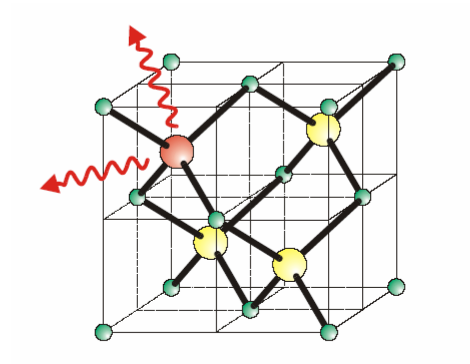
centro de física nuclear
da universidade de lisboa

Lattice Location of Ag in SrTiO3

&

New developements in position-sensitive detectors for Emission Channeling



ISOLDE
CERN
Workshop and Users meeting
2005/2006

Ana Cláudia Lourenço Santana Marques

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The purpose of the talk is twofold:

- Lattice site location of low dose implanted ^{111}Ag in $SrTiO_3$ by means of the Emission Channeling technique.
- Development of a novel DAQ system for 1mm thick EC detectors that, bring as major feature, the use of new isotopes in $SrTiO_3$ and another systems of potential interest.

Why SrTiO3?

1) $SrTiO_3$ has great potential for microelectronic applications due to its high bulk dielectric constant. In particular, $SrTiO_3$ has potential use for devices based on metal-oxide Si heterostructures such as high-k field effect transistors.

2) $SrTiO_3$ has interesting and complex electrical, optical and magnetic properties that can be modified by the incorporation of dopants.

3) Little is known on the lattice site location of implanted impurities and remaining point defects in their neighborhood.

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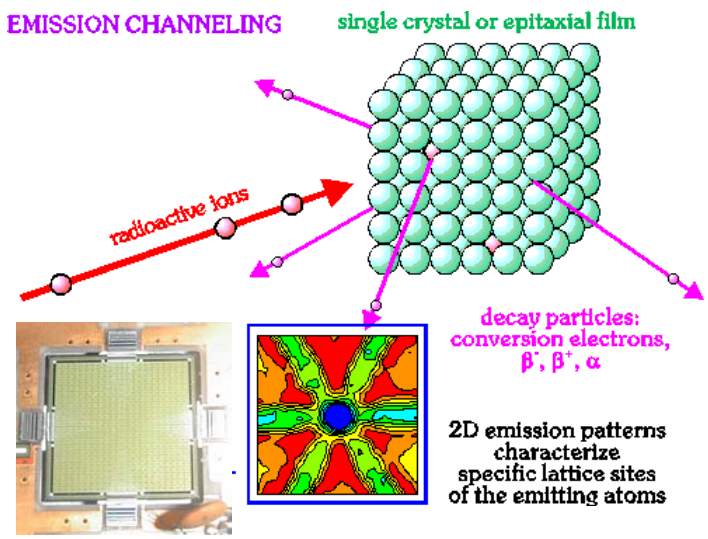

