JASTI

79th Task Group meeting

WorldSID50 Dummy new Lumbar spine study

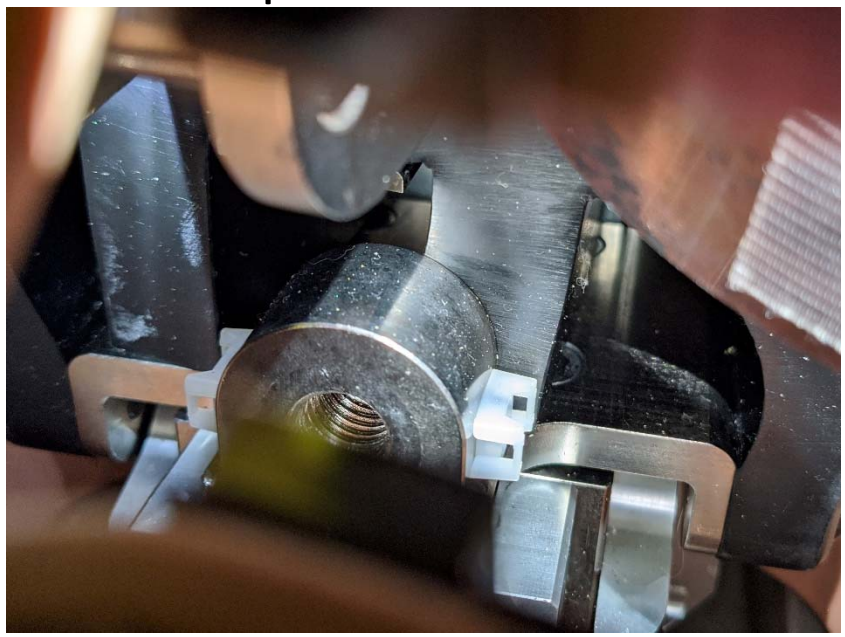
6th Oct. 2020

New Lumbar Spine study

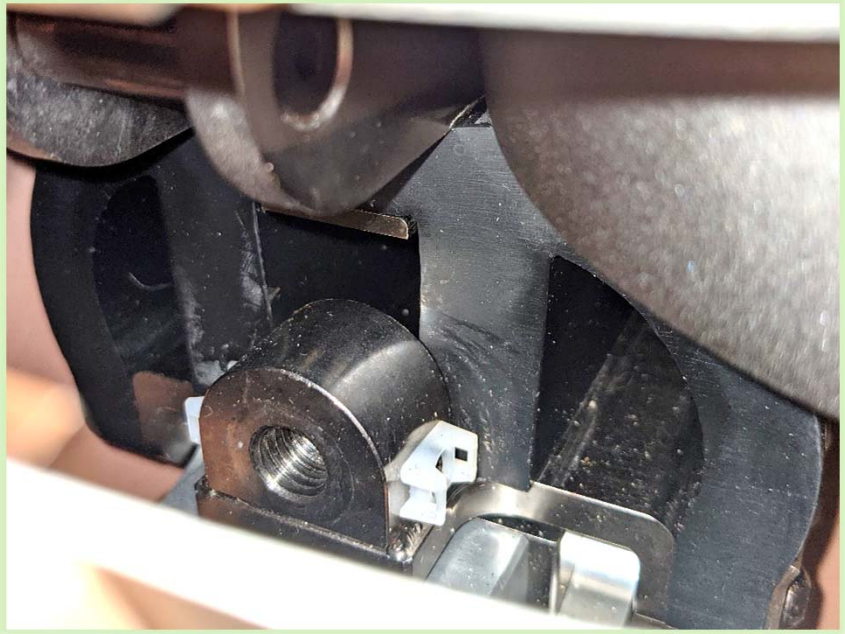
- **Background;** Lumbar spine bottom center position move.

  To get the repeatable of each impact tests.

- To keep Thorax movement repeatable.



After Abdominal test



After Shoulder test

- **Proposed Solution;**
- To keep the bottom position by center cables.

Lumbar Spine Bending Test Conditions

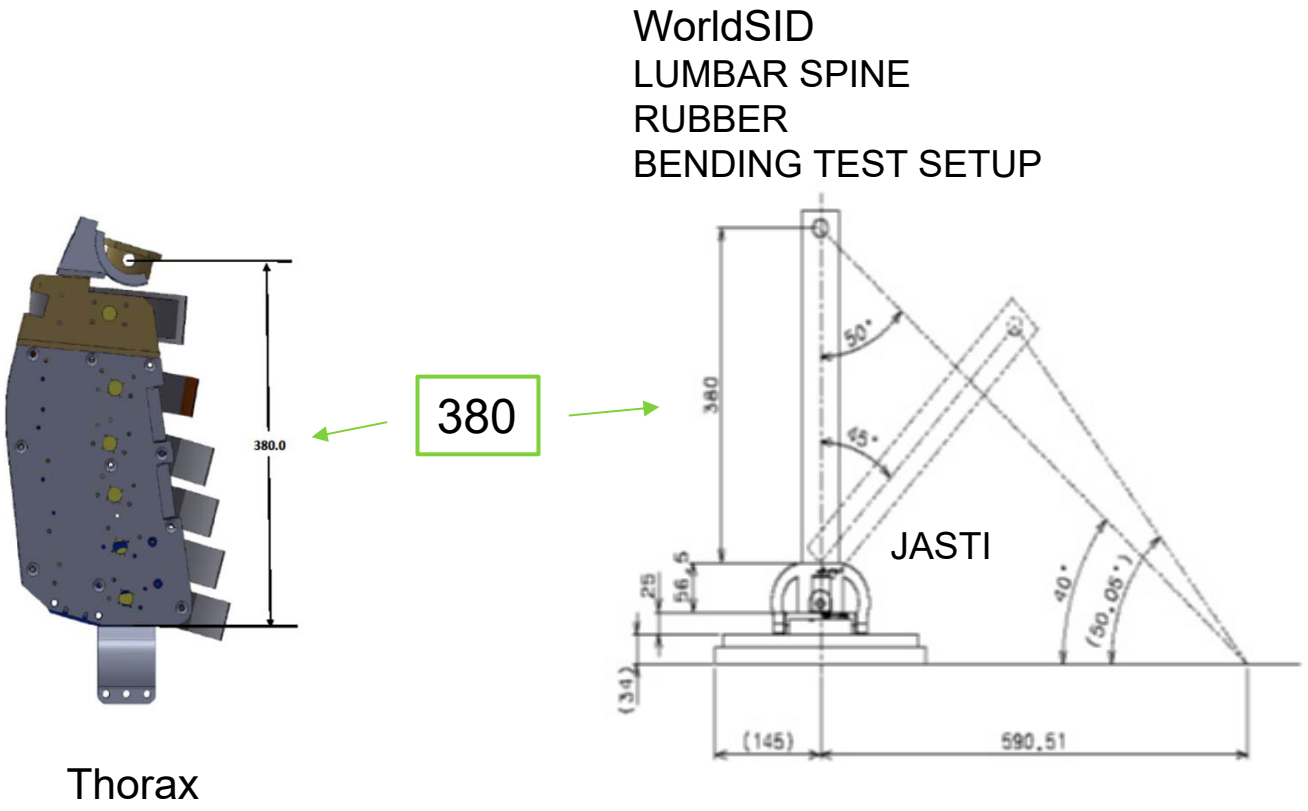
- Current Lumbar performance by different rubber hardness.
- Test method;
- Executed bending tests with different hardness of lumbar spines with Torso flexion test (5 lumbar spines, Shore A 70 - 85).

