



# FlexPLI weight tolerances

Reduction of proposed weight tolerances

# Pedestrian Protection

## FlexPLI weight tolerances

**A**

Proposal in draft regulative language

Assessment of proposed assembly tolerances

Assessment of the weight of available FlexPLI's

**B**

Proposal

Proposal for reduced FlexPLI assembly tolerances

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## FlexPLI weight tolerances



### Proposal in regulative language

#### 6.3.1.1. **Flexible lower legform impactor:**

The flexible lower legform impactor shall consist of the flesh and skin, the flexible long bone segments (representing the femur and the tibia), and the knee joint as shown in Figure 12.

**The assembled length of the impactor shall be 928 mm, having a total mass of  $13.2 \pm [0.7 \text{ kg}]$ .** When fully assembled in the impactor, the measurable lengths of the femur shall be 339 mm, of the knee joint shall be 185 mm and of the tibia shall be 404 mm. The knee joint centre position shall be 94 mm from the top of the knee joint at the vertical centre line of the knee.

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## FlexPLI weight tolerances



### Proposal in regulative language

#### 6.3.1.1.3

The masses of the femur and the tibia without the flesh and skin, including the connection parts to the knee joint, shall be  $2.46 [\pm 0.12]$  kg and  $2.64 [\pm 0.13]$  kg respectively.

The mass of the knee joint without the flesh and skin shall be  $4.28 [\pm 0.21]$  kg.

**The assembled mass of the femur, the knee joint and the tibia without the flesh and skin shall be  $9.38 \pm 0.46$  kg.**

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## FlexPLI weight tolerances



### Assessment of proposed assembly tolerances

- Possible maximum weight range of 1.4 kg represents more than 10% of the total weight of the FlexPLI
- Tolerances incorporate different sensor equipment for different FlexPLI's
- The tolerances of the assembled mass of the femur, the knee joint and the tibia are calculated by summarization of the tolerances of the subassemblies

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## FlexPLI weight tolerances



### Assessment of proposed assembly tolerances

- The FlexPLI shall be **standardized** in its state of construction for type approval or certification use
- Reduction of possible testing tolerances for reproducibility and comparability of test results

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## FlexPLI weight tolerances



