

APEX Task I

Flowing liquid wall in NSTX

Configuration Options

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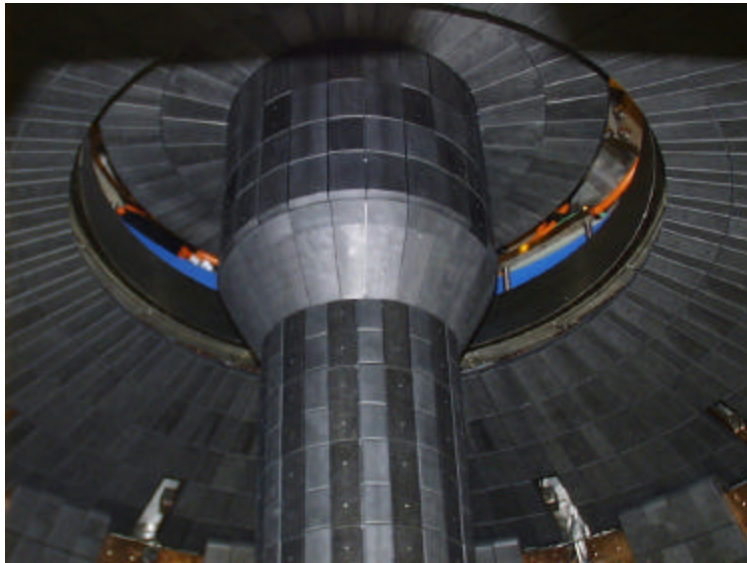
**APEX Electronic Meeting
March 24, 2000**

NSTX liquid walls: approach for developing configuration

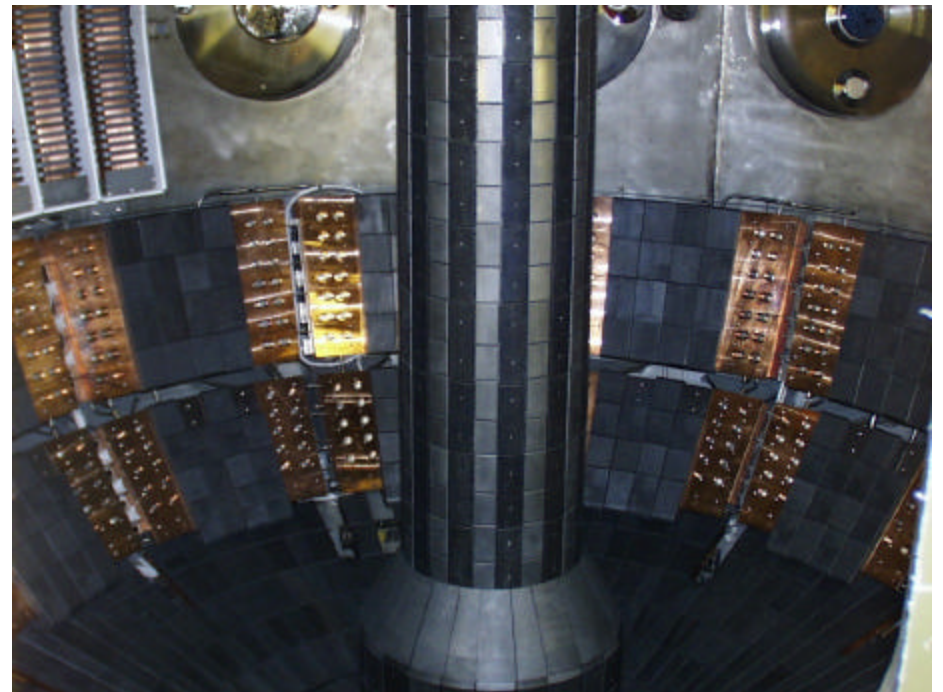
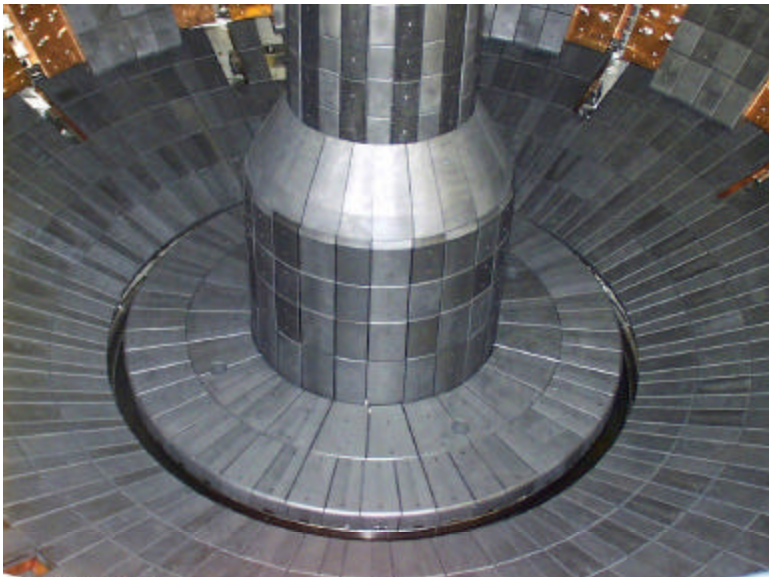
- **Gather NSTX information and update CAD models**
- **Develop strawman option parameters**
 - Option 1: Flow over centerstack only
 - Option 2: Flow over centerstack and lower divertor
 - Option 3: Flow over passive plates, centerstack, and lower divertor
- **Develop configuration for each option**
 - Produce CAD model of option
 - Identify constraints
 - Obtain feedback
- **Evaluate each option and assess feasibility**

