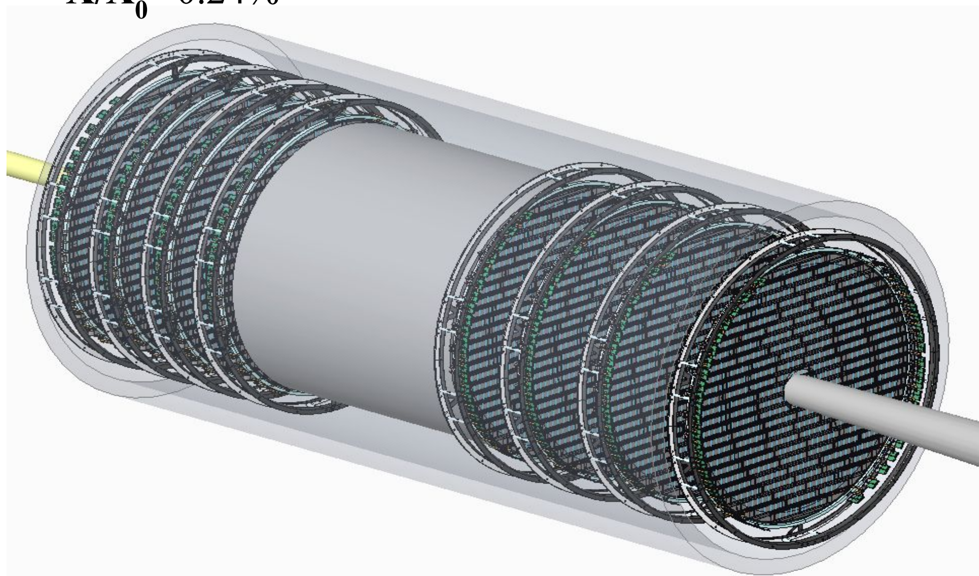
BERKELEY LAB

ePIC SVT Disks

ePIC

- **EIC Large-Area Sensor** with design based on ITS3 MOSAIX, mounted on low-mass CF support structure with integrated air cooling
- **AncASIC** provide negative sensor bias voltage, serial power and slow control
- **Outer radius** ranging from 24 to 40 cm
- **X/X_0** ~0.24%



z
y
electrical services
1
2
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air channel
air channel
electrical services

Sensor Inward Facing Module

Sensor Outward Facing Module

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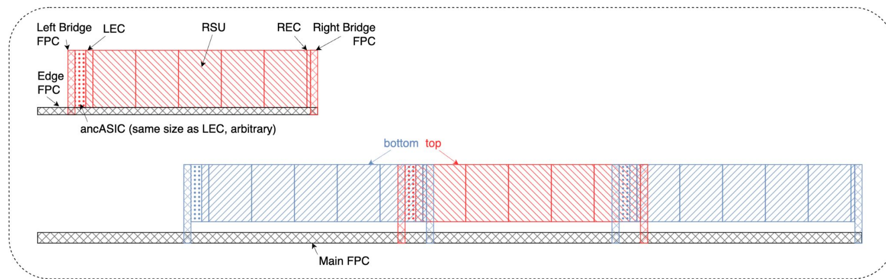
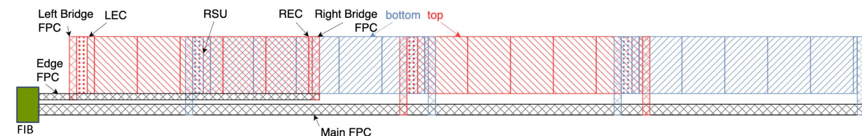
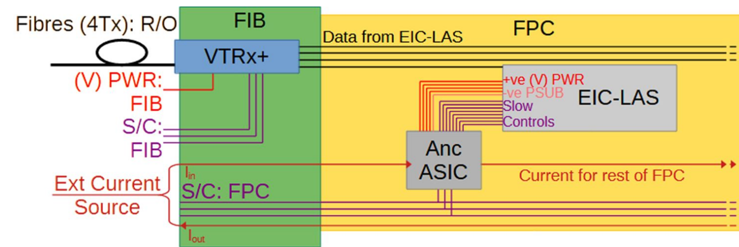
Electrical Interfaces for SVT Disks

