

Texas A&M University
Cyclotron Institute

TAMU EVALUATION CENTER
USNDP Report FY 2024

N. Nica

Evaluation of Nuclear Structure and Decay Data

OVERVIEW

- *Scope:*
 - *Promote and accomplish mass-chain nuclear structure data evaluation at Texas A&M University - Cyclotron Institute as regular activity and foresee future developments.*
 - *Address gaps in data through targeted experiments*
 - *Promote data-based research*
- *2005-2017: under contract with BNL/NNDC*
 - *67% FTE Mass Chain Evaluation*
 - *N. Nica (PI, evaluator), J.C. Hardy (scientific adviser)*
- *2018-2024: NSDD Data Center*
 - *FY2018: 67% FTE Mass Chain Evaluation*
 - *FY2019-2024: 100% FTE Mass Chain Evaluation*
 - *N. Nica (PI, evaluator), J.C. Hardy (scientific adviser)*

Texas A&M - Cyclotron Institute NSDD Center

Contributions

- *Major Direct Contribution to USNDP/NSDD: Nuclear Data Evaluation*
 - *19 publications*
- *Important Contribution to USNDP/NSDD: Precision ICC Measurements*
 - *BrIcc adopted the “Frozen Orbitals” calculations*
 - *^{93}Nb , ^{103}Rh , ^{125}Te , ^{127}Te , ^{111}Cd , ^{119}Sn , ^{134}Cs , ^{137}Ba , ^{191}Os , ^{193}Ir , ^{197}Pt*
 - *18 publications*
- *Texas A&M Contribution to Precision Nuclear Data Production: Precision β - γ Measurements (Standard Model, CKM matrix)*
 - *$T_{1/2}$, Branching Ratios, Efficiency calibration*
 - *21 publications*
- *Texas A&M Medical Radioisotopes*
 - *^{67}Cu , ^{99}Mo*
 - *4 publications*
- *Double Helix Level Schemes: Mesoscopic Paradigm of Rotational Nuclei*
 - *2 publications*

