DESIGN AND INITIAL TESTING OF THE LANP COMPUTER MODEL OF THE COLD FUSION PROCESS

By: Daniel S Szumski, Independent Scholar

An Application of LANP* Theory

*** Least Action Nuclear Process [LANP] Theory of Cold Fusion**

THE LEAST ACTION NUCLEAR PROCESS [LANP] THEORY OF COLD FUSION

1. ENERGY UPTAKE AND STORAGE IS TREATED AS AN *IMPERFECT* REVERSIBLE THERMODYNAMIC PROCESS

2. THE PROCESS IS STEPWISE AND STRICTLY DETERMINISTIC

3. EVERY NEXT STEP SATISFIES THE PRINCIPLE OF LEAST ACTION
   [i.e. SMALLEST MASS/ENERGY CHANGE]

4. NO RADIOACTIVE INTERMEDIATES
   NO HALF LIFE DELAYS

ONLY THE INITIAL AND FINAL ISOTOPES ARE OPERATIVE…BOTH ARE STABLE

THE REVERSIBLE THERMODYNAMIC PROCESS

Perfect Reversible Process

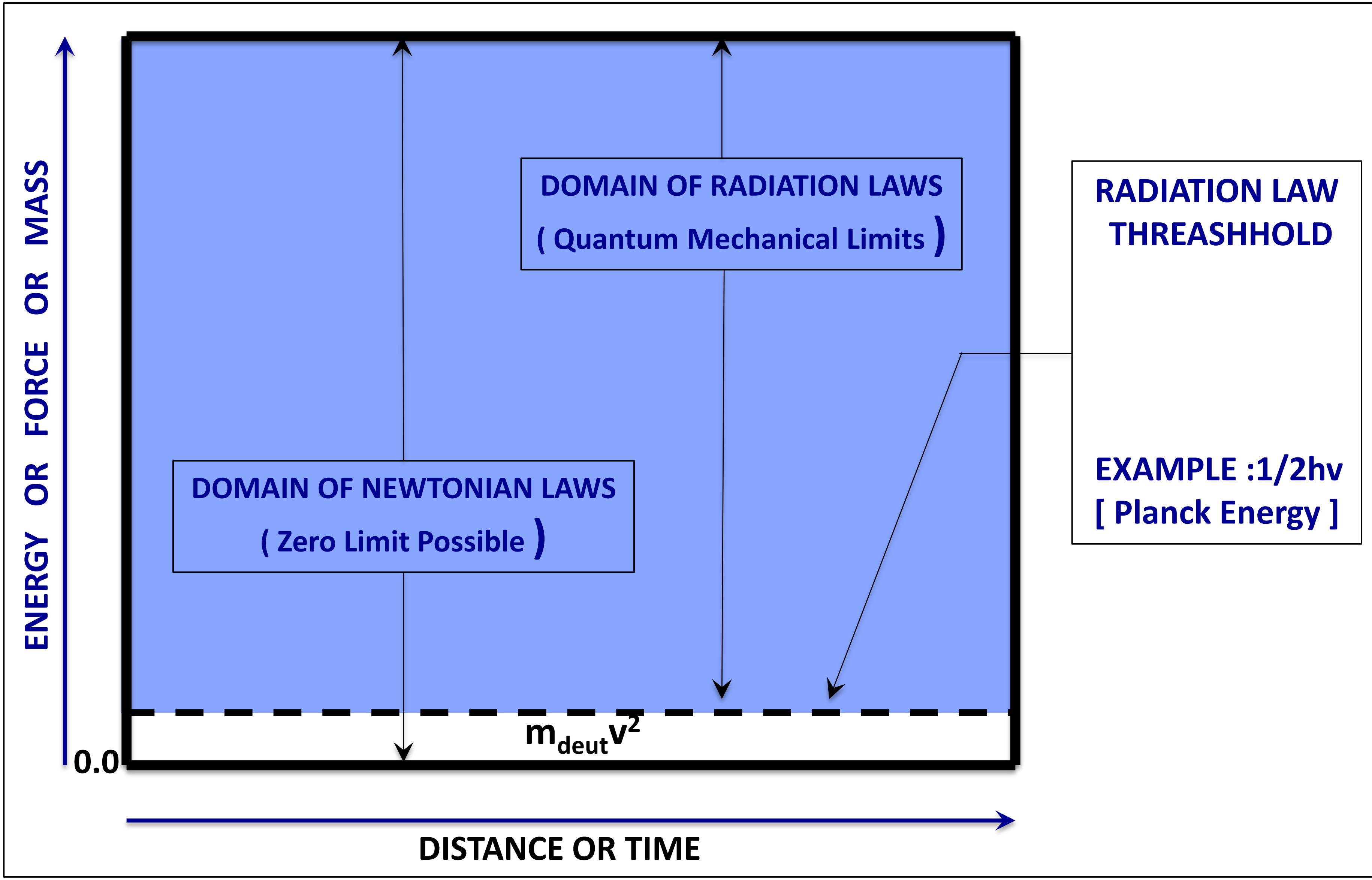
1. No particle movement
2. It accomplishes work
3. No kinetic energy
4. No renewal required
5. No change in nature as a result of its operation
   No external manifestation
   It is hidden from observation

Imperfect Reversible Process

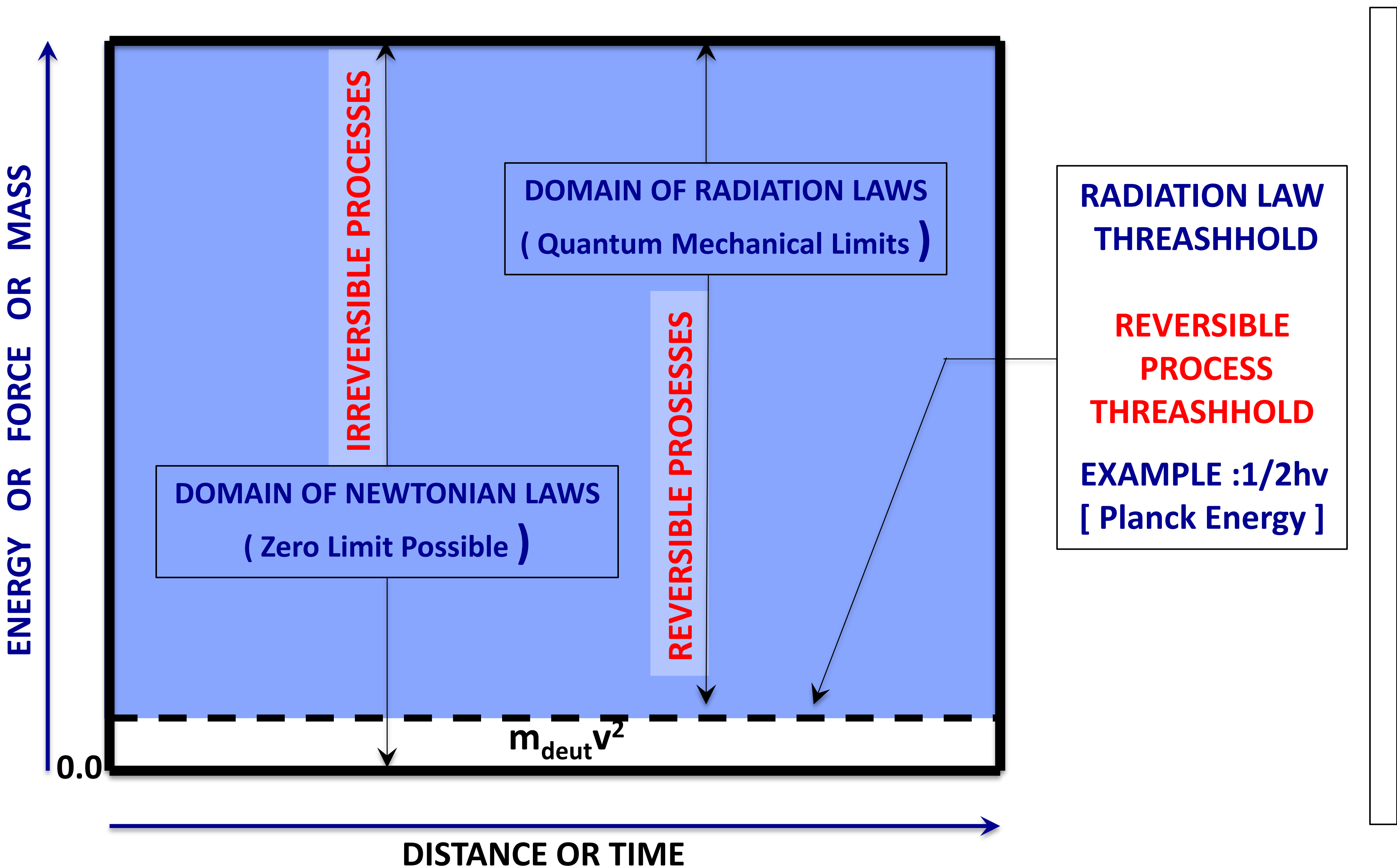
1. Involves mass (Deuteron) motion
   This introduces:
   Heisenberg uncertainty,
   Statistical behavior, and
   Irreversibility
2. It accomplishes work
3. At each step, a minute [mīˈnoot] amount of kinetic energy is consumed
4. And, during that STEP, a minute amount of energy must be restored
5. No detectable change in nature as a results of its operation
   it has no external manifestation.
   Its is hidden from observation.

