Review on shorter PSB main bending magnets

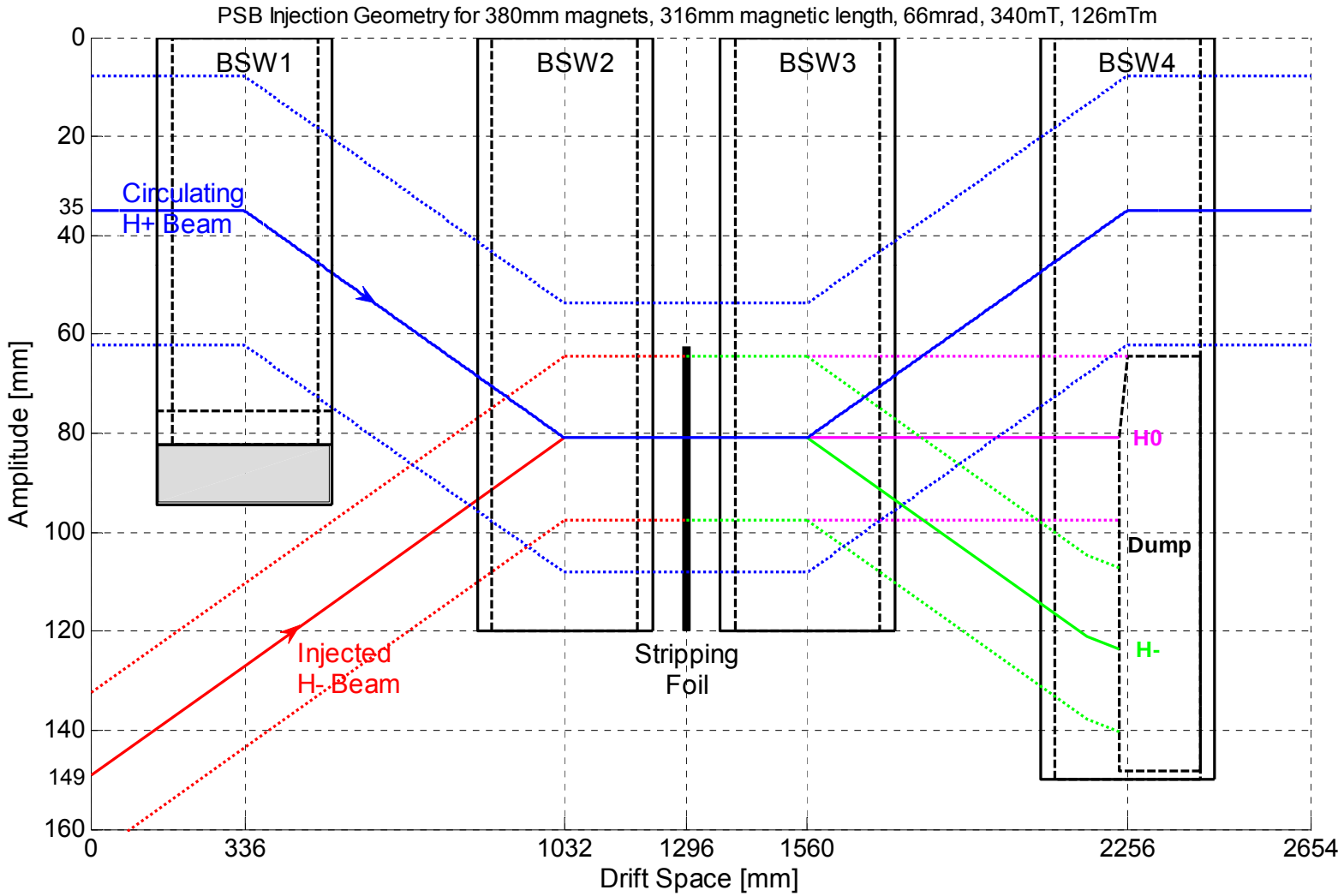
Injection layout with short magnets

Advantages & Disadvantages

Wim Weterings

21-06-2012

Current Baseline Layout

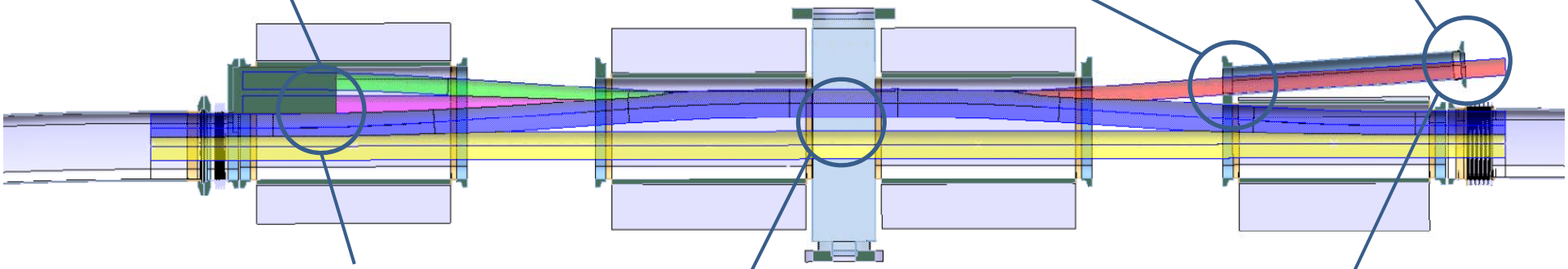


Issues in the Current Baseline Layout

The limited space forces to have an internal dump with instrumentation all inside BSW4

