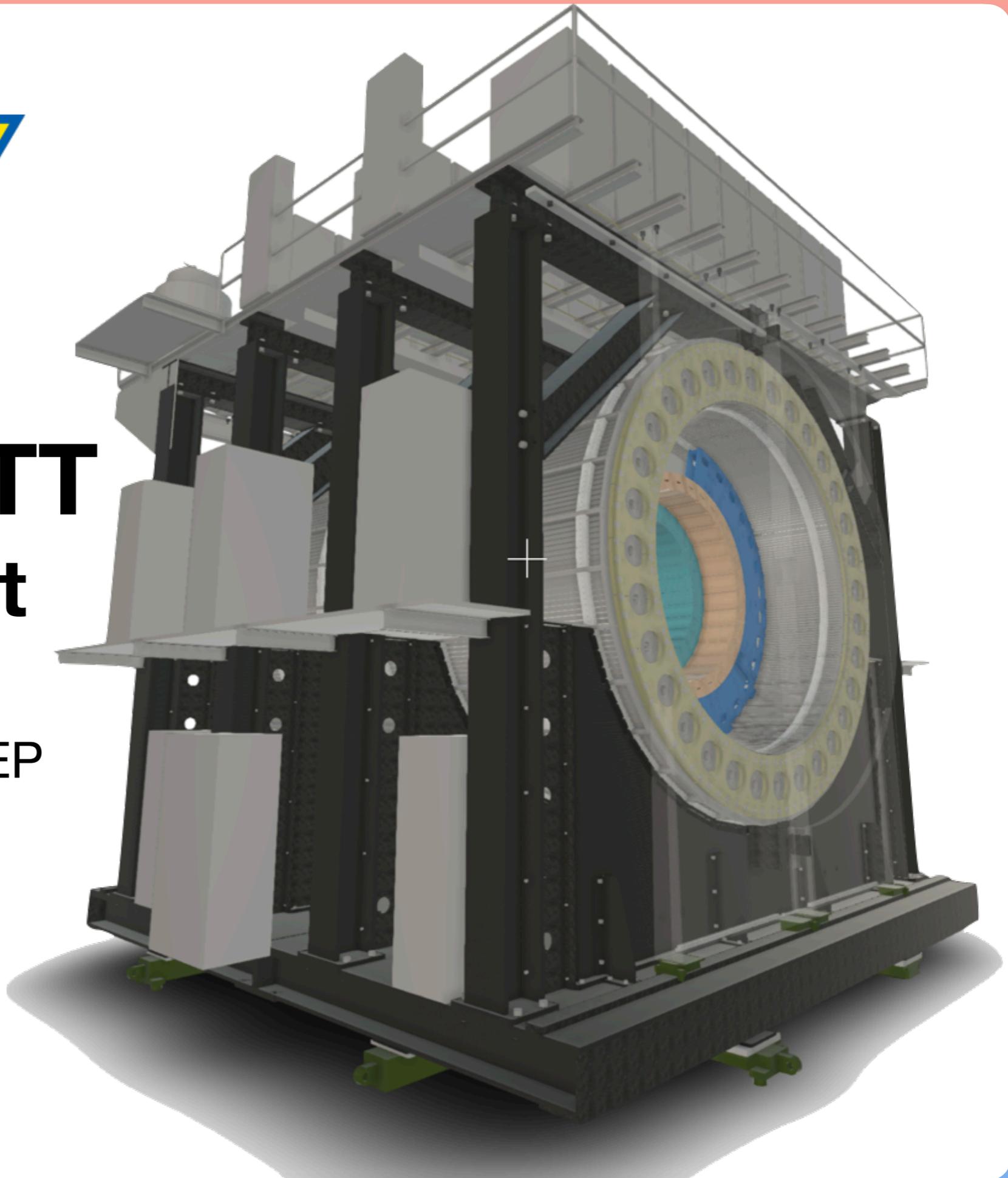




# SPHENIX INTT - Weekly Report

Cheng-Wei Shih, NCUHEP

2021/5/6



# Half-ladder assembly status



Half-ladder assembly

	<b>Total</b>	<b>Good</b>	<b>Not yet bonded &amp; tested</b>	<b>Bad</b>
<b>Chip to HDI</b>	11	1	0	10
<b>Sensor to HDI</b>	6	4	1	1
<b>Encapsulation</b>	3	3	0	0
<b>Thermal cycle</b>	30	26	0	4

One in NWU

all bonded	27
1 ~ 6 un-bonded	7
7 ~ 25 un-bonded	0
> 25 un-bonded	3

Bonding performance (chip to sensor)

