

Latest developments at Metrolab

IMMW21

ESRF / Grenoble / France

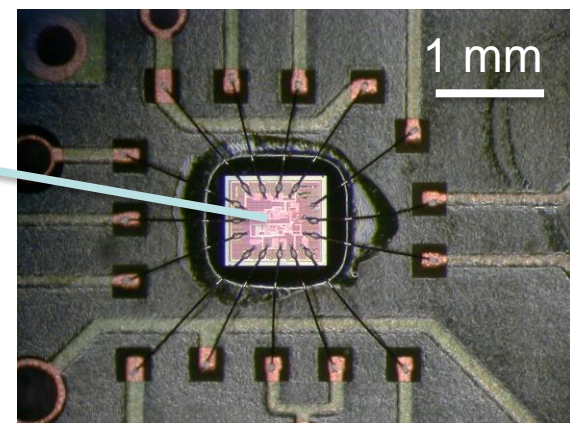
PT2026

A platform for NMR measurements

- Single-point & fast multi-point measurements.
- Large-bore (600 [mm] DSV) & small-bore (10 [mm] DSV) mapping.



NMR integrated circuit (I)



A single-chip integrated transceiver for high field NMR magnetometry.

[Grisi M](#), [Conley GM](#), [Sommer P](#), [Tinembart J](#), [Boero G](#)

NMR integrated circuit (II)

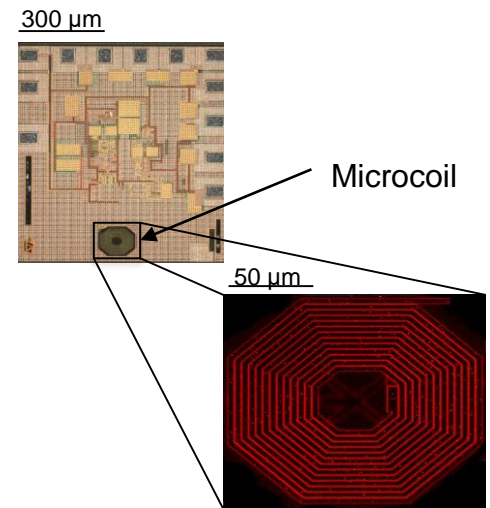
- Excellent S/N ratio.
- Prevent ferro-magnetic material to perturb the measurement.

Today's integrated circuits commonly use a lot of cheap IRON !!

- Low power consumption.

Low voltage drop over 100 [m] long cable.

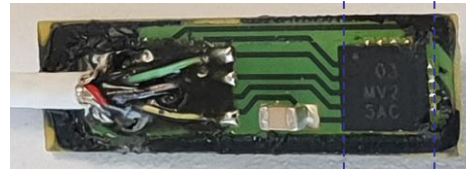
- 3rd generation of NMR IC under development.
- Nowadays, EPFL is working on an IC with integrated micro-coil for high field measurements (Grisi, Boero et al.).



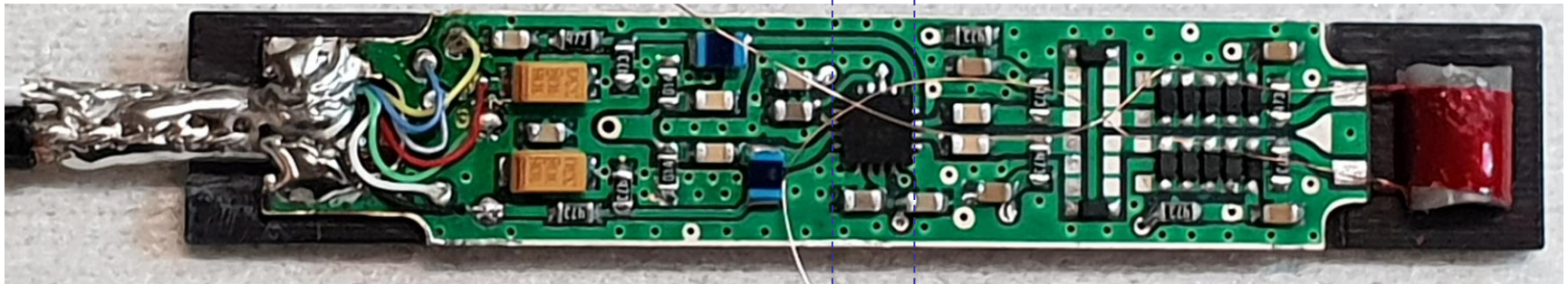
NMR integrated circuit (III) Probe 1526 (to be released Q4/19)



