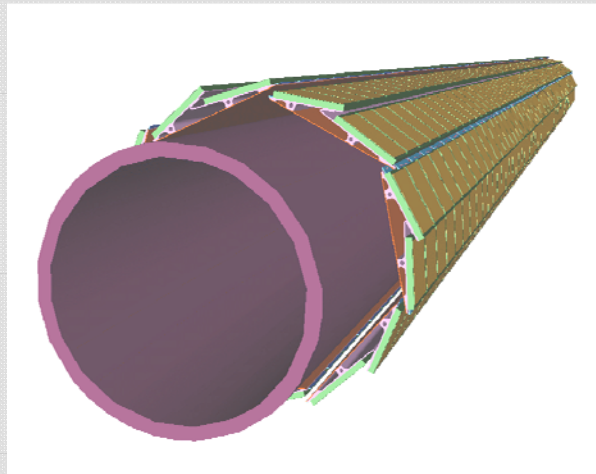


Powering of the Stave modules in the GOAT-1 proposal.



Vladimir Gromov,
Ruud Kluit, Harry van der Graaf.
NIKHEF, Amsterdam.

EUDET Annual Meeting, Amsterdam, the Netherlands.

October 6, 2008.

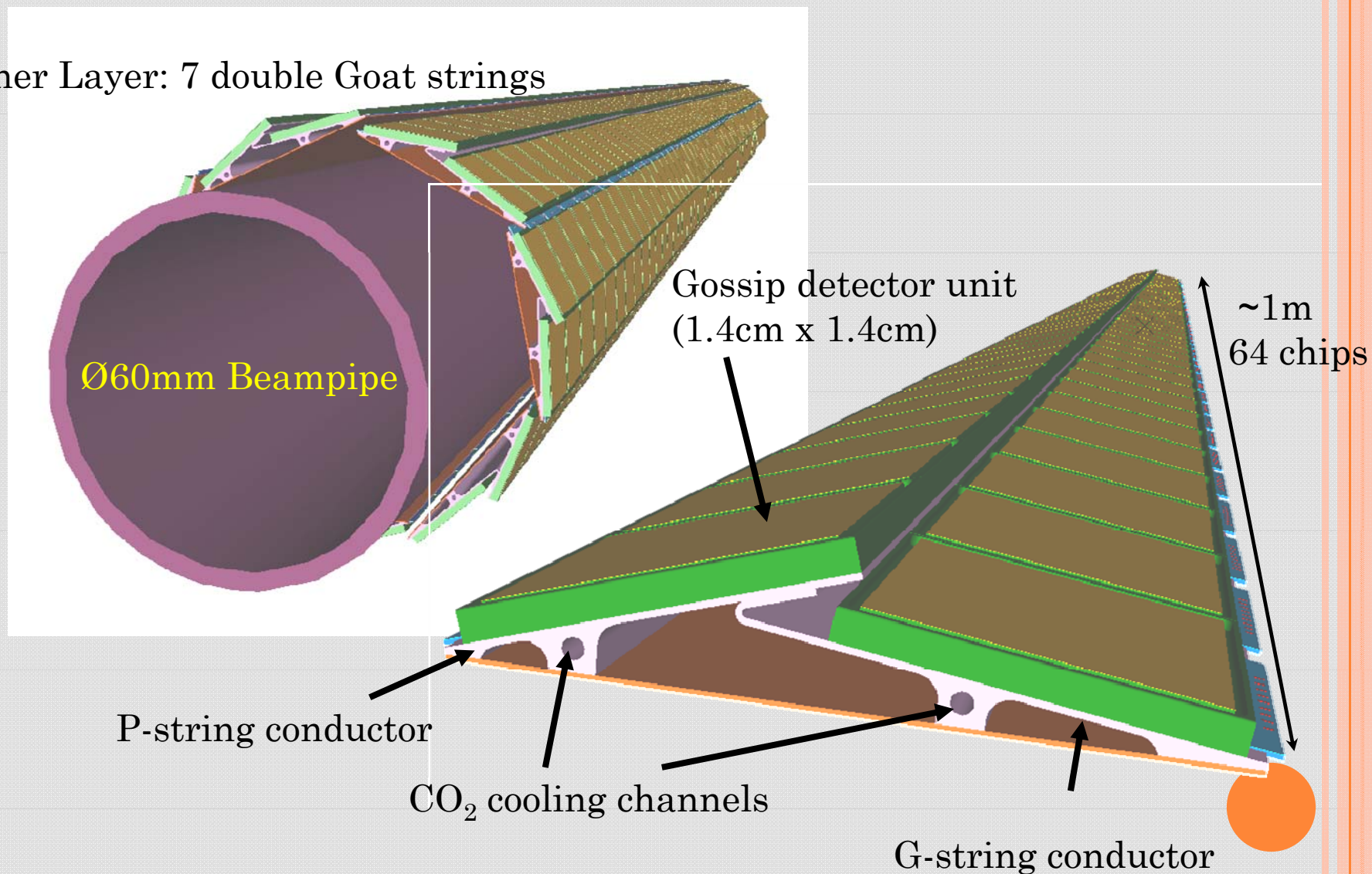
- **The GOAT-1 proposal : Gossip in ATlas.**
- **Cooling of the Stave module.**
- **Parallel powering scheme.**
- **Summary.**



