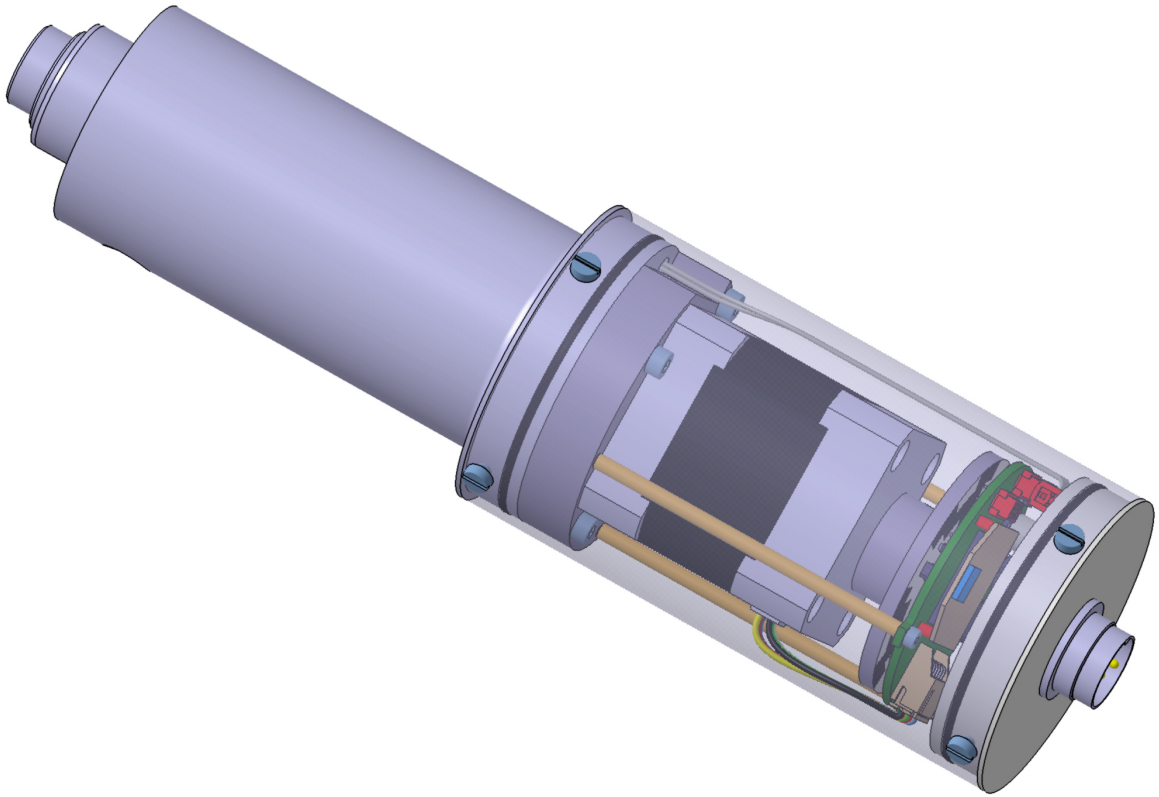
AMC Development, Uni Zürich



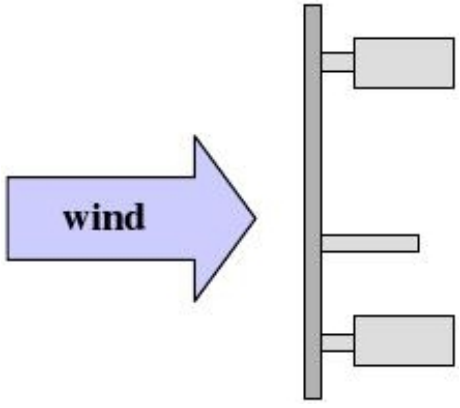
Ben Huber, UZH

First DWARF Meeting Würzburg, 26.02.09

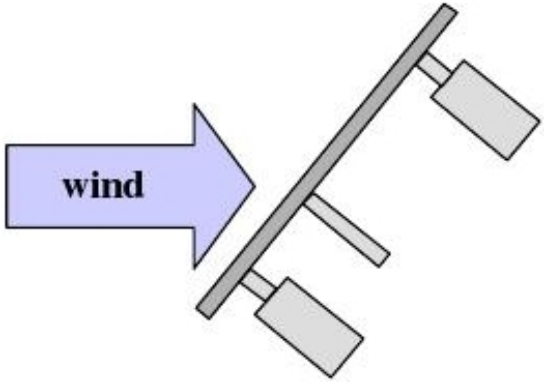
Boundary Conditions for CTA

- **Physical Properties of the Mirror Segments**
  - between 1 m^2 and 2.5 m^2
  - weight < 30 kg
- **Required AMC Performance**
  - driving time in the order of seconds
  - easy to mount/dismount
  - mirrors mounted by 3 fixpoints (2 actively driven)