- Test fixture as shown in Figure 1.

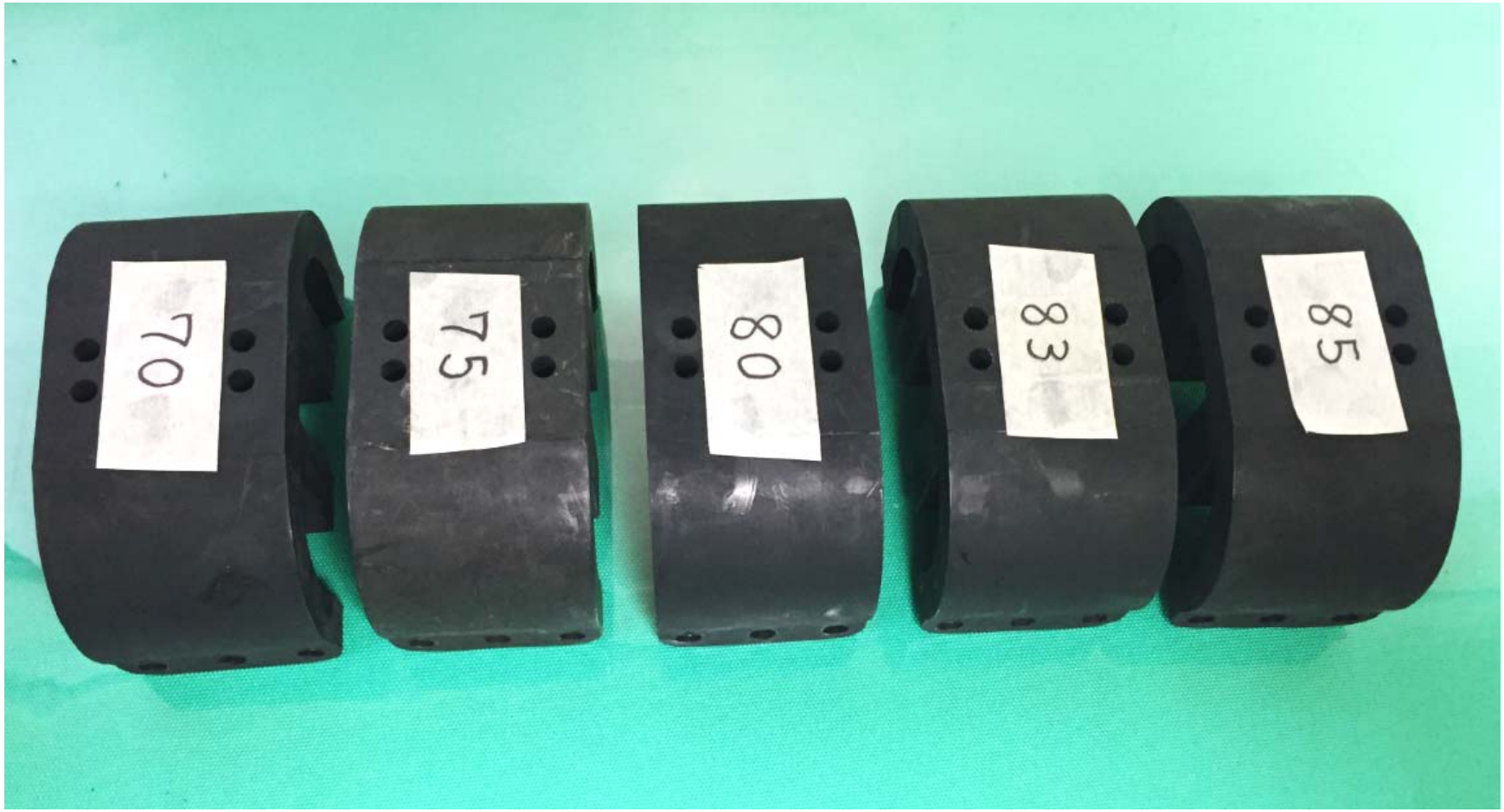
Test conditions;

- speed / Rotation angle down to 45 deg.
- pulling speed 0.5-1.5 deg/sec.