The process is reversible, but not perpetual

A BACK DOOR TO THE SECOND LAW OF THERMODYNAMICS



A BACK DOOR TO THE SECOND LAW OF THERMODYNAMICS



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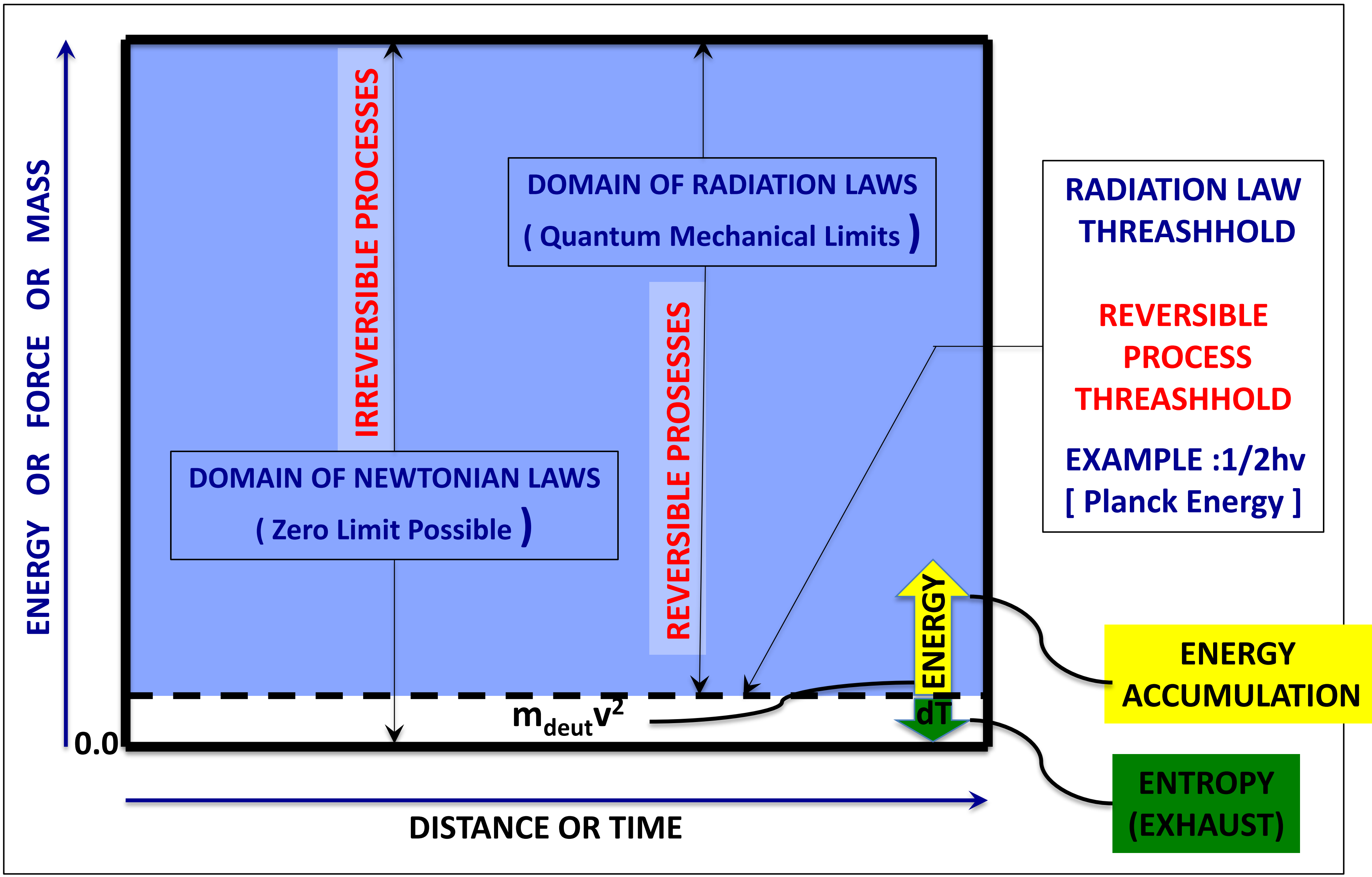
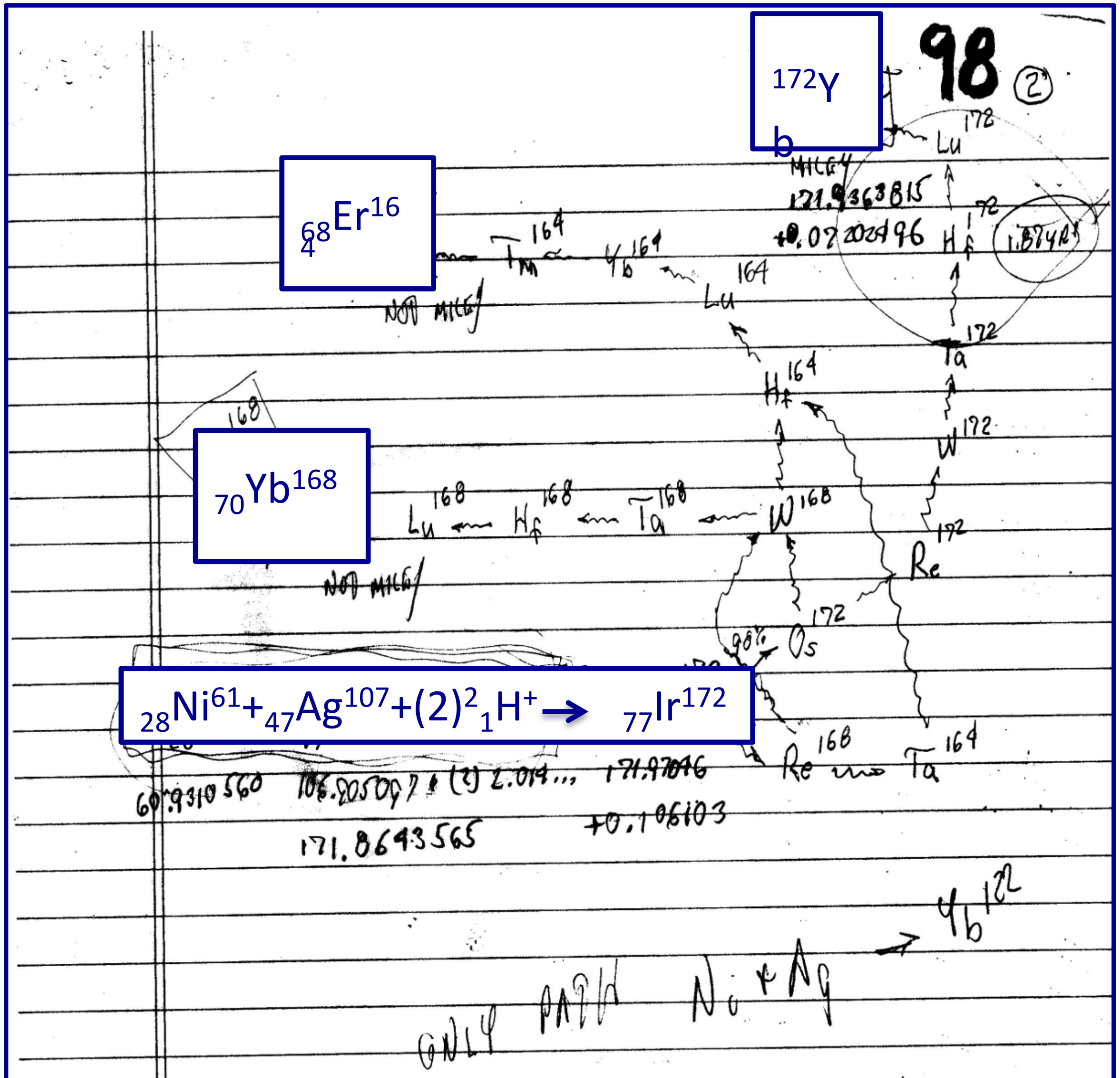


ANALYSIS OF GEORGE MILEY'S NICKEL TRANSMUTATION DATA

Principle of Least Action – How it works

$$ {}^{61}_{28}Ni + {}^{107}_{47}Ag + (2)\,{}^{2}_{1}H \xrightarrow{fusion} {}^{172}_{70}Yb $$



