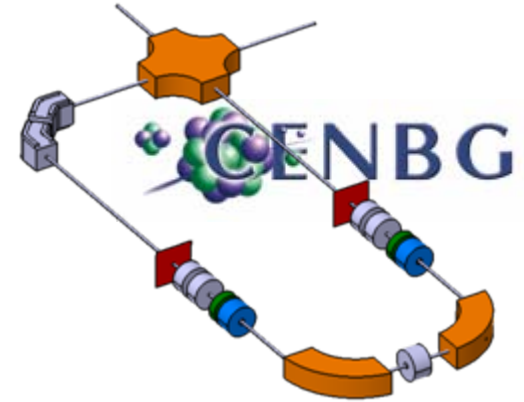




IN2P3

Institut national de physique nucléaire
et de physique des particules



DESIR-High Resolution Separator Status Report

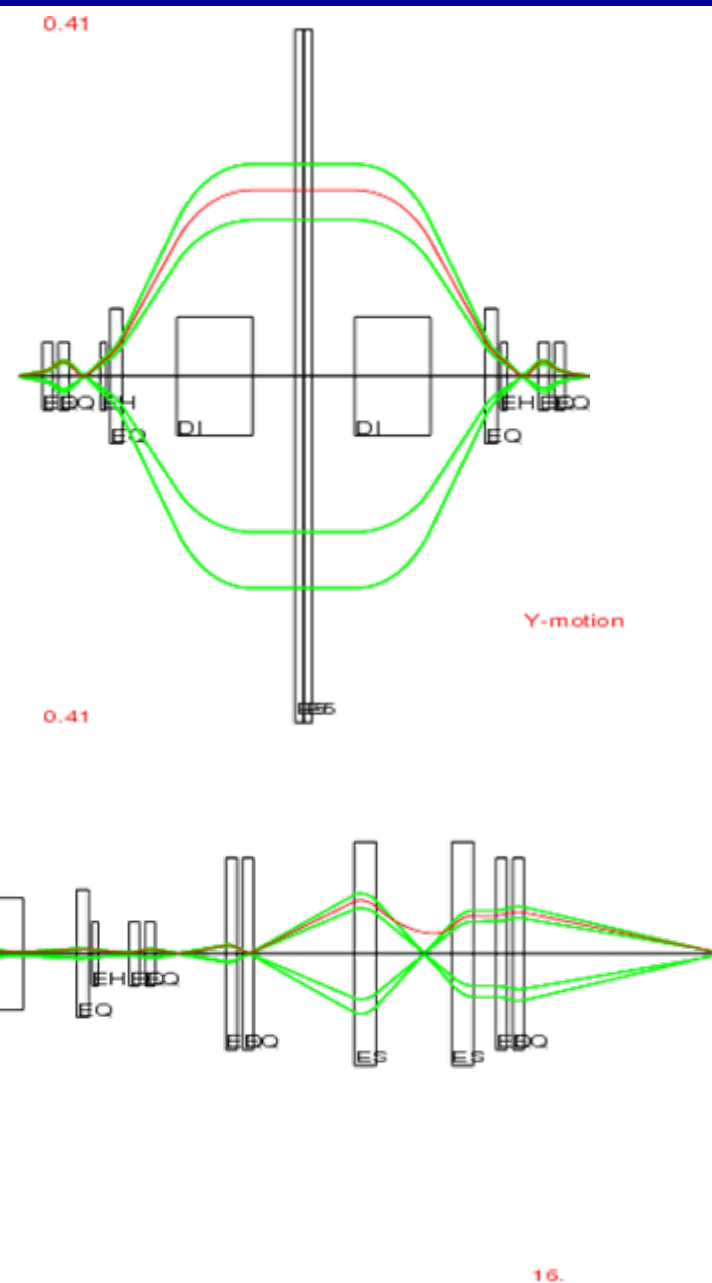
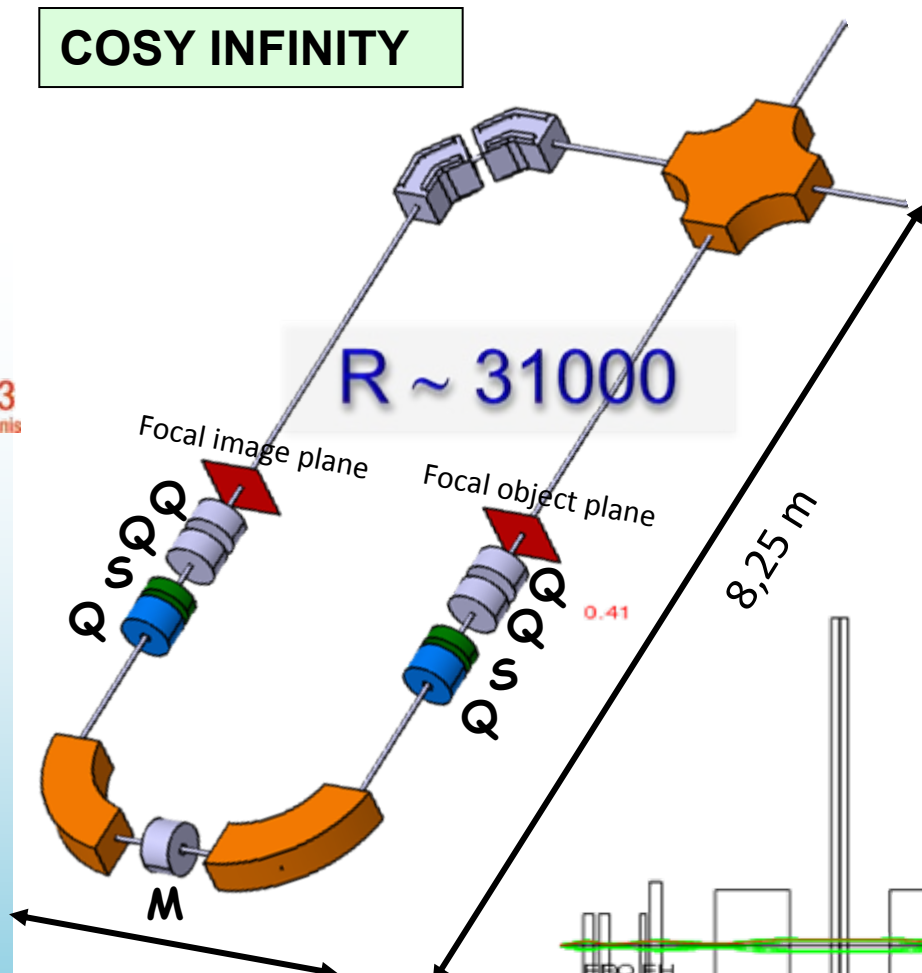
Teresa Kurtukian-Nieto

