

High Resolution Separator for Spiral2 Design and performances

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On behalf of the HRS Working Group





Contexte

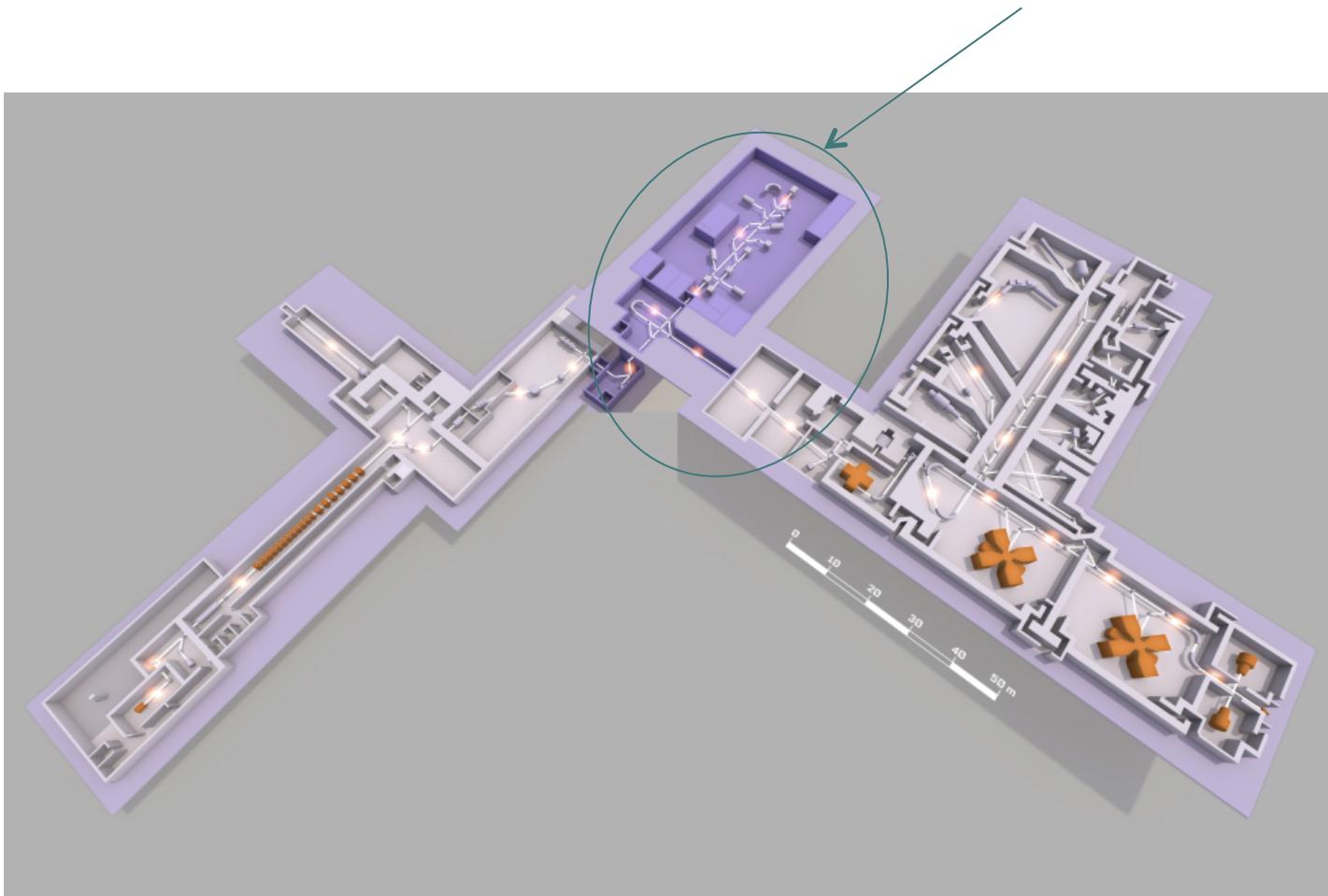
- Données entrées
- Pourquoi ce spectro
- Transmission total, online faisceau ISOL basse énergie
- Système dispersif/remplissage dipôles



Contexte

DESIR PROJECT

Desintegration Excitation and Storage of Radioactive Ions



Contexte



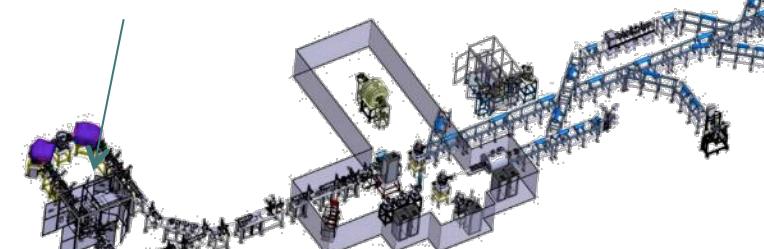
Two sites of Production with fento to nano Amps beams intensity
Broad Species
Transportation energy at 60keV