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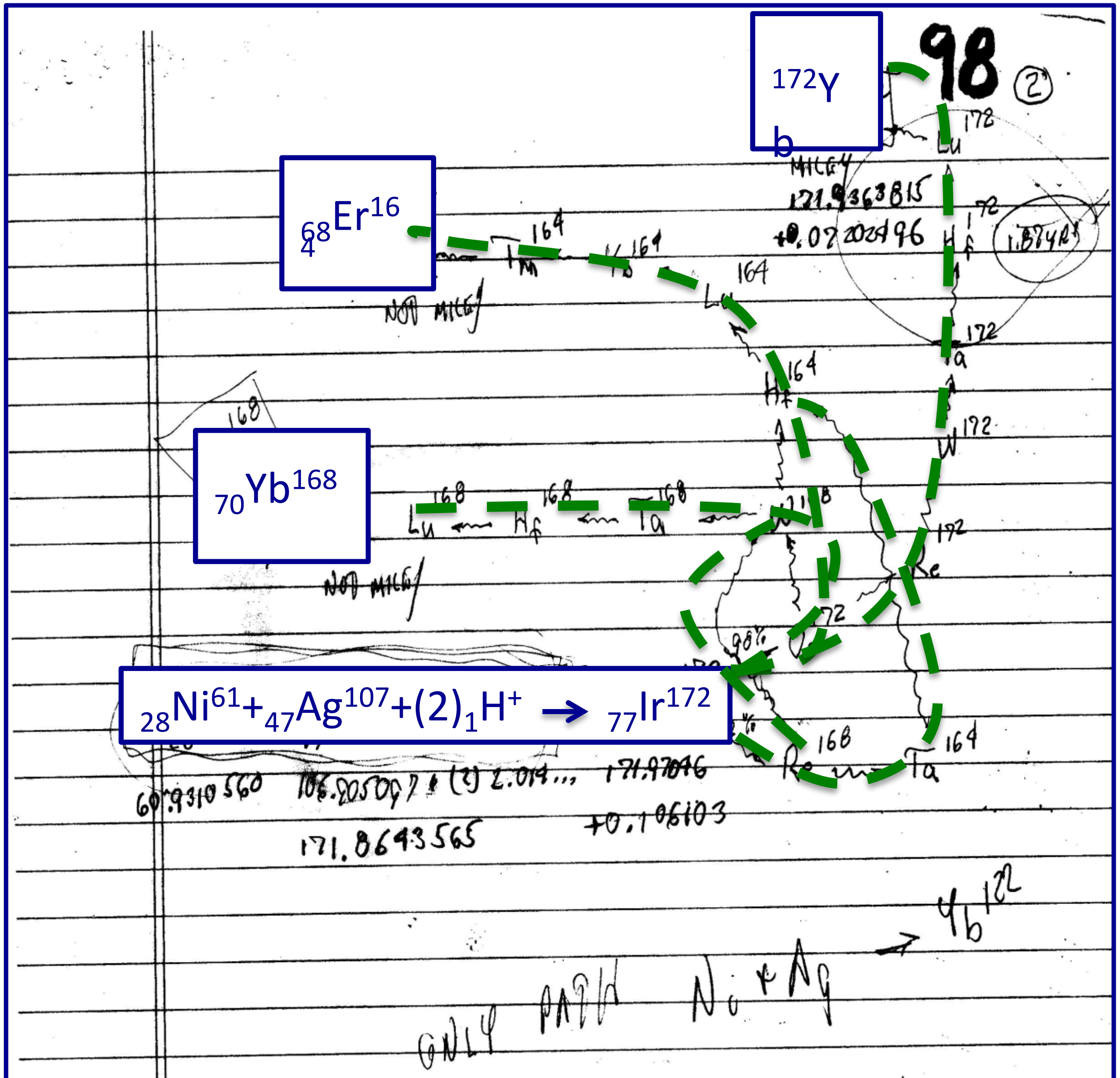

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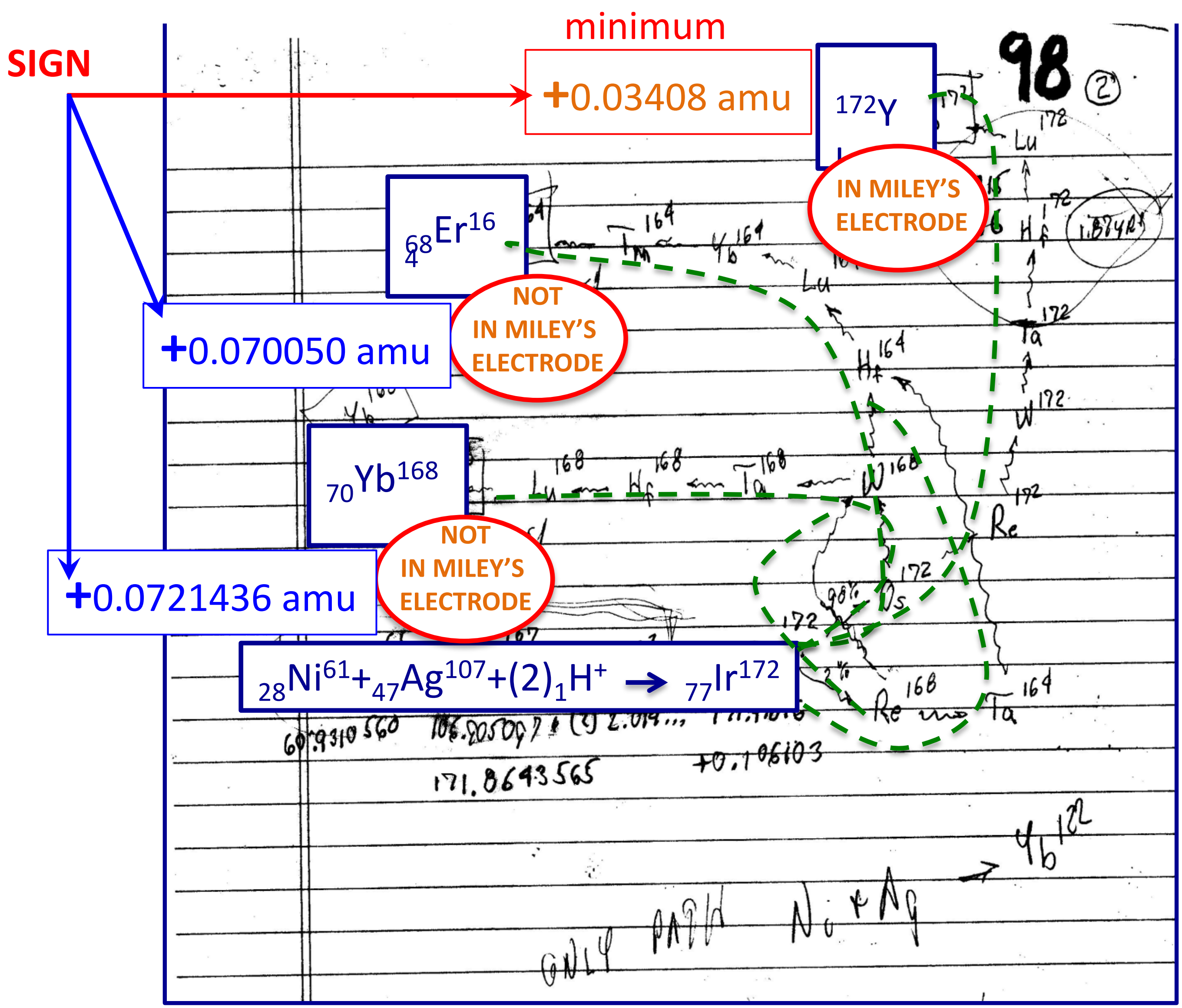


ANALYSIS OF MILEY'S NICKLE ELECTRODE DATA

1. The fundamental cold fusion process is neutron production
   [No LENR ... Deuterium-deuterium fusion?]

2. LANP always selects for the smallest energy change.

3. Both positive and negative heat changes occur.

4. Five classes of nuclear reactions:
   - Deuterons with base metal [Ni, Pd]
   - Deuterons with metal impurities [Si, Fe, Mn, Ag, etc]
   - Fusion of electrode materials and impurities [Ni+Ag]
   - Fission reactions
   - Alpha decay reactions yield He-4

