# USING LIGHT TO SEE NEUTRONS

# BAROTRON

# HIGH RESOLUTION 2D DETECTOR


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*P. Baroni, L. Noirez*



Brevet France n°: 0502379 (2005), Dépôt: PCT n°: EP2006/060611 (2006)
http://iramis.cea.fr/Phocea/Vie_des_labos/Ast/ast.php?t=brevet&id_ast=1276


ucans 8
PARIS
July 8-10th

Orphée Laboratoire Léon Brillouin

MAMI
*Magnetics and Microhydrodynamics*


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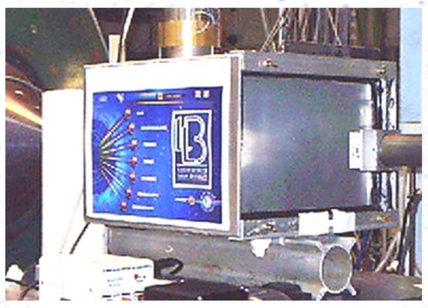
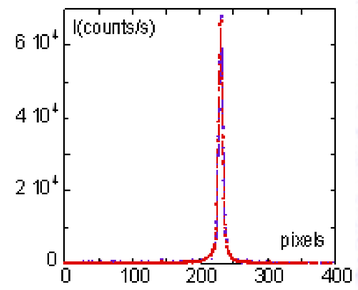
## Characteristics :

- 520x520 pixel **Multidetector**
- Spatial resolution : 0.25mm ,
- high sensitivity: very low threshold: <1 neutron/cm$^2$/s.
- Selectively sensitive to neutron radiation
(no gamma, no X ray sensitivity, no memory effects)
- True 16 bits storage (64000 levels): Fits or txt format,
- linear time-dependence. .



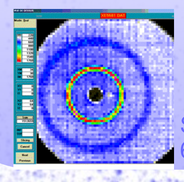



## Gas-chambers:

*$BF_3$, $^3He$, Micro-strips*

Advantages:
- short time response,
- Weak electronic background.

Drawbacks:
- Toxic or rare ($^3He$)
- High costs,
- Low spatial resolution
(large pixels > 5 x 5mm)
- Large samples



SANS (PAXE)
64 x 64 cells

## Solid detectors:

### Gd Image Plate

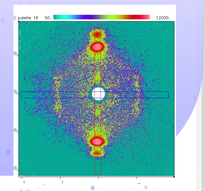
Advantages:
- Versatile and easy use,
- High resolution (typically: 520x520 pixels, pixel:0.5mm)

Drawbacks:
- slow photoemission: 0.1s
- slow relaxation: 0.9s relaxation.
- γ and X radiation sensitive,
- memory effects (Baryum activation ),
- γ production.

Built for X radiation. NOT adapted for neutron detection (γ sensitive and γ productive).

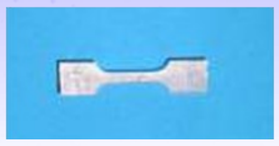
### BAROTRON

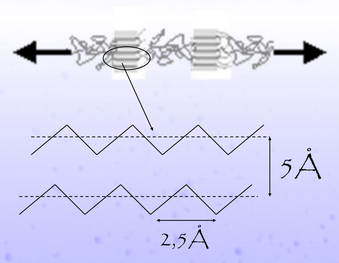
Advantages:
- Easy use,
- High resolution (520x520 pixels, pixel: <0.5mm)
- Short time response:
- Fast photoemission: 110 ns
- Fast relaxation time: 200 ns
- Neutron selective:
- Not sensitive to γ or X radiations.
- Versatile (modulable size).
- Low cost*

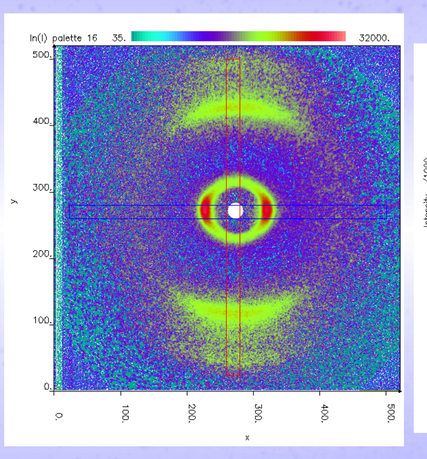


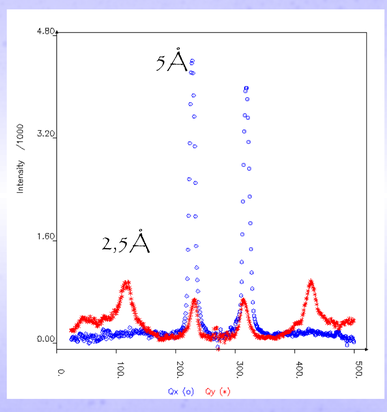
Barotron
520 x 520 cells

## PTFE (teflon*) stretched along the c axis (horizontal):
## elongation rate : 700%





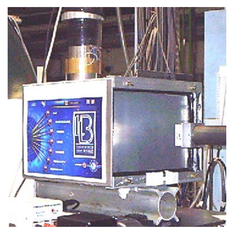



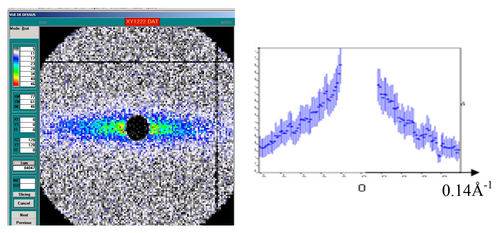

*Sample-detector distance= 45 mm, I=2.662Å$^{-1}$, acquisition time: 900s.*
*L. Noirez, P. Baroni, Applied Physics Letters 90 (2007).*