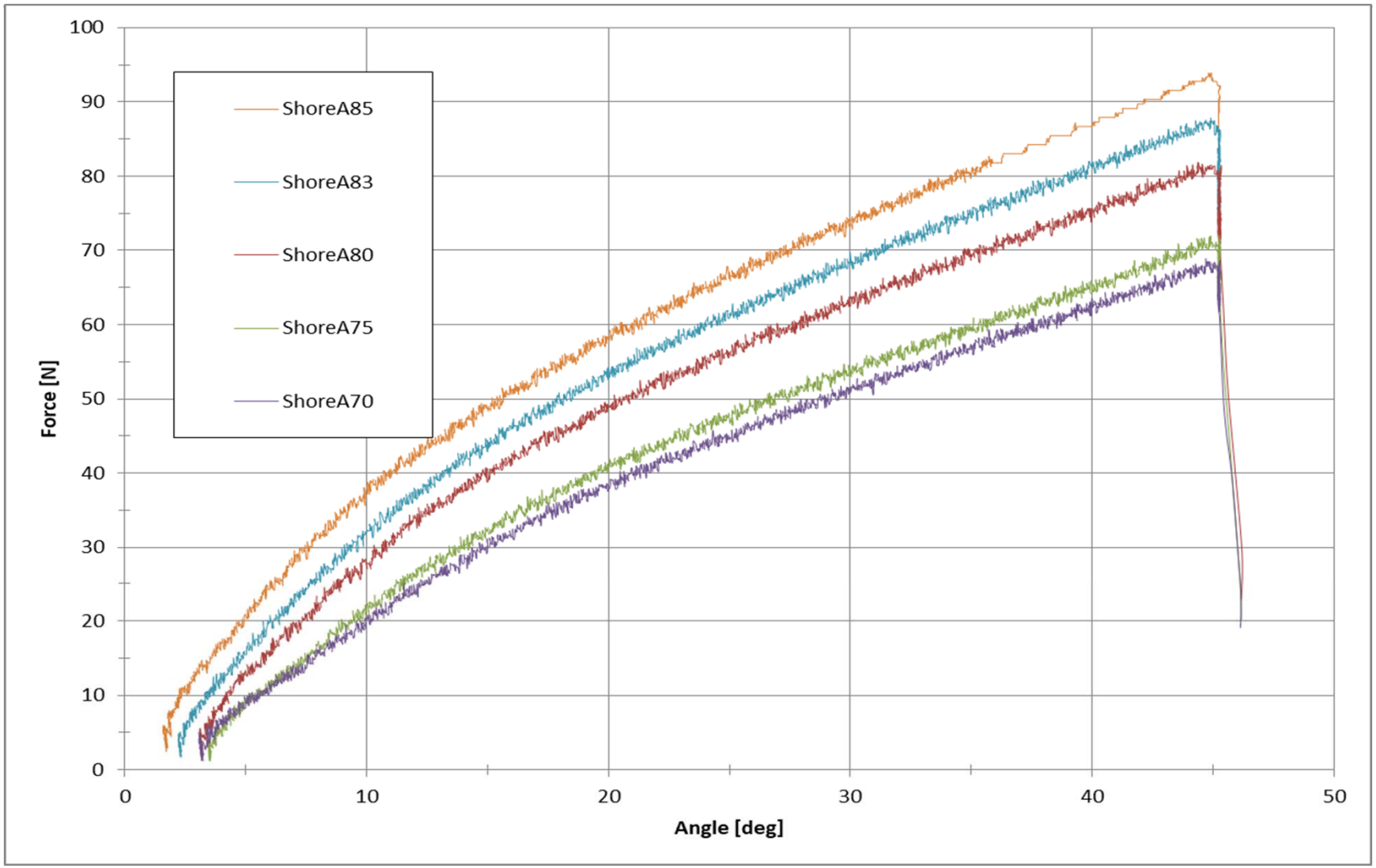
Lumbar Spine Bending Test
Figure 1 : Test Fixture



Current Lumbar spines for bending test



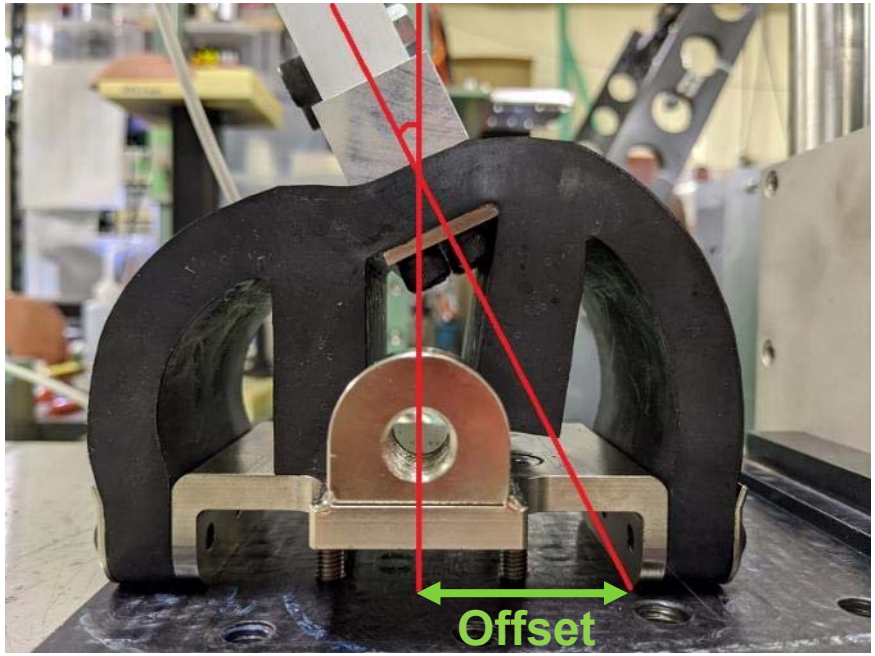
Current Lumbar spines Test Result
Different Hardness Shore A 70-85



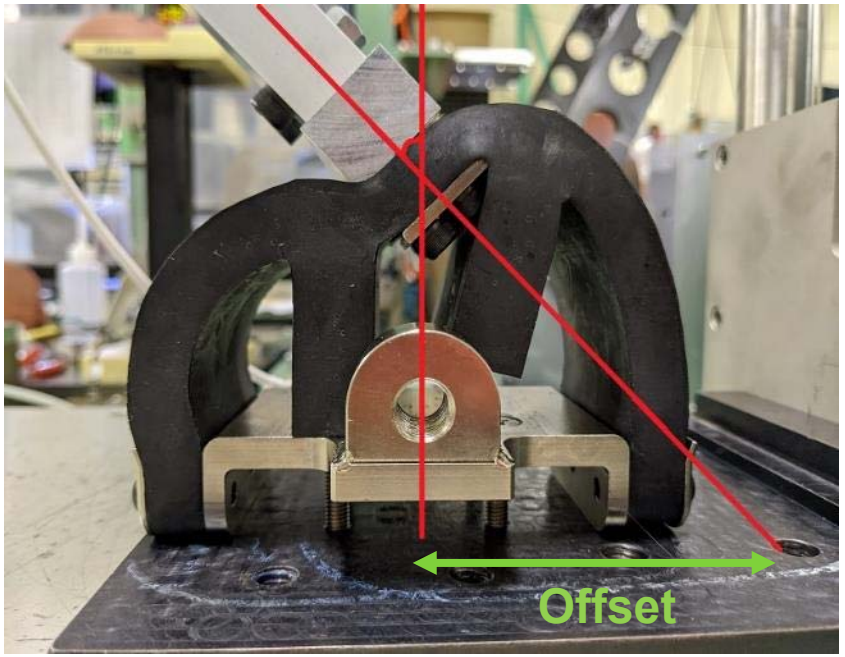
Issue of Lumbar Spine (without cables)Bending

- There is an offset between the centers.
- Causes unexpected tilt of thorax.
- Considerable root may cause of the far side problem.

