



Leading-edge Research Infrastructure Program  
Large-scale Cryogenic Gravitational Wave Telescope Project

JGW-E1604966-v1

*KAGRA*

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## BS Mass Budget

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of the KAGRA collaboration.

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## 1 Introduction

### 1.1 Purpose and Scope

Describes the masses of the major parts of the Type-B suspension for BS, for use in adjusting GAS filters and planning lifting procedures.

### 1.2 References

JGW-E1504006: [VIS Document and Drawing Tree \(Type-B\)](#)

### 1.3 Version history

3/10/2016: -v1.

## 2 Individual Masses

These values were provided from Hirata-san based primarily on a model of the BS suspension in the vacuum chamber dated 3/9/2016. The mass of the PI with ballast came from an older model of the Type B prototype at TAMA. Some of them are known to be slightly out of date because the versions of the BF and SF in the model have the wrong configuration of blades and no “fishing rod” components. The weight of the cables will probably be important to tuning the GAS filters but no values are available yet.

Item	Mass (kg)	Notes
Optic (BS)	18.71	
Recoil Mass (RM)	22.3	
Intermediate Mass (IM)	34.6	
Intermediate Recoil Mass (IRM)	16.1	
Bottom Filter (BF)	105.2	need to upgrade blades and add fishing rod
Cables up to BF	ccc	(value not yet available)
Standard Filter (SF)	95.4	need to upgrade blades and add fishing rod
Damper Ring for SF	18	
Cables from BF/SF up to PI	ddd	(value not yet available)
Preisolator	976.2	with ballast mass: 6*17.3 kg
Preisolator with ballast removed	872.4	
Cables within PI	eee	(value not yet available)
Cables from PR to Flange	fff	(value not yet available)
Security Structure	183.4	
Lower Breadboard	86	
Lower Breadboard Intermediate Ring	116.4	“yellow ring”
Lower Breadboard Damper Ring	49.3	“green ring”

### 3 Combinations important to GAS filter tuning

#### 3.1 Up through IM (for setting BF GAS filter)

$BF+RM+IM = 18.71+22.3+34.6 = 75.61 \text{ kg.}$

#### 3.2 Up through BF (for setting SF GAS filter)

$BF+RM+IM+IRM+BF+cables = 18.71+22.3+34.6+16.1+105.2+ccc = 196.91+ccc \text{ kg}$

#### 3.3 Up through SF (for setting PI GAS filter)

$BF+RM+IM+IRM+BF+cables+SF+some \text{ fraction of BF/SF-to-PI cables}$   
 $= 18.71+22.3+34.6+16.1+105.2+ccc+95.4+???*ddd = 292.31+ccc+???*ddd$

### 4 Combinations important to crane and/or tank loading

#### 4.1 Up through PI (for install)

$BF+RM+IM+IRM+BF+cables+SF+cables+DR+PI+cables+SS$   
 $= 18.71+22.3+34.6+16.1+105.2+ccc+95.4+ddd+18+976.2+eee+183.4$   
 $= 1,469.91 \text{ kg} +ccc+ddd+eee$

#### 4.2 Everything hanging from PI (including lower bread board)

$BF+RM+IM+IRM+BF+cables+SF+cables+DR+PI+cables+SS+cables+YR+LBB$   
 $= 18.71+22.3+34.6+16.1+105.2+ccc+95.4+ddd+18+976.2+eee+183.4+fff/2+116.4+86$   
 $= 1,672.31 \text{ kg} +ccc+ddd+eee+fff/2$

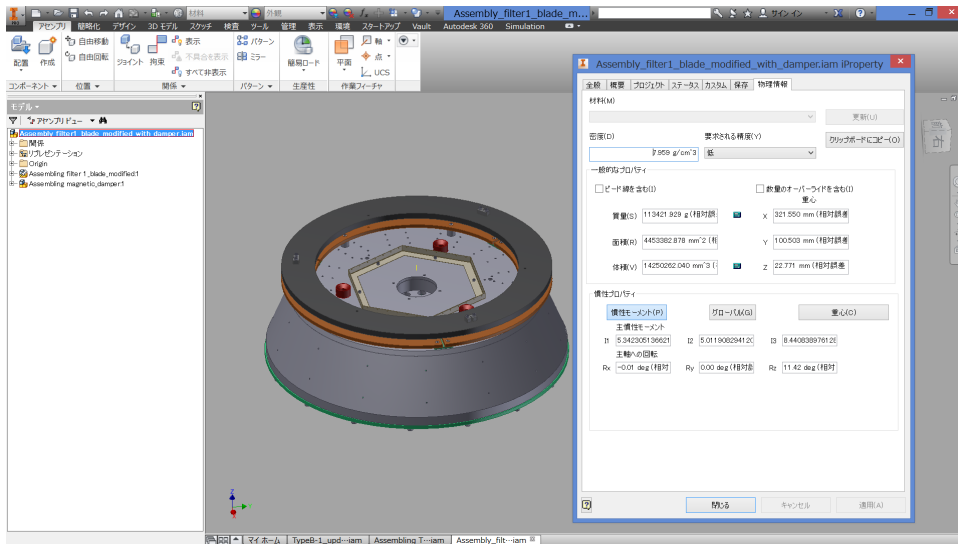
#### 4.3 Everything (for load on vacuum tank)

