

# Status of the ELENA extraction and Transfer lines

ADUC meeting  
Wolfgang Bartmann & Glenn Vanbavinckhove

# Table of contents

- Rotation and extraction optimization
- Source switch
- Current layout
- ELENA transfer lines
- Electro-static quadrupoles/bends
- ALPHA via ATRAP?

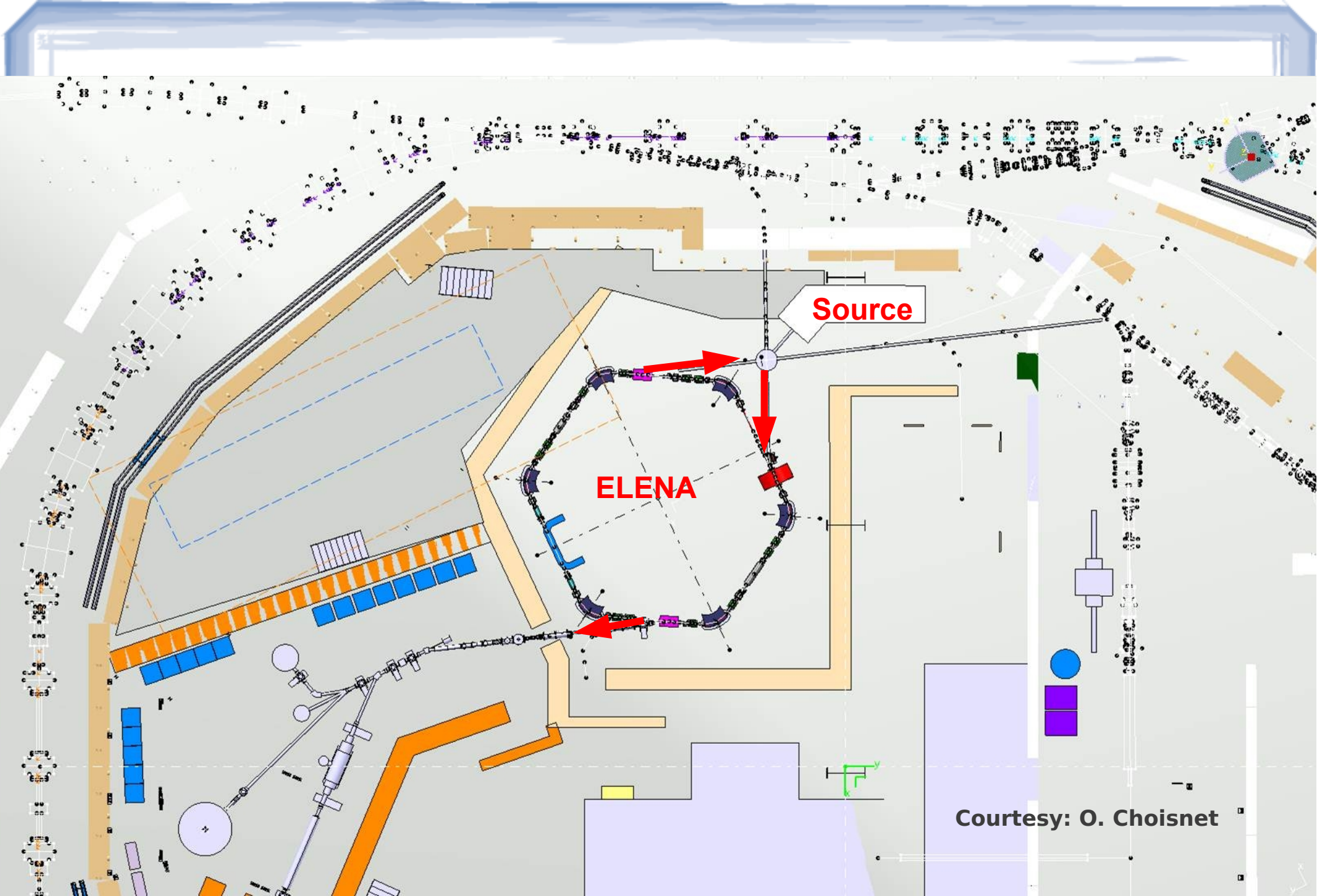
# Table of contents

- FODO CELL
- A typical line for ELENA
- Aperture
- GBAR
- Optics for the source
- Power converters
- Conclusions & outlook

