Dmitry Seliverstov PNPI RAS

PNPI participation in EXL and MATS experiments. (R3B and ILIMA)

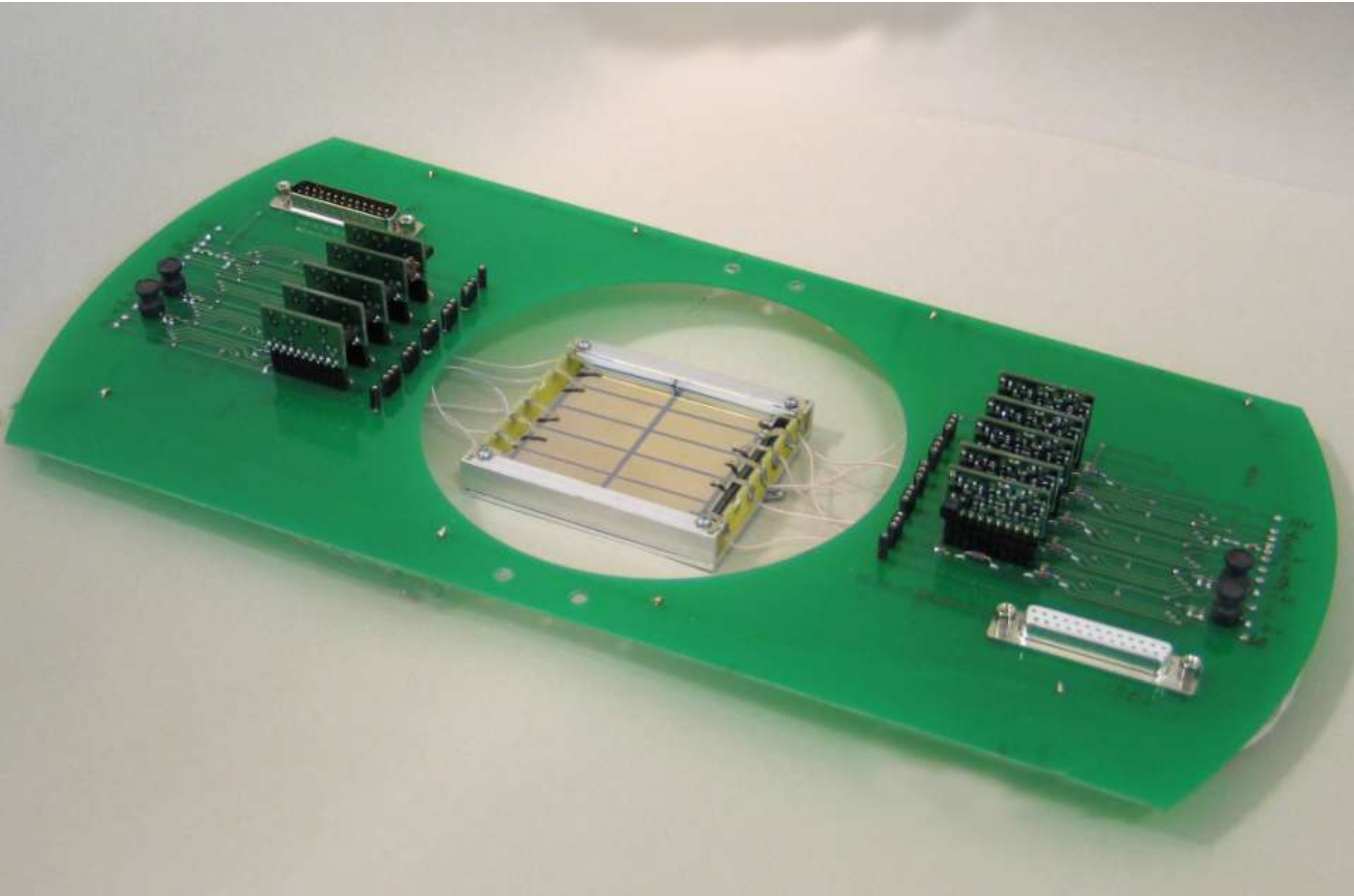
1. EXL
- ESPA Si(Li) detectors
- Neutron spectrometer on RPC. Phase 1
- Forward detector of fast particles MWPC. Phase 2

2. MATS
- Penning trap.
- System for calibration mass of single ions.
- Decay detectors for spectroscopy of slow charge particles.

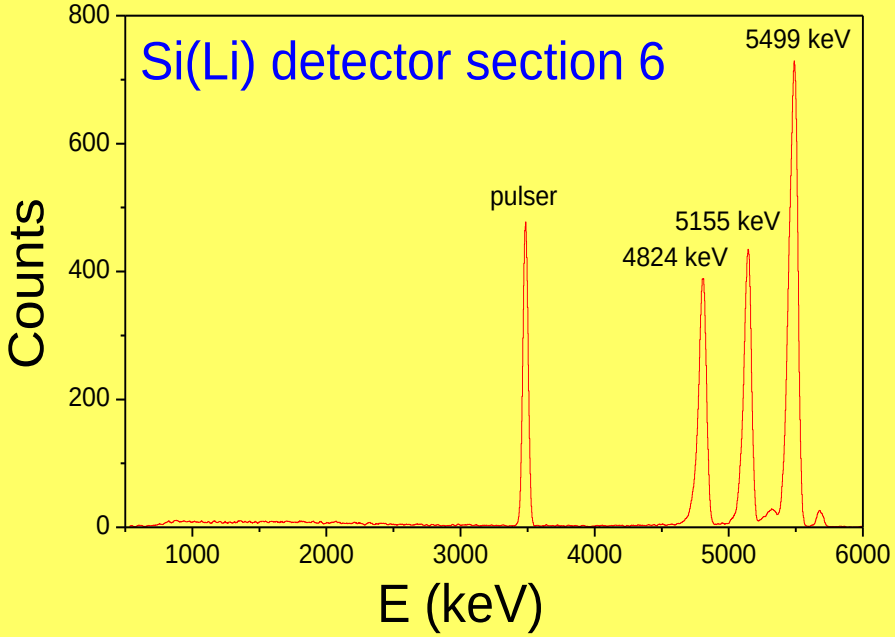
3. R3B
- Neutron Time-of-Flight spectrometers, RPC.
- Active target. Phase-2

