Celebrating Daniel Gogny Jubilee

Bernard Frois

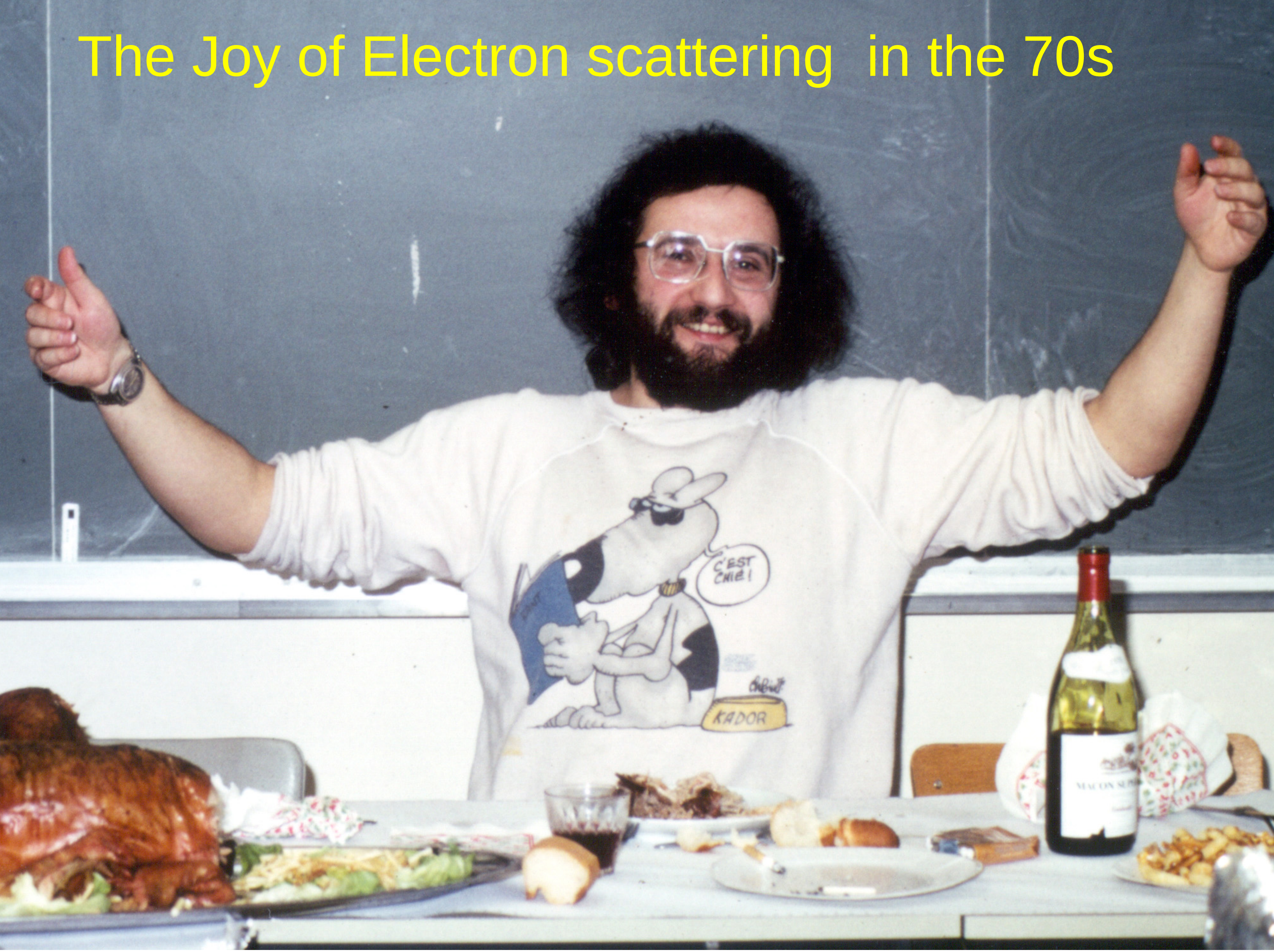
CEA DIF, Bruyères-le-Châtel
May 30-31, 2006

Celebrating also the galaxy of physicists of the BIII – Orsay – Saclay collaborations in the 70s