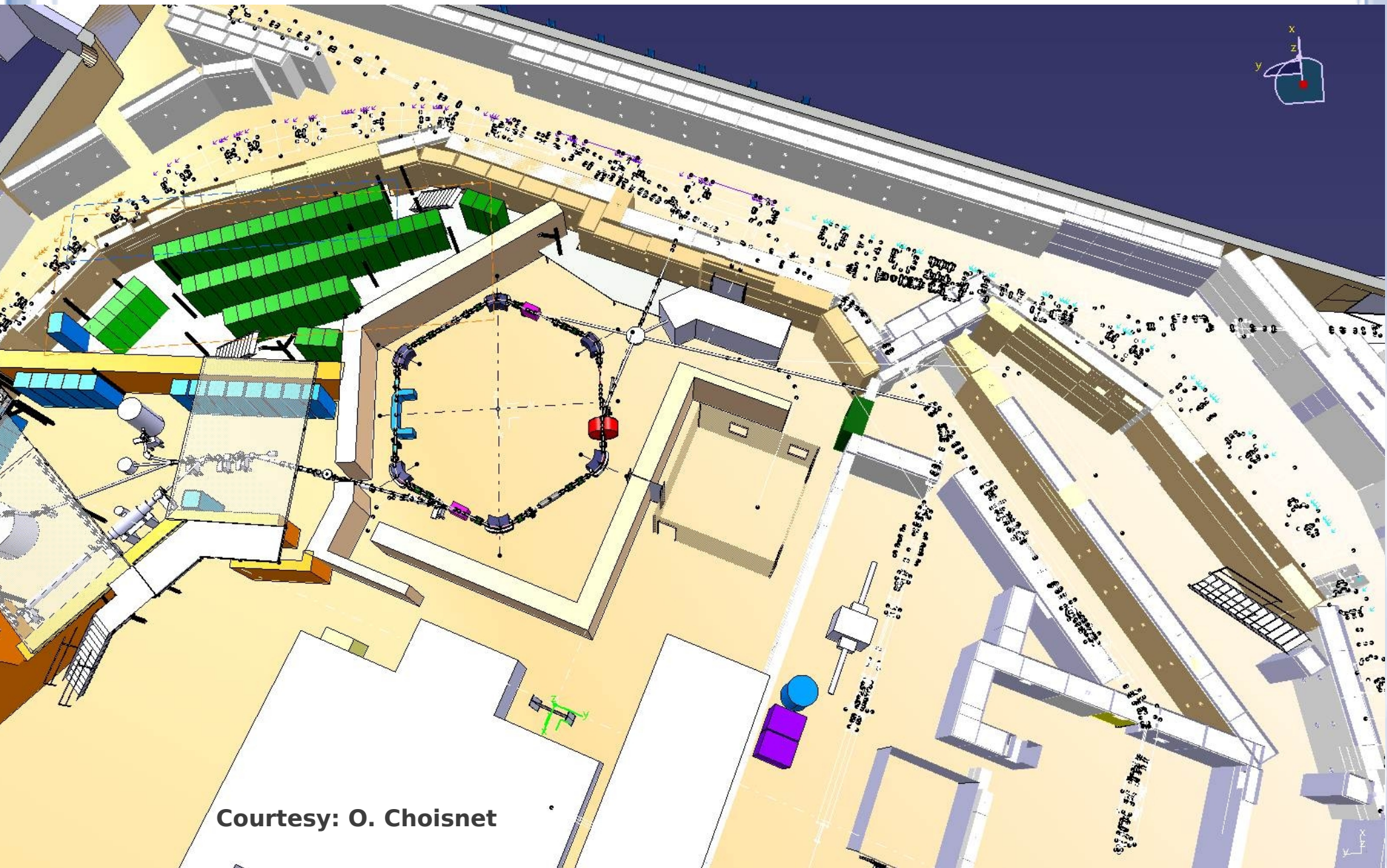
# Rotation and extraction optimization

- Reason:
  - Standardization of the needed bending angles
  - Avoiding possible integration problems
- Variables:

Bend	mrاد	degrees	Fast switch
EXTRACTION N	200	11.5	yes
EXTRACTION S	200	11.5	yes
ASACUSA1	835	47.8	yes
ASACUSA2	835	47.8	no
ATRAP	805	46.1	no
ALPHA	865	49.6	no
AEGIS1	220	12.6	yes
AEGIS2	1020	58.4	No