We are currently developing option 1 configuration

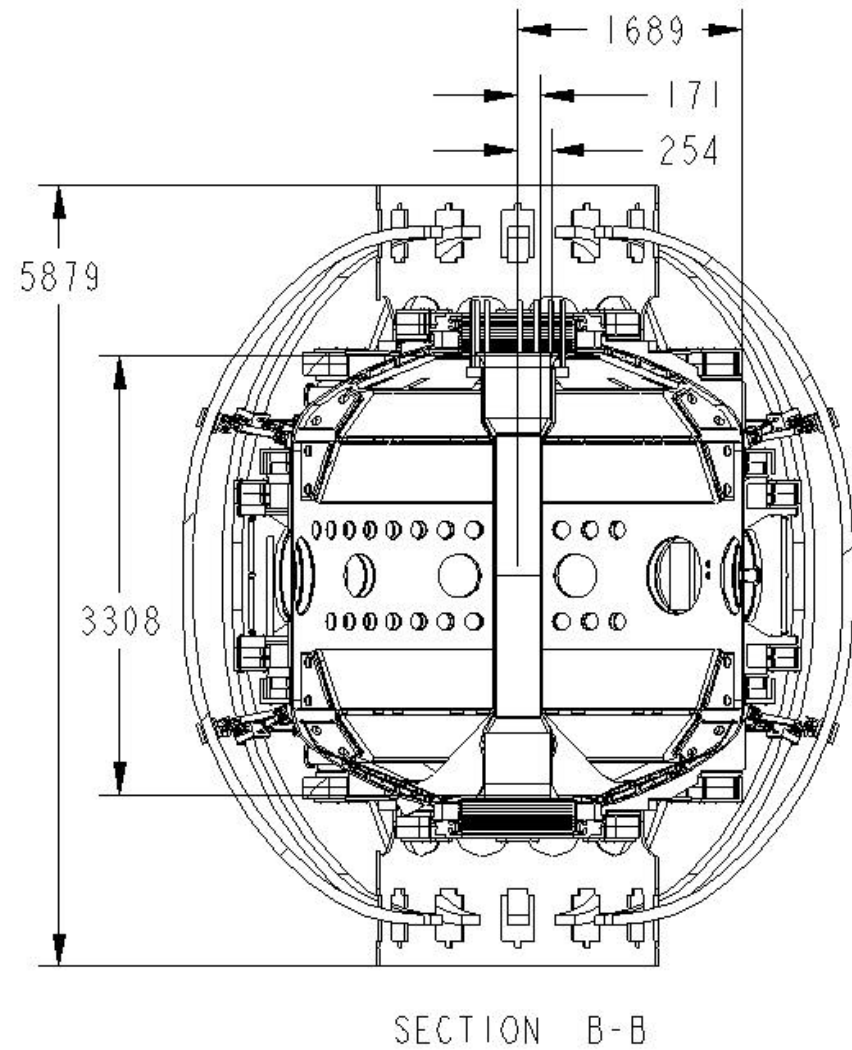
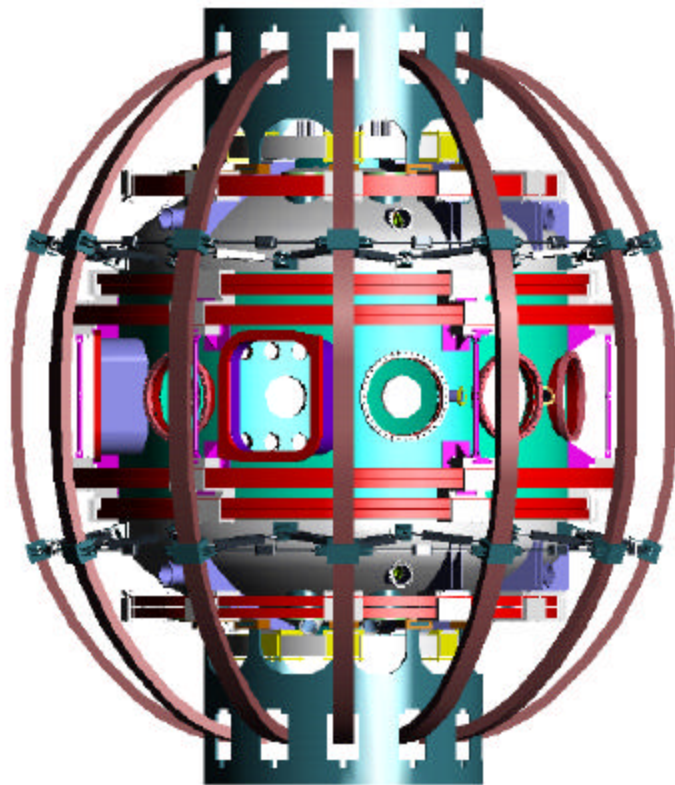
NSTX Device configuration



