

TIK-4.8 Monolith Shielding Systems Breakdown and re-packaging of Target In-Kind contribution scope

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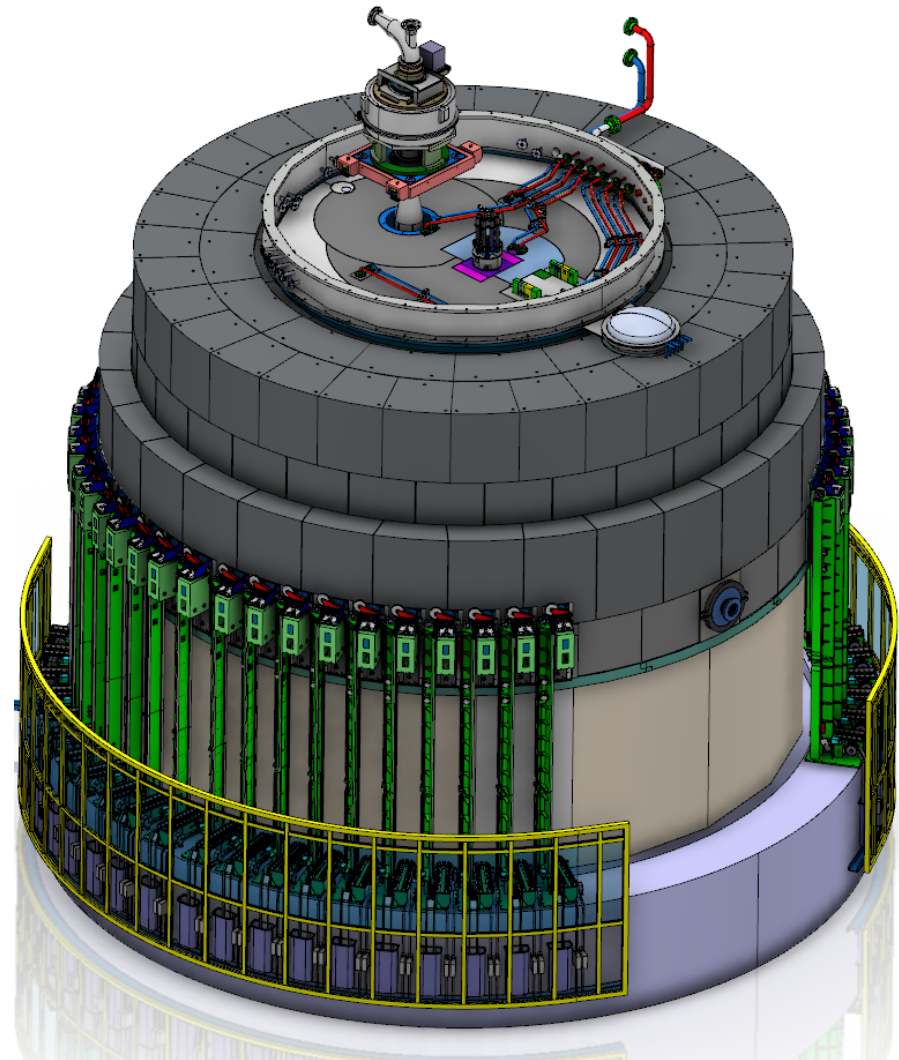
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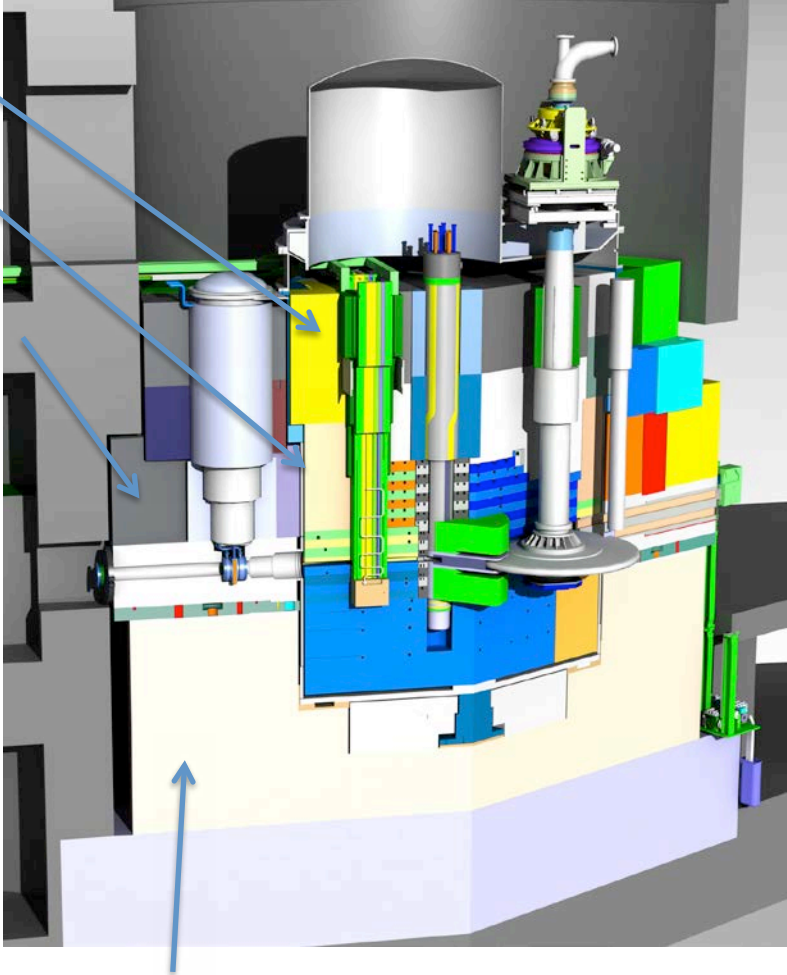
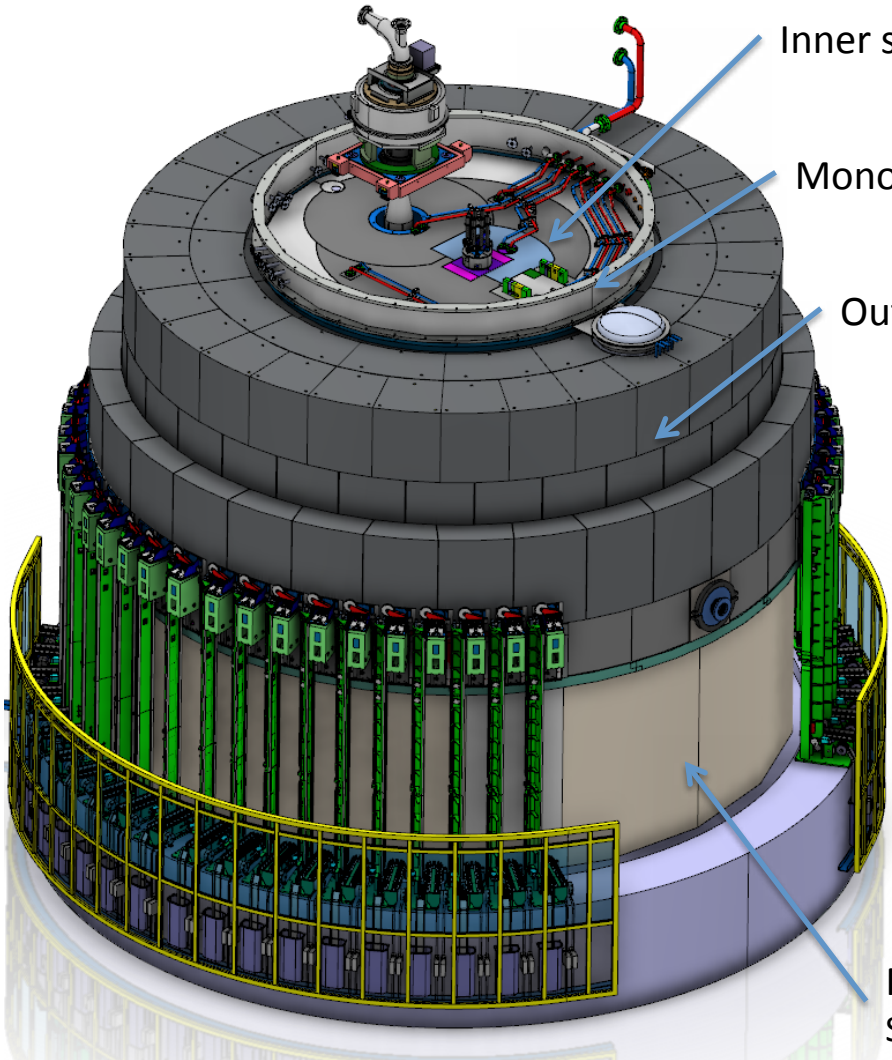
TIK 4.8 Scope

Monolith Shielding Systems

- **Main function**
 - Provide shielding
 - sufficient for personal protection
 - for reduction of background for the neutron science systems
- **Supporting functions**
 - Structural support for internal components, plugs and shielding blocks with appropriate and repeatable alignment precision
 - Allowing access (for maintenance, repair or replacement) to all parts of the monolith, in accordance with their expected lifetime and reliability
 - Cooling of excess heat
- **Global dimensions**
 - Diameter ~ 11 m
 - Height ~ 8 m
 - Steel mass ~ 3000 tons



