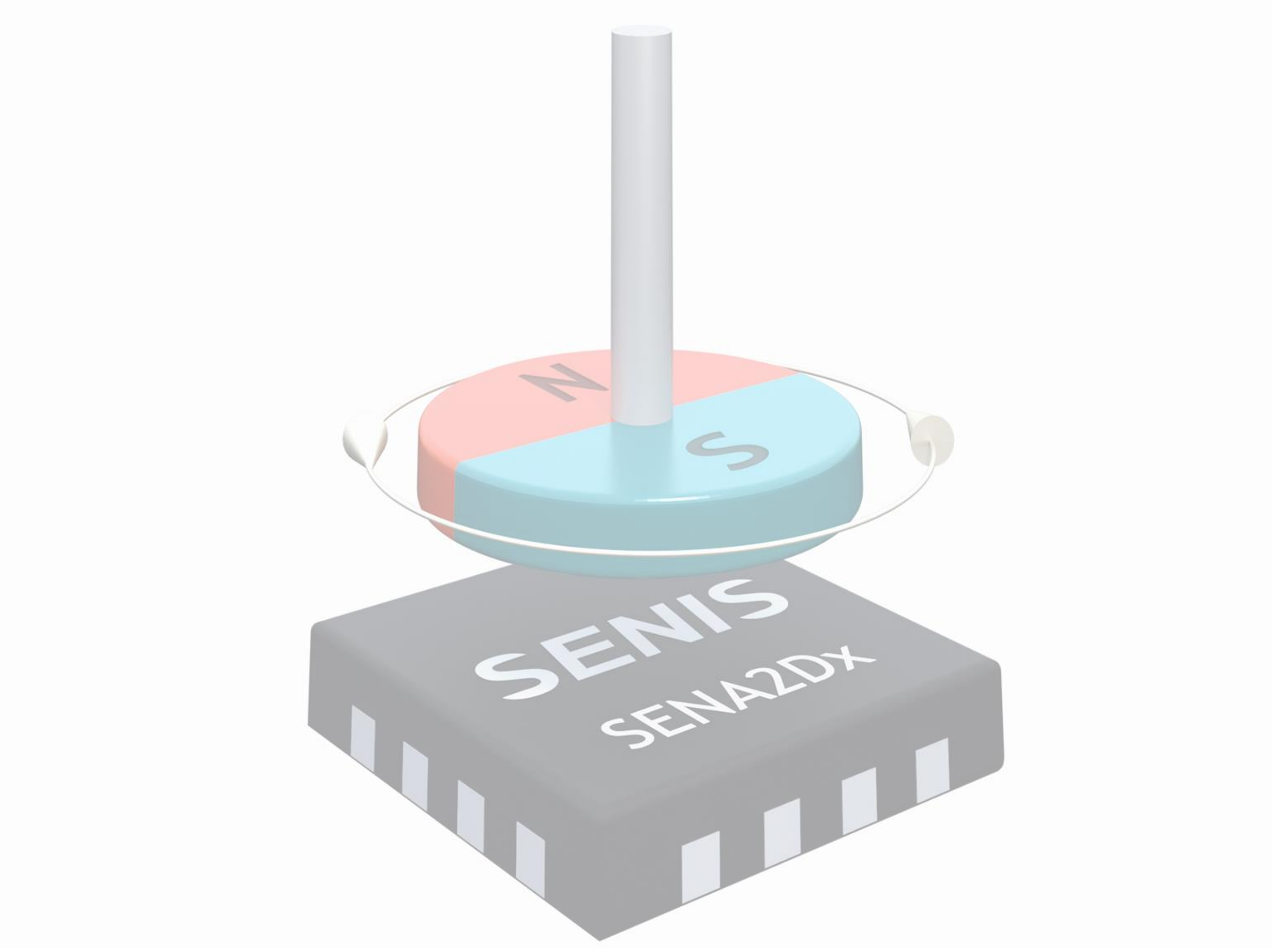
# FAMAS

## (Fast Magnetic Angle Sensor)




the **high performance**, **reliable, robust** and **low cost** magnetic angle sensor to ensure **control, safety** and extended **functionality** for **consumer electronics** and **vehicle applications**

# Company

**SENIS AG, Switzerland** provides **advanced smart sensors and instruments for magnetic field and electric current measurements.**

Our **solutions and services** help our clients **in the automotive, consumer and Test & Measurements industries** to create **powerful, robust** and **effective products**.

