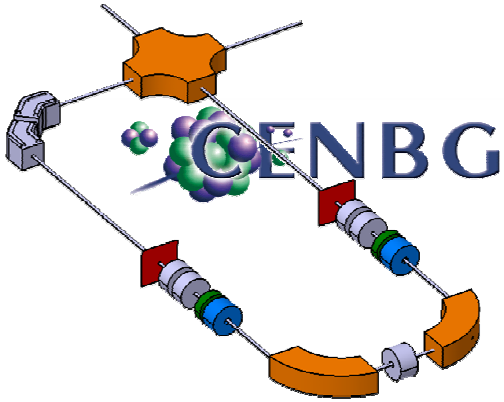
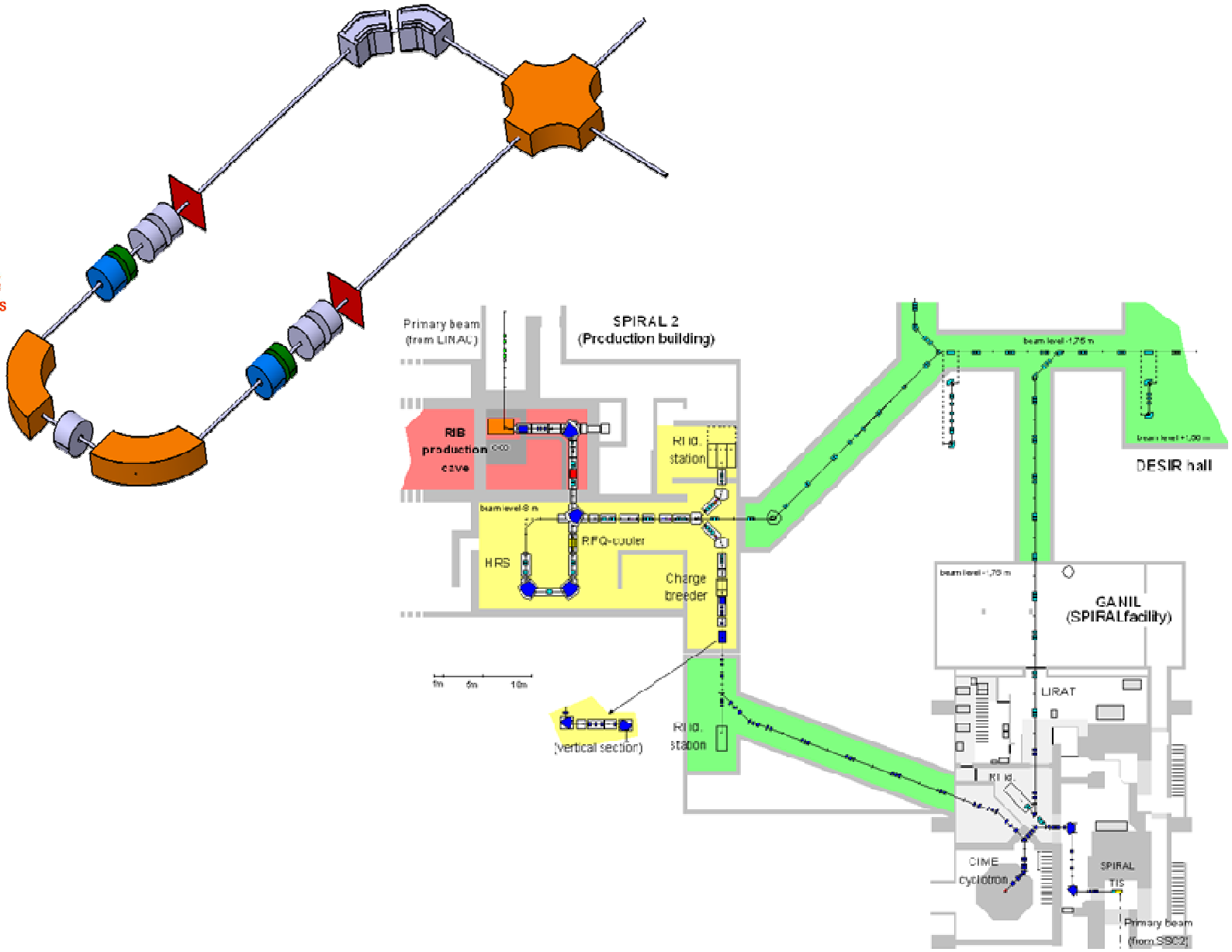
IN2P3
Institut national de physique nucléaire
et de physique des particules