### Assessment of the weight of available FlexPLI's

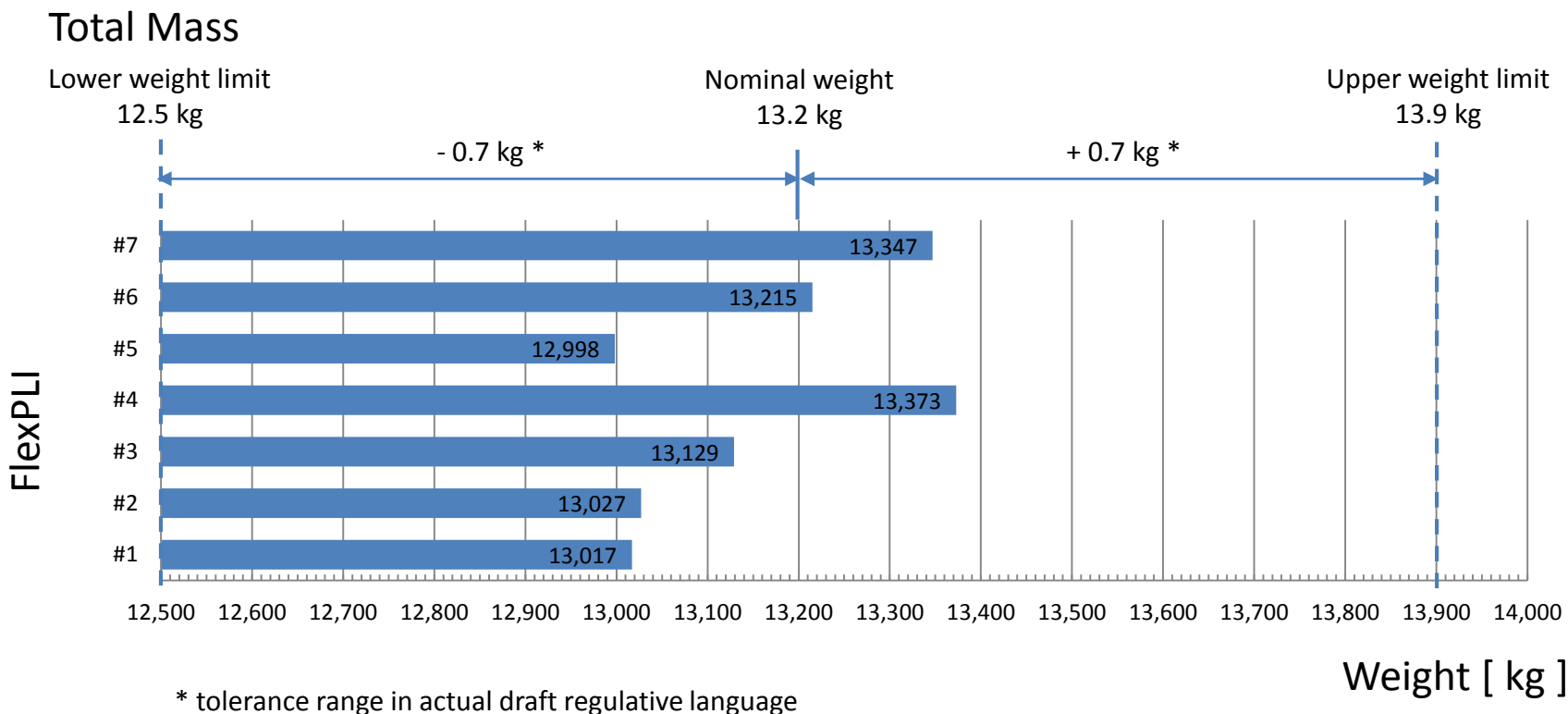
	target weight GTR9	FlexPLI							mean values	max deviation
		#1	#2	#3	#4	#5	#6	#7		
total weight of FlexPLI in testing order	13.2	<b>13.017</b>	<b>13.027</b>	<b>13.129</b>	<b>13.373</b>	<b>12.998</b>	<b>13.215</b>	<b>13.347</b>	<b>13.139</b>	<b>0.375</b>
Assembled mass of the femur, the knee joint and the tibia, without the flesh and skin	9.38	9.207	9.242	9.219	9.522	9.24	9.445	9.520	9.298	0.315
total weight of neoprene covers (N1F + N1T + N2F + N2T + N3)		0.979	0.970	0.932	1.051	0.967	0.991	0.946	0.980	0.119
total weight of rubber sheets (R1+R2)		2.780	2.764	2.915	2.8	2.745	2.730	2.833	2.801	0.151

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## FlexPLI weight tolerances