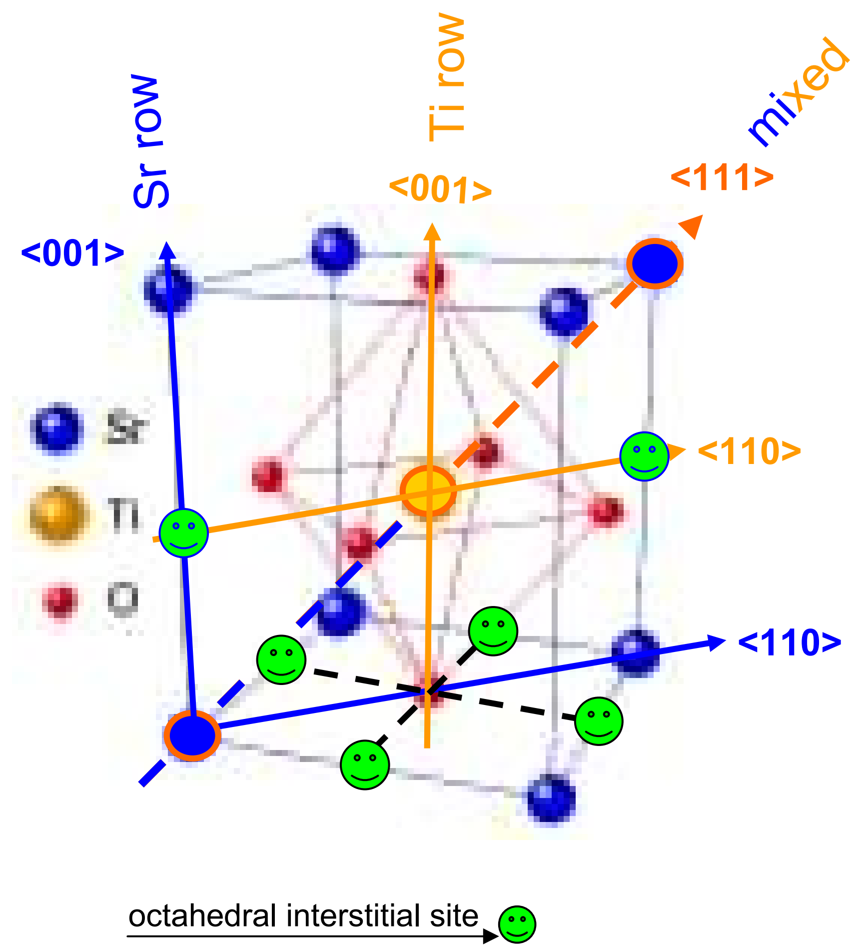

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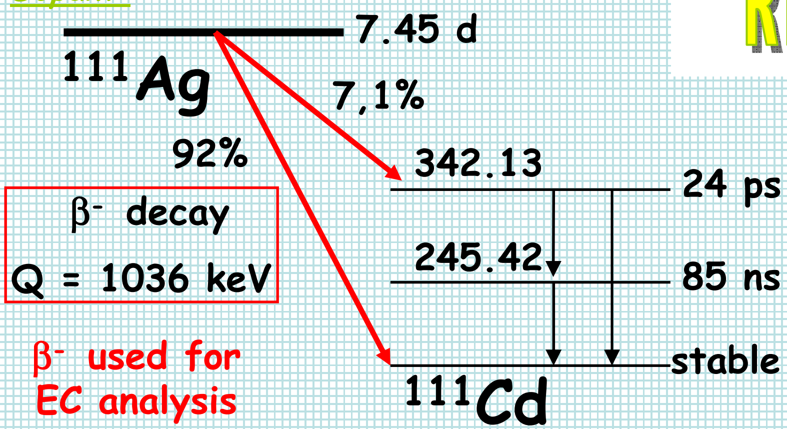
Experimental Details

Dopant:



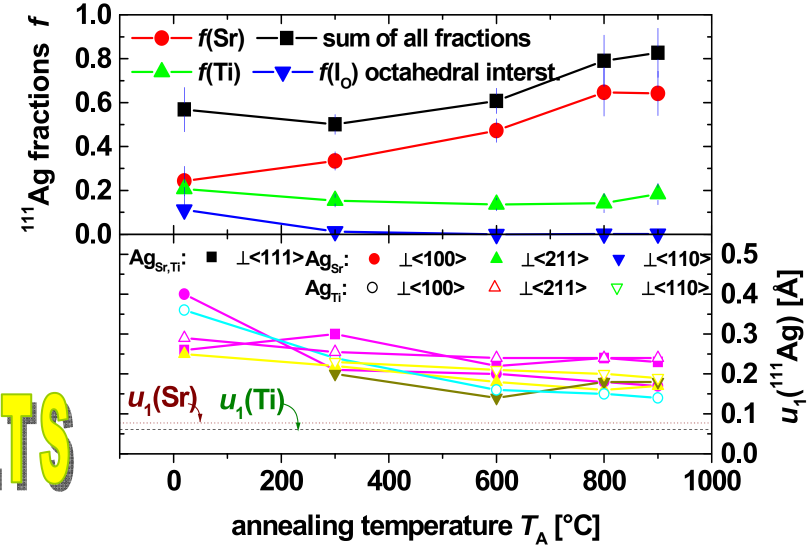
Implanted Sample:

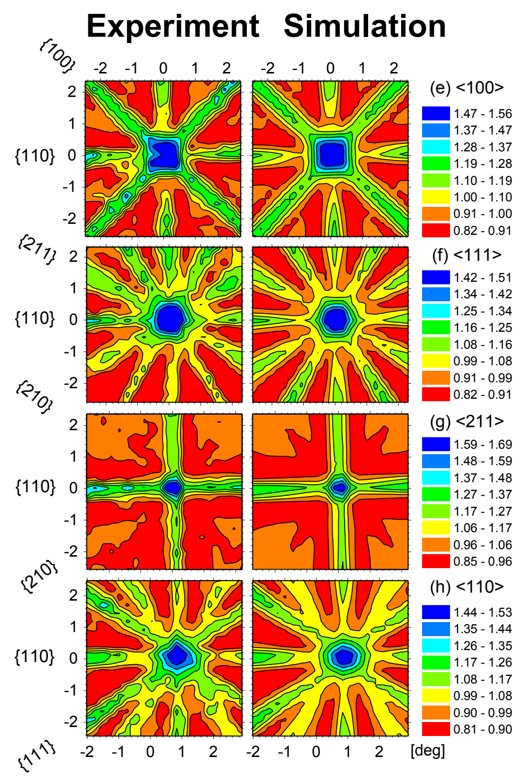
* $SrTiO_3$ single crystal, grown by the flame fused Vernuil method, cut and polished on a <100> surface.

