Fabrication of the first French spoke prototype

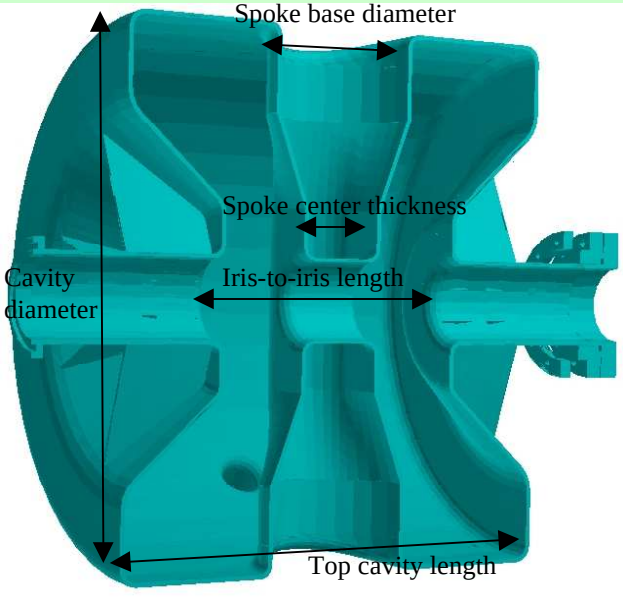
Jean Lesrel for the IPN Orsay cavity group

AMANDA $\beta = 0.35$

RF parameters

Frequency	**358.66 MHz**
Q_0 @ 4K	**$1.9\ 10^9$**
r/Q_0	**220 Ω**
G	**101 Ω**
E_{pk}/E_{acc}	**3.06**
B_{pk}/E_{acc}	**8.28 mT/MV/m**
Optimum beta	**0.363**

Dimensions



Main dimensions (in mm)	
Cavity diameter	408
Top cavity length	354
Spoke base diameter	118
Spoke center thickness	67
Spoke center width	147
Gap-center to gap-center length	150
Iris-to-iris length	200
Tube length (from iris to flange)	150
Beam tube aperture	60

Companies

Niobium: TOKYO DENKAI (Japan)

RRR 250 thickness: 3 mm

Cavity fabrication : CERCA (France)

