New Developments at the Tandem Accelerators Laboratory at IFIN-HH

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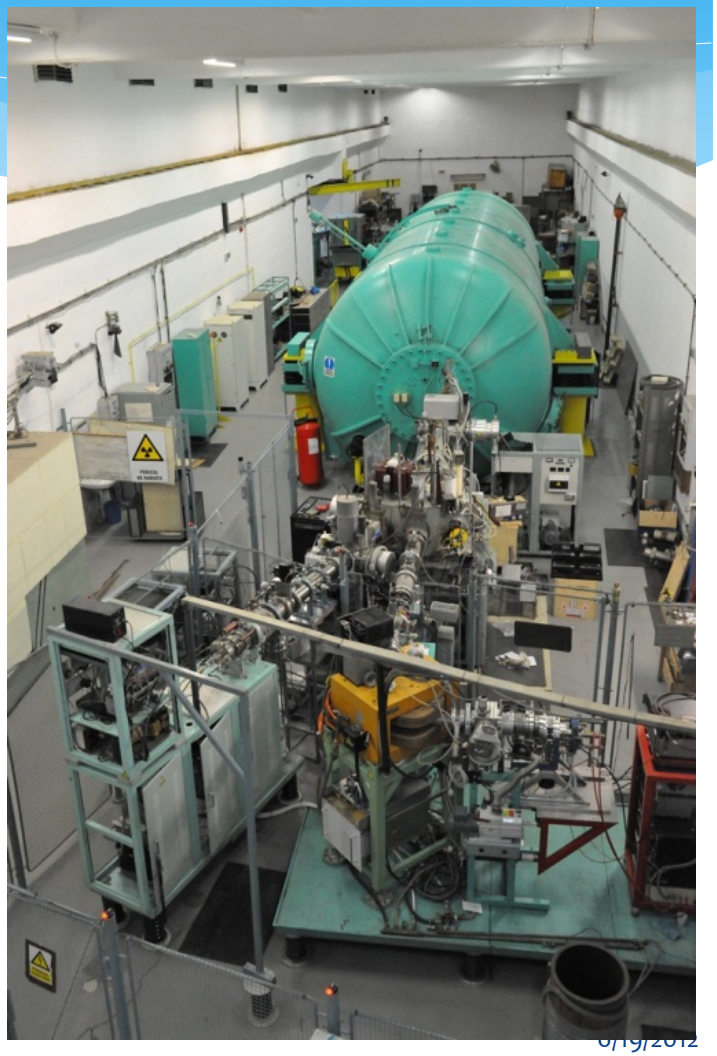
History

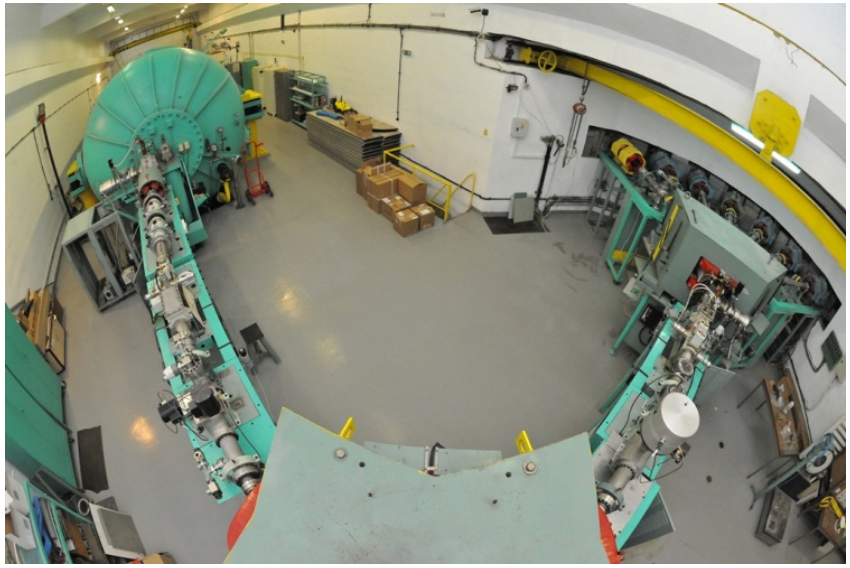
* 1973 – commissioning of the HVEC FN Tandem Accelerator
* 1977 – an earthquake of 7.2 degrees on the Richter scale destroyed the accelerating column
* 1983 – installation of a second injector (HICONEX 834)
* 1986 – second earthquake (6.2 on the Richter scale) damages the accelerating column again
* 1990 – installation of a earthquake protection system
* 2006 – started the upgrade program of the accelerator



Upgrade program 2006-2009

- The charging belt was replaced by a NEC Pelletron system
- New spiraled field titanium accelerating tubes were installed
- NEC SNICS II negative ion source was installed

* Nanosecond beam pulsing system was installed
* Vacuum system improvement
* New power supply for the bipolar magnets, quadrupole lenses and Einzel lenses



2009 and beyond

* Continuing the technical improvements at the 9MV FN Pelletron Tandem accelerator
* Comissioning of a new HVE 1MV Tandetron accelerator for AMS and ^{14}C dating along with its chemistry laboratory
* Comissioning of a new HVE 3 MV Tandetron accelerator for IBA techniques

