

# Supercondutividade e suas Aplicações

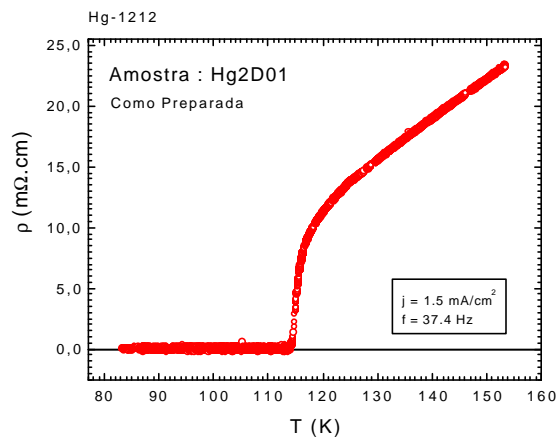
*Roberto Nicolisky*

LASUP

Laboratório de Aplicações de Supercondutores  
Politécnica da UFRJ

ABINEE-TEC, 08 de outubro de 2003, São Paulo

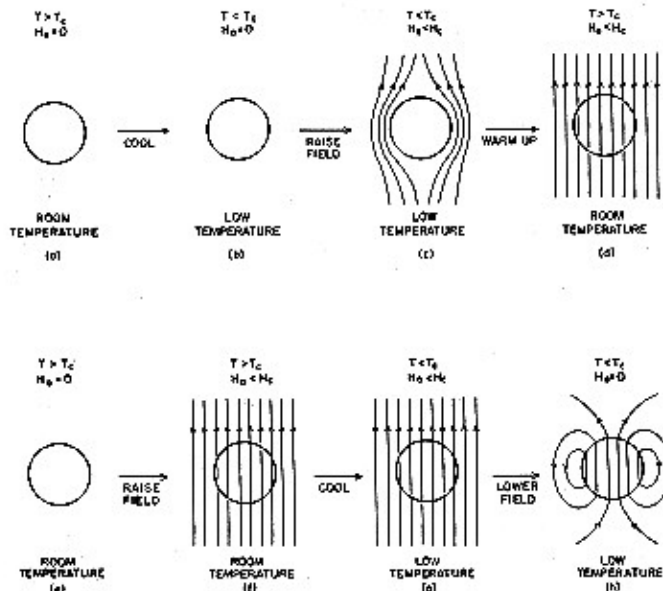
## Resistência Nula



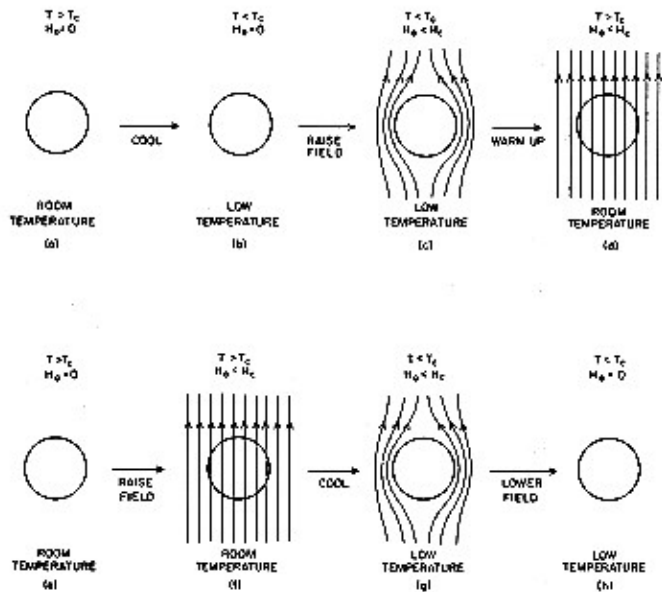
# ELEMENTOS SUPERCONDUTORES

IA																	VIIA				
1 H																	10 He				
	IIA																18 Ar				
3 Li	4 Be 0.03 K															5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg	IIIB		IVB	VB	VIB	VIIIB	---	VIIIB	---	IB	IIB	13 Al 1.18 K 105 Oe	14 Si 7.1 K	15 P 5.8 K	16 S	17 Cl	18 Ar			
19 K	20 Ca	21 Sc	22 Ti 0.4 K 5.40 K 56 Oe	23 V 5.40 K 1408 Oe	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn 0.85 K 54 Oe	31 Ga 7.5 K	32 Ge 5.35 K	33 As 0.5 K	34 Se 6.95 K	35 Br	36 Kr				
37 Rb	38 Sr	39 Y 2.5 K	40 Zr 0.61 K 47 Oe	41 Nb 9.25 K 2060 Oe	42 Mo 0.915 K 96 Oe	43 Tc 7.8 K 1410 Oe	44 Ru 0.49 K 69 Oe	45 Rh	46 Pd	47 Ag	48 Cd 0.52 K 28 Oe	49 In 3.41 K 282 Oe	50 Sn 3.72 K 305 Oe	51 Sb 3.55 K	52 Te 5.1 K	53 I	54 Xe				
55 Cs 1.5 K	56 Ba 5.4 K	57 La 6.00 K 1096 Oe	58 Hf 0.13 K 13 Oe	59 Ta 4.47 K 829 Oe	60 W 0.015 K 1.15 Oe	61 Re 1.70 K 200 Oe	62 Os 0.66 K 70 Oe	63 Ir 0.11 K 16 Oe	64 Pt	65 Au	66 Hg 4.15 K 411 Oe	67 Tl 2.38 K 178 Oe	68 Pb 7.20 K 803 Oe	69 Bi 8.55 K	70 Po	71 At	72 Rn				
87 Fr	88 Ra	89 Ac															85 At	86 Rn			
			58 Ce 1.9 K	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd 7.85 K 815 Oe	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu 0.1 K 350 Oe					
			90 Th 1.38 K 1.6 Oe	91 Pa 1.4 K	92 U 0.2 K	93 Np	94 Pu	95 Am 1.0 K	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lw					

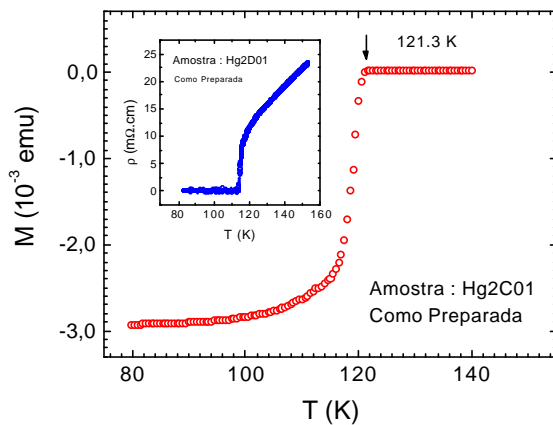
## Condutor Perfeito Hipotético



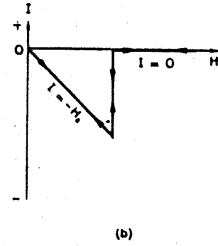
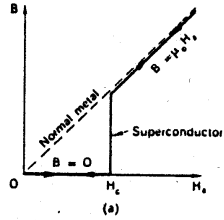
# Superconductor



