

halo collimators in the beam line from SIS100 to CBM/Hades

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FAIR Experiments and Accelerators

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Introduction

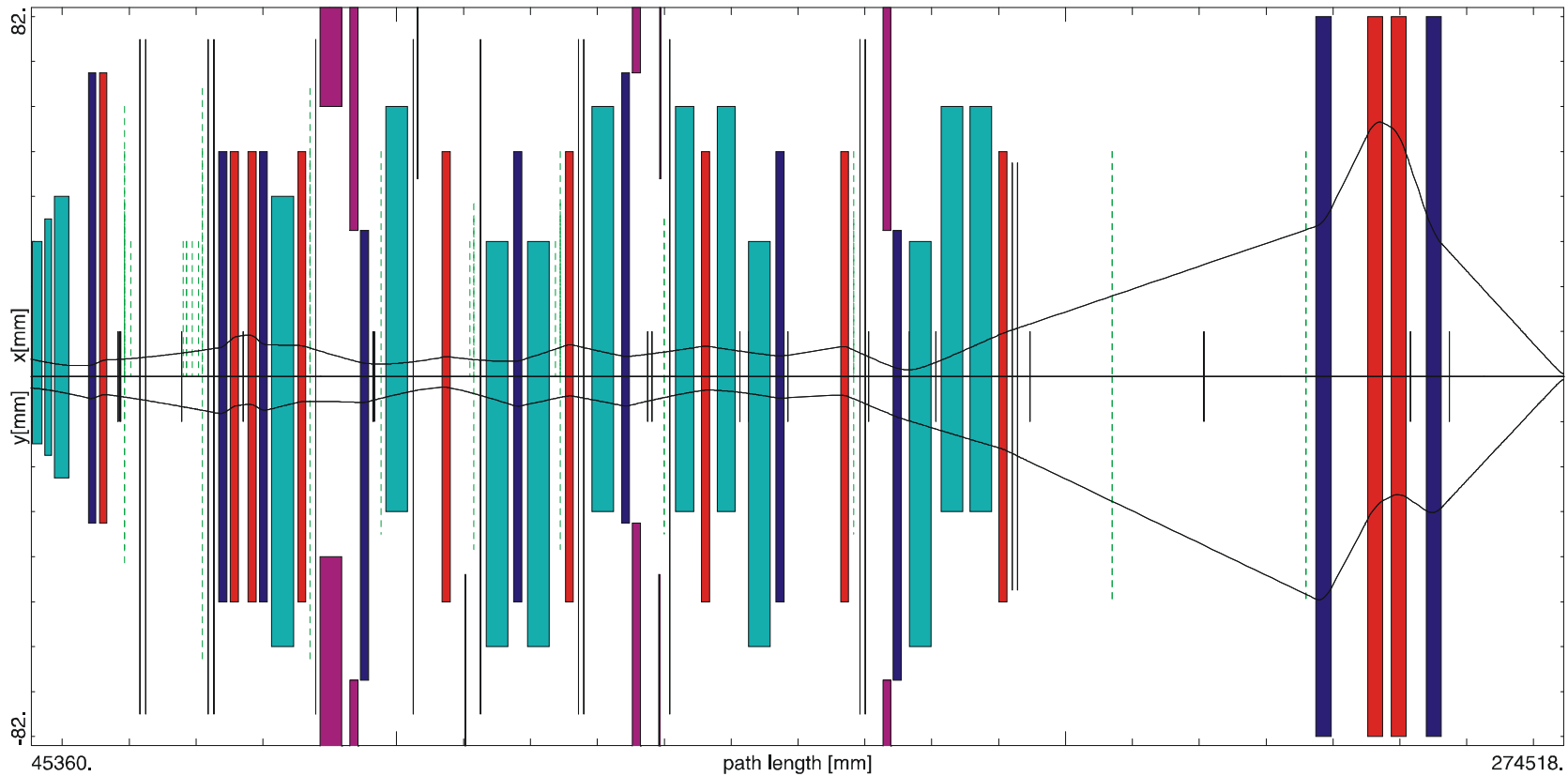
- a halo collimation system
 - is (only) foreseen in the beam line from SIS100 to CBM/Hades
- sources (and existence) of halo in the beam coming from SIS100 are largely unknown.
- halo builds up slowly
 - the beam line itself is not considered to be a source of halo at the experiment
- halo collimators will be a source of halo
 - primaries with reduced energy and secondaries must be sorted out by at least one dipole behind the collimator