# Ladder assembly in Taiwan



Stave : 01-0060, Half-ladder 051, Half-ladder 264      Assembly date : 2021/4/28



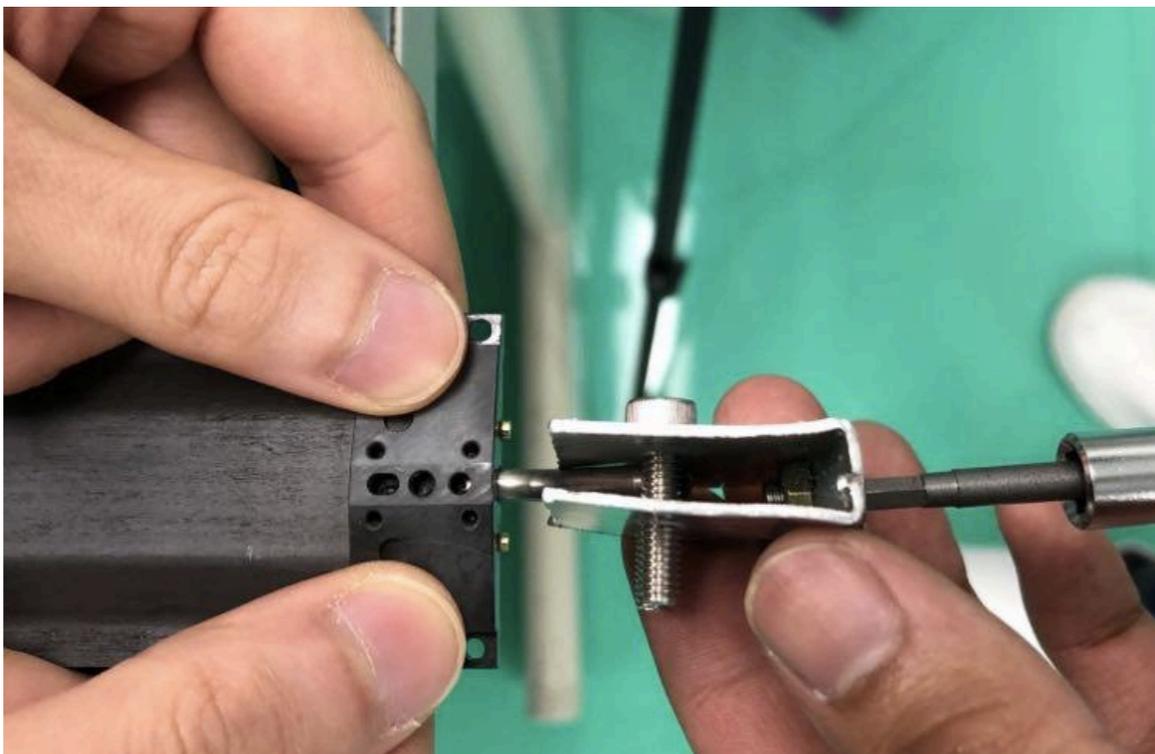
Calibration test was performed, results are consistent before & after ladder assembly



1 ladder, calibration results and manual file are on the way tot BNL

# Twist test : tool

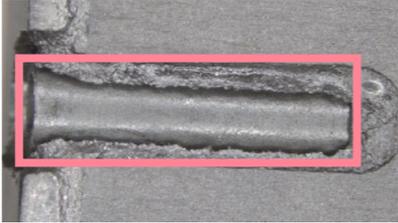
We made a clamp, try to do twist test with a torque screwdriver.



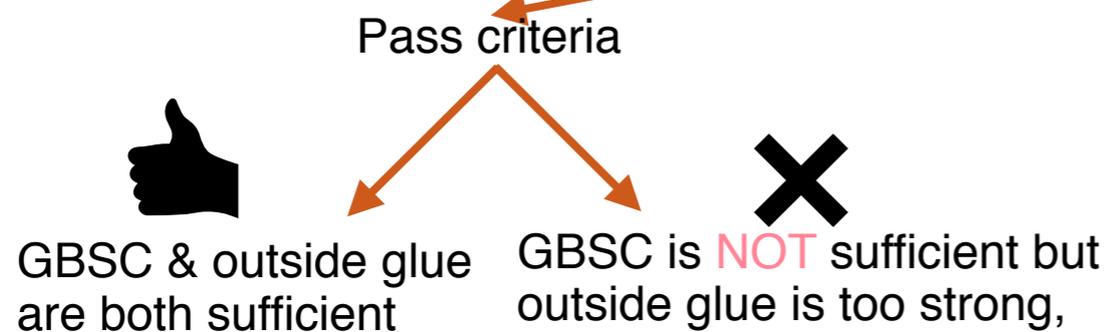
80cN\*m = 0.8N\*m



# Tree plot of stave twisting

Outside glue	Name definition
	<b>GBSC</b> : Glue Between SST & CFT Outside glue : the glue to connect SST and stave body
	
Stainless Steel Tube (SST)	Carbon Fiber Tube (CFT)

If we twist the stave by clamp + torque screw driver (0.8N\*m) Test 1



Fail, SST rotate

Lose the connection with Outside glue

Test 2

GBSC is sufficient

GBSC is **NOT** sufficient

Test 2 is in next slide

# Tree plot of stave twisting

Test 2

GBSC is sufficient

GBSC is **NOT** sufficient

Test 2 : no good method so far.

