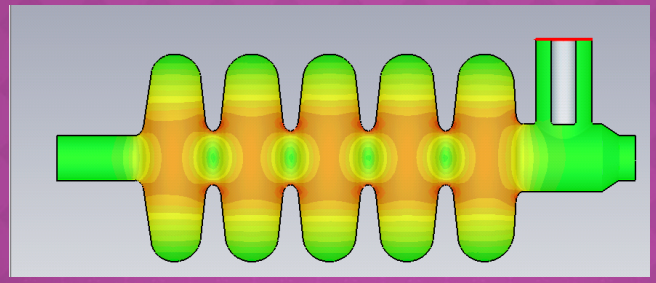
STATUS OF THE BETA=0.65 CAVITY FOR SPL LINAC

G. Olry

for the IPN Orsay team



5th SPL collaboration meeting, 25-26/11/2010, CERN

OUTLINE

Reminder since last SPL coll. Meeting in July '10

- New cavity design was under study based on
  - New parameter for vacuum load: 1.5 bar@300K
  - Proposal for common end-groups (same as β=1 CEA)

News from July '10

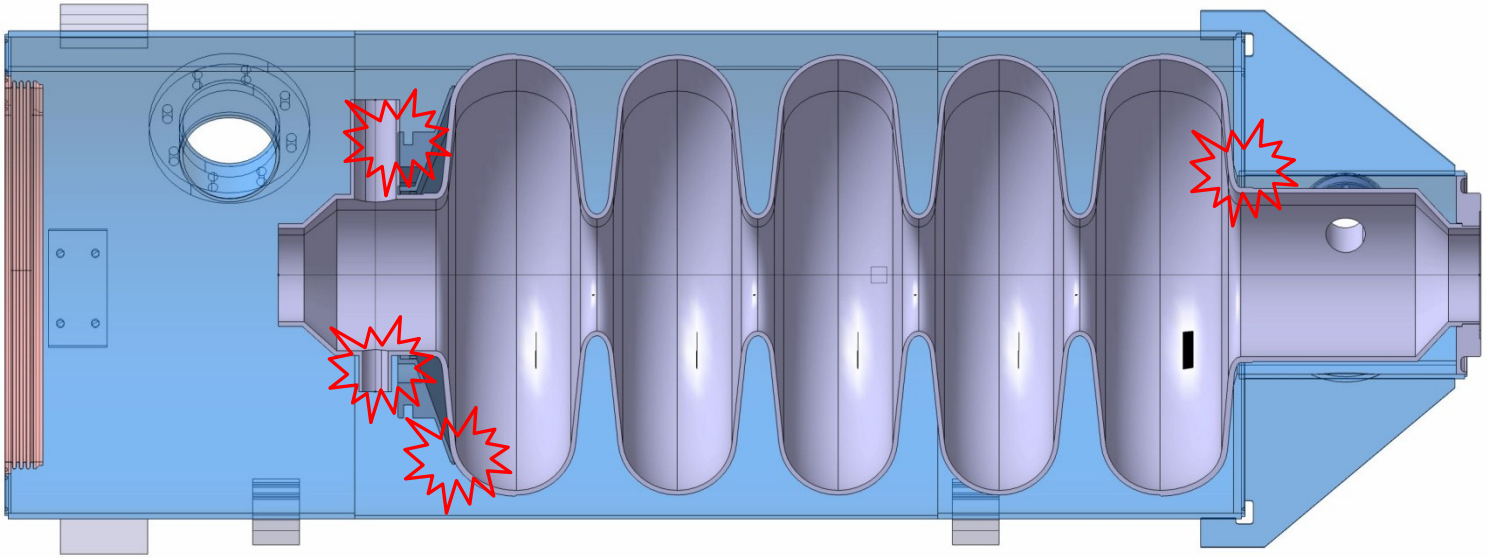
- Cavity and helium vessel designs completed
- Niobium ordered

Planning

REMINDER

<u>April'10:</u> Identical END-GROUPS between β=1 & β=0.65 cavities → major changes on beta 0.65 cavity mechanical and RF designs:

- Bigger beam tube apertures
  - →New design of the 2 external half cells (field flatness)
  - →New location and interface of the power coupler (Qext)
- New helium vessel
- New tuning system interface



beta=0.65 cavity inside beta=1 helium vessel

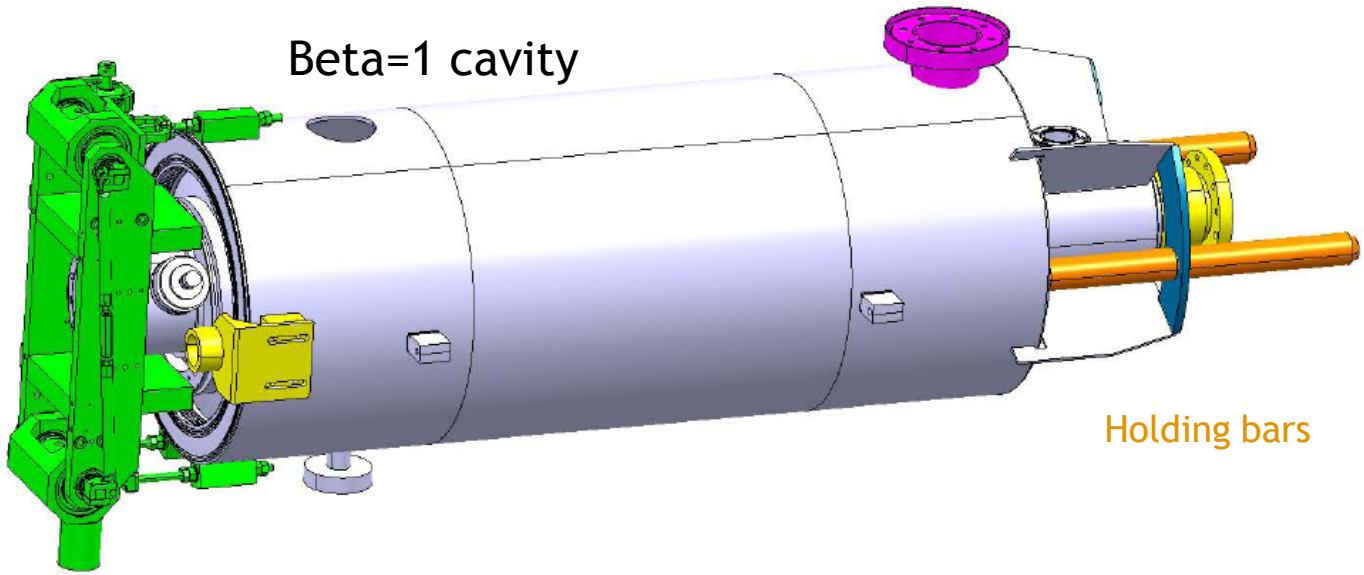
S. Rousselot (IPNO)

Transit Time Factor	0.65	

MODIFICATIONS

July'10 to 15th Oct'10: many iterations to fit the CERN cryomodule requests

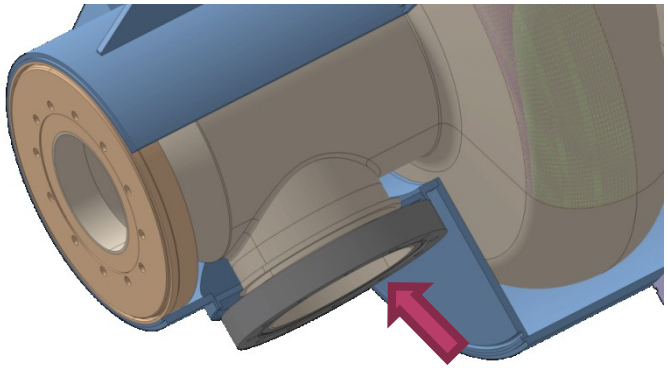
- Tuning system & holding bars integration: pb of angular position...
- Power coupler flange material: SS, Ti, Nb/Ti
- Overall Helium vessel design: connecting parts between cavity/tank, cryogenics pipes location, size...