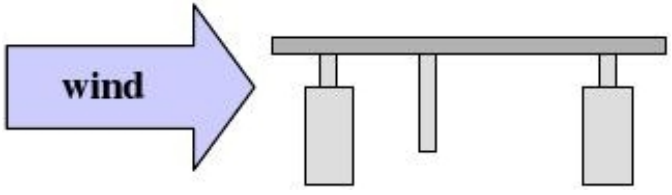
Estimation of the Actuator Load



Elevation angle 0^o
$\longrightarrow$ only **windload**
$\longrightarrow$ no weight along the arbors

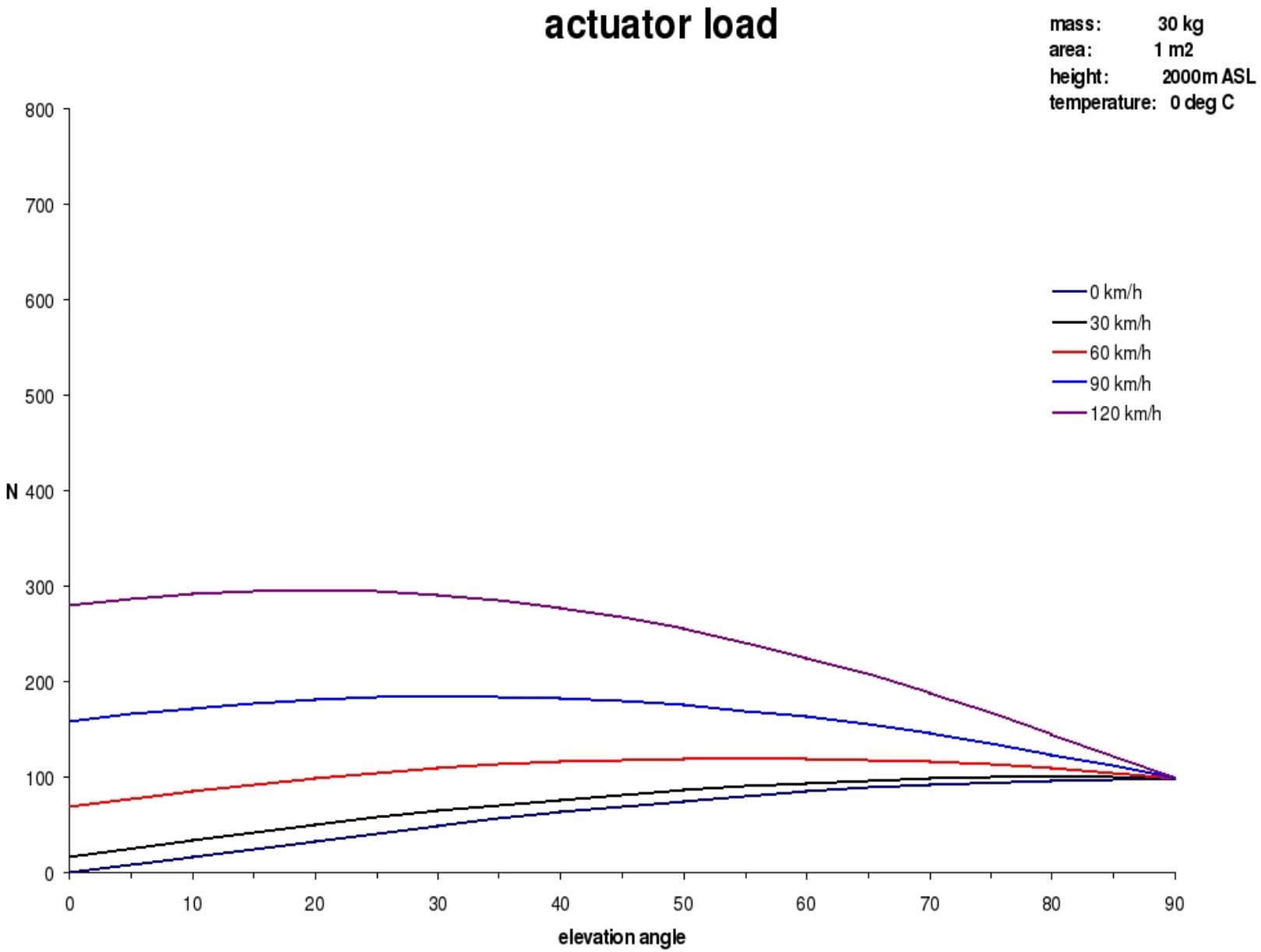


Elevation angle 40^o
$\longrightarrow$ **windload**
$\longrightarrow$ **weight along the arbors**