CENBG/CNRS/IN2P3-Université Bordeaux 1



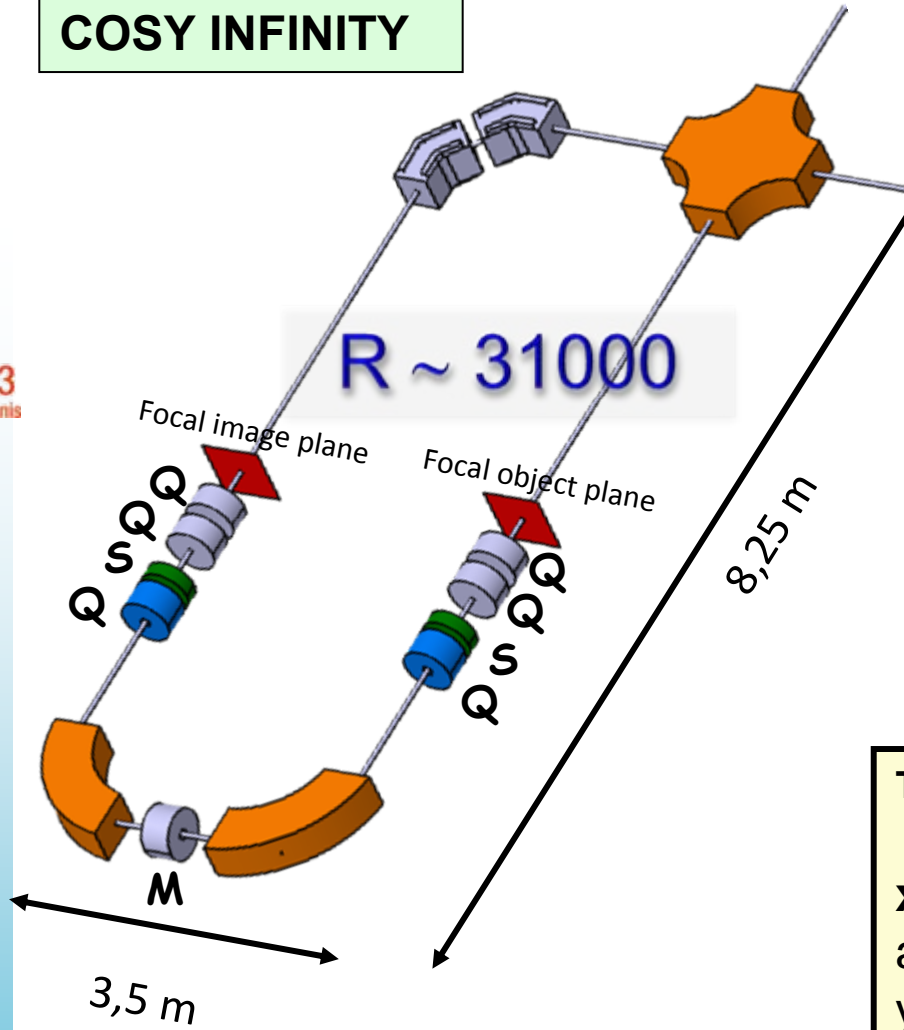
DESIR-HRS @SPIRAL2

COSY INFINITY



DESIR-HRS @SPIRAL2

COSY INFINITY



✓ $(x|\delta) = -31.32 \text{ cm}/\%$

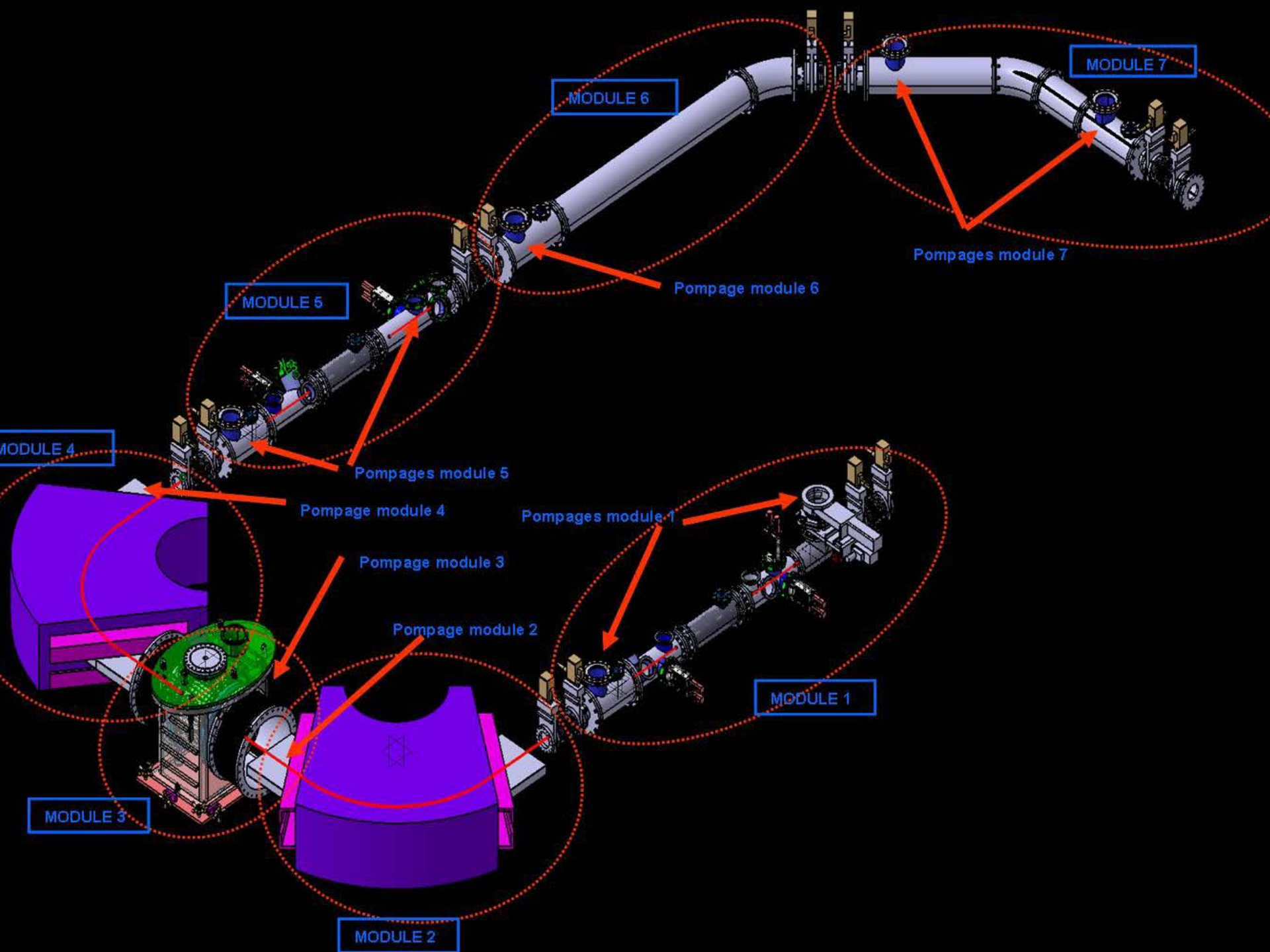
✓ Mirror symmetric

✓ point-to-point both x and y

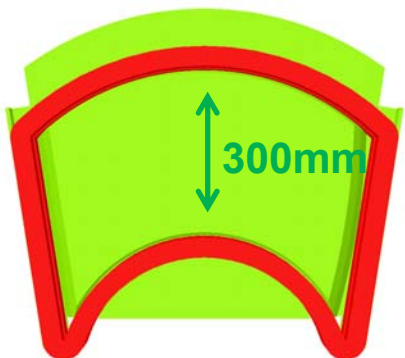
Transfer matrix

| | (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 |
| δm | -31.32 | -57.16 | 0.0 | 0.0 |