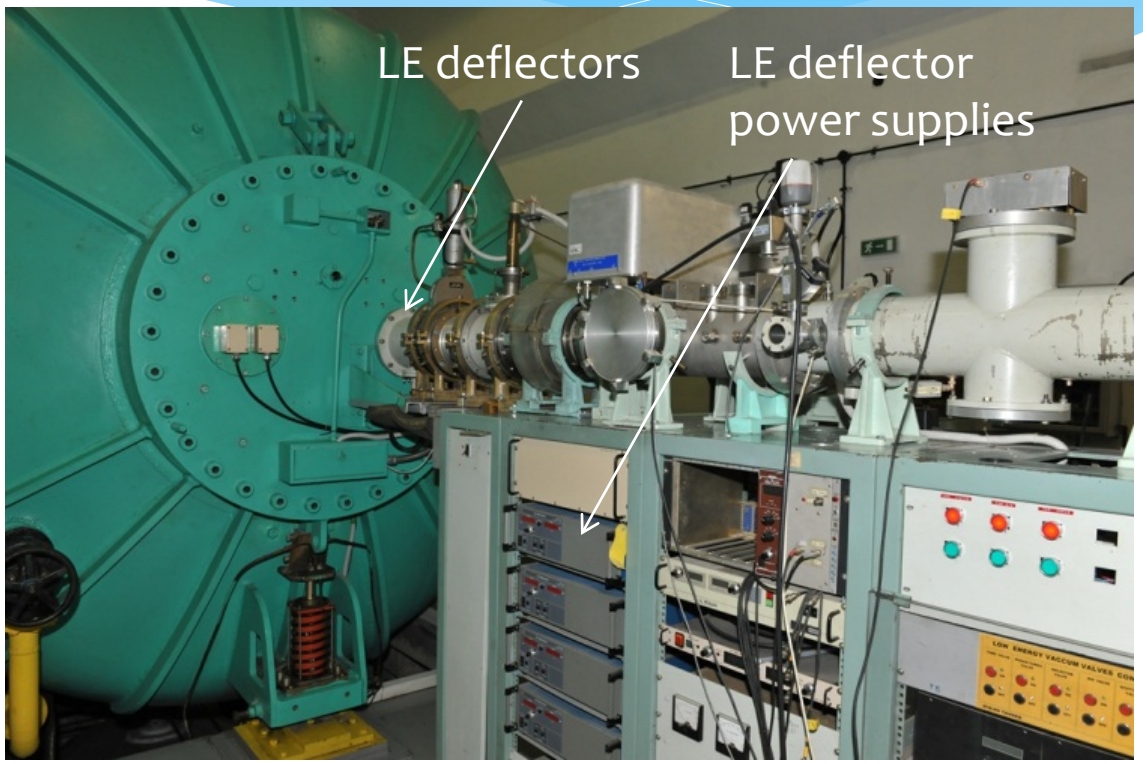
MAIN UPGRADES OF THE 9 MV FN PELLETRON TANDEM ACCELERATOR

* Upgrade of the beam steering system power supplies
* Installation of a new beam stabilization system
* Upgrade of the negative helium ion beam source
* Computer control system for the bipolar magnets power supplies and for the power supplies of the electrostatic and magnetic deflectors
* New gas transfer system
* Fast closing valve and new beam-lines on the high energy side
* New species of accelerated ions

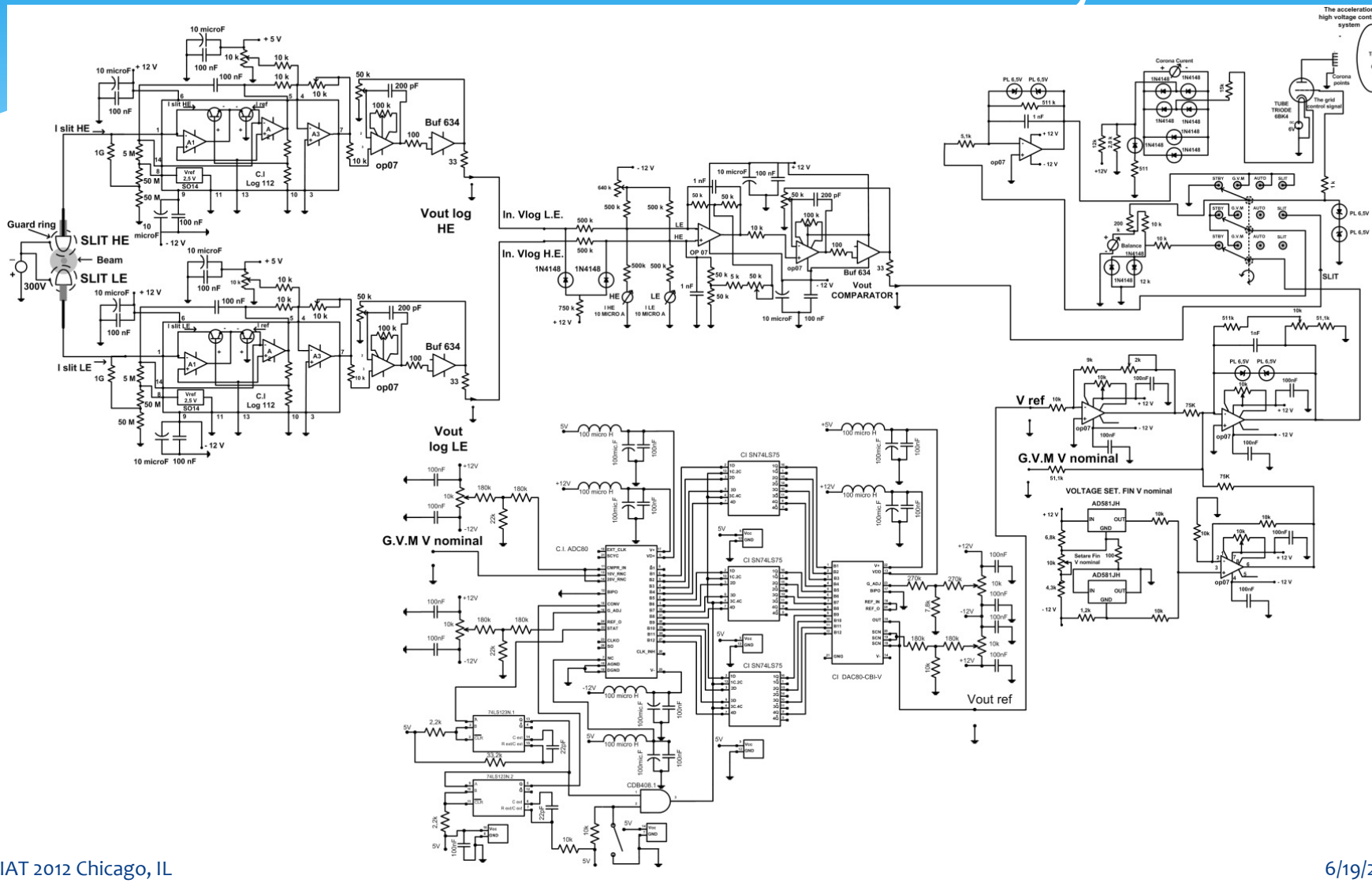
Power supplies

The old beam deflection system power supplies were replaced by new high voltage, **bipolar output and continuous zero crossing power supplies.**

