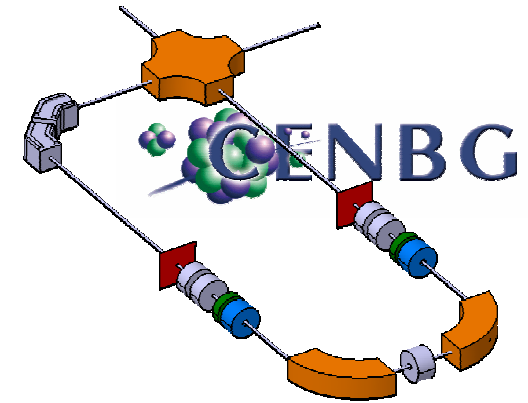




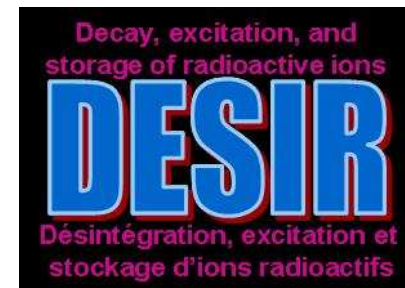
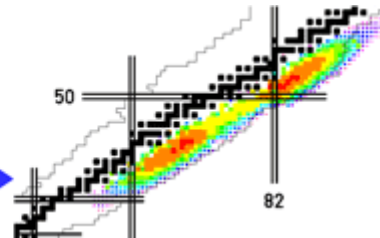
IN2P3

Institut national de physique nucléaire  
et de physique des particules



## High resolution separator for

  
*Spiral2*



Teresa Kurtukian-Nieto  
CEN Bordeaux-Gradignan

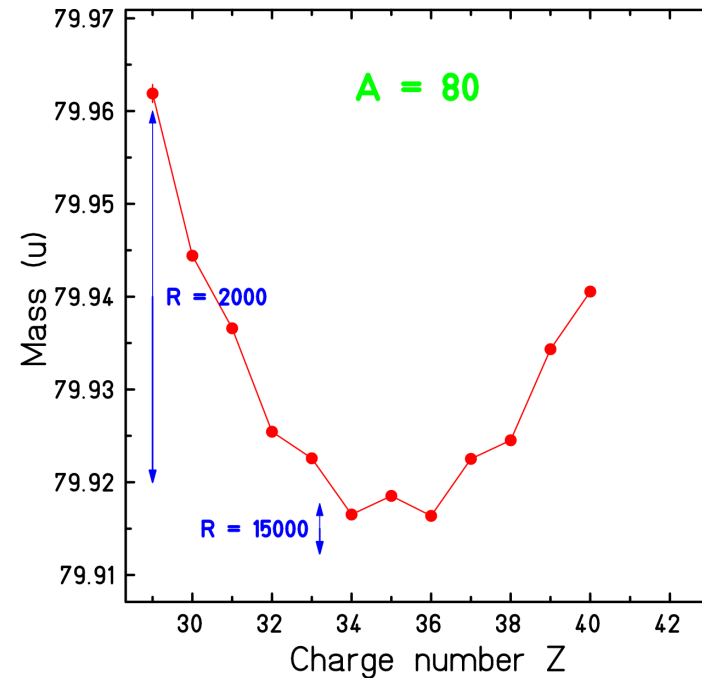
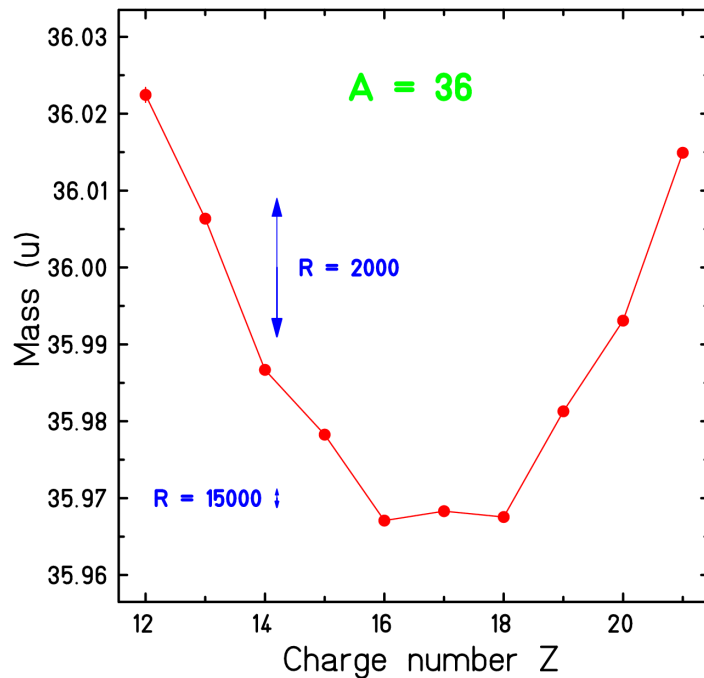
DESIR WORKSHOP 2010 Leuven, Belgium  
May 26<sup>th</sup> 2010

# Outline

- ❖ **HRS: Design Goal**
- ❖ **HRS-U180**
- ❖ **Ion optics discussion**
- ❖ **Performance study using Raytracing Turtle**
- ❖ **Status of the project**
- ❖ **Summary and outlook**