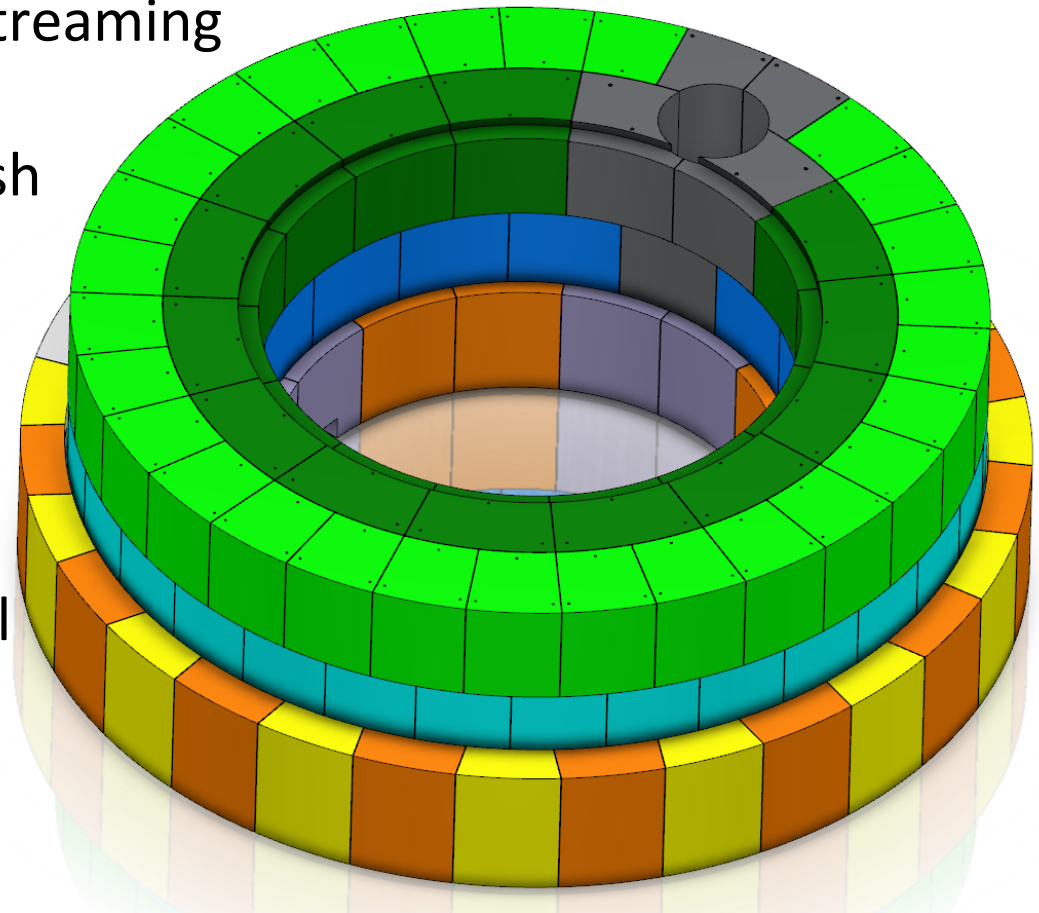
Monolith shielding



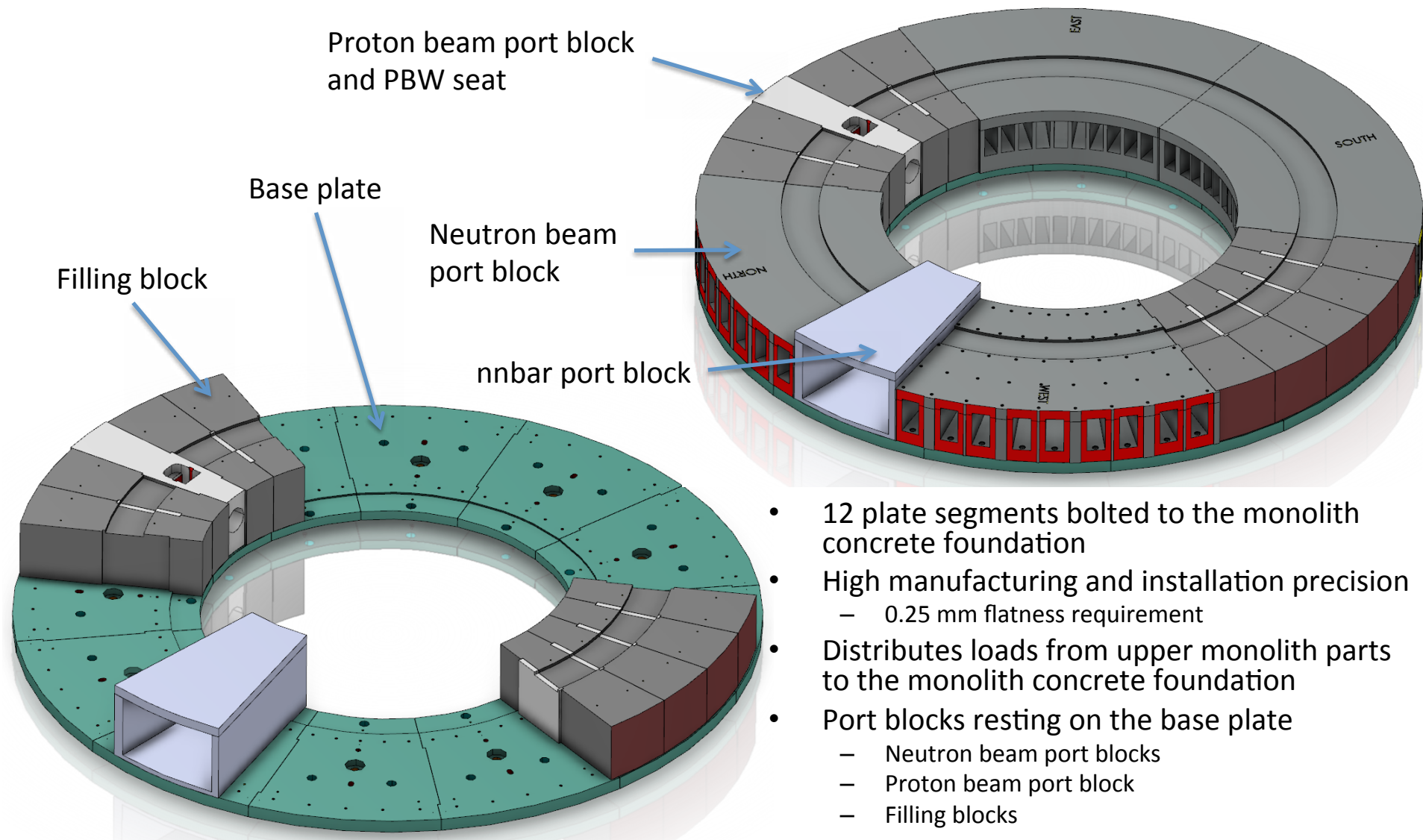
Monolith concrete foundation,
Scope transferred to Conventional Facilities project

Monolith outer shielding

- Stacked carbon steel blocks
- Staggered in order to achieve steps for prevention of neutron streaming
- Interlocking of blocks for prevention of impact or clash into the monolith vessel in case of earthquake
- Modular design to keep the number of different block shapes to a minimum
- About 1600 tons of material