RT implantation details:

* 60 keV ^{111}Ag ions
* Dose = 1×10^{13} atoms/cm^2
* 1mm beam spot
* 7° tilt from the crystal surface

RESULTS





☞ The majority of Ag atoms occupy substitutional sites or sites which are close to these positions.

☞ Because along the <211> direction only a single peak was observed, emitter atoms are mainly on Sr sites.

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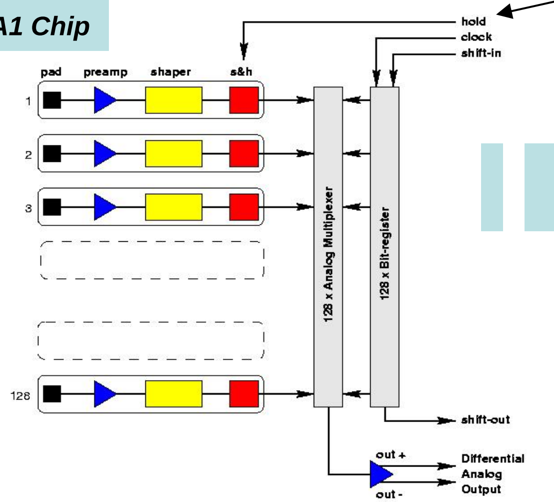
New developements in position-sensitive detectors for Emission Channeling

Backplane – Triggering Configuration

Self – Triggering Configuration

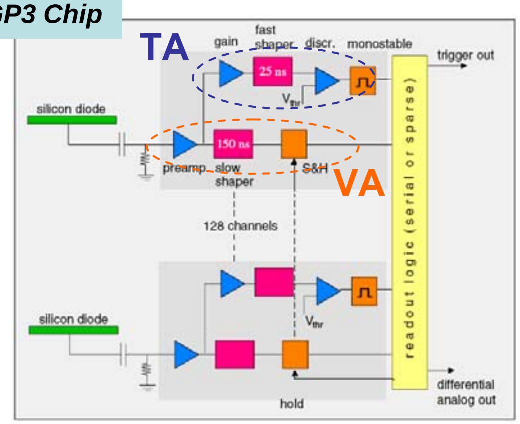
External trigger

VA1 Chip



Switching Readout Technique…

VATAGP3 Chip



By skipping the noisy backplane signal for triggering the readout.

…will bring two major benefits…

(1) LOW ENERGY ELECTRONS (≥ 15 keV) DETECTION

(2) HUGE INCREASE OF THE MAXIMUM COUNT RATE (~10 kHZ)

By reading only the hit channel in sparse readout mode.