**Can't** do Visual inspection : outside glue covers the joint point.

If we manually twist SST by hand for test 2

GBSC and CFT are both good

GBSC is good but we damage the CFT as we twisted it too much

GBSC is bad

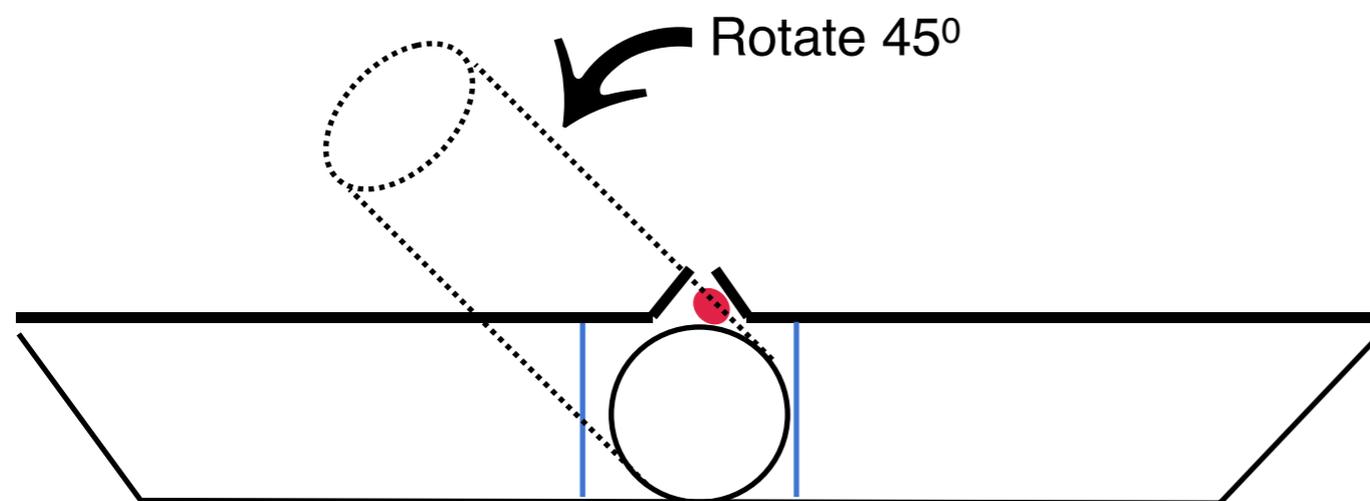
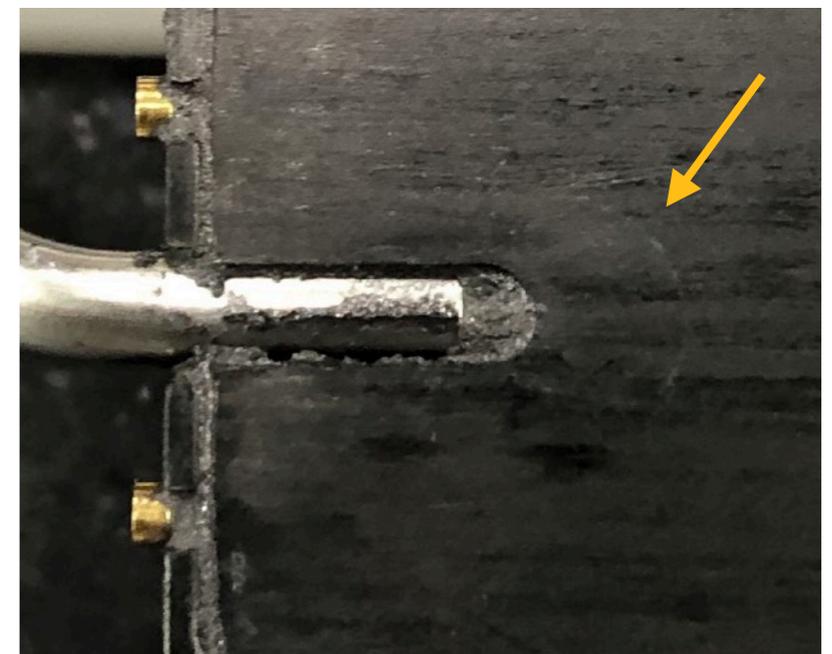
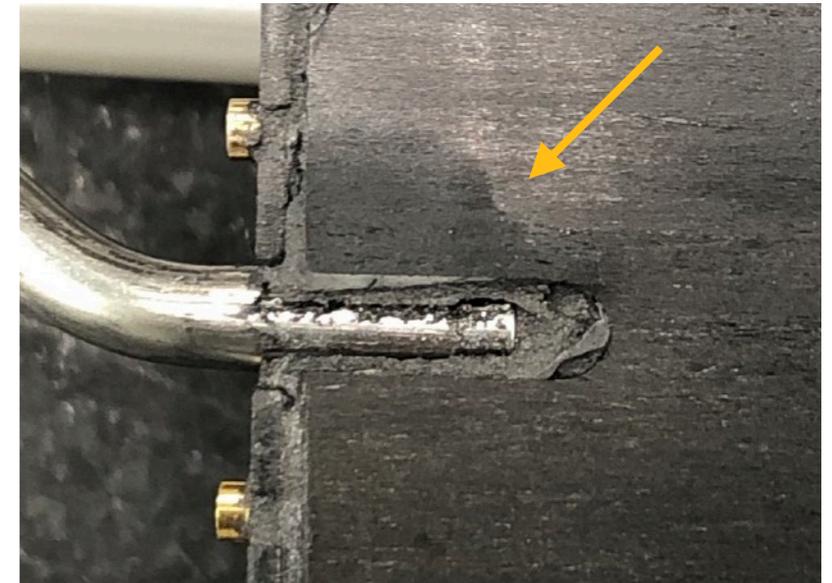
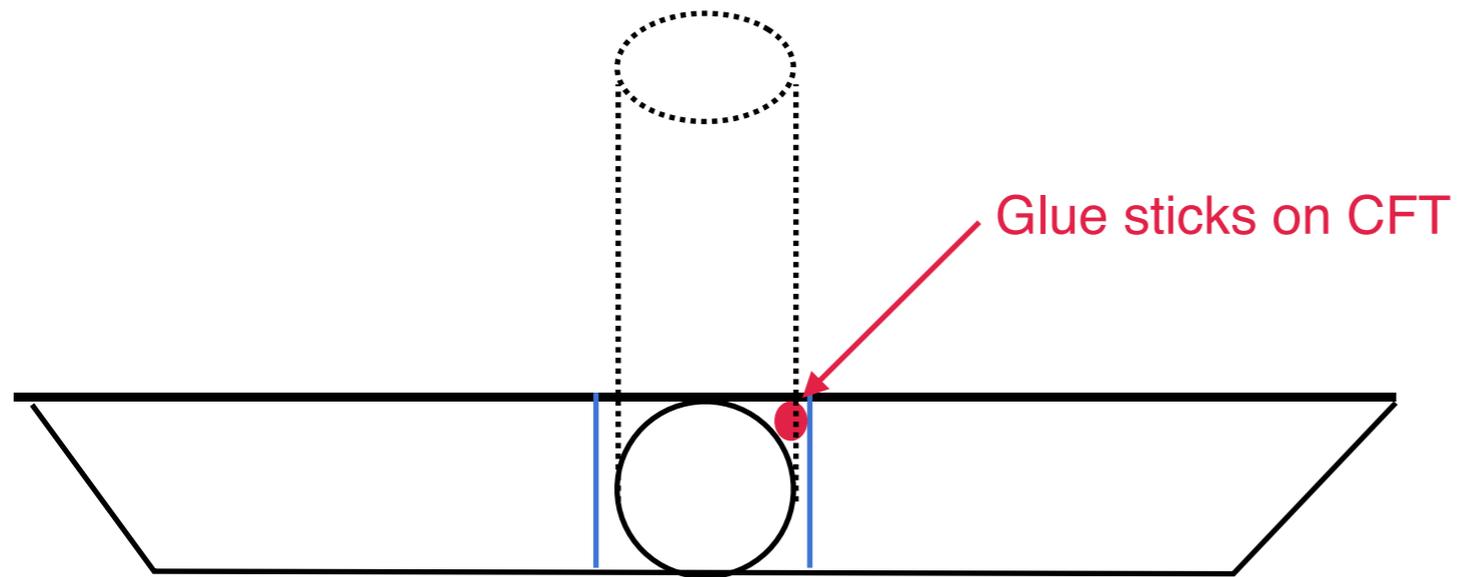