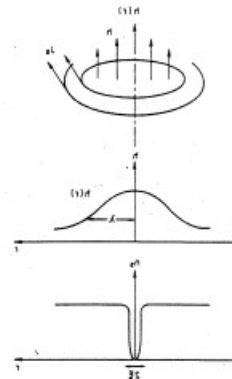
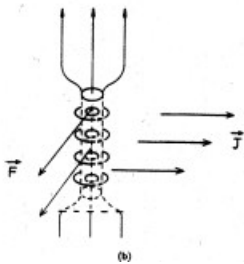
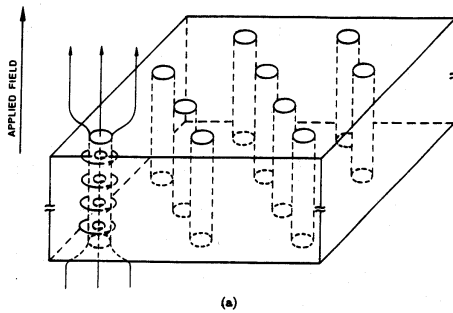
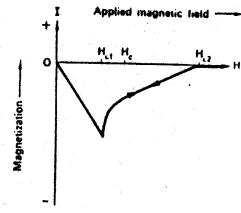
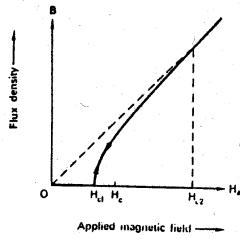
## Resistência Nula e Diamagnetismo Perfeito