3x3 [mm]



Hall MV2

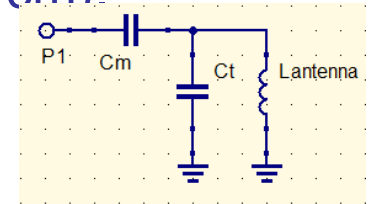


Standard probe 60 [mm] length, 10.5 [mm] width, 6 [mm] height / PCB coil
Low field probe 63 [mm] length, 12.5 [mm] width, 9 [mm] height / Wound coil

NMR integrated circuit (IV)

Probe 1326 0.2-3 [T]

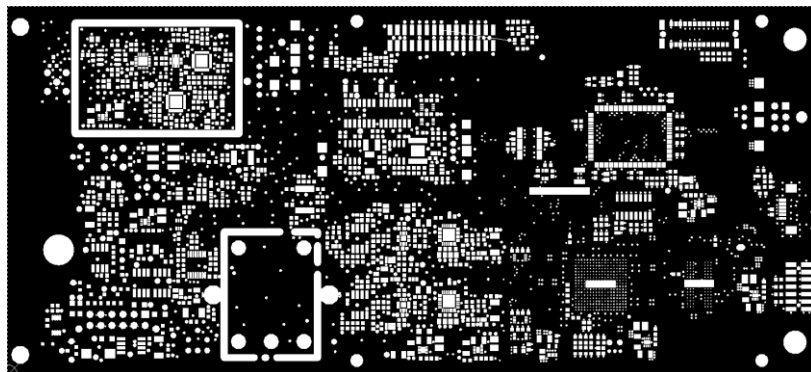
- Developed for Zack Wolf (SLAC) !
- One probe to cover 200 [mT] up to 3 [T].
 - 3 [T] upper limit – limited by our access to high field magnets.
 - No matching / tuning circuit.
 - Needs homogeneous field (better than 1000 ppm/cm).
- Dynamic of 3 is due to the matching / tuning circuit.
- Varactors $C_{T1}/C_{T28} \sim 20$
 - Dynamic range : Theoretical 5, experimental 4, guaranteed 3.
 - Upper limit of a probe range divided by 3 => probe dynamic range.
 - Measured probe dynamic range might be higher, no guarantee for the S/N ratio.



NMR Explorer

Targeting high speed NMR

- Using the properties of the analytic signal $I+jQ$
 - Prone to error, very noisy => lot of work !!!
- Using a specific pulse sequence
- Goal : kHz measurement rate
- First tests at Metrolab in 2017; Collaboration with the Robinson Research Institute (Wellington / New Zealand) will start 01/2020.