4. ILIMA
- Decay detectors.

PNPI Si(Li)prototype #2 65X65X6 mm^3



Parameters of Si(Li) detector



α- spectrum from pixel#6,T=22˚C
bias voltage HV=250 V

Section number	I mkA	$FWHM_{gen}$, keV	FWHM (keV) E_{α}=5155keV
1	0.8	32.9	43.59
2	2.0	37.0	49.21
3	3.0	44.5	59.8
4	3.3	54.2	67.25
5	5.5	67.0	75.9
6	4.1	45.9	62.08
7	4.8	56.6	77.4
8	5.0	59.7	76.5
9	5.1	54.8	76.6
10	5.5	63.4	79.6

Parameters of Si(Li) detector

Si(Li) detector test showed:

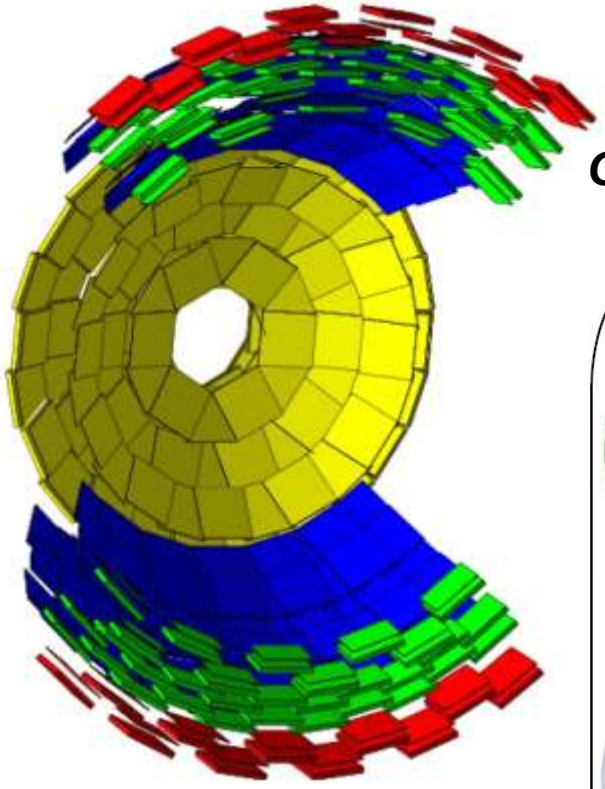
The improvement of the energy resolution in average 20% with decreasing of the temperature from 22°C to 0°C

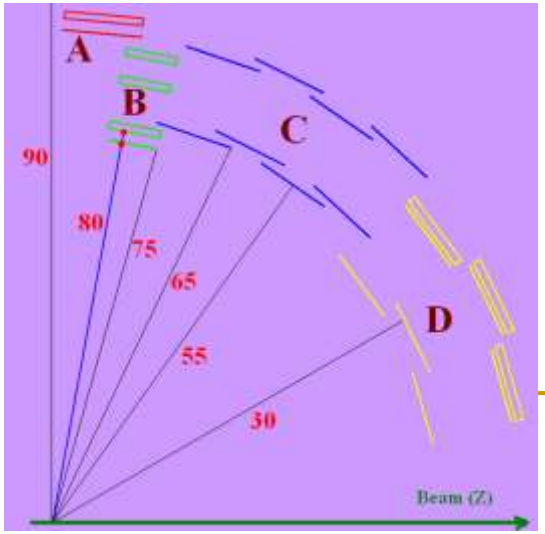
Problems:

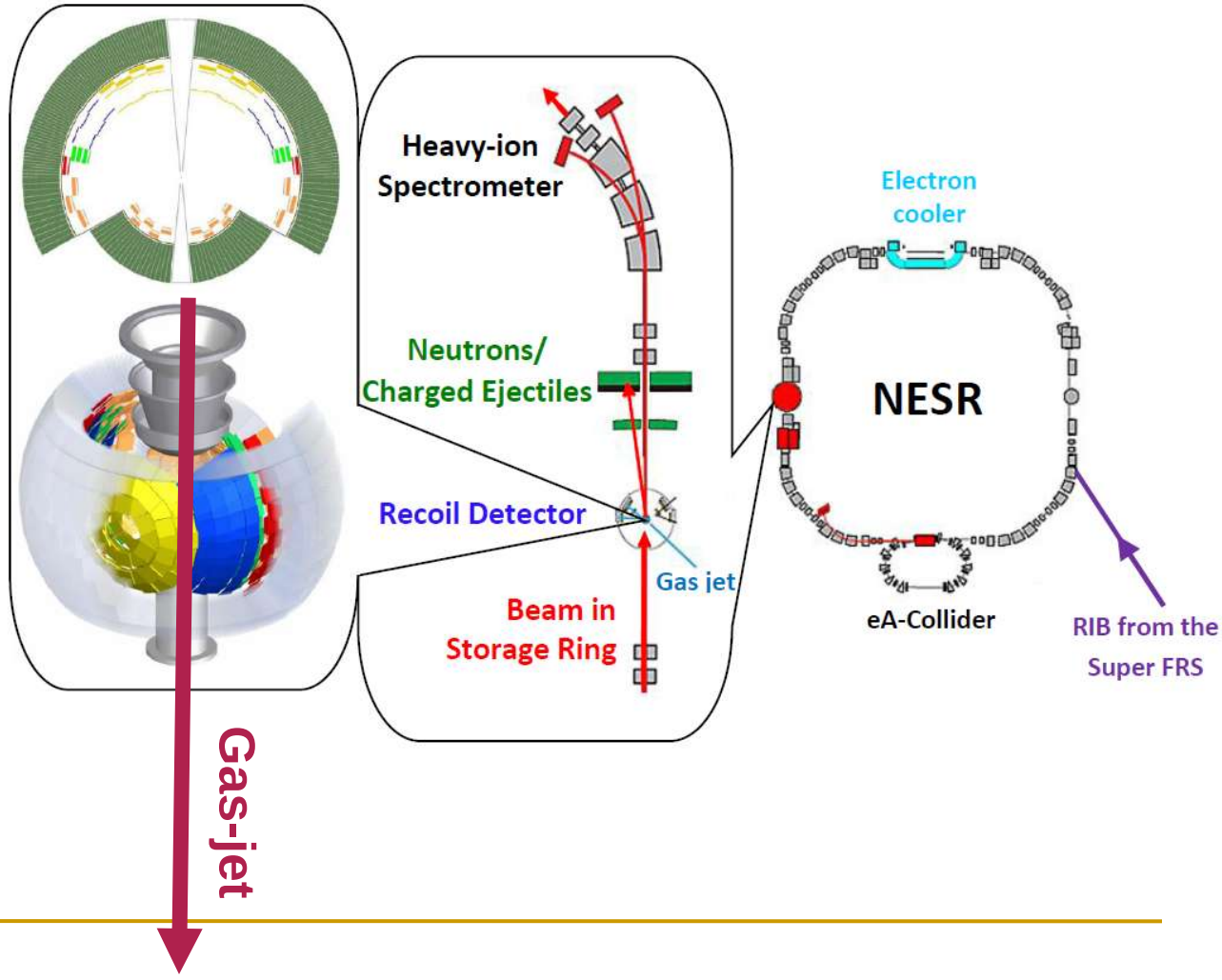
- Performance at cooling ~0°C.
- Wafers: It needs to have 6 mm thickness.
- Long-term stability.