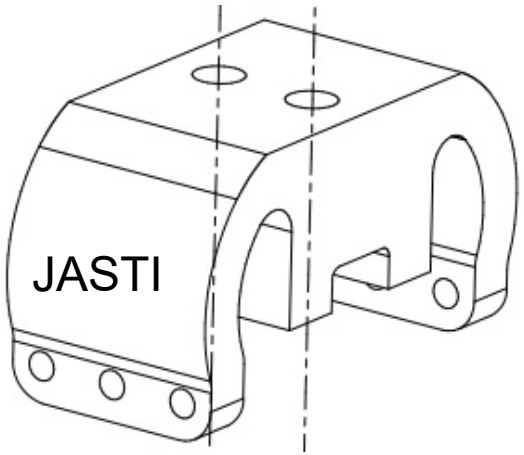
Bent at 20 deg.

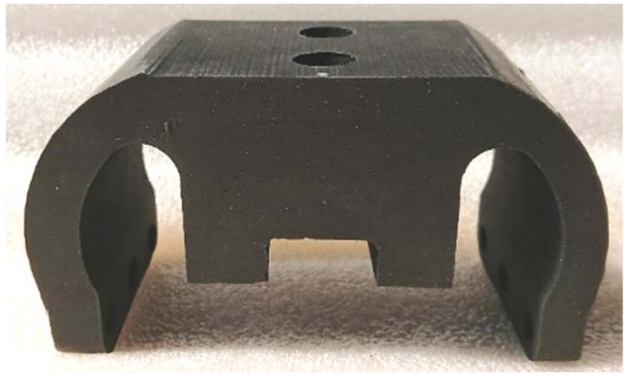


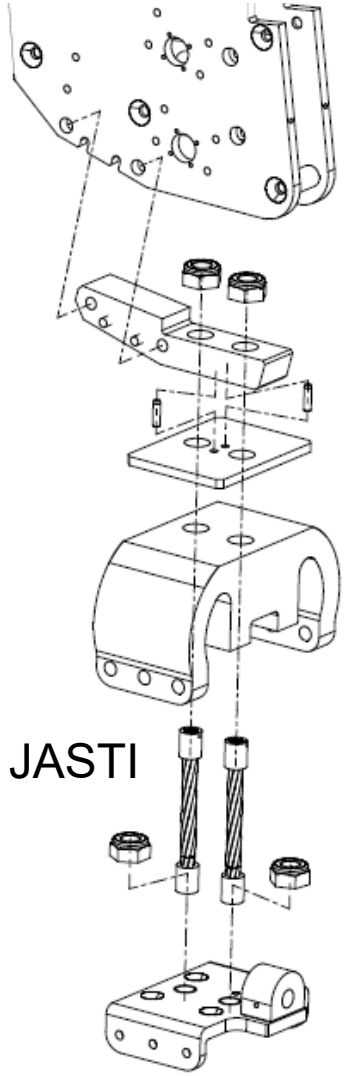
Bent at 40 deg.



Proposed Modification of Lumber Spine (Proto type A) with cables

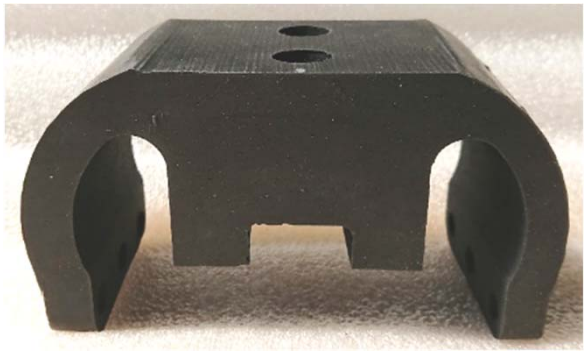






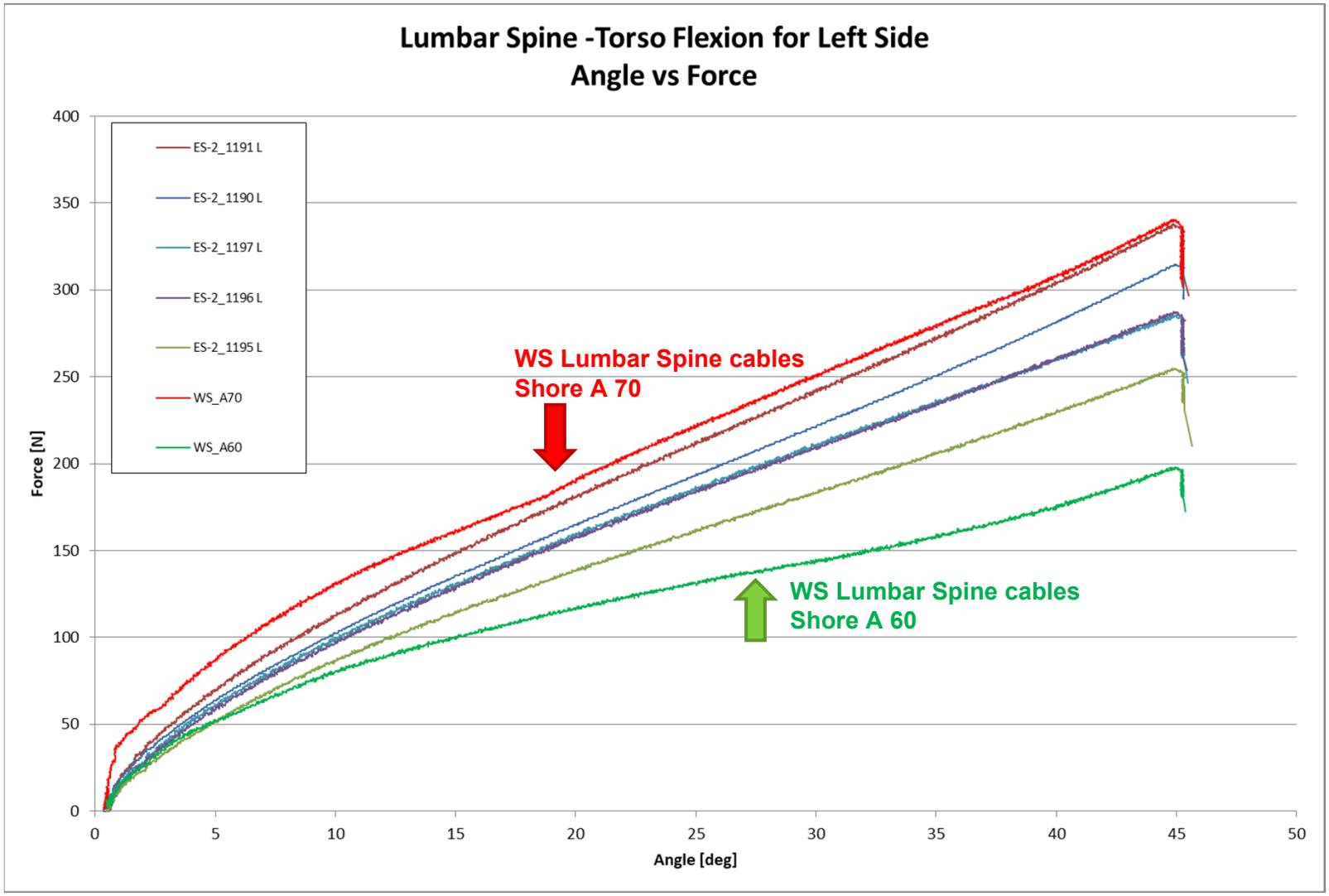
Prototype A study by Bending Test with Lumbar spine with cables