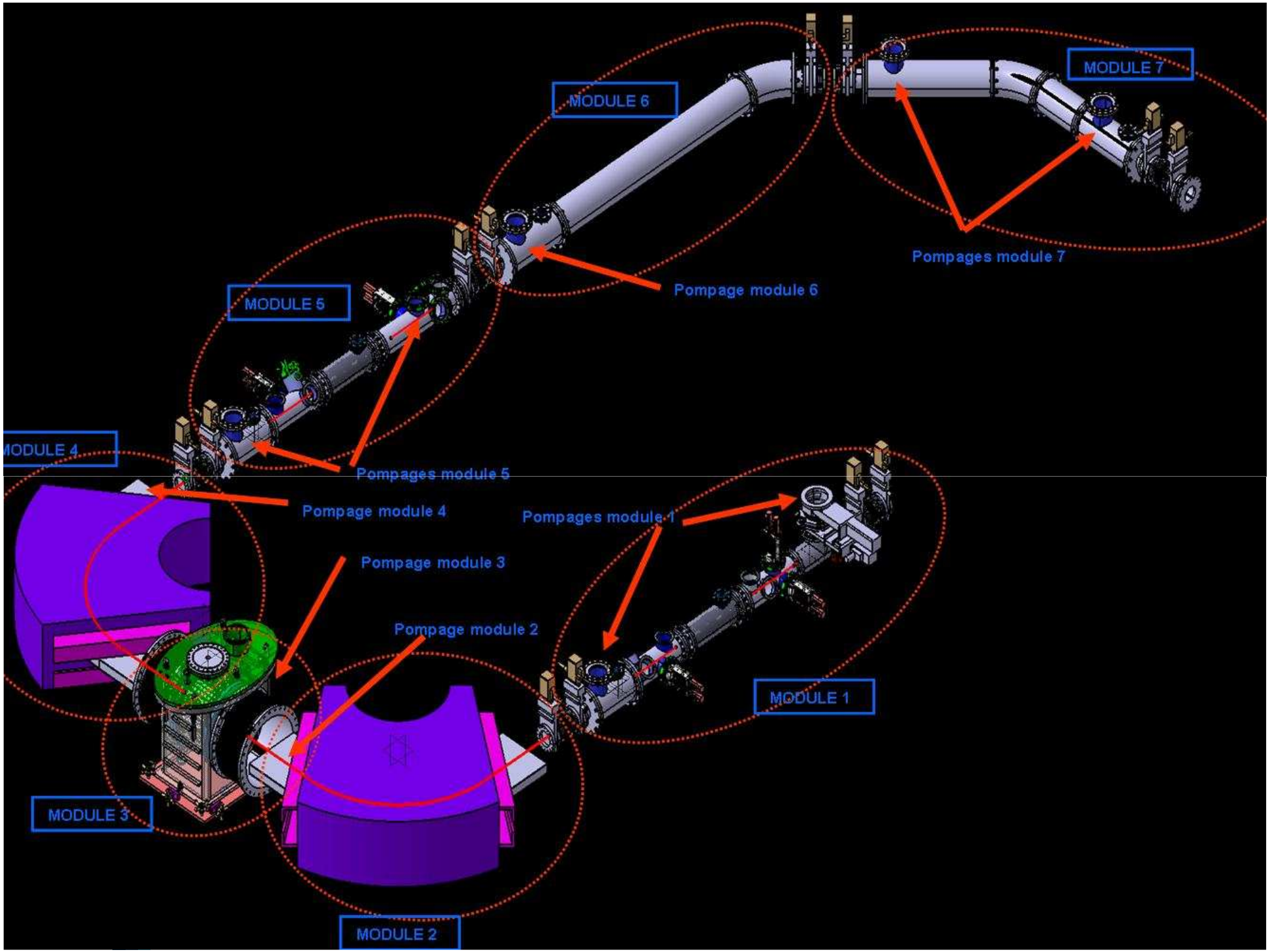


High Resolution Separator HRS

Teresa Kurtukian-Nieto
CEN Bordeaux-Gradignan

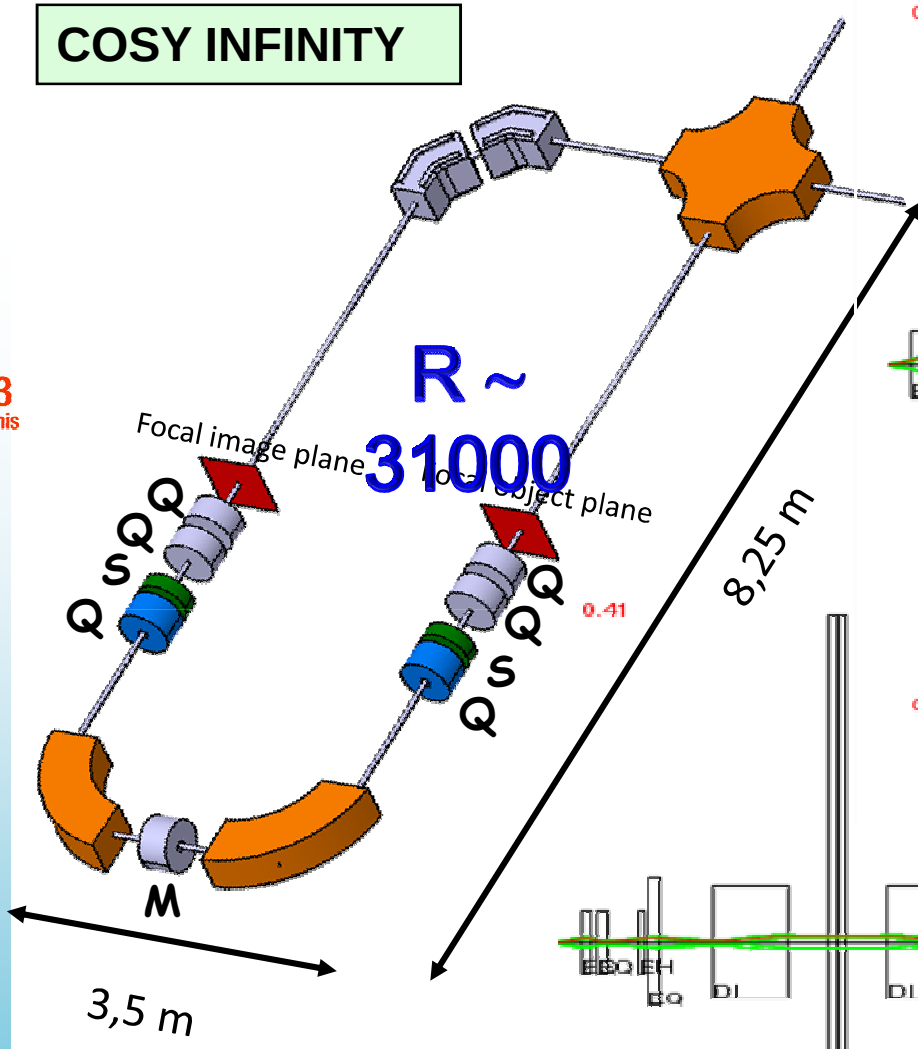
HRS-DESIR @ SPIRAL2 production building

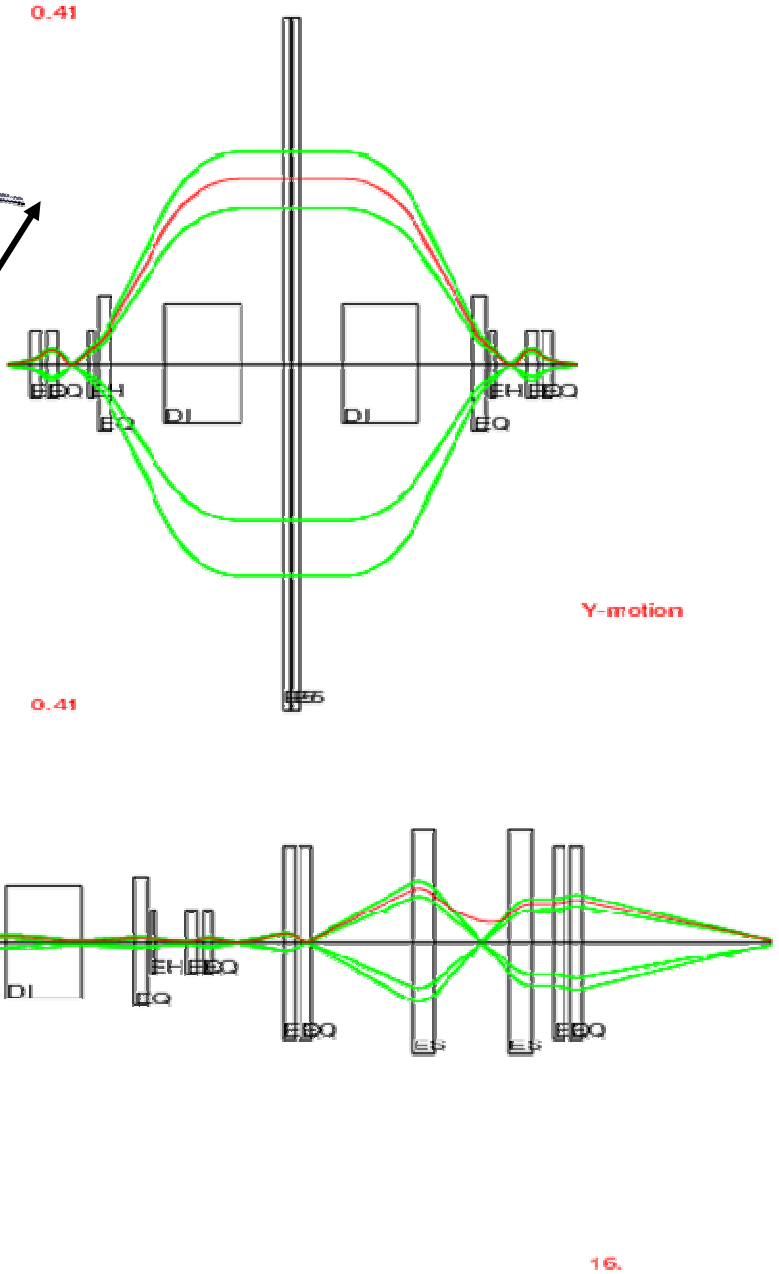



MODULE 6
MODULE 7
Pompages module 7