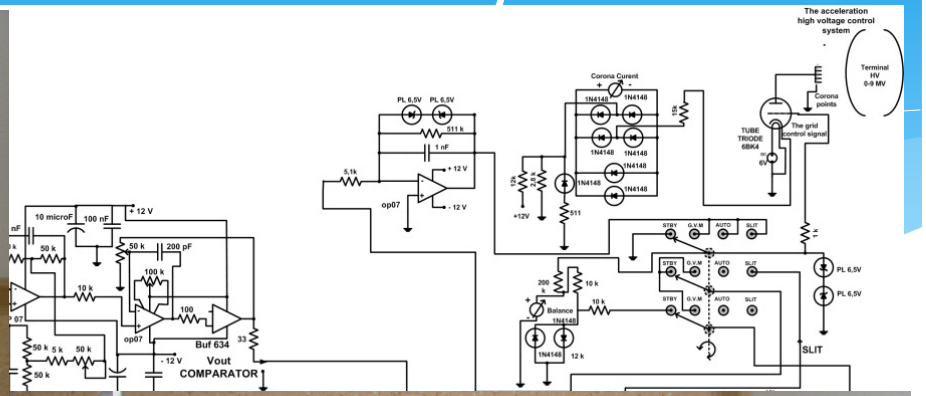
- Very good stability (level of 10^{-5}) of the voltage;
- Very low ripple;
- Very good stability with the temperature variation;
- Unlimited operation with rated current in a short-circuit condition;
- Unlimited operation with rated power;

