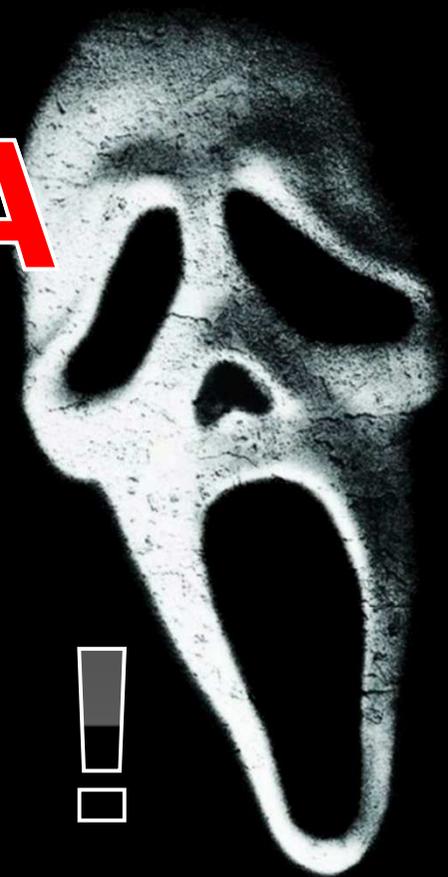




MundoGEO#Connect LatinAmerica



A
ASSUSTADORA
VERDADE
SOBRE
SENSORES !



Amauri Brandalize

MAIO de 2012

O que vai
acontecer em
10, 20, 50 ou **70**
anos ?

"Acho que há
mercado para uns
cinco computadores
no mundo"

~70 anos

Thomas Watson
Presidente da IBM
1943

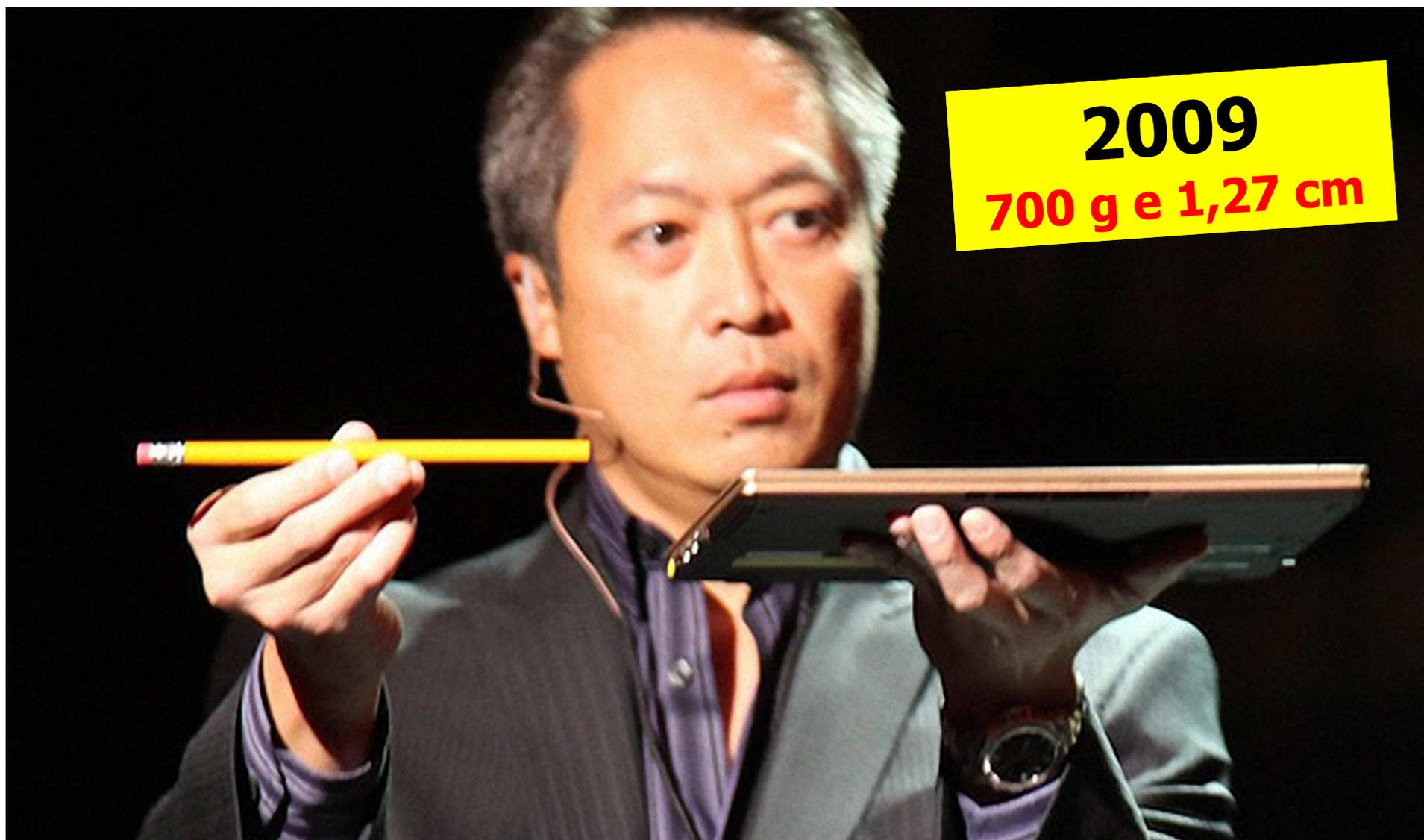


**“Os computadores
no futuro pesarão
não mais que **uma
tonelada e meia**”**

~60 anos

Revista *Popular Mechanics*

1949



2009
700 g e 1,27 cm

"Não há razão para
que alguém queira
ter um **computador**
em casa"

~35 anos

Ken Olson
Fundador da Digital Equipment Co.
sobre computadores pessoais

1977



2012
Quarto do meu filho ...

“É muito arriscado
fazer **previsões**.
Especialmente sobre
o **FUTURO**”

Arthur C. Clarke

Autor de obras científicas que inspiraram o filme

2001: Uma Odisseia no Espaço

1975

HAL 9000

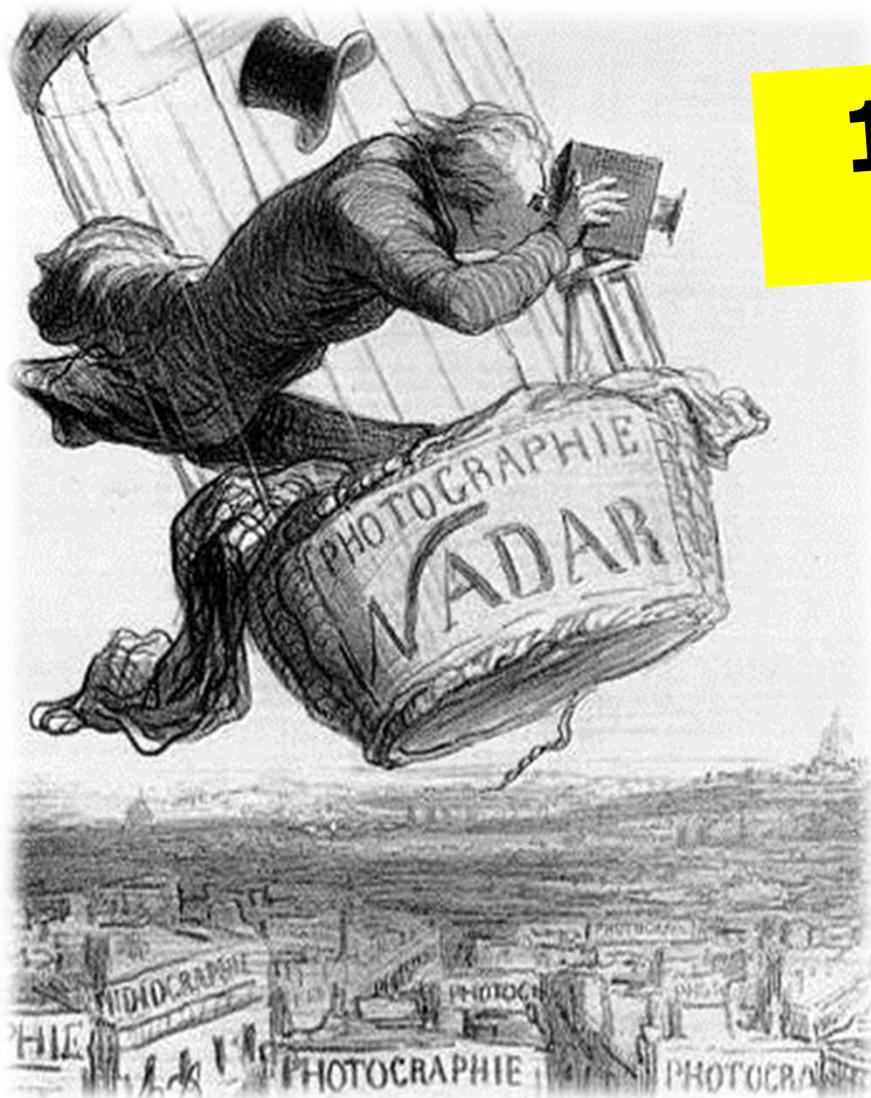
Hello, I'm Siri, your new personal assistant.

What can I help you with? 

HELLO DAVE

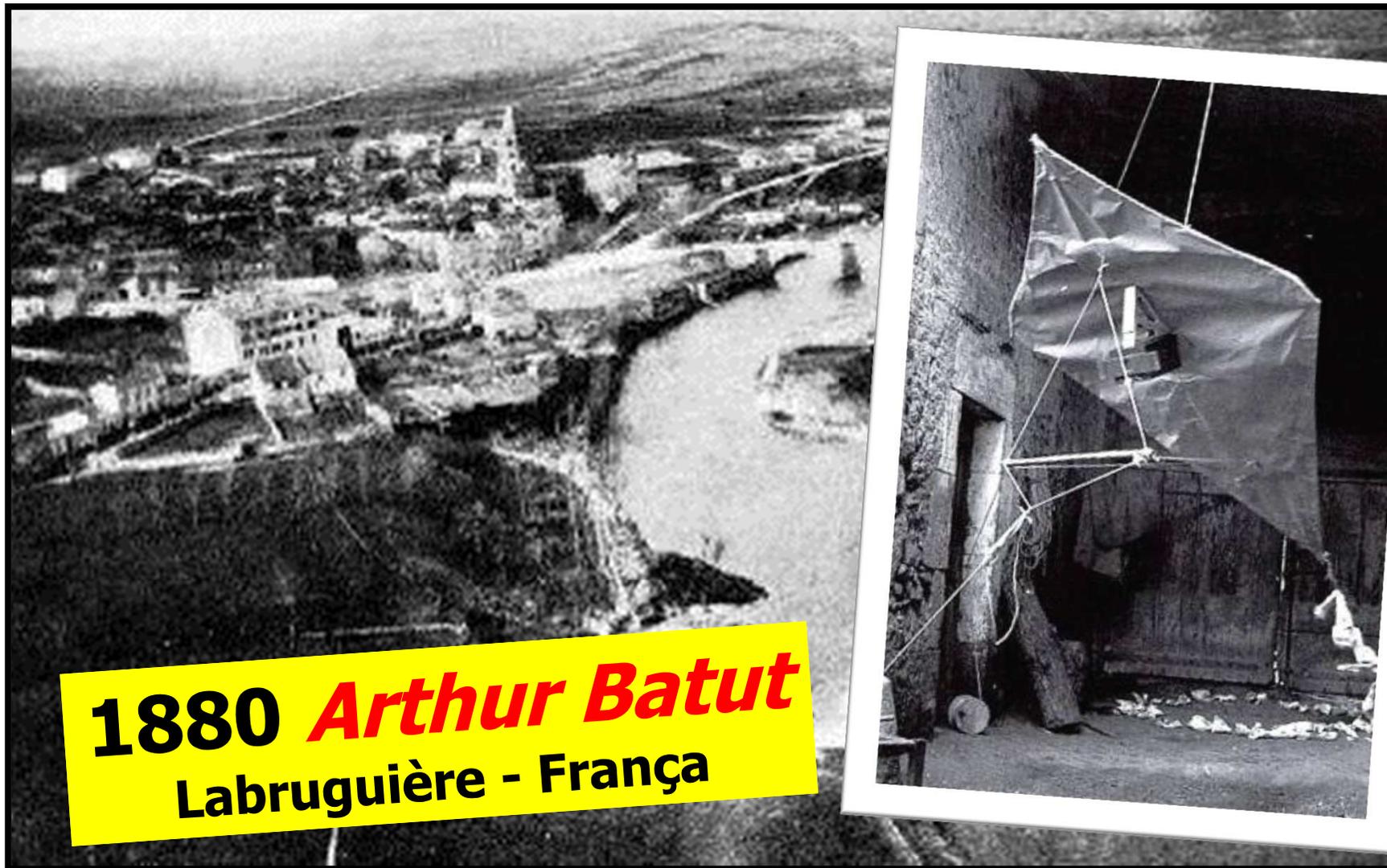


Aconteceu há
150, 100, 50, 10
anos ...

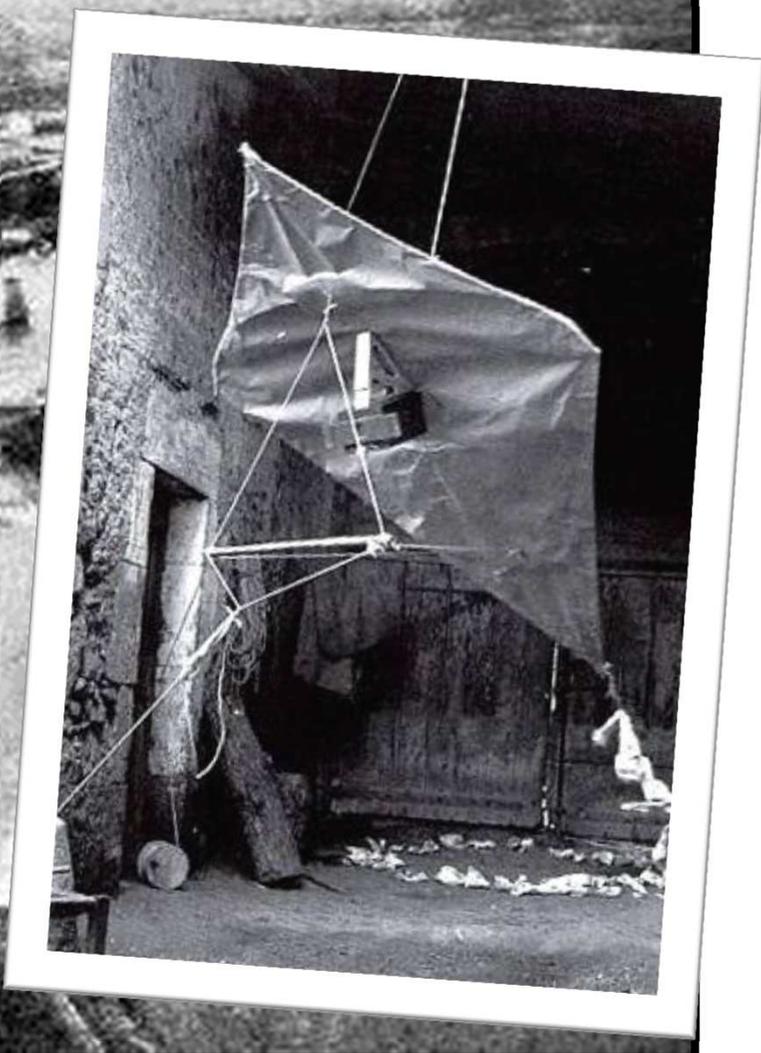


1858 *Félix Nadar*
Vale de Bievre - França





1880 *Arthur Batut*
Labruguière - França





1903/08 J. Neubronner
Kronberg - Alemanha



Câmara Aérea de



PEQUENO FORMATO

ou o primeiro

UAV ?

Fairchild K5 – cone de lente de 24"



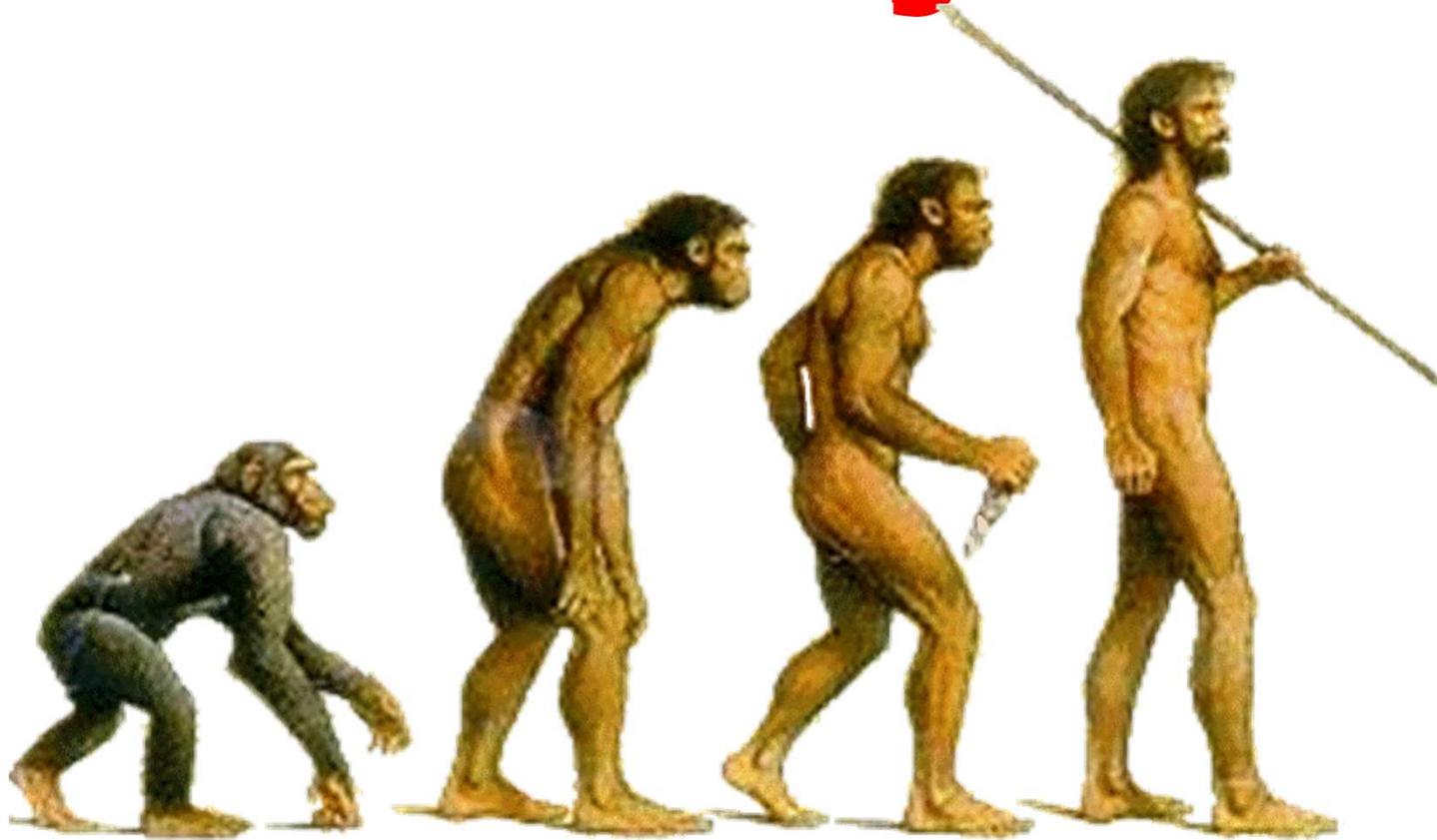
**Primeira Foto Aérea
em avião
1909 - Wright**



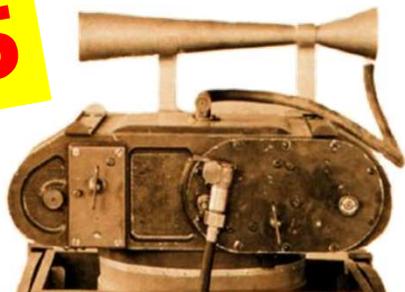
Wild C2 – f=165 mm

1927
Wild C1
1ª. Câmara Comercial

EVOLUÇÃO



1955



1996



40 anos



DA CÂMARA MANUAL PARA ...

A CÂMARA AUTOMÁTICA !!

Avanços Tecnológicos

1

LENTEs

2

FMC (Forward Motion Control)

3

PLATAFORMAS

4

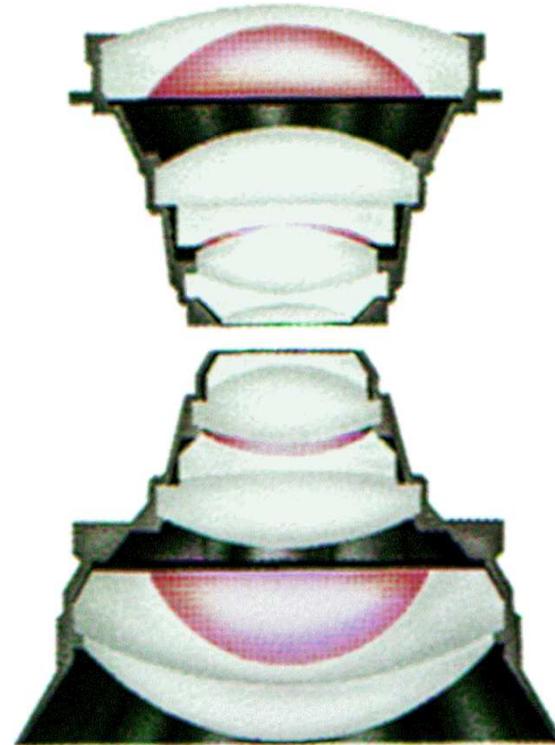
GNSS e INERCIAL

5

ELETRÔNICA

1

Lentes

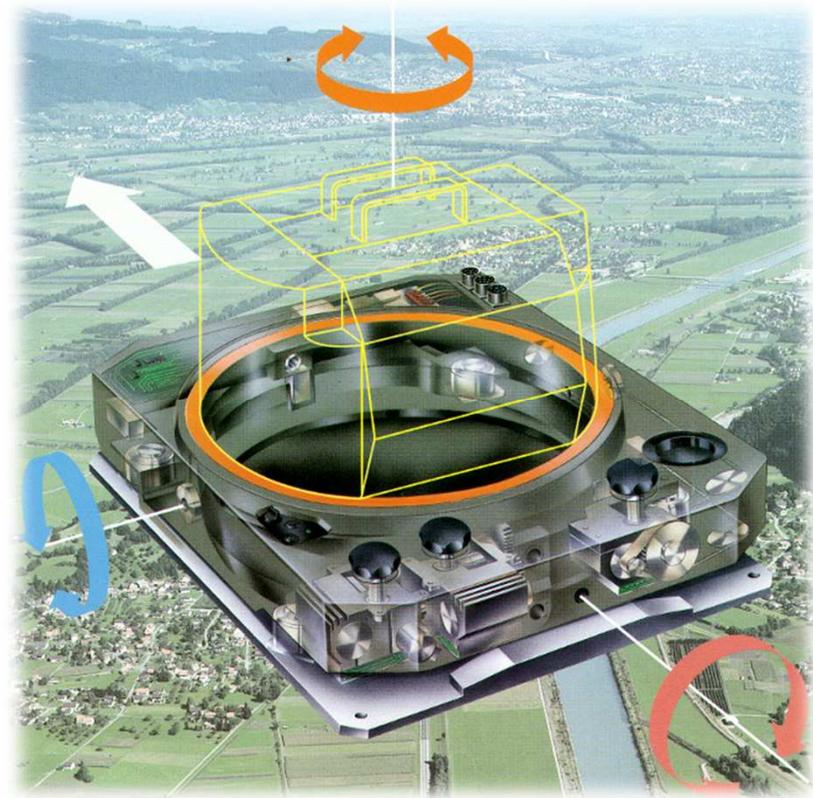


2

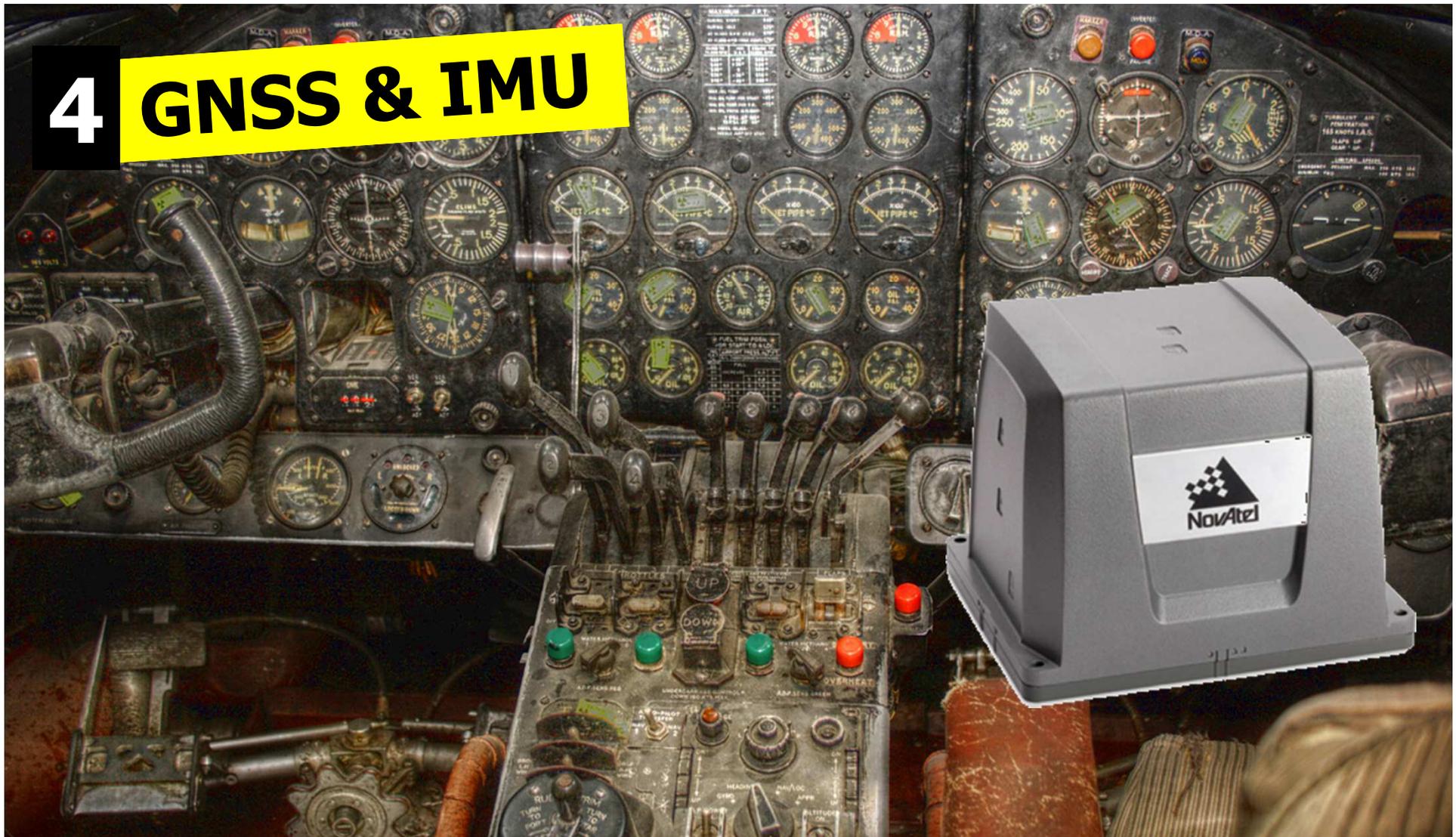
FMC



3 Plataforma



4 GNSS & IMU

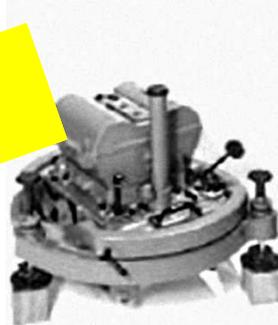


5

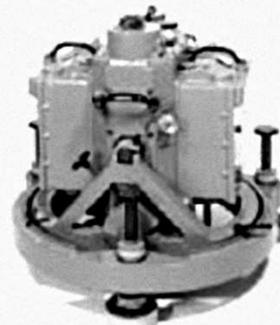
Eletrônica

ÓPTICO-MECÂNICA

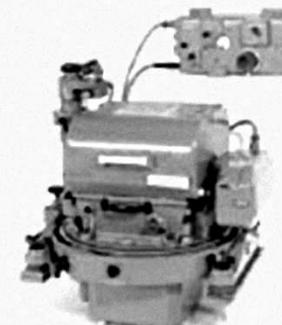
1935-1970



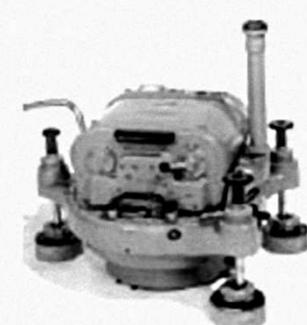
Wild RC5



Wild RC7



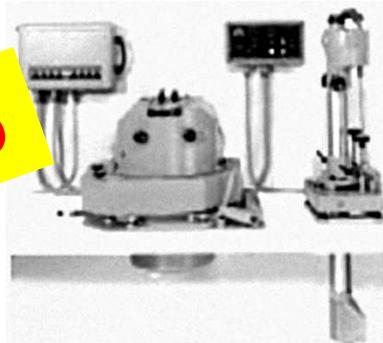
Wild RC8



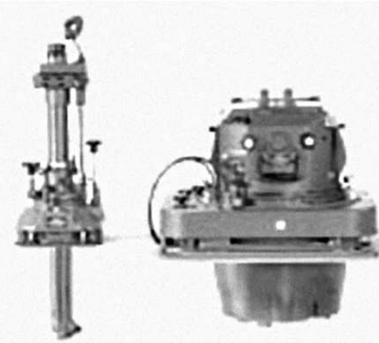
Wild RC9

ELETRÔNICA E MICROPROCESSADA

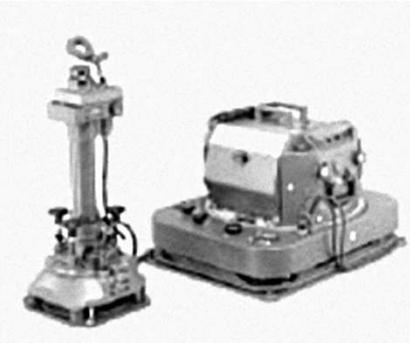
1970-1995



Wild RC10 eletrônica

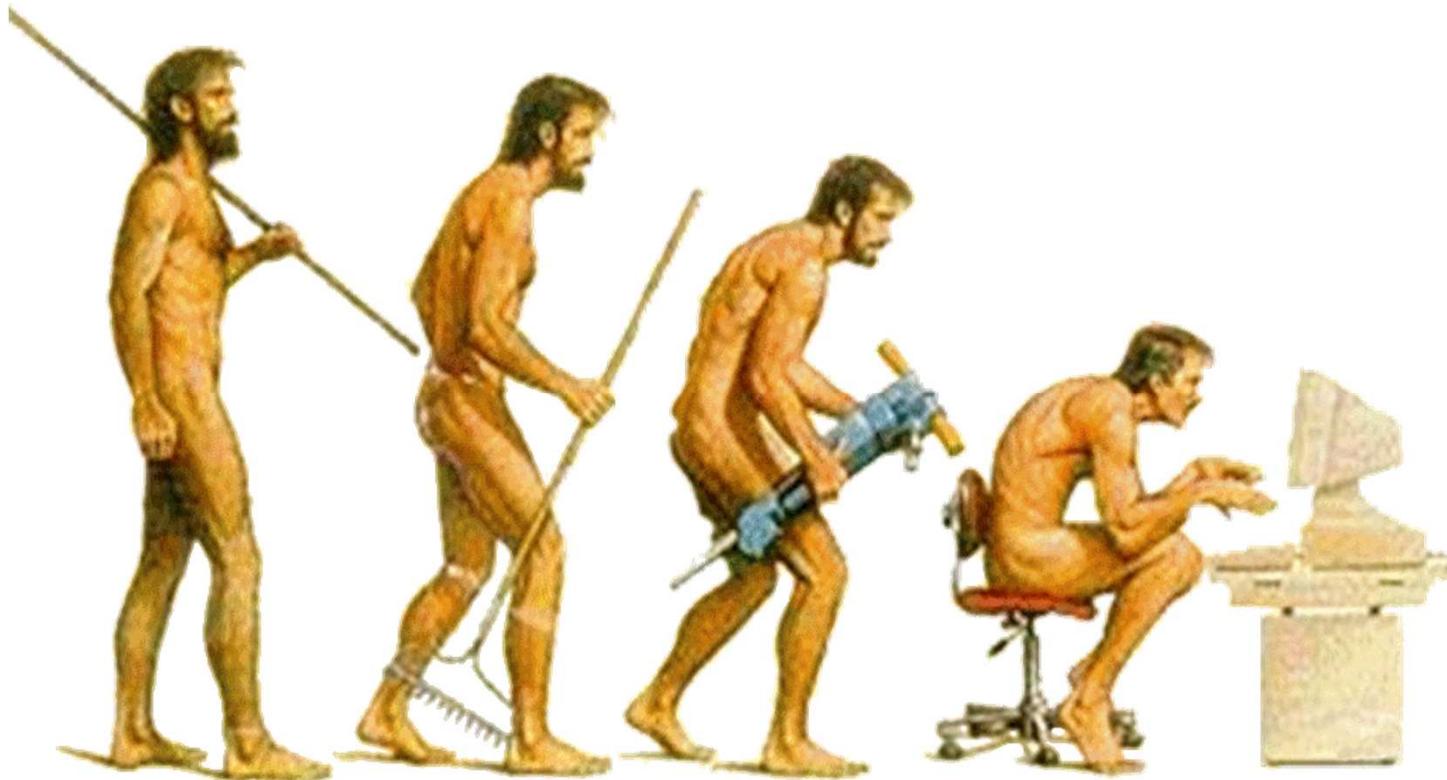


Wild RC10 microprocessada



Wild RC20 microprocessada

REVOLUÇÃO



1996



2001



5 anos



DA CÂMARA AUTOMÁTICA PARA

... A CÂMARA DIGITAL !!

