PXD Mechanics Update

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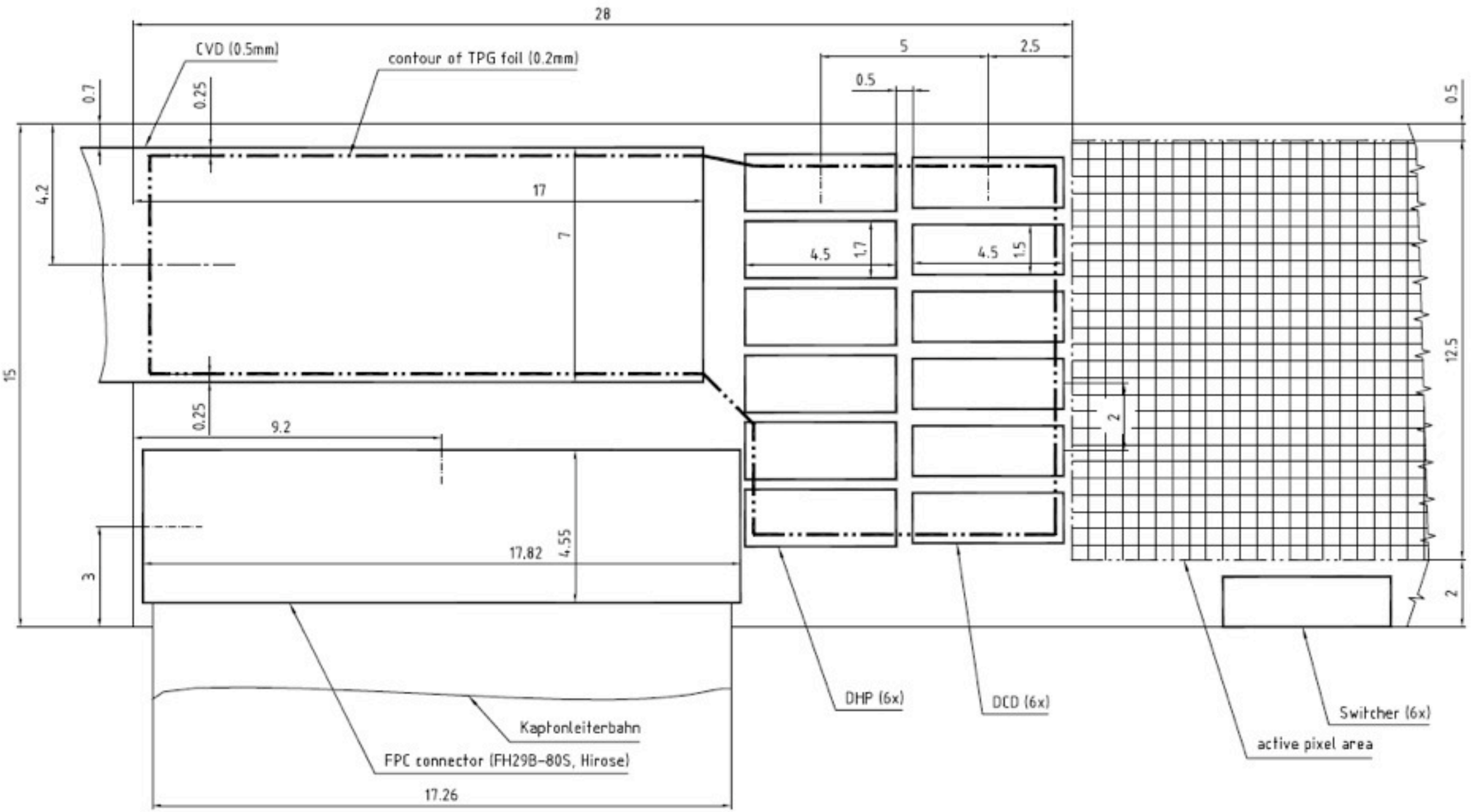
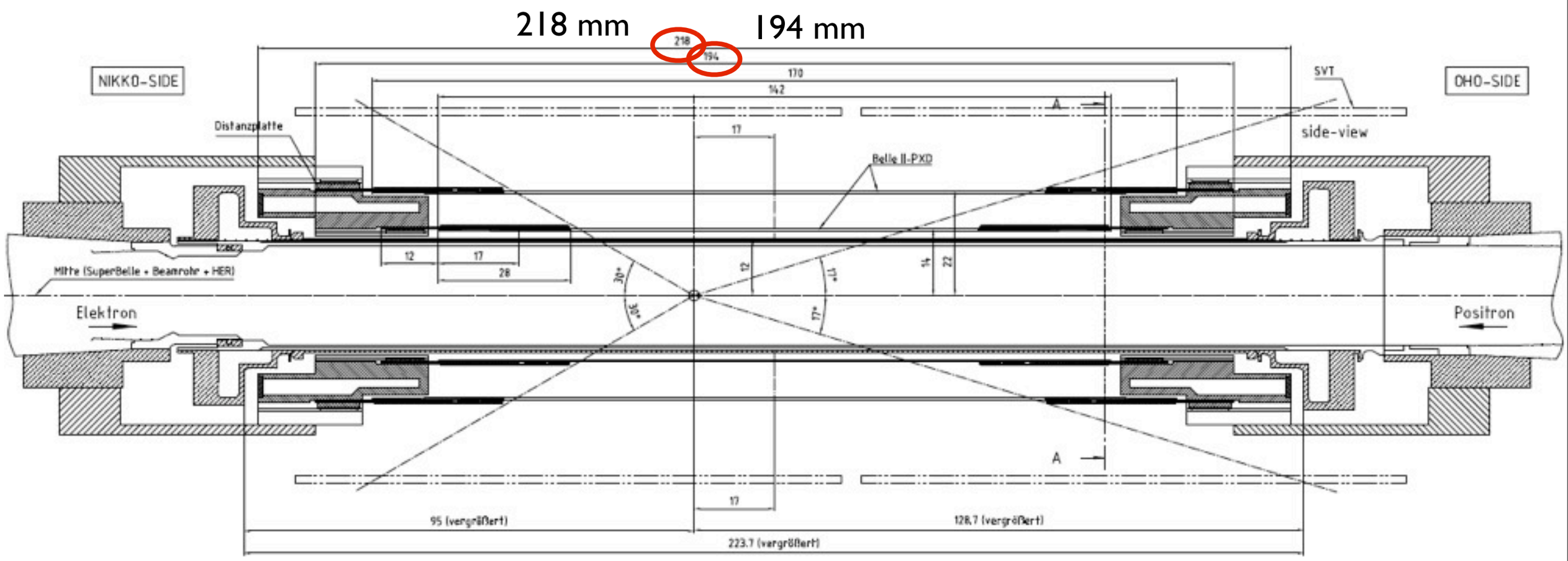
The New End of Stave