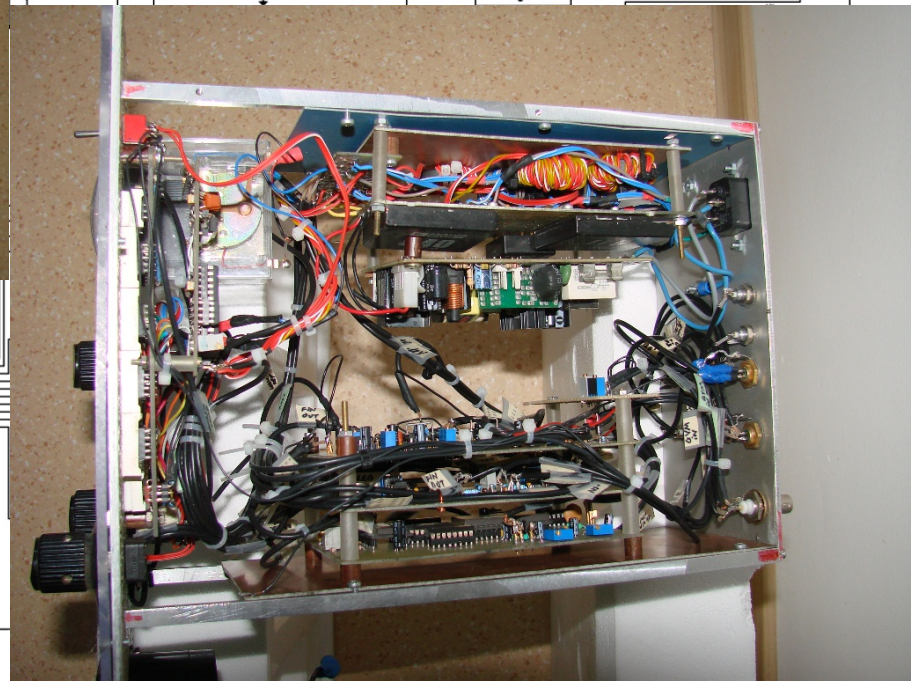


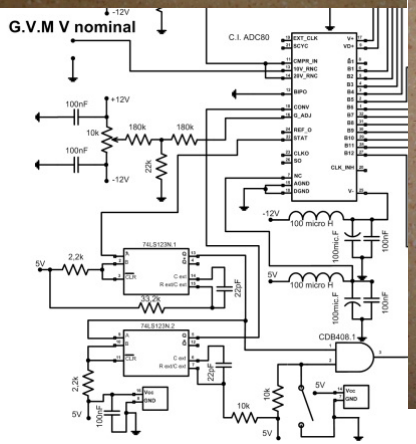
New beam stabilization system



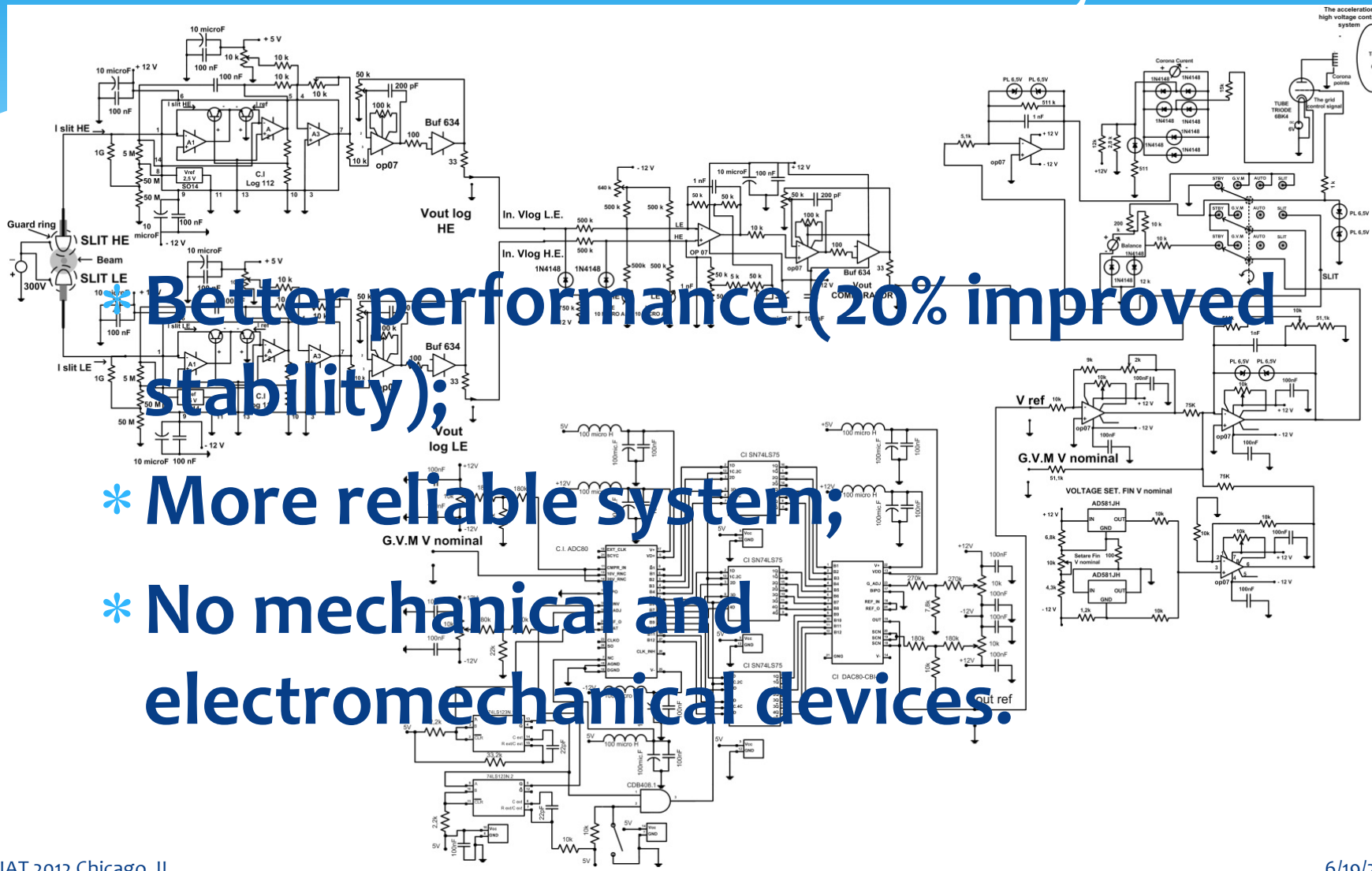
New beam stabilization system





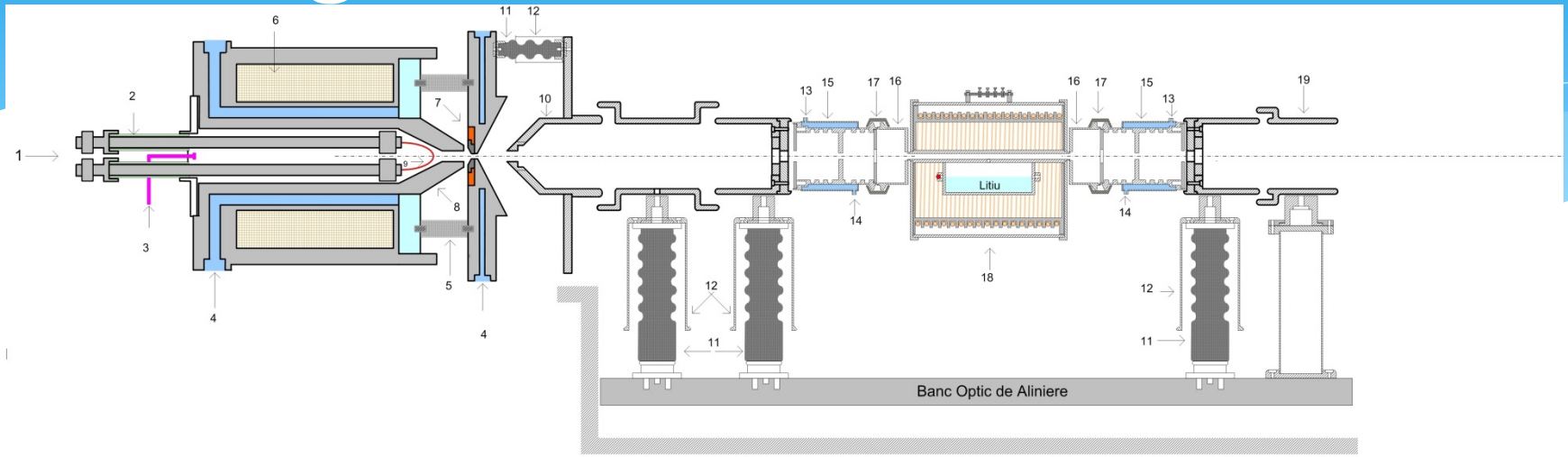


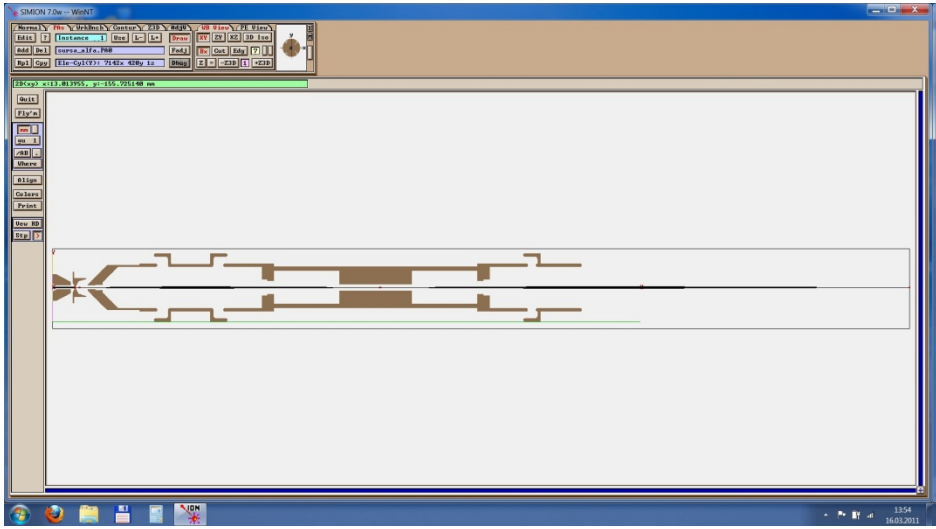
New beam stabilization system

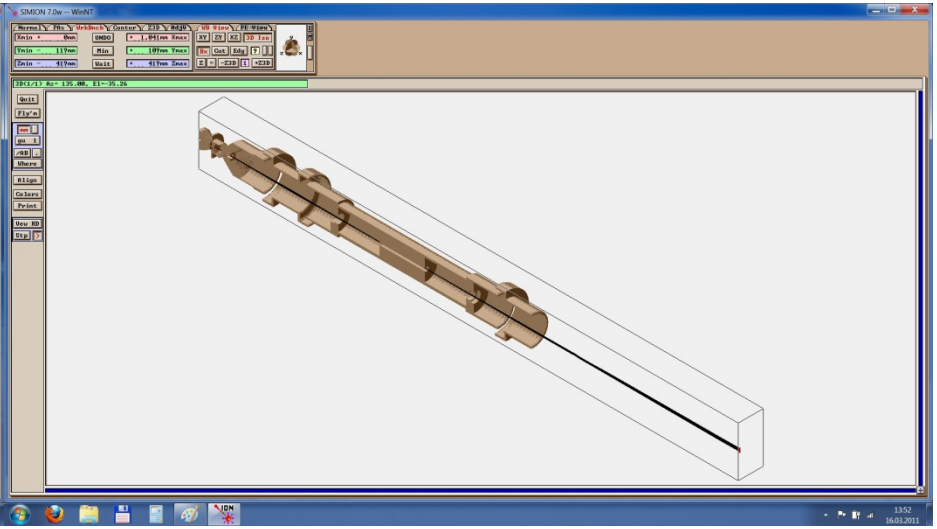


- **Better performance (20% improved stability);**
- **More reliable system;**
- **No mechanical and electromechanical devices.**