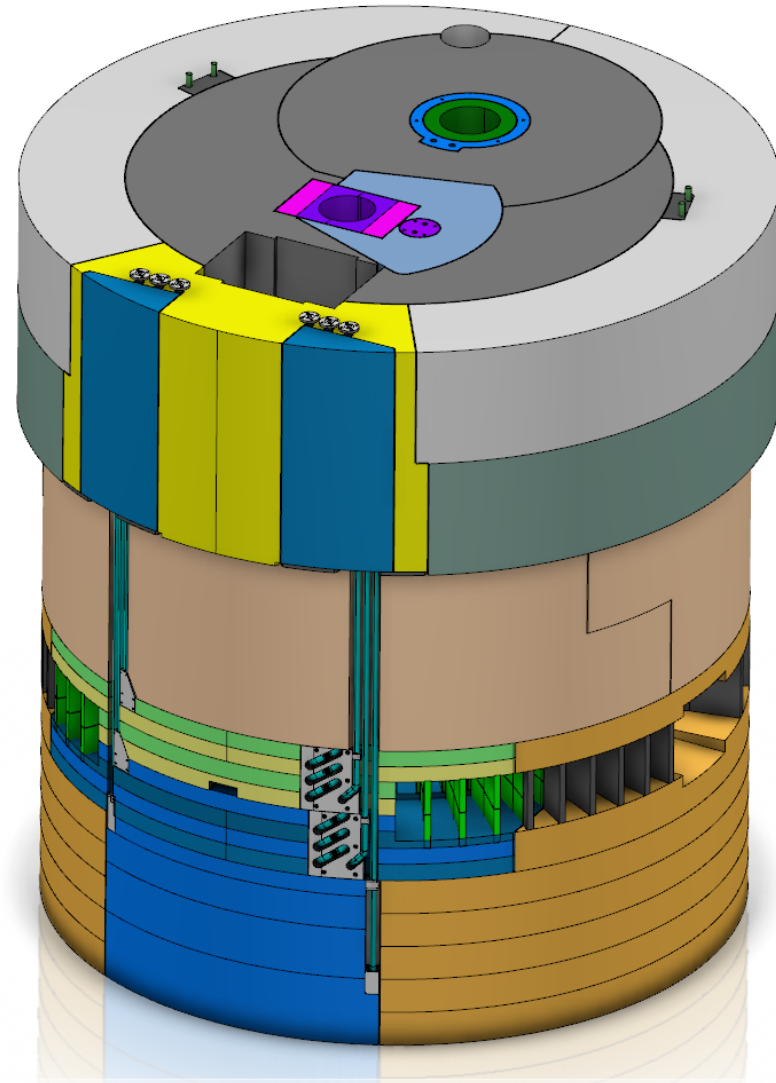


Monolith base plate and port blocks section



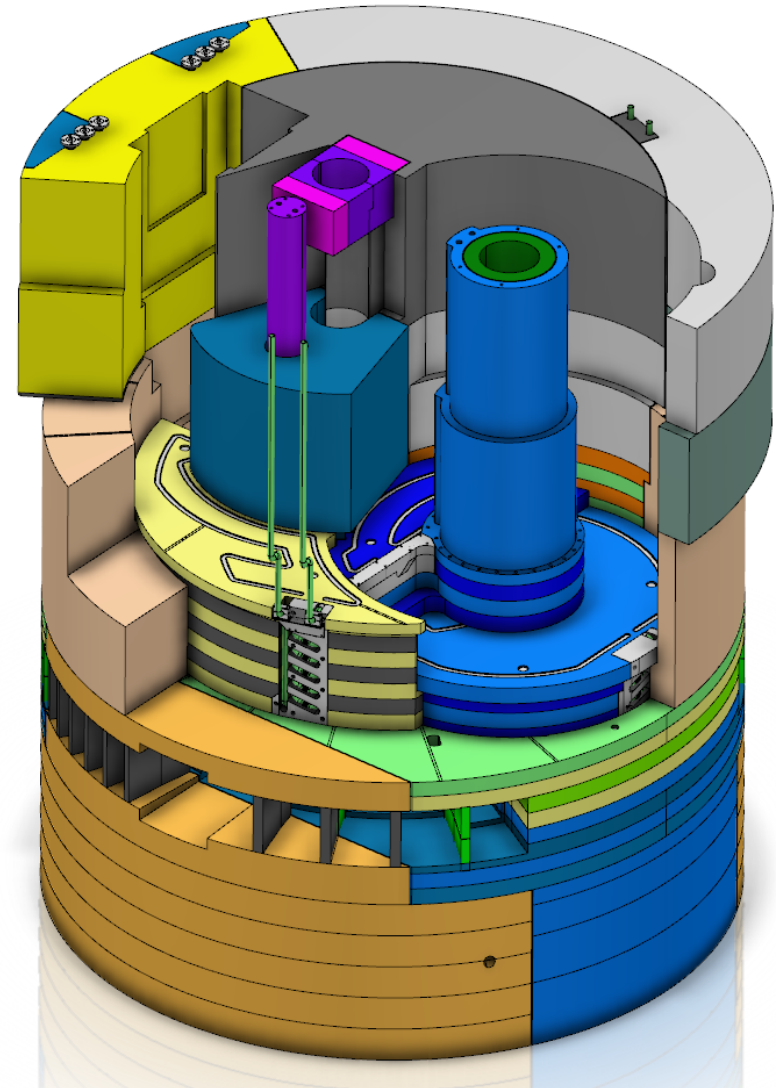
Monolith inner shielding

- Stacked stainless steel blocks
- Stepped design for prevention of neutron streaming
- Interlocking of blocks for prevention of impact or clash into the monolith vessel in case of earthquake
- Unique design of each block in order to adapt to the shapes and layout of internal components
- About 1000 tons of material



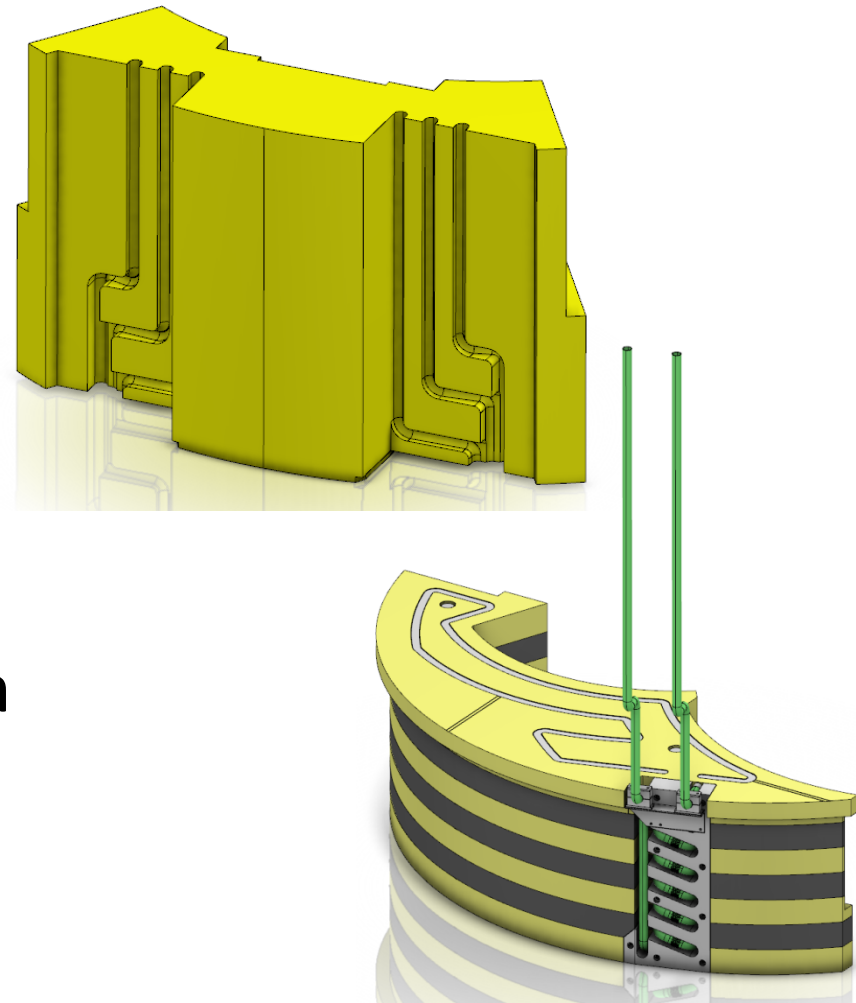
Inner shielding blocks design parameters

- > 10mm gap between blocks.
- Steps to prevent neutron streams.
- Hot blocks max weight 55 ton.
- Max crane capacity, 95 ton.
- Blocks needs to be cooled with water up to SR1,5 meter from center.
- Minimize number of lifts to be able to exchange components like moderator, target wheel etc.