- Executed bending tests with new lumbar spine concept prototype.
- Hardness: Shore A 60 & 70.

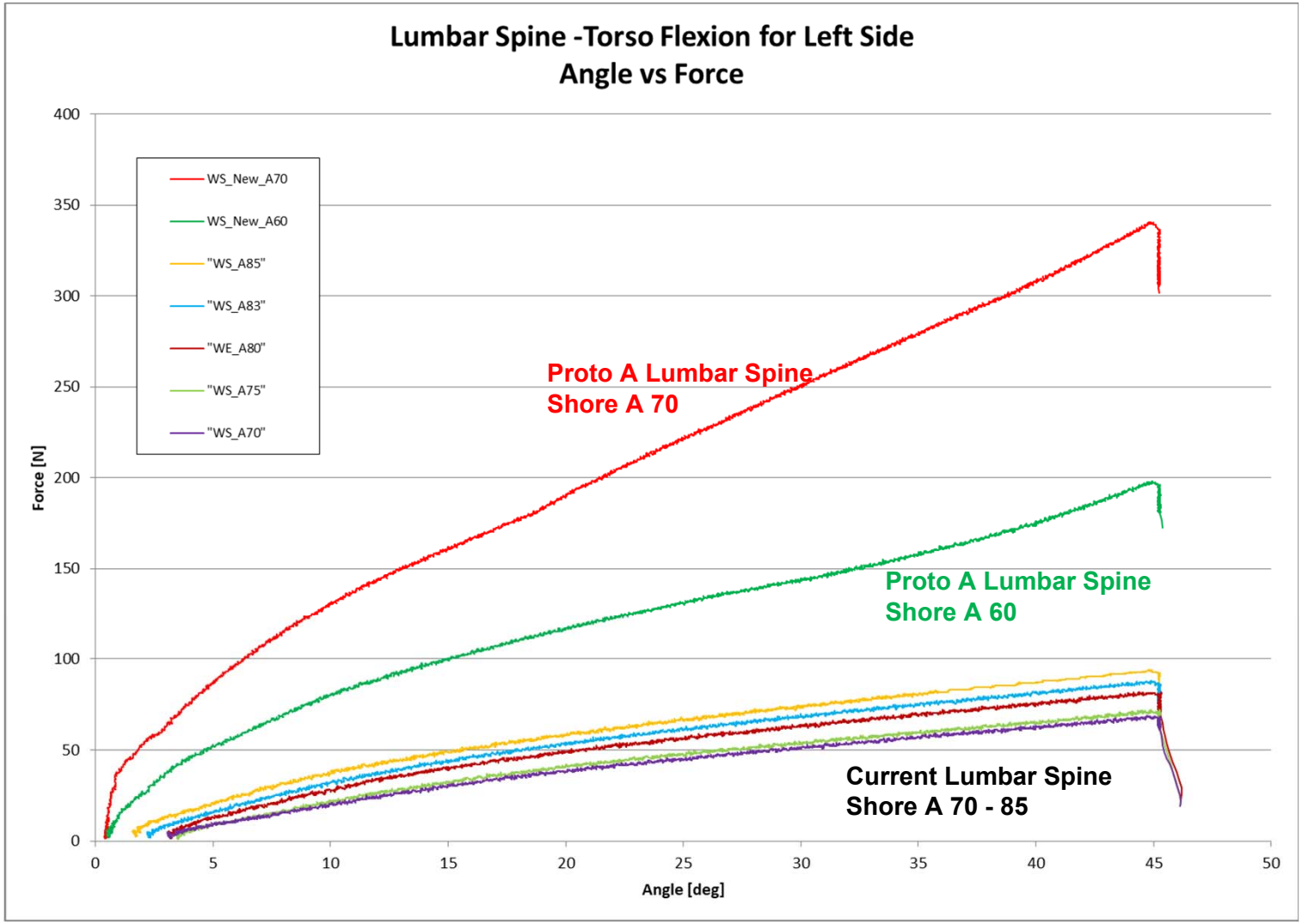


Bending Test Result Comparison;

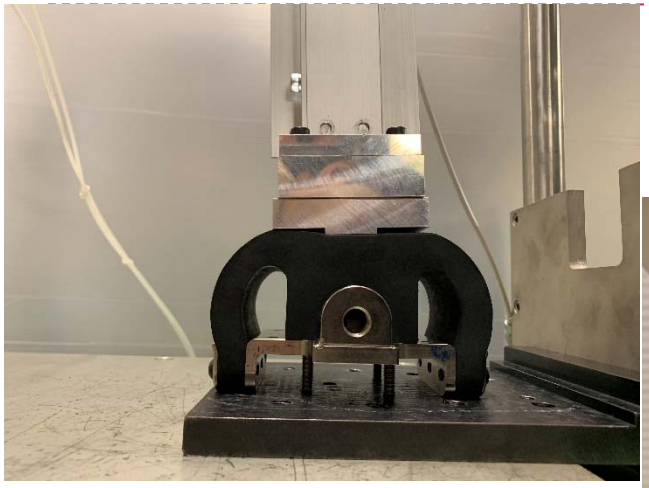
ES-2 vs WS Proto A Lumbar spine with cables