5. The more deuterons reacting ... the greater the energy change

6. Nuclear transmutations occur without regard to half life constraints

7. Transmutation products follow the same rules

COLD FUSION EXPERIMENT VARIABILITY

&

REPRODUCIBILITY

THREE LEVELS OF CAUSE/EFFECT VARIABILITY IN THE COLD FUSION PROCESS

PRIMARY INDEPENDENT VARIABLES

1. Energy storage within the electrode
2. Internal electrode Temperature

Part of the reversible process space, and hidden from our observation

SECONDARY VARIABLES

Nuclear Transmutations

TERTIARY VARIABLES

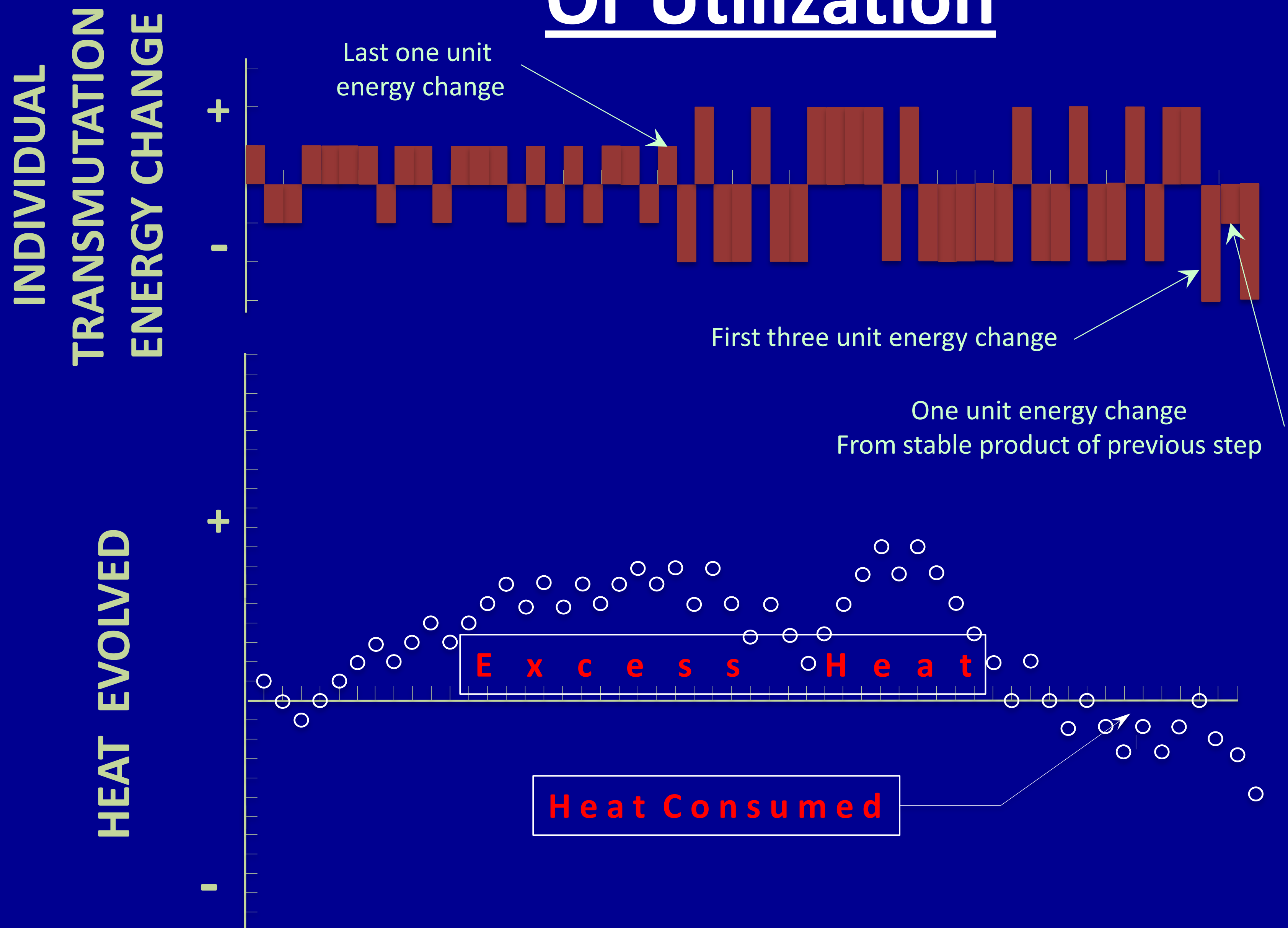
Excess heat

Possible Sources of Variability in LANP

Energy Storage Internal Process Temperature	Exactly Deterministic
Nuclear Transmutation Pathway	Exactly Deterministic
Transmutation Mass/Energy Change	Exactly Deterministic
Direction of Next Mass/energy Change [+ or -]*	Random

* This is the sole source of variability in cold fusion experiments… Knowing this, we can solve this problem

Time Series of Excess Heat Production Or Utilization



HIGH PERFORMANCE ELECTRODE DESIGN

WHAT DO HIGH YIELD EXPERIMENTS TELL US?

They tell us what is possible

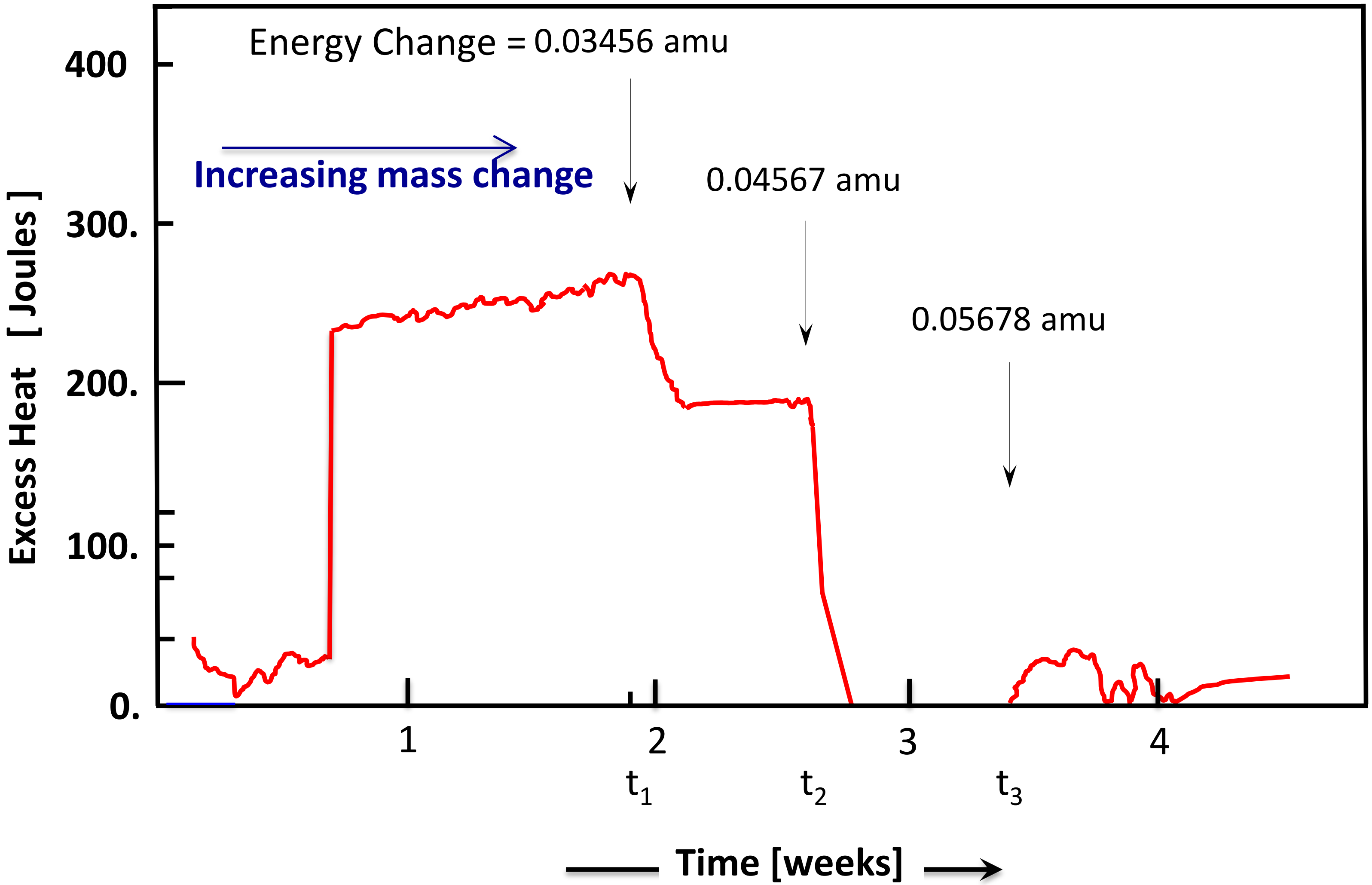
Our instincts tell us that the answer lies in the electrode