ePIC



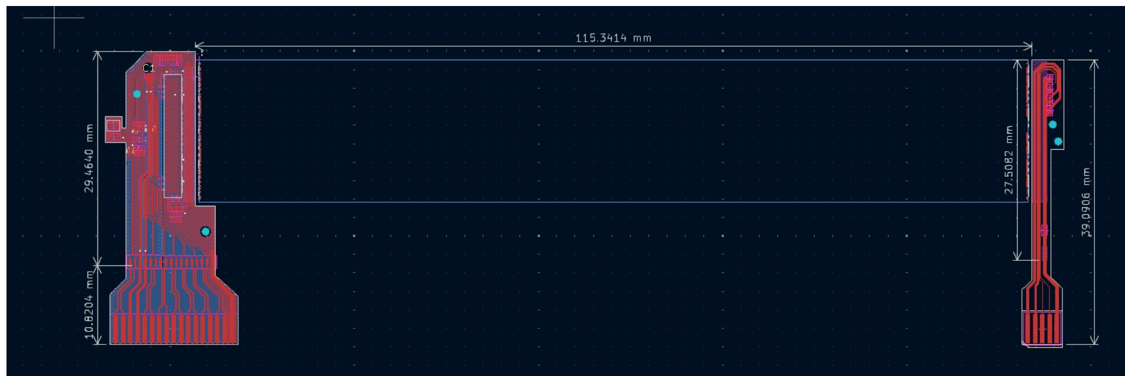


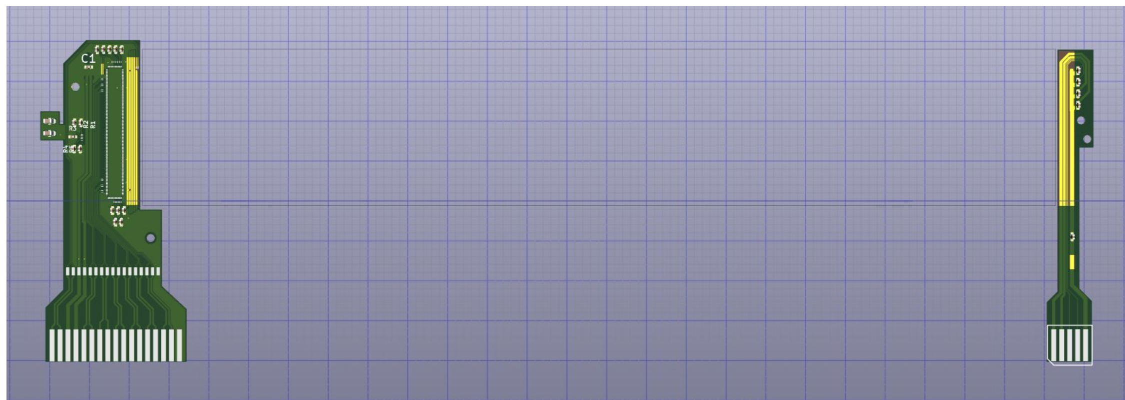


bold: preferred option

	FIB	Main/Edge FPC	Bridge FPC	AncASIC	EIC-LAS
FIB					
Main/Edge FPC	**Connector**, Soldering				
Bridge FPC	N/A	**soldering**, wire/TAB-bonding			
AncASIC	N/A	N/A	**wire-bonding**, TAB-bonding		
EIC-LAS	N/A	N/A	**wire-bonding,** TAB-bonding	N/A	