**Somente Câmaras
Digitais desde 2007 !!!**



~1.100

Câmaras Aéreas no Mundo

+ de 60% digitais !



UC
MS Vexcel



DMCII
Hexagon Z/I



ADS
Hexagon Leica





Leica RCD30 – 60Mpx



IGI DigiCam – 60Mpx



Geoniss Airborne Digital System – 60Mpx



Icaros IDM200 – 80Mpx



Optech DiMAC Ultralight - 60Mpx

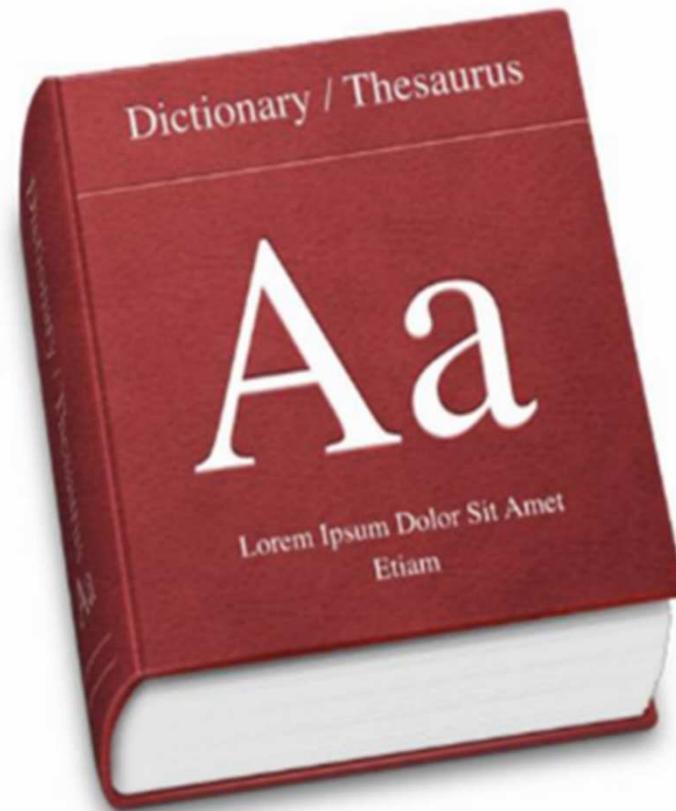


Trimble Digital Sensor System (DSS) – 39Mpx

A3
VisionMap



DEFINIÇÕES de FORMATO



2003 / 2004

As primeiras Câmaras de
GRANDE Formato tinham
a metade da

"quantidade de pixels"
das atuais Câmaras de
MÉDIO Formato

> 36 M px

**“Não se pode mais afirmar que
Câmara Aérea de Médio**

Formato

**é a câmara de lente única e
equipada com sensor CCD num
magazine de 6 x 6 cm”**

***EuroSDR – European Spatial Data Research
Performance of Medium Format Digital Airborne Cameras***

Novembro 2010



Fonte : EuroSDR, 2010



Fonte : EuroSDR, 2010

TECNOLOGIA dos FORMATOS



Tecnologia dos Formatos

1

PADRÃO DE CORES

2

LENTESES

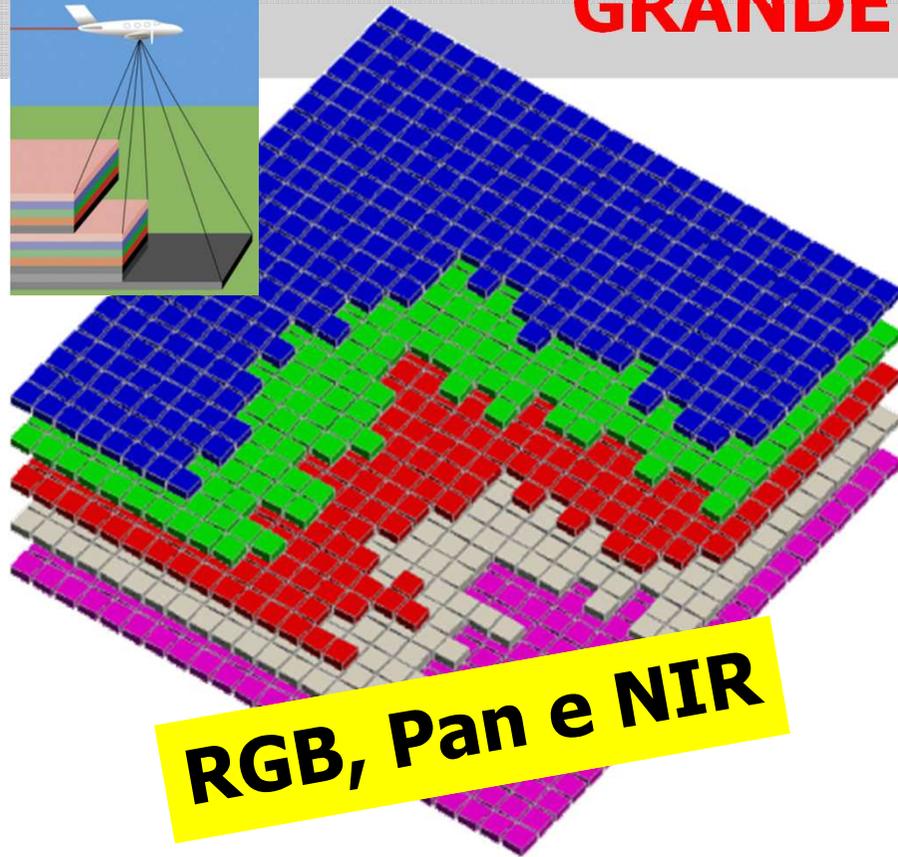
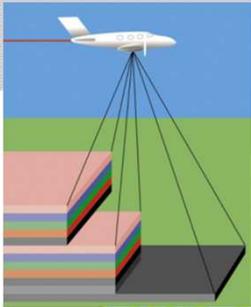
3

SISTEMA INERCIAL

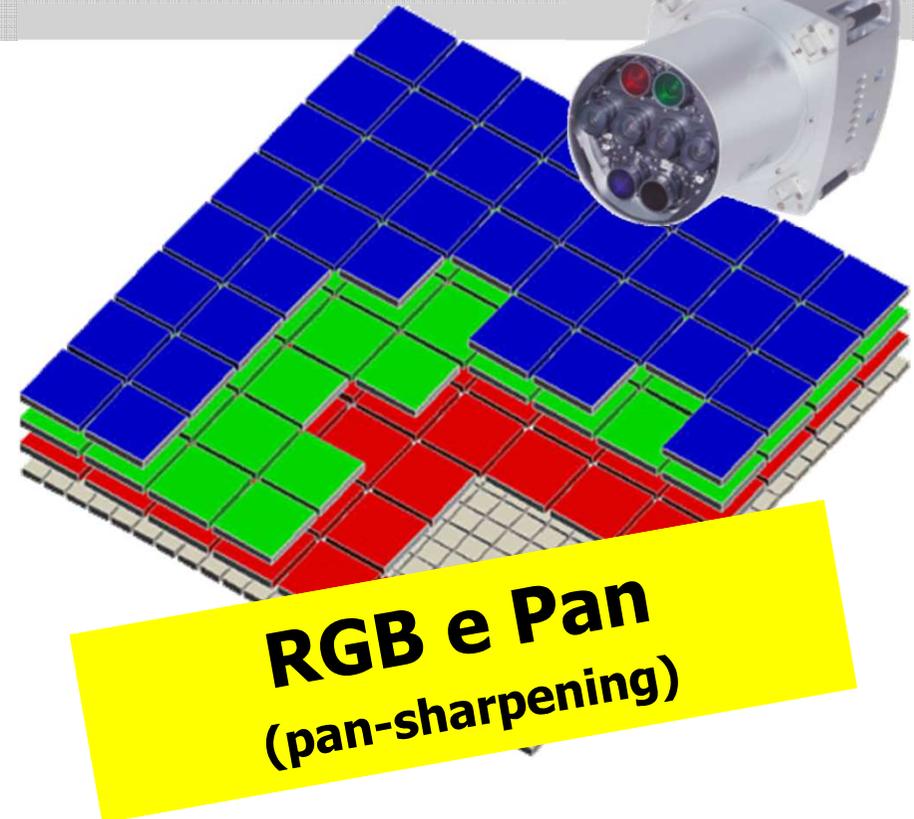
1

PADRÃO DE CORES

GRANDE FORMATO



RGB, Pan e NIR

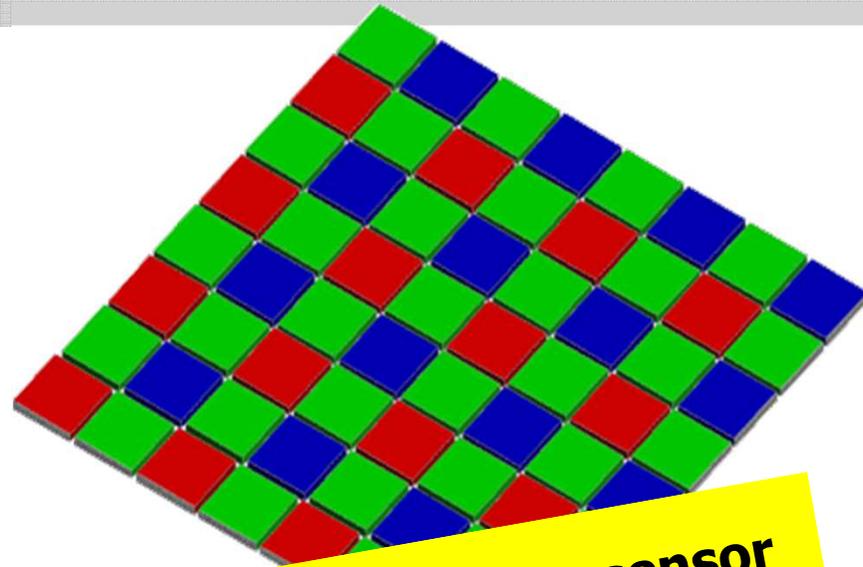


**RGB e Pan
(pan-sharpening)**

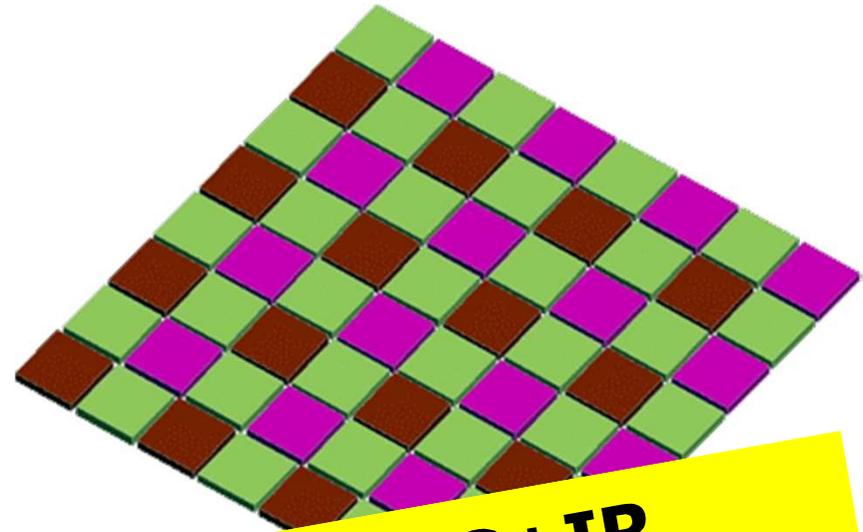
1

PADRÃO DE CORES

MÉDIO FORMATO

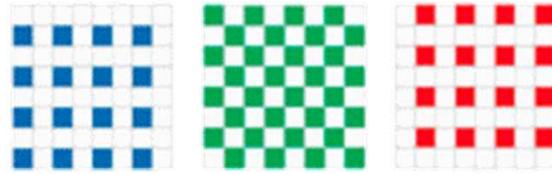
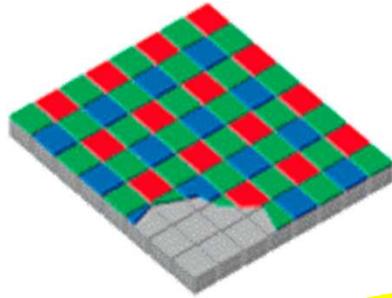


**R, G e B em único sensor
(Bayer)**

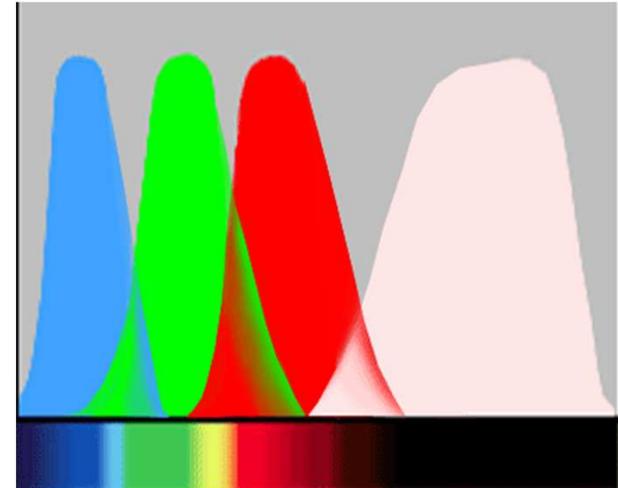


**R+IR, G+IR
(color infrared - CIR)**

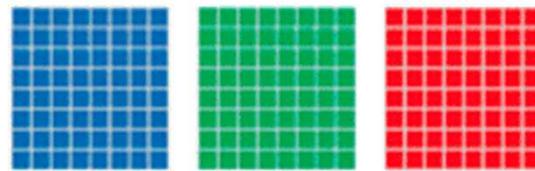
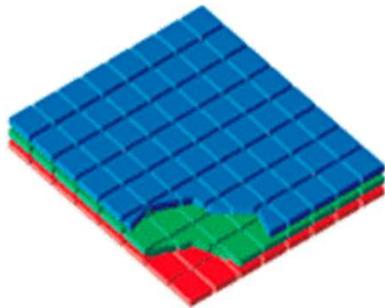
MÉDIO



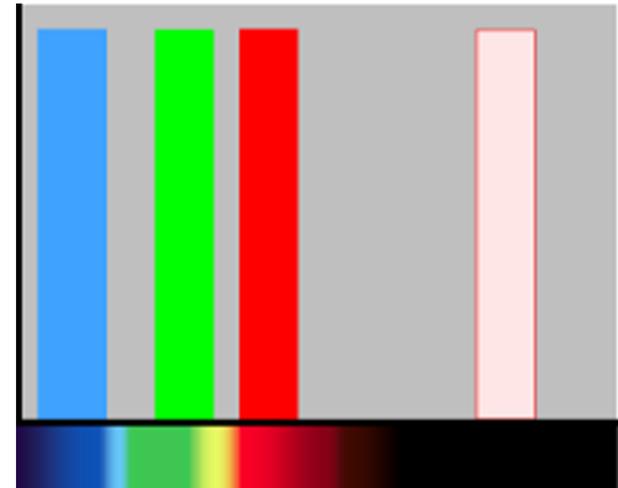
R,G,B composto



GRANDE



RGB 3 sensores



2

LENTES

GRANDE

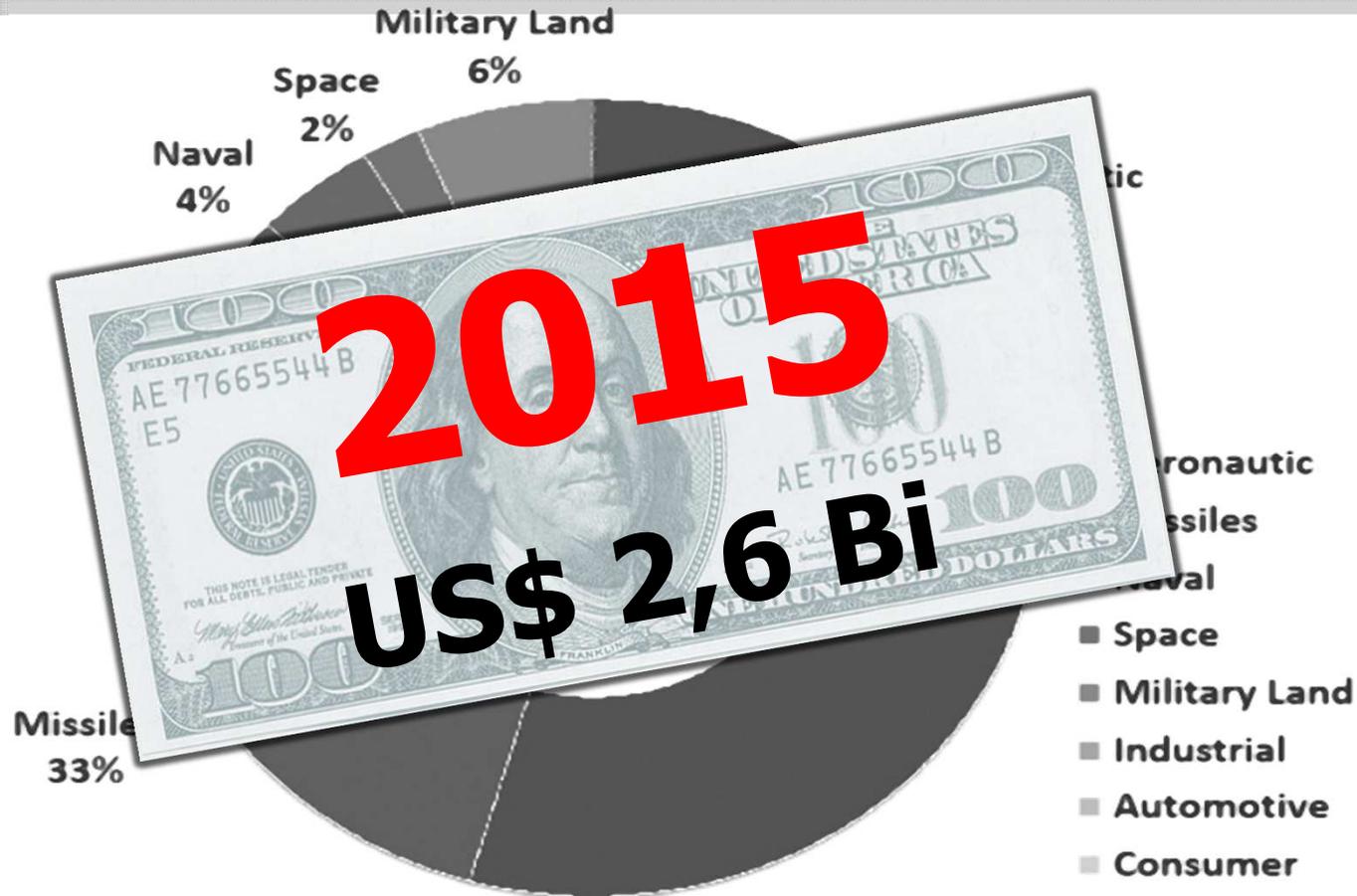


MÉDIO

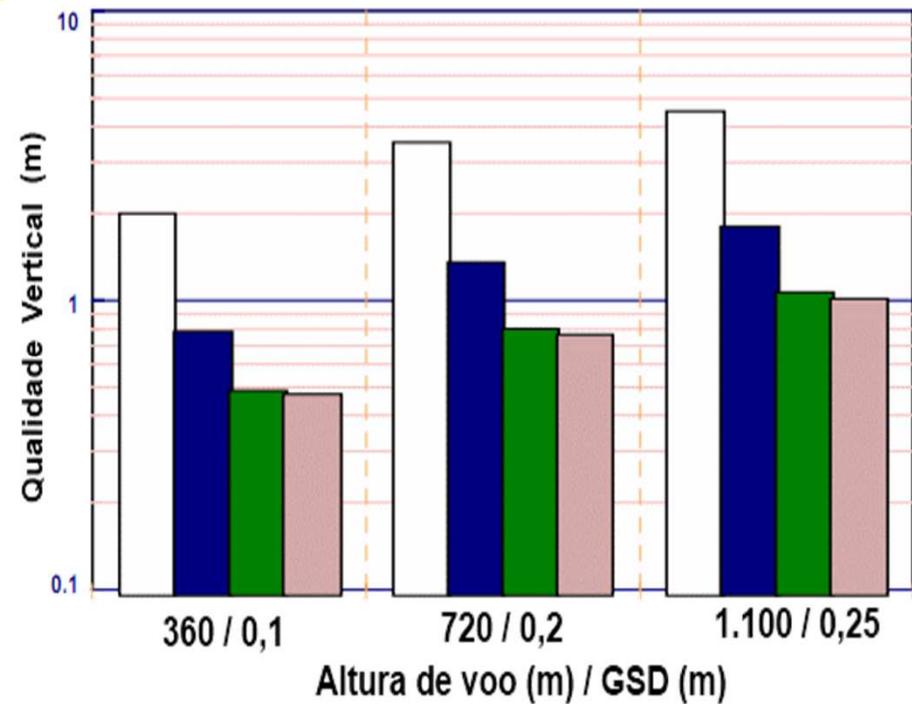
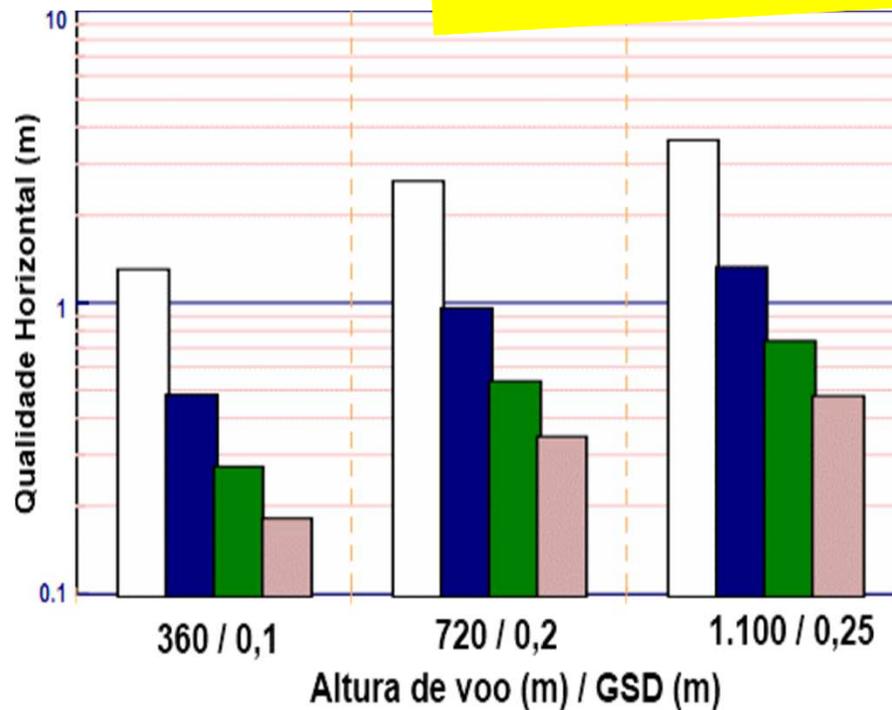


3

IMU (Inertial Measurement Unit)