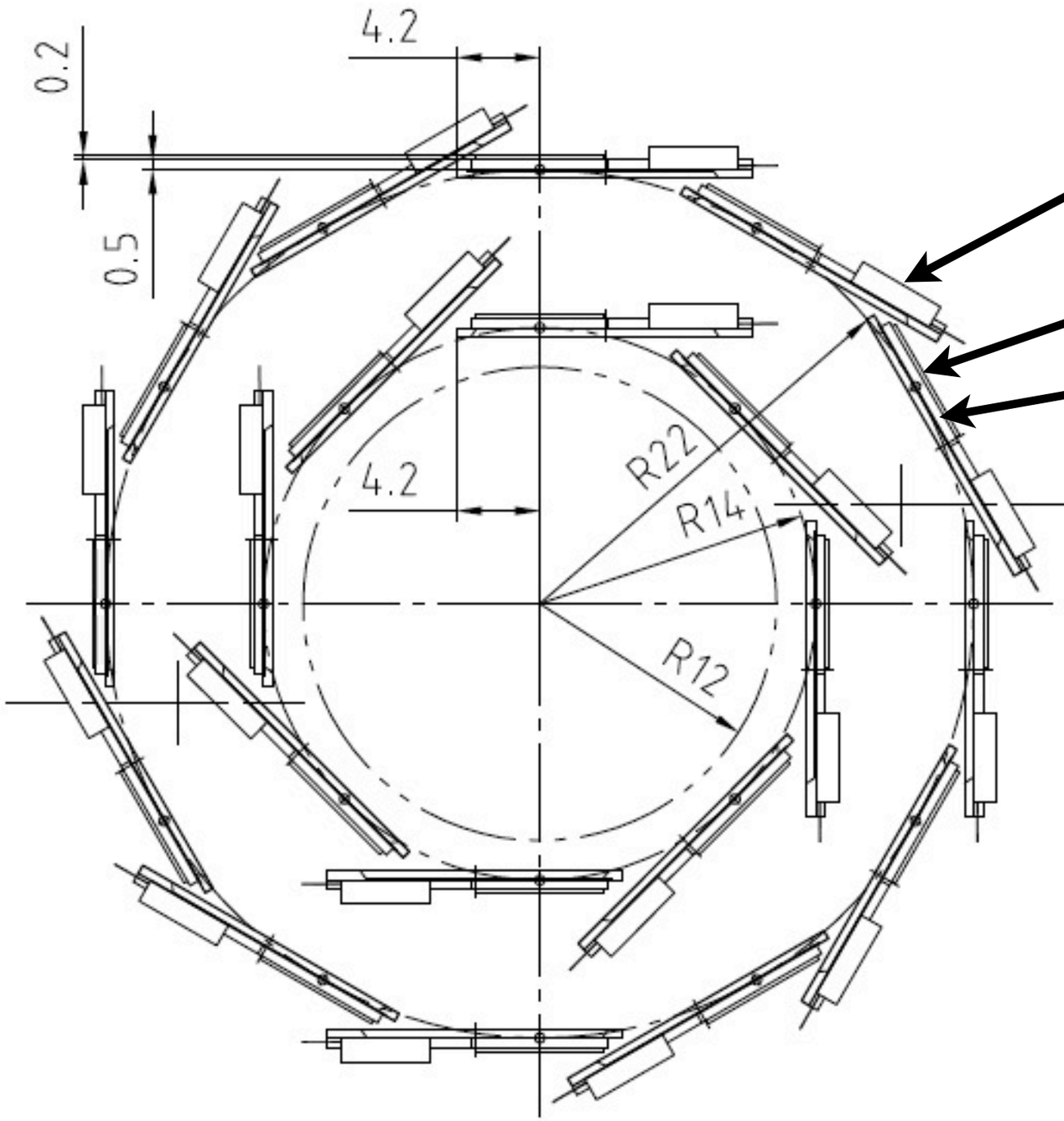
- New End of Stave with 17.82 mm long connector for flat cable: Total 28 mm
  - Additional length needed!