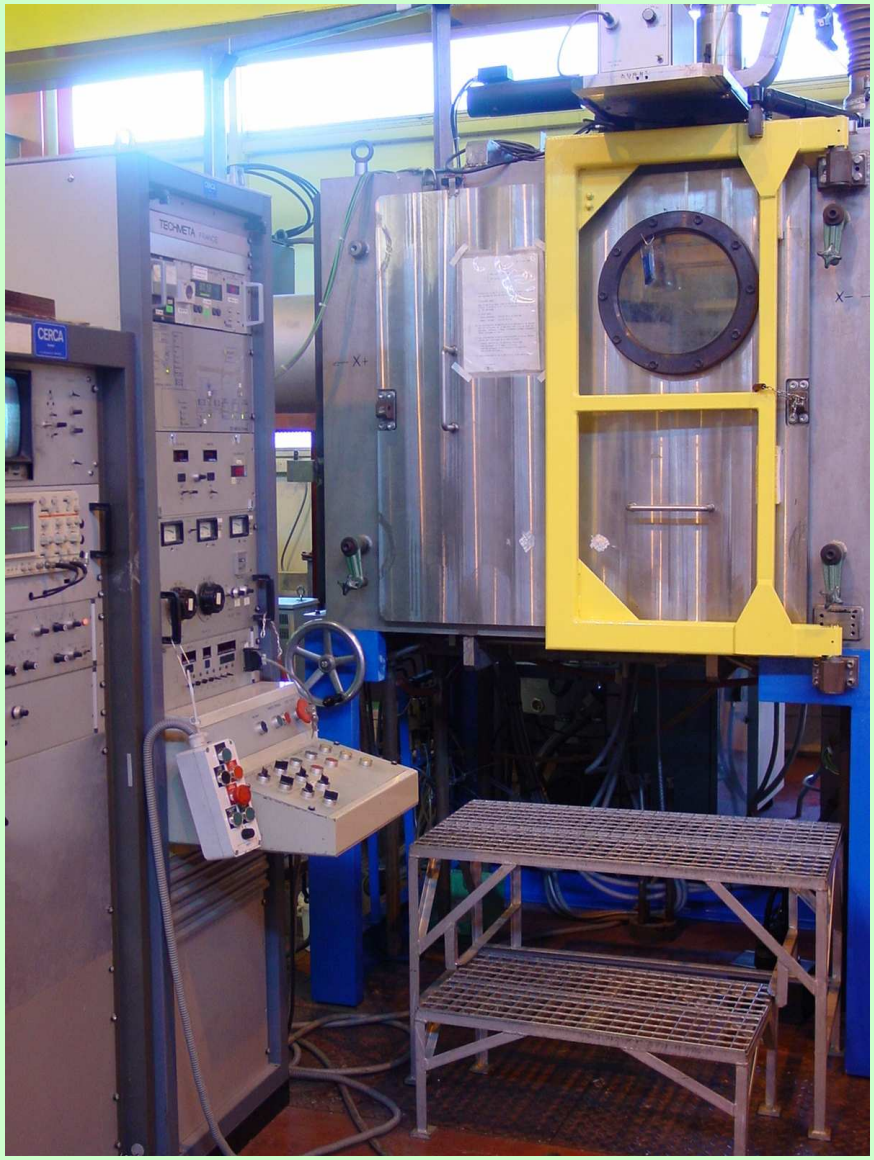
Fabrication time: 5 months

Subcontractors:

Spinning : BONITEMPO (France)

Machining : PRECISION MECANIQUE DUC (France)