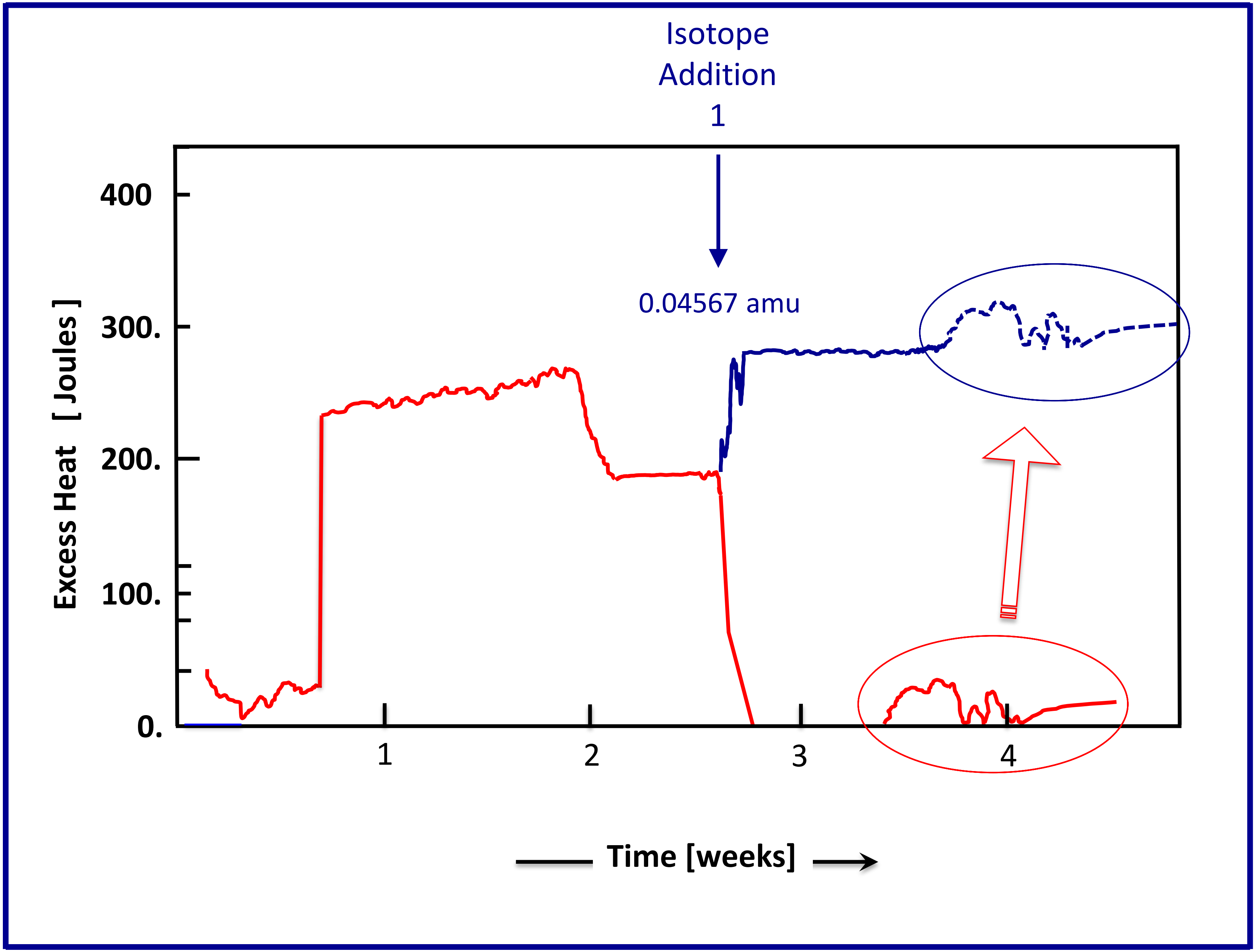
WHY DO WE NEED A THEORY?

Goal: Design an electrode isotope composition that optimizes excess heat

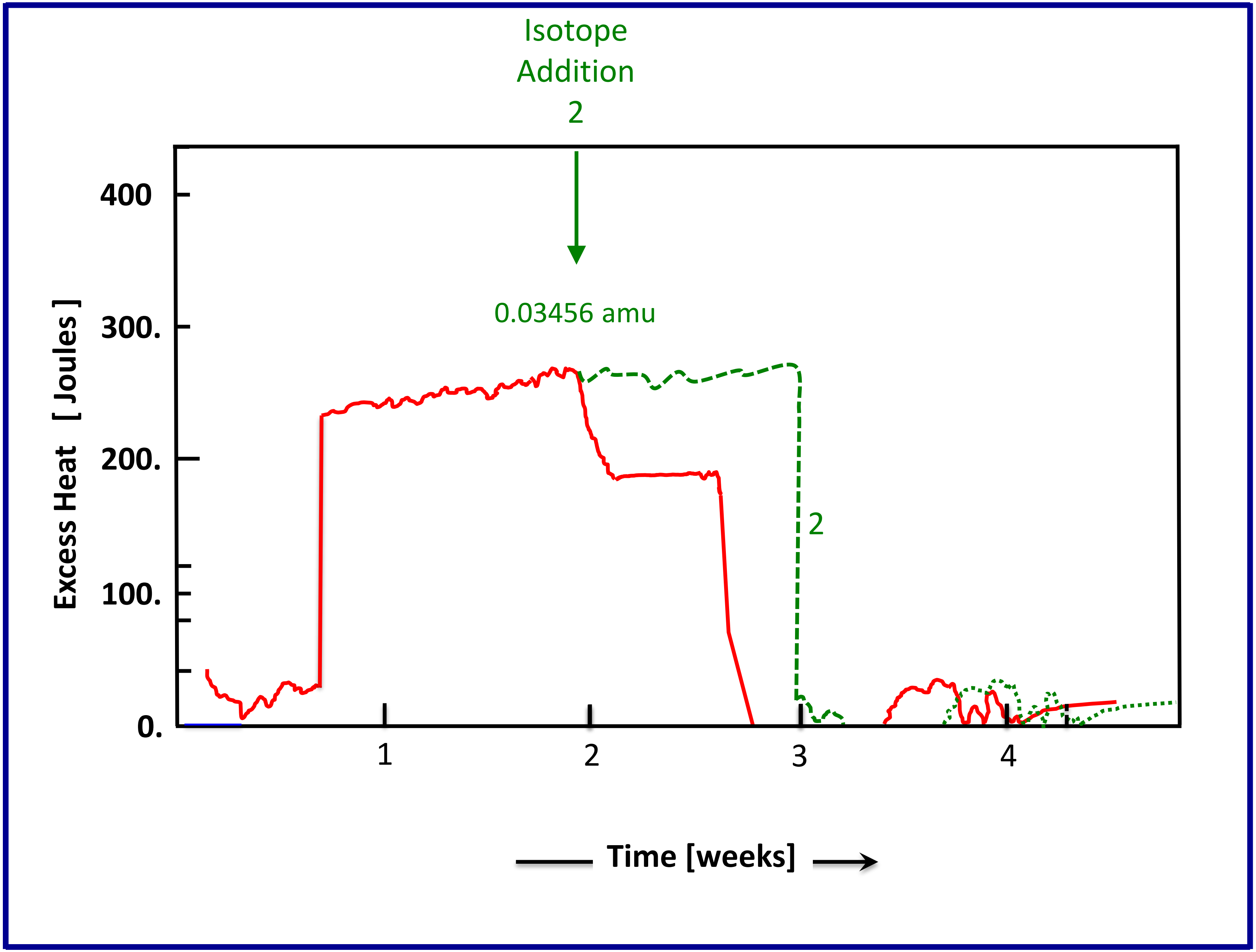
… produces those high yield experiments that we know are possible