# HRS: Design goal

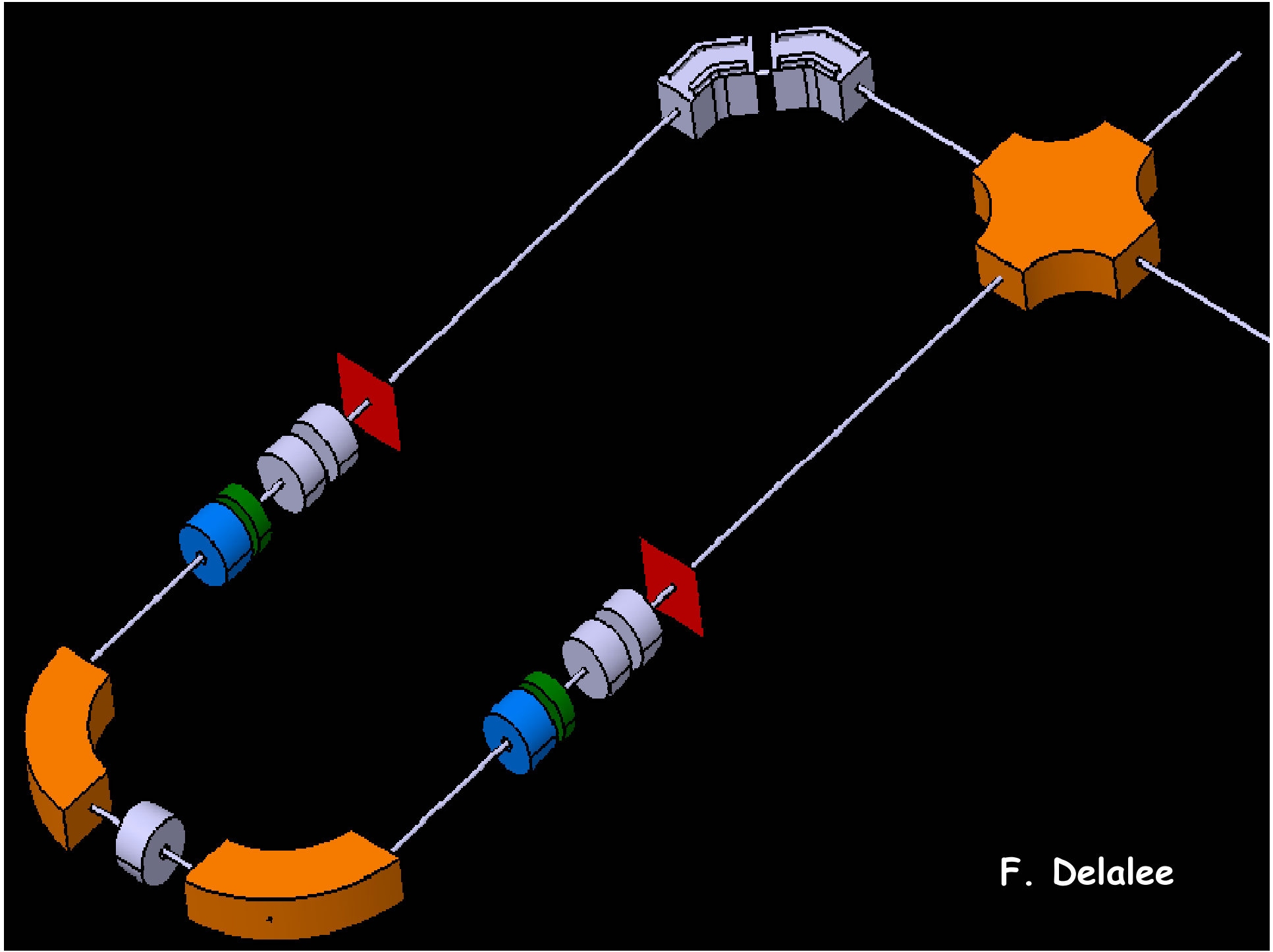
High resolution separator with enough mass resolving power to allow isobaric separation.



**Resolving Power**

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

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



F. Delalee

# FIRST DESIR-HRS WORKSHOP

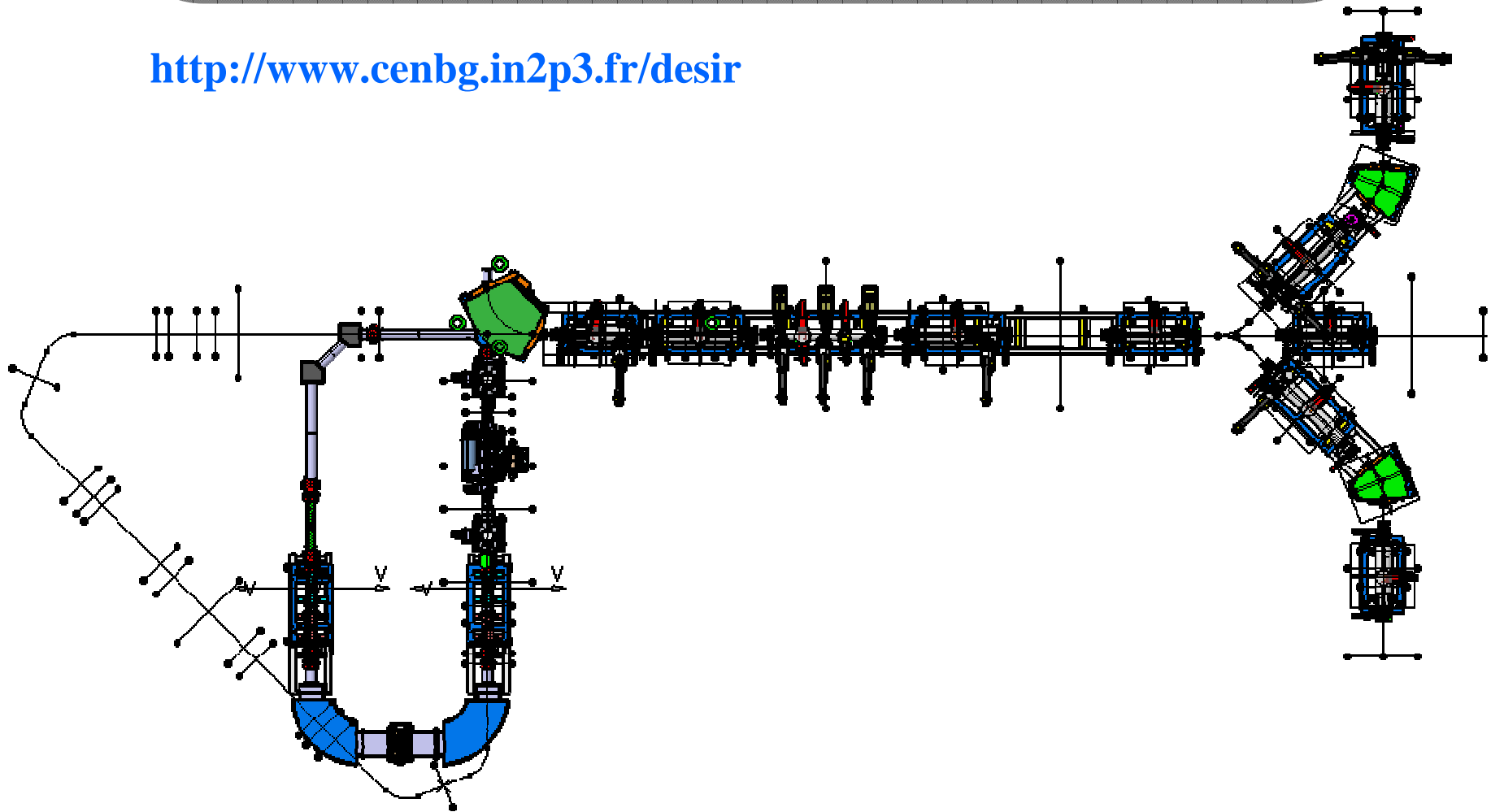
❖ November 12<sup>th</sup>-13<sup>th</sup> 2009, CENBG

❖ Participants:

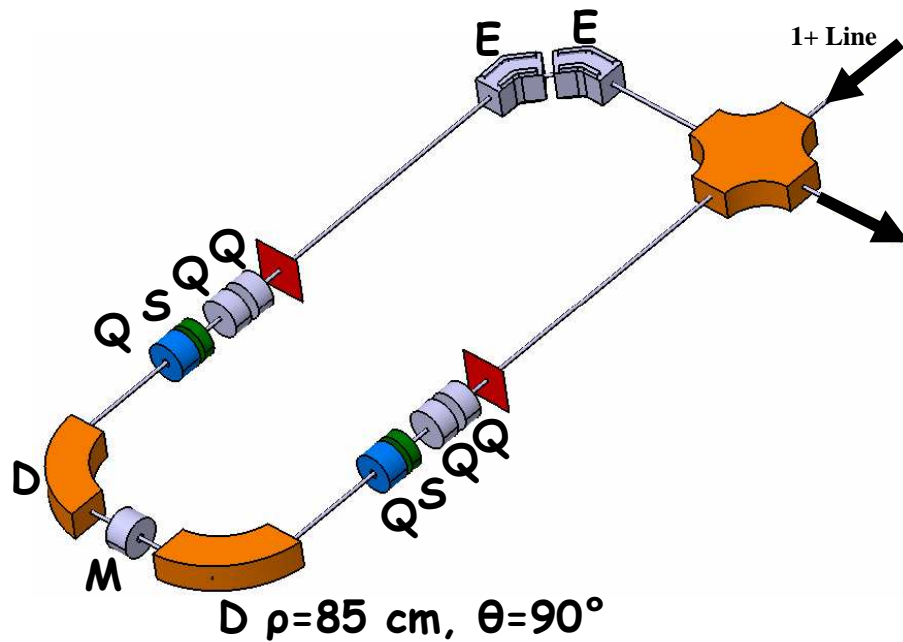
- ✓ Cary Davids ANL, USA
- ✓ Rich Baartman TRIUMF, Canada
- ✓ Helmut Weick, GSI, Germany
- ✓ François Méot, Grenoble, France
- ✓ Maurice Duval, GANIL, France
- ✓ Franck Varenne, GANIL, France
- ✓ David Lunney, CSNSM, France
- ✓ DESIR-HRS Bordeaux Team

# HRS: Layout

<http://www.cenbg.in2p3.fr/desir>



# HRS U180



Transfer matrix

	(x, )	(a, )	(y, )	(b, )
x	-1.0	-4.5	0.0	0.0
a	0.3E-7	-1.0	0.0	0.0
y	0.0	0.0	1.0	23.2
b	0.0	0.0	-0.2E-7	1.0
$\delta m$	-31.5	-70.9	0.0	0.0