Electron Beam Welding Machine



Vacuum < 10^{-5} mbar

Diameter 1.5 m

Length 4.5 m

Beam power 6 kW

Before welding

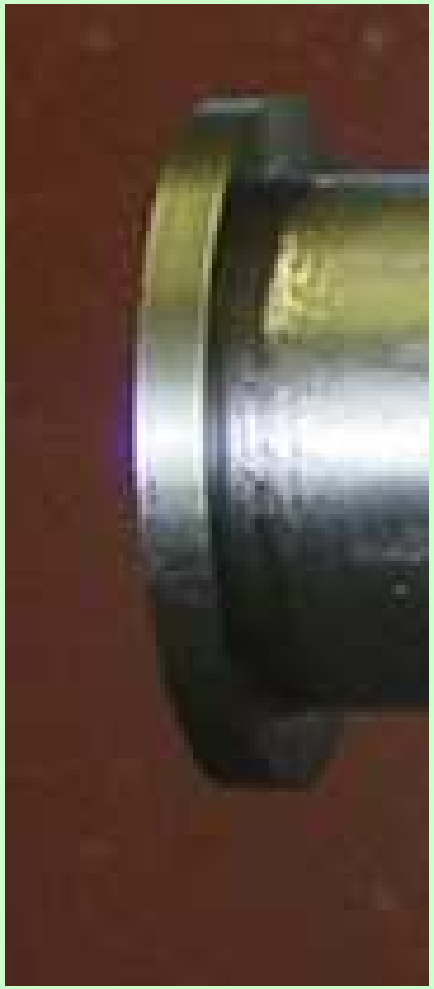
Chemical cleaning

degreasing

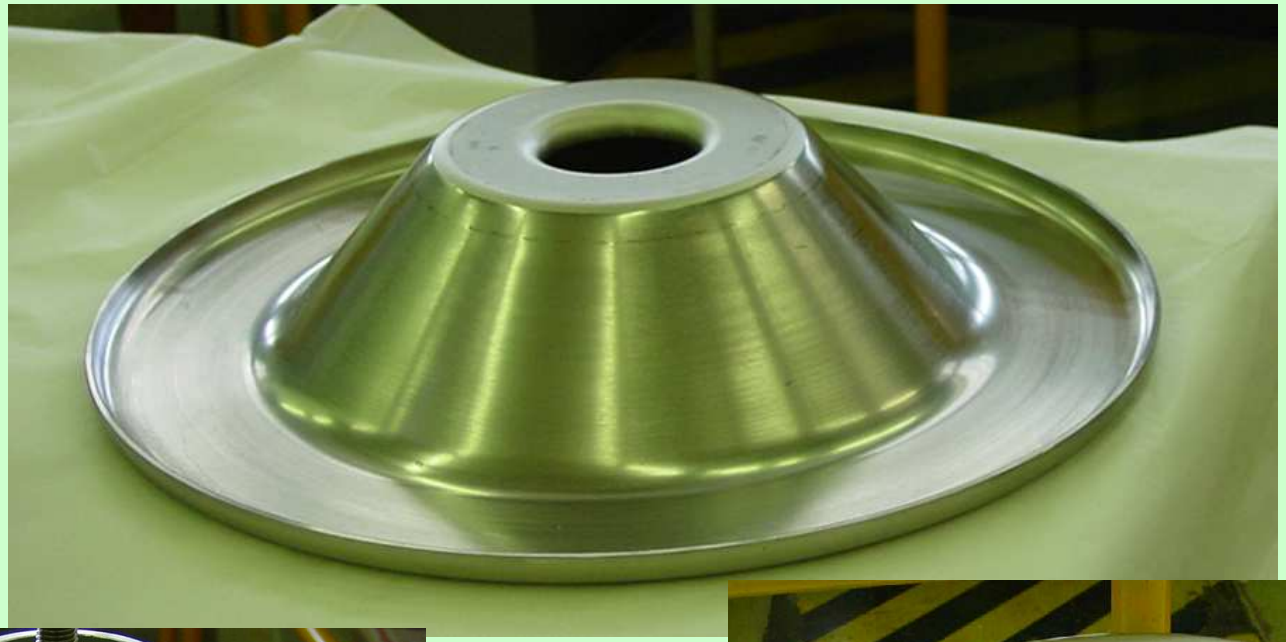
rinsing

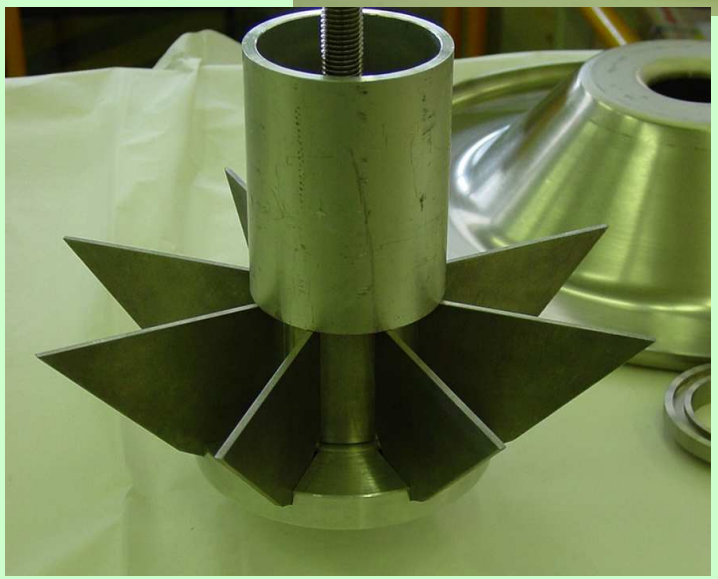
Drying under Nitrogen atm.

