

DESIGN OF THE ENERGY DISSIPATION STRUCTURES OF THE TERROBA DAM (LA RIOJA, SPAIN)

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GOBIERNO
DE ESPAÑA

MINISTERIO
DE TRANSPORTES
Y MOVILIDAD SOSTENIBLE

VICEPRESIDENCIA
TERCERA DEL GOBIERNO

MINISTERIO
PARA LA TRANSICIÓN ECOLÓGICA
Y EL RETO DEMOGRÁFICO

CEDEX
CENTRO DE ESTUDIOS
Y EXPERIMENTACIÓN
DE OBRAS PÚBLICAS

Terroba Dam

Design of the energy dissipation structures of the Terroba dam (La Rioja, Spain)



Terroba Dam



MAIN CHARACTERISTICS	
Location	Terroba (La Rioja)
River	Leza
Basin	Ebro
Type of dam	Rock fill dam
Volume (hm³)	8.14
Height (m)	43
Crest Elevation	777.00 AMSL
Normal Water Level	772.00 AMSL
Max Water Level	774.96 AMSL

Hydraulic Behavior

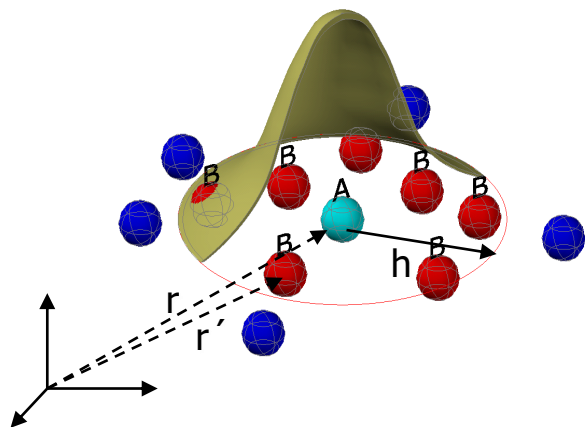


Design of the energy dissipation structures of the Terroba dam (La Rioja, Spain)

Hybrid Modeling

Mathematical Model

SPH Method: software SPHERIMENTAL



3D Navier-Stokes Equations:

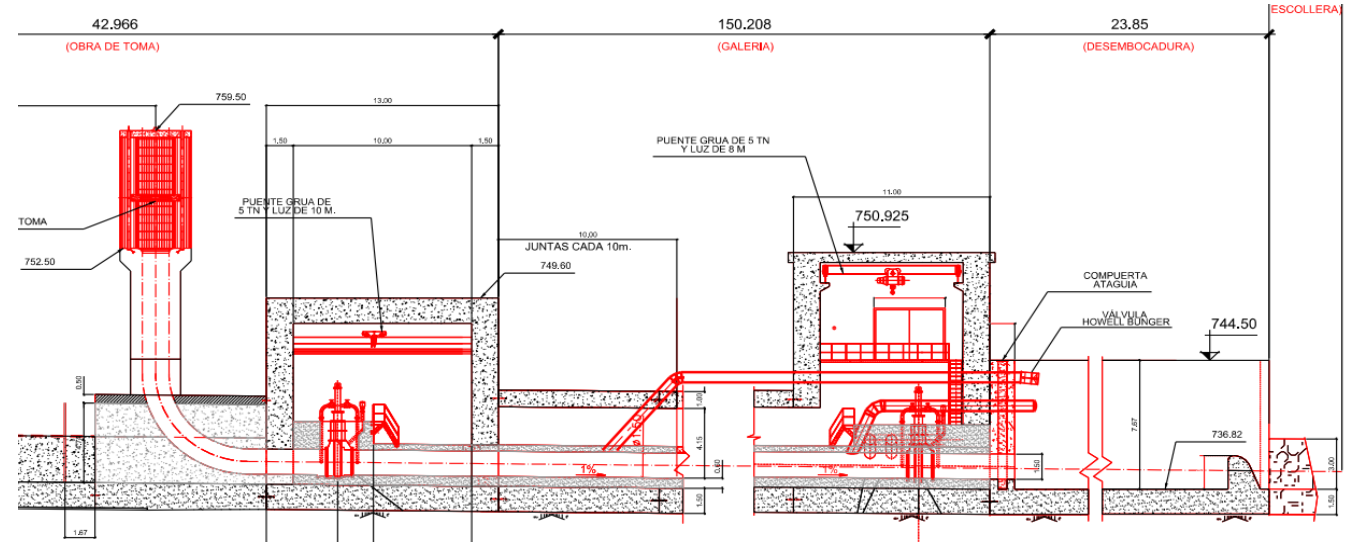
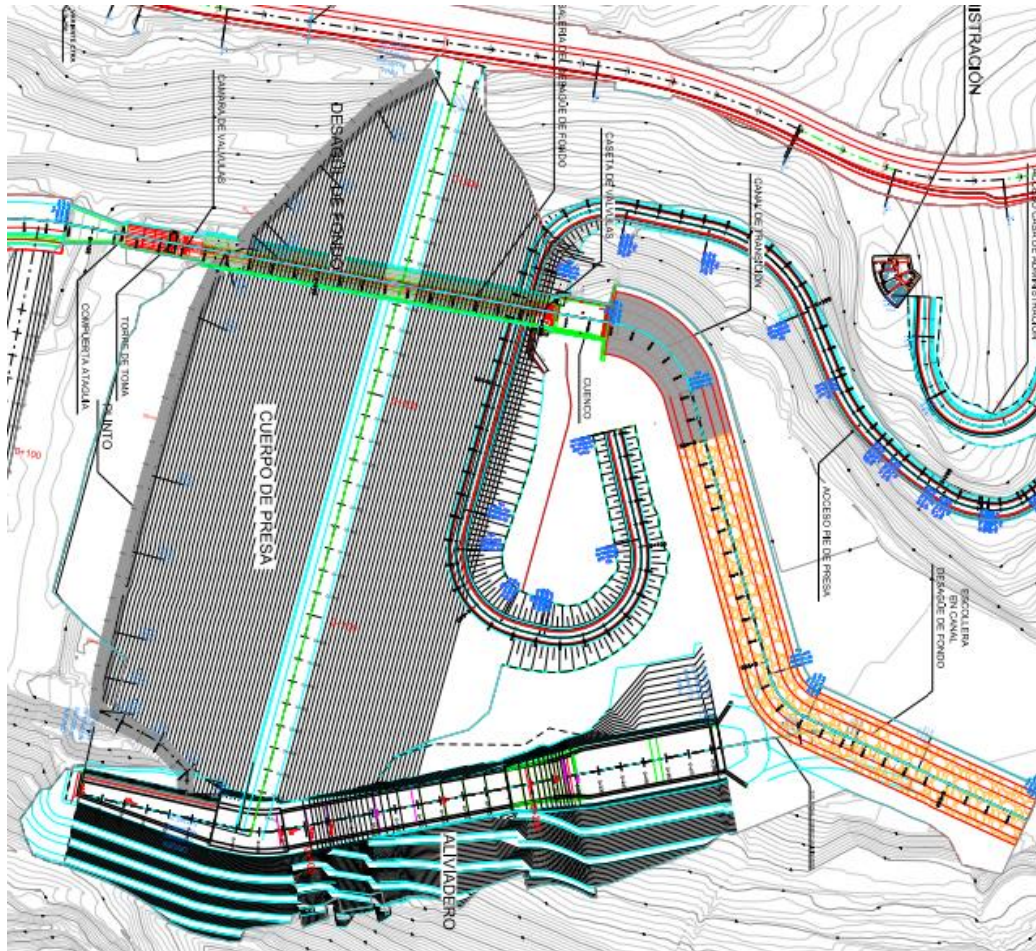
$$\frac{d\rho_a}{dt} = -\rho_a \sum_b \frac{m_b}{\rho_b} (v_b - v_a) \nabla W_{ab}$$

$$\frac{dv_a}{dt} = -\sum_b m_b \left(\frac{p_b}{\rho_b^2} + \frac{p_a}{\rho_a^2} + \Pi_{ab} \right) \nabla W_{ab}$$

