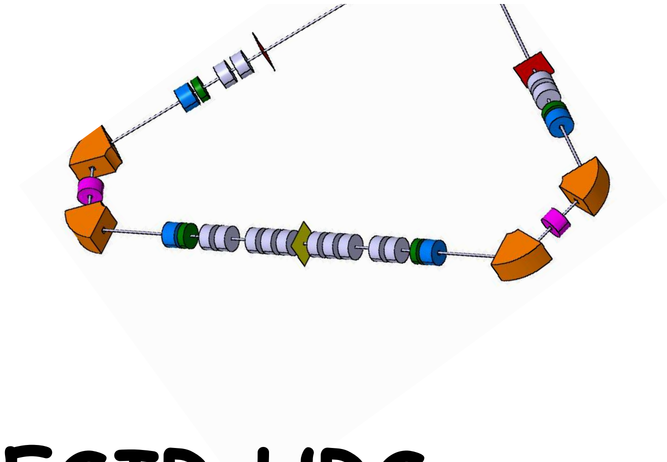
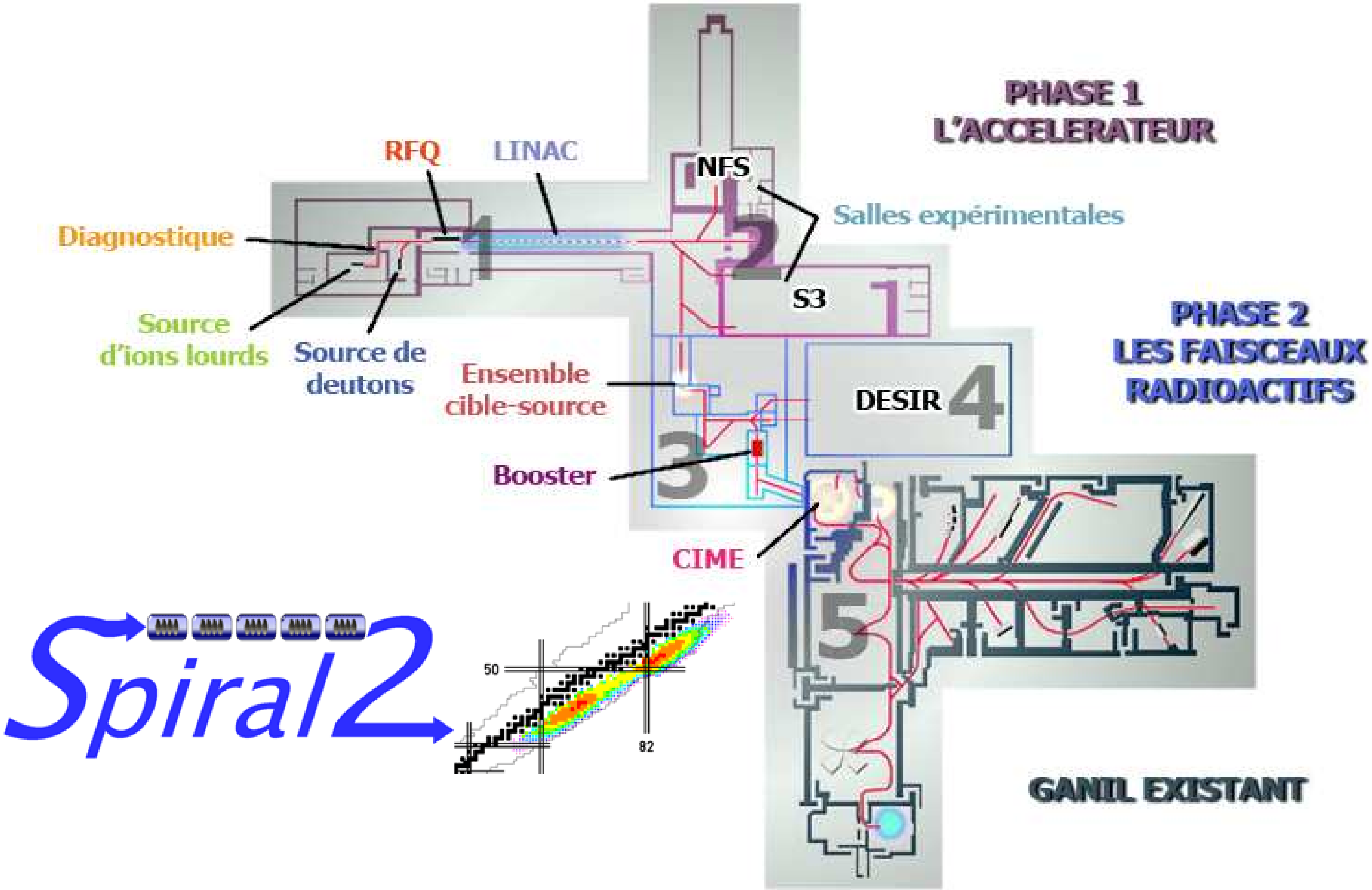


