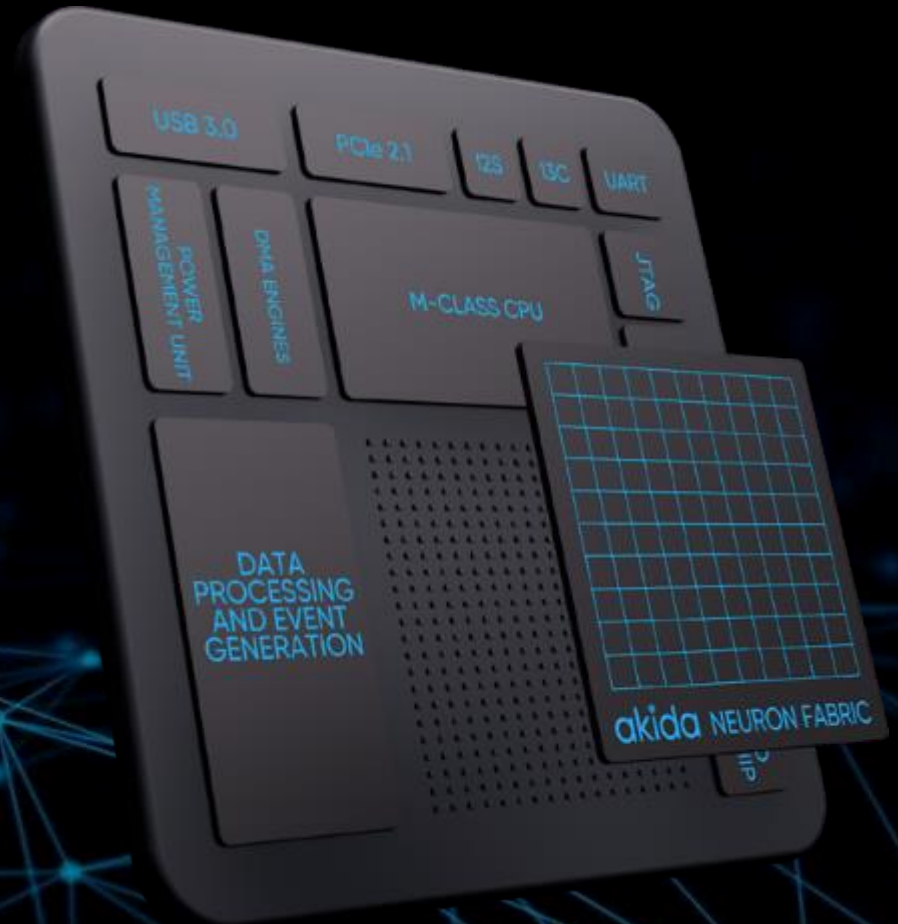


# Bringing Neuromorphic AI to Space – GR801

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BrainChip Alf Kuchenbuch



the first neuromorphic AI chip  
designed for space



<https://youtu.be/9Zers-FUHSE?si=1ooqhXm7HJ3DDAHQ>

# Why We Reach for the Stars?

Strategic and humanitarian goals of modern space programs



## Discovery

Earth observation, solar system mapping, and resource identification.



## Security

Strengthening national defense and environmental monitoring.



## Impact

Advancing medical technology and hyper-accurate climate forecasting for all humanity.