Pompage module 6
MODULE 5
ODULE 4
Pompages module 5
Pompage module 4
Pompages module 1
Pompage module 3
Pompage module 2
MODULE 1
MODULE 3
MODULE 2

HRS “U180”

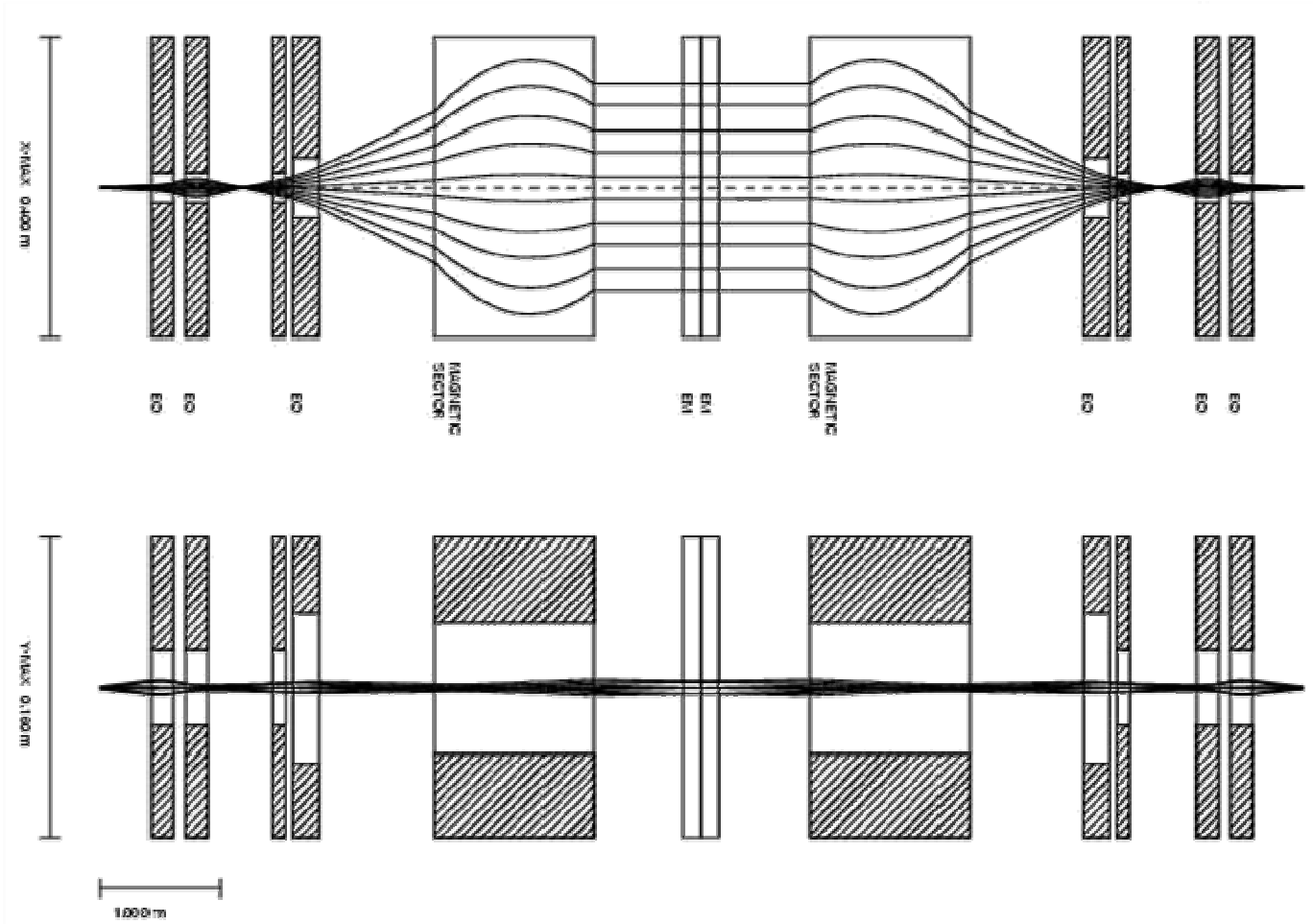
COSY INFINITY





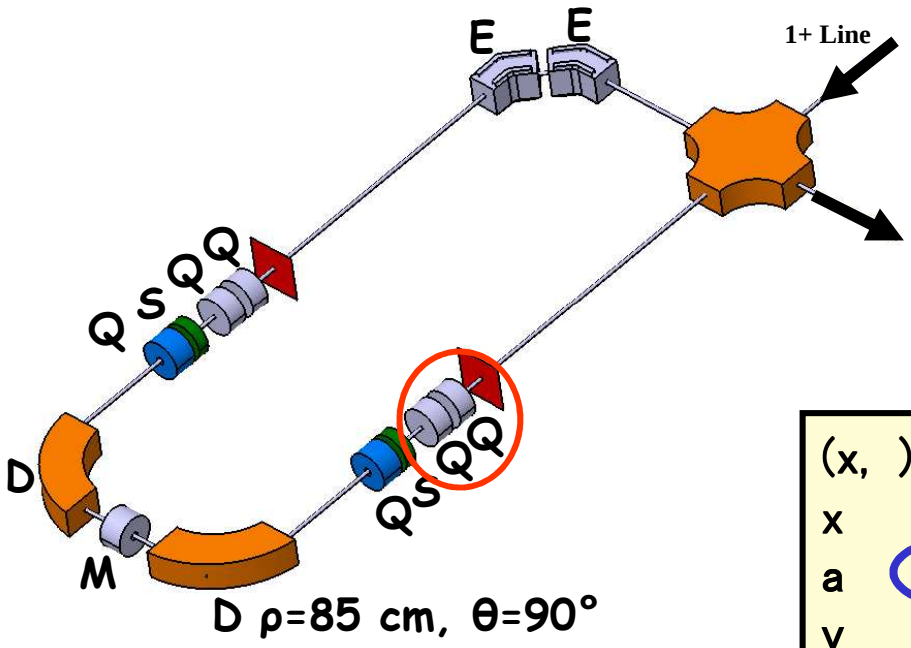
HRS: “U180”