EXL setup at NESR

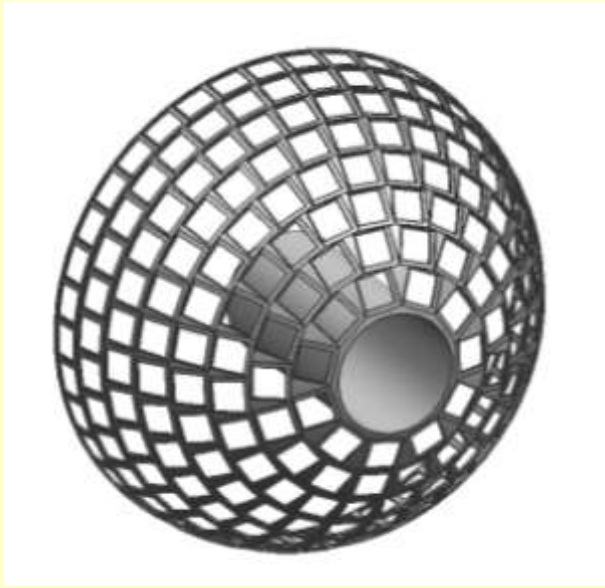
Geometry by Andrei Zalite, Milano







Support structure



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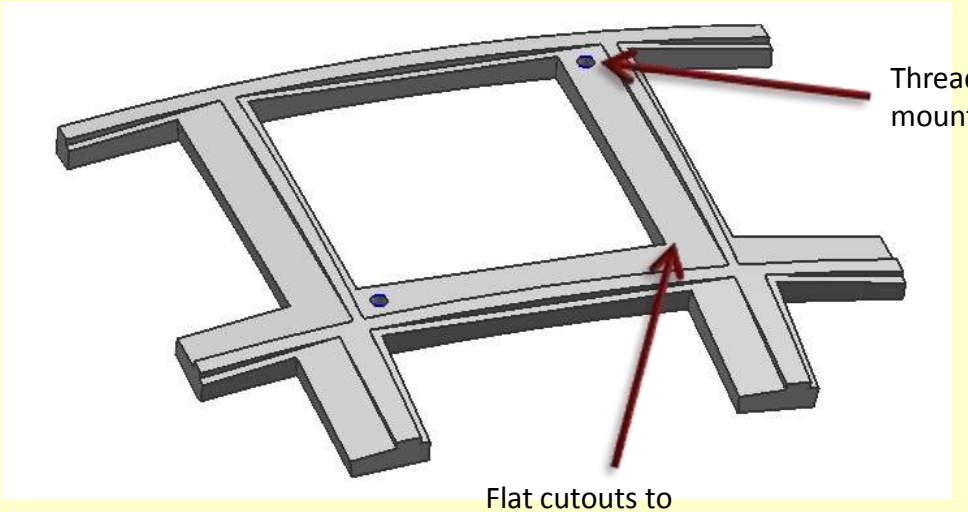