New PCB currently under development

NMR Explorer

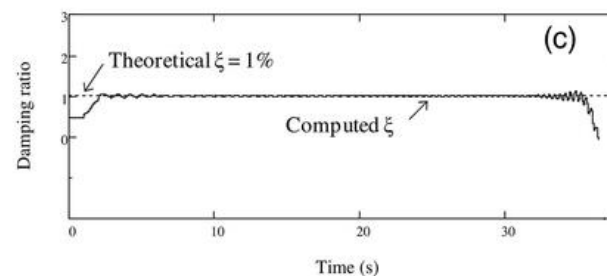
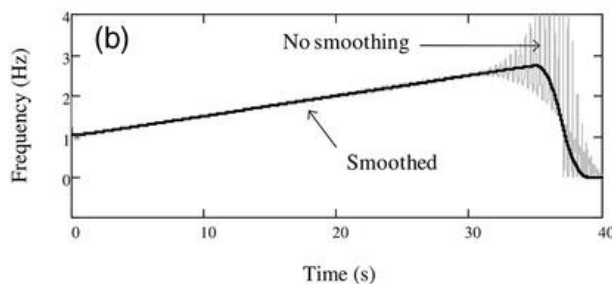
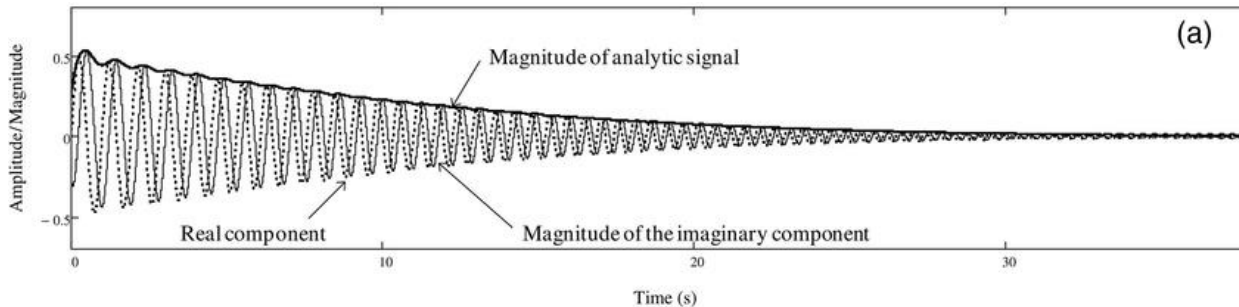
Measurement principle

The time derivative of the unwrapped instantaneous phase has units of radians/second, and is called the instantaneous angular frequency:

$$\omega(t) \triangleq \frac{d\phi}{dt}(t).$$

The instantaneous frequency (in hertz) is therefore:

$$f(t) \triangleq \frac{1}{2\pi} \omega(t).$$

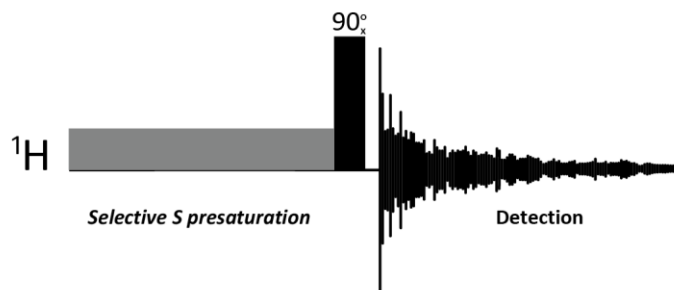


Low field NMR measurements

Targeting NMR @ 1 [mT]

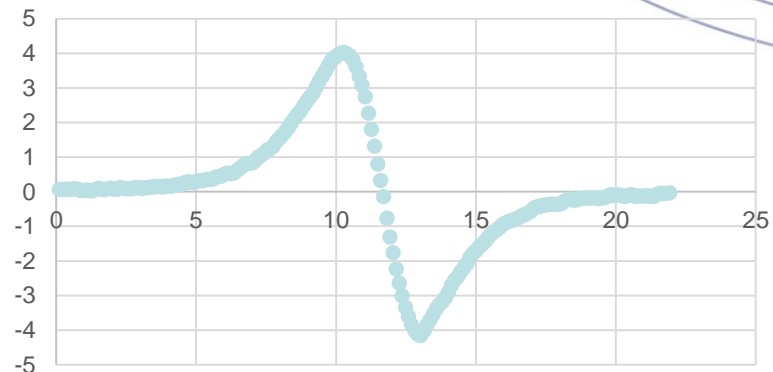
Using the Nuclear Overhauser Effect (NOE)

A phenomenological definition of the NOE in [nuclear magnetic resonance spectroscopy](#) (NMR) is the change in the integrated intensity of one NMR resonance that occurs when another is saturated by irradiation with an RF field.