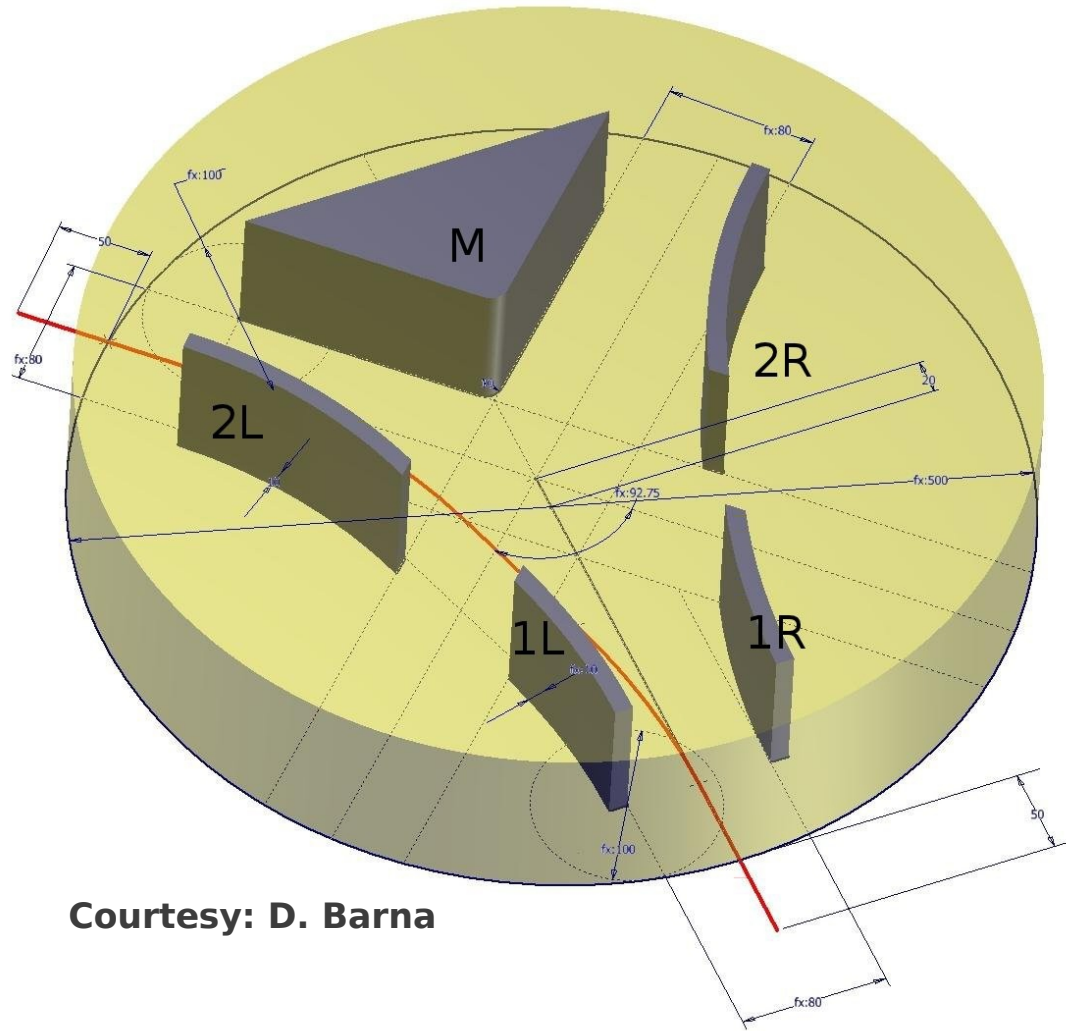




Courtesy: O. Choisnet

Wolfgang Bartmann & Glenn Vanbavinckhove

# Source switch

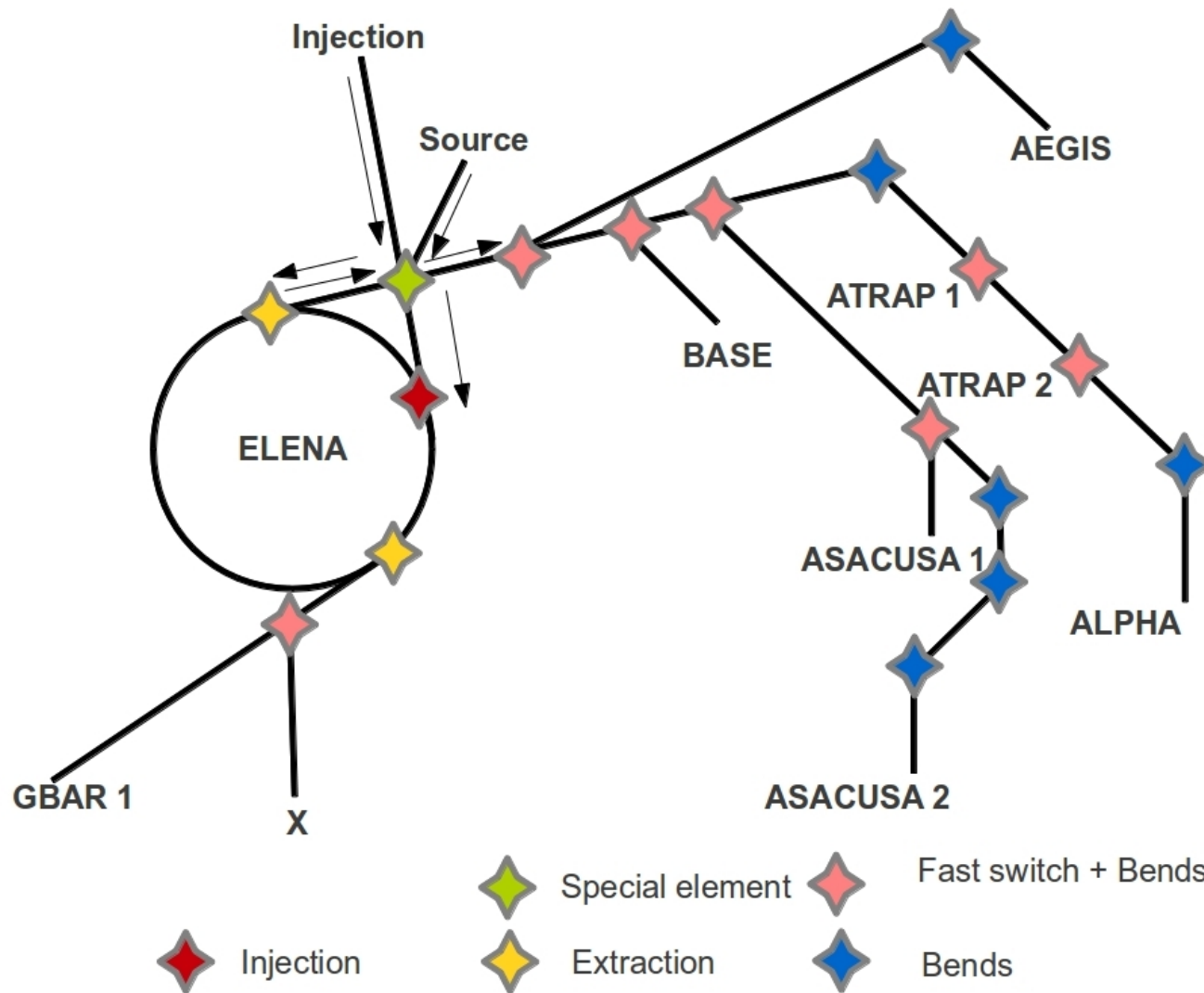


Courtesy: D. Barna

ADUC meeting  