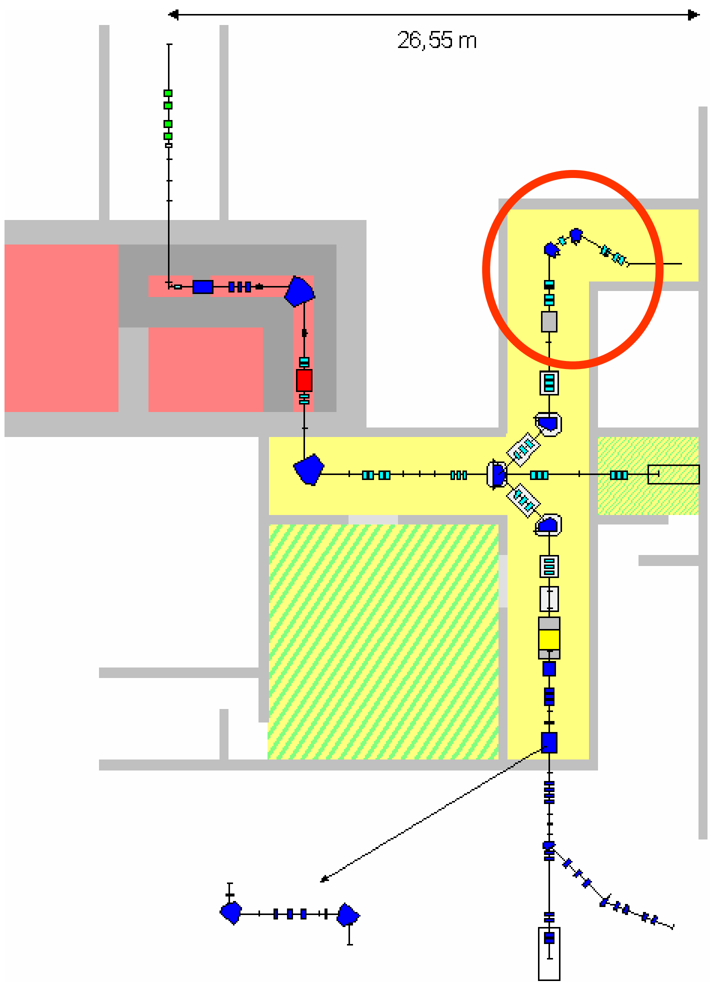
Design studies of the DESIR HRS

Teresa Kurtukian-Nieto

First DESIR-HRS Workshop
CENBG, November 12-13 2009


PHASE 1
L'ACCELERATEUR
RFQ
LINAC
NFS
Salles expérimentales
Diagnostique
S3
Source
d'ions lourds
Source de
deutons
PHASE 2
LES FAISCEAUX
RADIOACTIFS
Ensemble
cible-source
DESIR
Booster
CIME
Spiral2
50
82
GANIL EXISTANT