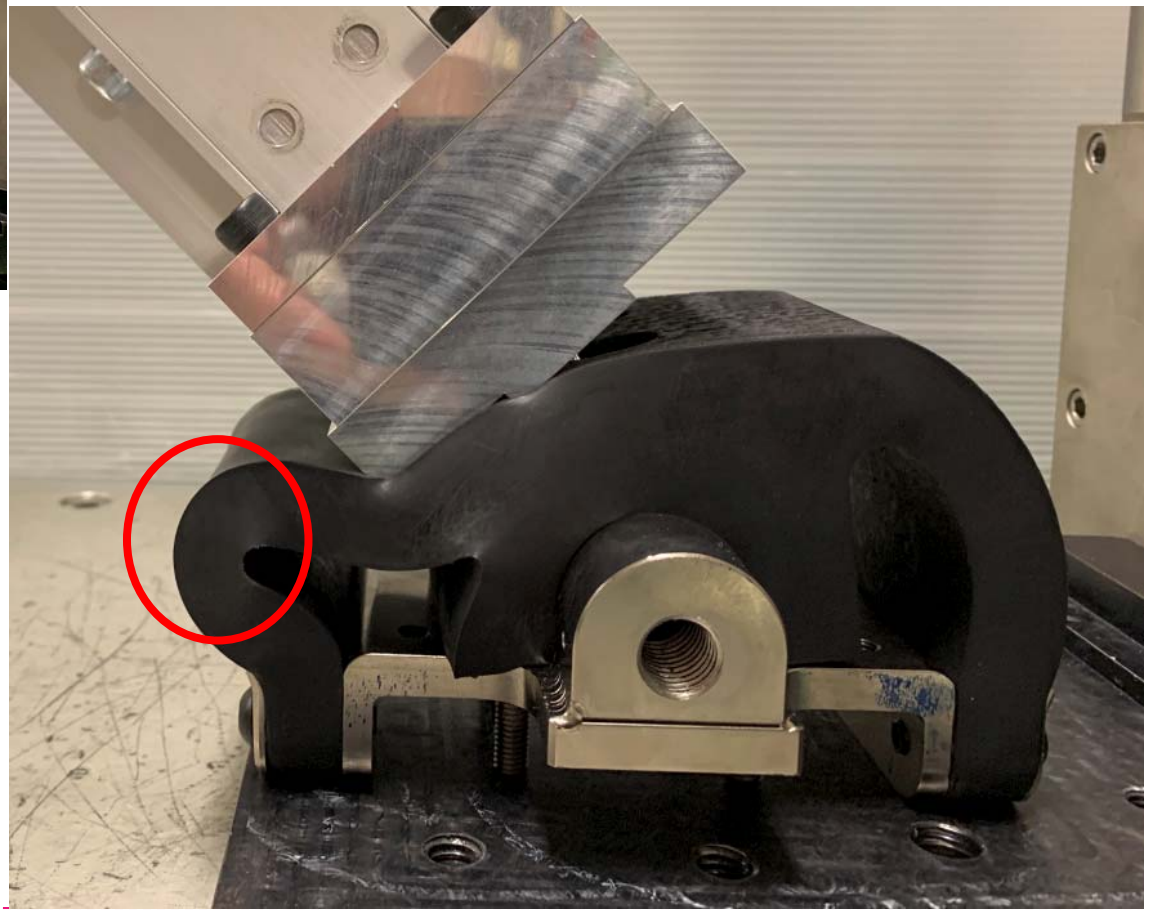


Lumbar Spine with two cables
Bending Test Results with current Lumbar spine



Proto A Lumbar spine bent at A 45 deg. Pictures





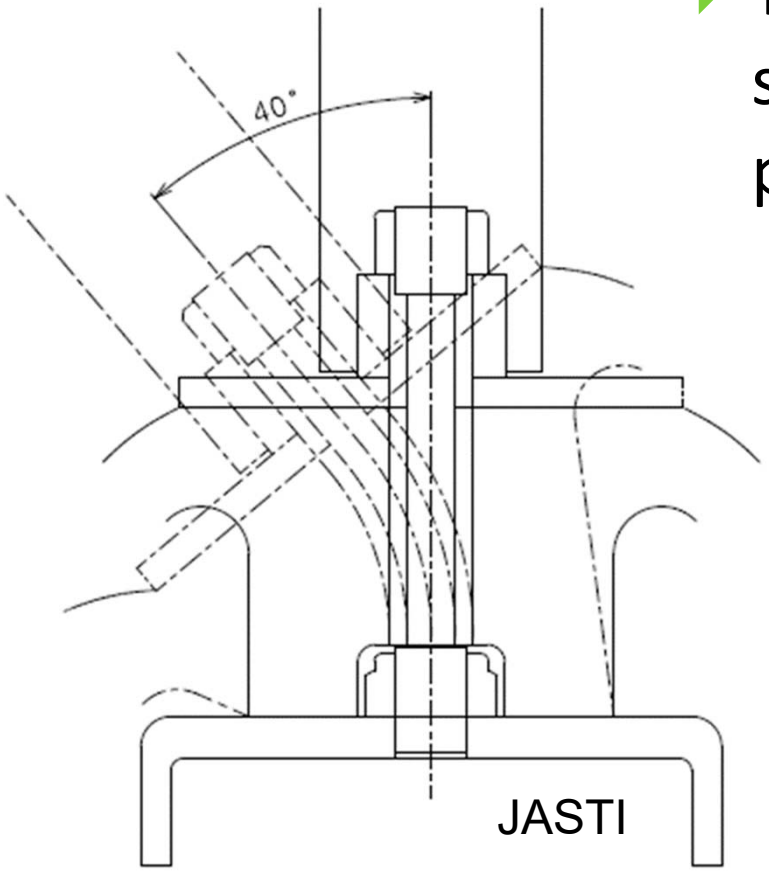
Conclusions (17th June 2020)

- **Proto A Lumbar spine with two cables;**
- Shore A 60 and 70 Bending force can be covered ES-2
- Lumbar spine Shore A 70-85 corridor.