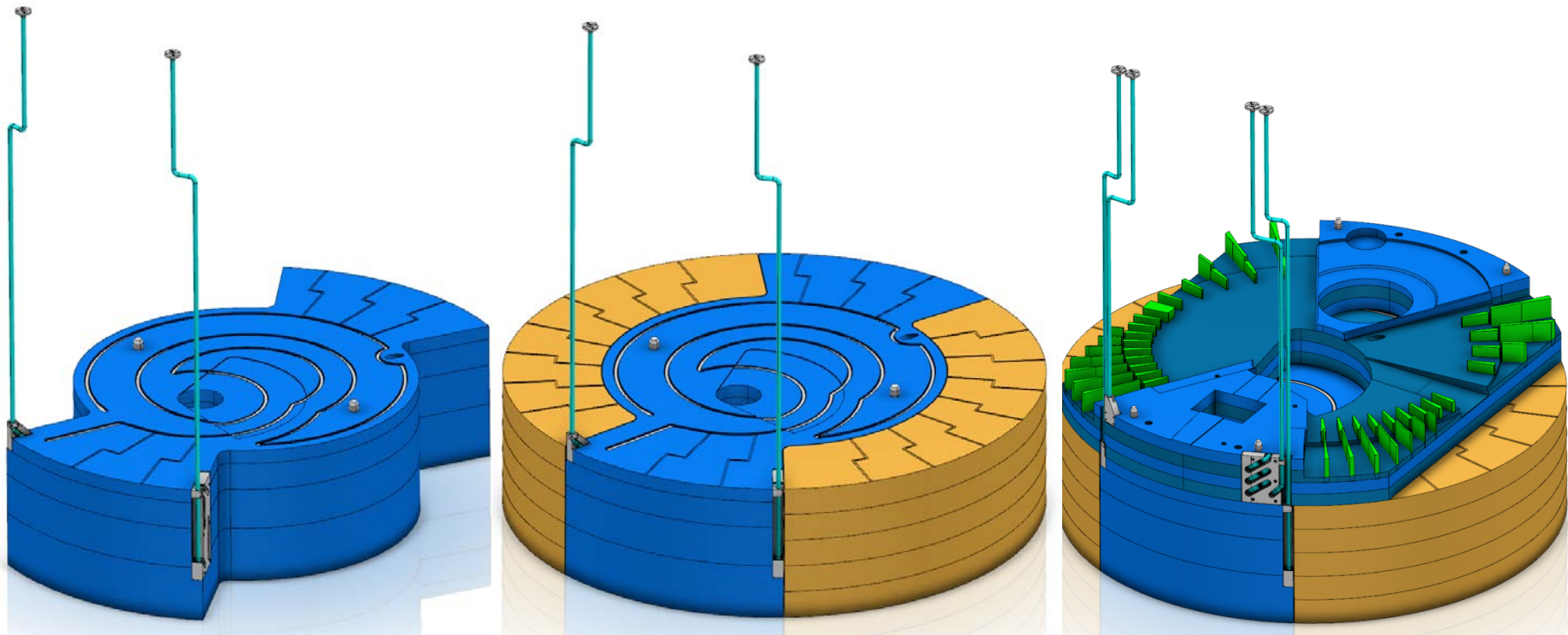


Type of blocks and build method

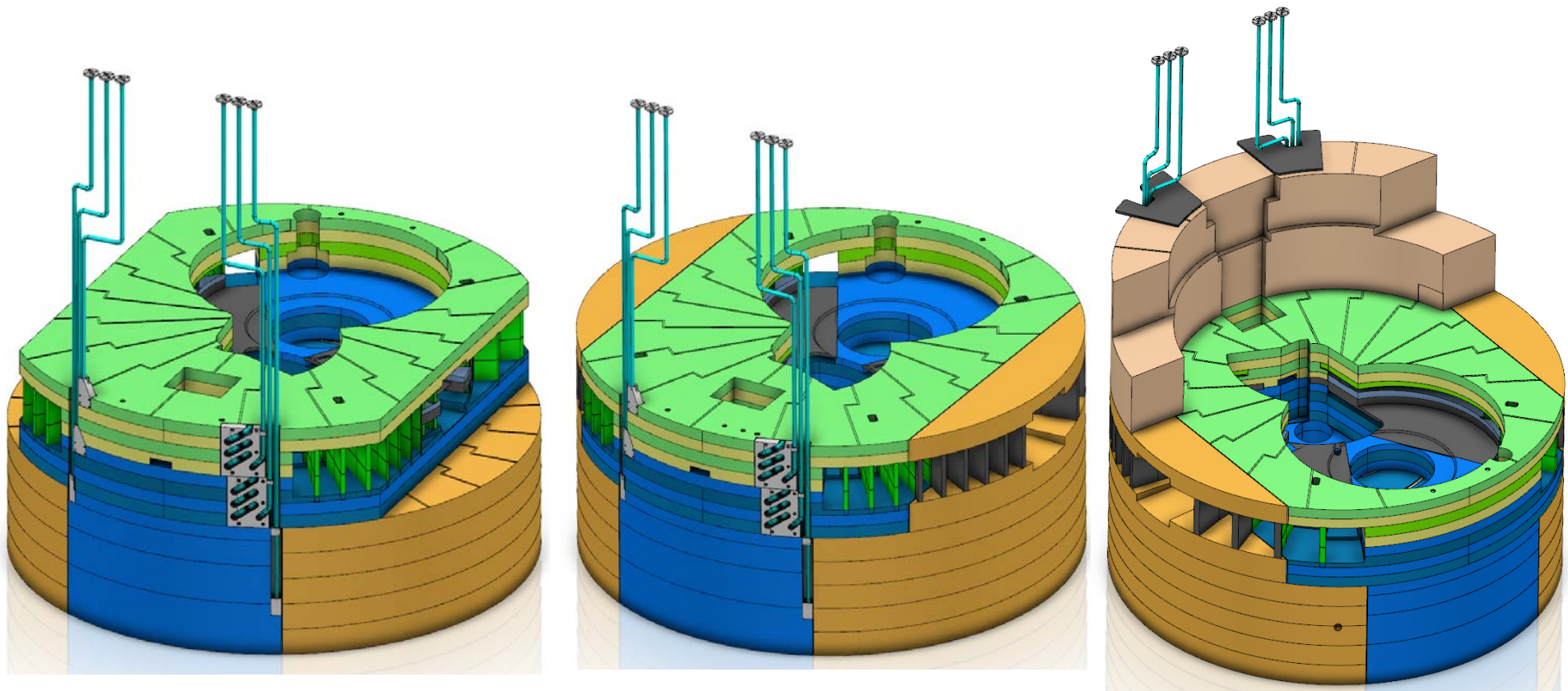
- Blocks with cooling.
- Blocks that just fills space.
- All large blocks built from stacked plates. Plates bolted together to form a complete block unit.
- Scrapped blocks can be taken apart for easier handling.



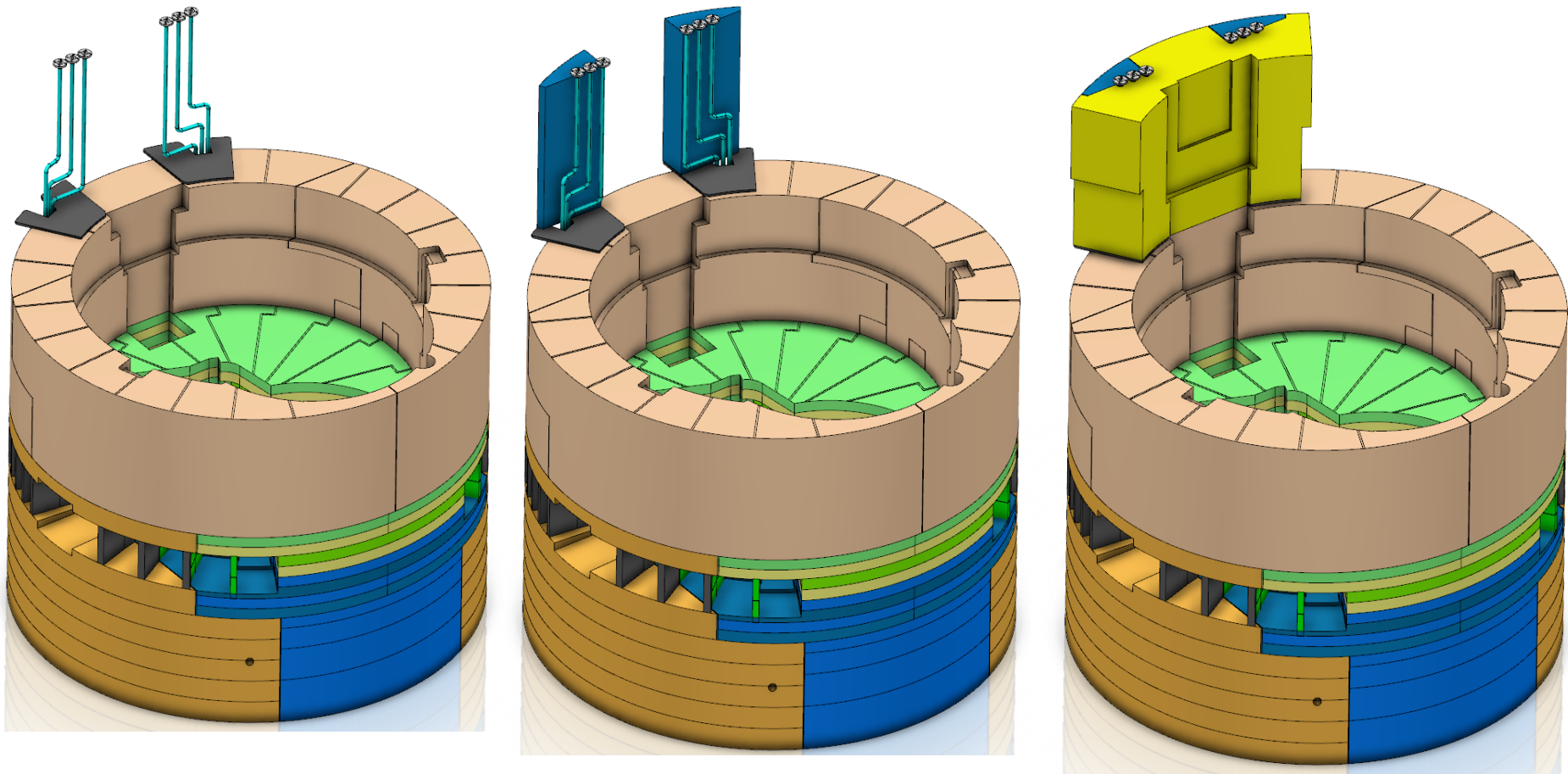
Shielding block assembly steps, 01



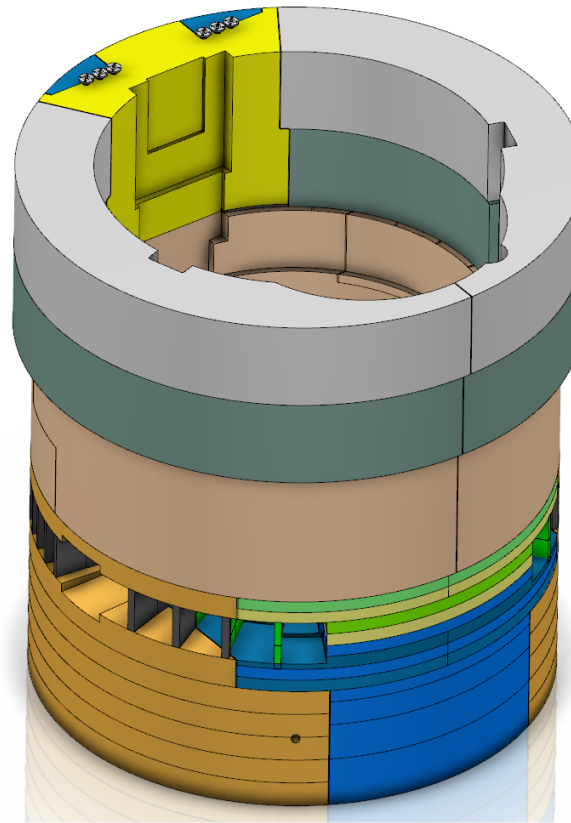
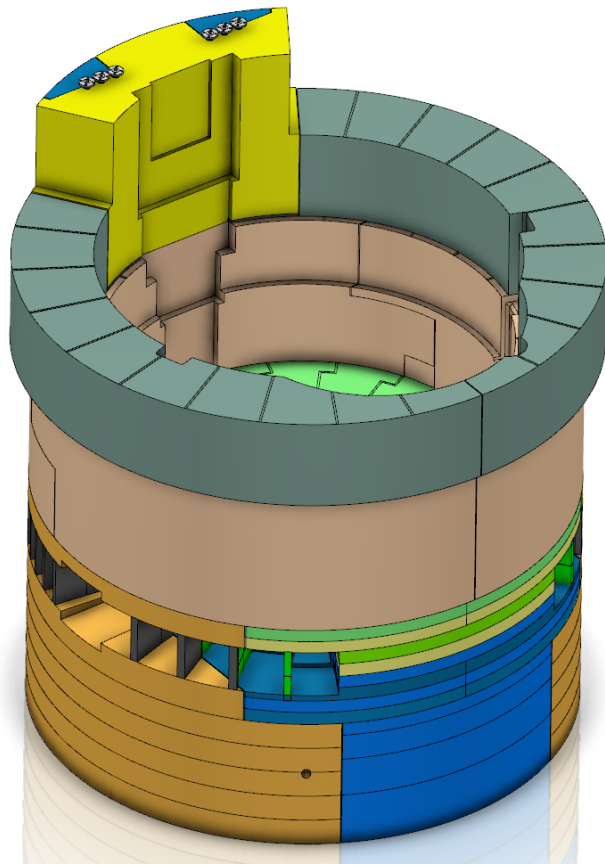
Shielding block assembly steps, 02