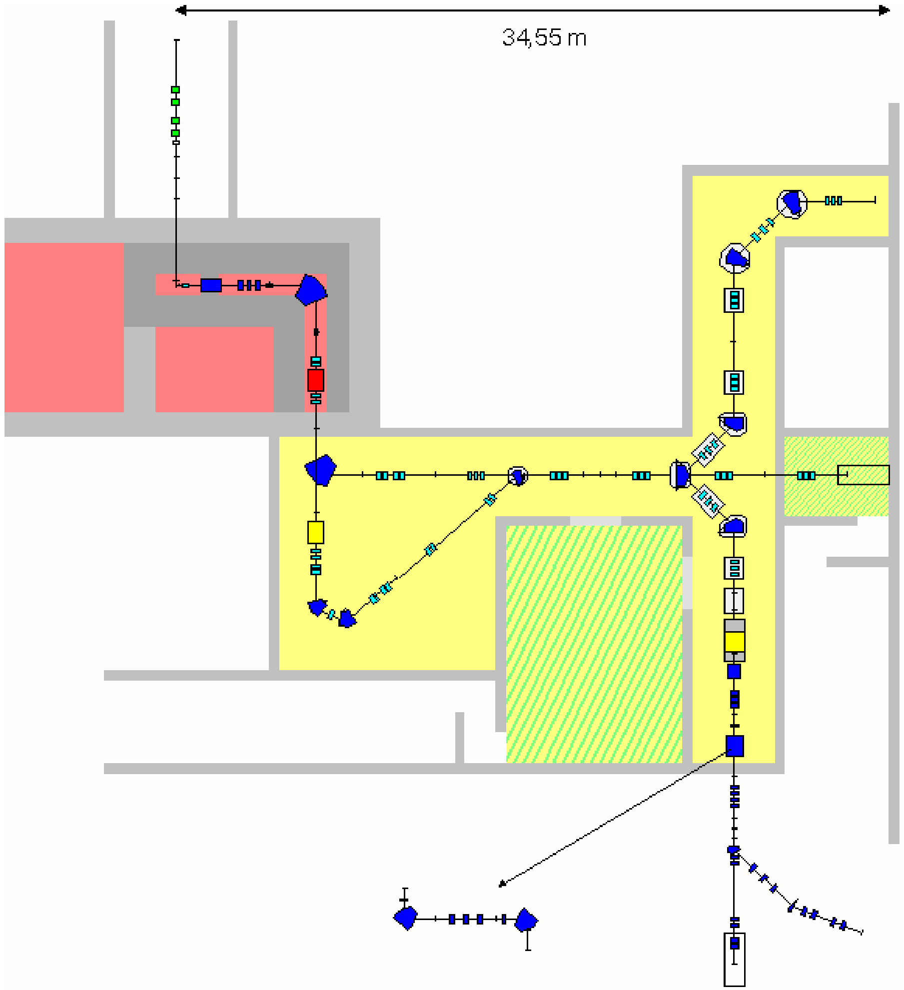
HRS: initial conception

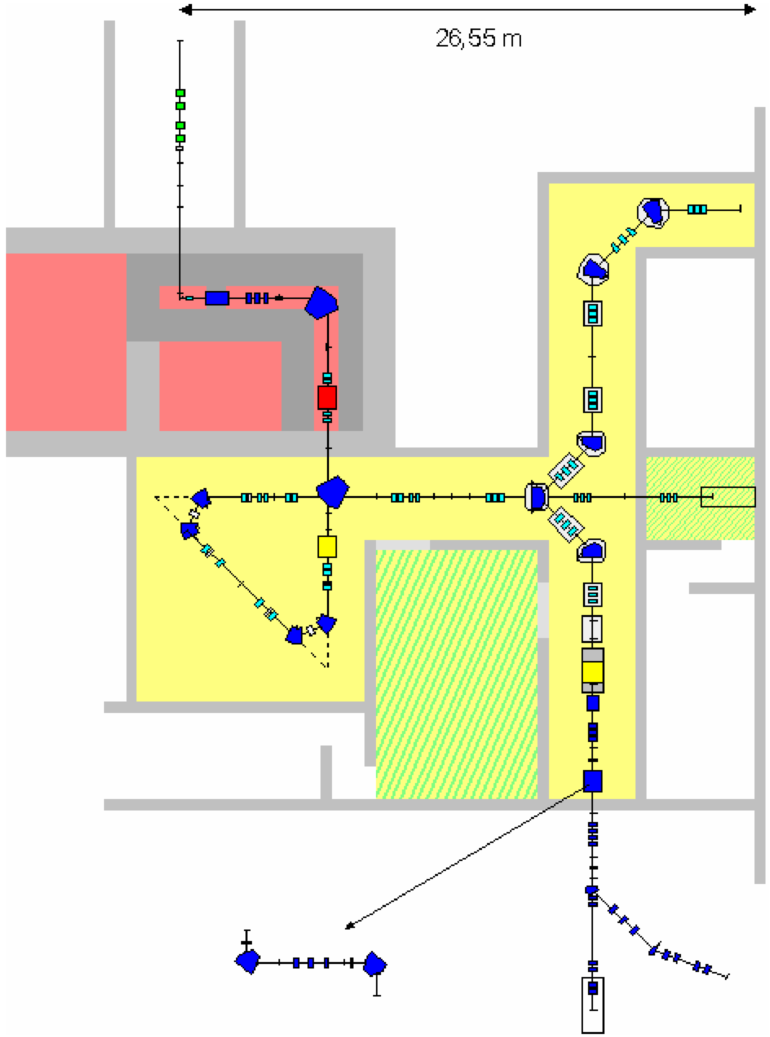


DESIR

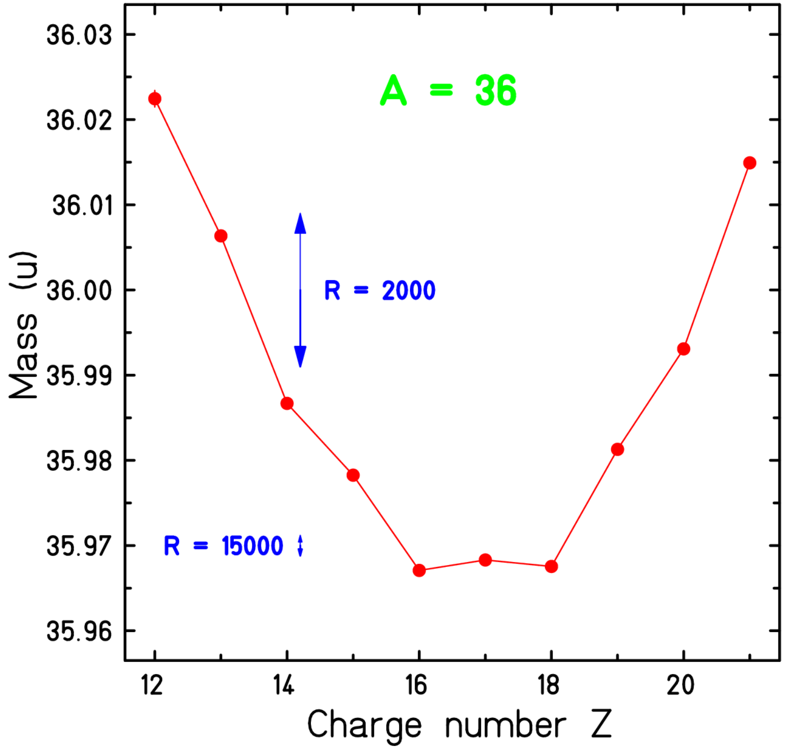
High resolution separator
with enough mass resolving power
to allow isobaric separation.