The available space for the septum magnet between the two adjacent chambers is only 13mm

The diameter of the injection chamber is reduced by 6mm in order to create space for the septum. This results in reduced aperture for the injected beam



At the entrance of the $H^{-/0}$ dump there is still overlap between the H^0 beam and painted beam envelope which can result in beam losses on the dump

The available space between BSW2-3 for the stripping foil unit is 148mm resulting in a limited stripping foil and beam screen space of ~120mm.

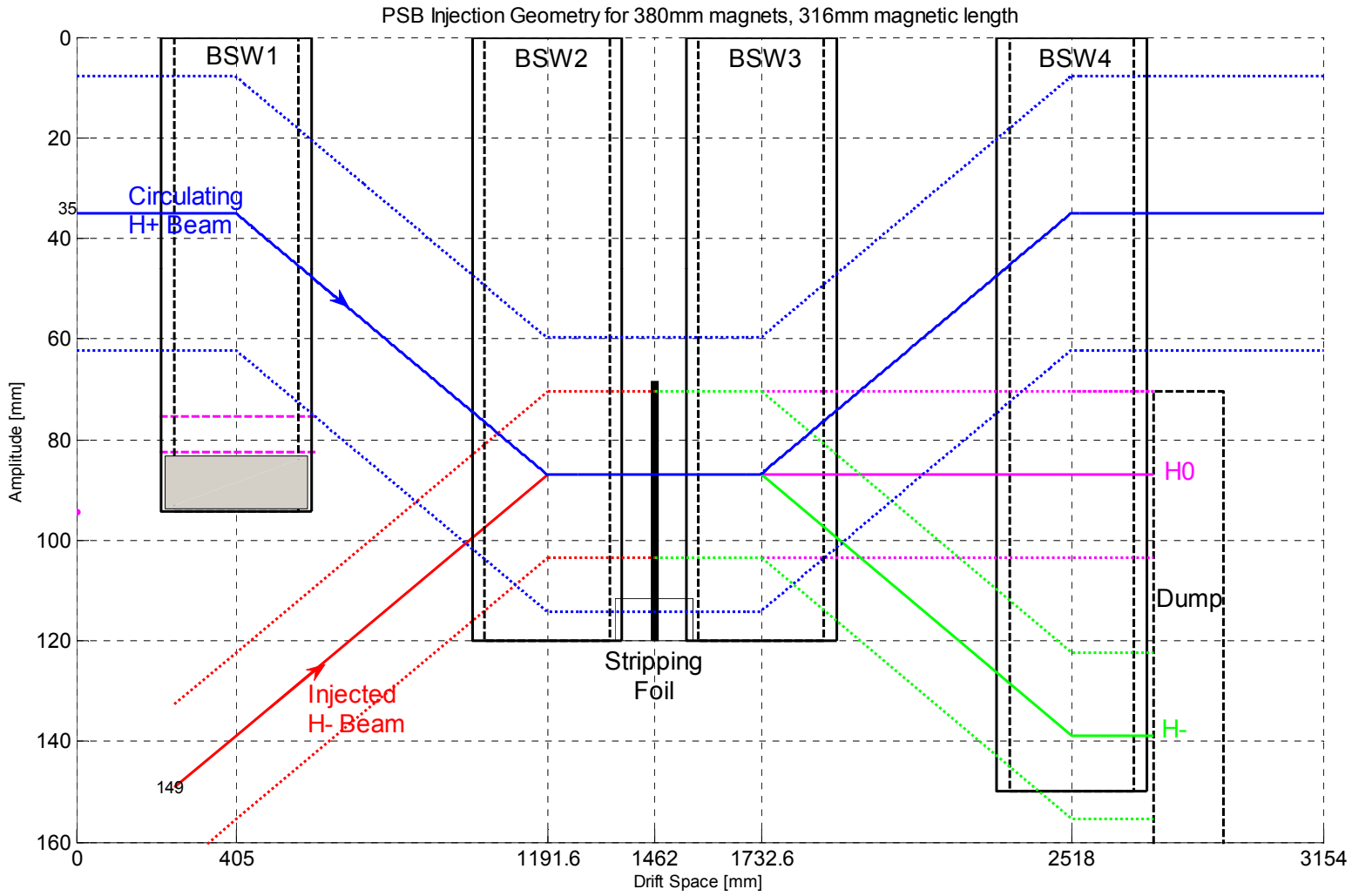
Injected beam 10mm offset inside injection chamber

The BSW1 and BSW4 magnets are in the fringe field of the main dipoles. Simulations have shown that only a small reduction of $\int B.dl$ of BSW1 occurs (~3‰).