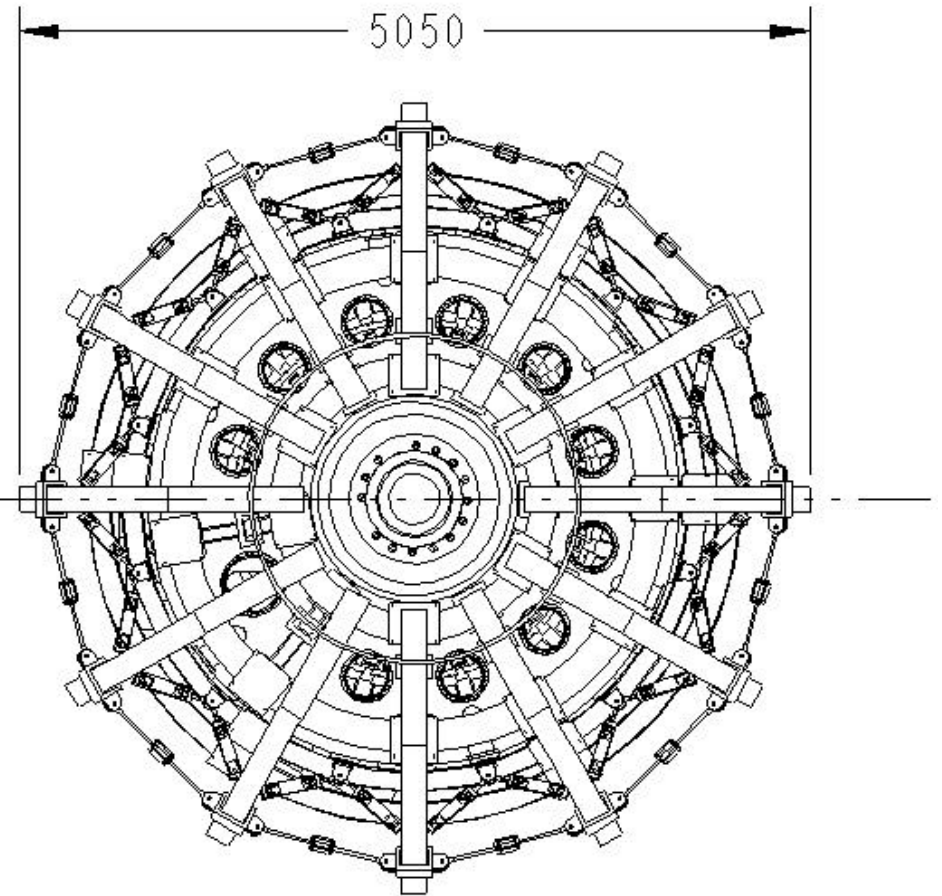
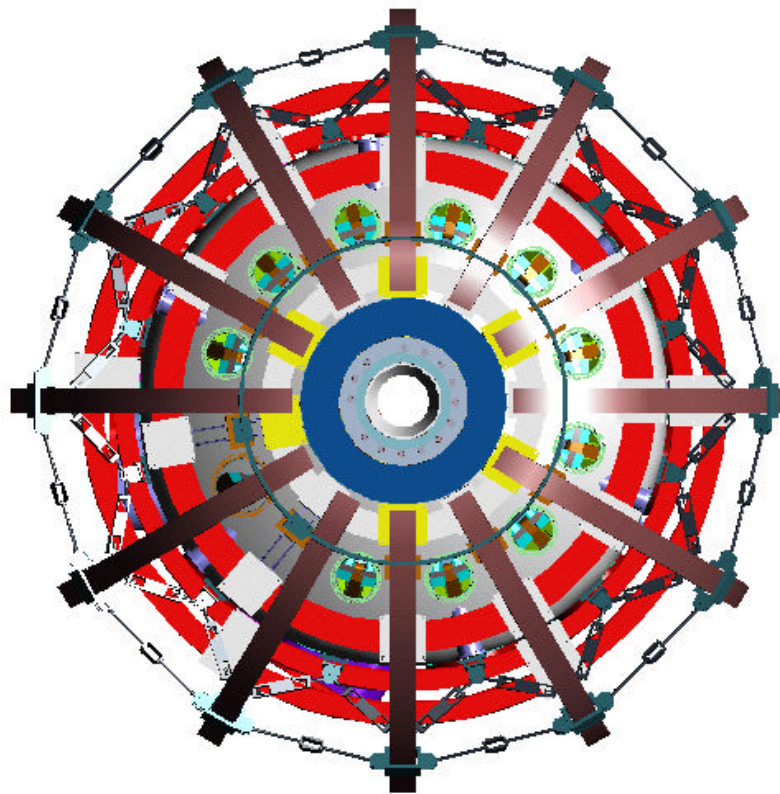
- Interior covered with carbon tiles
- Helicity injection requires insulating break between centerstack and rest of vacuum vessel



