Inuitive Breakthrough Solution for AR and VR Worlds

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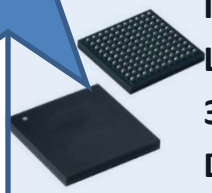
August 2016

Inuitive Background

- A fabless semiconductor startup company established 4.5 years ago with a mission to develop industry leading, cutting edge 3D Imaging and Vision Processors
- Located in the heart of the Israeli high tech industry there we are part of an emerging AR/VR technological ecosystem
- We are a team 80 R&D professionals – bringing ~1000 accumulated years of experience in the fields of Imaging, Computer Vision, Optics, Embedded Systems and System on Chip design
- We are developing both the System-on-Chip and the system around it
- Our first product, the NU3000, is already in production & well accepted as the smart sensor hub of choice by leading AR/VR HMDs developers
- Our next-gen product, the NU4000, is a revolutionary processor solution for any device that need to develop perception of the scene around it

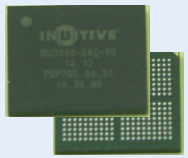
Our SoC Roadmap

NU4000



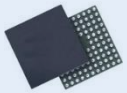
Improved depth and vision performance
Lower power, 28nm geometry
3D imaging accelerator Smart sensor hub
Deep Learning Processor
Connect to 6 cameras and a display
6.7x6.4mm

NU3000



Multi core CV and depth processor
Dedicated depth engine
40nm geometry
Connects to 3 cameras
12X10mm

NU4100 - *tentative*



Depth processor
Tango Tracking Algorithms
Connect to 4 cameras
4.0x4.0mm

	2014				2015				2016				2017	
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
NU3000	Samples						Qual							
NU4000													Samples	
NU4100														Samples

The Challenges

- Advanced implementations of VR/AR HMDs, Robots and Drones consists of many image sensors - can reach 6, 8 or more
- Many sensors → heavy image processing & computer vision requirements
- Heavy computing → memory becomes a bottle neck
- Advanced use cases (gaming, navigation) → low latency is critical
- Mobile use cases → power efficiency is extremely important
- Consumer electronics → mass-market penetration is gated by cost

Inuitive's NU4000 is designed to address those challenges and more

Inuitive Architectural Concept

- Market requirements justifies an optimized depth and vision processor which will combine between depth sensing accelerators, computer vision accelerators and computer vision processor(s)
- Inuitive approach is to adopt the most suitable processing technology/module for the different processing tasks:
  - NU4000 is integrating several types of processing engines to address different tasks of market's diverse use cases
  - Combining between highly optimized hardwire HW engines and fully SW programmable cores → best power/performance tradeoff
  - Use processing pipelines with dedicated SRAM → reduce DDR load
  - Offer ideal tradeoff between performance, scalability, flexibility, power consumption and cost
  - Best-of-breed architectural approach!!!