Wolfgang Bartmann & Glenn Vanbavinckhove



# Current layout



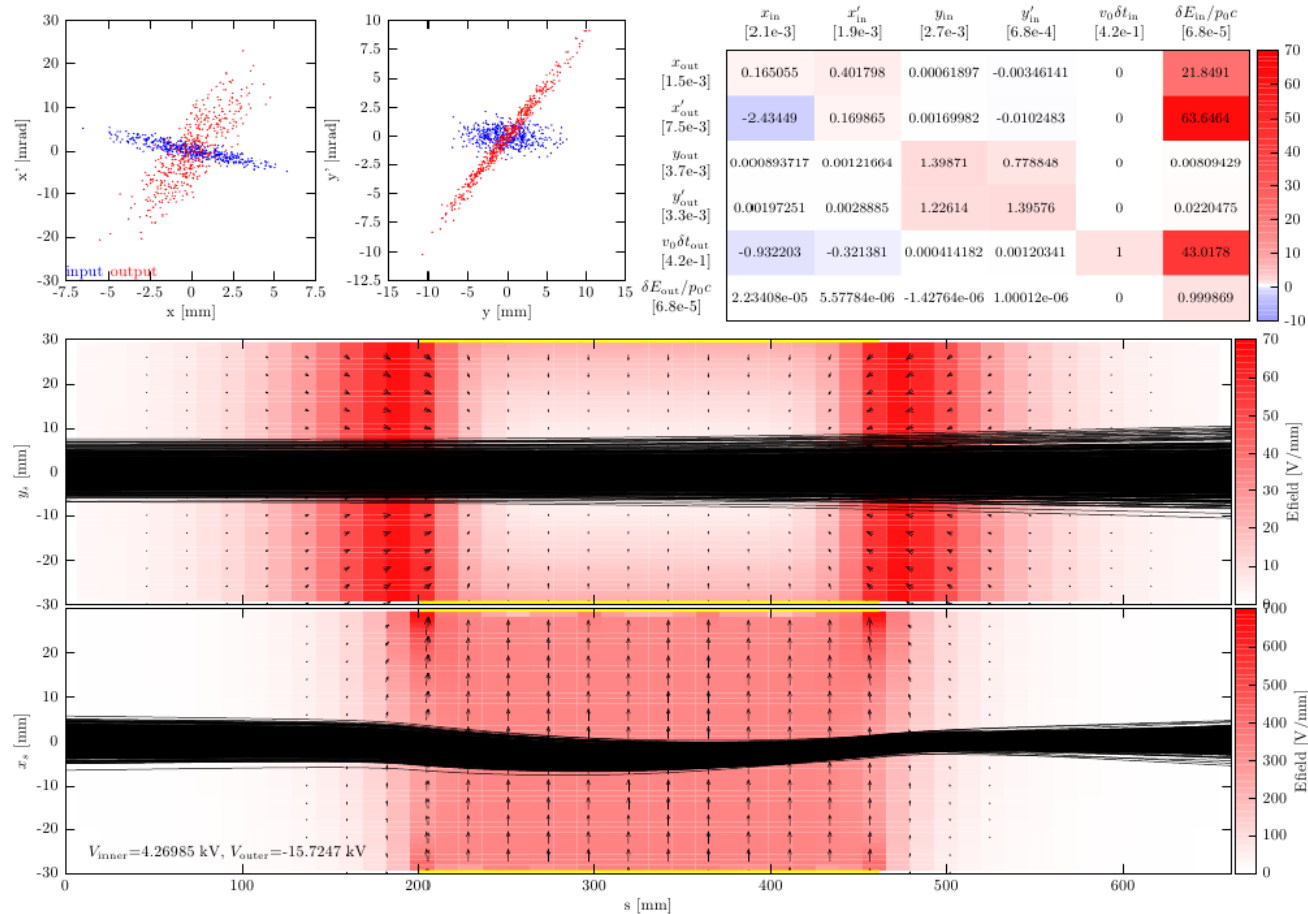
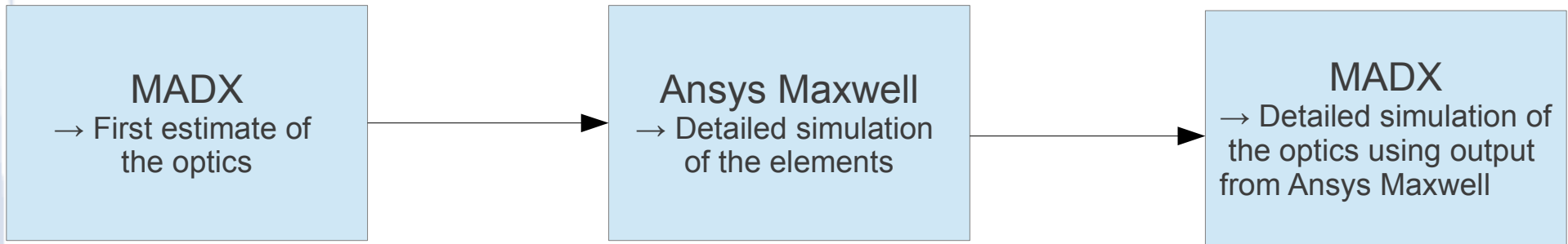
ADUC meeting  
Wolfgang Bartmann & Glenn Vanbavinckhove