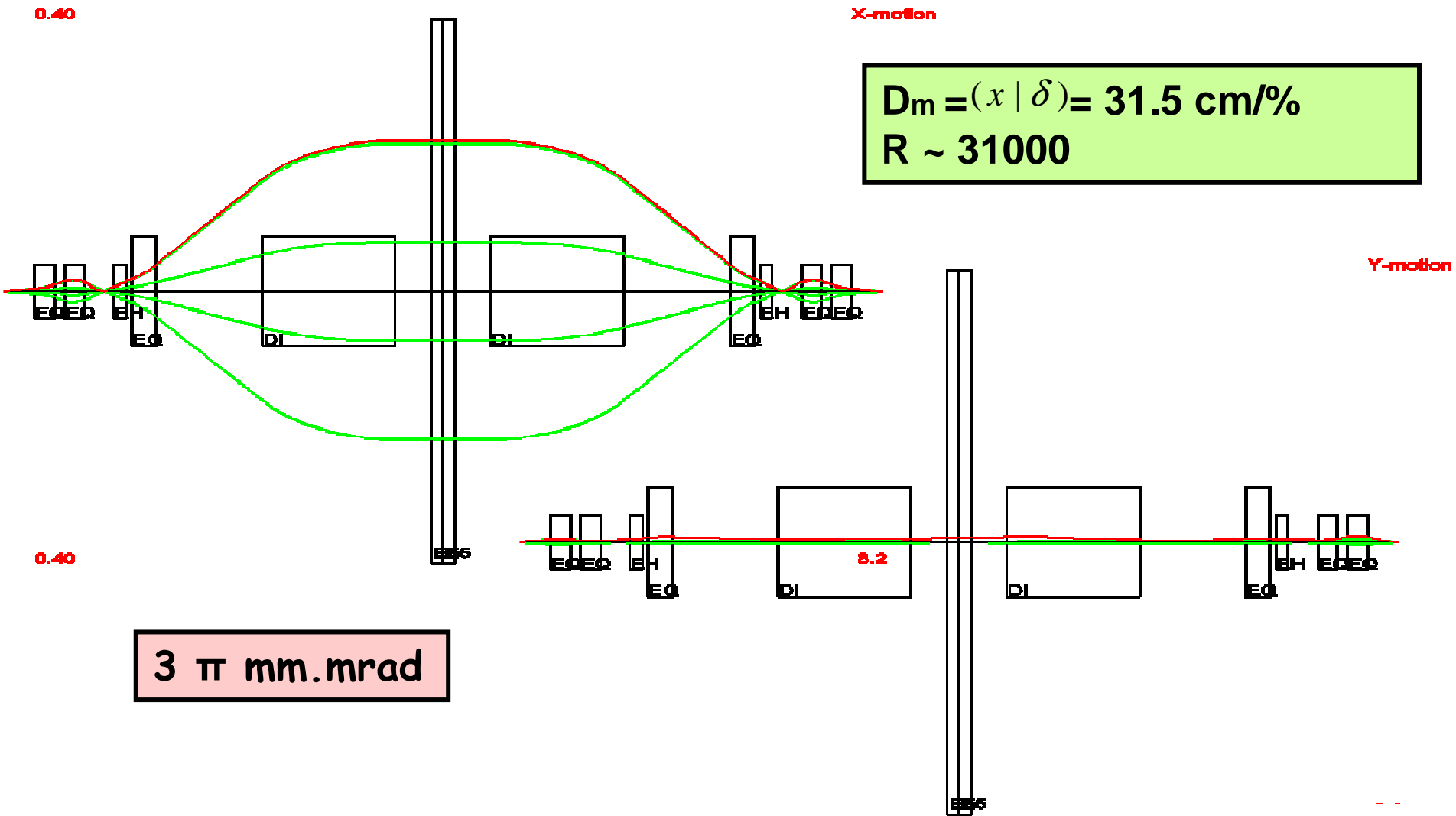
✓  $(x|\delta) = -31.5$  cm/%

✓ Mirror symmetric

✓ point-to-point both x and y

$R_{\max} = 31500$

# COSY INFINITY X and Y motion

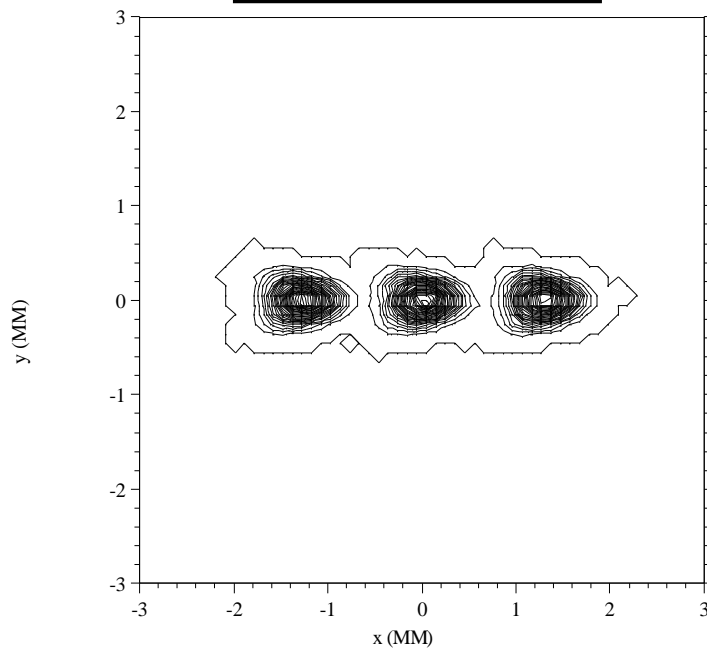




# Performance study using Raytracing Turtle

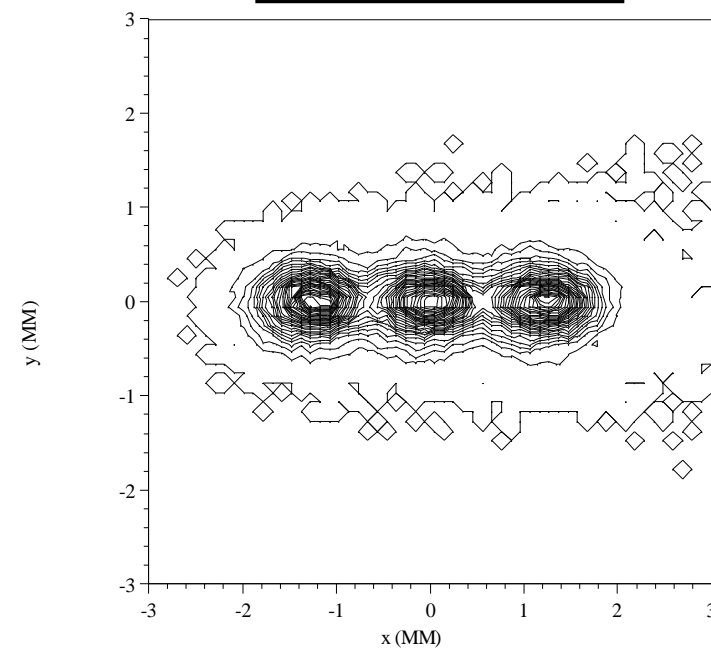
X-Y phase space for isobars with mass deviations  
-1/20000, 0, +1/20000 .