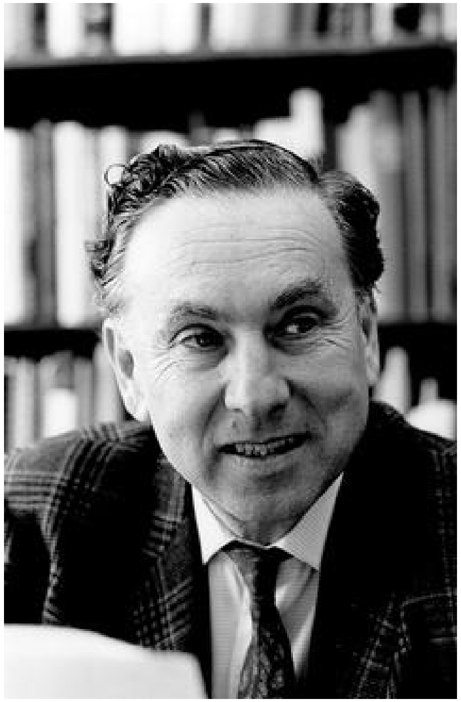

2000


1980

The Joy of Electron scattering in the 70s



Origins



1950's Robert Hofstadter

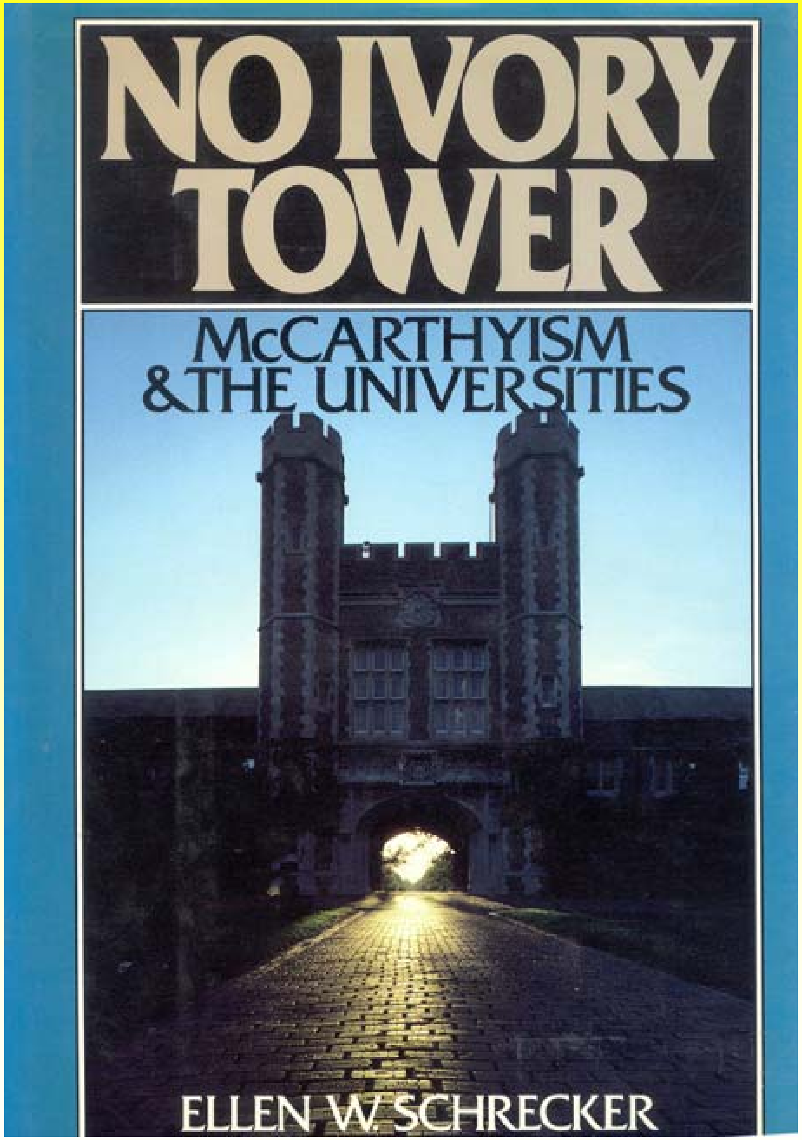
Nobel Prize in Electron scattering

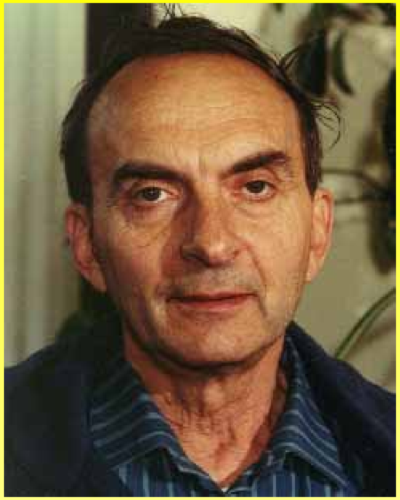
He is at the origin of the collaboration between B. Frois and D. Gogny in 1974

1960's The construction of a fusion facility in Cadarache is delayed. CEA decides to build an electron scattering facility (ALS).

1970 BBG Nuclear Matter in RMP

Orsay group plays a leading role in the new generation HF calculations and Vnn





V_{nn} and nuclear structure

Gerald Brown goes to England in 1950 on what he thinks is a Fulbright Fellowship. The fellowship is withheld, and Brown, who had been a Communist while a student at Yale in the late 1940s. He decides to take a job at the University of Birmingham and stays in England.

Nicole Vinh-Mau is one of his students. She is my professor in Bordeaux at the end of the 60's.