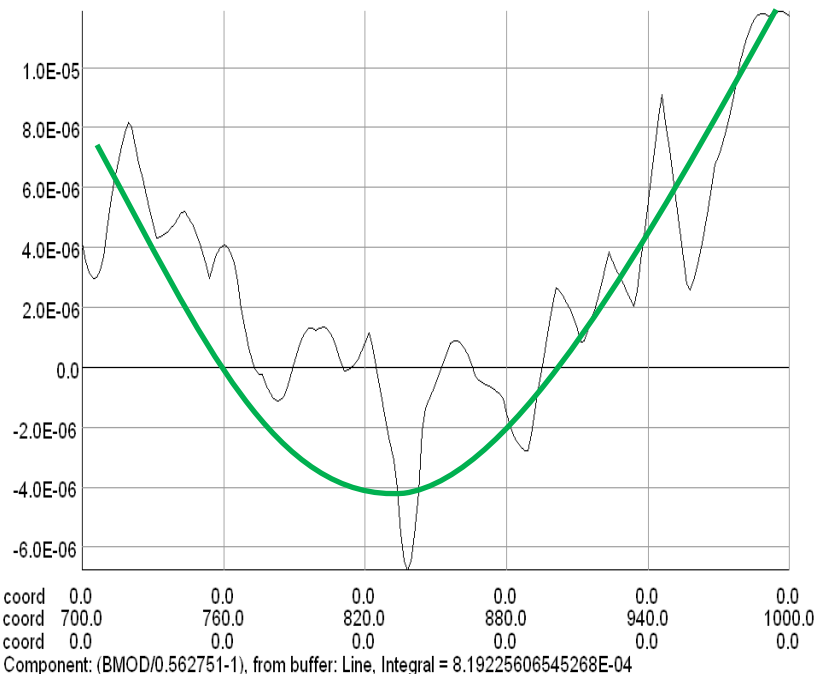
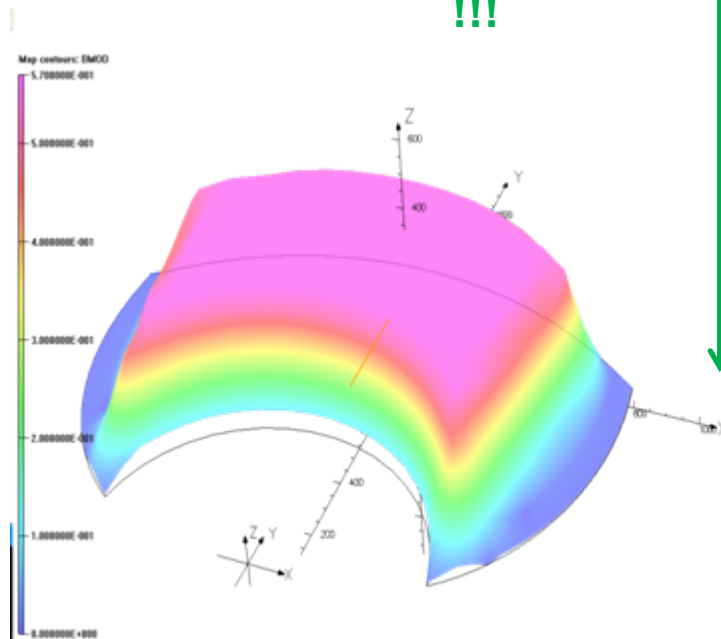