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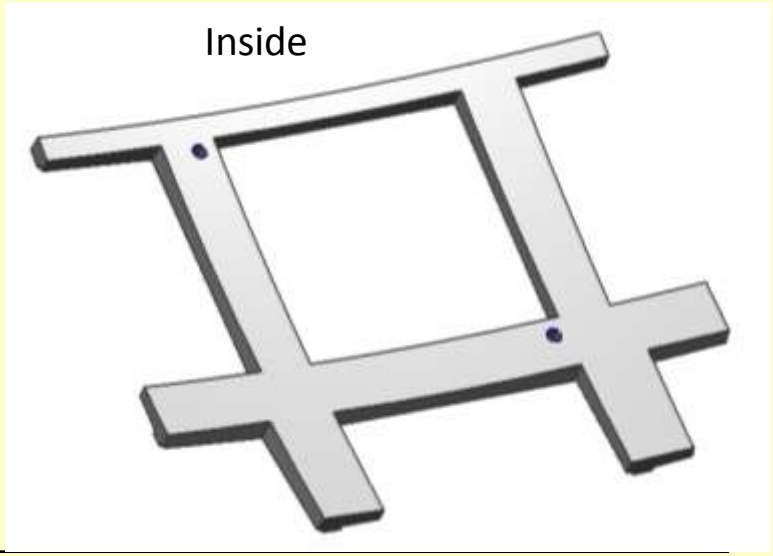
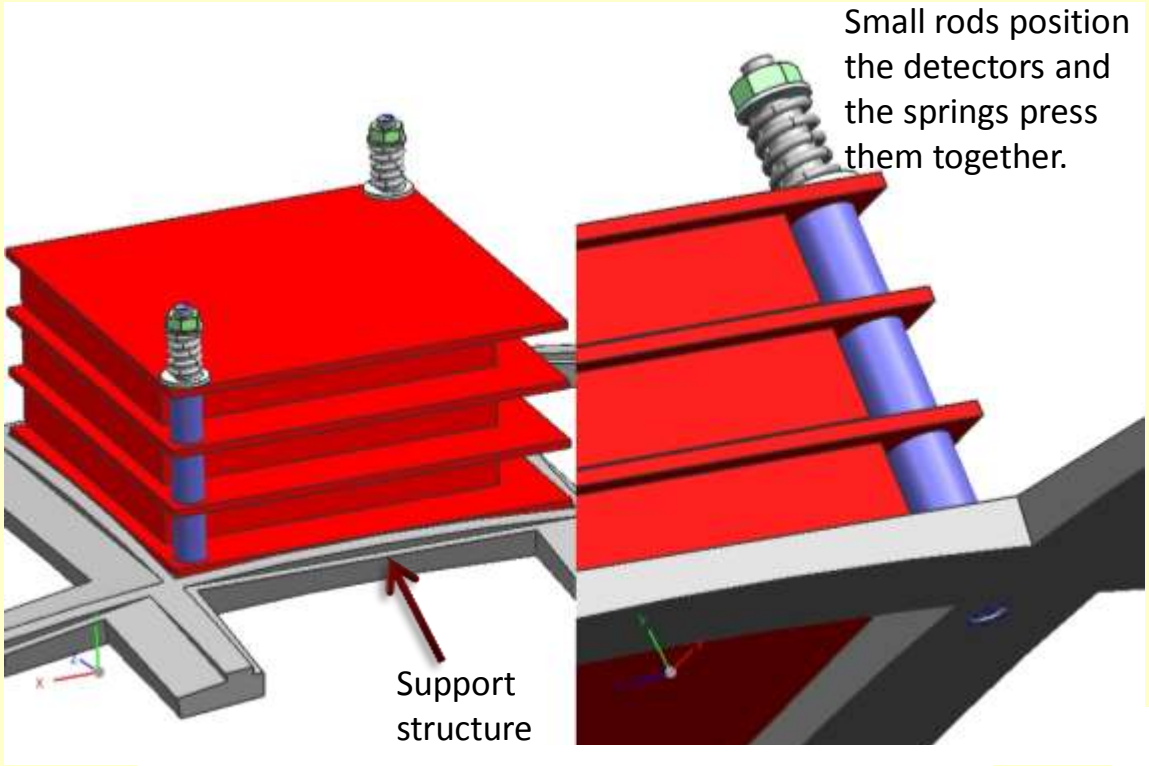
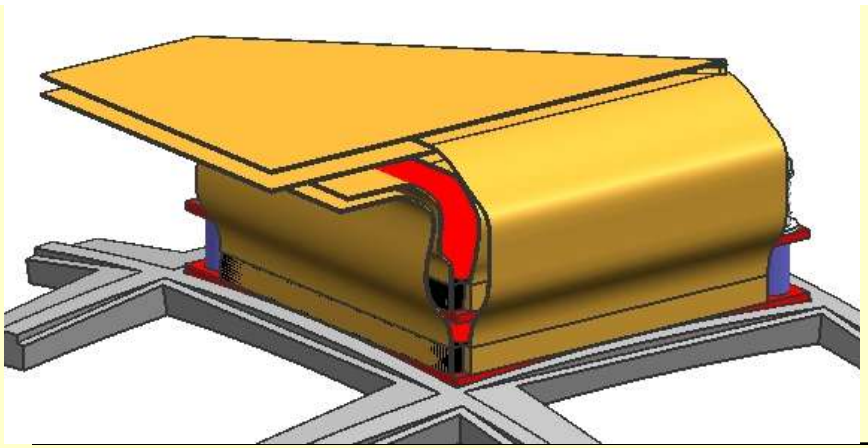


