De wetenschappelijk kant van "Advanced Instrumentation"

Big Science in het SRON programma

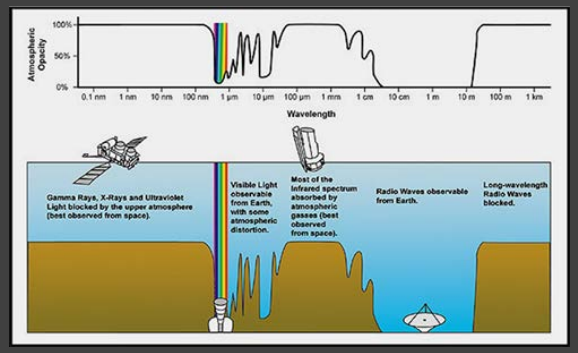
en de kansen die hieruit volgen

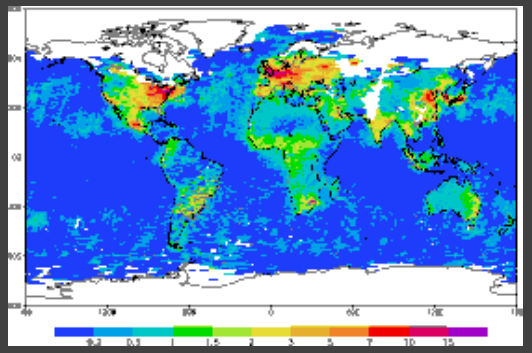
Gerard Cornet
Henk van der Linden
Henk Hoevers

SRON
Netherlands Institute for Space Research

SRON and BIG Science

To conceive and develop world-class innovative space instruments for Astrophysics and Atmospheric science of Earth and Exo-planets, and to analyze data provided by these instruments for advanced research.





SRON's high tech focus

- Cryogenic detector systems with world records
  - Nano sensor device development
  - Optics
  - Sensor read out and control
  - X-ray and SWIR/IR/FIR
- Cryogenic technologies
  - Detector box assemblies
  - Advanced flex wiring concept
  - Mechatronics
- Non-cryogenic technology
  - Mixed signal ASIC
  - Optics: immersed gratings
  - Space qualified electronics design and manufacturing
- Spectropolarimetry

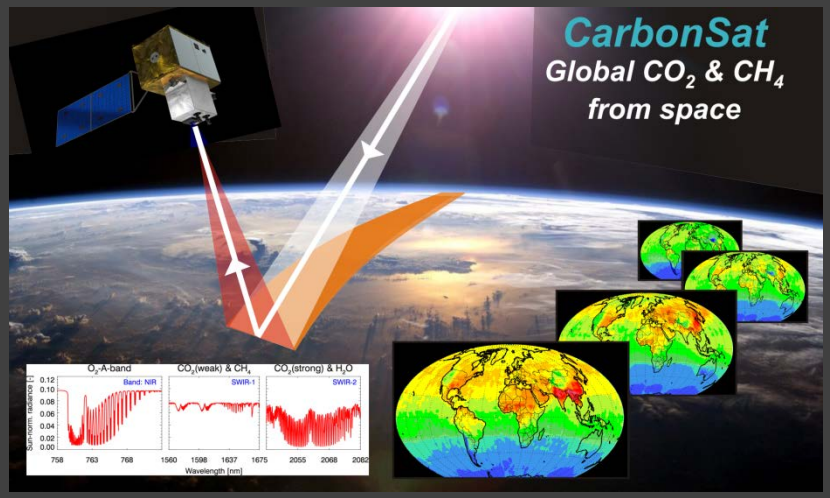
I

SRON

Upcoming mission opportunities

- LOFT - X-ray timing
- SAFARI - Far infrared high resolution imaging spectroscopy
- ATHENA+ - X-ray high resolution spectroscopy