Dipole Magnets



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

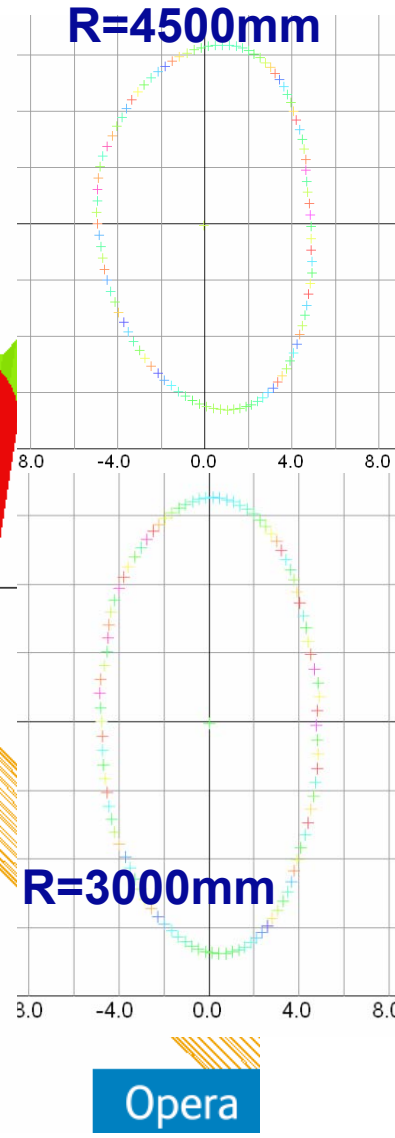
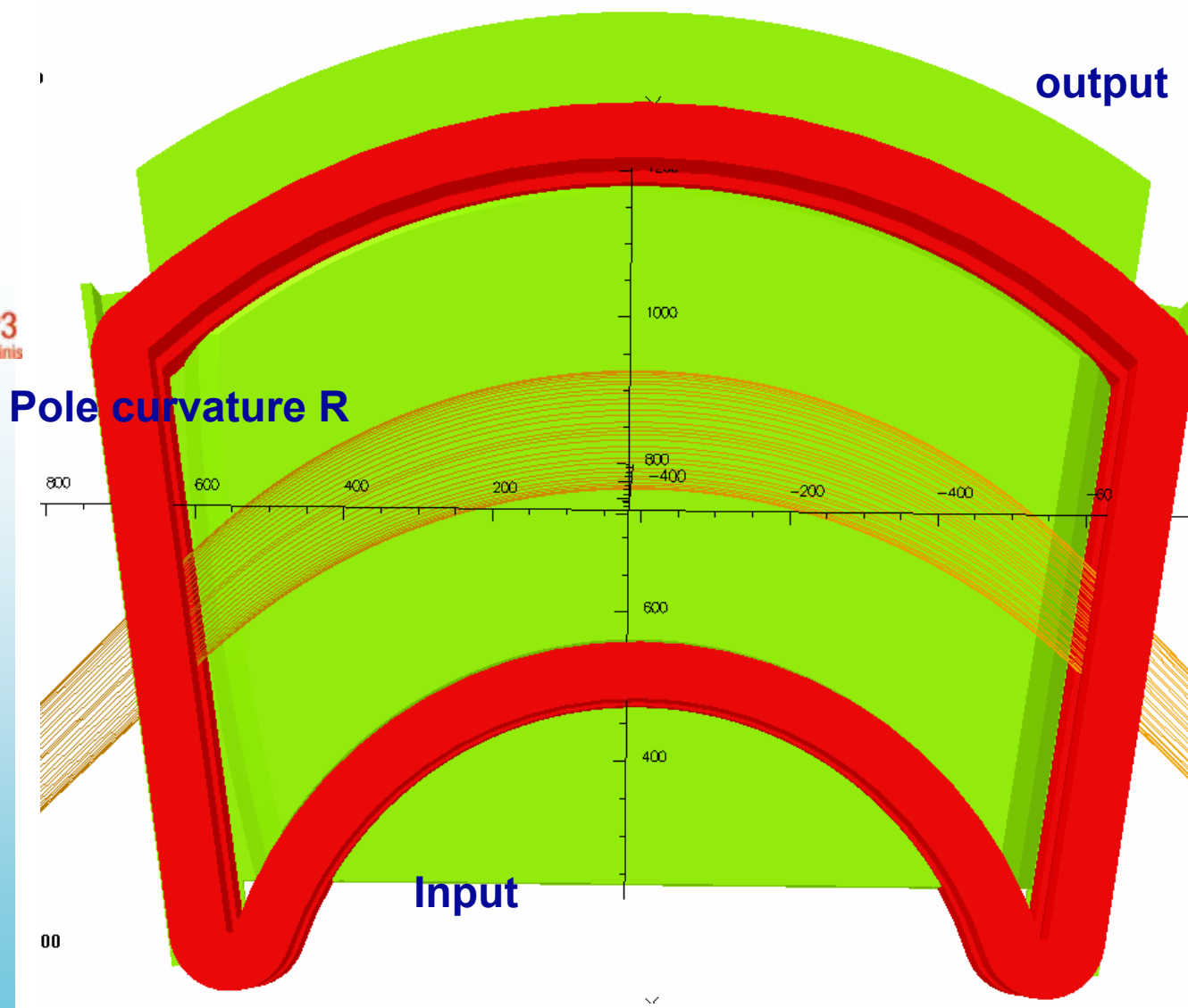
0.09 Gauss
!!!