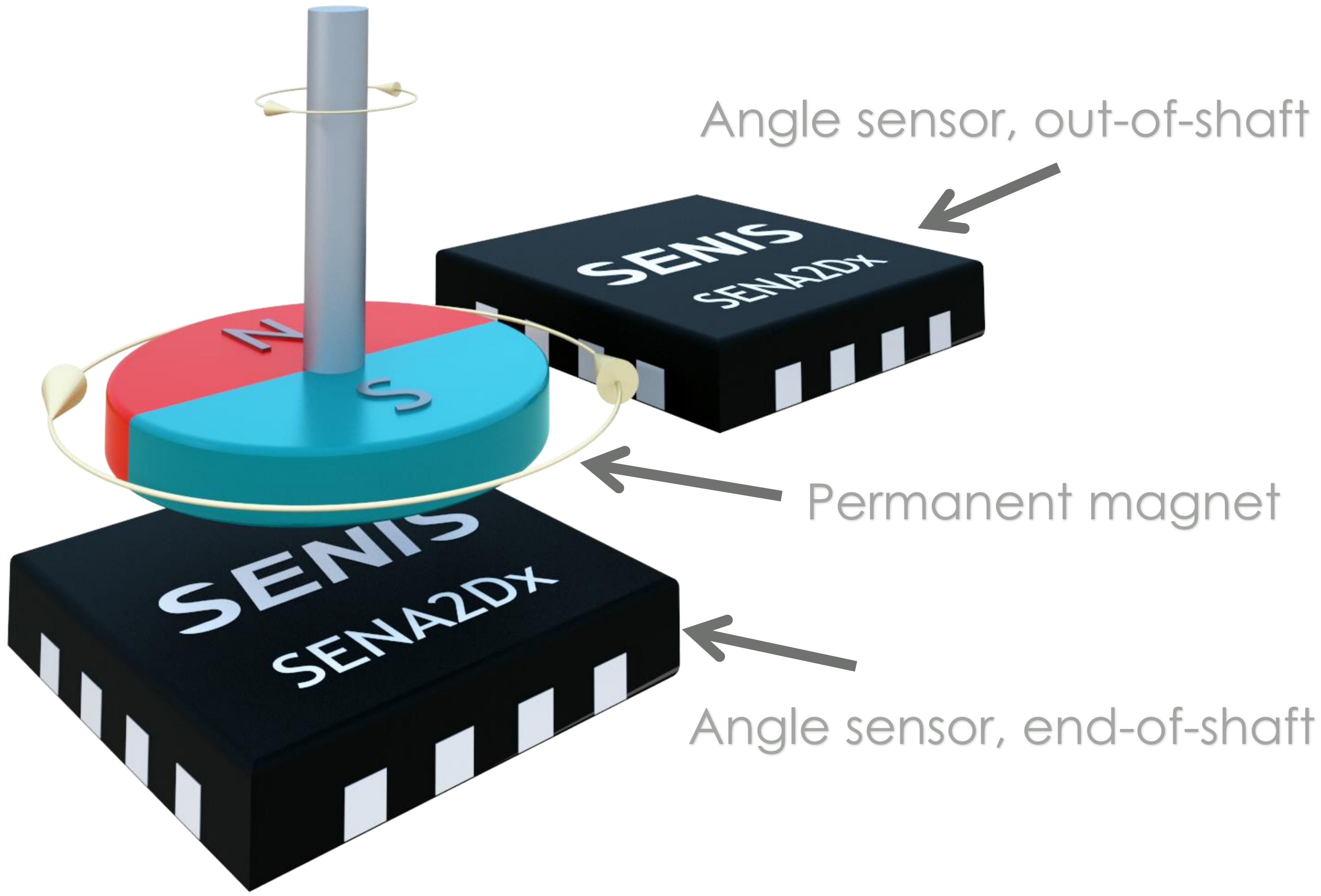
# Problems and Our Solution

**On the market available Sensors**

1 **Lack of performance & reliability:**
- Restricted magnetic field range
- Low accuracy or low speed
- Slow response
- Noisy

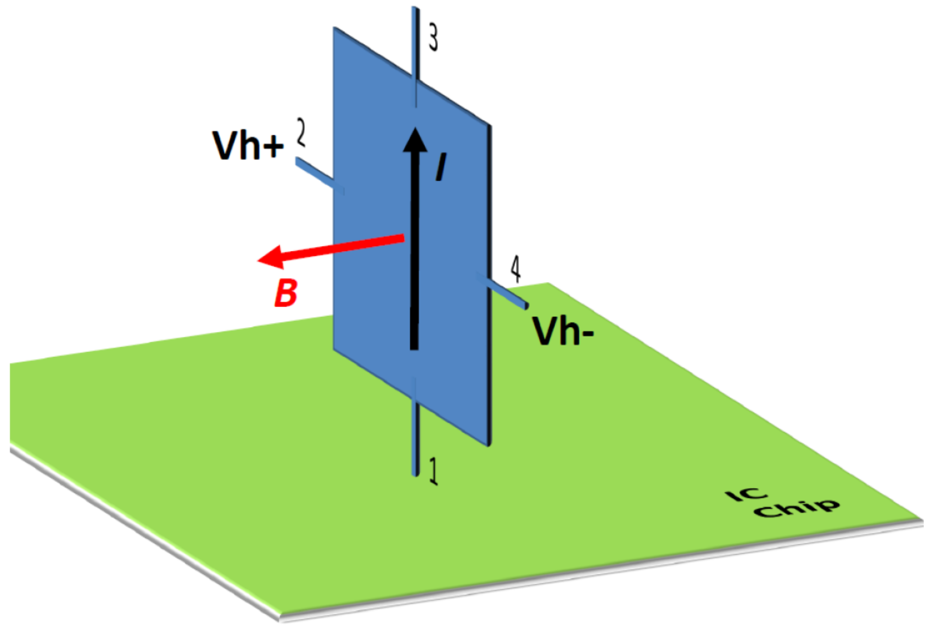
2 **Insufficient functionality:**
- Need an additional AD convertor
- Need angle calculation
- Work with precise positioned magnets
- End-of-shaft or Out-of-shaft

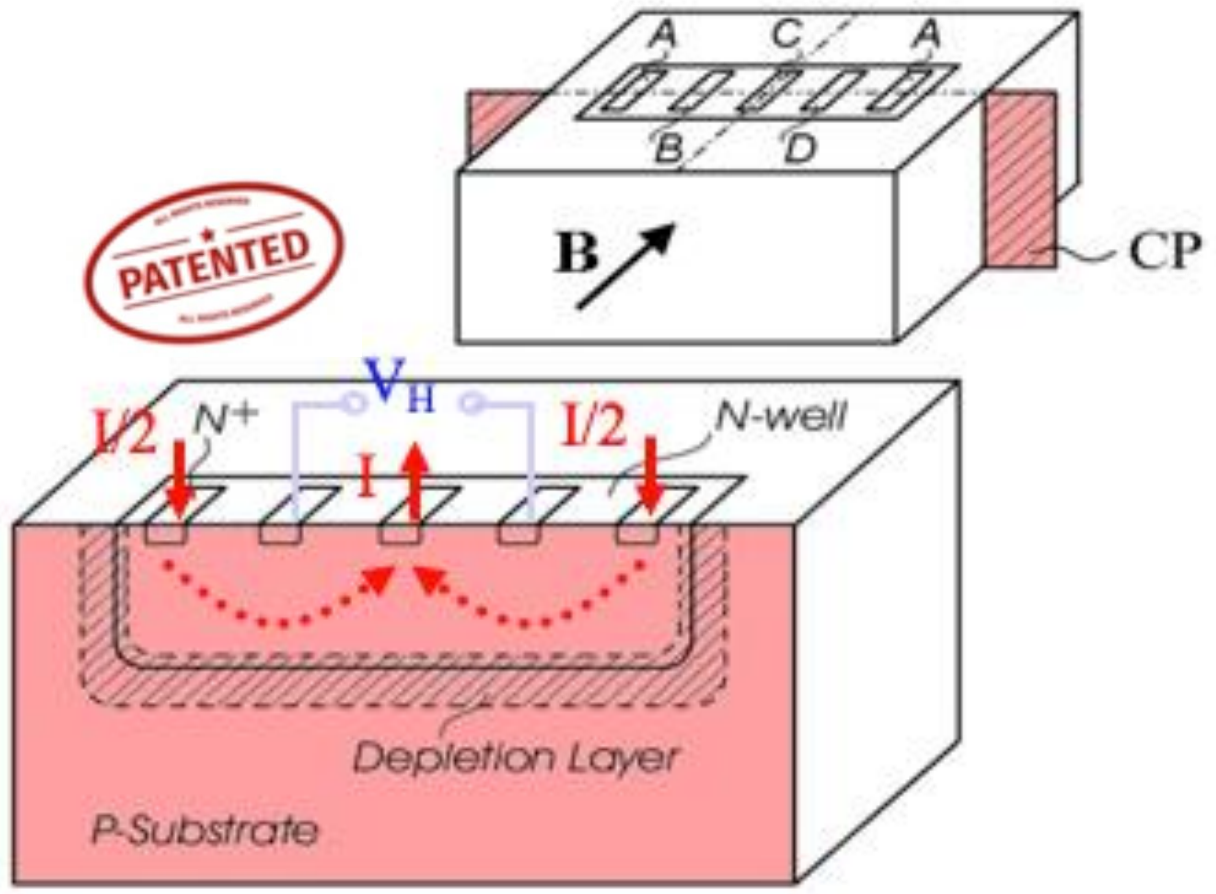
3 **Cost prohibitive:**
- Large size
- Need complex production processes
- Cost for the additional electronics