GOAT-1: GOssip in ATlas

The ATLAS Pixel B-Layer Replacement Proposal.

Inner Layer: 7 double Goat strings



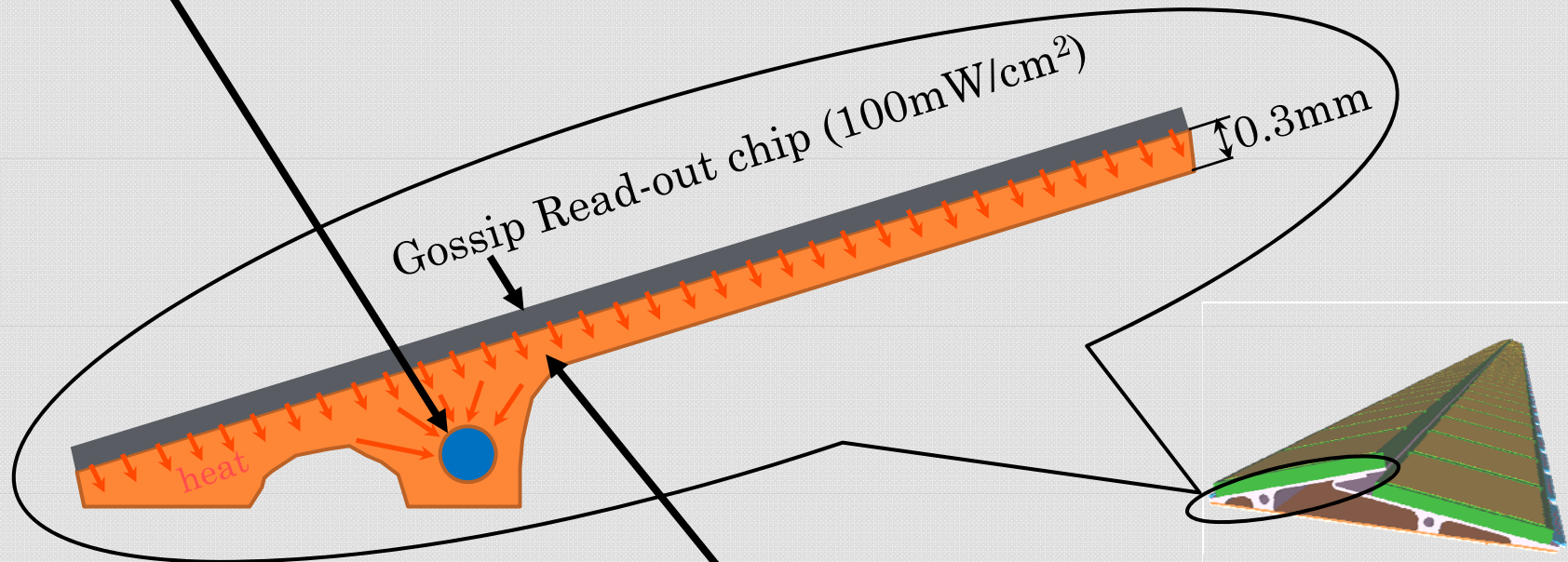
Cooling of the Stave module.