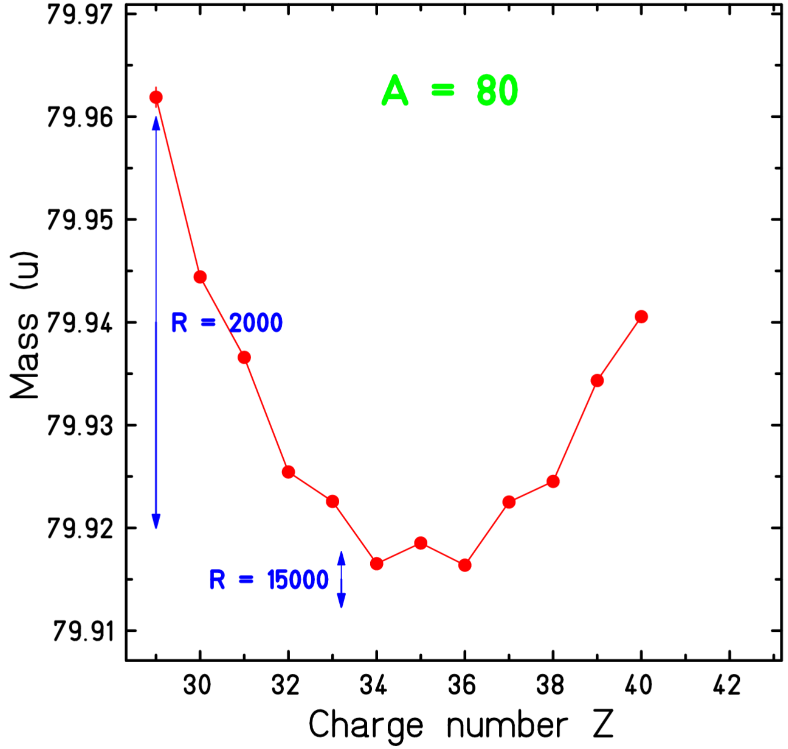
HRS: Implantation





Design Resolution



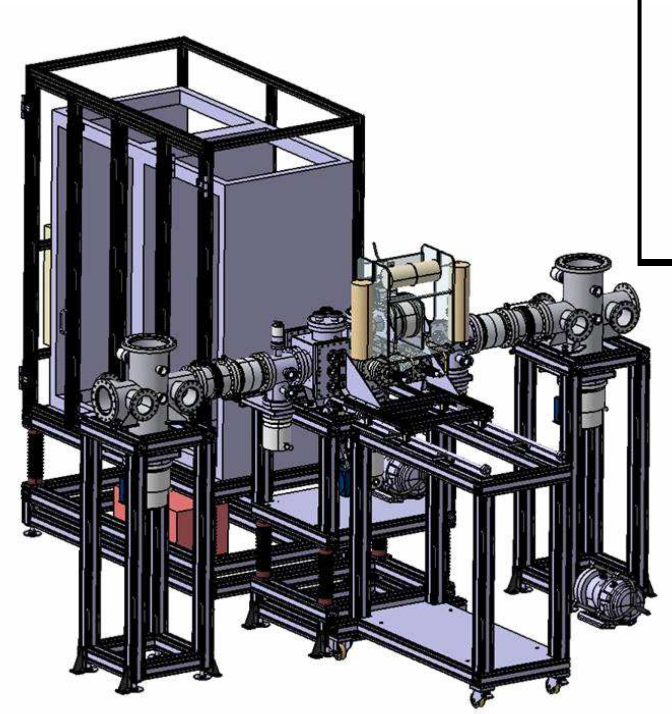


Resolving Power

$$R = \frac{m}{\Delta m} \sim \mathbf{20000}$$

$$R = \frac{(x|\delta)}{2x_{00}(x|x) + \Delta}$$

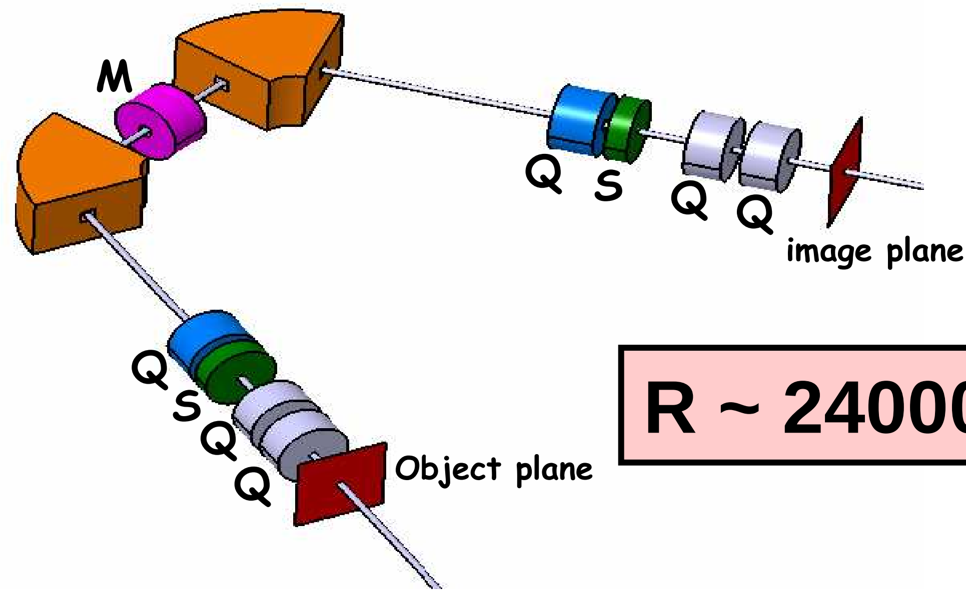
Beam Emittance given by SHIRaC



Spiral2 beam	Emittance	80 π.mm.mrad
	Diameter	20 mm
	Intensity	~ 1 µA
	Energy	60 keV
	Mass	6 - 250

		Transmission	
		Specifications	Results
Mass	$^{23}Na^{+}$	20%	25%
	$^{87}Rb^{+}$	60%	25%
Emittance at 60keV		< 3π.mm.mrad	2 π.mm.mrad
ΔE		1 eV	146 meV