### Assessment of the weight of available FlexPLI's





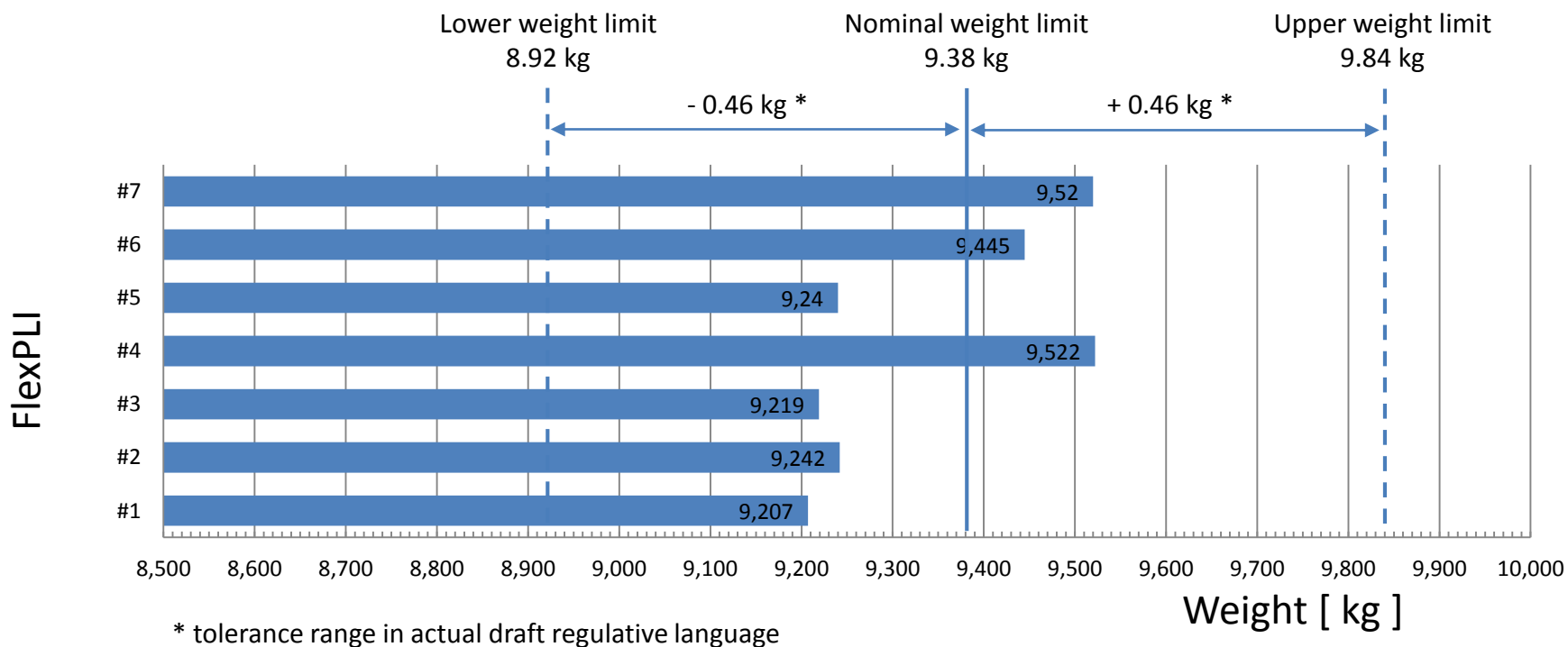
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## FlexPLI weight tolerances



### Assessment of the weight of available FlexPLI's

Assembled mass of femur, knee joint and the tibia, without flesh and skin



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## FlexPLI weight tolerances



### Proposal for reduced FlexPLI weight tolerances

- Weight tolerance of  $\pm 0.35$  kg for total FlexPLI
- Weight tolerance of  $\pm 0.23$  kg for assembled mass of femur, the knee joint and the tibia without the flesh and skin

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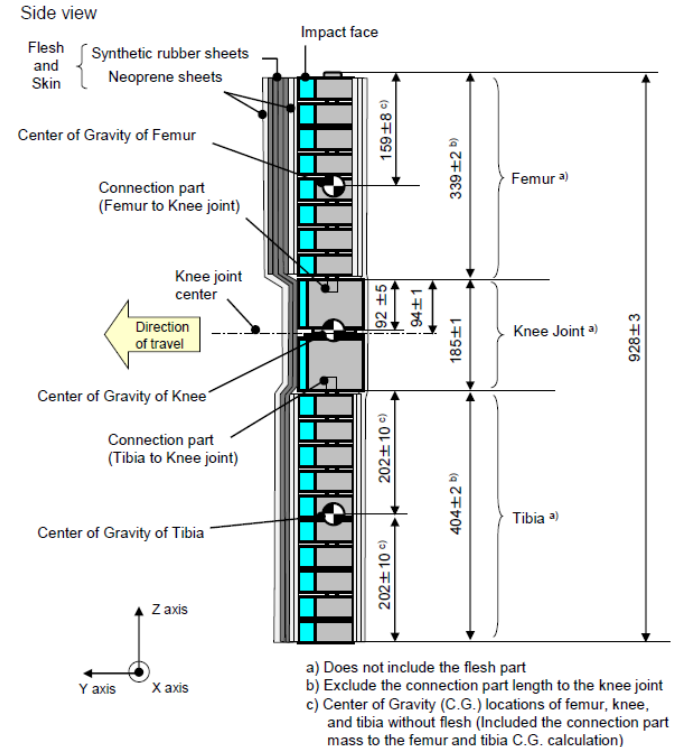
## FlexPLI weight tolerances