Physical Model

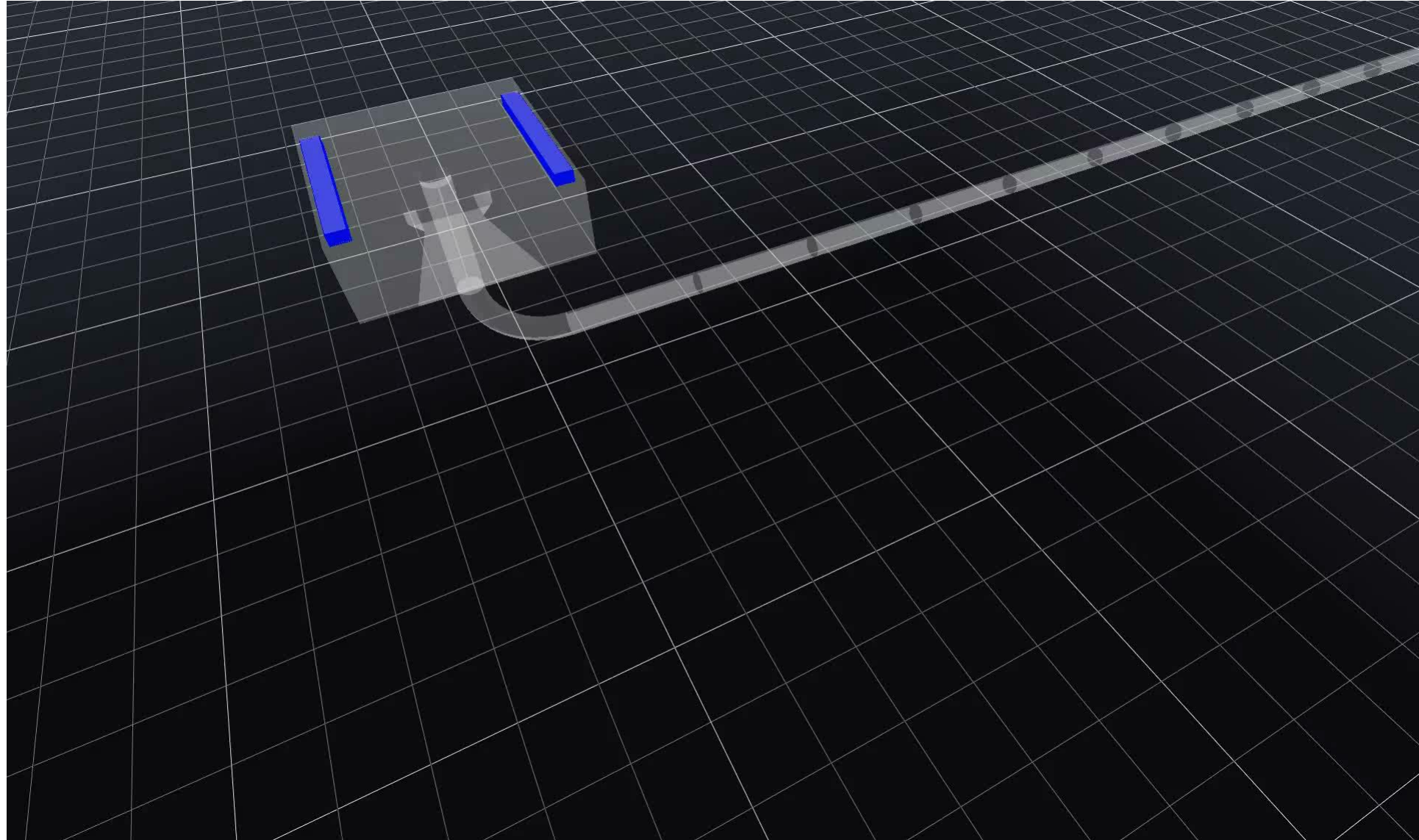


The bottom outlet

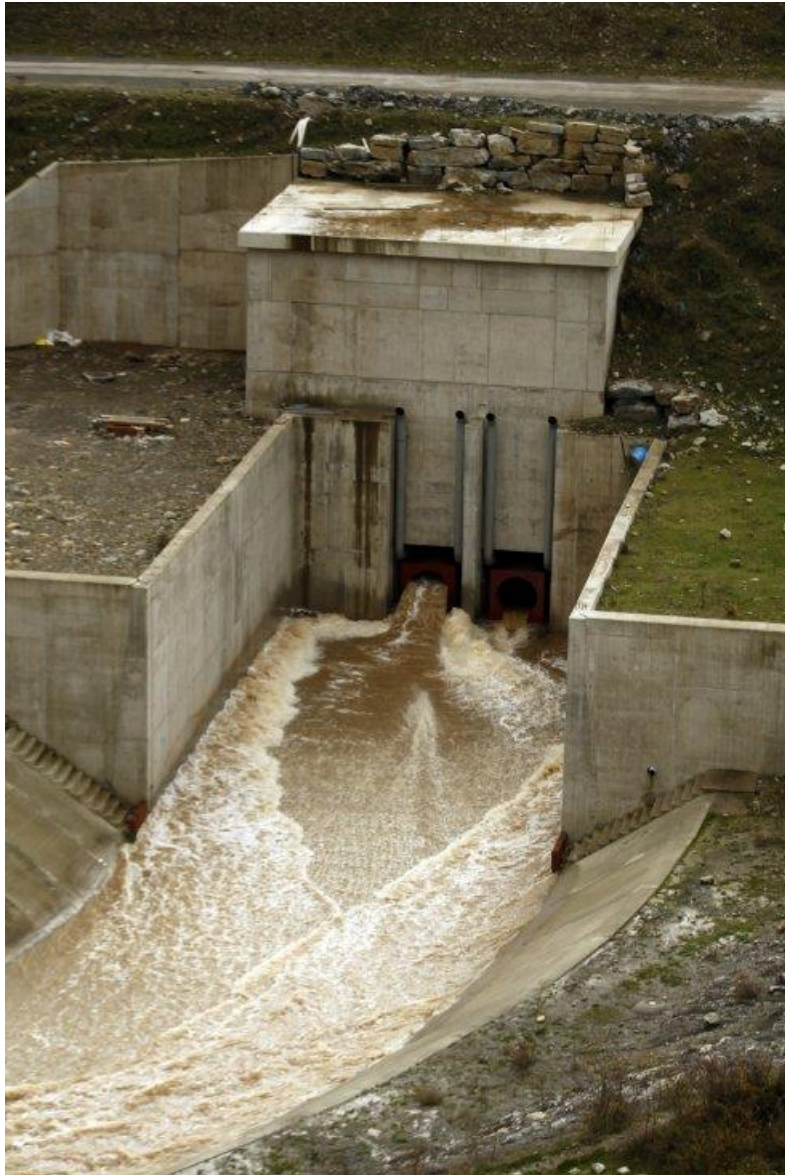


BOTTOM OUTLET INFORMATION	
Inlet elevation	752.50 AMSL
Outlet elevation	738.82 AMSL
Max Flow (m³/s)	47.69
Drainage pipes	2 pipes Ø 1500 mm
Slope of the pipes	1%
Stilling basin	23.85 m x 13.00 m

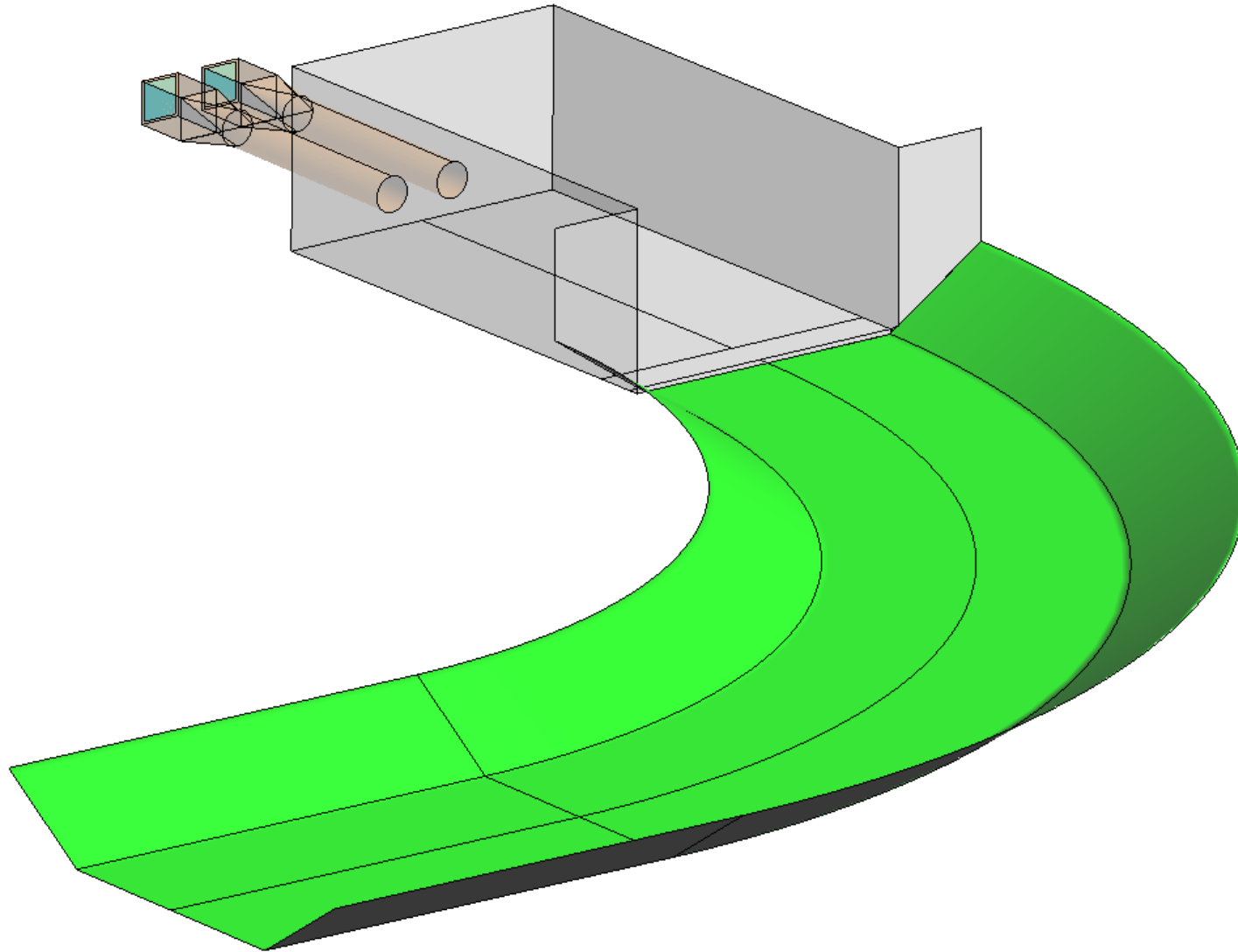
Main Problem



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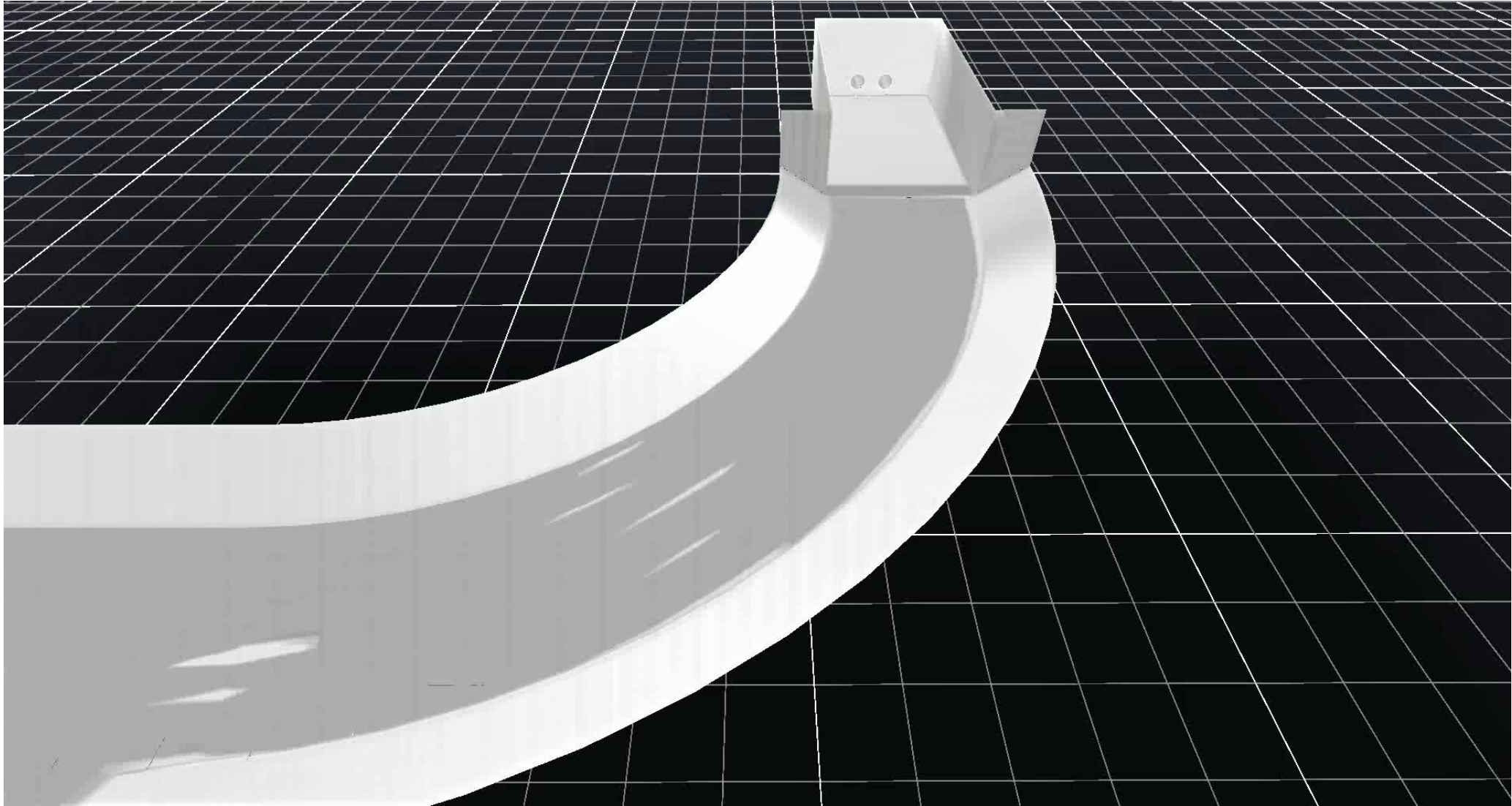


Previous situation (without weir)