- SPEX - Spectropolarimetry
- SENTINEL5 - Air quality
- Carbonsat - Air quality



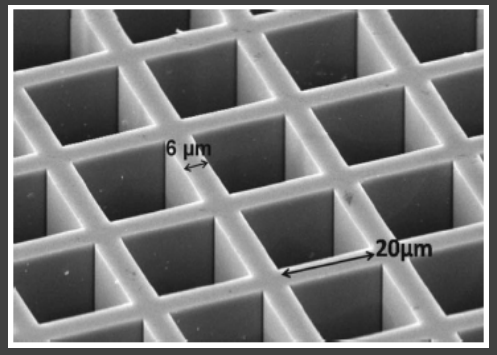
- EcHo - Exo planets
- eLISA - Gravitational waves
- EUCLID - Dark energy, dark matter

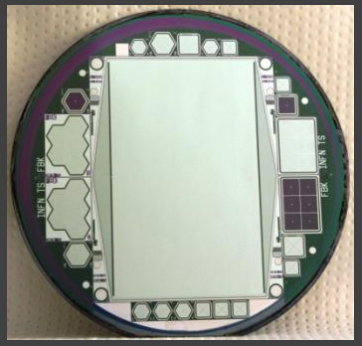
- Technology transfer & valorization of Terahertz technology, immersed grating technology, miniaturized electronics

LOFT Candidate ESA M3 mission for launch in 2022

- X-ray satellite to study extreme physics by timing (10 m^2 effective area, 20 x previous)

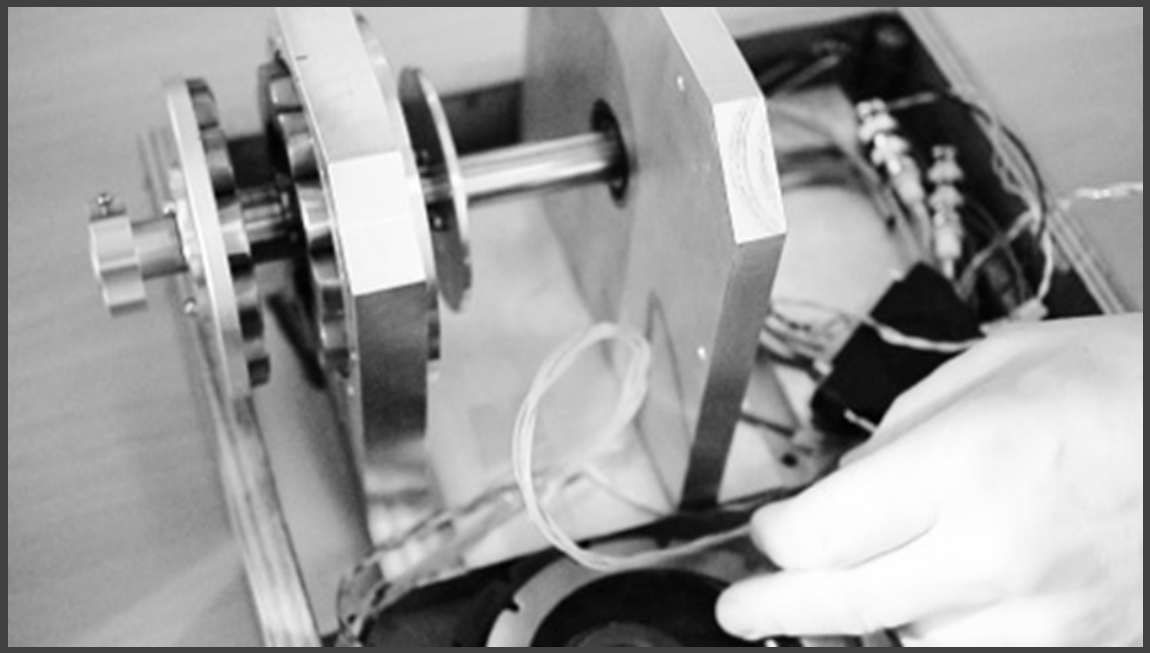
- SRON contribution to Wide Field Monitor
  - Front-end-electronics & support structure for the read out of 4 Silicon Drift detectors per WFM
  - In total 10 WFM's





SAFARI Cryo DC motor

- SRON: aanleveren eisen, fysisch model, cryogene test
- MECON: project management, system engineering, mechanical / electrisch / thermisch design
- PRANGE: ontwikkeling en productie spoelen
- PMP: productie mechanische delen