Requirements

- few percent of energy loss for halo particles
 - collimator length expected to be only few centimetres
- collimators must be (slowly) movable
- collimation in horizontal and vertical phase space (angle and position each)
 - in total four collimators with eight collimator jaws at different positions
- request for collimators came late during development of FAIR beam lines
 - last part of beam line to CBM is straight
 - not many empty spaces left

SIS100-CBM

horizontal and vertical beam widths



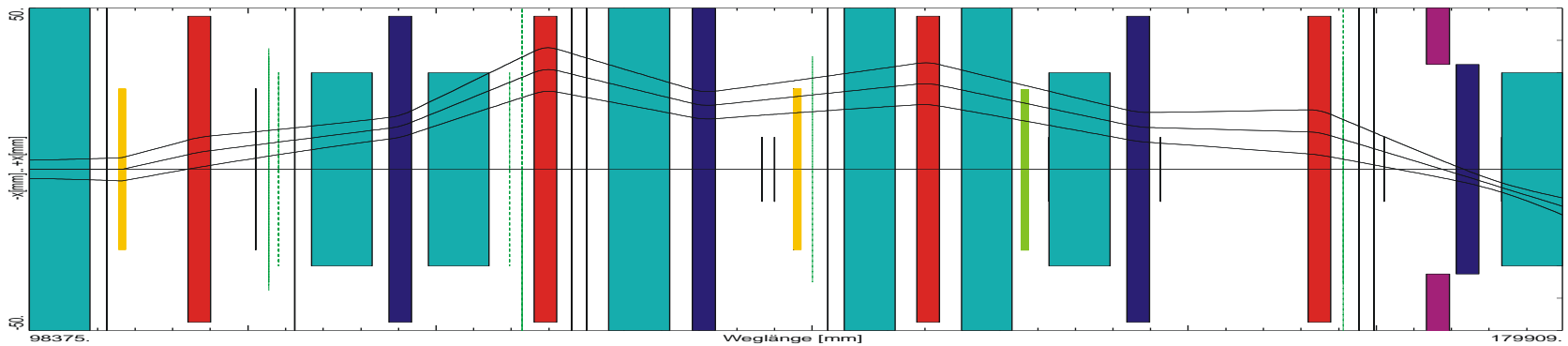
shared with other
beams

area where collimation
is possible

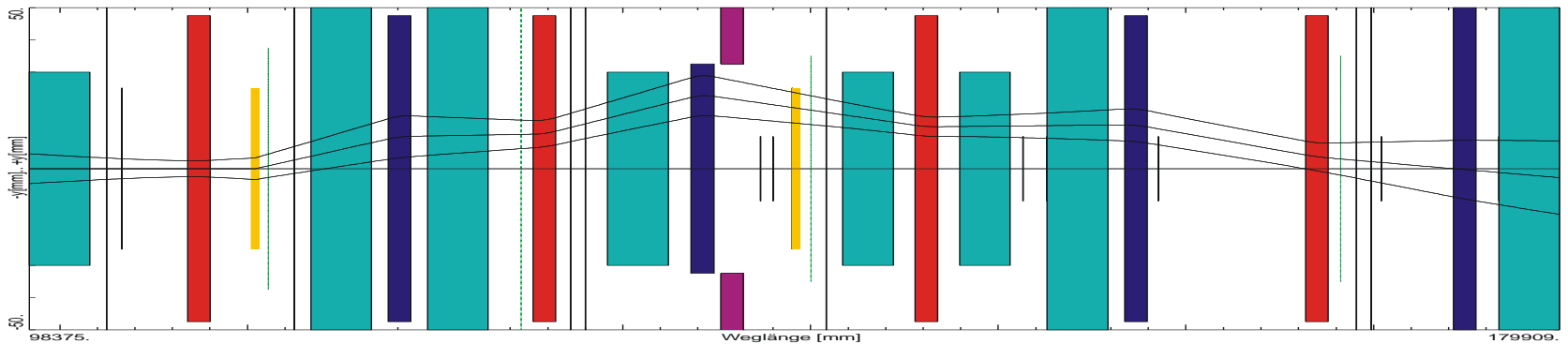
no dipoles left in front of target

Determine suitable positions for the four collimators

- Kick the beam at the position of the first collimator and place second collimator where the kick has transformed into (maximum) position offset