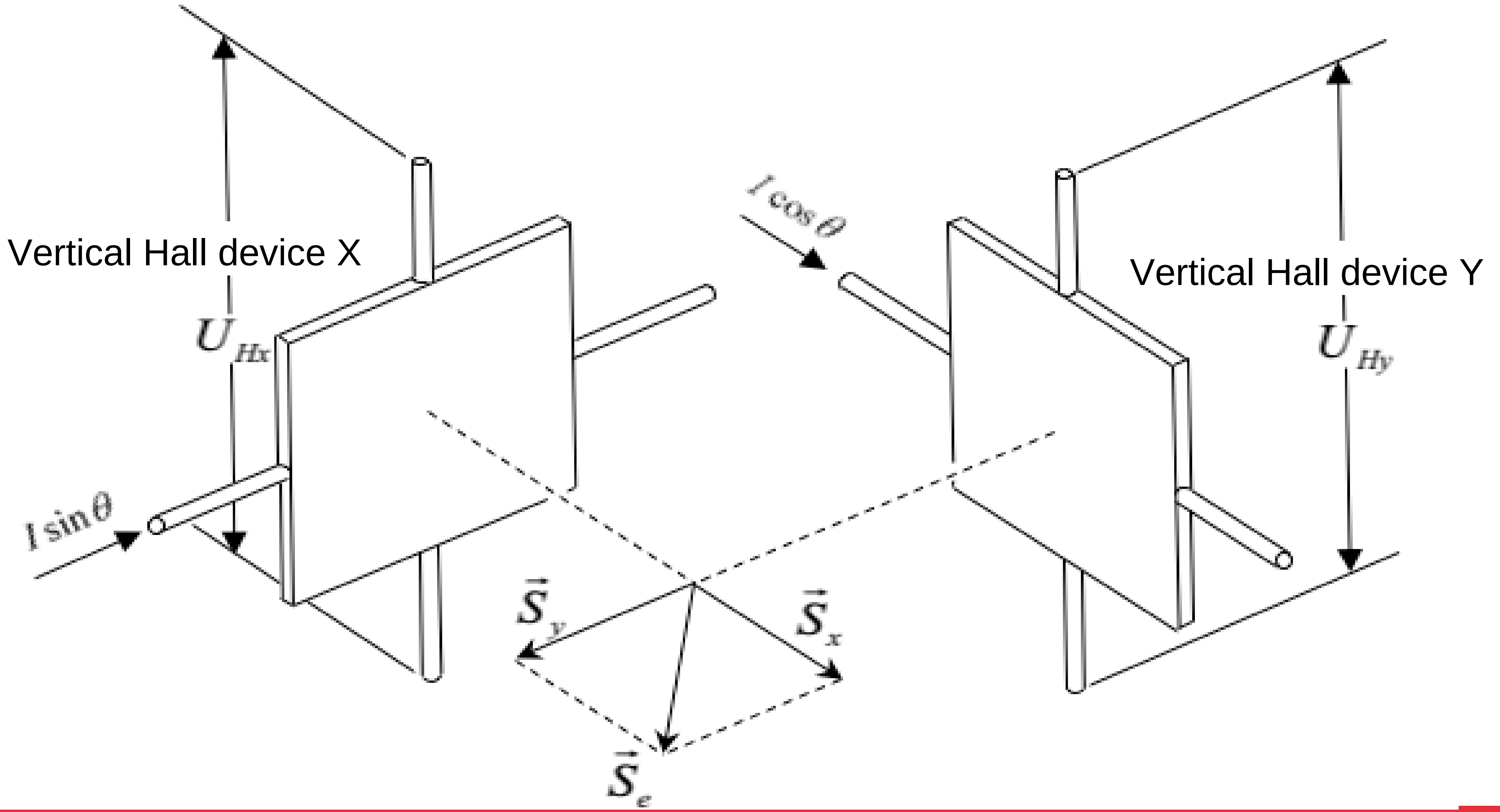
# FAMAS Innovation – Vertical Hall

SENIS
magnetic & current measurement




$$U_H = \vec{S} \cdot \vec{B}$$

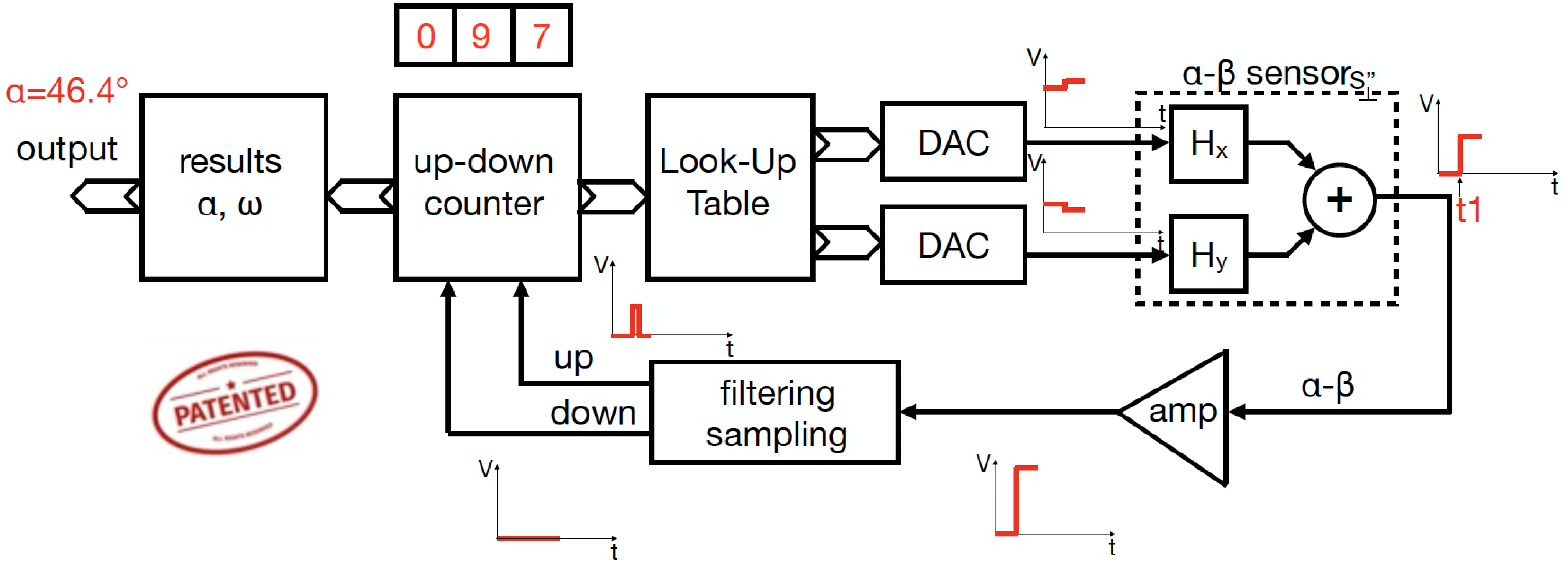


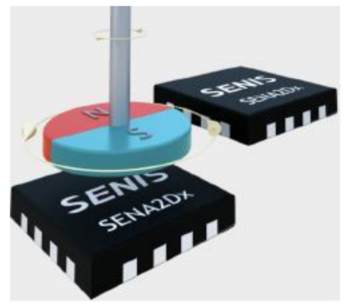

- The magnetic sensing function of FAMAS is fulfilled by novel (patented) vertical Hall devices, featuring at least 3 times better signal-to-noise ratio than any other vertical Hall device available on the market.
- FAMAS IC incorporates two such vertical Hall devices with mutually perpendicular sensitivity directions.
- The direction of the common sensitivity vector of the pair of the vertical Hall devices can be rotated in the plane of the FAMAS die by adequately adjusting the biasing currents of each of the Hall devices.

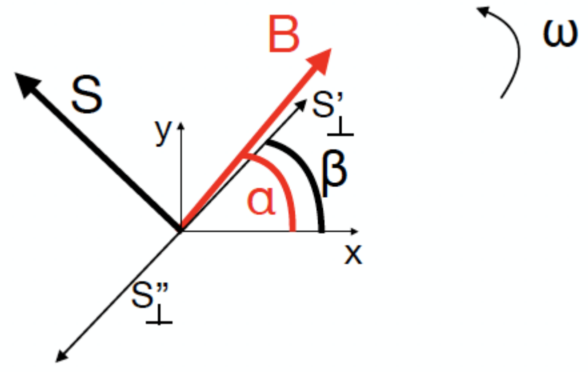
# Ultimately fast measurement update

The (patented) method of magnetic angle retrieval in FAMAS is based on a discrete-time feedback system. The system adjusts the biasing currents of the two vertical Hall devices so that their common sensitivity vector is kept orthogonal to the in-plane component of the magnetic field. In the figure below, α denotes the angle of the  magnetic field vector (of the magnet dipole), and β is the actual measured value of this angle (FAMAS output).

- The actual measured angle (β) is represented by the state (the number of angle steps) of an up-down counter;