Hypothetical Excess Heat Time Series

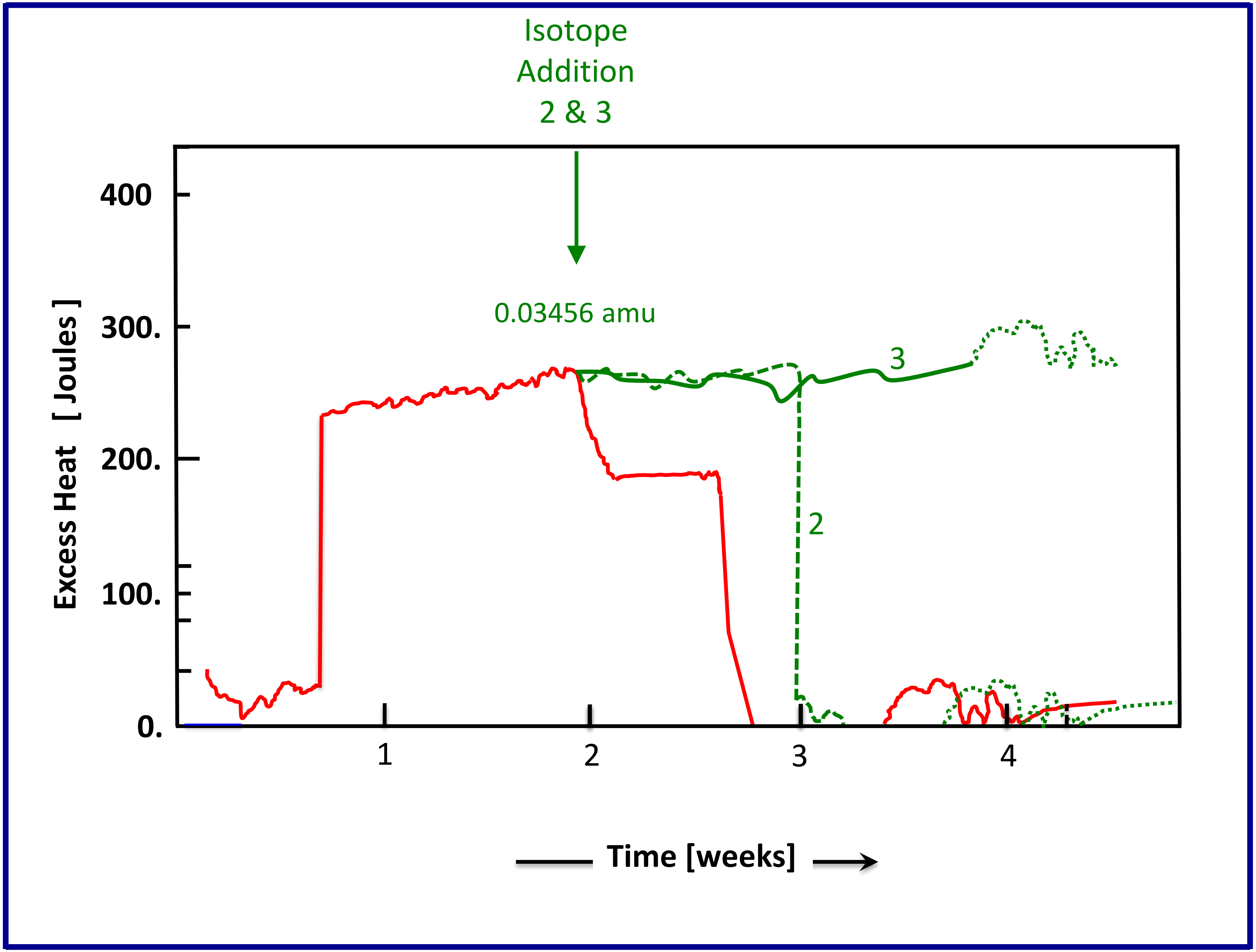


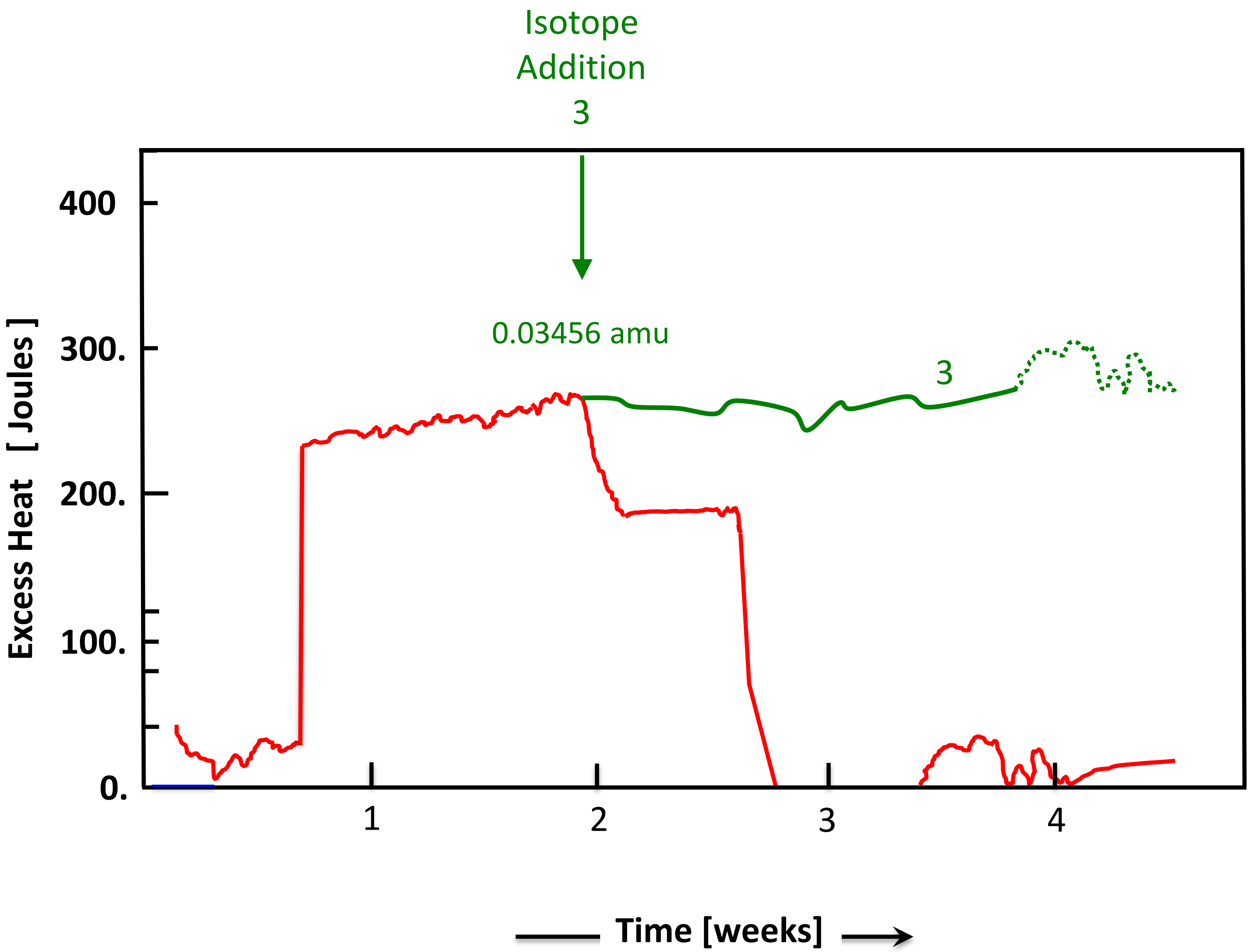


Isotope
Addition
1
0.04567 amu
400
300.
200.
100.
0.
Excess Heat [Joules]
1
2
3
4
Time [weeks]



Isotope
Addition
2
0.03456 amu
2
400
300.
200.
100.
0.
Excess Heat [Joules]
1
2
3
4
Time [weeks]


Isotope
Addition
2 & 3
0.03456 amu
Excess Heat [Joules]
400
300.
200.
100.
0.
1
2
3
4
3
2
Time [weeks]



THERE IS NO METALURGIST INVOLVED IN THE DESIGN PROCESS TO THIS POINT

LANP ELECTRODE DESIGN PROGRAM

LEAST ACTION NUCLEAR PROCESS COMPUTER PROGRAM

At each step: Calculates the smallest energy change
its stable isotope product, and
its excess heat contribution

In fact it:

Calculates precisely, ALL steps in the Least Action Nuclear Process

Proceedure

1. Select an initial electrode composition that favors exothermal reactions
2. Run it until endo-thermal reactions begin to dominate
3. Note the magnitude of energy change occurring then
4. Add an isotope(s) that favors exothermal reactions at that energy change

EXAMPLE WIKIPEDIA ISOTOPE TABLE - Ni

Isotopes of nickel

From Wikipedia, the free encyclopedia

nuclide symbol	Z(p)	N(n)	isotopic mass (u)	half-life	decay mode(s)[6][n 1]	daughter isotope(s)[n 2]
	excitation energy (keV)					
^{57}Ni	28	29	56.9397935(19)	35.60(6) h	β^+	^{57}Co
^{58}Ni	28	30	57.9353429(7)	Observationally stable[n 3]		
^{59}Ni	28	31	58.9343467(7)	$7.6(5)\times10^4$ y	EC (99%)	^{59}Co
					β^+ ($1.5x10^{-5}$%)[7]	
^{60}Ni	28	32	59.9307864(7)	**Stable**		
^{61}Ni	28	33	60.9310560(7)	**Stable**		
^{62}Ni[n 4]	28	34	61.9283451(6)	**Stable**		

INITIAL DATA SET

3299 ISOTOPE RECORDS: HYDROGEN through LEAD

P #	N #	INITIAL ISOTOPE	FIRST DECAY PRODUCT	ISOTOPE MASS	SYMB		DECAY MODE	MASS CHANGE FROM DECAY STEP
1	0	1H		1.00782503	H			0.00000000E+00
1	1	2H		2.01410178	H			0.00000000E+00
1	2	3H	3He	3.01604928	H	He	B-	-0.54857990E-03
1	3	4H	3H	4.02781110	H	H	1N	-0.10086650E+01
1	4	5H	3H	5.03531110	H	H	2N	-0.20173299E+01
1	5	6H	3H	6.04494280	H	H	3N	-0.30259948E+01
1	5	6H	2H	6.04494286		H	4N	-0.40346599E+01
1	6	7H	3H	7.05275108	H	H	4N	-0.40346599E+01
2	0	2He	1H	2.01589420	He	H	1P	-0.10072764E+01
2	1	3He		3.01602932	He			0.00000000E+00
2	2	4He		4.00260325	He			0.00000000E+00
2	3	5He	4He	5.01222500	He	He	1N	-0.10086650E+01
2	4	6He	6Li	6.01888918	He	Li	B-	-0.54857990E-03
2	5	7He	6He	7.02802118	He	He	1N	-0.10086650E+01
2	6	8He	8Li	8.03392270	He	Li	B-	-0.54857990E-03
2	6	8He	5He	8.03392315		He	B-,FF	-0.54857990E-03
2	7	9He	8He	9.04395300	He	He	1N	-0.10086650E+01
2	8	10He	8He	10.05240800	He	He	2N	-0.20173299E+01
3	1	4Li	3He	4.02719230	Li	He	1P	-0.10072764E+01
3	2	5Li	4He	5.01254500	Li	He	1P	-0.10072764E+01
3	3	6Li		6.01512279	Li			0.00000000E+00
3	4	7Li		7.01600456	Li			0.00000000E+00
3	5	8Li	8Be	8.02248736	Li	Be	B-	-0.54857990E-03
3	6	9Li	8Be	9.02678952	Li	Be	B-,1N	-0.10092135E+01
3	6	9Li	9Be	9.02678967		Be	B-	-0.54857990E-03
3	7	10Li	9Li	10.03548116	Li	Li	1N	-0.10086650E+01