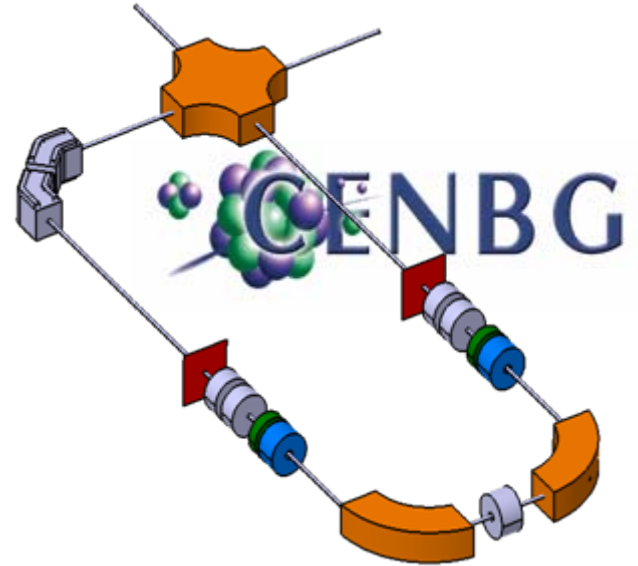
Maurice Duval,
Marc-Hervé Stodel

GANIL

2nd order correction



Assembly Hall @ CENBG



Cost Estimation

Total price : 1 423 100 k€

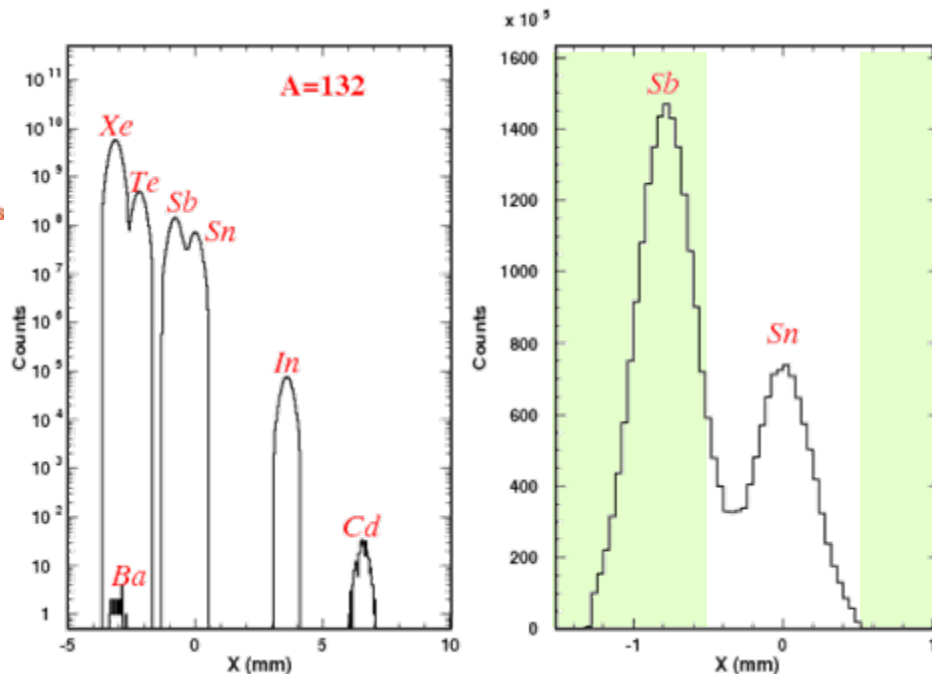
| <u>Element</u> | <u>Price</u> | <u>Quantity</u> | | <u>Cost k€</u> |
|--|--------------|-----------------|--------------------|----------------|
| Magnetic elements | | | sub-total : | 150 000 |
| Dipoles | 75000 | 2 | | 150 000 |
| Electrostatic elements | | | sub-total : | 136 000 |
| Quad or Setupole | 7000 | 8 | | 56 000 |
| Steerers | 5000 | 4 | | 20 000 |
| Bender | 10000 | 2 | | 20 000 |
| Multipole | 40000 | 1 | | 40 000 |
| Diagnostics | | | sub-total : | 194 000 |
| Faraday Cup | 14000 | 4 | | 56 000 |
| Silicon detectors | 14000 | 2 | | 28 000 |
| Profileurs | 22000 | 5 | | 110 000 |
| Slits | | | sub-total : | 90 000 |
| Mechanics | | | sub-total : | 279 200 |
| Vacuum | | | sub-total : | 225 900 |
| Alimentations and magnetic measurements | | | sub-total : | 206 000 |
| other | | | sub-total : | 142 000 |
| Control/Command | 30000 | 1 | | 30 000 |
| Automatisme | 46000 | 1 | | 46 000 |
| colliers | 550 | 120 | | 66 000 |



Monte-Carlo Simulations

Mass spectra calculated, for A=132 isobares, setting on ^{132}Sn .

SPiRAL2 Intensities from n-induced fission 50kW d beam, 280g 3.5g/cm³ UCx target



| Element | I (pps) | $\Delta m/m$ | Δx (mm) |
|---------|---------------------|----------------------|-----------------|
| Cd | $3.5 \cdot 10^2$ | $-2.1 \cdot 10^{-4}$ | +6.5 |
| In | $1 \cdot 10^6$ | $-1.2 \cdot 10^{-4}$ | 3.6 |
| Sn | $9.5 \cdot 10^8$ | 0 | 0 |
| Sb | $1.9 \cdot 10^9$ | $+2.5 \cdot 10^{-5}$ | -0.8 |
| Te | $6.6 \cdot 10^9$ | $+7.0 \cdot 10^{-5}$ | -2.2 |
| Xe | $7.4 \cdot 10^{10}$ | $+1.0 \cdot 10^{-4}$ | -3.2 |
| Ba | $2.2 \cdot 10^1$ | $+9.7 \cdot 10^{-5}$ | -3.1 |

Slits at $\pm 0.5\text{mm}$ \rightarrow **13.3% of contaminant** ^{132}Sb , **Transmission** $^{132}\text{Sn} = 97\%^*$

Slits at $\pm 0.25\text{mm}$ \rightarrow **0% of contaminant** ^{132}Sb , **Transmission** $^{132}\text{Sn} = 60.7\%$