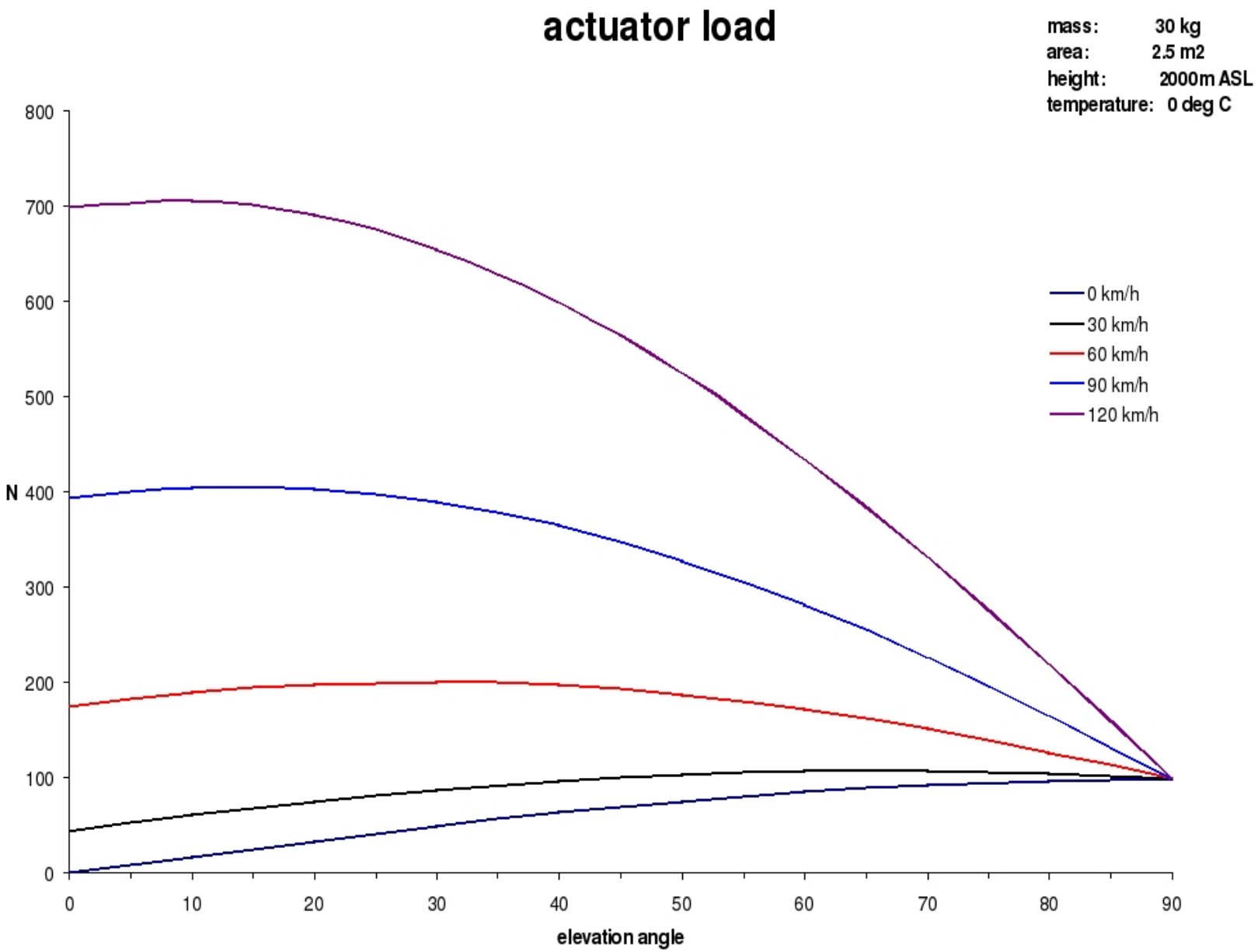


Elevation angle 90^o
$\longrightarrow$ no windload
$\longrightarrow$ only **weight along the arbors**