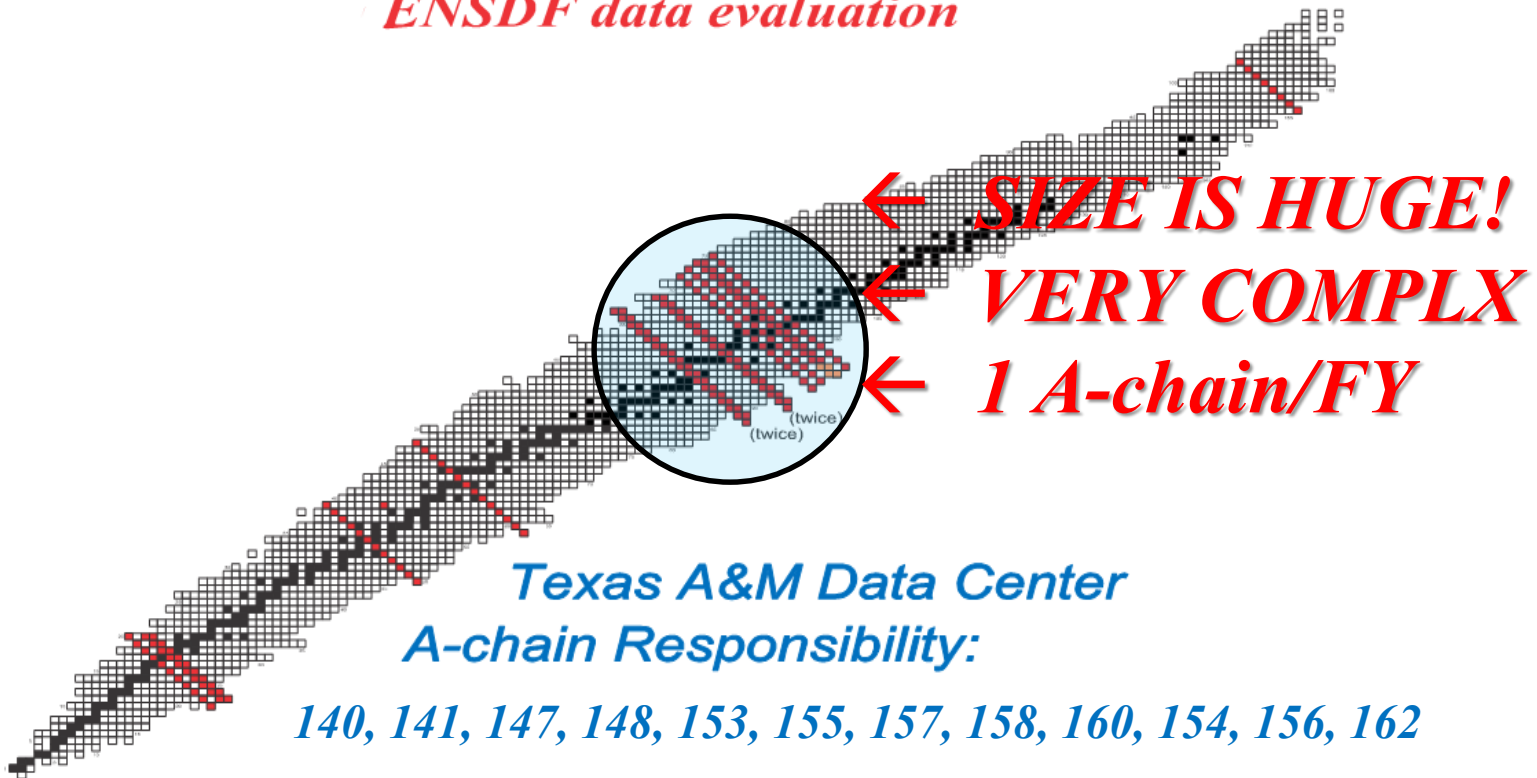
Mass Chain Evaluation: 328 nuclei, 23 A-chains