SHIRAC2 au LPC Caen



Need to have a setup with good resolution and hight efficiency



LPCTrap au GANIL



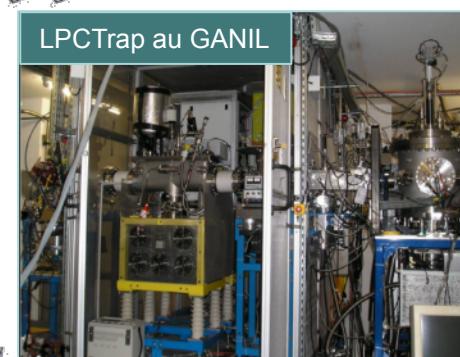
PIPERADE au CENBG

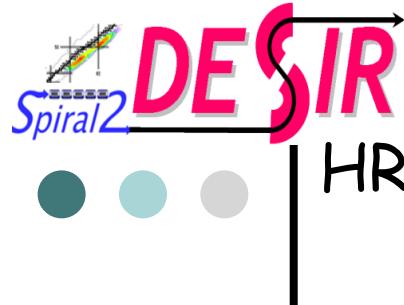


HRS1P et GPIB au CENBG



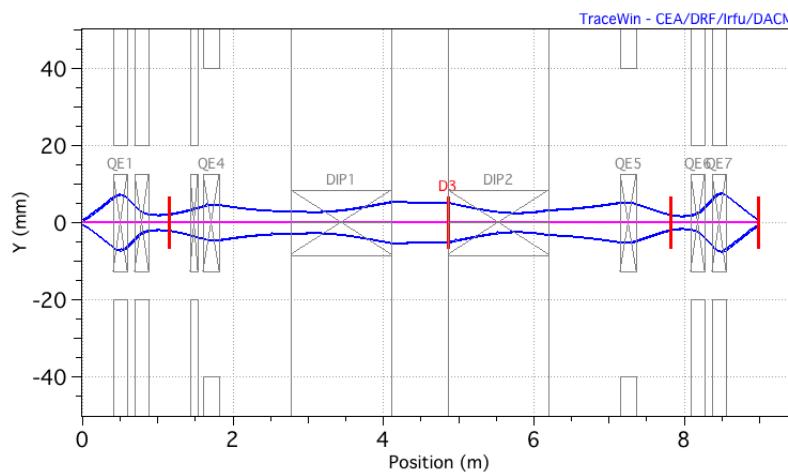
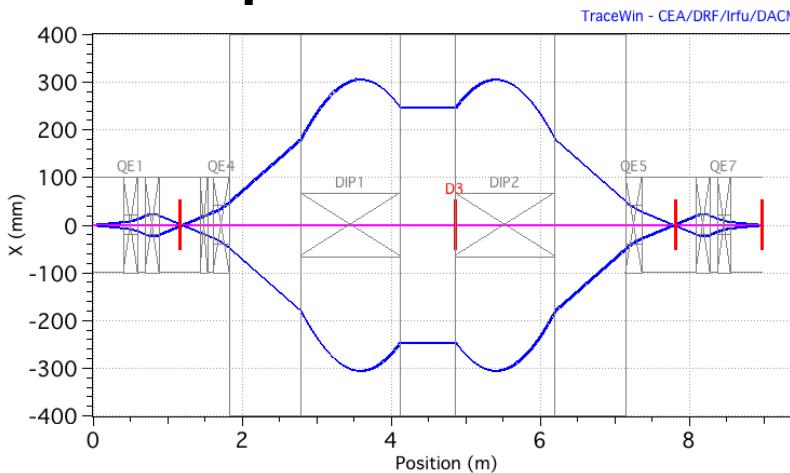
Section optique à l'IPNO





DESIR-HRS @SPIRAL2

HRS: a U180 Mass Spectrometer



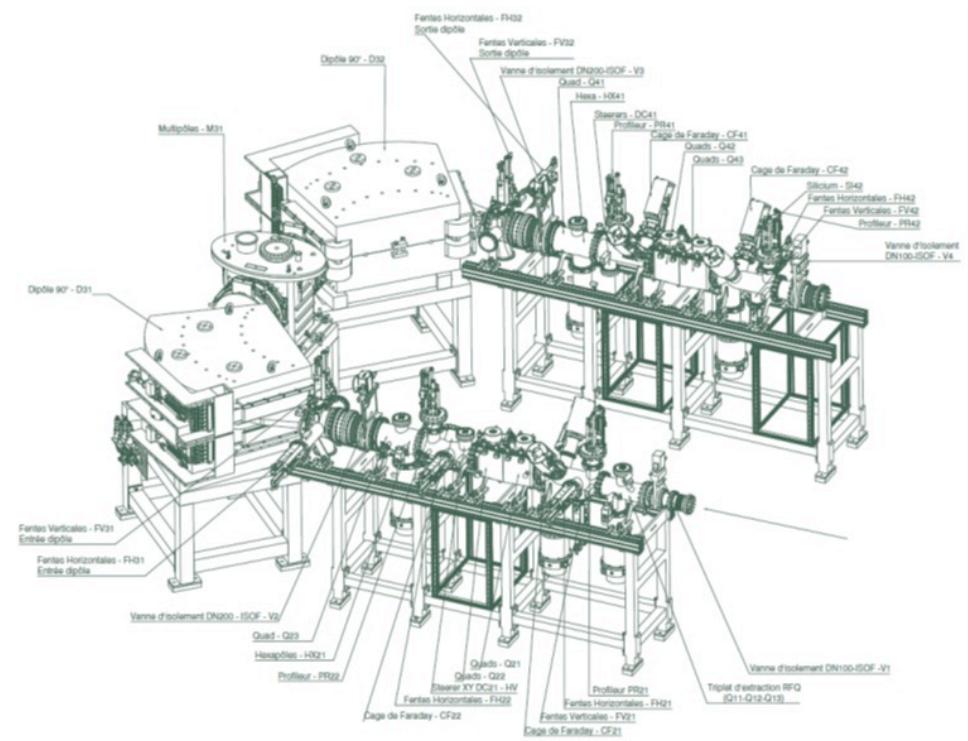
DESIGN:

U design: to be compact

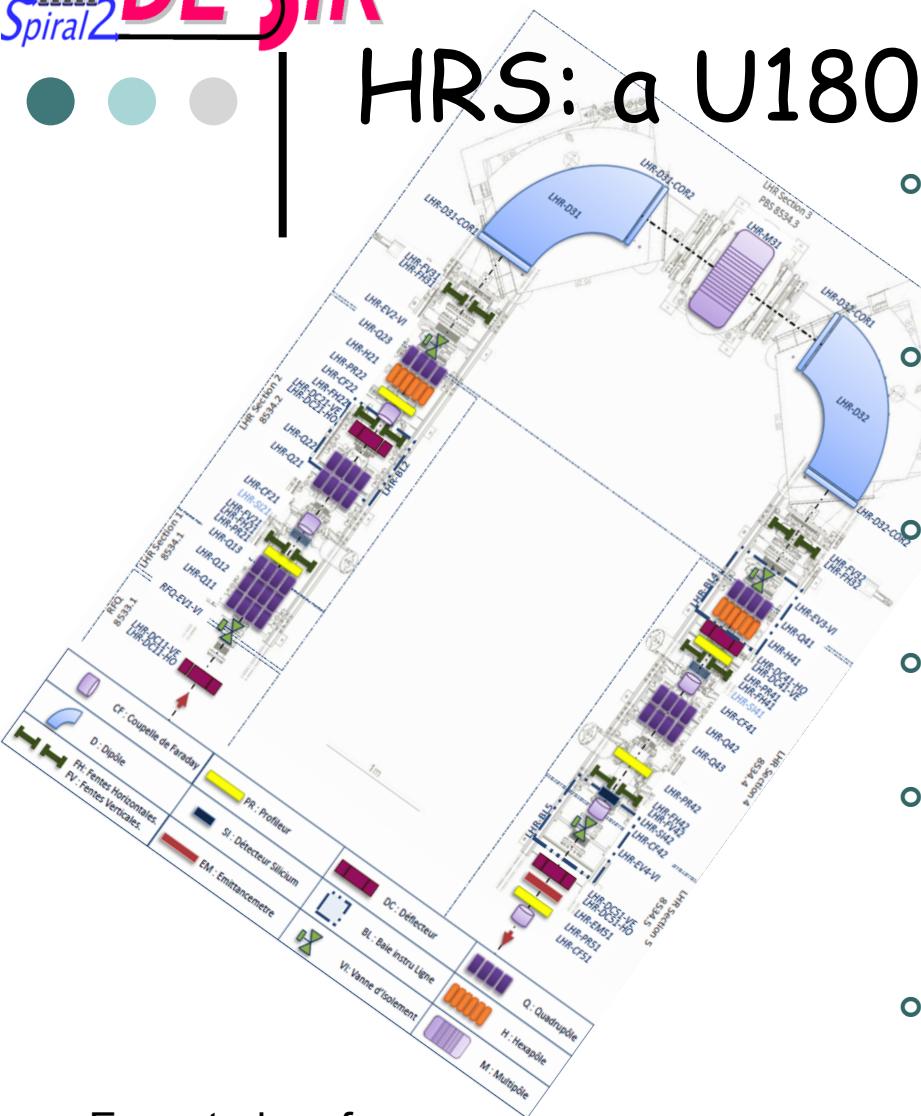
Mirror Symmetry : « suppress » pair and cross aberrations

1 to 1 transportation: try to

Large Dipôle: to increase the mass dispersion capacite



HRS: a U180 Mass Spectrometer



- The quadrupole doublet matching section produces a ribbon-shaped beam, so y -angles are small, minimizing b aberrations
 - The first quadrupole diverges in x and converges in y , giving a small y size which minimizes coupling aberrations
 - The large x area in the magnets gives mass dispersion
 - Transportation conditions in centre: $(a/a) = (y/b) = (b/y) = 0$
 - The reverse matching section transforms the ribbon-shaped beam back to a circular cross-section, allowing a 1 mm x -selection slit at the focal plane
 - The multipole to correct aberrations to 5th order

Expected performances:

Resolution of 20000 at 1Pimmmrad

Acceptance:5Pi

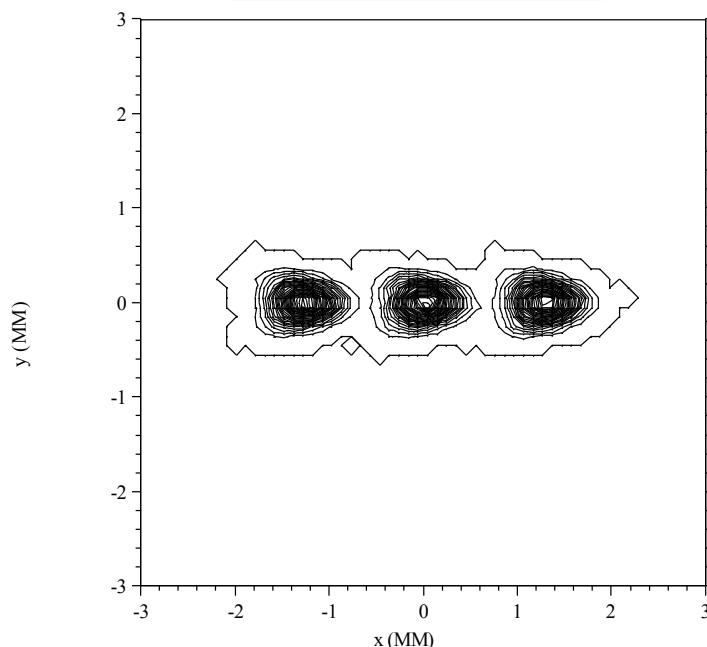
Transmission: close to 100% at 1Pi

Transmission and cross-contamination

First Approach with Turtle code

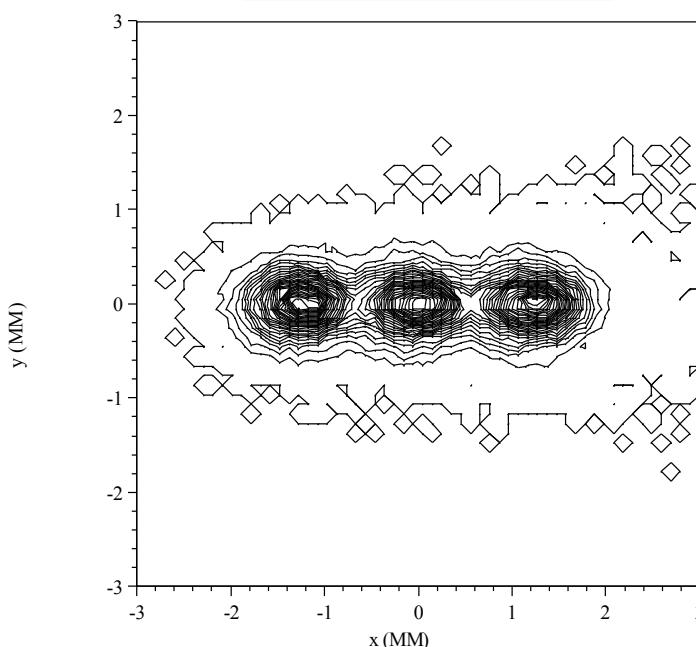
X-Y phase space for isobars with mass deviations
 $-1/20000, 0, +1/20000$.