Evaluations done by Bart Verlaat (NIKHEF, Amsterdam)

$$\text{Power_per_stave} = 1.4\text{cm} \cdot 1.4\text{cm} \cdot 128\text{chips} \cdot 100\text{mW/cm}^2 = 26\text{W}$$

CO₂ cooling tube

- diameter 0.5mm
- mass flux 858kg/m²•sec

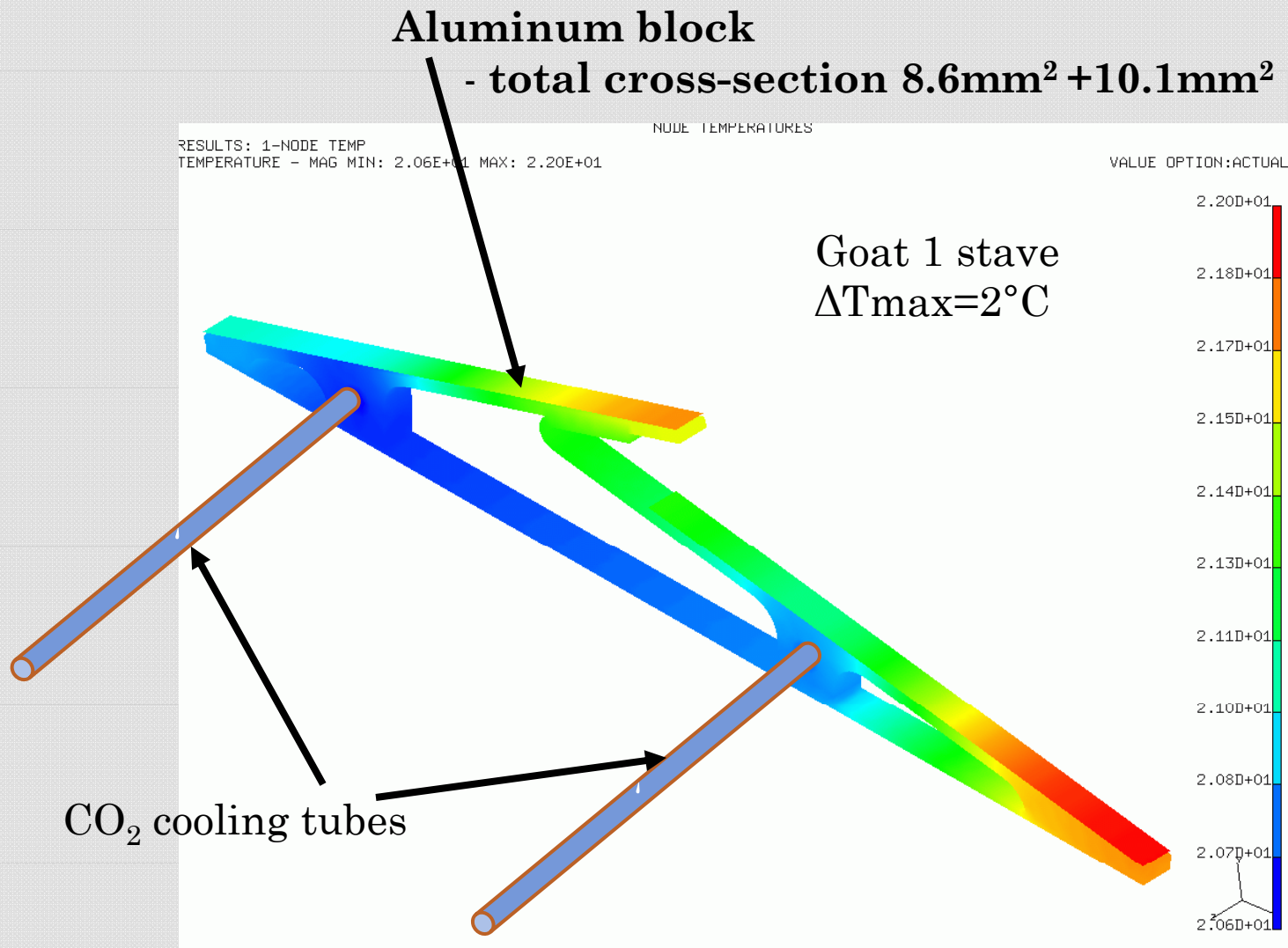