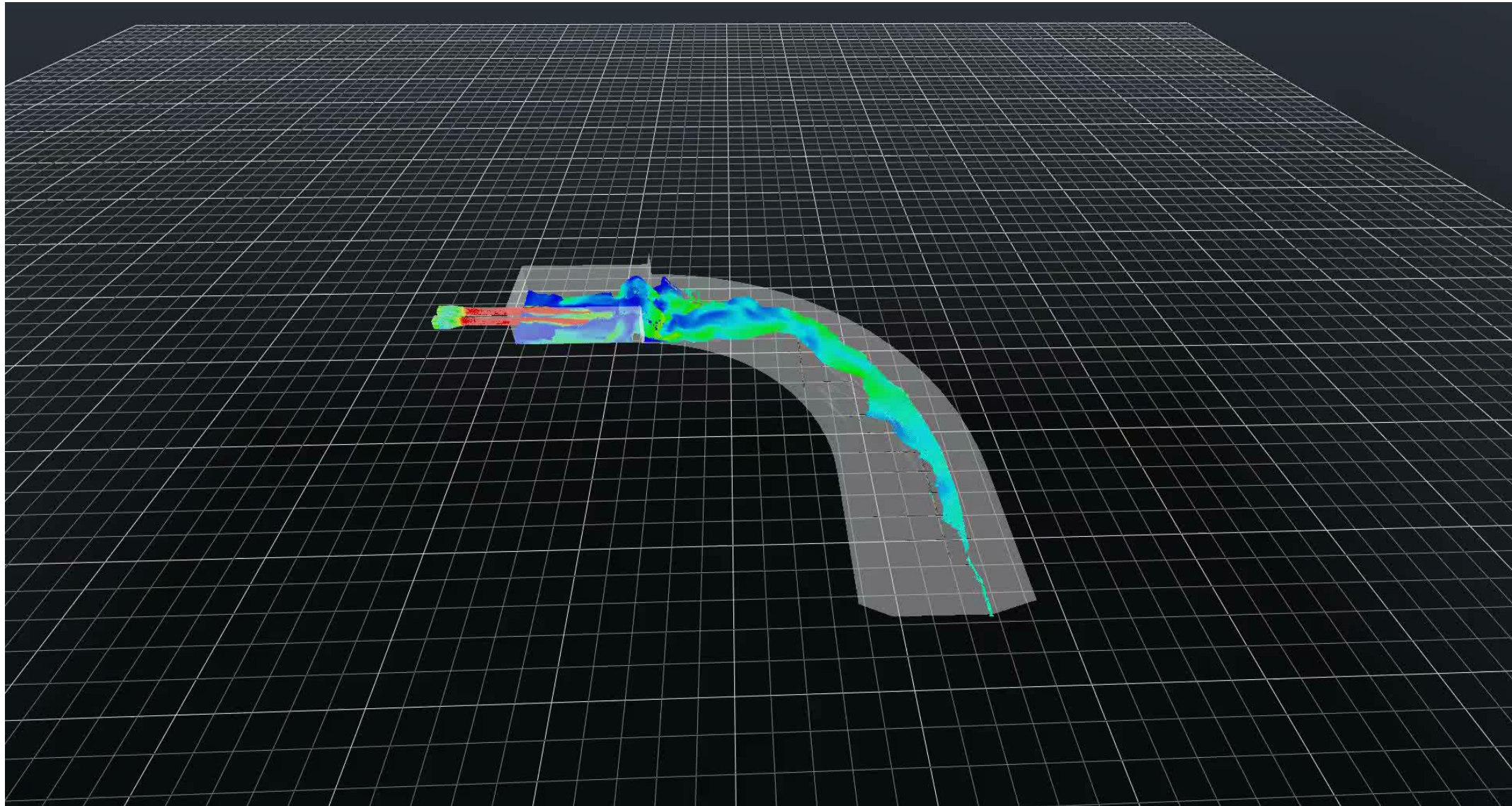


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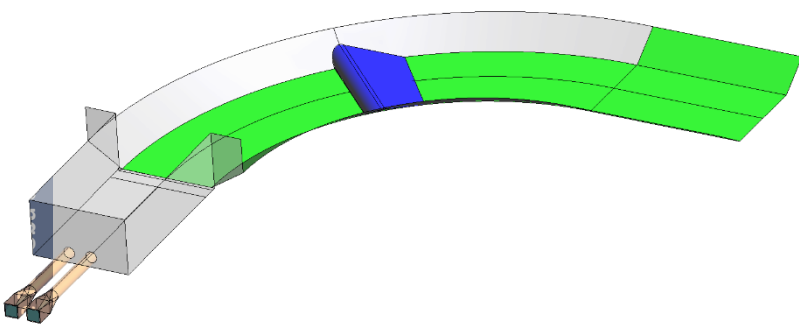
$$Q_{\max} = 48 \text{ m}^3/\text{s}$$



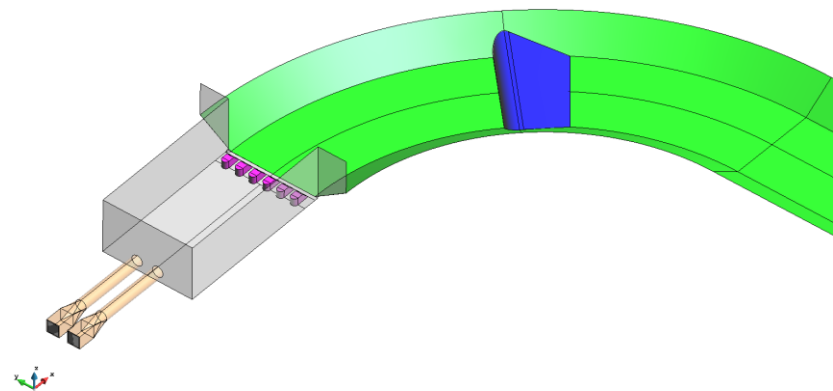
Current situation $Q_{\max}=48 \text{ m}^3/\text{s}$



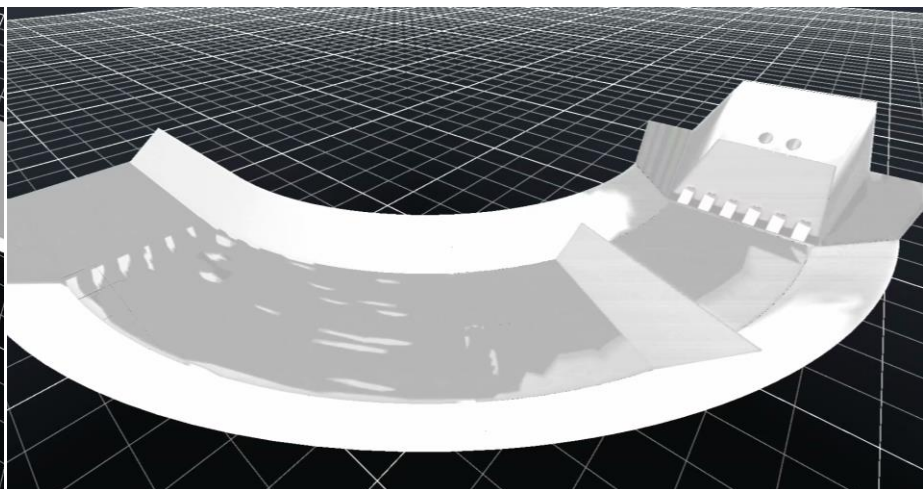
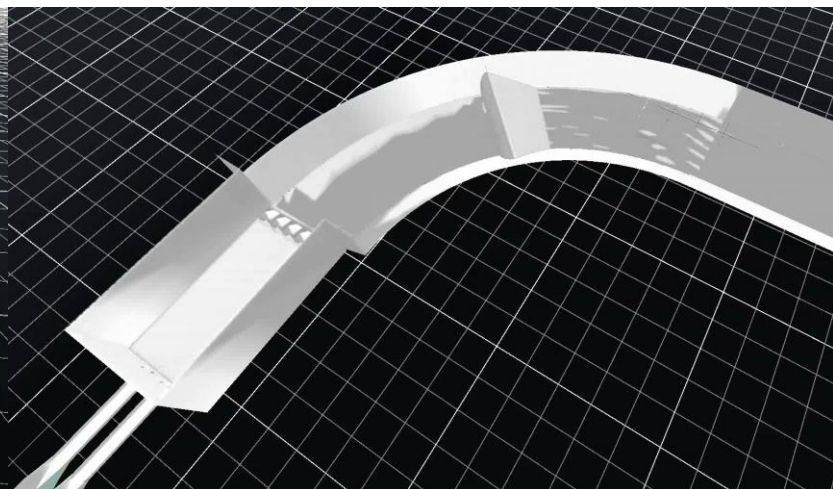
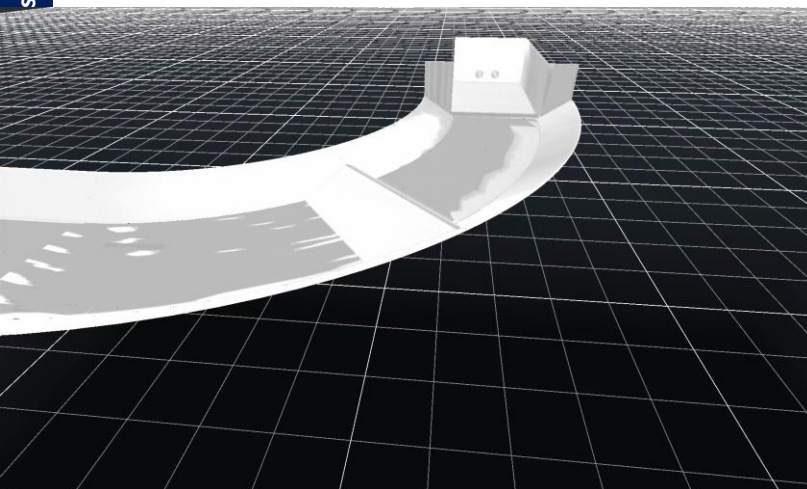
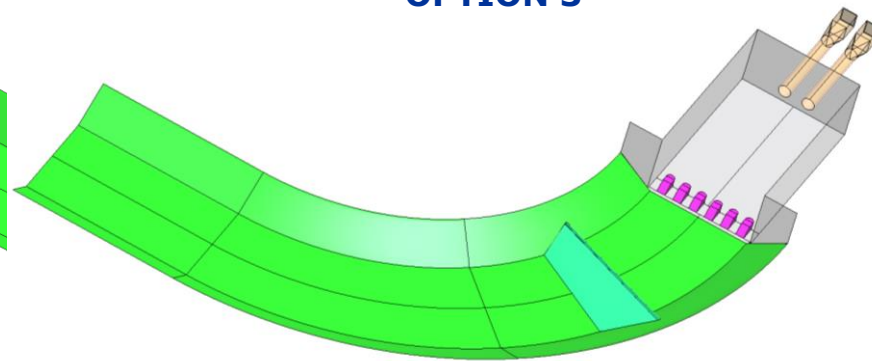
OPTION 1