HRS C135

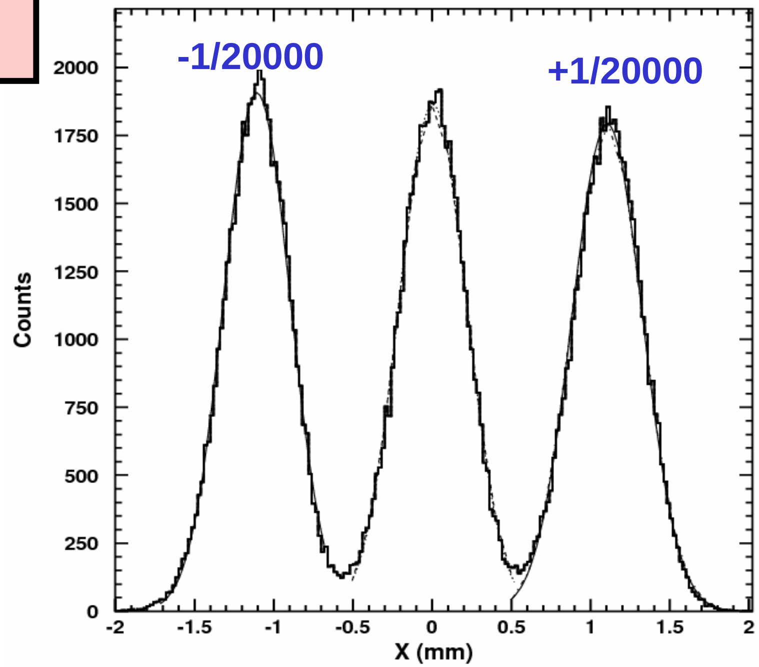


- ü (x|δ) = -24 cm/%
- ü Mirror symmetric
- ü point-to-point both x and y

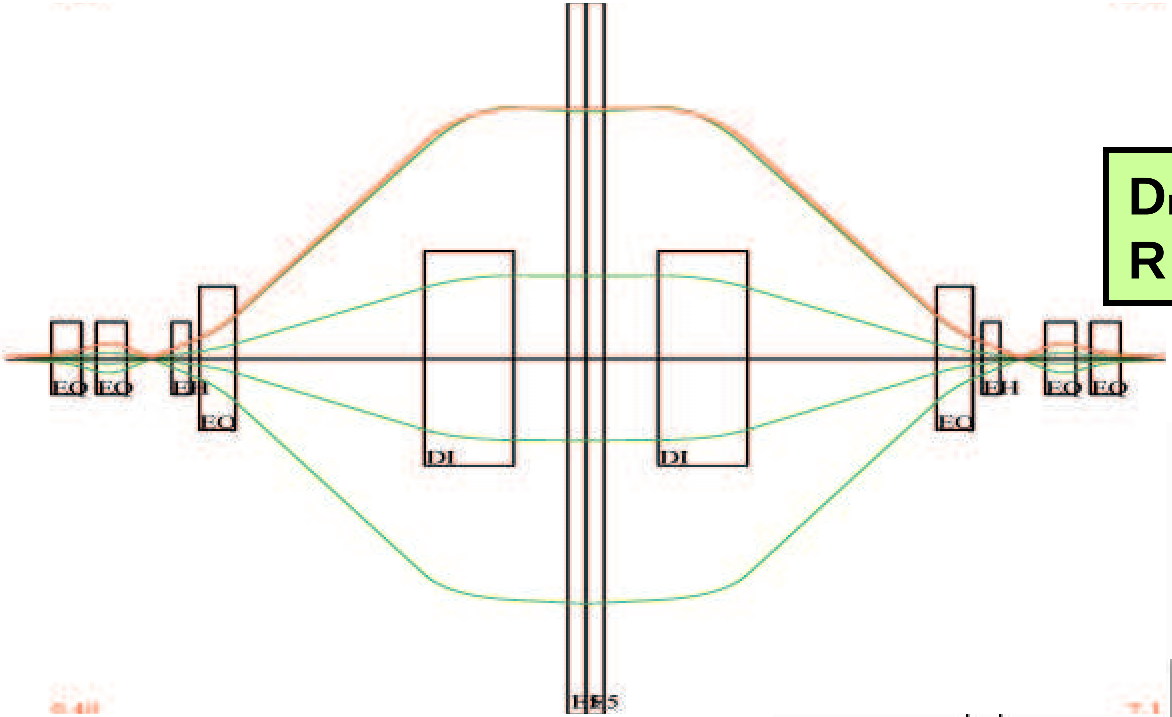
R ~ 24000

Transfer matrix

	(x,)	(a,)	(y,)	(b,)
x	-1.0000	-4.5202	0.0000	0.0000
a	0.28E-7	-0.9999	0.0000	0.0000
y	0.0000	0.0000	1.0000	0.25E-7
b	0.0000	0.0000	-0.12E-8	1.0000
δm	-24.10	-54.47	0.0000	0.0000