Daniel Gogny develops his finite range force with his group and his HFB calculations in the 70's

$$\mathrm{V}_{12} = \sum_{j=1}^{2} e^{-(\vec{r}_1-\vec{r}_2)^2/\mu_j{}^2}\left(W_j + B_j P_\sigma - H_j P_\tau - M_j P_\sigma P_\tau\right)$$

$$+\ t_3(1+x_0 P_\sigma)\,\delta(\vec{r}_1-\vec{r}_2)\left[\rho\left(\frac{\vec{r}_1+\vec{r}_2}{2}\right)\right]^\alpha$$

$$+\ iW_{LS}\overleftarrow{\nabla}_{12}\delta(\vec{r}_1-\vec{r}_2)\times\overrightarrow{\nabla}_{12}\cdot(\vec{\sigma}_1+\vec{\sigma}_2)$$

$$+\ (1+2\tau_{1z})(1+2\tau_{2z})\,\frac{e^2}{|\vec{r}_1-\vec{r}_2|}$$

Hartree-Fock-Bogolyubov calculations with the *D* 1 effective interaction on spherical nuclei

J. Dechargé and D. Gogny

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Received 3 August 1979

A self-consistent approach allowing the introduction of pairing into a comprehensive study of the bulk as well as the structure properties of nuclei is presented. It is emphasized that the density-dependent effective force used in the calculations reported here does permit the extraction of the mean field and the pairing field in the framework of the Bogolyubov theory. First, a brief review of Hartree-Fock-Bogolyubov formalism with density-dependent interactions is presented. Then the derivation of the effective interaction is explained and some details concerning the nuclear matter properties are given. Finally, we report the studies on spherical nuclei with special reference to the pairing properties. In order to demonstrate the versatility of our approach a comprehensive study of various nuclear properties is given. In view of the abundance of results obtained with our approach we plan to report the results on the deformed nuclei in a future publication.

NUCLEAR STRUCTURE Density-dependent Hartree-Fock-Bogolyubov (DDHFB) approximation applied to the calculations of the structure of spherical nuclei: binding energies, pairing correlations, density distributions, magnetic form factors, and quasiparticle spectra.

URL: http://link.aps.org/abstract/PRC/v21/p1568
DOI: 10.1103/PhysRevC.21.1568

A major progress

1975-1985

- A wealth of electron scattering data
- A powerful interaction between experiment and theory

Is the shell model valid in the nuclear interior ?