OPTION 2

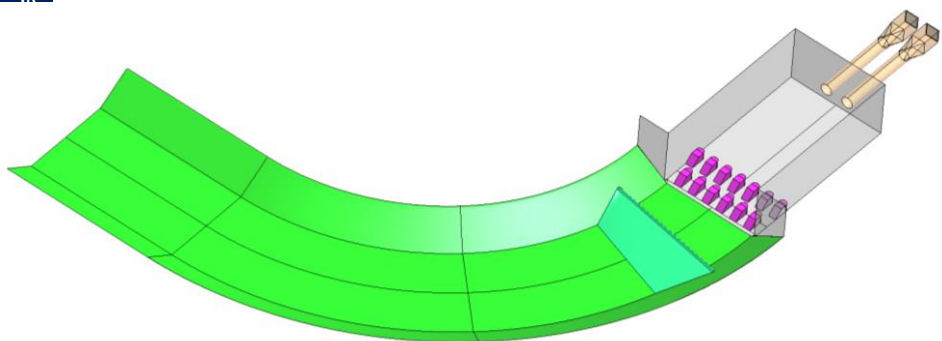


OPTION 3

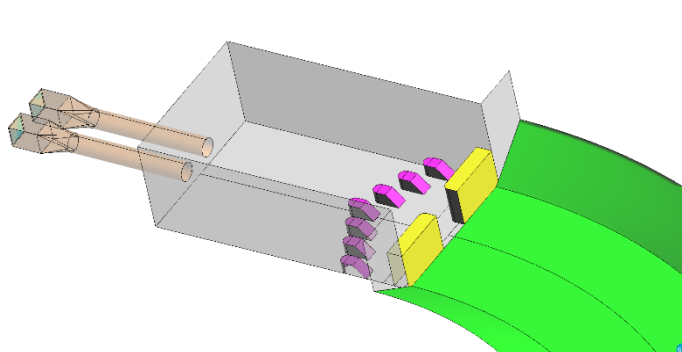


$Q_{\max} = 10-48 \text{ m}^3/\text{s}$

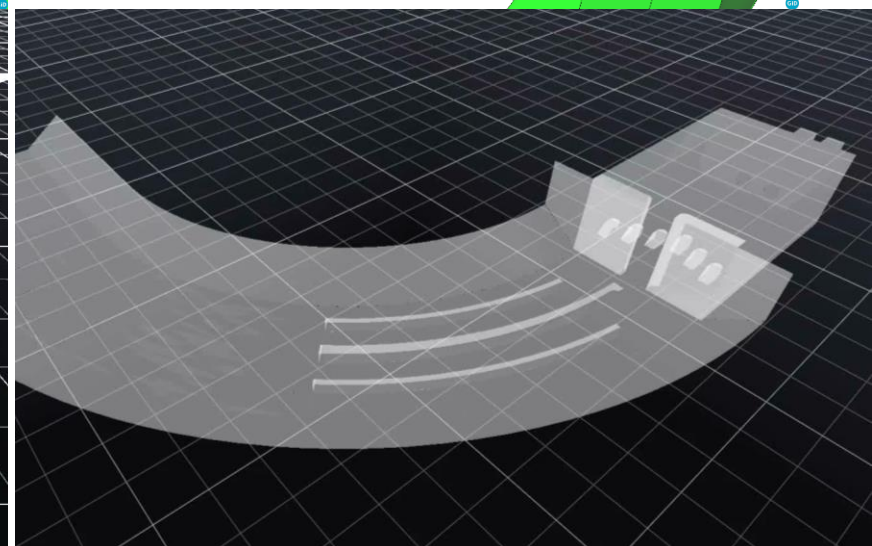
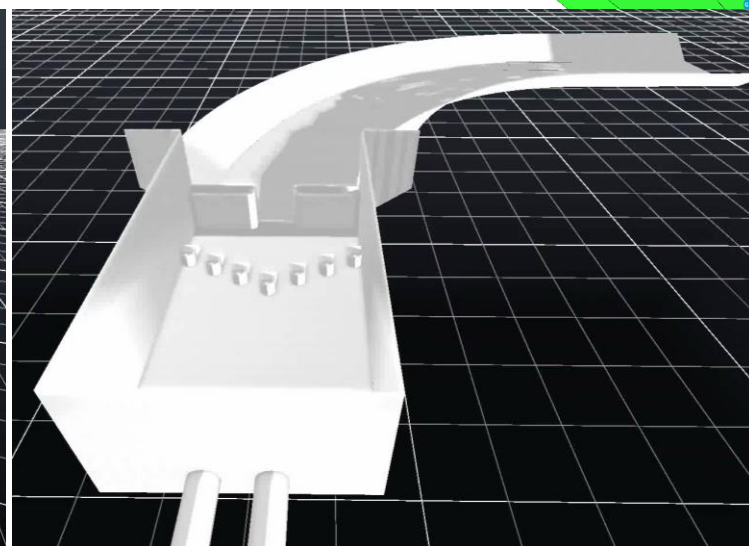
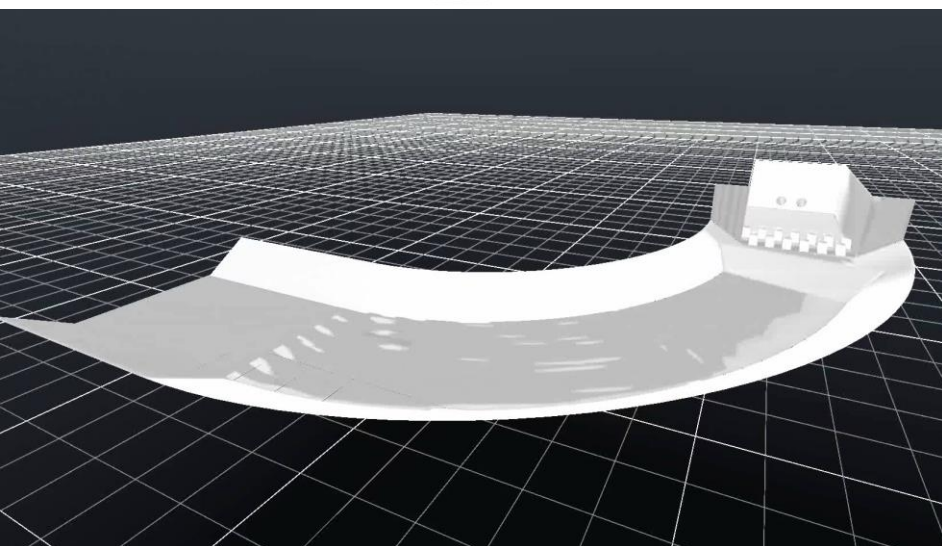
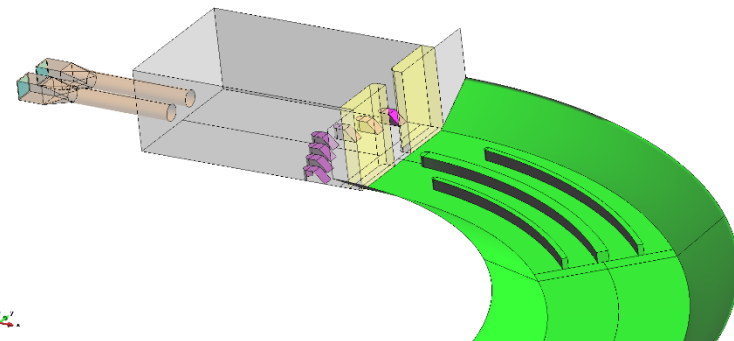
OPTION 4



OPTION 5

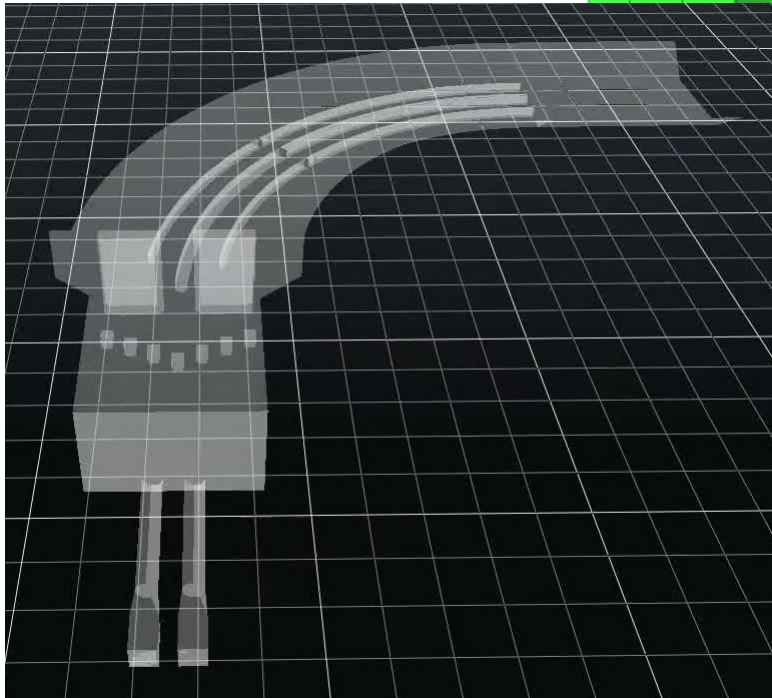
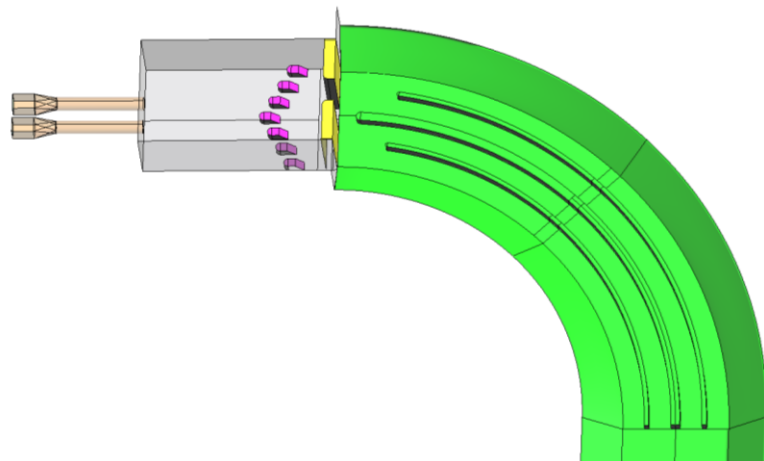


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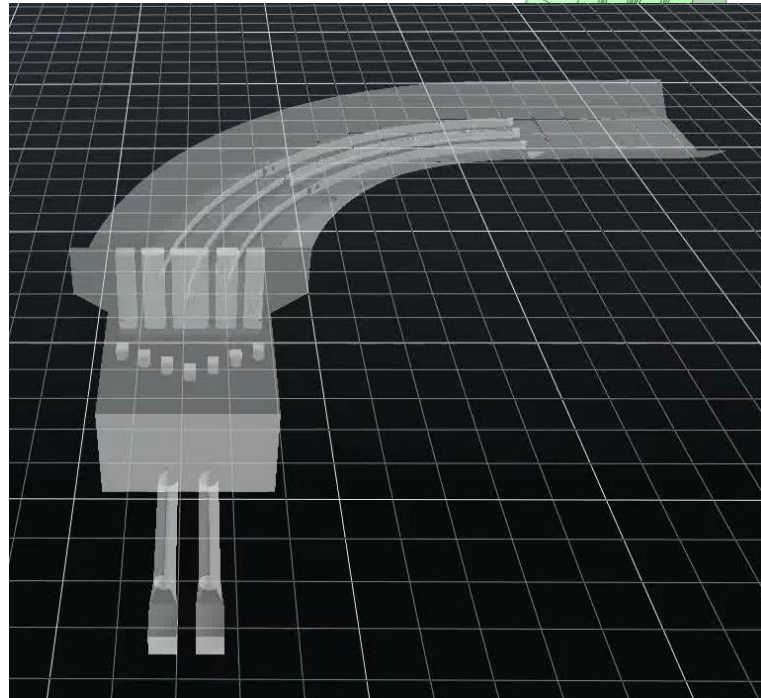
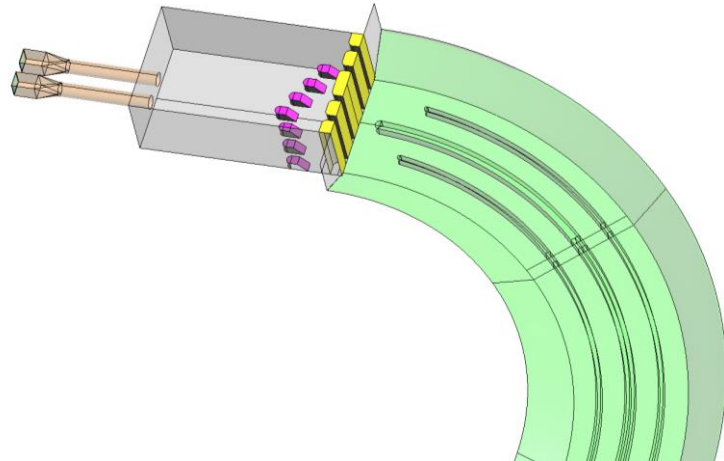


$Q_{max} = 10-48 \text{ m}^3/\text{s}$

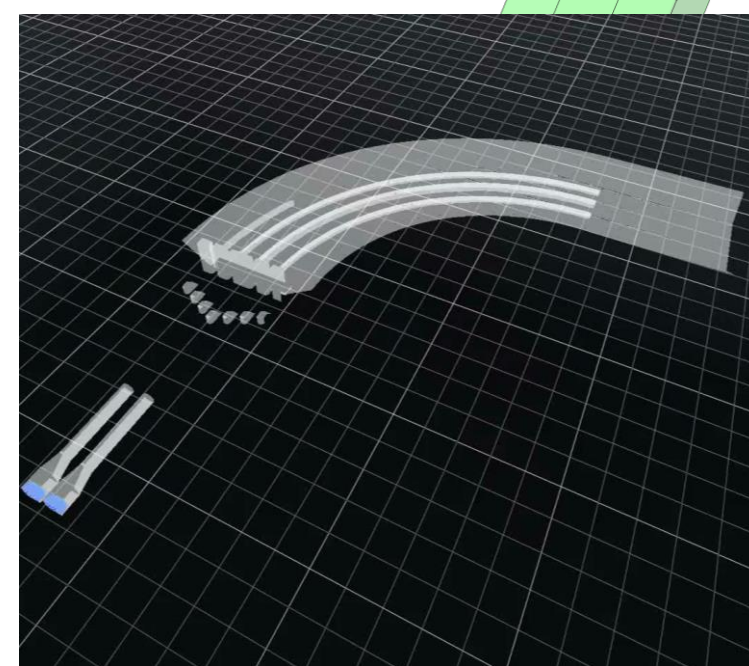
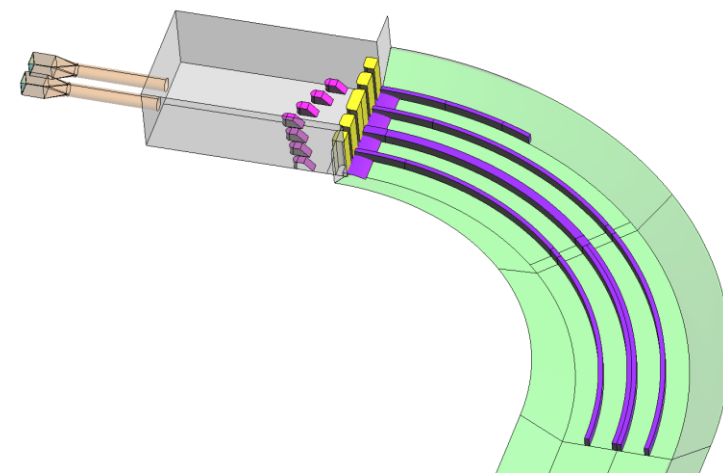
OPTION 8



