

# Panorama



des expériences



Emmanuel Dormy, GdR dynamo, juin 2003

# Superphenix



F. Plunian  
A. Alemany  
Ph. Marty  
J. Soto

LEGI, Grenoble

# Superphenix

$\Omega$ (r.p.m.)	200	300	400	491
$p$ ( $s^{-1}$ )	-0.117	-0.117	-0.106	-0.0987

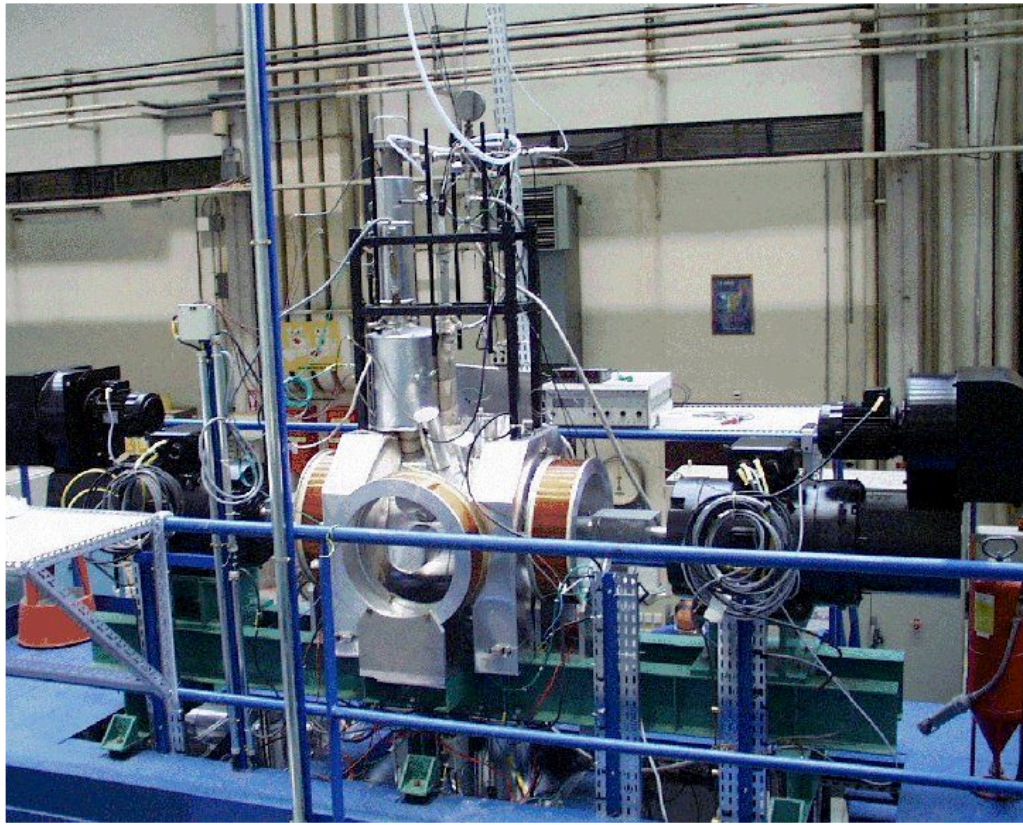
TABLE 2. The growth rate  $p$  versus the pump velocity.

Kinematic dynamo action in a network of screw motions;  
Application to the core of a fast breeder reactor,  
F.Plunian, P.Marty et A.Aleman, *Journal of Fluid Mechanics*, **382**, 137-154, (1999).

Experimental investigation of dynamo effect in the secondary pumps  
of the fast breeder reactor Superphenix,  
A.Aleman, Ph. Marty, F. Plunian et J. Soto., *Journal of Fluid mechanics*, **403**, 263-276, (2000).