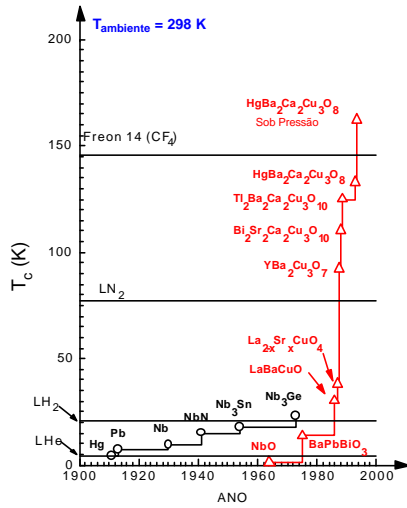


# Tipo I



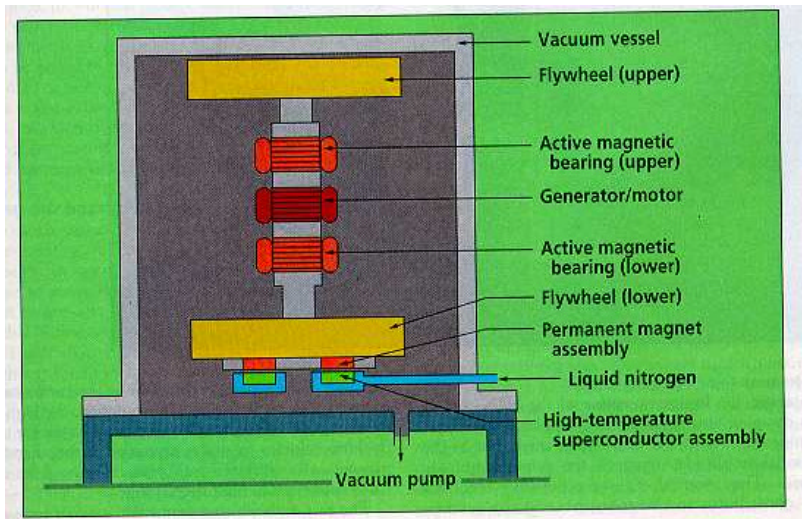
# Tipo II

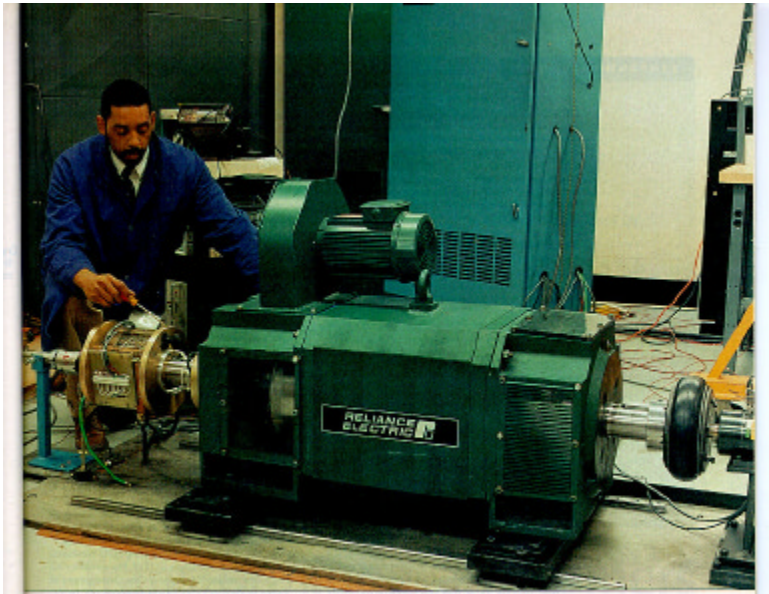




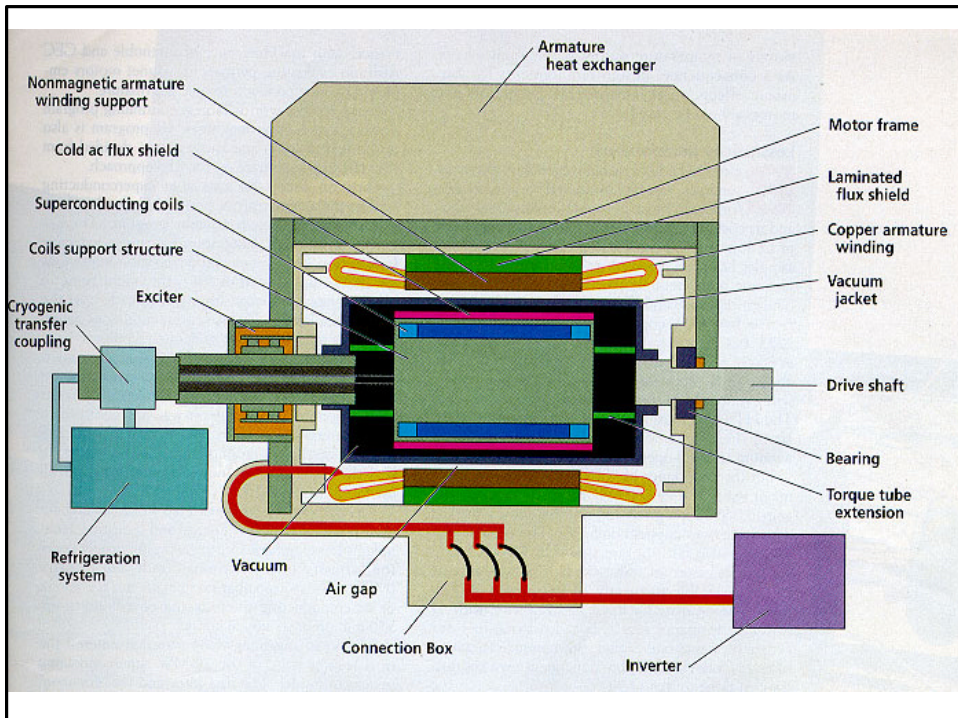
## Algumas Aplicações

# Flywheel

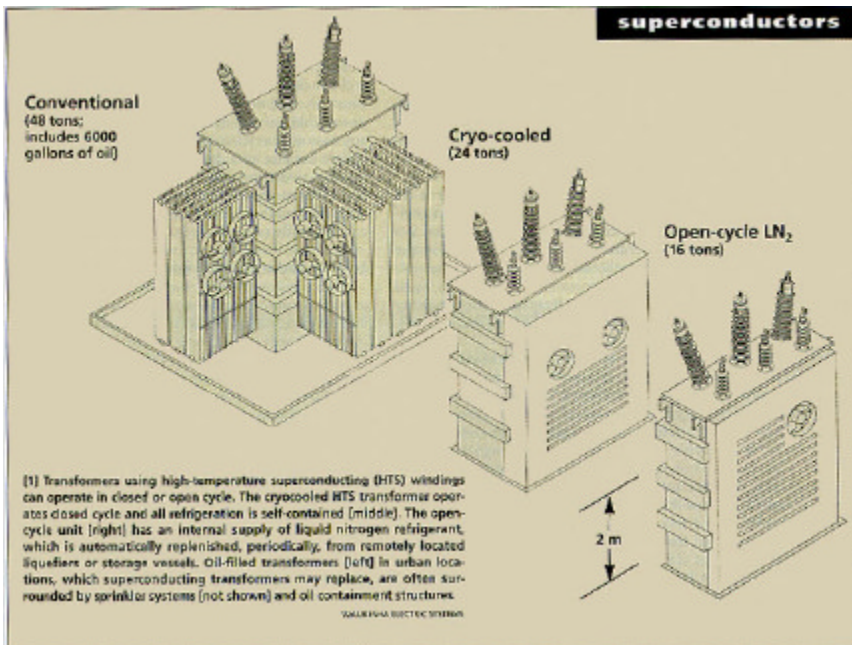
