Simulasi Suara (kebisingan)

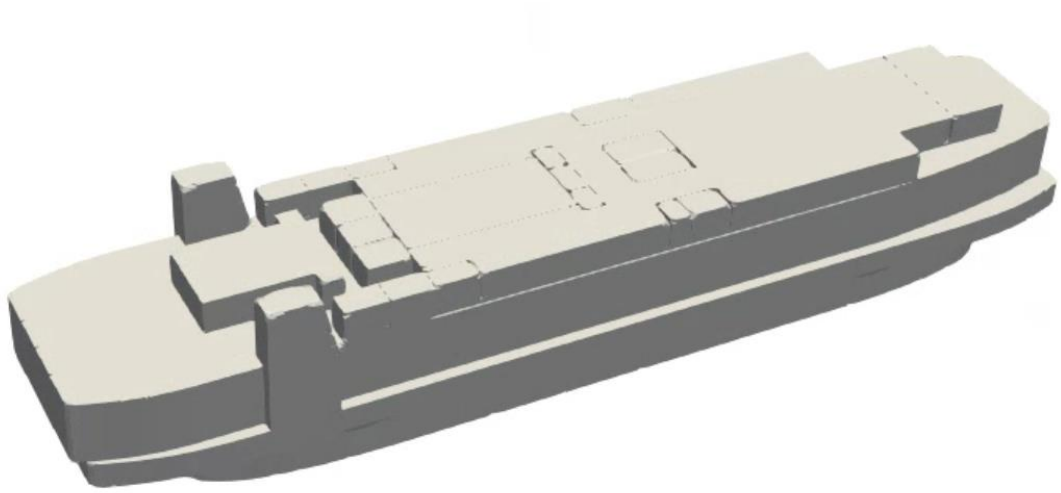
Hasil Simulasi CFD

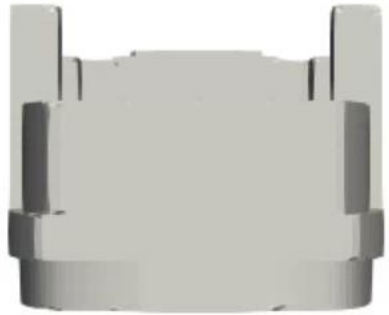
Konten

- Geometry
- Mesh
- Input
- Hasil Simulasi

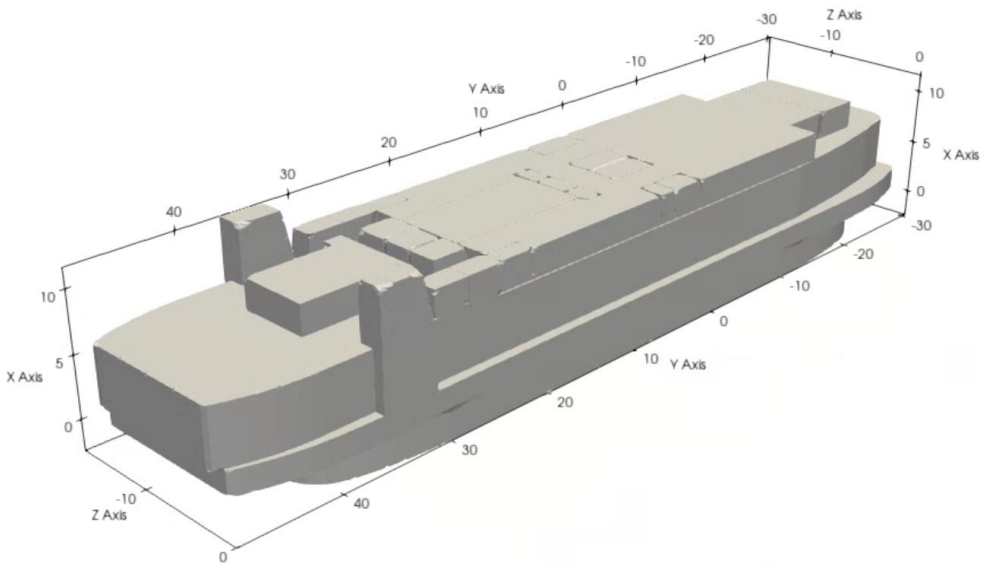
- *step simulasi CFD

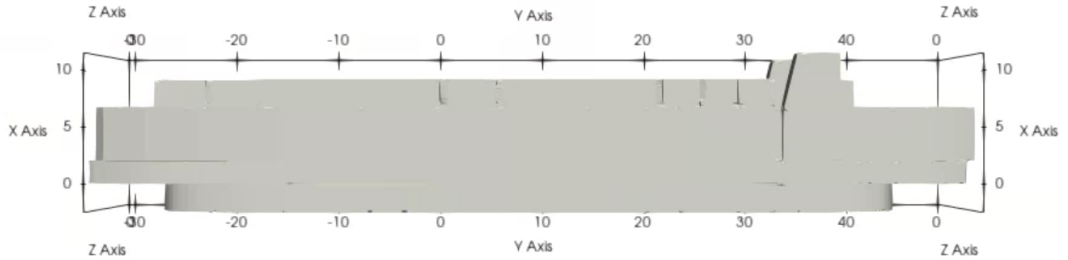
Geometry

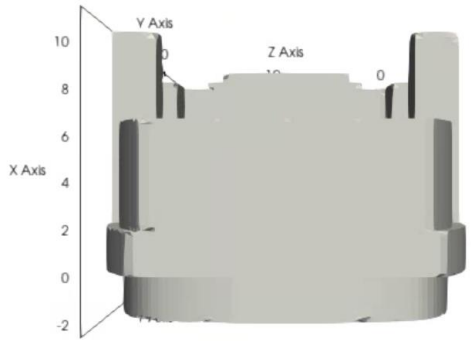


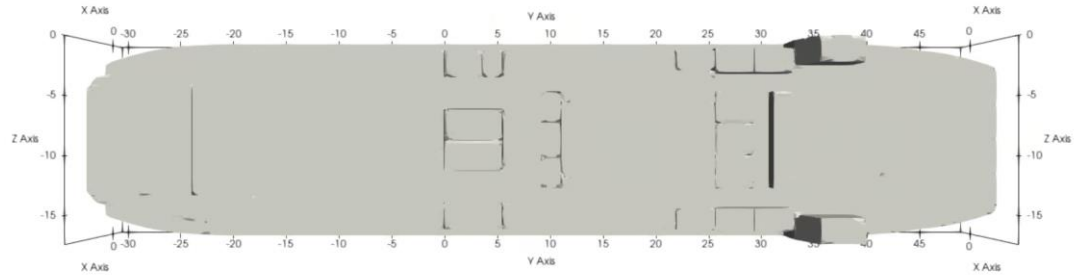


Geometry Dimensi

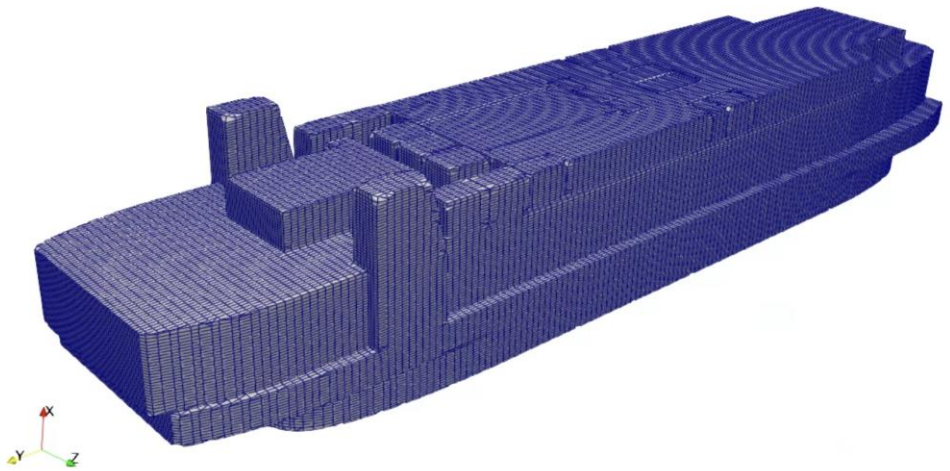


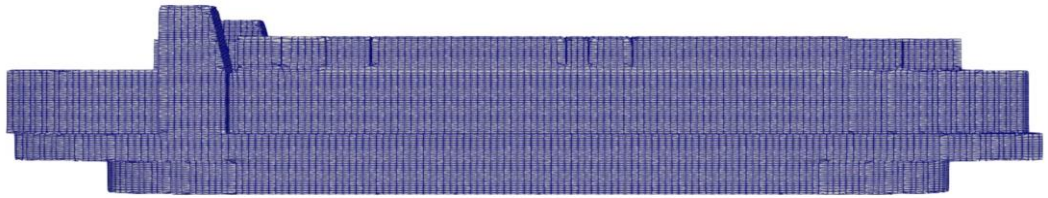


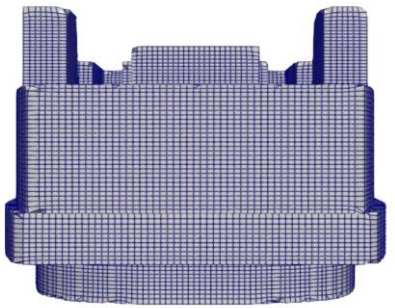




Mesh



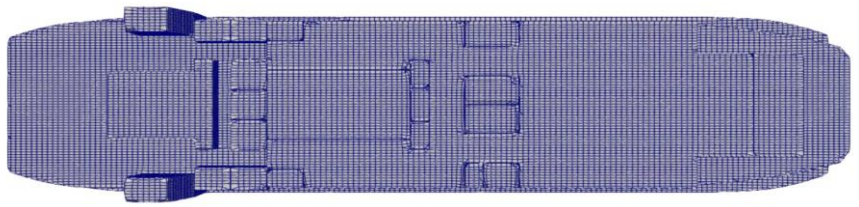




Data Statistics

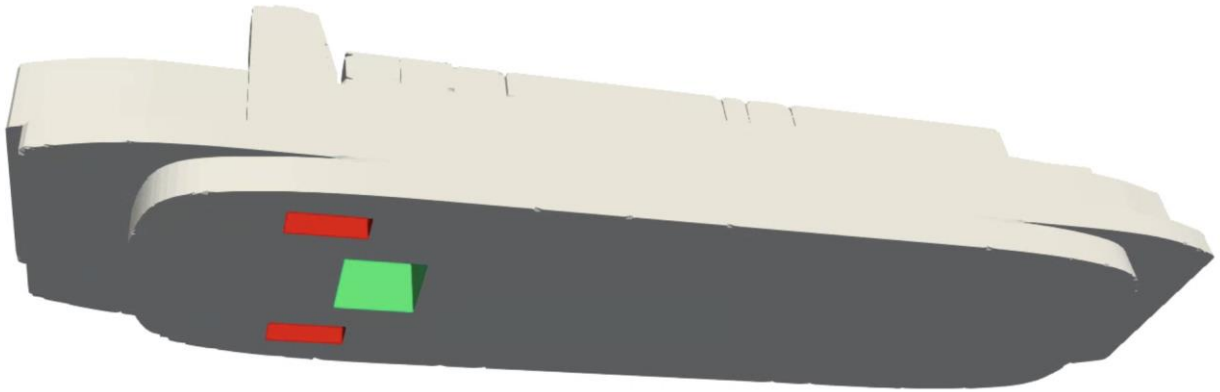