20 pontos de controle Modelo Estereoscópico



PIOR

INTERM 1

INTERM 2

MELHOR



PROBLEMAS

Nuvens



Sombras

COM SOMBRA

SEM SOMBRA

RGB - GSD 13 cm - h=1.250 m

Sombras

COM SOMBRA

SEM SOMBRA

RGB - GSD 13 cm - h=1.250 m



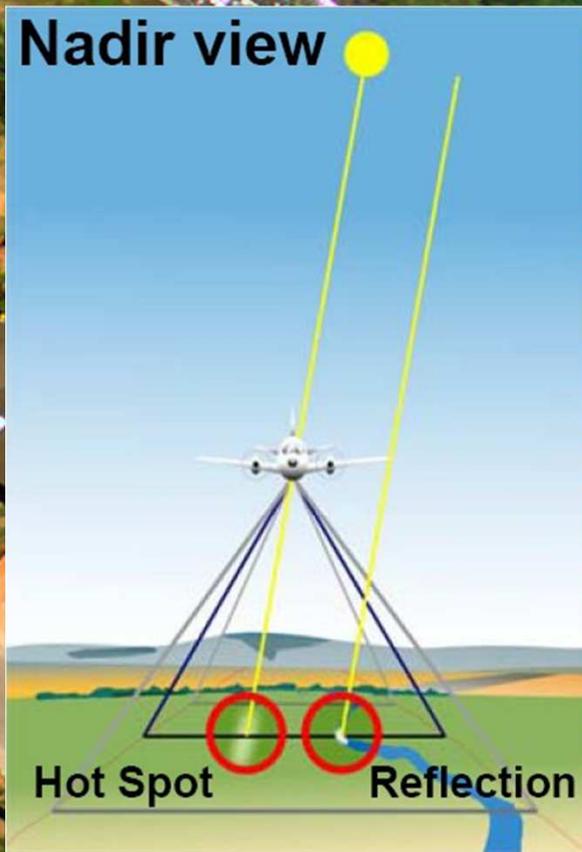
Hotspot

Reflexo

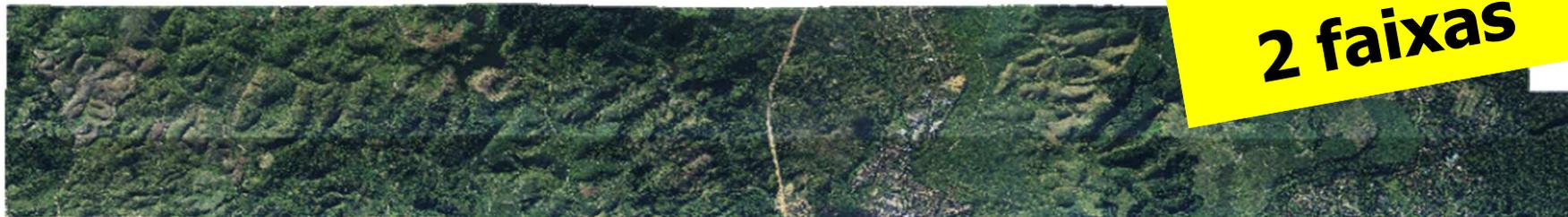


Reflexo

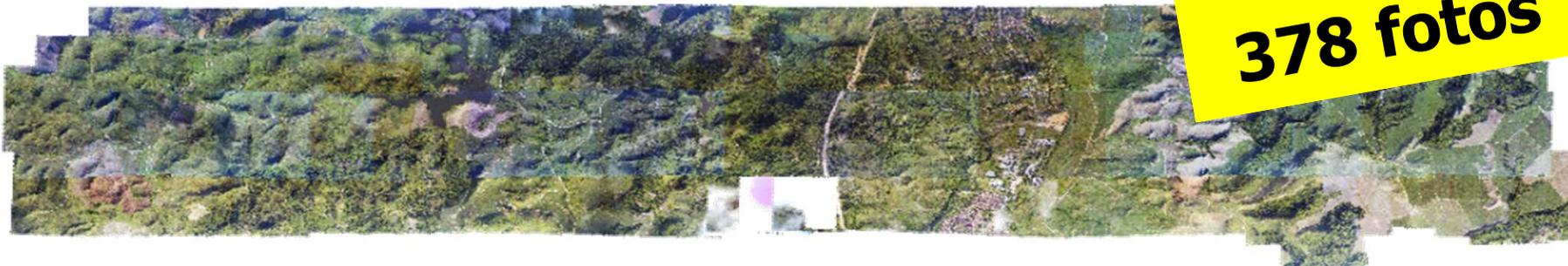
Nadir view



Quantidade de Imagens



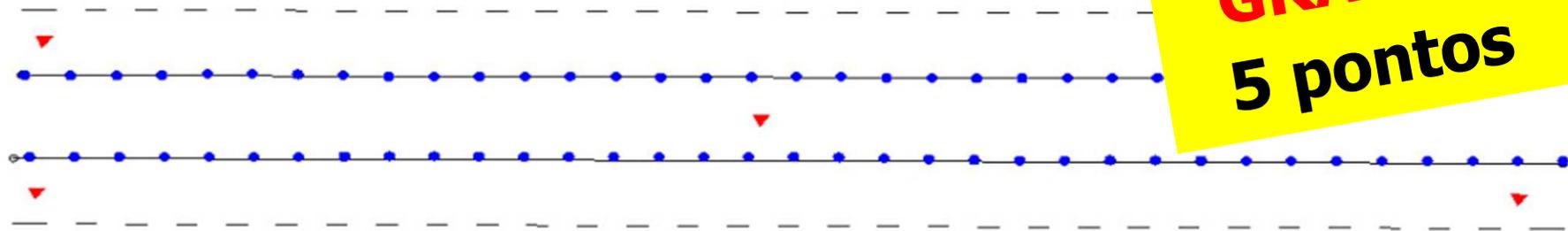
GRANDE
2 faixas



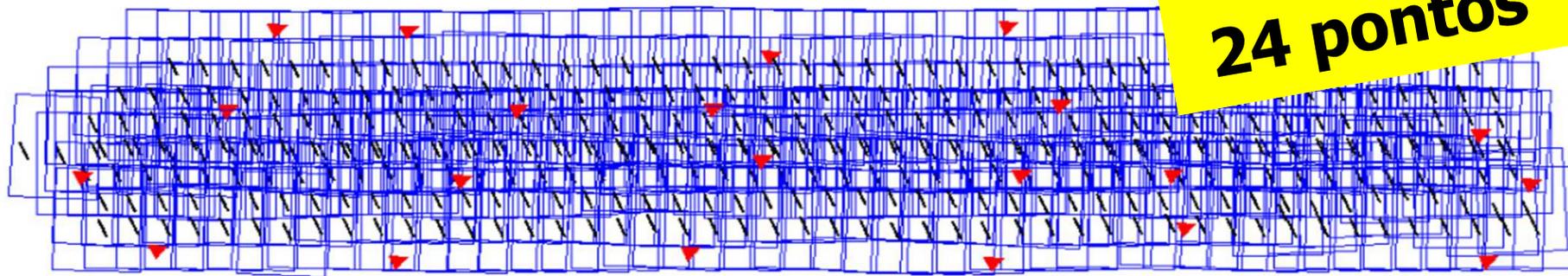
MÉDIO
378 fotos

Apoio Terrestre

GRANDE
5 pontos

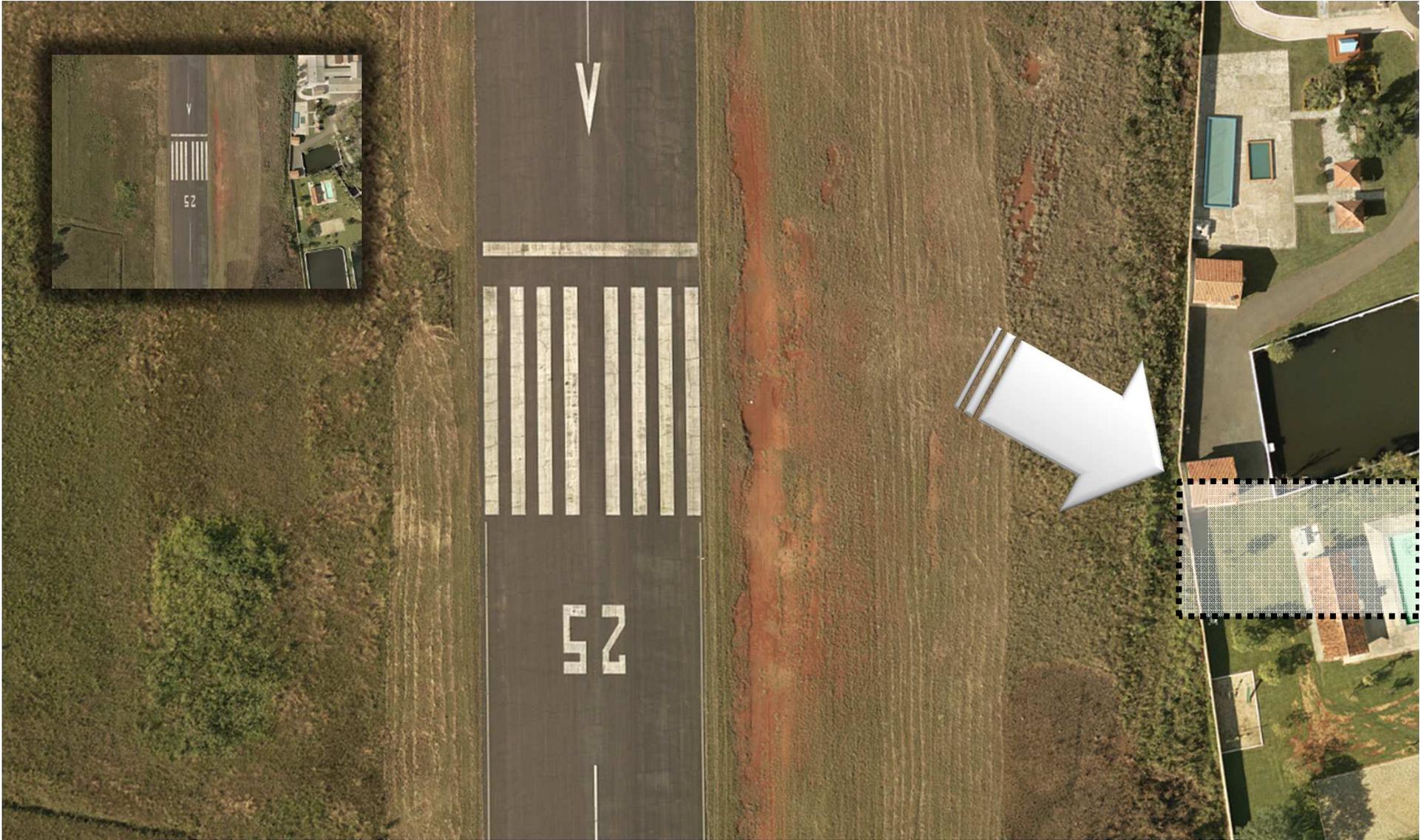


MÉDIO
24 pontos



IMAGENES





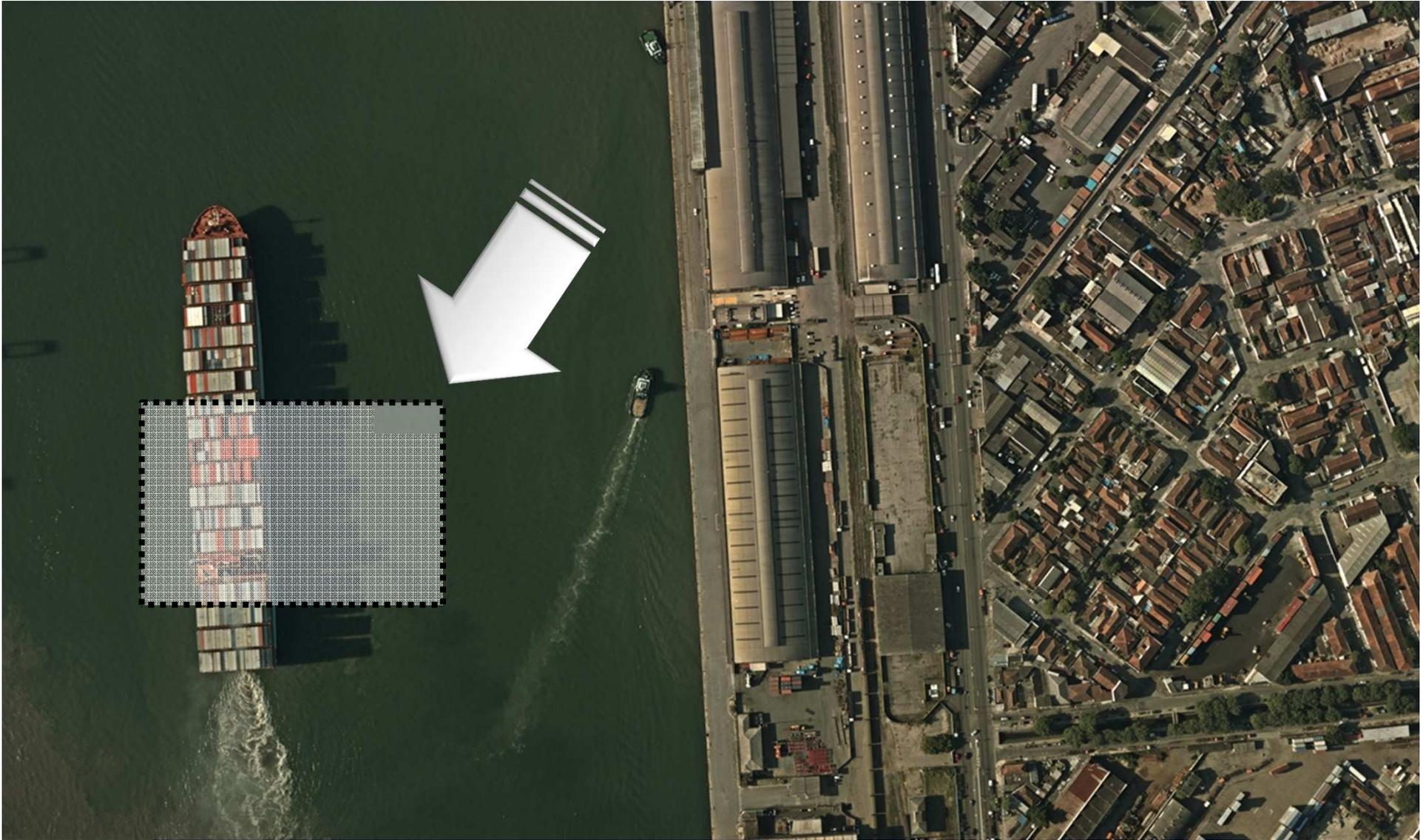




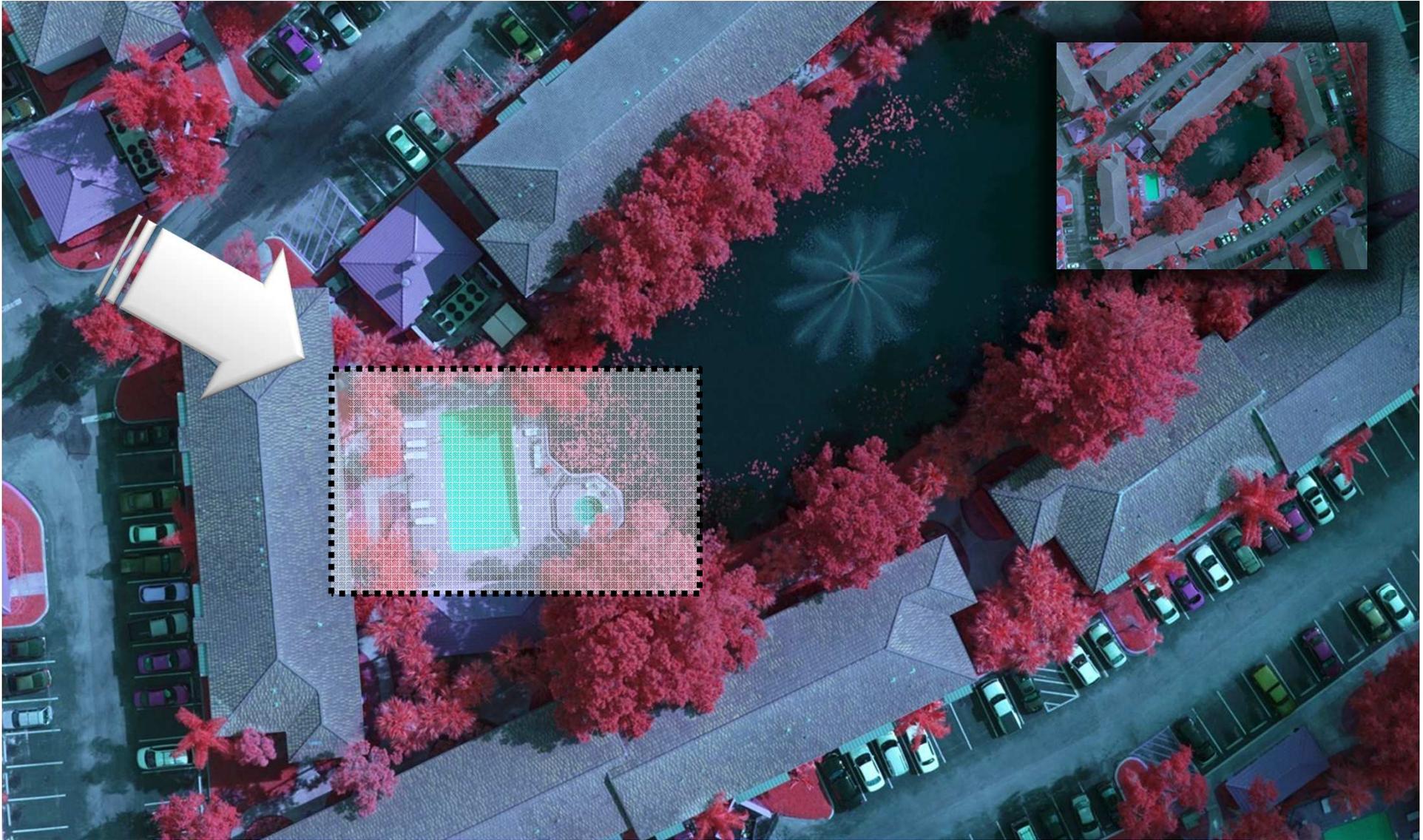
















COMPETIÇÃO



KAP (Kite Aerial Photography)
A partir de US\$ 100
(sem GPS!)

Copyright © 2011 Hamish Fenton



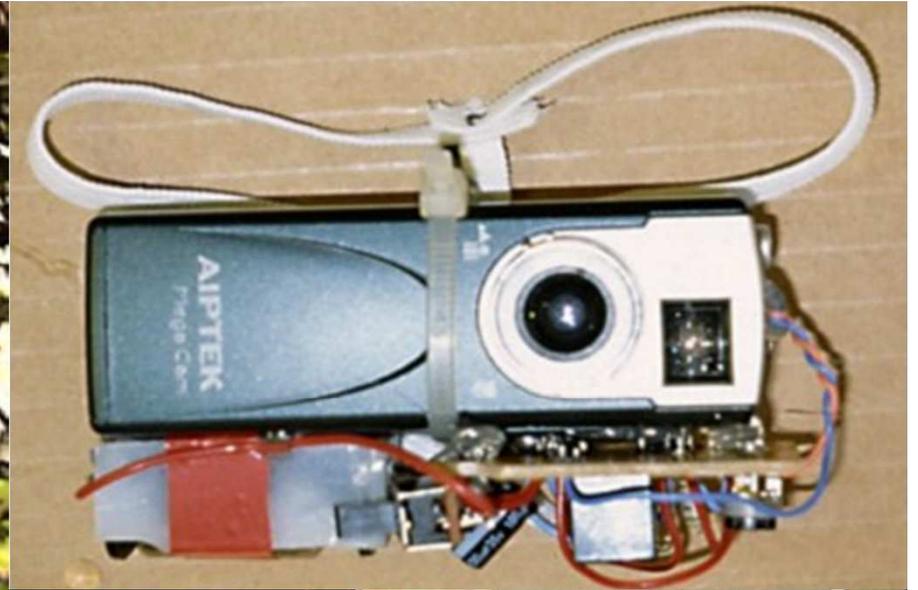
Note camera photographs

EXCLUSIVE USE PARKING SPACE IS APPURTENANT TO UNIT AND EXCLUSIVE USE PARKING SPACE IS APPURTENANT TO UNIT NO.

PROPOSED 10' WIDE SLOPE, UTILITY AND CONSTRUCTION EASEMENT.

EXISTING RIGHT WAY SEE L.C. # 04357 E







The Professional's Source
800.606.6969 / 212.444.6615

medium format search used store only

Succos Holiday Closing
The B&H SuperStore and Offices will close Wednesday, October 12, at 1:00PM

[Home](#) » [Search:medium format](#) » [Photography](#) » [Medium Format Digital Cameras](#)

Hasselblad H4D-60 Digital SLR Camera

HASSELBLAD



Product Highlights

- w/ 80mm Lens
- 60 Megapixels
- Wide 40.2 x 53.7mm CCD Sensor
- 16-Bit Color
- Wide ISO Range (100-800)
- 3" LCD
- True Focus w/ APL
- Phocus Software

B&H # HAH4D60L
Mfr# 70480533

[write a review](#)

Price: \$41,995.00

[Free Shipping \(USA\)](#)

IN STOCK

[No payments. No interest if paid in full in 6 Months. On](#)

Geoniss Airborne Digital System



Protect Your Purchase

[Learn More](#)

- 3-Year: \$2,399.99
- 5-Year: \$4,799.98 **best value!**
- No coverage

1

What item is right for you?

Ask our Experts!

[800.606.6969](#) [Live Chat](#)

Remember the Essentials

A memory card is not included with the camera.
Get a high-capacity memory card so you don't get caught without memory.



Fonte: site BH New York - 2011





DIRETÓRIOS





2008...

35 países

260 membros

EVENTOS

**International RPAS
Policy Forum
Junho 2012 - Paris, França**

Speakers From 19 Countries

Australia, Austria, Belgium, Brazil, France, Germany, Greece, India, Israel, Italy, Japan, Netherlands, Norway, Russian Federation, South Africa, Spain, United Kingdom, Ukraine, USA

10 European & International Organizations

European Defence Agency; EUROCONTROL (2x); ECAC - European Civil Aviation Commission DG Mobility & Transport; FRONTEX; ICAO - International Civil Authorities for Rulemaking on Unmanned Systems; SESAR Joint Undertaking

3 Standards Organizations

ASTM (F38), USA - EUROCAE (WG73 & WG93), France - RTCA (SC203), USA

6 National Governmental Organizations - Non-Military & Military

JAXA - Japan Aerospace Exploration Agency, Japan; Ministry of Infrastructure and the Environment, The Netherlands; NASA - National Aeronautics & Space Administration, Dryden Flight Research Center, USA; French Army, 61st Artillery Regiment, France; Ministry of Defence, Conseil Général de l'Armement, France; Royal Army, 32 Regiment, UK;

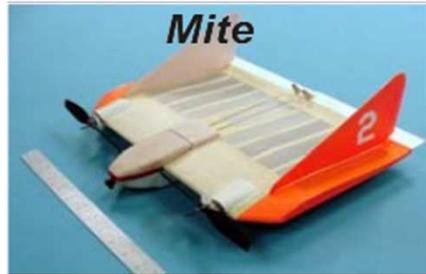
20 Industry Representatives

Aermatica, Italy; Aerofilms, Greece; AeroVironment, USA; Aratos Technologies, Greece; AVINOR, Norway; European Unmanned Systems Centre, UK; General Atomics Aeronautical Systems, USA; Indra, Spain; LFRG Ltd, Australia; Market Info Group, USA (India office); MultiModis M.M.Ltd., Israel; ProxDynamics, Norway; microdrones, Germany; Mitre Corporation, USA; Nova Integrated Systems, India; Padina Group, USA; QinetiQ, UK; Rheinmetall Defence Electronics, Germany; Sagem Defence & Security, France; Schiebel Aircraft, Austria

4 Research Organizations & Academic Institutions

CSIR, South Africa; Deusto University, Spain; TsAGI, Russian Federation, Russian Federation; Zhukovsky National Aerospace University

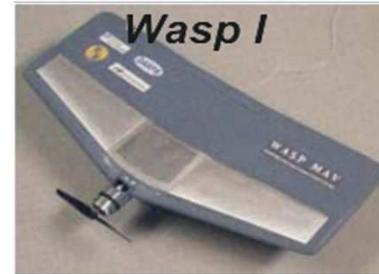
MICRO



Mite



Carolo C40



Wasp I



DragonSlayer

MINI



SensorCopter



Copter 1



Tracker



SkyLark I

PEQUENO ALCANCE



RMax II



Luna



Camcopter



CR

CURTO ALCANCE



RMax II



Luna



Camcopter



CR



GoldenEye 50



Phoenix



Pchela



Crecerelle

MÉDIO ALCANCE



Shadow 200



Sperwer



Ranger



FireScout

LONGO ALCANCE

A-160 Hummingbird



Bateleur



Heron TP



Predator A



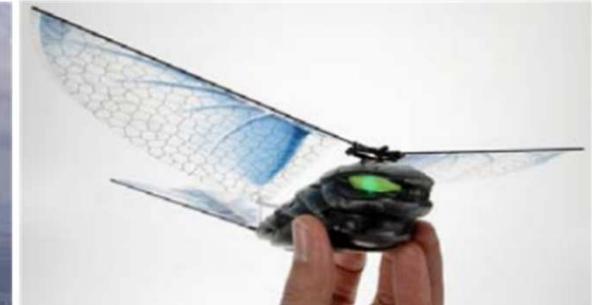
Eagle 1



Hermes 1500



ESPECIAIS ou ESPACIAIS





Take-over by pilot possible during any flight phase using emergency push button



Predator RQ-1
512 Kg - 1.020 Kg



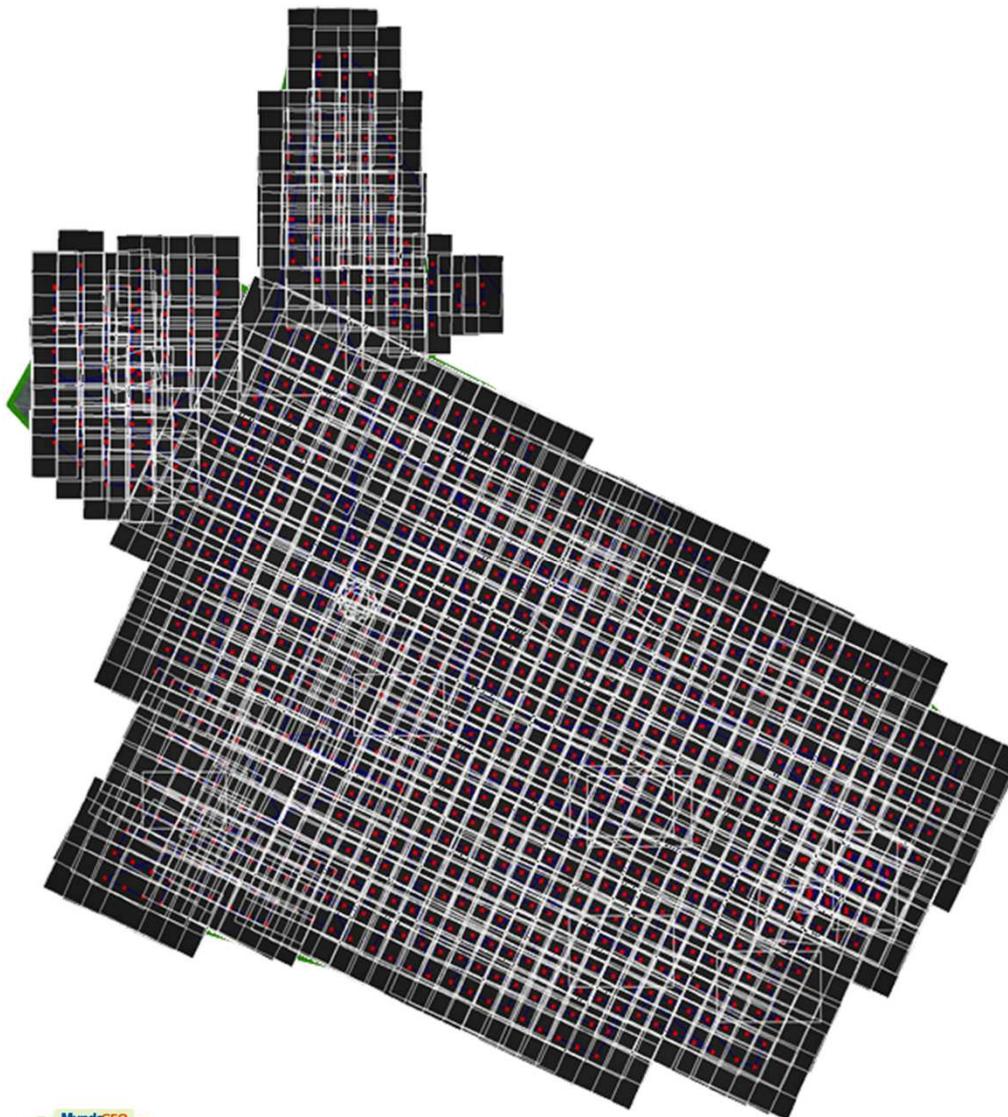




A USAF forma mais pilotos de UAS do que de aeronaves tripuladas !!

EXPERIÊNCIAS





NUS (National University of Singapore)

ÁREA

- 1,6 km²
- Variação de 75 m no terreno (ponto mais alto e mais baixo)
- Edifícios com até 60 m

PARÂMETROS

- 800 imagens em 42 voos
- Blocos máx de 5 faixas por 5 fotos
- Altura de voo < 150m (link com UAV e regulamentação de voo)
- Escala = 1: 9500
- GSD = 5 cm
- Superposição longitudinal = 80% e lateral = 60%
- Área coberta no terreno = 216 x 144 m

EQUIPAMENTO

- Sony NEX-5 CMOS 1,11"
- 14,2 Mpixel
- Focal de 16 mm

“A nossa experiência indica que, até mesmo em áreas relativamente pequenas, o UAV requer **muitos pousos e decolagens e muitas imagens.**”

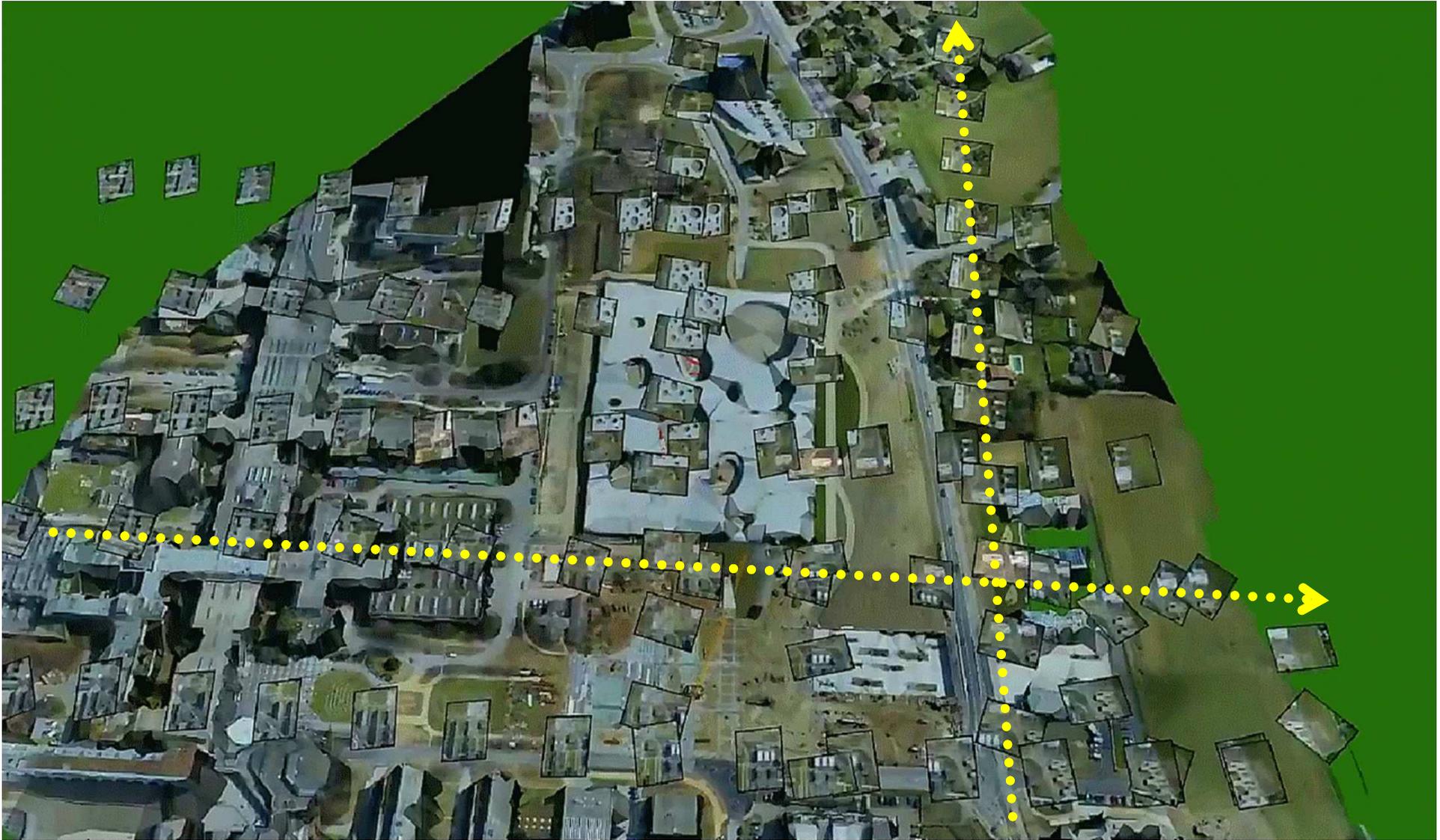
“Portanto, não devemos considerar plataformas UAV como algo competitivo para as imagens aéreas padrão, mas sim como **uma tecnologia complementar**, que em situações bem específicas pode ser vantajosa.”