Mecon® INNOVATION DELIVERED

Prange

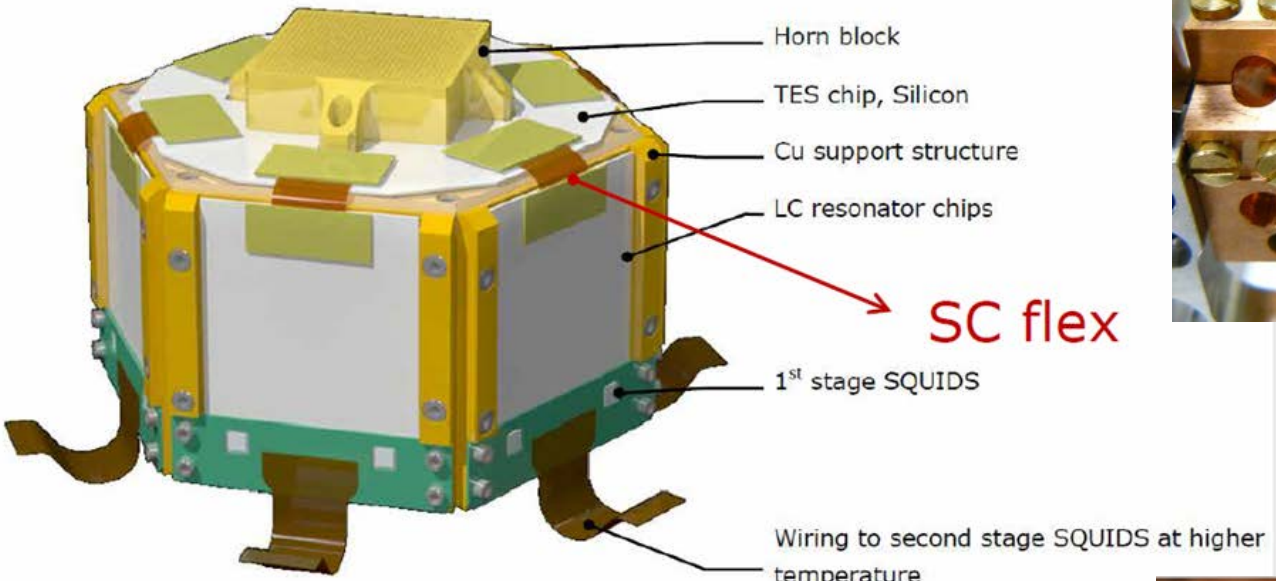
PMP Precision Mechanical Production

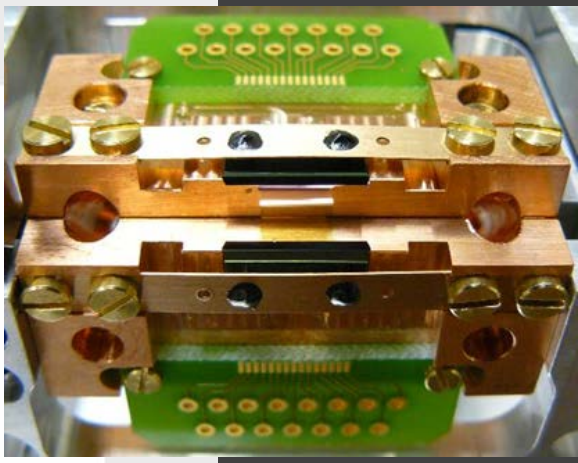
Athena+ Candidate ESA mission for launch in 2028

- X-ray observatory to study hot and energetic Universe
- Detector development SRON and partners
- Optics development cosine bv with partners
  - Optical design, production and metrology, system: cosine
  - Mechanical design SRON
  - Wafer production: Micronit Microfluidics
  - International partners: petals, multi-layer coating, X-ray tests

