ITk Pixel outer endcap cooling system: Capillary sizing

OEC Integration Workshop - Frascati

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INFN MILANO

ATLAS EXPERIMENT

Capillary sizing - Nominal power

Capillaries will be sized to reach 10 bar.

Nominal power

	Evaporator ΔP [bar]	Exhaust (longest) ΔP [bar]	Manifold ΔP [bar]	Proposed capillary ΔP [bar]	Sum [bar]
Layer 2	0.235	0.145	0.45	8.5	9.33
Layer 3	0.50	0.267	0.45	8	9.22
Layer 4	0.83	0.08	0.45	8	9.36

- Numbers in **green** come from direct measurements.
- Numbers in **orange** come from indirect measurements.
  - The exhaust for Layer 4 had an ID of 4.55mm instead of the design ID of 4mm.
    - Numbers in this table are scaled to a 4mm pipe.
  - For Layer 4 the exhaust and the manifold were measured together.
  - The manifold for Layers 2 and 3 is taken from the measurement of Layer 4.

Capillary sizing - Power + 20%

Capillaries will be sized to reach 10 bar.

Power + 20 %

	Evaporator ΔP [bar]	Exhaust (longest) ΔP [bar]	Manifold ΔP [bar]	Proposed capillary ΔP [bar]	Sum [bar]
Layer 2	0.277	0.172	0.44	8.5	9.39
Layer 3	0.60	0.327	0.44	8	9.37
Layer 4	1.07	0.12	0.44	8	9.63

- Numbers in **green** come from direct measurements.
- Numbers in **orange** come from indirect measurements.
  - The exhaust for Layer 4 had an ID of 4.55mm instead of the design ID of 4mm.
    - Numbers in this table are scaled to a 4mm pipe.
  - For Layer 4 the exhaust and the manifold were measured together.
  - The manifold for Layers 2 and 3 is taken from the measurement of Layer 4.

Capillary production procedure

- Capillaries will be **sized** at **CERN** at the capillary facility to reach the desired pressure drop.
- 🚕They will be **shipped** to **Frascati**.
- They will be **brazed** to the T shaped connector that will be part of the inlet line in **Frascati**.
- 🚕They will be **shipped** back to **CERN**.
- The pressure drop will be **measured** again at the capillary facility at **CERN**, to make sure there is no change and/or clogging.
- 🚕They will be **shipped** to **Milano**, for the inlet line welding.