NU4000 Architecture

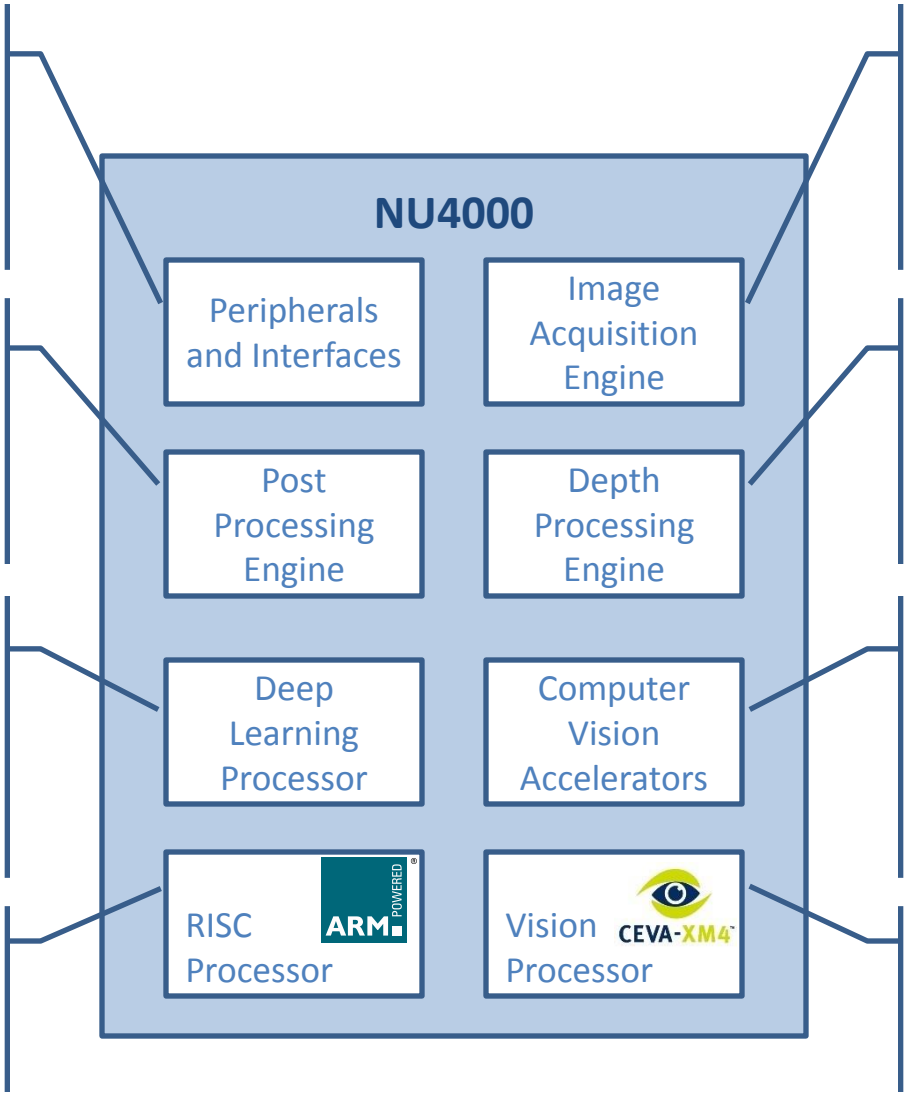
Best In Class 3D Imaging & Vision Processor

LPDDR2, LPDDR3,
USB2.0/3.0
4xUART, 2xSPI, 6xi2C,
I2S, 48xGPIO, 6xTimers,
2xWDT
Global Timing Unit

Image Scalers
ROI Cropping blocks
Histograms
Data Packing
Disparity to Depth
RGB-Depth Registration

Fully programmable
Convolutional Neural
