

dapnia



saclay

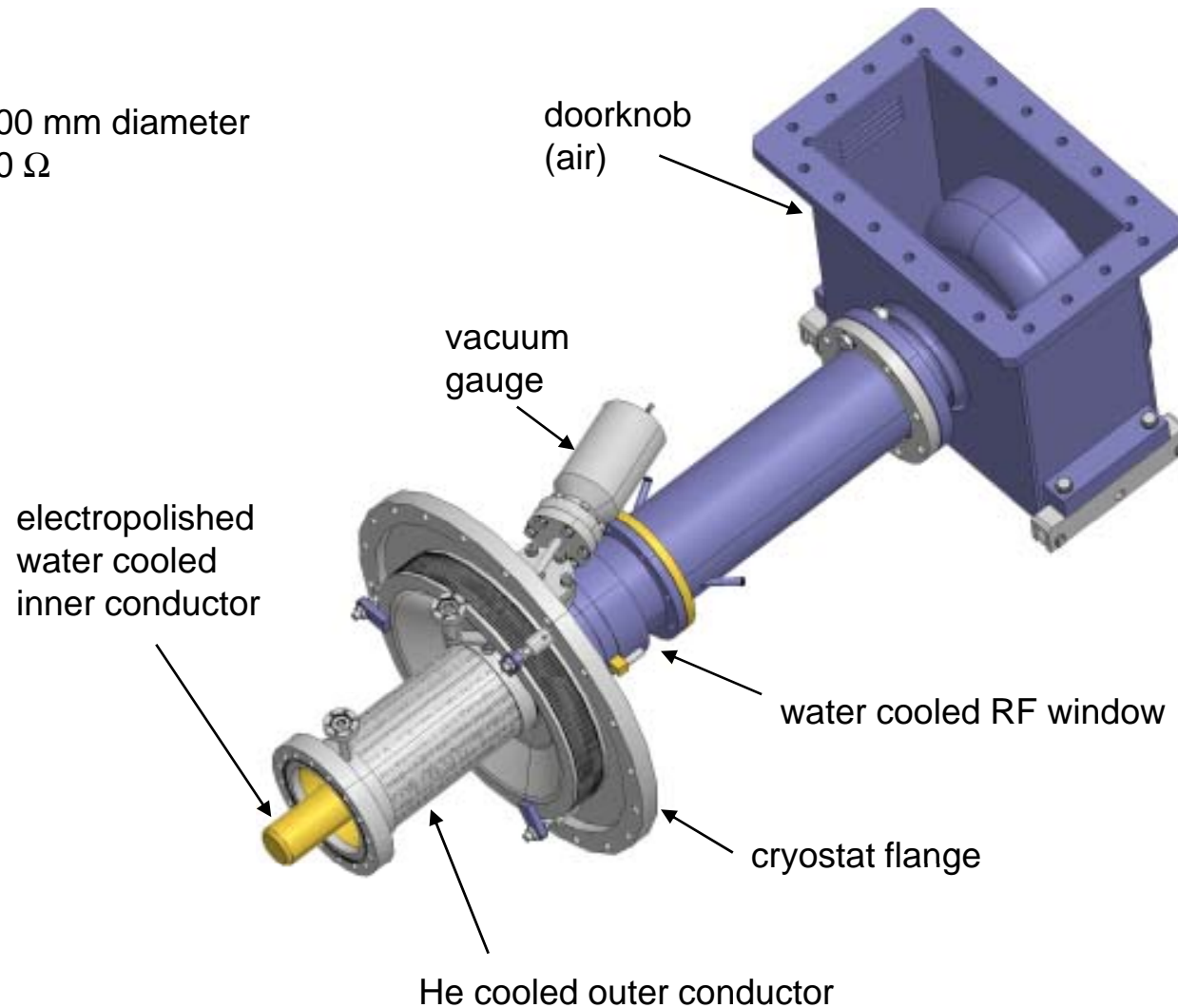
704 MHz coupler development at CEA

G. Devanz

1st SPL collaboration meeting CERN, dec. 11 2008

704 MHz -1 MW power coupler

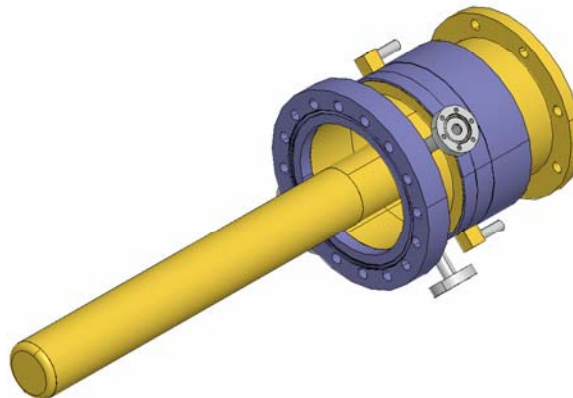
100 mm diameter
50 Ω



Coupler – window