Outside glue overlap the joint point



2021-04-20/15:51:28

# Derived problem from twist test



When SST is rotated by 45°, the glue on CFT also rotates, and results in the damage on the surface of stave

# stave test procedures revision



0.8 N\*m twist test



If it fails (tube is rotated by  $45^{\circ}$ ) && surface doesn't be damaged



20 psi pressure, submersion test (to test glue between SST and CFT)



If it passes the leakage (leakage  $< 0.1$  psi in 10 mins) && submersion test



Recover the connection between SST and outside glue by DP460  
(DP460 procurement is on going)

It may be the proper way to test stave, but it's time consuming

# Twist test status



All staves we have in Taiwan are shown below

Batch-1, barrel-1

Batch-1, barrel-2

Batch-2, barrel-1

Serial number	Twist test			Serial number	Twist test			Serial number	Twist test		
	Operator	North	South		Operator	North	South		Operator	North	South
<b>Purple : practice, hand</b> <b>sky blue : practice, tool</b> <b>blue: assembly</b> <b>yellow : high leak</b>	criteria : 0.8 [N*m] 45 degree G: good B: bad			<b>Purple : practice, hand</b> <b>sky blue : practice, tool</b> <b>blue: assembly</b> <b>yellow : high leak</b>	criteria : 0.8 [N*m] 45 degree G: good B: bad			<b>Purple : practice, hand</b> <b>sky blue : practice, tool</b> <b>blue: assembly</b> <b>yellow : high leak</b>	criteria : 0.8 [N*m] 45 degree G: good B: bad		
01-SIN0007				02-SIN0001				01-SIN0045	WC	B	B
01-SIN0008				02-SIN0005				01-SIN0048	CW		
01-SIN0012				02-SIN0006				01-SIN0051	WC	B	B
01-SIN0015				02-SIN0010				01-SIN0054	WC	B	B
01-SIN0018	WC	G	B	02-SIN0013				01-SIN0057	WC	B	B
01-SIN0021				02-SIN0016				01-SIN0060			
01-SIN0024				02-SIN0019				01-SIN0063	WC	B	B
01-SIN0027	WC	B	B	02-SIN0022				01-SIN0066	WC	B	B
01-SIN0030	WC	B	B	02-SIN0025	WC	G	G	01-SIN0069	WC	B	B
01-SIN0033	WC	B	B	02-SIN0028				01-SIN0072	WC	B	B
01-SIN0036	WC	B	B	02-SIN0031							
01-SIN0039	WC	B	B	02-SIN0034	WC	B	B				
01-SIN0042	WC	B	B	02-SIN0039							
				02-SIN0040							
				02-SIN0043							
				02-SIN0046							
				02-SIN0049							
				02-SIN0052							

So far, only 1 barrel-2 stave passes

Purple : twist practice, by hand  
 Sky blue : twist practice, by tool  
 Blue : has been assembled  
 Yellow : high air leakage