Type	Multi-block Dataset
# of Cells	1,450,085
# of Points	944,589 (float)
# of TimeSteps	1
Current Time	0 (range: [0, 0])
Memory:	92.3623 MB
Bounds	-2.50653 to 11.5697 (delta: 14.0763) -30.51 to 48.8183 (delta: 79.3283) -17.395 to 0.0078079 (delta: 17.4028)

```
Checking geometry...
    Overall domain bounding box (-2.50653117003 -30.5099640438 -17.3950390556) (11.5697305516 48.8183183624 0.00780789933656)
    Mesh has 3 geometric (non-empty/wedge) directions (1 1 1)
    Mesh has 3 solution (non-empty) directions (1 1 1)
    Boundary openness (-1.38904118679e-16 -1.12216925238e-16 2.44238085407e-16) OK.
    Max cell openness = 7.92517949121e-16 OK.
    Max aspect ratio = 67.6109617568 OK.
    Minimum face area = 0.000156866604472. Maximum face area = 2.217402417.  Face area magnitudes OK.
    Min volume = 7.25030240988e-06. Max volume = 1.4530911626.  Total volume = 13141.820551.  Cell volumes OK.
    Mesh non-orthogonality Max: 72.3205899888 average: 10.6564550825
   *Number of severely non-orthogonal (> 70 degrees) faces: 1.
    Non-orthogonality check OK.
  <<Writing 1 non-orthogonal faces to set nonOrthoFaces
    Face pyramids OK.
    Max skewness = 3.93357437779 OK.
    Coupled point location match (average 0) OK.

Mesh OK.

End
```