# Expériences VKS



CEA/DEN centre de Cadarache

## CEA-Saclay

François Daviaud  
Arnaud Chiffaudel  
Louis Marié  
Florent Ravelet

## ENS-Paris

Stéphan Fauve  
François Pétrélis

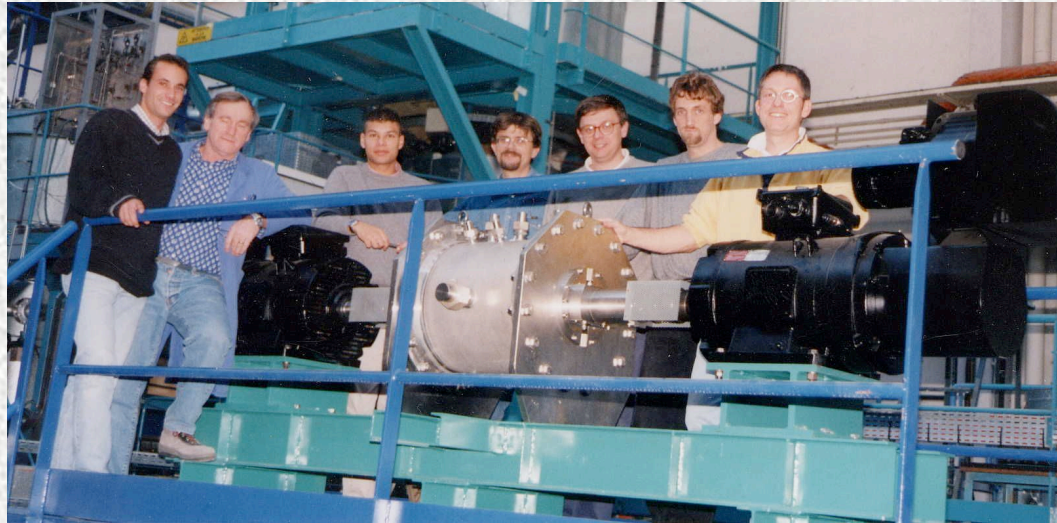
## ENS-Lyon

Jean-François Pinton  
Philippe Odier  
Mickael Bourgoïn  
Romain Volk

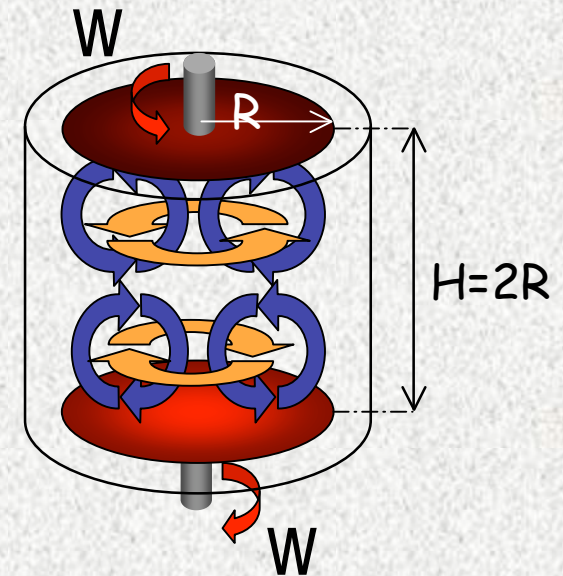
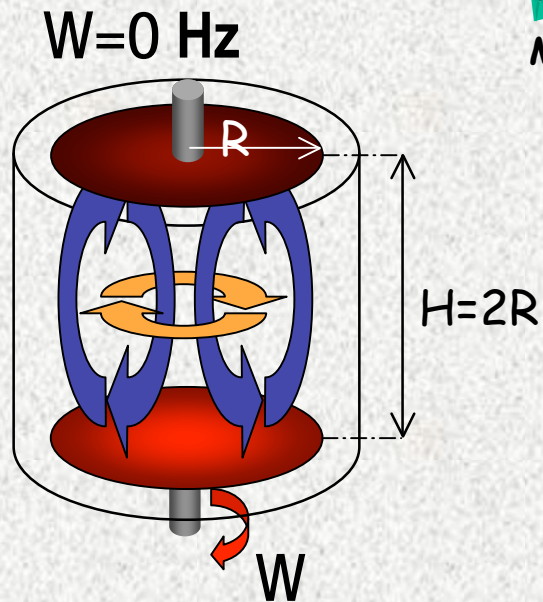
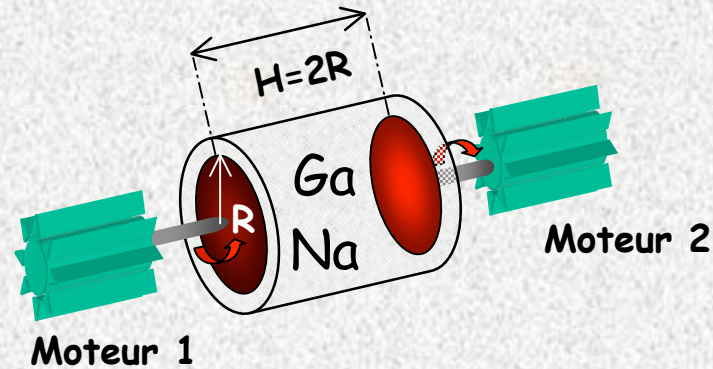


# Expériences VKS

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# Écoulements de Von Kármán



**&  
TURBULENCE**

● 1 disque tournant :