OPTION 9

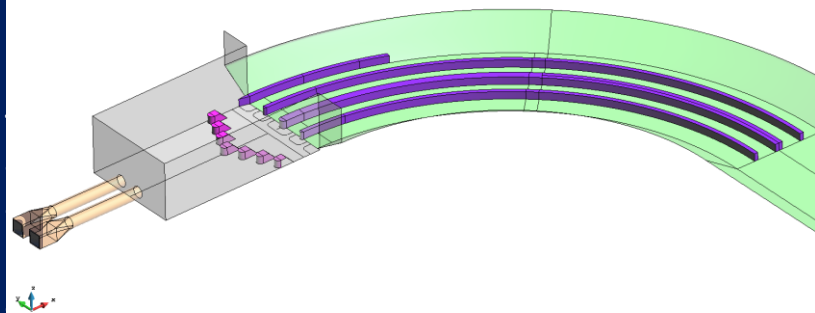


OPTION 10

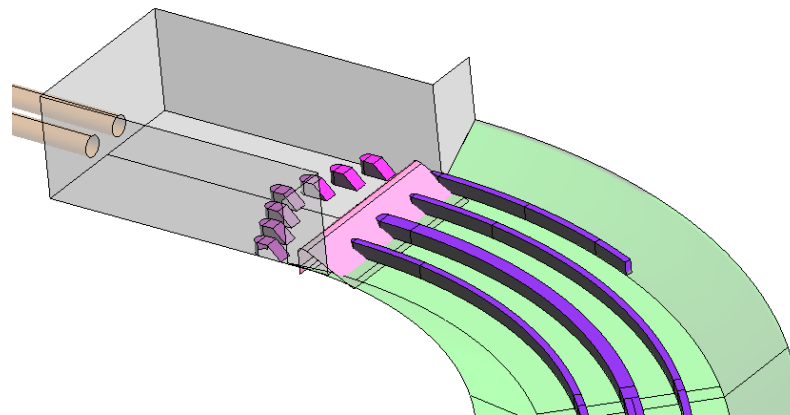


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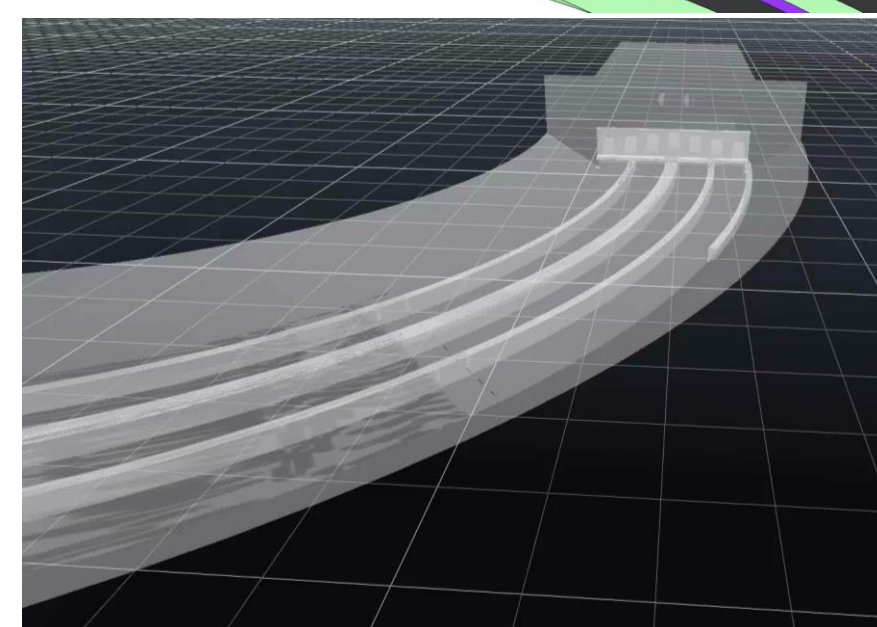
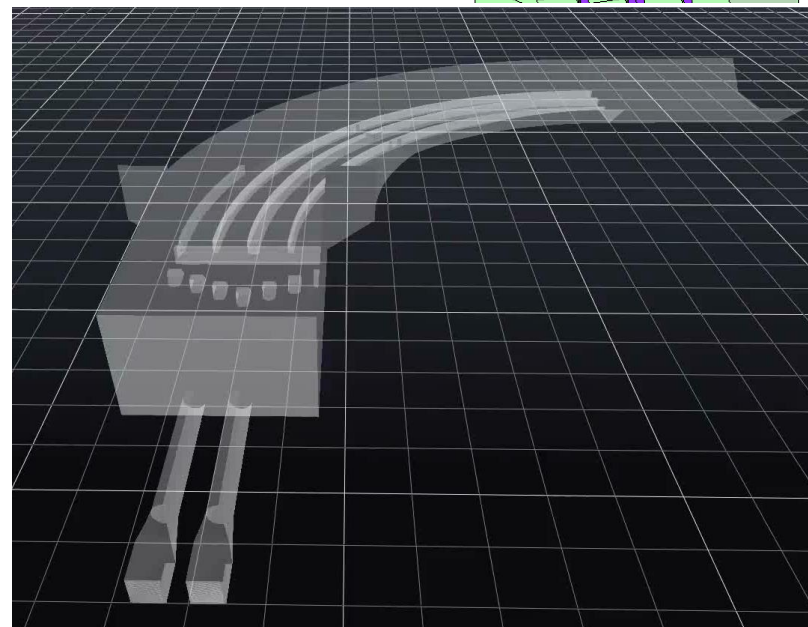
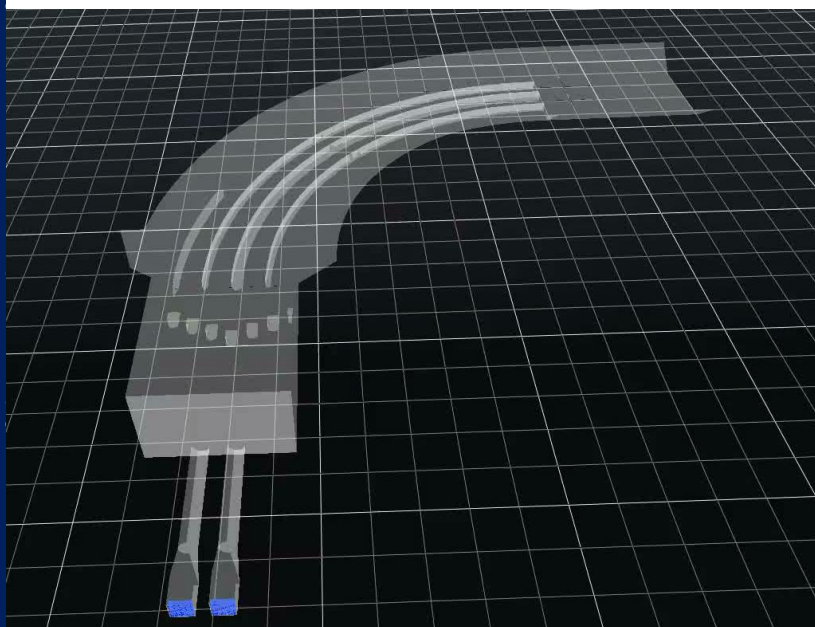
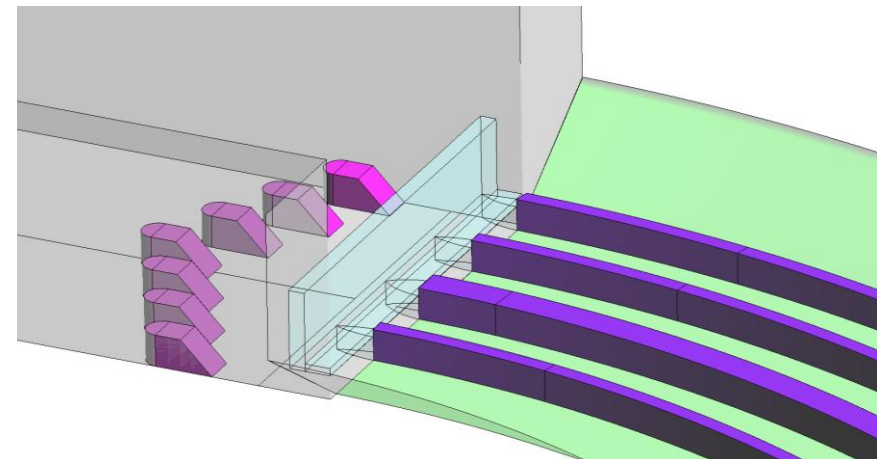
OPTION 11



OPTION 12

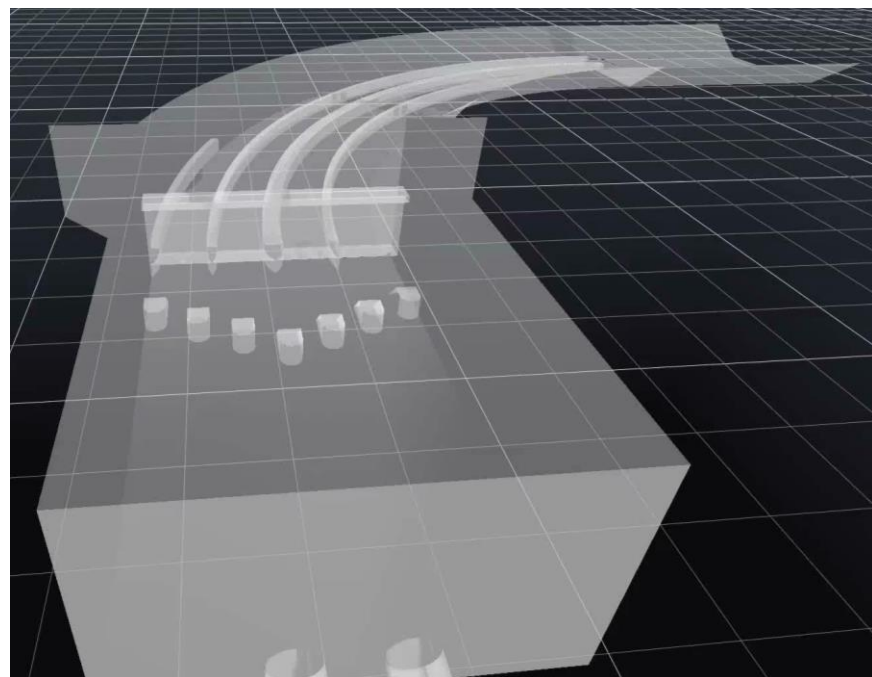
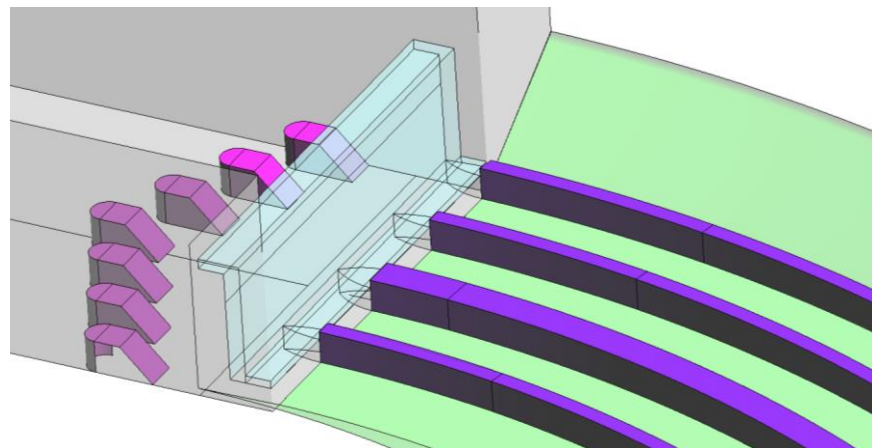