Maria Goeppert-Mayer

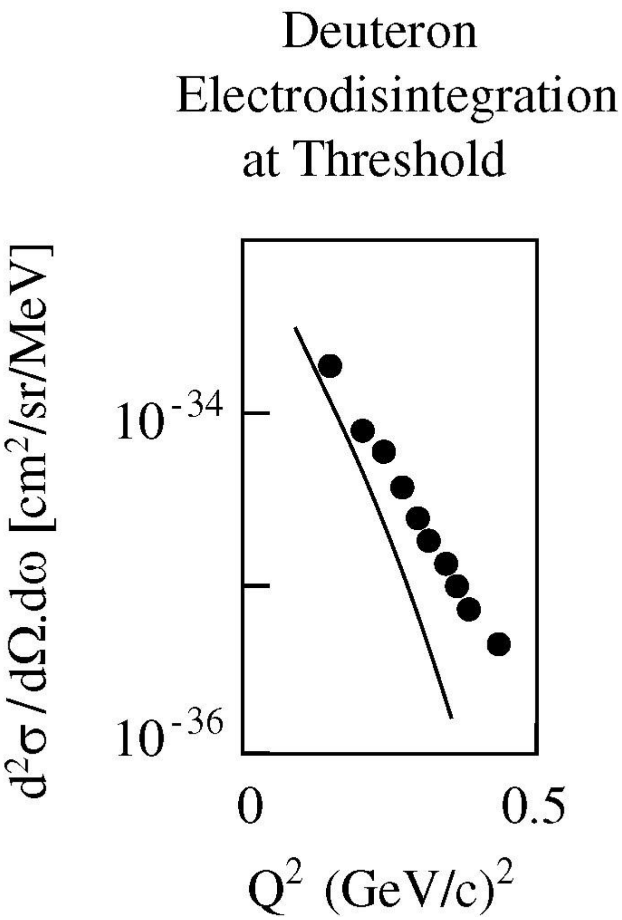
Magic number nuclides

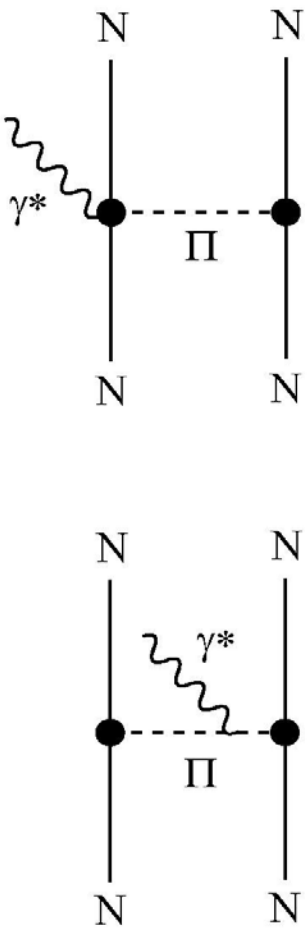
Number of protons	2	8	20	28	50	82	126
	^{4}He	^{16}O	^{40}Ca	^{58}Ni	^{112}Sn	^{204}Pb	
		^{17}O	^{42}Ca	^{60}Ni	^{114}Sn	^{206}Pb	
		^{18}O	^{43}Ca	^{61}Ni	^{115}Sn	^{207}Pb	
			^{44}Ca	^{62}Ni	^{116}Sn	^{208}Pb	
			^{46}Ca	^{64}Ni	^{117}Sn		
			^{48}Ca		^{118}Sn		
					^{119}Sn		
					^{120}Sn		
					^{122}Sn		
					^{124}Sn		
Number of neutrons	**2**	**8**	**20**	**28**	**50**	**82**	**126**
	^{4}He	^{15}N	^{36}S	^{48}Ca	^{86}Kr	^{136}Xe	^{208}Pb
		^{16}O	^{37}Cl	^{50}Ti	^{87}Rb	^{138}Ba	^{209}Bi
			^{38}A	^{51}V	^{88}Sr	^{139}La	
			^{39}K	^{52}Cr	^{89}Y	^{140}Ce	
			^{40}Ca	^{54}Fe	^{90}Zr	^{141}Pr	
					^{92}Mo	^{142}Nd	
						^{144}Sm	

Fig. 1. The magic numbers.

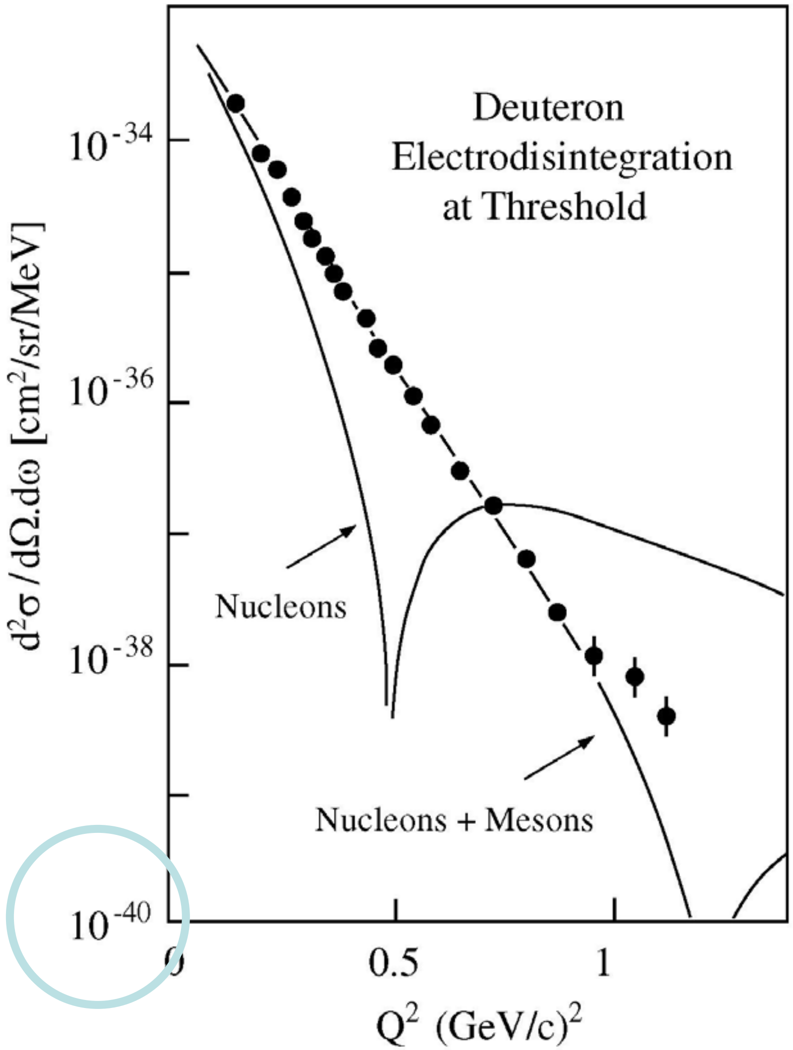
1970 : Meson exchange currents ??