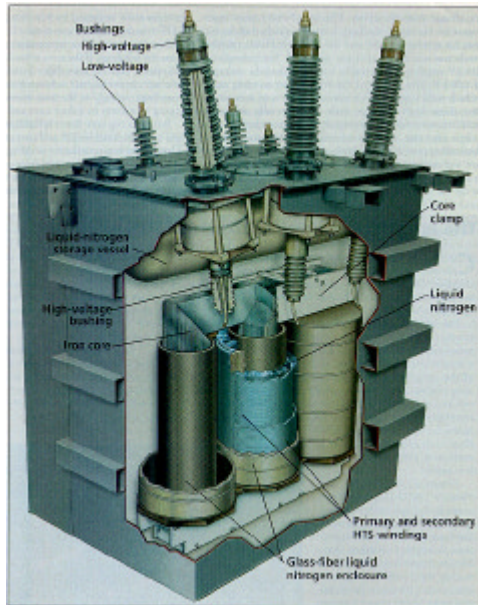




Motor Superconductor



# Transformadores



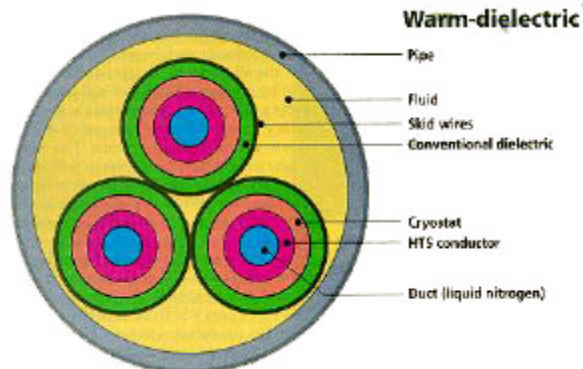


## Limitador de Corrente de Curto-circuito

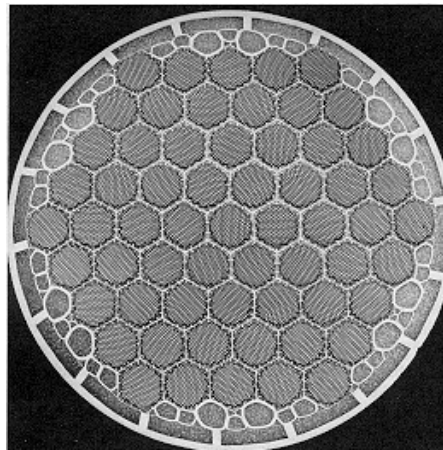
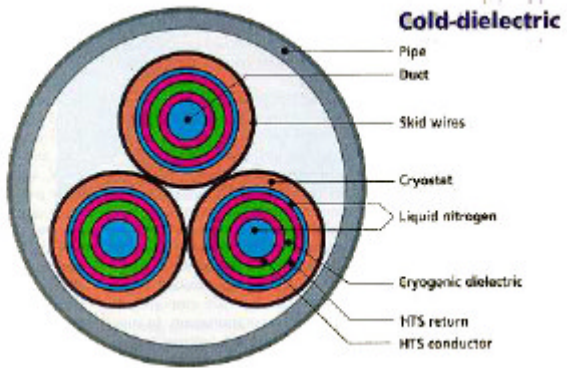


[4] The 630-kVA demonstration transformer based on high-temperature superconductor windings is presently under test by ABB, ASEA Brown Boveri Ltd., on the grid in Geneva, Switzerland. Designed to convert power from 18.7 kV to 420 V, its superconducting windings are made of power-in-tube BSCCO-2223.