- The state of the up-down counter is used as the address of the look-up table, where the digital values of the sin(β) and cos(β) are red, and then fed to a digital-to-analog converter (DAC).
- DAC generates two constant currents, one proportional to the sine, the other to the cosine of the angle β.
- These two currents are used as the biasing currents of the two vertical Hall devices. Biased in this way, the two mutually orthogonal vertical Hall devices become a sensor of the angle measurement error (α-β sensor): the sum of their output voltages is proportional to sin(α-β) ≈ α-β (for small α-β).
- The amplified voltage α-β updates the state of the up-down counter so as to reduce the difference α-β.
- The whole signal chain provides an updated output of FAMAS in less than 0.6μs.





# Value Proposition

## Accurate

- Highest angular resolution (<0.08°)
- The fastest response (latency <0.6us)
- Highest rotational speed (up to 400’000 rpm)
- Largest magnetic field ranges (20mT...up to 500mT), therefore immune to stray fields
- On-chip correction of sensitivity, offset, noise, drift

## Affordable

Solution that allows very competitive price due to:

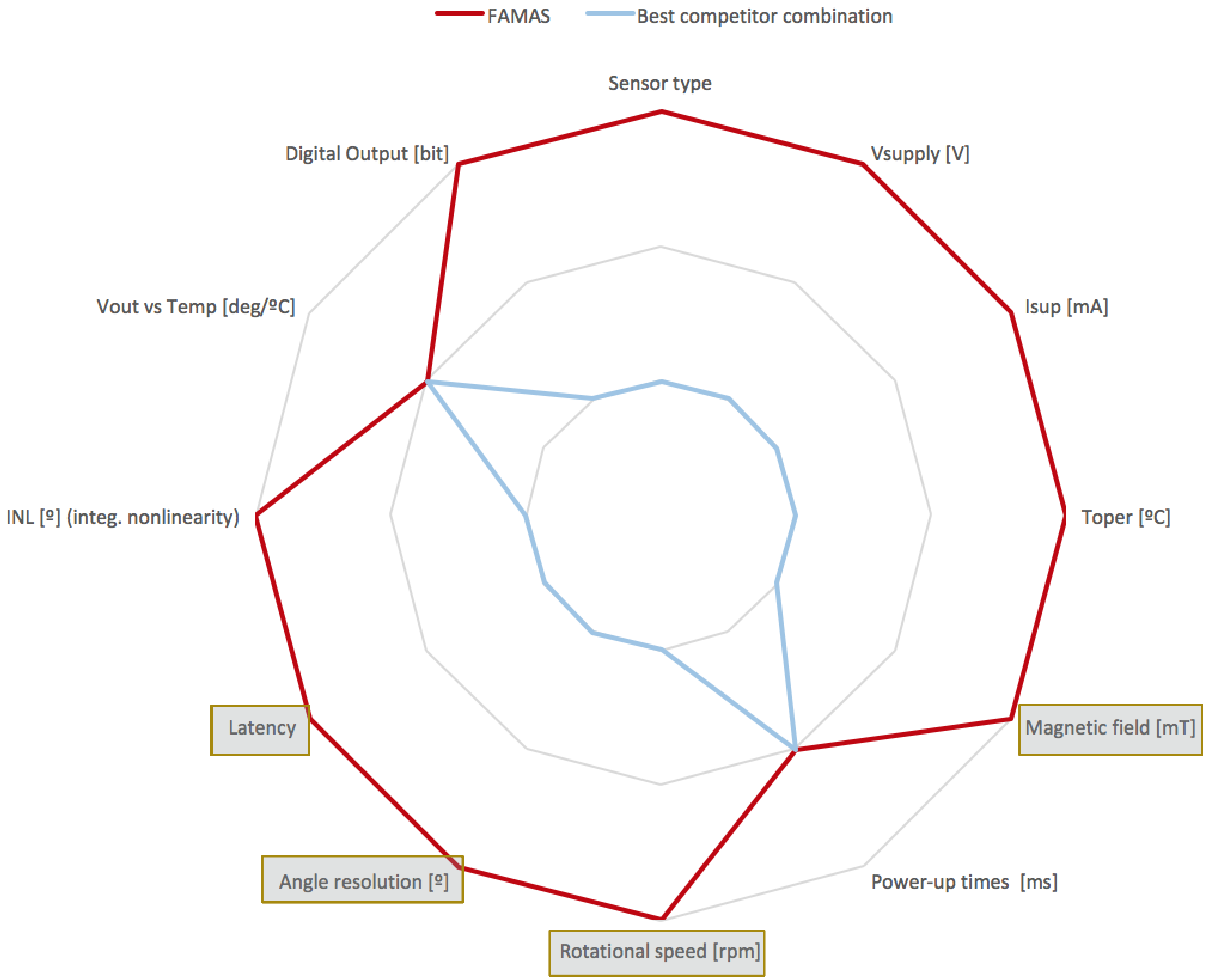
- small chip size
- standard Si CMOS technology
- no wafer postprocessing required
- no need for additional A/D converter and angle calculation