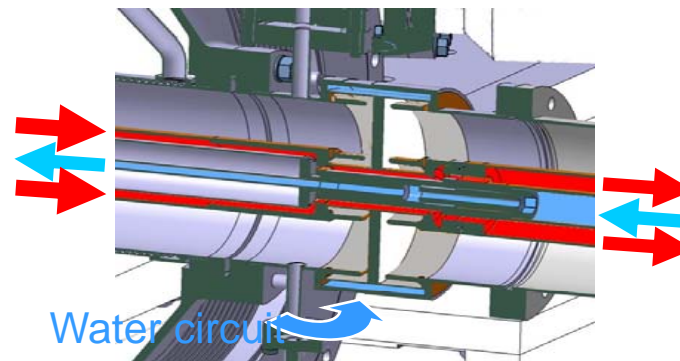
Two complete sets of window + inner conductor fabricated by Toshiba

- on time delivery
- few fabrication problems (excess EB weld shrinkage on antenna)



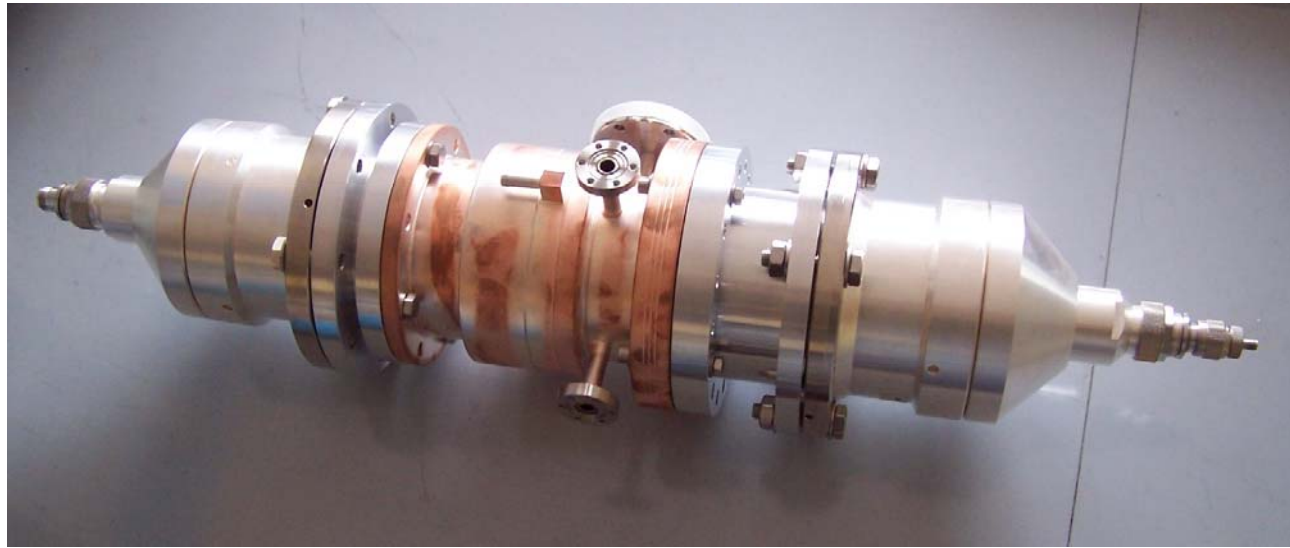
internal conductor dissipation
for 100kW average incident power