New Overall Layout



- Optimistic assumption: Beam pipe parallel to detector axis
  - allows significantly shorter detector modules
- Cu support rings on both sides with integrated cooling channel
  - Thin beampipe (detector components with radius ~ 12 mm) required over 194 mm
- Total length (with < ~ 16 mm radius): 218 mm without connections!

The Side View

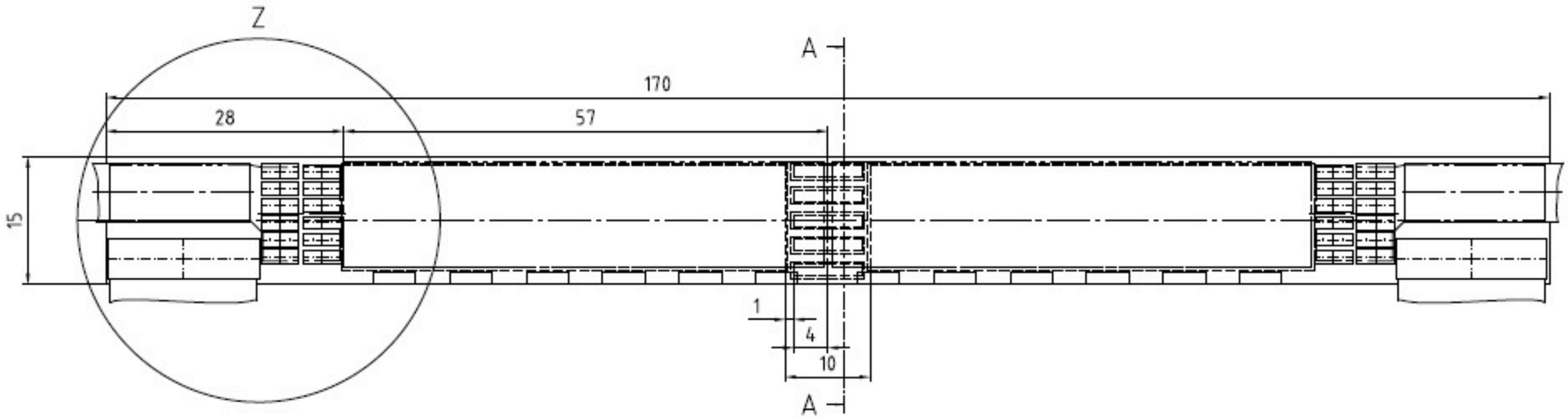


Connector for cable

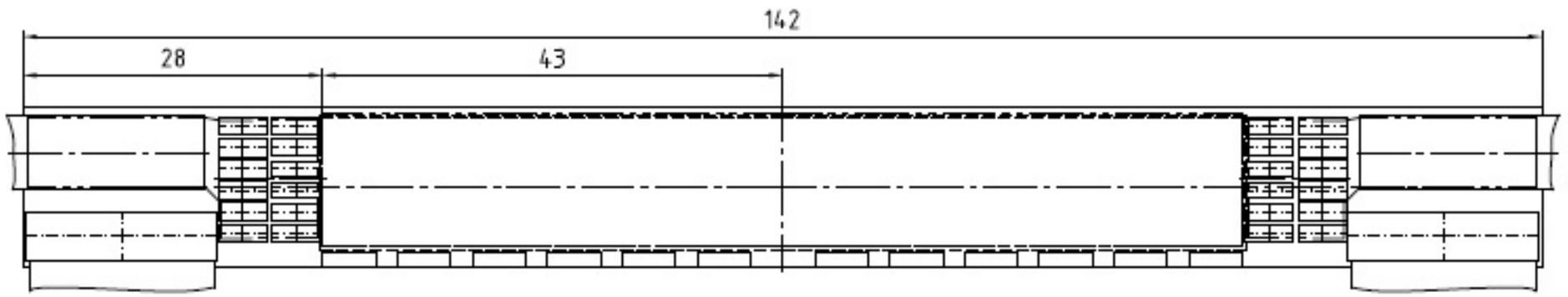
TPG layer

Diamond support bar

The Modules



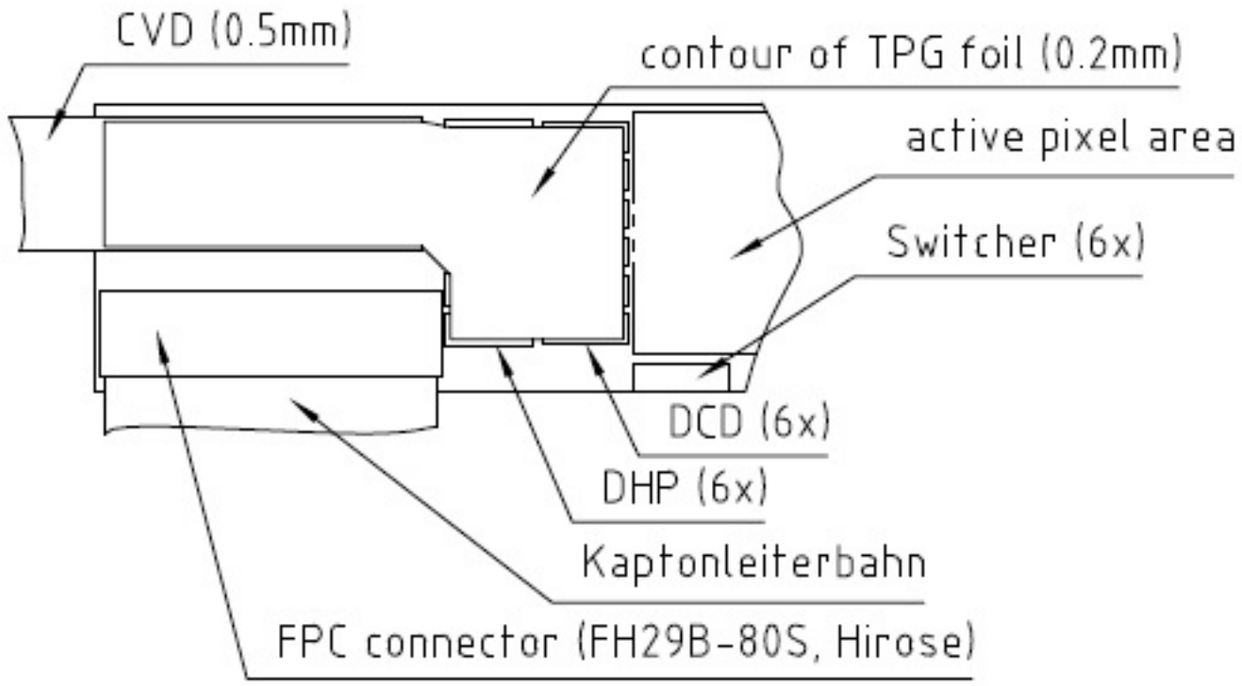
- Outer layers: 114 mm active length, 170 mm total Si length



- Inner layers: 86 mm active length, 142 mm total Si length
  - To keep the support symmetric, the active area is ~ 15 mm longer than it has to be (potential problem!)