Fabrication method (cylinders and flanges)



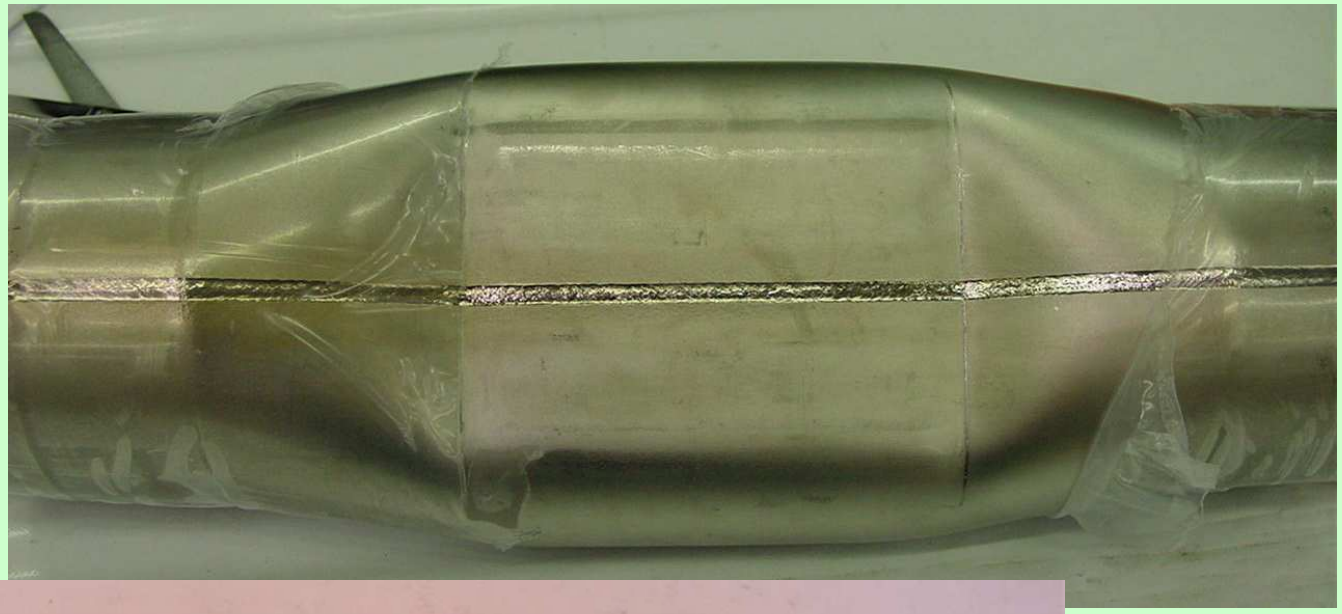
Fabrication method (walls and stiffeners)