## Feature-rich

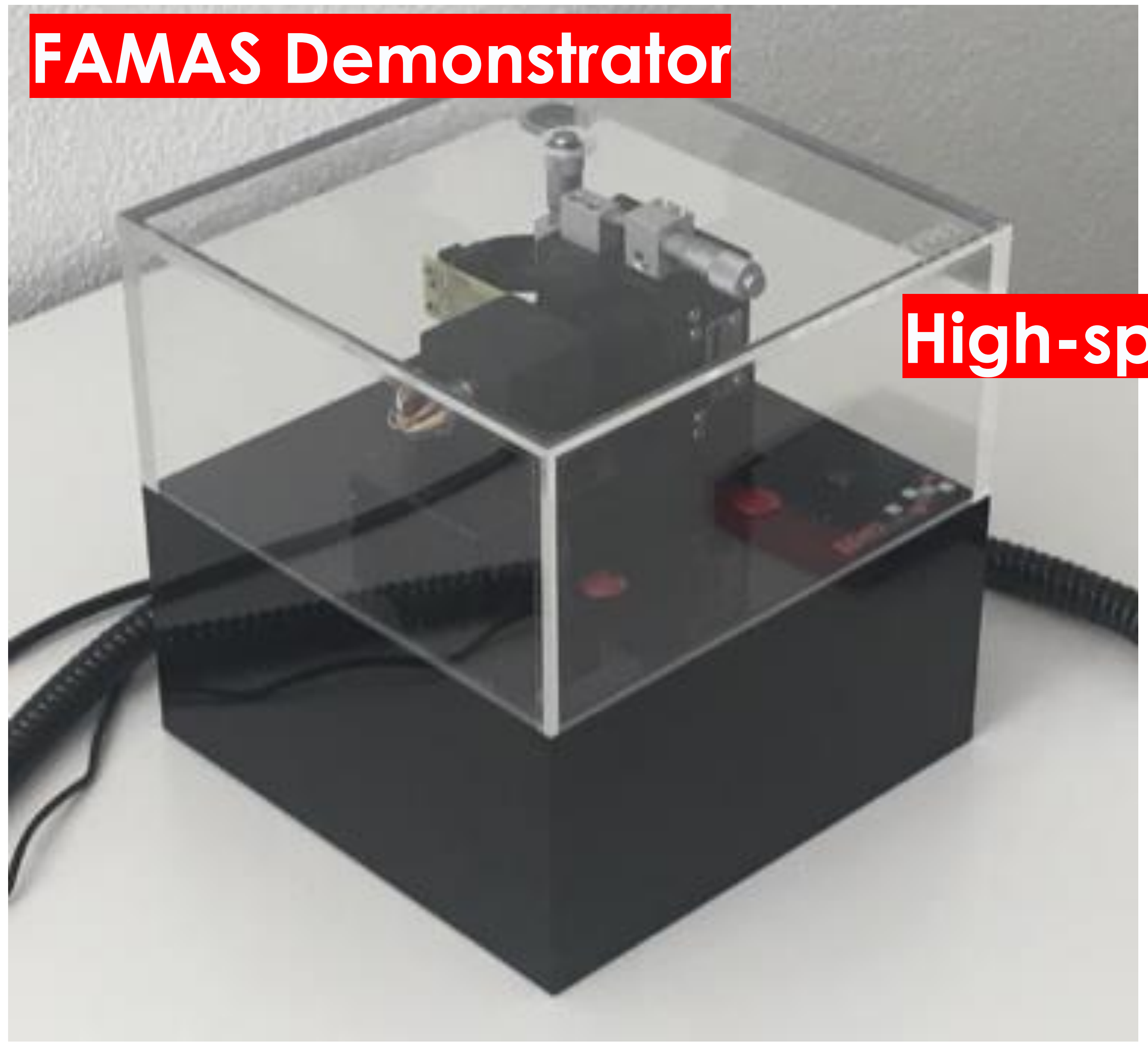
- New, patented angle sensor concept
- Instantaneous angle information (rotary position)
- Constant and changeable rotary speed measurement
- End-of-shaft & Out-of-shaft sensor
- High sensor spatial resolution => works with various magnet sizes
- On-chip parametrization
- SPI, A quad B, UVW outputs