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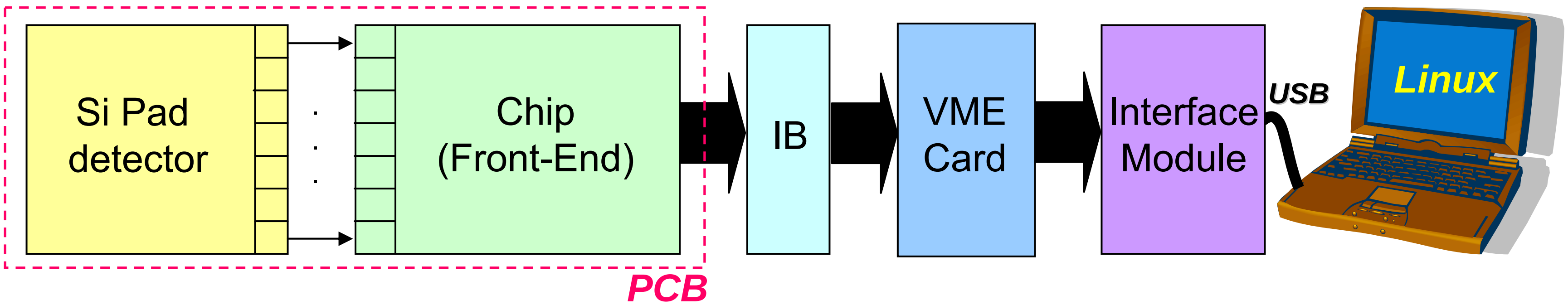
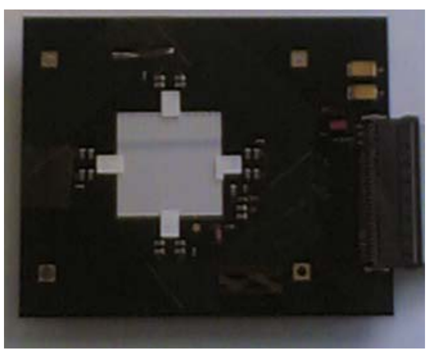
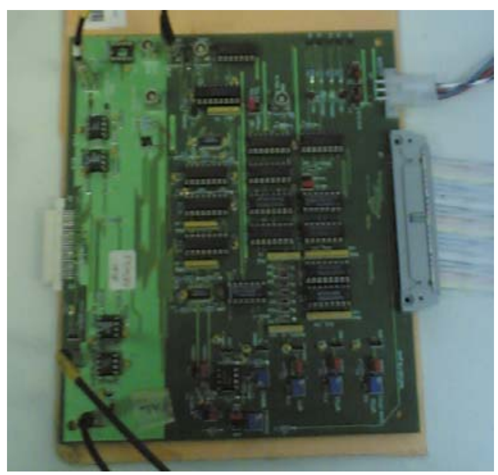
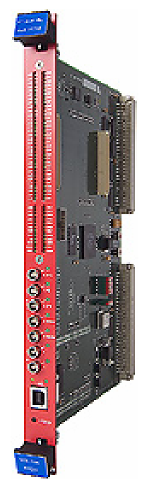
VATA-DAQ as a readout system









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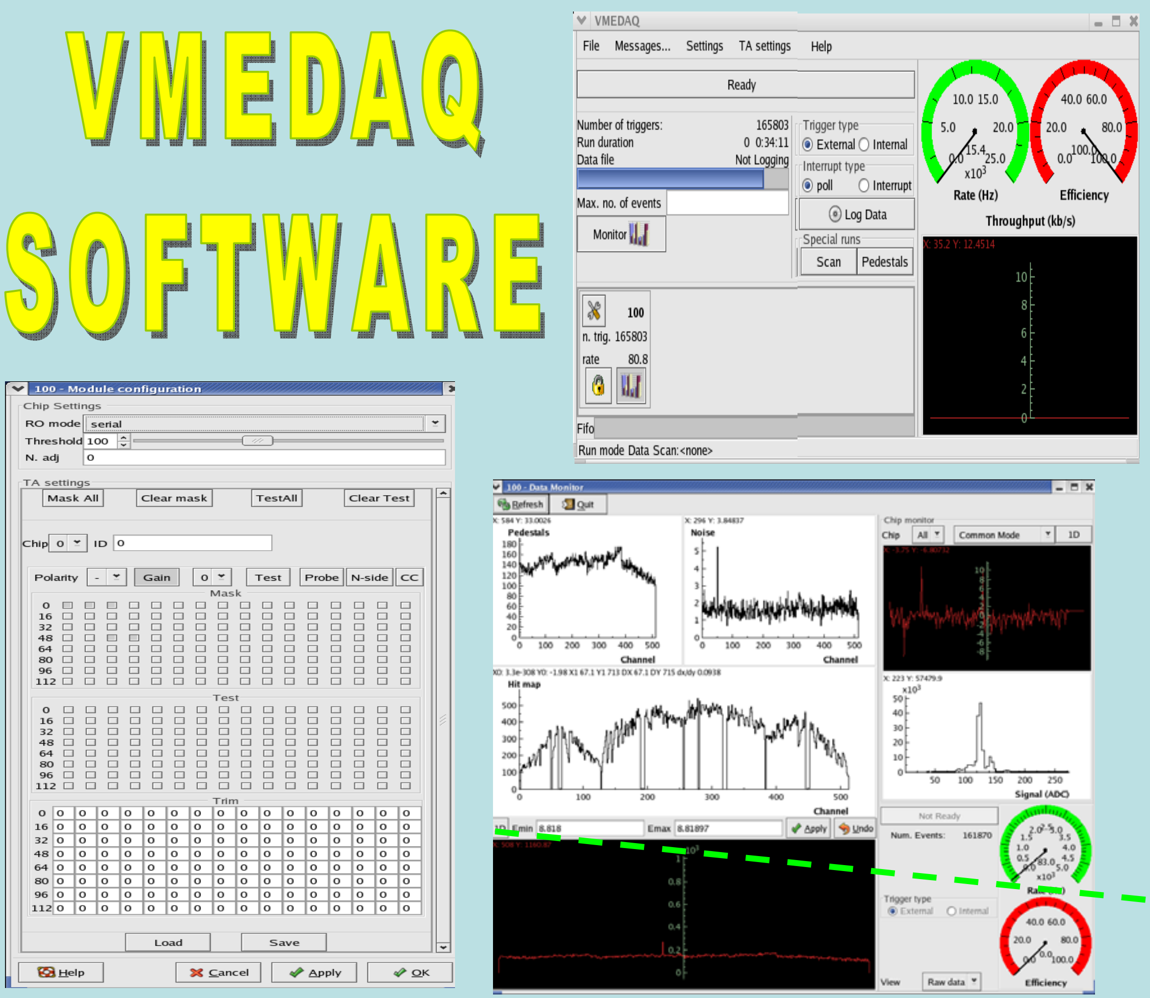
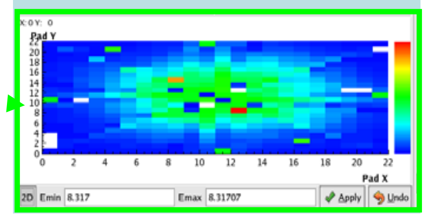
VMEDAQ SOFTWARE