Nevertheless, it is not excluded that the BSW1 will have Impact of on the main BHZ dipoles magnetic field.

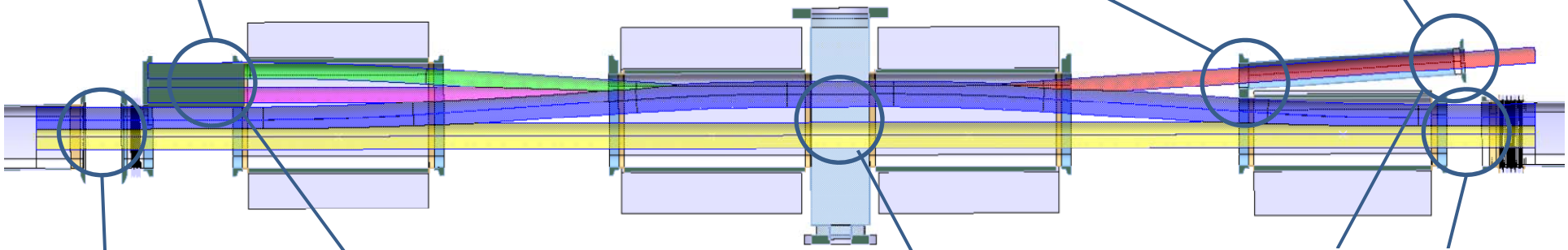
Proposed Layout

500mm increased injection straight - shorter MB162 and MB011 dipoles



Advantages Proposed Layout

500mm increased injection straight - shorter MB162 and MB011 dipoles



The possibility is created to have an external dump

The available space for the septum magnet can be increased to ~20mm

No more aperture restrictions for the injected beam

Sufficient space is created to have vacuum sector valves for each ring

At the entrance of the $H^{-/0}$ dump there is no more overlap between the H^0 beam and painted beam envelope thus reduced risk of beam losses on the dump

The available space between BSW2-3 for the stripping foil unit could be increased by ~15mm.

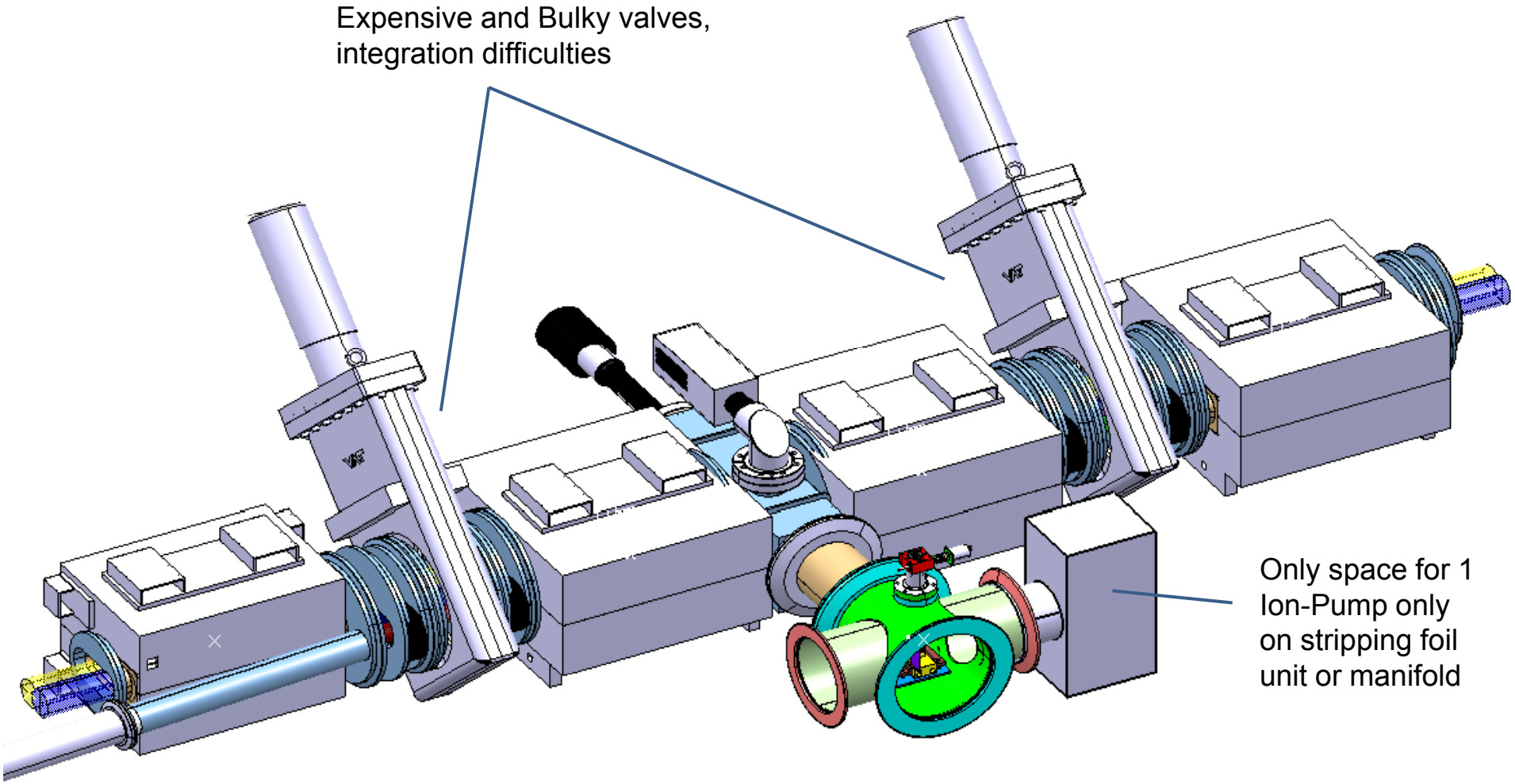
Injected beam can be centered inside injection chamber