Negative helium ion source

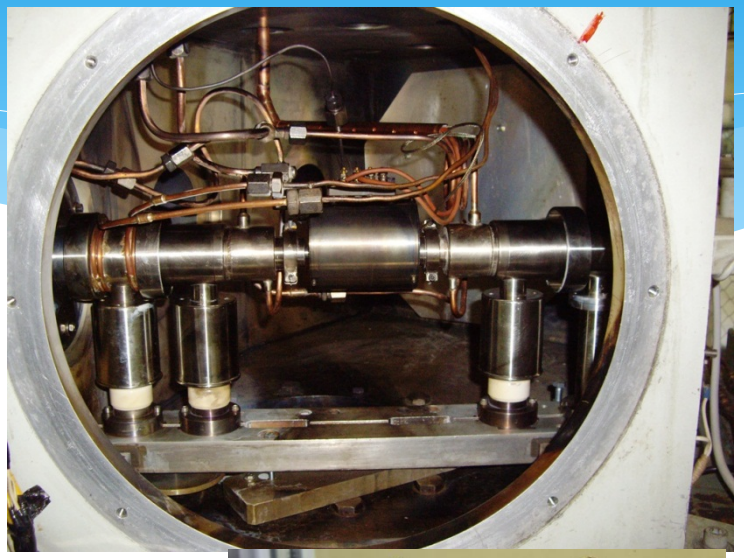






Negative helium ion source

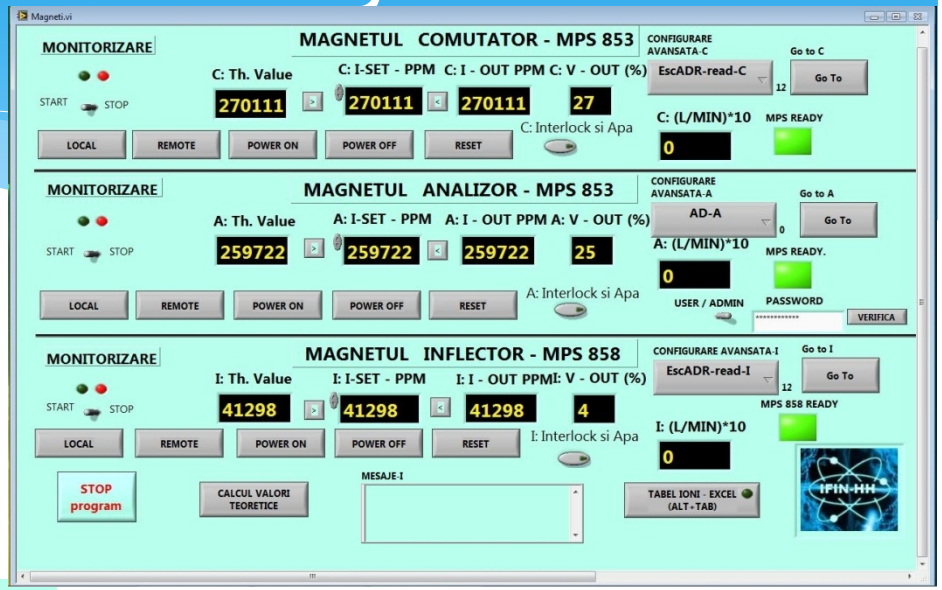
* More reliable;
* Stable running for longer periods of time;
* Less lithium vapors contamination of the insullators;



- The lithium oven was placed at high voltage;
- The condensors were redesigned for more efficiency;
- Easy lithium refill without misalignment of the ion source.
- 100 nA on the target, stable running for weeks.