NSTX CAD model, front view



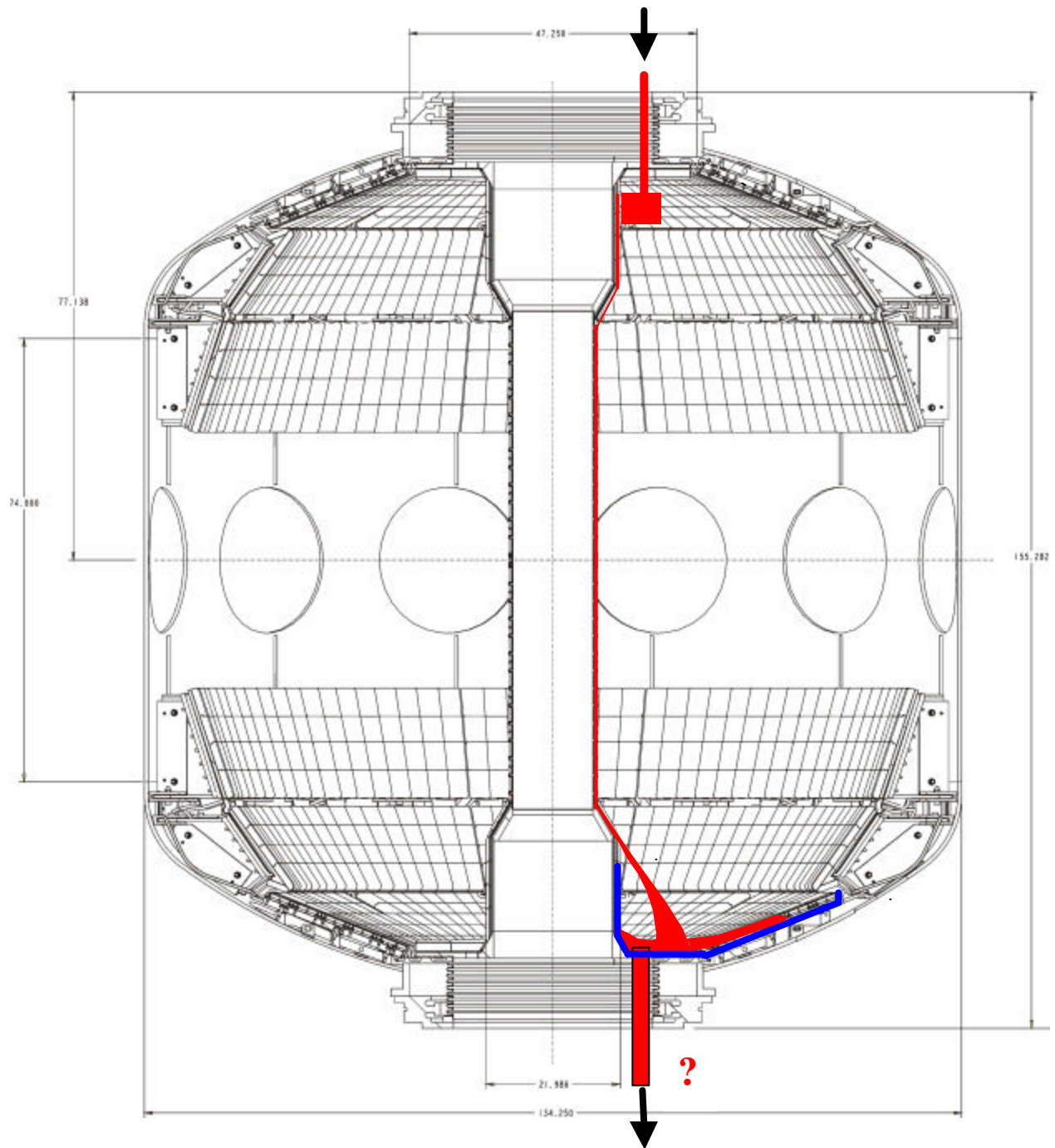
NSTX CAD model, plan view



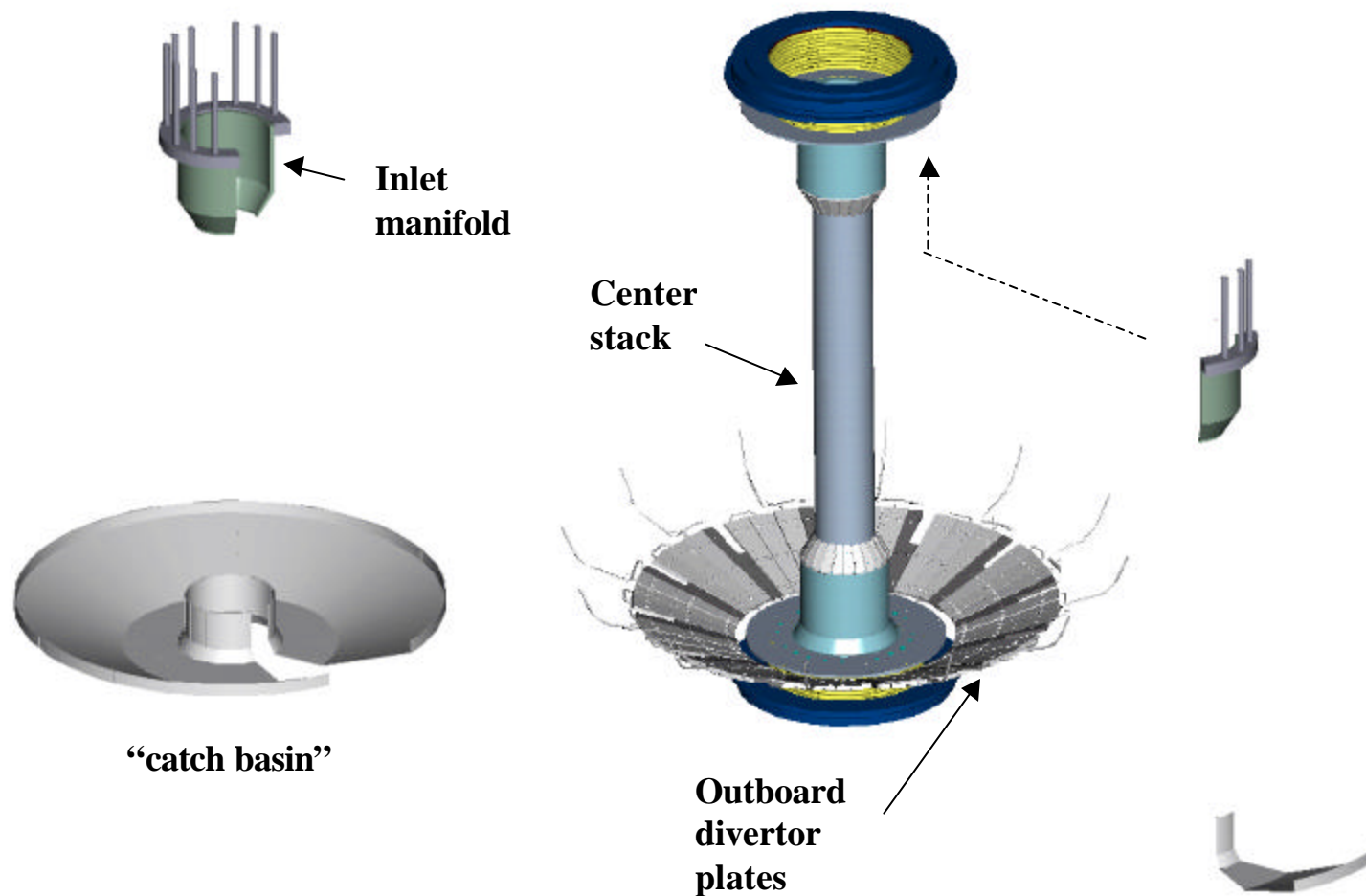
NSTX liquid wall experiment options (strawman)

Parameter	Option 1	Option 2	Option 3	Comments
<i>Plasma configuration</i>	Single null	Single null	?	Double null not an option because of upper manifolds?
<i>Liquid choice</i>	Li	Li	Li	
<i>Coverage and thickness:</i>				
IB cylinder	1 cm	1 cm	1 cm	
Lower Divertor	0 cm	2 cm	2 cm	
Upper Divertor	0 cm	0 cm	2 cm	
OB passive plates	0 cm	0 cm	4 cm	Stability experiments?
<i>Velocity of free surf flow:</i>				
IB cylinder	5 m/s	5 m/s	5 m/s	
Lower Divertor	0 m/s	0 m/s	5 m/s	
Upper Divertor	0 m/s	0 m/s	5 m/s	
OB passive plates	0 m/s	0 m/s	5 m/s	
<i>Inlet Temperature</i>	250 C	250 C	250 C	
<i>Volumetric flow rate:</i>				
IB cylinder	54 l/s	54 l/s	54 l/s	nominal radius = 0.17 m
Lower Divertor	0 l/s	0 l/s	314 l/s	nominal radius = 0.50 m
Upper Divertor	0 l/s	0 l/s	314 l/s	nominal radius = 0.50 m
OB passive plates	0 l/s	0 l/s	1,885 l/s	nominal radius = 1.50 m