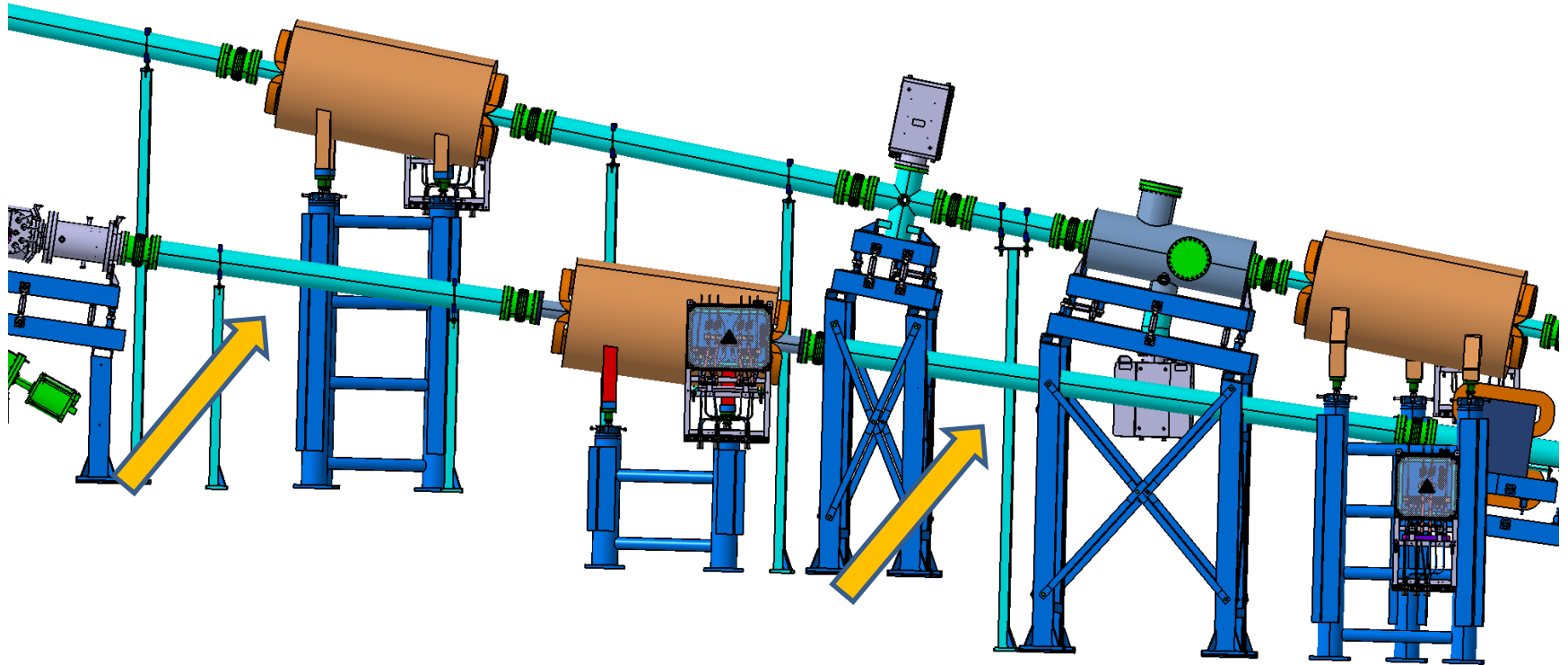


horizontal



vertical

Side view of positions where the first two collimators are to be installed

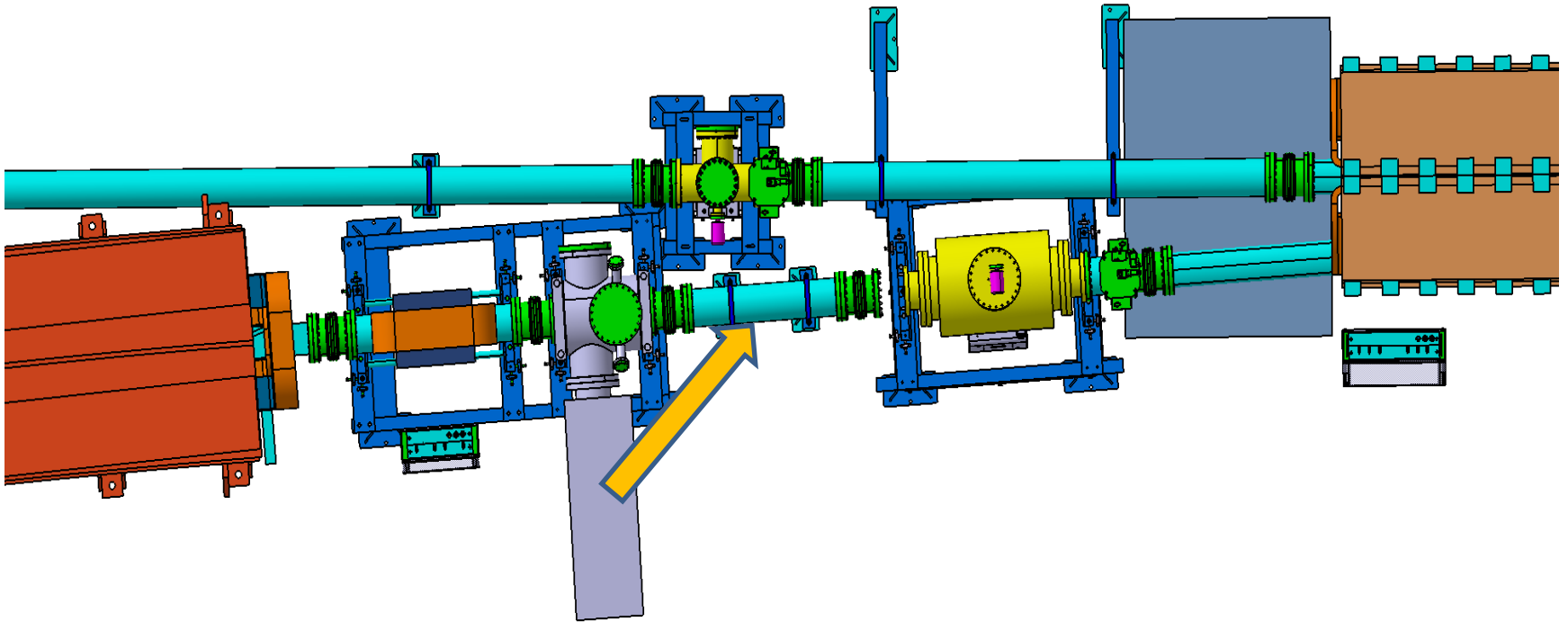


0.0533

Note that beam goes from right to left

Upper beam line goes to ground level, lower beam line goes to CBM/Hades

Top view of position where the second two collimators are to be installed



Beam goes from left to right

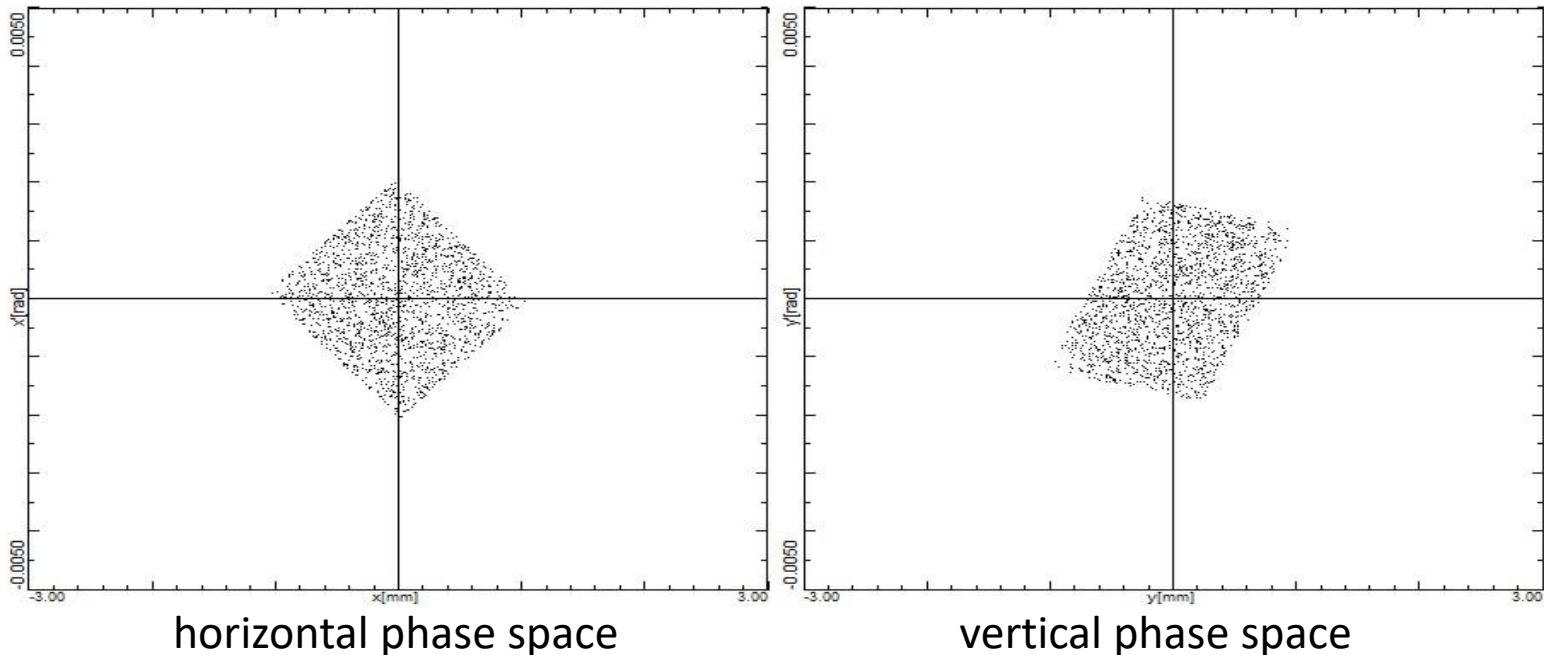
Upper beam line goes to ground level, lower beam line goes to CBM/Hades

What happens behind the collimators?

- behind the last collimator the beam is
 - transported another 122.5m
 - deflected by 12.2°
 - vertically offset by 1.4m
- three metres of concrete in front of CBM cave
 - shield the cave from radiation in beam tunnel (and vice versa)
- → no background from collimators will come through

Effect of collimation as seen at CBM target

no collimator is imaged onto the target, but collimators produce sufficiently different cuts



Pictures only show the principle of halo collimation
It is not planned to cut off more than 2% of the total beam

Status of technical layout and realization

- halo collimators will be technically easy
 - only few ($\leq 2\%$ of total beam) particles impinging at any time
 - no fast moving required
 - not heavy (small short blocks of steel or other metal)
 - standard step motor drives will be used
- beam diffusors and beam stripper (next talk) are more involved and currently have priority

but

- halo collimators are expected to be ready in time with the rest of the beam line

Summary

- existence of detrimental halo not clear
- if halo exists, the collimators will remove it
- collimators shall not remove more than 2% of total beam
 - mandatory from radiation protection point of view
 - may not be used to reduce the emittance of the beam which comes from SIS100
- halo collimators will be ready together with the rest of the beam line