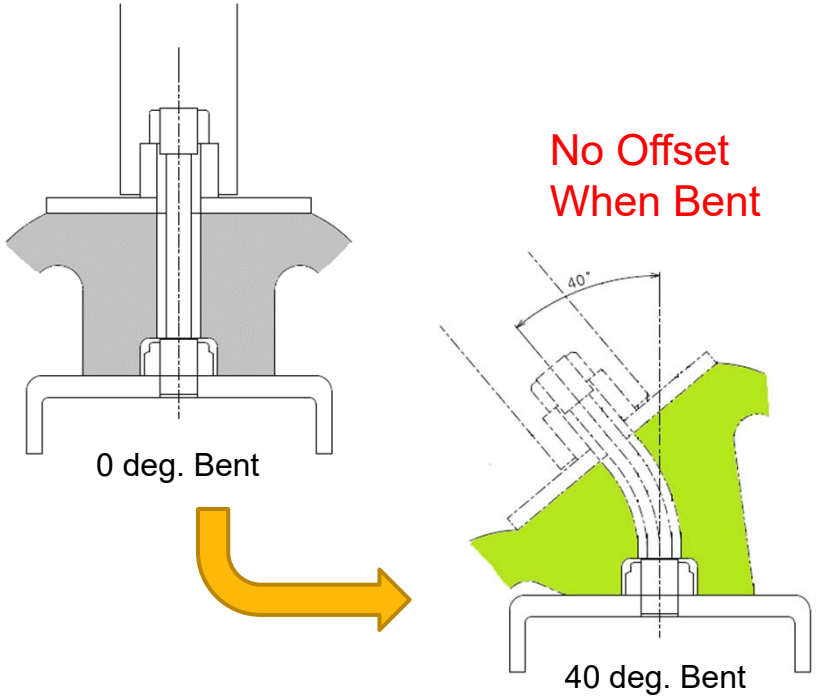
- **Problem; Durability (Picture Proto Model A at 45 deg.)**
- The **RED marked corner** are damaged by repeated bending test.

- **Next Proto model concert in next page**

New Concept B of New Lumber Spine



- The center of lumber spine should remain at the center of pelvis.



Considerations: New Proto Lumbar spine Durability, Repeatability, Reproducibility

- **The final specifications and modifications should be;**

1. Lumbar spine bending base is at the bottom center.

2. To keep the expected corridors within ES-2 and WS proto A Lumbar spine (with cables) by Torso bending test results.

3. Proto models are reviewed Rubber shape and hardness, wire cable size to meet target corridor.
   Target corridor; Low (Proto A 60) and High(Proto A 70)

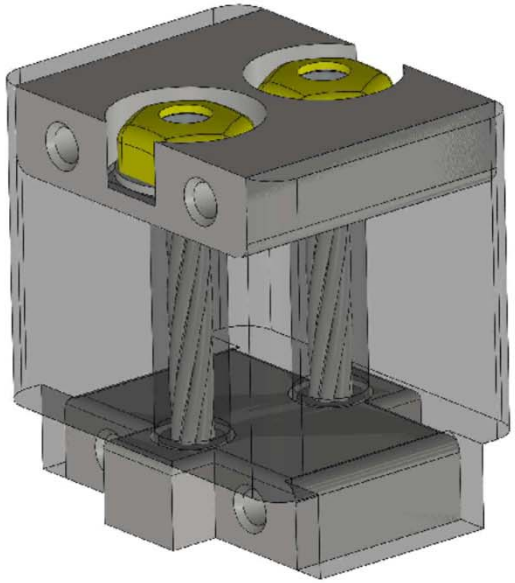
WorldSID50 New Lumbar spine concept B

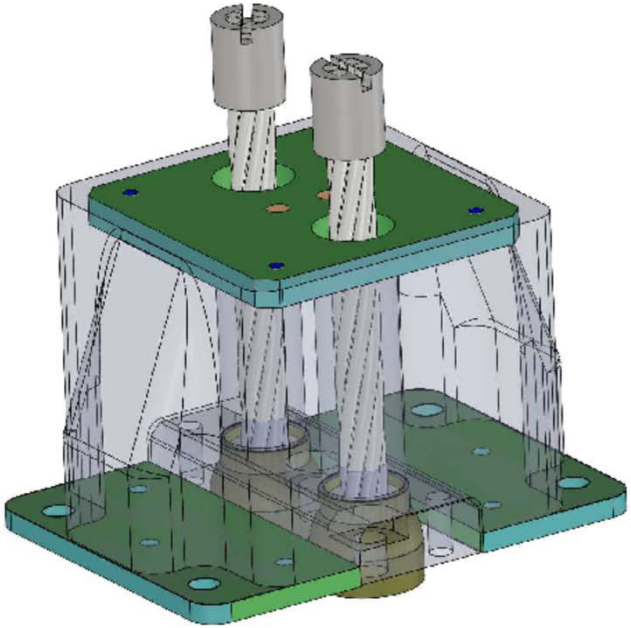
- **Lumbar spine structure as new generation dummies**

	THOR50	WorldSID50
Shape	Quadrangular prism	Quadrangular prism
Lumbar Cables	2 wire cables	2 wire cables
wire location	Parallel to front	Parallel to side
Rubber height (mm)	44.45	48