- 1. [N.Nica](#), *Nuclear Data Sheets for A = 252*, Nucl.Data Sheets 106, 813 (2005)
8 nuclei: ^{252}Cm , ^{252}Bk , ^{252}Cf , ^{252}Es , ^{252}Fm , ^{252}Md , ^{252}No , ^{252}Lr
- 2. [N.Nica](#), *Nuclear Data Sheets for A = 140*, Nucl.Data Sheets 108, 1287 (2007)
16 nuclei: ^{140}Te , ^{140}I , ^{140}Xe , ^{140}Cs , ^{140}Ba , ^{140}La , ^{140}Ce , ^{140}Pr , ^{140}Nd , ^{140}Pm , ^{140}Sm , ^{140}Eu , ^{140}Gd , ^{140}Tb , ^{140}Dy , ^{140}Ho
- 3. [D.Aabriola et al.](#), *Nuclear Data Sheets for A = 84*, Nucl.Data Sheets 110, 2815 (2009)
1 nucleus: ^{84}Y
- 4. [N.Nica](#), *Nuclear Data Sheets for A = 147*, Nucl.Data Sheets 110, 749 (2009)
16 nuclei: ^{147}Xe , ^{147}Cs , ^{147}Ba , ^{147}La , ^{147}Ce , ^{147}Pr , ^{147}Nd , ^{147}Pm , ^{147}Sm , ^{147}Eu , ^{147}Gd , ^{147}Tb , ^{147}Dy , ^{147}Ho , ^{147}Er , ^{147}Tm
- 5. [N.Nica](#), *Nuclear Data Sheets for A = 97*, Nucl.Data Sheets 111, 525 (2010)
14 nuclei: ^{97}Br , ^{97}Kr , ^{97}Rb , ^{97}Sr , ^{97}Y , ^{97}Zr , ^{97}Nb , ^{97}Mo , ^{97}Tc , ^{97}Ru , ^{97}Rh , ^{97}Pd , ^{97}Ag , ^{97}Cd
- 6. [J.Cameron](#), [J.Chen](#), [B.Singh](#), [N.Nica](#), *Nuclear Data Sheets for A = 37*, Nucl.Data Sheets 113, 365 (2012)
10 nuclei: ^{37}Na , ^{37}Mg , ^{37}Al , ^{37}Si , ^{37}P , ^{37}S , ^{37}Cl , ^{37}Ar , ^{37}K , ^{37}Ca
- 7. [N.Nica](#), [J.Cameron](#), [B.Singh](#), *Nuclear Data Sheets for A = 36*, Nucl.Data Sheets 113, 1 (2012)
10 nuclei: ^{36}Na , ^{36}Mg , ^{36}Al , ^{36}Si , ^{36}P , ^{36}S , ^{36}Cl , ^{36}Ar , ^{36}K , ^{36}Ca
- 8. [N.Nica](#), [B.Singh](#), *Nuclear Data Sheets for A = 34*, Nucl.Data Sheets 113, 1563 (2012)
11 nuclei: ^{34}Ne , ^{34}Na , ^{34}Mg , ^{34}Al , ^{34}Si , ^{34}P , ^{34}S , ^{34}Cl , ^{34}Ar , ^{34}K , ^{34}Ca
- 9. [B.Singh](#), [N.Nica](#), *Nuclear Data Sheets for A = 77*, Nucl.Data Sheets 113, 1115 (2012)
12 nuclei: ^{77}Ni , ^{77}Cu , ^{77}Zn , ^{77}Ga , ^{77}Ge , ^{77}As , ^{77}Se , ^{77}Br , ^{77}Kr , ^{77}Rb , ^{77}Sr , ^{77}Y
- 10. [N.Nica](#), *Nuclear Data Sheets for A = 148*, Nucl.Data Sheets 117, 1 (2014)
16 nuclei: ^{148}Xe , ^{148}Cs , ^{148}Ba , ^{148}La , ^{148}Ce , ^{148}Pr , ^{148}Nd , ^{148}Pm , ^{148}Sm , ^{148}Eu , ^{148}Gd , ^{148}Tb , ^{148}Dy , ^{148}Ho , ^{148}Er , ^{148}Tm
- 11. [N.Nica](#), *Nuclear Data Sheets for A = 141*, Nucl.Data Sheets 122, 1 (2014)