**1  $\pi$  mm.mrad**



97% transmission,  
0.09% cross-contamination

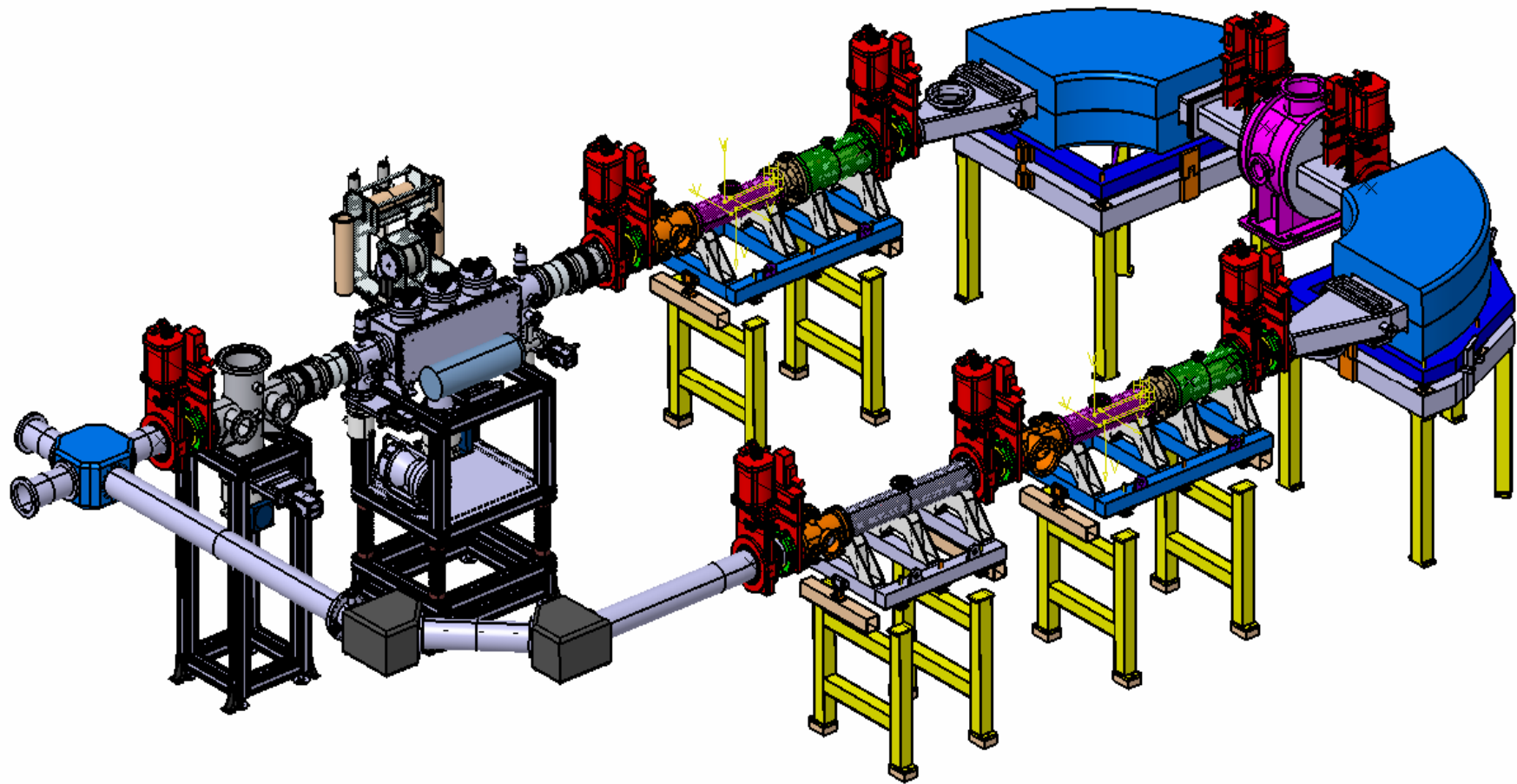
**3  $\pi$  mm.mrad**



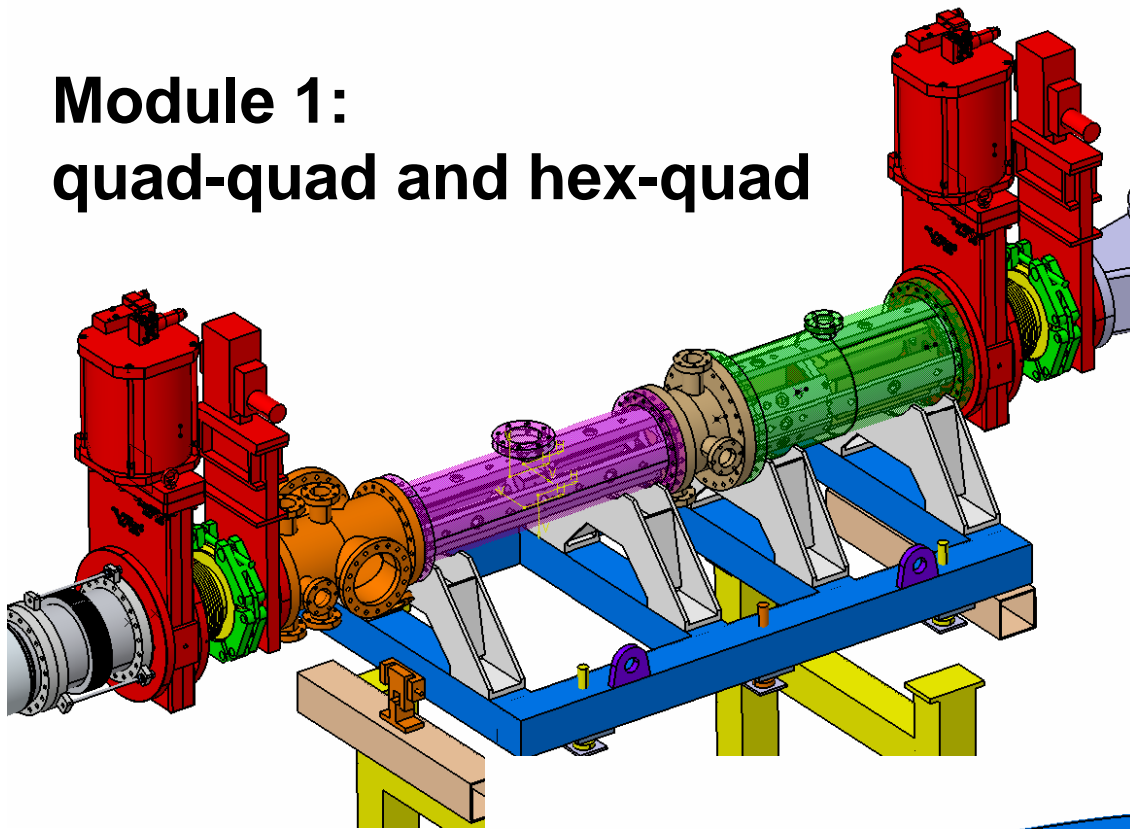
77% transmission,  
1.4% cross-contamination