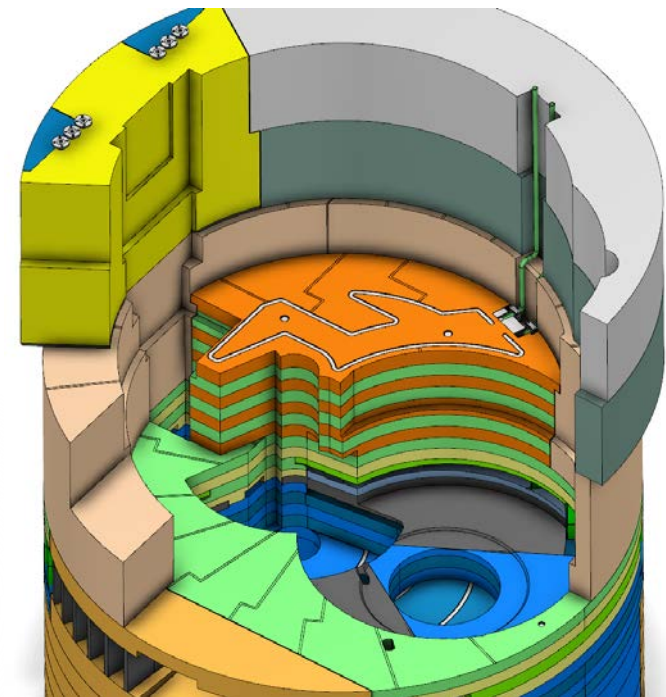
Shielding block assembly steps, 03



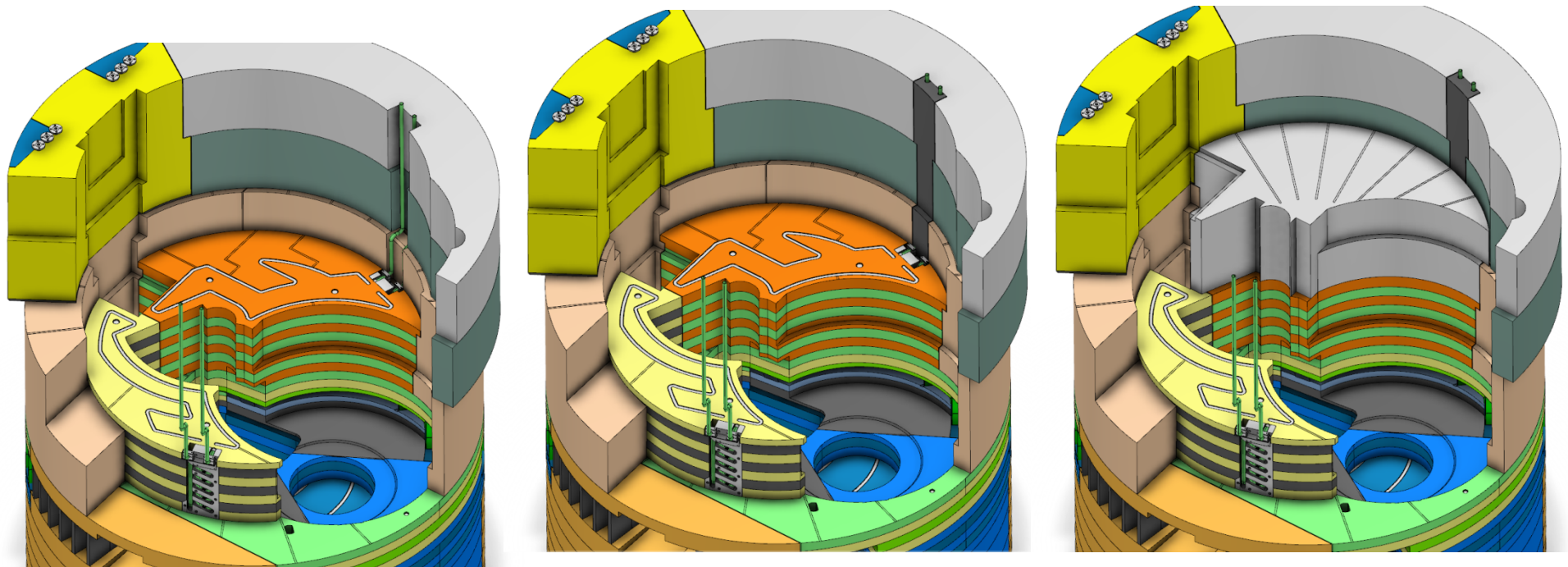
Shielding block assembly steps, 04



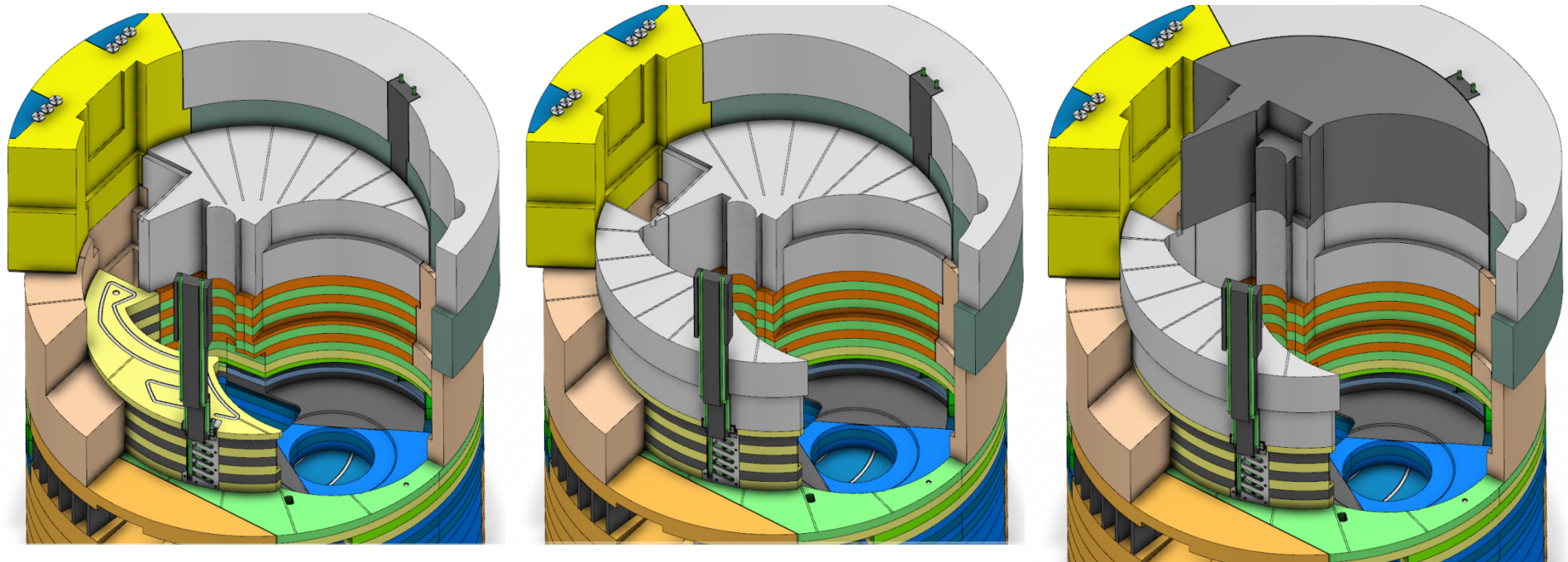
Front blocks removed
for visibility.