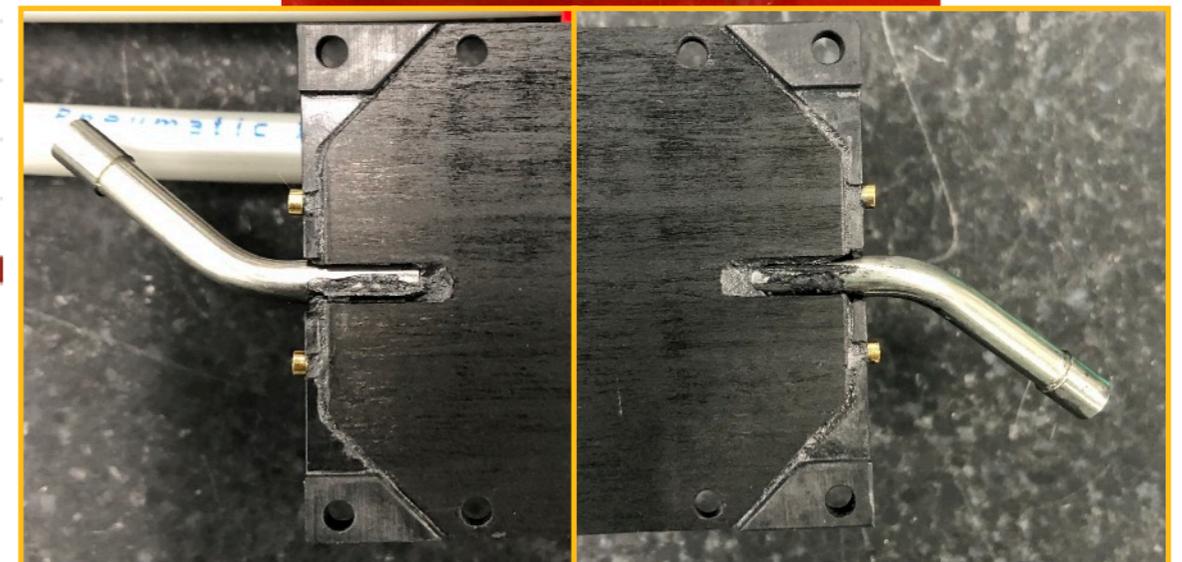
# Leakage & submersion test after twist



Severest case : 01-0045

- 8 trials → 1 passed

Serial number	Twist test			leakage test operator	leakage test $\Delta P$	submersion test
	Operator	North	South			
					20 - 10	
	criteria : 0.8 [N*m] 45 degree				Unit [psi]	G : no bubble
	G: good				G < 0.05	B : bubble appear
	B: bad				0.05 < OK < 0.1	
					B > 0.1	
01-SIN0045	WC	B	B	WC	20	B
01-SIN0048	CW	B	B	WC	0	B
01-SIN0051	WC	B	B	WC	0.37	B
01-SIN0054	WC	B	B	WC	4.406	B
01-SIN0057	WC	B	B	WC	0.229	B
01-SIN0060				WC	0.06	G
01-SIN0063	WC	B	B	MS	0.706	B
01-SIN0066	WC	B	B	MS	0.039	G
01-SIN0069	WC	B	B	MS	1.718	B
01-SIN0072	WC	B	B	MS	0.201	B

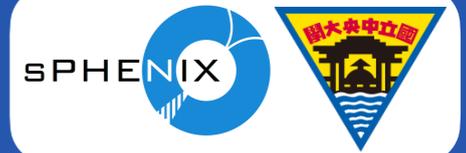


# Twist test status



- We first focused on barrel-1
- 23 barrel-1 staves in total (Batch-1 : 13, Batch-2 : 10)
  - 2 staves → failed in leakage test
  - 2 stave → ladder assembly.
  - 6 staves → twist test practice (all are bad in flatness)
- Remaining : 13 staves
  - 13 trials -> 13 failed
- We recorded the twist test for all staves and took photos after twist, photos and videos are in the [link](#).
- Leakage & submersion test for 8 batch-2 barrel-1 staves were performed after twist test → 1 passed
  - [link](#) of submersion test

# Summary



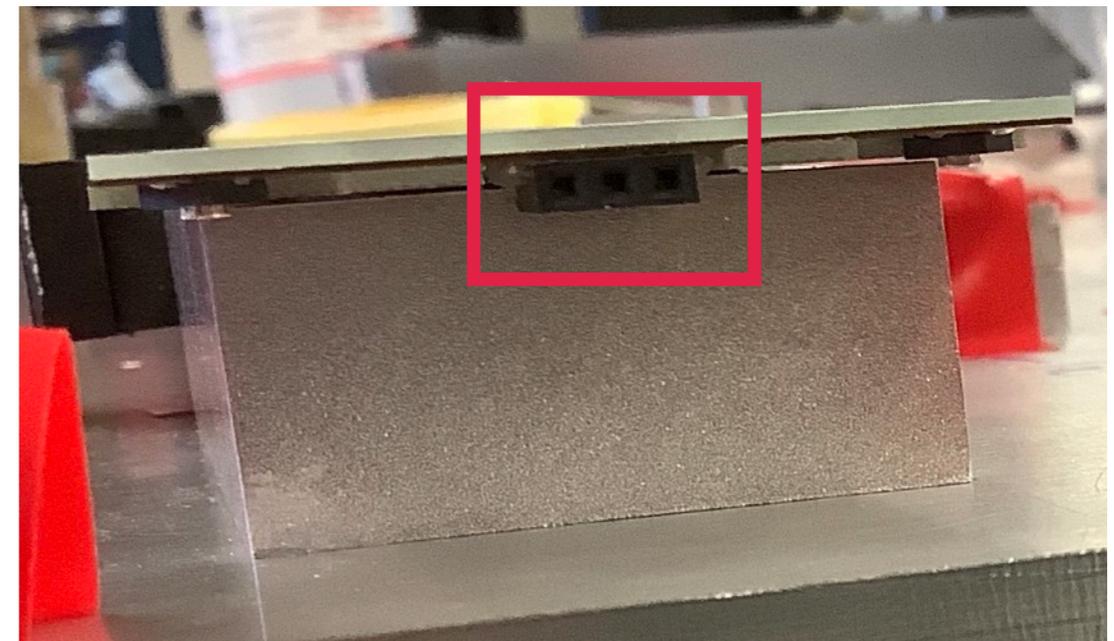
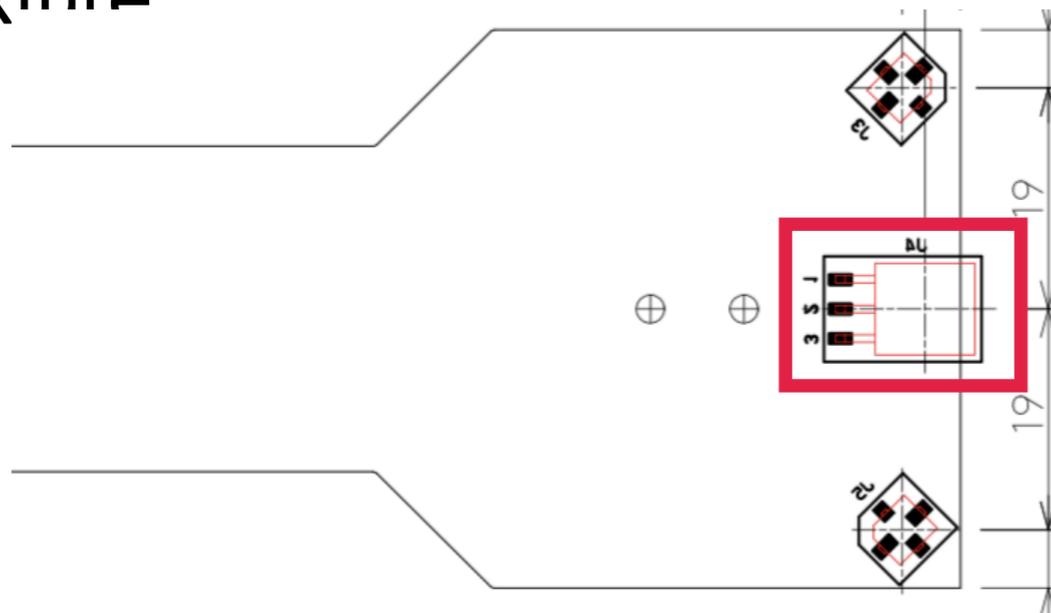
- We assembled second ladder, it is on the way to BNL with ladder assembly box
  - Stave ID : 01-0060 (passes leakage, submersion & flow test, **no twist test**).
  - Half-ladder ID : 051, 264 (Both are not fully functional)
- We stop the twist test
  - **13 trials → 13 failed (barrel-1)**
  - Leakage & submersion test for 8 batch-2 barrel-1 staves were performed after twist test → **1 passed**
  - Question : should we keep twisting staves or should the criteria be lower ?