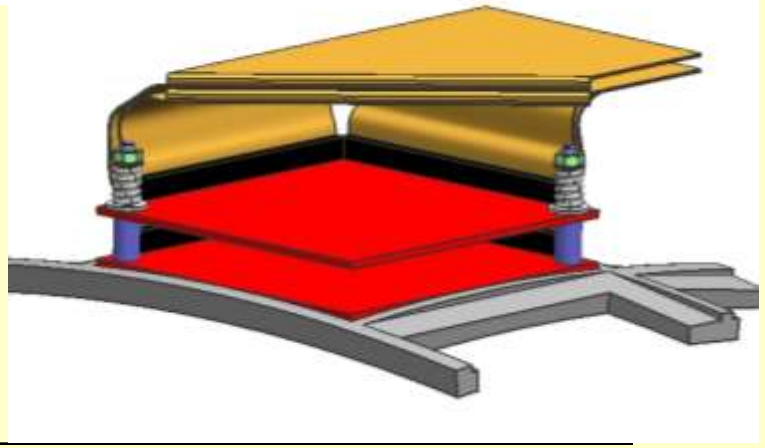
Lindemulder et al., KVI

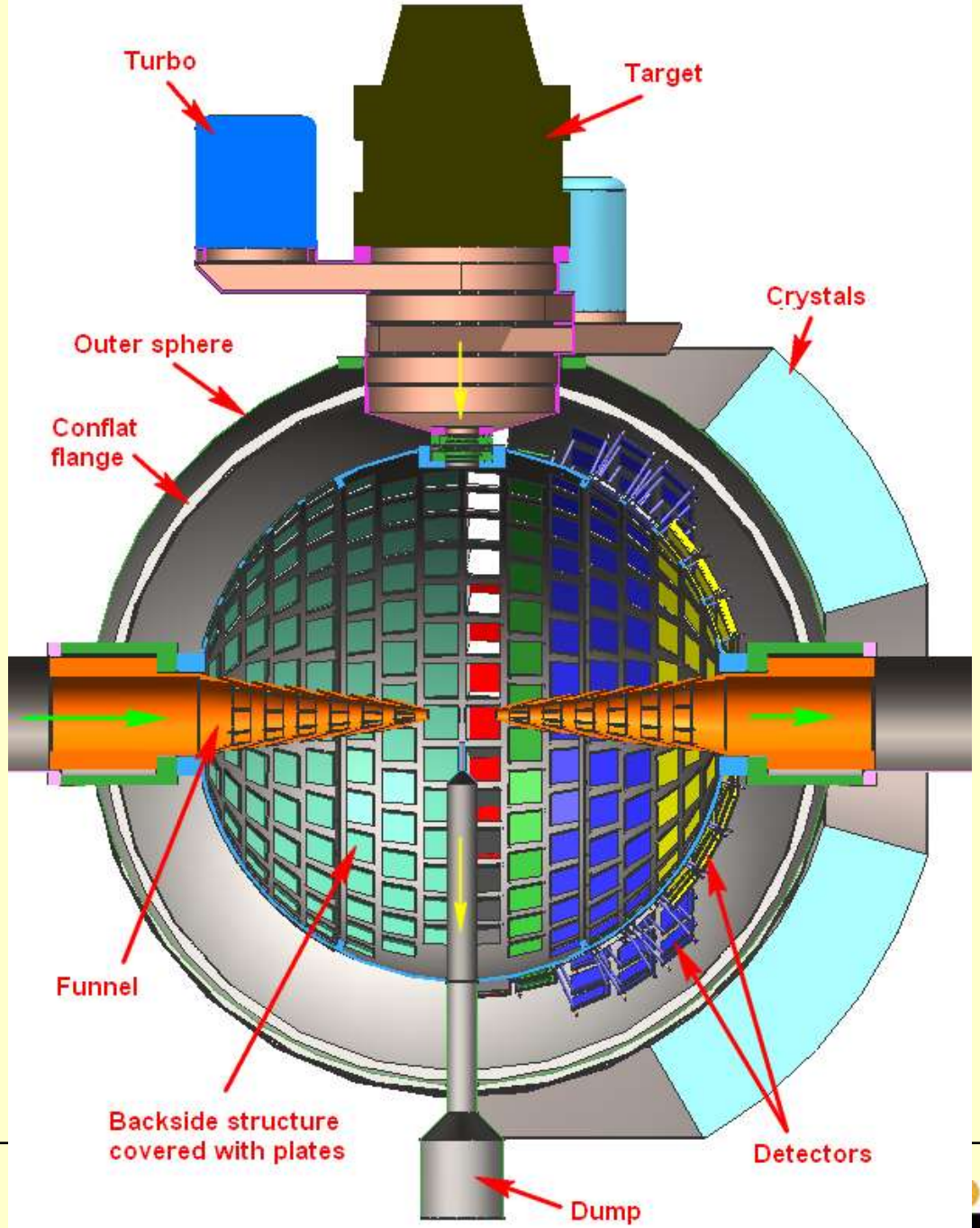
Connecting detectors



Lindemulder et al., KVI



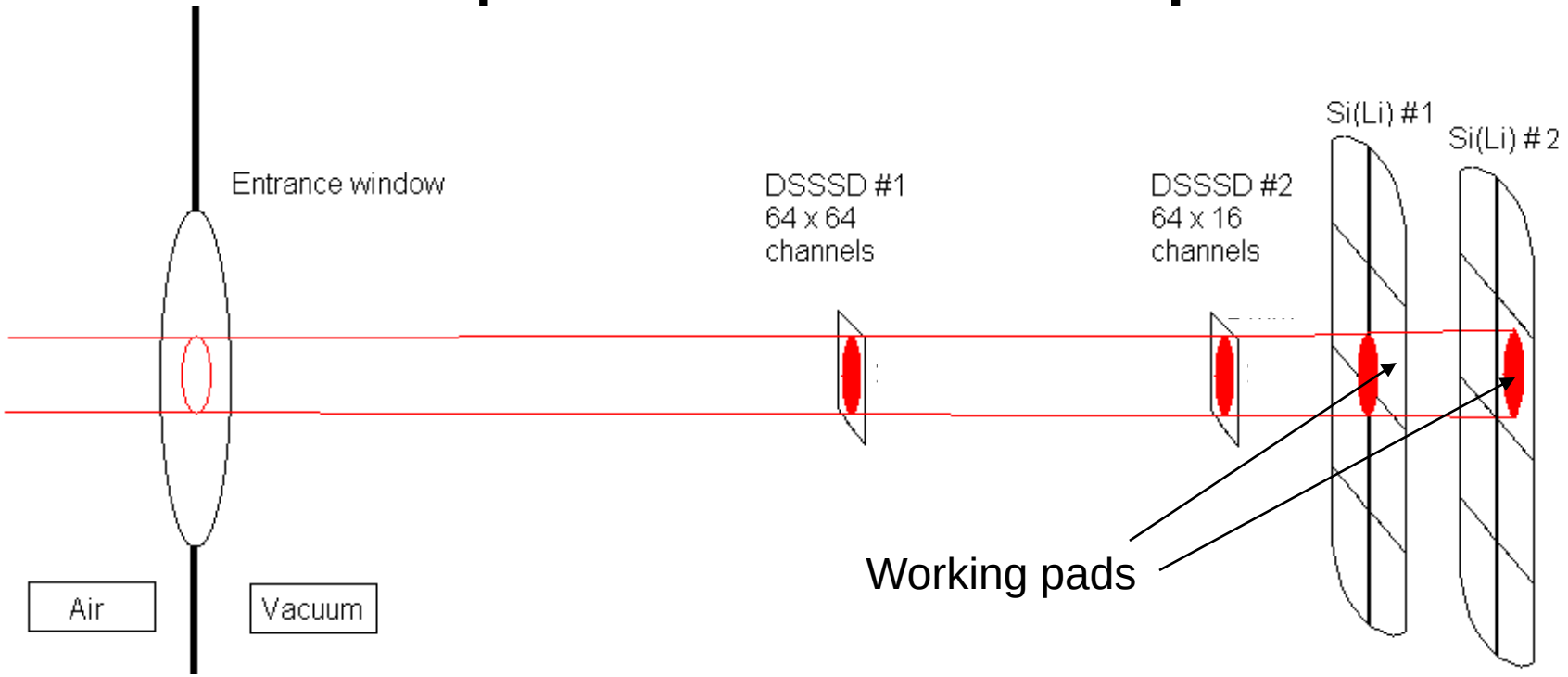




KVI

university of groningen

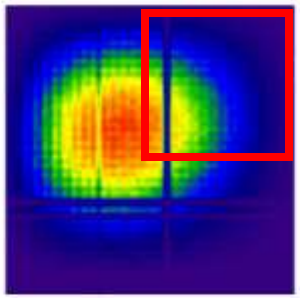
Experimental Setup



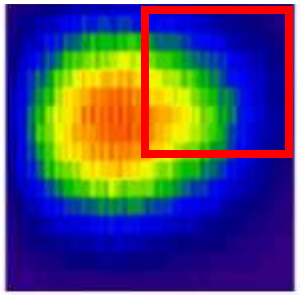
- 300 μm thick DSSDs (GSI) with preamps inside chamber
- Si(Li) 6.5 mm thick (FZ Jülich)
- Cooling -10˚C
- ~ 5 10^{-5} mbar vacuum