	P int (W)	dens. int (W/m ²)
TW	100	870
SW	200	1740



Coupler - window

Toshiba window prototype measurements

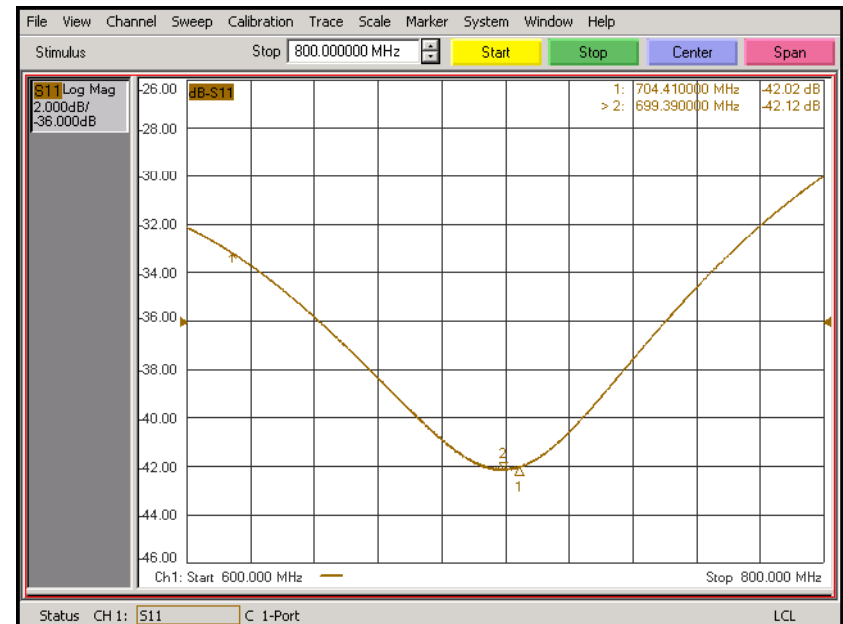


Special adapters for the vacuum side



-30 dB bandwidth
= 200 MHz

Minimum S11
= -42 dB



Coupler – outer conductors

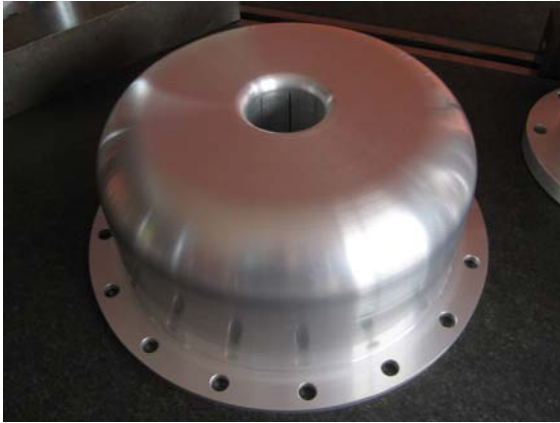
A lot of problems during manufacturing, including leaks at room temperature
-> extra caution was necessary so supplemental tests were done at CEA:

- thermal shocks performed on double- walled tube sub-assembly
- leak checks performed at ~30 K in a test cryostat (He bath)

Copper deposition on the inner surface performed by CERN using magnetron sputtering (S. Calatroni, O. Neupert).