Laurent Serani

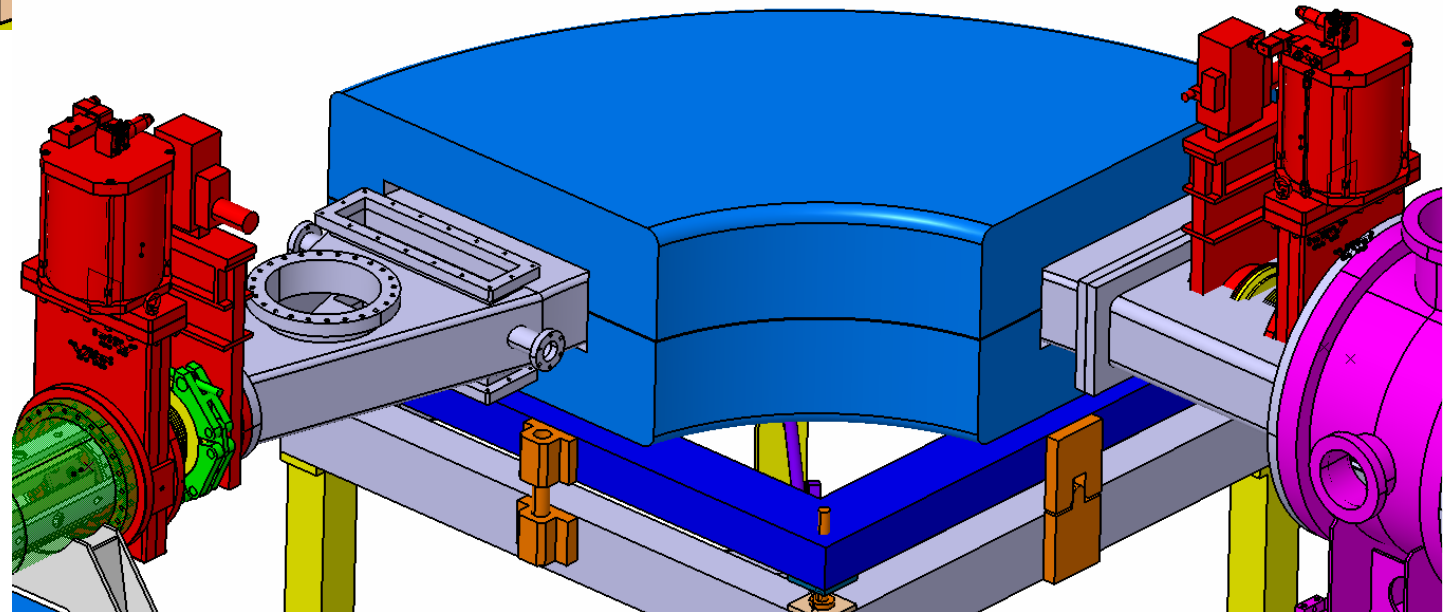
# Status of the project



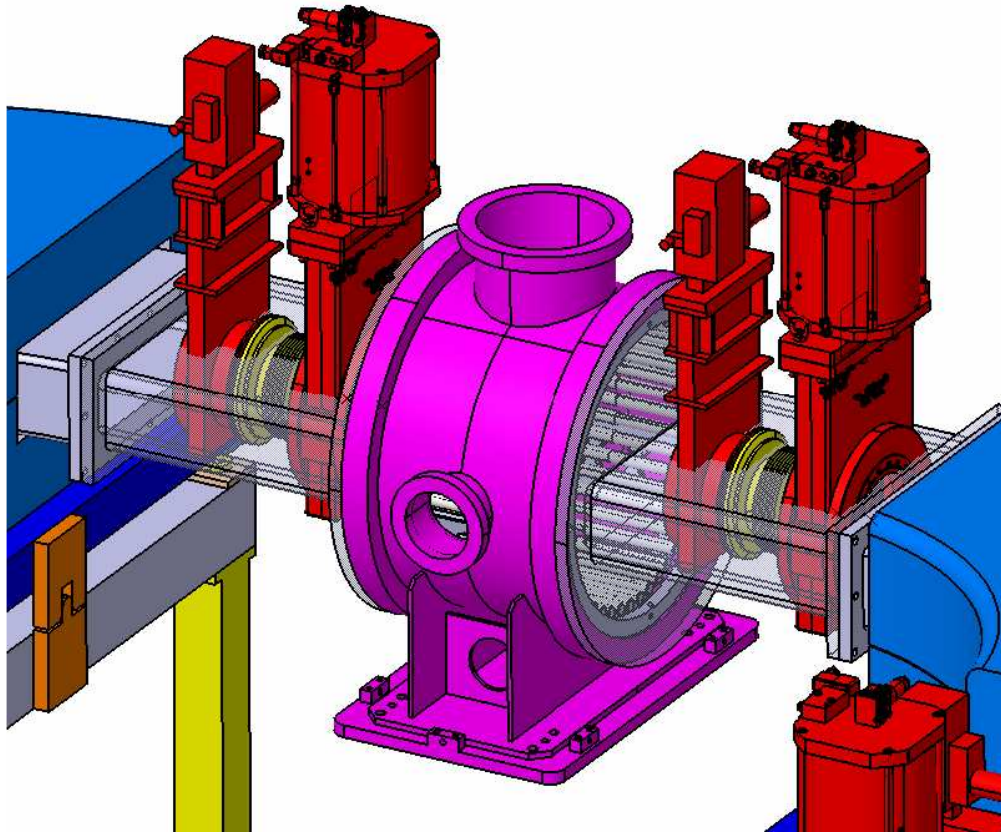
# Module 1: quad-quad and hex-quad



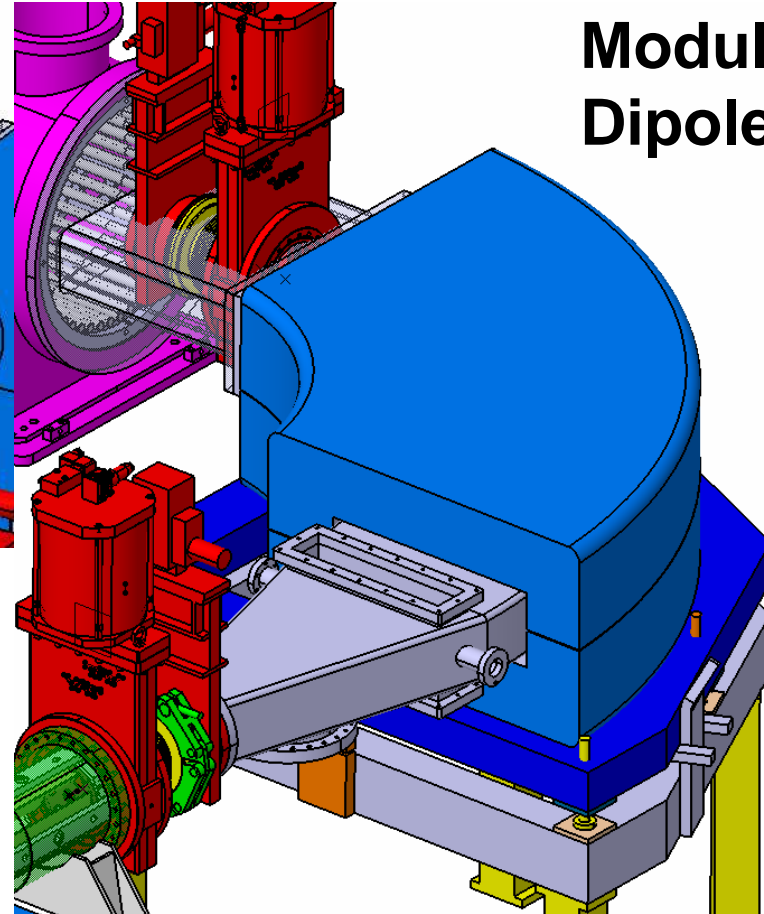
# Module 2: Dipole 1



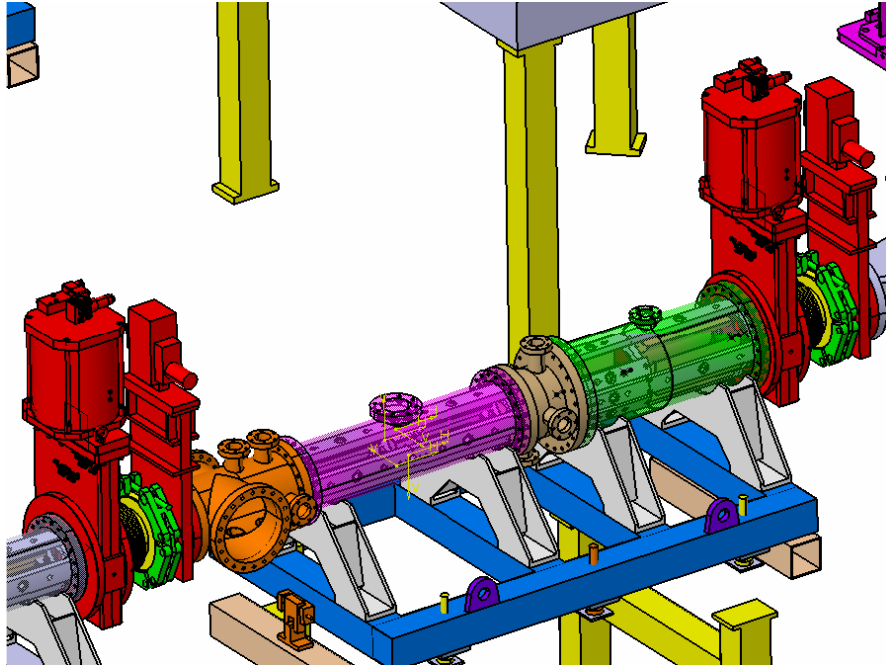
## Module 3: multipole



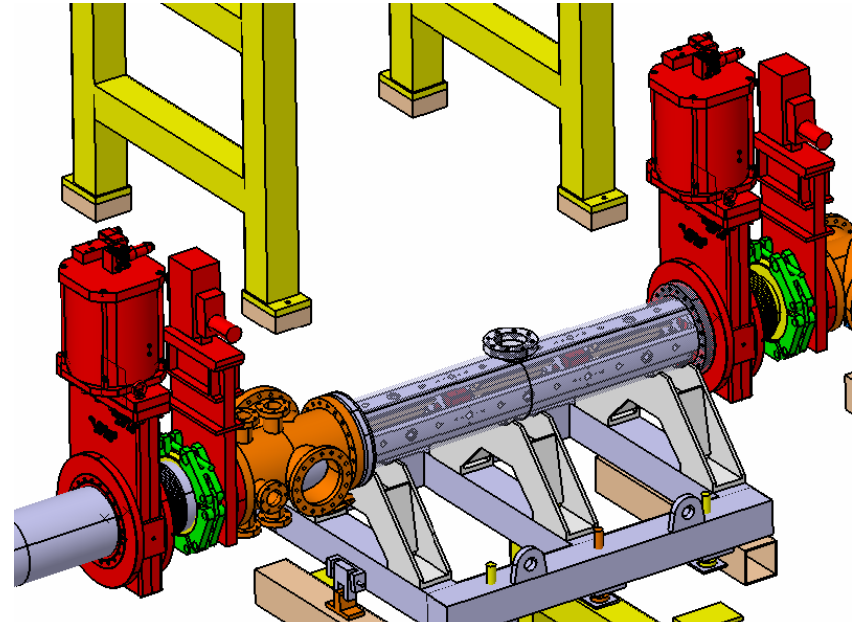
## Module 4: Dipole 2



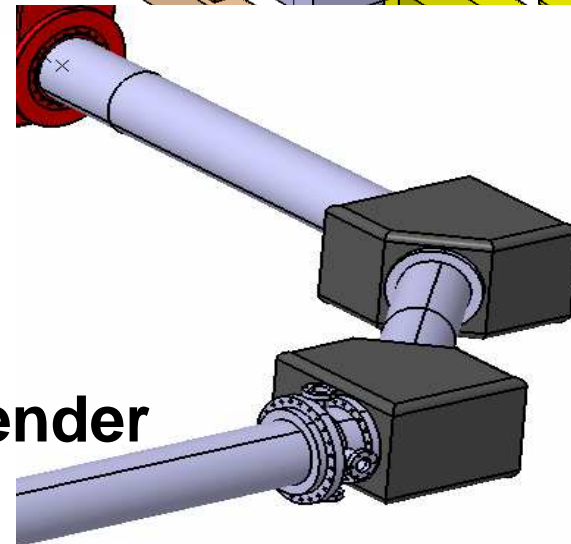
## Module 5: quad-quad and hex-quad



## Module 6: triplet

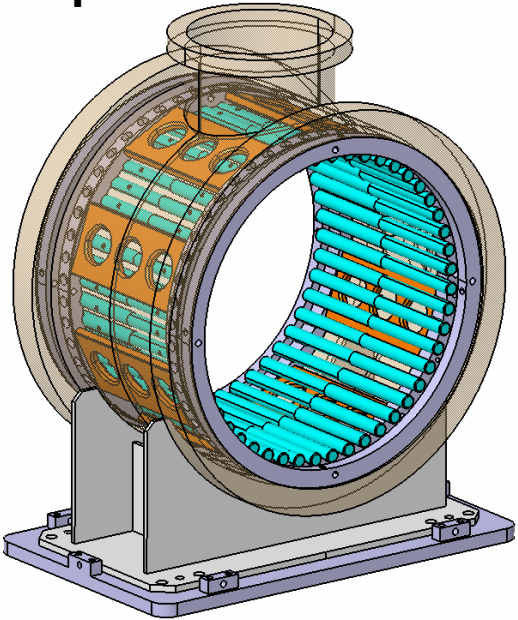


## Module 7: Electrical Bender

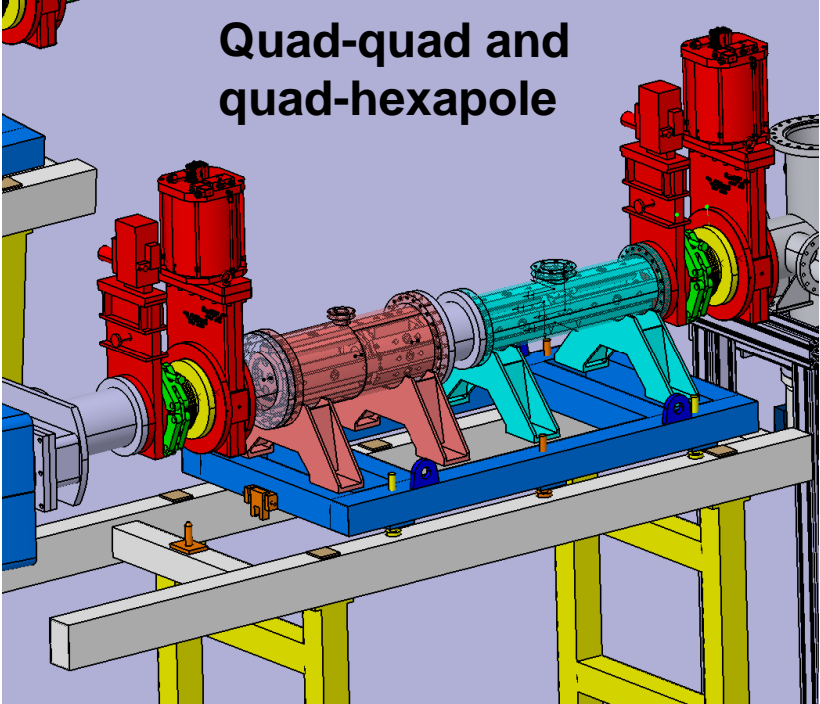