# The ELENA transfer lines

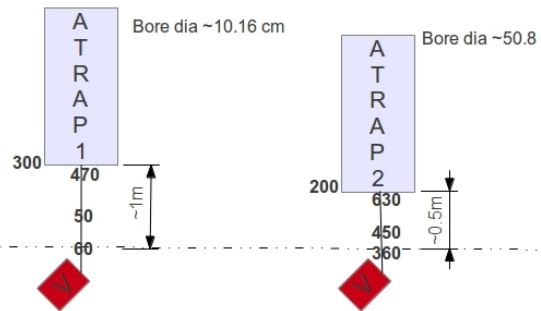
- 9 experiments (2-3 vertically)
- 2 extraction points
- About 110 m of transfer lines
- 9 fast switches (2 at extraction + 7 for experiments)
- Bends (bend angle range  $50^{\circ}$ - $80^{\circ}$ )
- About 12 m for Pbar and H-

# Electro-static quadrupoles/bends

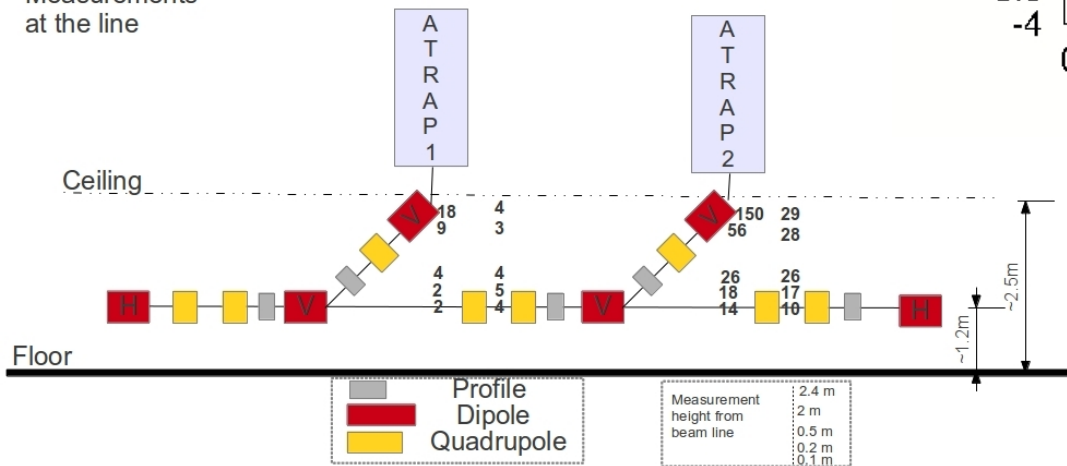


# ALPHA via ATRAP ?

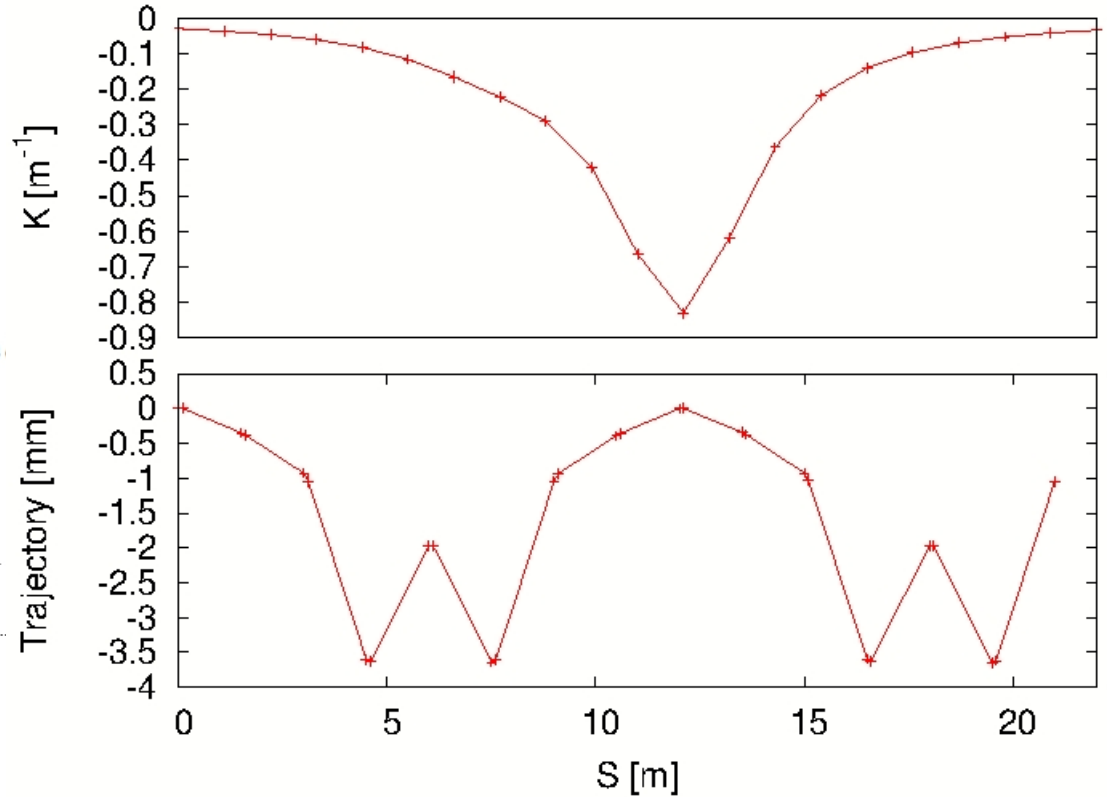
Measurements at the experiments



Measurements at the line



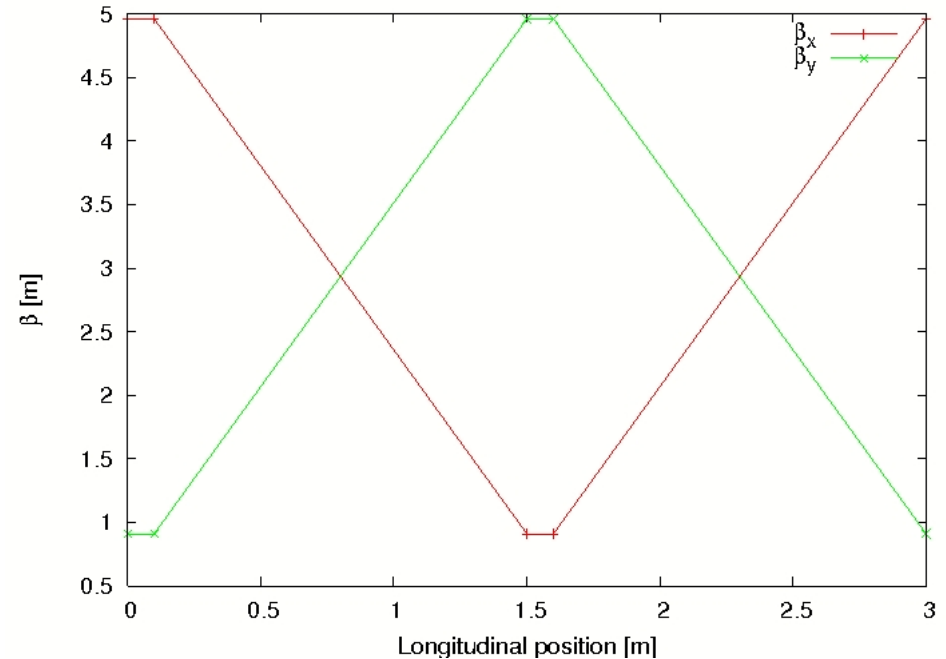
Measurements conducted together with: M. Buzio



- Should be fine
- Correctors should do the work

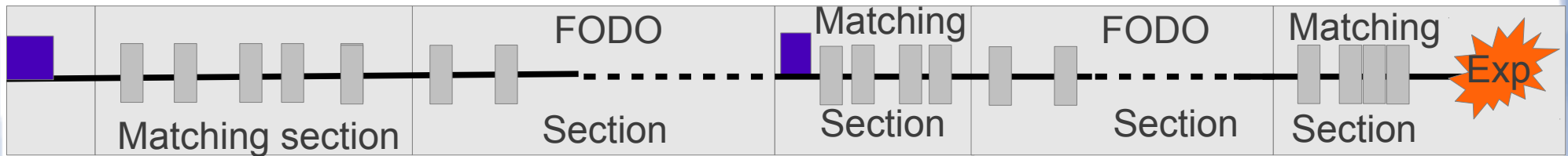
# FODO cell

- Voltage= 1735 V
- Drift space 1.4 m
- Phase advance per cell:  $90^\circ$
- Dispersion will be defined in the matching sections (<10m)

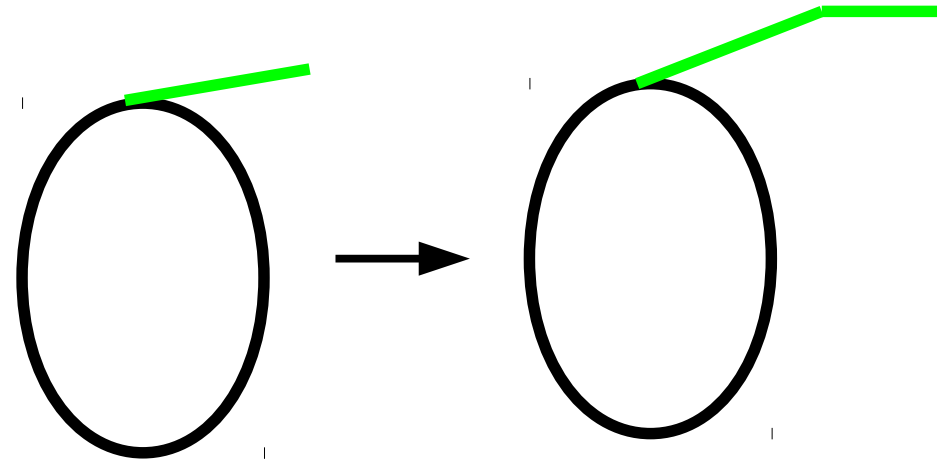
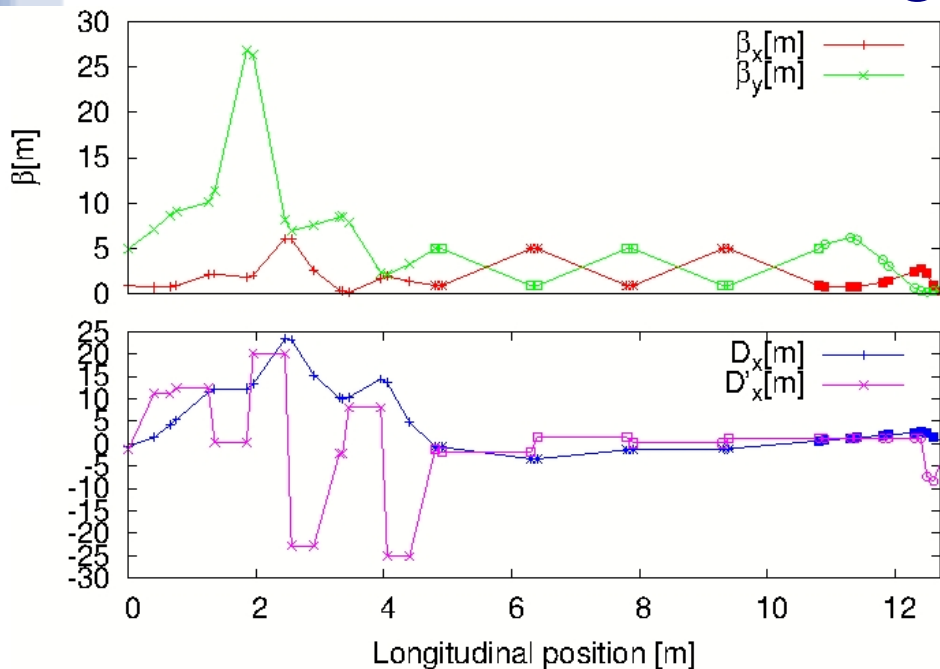