$1 \pi \text{ mm.mrad}$



97% transmission,
 0.09% cross-contamination

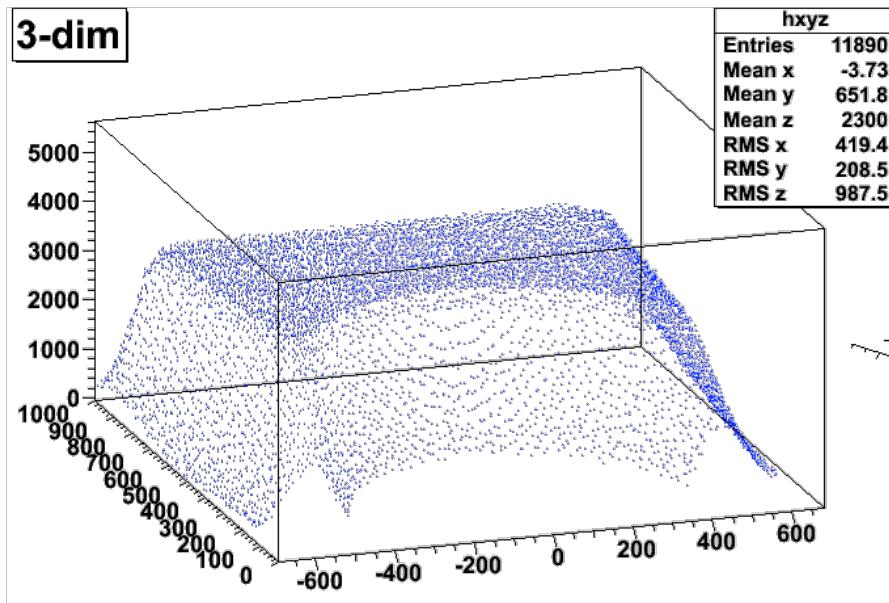
$3 \pi \text{ mm.mrad}$



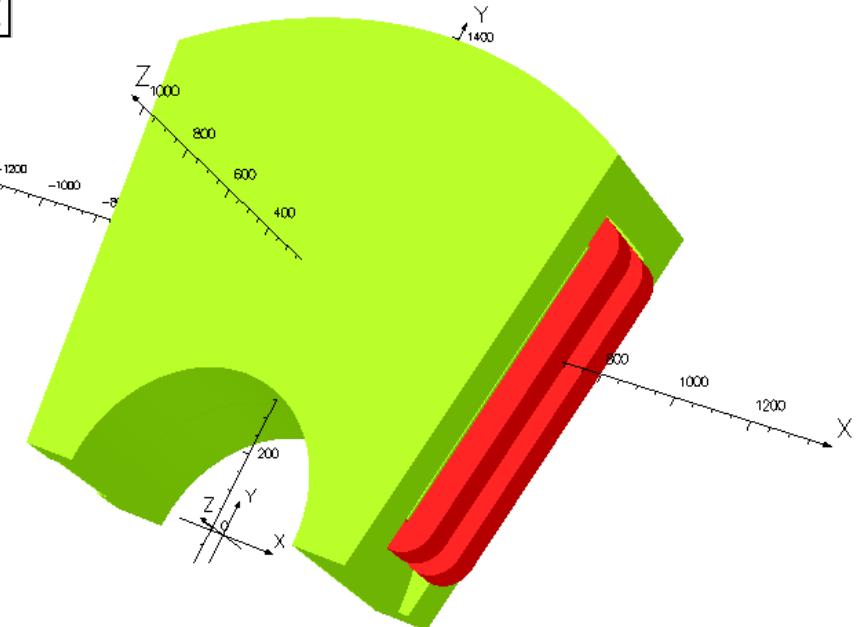
77% transmission,
 1.4% cross-contamination

TOSCA Field map for dipoles

Toward the real life



Maurice Duval,
Marc-Hervé Stodel
GANIL



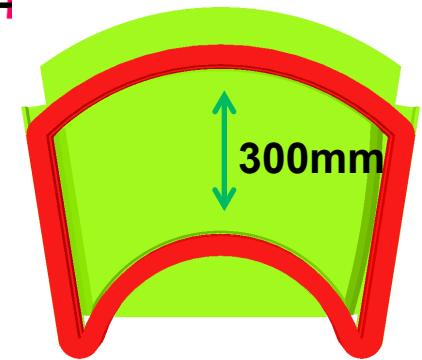
Change from matrix calculations:
TRANSPORT, COSY, GCOSY