Results

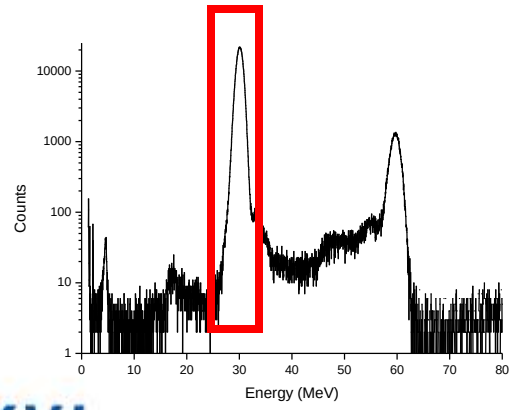
DSSD 1

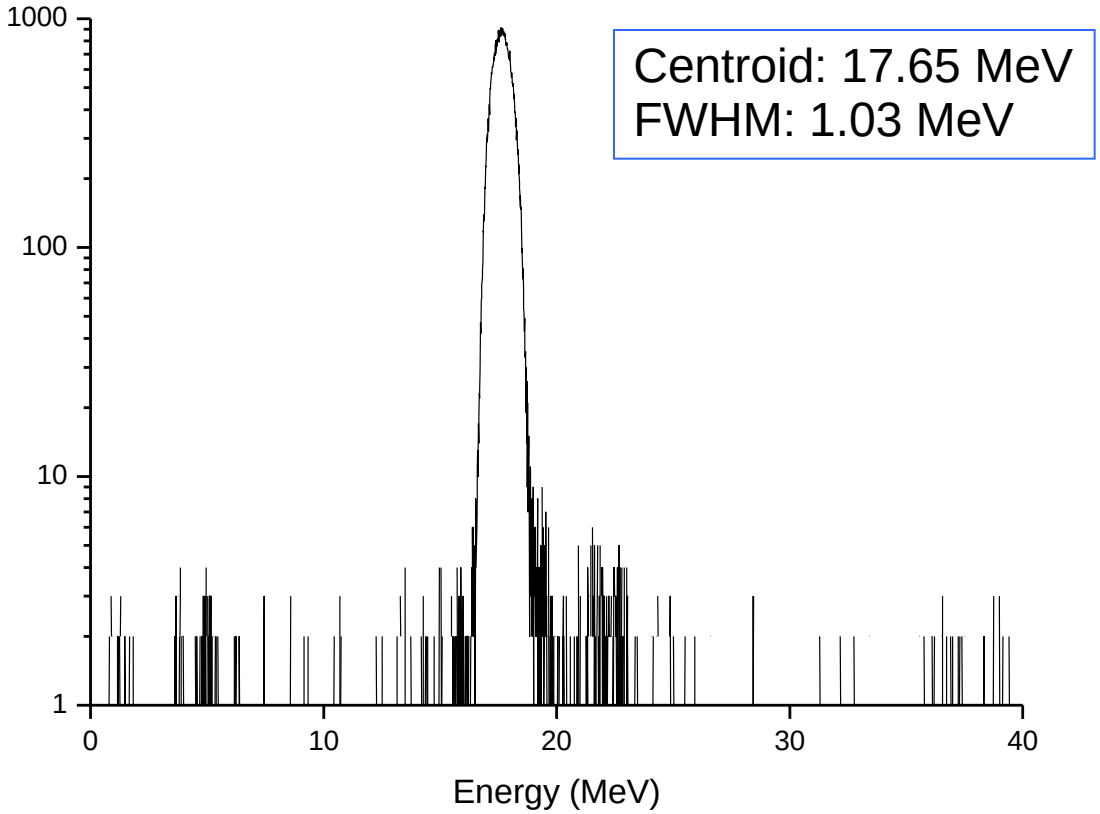


DSSD 2



Si(Li) 2





Centroid: 17.65 MeV
FWHM: 1.03 MeV

Si(Li) 1

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Project MATS

Principal design of proposed mass-calibration unit

The device will be developed, manufactured and installed in the MATS as an in-kind contribution of PNPI.

