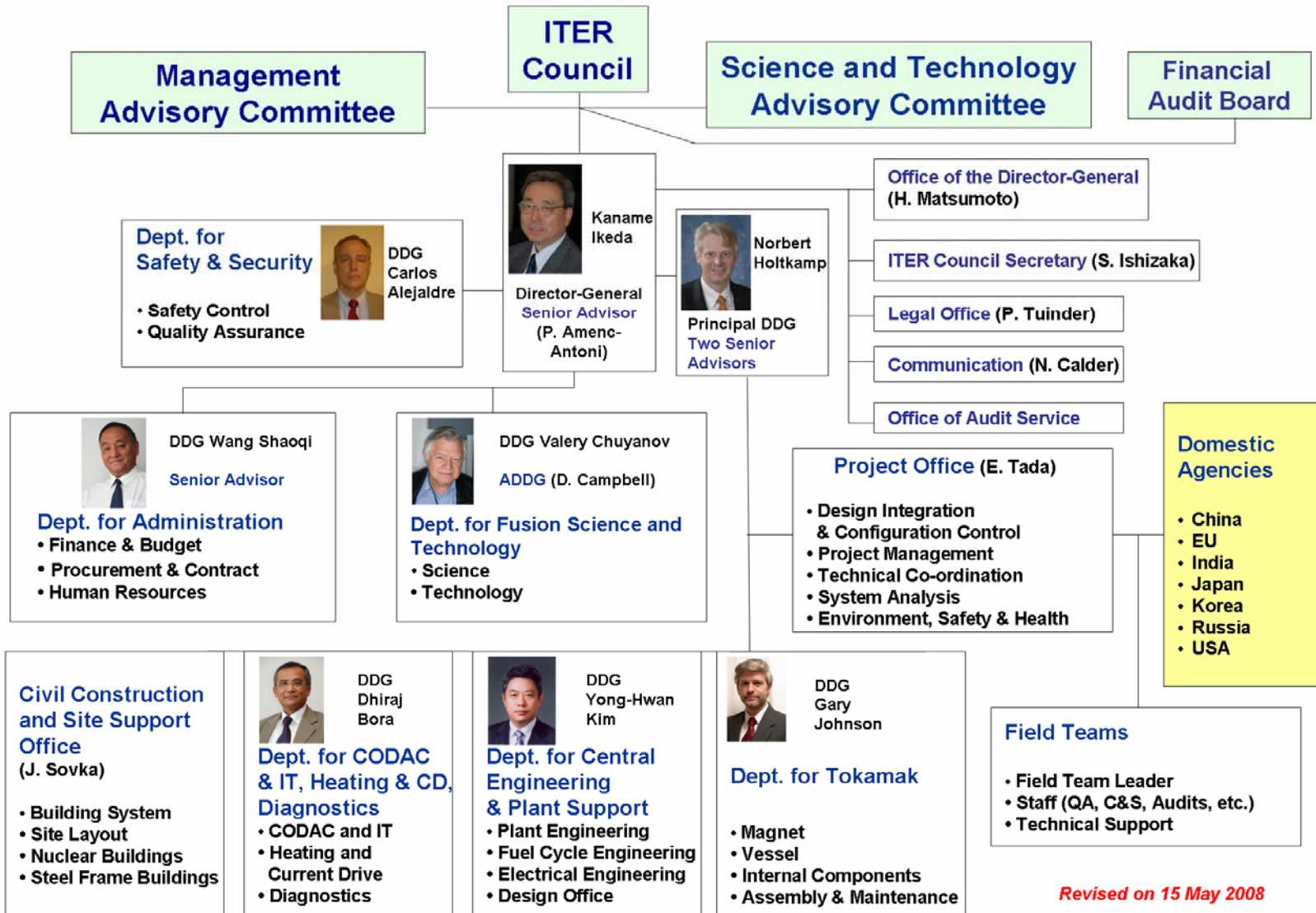
Construction Sharing

- Overall cost sharing:
- EU 5/11,
- other six parties 1/11 each.
- Overall contingency of 10% of total.
- Total amount: 5.365 Mil € / 2008
 - 80% in kind
 - Staff recruited between members ~equal to sharing