EXAMPLE LANP PROGRAM OUTPUT

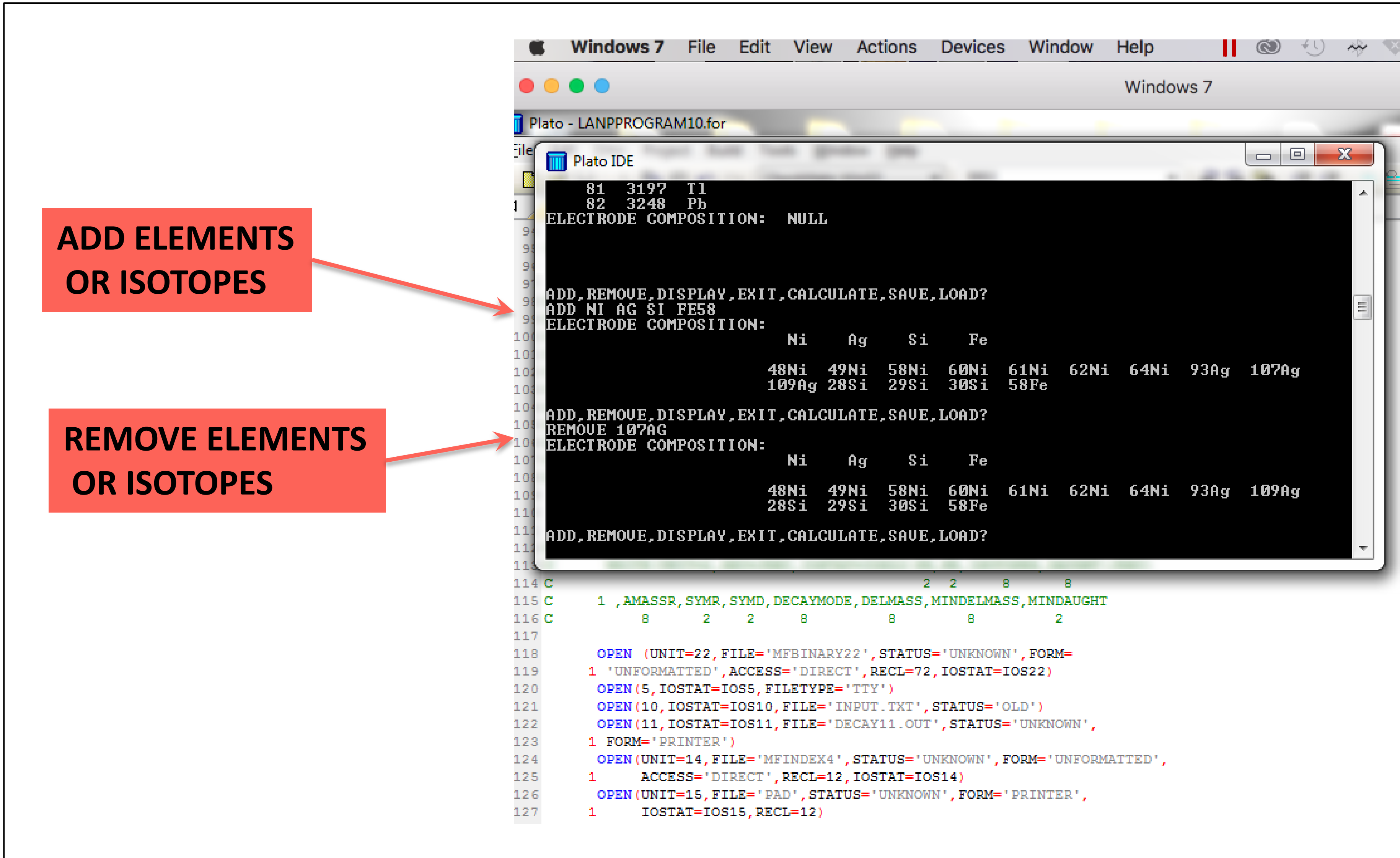
167Os	163W	166.97155800	162.92873122	-3.53073297
167Os	167Re	166.97155762	162.92873122	0.46934703

188Re	188Os	187.95811441	187.95583821	-0.00054858	0.00172762	0.00172762	188Os	,B-
189Re	189Os	188.95922990	188.95814751	-0.00054858	0.00053381	0.00053381	189Os	,B-
190Re	190Os	189.96182160	189.95844701	-0.00054858	0.00282601	0.00282601	190Os	,B-
191Re	191Os	190.96312511	190.96059401	-0.00109716	0.00143394	0.00143394	191Ir	,B-,B-
192Re	192Os	191.96596210	191.96148072	-0.00054858	0.00393280	0.00393280	192Os	,B-
162Os	158W	161.98443540	141.90772332	3097.39636818	161.98443540	3117.47308026		,AA,AA,B+,B+,AA,B+,B+,B+,B+,AA,AA
163Os	159W	162.98269430	142.90981432	6162.59358492	162.98269430	6182.66646490		,AA,AA,B+,AA,B+,B+,B+,B+,B+,EC,AA,B-,AA
163Os	162W	162.98269653	161.92877840	-0.48204786	0.57187027	0.57187027	162Er	,B+,1P,B+,B+,B+,B+,B+,B+
163Os	163Re	162.98269653	162.92873122	0.98379948	1.03776479	1.03776479	163Dy	,B+,B+,B+,B+,B+,B+,B+,B+,B+,EC
164Os	160W	163.97804220	143.91199930	570.70358015	163.97804220	590.76962305		,AA,AA,AA,B+,B+,AA,B+,B+,AA
164Os	164Re	163.97804260	143.91199930	586.71778729	163.97804260	606.78383059		,B+,AA,AA,AA,B+,AA,B+,B+,AA
165Os	161W	164.97676220	148.91718472	13.89967622	29.95925370	29.95925370	149Sm	,AA,AA,AA,AA,B+,B+,B+,B+,B+,EC
165Os	165Re	164.97676086	164.93032212	0.65763721	0.70407595	0.70407595	165Ho	,B+,B+,B+,B+,B+,B+,B+,B+,EC
166Os	162W	165.97269120	161.92877840	-3.47572916	0.56818364	0.56818364	162Er	,AA,B+,B+,B+,B+,B+,B+
166Os	166Re	165.97268677	165.93029312	0.70257899	0.74497264	0.74497264	166Er	,B+,B+,B+,B+,B+,B+,EC,B+
167Os	163W	166.97155800	162.92873122	-3.53073297	0.51209381	0.51209381	163Dy	,AA,B+,B+,B+,B+,B+,B+,B+,EC
167Os	167Re	166.97155762	162.92873122	0.46934703	4.51217343	4.51217343	163Dy	,B+,AA,B+,B+,B+,B+,B+,B+,EC
168Os	168Re	167.96780413	167.93389750	0.23352828	0.26743491	0.26743491	168Yb	,B+,B+,B+,B+,B+,B+
168Os	164W	167.96780396	163.92920030	-3.55805545	0.48054821	0.48054821	164Er	,AA,B+,B+,B+,B+,EC,B+
169Os	169Re	168.96701927	168.93421332	0.21832002	0.25112597	0.25112597	169Tm	,B+,B+,B+,B+,B+,B+,EC
169Os	165W	168.96702576	164.93032212	-3.69052270	0.34618094	0.34618094	165Ho	,AA,B+,B+,B+,B+,B+,B+,EC
170Os	170Re	169.96357712	169.93476182	0.18752178	0.21633708	0.21633708	170Yb	,B+,B+,B+,B+,EC,B+
170Os	176W	169.96357727	175.94140862	-3.99092174	-9.96875309	-9.96875309	176Hf	,AA,EC,B+
171Os	171Re	170.96318520	170.93632582	0.11946010	0.14631948	0.14631948	171Yb	,B+,B+,B+,B+,B+,B+
171Os	167W	170.96318054	166.93204822	-3.85000569	0.18112663	0.18112663	167Er	,AA,B+,B+,B+,B+,B+,EC
172Os	172Re	171.96002316	171.93638150	0.13398710	0.15762876	0.15762876	172Yb	,B+,B+,B+,B+,EC,B+
172Os	168W	171.96002197	167.93389750	-3.89803133	0.12809314	0.12809314	168Yb	,AA,B+,B+,B+,B+
173Os	173Re							
173Os	169W							
174Os	174Re							