# HRS parts

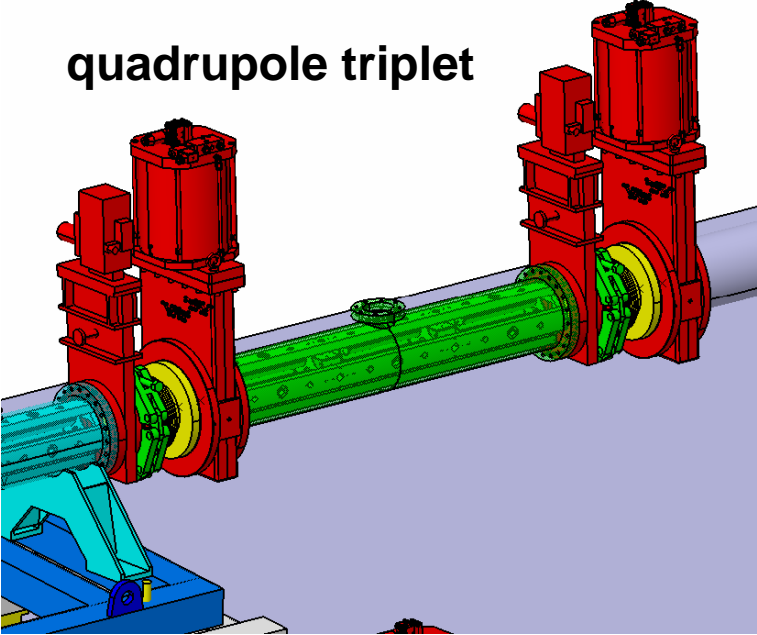
multipole



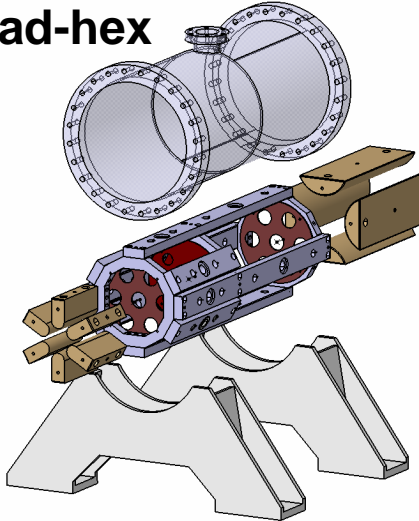
Quad-quad and quad-hexapole



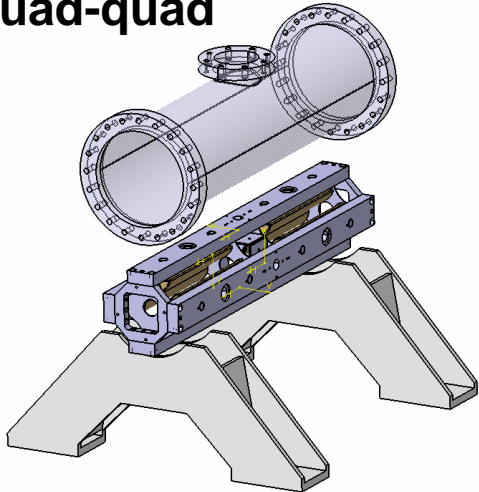
quadrupole triplet



quad-hex



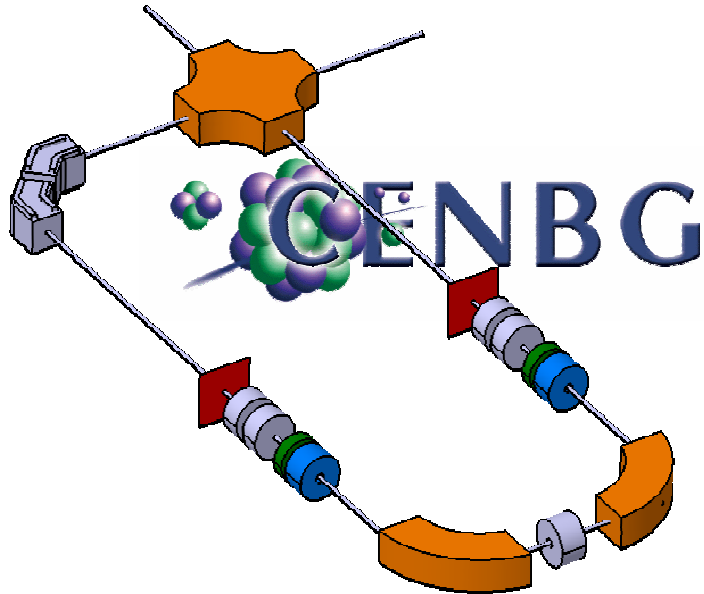
quad-quad



# Status of the project

- ❖ **Global optical design finished, to be checked with mechanical and magnetical design**
- ❖ **Magnetic design of dipoles on the way (M. Duval, GANIL)**
- ❖ **Mechanical design and integration done presently (F. Delalee)**