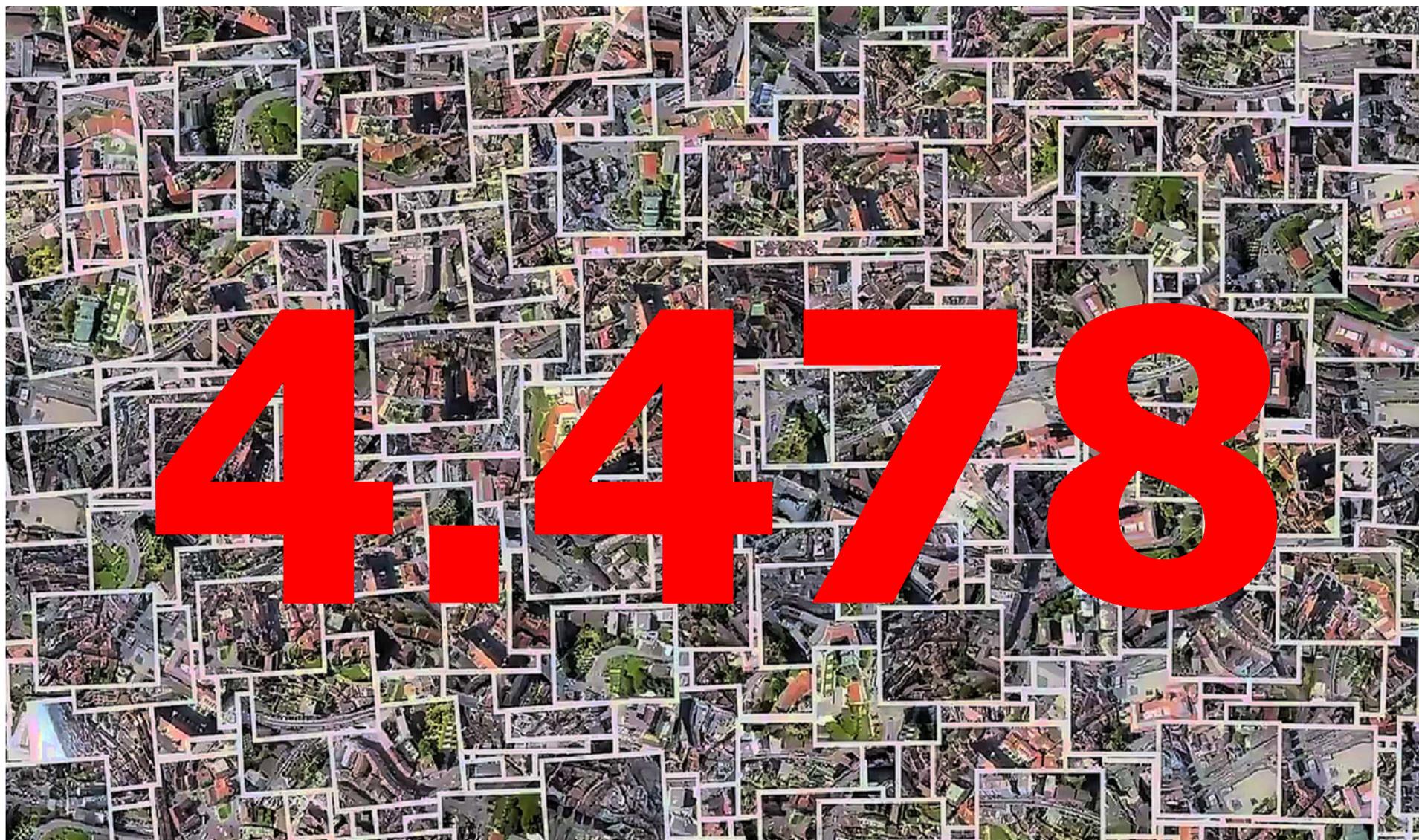
Prof. em. Dr. Armin Gruen

Pesquisador no Singapore-ETH Centre for Global Environmental Sustainability

Future Cities Laboratory

Março 2012









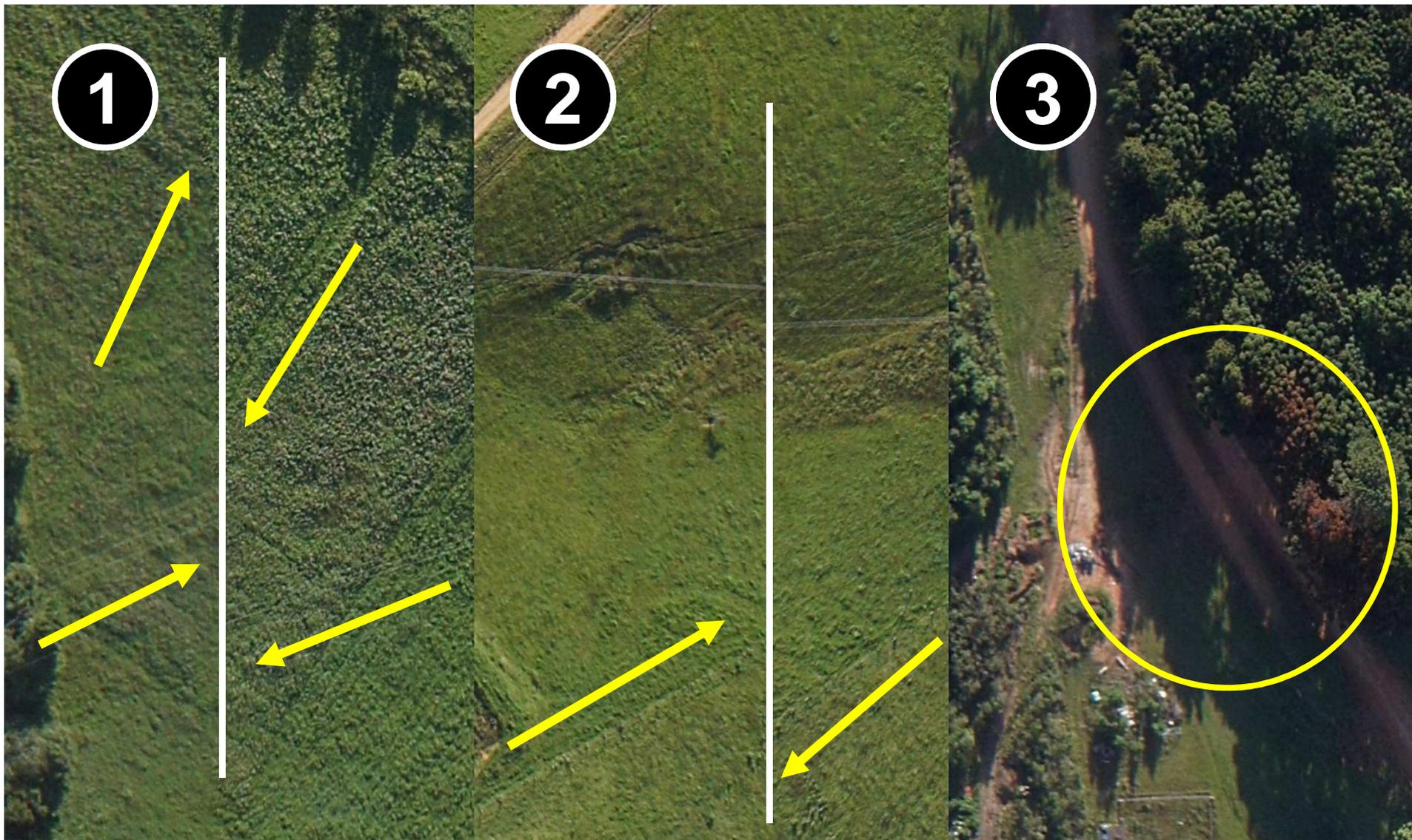
1

MOSAICO

3



2



LEGISLAÇÃO



President Obama Signs The FAA
Modernization And Reform Act Of
2012 (H.R. 658)



- ❑ to simplify and accelerate permission for drone operations. The agency's already working on loosening regulations by spring 2012.
- ❑ to establish a pilot project within six months for six test zones to integrate drones "into the national airspace system."
- ❑ create a comprehensive plan within nine months "to safely accelerate the integration of civil (privately operated) unmanned aircraft systems into the national airspace system."
- ❑ after submitting a comprehensive plan, publish final rules within 18 months to allow civil operation of small (under 55 pounds) drones in America's airspace.

2 Kg seria uma referência de segurança que coloca o UAV na mesma categoria dos **pássaros**.

ESTATISTICAMENTE, uma aeronave tripulada pode sobreviver a uma colisão com aves até 2 Kg, de modo que o **UAV voando baixo (?)** representaria um risco mínimo para aviões tripulados.

UAS Standards

FAA bill

Fevereiro 2012



**"A ameaça existe do ponto de vista da colisão."
Mike Fergus, Porta-voz do FAA**

NOTAM
*Notice
To
Airmen
(15 dias)*

**Manutenção
de Aeronave
e
Certificação
de Piloto**

**Apenas
ARP
permitida**

**Proibido voo
sobre áreas
urbanas,
aeroportos e
aglomerado
de pessoas**



**Espaço
Aéreo
Restrito**

**Altura de
voo maior
que 120 m
somente
com
autorização**

MERCADO

GIM
INTERNATIONAL

Latest issue

08/05/2012

Poll

Are you considering working with an UAV for surveying?

I already use UAVs (please share your experience in the comments)



I'm orienting to invest in UAVs



I'm not sure yet



No, I will not use UAVs (why not? Please comment)



Qual o impacto dos UAV na indústria do mapeamento ?

Lacuna entre o levantamento topográfico tradicional e da fotogrametria com elevada (?) altura de voo ...

Resposta rápida onde o tempo é condicionante como situações de desastre ...

Monitoramento de empreendimentos onde se deseja fazê-lo de maneira sistemática ...

Não é tão preciso como estações totais e GNSS, mas será bom o suficiente em alguns casos ...

Anders Rhodin

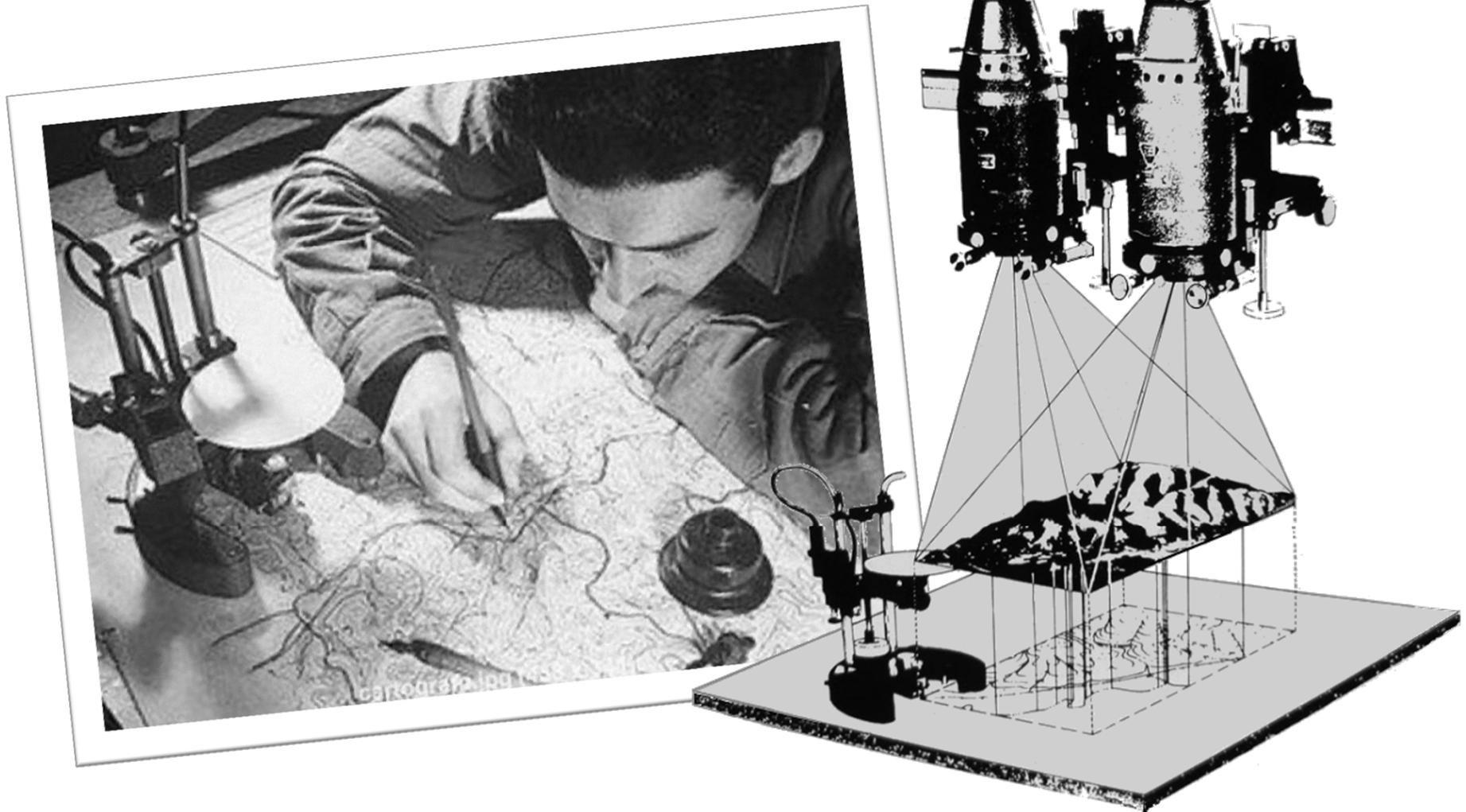
Chefe da Divisão de Levantamentos da TRIMBLE

Abril 2012

Aconteceu
há **50**, **20**, **10**
anos ...

Multiplex





THE THEORY AND APPLICATION

OF THE

DIGITAL TERRAIN MODEL

With the rapid developments in the use of electronic computers in highway engineering practice, it is expected that the future will see the photogrammetric firm or division furnishing data in three forms - aerial photographs, topographic maps, and on punched tape or cards - to the highway engineering organization or division. **The digital terrain model** approach furnishes considerable flexibility in the use of the punched data for computer analysis of highway problems

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

June 1958



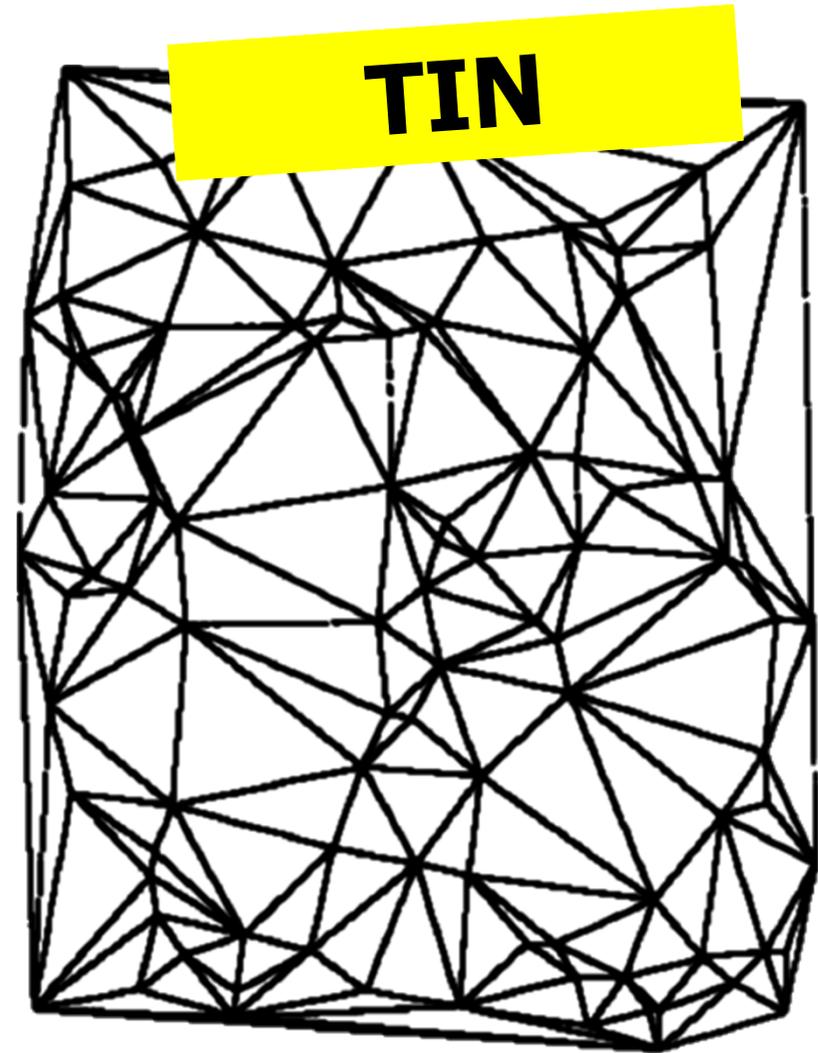
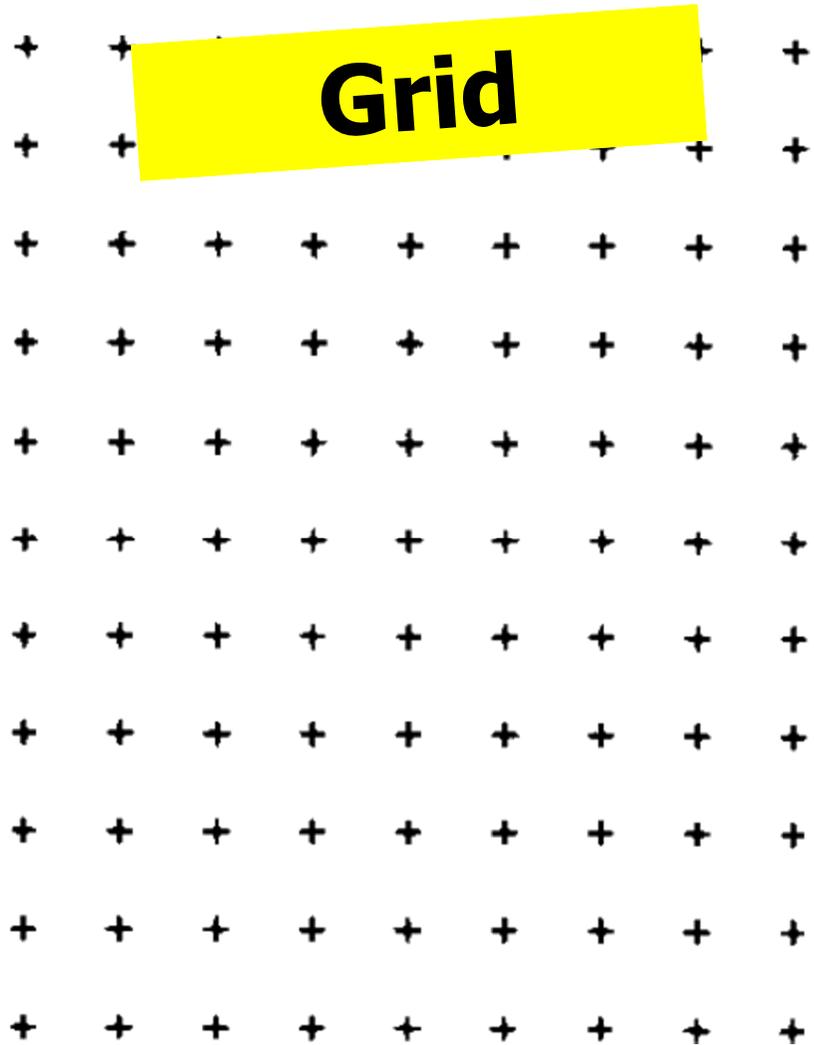
Readout System with Bendix Punch Tape Output

M.I.T. Photogrammetry Laboratory



Fonte : The Digital Terrain Model - Theory and Applications - Miller e Laflamme – Photogrammetric Engineering # 24 - 1958

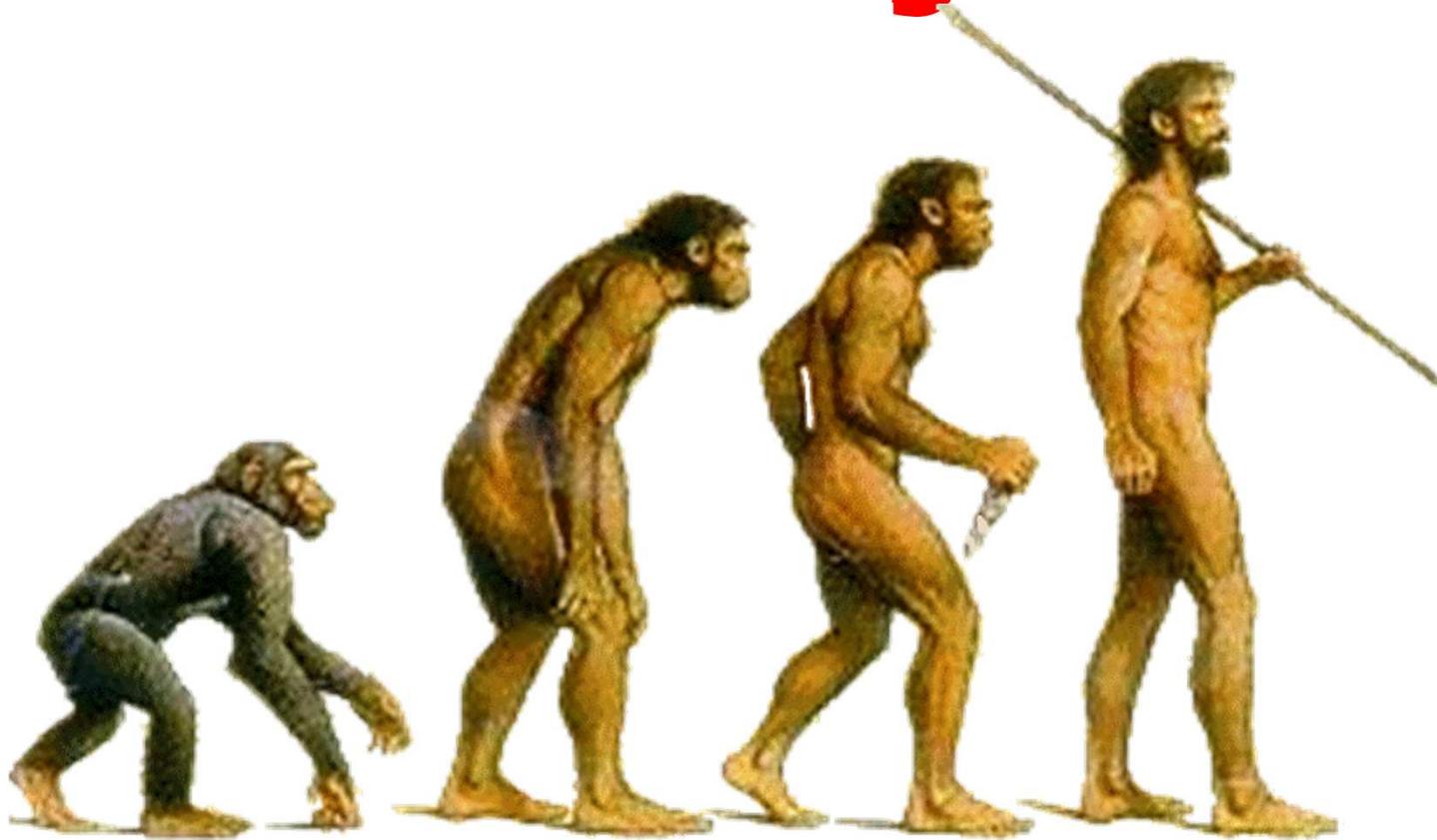




Correlação de Imagem



EVOLUÇÃO



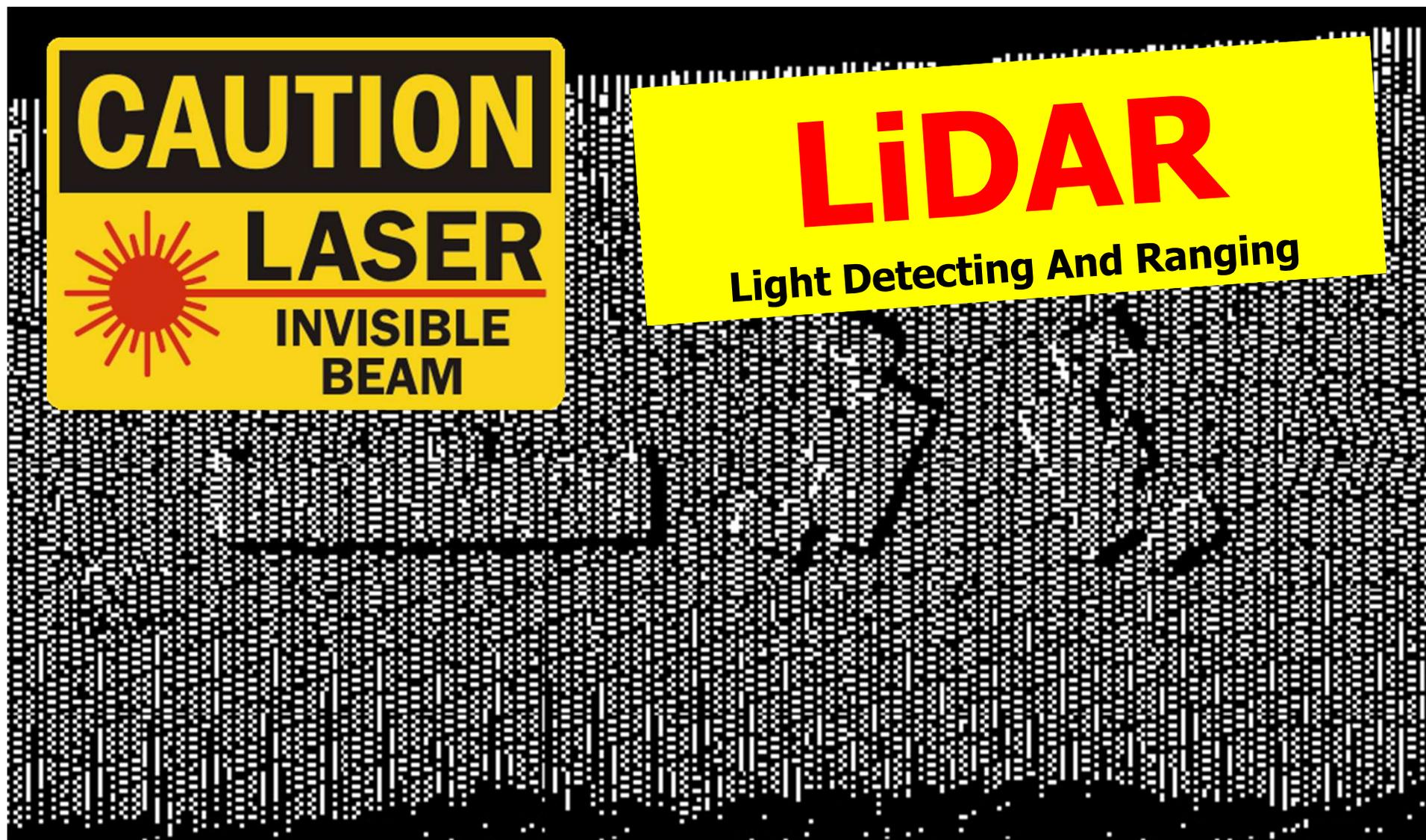


1980s

**Atmospheric Oceanographic
LiDAR (AOL)
Airborne Topographic
Mapper (ATM)**

1990s

**Azimuth Co. (EUA)
Optech Inc. (Canadá)
TopEye (Suécia)**



1993



2011



18 anos

2 KHz @ 1.000 m ...

... 500 KHz @ ~1.000 m !!

50% em operação ?

~400

ALS (Airborne LASER Scanning)

no Mundo ...

FABRICANTES



Leica
Geosystems



RIEGL
LASER MEASUREMENT SYSTEMS



Optech



Trimble



AHAB DragonEye



FUGRO Fli-Map



IGI LiteMapper

EVENTOS



June 5 & 6, 2012
Kawasaki Industry Promotion
Kawasaki, Japan



12-14 November 2012
World Forum
The Hague, The Netherlands



April 15-18, 2013
The Broadmoor
Colorado Springs, Colorado

DIRETÓRIOS



ESTEIO Engenharia e Aerolevantamentos S.A.

Service Provider

ESTEIO
Engenharia e Aerolevantamentos S.A.

Contact Information:
Reinaldo Machado, 1151 City: Curitiba

POC: Amauri Brandalize
Phone: 55 41 3271-600
Email: amauri@esteio.com.br
www.esteio.com.br

Own Sensor: Yes
Operate Sensor: Yes

Sensor: ALTM2025, 2 X ALS-50-II MPIA

Rep Rate: 150KHz MPIA
Maximum Altitude: 4000m
Minimum Altitude: 700m

Founded in 1969, ESTEIO-ENGENHARIA E AEROLEVANTAMENTOS S. A. is a closed-capital Brazilian company. Acting as a consulting company, ESTEIO had its activities mainly concentrated on the development of projects and surveys of civil engineering area, mainly roads, railways, airports, sanitation, pipelines, power lines, LiDAR and digital mapping.

In 1995, ESTEIO acquired its first digital orthophoto and image processing system and now it has more than 20 digital workstations. Flying with three own airplanes, ESTEIO acquired a ZEISS RMK-TOP aerial camera in 1997 and in 2001, ESTEIO acquired an OPTTECH's ALTM 2025 and start a new era using LiDAR systems. Since then, ESTEIO acquired two Leica's ALS50-II MPIA LiDAR systems and an ADS40/S2 digital sensor and more recently, a RCD30 medium format digital camera.

ESTEIO has been working with Pipeline projects using new technologies like PCM (Pipeline Current Mapper), GPR (Ground Penetrating Radar), SBP (Sub Bottom Profilers), DCVG (Direct Current Voltage Gradient) to locate and investigate buried and underwater pipe structures.

ESTEIO has an engineering division in charge of development of infrastructure & construction linear projects including roads, railways, airports and pipelines. It is also responsible by construction site inspection as a supervision representative.