Aluminum block

- total cross-section 8.6mm²

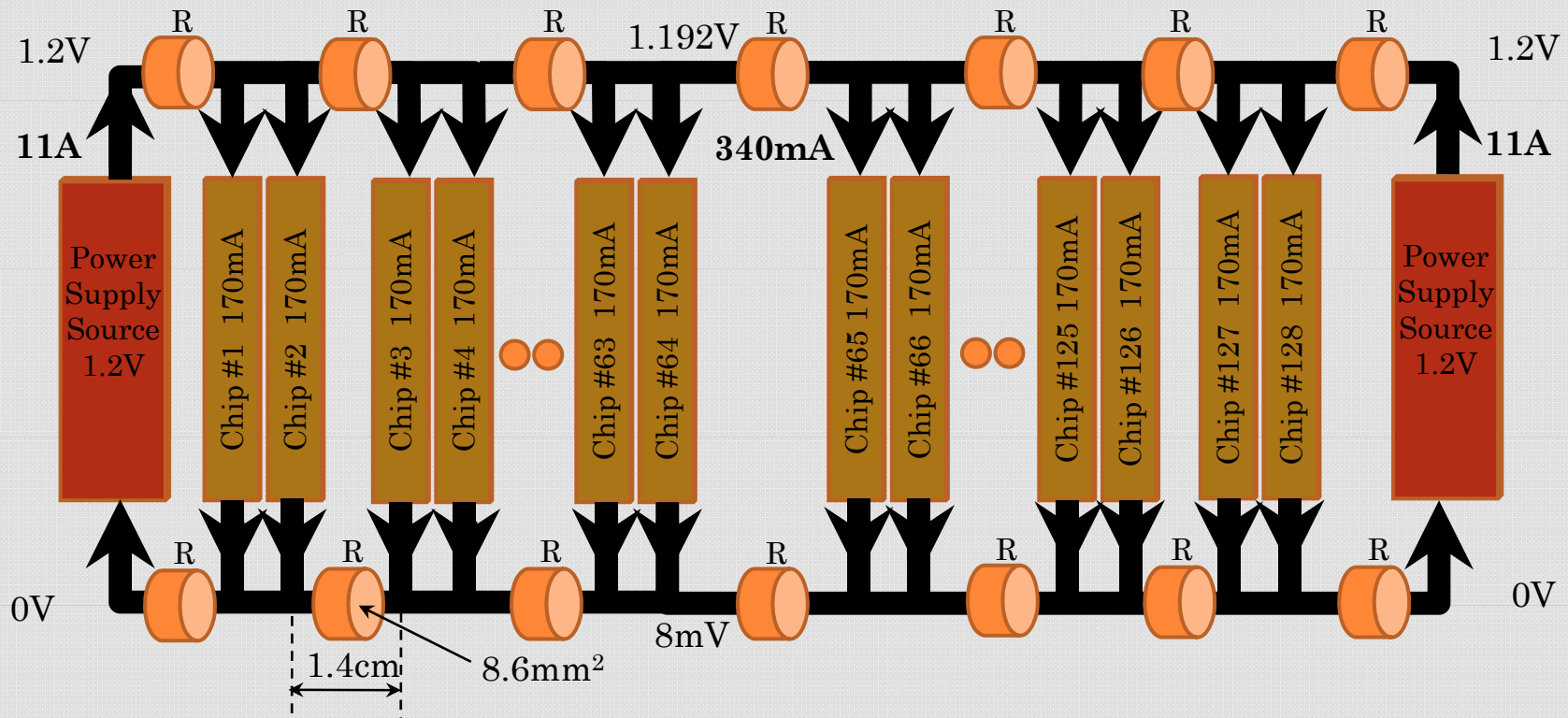
Heat transport to the cooling tube.

Simulations done by Bart Verlaat (NIKHEF, Amsterdam)



Parallel powering scheme.

Consider the use of the available ALU block cross-section ($S=8.6\text{mm}^2$).