● hélicité

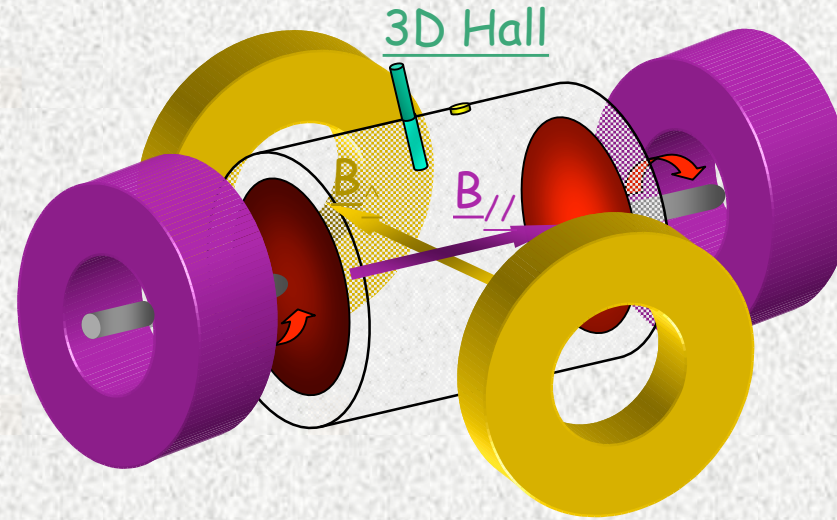
● 2 disques contra :

● hélicité

● rotation différentielle



# VKS1 : réponse à un champ appliqué



Non linear induction in a swirling flow of liquid sodium,  
F. Pétrélis et al., *Phys. Rev. Lett*, **90**, 174501, (2003).

Open questions about homogeneous fluid dynamos; the VKS experiment,  
L. Marié et al., *Magnetohydrodynamics*, **38**, 163-176, (2002).

MHD measurements in the von Karman sodium experiment,  
M. Bourgoïn et al., *Phys. Fluids*, **14**, 3046-3058, (2001).

MHD in von Karman flows, development and first run of the Sodium experiment,  
L. Marié et al., in *Dynamo and Dynamics, A Mathematical Challenge*, Cargèse (2000).

# VKS : études connexes

- **étude de prototypes en eau**
  - co et contra-rotatifs
  - sans et avec rotation globale

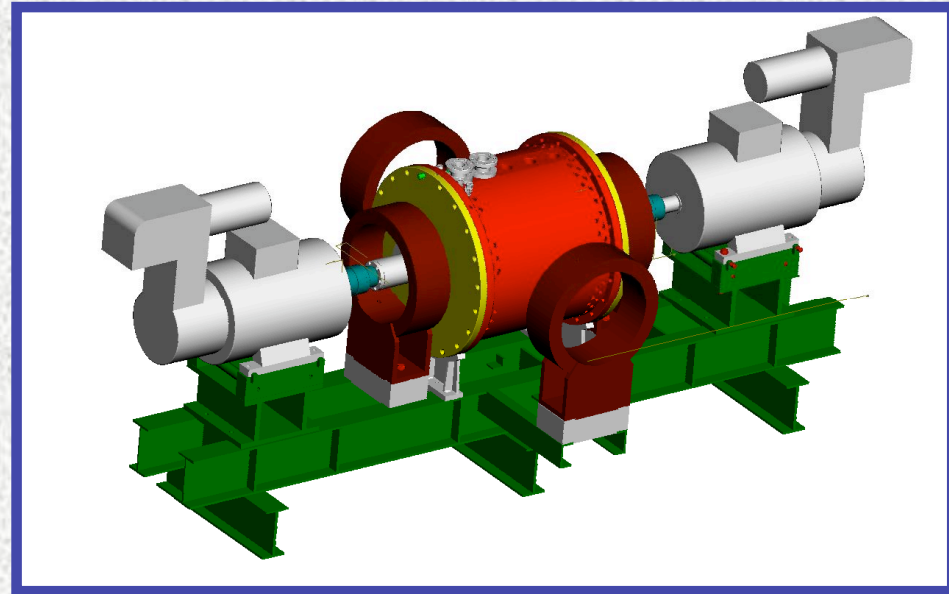
Marié et al. *EPJB* (2003)
- **étude de MHD en Gallium**
  - réponse à un champ appliqué,

Bourgoin et al., *Magnetohydrodynamics*, (2003)
- **instrumentation MHD**
  - méthodes acoustiques (DOP, diffusion, ...): essai Na
  - mesures locales (B, p)
  - mesures globales (couple, puissance)