Estimation of the Actuator Load: 1 m^2 Mirror



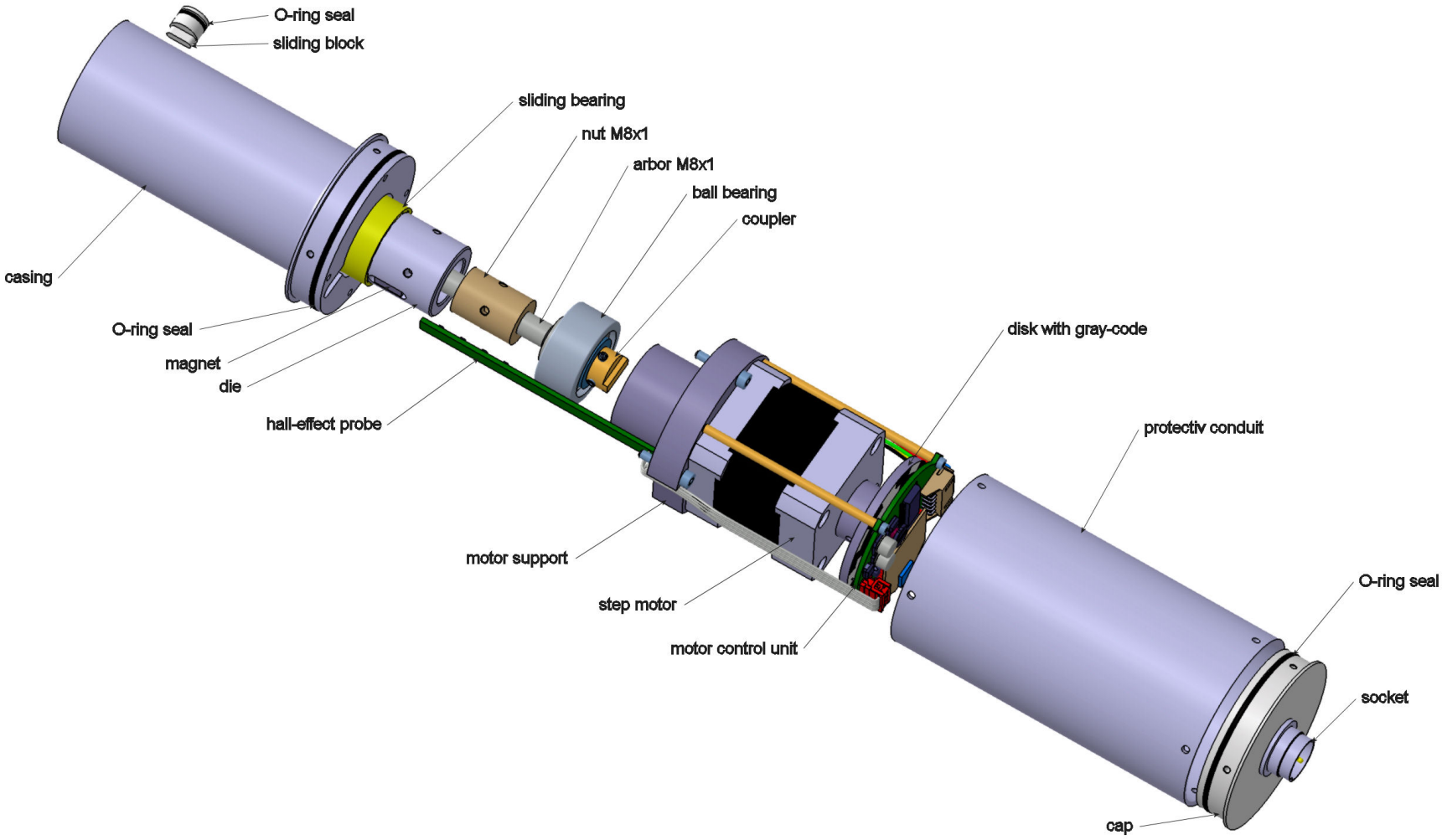
Estimation of the Actuator Load: 2.5 m^2 Mirror



AMC Mechanics

- **Step Motor Drive**
  - mechanical driving range: 37 mm
  - single power supply connector
    IP67/68: dust-tight, waterproof($>$ 1m head of water)
- **Arbor M8x1**
  - diameter: 8mm
  - 1 arbor turn $\longrightarrow$ 1mm elevation
  - self-blocking
- **Material Aspects**
  - no glued parts $\longrightarrow$ dis-/mounting in few minutes
  - back side cap is UV-resistent, but RF-transparent