# Back up



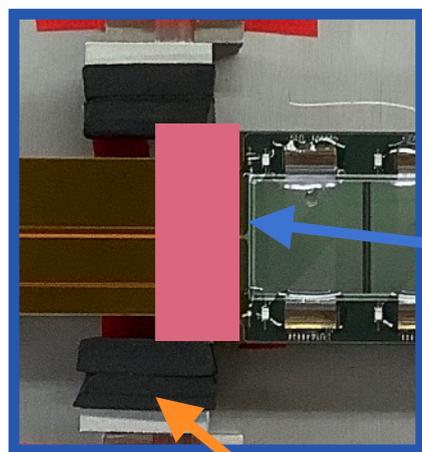
# Attention

- The 3-pins adapter is outside the fixture.
- You may need to lift the tail of HDI a little bit when moving the ladder out from box, to avoid the jamming of the adapter and fixture

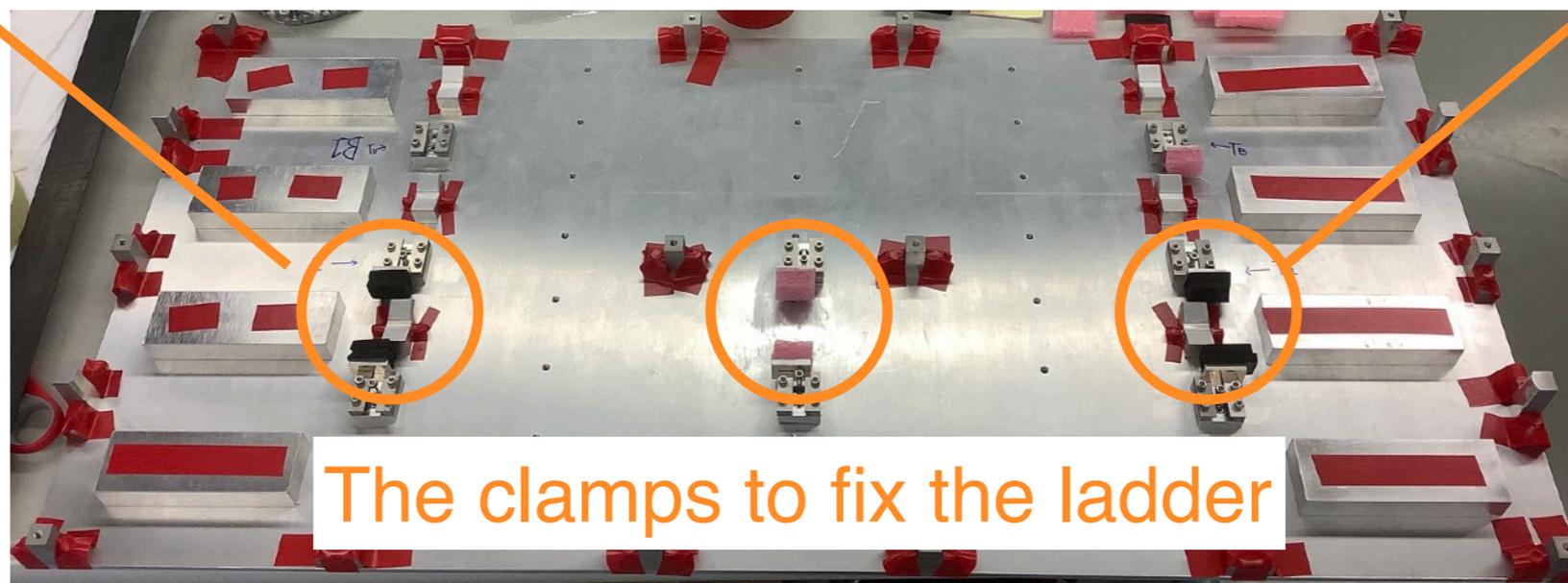
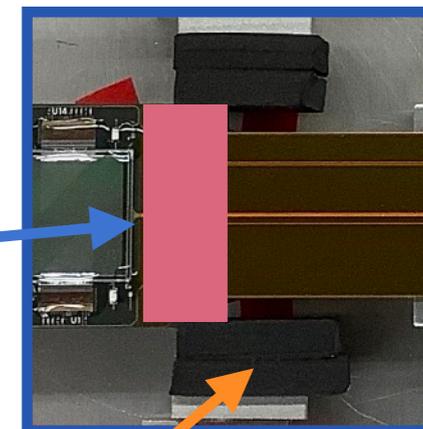


# Method to fix ladder

- The principle is to fix the ladder by foams. The foams apply some pressure to fix the ladder.