To

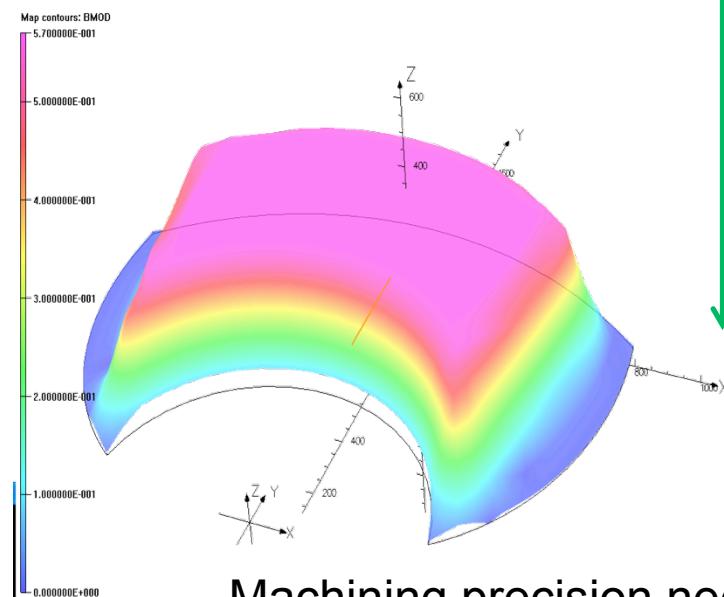
ZGOUBY integrating track evolution

Dipole Magnets

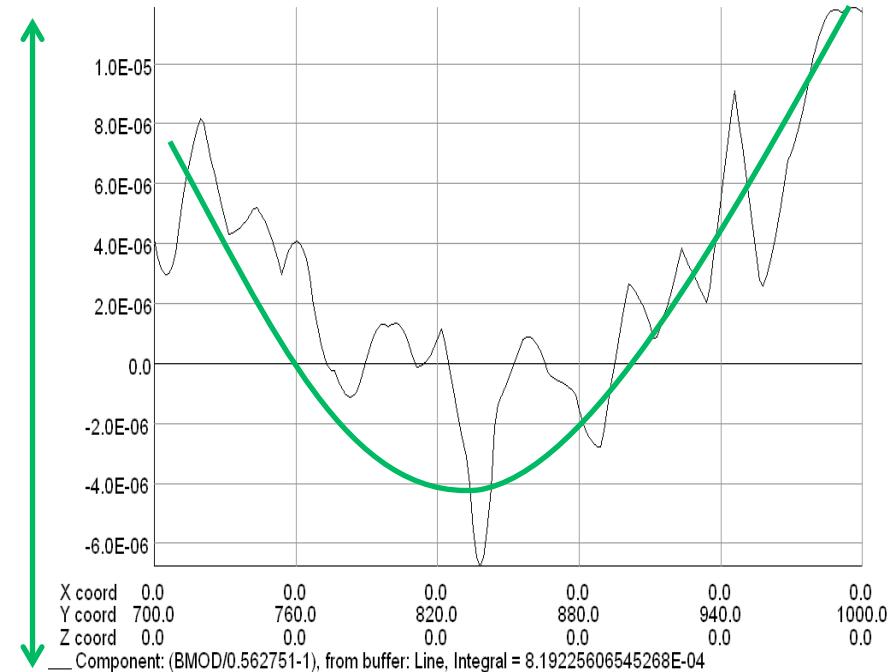
SpiralZ 



Homogeneity $1.6 \cdot 10^{-5}$



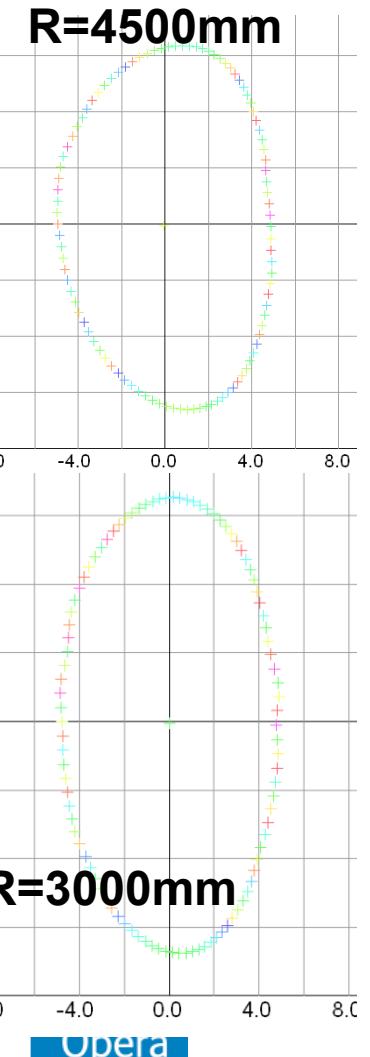
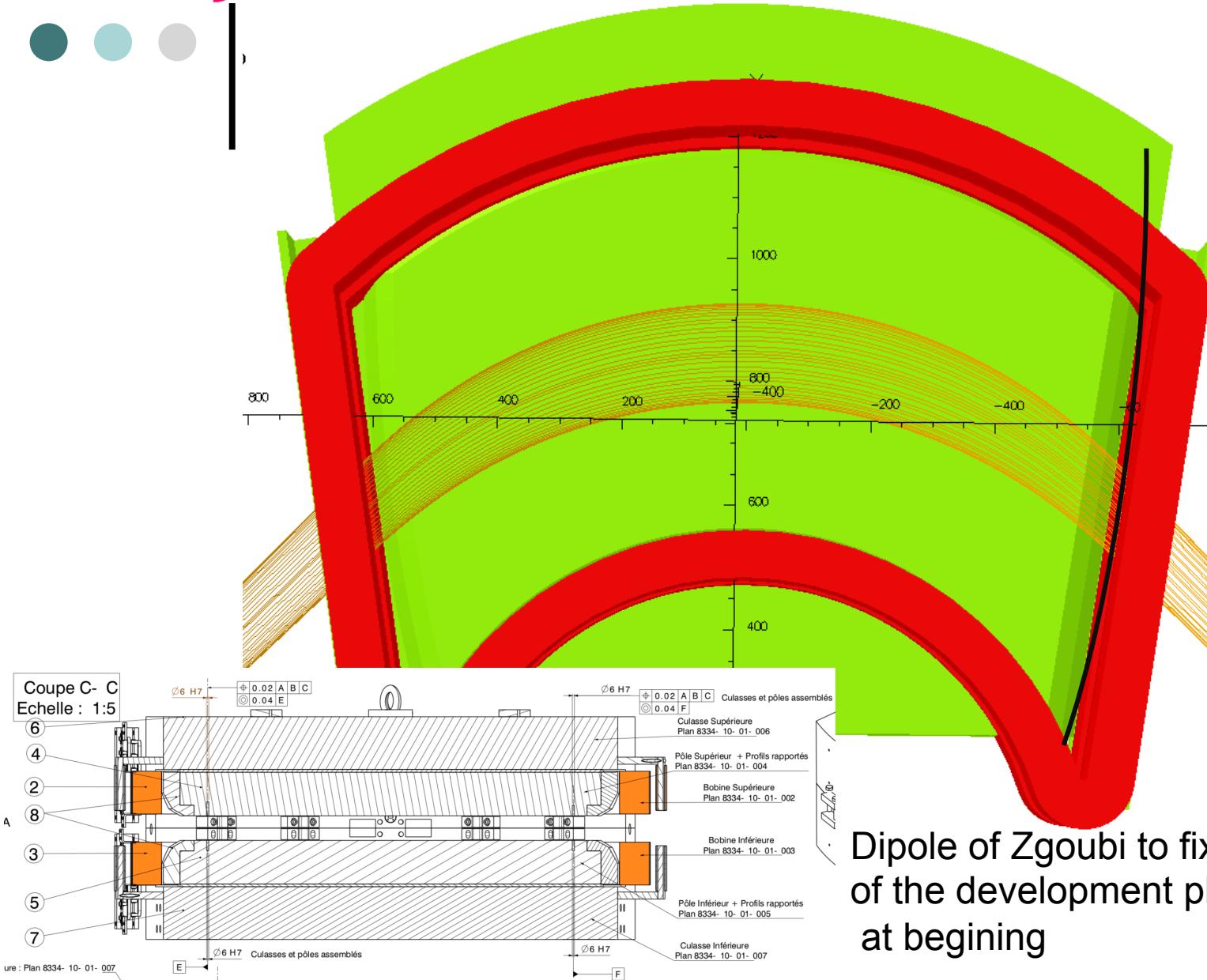
**0.09
Gauss !!!**