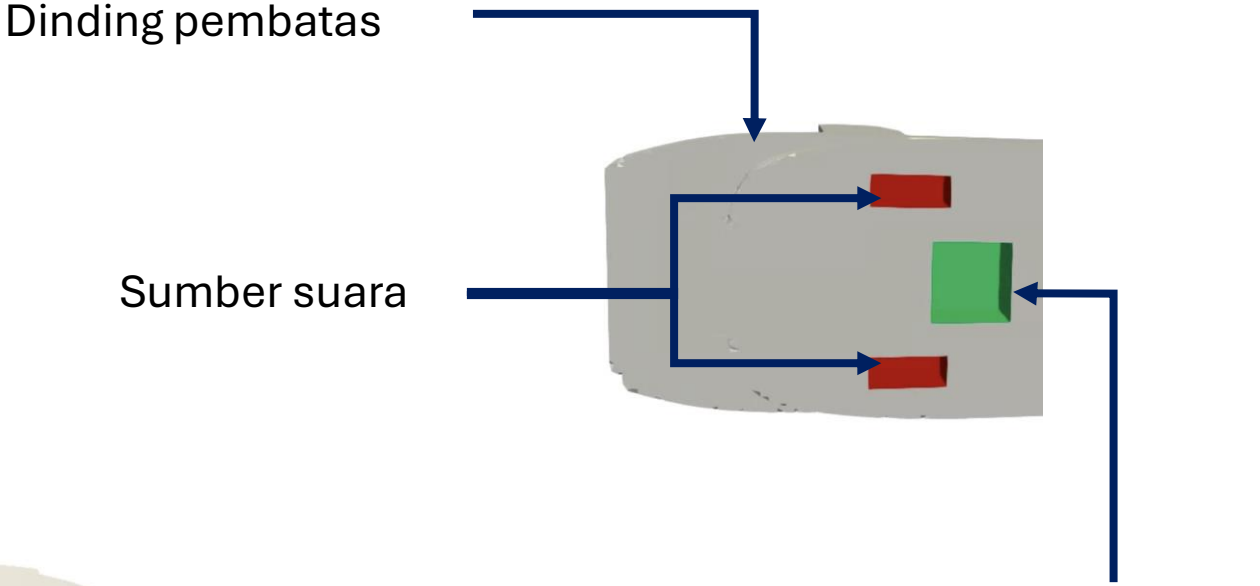
Input Pemodelan

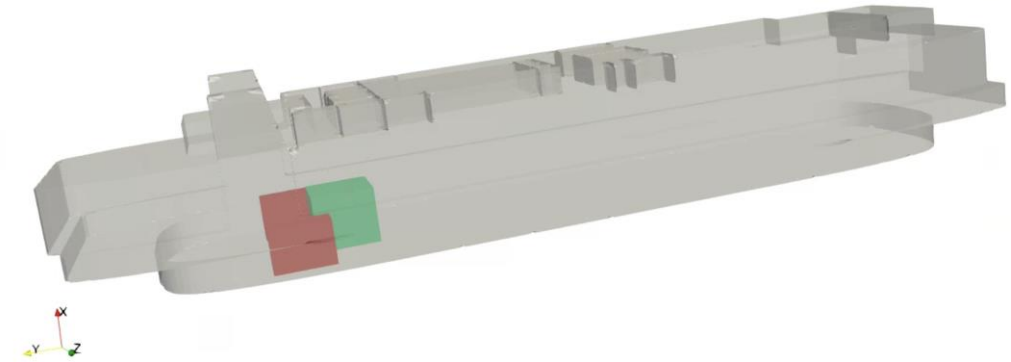
Domain
- Sumber suara
- Ruang terbuka
- Dinding