Backside of lid

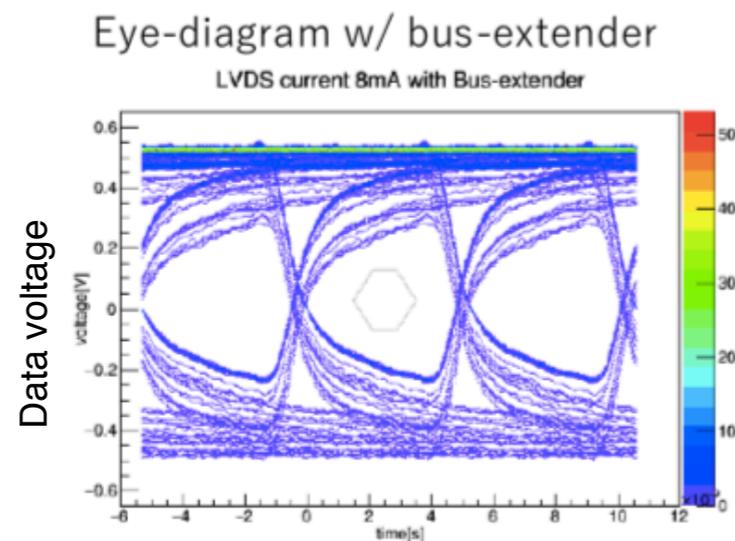
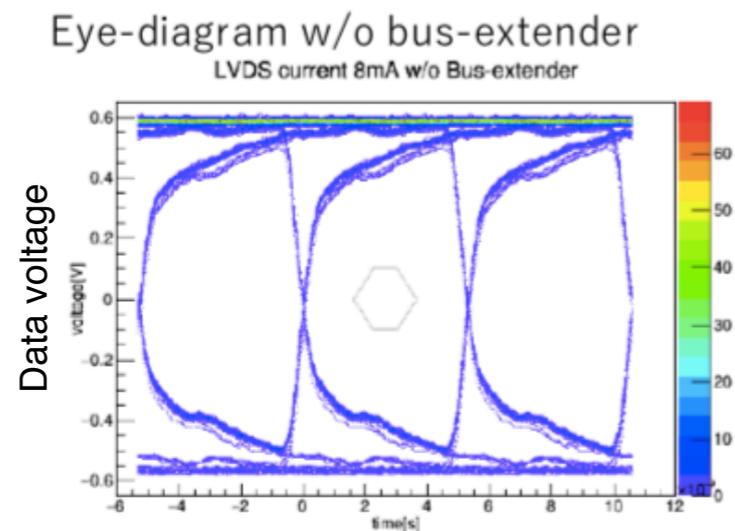


The clamps to fix the ladder

Baseplate

# INTT DAQ problem

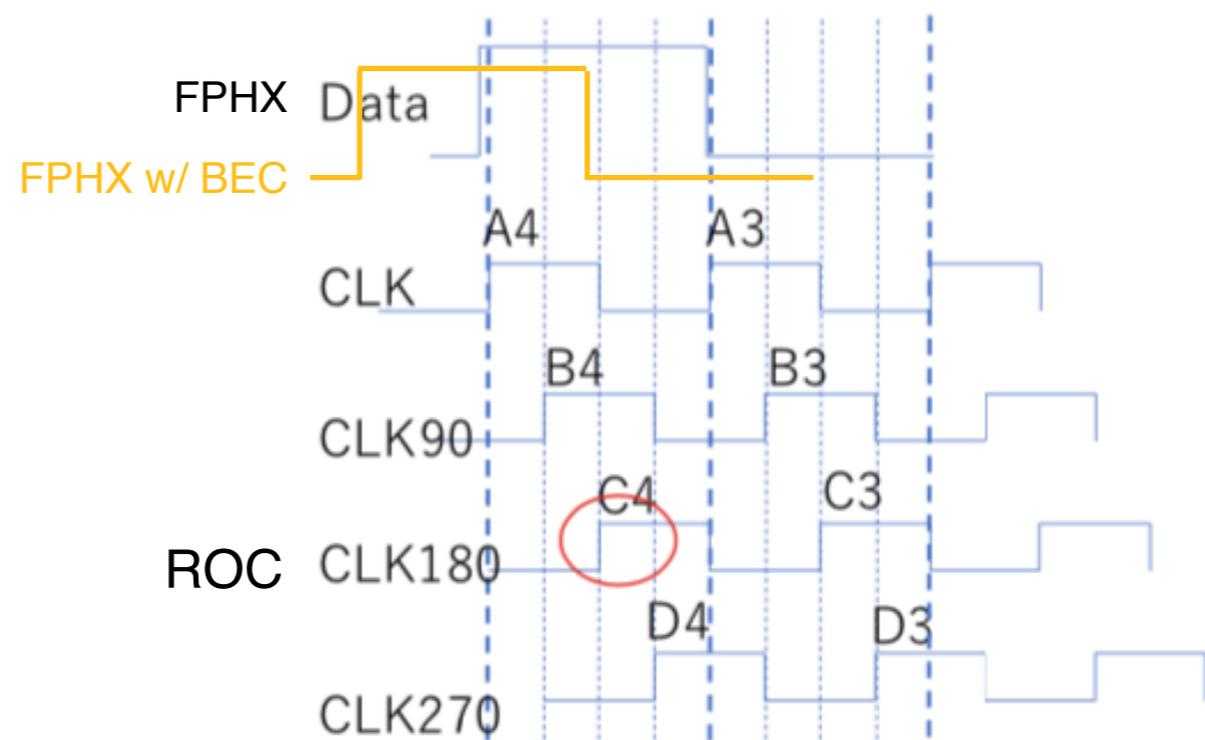
- General chip : output signal & clock. Example : CMS Pixel
  - Clock : to synchronize with following electronics
- INTT FPHX : output signal only



