

MVTX stave update

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Stave flex circuit design

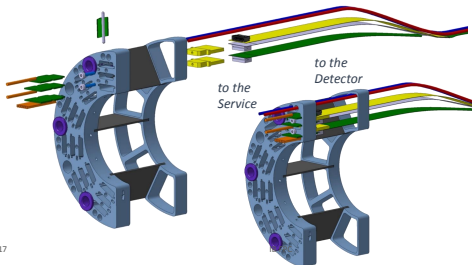
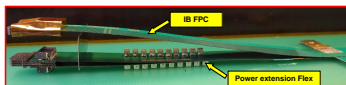
- Stave consists of three flex circuits: one AI FPC that connects to ALPIDE sensors and carries signals, two Cu FPCs that carry analog and digital supplies
- In the ALICE design, all FPCs end at the same patch panel

FPC Extension for Connection to Electrical Services

ALICE ITS Upgrade



Such extensions are equipped with passive components (10x 220 uF capacitors) to stabilize the analogue and digital power supplies, respectively



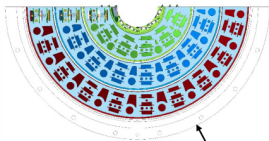
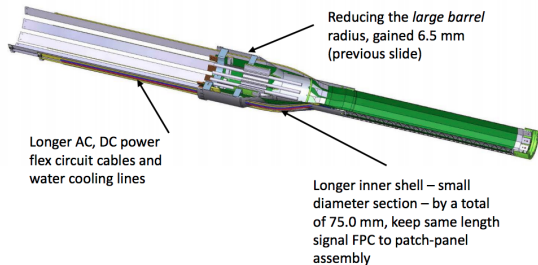
This solution allows to implement a “flexible” connection to external service cables with minimized space occupancy

27/04/17

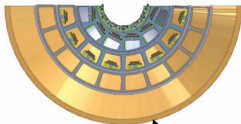
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MVTX integration needs

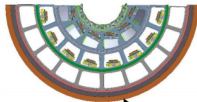
- INTT limits the OD of the MVTX patch panel
- Solution: make the power FPCs longer
 - ▶ Original patch panel only has signal connectors; power FPCs pass through to a new patch panel further out in z



Original MVTX detector, end view showing patch-panels, outer shell including aluminum flange



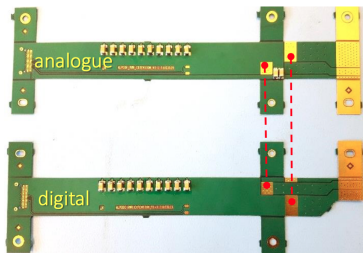
Shell OD from previous slide 128.6 mm, with reduced patch-panels



New shell OD, modified to mate with OD of outer layer 107.1 mm

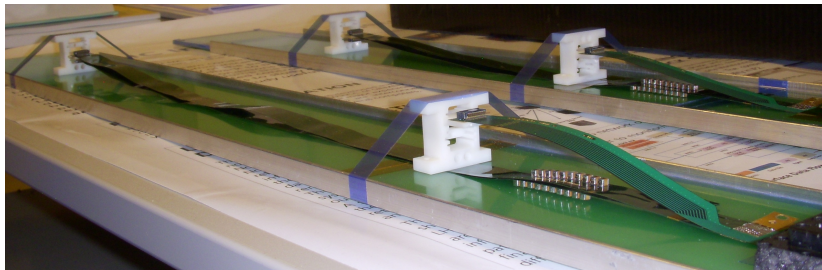
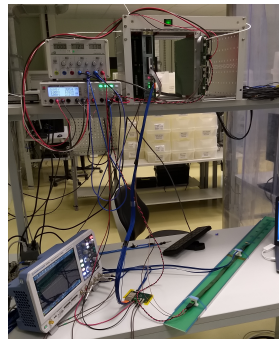
Extending the power FPC

- ALICE power FPC design extended from 15 cm to 40 cm and 60 cm for tests (40 cm is enough)
- Expect no change to the power integrity at the sensors
 - ▶ Decoupling capacitors (large-value caps on the power FPCs, high-frequency caps next to wirebonds on the signal FPCs) stay in same positions relative to loads
 - ▶ Power planes are 1-ounce copper, small increase in IR drops (compensated at supply)
 - ▶ ALPIDE has good noise immunity on AVDD and DVDD; sensitive to sensor bias but that has very low current



Testing

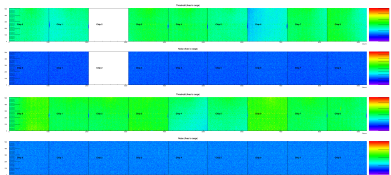
- For “apples-to-apples” comparison: take a fully tested HIC (stave without support structure), remove the 15 cm power FPCs and replace with ours, retest
- This week at CERN: ALICE experts did the resoldering work and ran their standard QA suite



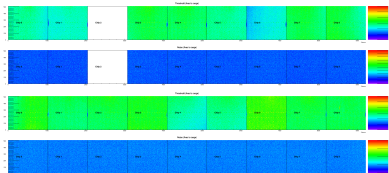
Results

- Threshold and noise (from charge injection turn-on curve) are indistinguishable
- Other tests also see no change: supply currents, high-speed data transmission

- 15 cm:



- top 40 cm, bottom 60 cm:



Moving forward

- We will bring these HICs back to LANL for any further tests
- This test fulfills one of the recommendations from the MVTX review
 - ▶ ALPIDE performance at high integrated dose: done immediately after the review
 - ▶ Inner tracker optimization task force and mechanical mockups: making good progress
- ALICE expects to finish their production in December, build MVTX staves in 2019