# ETL Disk Flex Cabling Option

- Motivation
  - Lack of real estate for cabling
  - Magnetic force on the LV conductors
  - LV conductor safety all the way to PS's 20A
  - Cable termination compactness (at least at the RB end)
  - Cable management

- Maximum LV current per RB is $\approx$6A
- Maximum PS output 20A
- From generic power distribution safety every conductor should be able to carry those 20A (famous Natalia's AWG18)
- Even a solid AWG18 conductor with PI insulation has an OD 1.27mm
- 6A x 4T = 24 N/m – LV wires should be twisted
- DSS wires can be twisted with the LV wires to fit in the same envelope
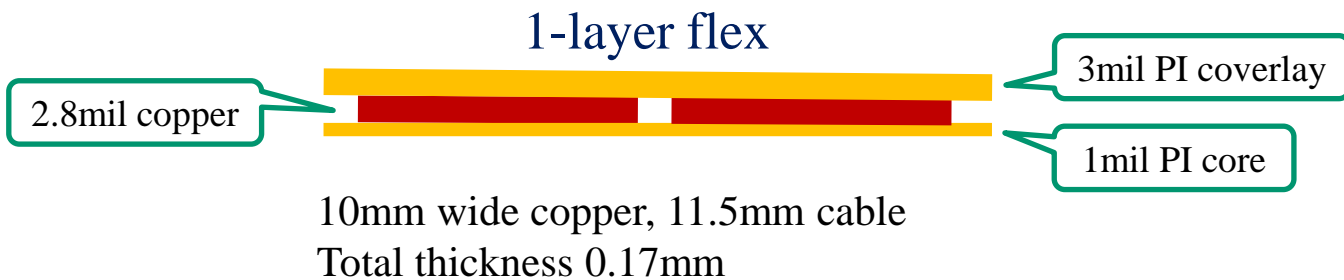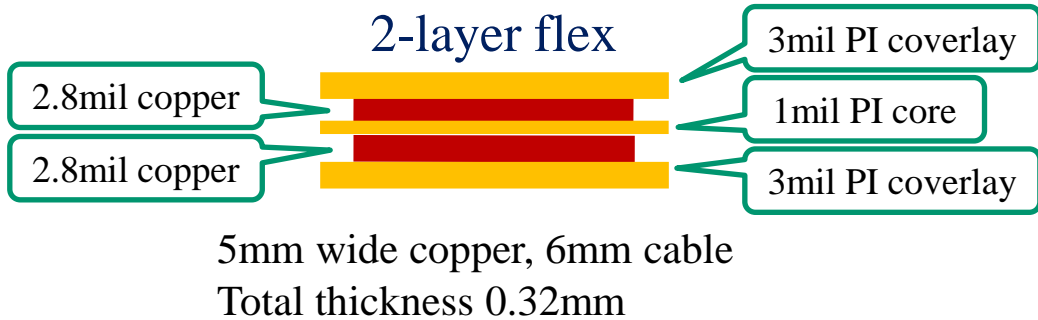
# Wire/Flex LV Options

Results for External Layers in Air:

| Required Trace Width | 189 | mil ▾ |
|---|---|---|

### 2-layer flex

- 3mil PI coverlay
- 2.8mil copper
- 1mil PI core
- 2.8mil copper
- 3mil PI coverlay

5mm wide copper, 6mm cable
Total thickness 0.32mm

| Current | 20 | Amps |
|---|---|---|
| Thickness | 2 | oz/ft^2 ▾ |

Optional Inputs:

| Temperature Rise | 30 | Deg C ▾ |
|---|---|---|
| Ambient Temperature | 25 | Deg C ▾ |
| Trace Length | 40 | inch ▾ |

18 AWG × 15 ft
0.050 Dia.
0.040 Dia.
UHV Wire
Kapton® Insulated

18 AWG × 15 ft
0.051 Dia.
19x 0.009
UHV Wire
Stranded, Kapton® Insulated

### 1-layer flex

- 3mil PI coverlay
- 2.8mil copper
- 1mil PI core

10mm wide copper, 11.5mm cable
Total thickness 0.17mm

DSS wires

2.6mm OD AWG18

- Flex solution complication:
  - At disk edge transition to wires should happen for routing flexibility
  - Many individual lengths or folds or trim options
  - DSS conductors can be added at additional 0.5/1mm width

# Wire/Flex LV Options

## 1-layer flex

2mil PI coverlay

1.5mil copper

2mil PI core
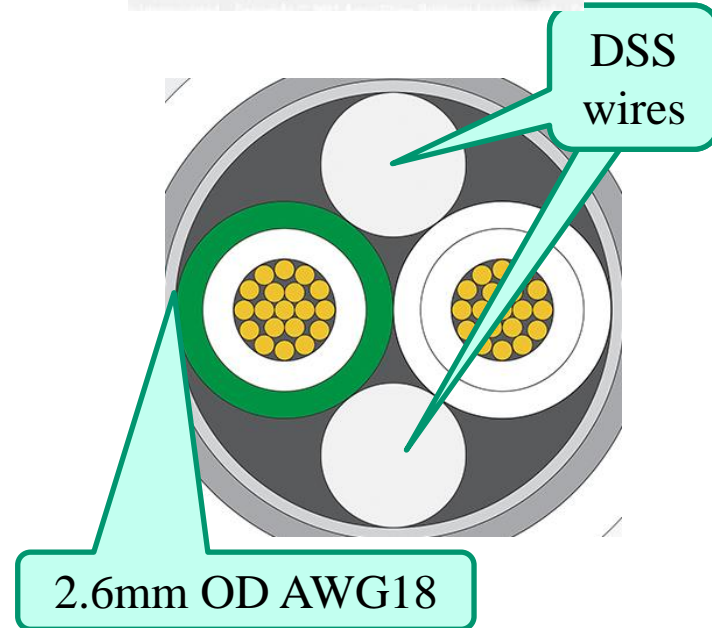
N x 0.2mm traces, (N x 0.4 + 0.8)mm cable width
Total thickness 0.14mm

30 AWG × 30 ft
0.020 Dia.
0.010 Dia.

UHV Wire
Kapton® Insulated

- Flex for BV:
  - Very flexible
  - Can be creased
  - DSS conductors can be added, but better be held together with the LV
  - What type of connectors at the PP0 end? (could transition to wire)

- An integrated Flex for LV/BV/DSS is feasible if we decrease the copper weight to that of BV design, so LV would not be able to carry the full 20A, which might be acceptable since that is "inside the detector" connection
- If a single RB overcurrent happens, all we can do is to shut down corresponding PS

March 01, 2022                    S. Los                    3