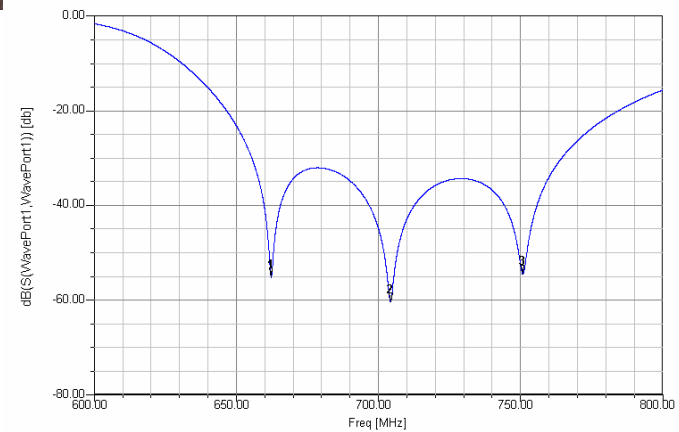
Coupler - Doorknobs



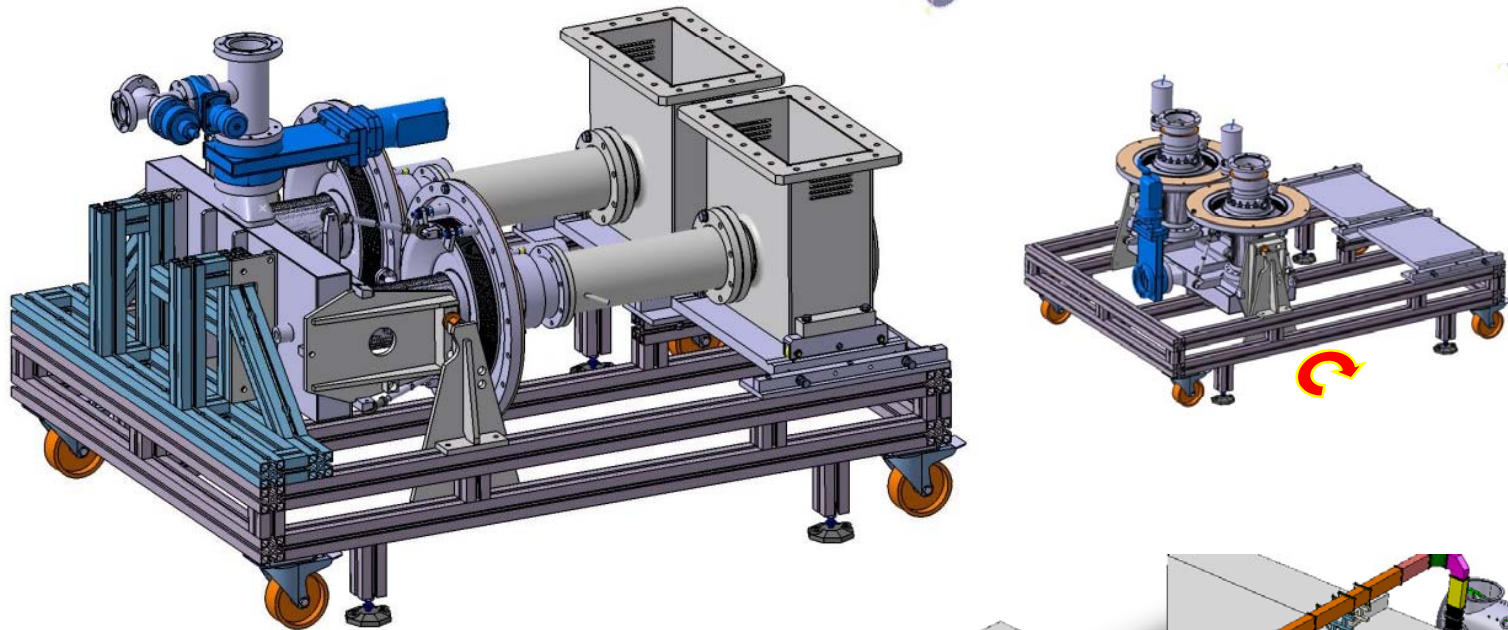
- Al + alodine surface treatment
- knob fully machined