Gasquet et al., *rapport CEA*, (2002)  
Marié et al., soumis à *Phys. Fluids*



# VKS2 : 2003-2006



- ✓ expérience refroidie
- ✓ 170 litres Na
- ✓ 2 x 150 kW
- ✓ écoulement moyen optimisé
- ✓ mesures en 2004

[http://www.ens-lyon.fr/~pinton/VKSWEB/vks\\_main.html](http://www.ens-lyon.fr/~pinton/VKSWEB/vks_main.html)



# Expériences DTS



Université Joseph-Fourier, Grenoble

Daniel Brito  
Philippe Cardin  
Henri-Claude Nataf  
Dominique Jault  
(Thierry Alboussière)  
Jean-Paul Masson  
Antoine Alemany  
Bérangère Deleplace  
Nicolas Gillet  
Gédéon Legaut □  
Nathanael Schaeffer  
Jérôme Noir □  
Julien Aubert

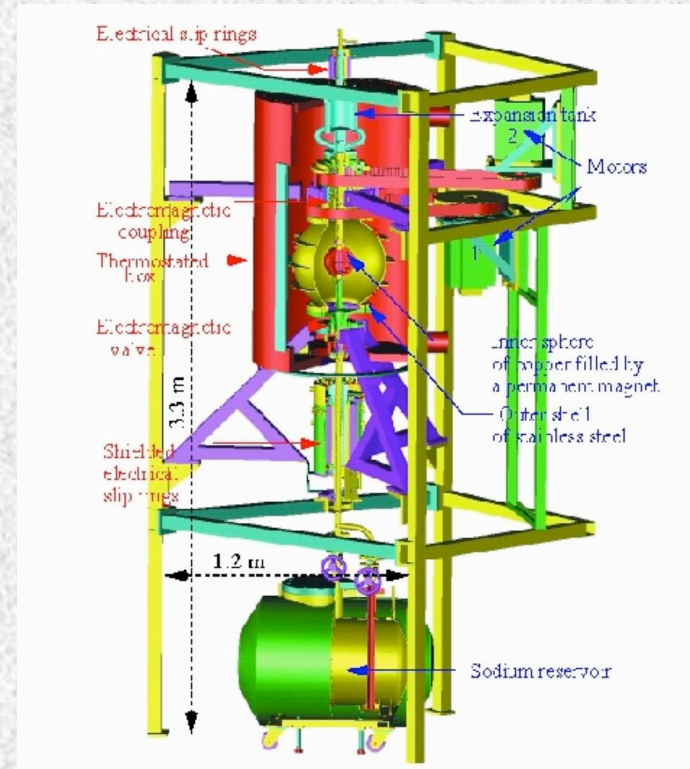


# Expériences DTS





# DTS: Derviche Tourneur Sodium



- ✓  $R_m < 30$
- ✓  $a = 0.21 \text{ m}$
- ✓  $P = 2 \times 13 \text{ kW}$
- ✓  $V = 50 \text{ l}$
- ✓  $B = 20 \text{ mT}$

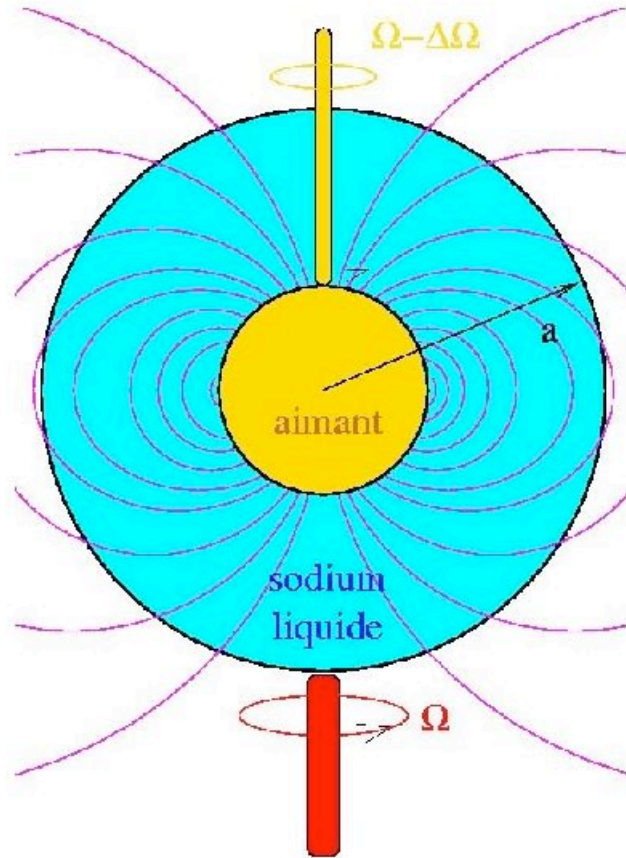
<http://www-igut.obs.ujf-grenoble.fr/recherche/geodynamo/geodynamo.htm>