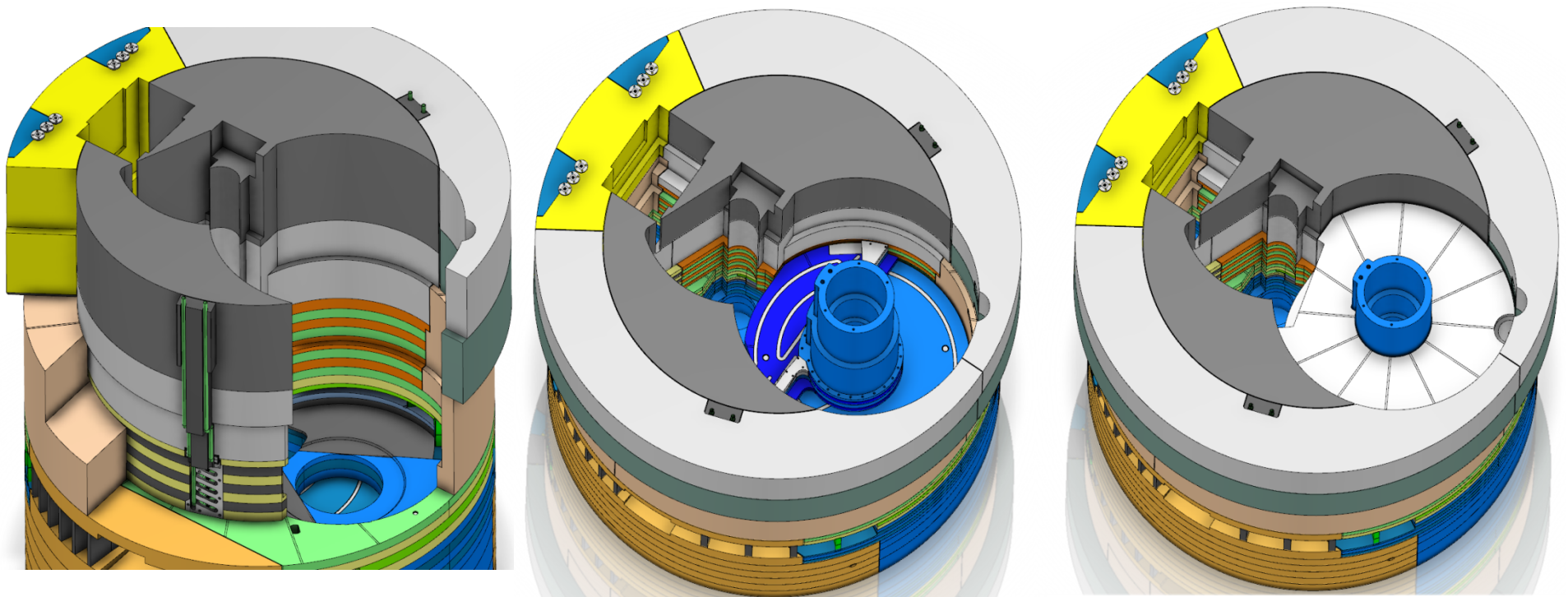
Shielding block assembly steps, 05



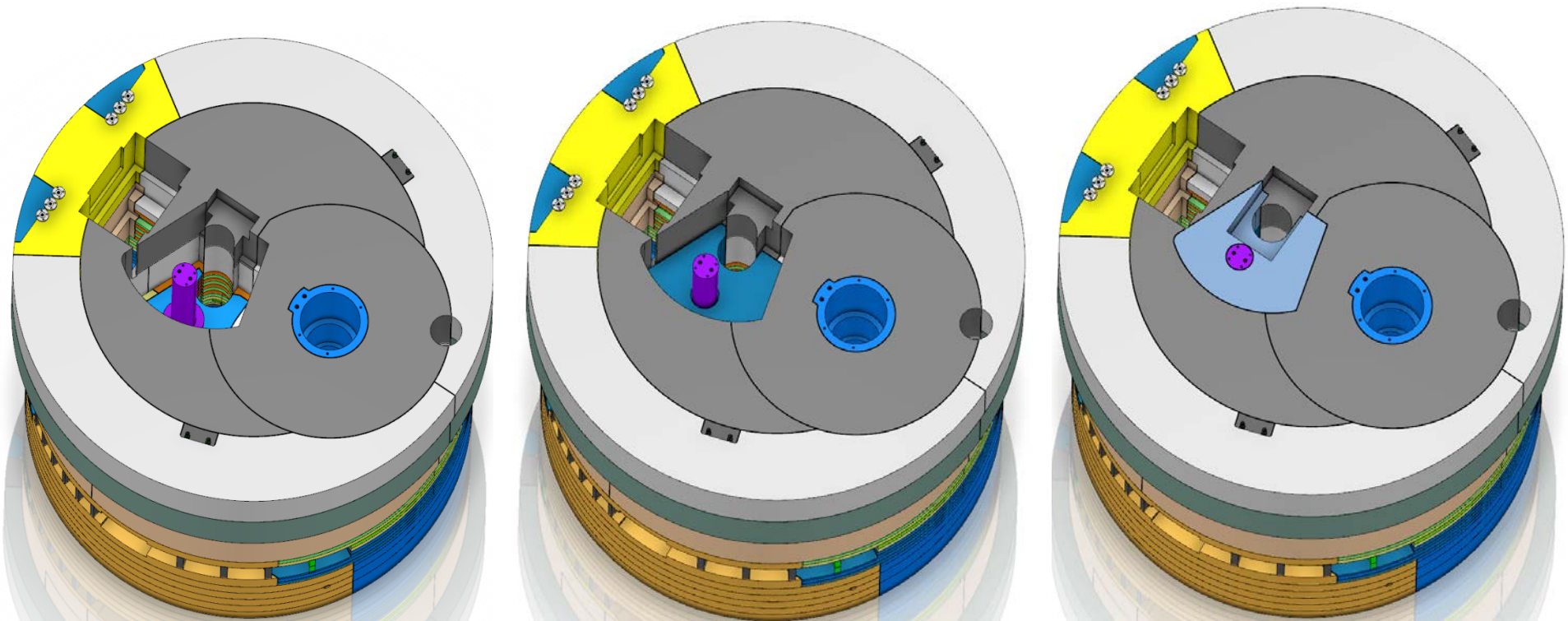
Shielding block assembly steps, 06



Shielding block assembly steps, 07

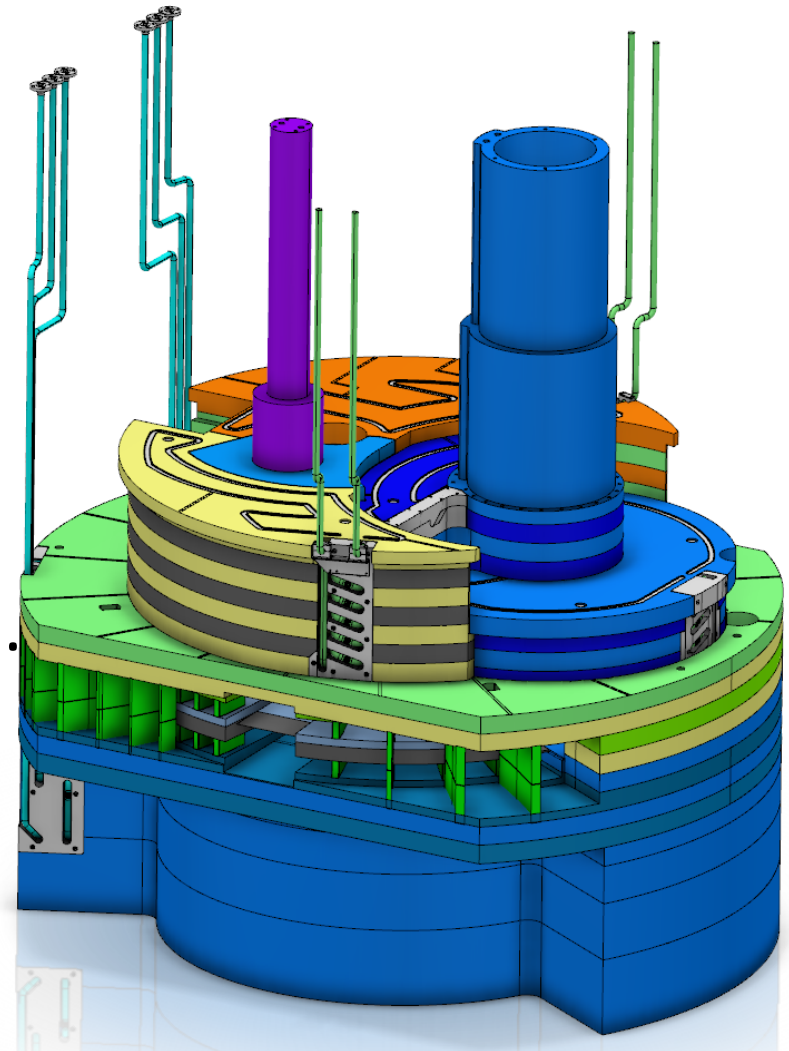


Shielding block assembly steps, 08



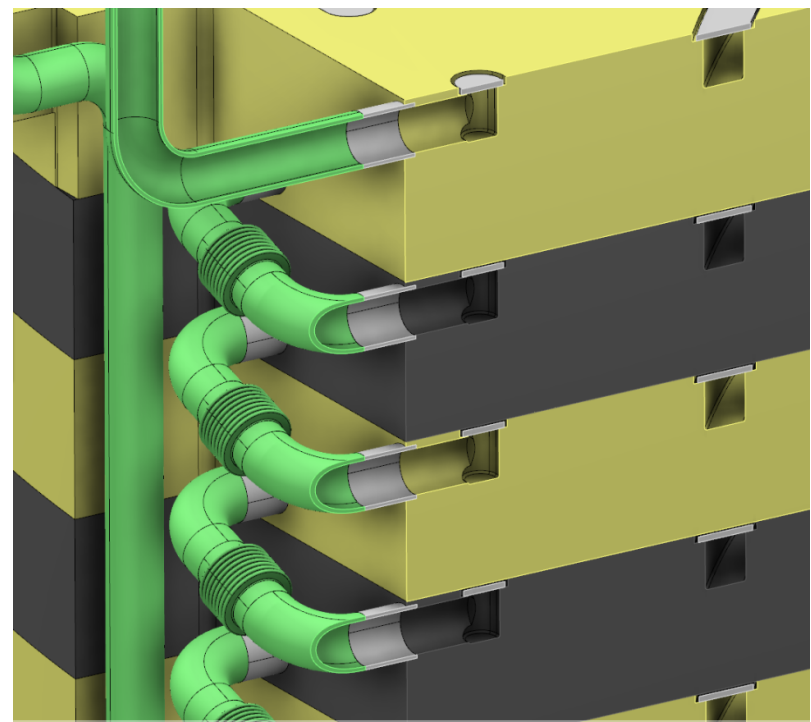
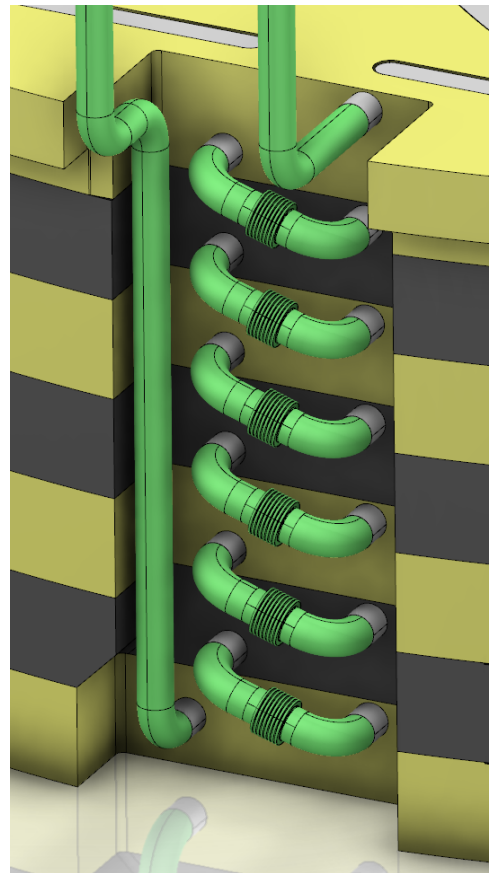
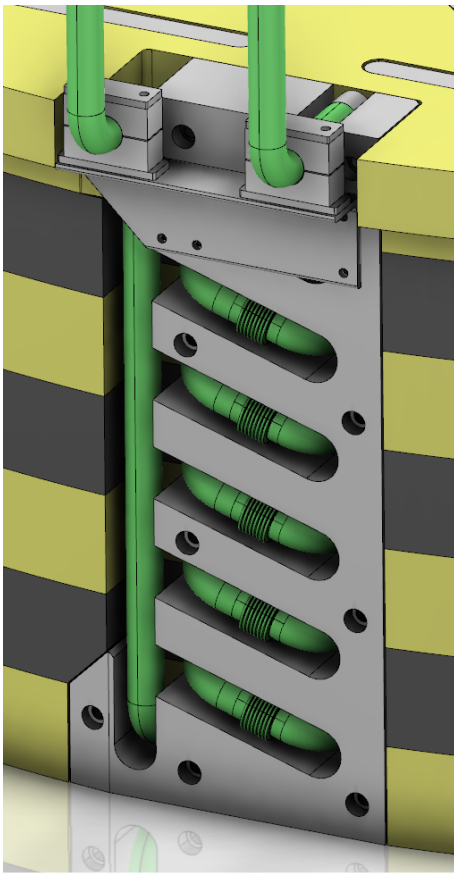
Cooled blocks