Bridge FPC - Overview





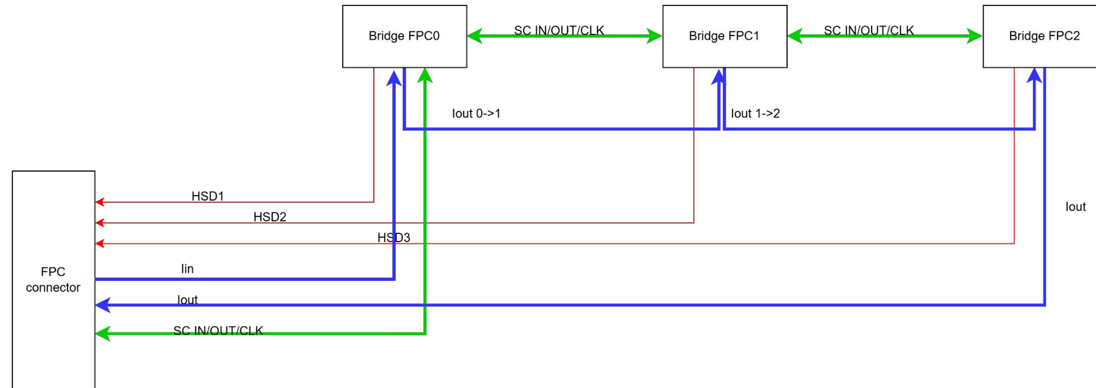
- **Left bridge FPC** with **AncASIC** will handle **EIC-LAS LEC** power, slow control, high-speed data transmission.

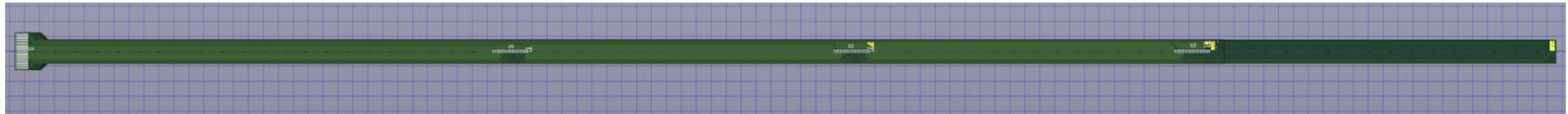
	Area (mm^2)	Copper area (mm^2)	Fill factor
Top Layer	278.2	190	0.69
Bottom Layer	278.2	260	0.94

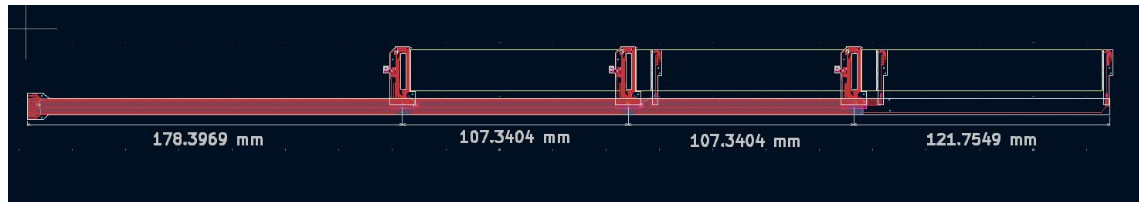
- **Right bridge FPC** with power buses connected to GND through decoupling capacitors will connect to the **EIC-LAS REC**.

	Area (mm^2)	Copper area (mm^2)	Fill factor
Top Layer	78.9	32.9	0.42
Bottom Layer	78.9	0	0

Main FPC Overview







	Area (mm^2)	Trace Area (mm^2)	Power net area (mm^2)	Fill factor
Top Layer	4747.6	221.5	1875.6	0.45
Bottom Layer	4747.6	0	3202.2	0.68