### Proposal for reduced FlexPLI weight tolerances

- Unchanged tolerances for femur, tibia and knee subassemblies (position of center of gravity of FlexPLI)

Figure 12  
of doc.  
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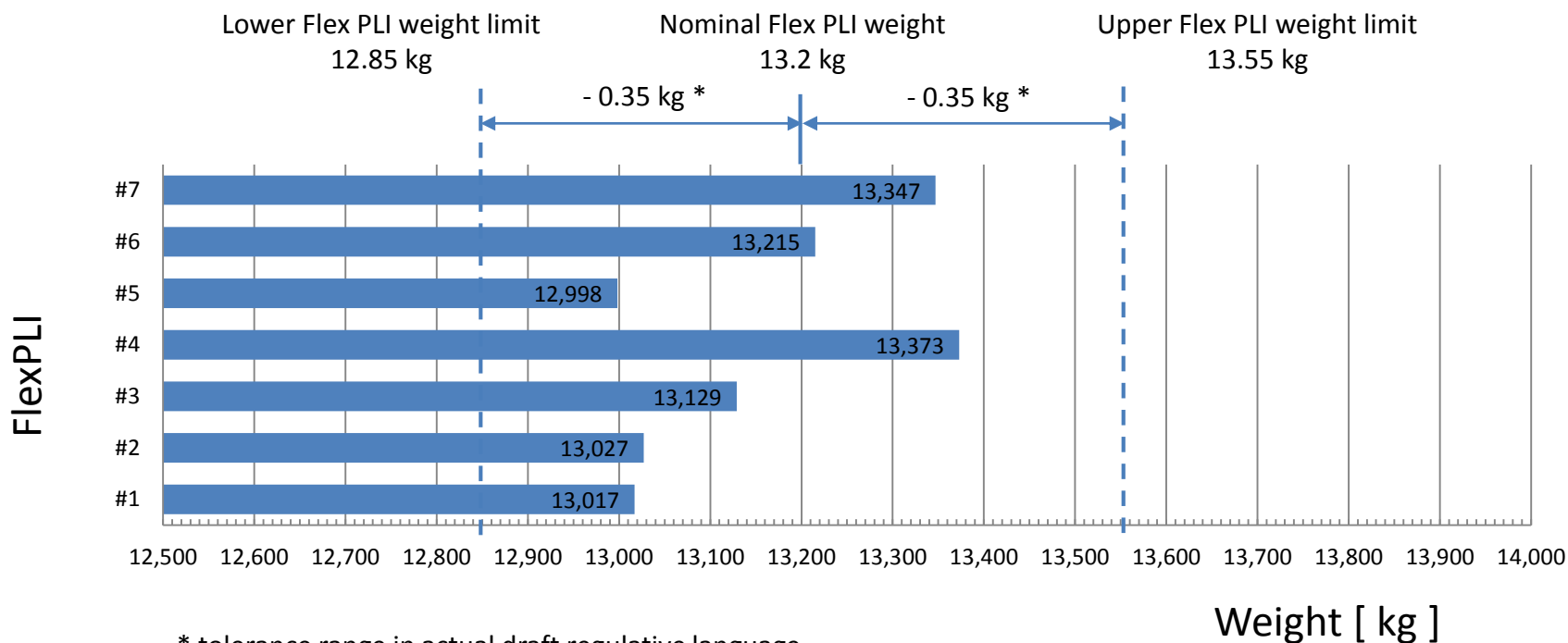
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## FlexPLI weight tolerances