Medium	Kecepatan	
	M/det	Fps
Udara	344	1130
Air	1410	4625
Kayu	3300	10.825
Bata	3600	11.800
Beton	3700	12.100
Baja	4900	16.000
Kaca	5000	16.400
Alumunium	5800	19.000

Tabel 2. 5 Kecepatan Penyebaran Suara





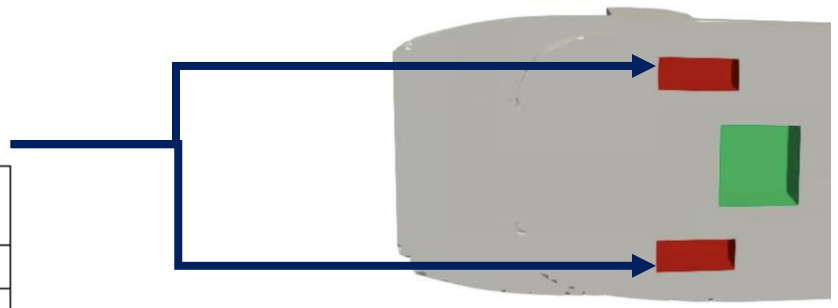
Input Data

- Informasi

Sumber suara :

Jenis Hunian	Tingkat Bunyi yang Dianjurkan	
	Baik [dBA]	Maksimum [dBA]
Ruang Mesin	50	70
Bengkel Mesin	45	55
Kantin	45	50
Ruang Istirahat	40	45
Ruang Tidur	30	35
Lounge	45	55

Tabel 2. 7 Tingkat Kebisingan menurut SNI



- Glasswool

PHYSICAL CHARACTERISTICS

Type	Blanket						Sheet	
Nominal Density (kg/m³)	16		24		32		48	
Nominal Thickness (mm)	25	50	25	50	25	50	25	50
Standard Width (m)	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Standard Length (m)	30	15	30	15	30	15	2.3	2.3
Mass Perunit Area (kg/m²)	0.40	0.80	0.60	1.20	1.80	1.60	1.20	2.40

THERMAL CONDUCTIVITY (K-Value)

- Density 16 kg/m³ (0.037 W/mk) at 20°C mean temperature (0.257 BTU-in/hr.ft²°F at 68°F mean temperature.)

- Density 24 kg/m³ (0.035 W/mk) at 20°C mean temperature (0,243 BTU-in/hr.ft²°F at 68°F mean temperature.)

* Mean temperature = (T1+T2)/2
Where T1 = Temperature of hot side of insulation
T2 = Temperature of cool side of insulation

At mean temperatur 20°C (metric value) and 68°C (imperial value)									
Type		Blanket						Sheet	
Nominal Density (kg./m³)		16		24		32		48	
Nominal Thickness (mm)		25	50	25	50	25	50	25	50
Thermal Conductivity	W/mK	0.037	0.037	0.035	0.035	0.034	0.034	0.033	0.033
(K)	BTU in/hr.ft².°F	0.257	0.257	0.243	0.243	0.236	0.236	0.229	0.229
Thermal Conductance	W/m²K	1.48	0.74	1.40	0.70	1.36	0.68	1.32	0.66
(C)	BTU in/hr.ft².°F	0.26	0.13	0.24	0.12	0.24	0.12	0.23	0.11
Thermal Resistance	m²K/W	0.67	1.35	0.71	1.43	0.74	1.47	0.76	1.52
(R)	hr.ft².°F/BTU	3.89	7.78	4.12	8.23	4.24	8.47	4.37	8.73

Sond Absorption Coefficient (reverberation)							
Nominal Density	Nominal Thickness	Frequency - Hz					
(kg./m³)	(Mm)	125	250	500	1000	2000	NRC
16	25	0.28	0.30	0.37	0.61	0.78	0.52
16	50	0.25	0.47	0.74	0.79	0.81	0.70
24	25	0.16	0.27	0.57	0.79	0.90	0.63
24	50	0.26	0.55	0.92	1.05	1.04	0.89
32	25	0.15	0.33	0.64	0.77	0.88	0.65
32	50	0.26	0.59	0.98	1.04	1.03	0.90
48	25	0.08	0.25	0.64	0.90	1.05	0.71
48	50	0.27	0.79	1.11	1.18	1.10	1.05

Result tested in accordance with AS 1045 - 1976 By the Reverberation Room Method

FIRE PERFORMANCE

AB Wool Insulation glasswool products are non-combustible. When it is exposed to the conditions of the test specified in British Standard 476: Part 4: 1970 "Fire Test on Building Materials and Structures - Non-combustibility Test for Materials".