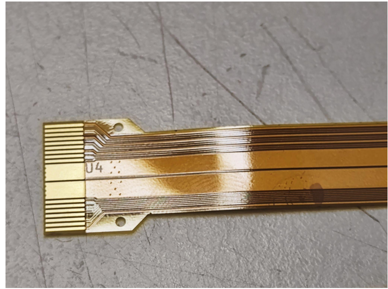
Summary and Outlook

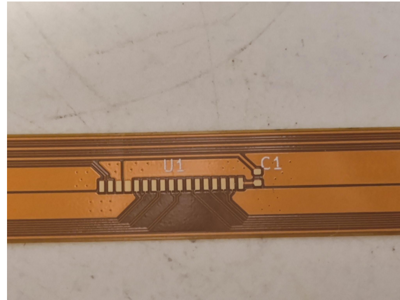
- **FPCs** provide electrical interfaces between EIC-LAS, AncASIC and FIB (lpGBT and VTRX+).
- A first layout design is completed for SVT disk FPC, taking into account the requirements of power and data transmission.
- Plan to produce a first batch of Cu-based mechanical prototypes to check FPC dimensions and inter-connection, with the main goal to facilitate disk module development.
- Will engage with **LTU** to design and produce Al-based FPCs for electrical functionality tests.
    - On-going work by UK and Trieste for bonding and data transmission with LTU FPCs

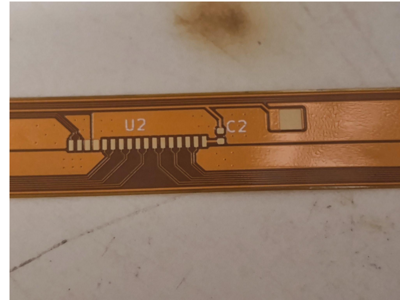
Testing Plan

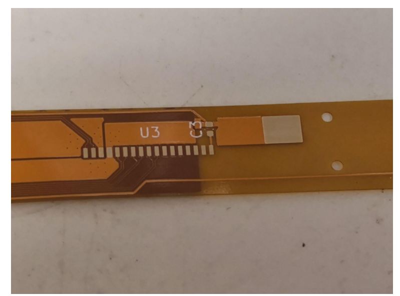
- Visual Inspection -> done
- Soldering SMP components onto bridge FPC -> done
- Cutting bridge FPC -> in progress, 1st trial done
- Soldering bridge FPCs onto main FPC -> in progress, 1st trial done
- Gluing FPCs
- Wire-bonding