Machining precision needed:
Pole faces Parallelism : $10\mu\text{m}$
Poles positionning: $50\mu\text{m}$

Maurice Duval,
Marc-Hervé Stodel
GANIL

Correction of the 2nd intrinsec order Pole curvature R



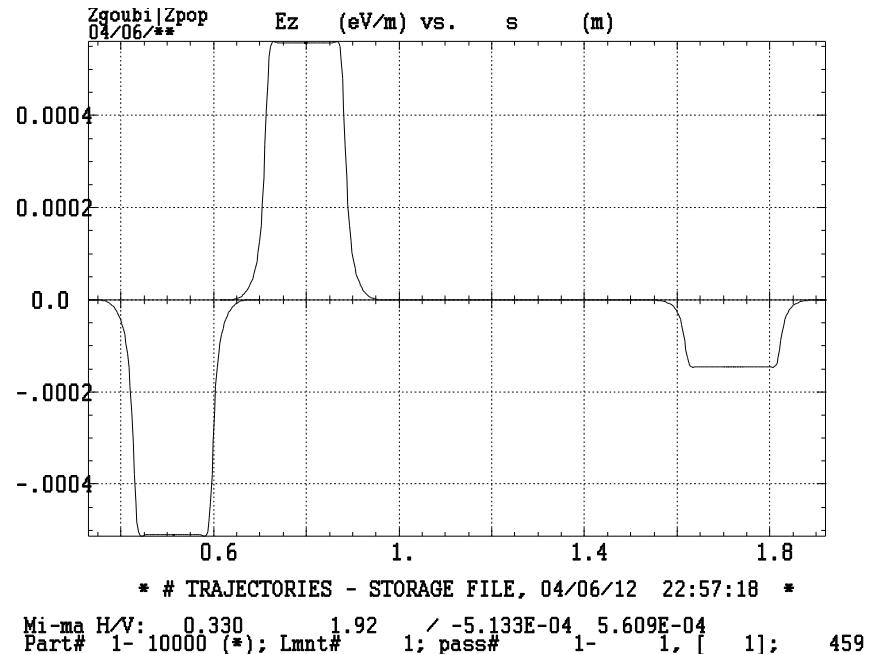
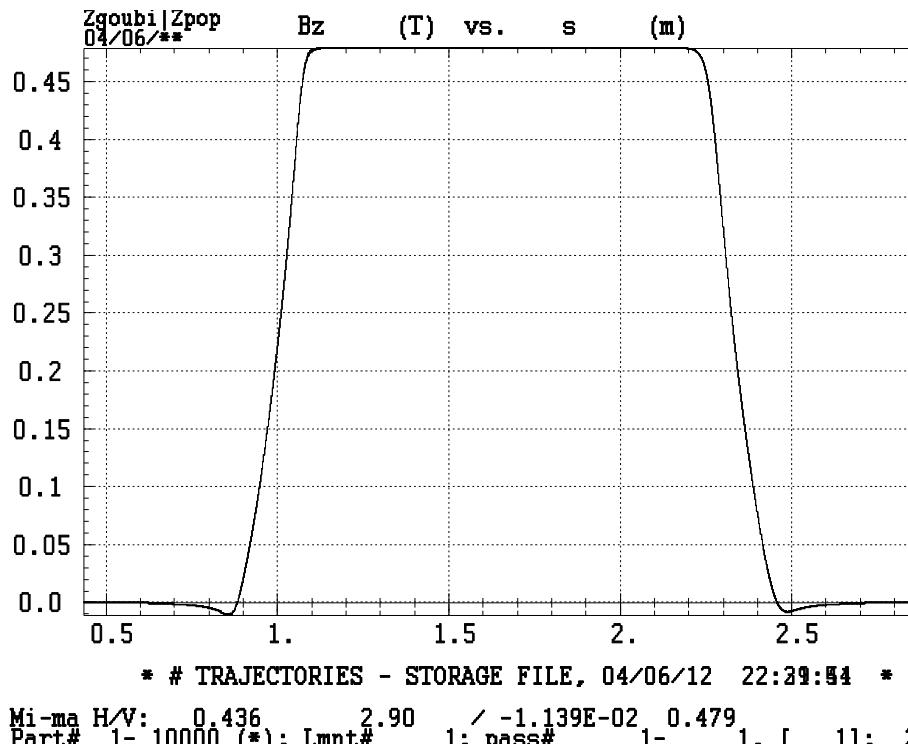
Dipole of Zgoubi to fix this parameter
of the development plan like SPES2
at begining