RESULTS:

Description	Specimen 1	Specimen 2	Specimen 3	Requirements
Time of continuous flaming (sec.)	0	0	0	<10
Temperature rise of furnace (°C)	28	21	19	<50
Temperature rise of sample (°C)	0	0	0	<50
Classification	Non-Combustion	Non-Combustion	Non-Combustion	-

Input Data Simulasi

```
dimensions      [1 -1 -2 0 0 0 0];

internalField   uniform 0;

boundaryField
{
    box //sumber suara
    {
        type            acousticWaveTransmissive;
        advectiveSpeed  344;
        value           uniform 0.00632;//70 dB (Teori dB = 20 Log (pa/ 2e-6))
    }
```

SPL = Sound Pressure level (dB)
Pa = Pressure Acoustic (Pa)
P_0 = Acoustic Pressure of Air (2e-5 Pa)

$$SPL\ (dB) = 20\ Log_{10}\ (\frac{P_a}{P_0})$$

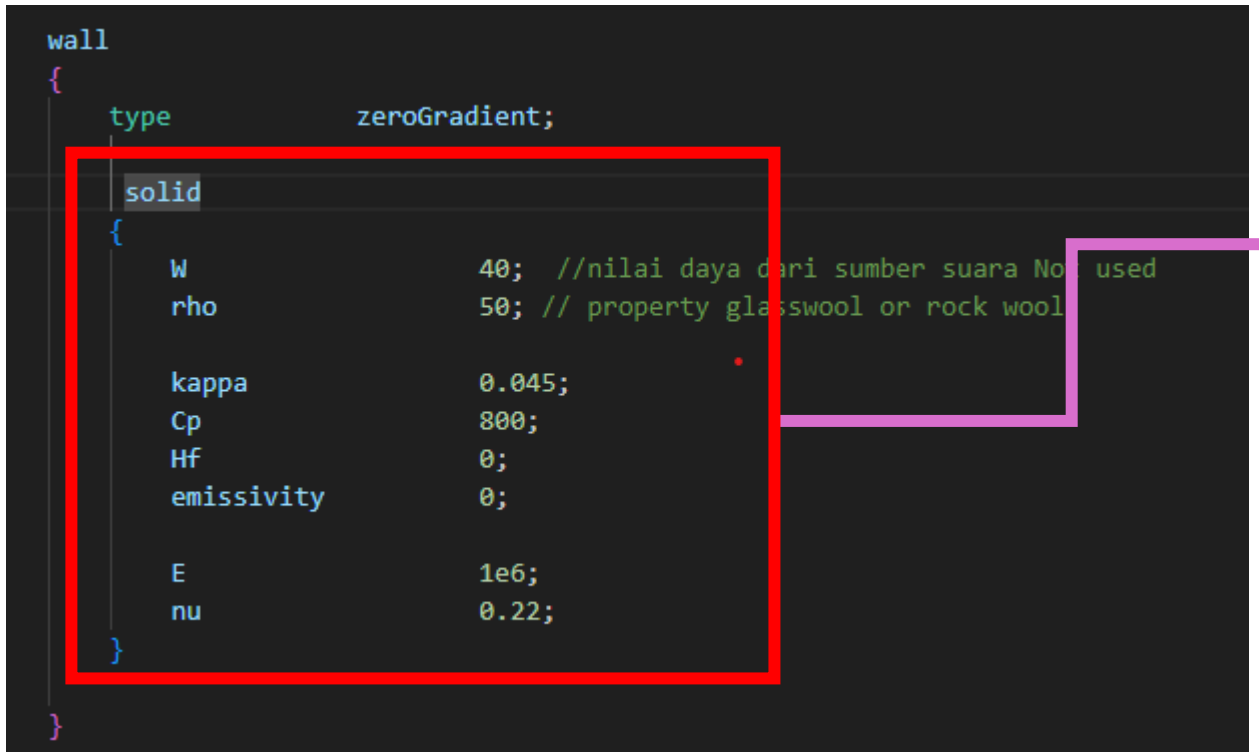
Input = 70 dB >> 0.00632 Pa

```
window
{
    type                vibrationShell;
    active              true;
    p                   pa;

    solid
    {
        W                   40;  //nilai daya dari sumber suara Not used
        rho                 50; // property glasswool or rock wool

        kappa               0.045;
        Cp                  800;
        Hf                  0;
        emissivity          0;

        E                   1e6;
        nu                  0.22;
    }

    region              vibrationShell;
    vibrationShellModel KirchhoffShell;

    f0          0.04;
    f1          0;
    f2          0;

    value       $internalField;
}
```