Networks Engine.
Process >100 AlexNet
ROIs per seconds.
Reduce DDR bandwidth

ARM Cortex-A5 + FPU
& Neon co-processor
Running at 1GHz with
Embedded Linux OS



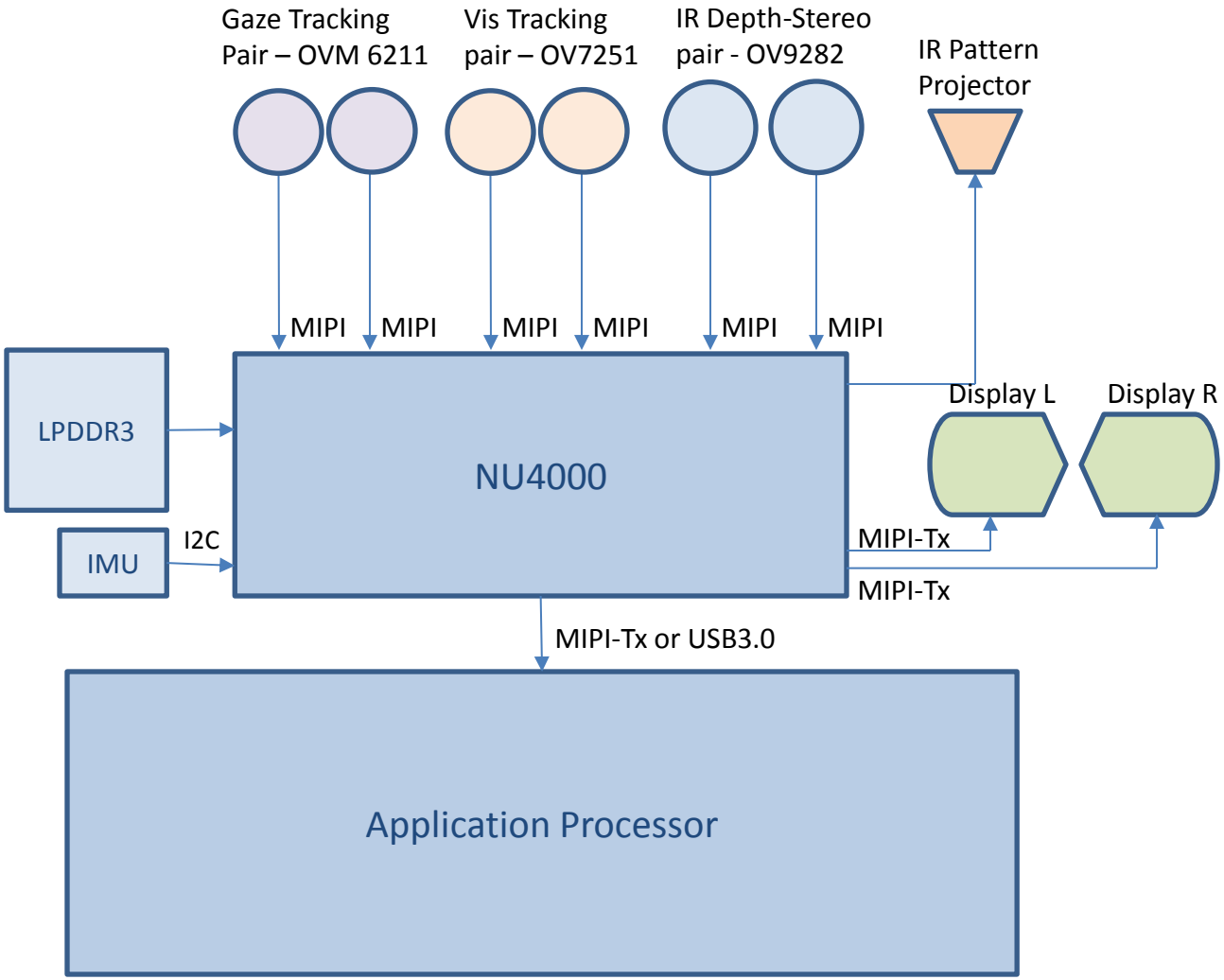
6 x MIPI-Rx Ports
3 x MIPI-Tx Ports
Stereo Pre-Processing –
Distortion Rectification
(120x90Deg), Images
alignment and balance