Opera



Way to real life

Tosca Map
Going across the Dipole at z=2cm



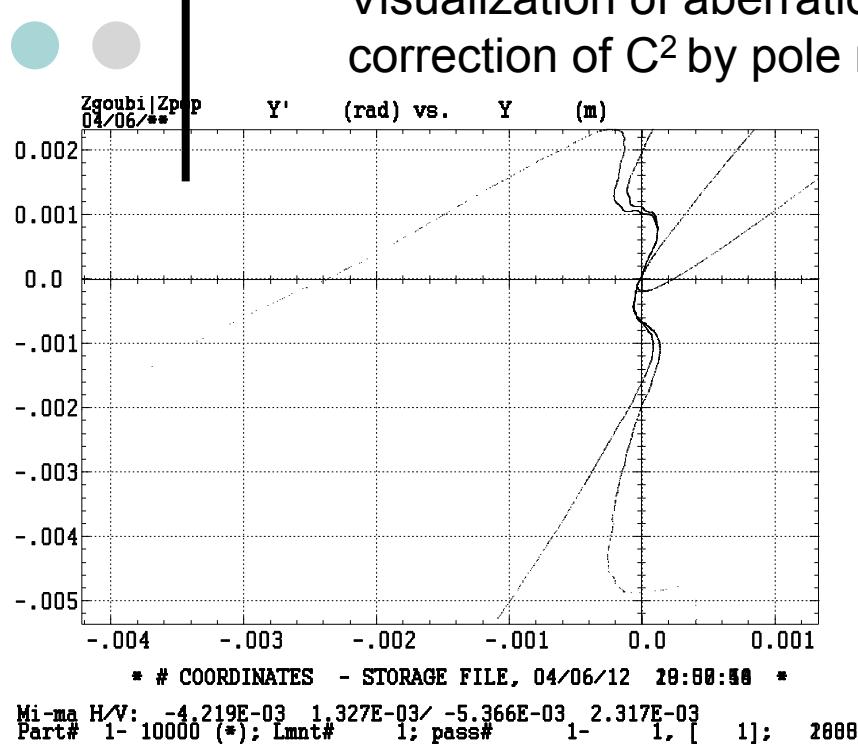
Quadrupole with Fringe Field
Going across at z=1.5cm

Not necessary for the preliminary
design but request for the final design

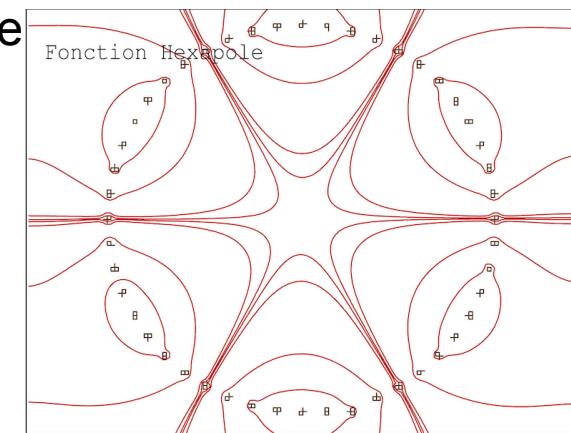
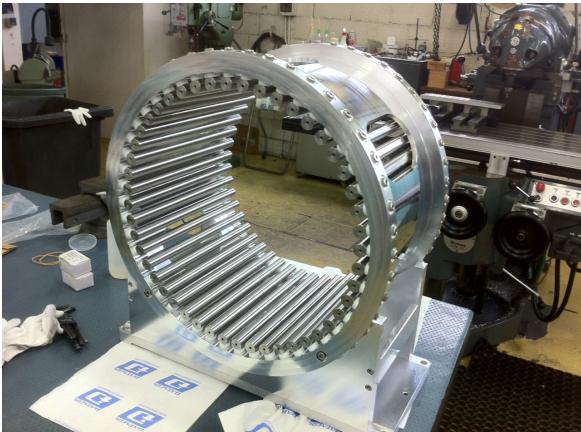


At Focal Plane: Phase Space Y versus Y'