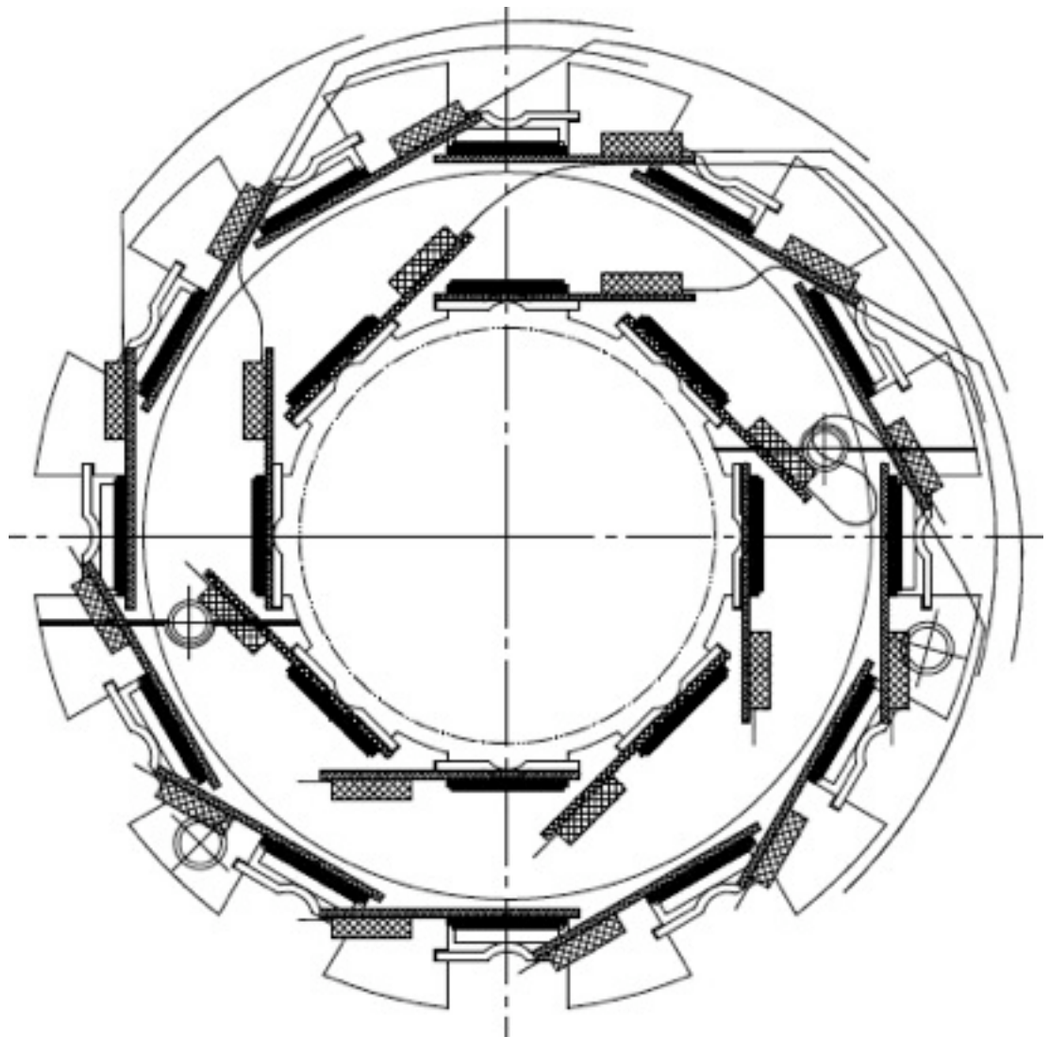
⇨ The connector for the cable takes up a lot of space!