Sufficient space is created to have vacuum sector valves for each ring

The BSW1 and BSW4 magnets would be further away from the fringe field of the main dipoles.

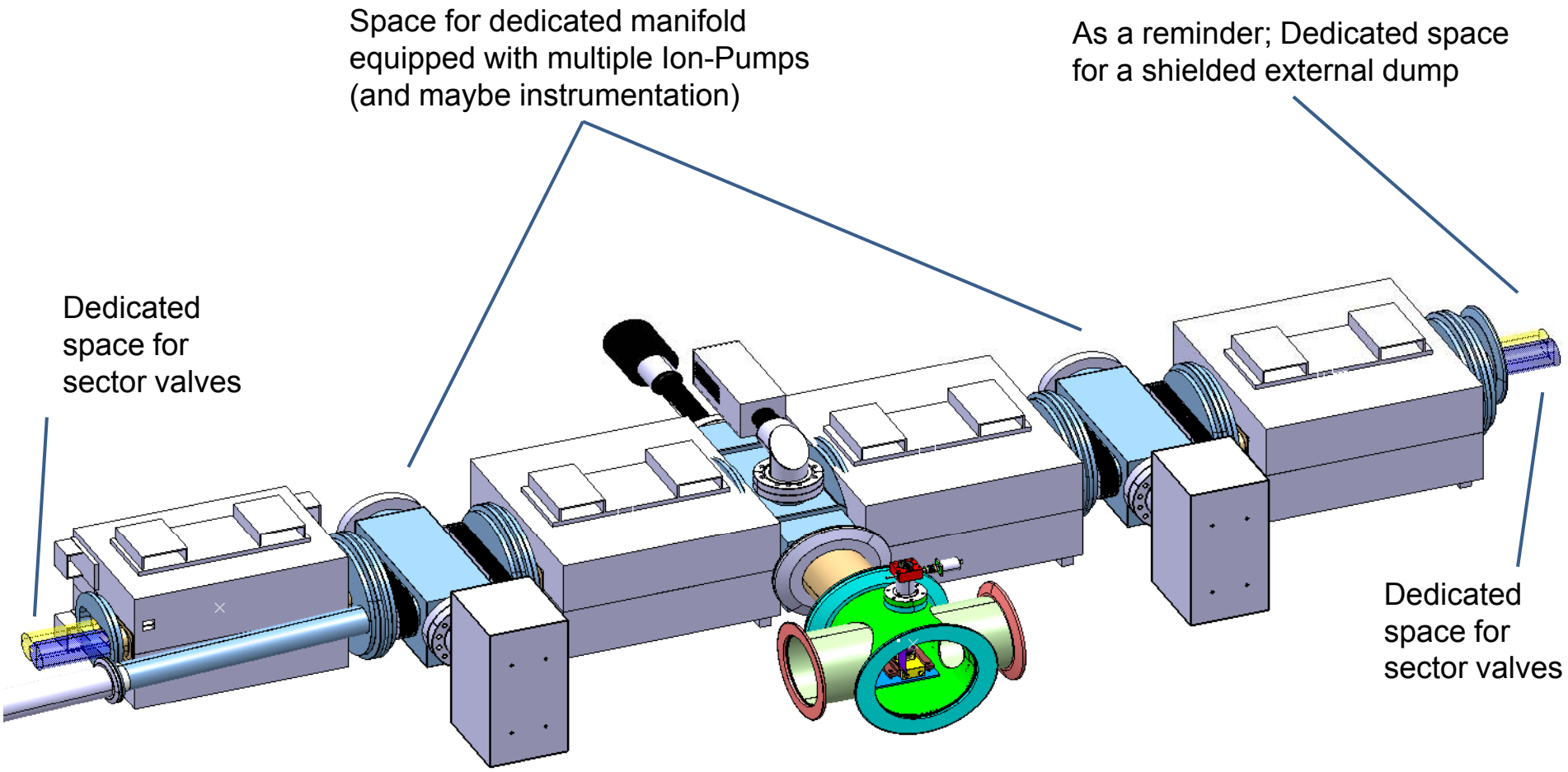
Vacuum Sector Valves Options

Current proposal



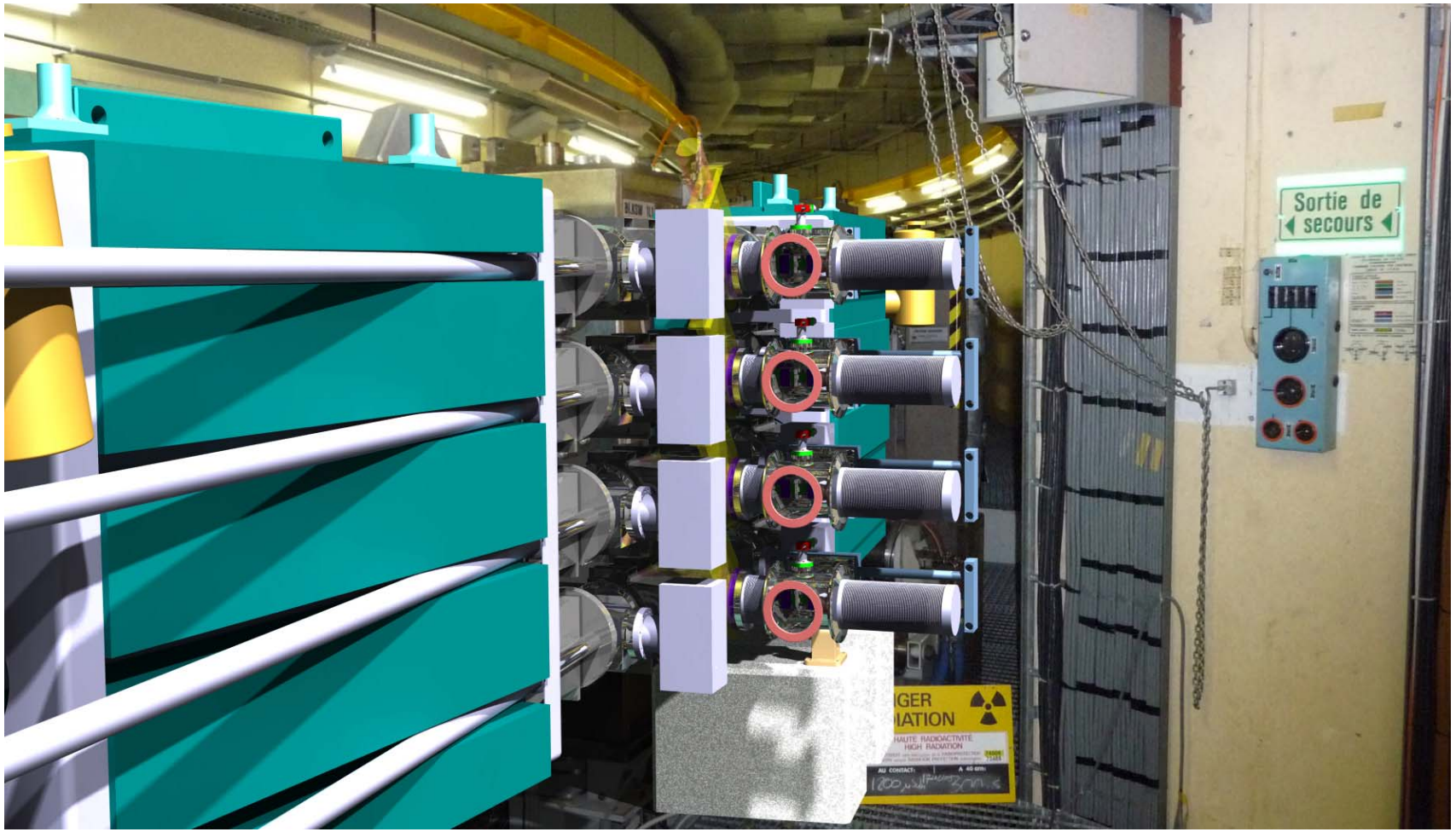
Vacuum Sector Valves Options