ESTEIO blog: <http://www.esteio.com.br/novoblog/blogs/index.php>
ESTEIO RSS feed: <http://www.esteio.com.br/feed/2007-esteio-feed.rss>
YouTube: <http://www.youtube.com/user/EsteioSA7gl=BR>
Twitter: <https://twitter.com/ESTEIO>
Facebook: <https://www.facebook.com/pages/Esteio-SA/114263225315366>
Twitter Pic: <http://twitpic.com/photos/ESTEIO>
LinkedIn: <http://www.linkedin.com/company/esteio-engenharia-e-aerolevantamentos-s-a>
Skype: amauri.brandalize

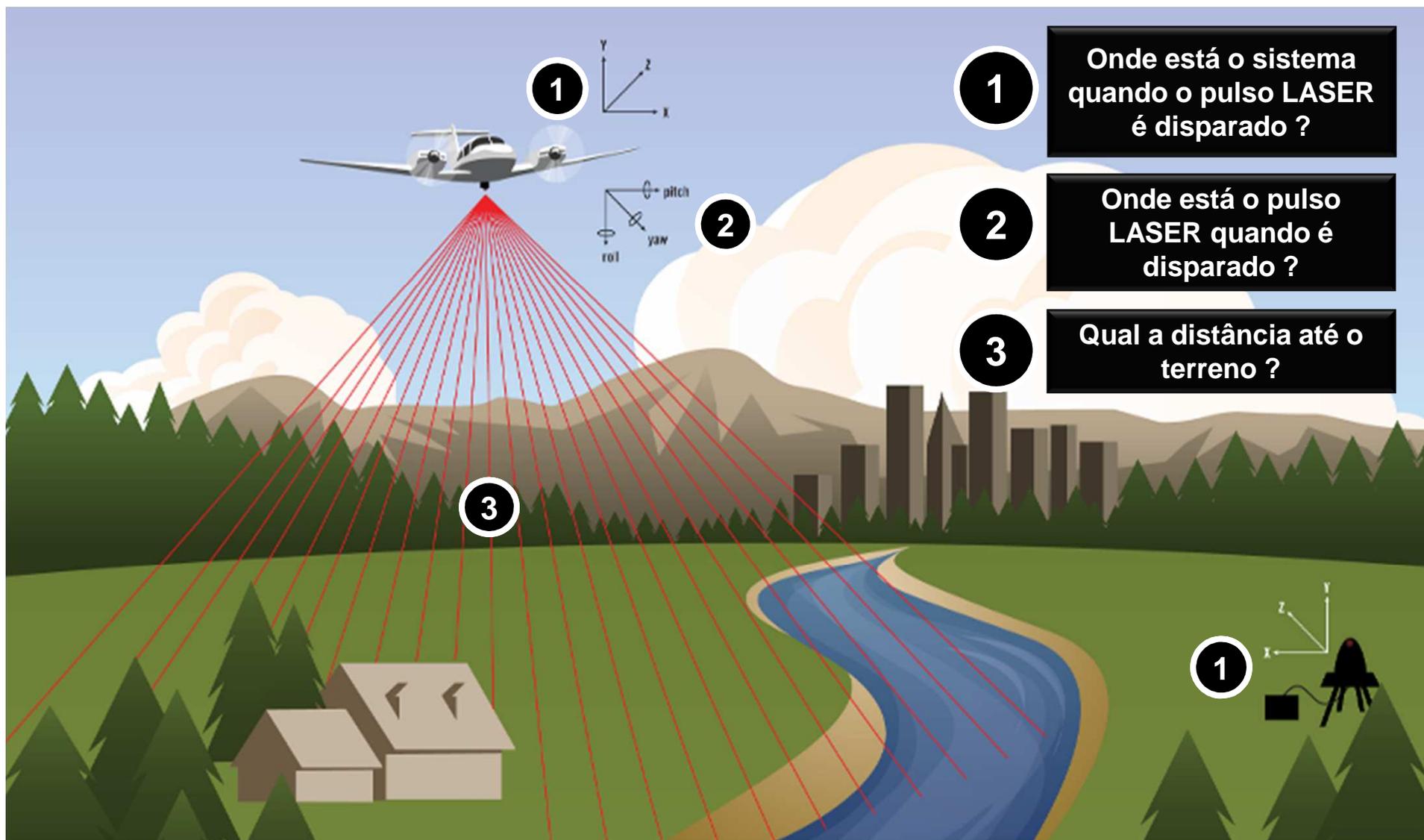


Fonte : Internet – Sites Proprietários © - 2012



TECNOLOGIA

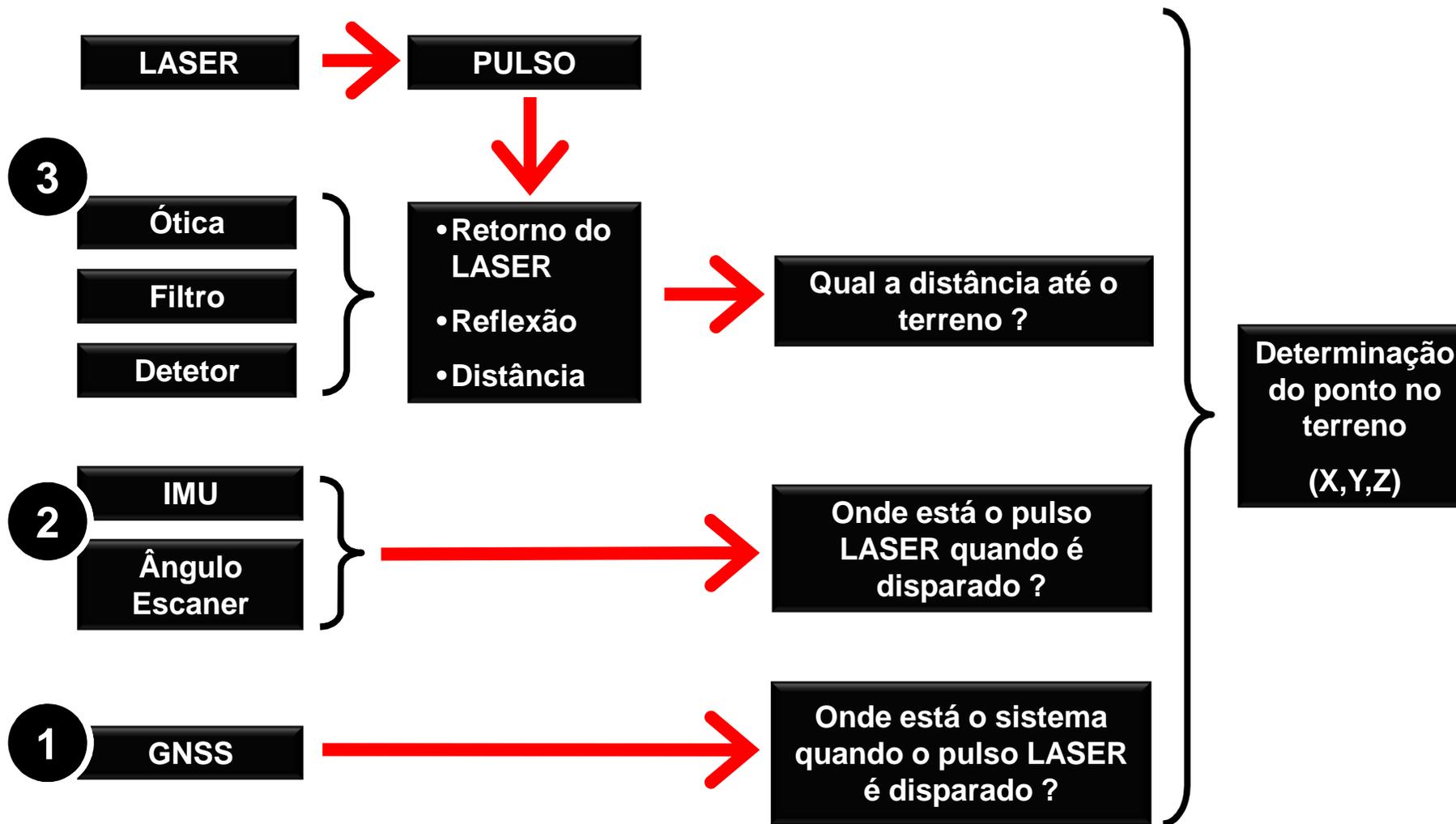




1 Onde está o sistema quando o pulso LASER é disparado ?

2 Onde está o pulso LASER quando é disparado ?

3 Qual a distância até o terreno ?



Avanços Tecnológicos

1

PERFILAMENTO

2

FREQUÊNCIA (SPiA e MPiA)