State of the Art Depth
from Stereo Engine,
3rd generation design
120Mp/s - FHD@60fps,
720p@120fps
Below 1msec latency

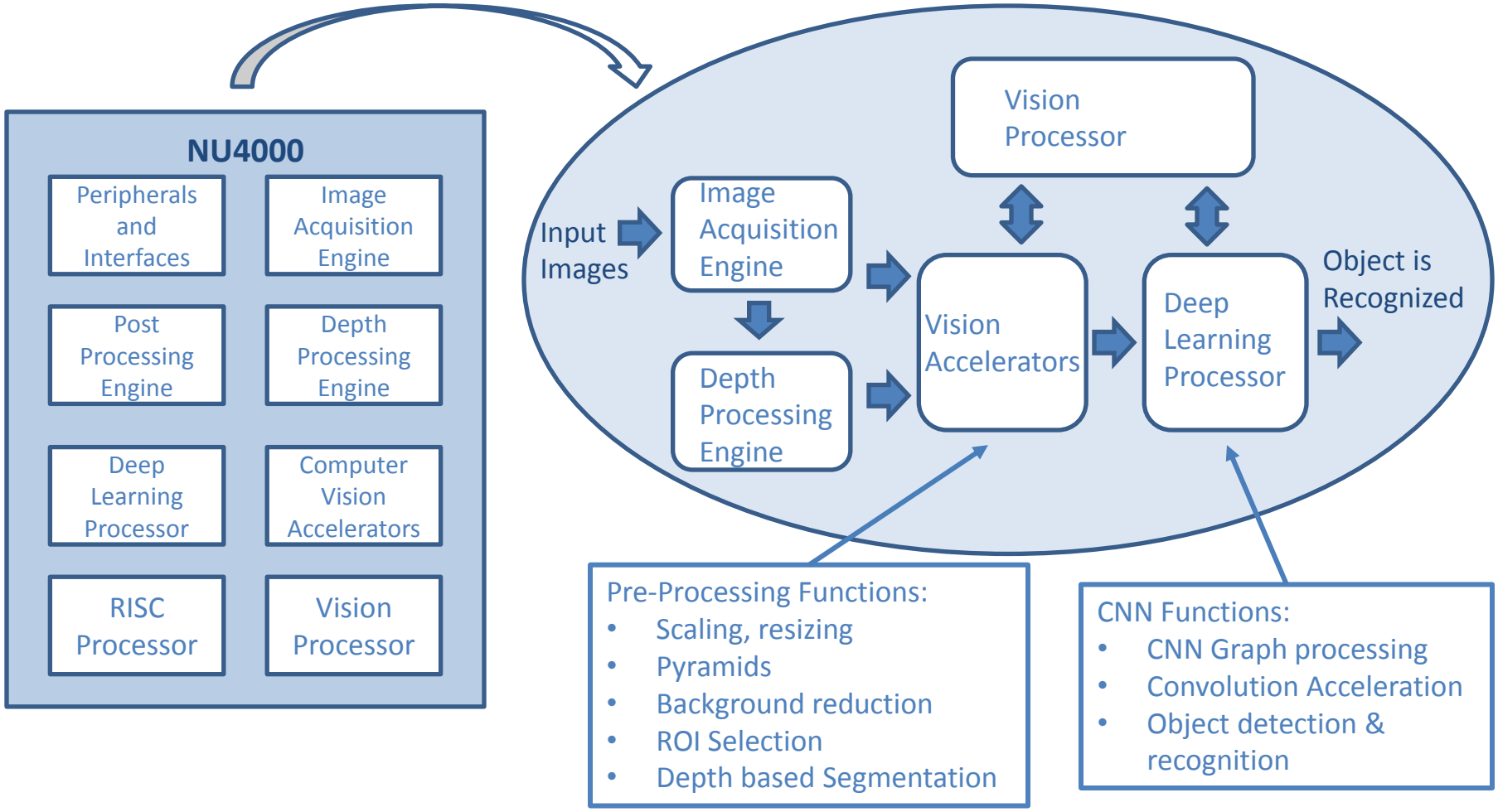
Very low power & zero
Latency Vision Modules
DoG, HoG, FAST, ORB,
FREAK & Normal Estimation
– HD@60fps or
2xVGA@60fps