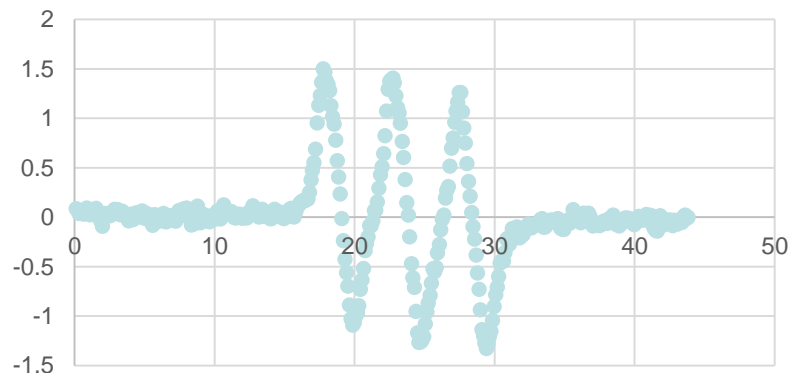


© Wikipedia

ESR resonance @ 9 [GHz]
concentration 100 [mM]



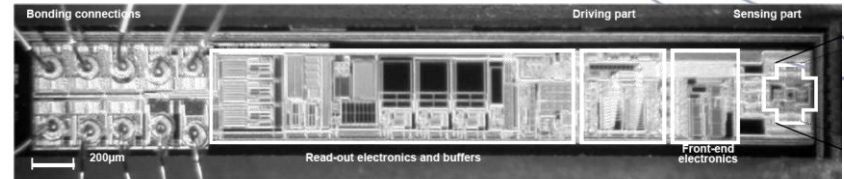
ESR resonance @ 9 [GHz]
concentration 10 [mM]



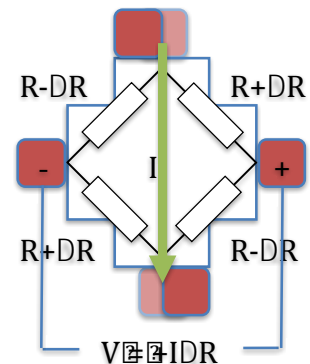
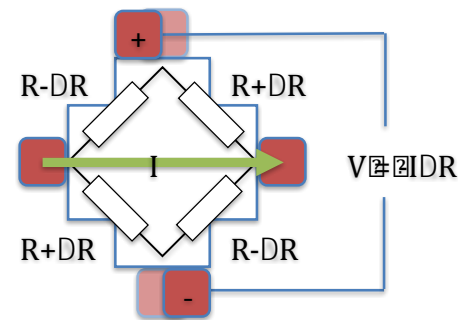
Measurement made @ EPFL / Boero, Tinembart

Integrated Hall Probe

- Integrated current source and amplifier
- Integrated temperature sensor
- “Spinning current” to minimize offset, Planar Hall Effect, and noise