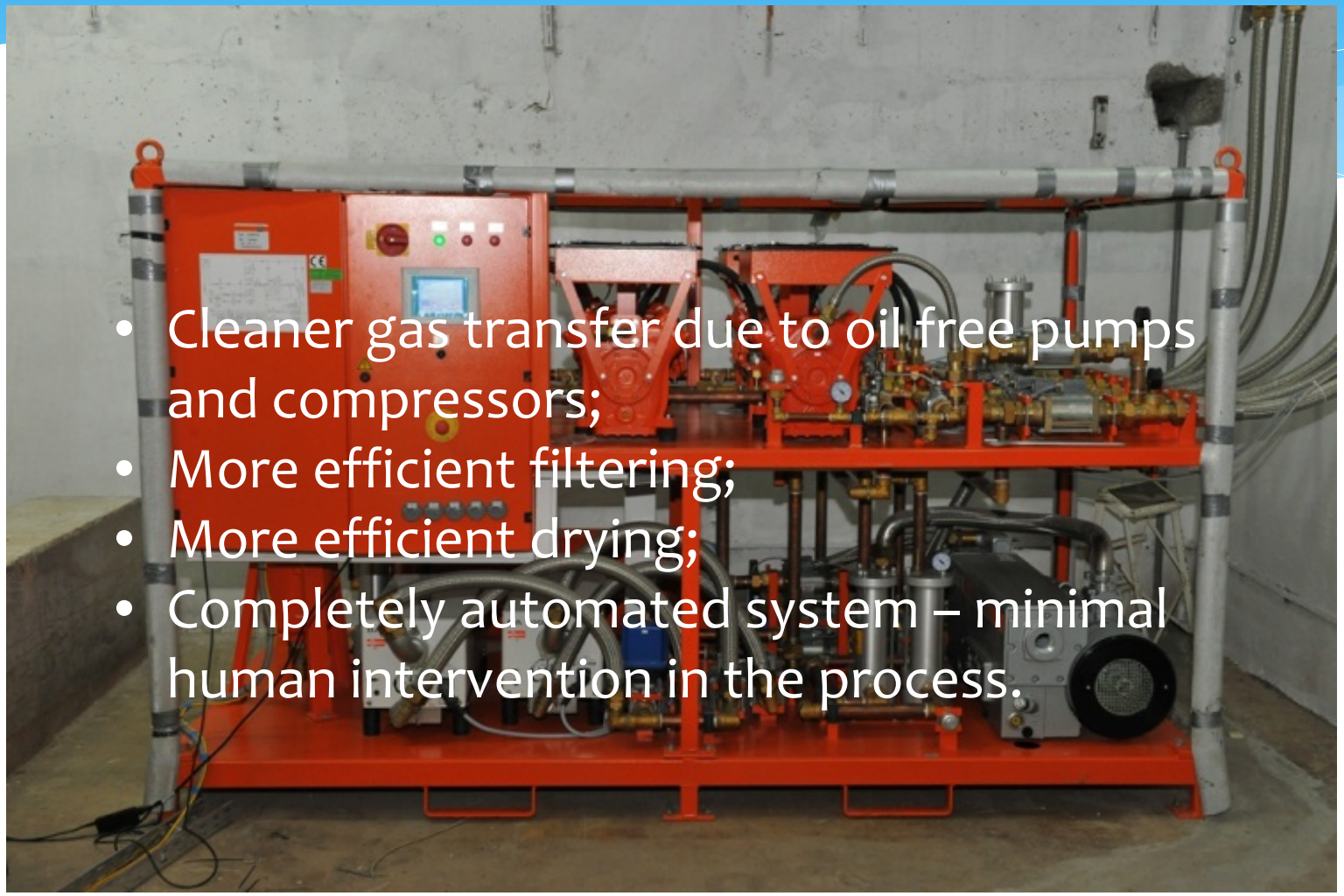
Computer control system

- Main panel of the computer control system for the bipolar magnets (inflection, analyzing and switching magnet);
- Automatic setting up of the fields by just introducing the energy, mass and charge state after stripping process.



Main panel for the computer control system of the electrostatic and magnetic deflection systems.

Gas transfer system



- Cleaner gas transfer due to oil free pumps and compressors;
- More efficient filtering;
- More efficient drying;
- Completely automated system – minimal human intervention in the process.

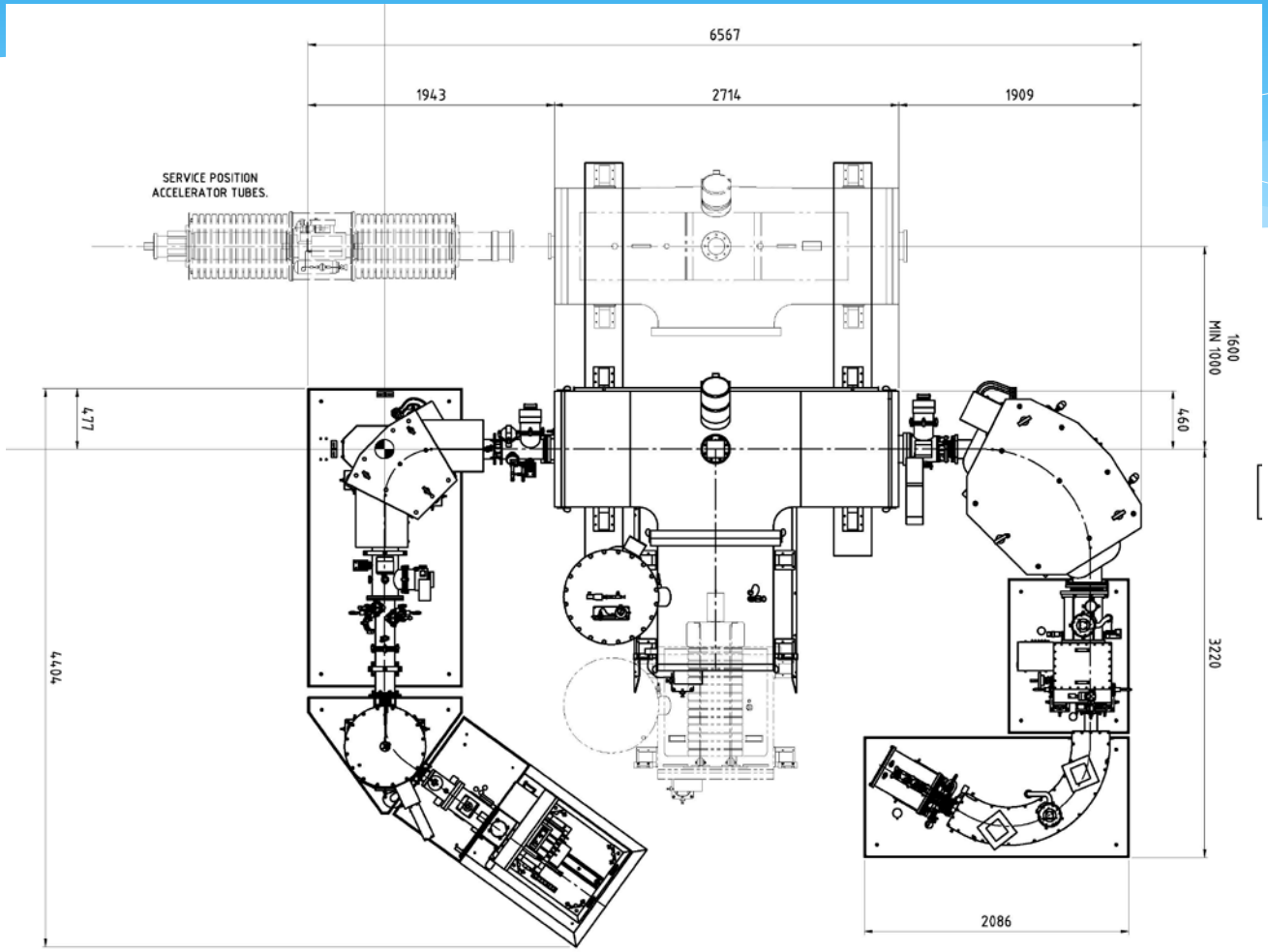
Fast closing valve

* Closing speed <20 ms
* Better protection against accidental input of air;
* New beam lines for better vacuum.