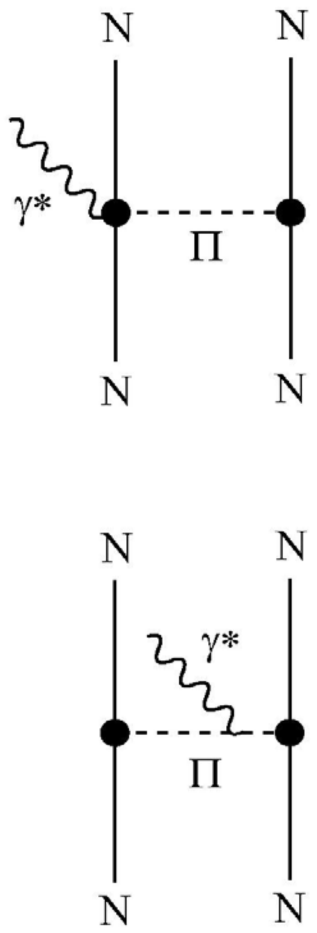
Rho and Brown



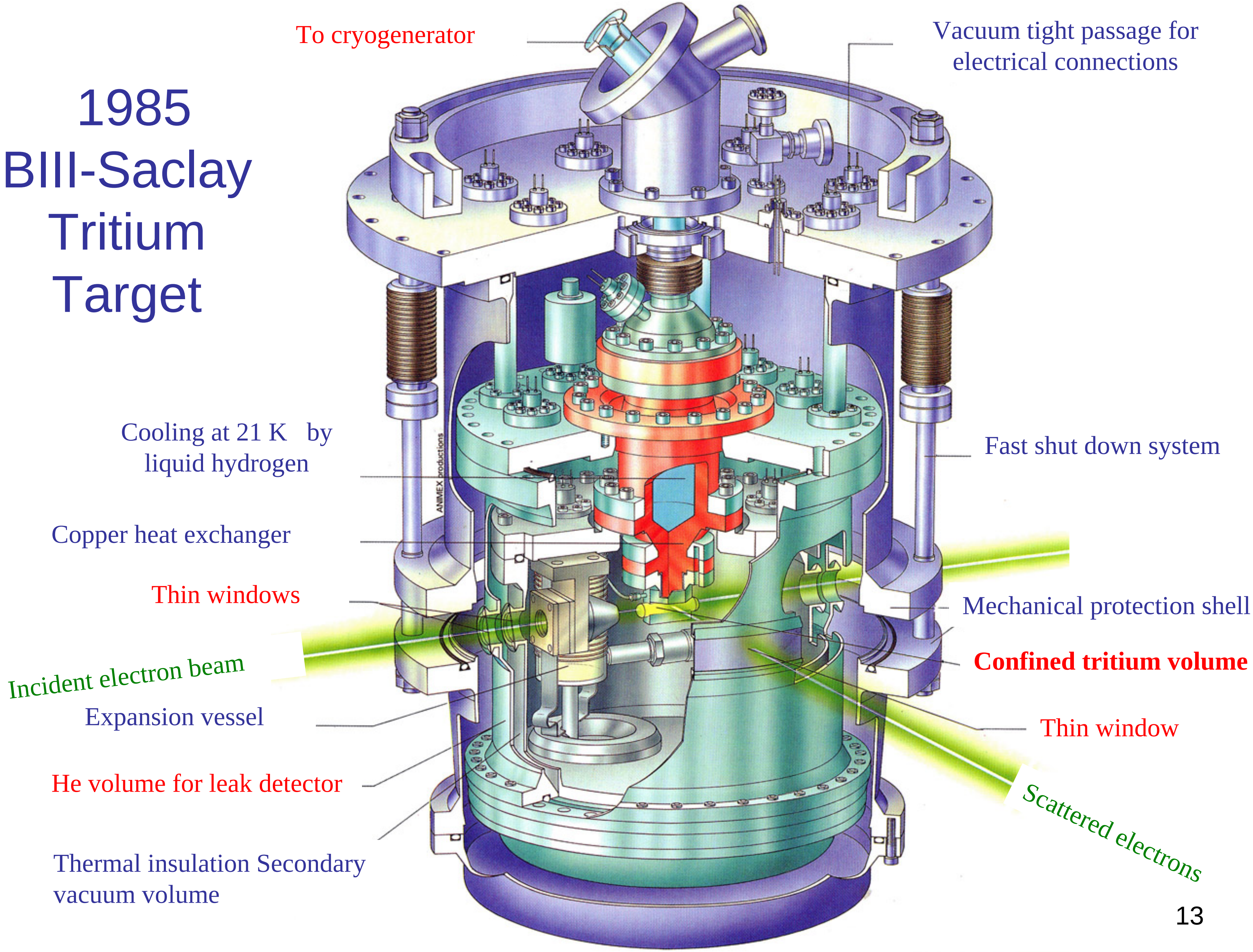