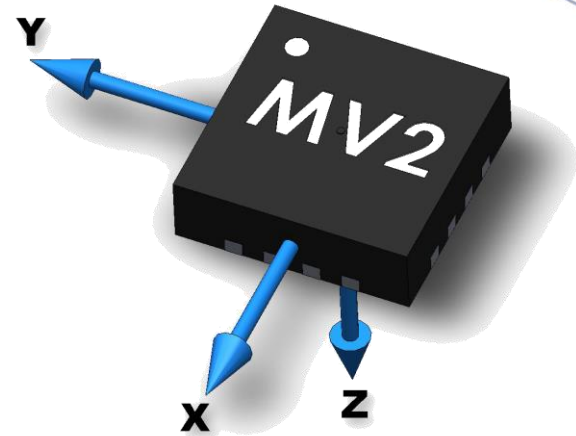


Credit: presentation by D. Popovic (Senis) at IMMW-14



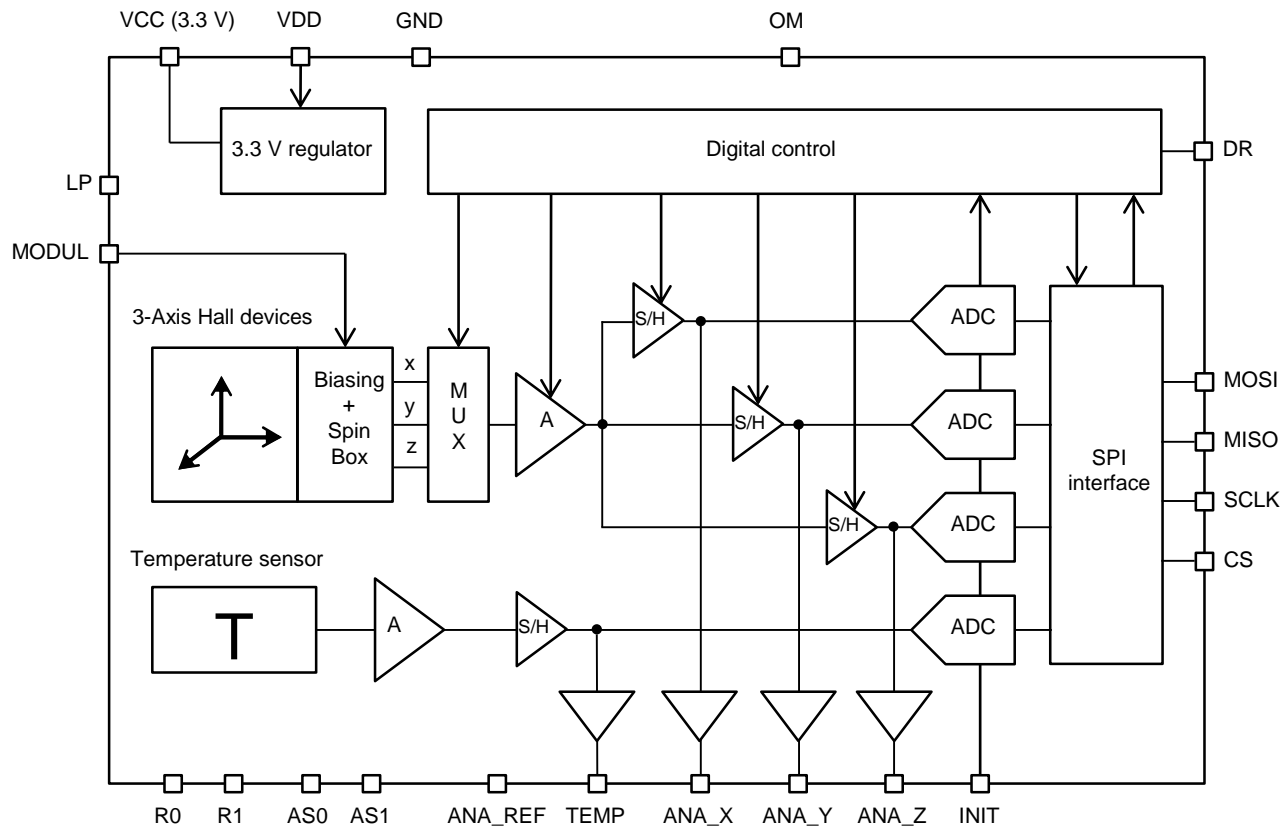
MagVector™ MV2

- Integrated ADC
 - Digital interface
- Advantages:
 - Minimize system complexity & cost
 - Minimize errors from inductive voltages
 - Additional controls
 - Sensor arrays feasible
- Disadvantages:
 - ADC performance



An evaluation kit exists !
It comes with a price but with a lot of support, don't hesitate to call us !