# DTS

Maquette  
(éch. 1/5):

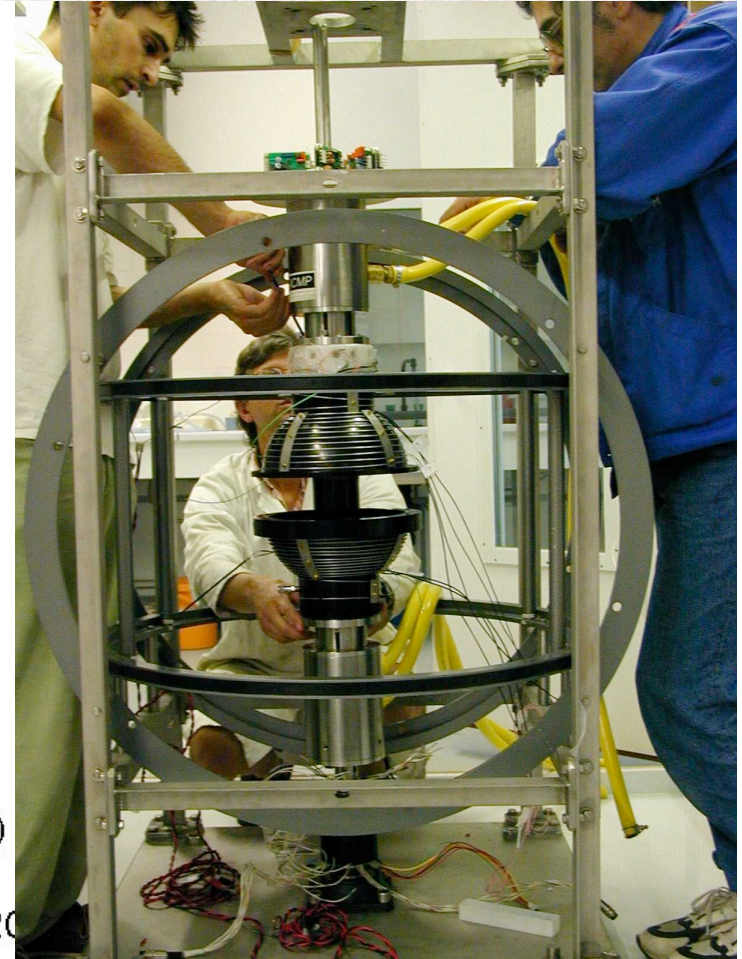
Derviche  
Tourneur  
Sodium



Système Terre (MENRT)

Intérieur de la Terre (INSU)

Equipe Géodynamo 20





# Convection-Magnétoconvection





# Précession

Geodynamo - LGIT

## Montage expérimental



$R$  (cm) 12.5 $\pm$ 0.002

$\eta$  1/25

$\alpha$  (degrés) 0-45

$\omega_c$  (tpm) 100-1600 tpm

$\Omega_p$  (tpm) -0.1-10 tpm

Ekman  $1.2 \cdot 10^{-5}$  -  $3.8 \cdot 10^{-7}$



# Expériences ATER

(Agitateur pour la Turbulence En Rotation)