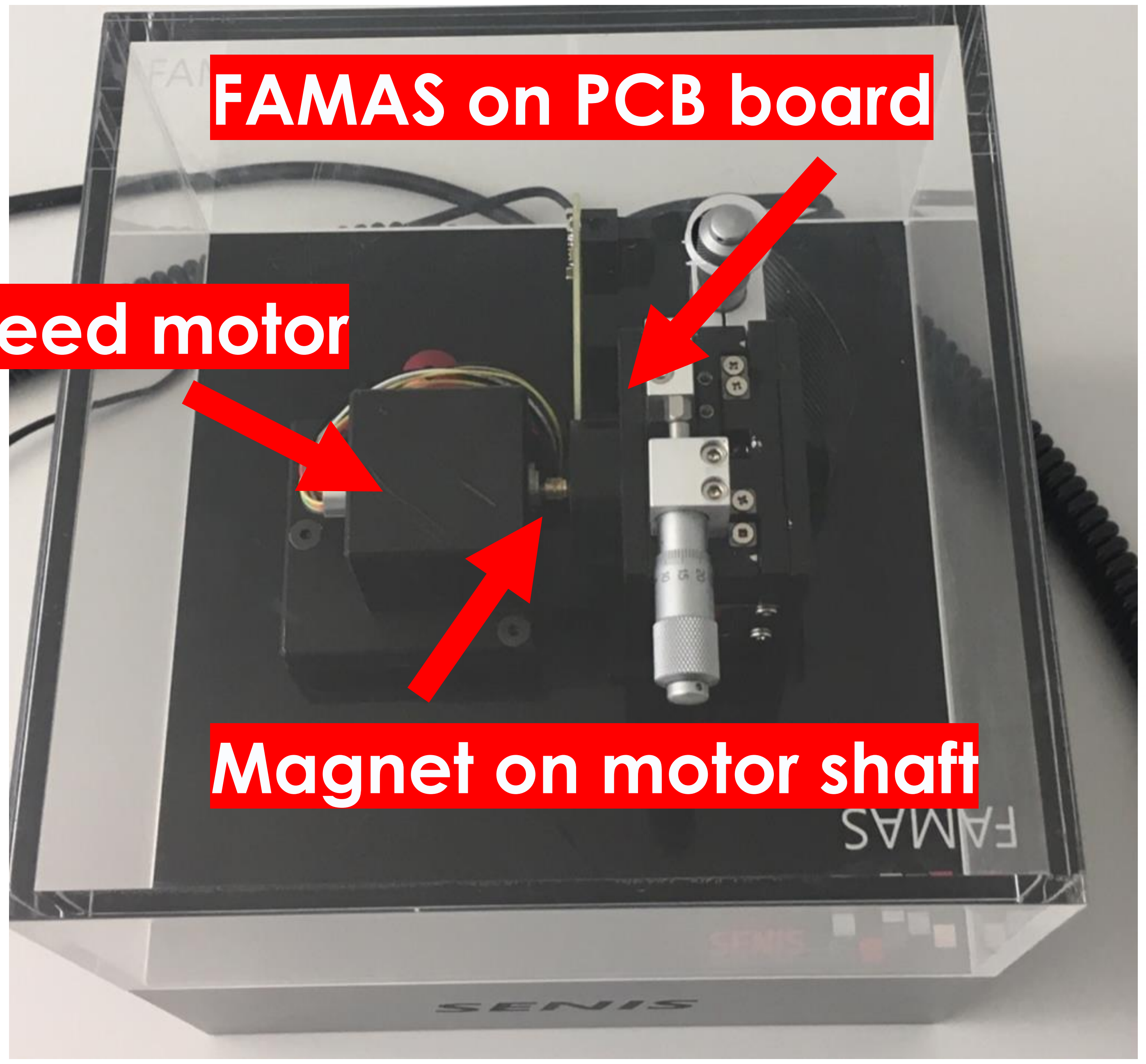
# Competition

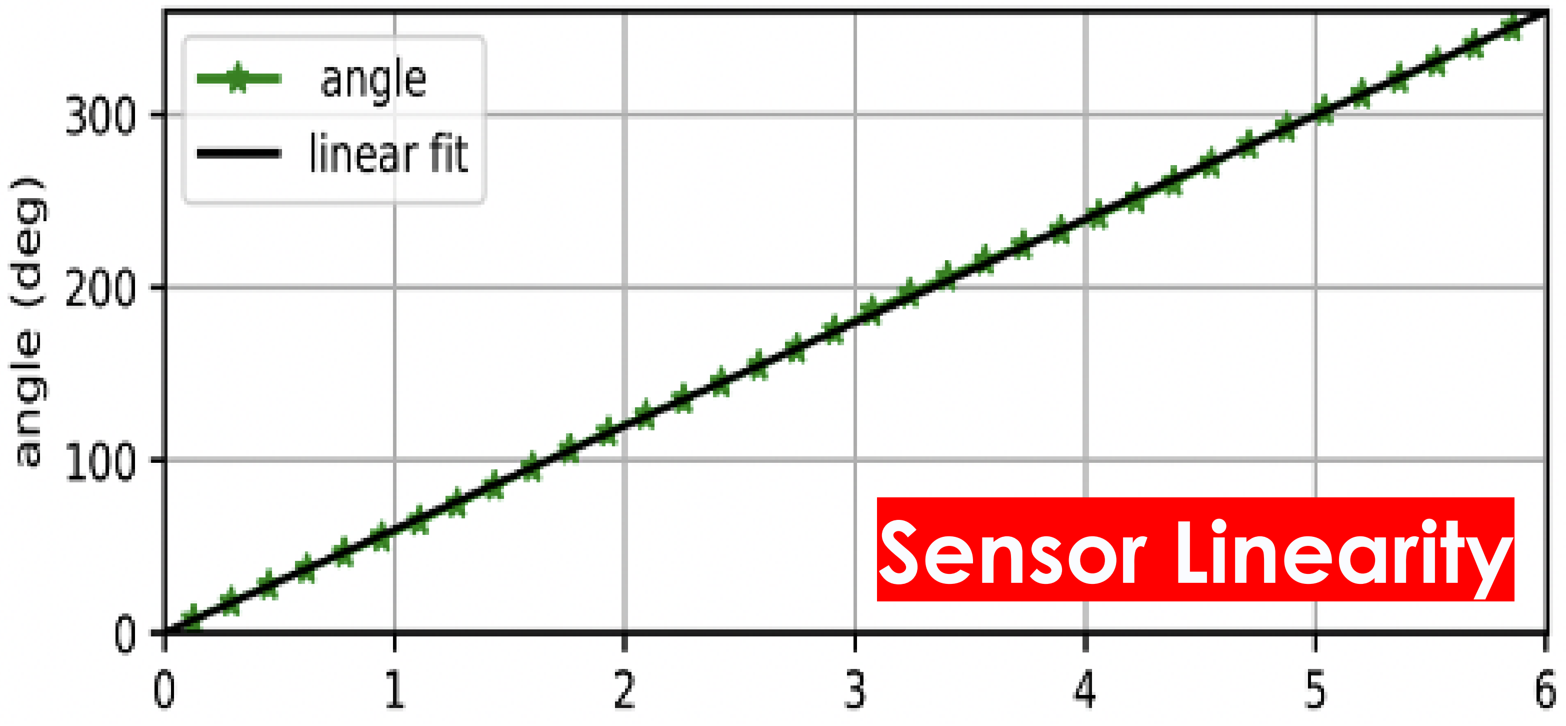
| Parameter | FAMAS | Best competitor combination |
|---|---|---|
| Sensor type | Digital | Digital |
| Vsupply [V] | 5 | 3.3 or 5 |
| Isup [mA] | <15 | 10 |
| Toper [ºC] | [-40, 125] | [-40, 150] |
| Magnetic field [mT] | 20-200 | 50-200 |
| Power-up times [ms] | 2 | 2 |
| Rotational speed [rpm] | 400’000<br>50,000<br>25,000 | 200’000 |
| Angle resolution [º] | 0.08<br>0.35<br>2.8 | 0.1 |
| Latency | 1<br>5<br>20 | 3 |
| INL [º] (integ. nonlinearity) | 0.3 | 1 |
| Vout vs Temp [deg/ºC] | 0.03 | 0.03 |
| Digital Output [bit] | 12 | 16 |