MV2 Architecture

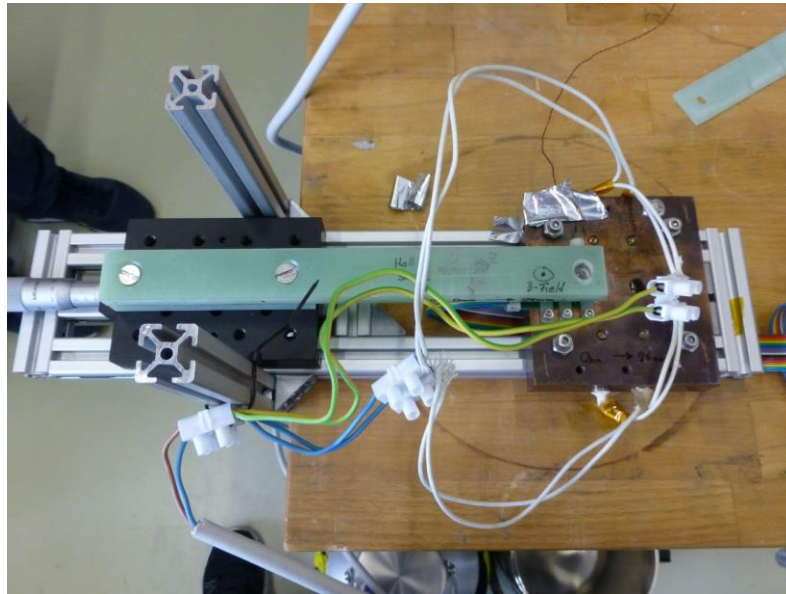


MV2 In Cryo conditions

The first cryo tests were made by Alexander Warth / GSI
and confirmed by Andreas Grau / KIT

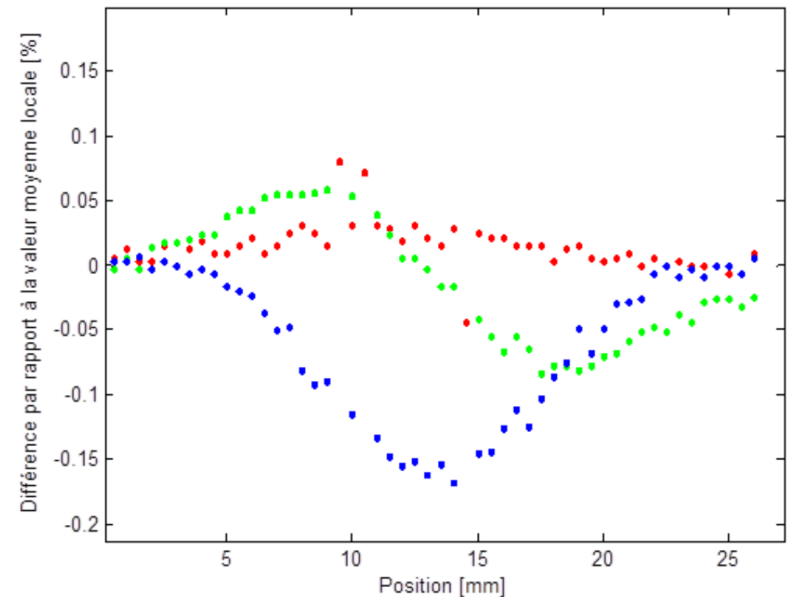
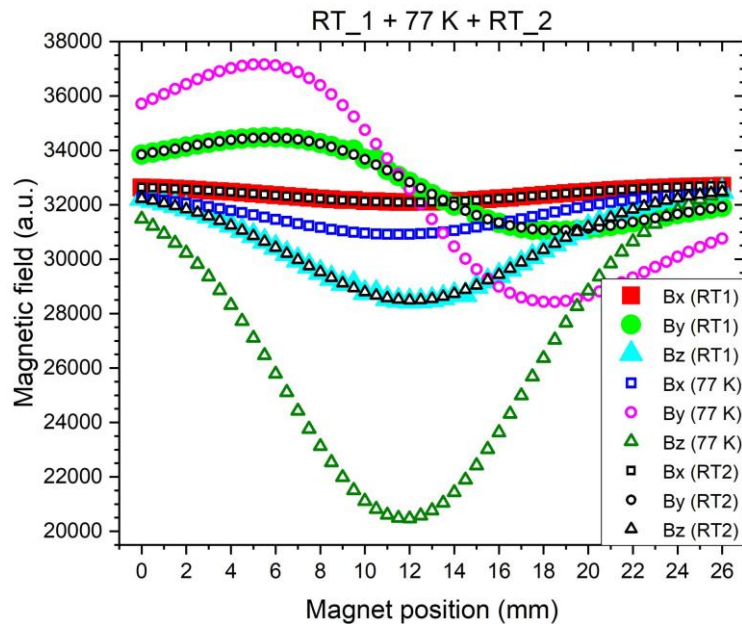