Input material property glass wool pada dinding

W	= Daya pada ruang mesin	
Rho	= density	= 50 kg/m3
Kappa	= thermal cond.	= 0.045 W/mC
Cp	= specific heat	= 800 J/kg C
Hf	= heat flux	= 0
Emissivity	=	= 0
E	= young modulus	= 1e 6 Pa
nu	= poisson's ratio	= 0.22

Input data



```
wall
{
    type            zeroGradient;

    solid
    {
        W                   40;  //nilai daya dari sumber suara No used
        rho                 50; // property glasswool or rock wool

        kappa               0.045;
        Cp                  800;
        Hf                  0;
        emissivity          0;

        E                   1e6;
        nu                  0.22;
    }
}
```

Input material property glass wool pada dinding ruang mesin

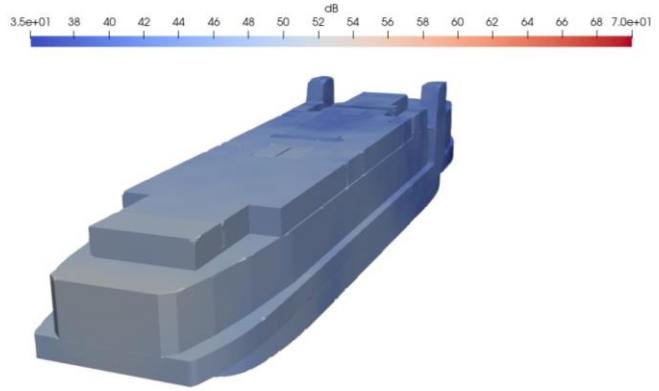
W	= Daya pada ruang mesin	
Rho	= density	= 50 kg/m3
Kappa	= thermal cond.	= 0.045 W/mC
Cp	= specific heat	= 800 J/kg C
Hf	= heat flux	= 0
Emissivity	=	= 0
E	= young modulus	= 1e 6 Pa
nu	= poisson’s ratio	= 0.22

