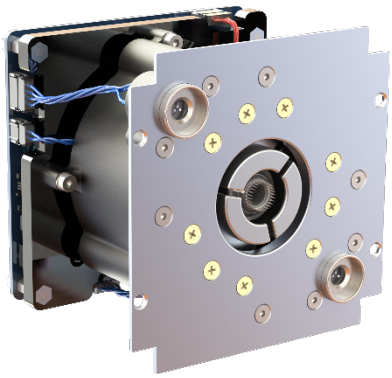
IFM NANO THRUSTER SE

THRUST VECTORING CAPABILITY

Building on the **flight heritage** of the IFM Nano Thruster, the IFM Nano Thruster SE expands controllability towards active **thrust vector control**, without moving parts.

The IFM Nano Thruster SE therefore **combines** advanced vector controllability with the **very mature** and worldwide unique FEEP technology that has been developed at FOTEC under ESA contracts for over 15 years. ENPULSION has been founded as a Spin-Out together with FOTEC to meet this market demand by preparing to **scale the production of this thruster to several hundred units per year.**



ACTIVE THRUST VECTOR CONTROL

The IFM Nano Thruster SE allows to actively control the resulting thrust vector, without any moving parts. It can therefore steer, correct for CoG mismatch or enable advanced missions requiring precise thrust pointing.

CONTROLLABLE SPECIFIC IMPULSE UP TO 6,000 S

Due to the efficient ionization process, which allows the capacity to ionize up to 60% of the evaporated Indium atoms, the IFM Nano Thruster can provide a higher specific impulse than any other ion propulsion system currently on the market.

MATURE TECHNOLOGY

The IFM Nano Thruster SE is a mature technology, developed under ESA contracts for 15 years. In this time more than 100 emitters have been tested and an ongoing lifetime test has demonstrated more than 20,000 h of firing without degradation of the emitter performance.

SAFE AND INERT SYSTEM COMPLIANT WITH ALL LAUNCHER REQUIREMENTS

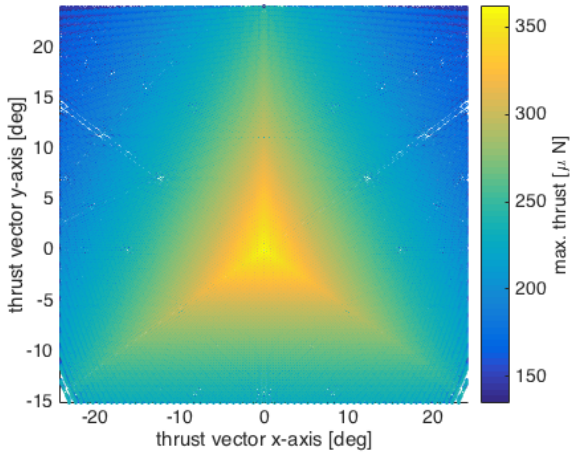
The thruster contains no moving parts and the propellant is in its solid state at room temperature. Avoiding any liquid and reactive propellants as well as pressurized tanks significantly simplifies handling, integration and launch procedures.

COMPACT BUILDING BLOCKS

The IFM Nano Thruster SE module is used as a compact pre-qualified building block in order to provide custom solutions at a commodity price and ultra-short lead times. Although building blocks are completely self-contained propulsion systems, the whole cluster can be operated as a single plug-and-play unit.

DYNAMIC PRECISE THRUST CONTROL

The thrust can be controlled through the electrode voltages, providing excellent controllability over the full thrust range and a low thrust noise.



Thrust vectoring capability of the IFM Nano SE

DYNAMIC THRUST RANGE	10 µN TO 0.4 mN
NOMINAL THRUST	350 µN
SPECIFIC IMPULSE	2,000 TO 6,000 s
PROPELLANT MASS	230 g
TOTAL IMPULSE	MORE THAN 5,000 Ns
POWER AT NOMINAL THRUST	40 W INCL. NEUTRALIZER
OUTSIDE DIMENSIONS	100.0 x 100.0 x 95 mm
MASS (DRY / WET)	<720 /< 950 g
TOTAL SYSTEM POWER	8 – 40 W
HOT STANDBY POWER	3.5 W
COMMAND INTERFACE	RS422/RS485
TEMPERATURE ENVELOPE (NON-OPERATIONAL)	-40 TO 105°C
TEMPERATURE ENVELOPE (OPERATIONAL)	-20 TO 40 °C
SUPPLY VOLTAGE	12 V, 28 V, OTHER VOLTAGES UPON REQUEST
THRUST VECTOR CAPABILITY	UP TO 24DEG OFF NOMINAL

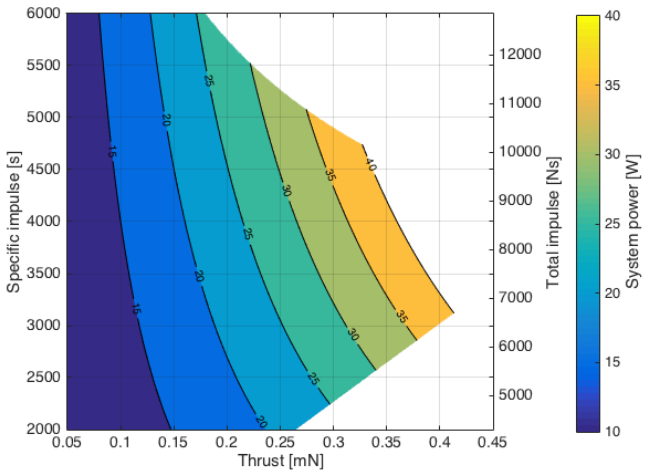
MODULARITY

The IFM Nano Thruster SE can be clustered in order to **meet any specific mission need**. As we are using a number of pre-qualified modules (building blocks), this customization can be done **without increasing the cost or lead times of the thruster.**

PROPERTIES AND PERFORMANCE

The IFM Nano Thruster SE uses differential emission throttling within the proprietary crown ion emitter to actively control the emitted ion beam and therefore thrust. The thrust vector capability is an additional feature compared to the IFM Nano Thruster and does not reduce total impulse capability. The dependency of maximum thrust on thrust vector angle is shown on the left.

While the required power to operate the IFM Nano Thruster starts at around 8 W, at higher thrust levels one can choose between high thrust and high specific impulse operation. The IFM Nano Thruster SE can operate at an I_{sp} range of 2,000 to 6,000 s. At any given thrust point, higher I_{sp} operation will increase the total impulse, while it will also increase the power demand. The thruster can be operated along the full dynamic range throughout the mission. This means that high I_{sp} and low I_{sp} maneuvers can be included in a mission planning, as well as high thrust orbit maneuver and low thrust precision control maneuvers.



Depending on available power, the user can choose from any operational point - data shown corresponds to 12 V configuration