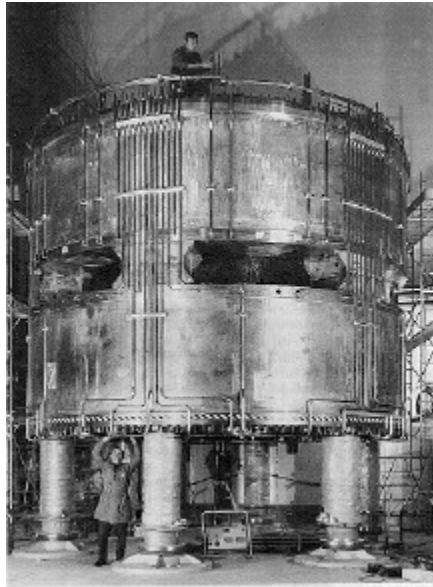
## Cabos Supercondutores



(1) High-temperature superconducting (HTS) cable of the warm-dielectric design (above in cross section) is suitable for retrofitting in existing pipes. Cryogenic-dielectric cables (right) have lower losses but need more investment. Both HTS designs promise higher power and lower losses than commercial cables.



# SMES



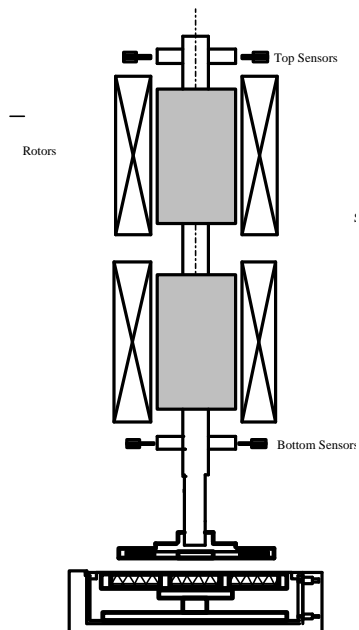
# Maglev

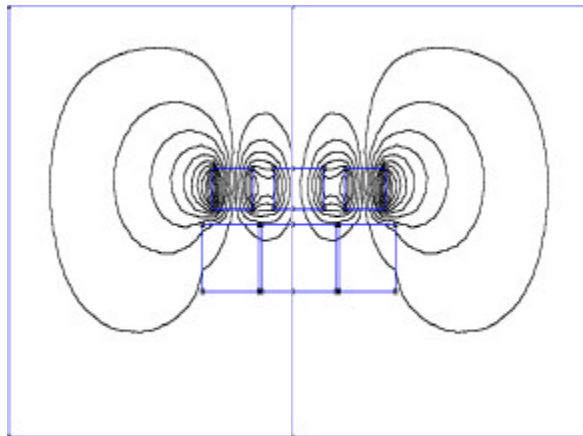
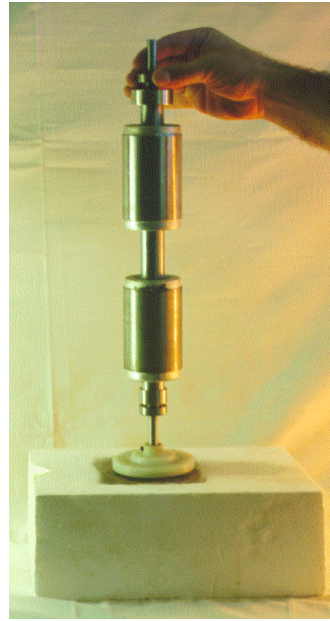