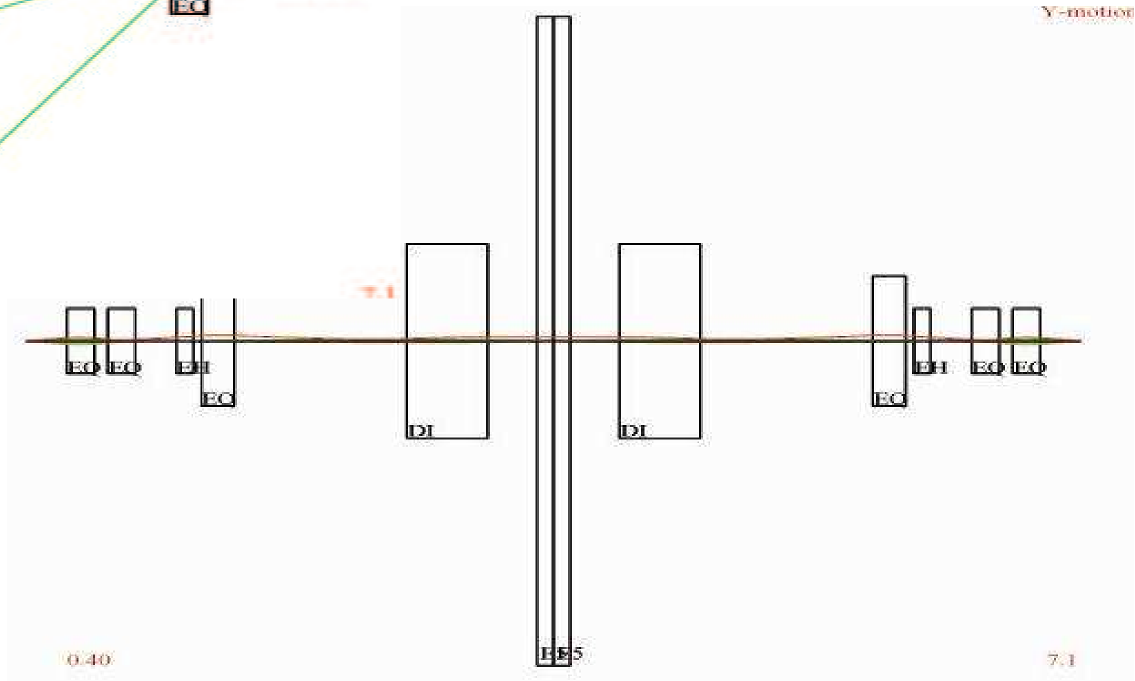


COSY INFINITY X and Y motion

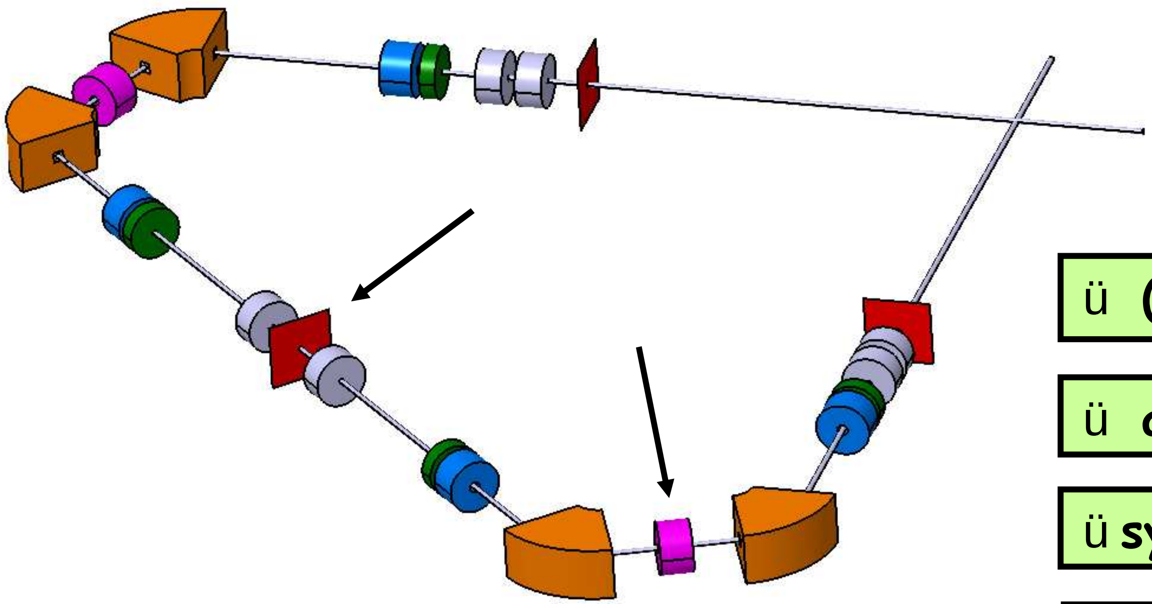


$D_m = (x|\delta)$ = **24.10 cm/%**
R ~ 24000

3 π mm.mrad



HRS Alpha Asymmetric: short



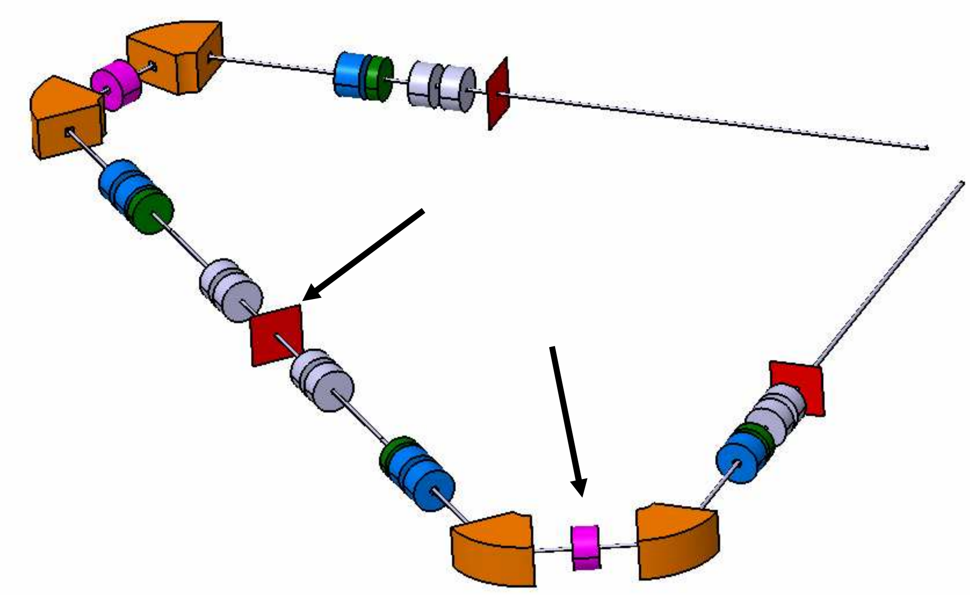
Transfer matrix :

	(x,)	(a,)	(y,)	(b,)
x	0.4004	5.9434	0.0000	0.0000
a	0.10E-6	2.4972	0.0000	0.0000
y	0.0000	0.0000	1.7245	4.5850
b	0.0000	0.0000	-0.53E-7	0.5799
δm	8.66	-0.13E-6	0.0000	0.0000

- ü (x|δm) ~ 9 cm/%
- ü asymmetric for M plane
- ü symmetric for mid-plane
- ü (x|x) ~ 0.4
- ü point-to-point both x and y