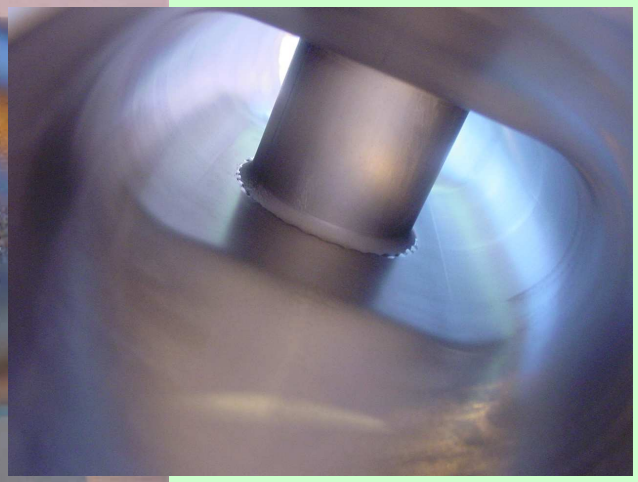




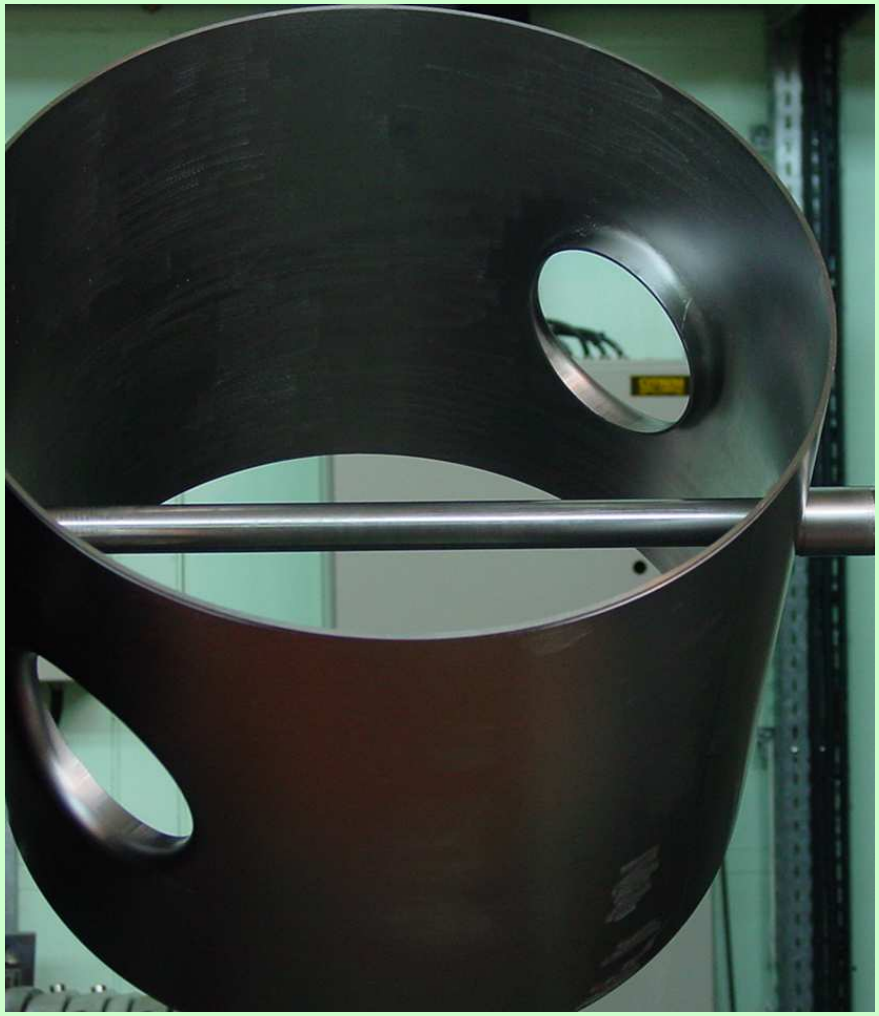
Fabrication method (walls and stiffeners)

Fabrication method (spoke bar)





Fabrication method (cavity body)



Fabrication method (final assembly)

Dimension control

	calculated sensitivity	dimension	measured	frequency variation
Cavity diameter	-950 kHz/mm	414 ± 0.2	413.9	+ 95 kHz
Spoke base diameter	+650 kHz/mm	118 ± 0.1	117.8	- 130 kHz
spoke center width	-800 kHz/mm	147 ± 0.2	146.8	-160 kHz
Spoke center thickness	-600 kHz/mm	67 ± 0.1	67.2	+ 120 kHz
top cavity length	+450 kHz/mm	360 ± 0.5	361	+ 450 kHz
			Total	+375 kHz

Calculated frequency : **358.55 MHz**

Measured frequency : **358.85 MHz**

Δf=300 kHz

Mechanical tests at room temperature

Tuning sensitivity: 500 kHz/mm

Structure spring constant: 2600 N/mm

Frequency variation under vacuum:

100 kHz

Frequency variation at 4 K:

in November