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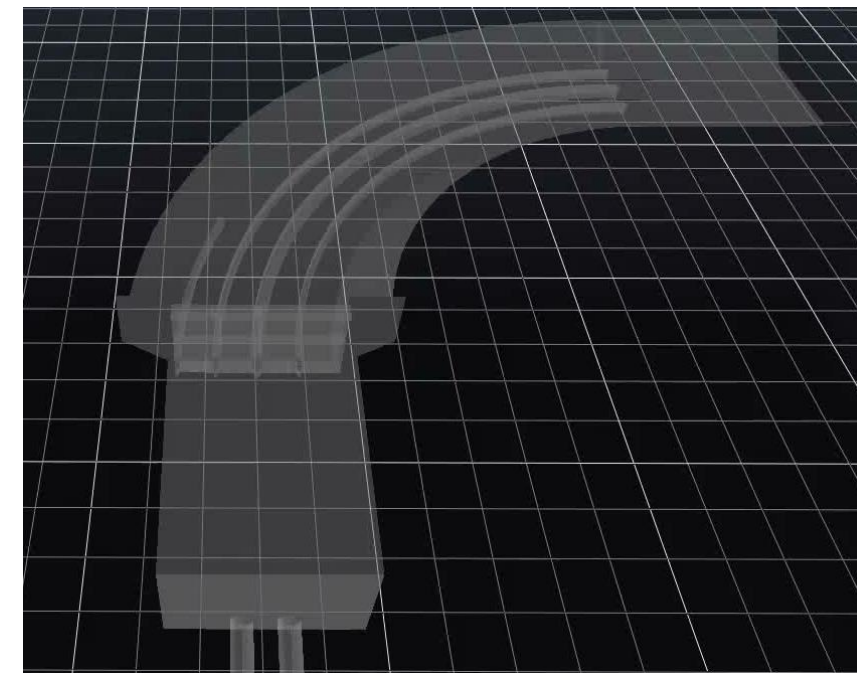
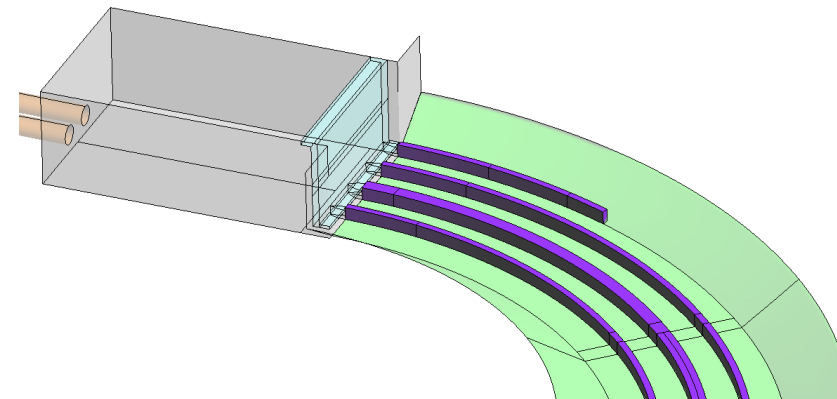


$Q_{max} = 10-48 \text{ m}^3/\text{s}$

OPTION 14

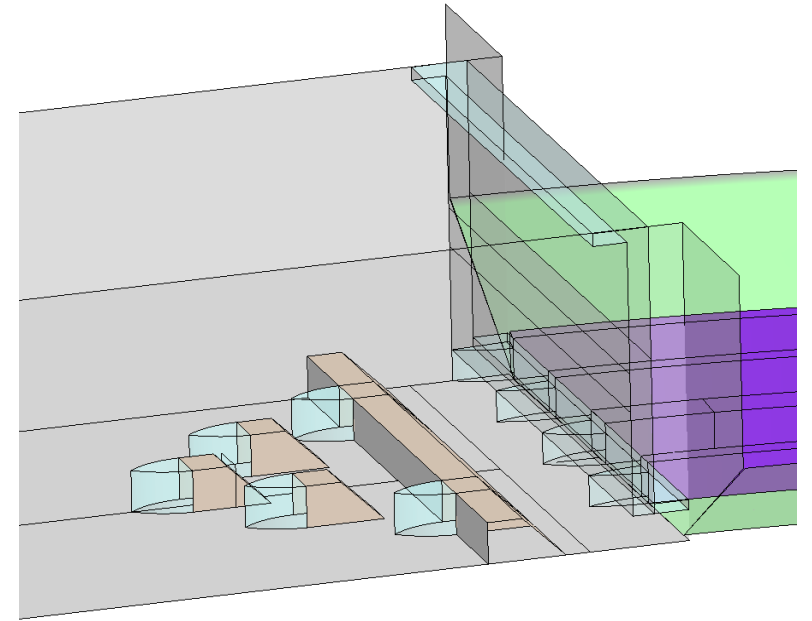
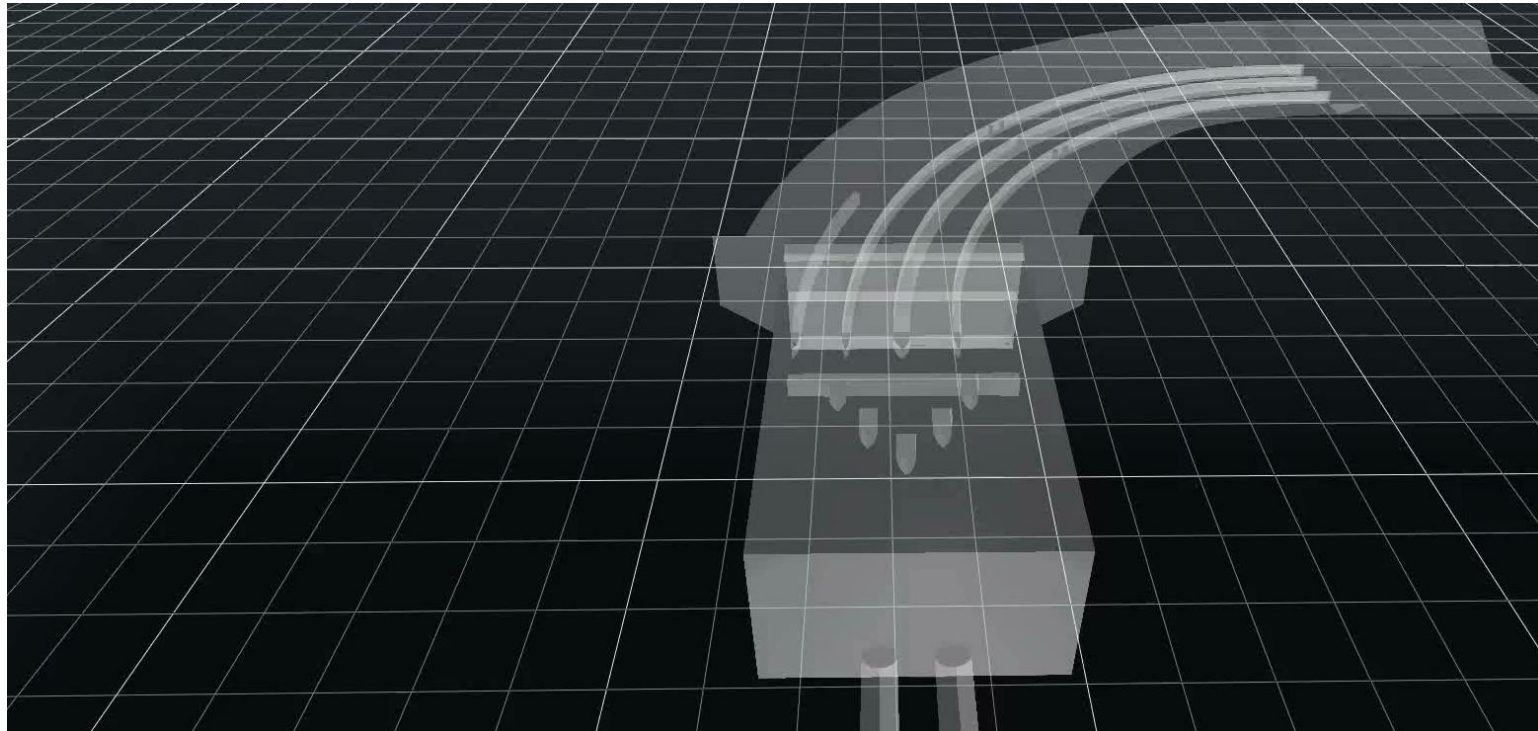
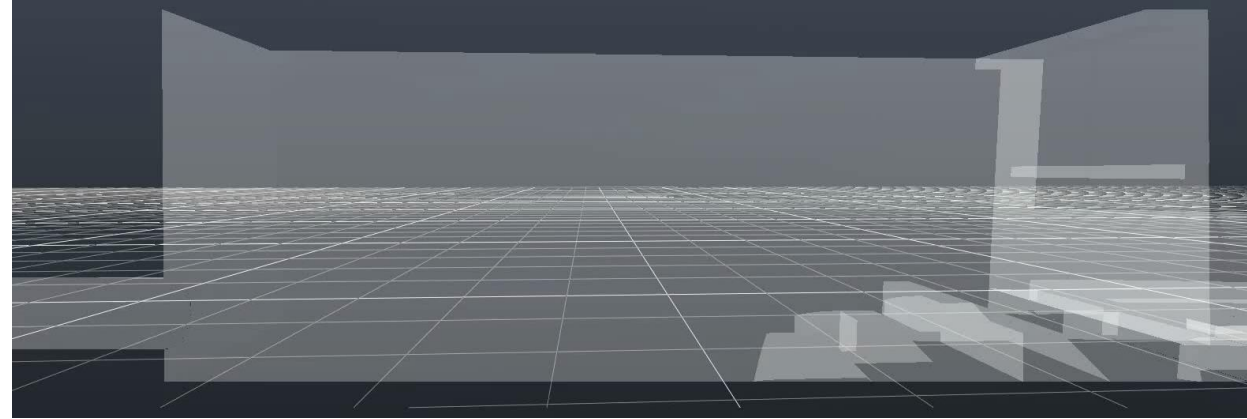
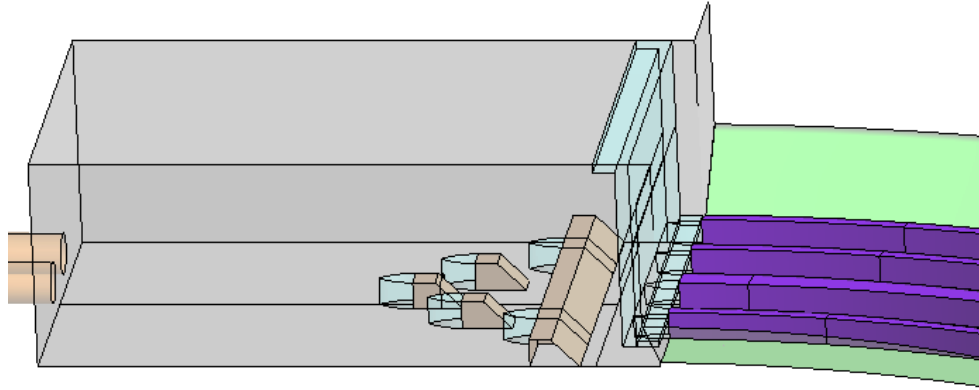