SAFARI & Athena+ FPA detector module

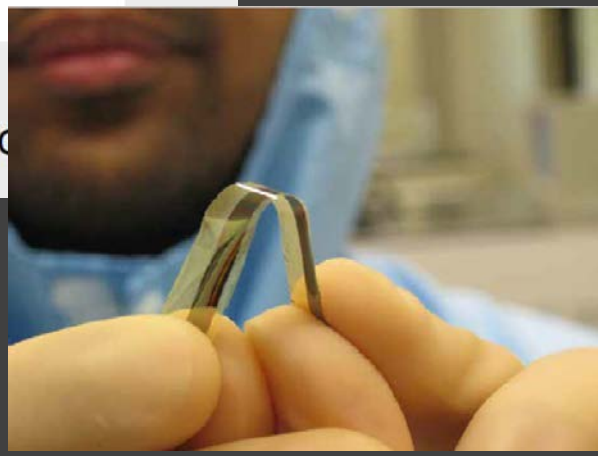
Location of the flexes in the detector assembly:



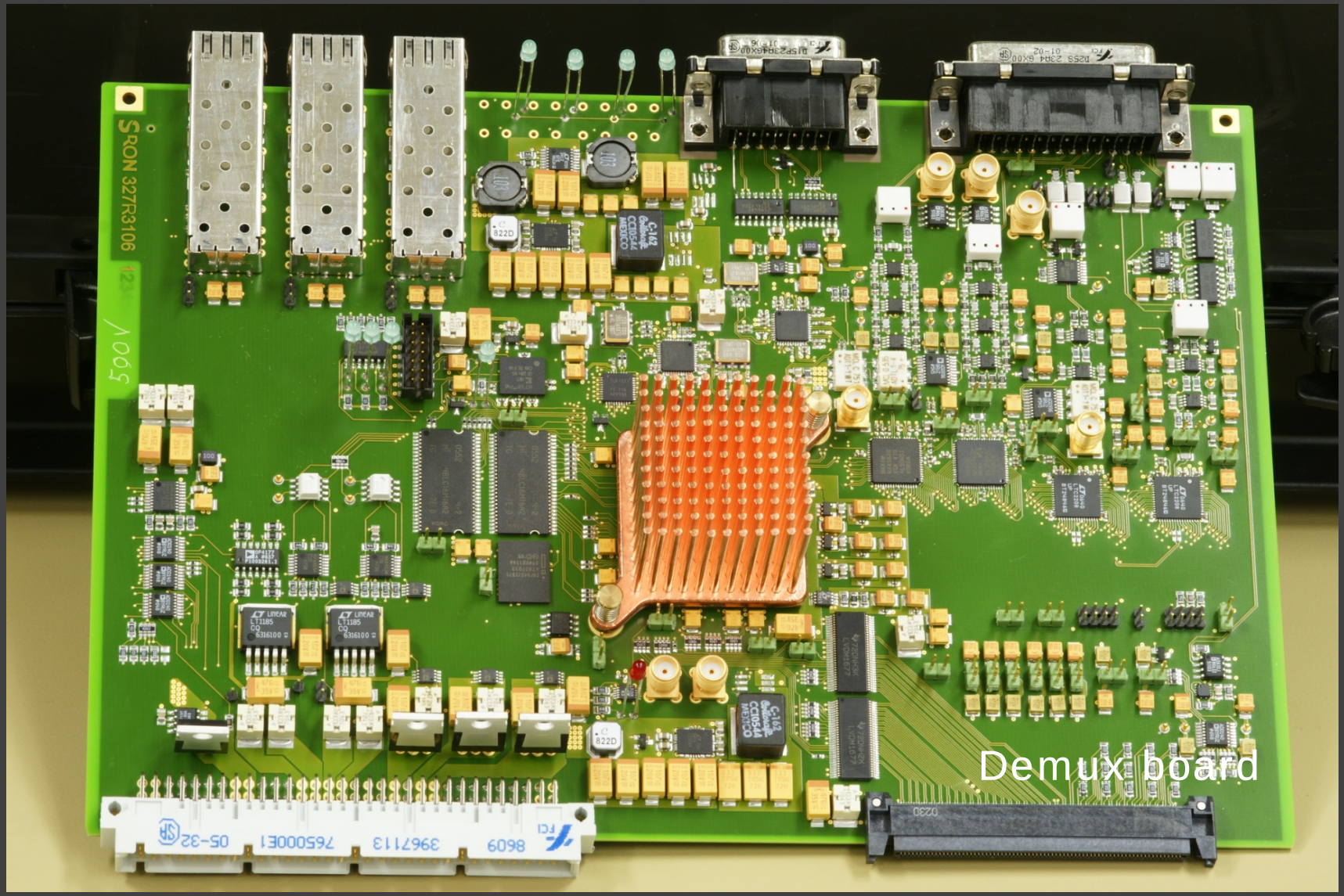


SC flex:

High density superconducting, flexible, and detachable interc

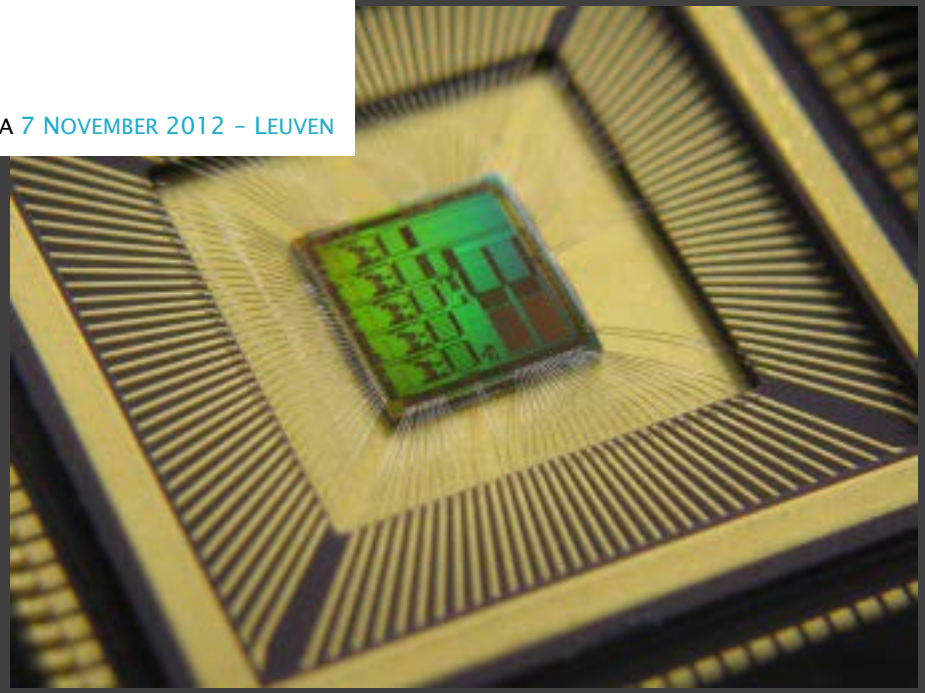


SAFARI & Athena+ sensor read-out and control



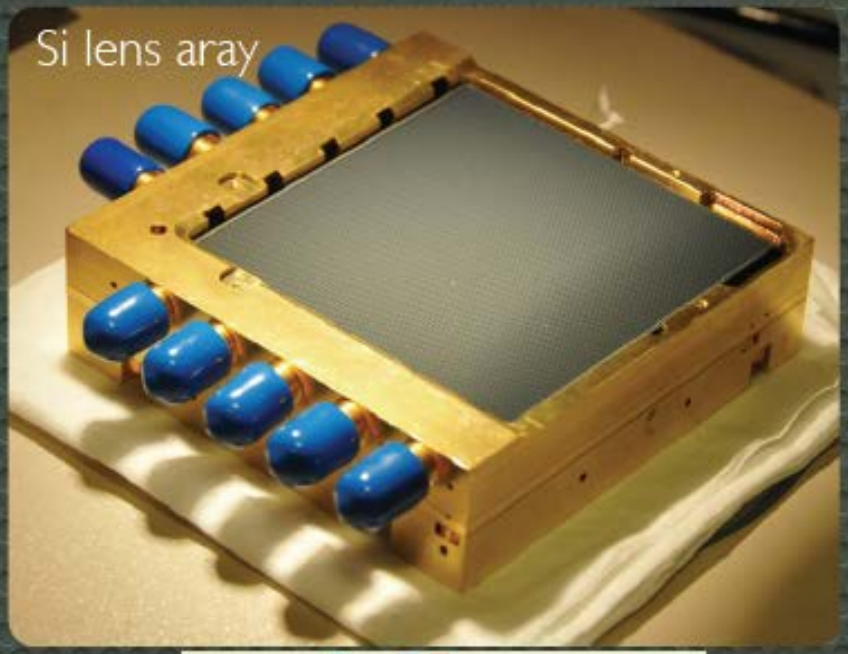
Front-end ASIC for InfraRed detector read-out
The FAIR project