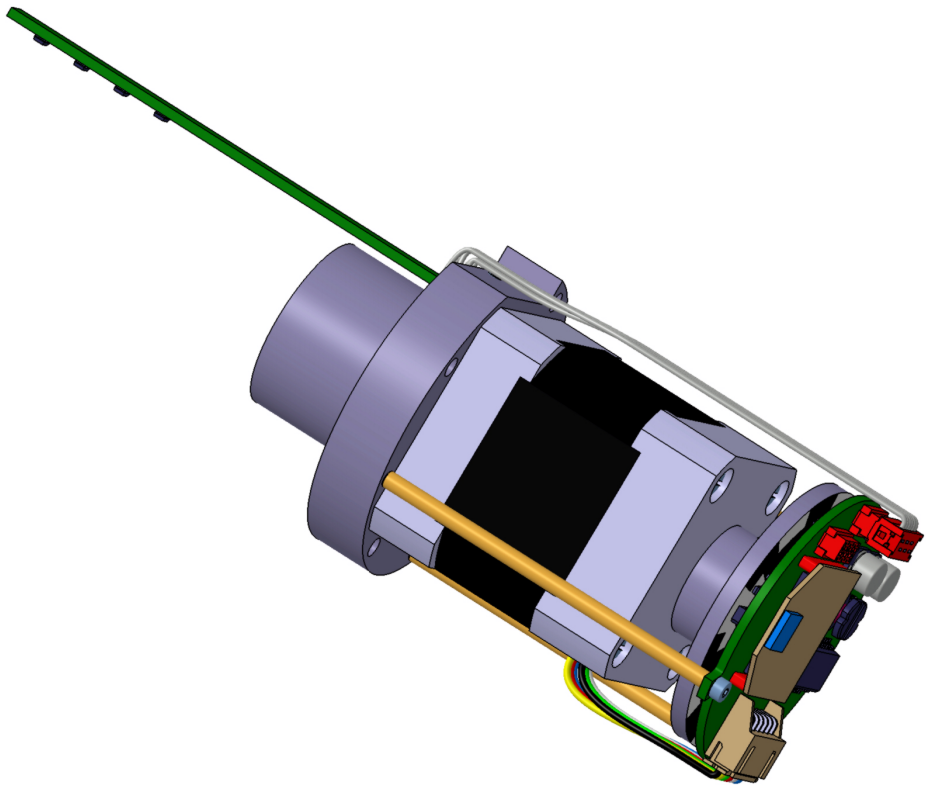
AMC Mechanics: exploded View



AMC Drive Controller: Positioning

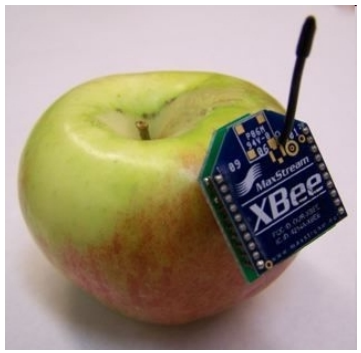
- 1 arbor turn $\longrightarrow$ 1mm elevation
- a small magnet, included in die
- 4 hall sensors on a pcb for coarse positioning (mm-range)
  - leads to 4 values
- 5 Bit optical Gray-Code for fine positioning (within 1mm)
  - 1 arbor turn = 32 Gray-Code steps, each $\frac{1}{32}$ mm
  - leads to 1 additional value
- Calibration:
  - only 5 values for calibration needed
  - absolute position can always be determined
    $\rightarrow$ no initialisation necessary
  - calibration required only once
    (possibly universal for all actuators)
  - on-board memory for Look-Up Tables

AMC Drive Controller



Communication

- **Options**
  - wired: RS-485
  - wireless: ZigBee (industry standard)



- **Ideas**
  - self-organizing network with > 1000 nodes
  - each node has individual 48 Bit number
    $\longrightarrow$ also individual access possible
  - broadcast command to all + individual LUTs?

Comparison to current MAGIC Setup

	MAGIC II	CTA Prototype
range of drive	35 mm	37 mm
possible elevation step size	5 μm	5 μm
effective elevation accuracy	5 μm	30 μm (Gray-Code steps)
actuator weight	1.4 kg	$<$ 1 kg
elevation speed	3.75 $\frac{mm}{s}$	0.5 $\frac{mm}{s}$
force to move	$>$ 330 N	200 N
force to hold	$>$ 330 N	self-blocking
operational voltage	24 V	18 V
standby current	350 mA	$<$ 50 mA
driving current	350 mA	450 mA
position encoding	relative	absolute (no init necessary)
communication	wired	wireless