OPTION 15



$Q=10-48 \text{ m}^3/\text{s}$

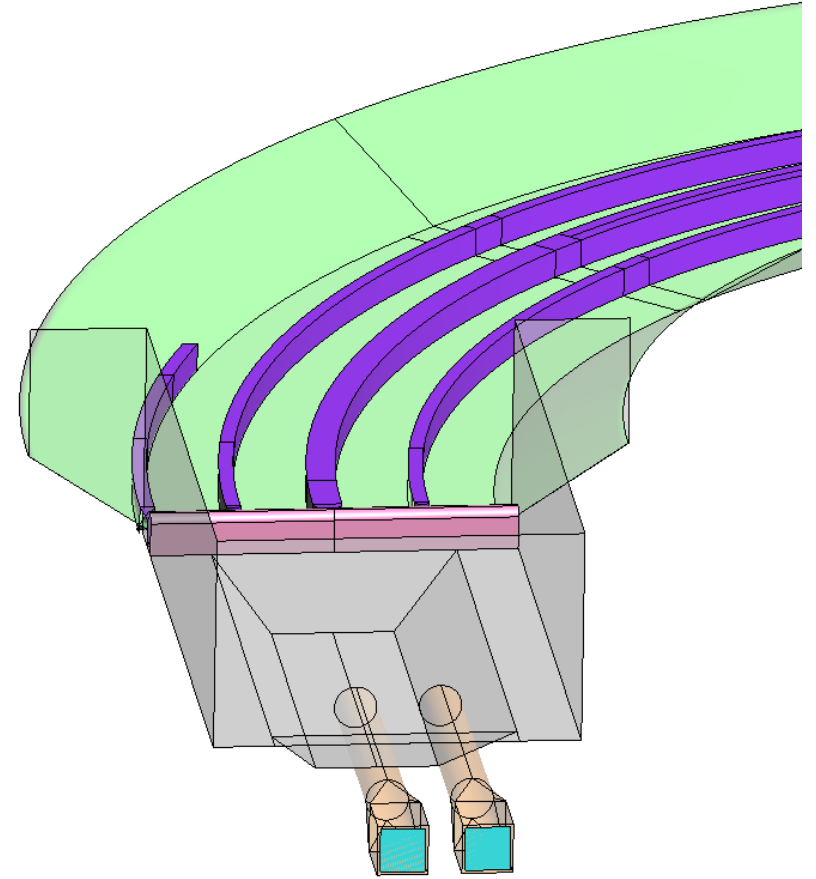
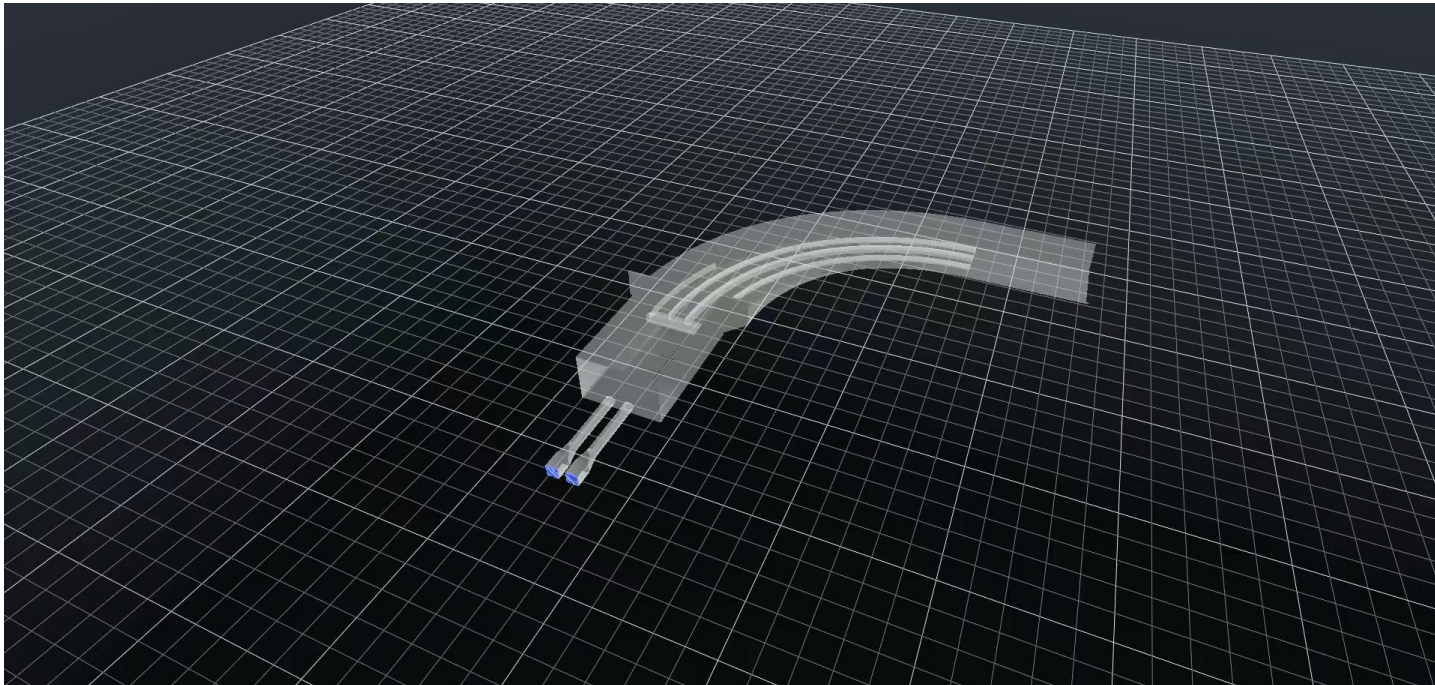
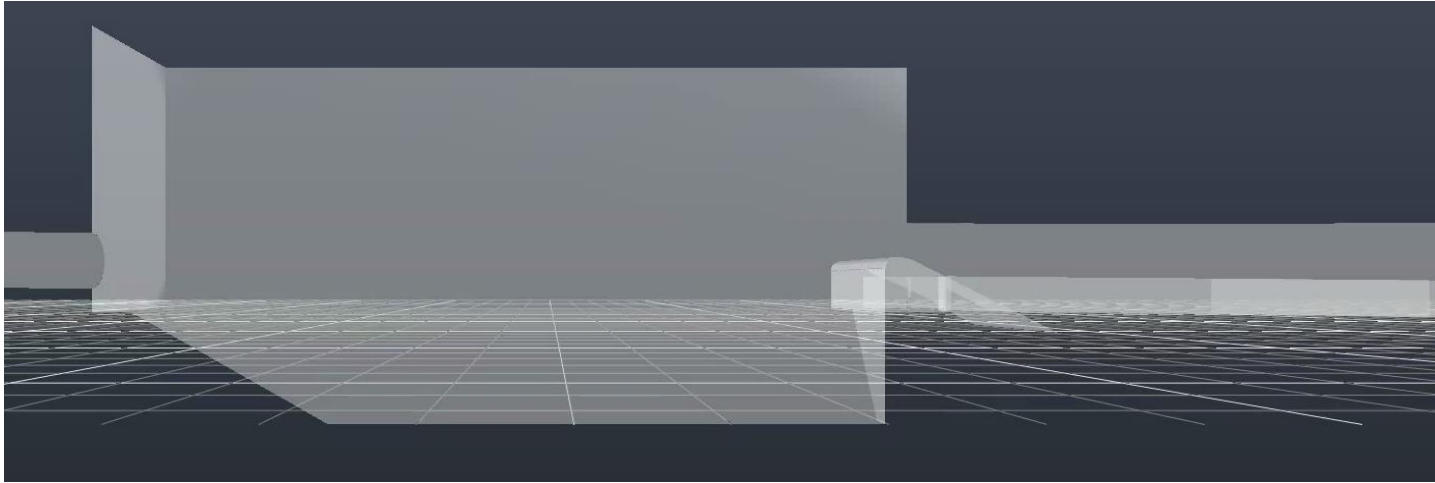
OPTION 17



$Q_{max} = 10-48 \text{ m}^3/\text{s}$

OPTION 18

Design of the energy dissipation structures of the Terroba dam (La Rioja, Spain)



Q=10-48 m³/s



GOBIERNO DE ESPAÑA

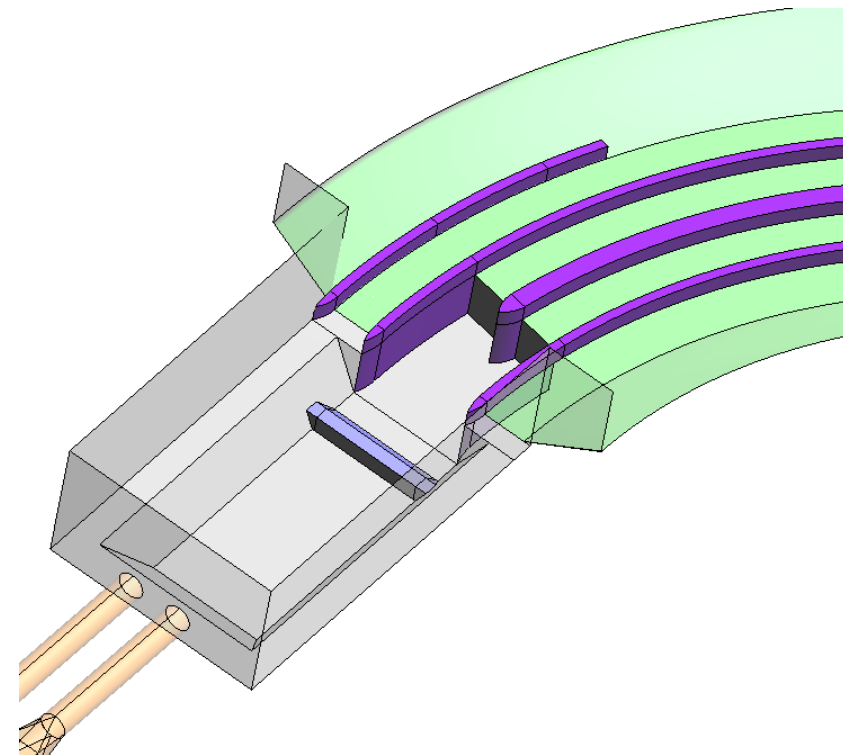
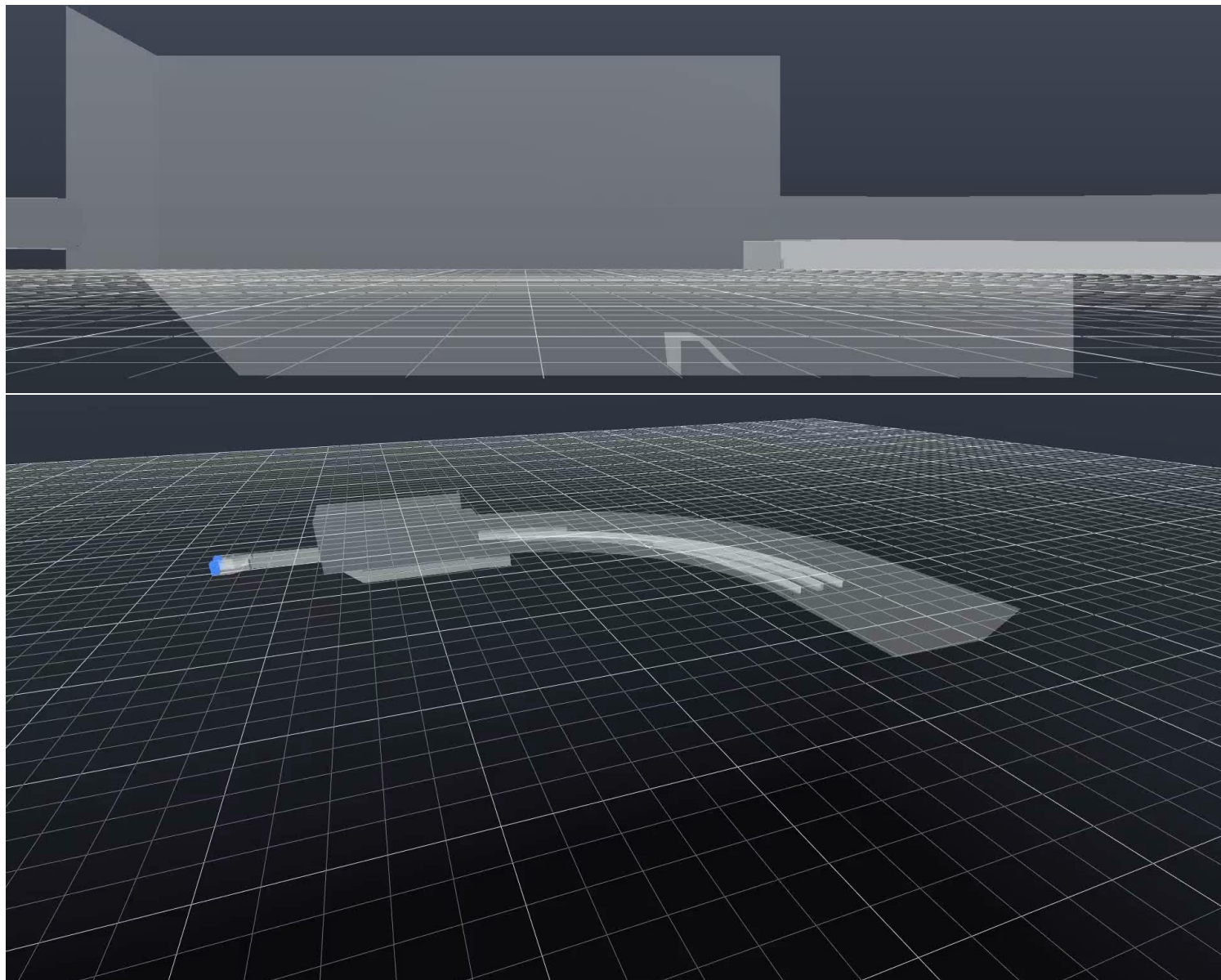
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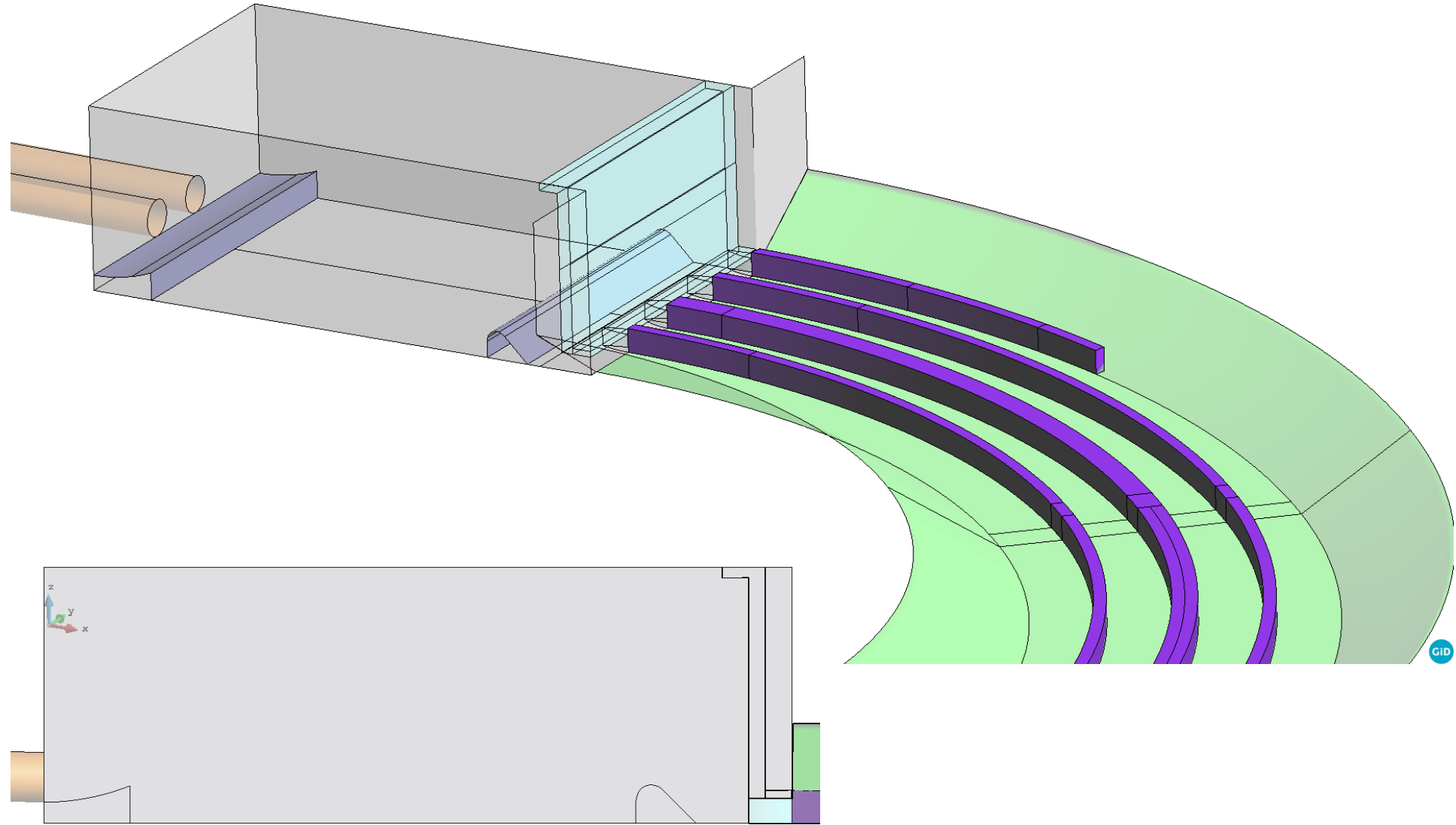
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OPTION 21