- North block, yellow and grey.
- East block, purple and blue.
- South block, orange and green.
- West block, blue and dark blue.
- Pancake top, green and yellow.
- Pancake bottom, blue and green.
- Reflector base, blue.



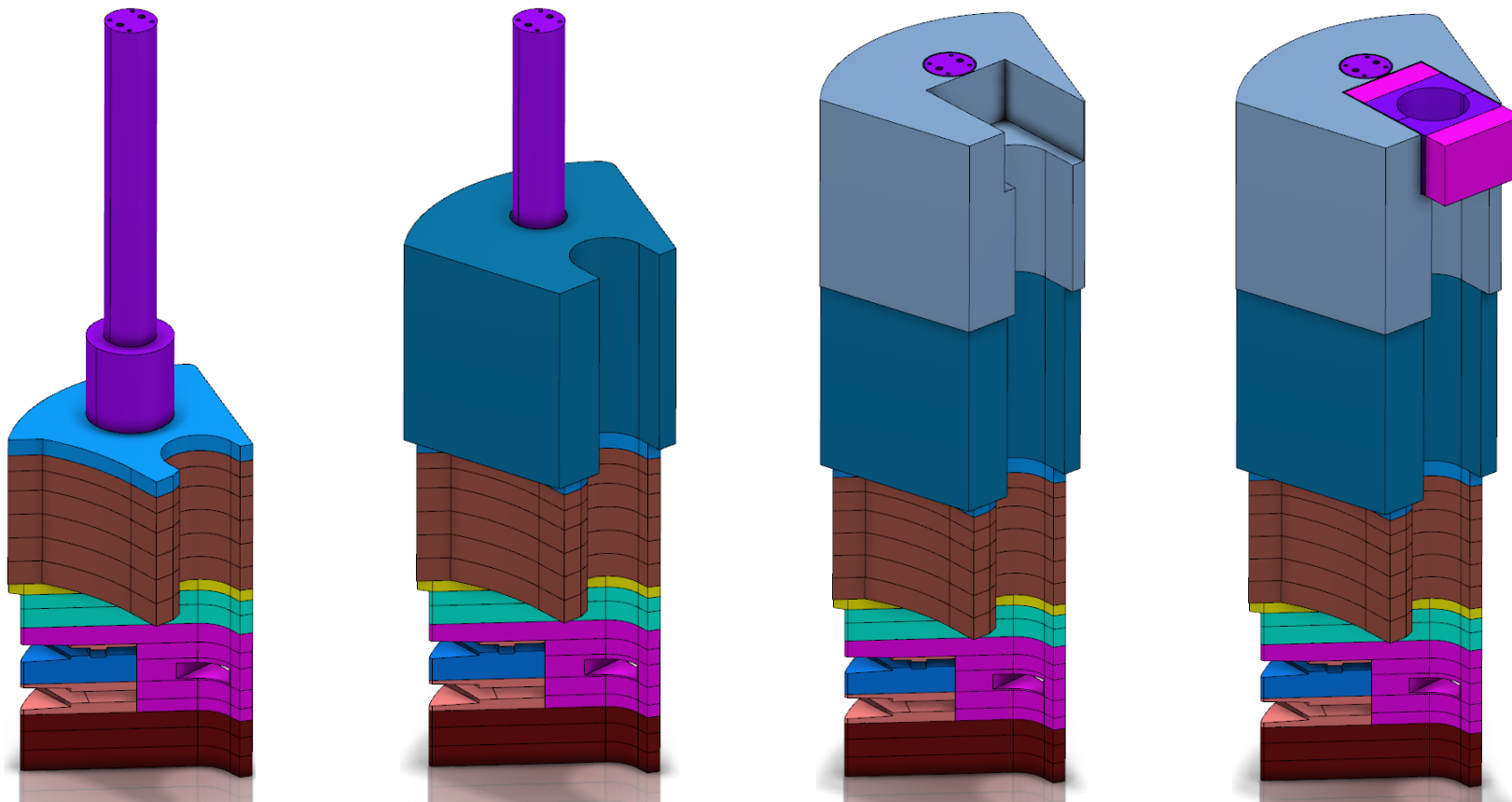
North cooling block details

- Cooling pipe shielding and pipe clamps.
- Cooling pipes, welded to pipe studs.
- Cross section through pipes, studs and cooling channels.



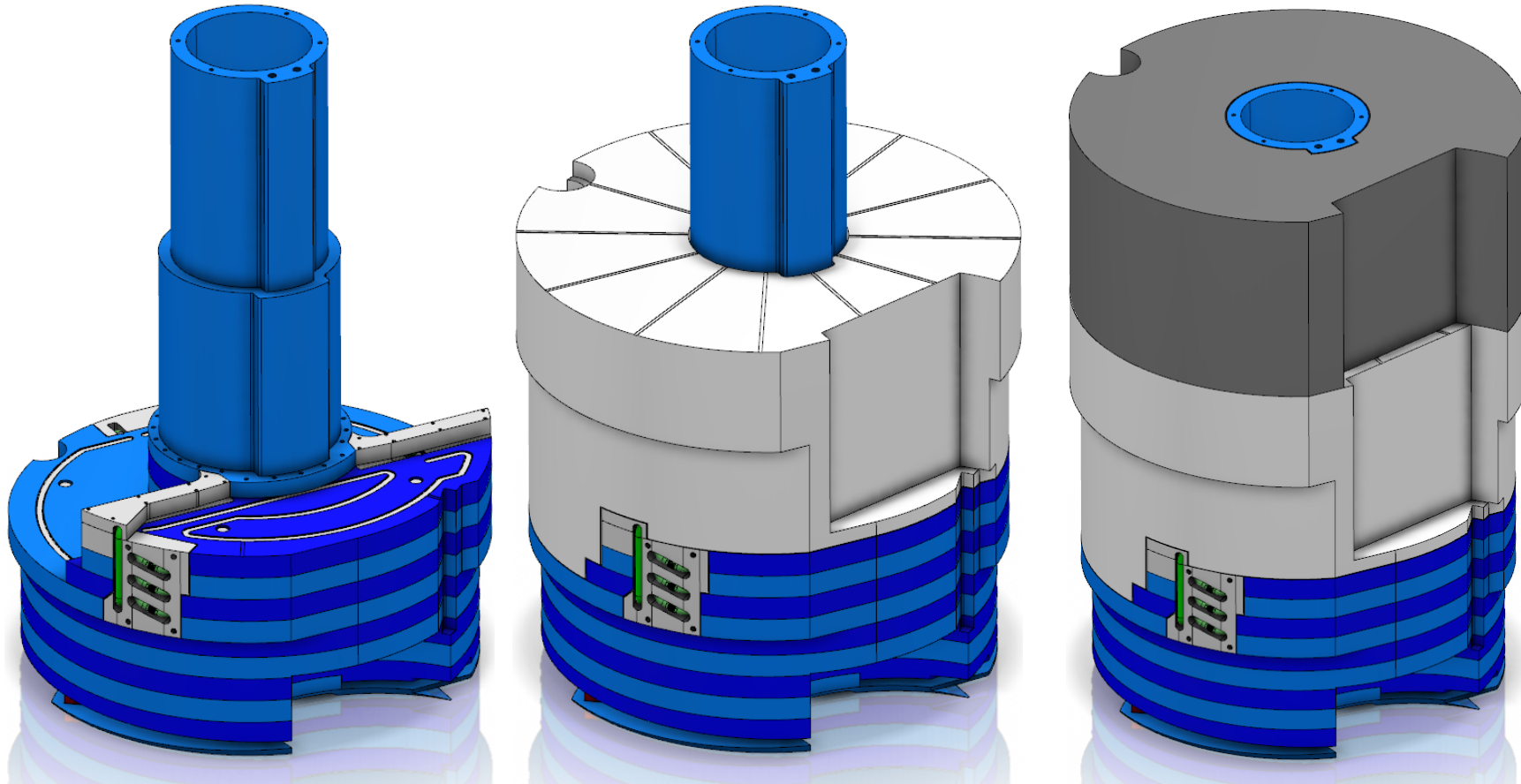
East cooling block details

- East cooling block should be matched to the shielding blocks above since geometry is complex.
- One supplier should make all components.