# A typical line for ELENA



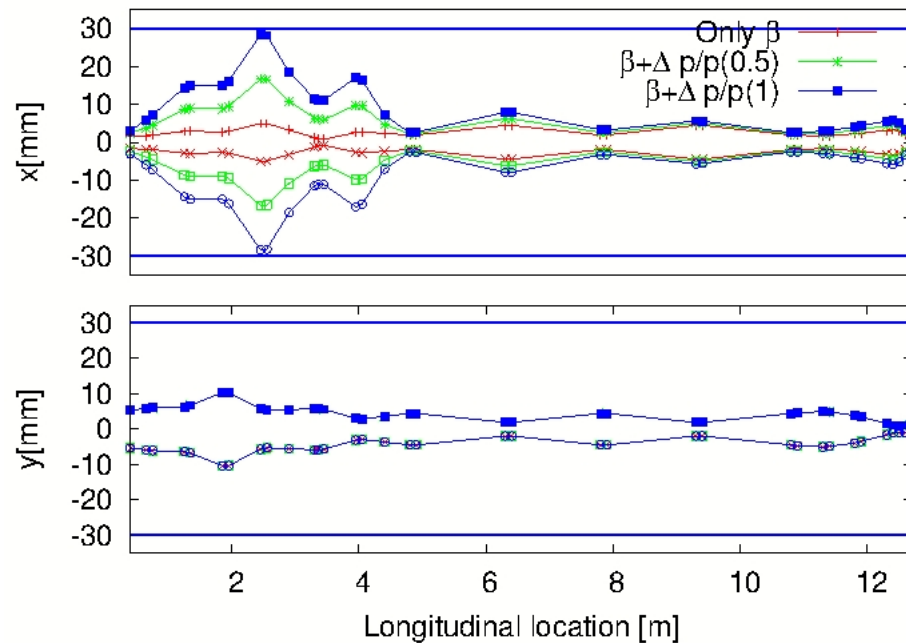
- Dispersion difficult to control at extractions
- At other locations achromats will be used.
- Total of 14 matching sections



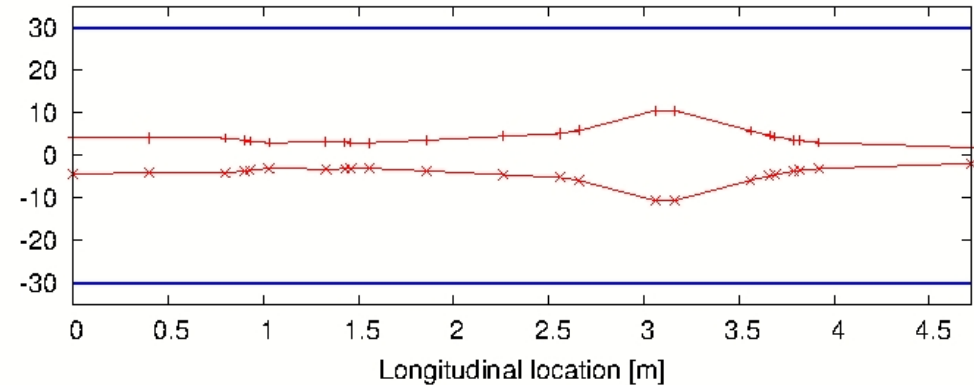
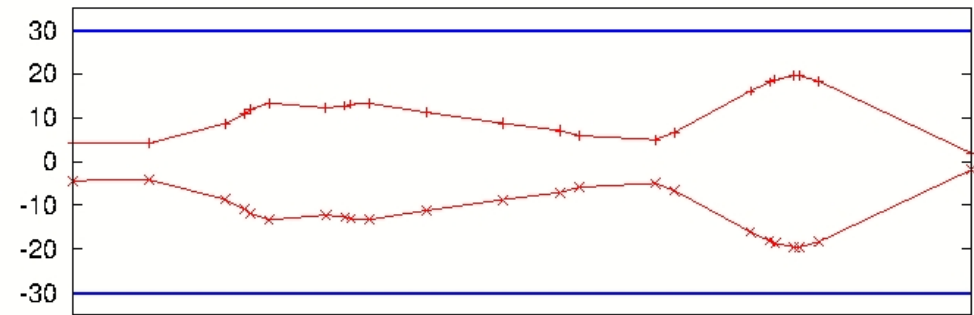
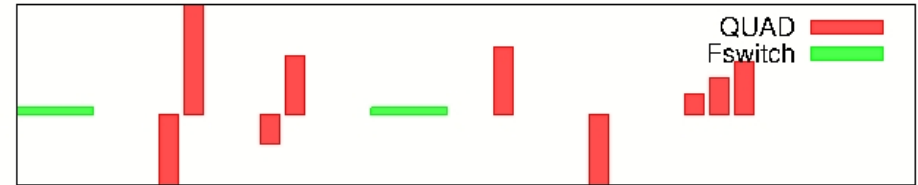
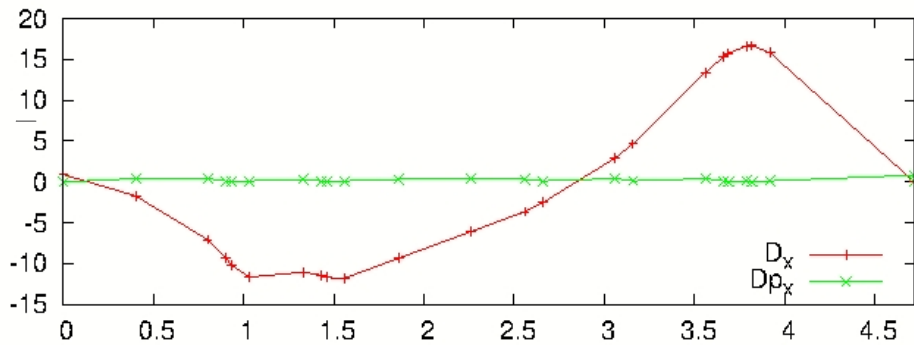
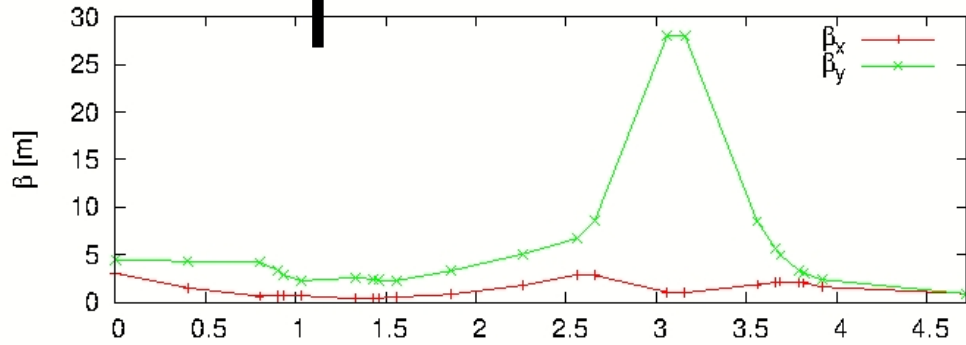
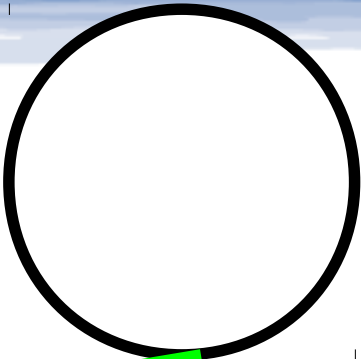
ADUC meeting  
Iann & Glenn Vanbavinckhove