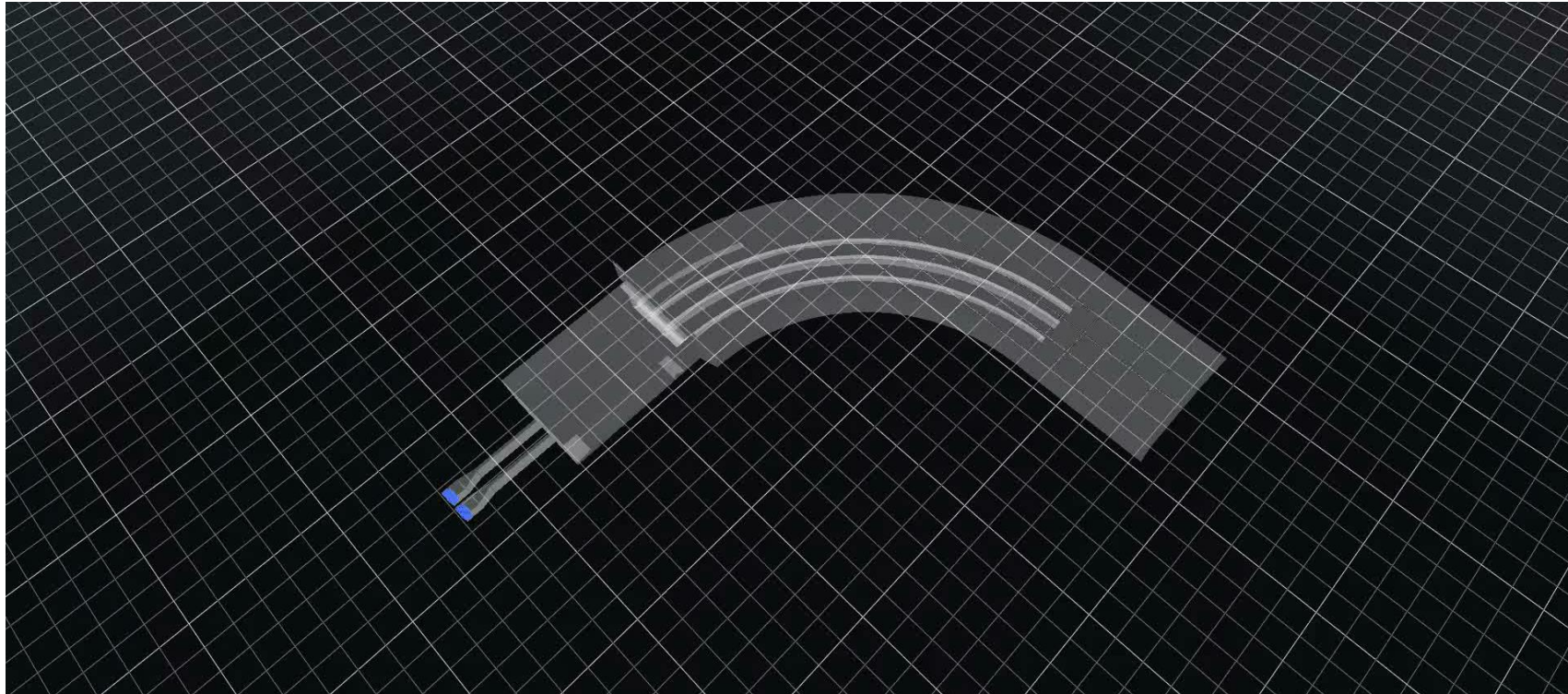


Q=10-48 m³/s

PROPOSED SOLUTION



PROPOSED SOLUTION



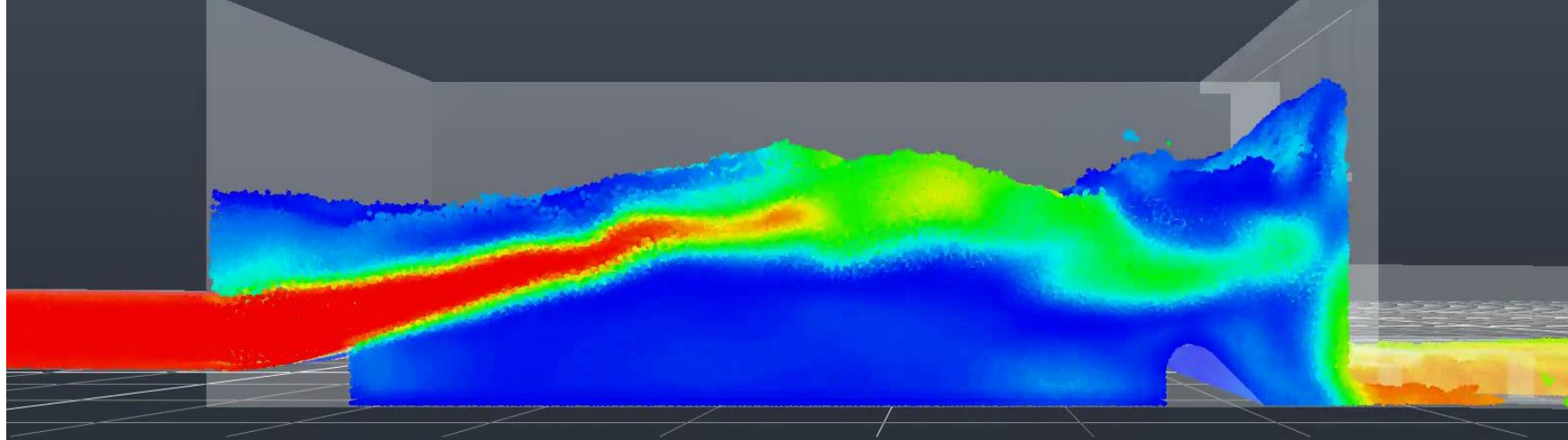
PROPOSED SOLUTION

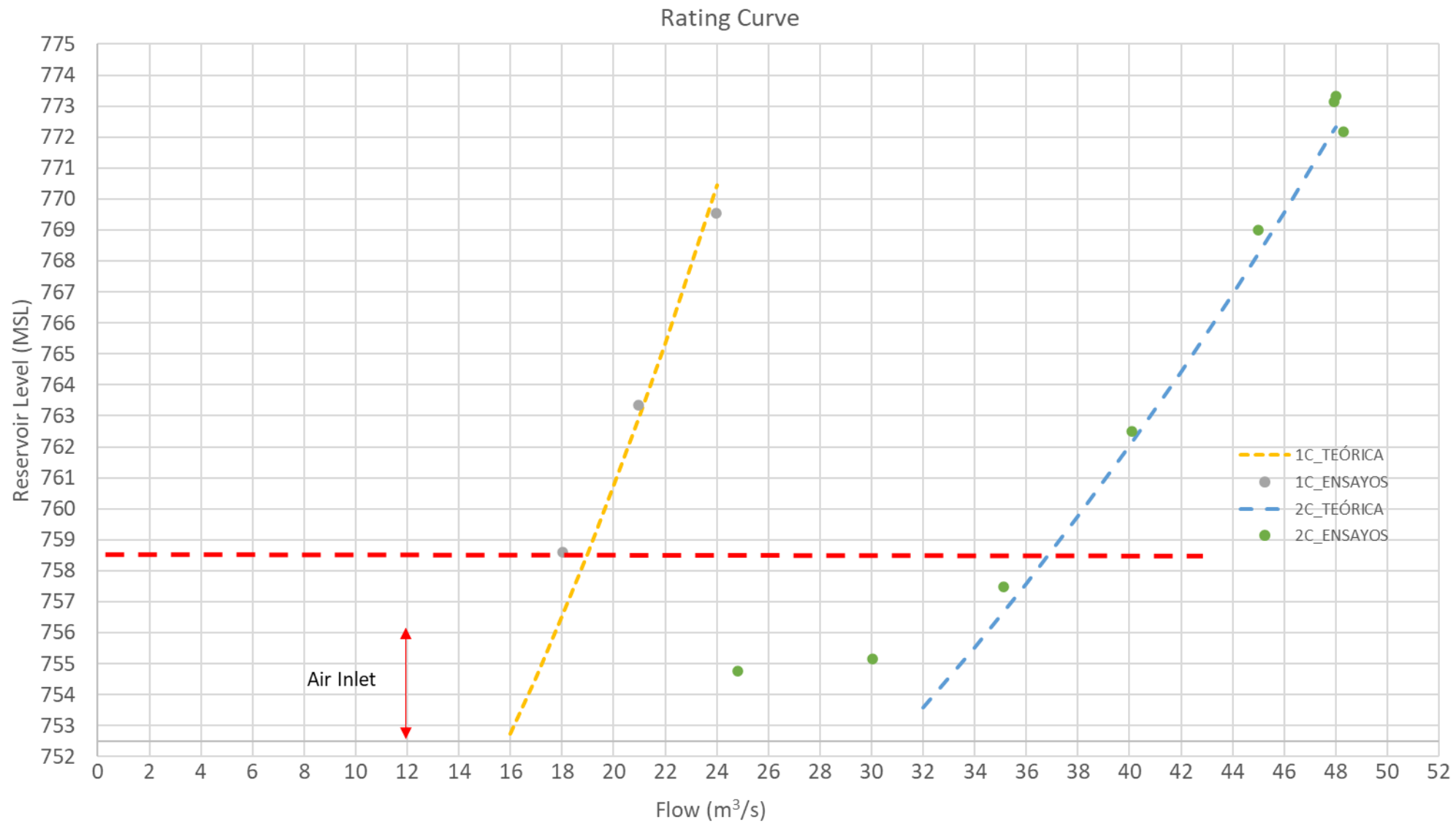
Physical Model



PROPOSED SOLUTION

$$Q_{\max} = 48 \text{ m}^3/\text{s}$$







Centro de Estudios Hidrográficos

Thank you for your attention

Location

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Contact

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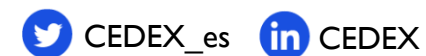
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