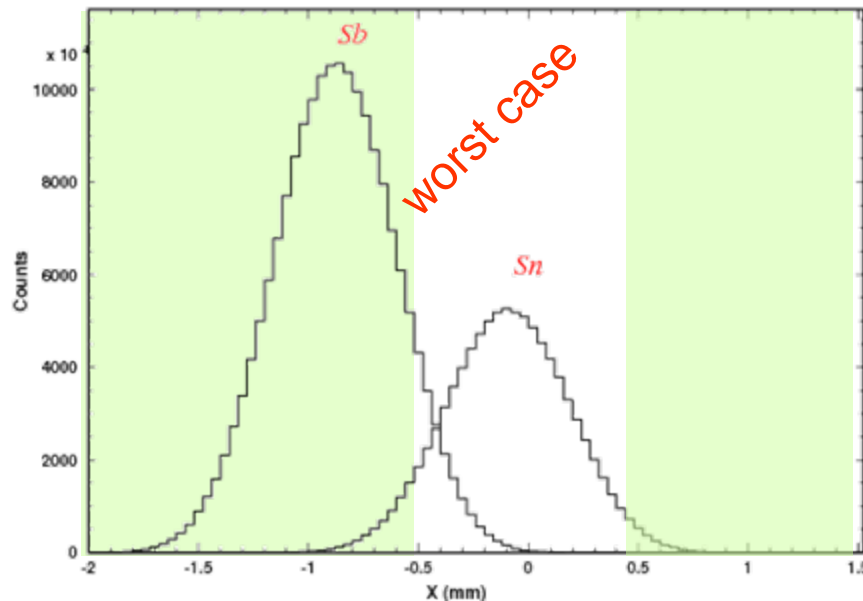
***No misalignment effects taken into account**



Monte-Carlo Simulations

Mass spectra calculated, for A=132 isobares, setting on ^{132}Sn .

Misalignment tolerances included, 5th order, R ~20000



| | |
|----------------------|--------------|
| Second Order T122: | 1.3066 |
| Second Order T133: | 11.4427 |
| Third Order T1222: | -15.2000 |
| Fourth Order T12222: | 876.6499 |
| Fifth Order T122222: | 2790878.7029 |

Slits at $\pm 0.5\text{mm}$ \rightarrow **15.6% of contaminant** ^{132}Sb

Transmission $^{132}\text{Sn} = 84.4\%^*$

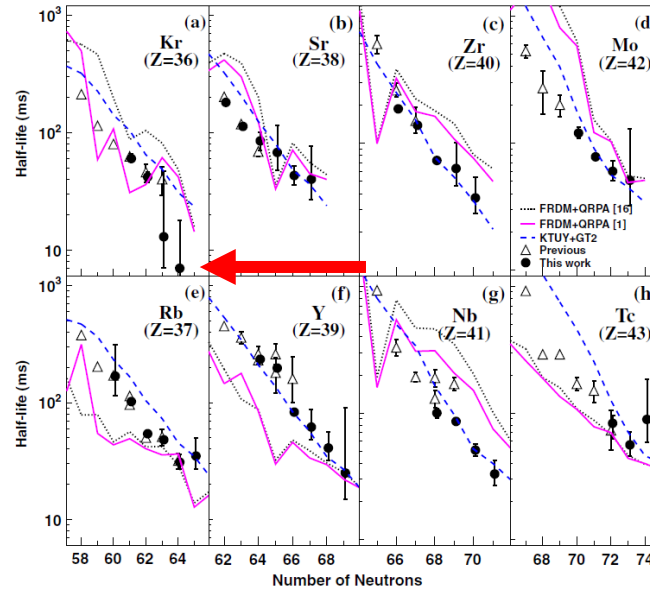
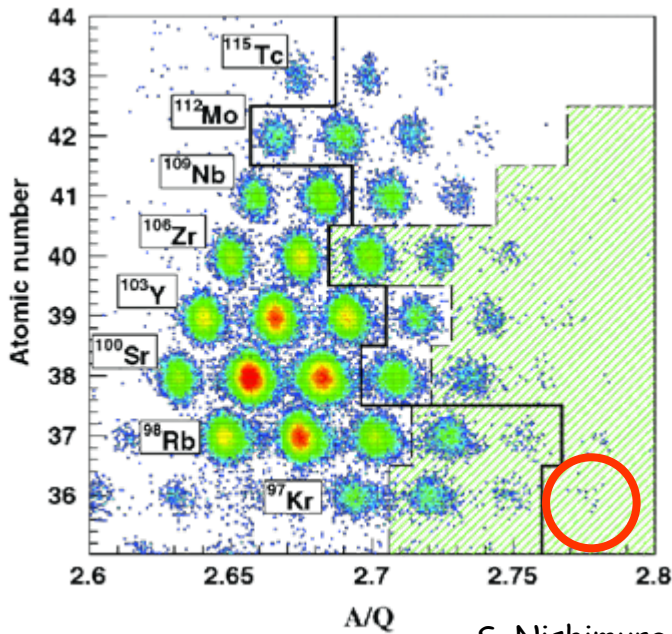


send beam to

PIPERADE



Monte-Carlo Simulations, ^{100}Kr DESIR LOI r-process



^{100}Kr :

S. Nishimura, PRL, 106, 052502 (2011)

12 events / 8h @ RIBF RIKEN in-flight fission ^{238}U on 550-mg/cm^2 Be

@SPIRAL2 10 pps from n-induced fission 50kW d beam, 280g 3.5g/cm^3 UCx target

| Element | I (pps) | $T_{1/2}$ (ms) | $\Delta m/m$ |
|---------|------------------|----------------|----------------------|
| Kr | $1.0 \cdot 10^1$ | 7_{-3}^{+11} | 0 |
| Rb | $2.0 \cdot 10^5$ | 51 ± 8 | $1.13 \cdot 10^{-4}$ |
| Sr | $5.9 \cdot 10^3$ | 202 ± 3 | $2.58 \cdot 10^{-4}$ |
| Y | $1.1 \cdot 10^4$ | 735 ± 7 | $3.34 \cdot 10^{-4}$ |