New beams at the 9 MV Tandem accelerator

Particle	Energy (MeV)	Intensity of the analyzed beam (nA)
^{6}Li	32	150
^{18}O	34	90
^{15}N	14	10
^{13}C	42	50
^{36}S	80	50

1 MV Tandetron for AMS



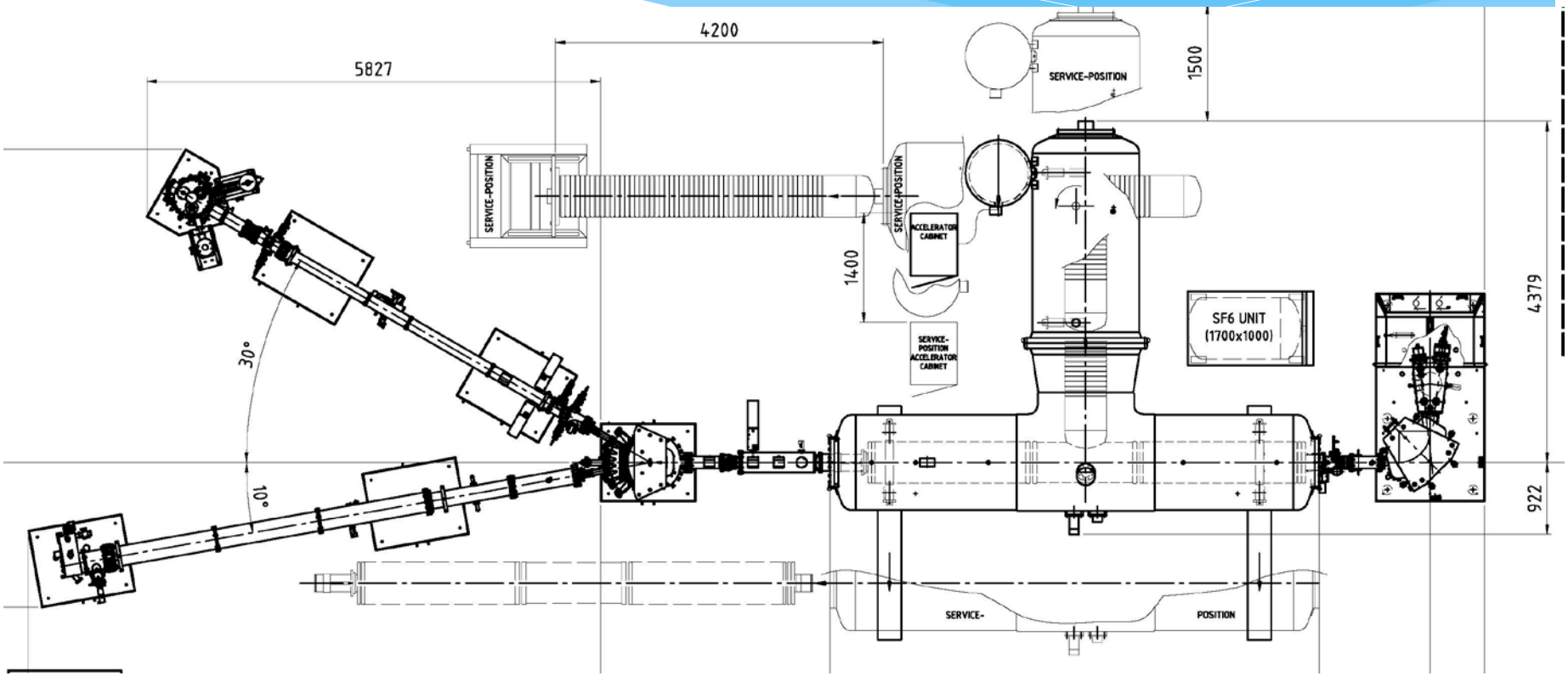
1 MV Tandetron for AMS

Acceptance tests

Isotope	Rare isotope/stable isotope (av. of 4 samples)	Average statistical error (‰)	Relative standard deviation (‰)	Background level
^{14}C	1.3×10^{-12}	2.4	3.7	1.7×10^{-15}
^{10}Be	1.5×10^{-12}	12.3	6.6	2.6×10^{-14}
^{26}Al	7.4×10^{-11}	7.6	12.5	3.7×10^{-15}
^{129}I	1.2×10^{-11}	19.5	15.1	6.7×10^{-14}

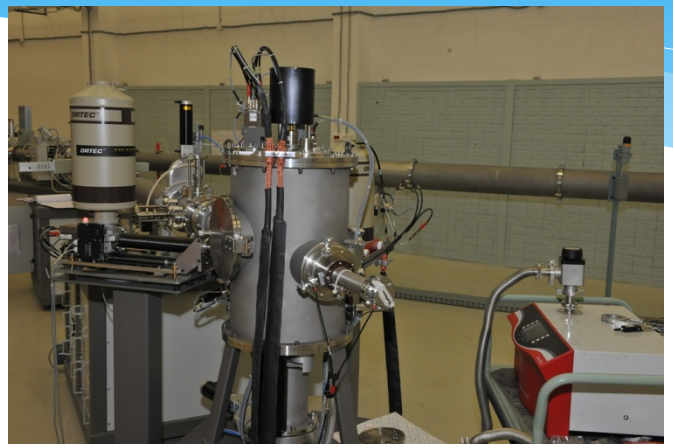
For these measurements were used standard and background samples.