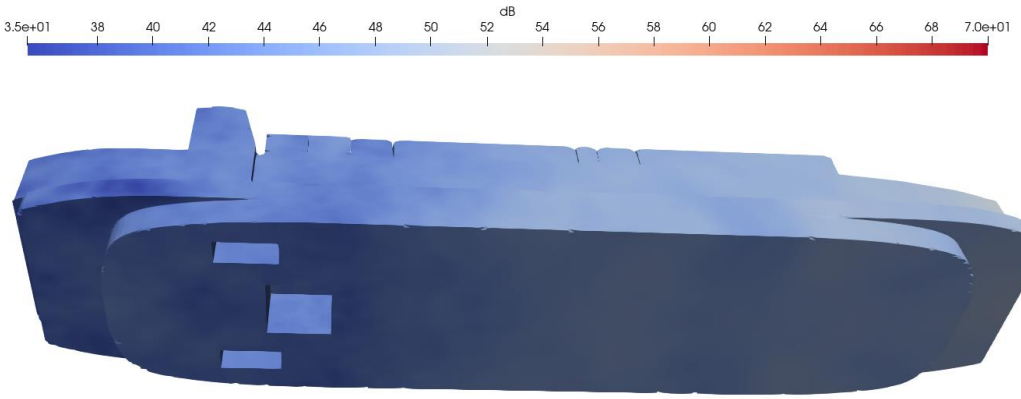
Hasil Simulasi CFD

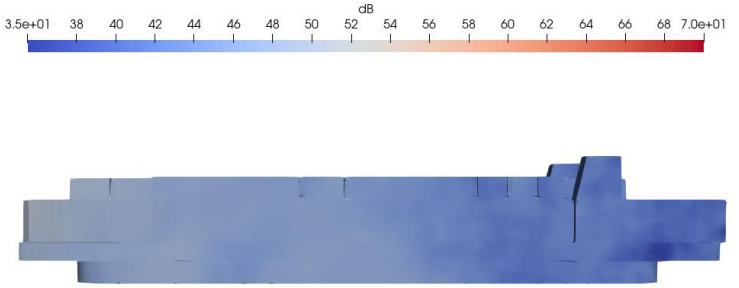
Dengan Glasswool

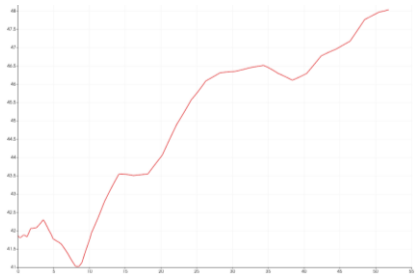
- Perhitungan input Pa (Pressure Acoustic) -> dB (Tingkat kebisingan)

$$SPL\ (dB) = 20\ Log_{10}\ (\frac{P_a}{P_0})$$





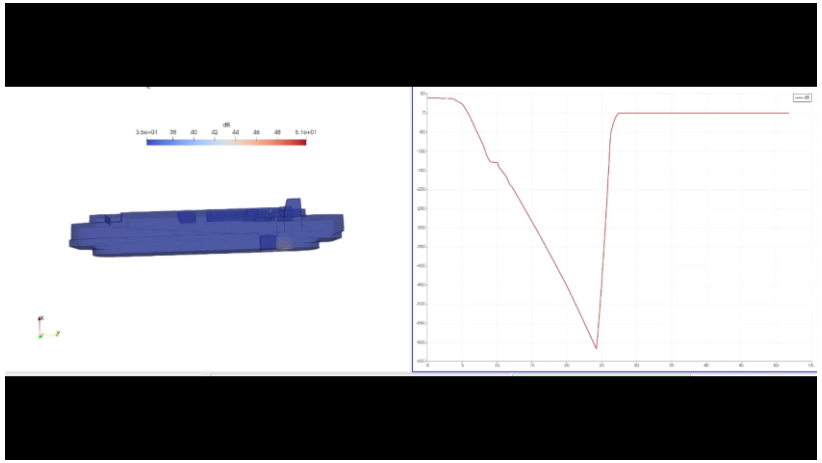


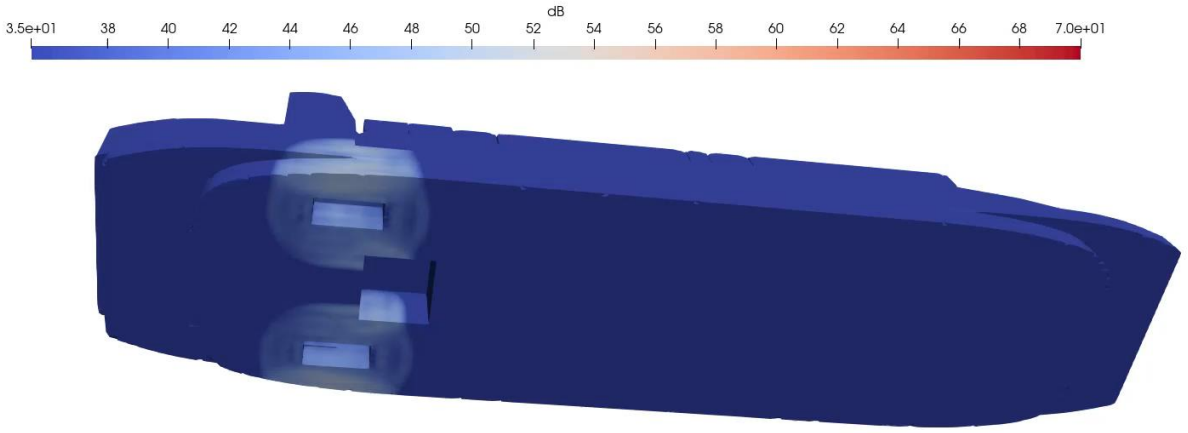


Grafik kenaikan gelombang bunyi

Hasil Simulasi CFD

Animasi nilai kebisingan





Pemasangan Glasswool

Step-step simulasi CFD

- Pre processing
- Processing
- post processsing