16 nuclei: ^{141}Te , ^{141}I , ^{141}Xe , ^{141}Cs , ^{141}Ba , ^{141}La , ^{141}Ce , ^{141}Pr , ^{141}Nd , ^{141}Pm , ^{141}Sm , ^{141}Eu , ^{141}Gd , ^{141}Tb , ^{141}Dy , ^{141}Ho
- 12. [N.Nica](#), *Nuclear Data Sheets for A = 157*, Nucl.Data Sheets 132, 1 (2016)
15 nuclei: ^{157}Nd , ^{157}Pm , ^{157}Sm , ^{157}Eu , ^{157}Gd , ^{157}Tb , ^{157}Dy , ^{157}Ho , ^{157}Er , ^{157}Tm , ^{157}Yb , ^{157}Lu , ^{157}Hf , ^{157}Ta , ^{157}W
- 13. [N.Nica](#), *Nuclear Data Sheets for A = 158*, Nucl.Data Sheets 141, 1 (2017)
15 nuclei: ^{158}Nd , ^{158}Pm , ^{158}Sm , ^{158}Eu , ^{158}Gd , ^{158}Tb , ^{158}Dy , ^{158}Ho , ^{158}Er , ^{158}Tm , ^{158}Yb , ^{158}Lu , ^{158}Hf , ^{158}Ta , ^{158}W
- 14. [N.Nica](#), *Nuclear Data Sheets for A = 140*, Nucl.Data Sheets 154, 1 (2018)
17 nuclei: ^{140}Sb , ^{140}Te , ^{140}I , ^{140}Xe , ^{140}Cs , ^{140}Ba , ^{140}La , ^{140}Ce , ^{140}Pr , ^{140}Nd , ^{140}Pm , ^{140}Sm , ^{140}Eu , ^{140}Gd , ^{140}Tb , ^{140}Dy , ^{140}Ho
- 15. [N.Nica](#), *A = 155, Nuclear Data Sheets for A = 155*, Nucl.Data Sheets 160, 1 (2019)
16 nuclei: ^{155}Ce , ^{155}Pr , ^{155}Nd , ^{155}Pm , ^{155}Sm , ^{155}Eu , ^{155}Gd , ^{155}Tb , ^{155}Dy , ^{155}Ho , ^{155}Er , ^{155}Tm , ^{155}Yb , ^{155}Lu , ^{155}Hf , ^{155}Ta
- 16. [N.Nica](#), *A = 153, Nuclear Data Sheets for A = 153*, Nucl.Data Sheets 170, 1 (2020)
16 nuclei: ^{153}La , ^{153}Ce , ^{153}Pr , ^{153}Nd , ^{153}Pm , ^{153}Sm , ^{153}Eu , ^{153}Gd , ^{153}Tb , ^{153}Dy , ^{153}Ho , ^{153}Er , ^{153}Tm , ^{153}Yb , ^{153}Lu , ^{153}Hf
- 17. [N.Nica](#), *A = 160, Nuclear Data Sheets for A = 160*, Nucl.Data Sheets 176, 1 (2021)
17 nuclei: ^{160}Pr , ^{160}Nd , ^{160}Pm , ^{160}Sm , ^{160}Eu , ^{160}Gd , ^{160}Tb , ^{160}Dy , ^{160}Ho , ^{160}Er , ^{160}Tm , ^{160}Yb , ^{160}Lu , ^{160}Hf , ^{160}Ta , ^{160}W , ^{160}Re
- 18. [N.Nica](#), [B.Singh](#), *Nuclear Data Sheets for A = 147*, Nucl.Data Sheets 181, 1 (2022)
16 nuclei: ^{147}Xe , ^{147}Cs , ^{147}Ba , ^{147}La , ^{147}Ce , ^{147}Pr , ^{147}Nd , (^{147}Pm Balraj Singh), ^{147}Sm , ^{147}Eu , ^{147}Gd , ^{147}Tb , ^{147}Dy , ^{147}Ho , ^{147}Er , ^{147}Tm
- 19. [N.Nica](#), *Nuclear Data Sheets for A = 141*, Nucl.Data Sheets 187, 1 (2023)
17 nuclei : ^{141}Sb , ^{141}Te , ^{141}I , ^{141}Xe , ^{141}Cs , ^{141}Ba , ^{141}La , ^{141}Ce , ^{141}Pr , ^{141}Nd , ^{141}Pm , ^{141}Sm , ^{141}Eu , ^{141}Gd , ^{141}Tb , ^{141}Dy , ^{141}Ho