SME partner:
- Start Q4 2012
- Finish Q2 2014
- Low temperature
- High stability
- Space qualified

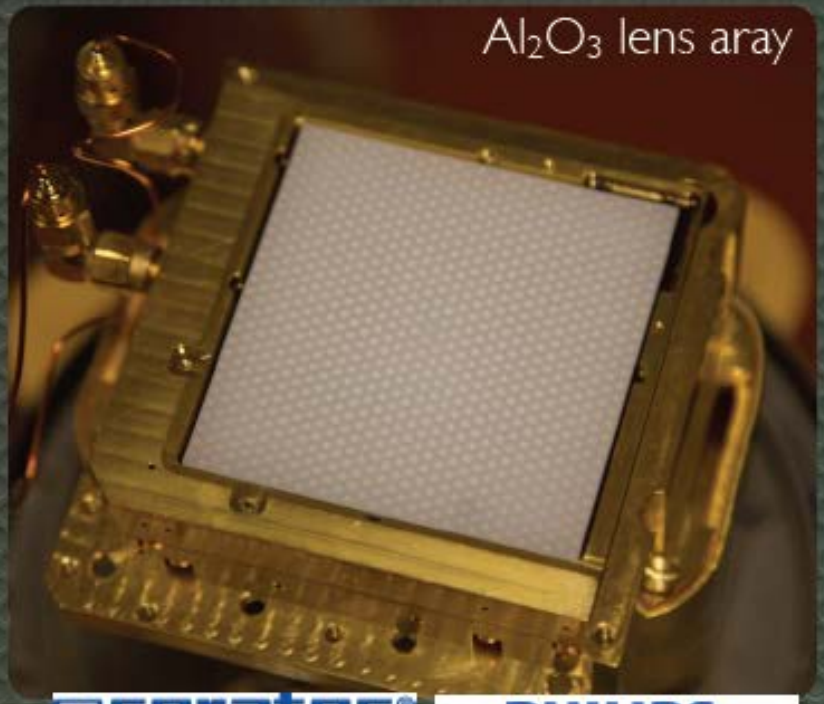


Large area Chips

New lens arrays



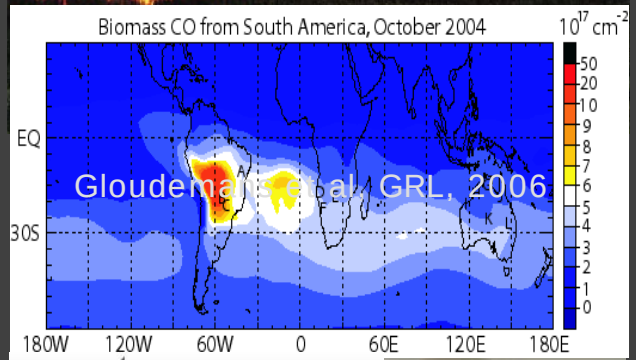
veldlaser
laser micro machining materials