R ~ 21750

HRS Alpha Asymmetric: Large



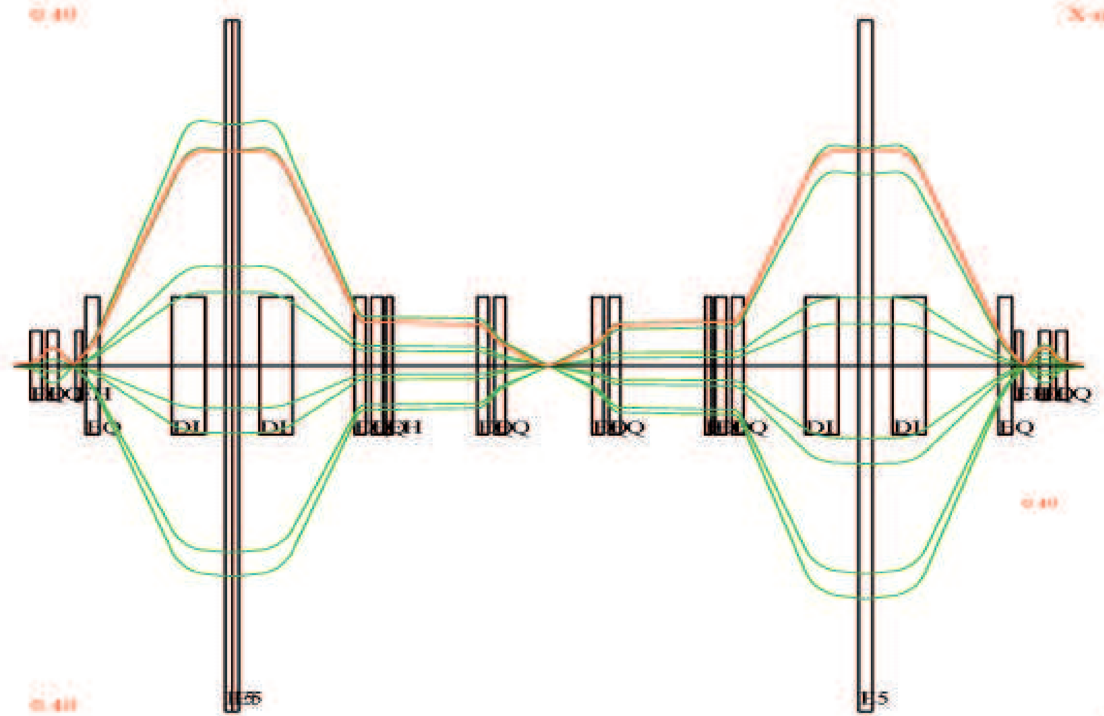
Transfer matrix :

	(x,)	(a,)	(y,)	(b,)
x	0.4043	5.8394	0.0000	0.0000
a	-0.53E-7	2.4732	0.0000	0.0000
y	0.0000	0.0000	26.19	-0.2400
b	0.0000	0.0000	4.1672	-0.16E-10
δm	10.23	0.49E-8	0.0000	0.0000

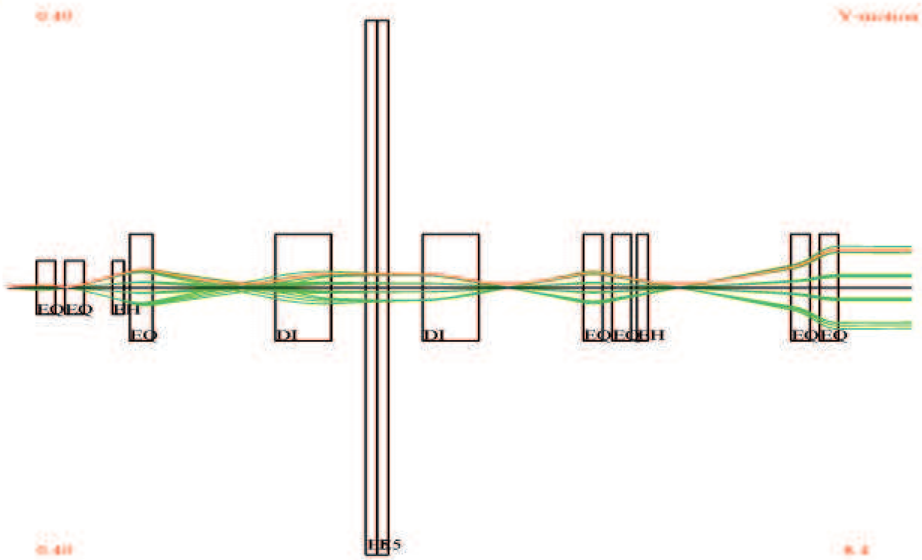
- ü (x|δm) ~ 10 cm/%
- ü asymmetric for M plane
- ü symmetric for mid-plane
- ü (x|x) ~ 0.4
- ü point-to-point in x

R ~ 25500

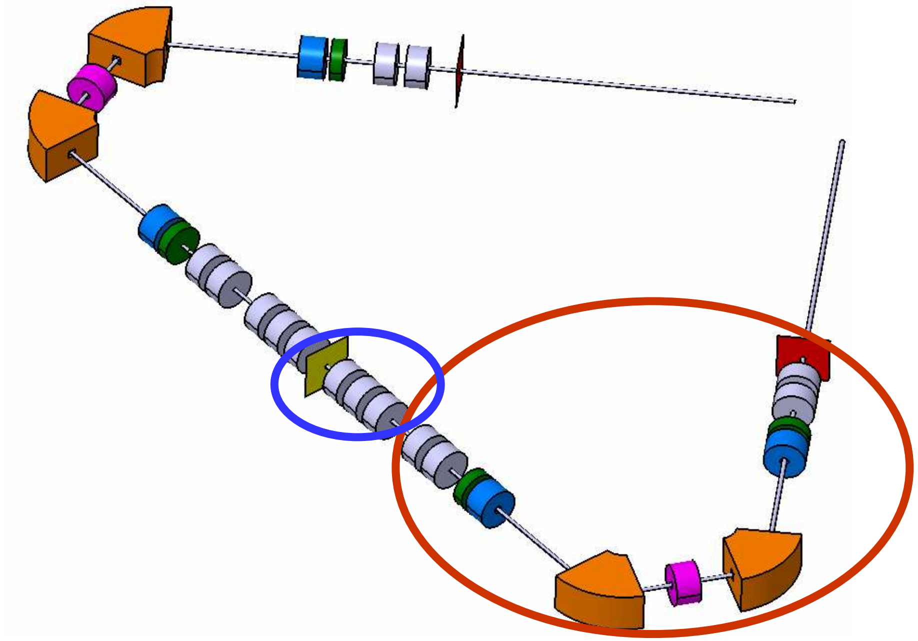
COSY INFINITY X and Y motion



$D_m = (x|\delta) \sim$ 10 cm/%
R ~ 25500



HRS Alpha Symmetric



- ü Same as HRS C135
- ü Compensation triplet
- ü Doubly symmetric

R ~ 24000

Transfer matrix

	(x,)	(a,)	(y,)	(b,)
x	**-1.0000**	-4.5202	0.0000	0.0000
a	0.28E-7	**-0.9999**	0.0000	0.0000
y	0.0000	0.0000	**1.0000**	0.25E-7
b	0.0000	0.0000	-0.12E-8	**1.0000**
δm	**-24.10**	-54.47	0.0000	0.0000