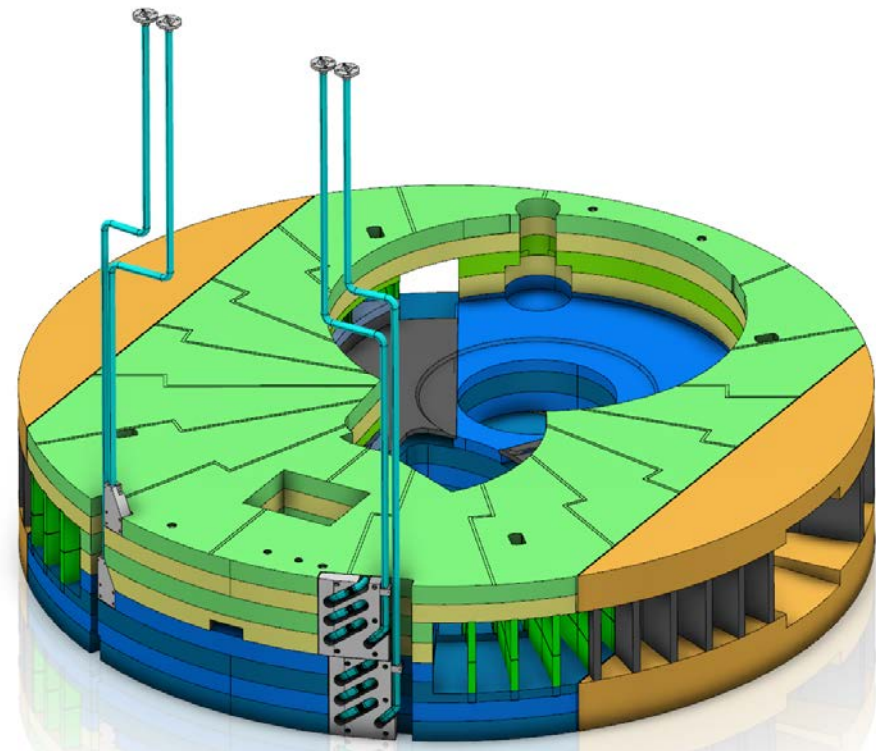
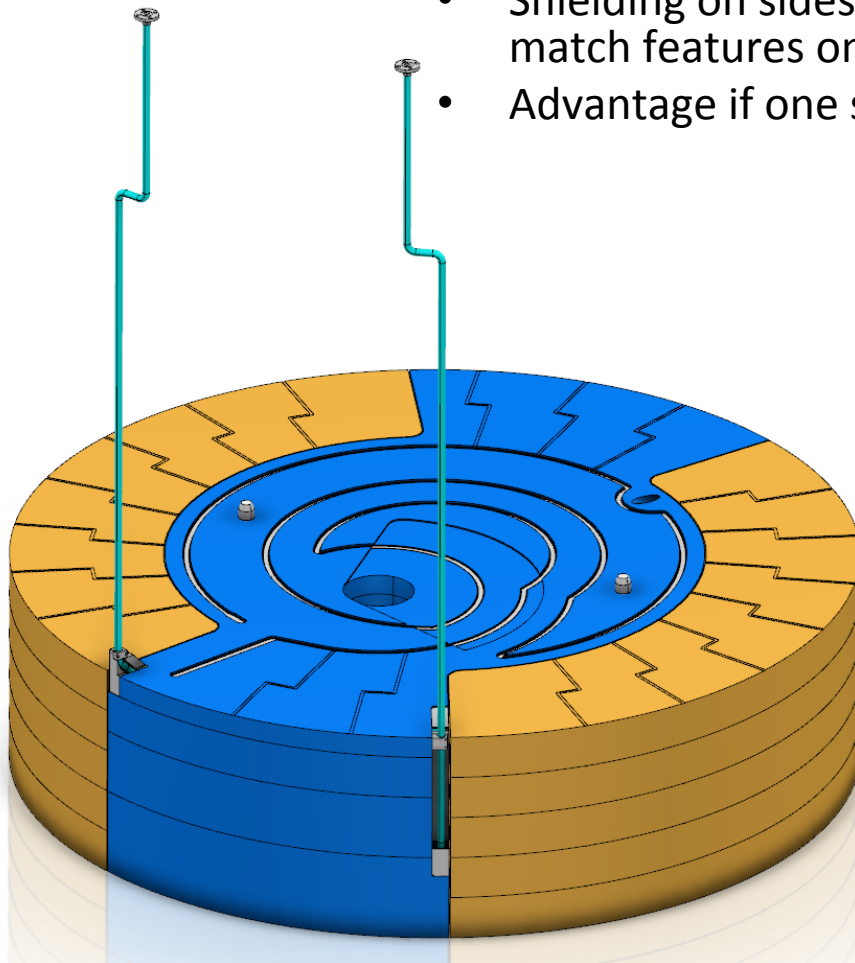
West cooling blocks details

- West cooling block should be matched to the shielding blocks above since geometry is complex.
- One supplier should make all components.

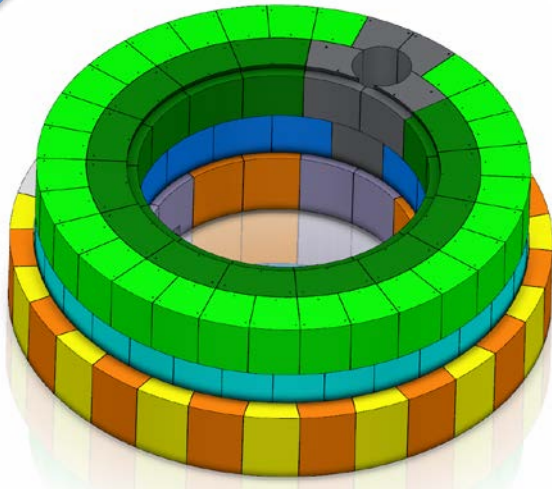


Lower inner shielding

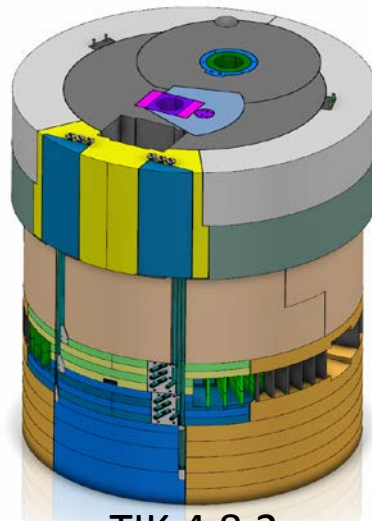
- Cooling block and outer shielding are to be matched to each other.
- Pipe welding must be done inside vacuum vessel.
- Shielding on sides (orange) have shield plates and slots that must match features on cooling blocks.
- Advantage if one supplier make the complete unit.



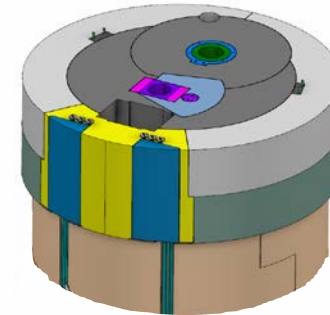
Proposed packages



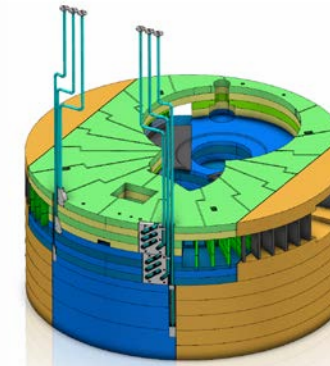
TIK.4.8.1
Outer shielding



TIK.4.8.2
Inner shielding

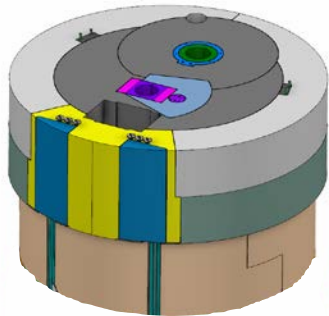


TIK.4.8.2.b
Upper inner shielding

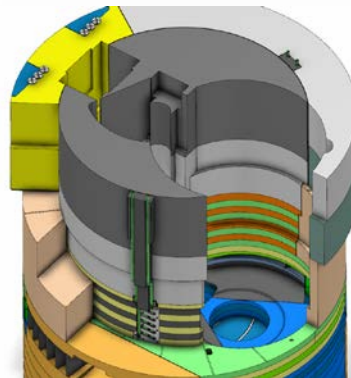


TIK.4.8.2.a
Lower inner shielding

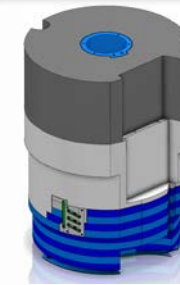
Possible further breakdown



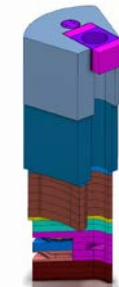
TIK.4.8.2.a
Upper inner shielding



TIK.4.8.2.a.i
Upper inner
peripheral shielding



TIK.4.8.2.a.ii
Target stack



TIK.4.8.2.a.iii
MR stack

TIK-4.8 Cost Monolith Shielding Systems



In-Kind Values

WBS	Item	Total Value (M€)	In-Kind Value (M€)	In-Kind %
12.4.4	Monolith Shielding System	15,6	14,1	90%

In-Kind Scope

WBS	Item	Prelim Design	Final Design	Procurement/ fabrication	Installation and commissioning
12.4.4	Monolith Shielding Systems	S	L	L	P

L - In-kind Partner has lead role

S - In-Kind Partner has support role

N - In-Kind Partner has no role

P - No role currently planned for In-Kind Partner, but role is possible