Andreas Grau depicted with his setup



MV2 In Cryo conditions (II)

Andreas Grau's measurements




Difference between measurement
taken at RT_1 and RT_2
RT_1 & RT_2 varies by 0.5 %

PT2025 : End of an Era


- End of life notified September 27th 2018.
- 30 years of good service.
- Probes 1062 & 1082, mux. 2030 and cables still available.
- Discontinued product repaired for two years. Then on a “best effort” basis.
- Calibration can still be performed for the instrument’s lifetime.




PT2025 2nd source : eBay !

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MetroLAB PT 2020 PT2020 Precision NMR Teslameter

Condition: **For parts or not working**

Quantity: **Last one** / [1 sold](#)

Price: **AU \$11,946.00**
Approximately US \$8,262.45

[Buy It Now](#)

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More than 49% sold Last item available Longtime member

Shipping: **AU \$289.60 (approx. US \$200.30)** Australia Post Air Mail Parcel | [See details](#)
See details about international shipping here. ²
Item location: Atlanta, Georgia, United States
Ships to: Worldwide [See exclusions](#)

Delivery: Estimated between **Mon. Jul. 1 and Wed. Jul. 10**
Seller ships within 3 days after [receiving cleared payment](#). ²

Payments: [PayPal](#) [VISA](#) [MasterCard](#) [AMERICAN EXPRESS](#) [DISCOVER](#)

Returns: Seller does not accept returns | [See details](#)



Metrolab : Management buyout

- Pascal & Philip to progressively diminish their activities.
- 40% of the shares still owned by Metrolab's employees.



Renaissance
FONDATION & MANAGEMENT

Newsletter – Mai 2018



Renaissance finance la reprise par le management de la société Metrolab

La fondation de placement Renaissance et le management de Metrolab s'allient et reprennent l'ensemble du capital de la société dans le cadre d'un Management Buy-Out (MBO). M. Pascal Sommer, fondateur de la société, demeure Président du Conseil d'administration. Cette étape assure la continuité de l'activité pour les collaborateurs et les clients de l'entreprise.

Metrolab Technology SA leader mondial des magnétomètres de haute précision

Metrolab a été créée en 1985 avec l'objectif de mesurer les champs magnétiques avec une très haute précision. Outre les systèmes dédiés à l'IRM, Metrolab fabrique différents types de magnétomètres capables d'évaluer les variations et les orientations des champs.

Aujourd'hui, Metrolab est devenu leader mondial dans son domaine de haute technologie et conçoit différents types d'appareils pour de prestigieux clients répartis à travers le monde, fabricants d'IRM et laboratoires de physique.

► Plus d'informations sur Metrolab: www.metrolab.com

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Committed to supporting your magnetic measurement needs.

Thank you !

Visit our website : www.metrolab.com