Visual Inspection

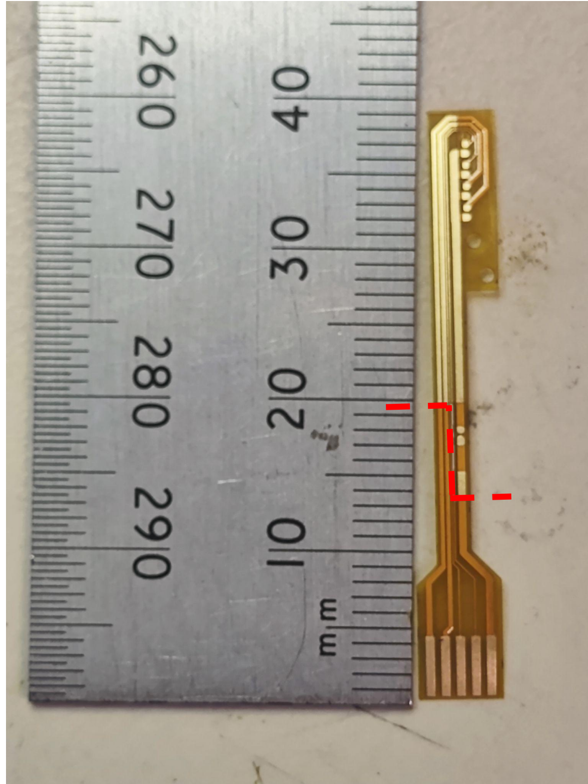




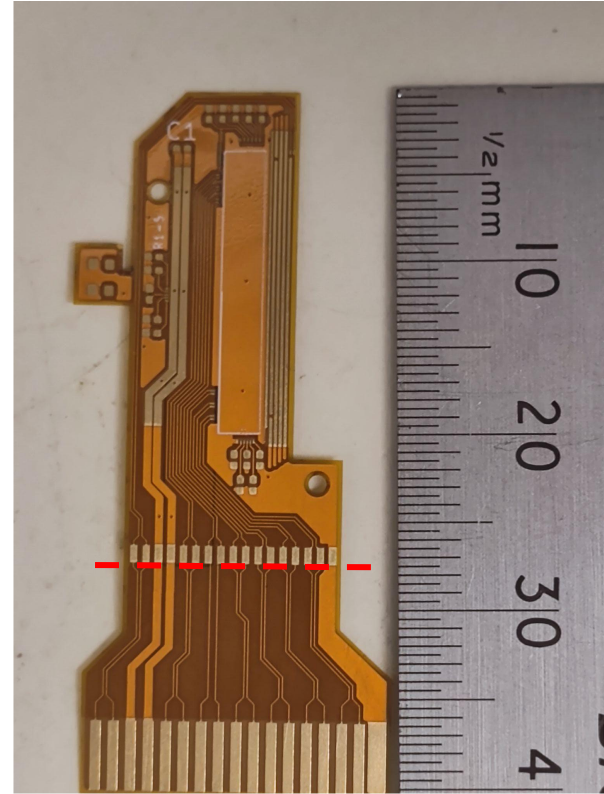




Visual Inspection



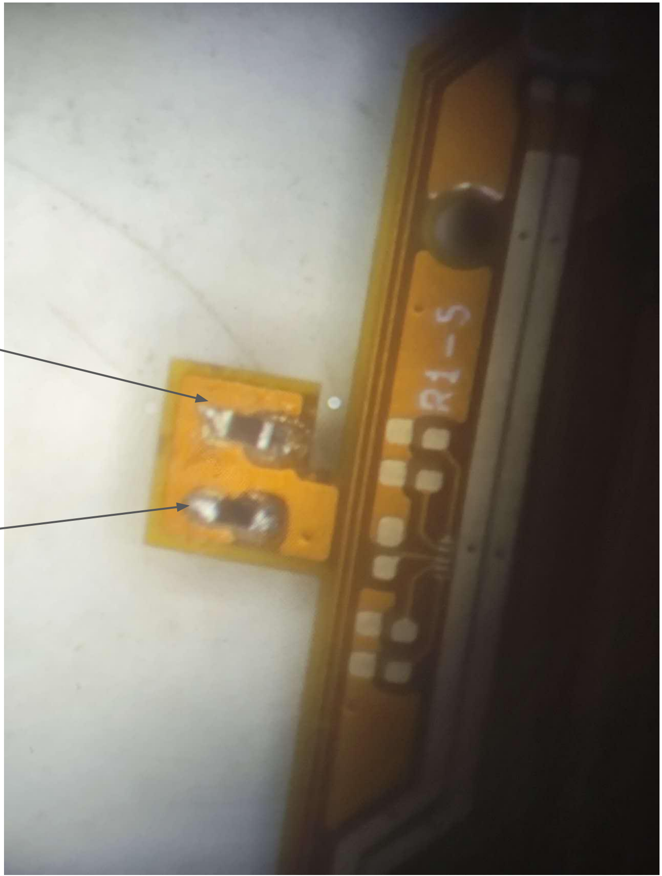
Cut lines



The BFPC wrapper match to the FPC connector very well.

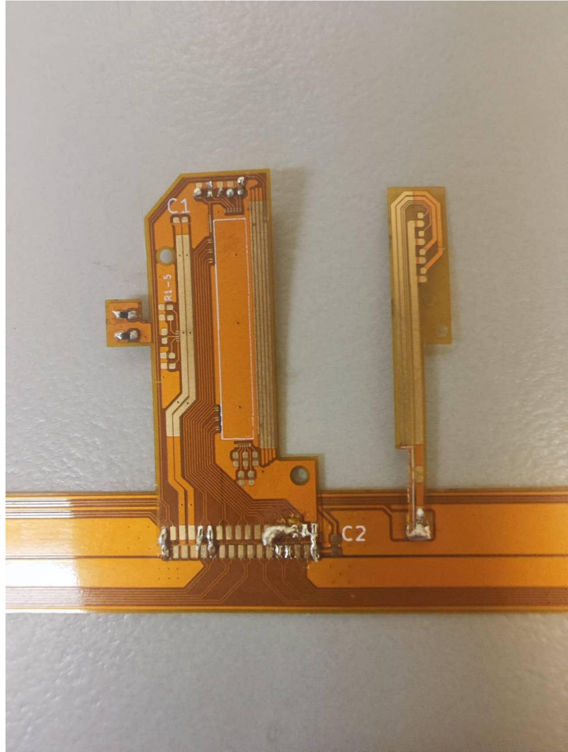
However, the main FPC is very loose, need to increase the thickness of the FPC on connection area to 0.3 mm (currently, the thickness is around 0.1mm only)