Mass Chain Evaluation: 328 nuclei, 23 A-chains

- 20. [N.Nica](#), *Nuclear Data Sheets for A = 162*, Nucl.Data Sheets 195, 1 (2024)
17 nuclei: ^{162}Nd , ^{162}Pm , ^{162}Sm , ^{162}Eu , ^{162}Gd , ^{162}Tb , ^{162}Dy , ^{162}Ho , ^{162}Er , ^{162}Tm , ^{162}Yb , ^{162}Lu , ^{162}Hf , ^{162}Ta , ^{162}W , ^{162}Re , ^{162}Os
- 21. [N.Nica](#), *Nuclear Data Sheets for A = 154 – Post-review*
17 nuclei: ^{154}Ba , ^{154}La , ^{154}Ce , ^{154}Pr , ^{154}Nd , ^{154}Pm , ^{154}Sm , ^{154}Eu , ^{154}Gd , ^{154}Tb , ^{154}Dy , ^{154}Ho , ^{154}Er , ^{154}Tm , ^{154}Yb , ^{154}Lu , ^{154}Hf
- 22. [N.Nica](#), *Nuclear Data Sheets for A = 148 – Post-Review*
17 nuclei: ^{148}Xe , ^{148}Cs , ^{148}Ba , ^{148}La , ^{148}Ce , ^{148}Pr , ^{148}Nd , ^{148}Pm , ^{148}Sm , ^{148}Eu , ^{148}Gd , ^{148}Tb , ^{148}Dy , ^{148}Ho , ^{148}Er , ^{148}Tm , ^{148}Yb
- 23. [N.Nica](#), *Nuclear Data Sheets for A = 156 – Submitted*
18 nuclei: ^{156}La , ^{156}Ce , ^{154}Pr , ^{156}Nd , ^{154}Pm , ^{156}Sm , ^{154}Eu , ^{156}Gd , ^{154}Tb , ^{156}Dy , ^{154}Ho , ^{156}Er , ^{154}Tm , ^{156}Yb , ^{154}Lu , ^{156}Hf , ^{154}Ta , ^{156}W

Our accomplishments
ENSDF data evaluation



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- 20. [N.Nica](#), *Nuclear Data Sheets for A = 162*, Nucl.Data Sheets 195, 1 (2024), **FY2021**
17 nuclei: ^{162}Nd , ^{162}Pm , ^{162}Sm , ^{162}Eu , ^{162}Gd , ^{162}Tb , ^{162}Dy , ^{162}Ho , ^{162}Er , ^{162}Tm , ^{162}Yb , ^{162}Lu , ^{162}Hf , ^{162}Ta , ^{162}W , ^{162}Re , ^{162}Os
- 21. [N.Nica](#), *Nuclear Data Sheets for A = 154, – Post-review*, **FY2022**
17 nuclei: ^{154}Ba , ^{154}La , ^{154}Ce , ^{154}Pr , ^{154}Nd , ^{154}Pm , ^{154}Sm , ^{154}Eu , ^{154}Gd , ^{154}Tb , ^{154}Dy , ^{154}Ho , ^{154}Er , ^{154}Tm , ^{154}Yb , ^{154}Lu , ^{154}Hf
- 22. [N.Nica](#), *Nuclear Data Sheets for A = 148 – Post-Review*, **FY2023**
17 nuclei: ^{148}Xe , ^{148}Cs , ^{148}Ba , ^{148}La , ^{148}Ce , ^{148}Pr , ^{148}Nd , ^{148}Pm , ^{148}Sm , ^{148}Eu , ^{148}Gd , ^{148}Tb , ^{148}Dy , ^{148}Ho , ^{148}Er , ^{148}Tm , ^{148}Yb
- 23. [N.Nica](#), *Nuclear Data Sheets for A = 156 – Submitted*, **FY2024**
17 nuclei: ^{154}La , ^{154}Ce , ^{154}Pr , ^{154}Nd , ^{154}Pm , ^{154}Sm , ^{154}Eu , ^{154}Gd , ^{154}Tb , ^{154}Dy , ^{154}Ho , ^{154}Er , ^{154}Tm , ^{154}Yb , ^{154}Lu , ^{154}Hf , ^{154}Ta
- 1. **Review: A = 63**, Review of full mass chain evaluation, **FY2024**
13 nuclei: ^{63}Ti , ^{63}V , ^{63}Cr , ^{63}Mn , ^{63}Fe , ^{63}Co , ^{63}Ni , ^{63}Cu , ^{63}Zn , ^{63}Ga , ^{63}Ge , ^{63}As , ^{63}Se

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Mass chain evaluations: Statistics