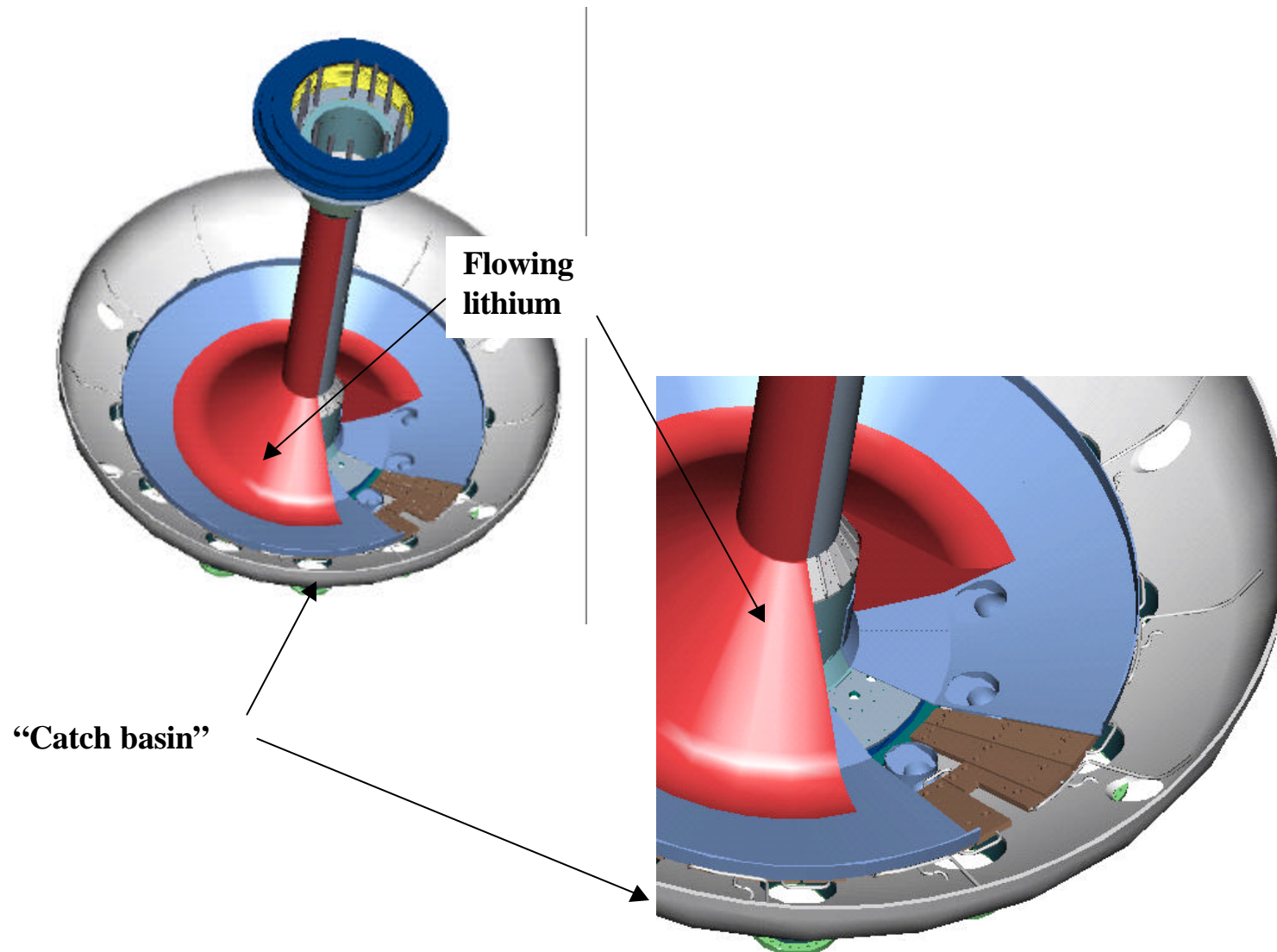
NSTX option 1: *Li on centerstack only*



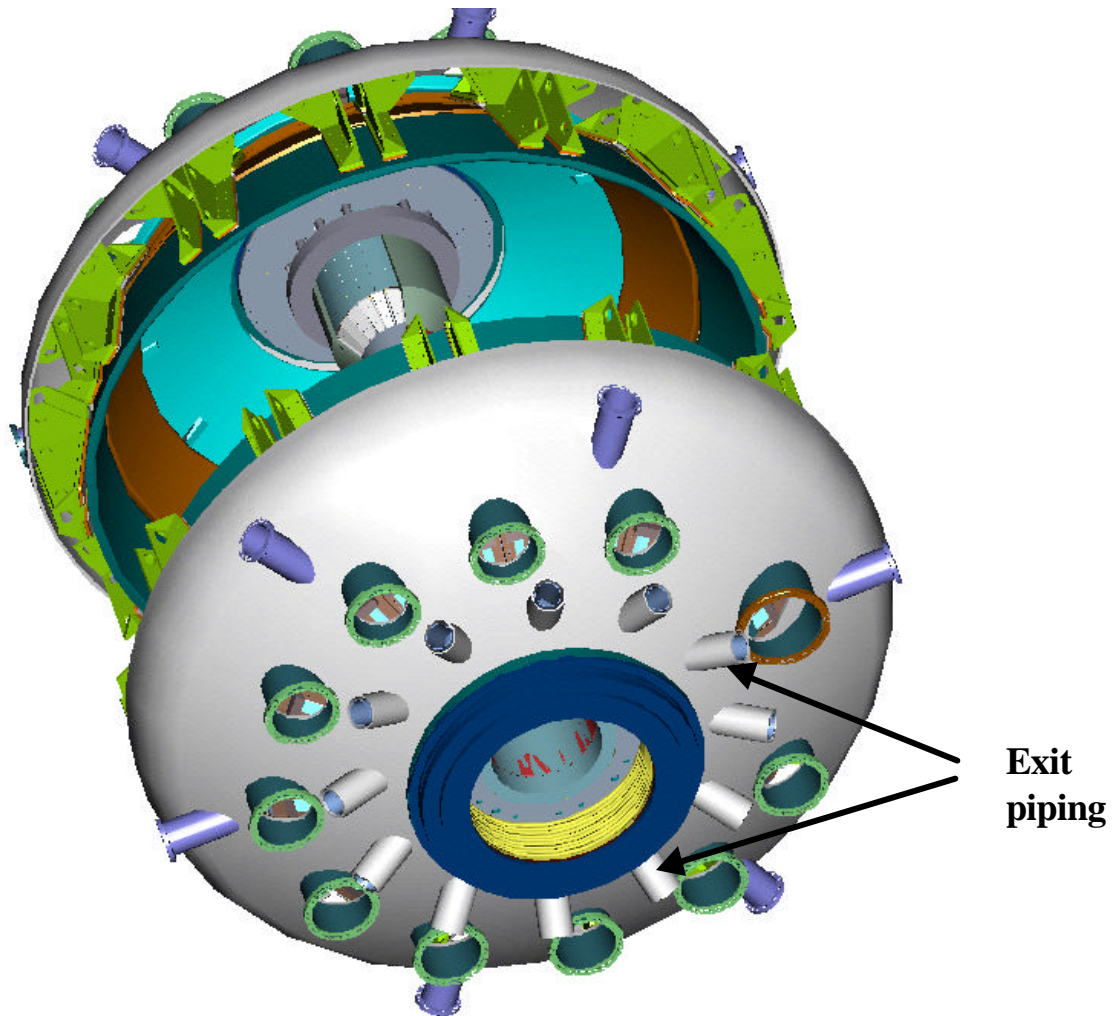
Inlet manifold and exit “catch basin” are needed to put lithium on center stack