3

RETORNOS

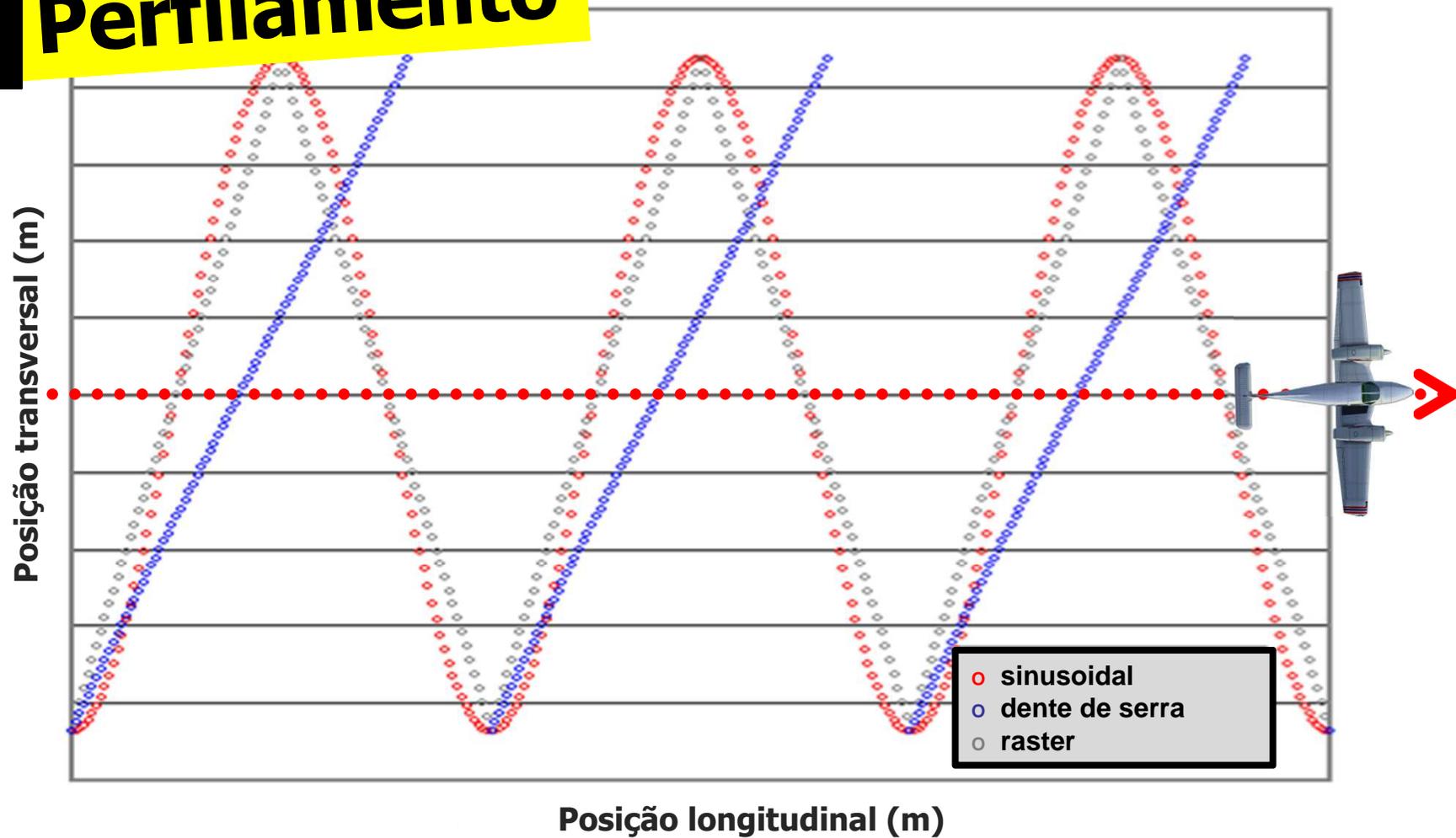
4

INTENSIDADE

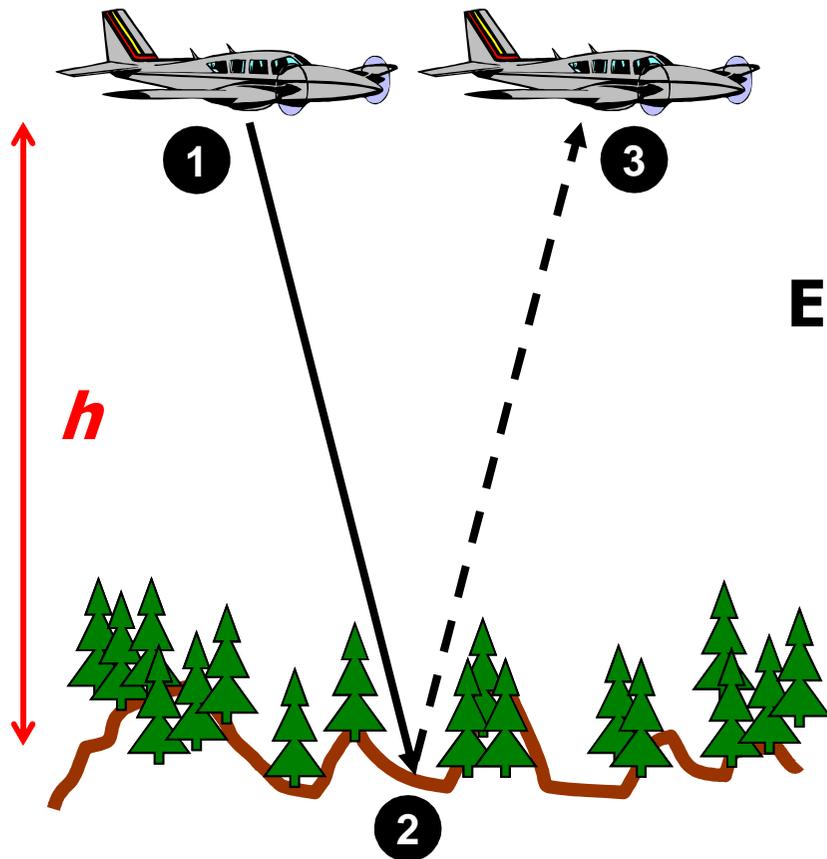
5

WAVEFORM

1 Perfilamento



2 Frequência



Supondo que $h = 1.000\text{m}$

$$\overline{123} = 2 \times 1.000\text{m} = 2 \text{ Km}$$

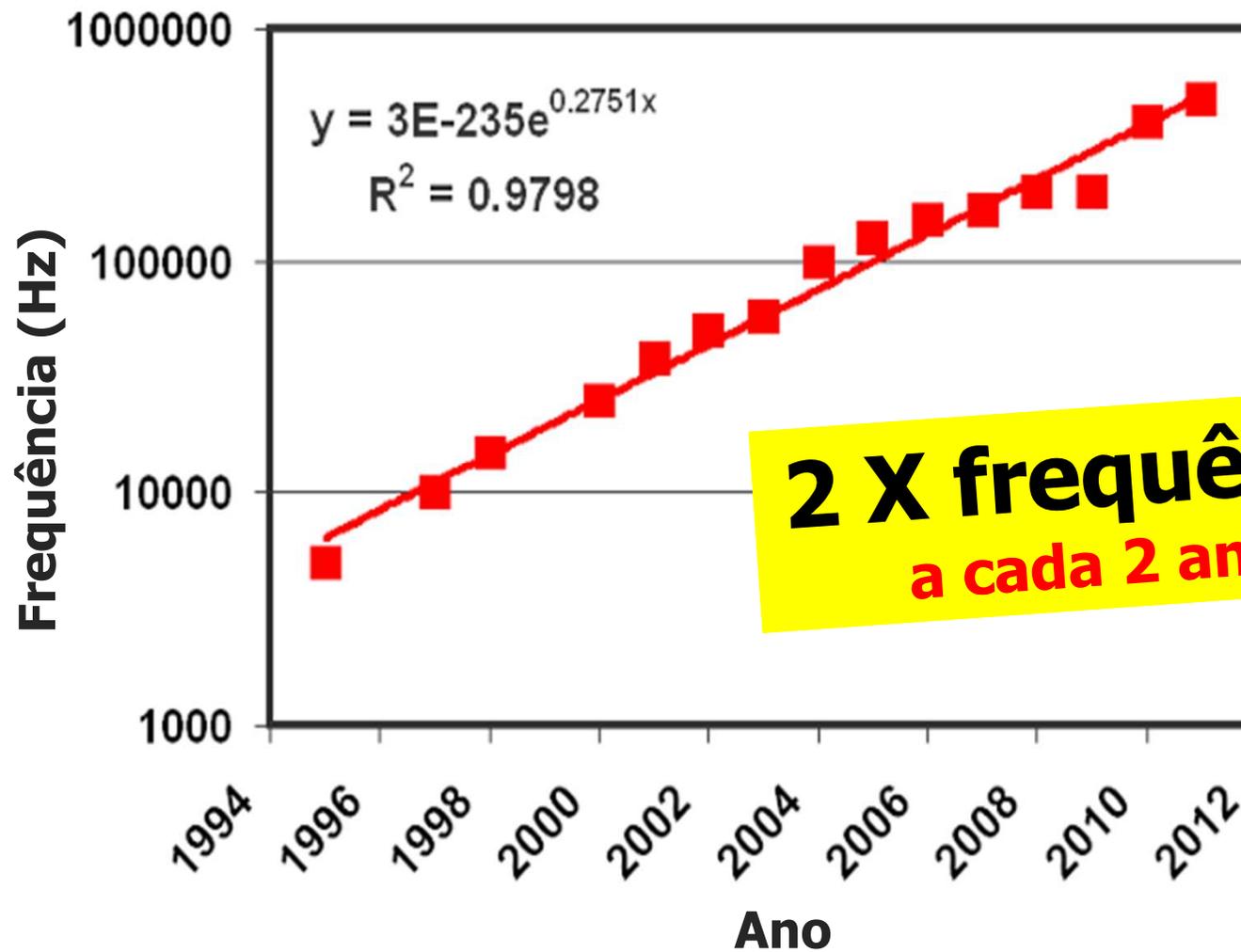
Como $c = 299.792,46 \text{ Km/s}$

Então, $t = 2 \text{ km} / 299.792 \text{ Km/s}$

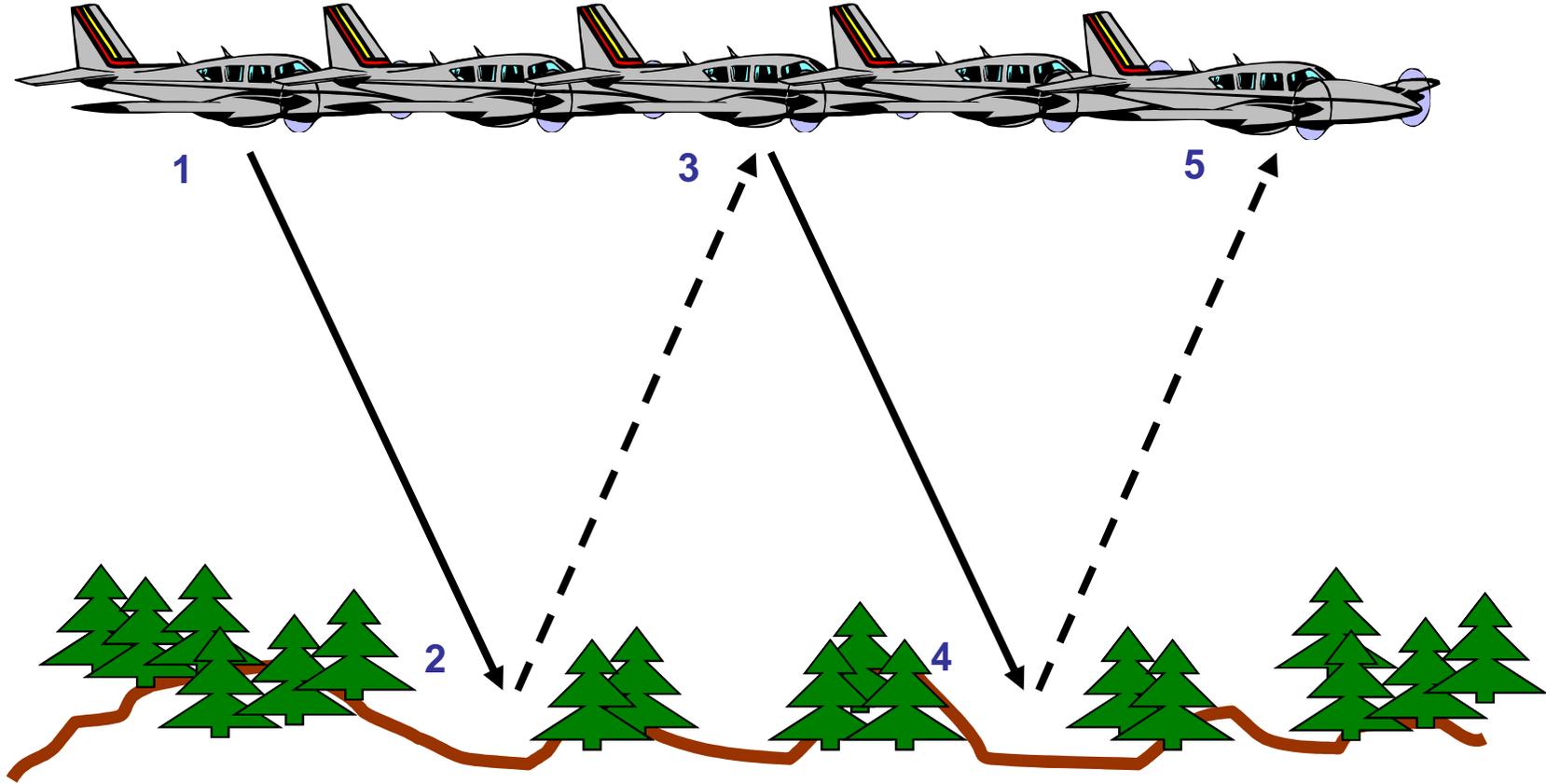
$$t_{123} = 6,67 \mu\text{s}$$

Em 1 s, temos $1 / 6,67 \mu\text{s} =$

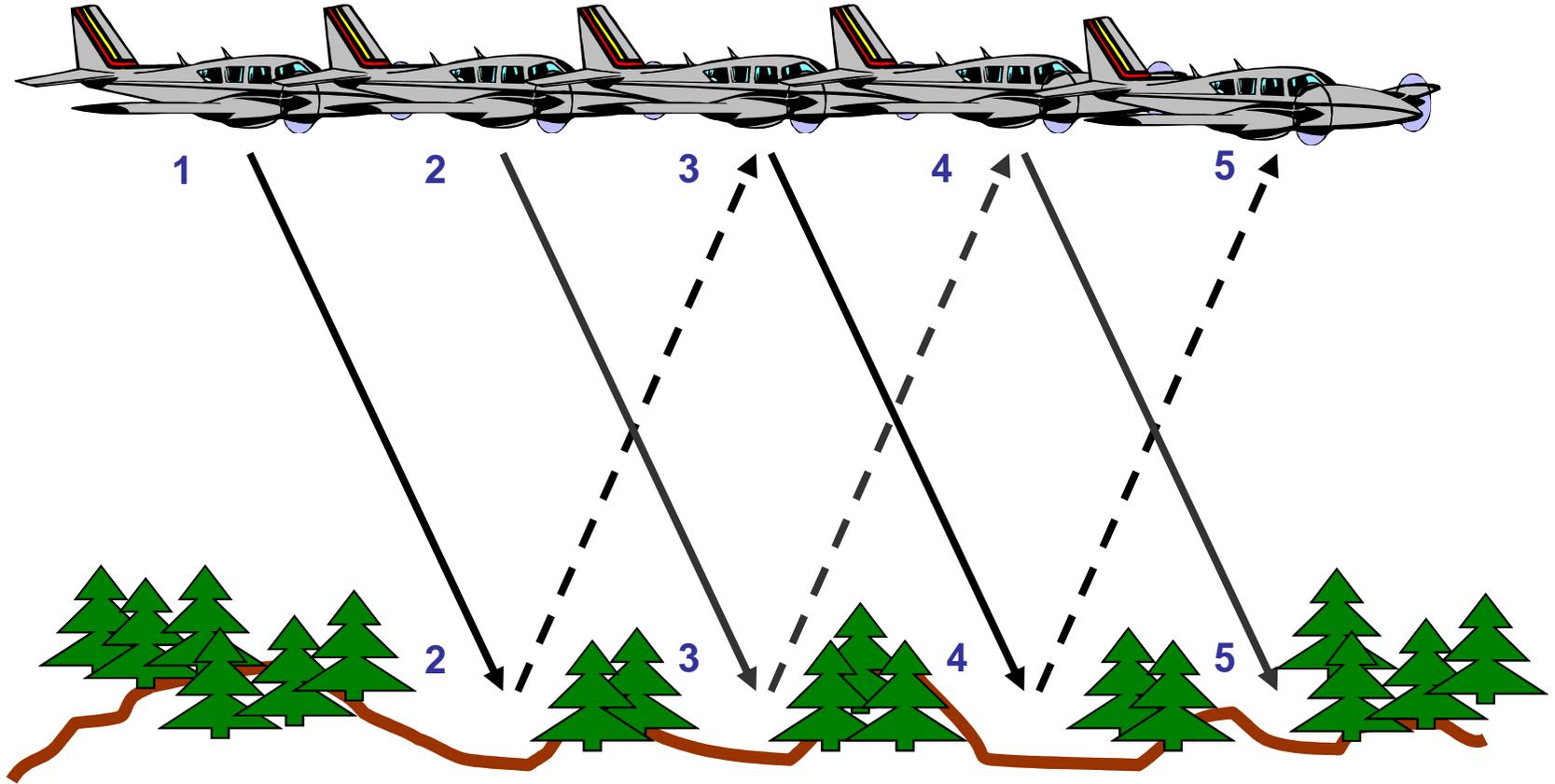
$$149.896 \sim = 150 \text{ KHz}$$



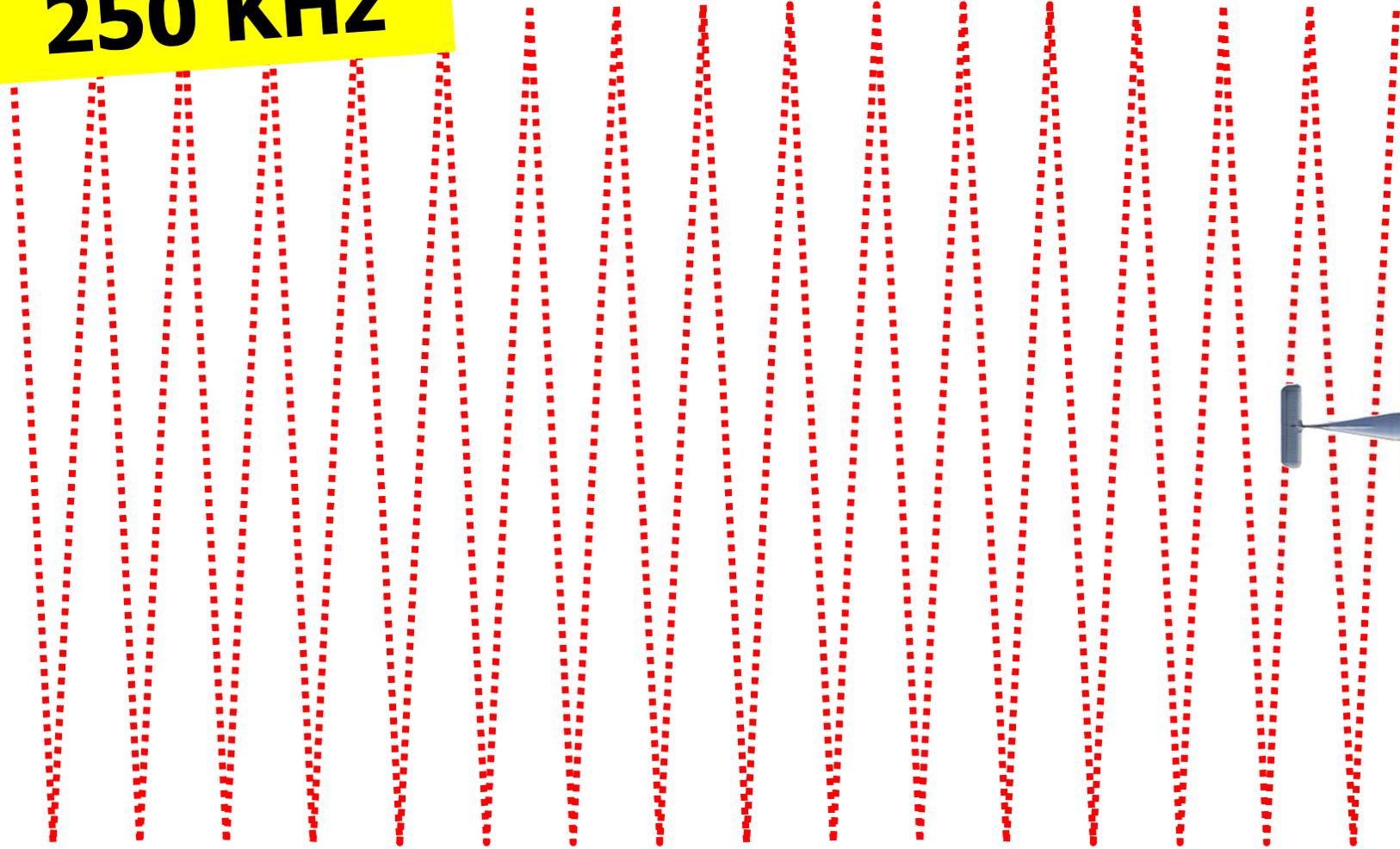
SPIA



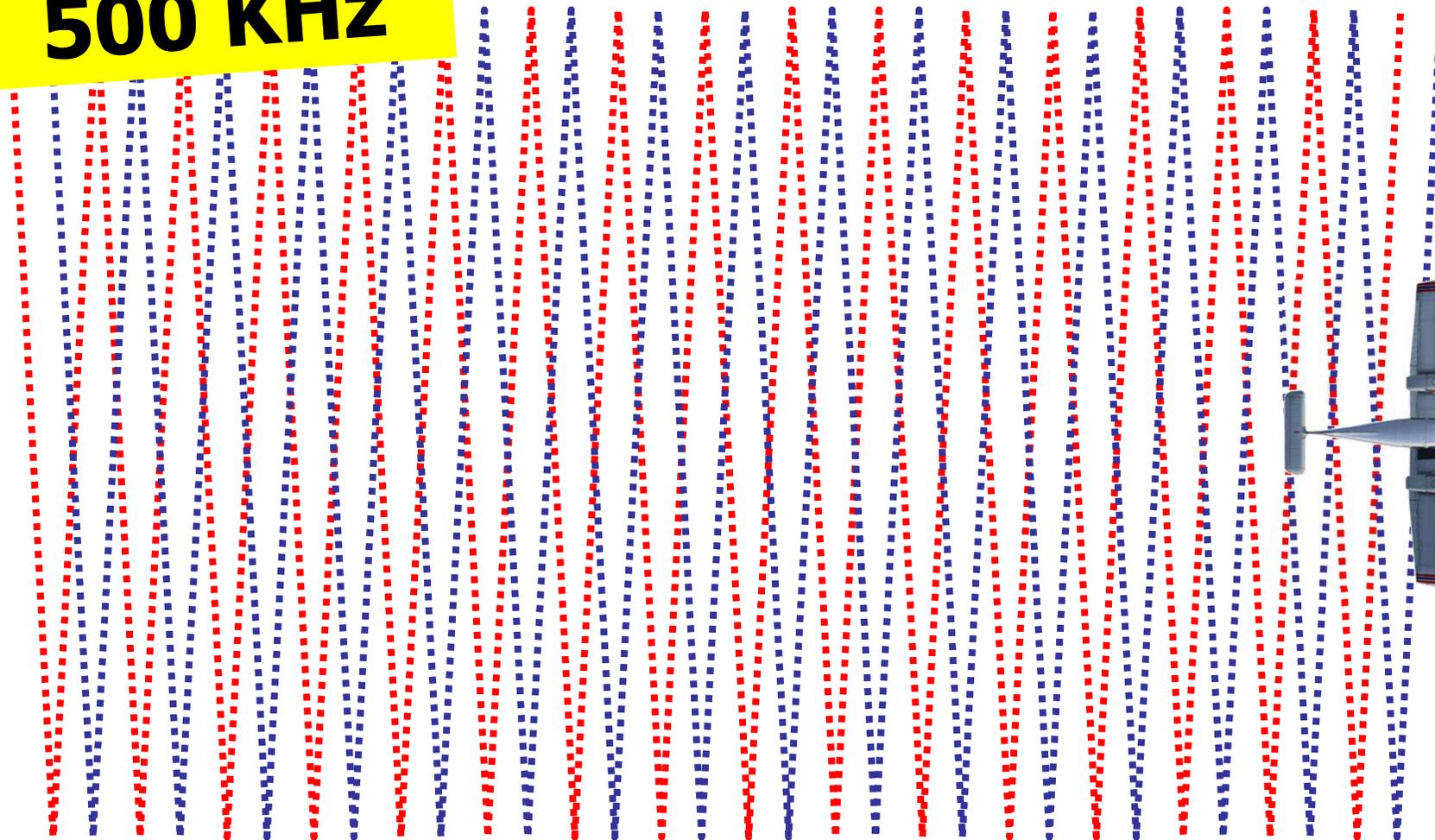
MPiA



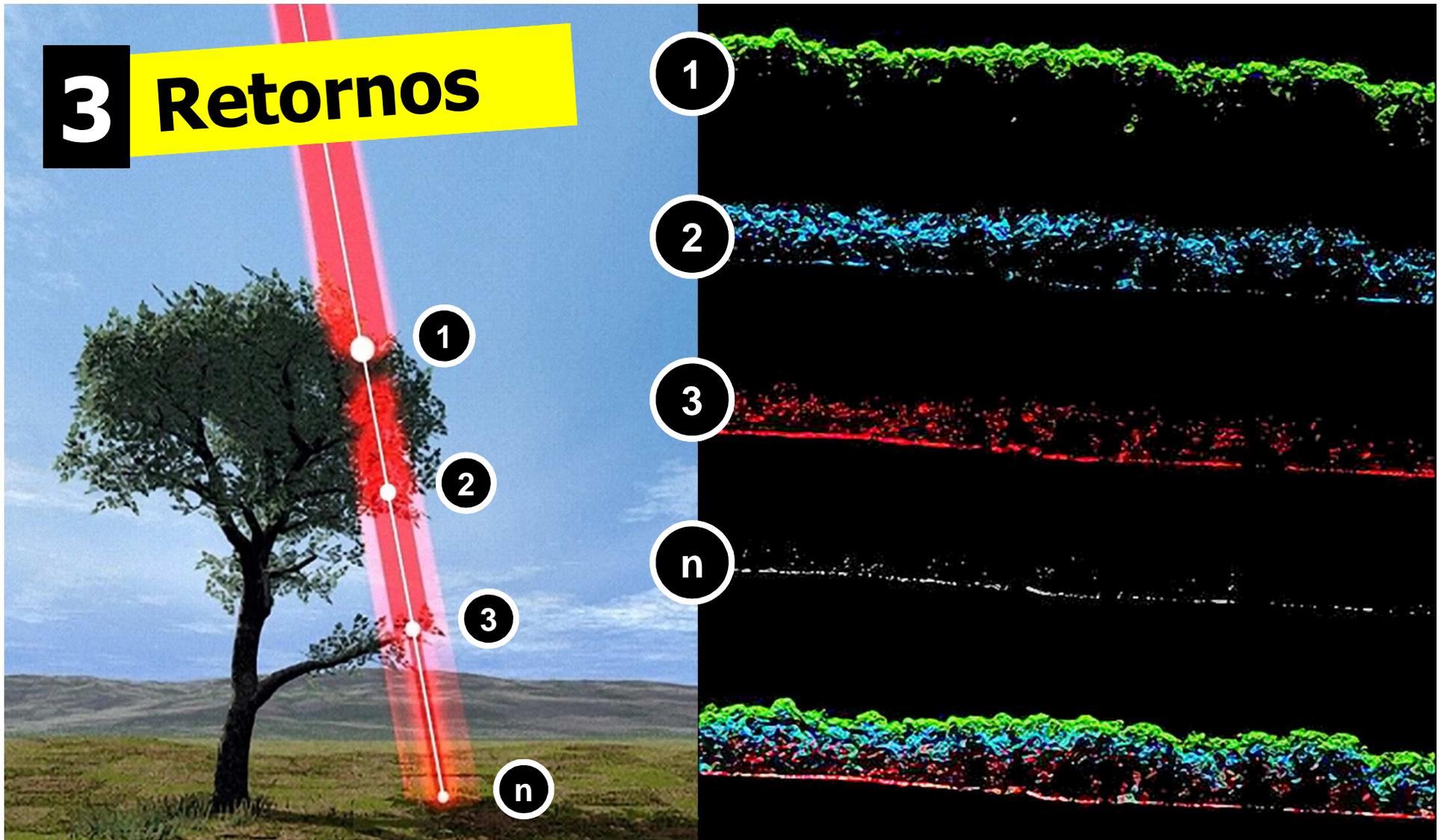
250 KHz



500 KHz



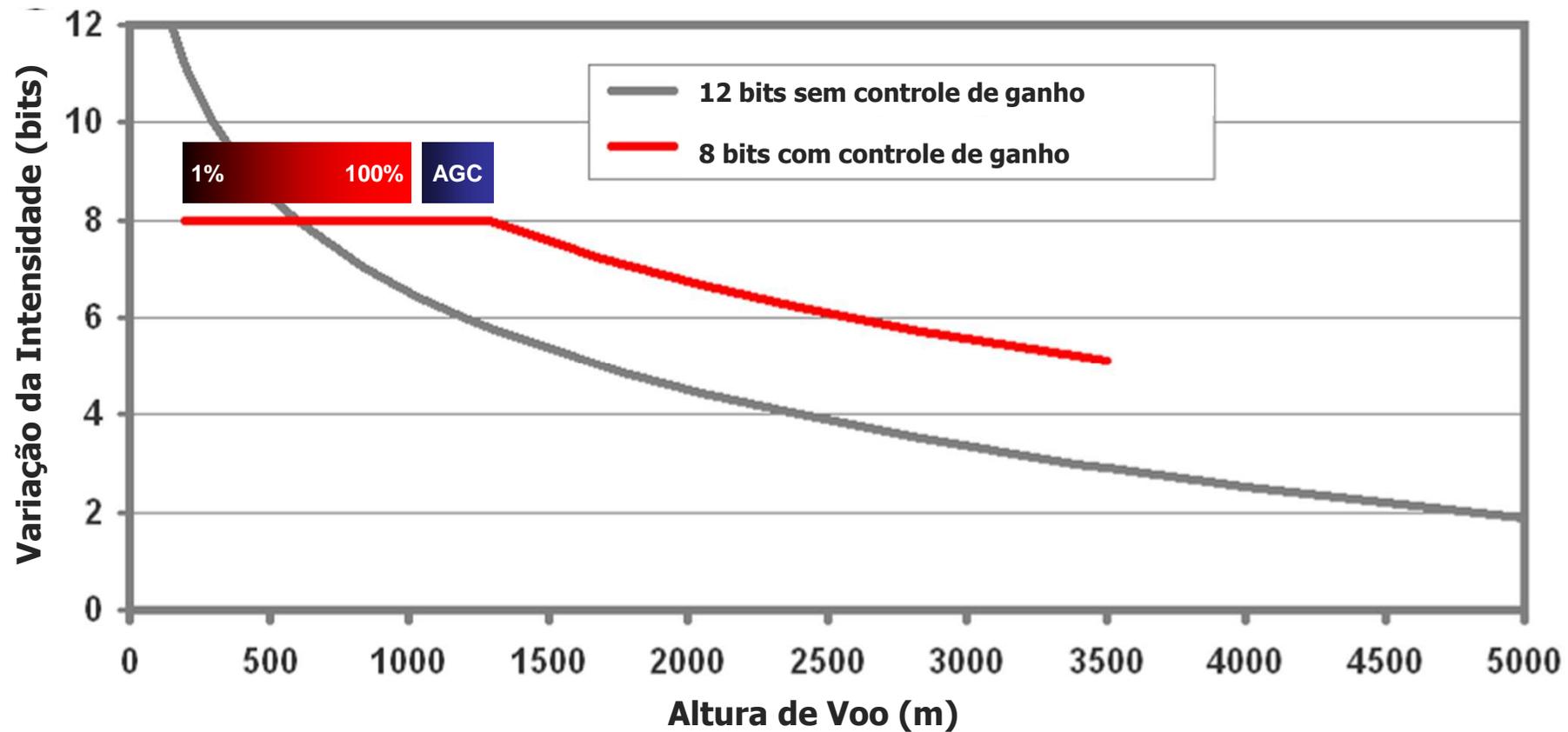
3 Retornos



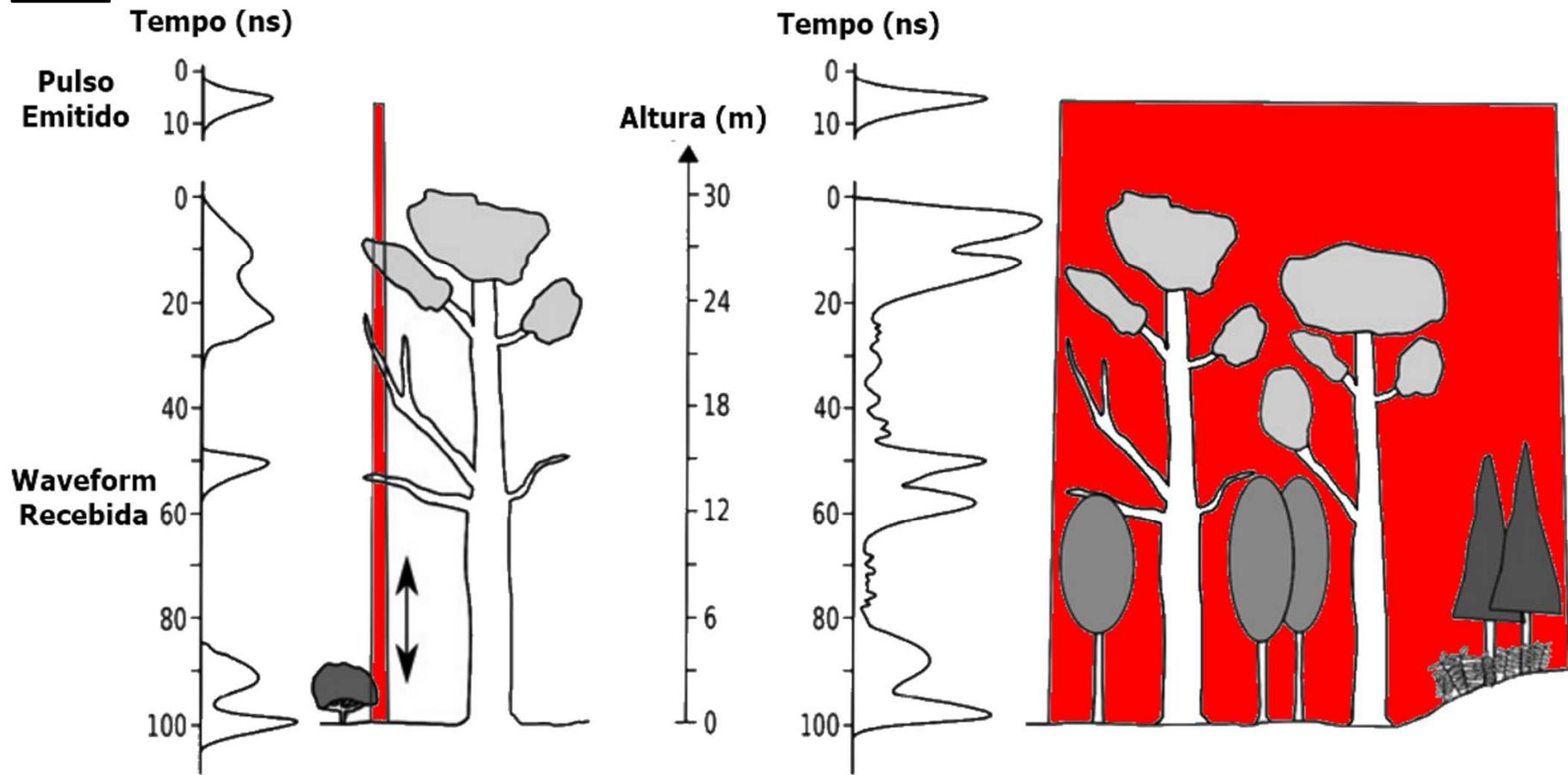
4 Intensidade



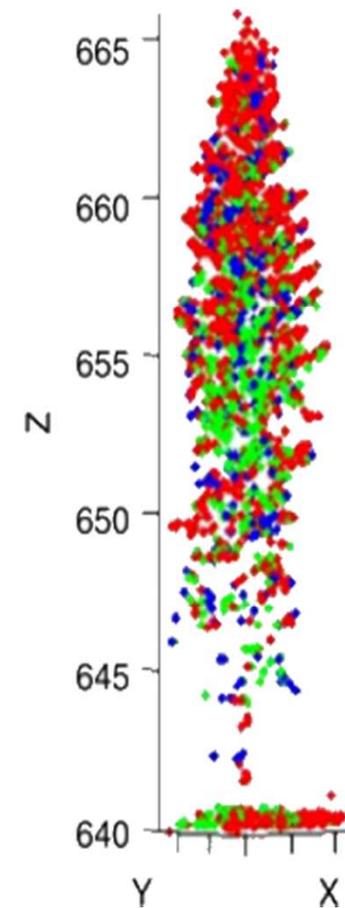
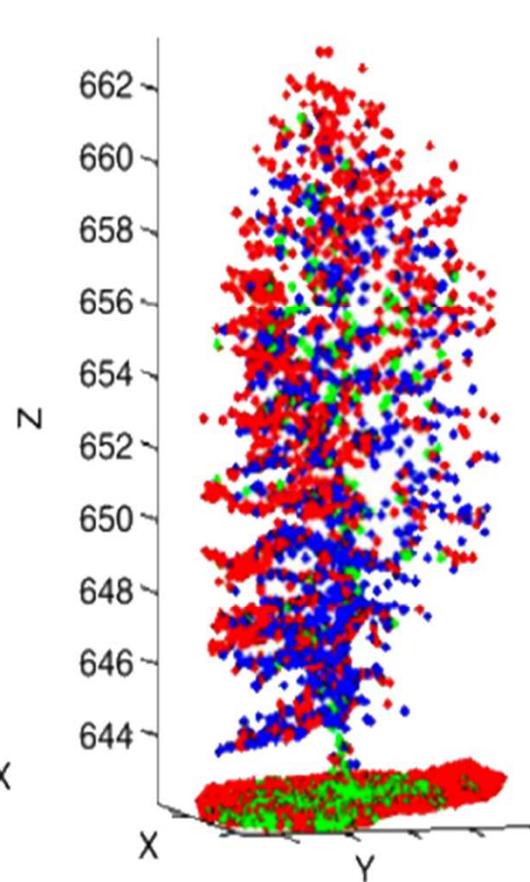
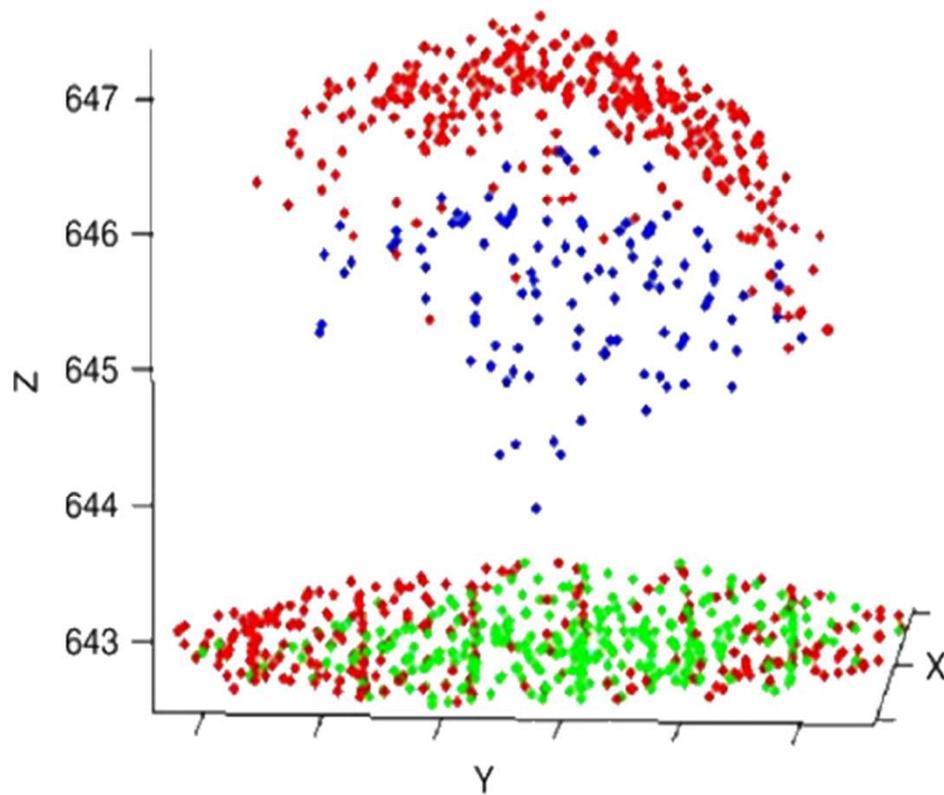
4 Intensidade

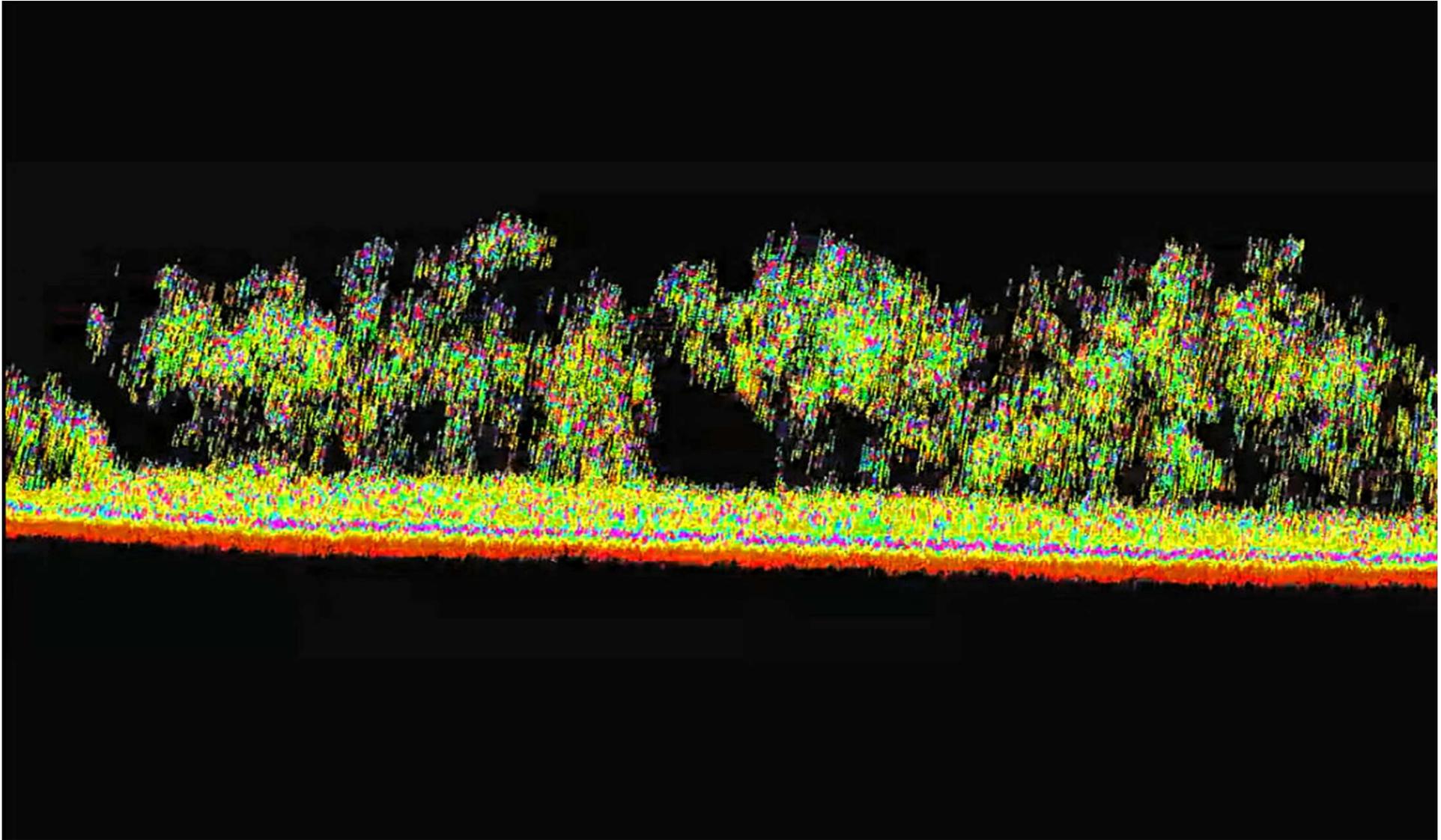


5 Waveform

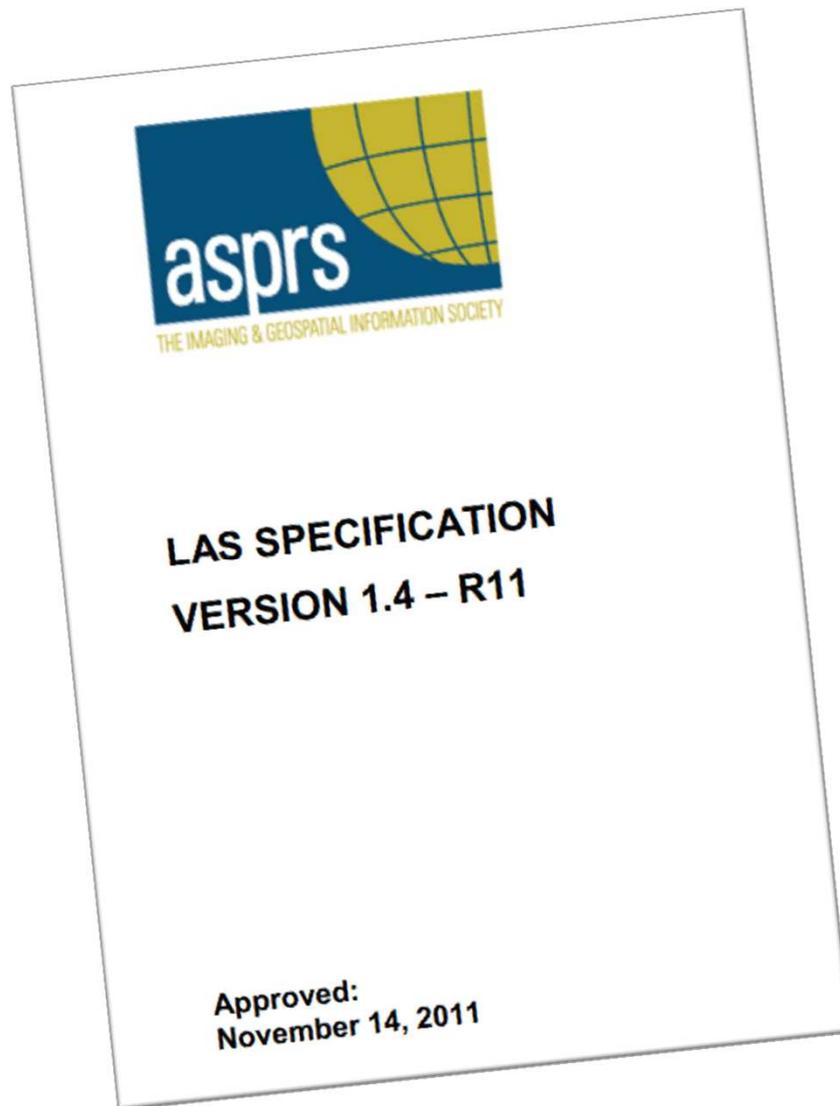


5 Waveform





FORMATO



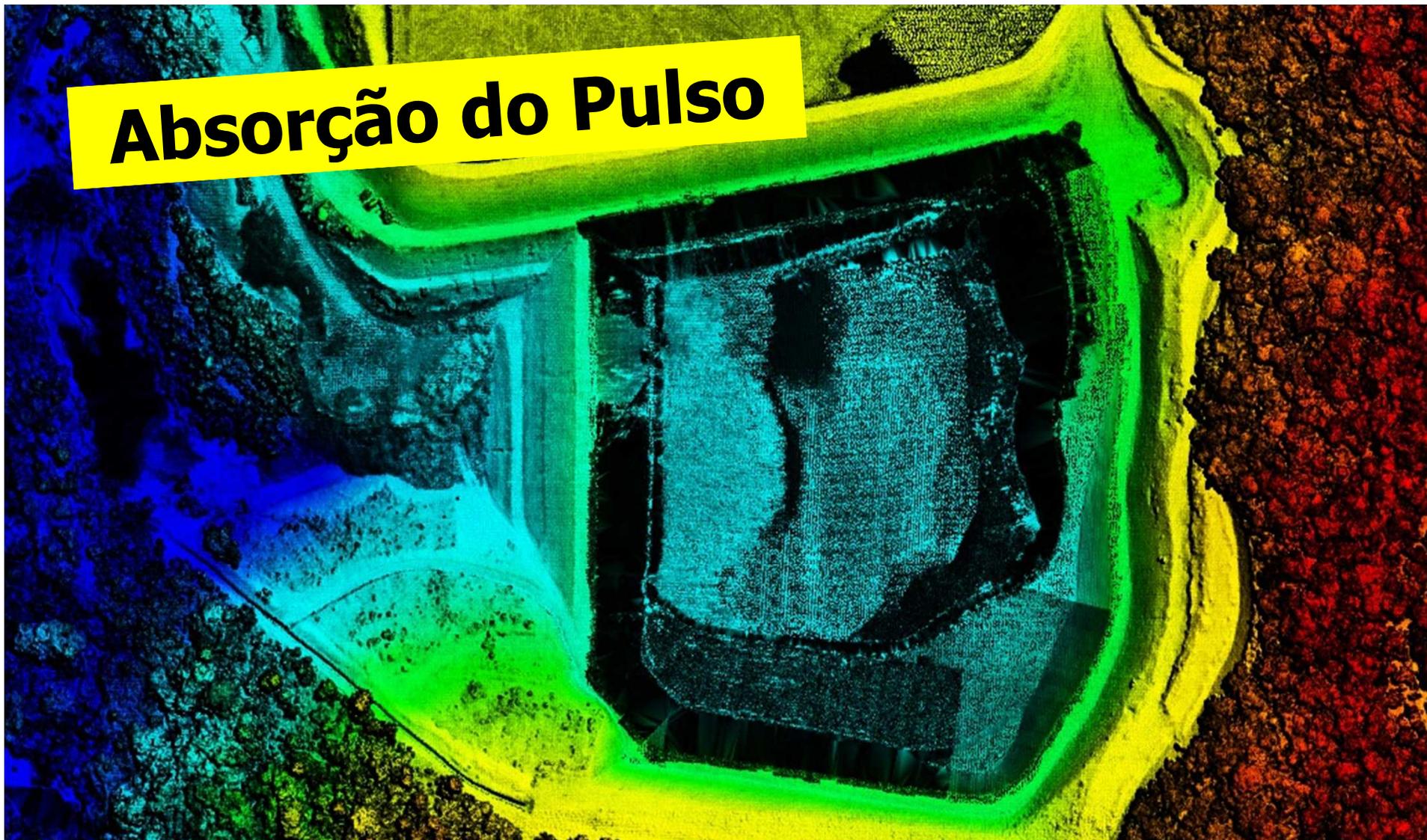
ASCII > BIN

- ... **Executor**
- ... **Equipamento**
- ... **Programa**
- ... **Datas**
- ... **Parâmetros**
- ... **Referencial**
- ... **Dados XYZ**
- ... **RGB e Class**