500mm increased injection straight proposal



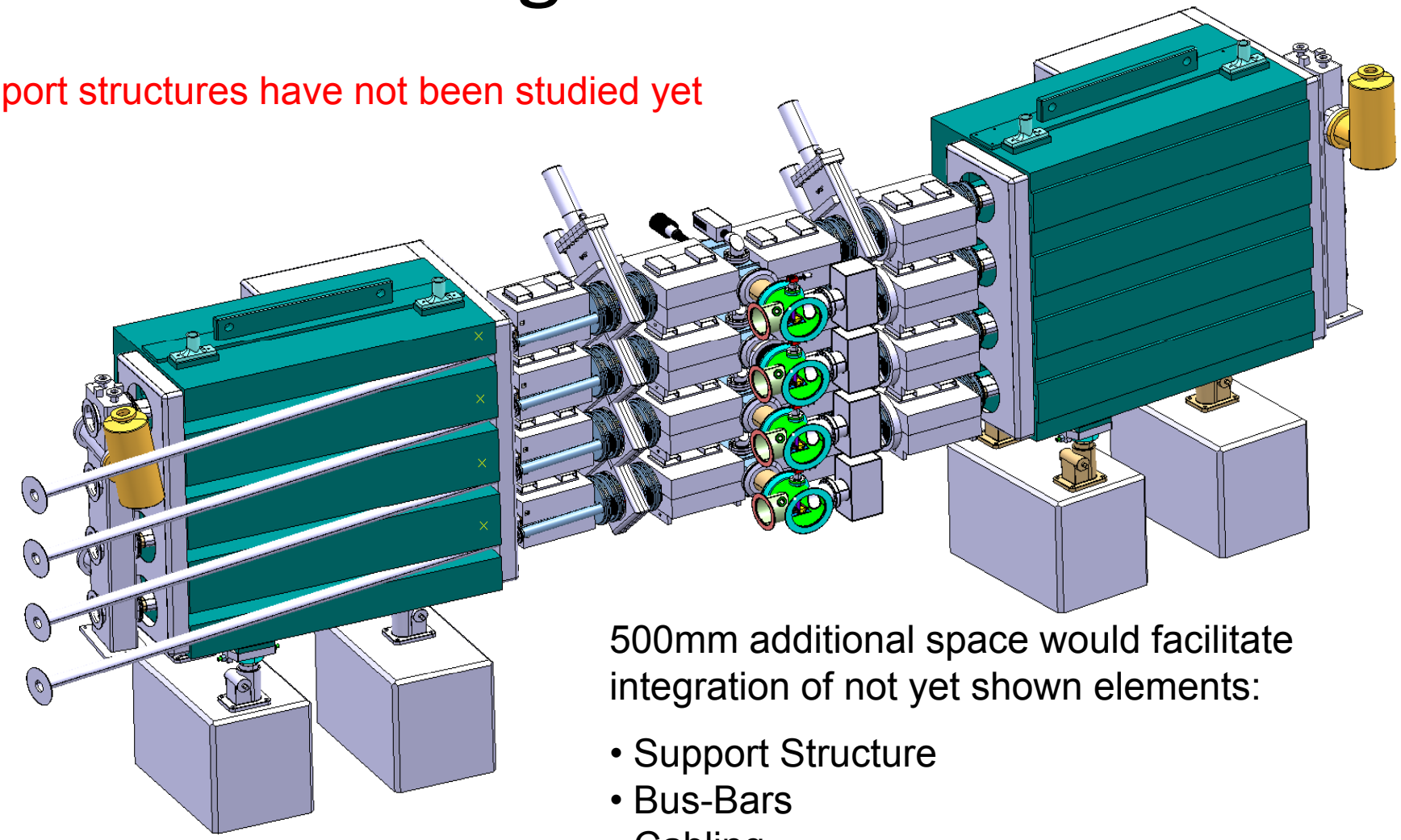
Integration Issues

Current design creates a very crowded area !