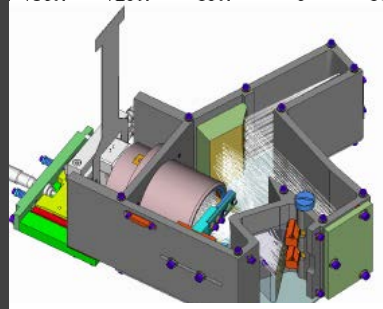


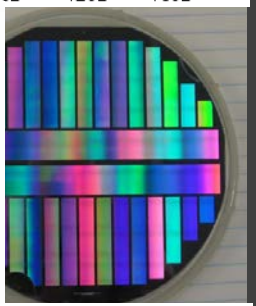
ceratec Technical Ceramics BV

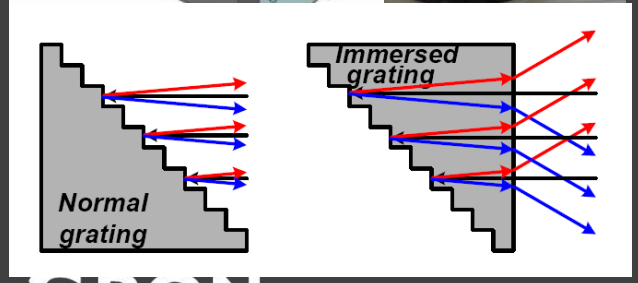
PHILIPS
Philips Lighting Uden

TROPOMI instrument: luchtkwaliteit en klimaat









Doelstelling

- Meting aan luchtvervuiling, broeikasgassen en aerosol met hoge ruimtelijke resolutie gevoeligheid tot aan het aardoppervlak.
- In 3 dagen zelfde hoeveelheid metingen van CO and CH_4 als SCIAMACHY in een jaar!
- Samenwerking: KNMI (PI), SRON, DS, TNO, Mecon.

SRON leiding SWIR spectrometer en wetenschap

- Broeikasgas CH_4 and luchtverontreinigend CO.
- Na SCIAMACHY geen ander instrument voor CH_4 en CO voorzien met deze gevoeligheid tot aan oppervlak.

SRON/TNO enabling technology

- Miniaturisatie van 2D optische module door 'immersed grating' technology: ≈120 ℓ => 3 ℓ.

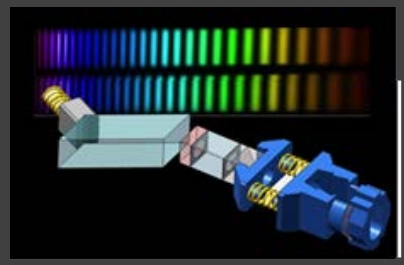
Huidige status

- Immersed grating ontwikkeld.
- SWIR kanaal gedemonstreerd als verwacht.

SPEX2Earth - aerosol and cloud properties

- Acquiring space-based, multi-angle, multi-wavelength measurements of intensity and polarization with unrivalled accuracy

- SPEX2Earth Design
  - Best performance in degree of linear polarization
  - Flux and polarization in a single measurement with a single aperture – no parallax
  - Based on innovative technology:
    - Passive spectral modulation
    - No moving parts
    - Modular design
  - Prototype realized



Technologie naar de markt

Netherlands Space Office

SNN

DUTCH TECHNOLOGY TRANSFER PROGRAMME

Gas Chromatografie
Gas detectie

Water detection
drying processes

FrieslandCampina

AVEBE

dcdi Dutch Drying Institute

PANalytical
The Analytical X-ray Company

Materiaal
karakterisatie

Cryo
Mechatronics

ASML

FOKKER AEROSTRUCTURES

Non-Destructive
Inspection
Composites

AXIOM IC TWENTE

SRON

Technologie naar de markt ism groot consortium

FOKKER TECHNOLOGIES

PHILIPS

TENCATE materials that make a difference

+ MKB

Smart FACTORY

ASTRON

SRON Netherlands Institute for Space Research

- Complexe rekenmodellen
- Robotics
- Big data handling
- Advanced instruments
- Sensoriek
- Super-computing

Basisingrediënten Smart Factories

Aansturen ultra complexe ontwikkel- en fabricage trajecten

University of Twente The Netherlands

NHL HOGESCHOOL

Hanzehogeschool Groningen University of Applied Sciences

FEI

Brainport

VDL

Brabantse klasje machinebouwers

ASML

Conclusies en trends

- Veel mogelijkheden om industrie (i.h.b. mkb) te betrekken bij instrument-ontwikkeling in het ruimteonderzoek, zal naar verwachting toenemen.

- Trends
  - Grote arrays – afbeeldende hoge resolutie spectroscopie
  - Verder gaande integratie op de chip (miniaturisering)
  - In formatie vliegende systemen; netwerktechnologie/interferometrie

- Kansen voor het naar de markt brengen van SRON technologie
  - Terahertz verinfrarood detectietechnologie
  - Miniaturisatie electronica o.m. ASIC's
  - Optische technologie als immersed gratings