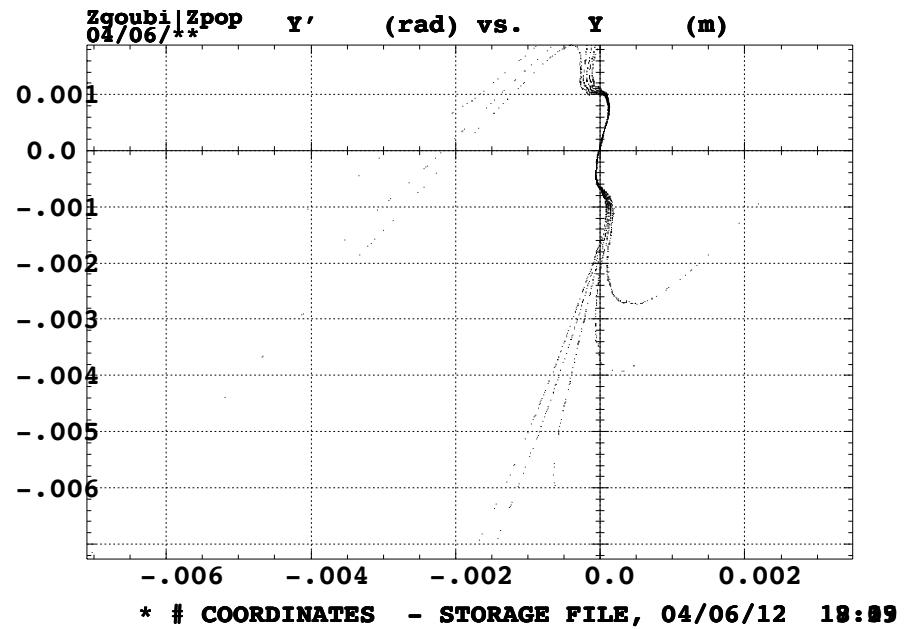
Visualization of aberration order with a first correction of C^2 by pole radius curvature



With Multipole off



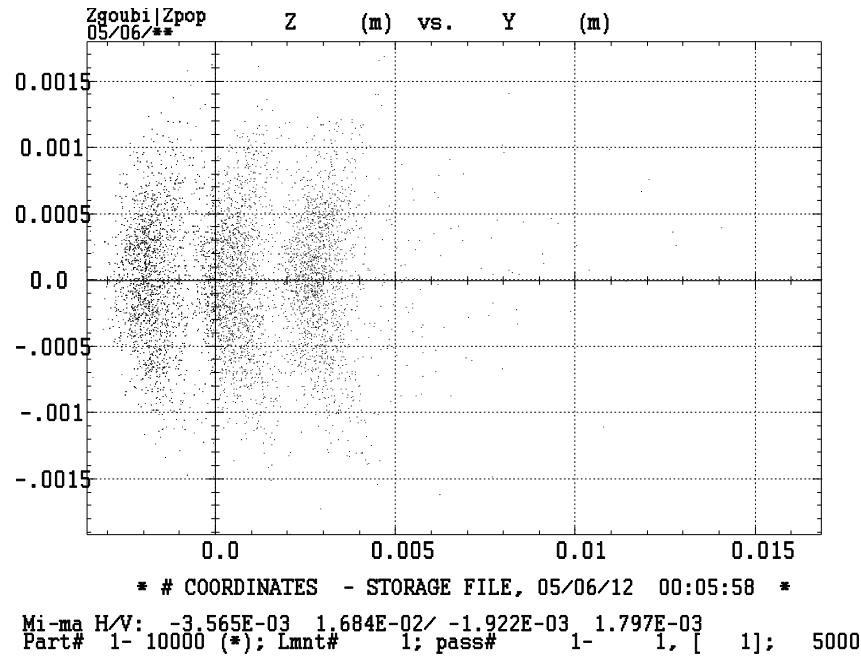
With Multipole on



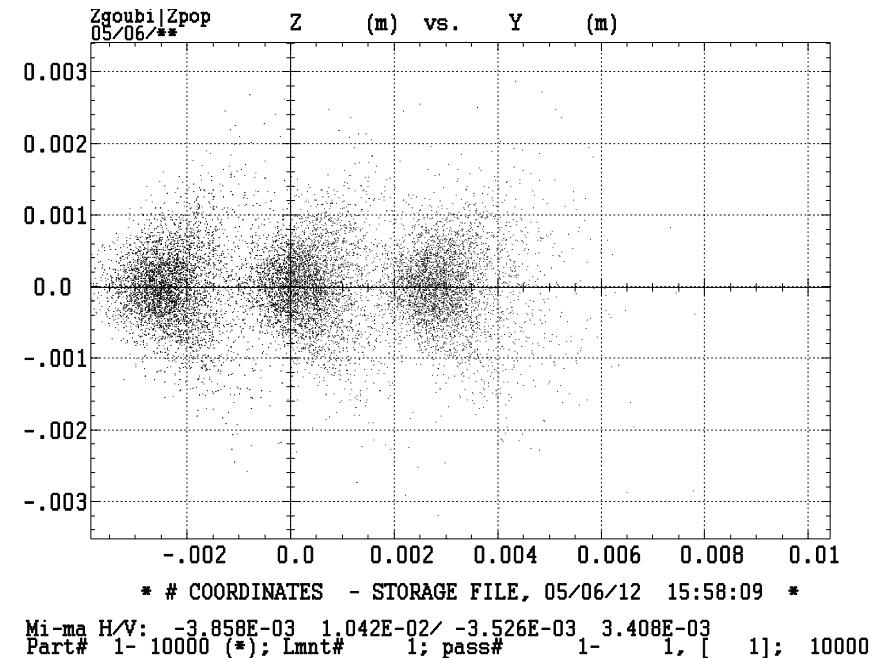
Mi-ma H/V: -7.098E-03 3.491E-03/ -7.268E-03 1.879E-01
Part# 1- 10000 (*); Lmnt# 1; pass# 1- 1,



Resolution after roughly aberrations correction at the focal plane



R=4m on one side of each Dipole
+ correction with the Multipole



R=4m on both side of each Dipole
Without correction with the Multipole

If the Life is as Zgoubi, the Life will be great



● ● DESIR-HRS working group:

- ✓ Blank, B. Scientific coordination
- ✓ Delalee, F. Mechanical Design
- ✓ Kurtukian-Nieto, T. Optic Design
- ✓ Daudin L. & Alfaunt P. CC and PLC
- ✓ Serani, L. Project Leader, Optic Design



- Thank You for your attention!*
- ✓ Guaval, M. Magnet Design
 - ✓ Stodel, M.-H. Magnet Design
 - ✓ Varenne, F. Optic Design
 - ✓ Méot, F. Optic Design
 - ✓ Weick H. Optic Design