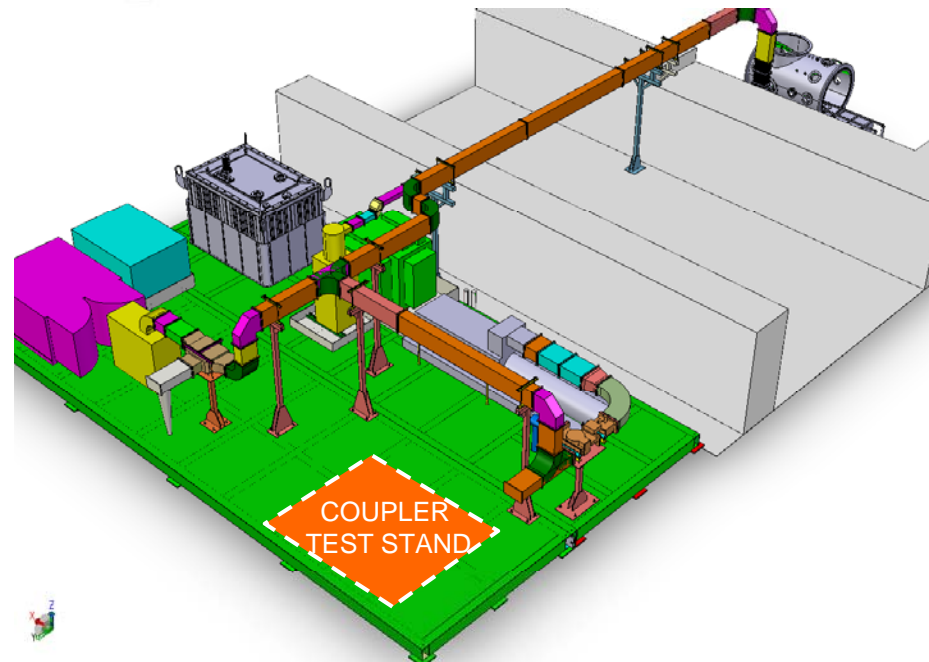
air-side connection of
water cooling channels