	A=162 Evaluation	A=154 Evaluation	A=148 Evaluation	A=156 Evaluation	A=200 Review	A=63 Review
Number of Adopted Levels	1120	1256	1269	1255	518	1032
Number of Adopted Gammas	1787	2604	2049	2260	899	1500
Number of nuclides	17	17	17	18	12	13
Number of datasets	86	86	97	84	67	108
Number of .ens lines	21138	25401	19971	25819	11912	17280
NG/NL	1.60	2.07	1.61	1.74	1.73	1.45

Texas A&M - Cyclotron Institute NSDD Center Publications FY2024

- **2024Ni13** At. Data Nucl. Data Tables 160 (2024) 101682
N.Nica
Double helix level scheme of ^{171}Yb nucleus
- **2024NI10** Nucl.Data Sheets 195, 1 (2024)
N.Nica
Nuclear Data Sheets for A=162

Texas A&M - Cyclotron Institute, NSDD Center Conferences FY2024

- **N. Nica**, "*Status of Texas A&M - Cyclotron Institute USNDP Evaluation Center*," Nuclear Data Advisory Committee Meeting, Sept 2023, National Nuclear Data Center, Brookhaven National Laboratory, Upton, NY, USA
- **N. Nica**, "*TAMU NSDD EVALUATION CENTER Report Oct 2022 – Apr 2024*", 25th Technical Meeting of the Nuclear Structure and Decay Data Network, Apr 14, 2024, IAEA Vienna, Austria
- **N. Nica**, "*Data-Based Research Project: How to build a Level Scheme*", 25th Technical Meeting of the Nuclear Structure and Decay Data Network, Apr 18, 2024, IAEA Vienna, Austria
- **N. Nica**, "*Developing a New Visualization of High-Spin Level Schemes*", 25th Technical Meeting of the Nuclear Structure and Decay Data Network, Apr 22, 2024, National Institute for Physics and Nuclear Engineering "Horia Hulubei", Bucharest, Romania – ***Invited lecture***
- **N. Nica**, "*Could revisiting the principles of a level scheme bring new insight into high-spin physics?*", 7th Workshop of the Hellenic Institute of Nuclear Physics on Nuclear Structure, Astrophysics and Reaction Dynamics, HINPw7, June 1, 2024, Ioannina, Greece – ***Invited lecture***

A-Chain Evaluation Currency

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- *Responsibility:*

140, 141, 147, 148, 153, 155, 157, 158, 160, 154, 162, 156

- *Status:*

- ✓ *162 (Sep 2023, since Mar 2007)*
- ✓ *141 (Oct 2022)*
- ✓ *147 (Mar 2022)*
- ✓ *160 (May 2021)*
- ✓ *153 (Aug 2020)*
- ✓ *155 (Oct 2019)*
- ✓ *140 (Nov 2018)*
- ✓ *158 (Feb 2017)*
- ✓ *157 (Dec 2015)*
- *154 (Aug 2022, post review, since May 2008)*
- *148 (Oct 2023, post review)*
- *156 (Mar 2024, submitted FY24, since Mar 2012)*

HELP ENSDF CURRENCY

Good Standing @ Texas A&M University CI

A-Chain Evaluation FY2024

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➤ *FY2025: A157 (4-Dec-2015)*