slow voltage rising rate

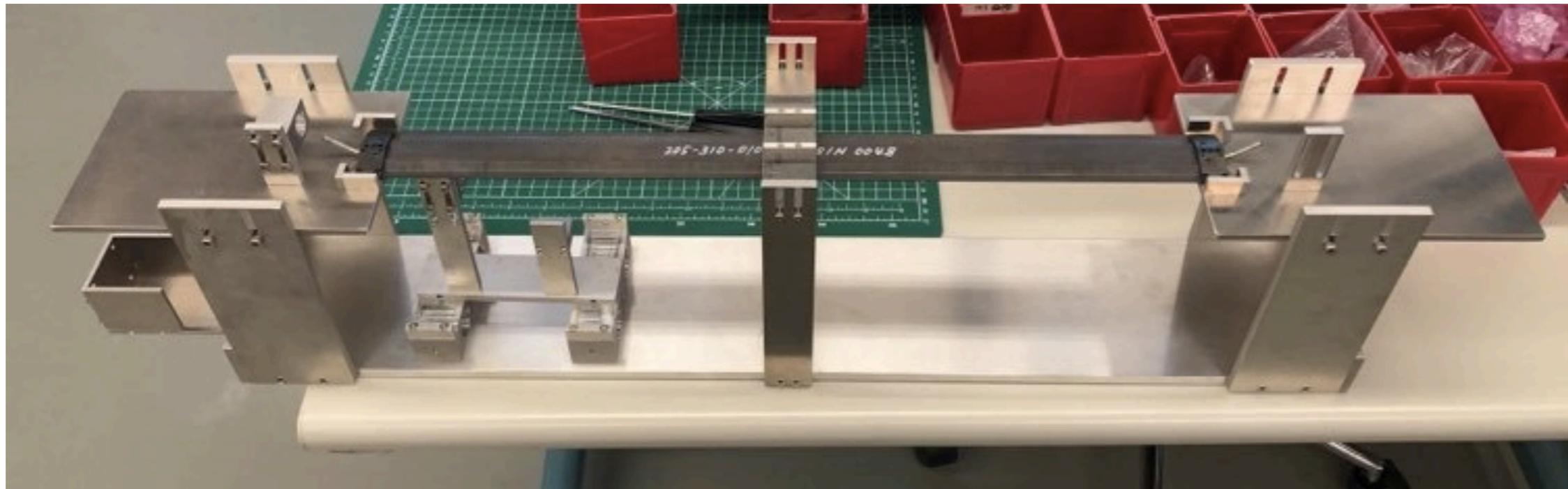
Goal : try to change the phase

FPHX - ROC synchronize method :  
fix the phase at 180°



works in FVTX (short transmission cable)

# INTT test stand



Assembly in progress

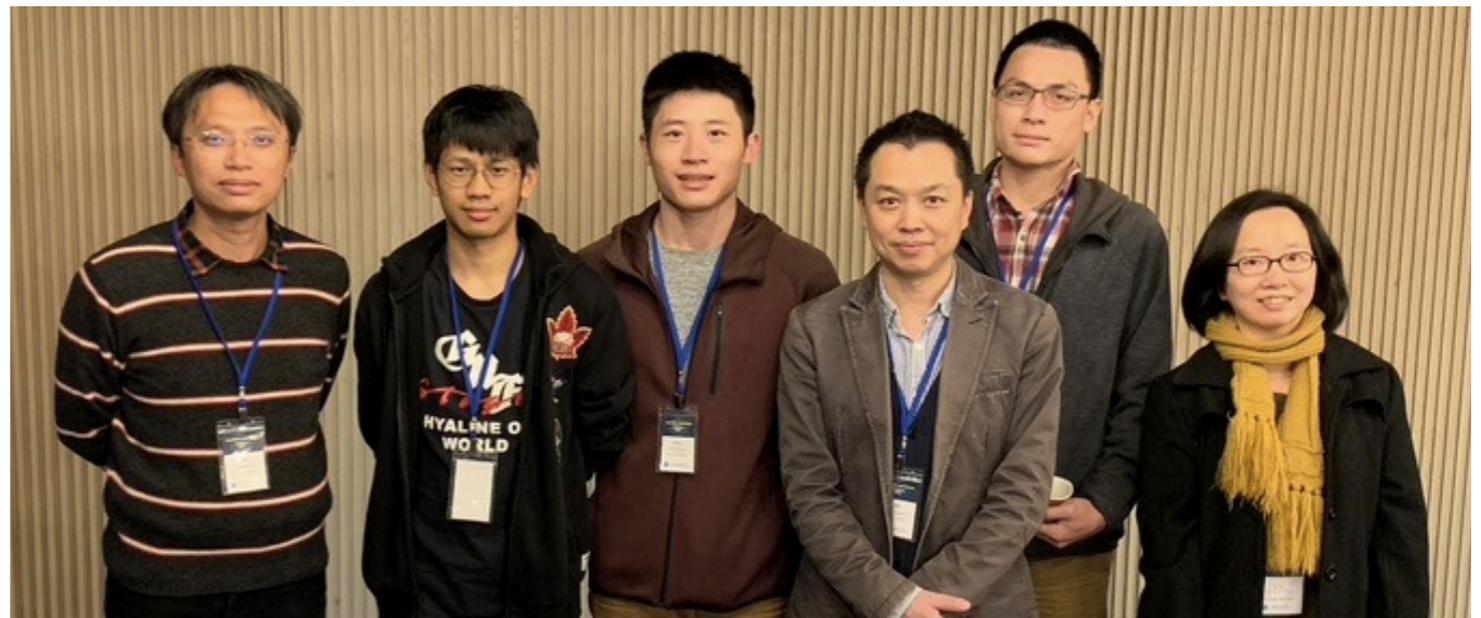
# Taiwan INTT team



Ou-Wei Cheng



Kai-Yu Cheng



Chia-Ming Kuo    Cheng-Wei Shih    Lian-Sheng Tsai  
Wei-Che Tang    Rong-Shyang Lu    Janny Huang