# The **Harsh Reality** of the Space Exploration

## Challenges



**Extreme  
Environment**



**Latency**



**Frame-Based  
Bottleneck**



**Rigid  
Programming**

# Akida™: Intelligence Redefined



Extreme Environment



Latency



Frame-Based Bottleneck



Rigid Programming



Ultra-Low SWaP-C & Thermal



Reduced Latency



Sparsity Engine



Edge Learning

Efficiency = Longevity At The Extreme Edge

# Event-Based Neuromorphic Processing

Leverage "Sparsity" in the "sparse" space environment



**10X**  
**Computational Efficiency**  
than traditional computing as it only processes relevant data

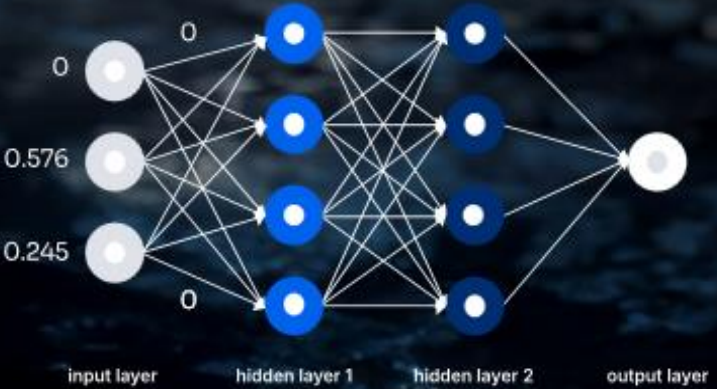


**mW**  
**Ultra-Low Power**



**<10ms**  
**Latency**  
enabling instant hazard avoidance during critical landing

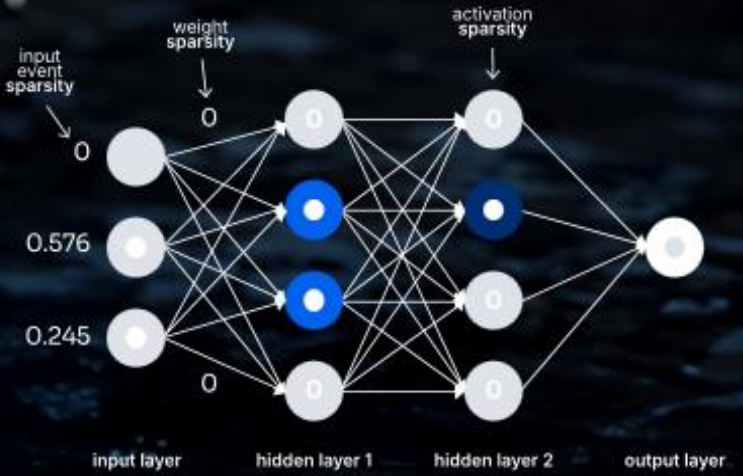
## Conventional NPU



Conventional NPUs running CNNs fire every element

Compute all data  
*"brute force"*

## Akida NPU



Akida NPUs running CNNs only fire when an event threshold is detected

Compute only event data  
*"elegant, like the brain"*

# GR801

## First Neuromorphic AI Solution for Space



### Pioneering AI for Extreme Space Exploration

Bringing neuromorphic AI to space-grade SoCs with Gaisler's proven radiation-hardened technology.



### Unprecedented Power Efficiency

Radically lower power consumption, ideal for resource-limited space missions.



### Enhanced Mission Capabilities

Real-time object detection, navigation without ground control, autonomous docking/landing, and intelligent data compression.



# Proven Success in Space

## ESA NEURAVIS Project



### \* Lunar Landing Navigation

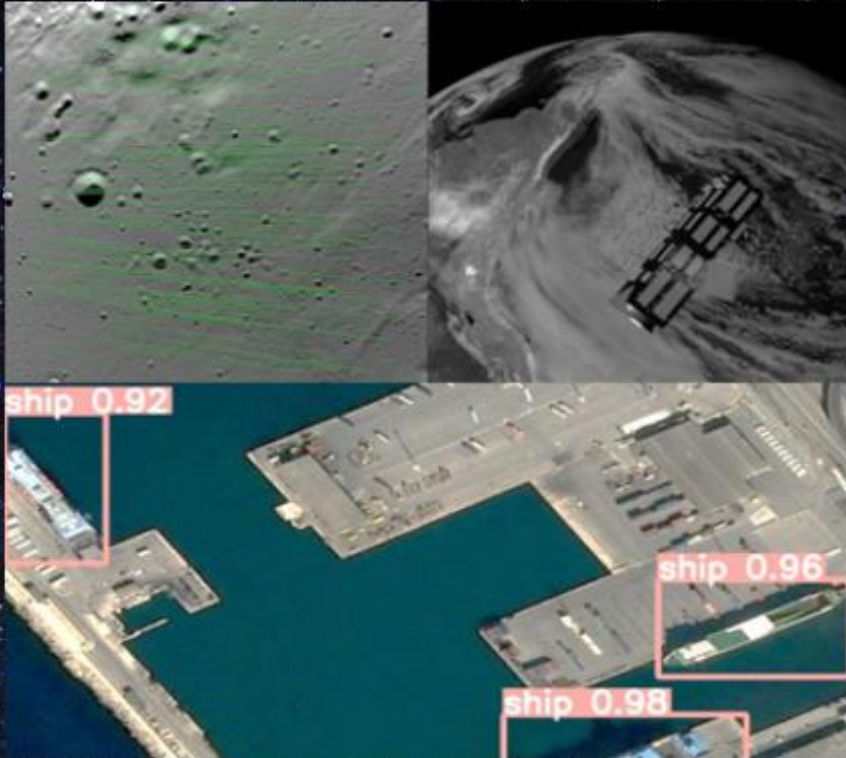
5.75x acceleration factor over traditional high-performance CPUs

### \* Satellite Pose Estimation

92% accuracy in detecting alignment/misalignment

### \* Earth Observation at Scale

AkidaNet (MobileNet-based) for real-time ship localization on the edge



Top-left: Lunar terrain reconstructed with a structure from motion algorithm; Top right: Monitoring Envisat Pose estimation measurements with a CNN or SNN; Bottom: Examples of ship detection.

EDHPC 2025 - 2nd European Data Handling & Data Processing Conference 11-12 October 17, 2025; Evaluation of Neuromorphic computing technologies for very, low power AI/ML applications - Indico at ESA / ESTEC

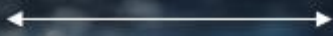
# Leadership in Synergy

## Looking Ahead

**FRONTGRADE**

**Gaisler's Heritage**

**25 years of gold-standard reliability.**  
 Providing the unbroken digital lineage that guarantees mission success where failure is not an option.



**brainchip\***

**BrainChip's Vision**

**The pioneer of event-based AI.**  
 Providing the cognitive power for the next frontier of exploration.

**"GR801 is the foundation, not the finish line."**

We are engineering the cognitive autonomy that will take humanity beyond the edge of the solar system.

**brainchip**<sup>TM</sup>  
Thank You

Get in Touch with  
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