Lumbar spine THOR50 and WorldSID50

- THOR50 view
- WorldSID50 view Concept B

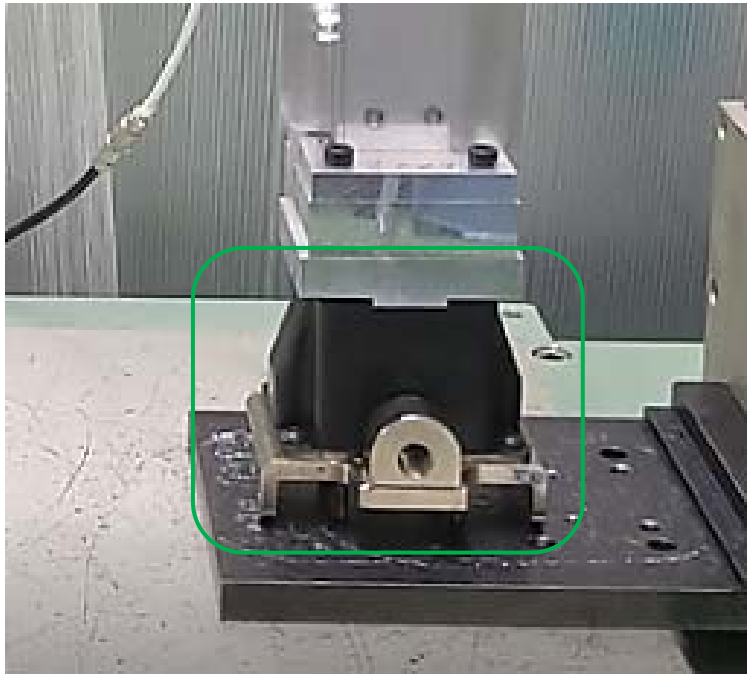


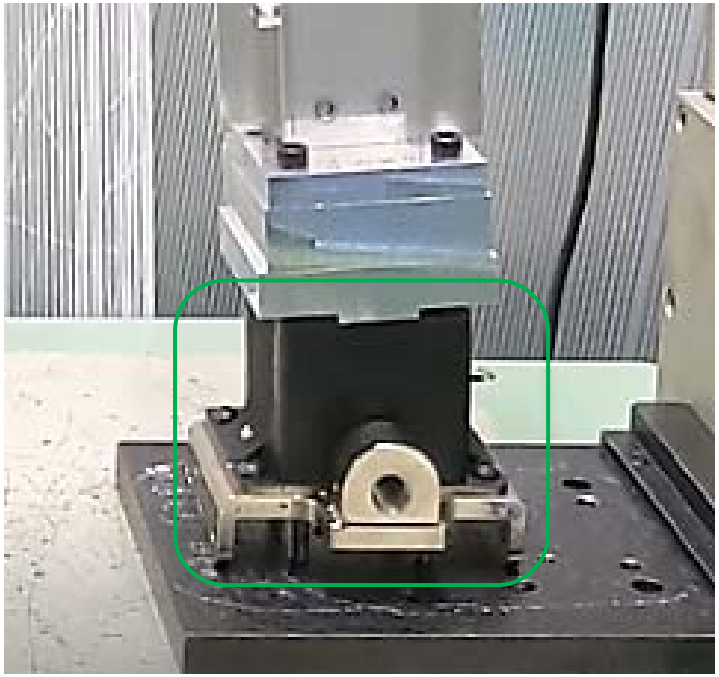


Proto Model B, C Lumbar spine bending test

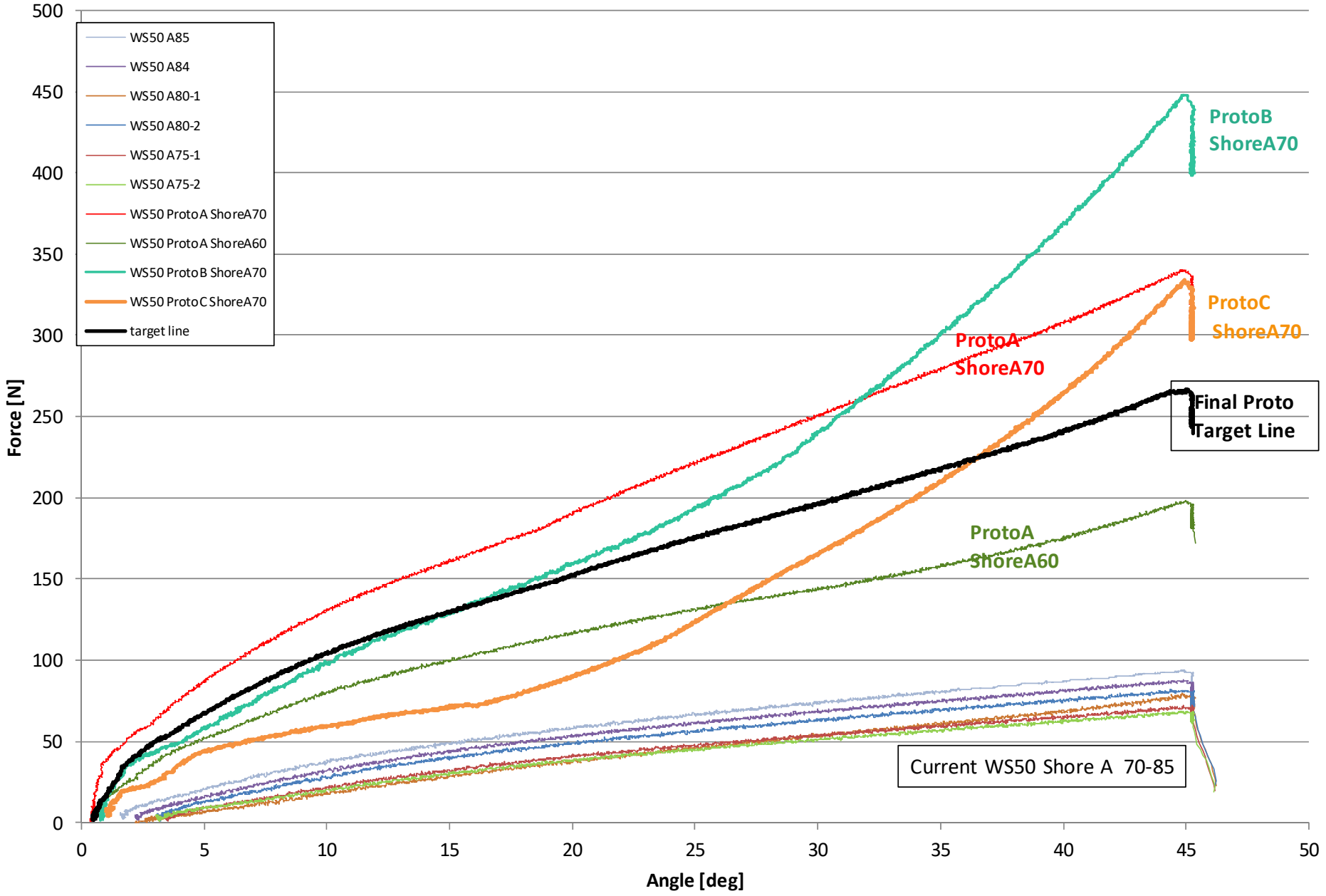
- Proto Model B

Proto Model C





World SID 50th Lumbar Spine -Torso Flexion for Left Side
Angle vs Force



Next Steps ; Final proto shape Shore A 70

- New Lumbar spine concept B and C are not in the expected corridor. (Concept A Shore A 60-70)

- Other new shape of concept D or more meet the corridor. (Concept D ; Shore A 70 as the center of expected corridor to extend bending performance)

- To select the rubber hardness can cover the corridor lowest and highest.
- Complete WorldSID50 with the modified new lumbar spine for both the standard & the far side tests.

Thank you