GICOSY without FF



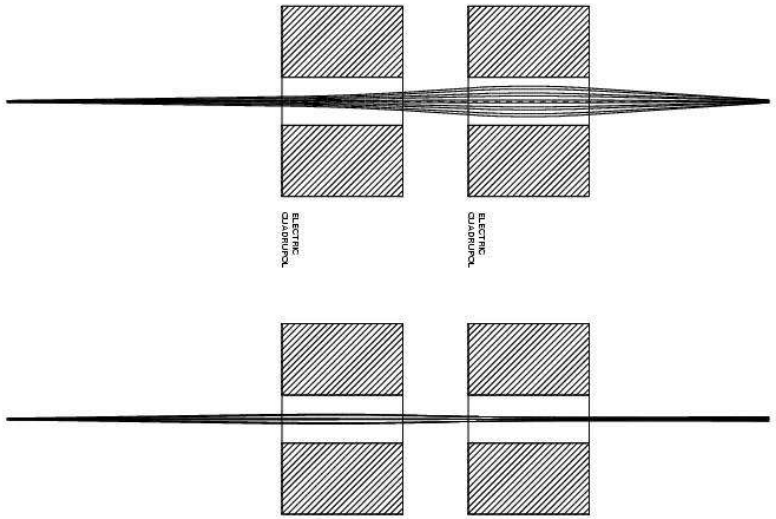
ZGOUBY, TRANSPORT, GALOP

HRS: “U-180”



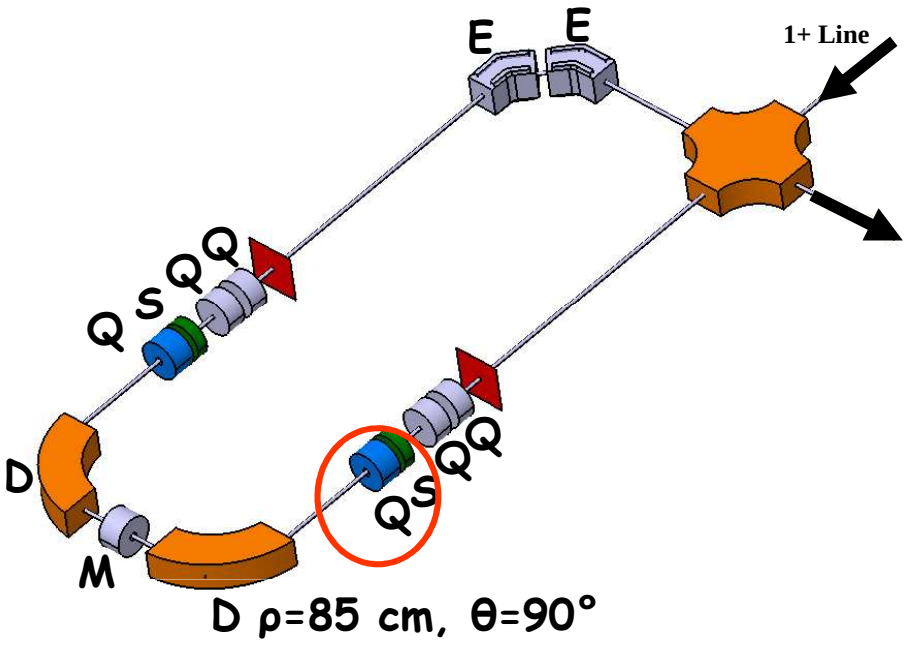
- The quadrupole doublet matching section produces a ribbon-shaped beam.

(x,)(a,)		(y,)	(b,)	
x	−0.2342	−8.0416	0.0000	0.0000
a	−0.76E−2	−4.5302	0.0000	0.0000
y	0.0000	0.0000	−2.6125	−6.5271
b	0.0000	0.0000	0.63E−1	−0.2242
δ m	0.0000	0.0000	0.0000	0.0000

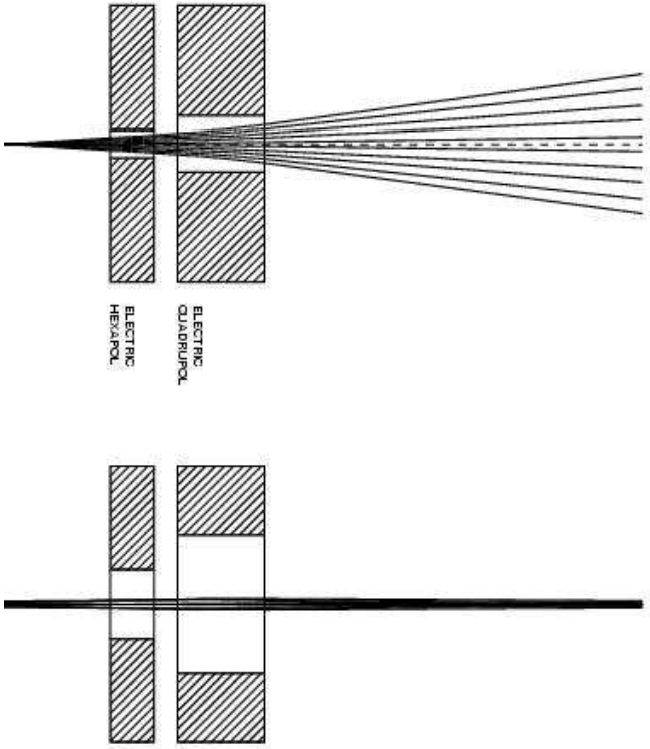


- y-angles are small, minimizing b aberrations

HRS: "U-180"



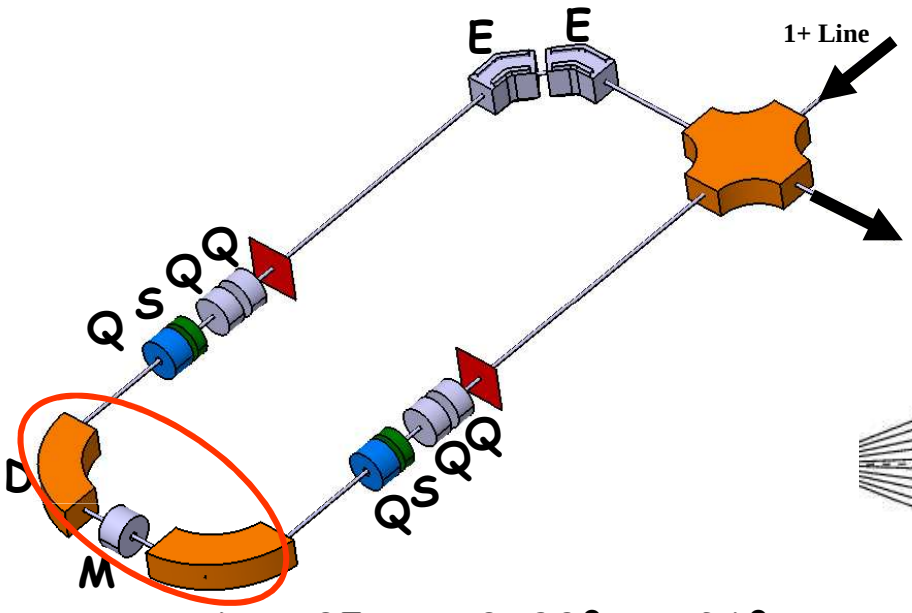
- The first quadrupole diverges in *horizontal* and converges in *vertical*, giving a small y size which minimizes y aberrations
- The large x area in the magnets gives mass dispersion