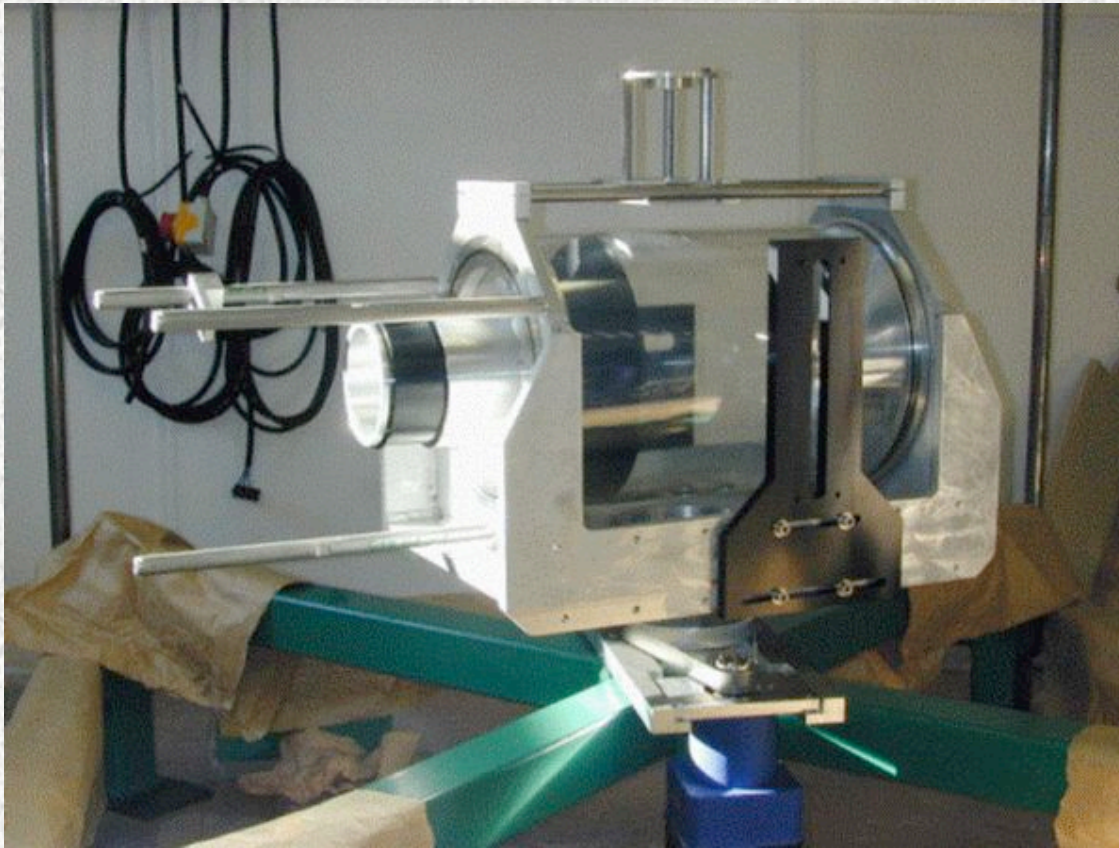


J. Léorat  
F. Rigaud  
R. Vitry  
G. Herpe

Observatoire de Meudon



# ATER

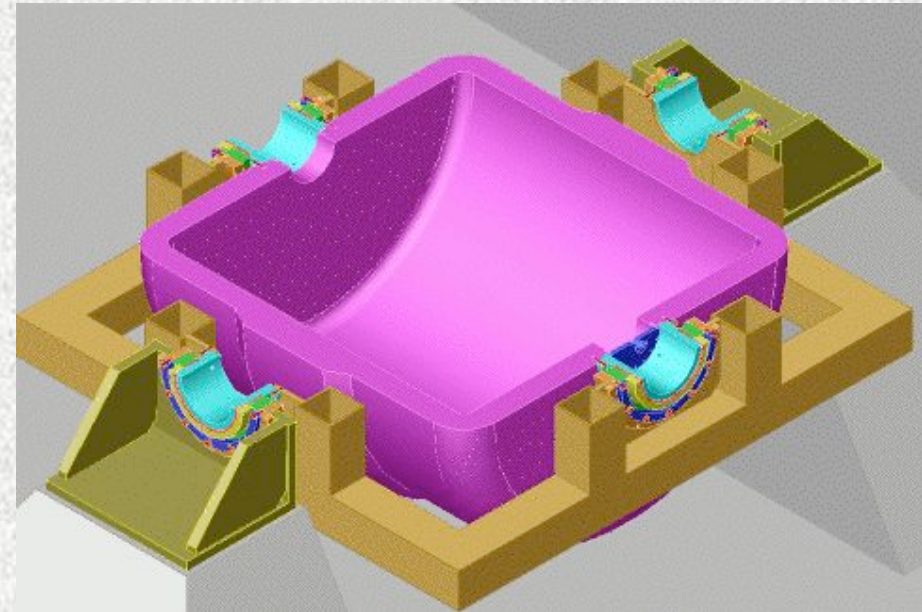
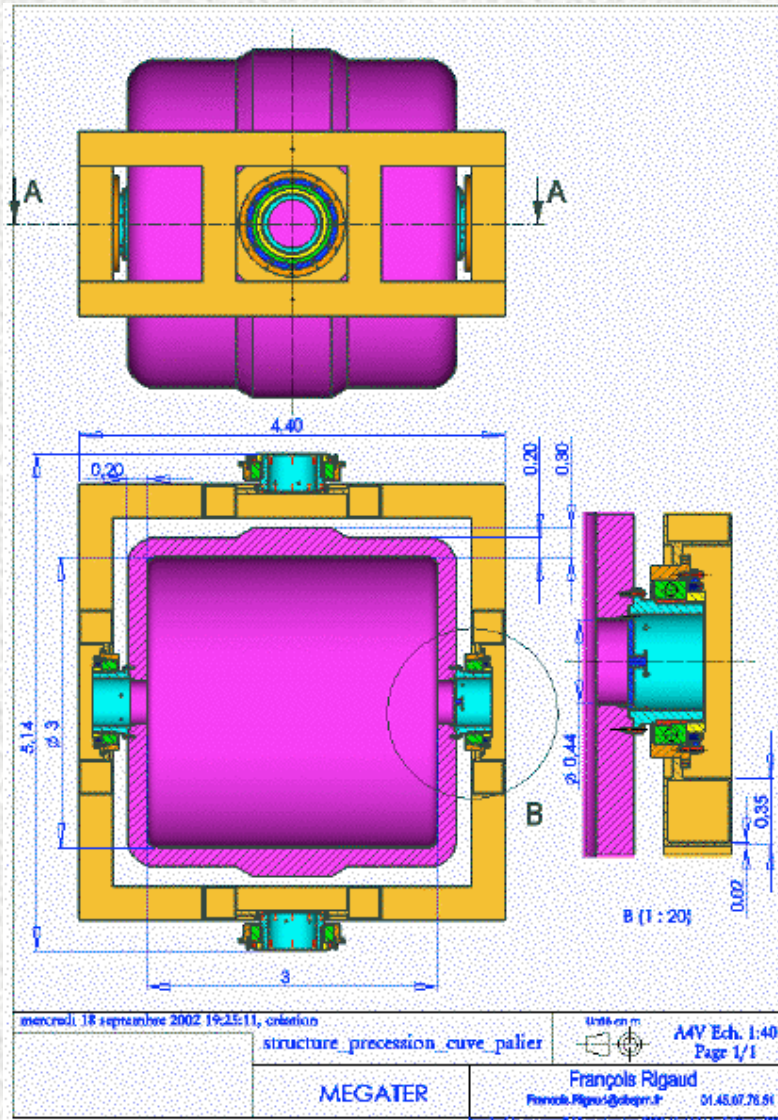