Coupler test stand

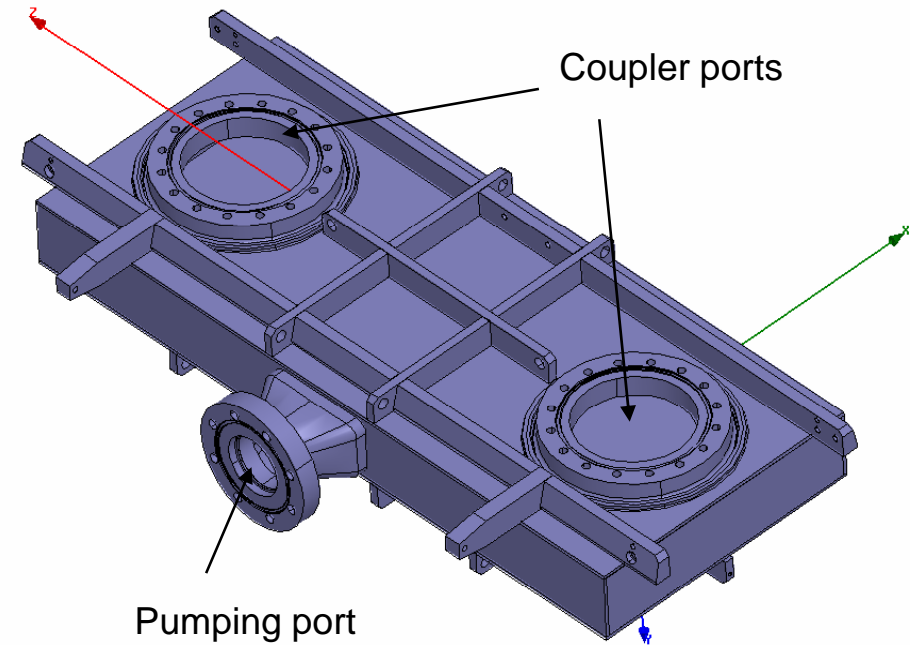


- working position is horizontal
- same doorknob alignment system as on CryHoLab

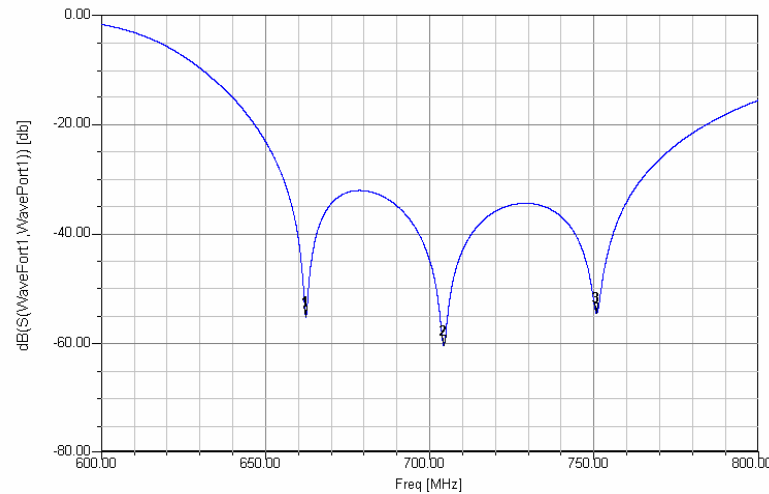


Coupler test stand – coupling box

- Connects 2 couplers for TW conditioning
- A strong coupling is needed, otherwise the bandwidth is too sharp to be of practical interest
- Copper coated for low RF losses (80W for 100 kW avg. TW)
- Strong pressure effects if not stiffened, impairs the RF transmission
- Extra mechanical adjustment of the frequency by deformation of the bottom side