Matrice de transfert

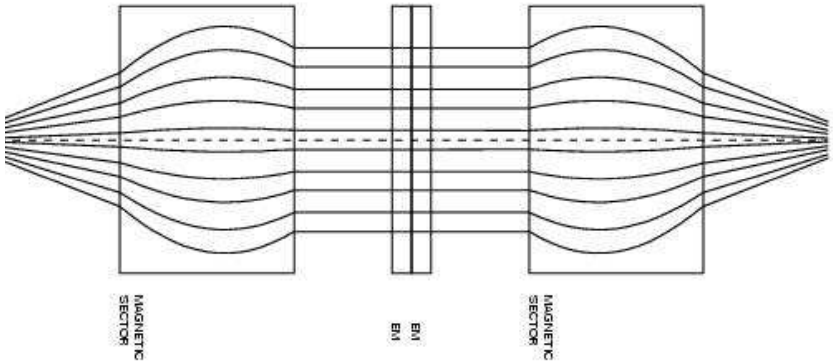
(x,)(a,)		(y,)	(b,)	
x	−24.134	−18.375	0.0000	0.0000
a	−13.179	−10.076	0.0000	0.0000
y	0.0000	0.0000	−0.6600	5.2412
b	0.0000	0.0000	−0.1773	−0.1075
δ m	0.0000	0.0000	0.0000	0.0000

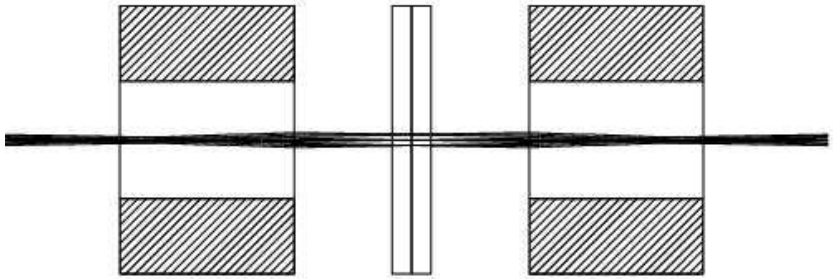
HRS: “U-180”



D ρ=85 cm, θ=90°, β=36°

- Focus conditions in centre:
  (a, a) = (y, b) = (b, y) = 0

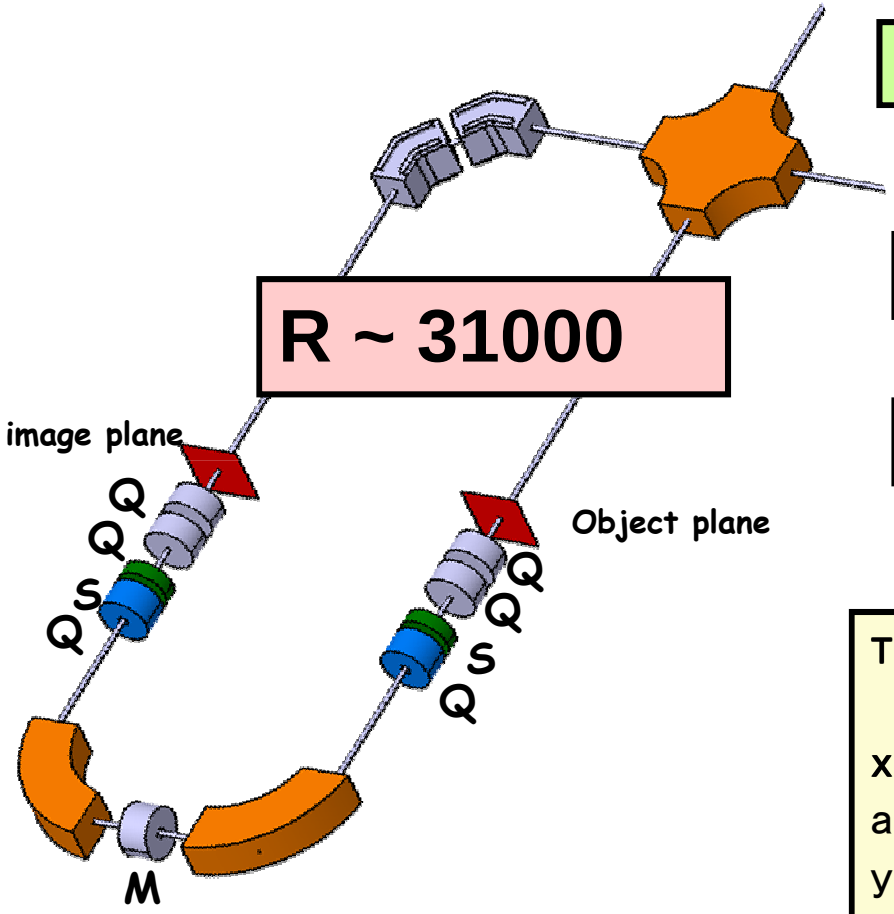




Matrice de transfert

(x,)(a,)		(y,)	(b,)	
x	−33.104	0.55E−1	0.0000	0.0000
a	−18.139	0.79E−4	0.0000	0.0000
y	0.0000	0.0000	7.0741	−0.17E−4
b	0.0000	0.0000	−0.56E−4	0.1414
δ m	1.2020	0.8633	0.0000	0.0000

HRS: “U180”



✓ (x|δ) = -31.32 cm/%

✓ Mirror symmetric

✓ point-to-point both x and y

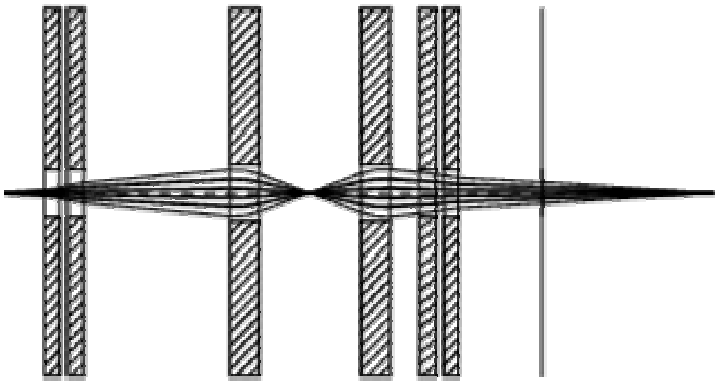
Transfer matrix

	(x,)	(a,)	(y,)	(b,)
x	−1.0000	−3.6499	0.0	0.0
a	−0.40E−5	−1.0000	0.0	0.0
y	0.0	0.0	1.0000	0.50E−4
b	0.0	0.0	−0.60E−6	1.0000
δ m	−31.32	−57.16	0.0	0.0