- ✓ expérience en eau
- ✓ Diamètre 30cm,
- ✓ Longueur 40 cm
- ✓ Rotation max 10t/s
- ✓ Precession max 1t/s
- ✓ PIV en cours

<http://melamp.obspm.fr/LEORAT/index.html>



# MEGATER

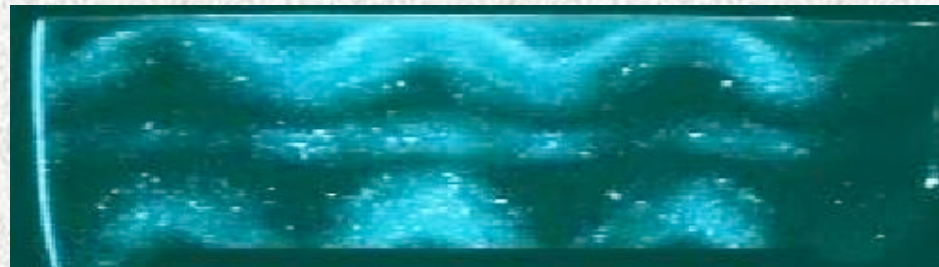
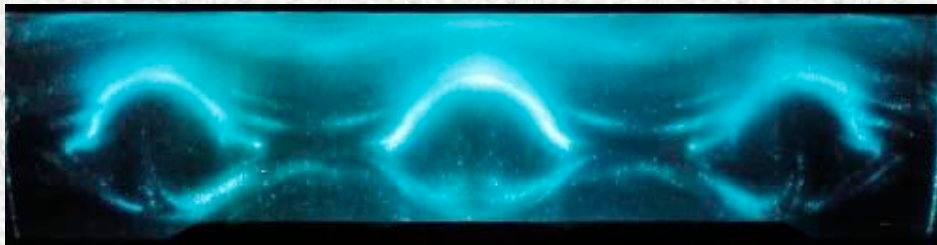


- ✓  $L = \text{diameter} = \text{length} = 3\text{m}$
- ✓ Sodium mass : about 27 tons
- ✓ Precession frequency  $< 1\text{Hz}$
- ✓ Flow speed  $\sim 30\text{ m.s}^{-1}$
- ✓  $R_m \sim 450$
- ✓ Centrifugal pressure  $\sim 50\text{ atm}$