Ceva XM4
Most advanced Vision
Processor in the market
running at 800MHz

VR/AR System Based on NU4000

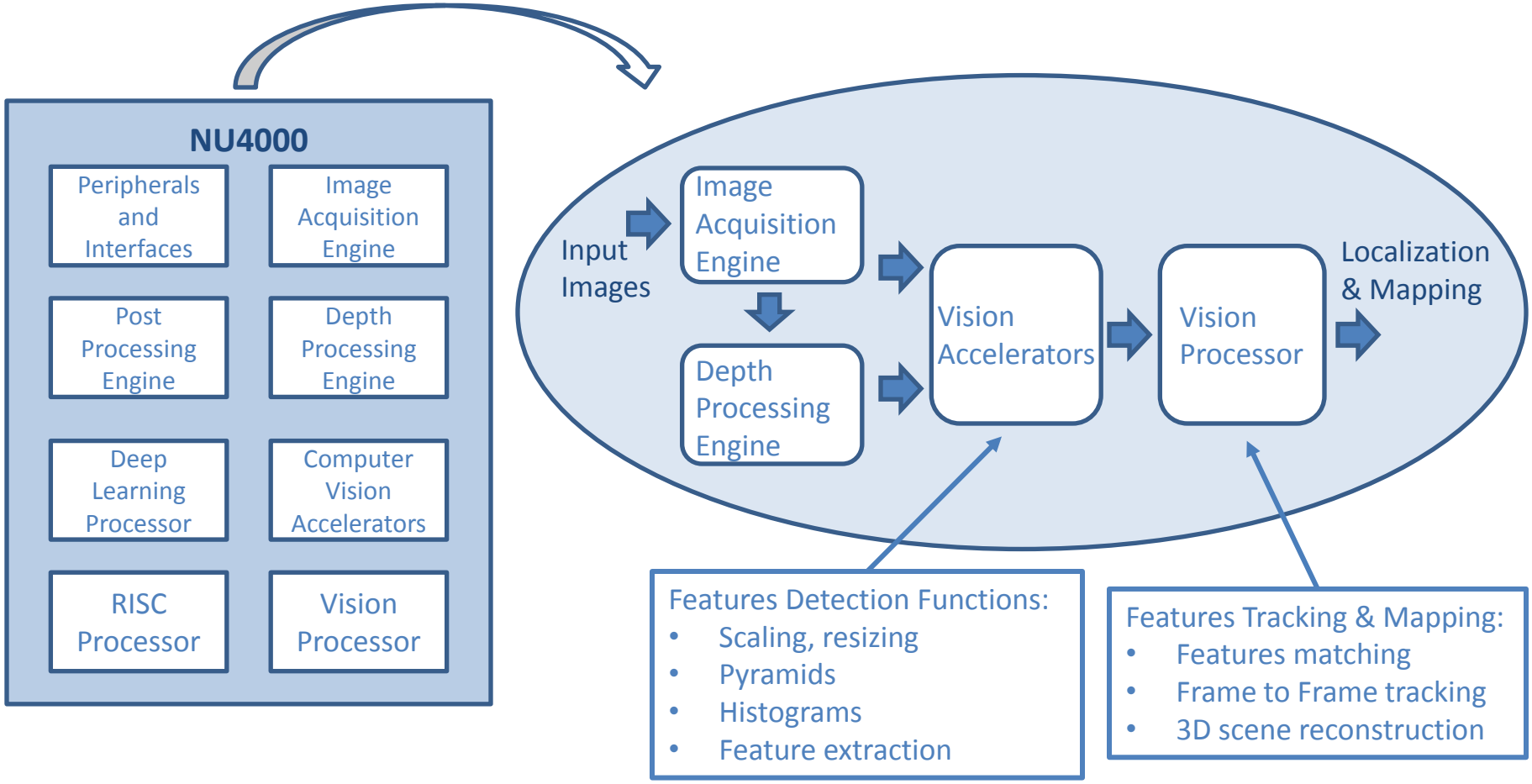


Example 1: Optimized CNN Solution by HW/SW



Optimized tradeoff between flexibility and performance

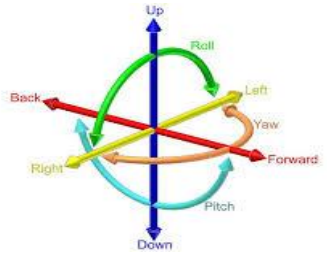
Example 2: SLAM Optimization by HW/SW

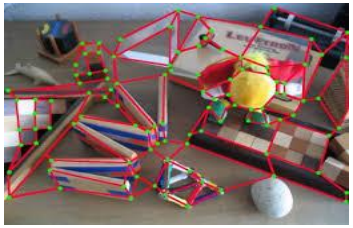


Optimized tradeoff between flexibility and performance

Inuitive Offering Advantages (1)

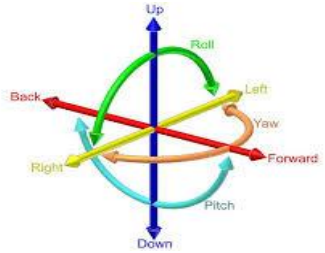
- Optimized solution for mobile devices - Low power, Small form factor
- Operates both indoor and outdoor
- Provide seamless coexistence of multiple users for both passive and active solutions
- Highly scalable and flexible solution – same chip suitable for multiple platforms and variety of use-cases by using off-the-shelf optical components
- Inuitive provides to its customer both powerful 3D Imaging & vision processor as well as system solution for depth sensing (optics, calibrations, reference design)

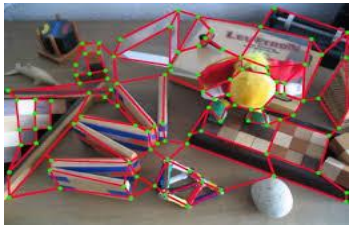




Inuitive Offering Advantages (2)

- Effective architecture for diverse applications – Mobile, AR/VR, Robotics, Drones, Scanning
- Unique architecture that addresses the challenges of VR/AR HMDs
  - The only solution to Combine depth sensing with computer vision
  - Best in class Vision Processor combined with Vision Accelerators:
    - Ultimate power efficiency
    - Best vision-performance/power & performance/$ ratios
  - Integrate all timing-critical sensing functions to one device/entity





Thank You!

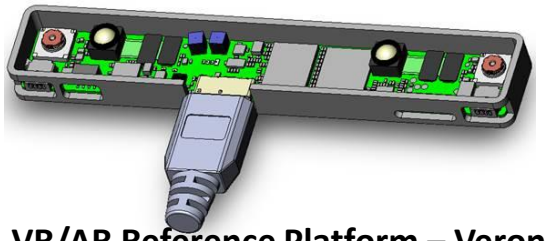
Reference Design Modules

Range / baseline

M3.1T
Released: Q3 3015
Applications: surveillance, elderly care tracking

M3.2 Line
Released: Q1 2016
Applications: Mobile, Google Tango
3 versions:

- **60mm baseline with color camera**
- **60mm baseline with Fisheye camera**
- **25mm baseline smartphone version (Twiggy)**



VR/AR Reference Platform – Veronica
Early Adaptors Release: Q3 2016
Wide FoV, VR Middleware
Applications: VR, AR

2015		2016			
Q3	Q4	Q1	Q2	Q3	Q4