### Proposal for reduced FlexPLI weight tolerances

#### Total Mass



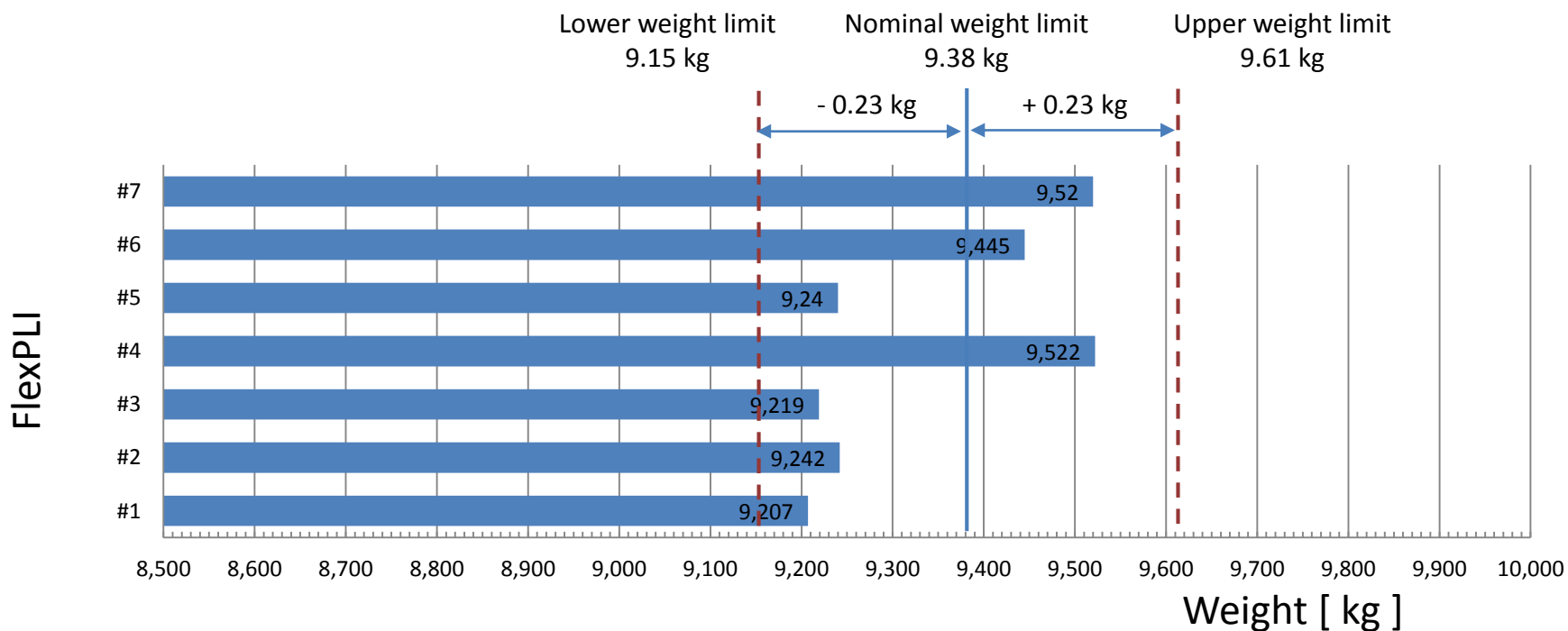
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## FlexPLI weight tolerances



### Proposal for reduced FlexPLI weight tolerances

Assembled mass of femur, knee joint and the tibia, without flesh and skin



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## FlexPLI weight tolerances



Thank you for your attention!

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## FlexPLI weight tolerances



# BACK-UP

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## FlexPLI weight tolerances