Important features

ON LINE

- Energy spectrum
- Angular distribution to a pre-selected energy ROI



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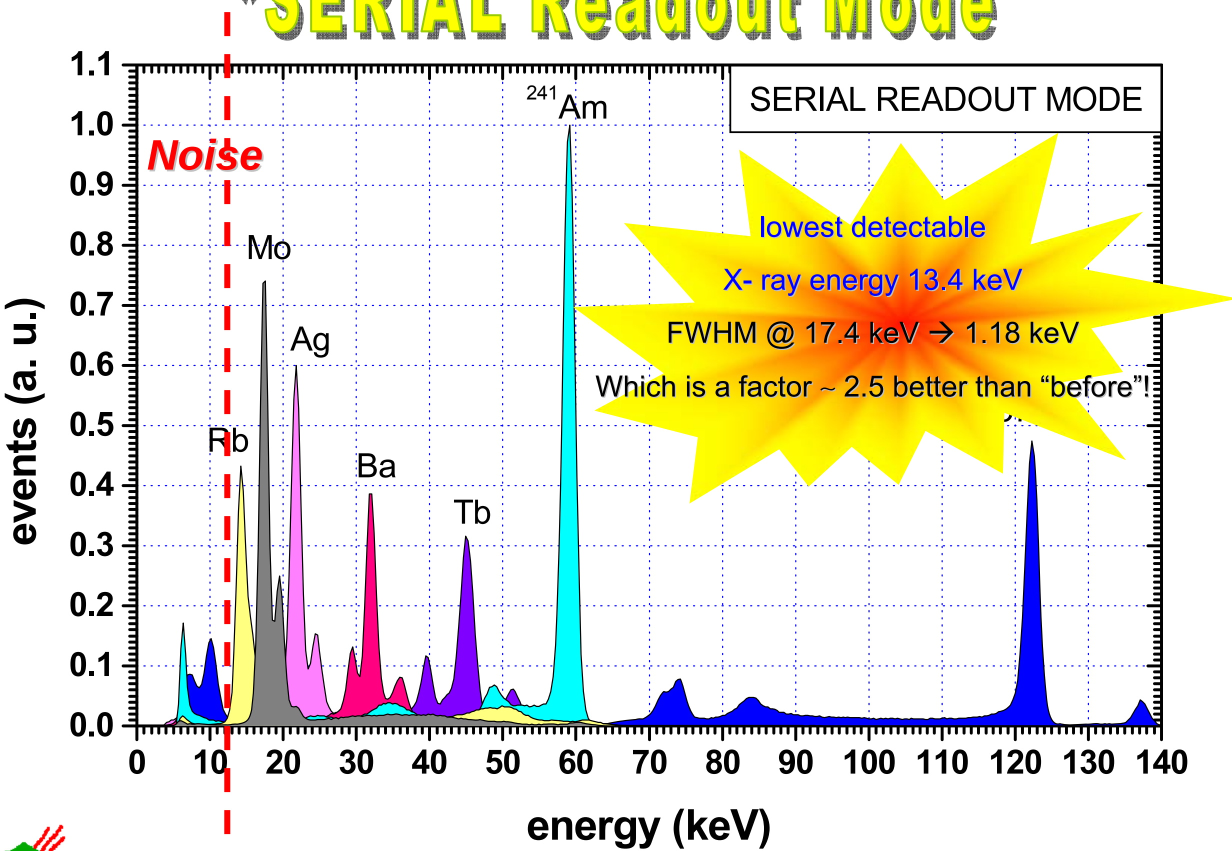
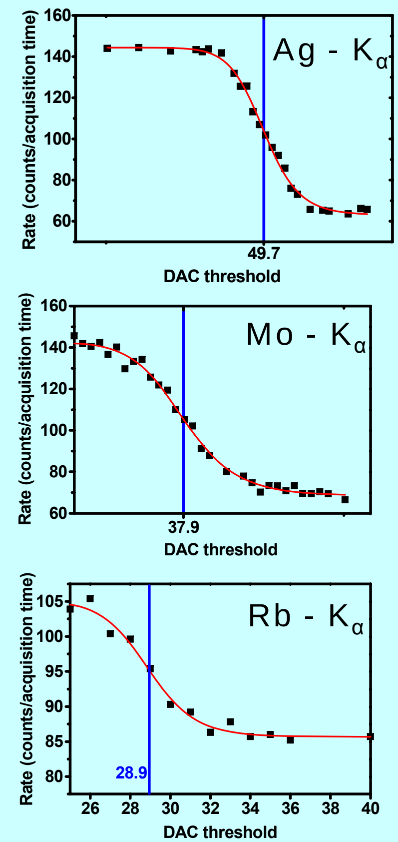
Recent Results with X-ray Sources