# Instabilités Elliptiques

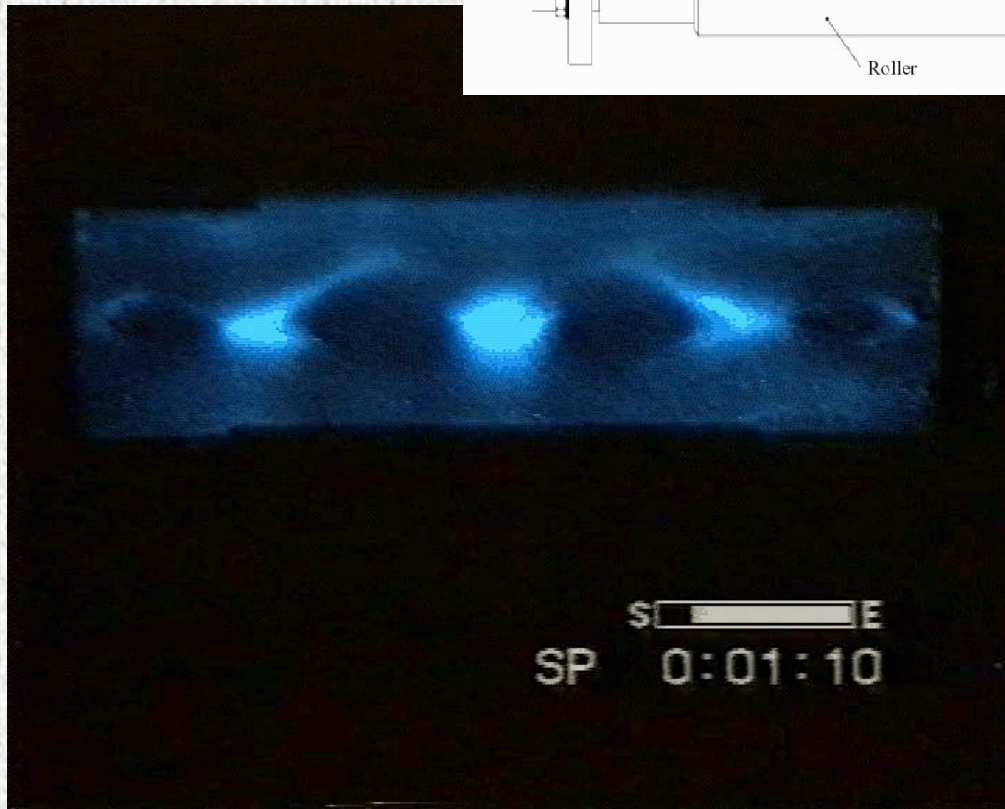
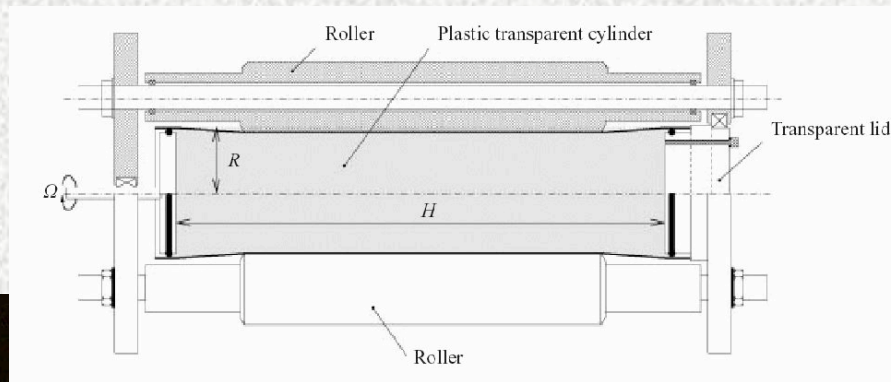
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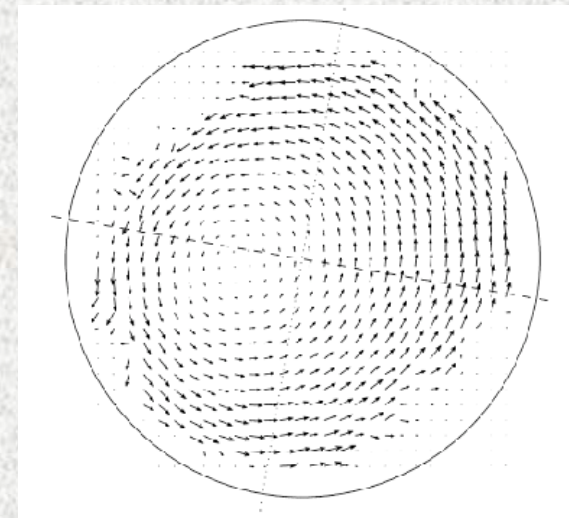
P. Le Gal  
C. Eloy  
S. Le Dizès  
L. Lacaze

Université Aix-Marseille

# Instabilités Elliptiques



- ✓ expérience en eau
- ✓ PIV



<http://www.irphe.univ-mrs.fr/~legal/>