## Performances : real time - identical conditions

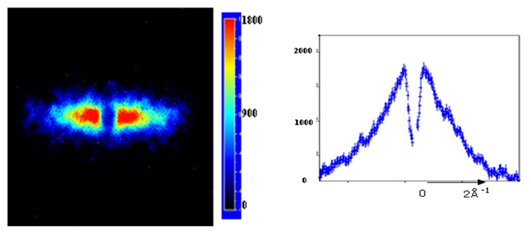
*2D gas detector (PAXY)*

*2D Solid detector (Barotron)*





SANS Spectrometer (PAXY): t=180s
7 metres, 5 tonnes, 128*128 cells.




SANS Barotron: t=180s
35 Kg, 0.50m, 520*520 pixels.

## Neutron diffraction on Silica samples: Polymorphism of Silica

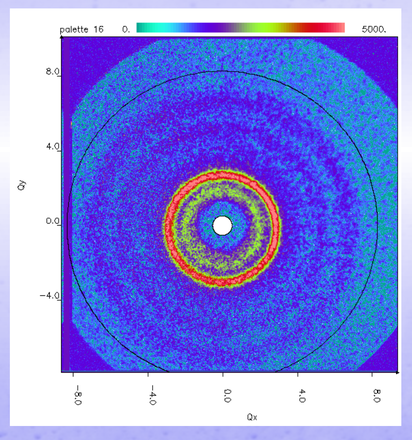
- Silica from Neolithic flints (silex)

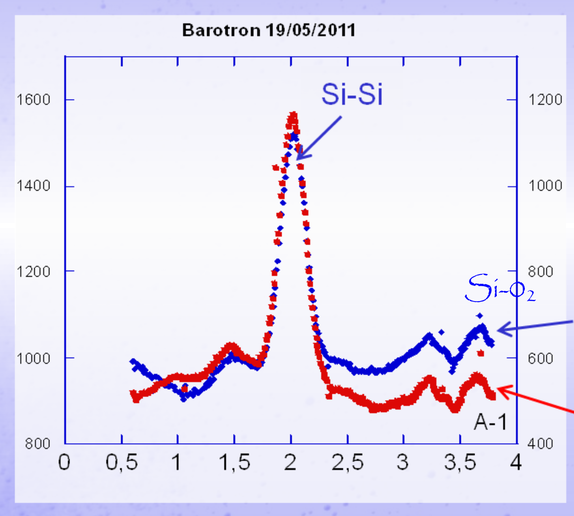
collaboration with Ph. Sciau, N. Ratel-Ramond, CEMES) and V. Léa (TRACES)
Non-destructive analysis of archaelogical tools

Treated vs natural flints:
- Identical peak positions:
- Background increased -> $H_2O$ trapped in heated flints!

Heating closes the porosity –> water is conserved
-> improved mechanical properties

Powder

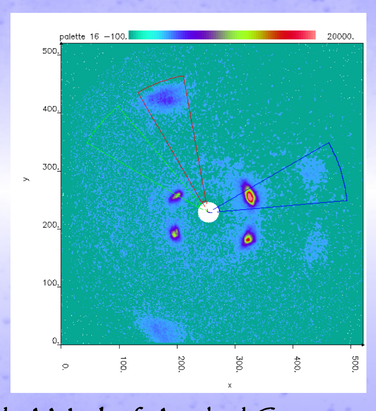


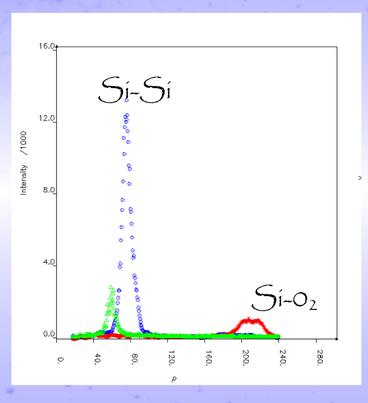




treated flint
(long heating by neolithic guys)
native flint

- Silica from eruptive rock (pyroclastic cloud):

Crystal formation




The presented Neutron Patterns are raw; i.e; without binning, smoothing, integration, regroupment or normalization.

Unique performances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P. Baroni and L. Noirez Neutron News, 18 (3), 17 (2007), ibid. AM. J. of Applied Sciences 11 (9) 2014, 1558