Integration Issues

Support structures have not been studied yet

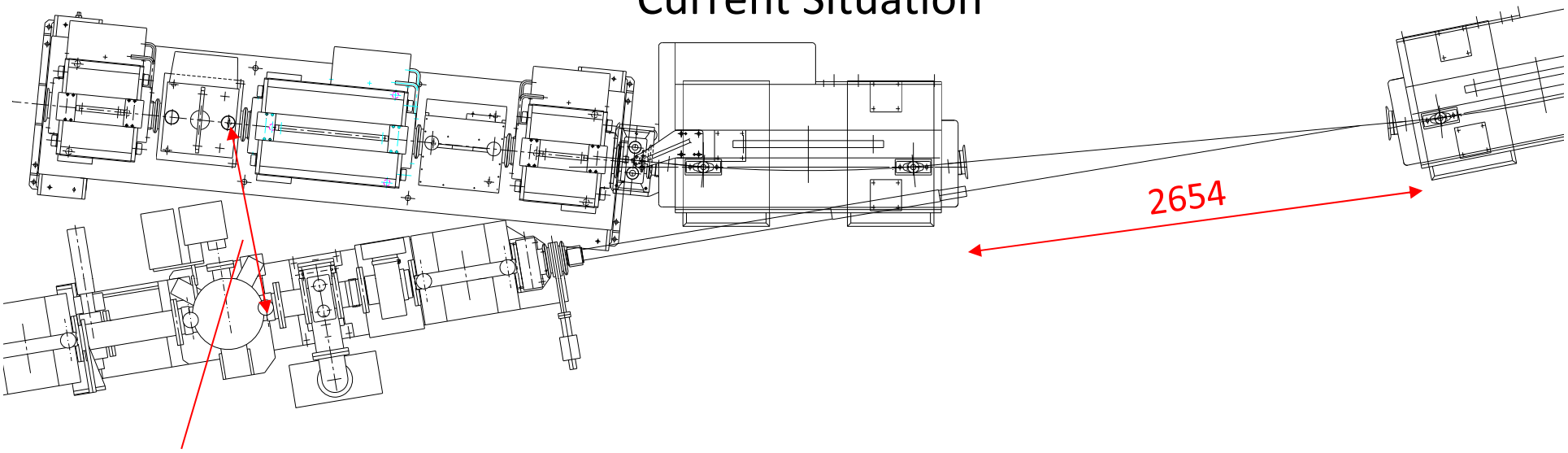


500mm additional space would facilitate integration of not yet shown elements:

- Support Structure
- Bus-Bars
- Cabling
- Power Transformers
- etc.

Layout Implications

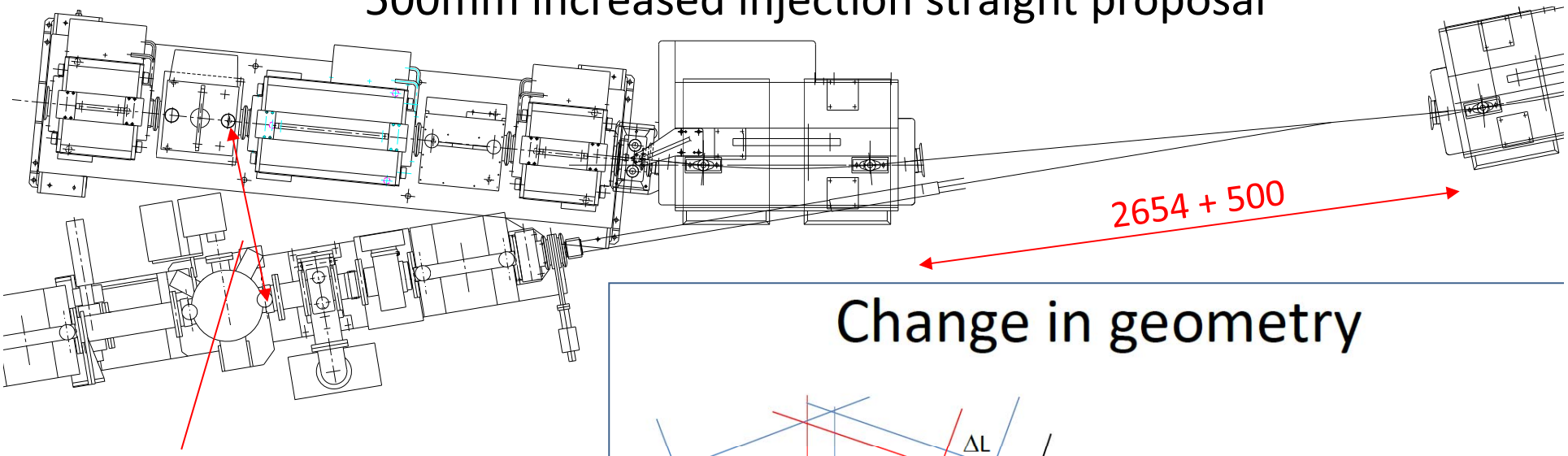
Current Situation



Dimension “A”