1985 Evidence for meson-exchange currents

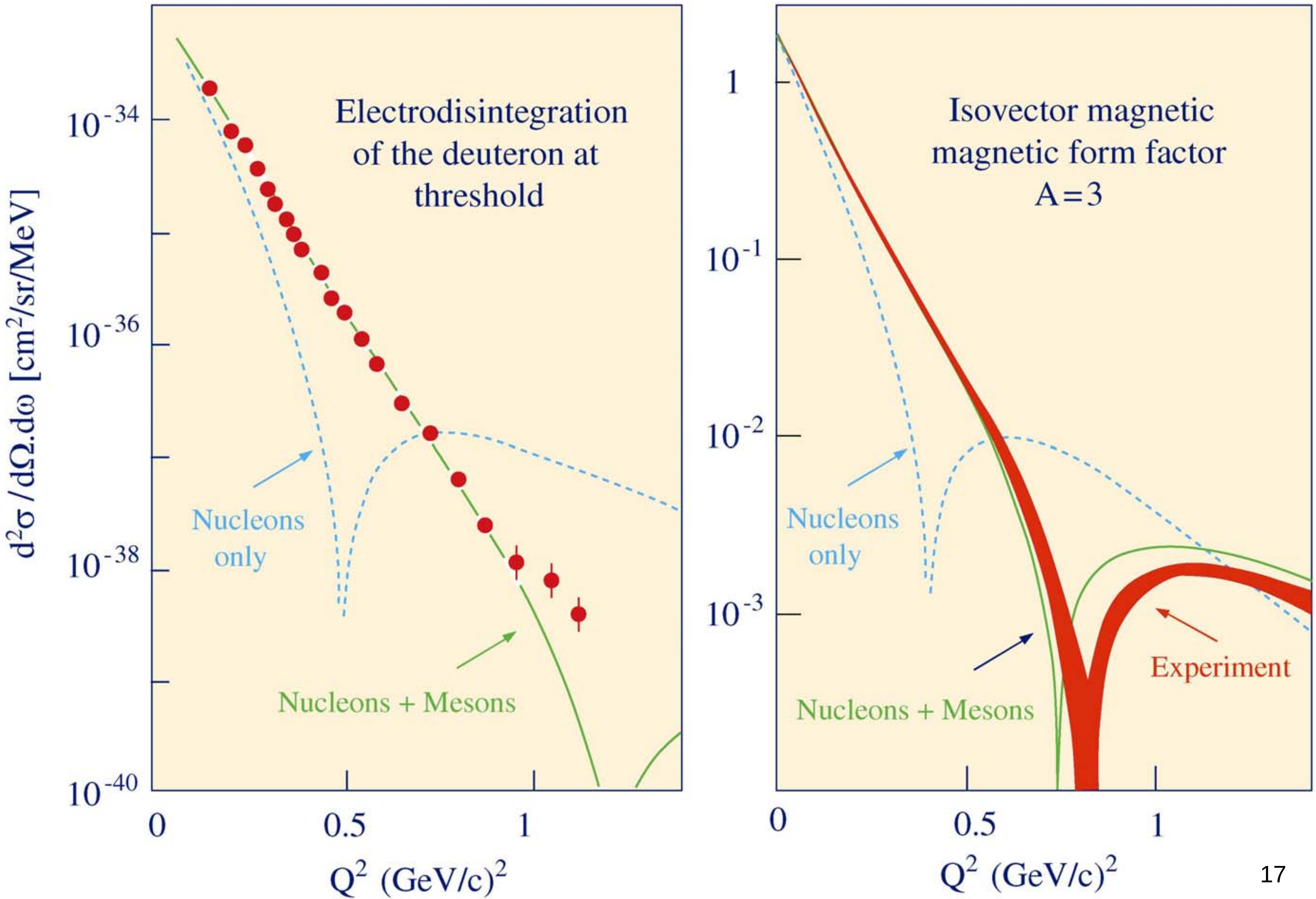




1985 BIII-Saclay Tritium Target