# O que temos feito

## Mancais Magnéticos Supercondutores

**Rotativos**

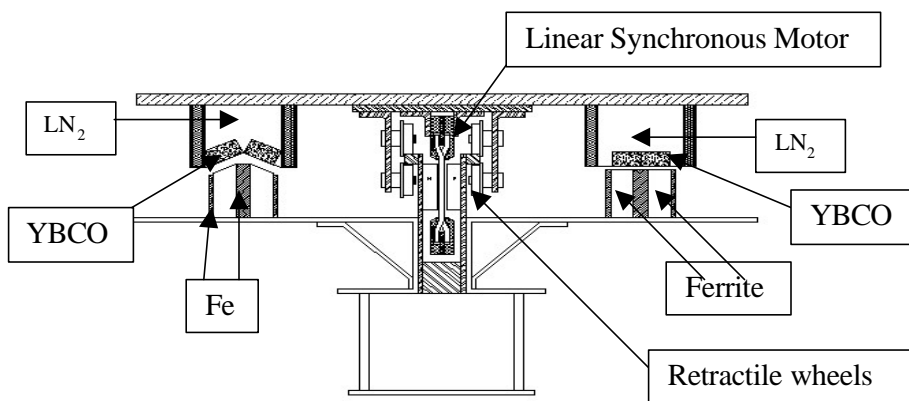




# Mancais Magnéticos Supercondutores Lineares

## Protótipo Trilho-Veículo

### Esquema do Protótipo

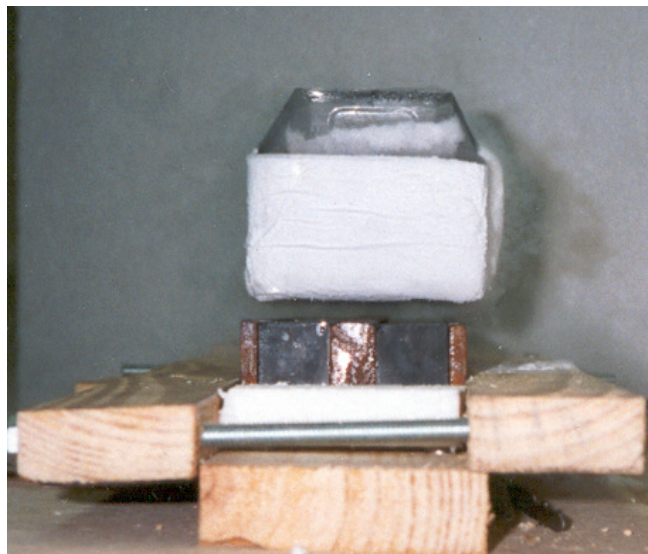


# 1º Protótipo em escala reduzida

7m lineares com estator longo



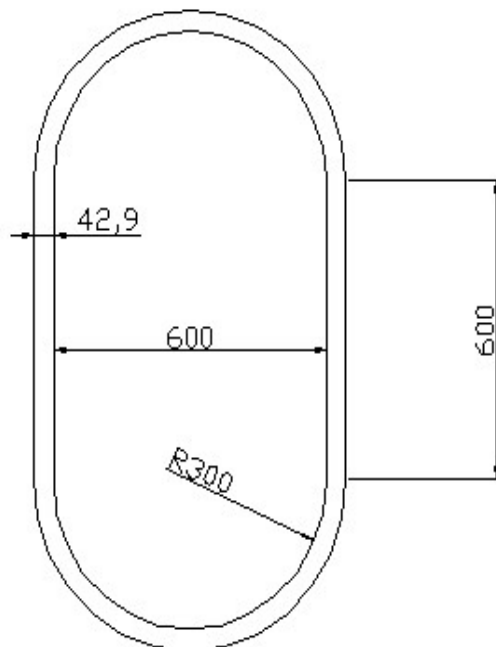
# Trilho de Ferrita



# Trilho de NdFeB



## Traçado do Trilho





## Protótipo 30 m Trilho-Veículo em escala reduzida (formato oval)



## Armazenador Cinético de Energia