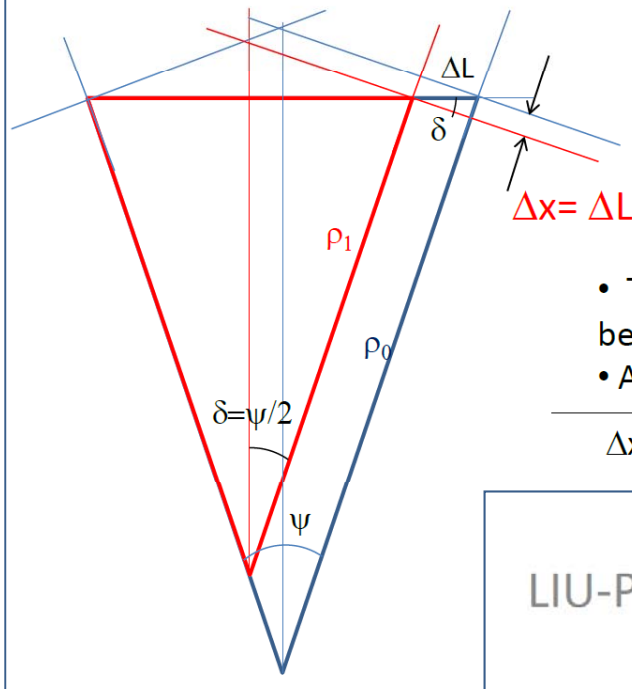
Layout Implications

500mm increased injection straight proposal



Dimension “A” - 34.5mm shift

Change in geometry



$\Delta x = \Delta L \sin(\delta) = 24.5\text{mm}$

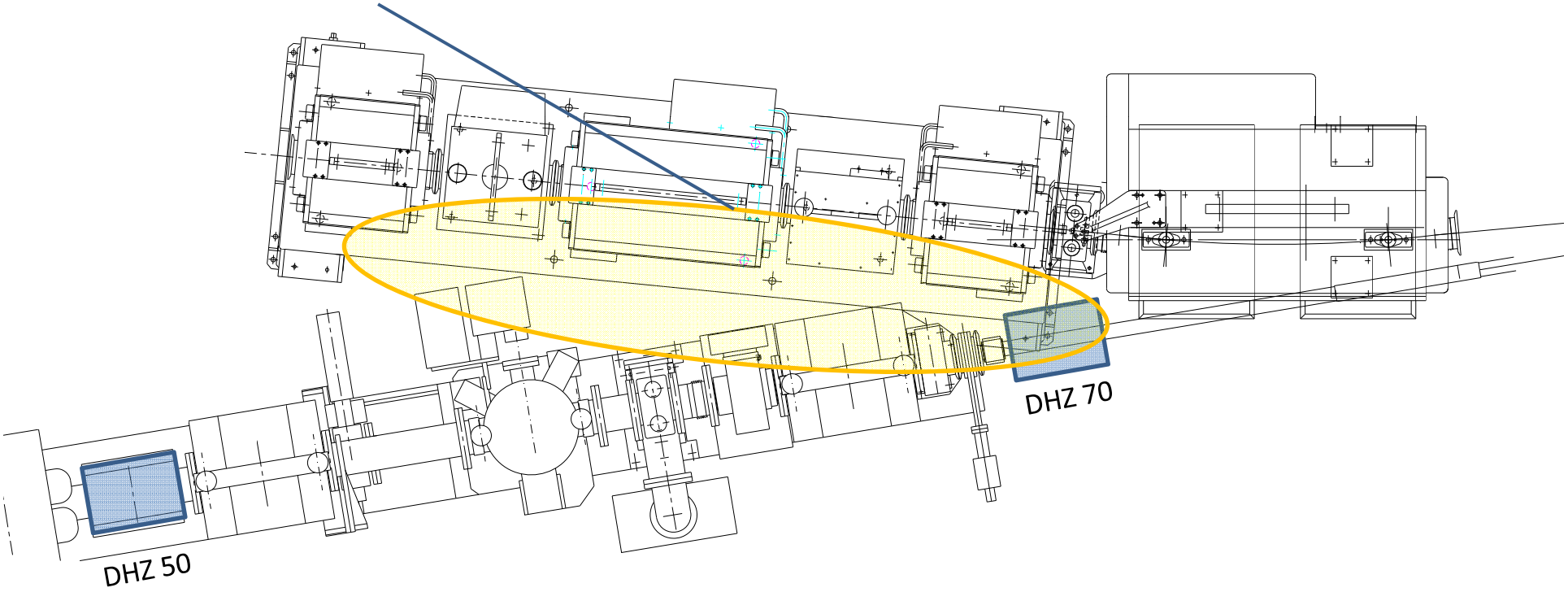
- Trajectory @ exit of short BHZ16 will be Δx= -24.5mm offset
- Add Δx= -10mm offset w.r.t. Linac2

Δx_{tot} = -34.5mm

Layout Implications

Option for 34.5mm shifted injection line

No direct interference due
to shifted beam line



Possible to use DHZ 50 & DHZ 70 for 34.5mm offset
(34.5mm / 3m -> ~11.5mrad deflection)

Summary

- No more aperture restriction.
- Increased space for septum to ~20mm.
- Tight space between BSW2 & 3 for the stripping foil unit improved.
- No more scraping of beam envelope on $H^{-/0}$ dump.
- Shielded external dump.
- Small vacuum sector valves for each ring.
- BSW1 & 4 further away from BHZ fringe field.

But

- Introduction of new type of main dipole.
- PSB lattice perturbation.
- Shifted injection line needed.
- Additional requirements for DHZ 50 & DHZ 70 to create a 34.5mm offset.