FINAL DESIGN

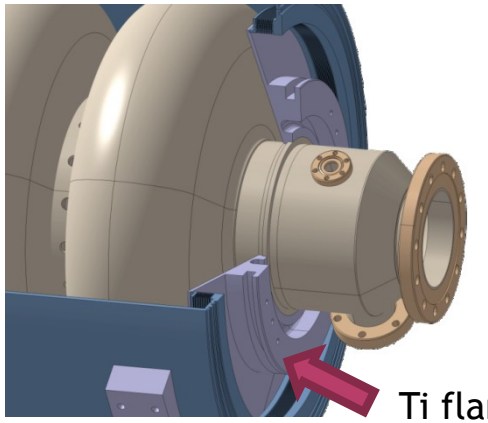
15th Oct '10: CERN-CEA-CNRS major decision → **Beta=1 and Beta=0.65 cavities will be tested in CRYHOLAB only!**

→ Helium vessel design: free from CERN cryomodule requests

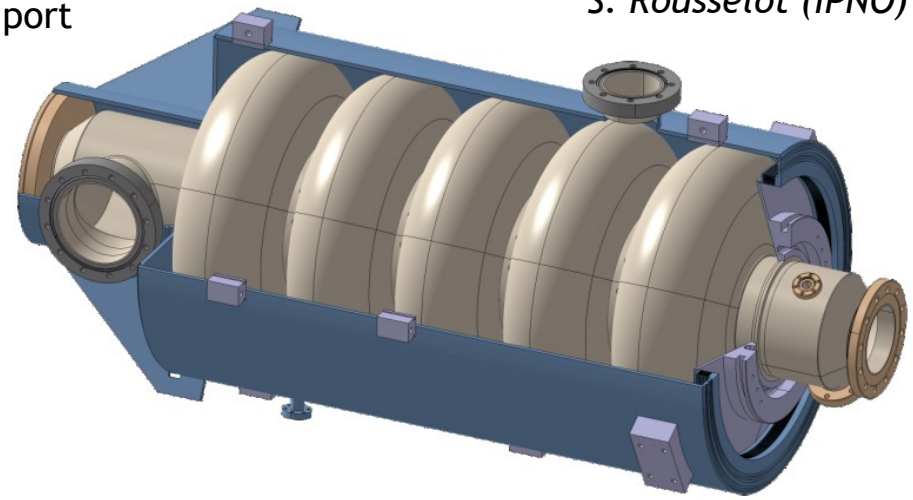


Flange of the coupler port

S. Rousselot (IPNO)



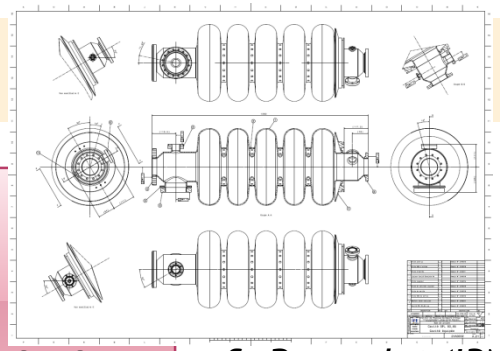