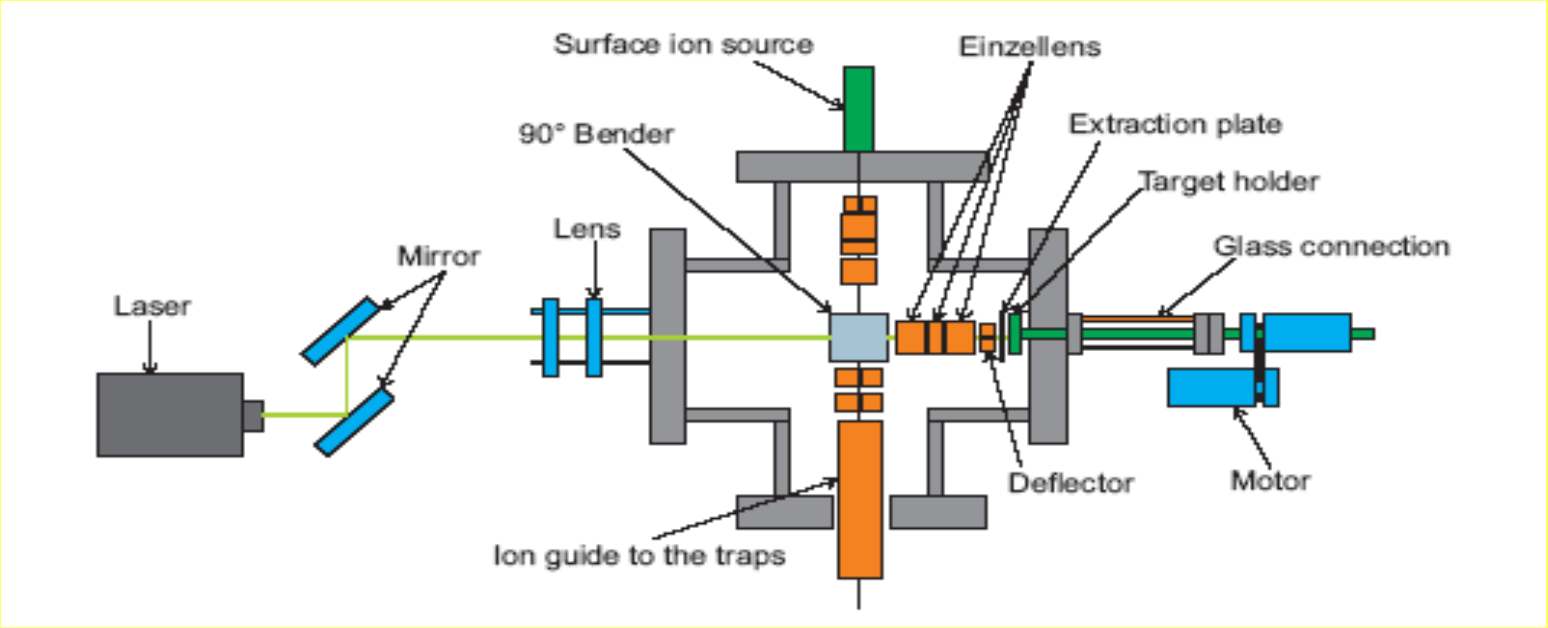


Figure : Drawing of the ion source device for mass calibration by well known reference. A laser beam is focused on the rotatable target. The ions produced are removed with an extraction plate and directed to a 90°- bender by a deflector and by the Einzel lens (three electrodes: two of them with the length of 45 mm and one with the length of 15 mm installed with the ≈ 1 mm gap between each other). Ion guide is delivering the ions towards the traps.

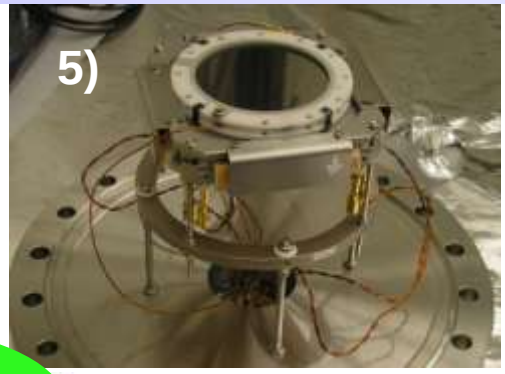
The MATS collaboration

• **BELGIUM:** *Université Libre de Bruxelles* Paul-Henri Heenen
• **CANADA:** *TRIUMF* Jens Dilling, Paul Delheij, Alain Lapierre**,** Maxime Bordeur, Stephan Ettenauer, Thomas Brunner
• **FRANCE:** *CSNSM-IN2P3,CNRS*, Georges Audi, David Lunney, Sarah Naimi, Enrique Minaya-Ramirez *CEA Sacley,* Michael Bender
• **FINLAND:** *University of Jyväskylä*, Juha Äystö, Ari Jokinen, Iain Moore, Veli Kolhinen
• **GERMANY**: *Max-Planck-Institute for Nuclear Physics*, Klaus Blaum, R. Burco Cakirli, Sergey Eliseev, Sebastian George, Alban Kellerbauer, Yuri A. Litvinov, Szilard Nagy, Julia Repp, Christian Roux, Joachim Ullrich, José R. Crespo López -Urrutia *Ernst-Moritz-Arndt University*, Alexander Herlert, Gerrit Marx, Lutz Schweikhard, Falk Ziegler *Friedrich-Alexander University Erlangen-Nürnberg*, Paul-Gerhard Reinhard *GSI,* Dietrich Beck, Michael Block, Michael Dworschak, Hans Geissel, Sophie Heinz, Frank Herfurth, Wolfgang Quint, Christoph Scheidenberger, Martin Winkler *Johannes Gutenberg University*, Klaus Eberhardt, Christopher Geppert, Jens Ketelaer, Susanne Kreim, Dennis Neidherr, Wilfried Nörtershäuser, Birgit Schabinger, *Justus-Liebig University* Timo Dickel, Christian Jesch, Martin Petrick, Wolfgang R. Plaß *Ludwig-Maximilians University München* Eva Gartzke, Jerzy Szerypo, Peter G. Thirolf, Christine Weber
• **INDIA:** *Variable Energy Cyclotron Centre,* Manir Ahammed, Parnika Das, Anirban De, Amlan Ray, *Raniganj Girls' College* Alokkumar De
• **RUSSIA:** *St. Petersburg Nuclear Physics Institute* Yuri Gusev, Dmitri Nesterenko, Yuri N. Novikov, A. Popov, Maxim Seliverstov, Alexander Vasiliev , Gleb Vorobjev
• **SPAIN**: *University of Granada,* Antonio M. Lallena, Daniel Rodríguez, *IFIC-CSIC,* Berta Rubio, José Luis Taín, Alejandro Algora *University of Huelva* José Enrique García Ramos, *CIEMAT* Daniel Cano-Ott, Trinitario Martínez, *UPC*, M. Belén Gómez Hornillos, Guillén Cortés
• **SWEDEN:** *Stockholm University,* Reinhold Schuch, Markus Suhonen, Andreas Solders, Matthias Hobein
• **USA:** *Lawrence Livermore National Laboratory* Dieter Schneider *Michigan State University* Georg Bollen, Oliver Kester, Rafael Ferrer, Stefan Schwarz, *Louisiana State University* Milan Matos