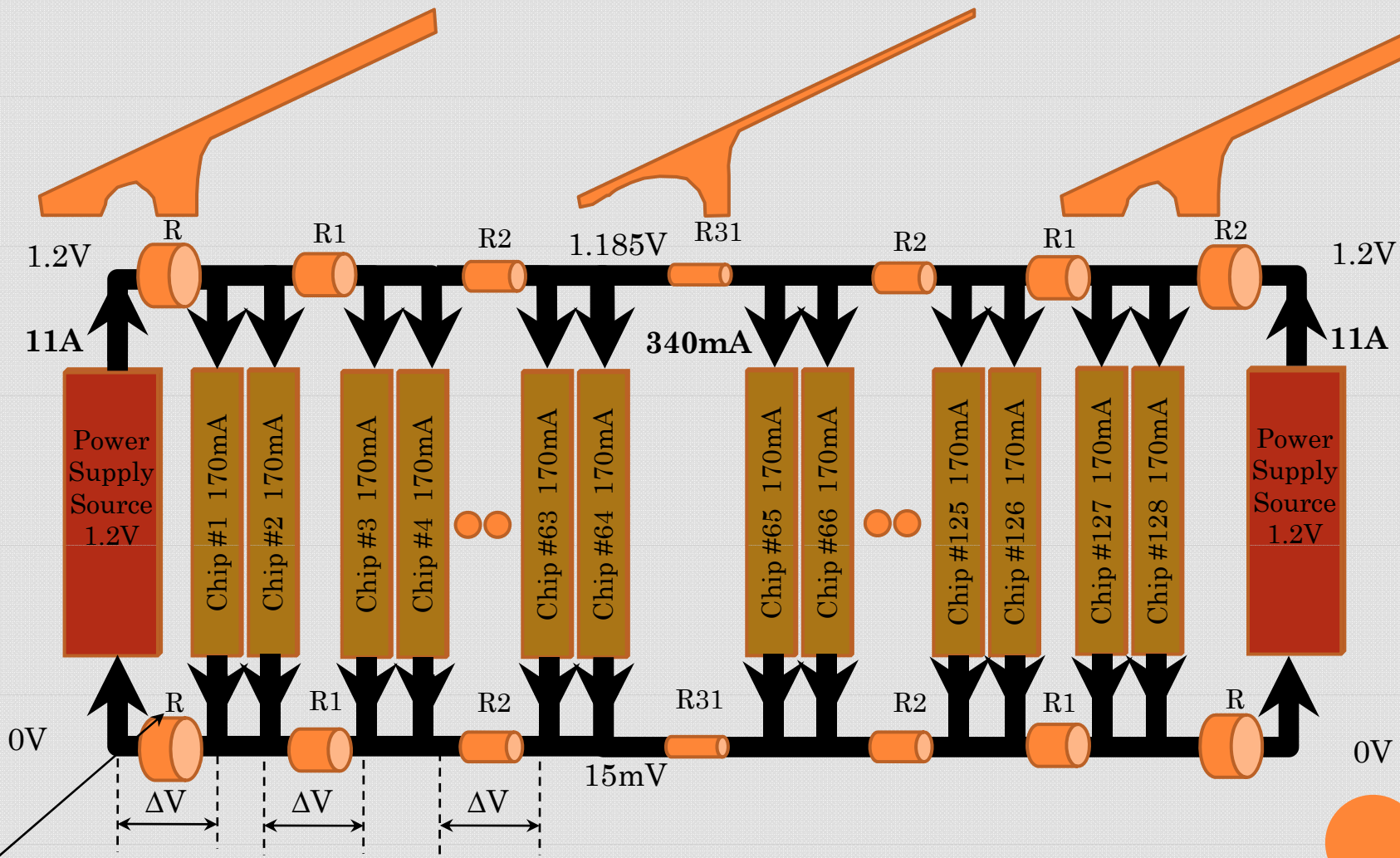


$$R = 26.5 \cdot 10^{-9} \Omega \cdot \text{m} \cdot 1.4 \cdot 10^{-2} \text{m} / 8.6 \cdot 10^{-6} \text{m}^2 = 4.3 \cdot 10^{-5} \Omega .$$

$$\Delta V = R \cdot 11\text{A} + R \cdot (11\text{A} - 0.34\text{A}) + R \cdot (11\text{A} - 2 \cdot 0.34\text{A}) + \dots + R \cdot 0.34\text{A} = 8\text{mV}$$

Power losses $\approx 0.9\%$

Powering scheme with non-regular ALU block.



$$R = 4.3 \cdot 10^{-5} \Omega$$

$$\Delta V = R \cdot 11A \cdot 32 = 15mV$$

Power losses $\approx 1.3\%$

Summary.

- **The cooling system proposed for the GOAT-1 project requires an Aluminum stave for heat transportation to the CO₂ tube.**
- **The Aluminum stave could also be used for the powering of the read-out electronics.**
- **The presented analysis demonstrates that with the available amount of conductive material (aluminum) the parallel powering scheme could be successfully used.**