Ti flange for the tuning system



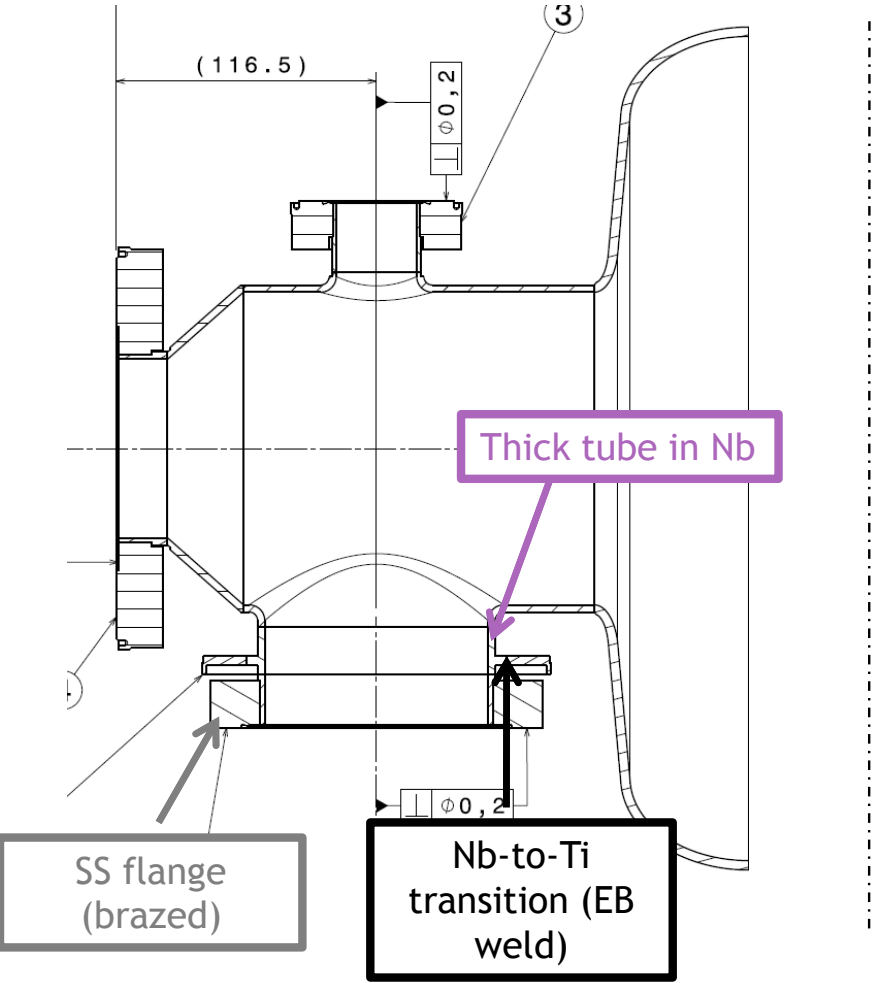
Final design

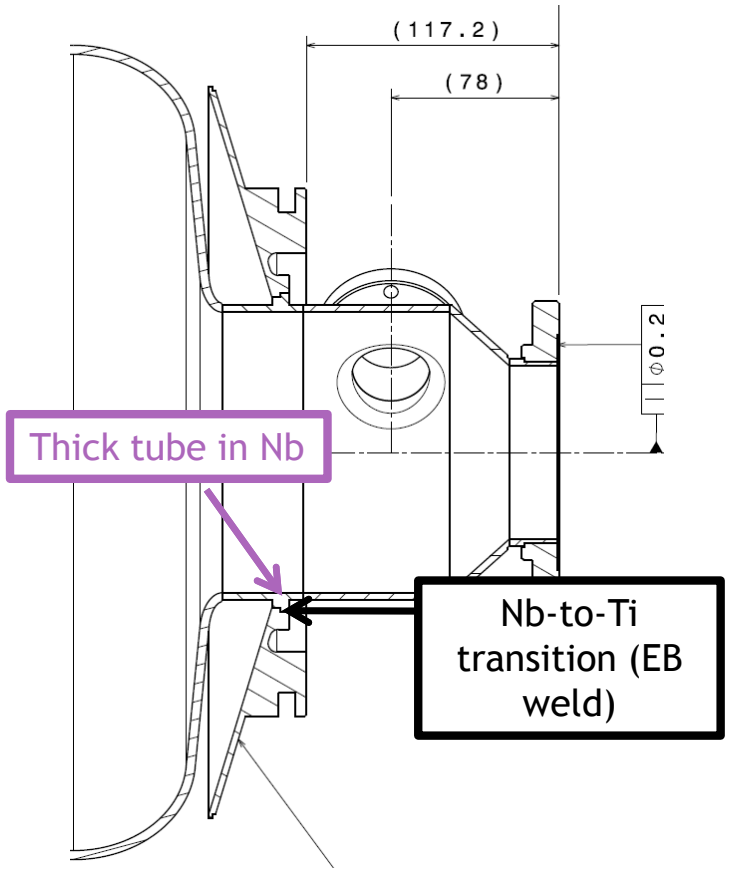
TECHNICAL DRAWINGS

- Cavity: ready
- Helium vessel: almost done
- Internal review: first week of december 2010



S. Rousselot (IPNO)





NIOBIUM

- Nb sheets: 4.2 mm (cells), 3.2 mm (end-groups), 2 mm (pick-up & HOM ports)