PROBLEMAS



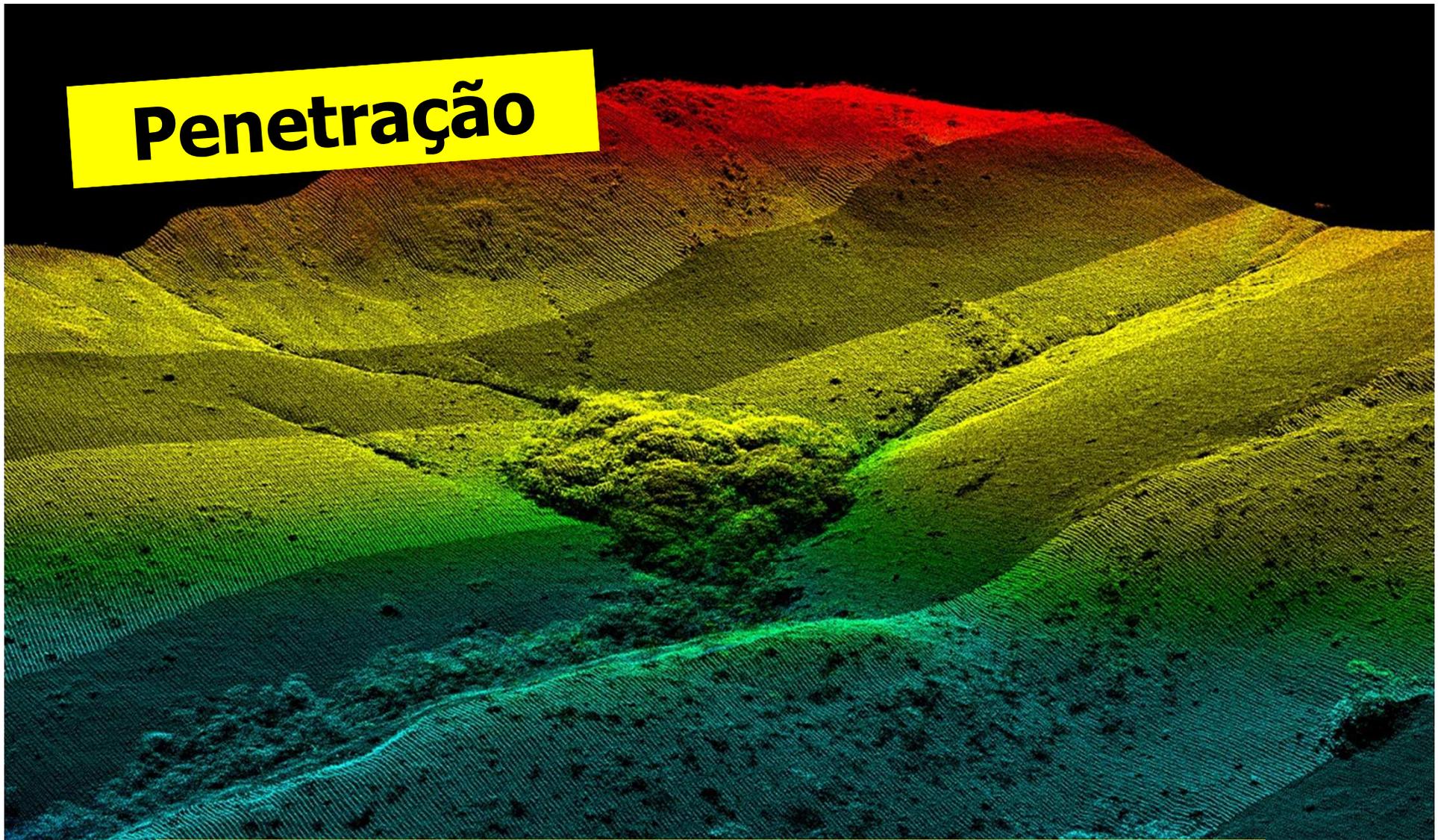
Absorção do Pulso



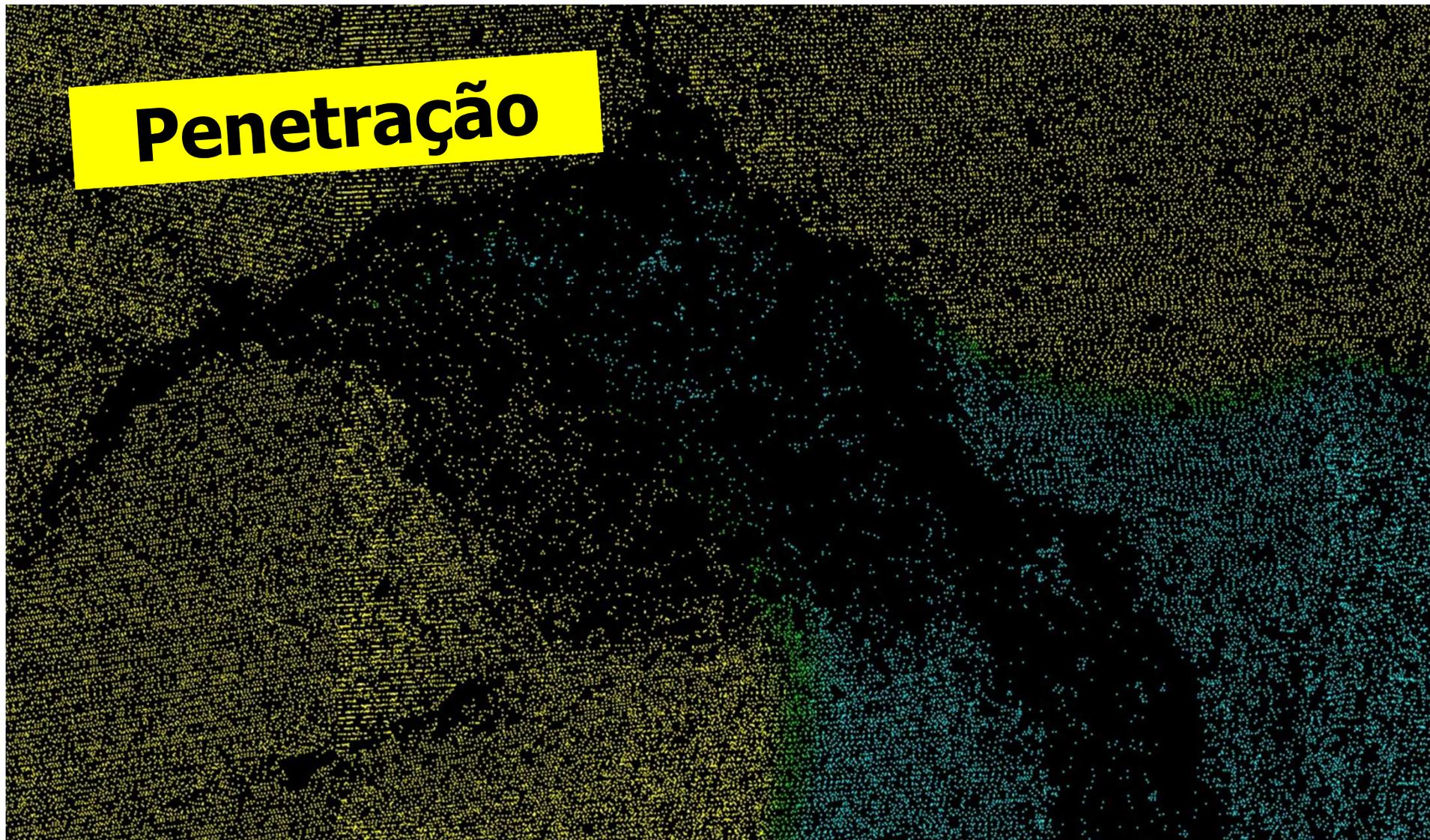
Deslocamento



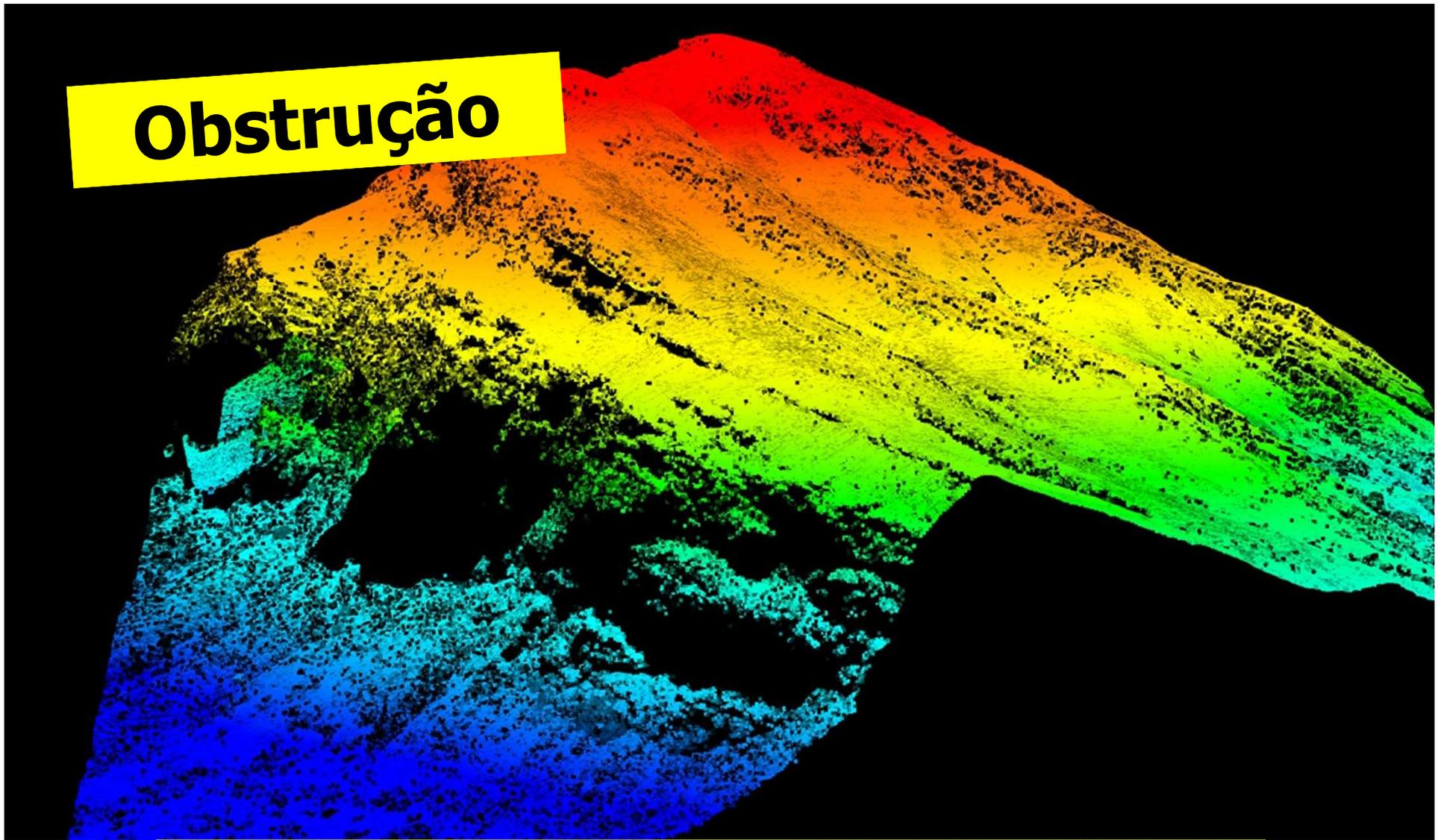
Penetração



Penetração

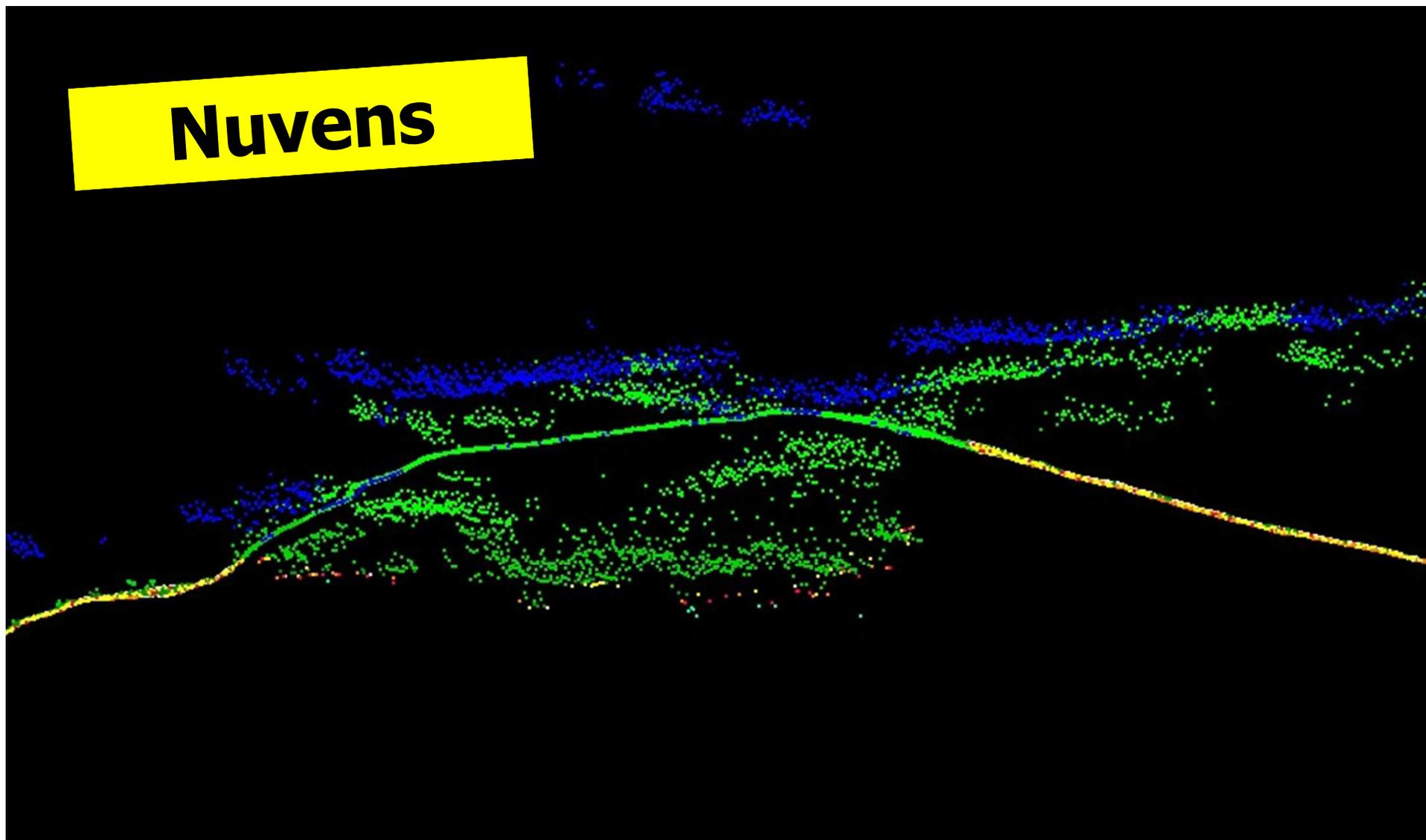


Obstrução



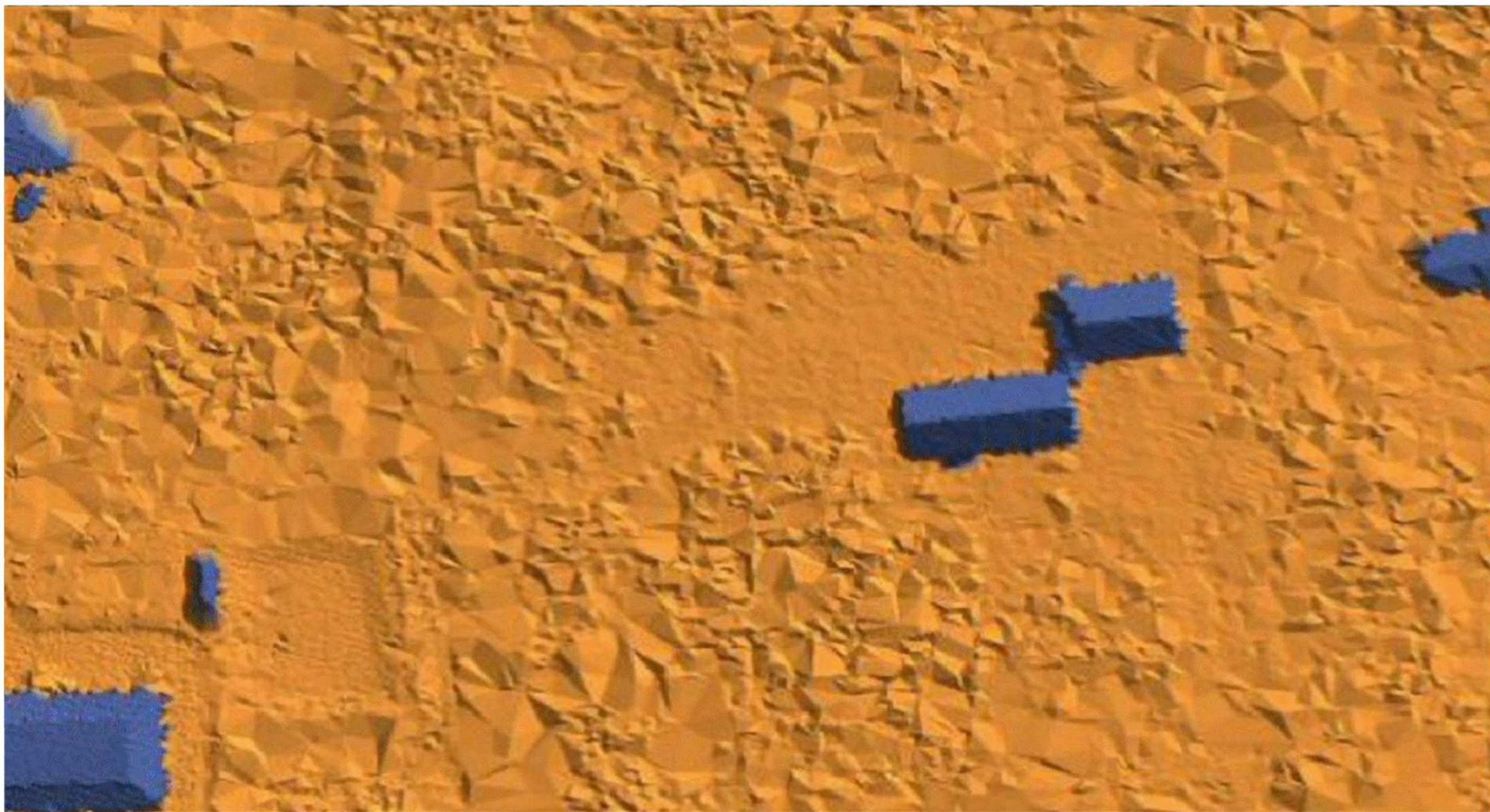
Anglo – 2 pts/m² – 30°

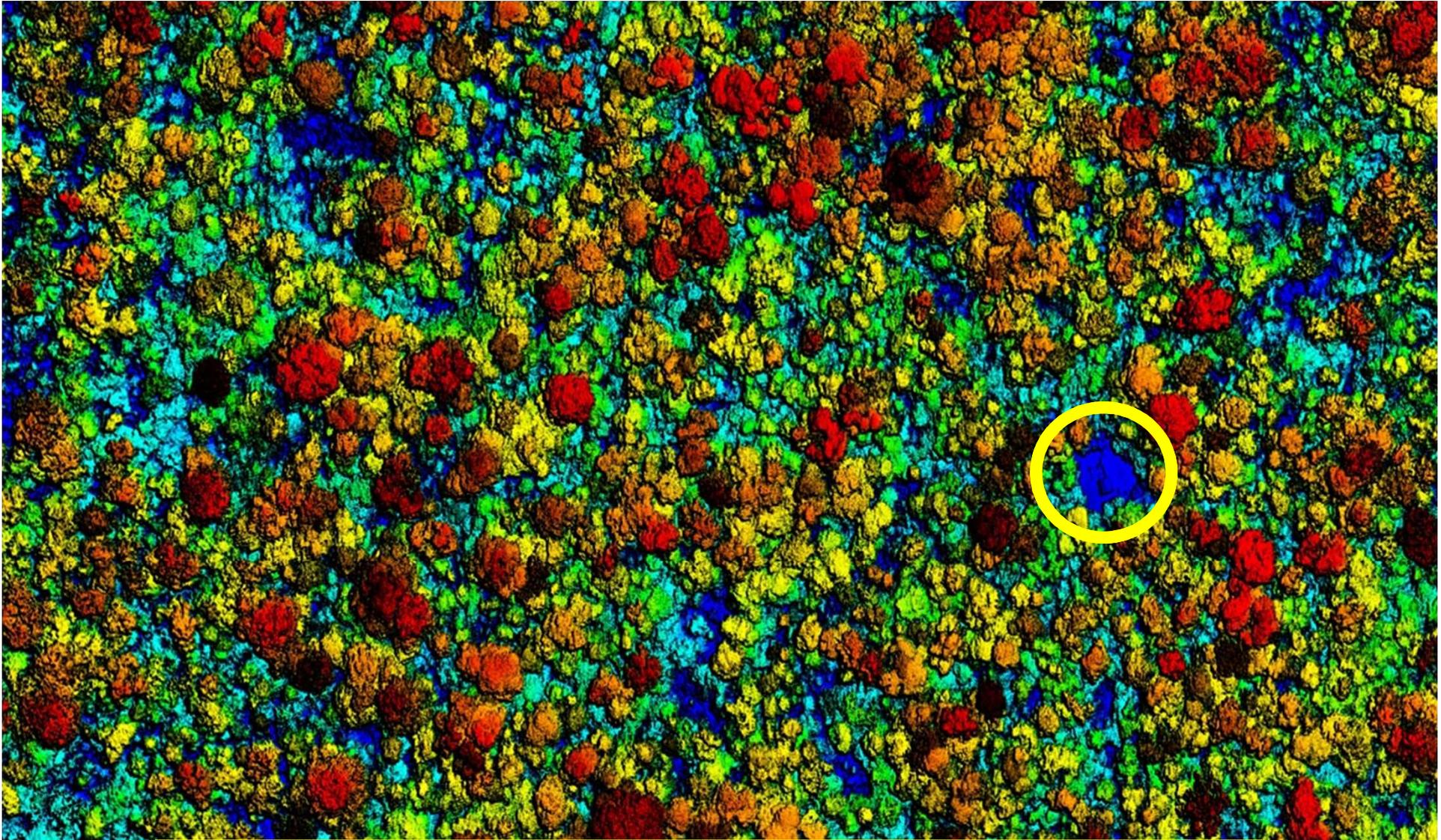
Nuvens

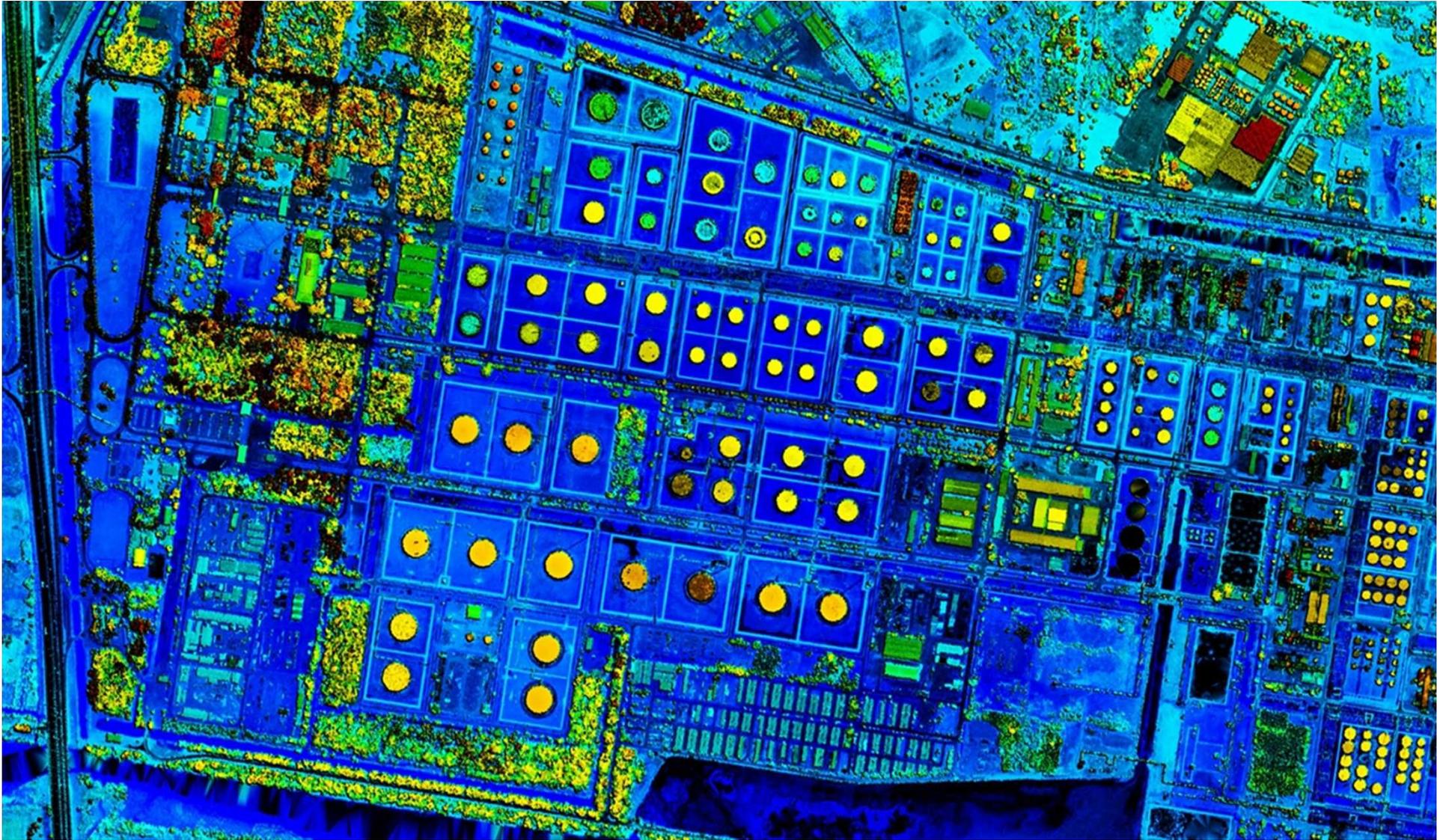


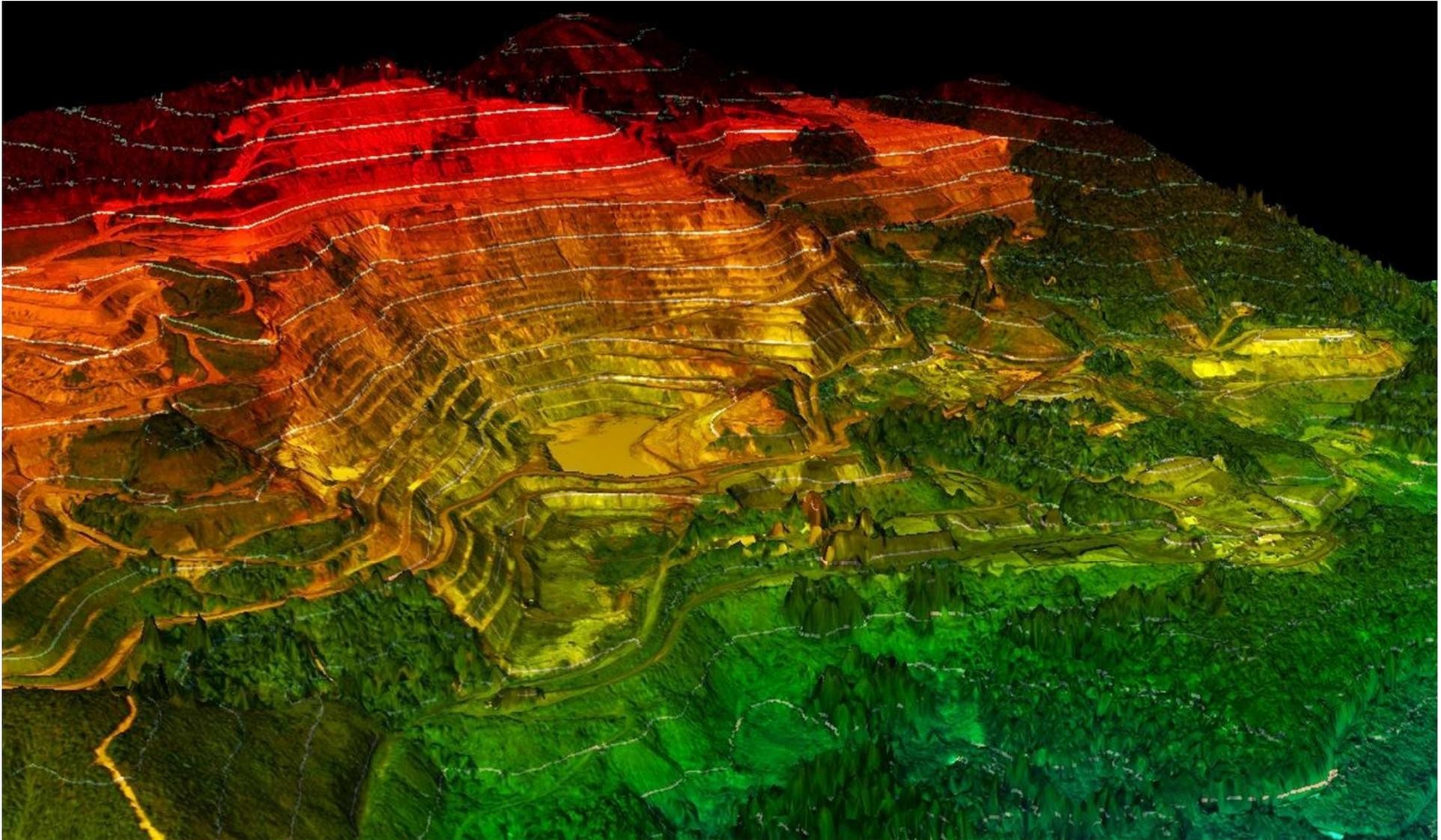
HIPSOS





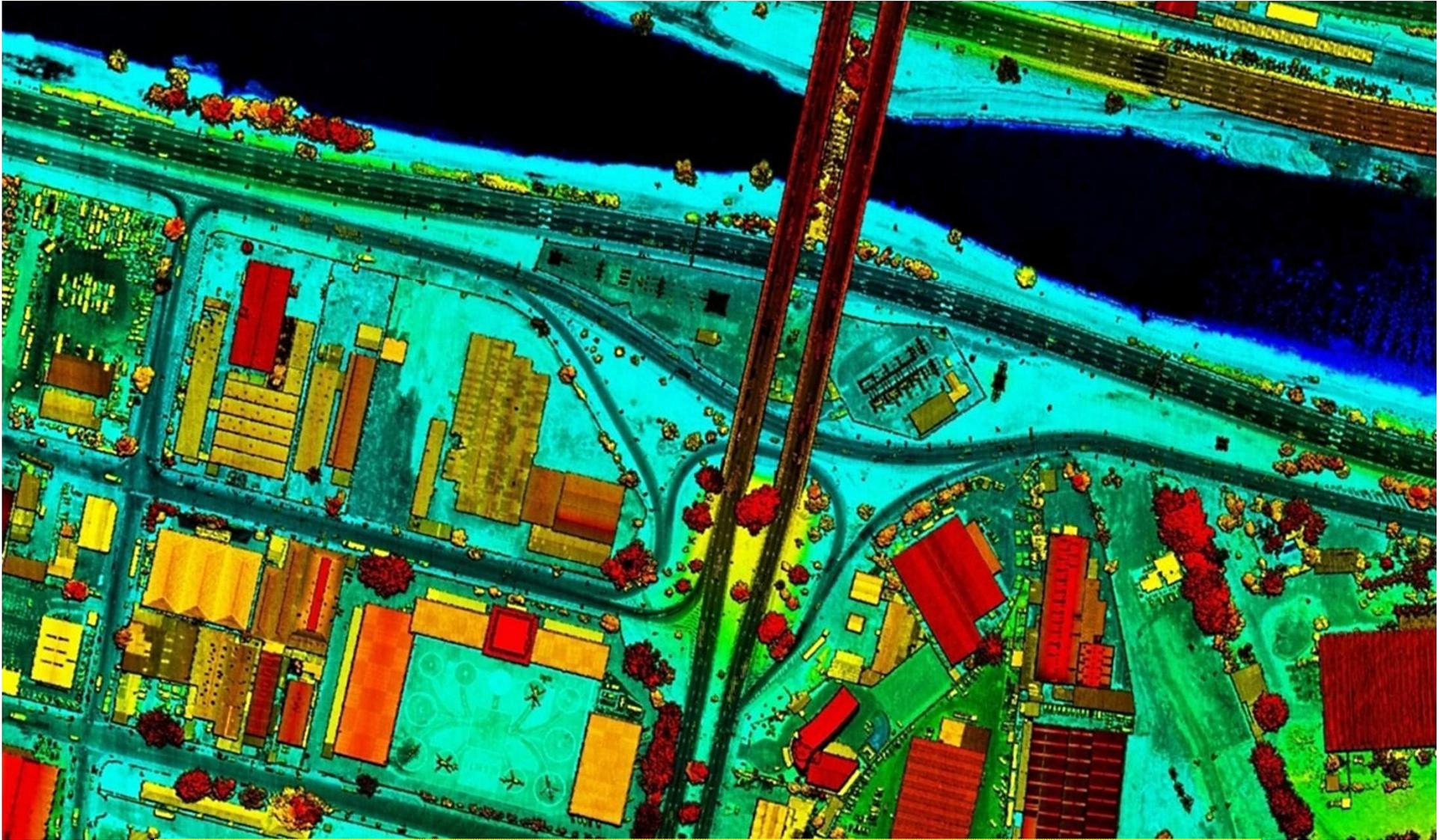


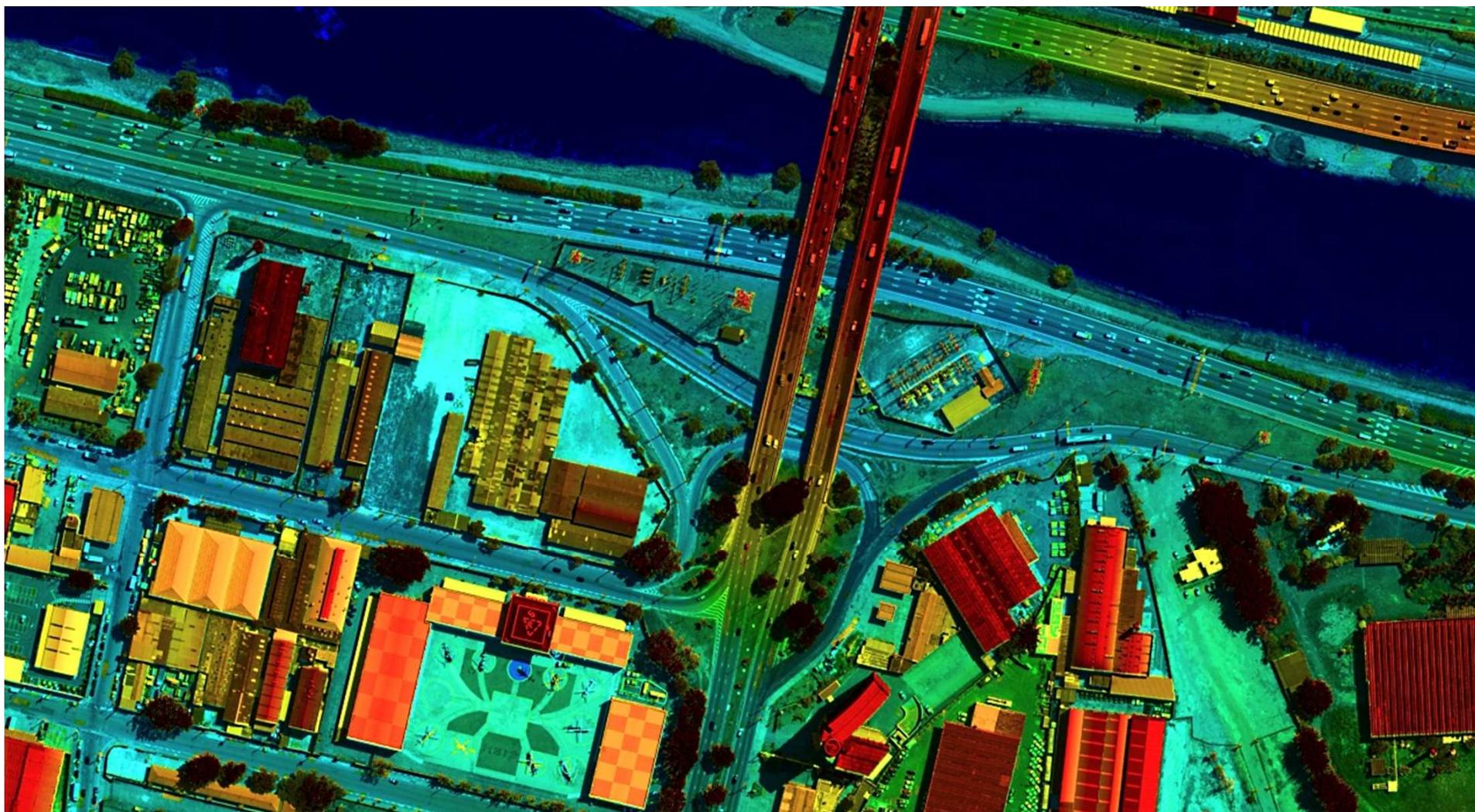




VALE Salobo – 2 pts/m² – 20°







HIPSOMÉTRICO

HIPSO + IMAGEM

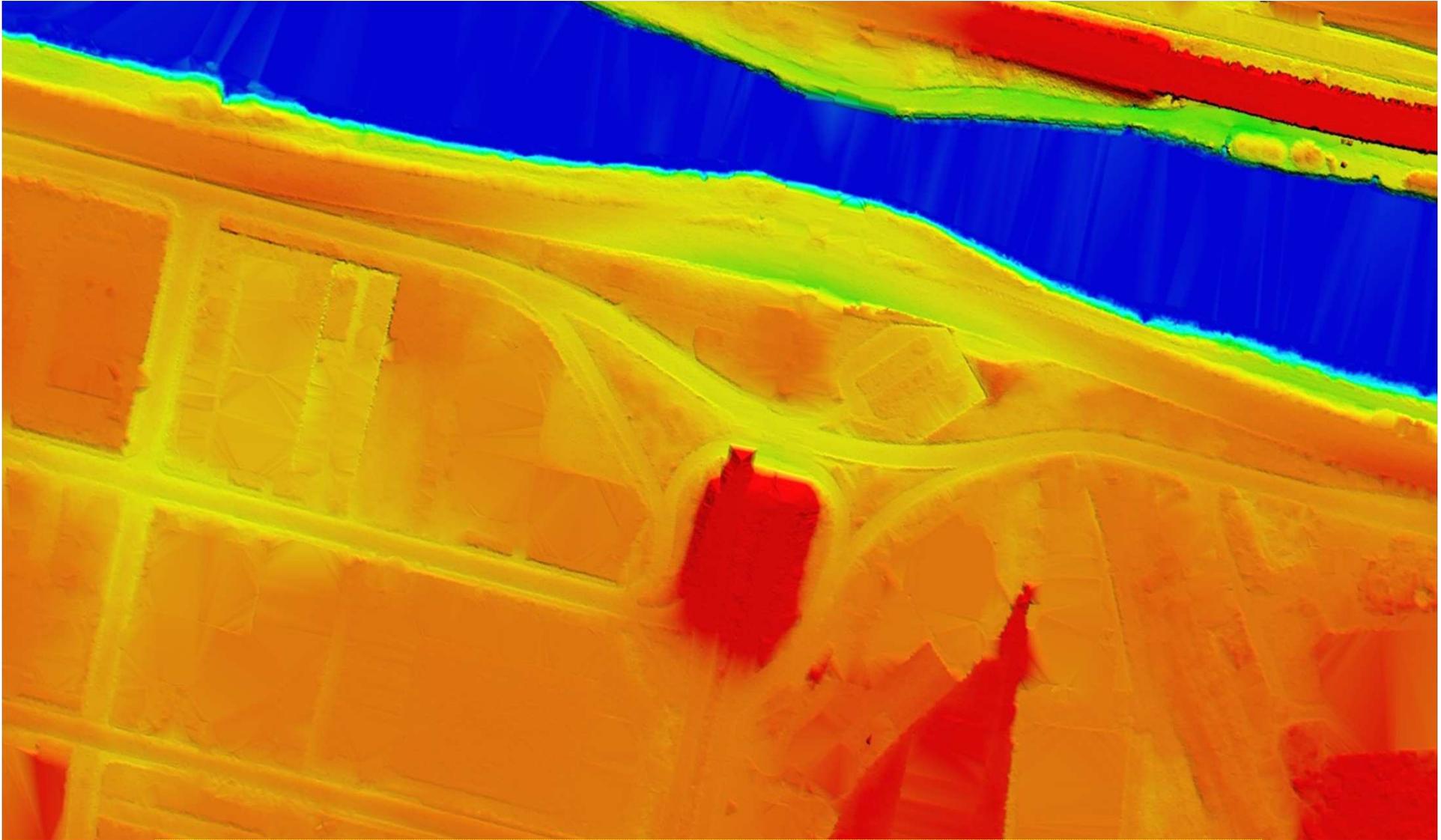
MDT

CURVAS



FunDeB UNESP – 8 pts/m² – 20°

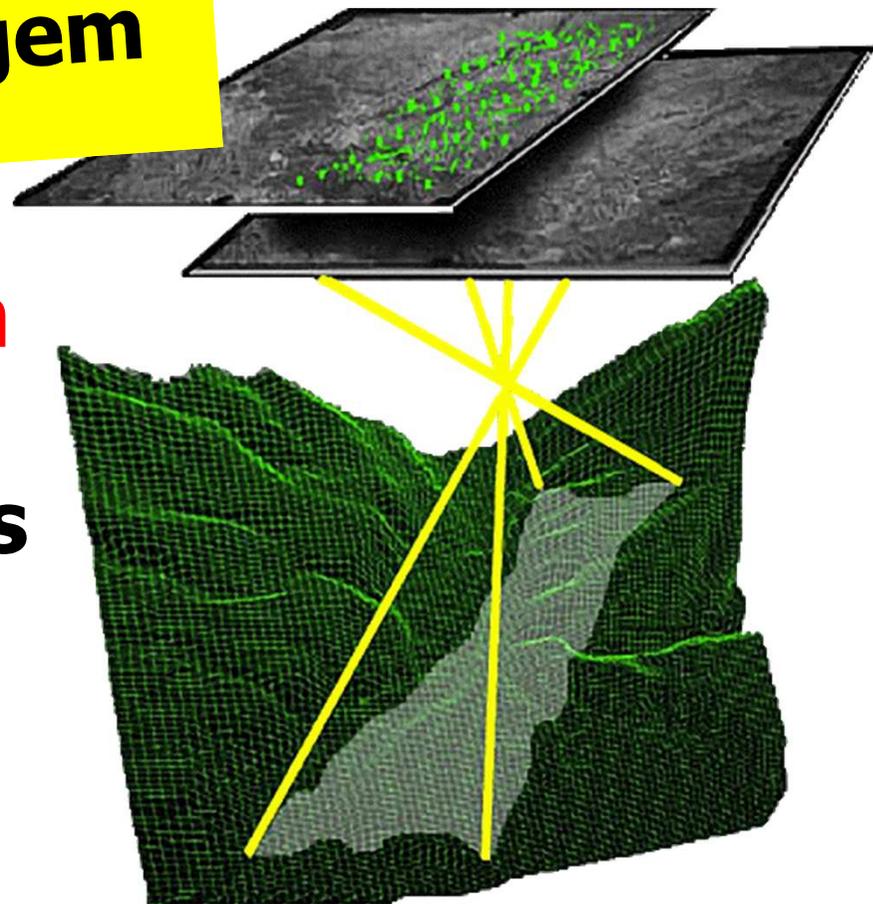




Aconteceu há
7,5 ou **2**
anos ...

Nova abordagem
Correlação de Imagem
Hirschmüller (2005 ...)

Mutual Information
(MI)
Registro de imagens
considerando a
iluminação e a
geometria



Prêmio *Carl Pulfrich* 2011
Dr. Heiko Hirschmüller

A aplicação do **Semi-Global Matching (SGM)** para a geração de modelos de superfície densos tem um impacto positivo e sustentável sobre a Fotogrametria, hoje e no futuro - é um divisor de águas na geração de nuvens de pontos ...