HFSS computation of S11



: 662.21MHz	X2= 704.34MHz	X3= 750.71MHz
: -55.10	Y2= -60.35	Y3= -54.50

Coupler test stand – coupling box

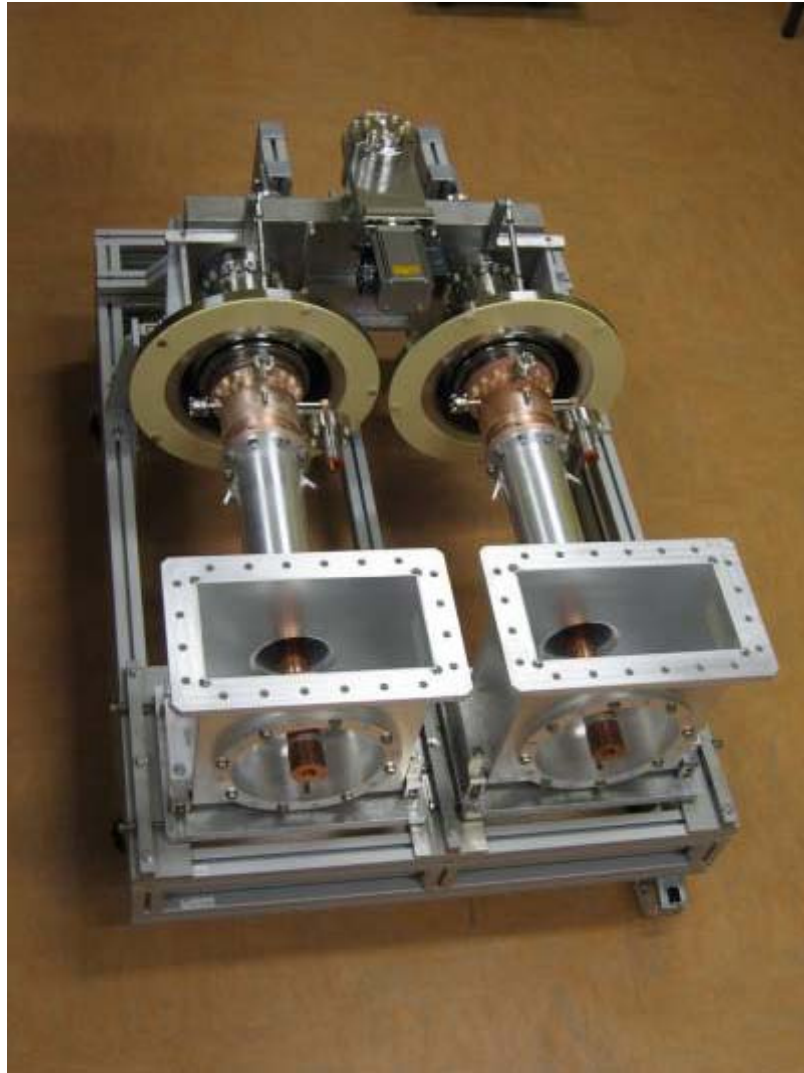
- manufacturing completed 2 weeks ago
- electrolytic copper deposition done inside the finished waveguide. 3 different sets of electrodes were tried to achieve a uniform layer on flats



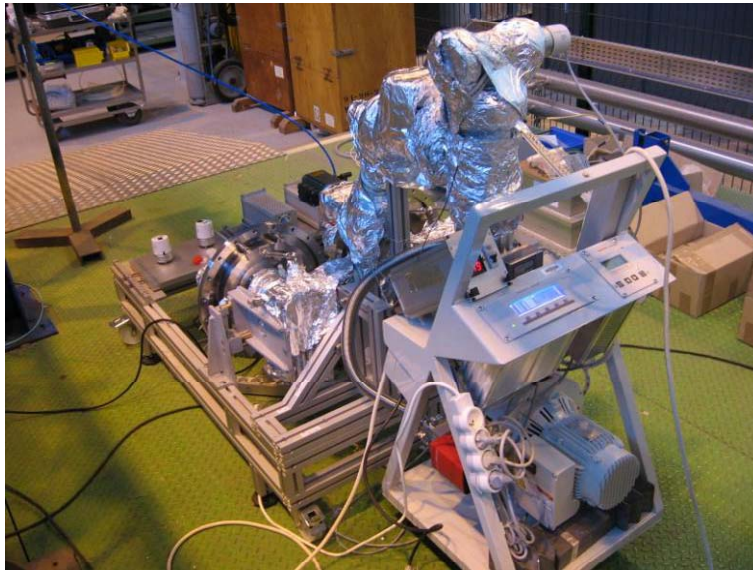
Coupler preparation in clean room



Coupler test stand



Coupler test stand



200 l/s turbo + dry pump
after baking at 200°C,
 $p=1.2 \cdot 10^{-9}$ mbar at pump level
 $p=2 \cdot 10^{-8}$ mbar at window level (small
conductance)

RF power 1MW TW, CW
movable short all phases

for each window

- 1 electron pickup
- 1 photomultiplier
- 1 vacuum gauge

for the antenna water cooling channel (antenna in series)
and external ceramic cooling channels

- 1 flow meter
- 3 temperature sensors (ΔT for each window)

1 MW RF power source

- klystron tested at nominal power (1MW, 2ms, 50 Hz)
- circulator tested on a matched load at full power (dry N2)
- circulator tested on a variable short at all phases, nominal peak power, reduced repetition rate
- breakdowns in the High Voltage Power Supply have been corrected