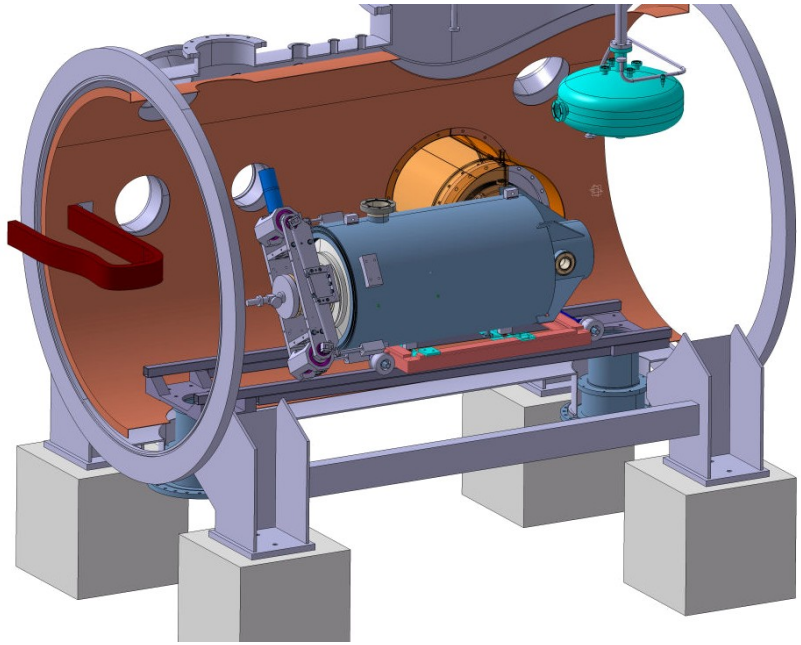
- 3 offers for RRR>250
  - Neyco: 69700 euros
  - Plansee: 67500 euros
  - Tokyodenkai: 62600 euros → winner!...

- ”small” budget overrun of about 100%!
- Nb sheets: 520 €/kg! (270 € in 2006, 350 € in 2008)
- Thick tubes for cavity-to-helium vessel transition
  - Coupler side: 1500 euros
  - Tuning system side: 3300 euros

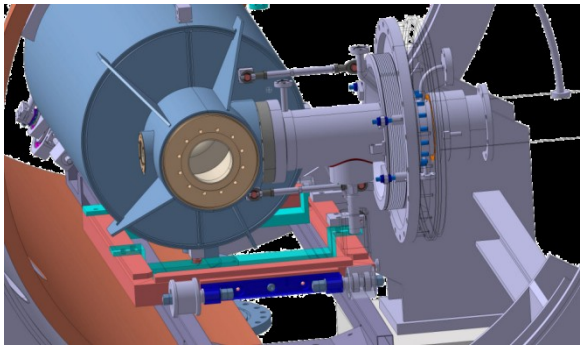
- Delivery lead-time: 3 months

TEST IN CRYHOLAB

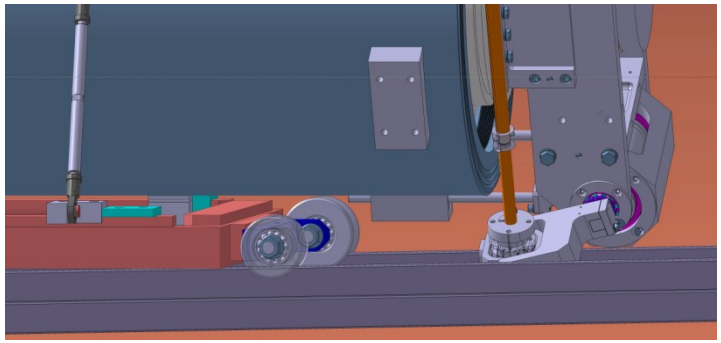
On-going studies...integration in Cryholab