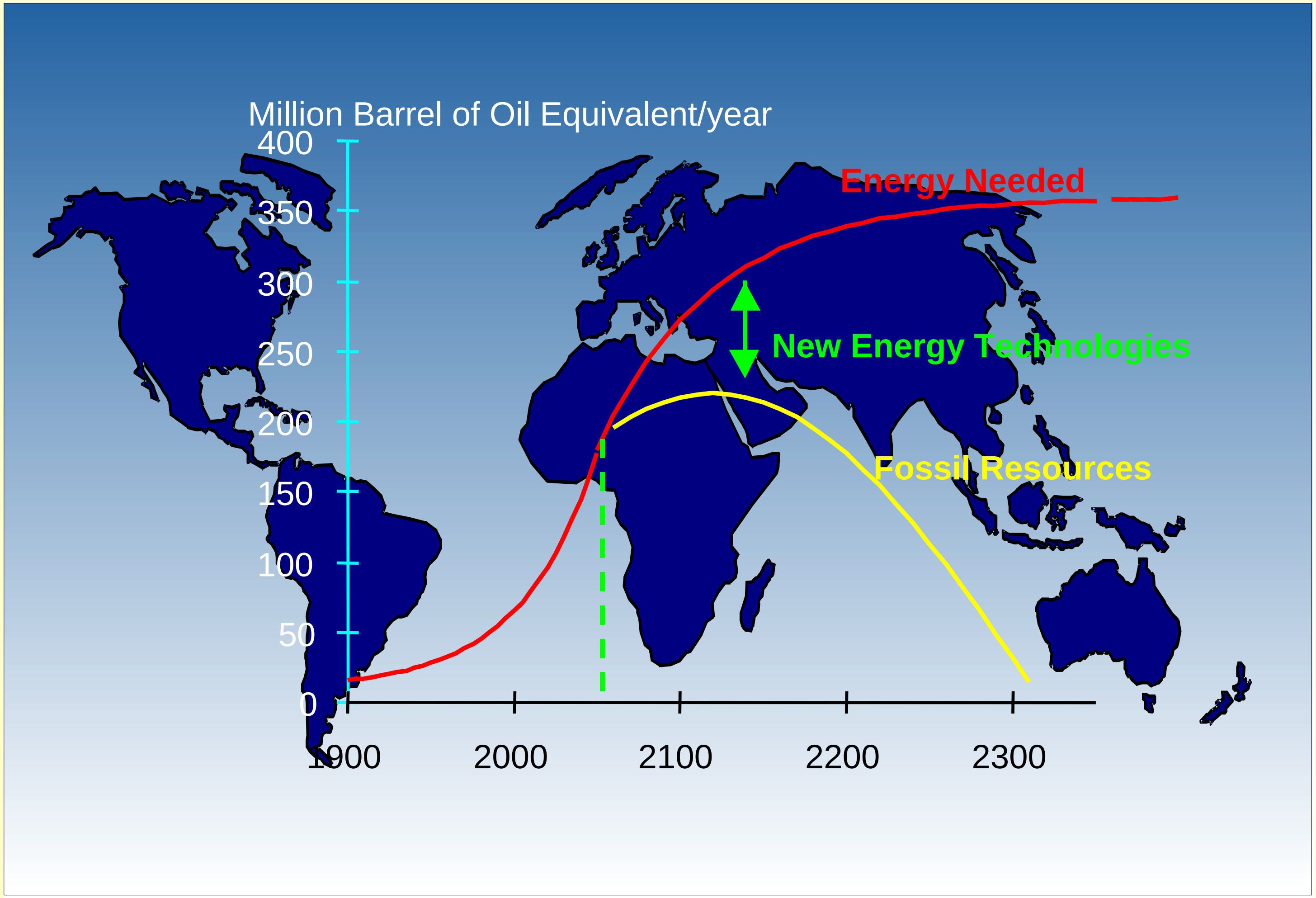


Validity of meson description of NN potential confirmed up to $(1\ \mathrm{GeV/c})^2$