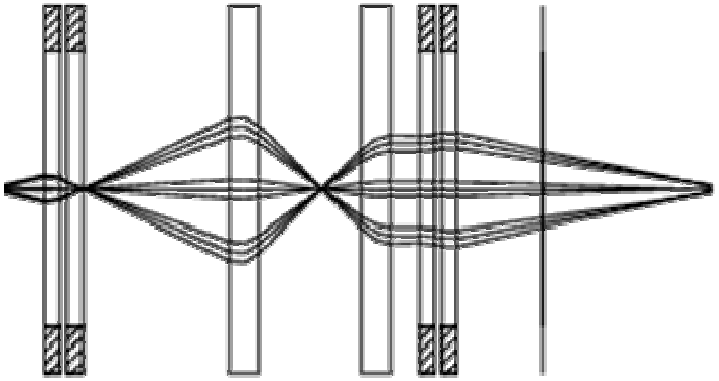
Reinjection to the 1+ Line

Element	Distance (mm)	Element	Distance (mm)
Drift length L7	850	EB ρ = 500 mm, θ = 45º, a = 140 mm	392.70
Quadrupole FQ3, a = 120 mm	200	Drift length L11	400
Drift length L8	100	Quadrupole FQ5 a = 120 mm	200
Quadrupole FQ4 a = 120 mm	200	Drift length L12	100
Drift length L9	1807.93	Quadrupole FQ6 a = 120 mm	200
EB ρ = 500 mm, θ = 45º, a = 140 mm	392.70	Drift length L12	1142.93
Drift length L10	1353.5	1+ Line Dipole	

Horizontal



Vertical

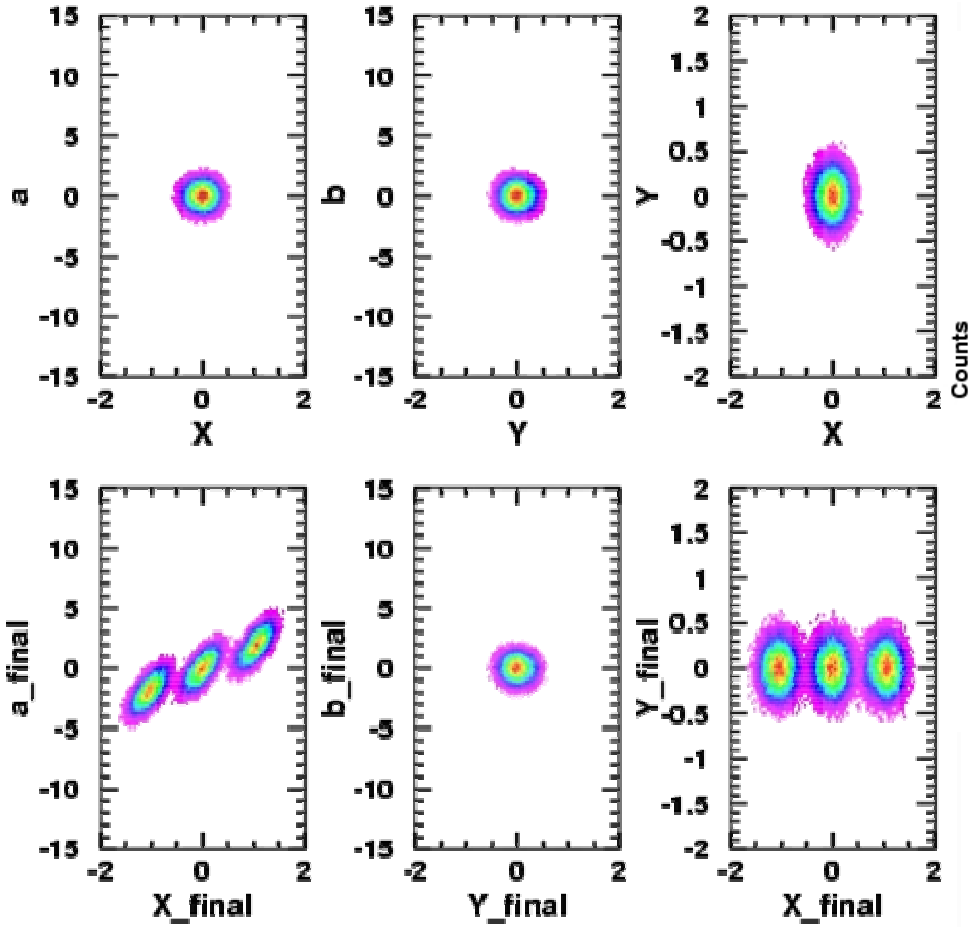


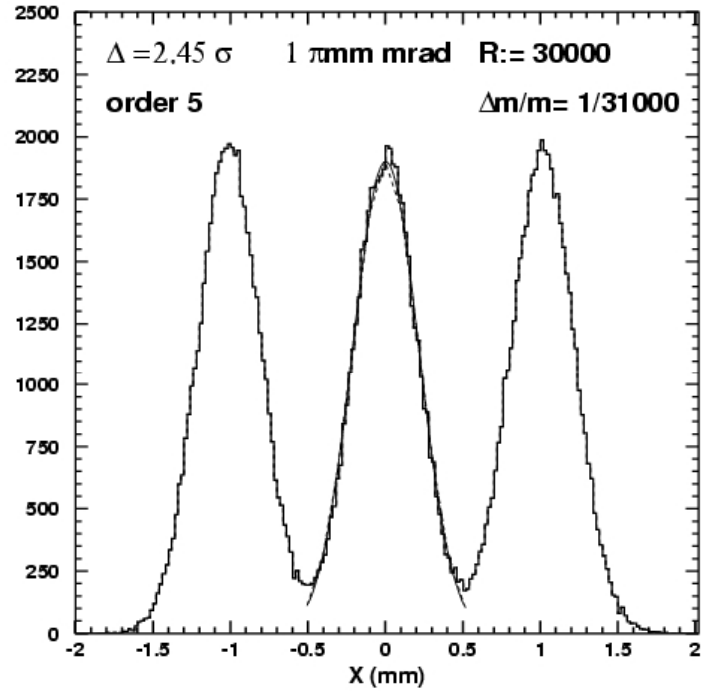
- two de quadrupole doublets.
- two 45° electrical benders
  - ✓ρ =500mm, aperture = 140 mm
- Homothetic to 80 π mm mrad

At the compensation point, the beam is considered as emitted from a minimum envelope of ± 2.25 mm in horizontal and ± 7.45 mm in vertical