# It's all about aperture

- How do we define aperture:  $\sigma_{x,y} = \sqrt{\epsilon \beta_{x,y}} + \frac{\Delta p}{p} D_{x,y}$
- Horizontal and vertical  $\epsilon$  of 4
- Momentum offset of  $10^{-3}$



# GBAR

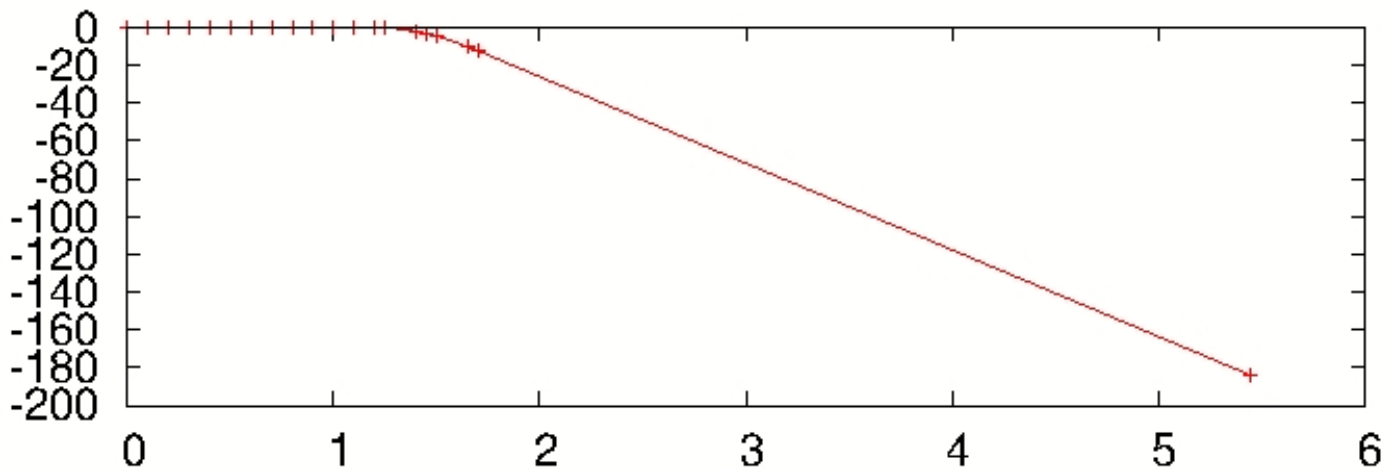
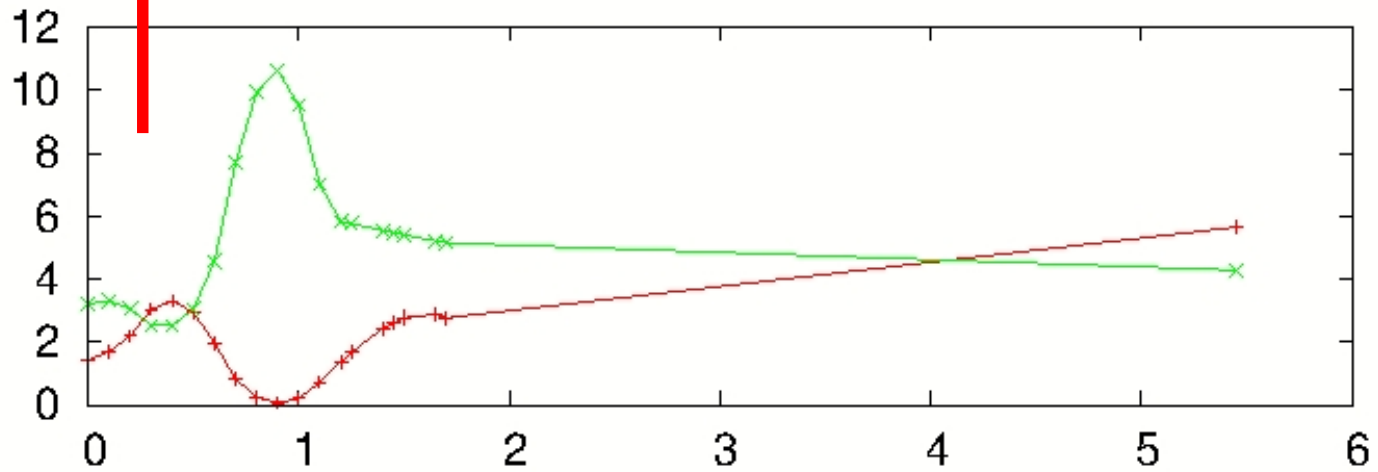
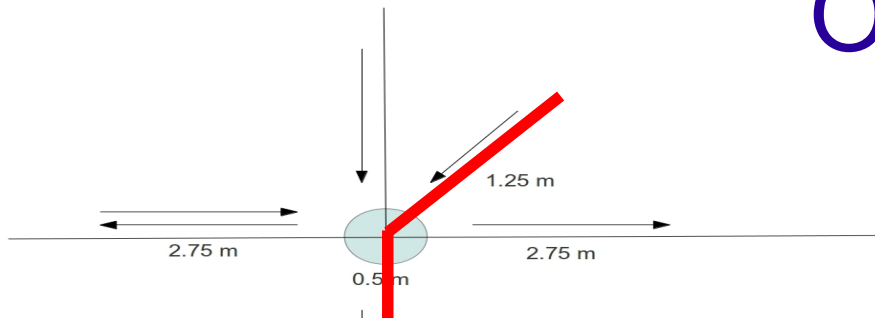