*SERIAL Readout Mode



S - CURVES



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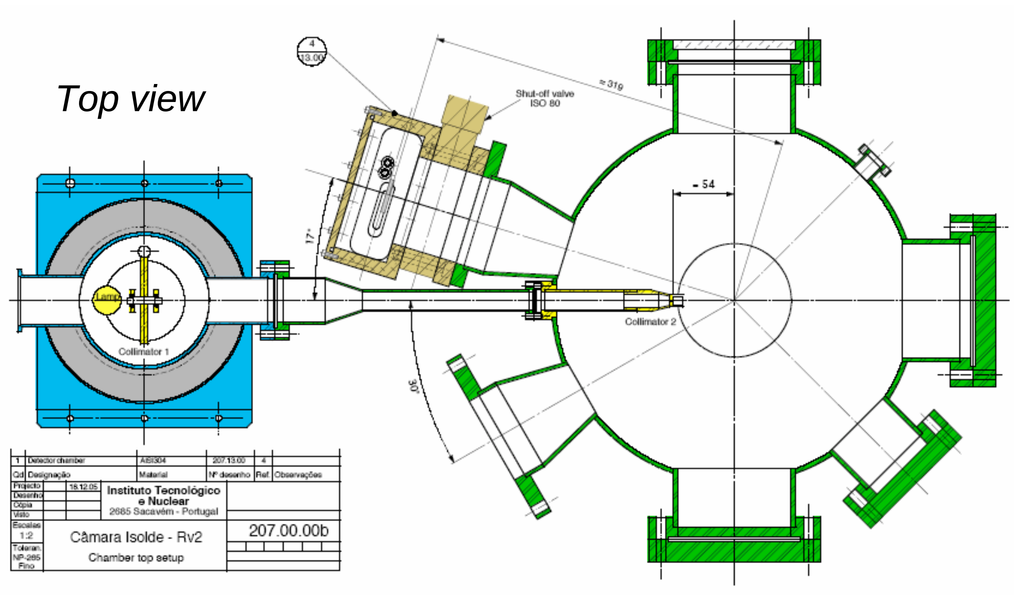
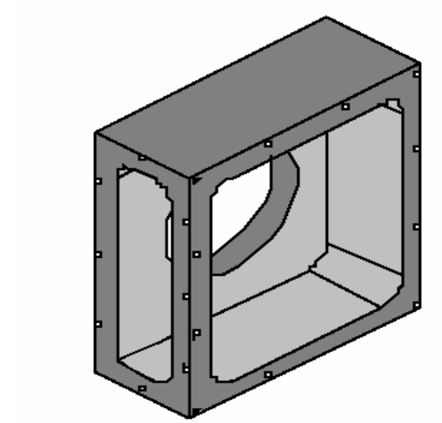
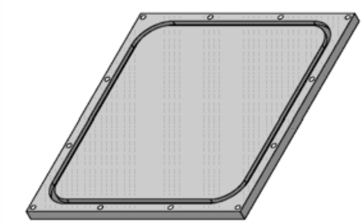
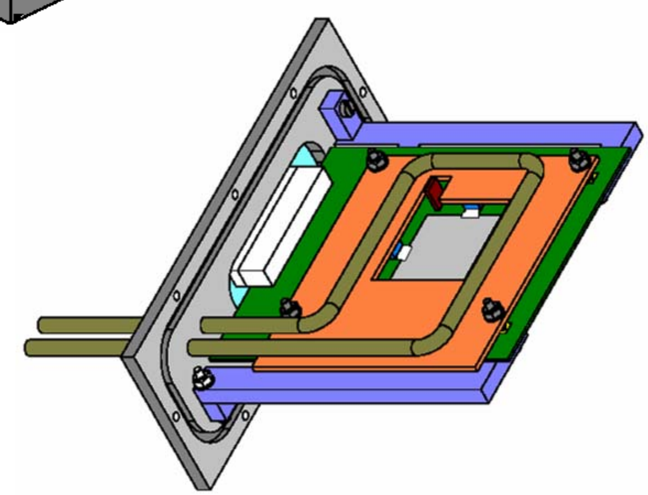
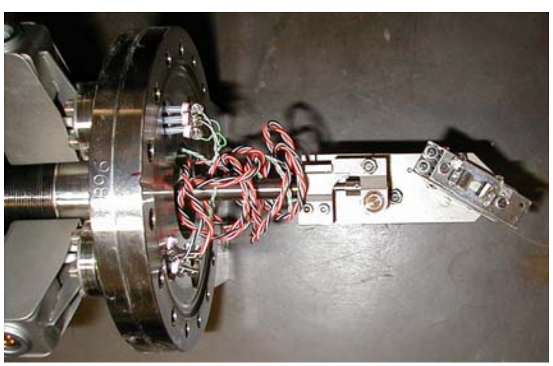
NEW ON LINE EC SETUP