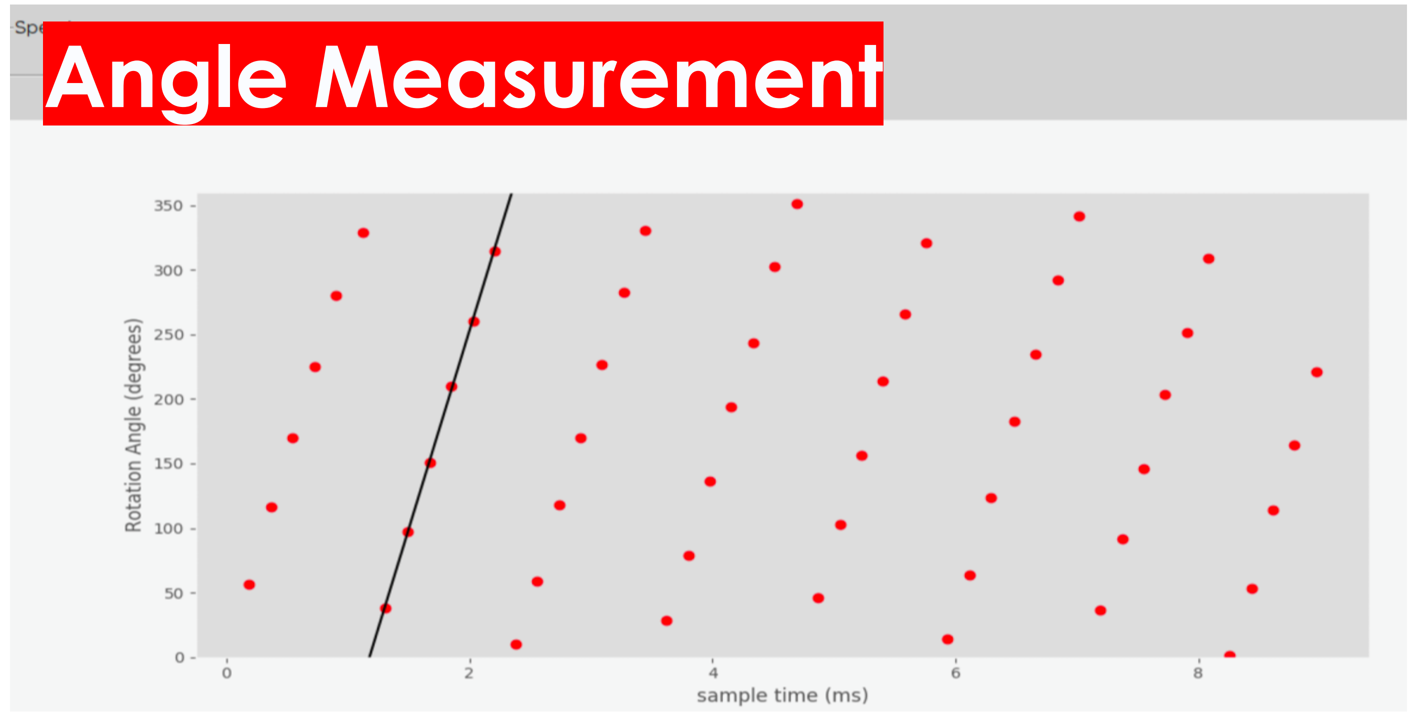


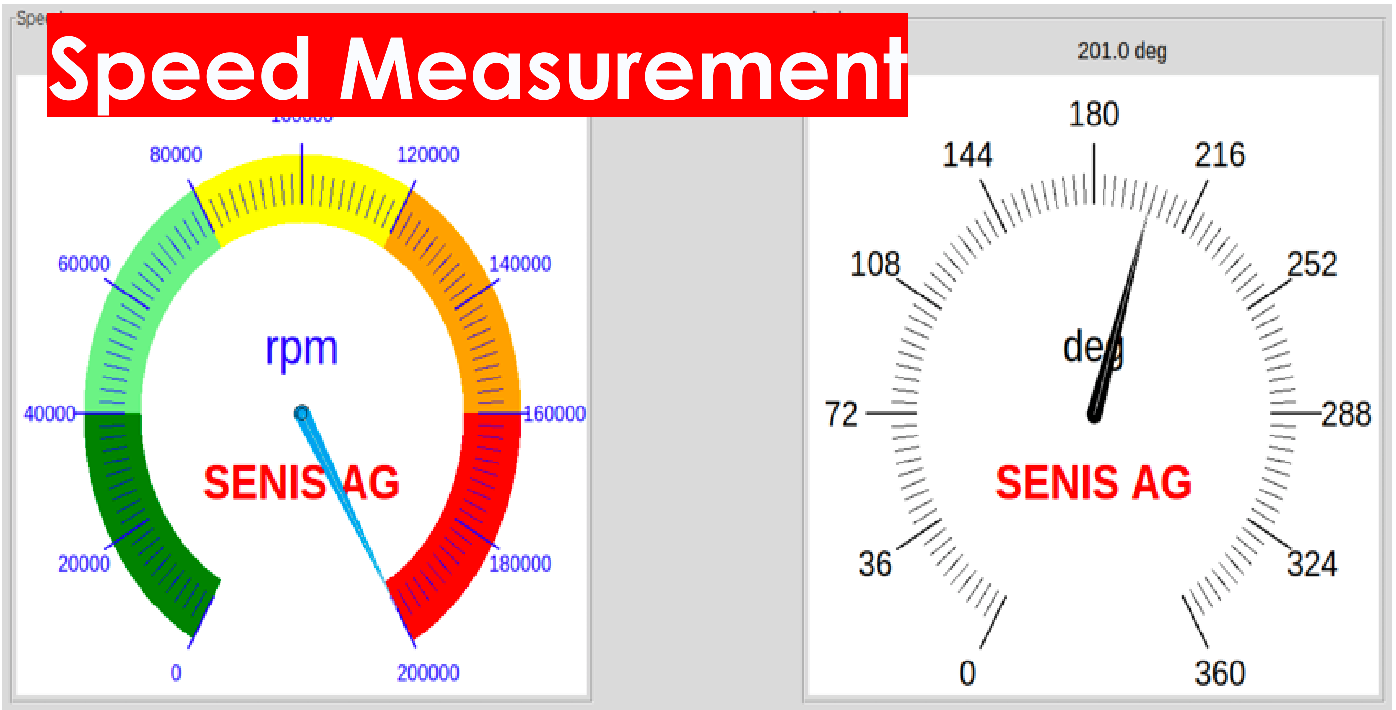
# Ready to Market

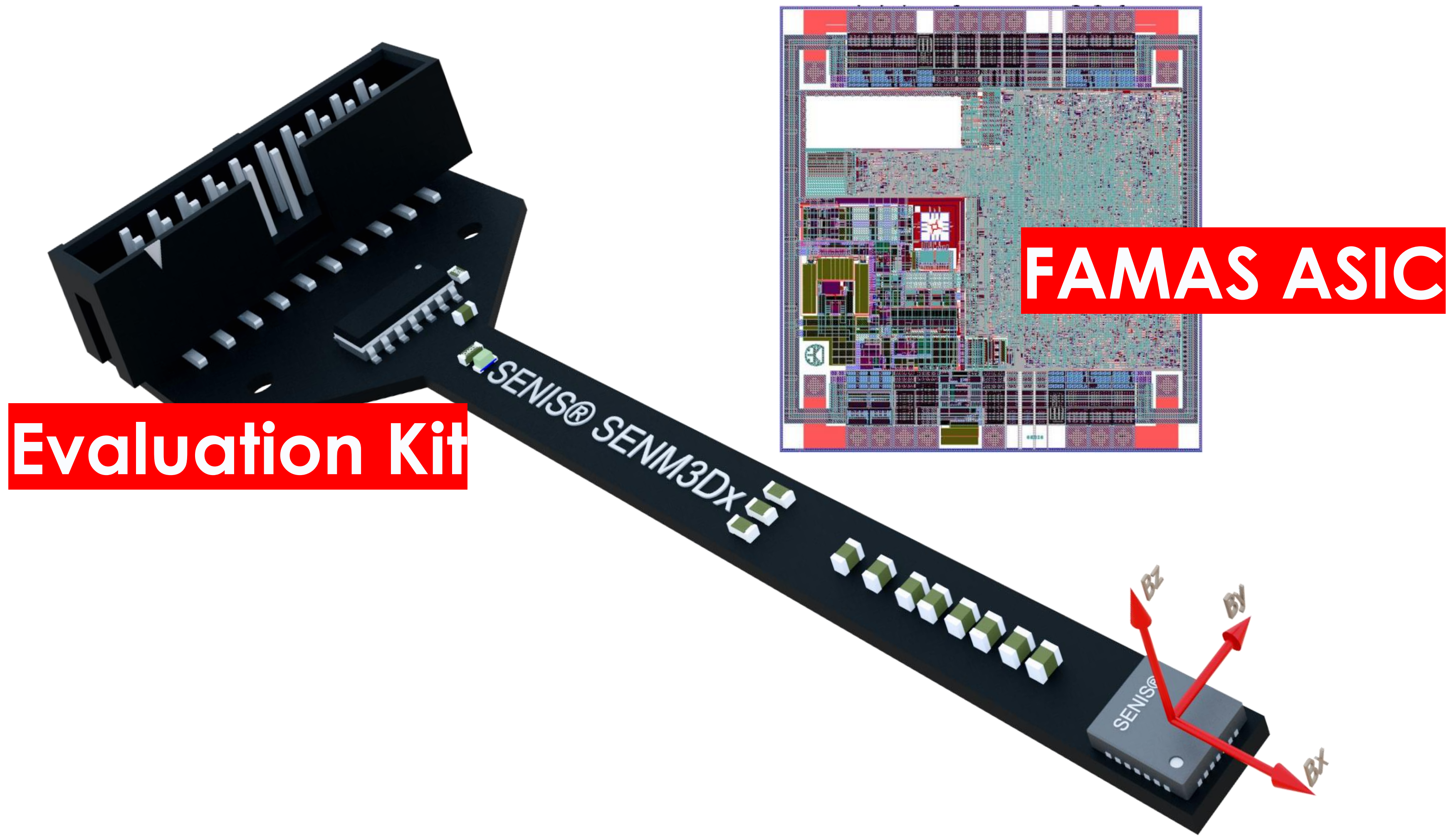


# Summary

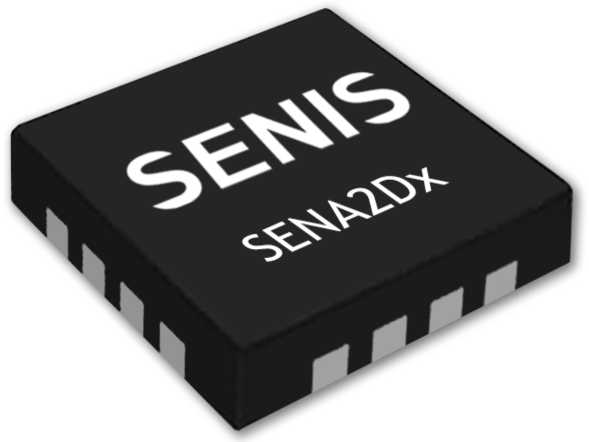
FAMAS satisfies a huge need in a large and growing market

FAMAS is the result of extensive R&D and long-standing expertise in the sensor field

FAMAS innovative sensor gives instantaneous angle information without ADC or calc

FAMAS is accurate, fast, affordable, robust and reliable product


FAMAS disrupts the sensor market and contributes to society





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