$\sigma_x$	1.89 mm
$\sigma_y$	1.88 mm

ADUC meeting  
Wolfgang Bartmann & Glenn Vanbavinckhove

# Optics design source

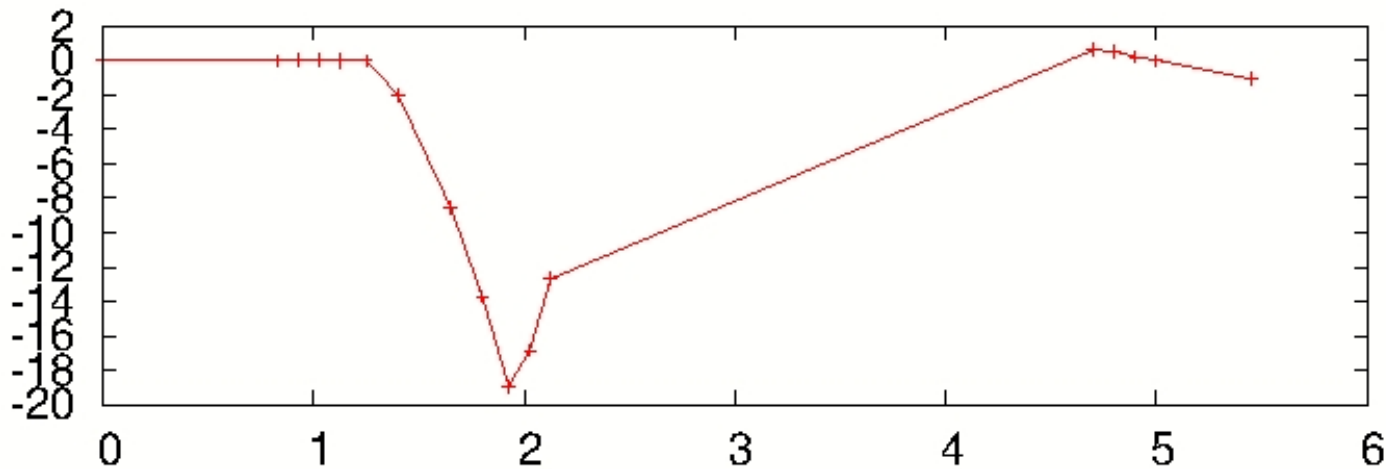
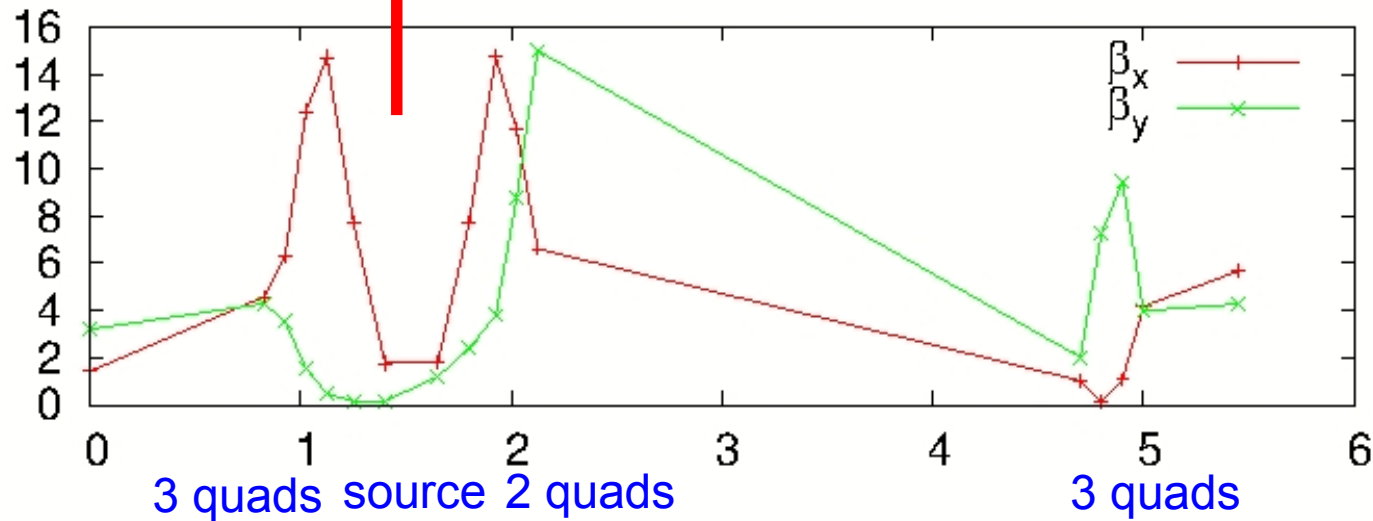
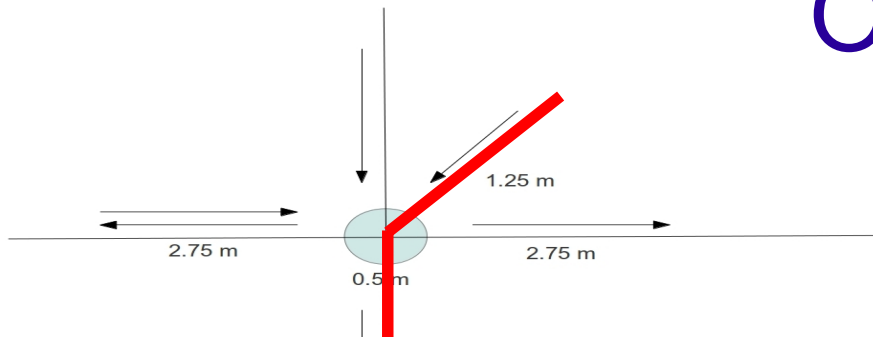
Source to injection  
(No quadrupoles in the injection line)





# Optics design source

Source to injection  
(With quadrupoles in the injection line)



# Power converters (preliminary)

- Orbit correctors ( $n \sim 60, L \sim 10 \text{ cm}, D = 60 \text{ mm}$ ):
  - $\sim 30$  orbit correctors in the FODO cells ( $\sim 15$  per plane).
  - $\sim 48$  orbit correctors in the matching and triplet sections ( $\sim 24$  per plane).
- Quadrupoles ( $n \sim 79, L = 10 \text{ cm}, D = 60 \text{ mm}$ ):
  - $\sim 30$  quadrupoles at a Voltage of  $\sim 1700 \text{ V}$ .
  - $\sim 24$  quadrupoles for the matching sections ( Voltage range between  $400 \text{ V}$  and  $5000 \text{ V}$ ).
  - $\sim 9$  triplet assemblies ( Voltage range between  $800 \text{ V}$  and  $8000 \text{ V}$ ).
  - $\sim 5$  (magnetic?) quadrupoles at the injection line

# Conclusions & outlook

- Location of source and ring is fixed:
  - Detailed design of the lines is started
  - Error and alignment studies as soon as optics design is finished → will define alignment tolerances
- ALPHA can go underneath ATRAP
- Dispersion is hard to control, specially at the extraction points.
- Extra (magnetic ?) quadrupoles are needed in the injection line
- First estimate of number of elements in the lines

ADUC meeting

Wolfgang Bartmann & Glenn Vanbavinckhove

# Conclusions & outlook

- Open issues – next steps:
  - Check extraction clearance
  - AEGIS/BASE position
  - HW design of bends, quadrupoles, steerers and switches