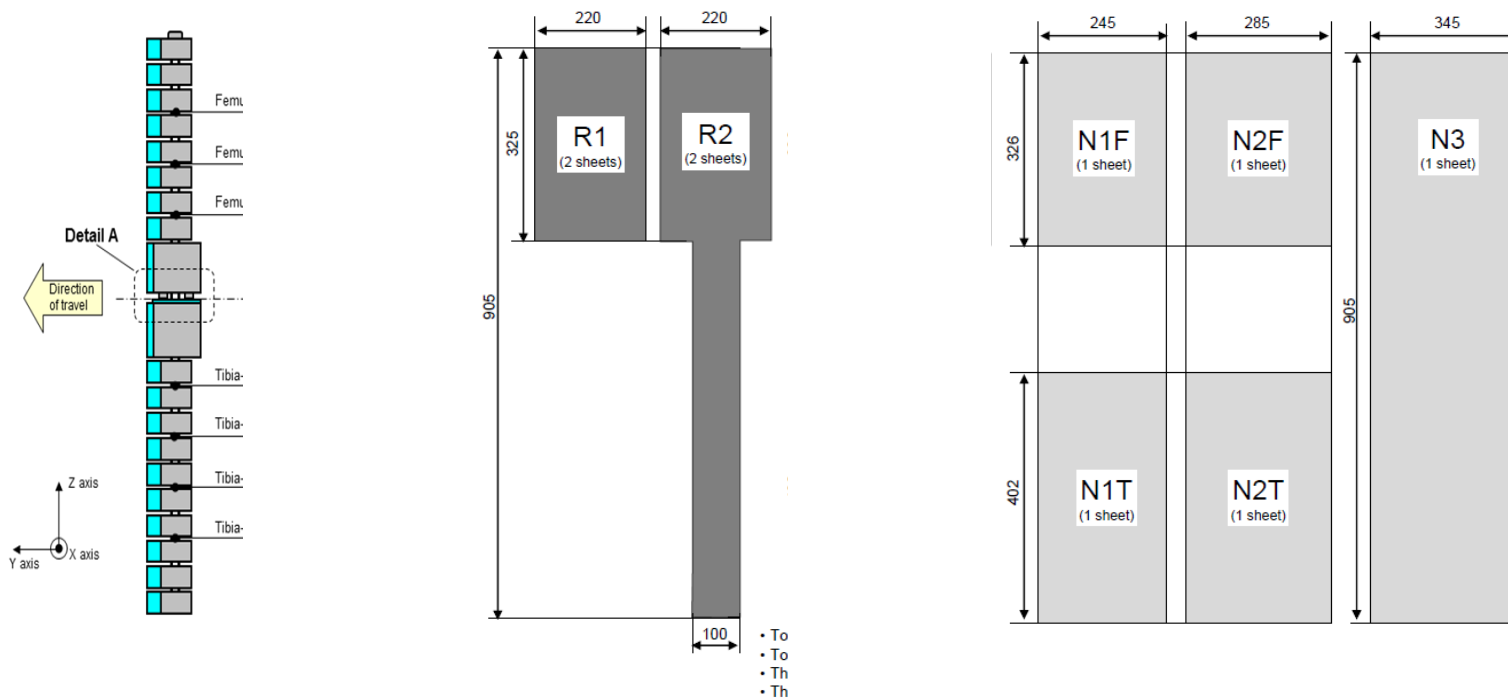


Figure 15  
of doc.  
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## FlexPLI weight tolerances



FlexPLI version GTR User Manual (document GTR9-6-06):

### 2.1 Standard 12 Channel instrumentation

FLEX-PLI-GTR is offered with 12 channel standard instrumentation, measuring tibia and femur bending moments and knee ligament elongations as well as tibia acceleration in impact direction. The standard instrumentation channels are listed in Table 2. The channels intended for injury assessment are the 4 tibia bending moments, knee medial collateral ligament (MCL) elongation and ACL and PCL elongations are being monitored. These channels are controlled by the certification procedures given in Sections 8 and 9.

Instrument Channels	Purpose	Standard	DAS
Femur moment 1,2 and 3	-	3	Standard Option iDummy
Tibia moment 1,2,3 and 4	Injury Assessment	4	
Tibia Top Acceleration AX	-	1	
MCL elongation	Injury Assessment	1	
ACL elongation	Monitoring	1	
PCL elongation	Monitoring	1	
LCL elongation	-	1	
	<b>Total</b>	<b>12</b>	

Table 2. 12 Channel Instrumentation

Number of sensors can be increased depending on the usage of the impactor  
(User Manual lists up to 30 additional sensors as optional equipment)