Monte-Carlo Simulations

Mass spectra calculated, for 3 isobares with mass deviations -1/31000, 0, +1/31000



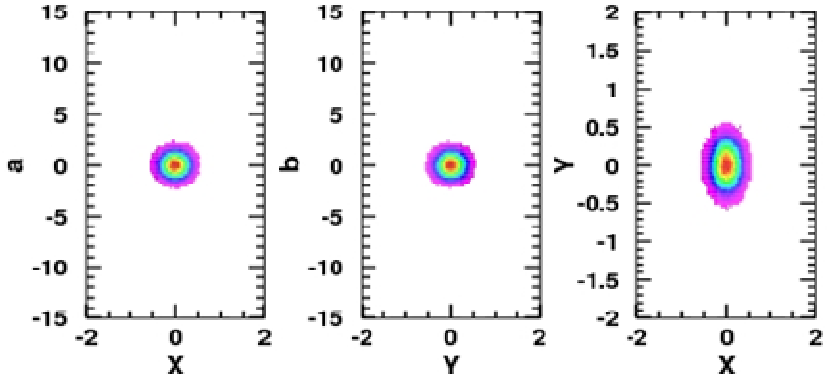


calculated to 5th order

The mass separation is 1:30000

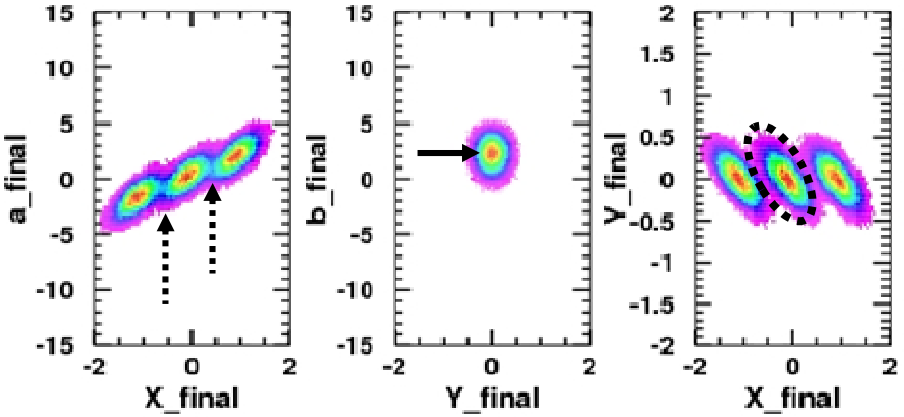
Misalignment effects on mass resolution

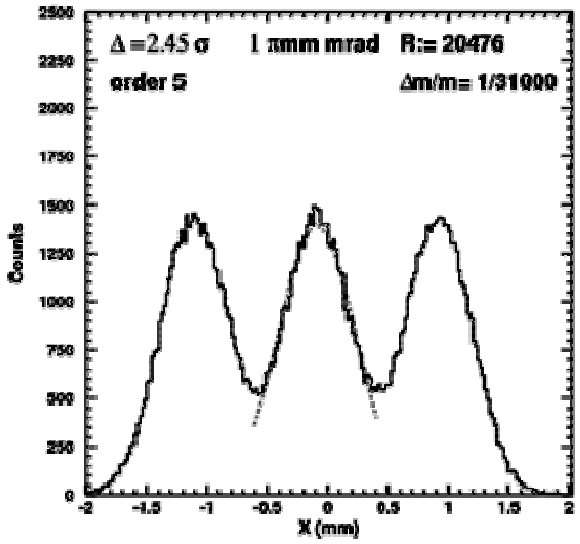
Beam at the entrace of the HRS



Module	ΔX(mm)	ΔY(mm)	Δθ(°)
1	-0.1	-0.1	-0.2
2	-0.1	-0.1	-0.2
3	-0.05	-0.05	-0.2
4	-0.1	-0.1	-0.2
5	-0.1	-0.1	-0.2
X-Offset (mm)	-0.09		
R	20477		