Module Support: Diamond

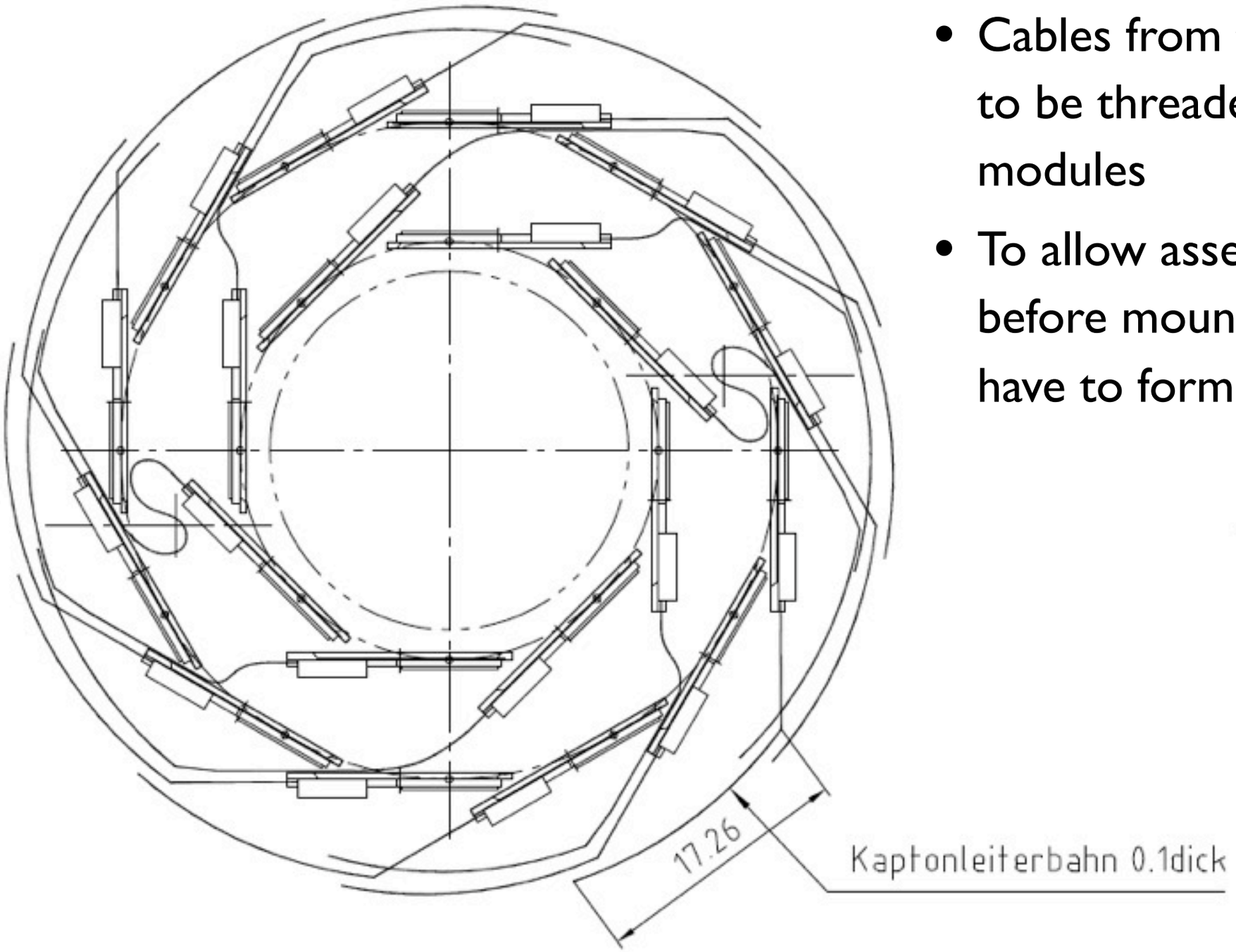


- Diamond bars held by springs, one side fixed by a bolt, the other one sliding in longitudinal direction
- Top layer: Additional support plate to get required thickness

- 0.5 mm thick diamond support bar, 7 mm wide
- 0.2 mm TPG foil on top of chips to transfer heat to diamond