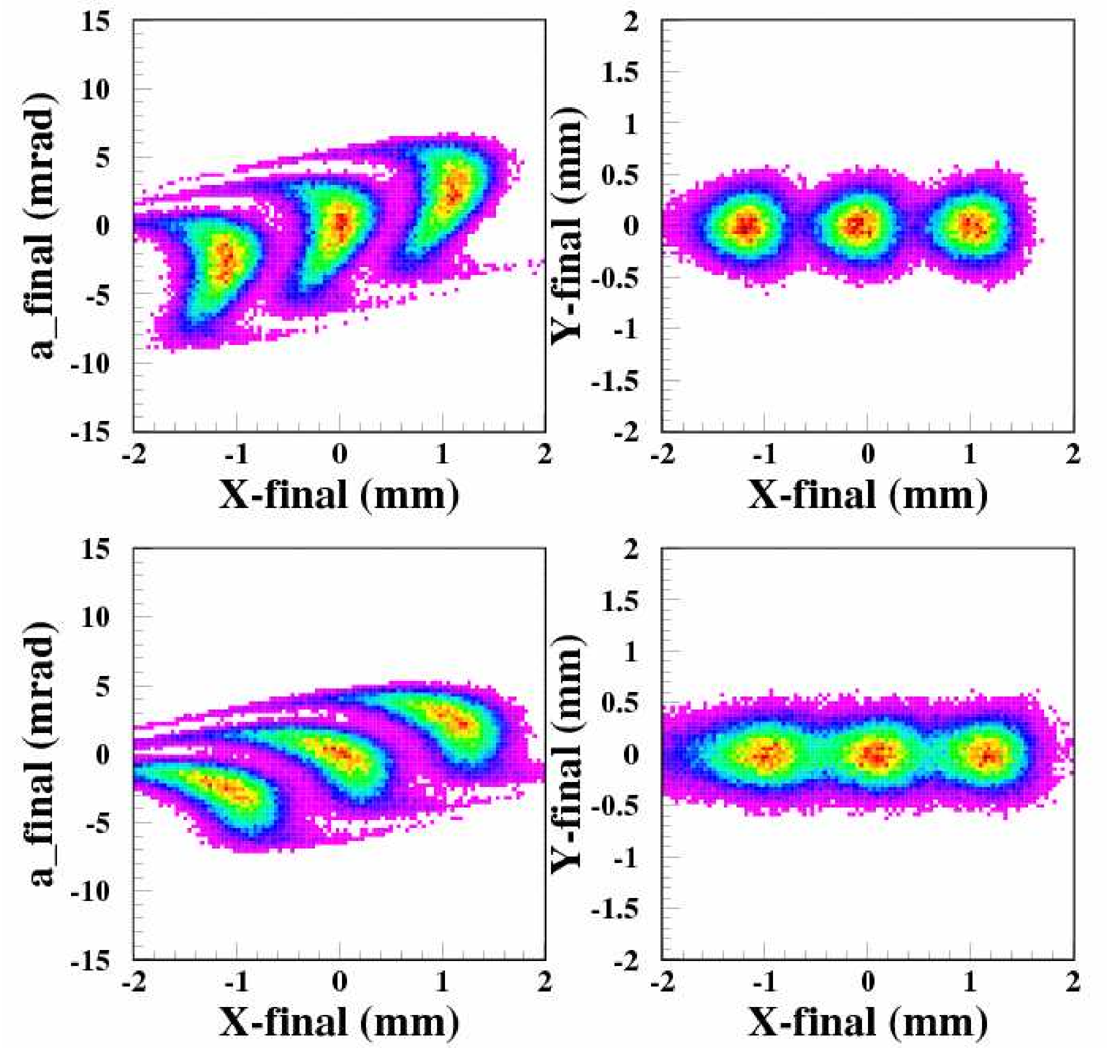
Transfer matrix

	(x,)	(a,)	(y,)	(b,)
x	**0.3787**	-5.9685	0.0000	0.0000
a	-0.11E-7	**2.6407**	0.0000	0.0000
y	0.0000	0.0000	**-0.8472**	-4.3693
b	0.0000	0.0000	0.2289	0.38E-6
δm	**9.1254**	0.34E-5	0.0000	0.0000

Open Questions:

- Which is the best solution, a highly dispersive system (~20 cm/%) or the less dispersive (~10 cm/%) system with smaller beam spot?
- Misalignment and/or mechanical errors on the final resolution
- Fringe field and effective field boundary effects
- Homogeneity of the dipoles field

Misalignment effects on mass resolution



Phase spaces calculated to 5th order

50000 particles with mass deviations -1/20000, 0, +1/20000

A shift in the multipole of 0.2 mm in the x-direction induces a deformation in the x-a phase space which is responsible for the blur in the final mass separation. In this example m/Δm is reduced to ~11000

DESIR-HRS working group @CENBG

- Bertram Blank
- Franck Delalée
- Teresa Kurtukian-Nieto
- Laurent Serani

Thank you