$BF+RM+IM+IRM+BF+cables+SF+cables+DR+PI+cables+SS+YR+LBB+GR+cables$   
 $= 18.71+22.3+34.6+16.1+105.2+ccc+95.4+ddd+18+976.2+eee+183.4+116.4+86+49.3$   
 $= 1,721.61 \text{ kg} +ccc+ddd+eee+fff$

### 5 Appendix – Raw Data

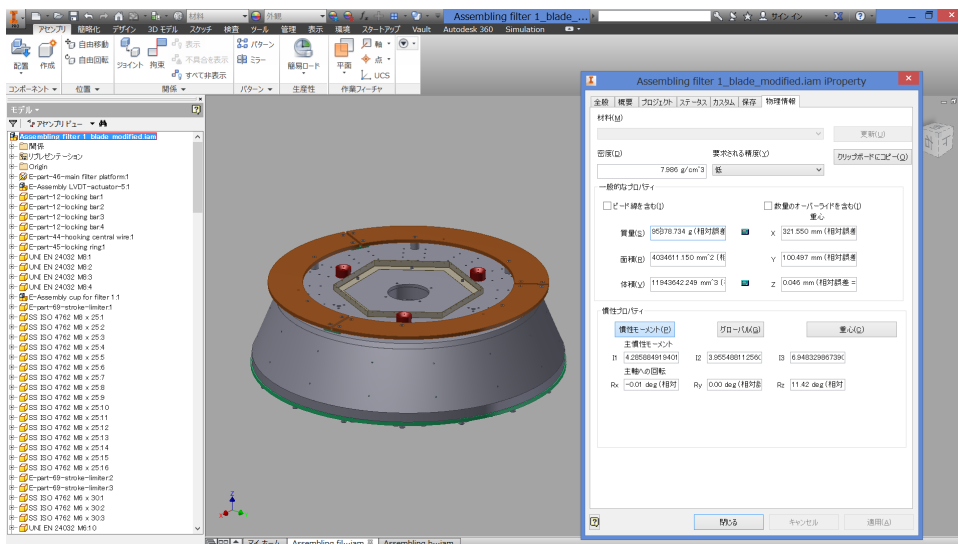
#### 5.1 Standard filter with damper ring + magnets

(The damper ring is actually independently suspended, so this is not a natural grouping.)

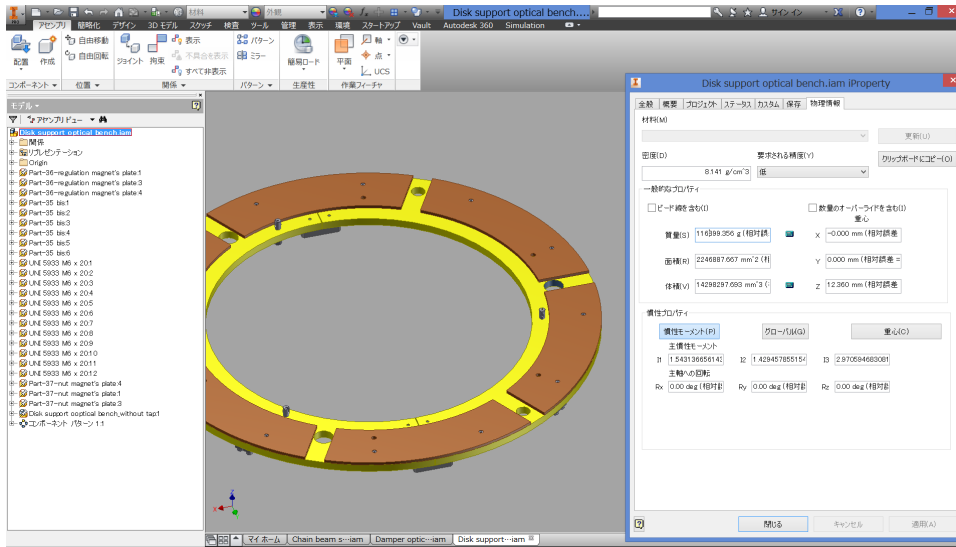


## 5.2 Standard filter without upper ring

This is the SF as suspended. Subtracting this from the previous gives 18 kg for the damper ring.



• Yellow ring with copper plate



• Green ring