Beam at the exit od the HRS



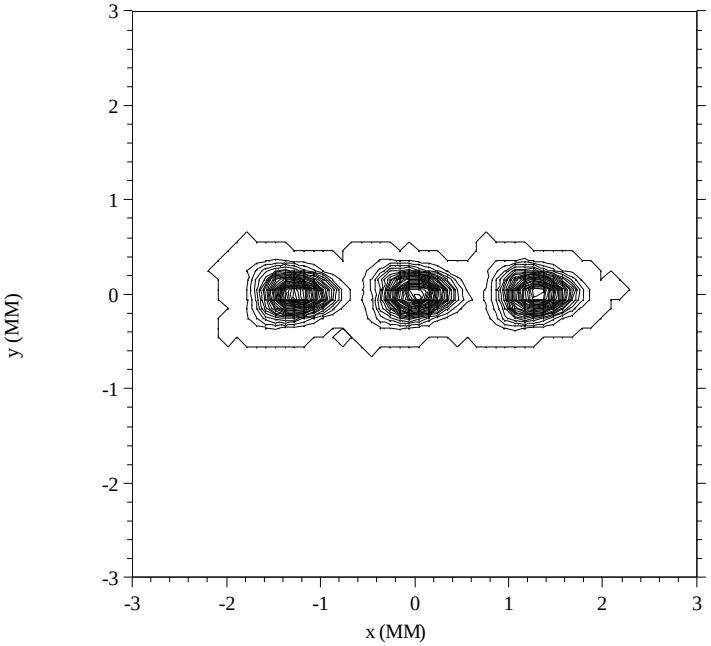


Transmission and cross-contamination

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

Laurent Serani

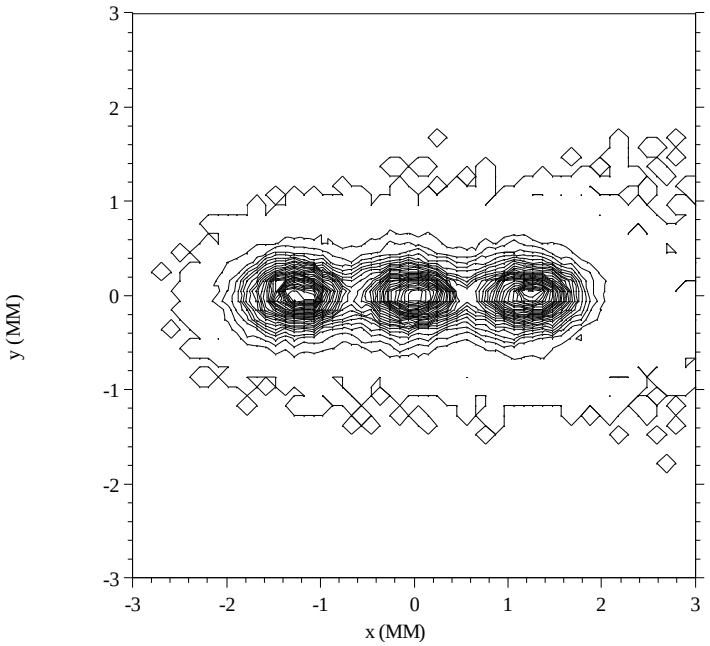
1 π mm.mrad



97% transmission,

0.09% cross-contamination

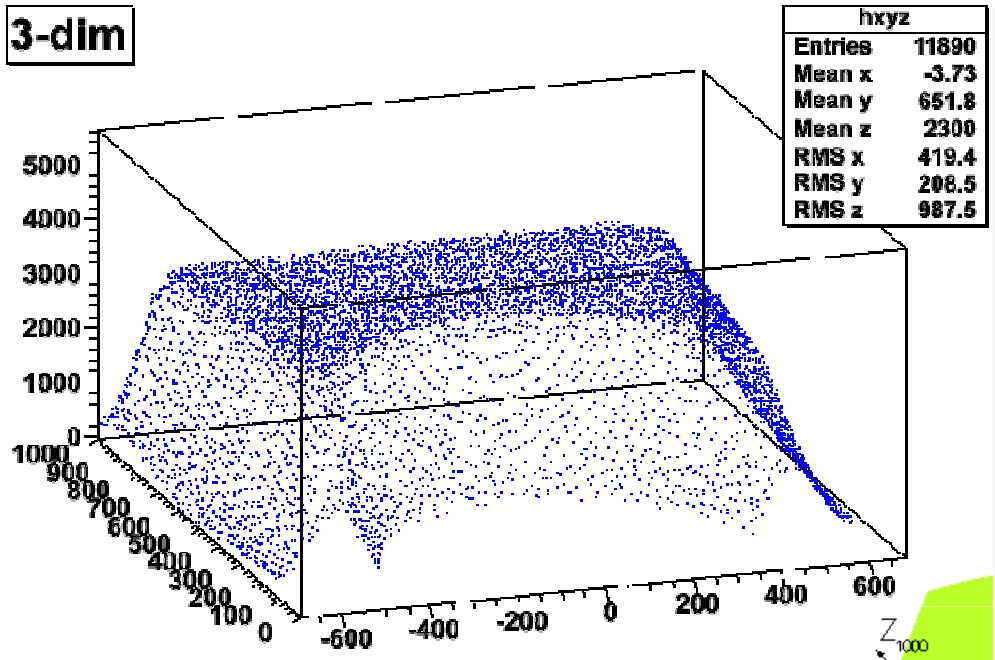
3 π mm.mrad



77% transmission,

1.4% cross-contamination

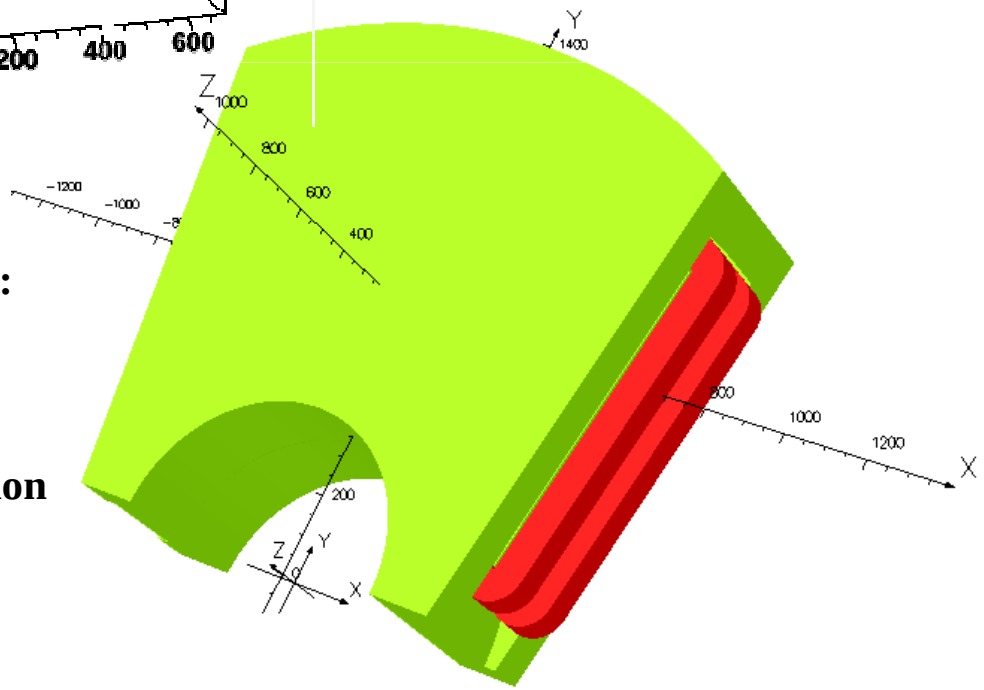
TOSCA Field map for dipoles



Maurice Duval,

Marc-Hervé Stodel

GANIL



Change from matrix calculations: TRANSPORT,COSY, GICOSY

To

ZGOUBY integrating track evolution

Laurent Serani

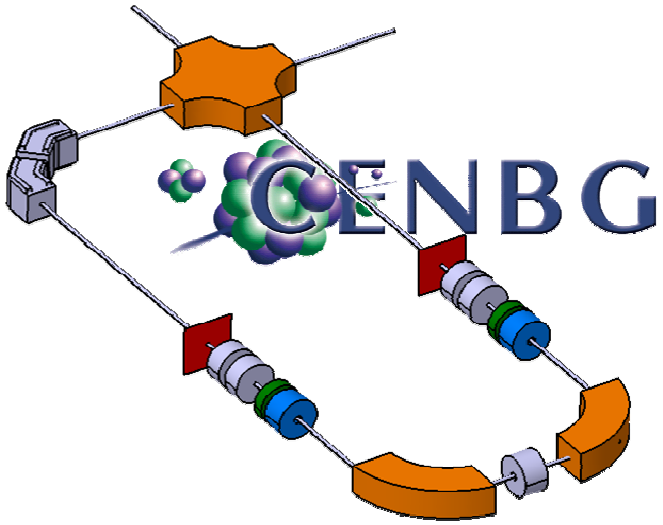
Assembly Hall @ CENBG

~300 m² 350 k€

Status of the project

- Global optical design finished
  - To be validated within this workshop
- Mechanical design and integration done presently
- Assembly Hall at CENBG
- End of 2011: « cahier de charge » for dipole magnets
- Ordering of dipoles 2012 ➔ 400 k€ CPER Basse Normandie
- Manufacturing of other elements at CENBG
- Installation at CENBG during 2013
- Tests (transmission, resolution) 2014
- Transfer to GANIL 2015

DESIR-HRS working group:



- ✓ Bataille, T.
- ✓ Blank, B.
- ✓ Chiron, T.
- ✓ Delalee, F.
- ✓ Kurtukian-Nieto, T.
- ✓ Serani, L.

GANIL
laboratoire commun CEA/DSM Spiral2 CNRS/IN2P3

- ✓ Duval, M.
- ✓ Stodel, M.-H.

Thank you