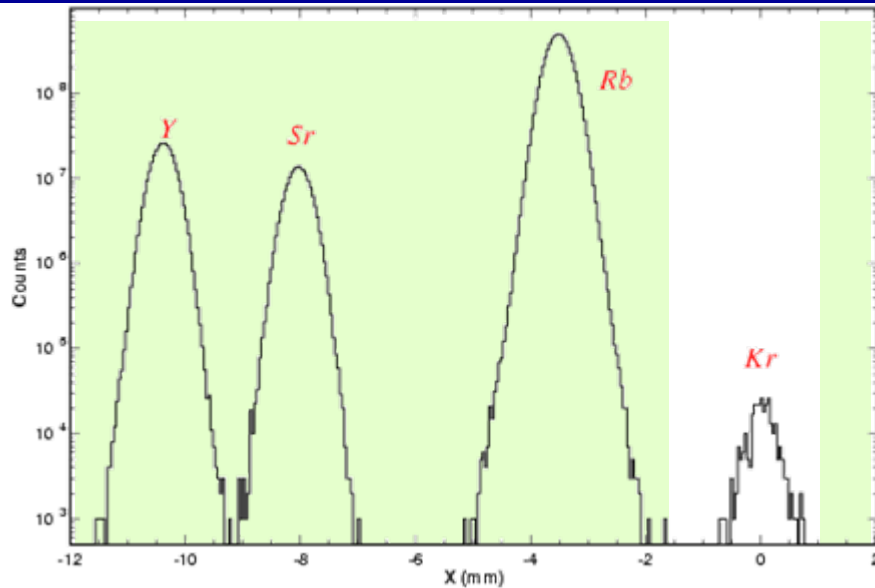
Overwhelming contaminants



R > 9000

HRS required

Monte-Carlo Simulations, ^{100}Kr DESIR LOI r-process



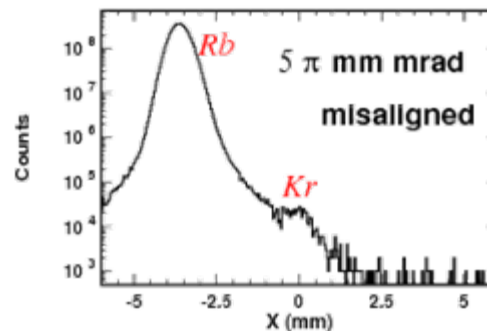
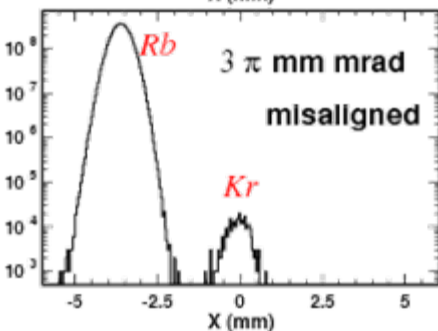
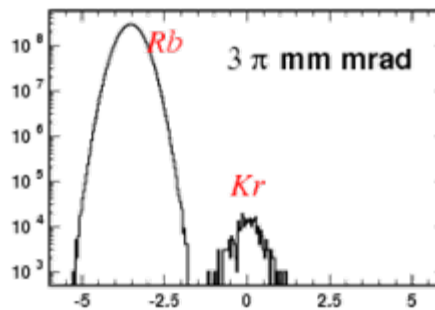
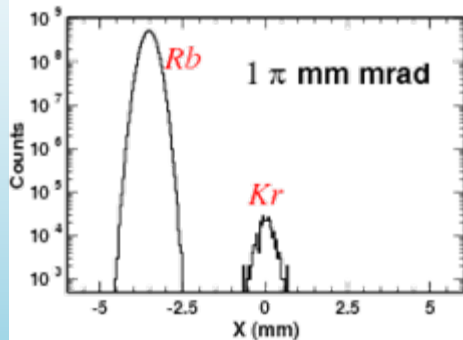
| Element | I (pps) | ΔX (mm) |
|---------|------------------|-----------------|
| Kr | $1.0 \cdot 10^1$ | 0 |
| Rb | $2.0 \cdot 10^5$ | -3.6 |
| Sr | $5.9 \cdot 10^3$ | -8.0 |
| Y | $1.1 \cdot 10^4$ | -10.4 |

Slits at $\pm 0.5\text{mm}$ \rightarrow

0% of contaminants

100% mono-isotopic ^{100}Kr beam

- ✓ **$T_{1/2}$ measurements**
- ✓ **Mass measurements**
- ✓ **β - γ branches**
- ✓ **β -n branches**



Status of the project



- ❖ Global optical design finished and validated at the 2nd DESIR-HRS Workshop, Bordeaux November 17th -18th , 2011.
- ❖ Mechanical design and integration in progress.
- ❖ Assembly Hall at CENBG ready.
- ❖ 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.

Thank you