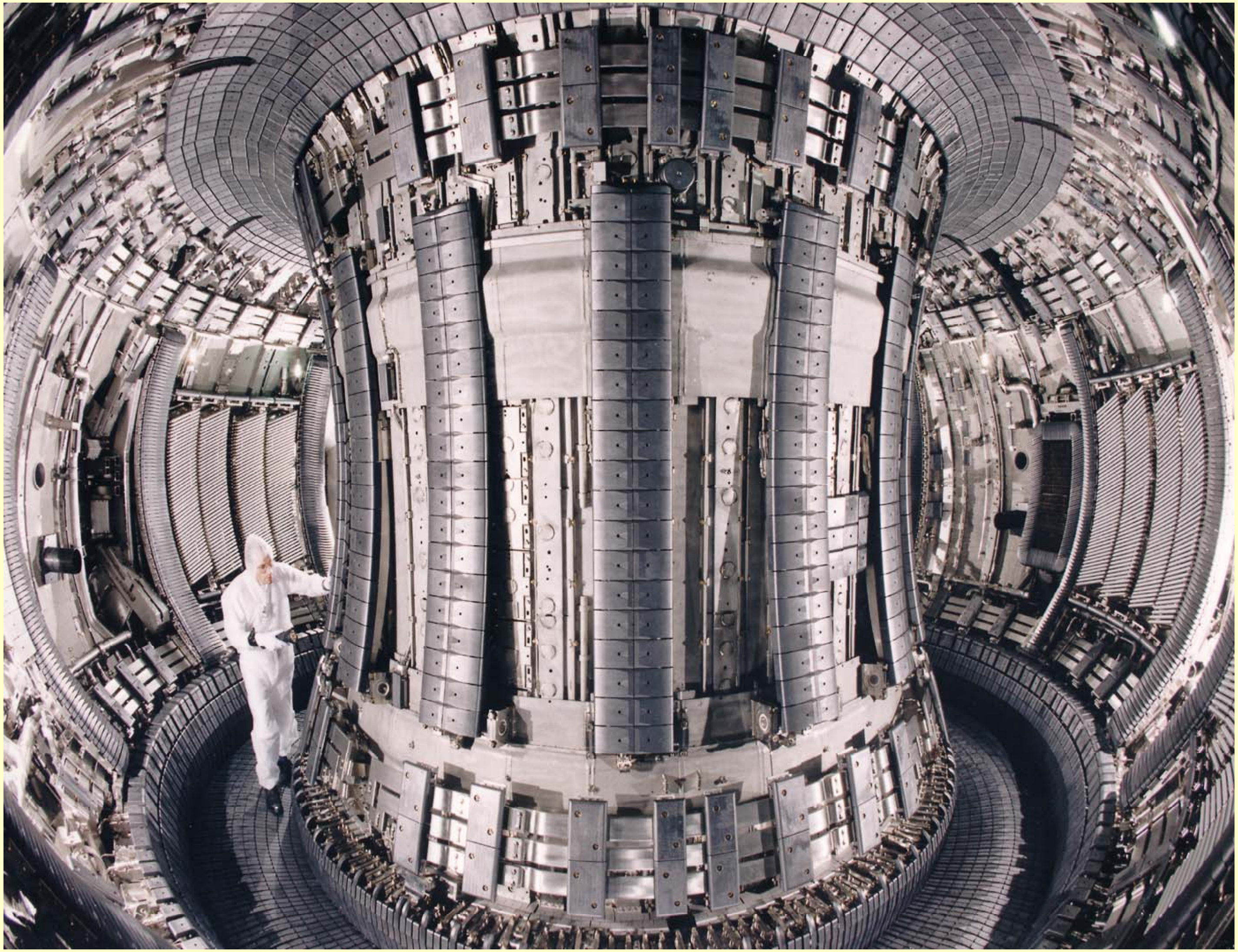


INPC98
The young generation is ready

The world needs new sources of energies

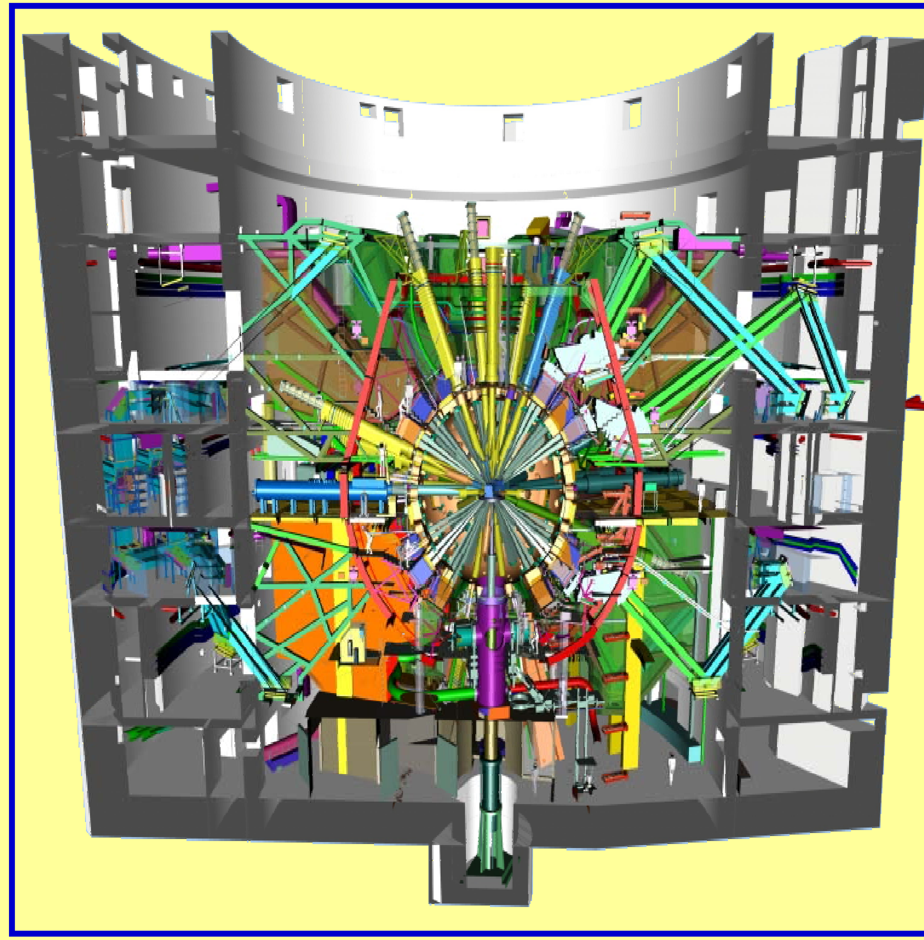


JET Fusion power is within our reach



Last week in Brussels: Looking forward to building ITER

ITER in
Cadarache



Inertial fusion with LMJ is
also an extraordinary
challenge

Avec toute mon amitié