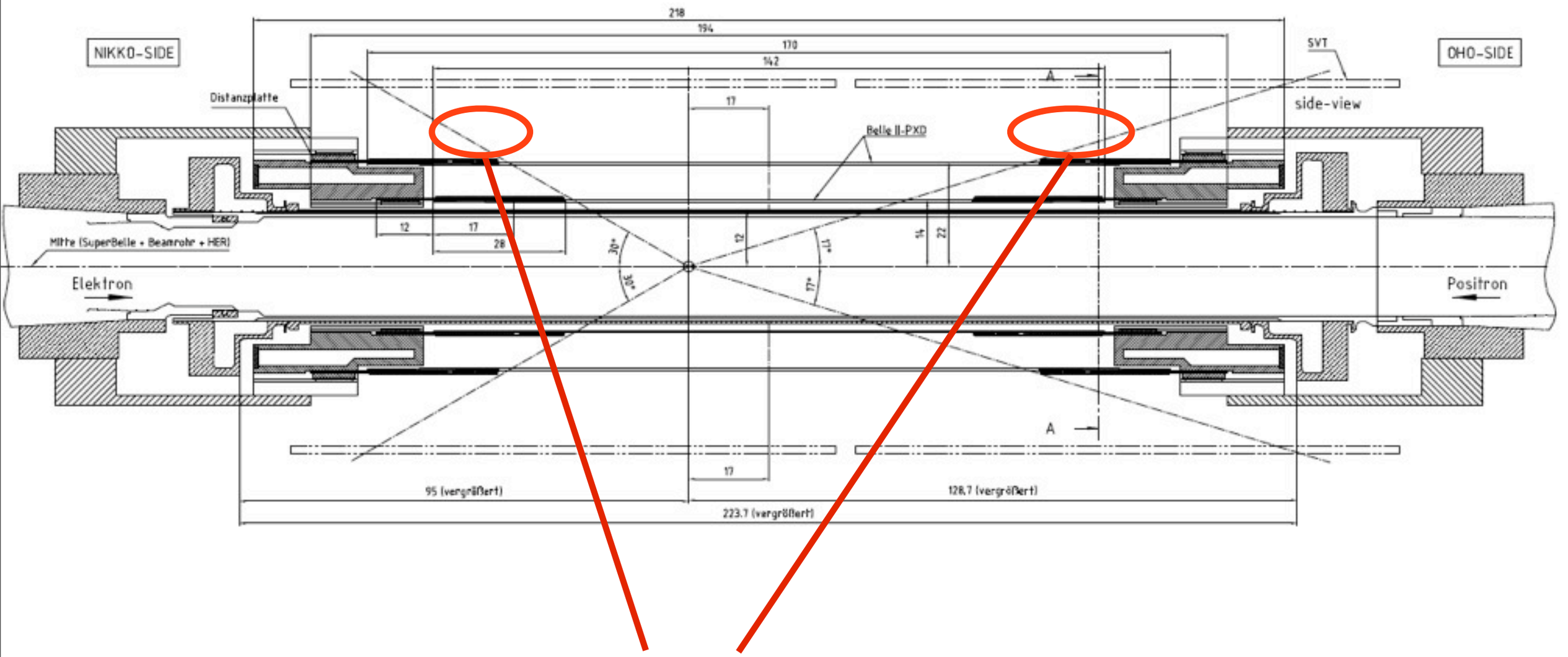


Issues: Getting the Cables out



- Cables from the inner modules have to be threaded through the outer modules
- To allow assembly of two half-shells before