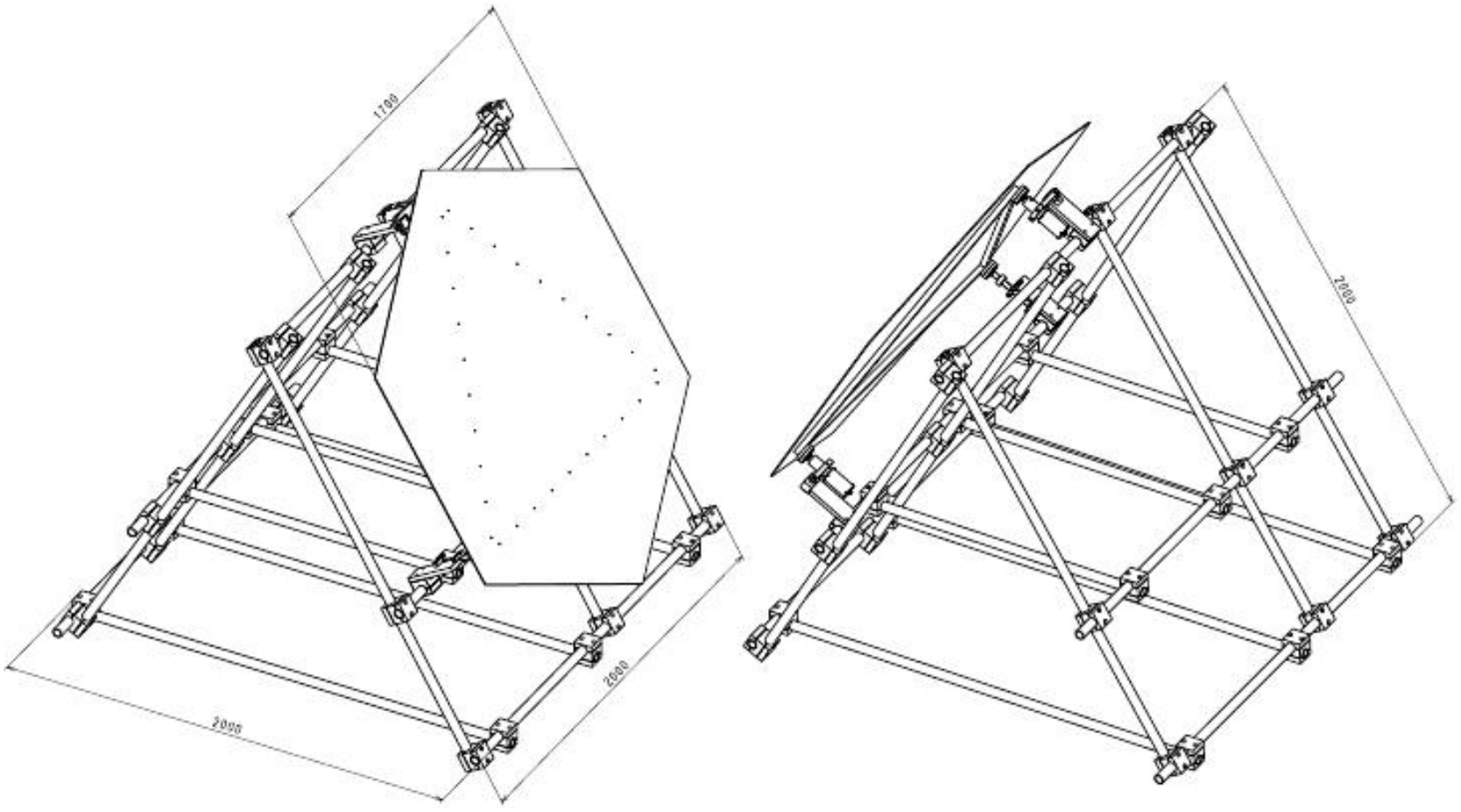
Costs projected on 4000 actuators

	CHF	EURO
drive controller (incl. assembly)	45	30
AMC mechanics	216	144
1x IP 67/68-connector-couple	9	6
total:	270	180

Outlook

- 2 AMC prototypes are completed
- test stand with dummy-mirror is ready to use
- long-duration test on institute's rooftop will start during the next few weeks