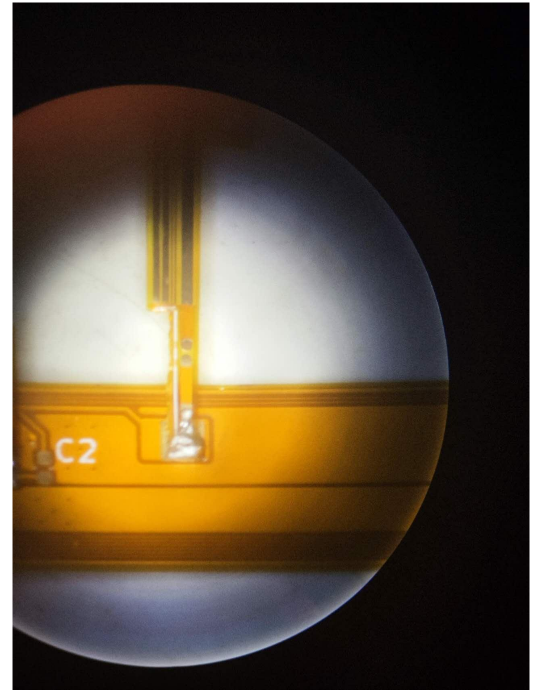
With stiffer



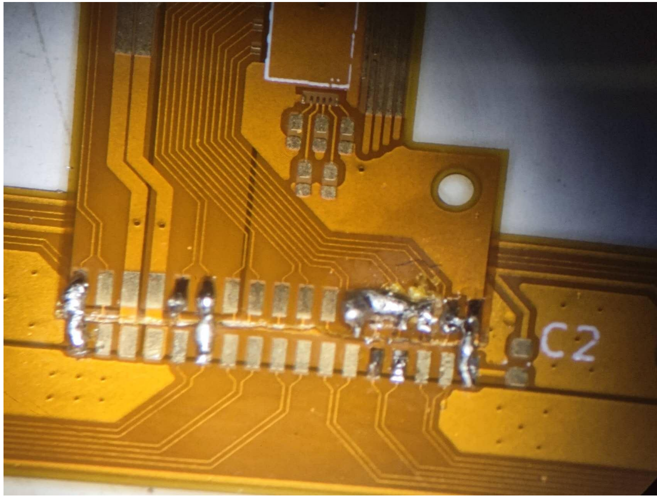
Without stiffer

Both capacitors were successfully soldered with no significant difference observed. Therefore, it can be concluded that:
The stiffer is not necessary.





Solder the right BFPC to Main FPC: Easy, Stable



Solder the left BFPC to Main FPC: short circuits or damaging the traces. Suggestion:

1. Increase the pad width and spacing (Currently, they are 0.4mm/0.3mm);
2. Fixed Main FPC and Bridge FPC before soldering;
3. Reduce the pad distance between the Main FPC and the Bridge FPC (requires precise cutting of the Bridge FPC).

Next Steps

- Complete the tests on Cu-based v1 FPC from JLC
  - Visual Inspection -> done
  - Soldering SMP components onto bridge FPC -> done
  - Cutting bridge FPC -> in progress, 1st trial done
  - Soldering bridge FPCs onto main FPC -> in progress, 1st trial done
  - Gluing FPCs
  - Wire-bonding
- Update the design based on the test results and including both inward- and outward-facing modules to produce Cu-based v2 FPCs from JLC
- Design and produce Al-based FPCs by LTU with inputs based on JLC v2 and high speed transmission test results from UK and INFN