S. Rousselot (IPNO)



Power coupler integration



... A lot of available space ☺

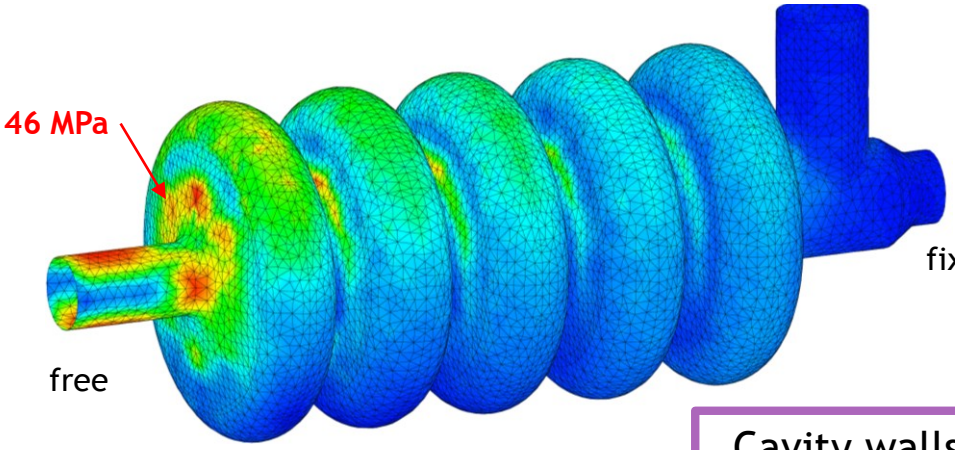
PLANNING

- Dec'10: Technical drawings review
- Dec'10-Feb'11: call for tender preparation (public contract > 125k€ HT)
- March-April'11: …waiting for (interesting and cheap) offers + Niobium delivery + Choice of the manufacturer
- May'11: Contract signature & start of the fabrication
- Jan'12: Cavity delivery (w/o helium vessel) + Field flatness
- Feb'12: Cavity preparation (BCP + HPR) + test in vertical cryostat
- April'12: Helium vessel welding
- May'12: Field flatness verification + cavity preparation (light BCP + HPR)
- Before end of 2012: Cavity installation & test in CRYHOLAB

THANK YOU FOR YOUR ATTENTION

NEW PARAMETER FOR VACUUM LOAD

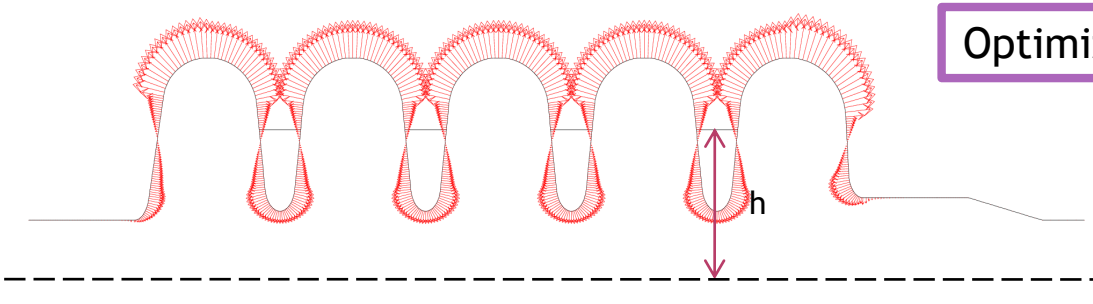
- Von Mises stresses for 1.5 bar @ 300K < 50 MPa with 4mm



H-M Gassot (IPNO)

Cavity walls thickness = 4mm

- Lorentz forces detuning with 1 stiffening ring : K_L~ -1.6 Hz/(MV/m)^2



Optimized rings position: h=94 mm

H-M Gassot (IPNO)

REQUIREMENTS

Table 4.11: SPL superconducting linac design parameters

Maximum peak surface electric field	50 MV/m
Maximum peak surface magnetic field	100 mT
Cavity quality factor at 2 K	$\geq 10^{10}$
Accelerating gradient ($\beta = 1.0$)	25 MV/m
R/Q ($\beta = 1.0$)	570 Ω
Frequency	704.4 MHz
Number of cells	5

Conceptual design of the SPL II, CERN-2006-006

GOALS

Epeak/Eacc < 2.6

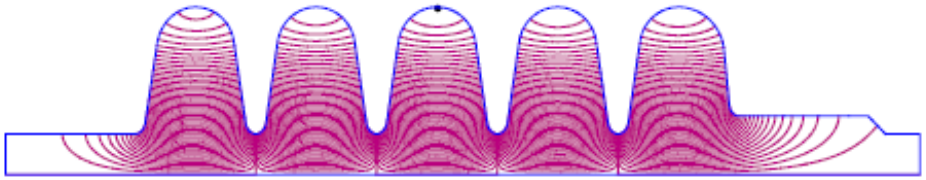
Bpeak/Eacc < 5.2 mT/(MV/m)

+

Cell-to-cell coupling factor k ≈ 1.5 %

Starting point :

1999, EUROTRANS cavity β= 0.65



	Cavité β_g=0,47	Cavité β_g=0,65
$[B_{pk}/E_{acc}]_{ref}$ (mT/MV/m)	5,88	4,88
$[E_{pk}/E_{acc}]_{ref}$	3,58	2,61
G (Ω)	152,7	194,1
$[r/Q]_{ref}$ (Ω)	79,5	157,5
K (%)†	1,35	1,11
plat de champ (%)	1,3	1,3
$f_{SUPERFISH}$ (MHz)	704,42	704,42

J-Luc Biarrotte, PhD Thesis, 2000, Orsay