mounting on the BP: 2 Cables have to form an S-Shape

Issues: Getting the Cables out II

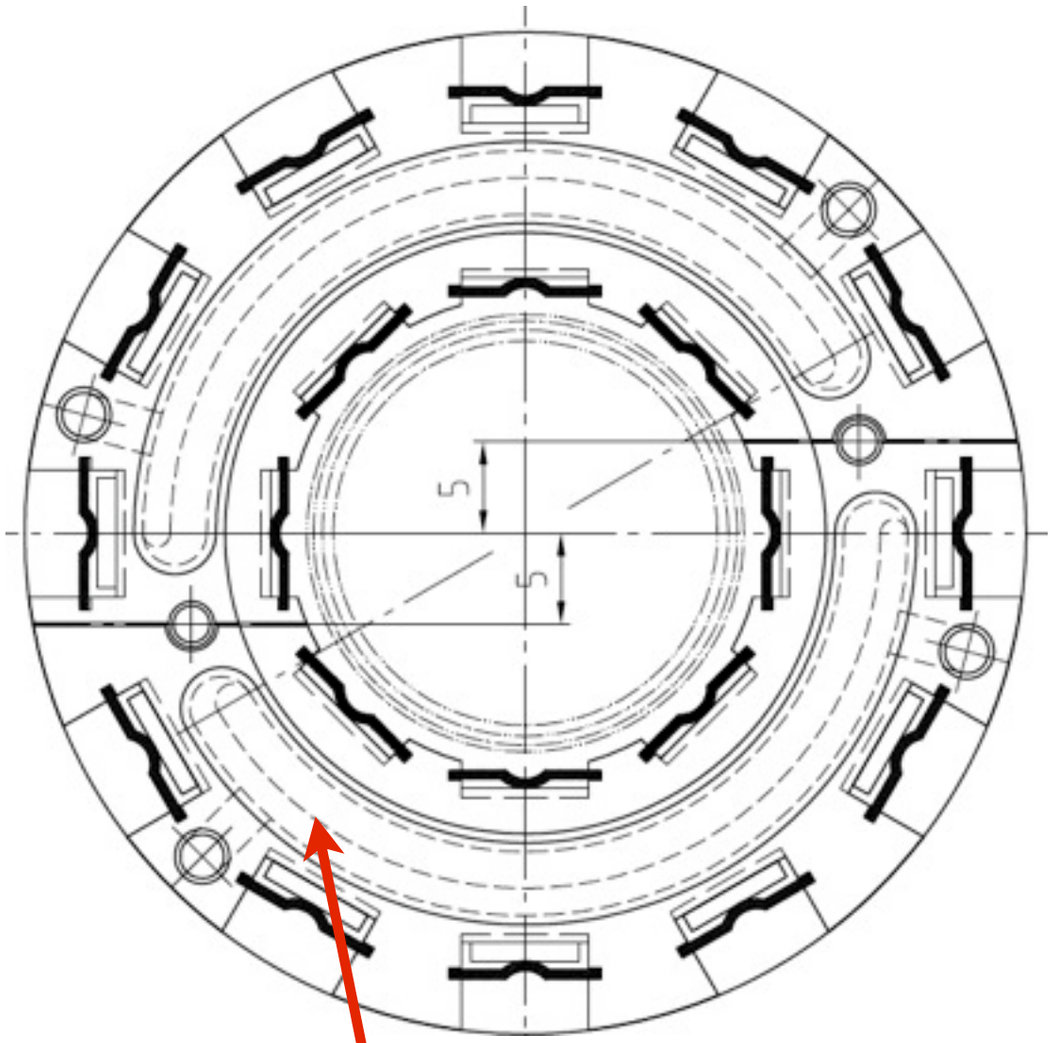


For a reasonable routing, cables will go into the detector acceptance!