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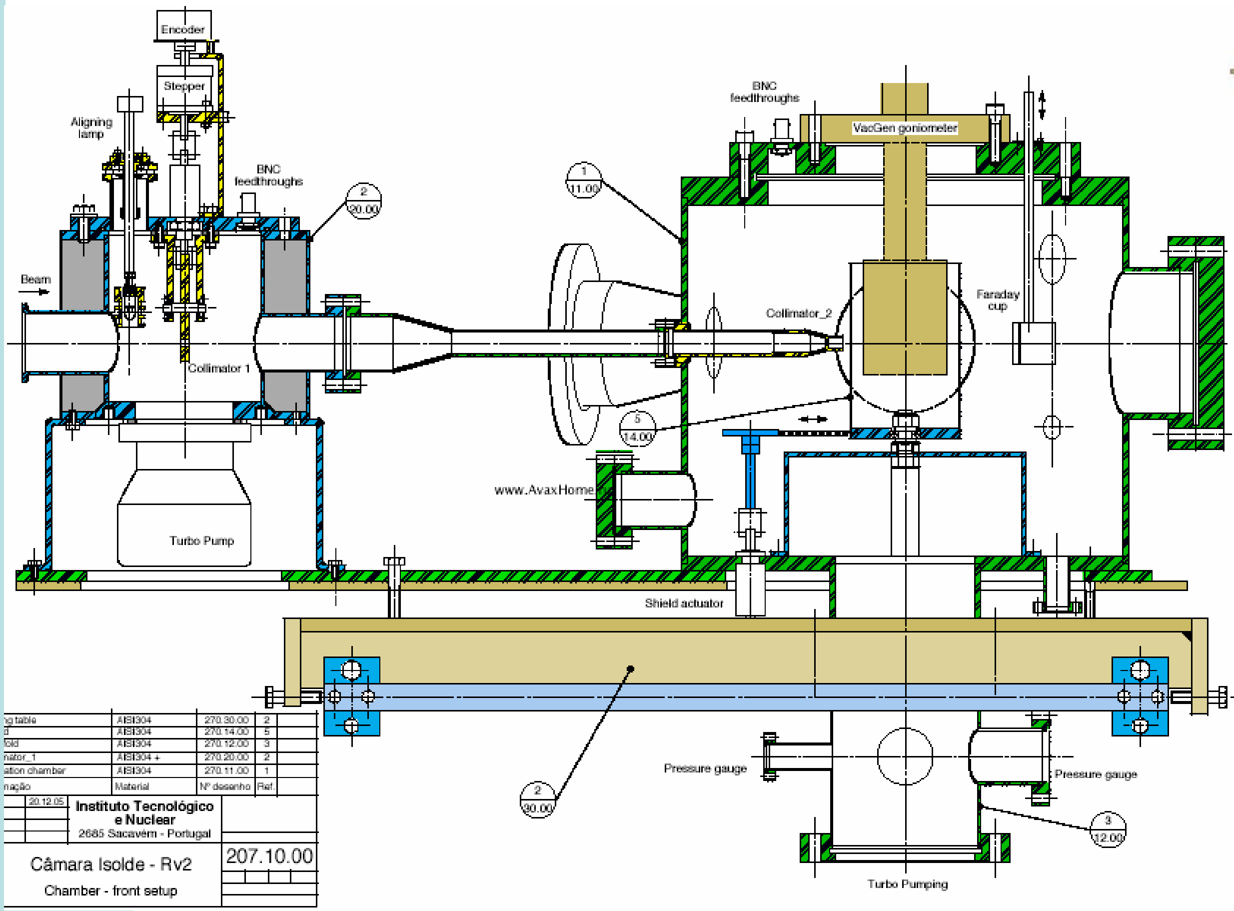