- ❖ **For the end of the year: « cahier de charge » for dipole magnets**
- ❖ **Detailed drawings of all elements for end 2010**
- ❖ **Ordering of dipoles in 2011 → financing needed**
- ❖ **Manufacturing of other elements at CENBG**
- ❖ **Installation at CENBG during 2013**
- ❖ **Transfer to GANIL 2014**

# DESIR-HRS working group @CENBG

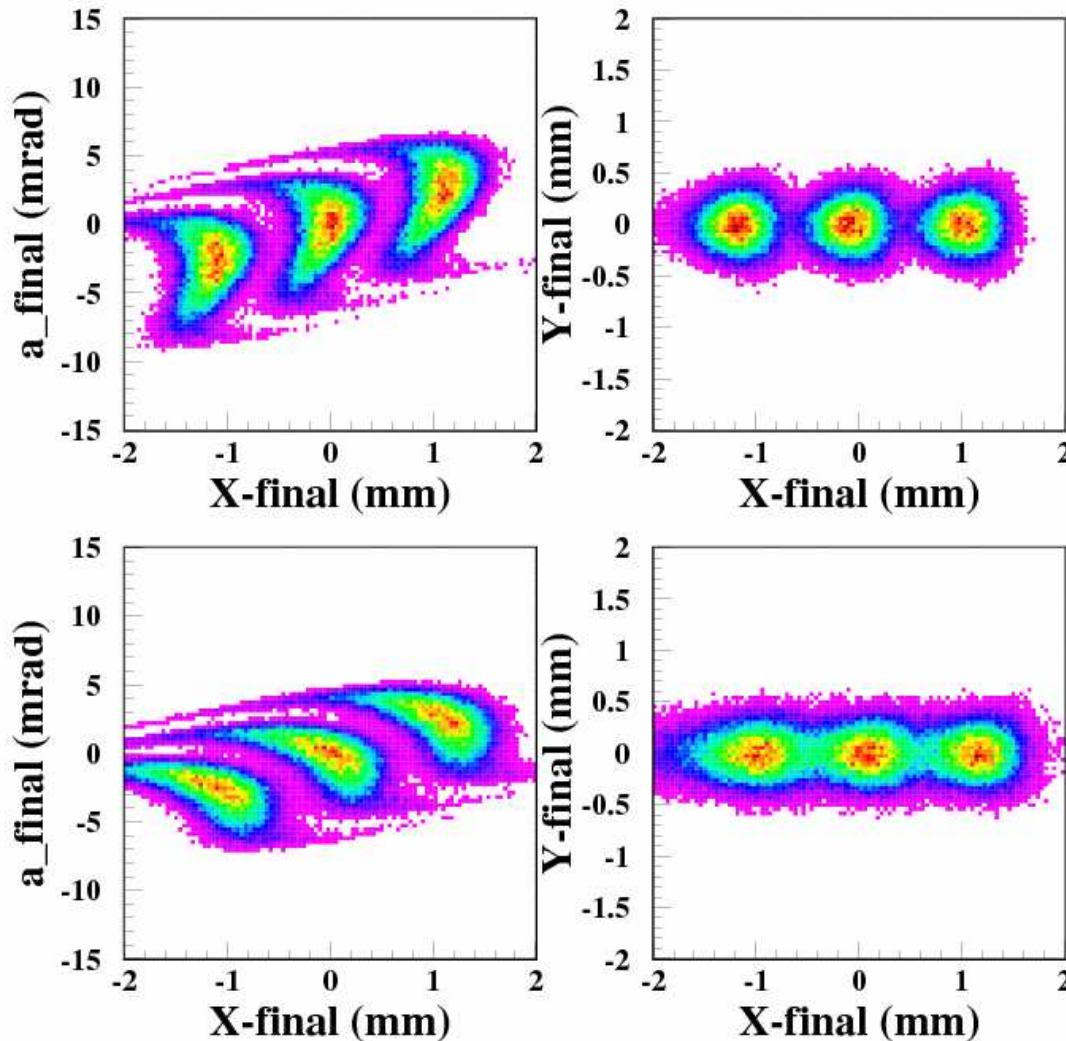


- ✓ Blank, Bertram
- ✓ Delalee, Franck
- ✓ Kurtukian-Nieto, Teresa
- ✓ Serani, Laurent



**Backup slides**

# 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  $m/\Delta m$  is reduced to  $\sim 11000$