Some Pictures of the Test Stand



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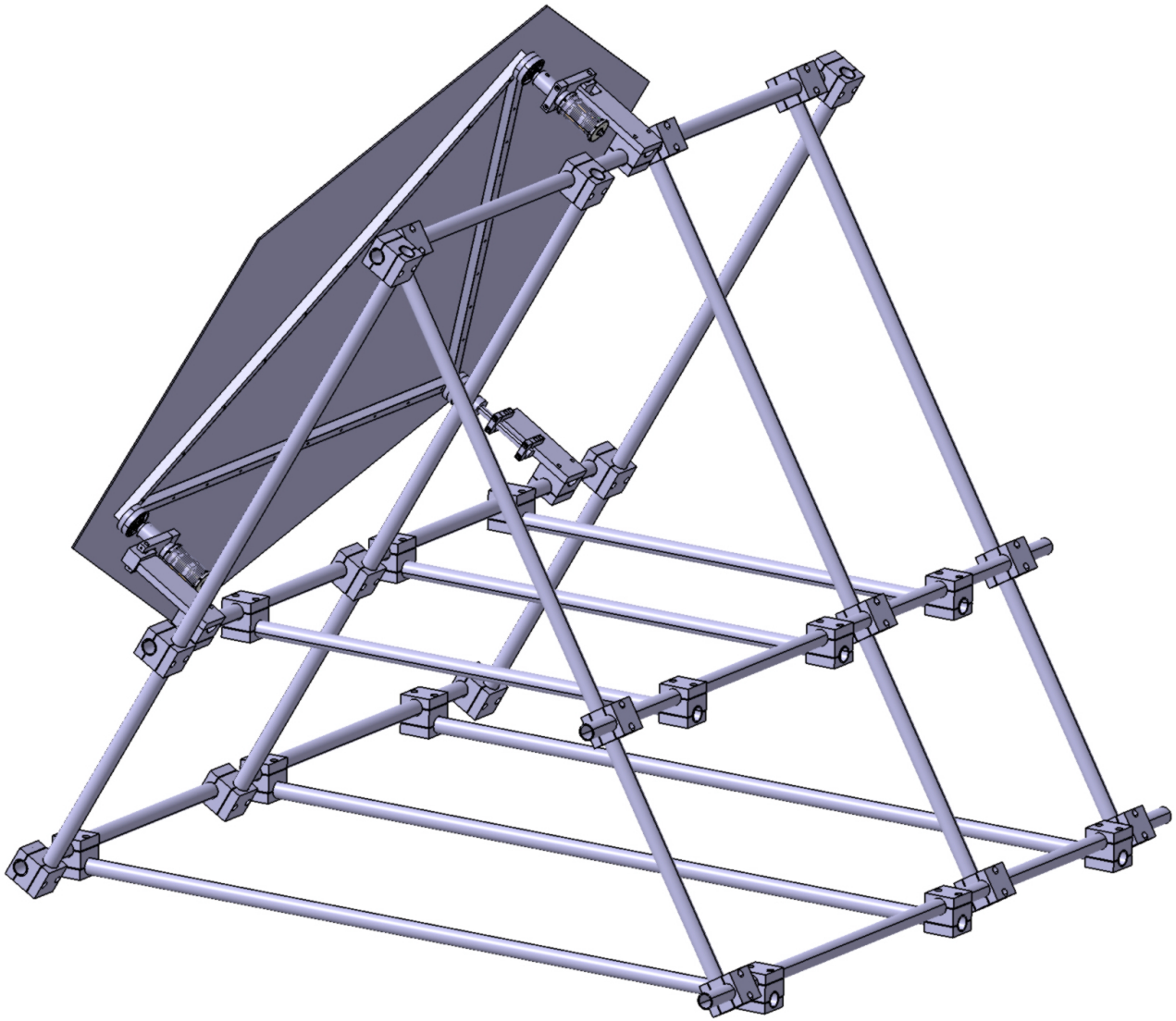

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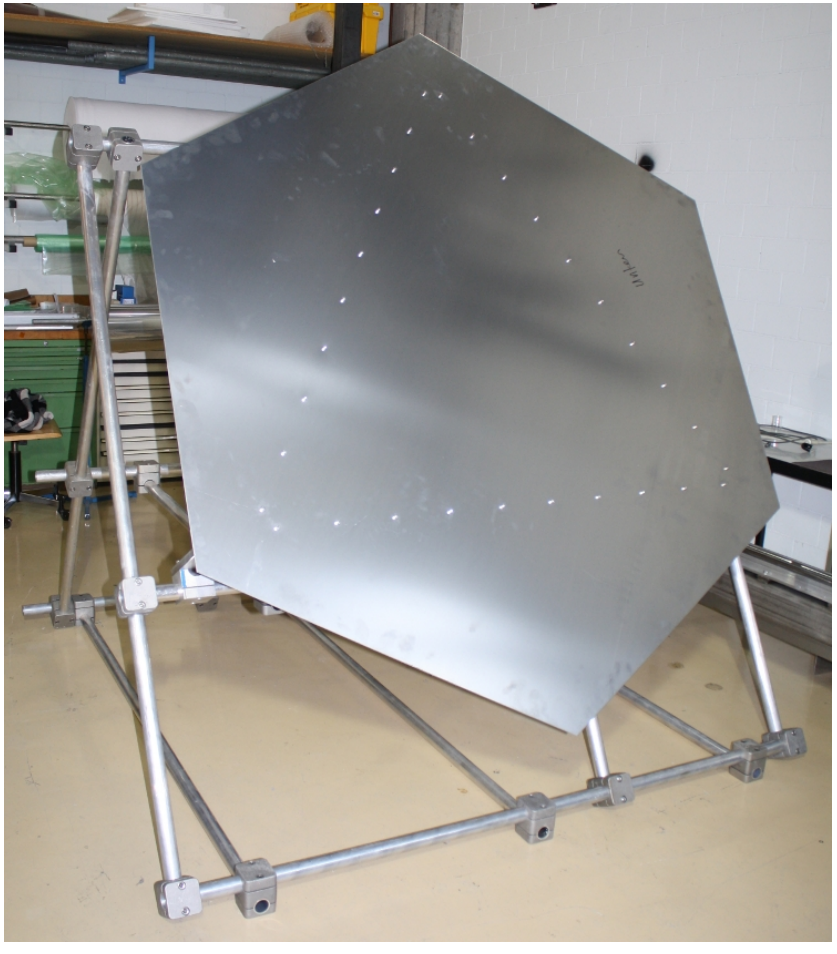