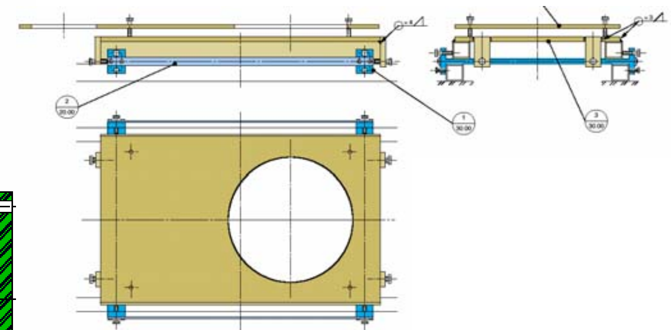

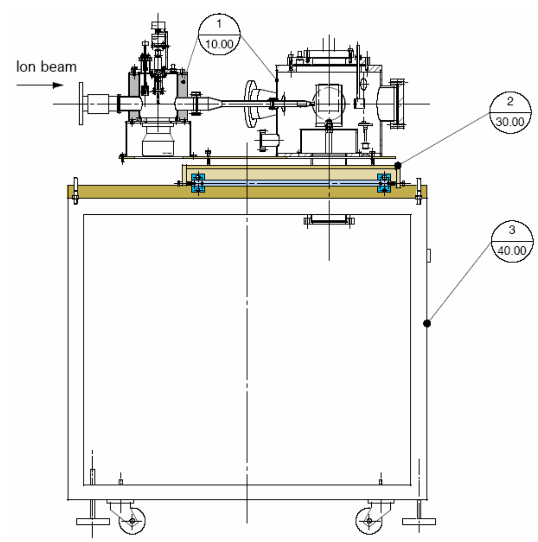

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Conclusions

^{111}Ag:SrTiO$_3$

•^{111}Ag atoms mainly occupy near-substitutional Sr (59%) and Ti(24%) sites with high root mean square displacements.

• The high displacement values following 900ºC annealing seem to be due to Ag interaction with remaining point defects.

Detector

• The serial readout mode results demonstrate that Si pad sensors are excellent imaging spectroscopic sensors for gamma-rays in the energy regime from 12 to 300 keV. And as well for electrons with energies high than 15 keV having in account the electron energy loss in the backplane detector entrance window.

NEXT STEPS

• Energy and gain calibration in sparse
• Tests with electron sources in both re
• 'Pedestal subtraction routine' in spars
• Design and production of the box-PCE connections
• Assembling of the EC set-up (box anc
• NEW lattice site location EC experime

Low CEE	Parent	half-life	Fracti
^{125}Te	^{125}I	60.1 d	33
^{58}Co	^{58m}Co	9.15h	92
β$^-$ Short-lived E	Posiible parent	half-life	<Energ
^{27}Mg	^{27}Na	9.5 min	7
^{61}Co	^{61}Mn	1.7 h	4
^{65}Ni		2.5 h	6
^{69}Zn	^{69}Cu	56 min	3
^{75}Ge	^{75}Ga	83 min	4

Thanks

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