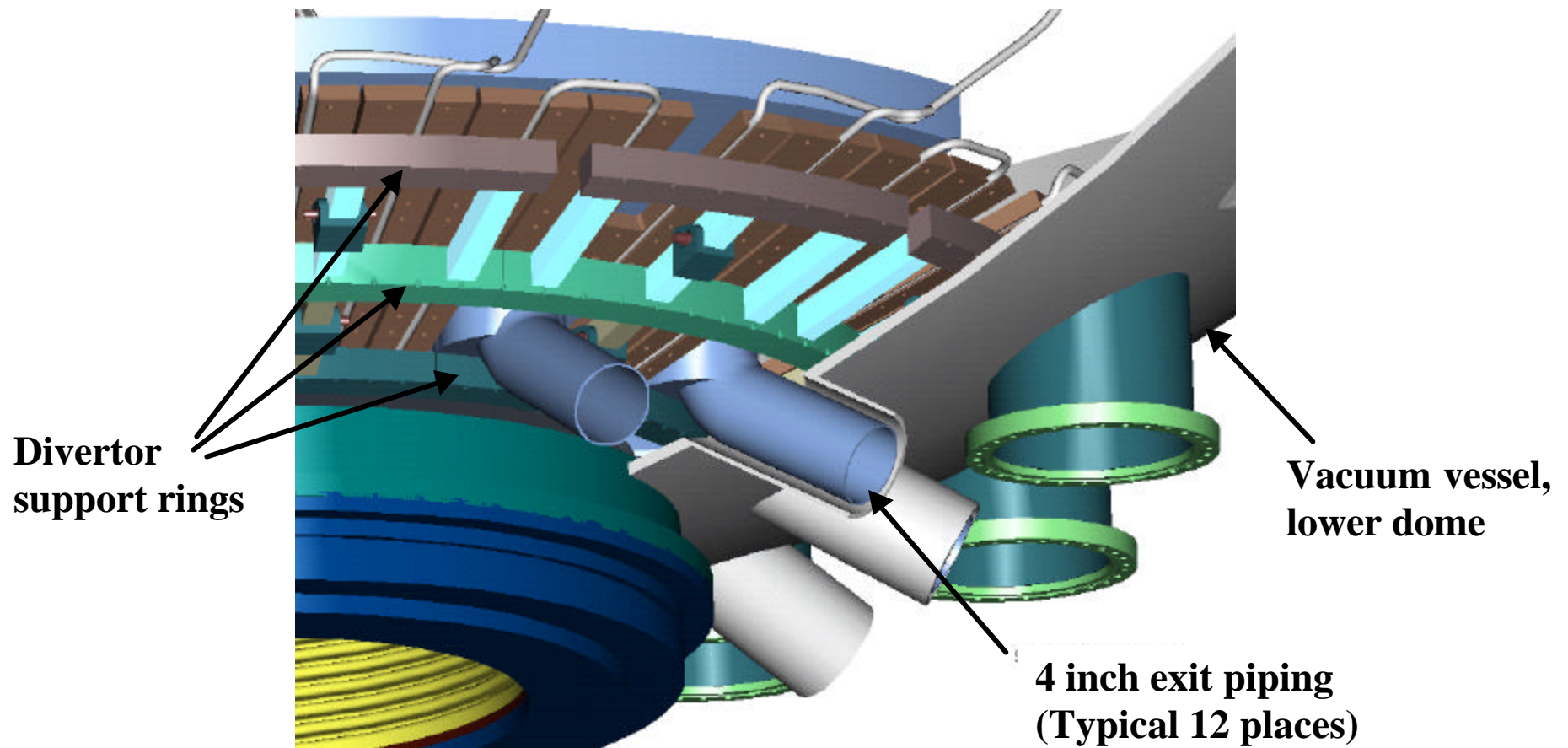
Inlet manifold and exit “catch basin” are needed to put lithium on center stack