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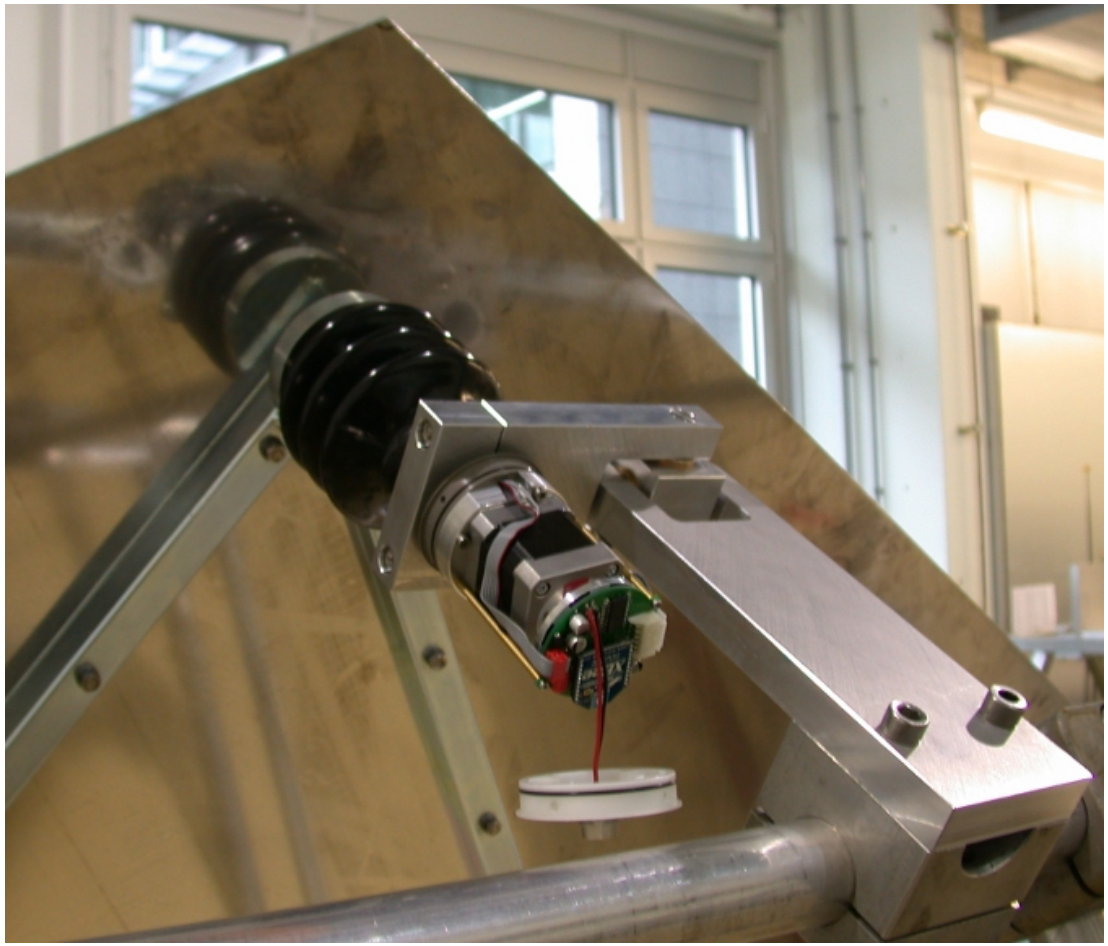

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