➤ *For next year:*

- *Solve backlog:*

 - A154*

 - A148*

- *Review A-chain evaluations*

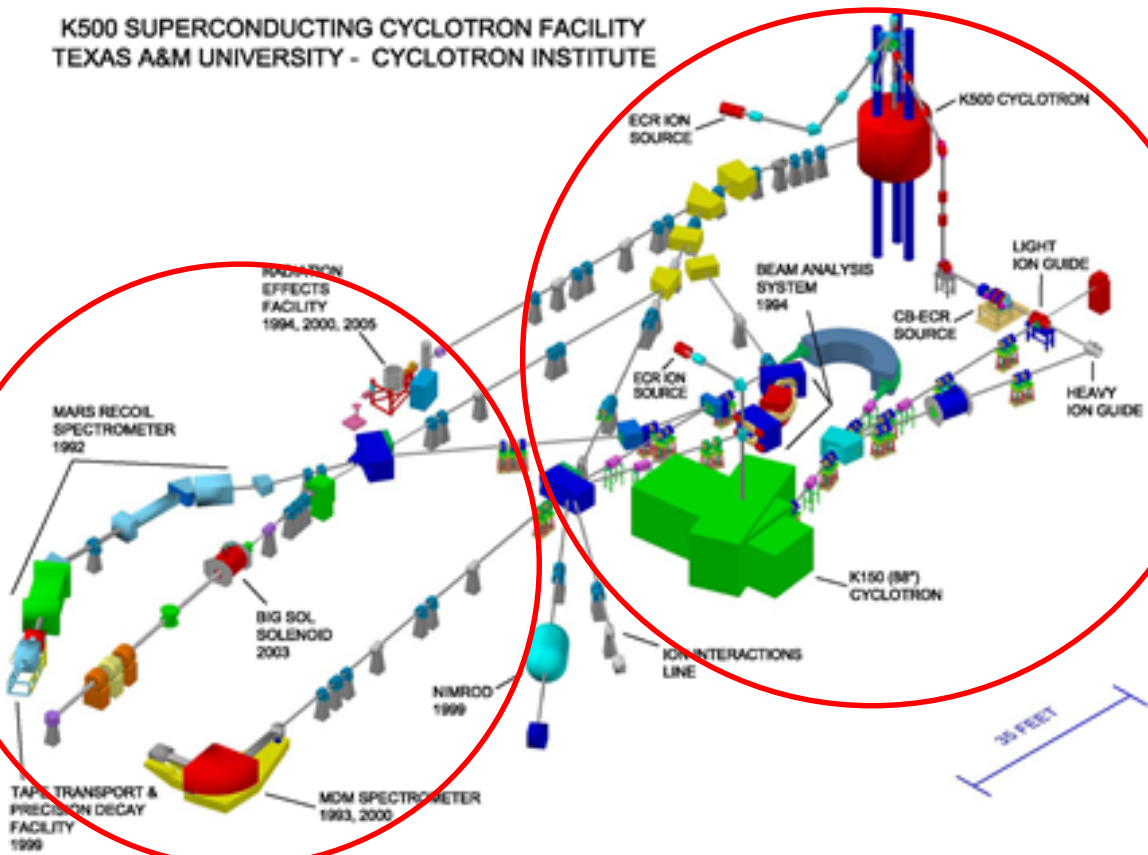
- *XUNDL (limited)*

➤ *Personnel changes*

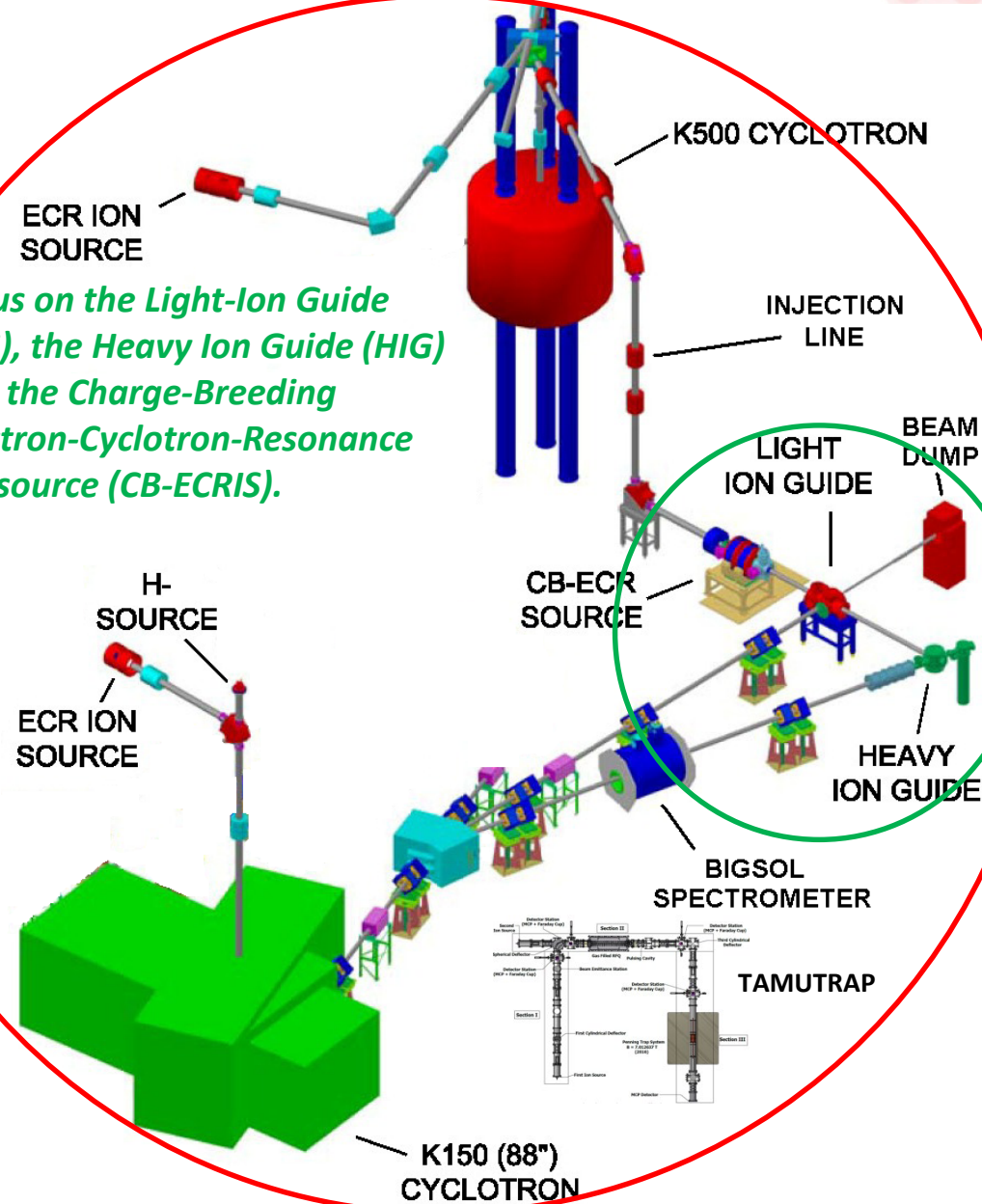
- *Not foreseeable*

Texas A&M Evaluation Center: Data Evaluation Station at Cyclotron Radioactive Ion Beam Facility to assist experiments and pre-evaluate data

K500 SUPERCONDUCTING CYCLOTRON FACILITY
TEXAS A&M UNIVERSITY - CYCLOTRON INSTITUTE



Focus on the Light-Ion Guide (LIG), the Heavy Ion Guide (HIG) and the Charge-Breeding Electron-Cyclotron-Resonance ion source (CB-ECRIS).



Texas A&M NSDD Evaluation Center Strategic Priorities

- **Continuing ENSDF Mass Chain Evaluation**

First Strategic Priority according to the Mission Statement.

All other priorities will be strictly subordinated to this purpose

- **Produce experimental nuclear data to aid data evaluation**

Precision $\beta\gamma$ Spectroscopy for $T_{1/2}$ and BR for Standard Model

- **Reevaluation of data procedures for basic science and data evaluation**

Level scheme re-concept based on Repeatability

Second Strategic Priority according to the Mission Statement.

Extend study on multiple level schemes and define mesoscopic paradigm for rotational nuclei