

# Alignment CR

## GSI Survey & Alignment (s&a) point of view:

- Current state of knowledge concerning CR
- S&A @GSI: typical way of working - alignment strategy – basic steps
- Questions, requirements

# Current state of knowledge concerning CR

administrative:

? (not yet fixed)

technical:


?

?

?

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**BINP DS 2.5.2 installation concept of CR**

This document describes the concept of delivery, unloading and placement of equipment and CR elements in building G007. Also, the requirements for device and tools, the requirements for the number of personnel and their qualifications are described.

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<b>Detailed Specification CR installation</b>
This document describes the basic idea of organizing the delivery, storage of CR components, the CR assembly plan and the equipment used.
GSI MIN Department
Project FAIR@GSI

## S&A @GSI: typical way of working - alignment strategy – basic steps

- Strong interaction with magnet designer, mechanical designer, ... to reach alignment ability (optimised to accuracy – time – costs)
- Fiducialisation of nc / sc magnets, chambers, special devices that need alignment to tight tolerances (1/10mm range)
- Basic 3D point network in the tunnel to establish a blue line (markings on the floor, wall)
- Pre-alignment is done by the assembly/installation team based on blue line
- High precise 3D reference network / mapping components as the basis for the precise alignment
- Precise component alignment
- Quality control measurement, 2nd alignment if needed
  
- *Component alignment (screwing...) is only done with the help of assembly team, measurement team provides only deviation to be aligned.*
  
- *Due to its limited number of team members and the number of different workpackages for FAIR, GSI S&A team will not execute the measurements personally, but will supervise external service providers*

## Questions, requirements:

- Required alignment tolerances for different kind of machine components in the tunnel (dipoles, quadrupoles, sextupoles, diagnostic chambers, specials...)?
- Shape, number, position of fiducials on the components?
- References on components for lifelong secure existence: surfaces, pin holes, grooves, ...? Auxiliary devices for pre-alignment?
- Fiducialisation procedure @BINP ?
- Data of magnetic axis and mechanical axis known w.r.t. fiducial points? Coming from BINP?
- Fiducial point coordinates in magnet coordinate system and CR machine coordinate system? Coming from BINP?
- Alignment feet: Same type for all? Shape, number per comp.,? how to use? written directions for use existing? ...
- Reference network @CR tunnel: Simulation with results coming from BINP? Planning of possible line-of-sights coming from BINP?
- ...
- ...
- ...

⇒ Needed to do a reliable estimation of needed time, equipment, personal, costs !

## Special requirements from BINP due to their technical solution for installation in the tunnel:

- asked for continuous company of alignment team with laser tracker during installation
  - not needed @accuracy of ~1-2mm
- possible solutions:
  - trained installation team with level, plumb-line and template
  - trained installation team with totalstation
  - ...

*arose during the discussion :*

*not the magnets (like supposed at first), but the vacuum flanges should be aligned to each other with +/- 0.5 mm precision during the installation of the machine, so that the welding method works (magnet yokes can be pre-aligned with some mm). This means that a relative alignment of 0.5mm between two adjacent flanges is required, but not an absolute accuracy of the vacuum system of 0.5mm in relation to the blueline and thus to the ion-optical layout. This accompanying of the installation work is therefore not a classic task of alignment (=high-precision positioning of the accelerator components in relation to the overall 3D machine coordinate system), but part of the assembling of the system.*