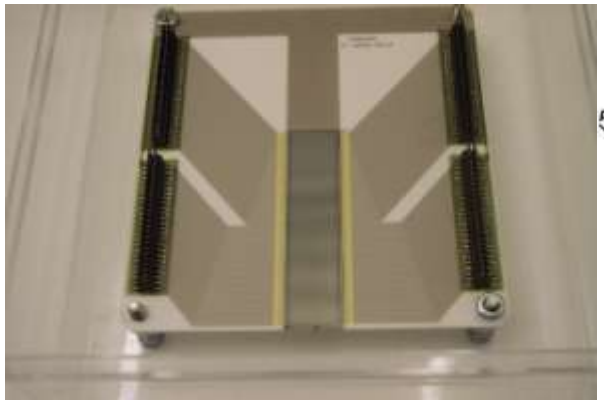
10 countries, *24 institutes*, 87 members

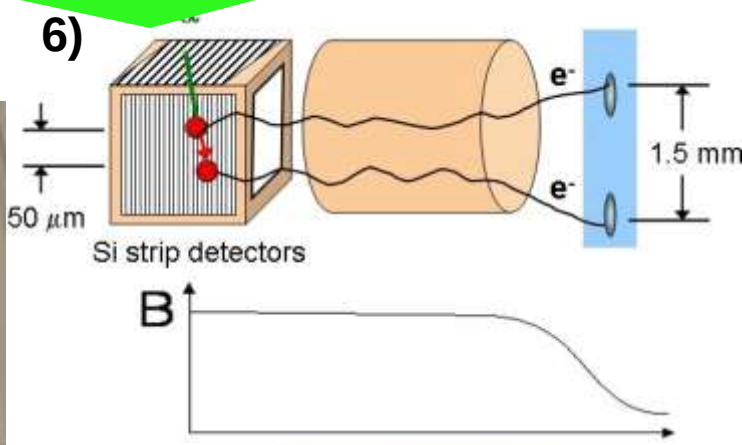
Advanced trapping techniques

5) Use of position sensitive detectors for Penning trap spectrometry



6) In-trap detectors



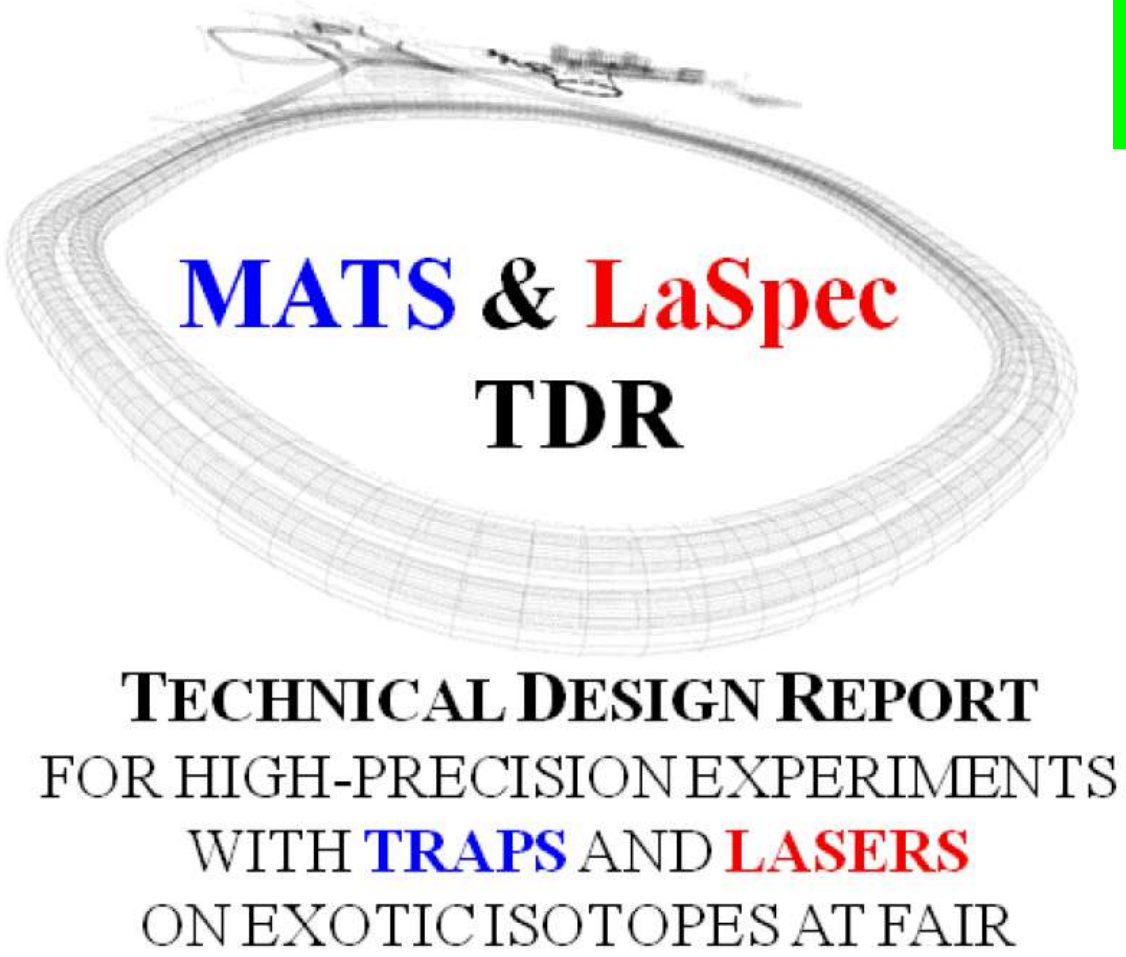


7) Narrow band FT-ICR→ Single ion sensitivity

8) Broad band FT-ICR and SWIFT

LaSpec-MATS TDR

- The table of contents for the TDR was fixed in the 3rd LaSpec-MATS collaboration meeting in October 2008



TDR submitted 25th September 2009

- Masses
- Nuclear lifetimes and quadrupole moment
- Conversion electron spectroscopy
- Rare and isomeric α decay spectroscopy
- β strength distributions
- Neutron emission probability
- Neutron time-of-flight spectrometry