ITER Organization

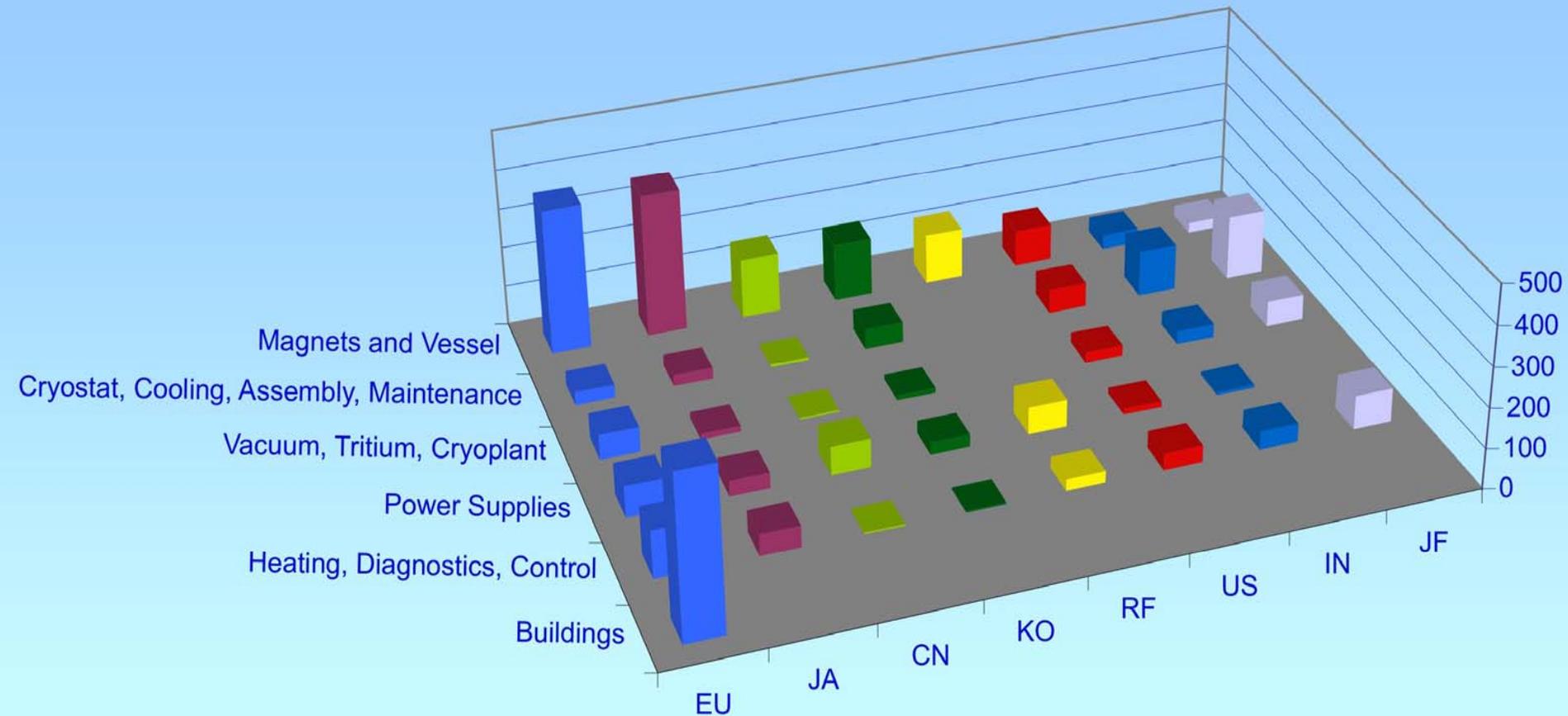


Revised on 15 May 2008



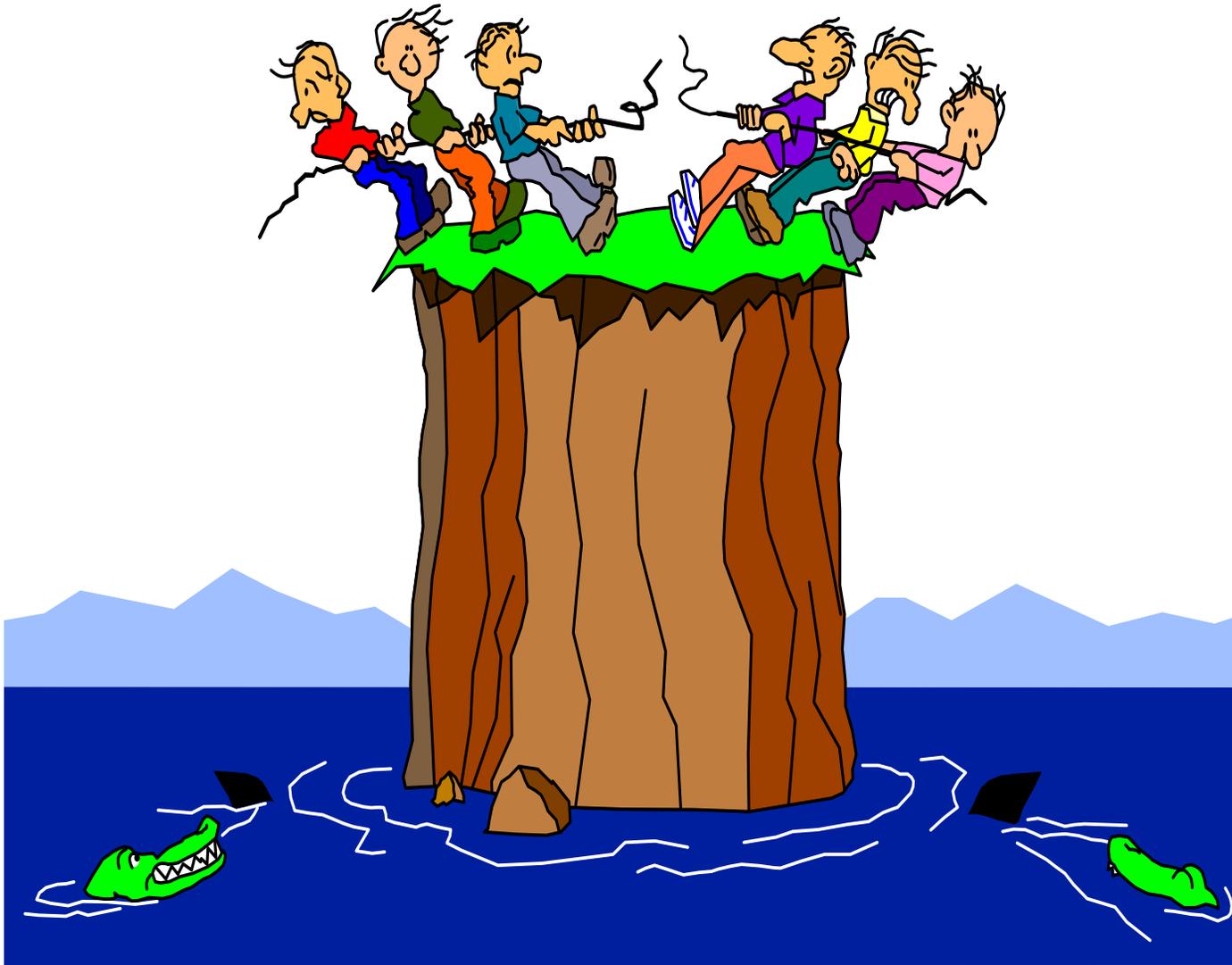
Procurement Sharing

A unique feature of ITER is that almost all of the machine will be constructed through *in kind* procurement from the Parties





Failure is not an option!





Thank You for this Award !

- I want to thank many people, but there is not enough time here in the conference, nor enough space on this transparency.
- Several categories of people:
 - The people from which I learned the job
 - The people that allowed me to do this job (or any other job for that matter)
 - The people I worked for
 - The people that worked with me (including those that had to...)
 - The people that supported me to in any other way
 - The people on the prize committee that recognized the work done
 - All of you who support the recognition through prizes like this.
- And: What else can one hope for?



...One can always hope for more!





Resulting Reference IPS

31 March 2008

Start

Tokamak
Assembly

Complete
Tokamak
Construction

First
Plasma

ITER IO

"Permis de
Construire"