Prof. Dr. Dieter Fritsch

Chairman of the Carl Pulfrich Award Committee 2011

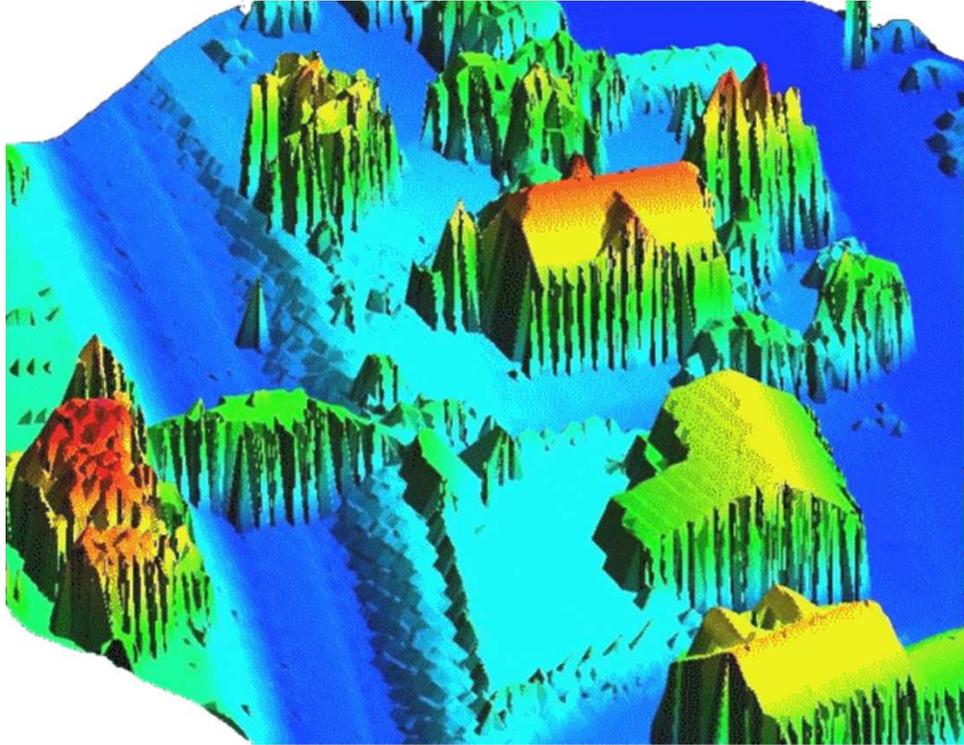
53th Photogrammetric Week - University of Stuttgart

2011

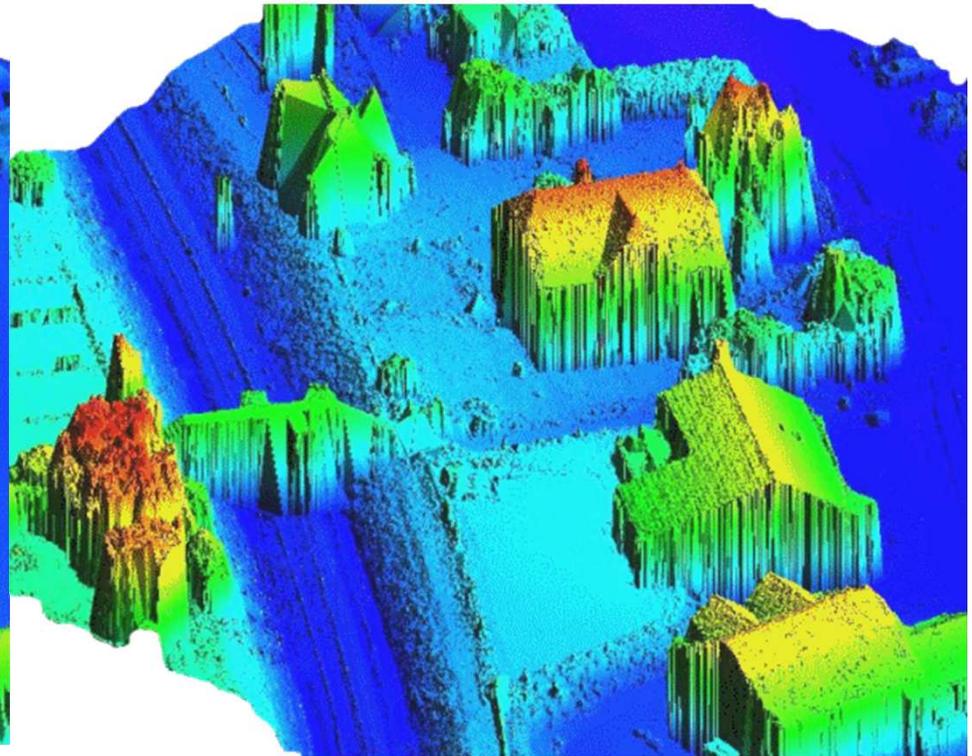
	LiDAR	SGM
Qualidade Horizontal	10-30 cm - f(H)	0,5 GSD
Qualidade Vertical	10 cm - f(H)	1,5 GSD
Identificação	Superfície e Terreno	Superfície
Processamento	1.000.000 pt/s	20.000 pt/s
Densidade	f (freq, abert, Típico = 4 pt/m²)	$(10/GSD)^2$ pt/m² =10cm ≈ 100 pt/m²

-50 X

+25 X

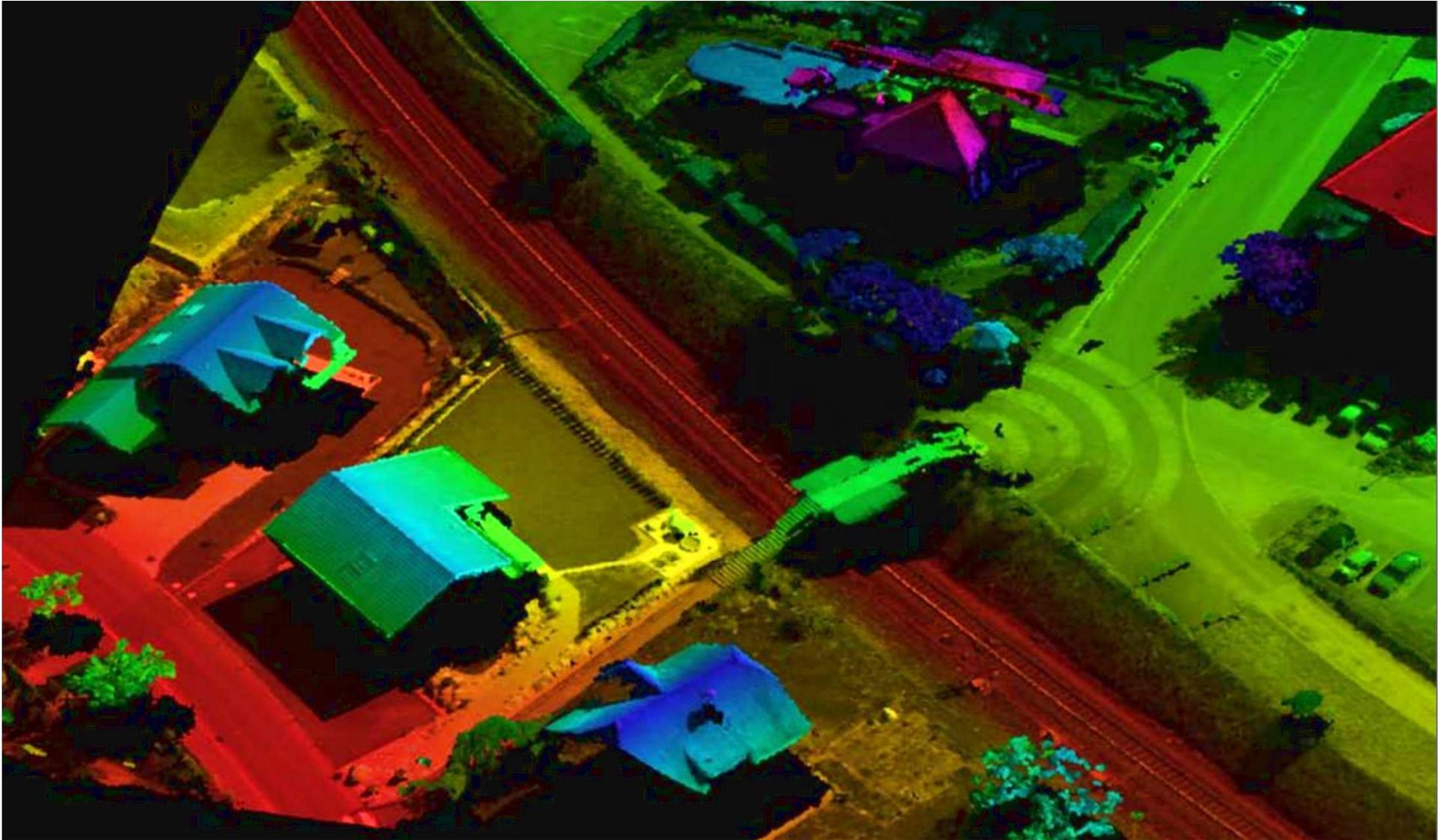


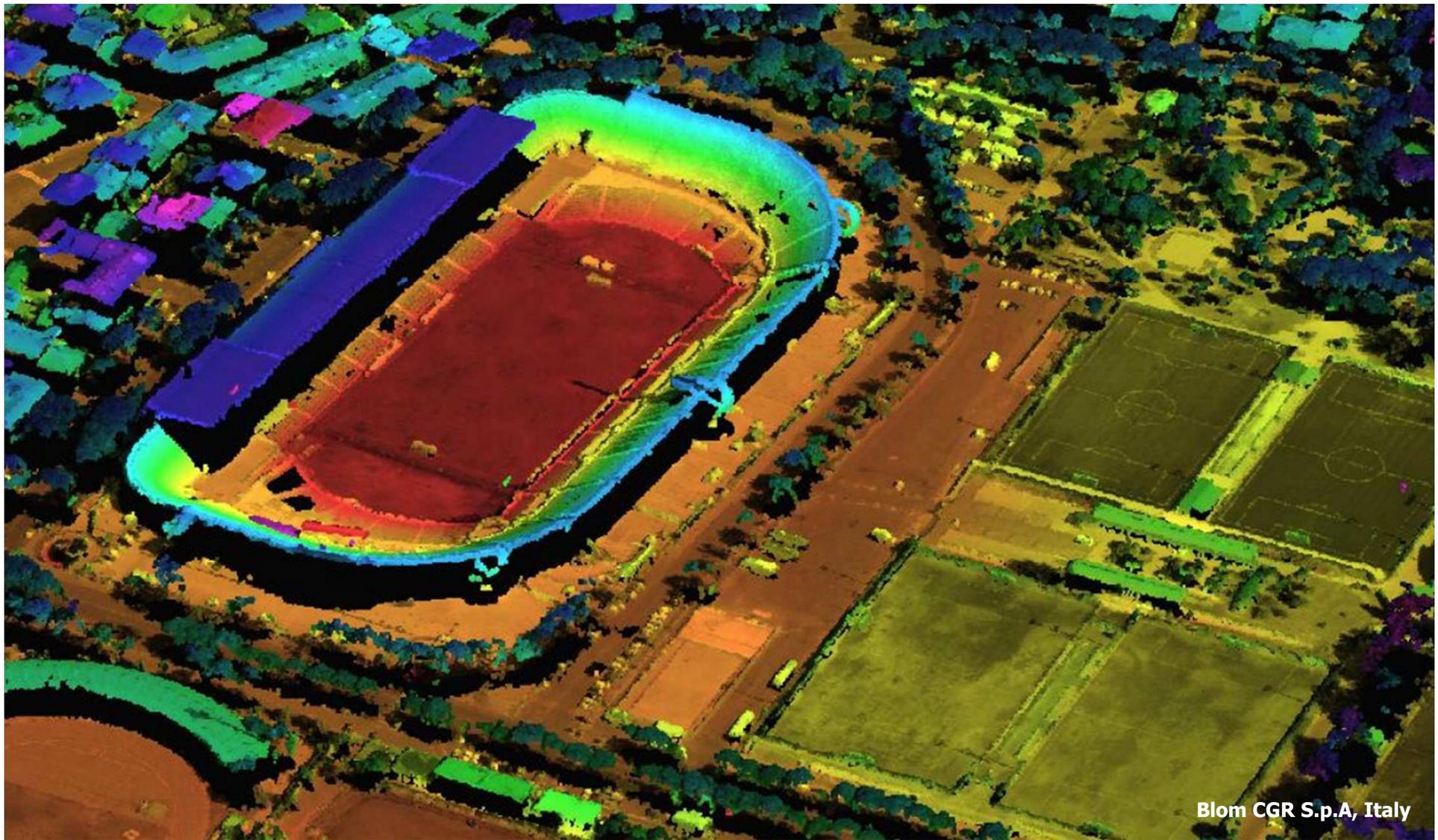
LiDAR



GSM





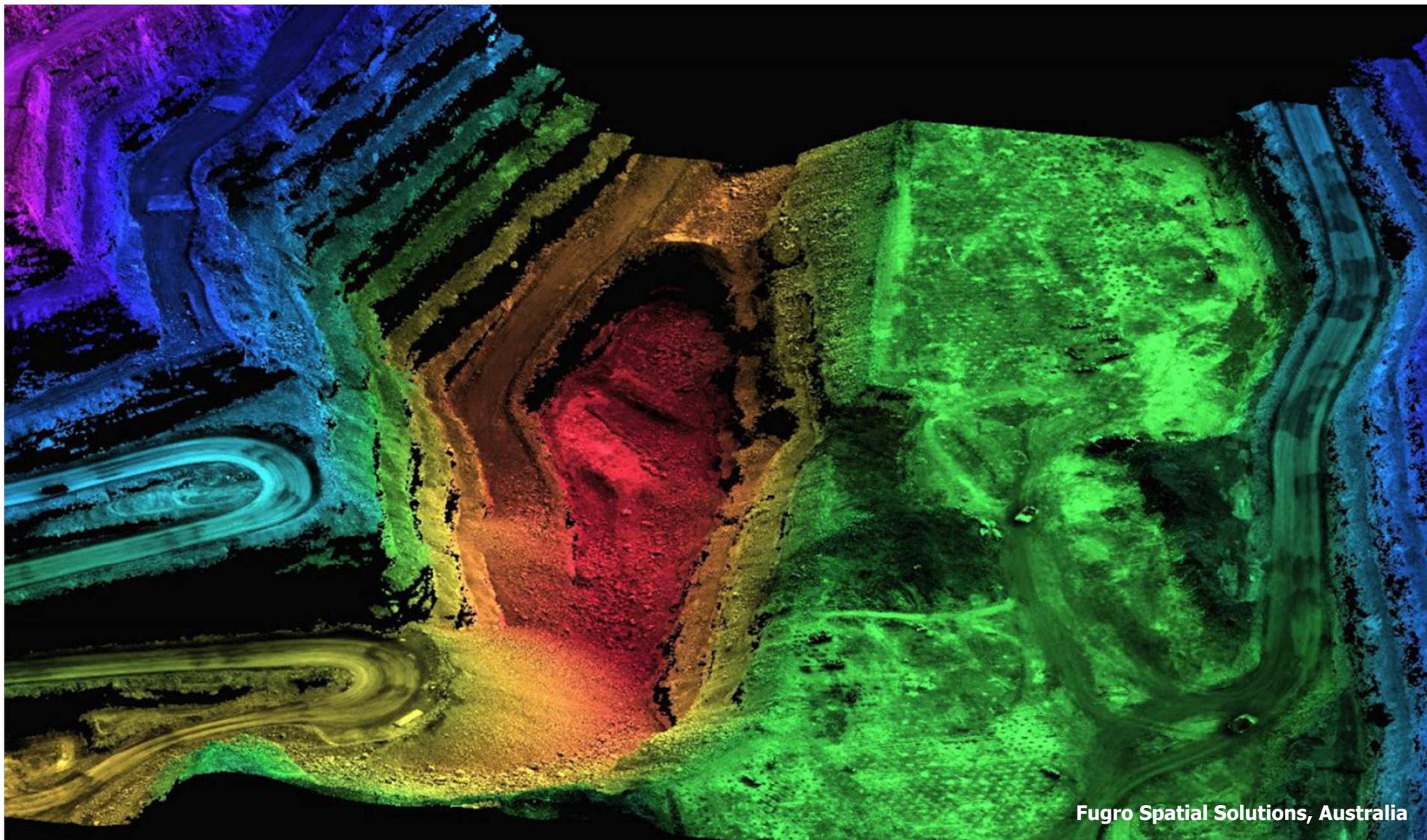


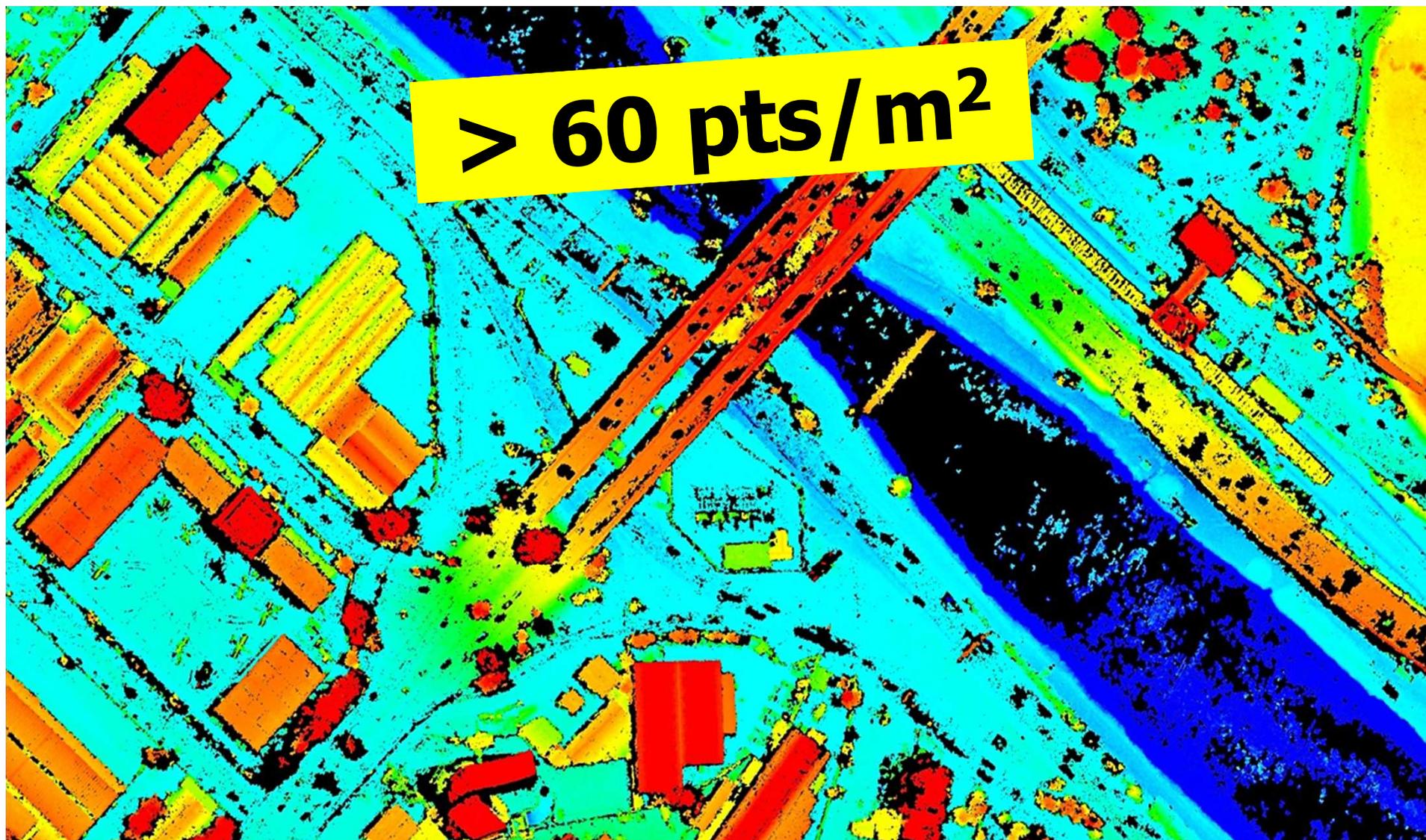
Blom CGR S.p.A, Italy



Fonte : Leica - From Pixel to Info-Cloud – Ruedi Wagner - 2011







> 60 pts/m²

Pixel de Imagem sobre GSM



PROBLEMAS



SEM Correlação de Imagem







Efeito "Cortina"



Efeito "Cortina"



RESUMMO

O que o CLIENTE deseja ?

- Prazo
- Qualidade

O que é viável no MERCADO ?

- Custos
- Produtividade

O que é possível com a TÉCNICA ?

- Limites
- Tolerâncias



O que vai
acontecer em
10, 20 ou 50
anos ?



Obrigado pela Atenção !





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