Exit piping must clear other ports and centerstack



Exit piping must snake through divertor supports



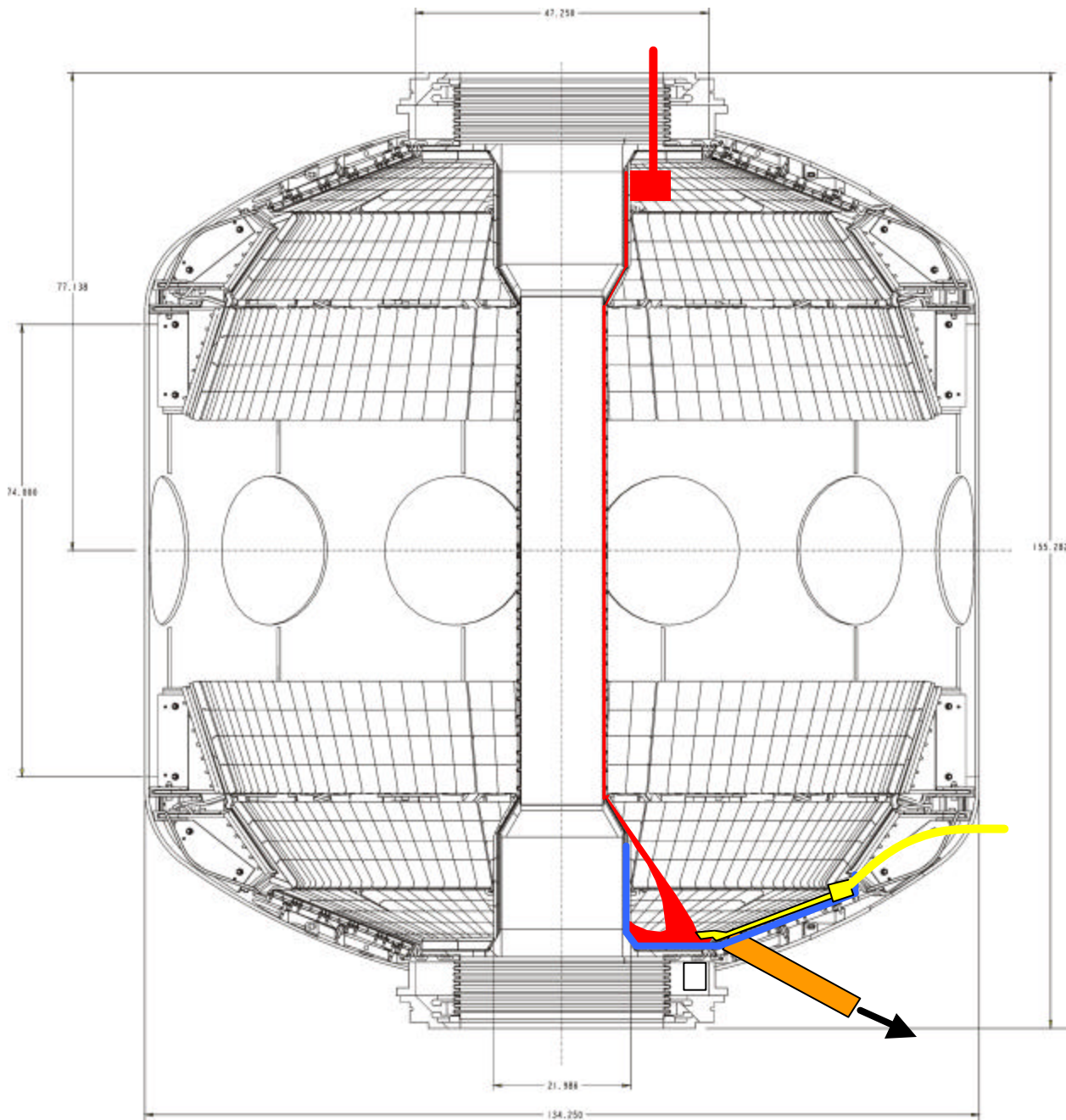
Option 1: Some of the issues

- Liquid flow should be modified at bottom of stack to reduce “splash” angle
- Exit piping is awkward and may not drain lithium adequately

EM pump integrated around centerstack has been suggested, but requires re-closed basin and extra space

- Magnetic diagnostics are not possible on center stack
- Helicity injection may not be compatible with lithium flow, even if catch basin is electrically isolated from outboard vessel

NSTX liquid wall option 2: *Li on centerstack and OB divertor*



This technical drawing shows a cross-section of a ship's hull. The internal structure includes a grid-like floor, several large oval-shaped voids, and a complex arrangement of beams and supports. Dimensions are provided in millimeters: 47,258 (width), 77,138 (height), 74,886 (height), 135,281 (height), 21,888 (width), and 134,250 (width). A green path is highlighted, starting from a red square at the top center, moving right, then down, then left, and finally down to a red circle at the bottom center. A black arrow points to the red square, and another black arrow points to the red circle. A green line connects the red square to the red circle, passing through the green path.