General Issue: Assembly

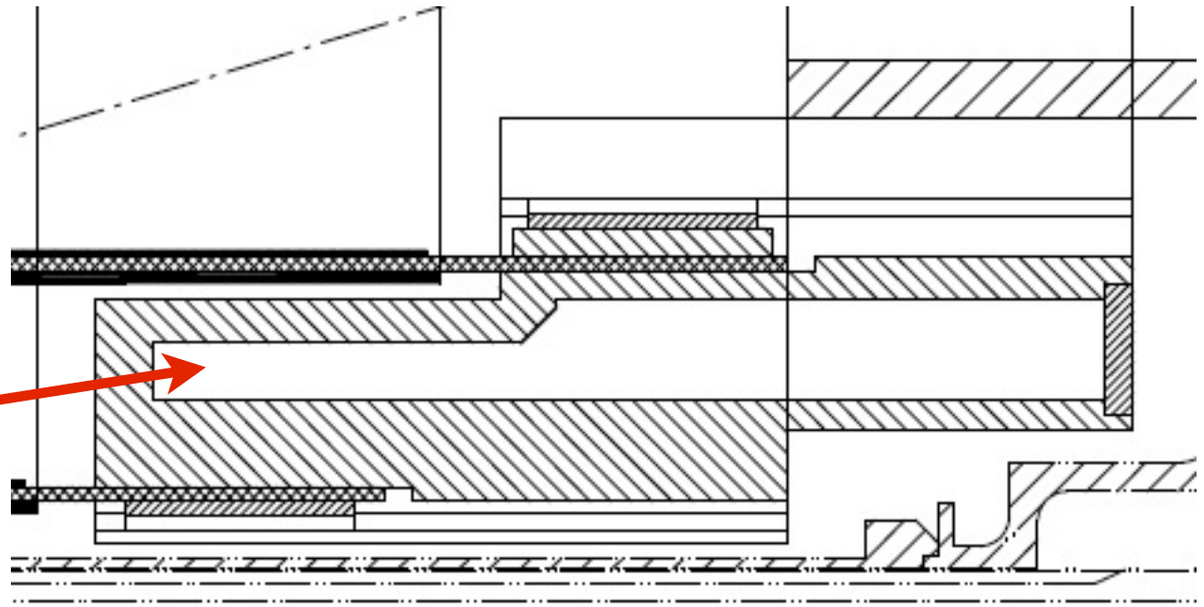
- Assembly on the beam pipe with the beam pipe installed in Belle-II seems extremely complicated
- Assemble the detector on the beam pipe before installation, with two half shells
- Preferably, the first stage of off-detector electronics (or a patch panel) should also sit on the beam pipe structure, so that there are no loose cables during the installation of the beam pipe with the PXD mounted to it

Included: Liquid Cooling



- Channel for cooling liquid integrated into Cu support:
  - Present design works only for low pressure!
  - Choice of coolant depends on the required temperatures

integrated cooling channel



Idea for Water Colling

The design

- Coolant: Water / Antifrogen-Mixture: high heat capacity
- Input temperature: -5 deg C (output at +5 deg C)
  - potentially the coolant temperature could be reduced further
- Flow speed through pipes: ~ 0.4 m/s
- diamond contact surface at ~15 deg C (this might be too high!)

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⇨ Prototype has to be built to fully validate the concept

Summary

- New iteration of the mechanical design to accommodate the new end of stave
  - Optimistic thinking: Beam pipe parallel to detector axis: Allows a significantly shorter detector to cover the full Belle-II acceptance

- The numbers:
  - ~194 mm with smallest radius: ~ 12 mm
  - total length, radius < ~ 16 mm: 218 mm: Cooling & air connections ignored!

- The issues:
  - Complex cable routing to allow splitting into two half shells for easy installation
  - Cables reach into the detector acceptance
  - Detector has to be mounted on the beam pipe outside of Belle-II
  - Cables should be fixed on the beam pipe to avoid damage during installation
  - Need a working solution for the cooling!