3 MV Tandetron for IBA

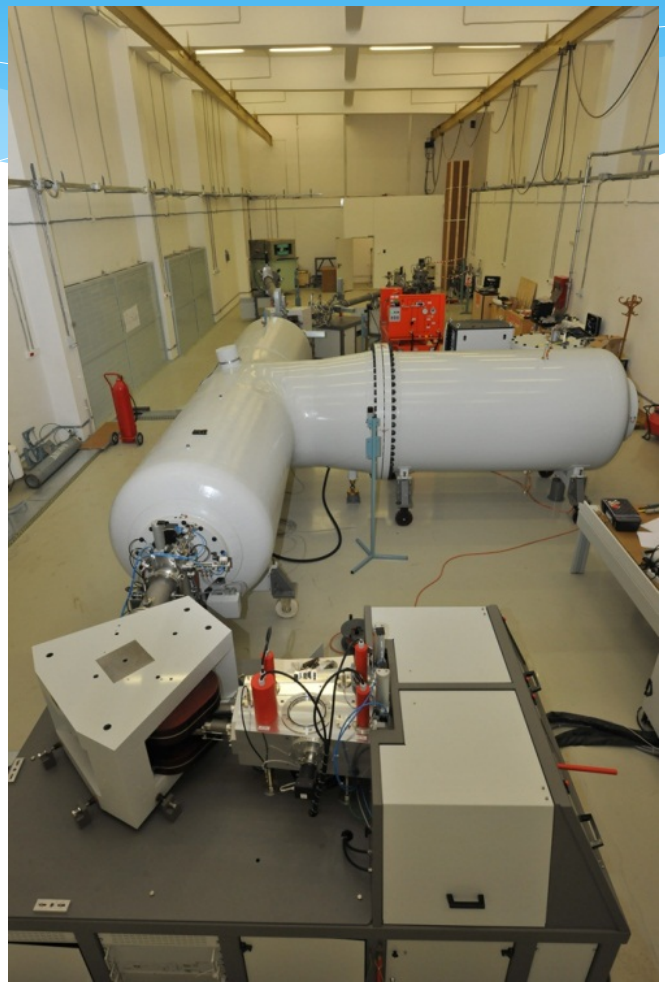


3 MV Tandetron for IBA

Ion beam analysis chamber

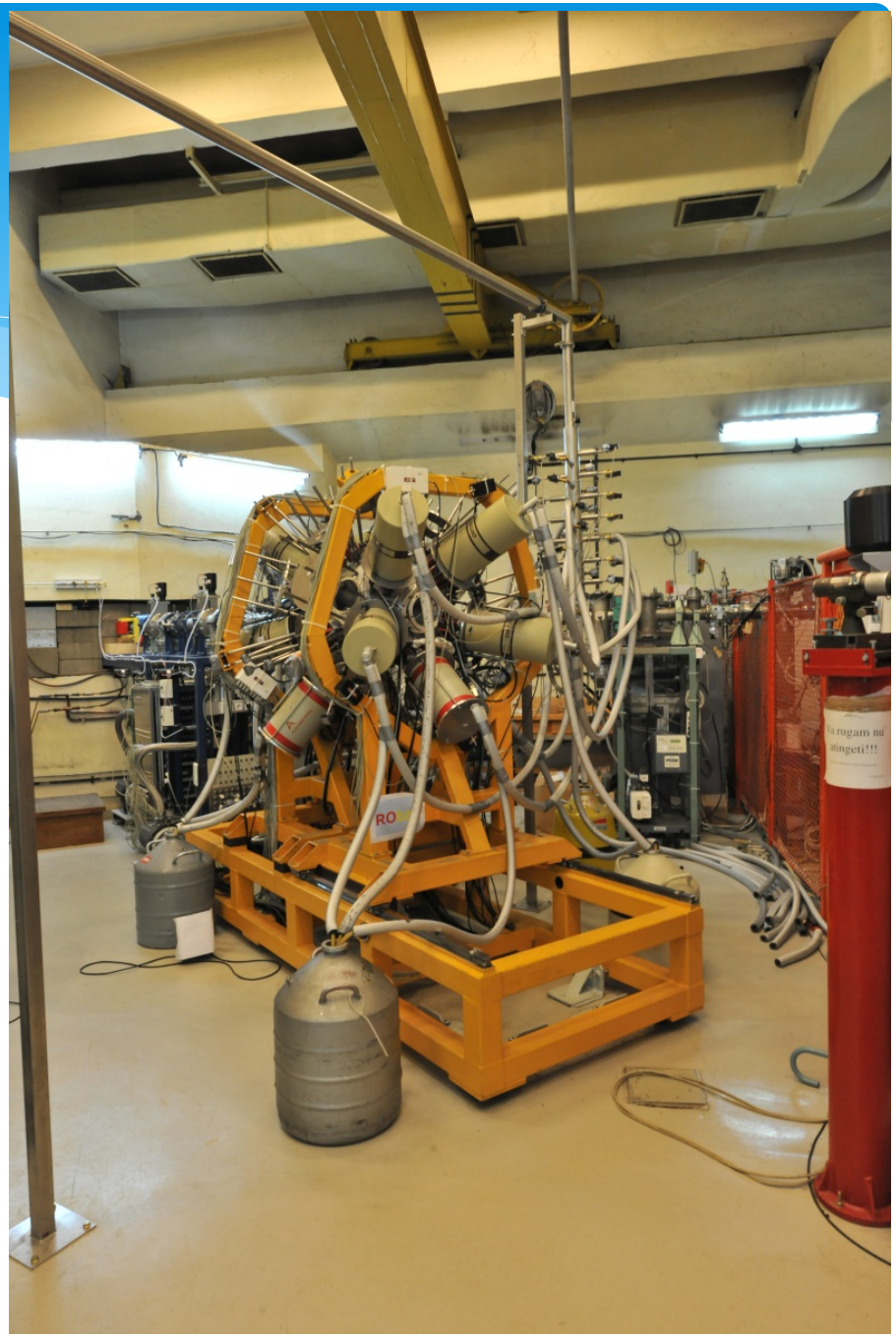


Ion implantation chamber



ROball

* 25 HPGe detectors with 50% relative efficiency and BGO shields;
* 12 LaBr3:Ce;
* Digital and analog electronics and data acquisition systems;
* Computer controlled LN_2 filling system.



Conclusions

* The 9 MV Tandem accelerator was transformed in a very reliable machine. Along with the experimental setups around the machine it makes now a great tool for basic and applied research;
* The installation of the 1 MV Tandetron accelerator creates great opportunities for research using AMS techniques and carbon dating techniques;
* The 3 MV Tandetron allows the continuation of the IBA measurement techniques done until now at the 9 MV Tandem accelerator.

THANK YOU