0.51209381	163Dy	,AA,B+,B+,B+,B+,B+,B+,B+,EC
4.51217343	163Dy	,B+,AA,B+,B+,B+,B+,B+,B+,EC

4.51217343-4.0015063=0.5106671

LANP PROGRAM: ELECTRODE COMPOSITION



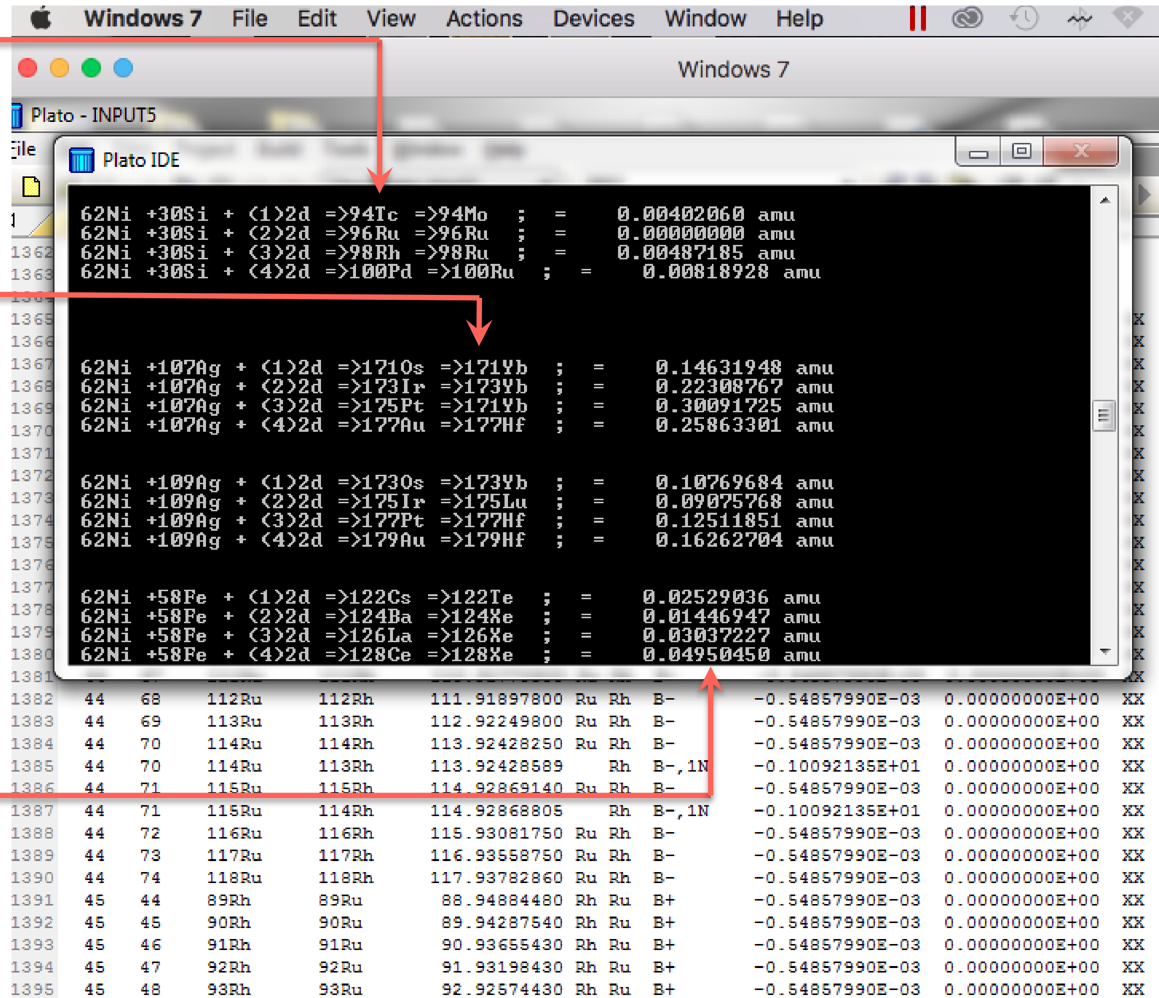
LANP PROGRAM: ELECTRODE COMPOSITION

INITIAL REACTION PRODUCT

LEAST ACTION TRANSMUTATION PRODUCT

LEAST ACTION MASS CHANGE

INCREASING MAGNITUDE IS ORDER OF ISOTOPE APPEARANCE IN ELECTRODE



Comprehensive Tracking Experiment is Needed

Two sets of experiments: Ni and Pd electrodes.

Five identical experiments with a common power source

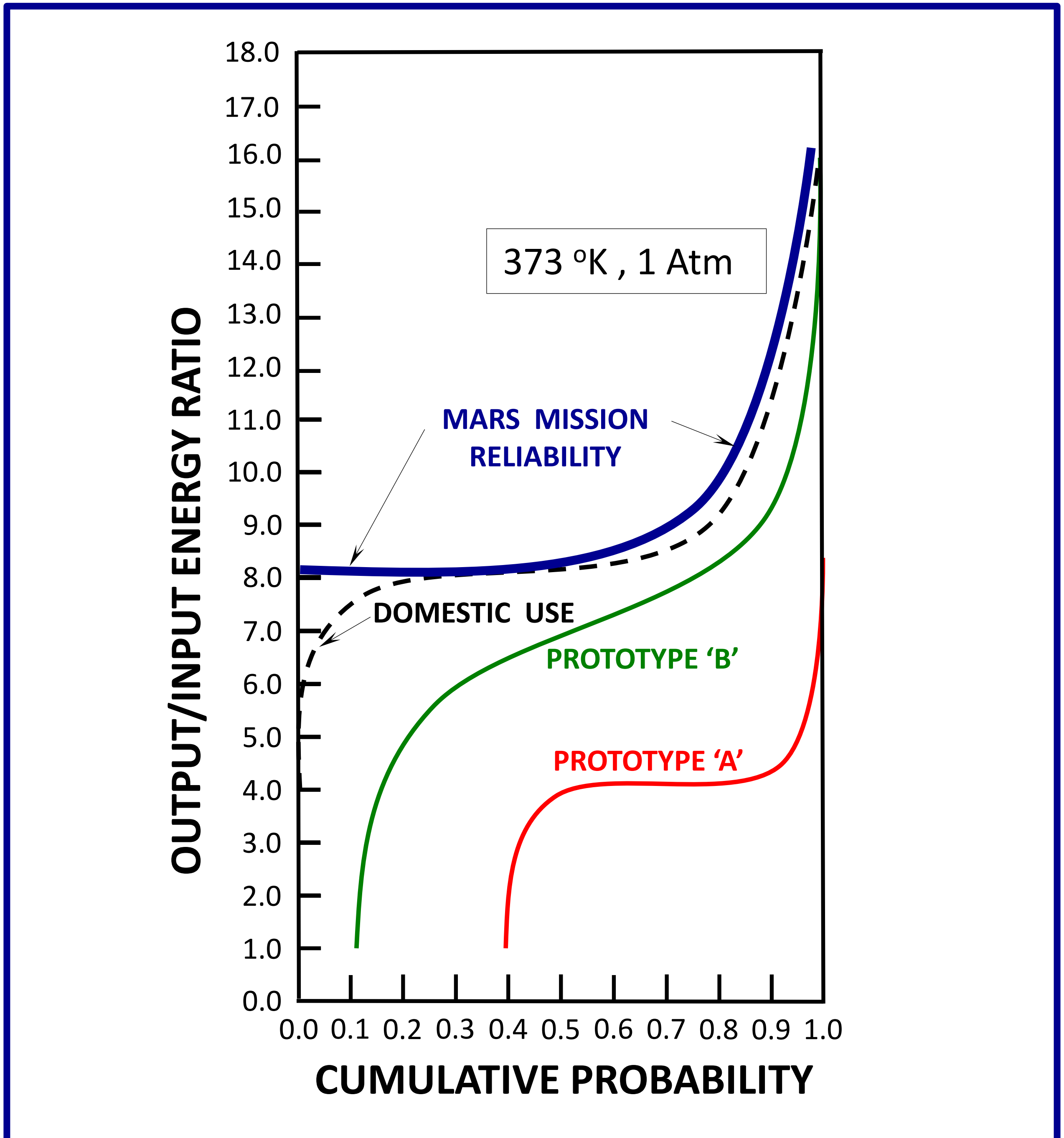
Sampling: initial, excess heat initiation, three other intervals, following heat cessation.

Measurements

- Before and after SIMS analysis on each electrode
- AA measurements to confirm SIMS
- Cumulative gas phase analysis at each sampling
- Radiation measurements :RF, microwave, far/near IR, UV, X-ray, and Gamma
- Excess heat calorimetry

…What else do we need?

WE NEED TO SEE THE BIG PICTURE…THE RELATIONSHIPS BETWEEN VARIABLES



373 °K , 1 Atm
MARS MISSION RELIABILITY
DOMESTIC USE
PROTOTYPE 'B'
PROTOTYPE 'A'
OUTPUT/INPUT ENERGY RATIO
CUMULATIVE PROBABILITY
18.0
17.0
16.0
15.0
14.0
13.0
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0

Thank you …

…It is an honor to speak here

Daniel Szumski, Independent scholar

www.LeastActionNuclearProcess.com

SO FAR…

ELECTRODE METHODS

ELEMENT DOPING: [Ag^{107}, Ag^{109}] at natural abundance ratio

ISOTOPE DOPING WITH SPECIFIC ISOTOPES: [Ag^{107} only]

BASE METAL ISOTOPE ADJUSTMENT: i.e. Ni^{60} only

[May be required for Mars Mission Reliability]

OPERATIONAL METHODS

CONTINUOUS FLOW OF ELECTRODE PARTICLES

DYNAMIC ELECTRODE SUBSTITUTIONS

ELECTRODE ADDITIONS AND DELETIONS

MULTIPLE ELECTRODES TO ‘SMOOTH OUT AMPLITUDE EFFECTS

ELECTRODE RE-PLATING FOR RECYCLING IN RESOURCE LIMITED APPLICATIONS [SPACECRAFT]

ELECTRODE APPLICATIONS

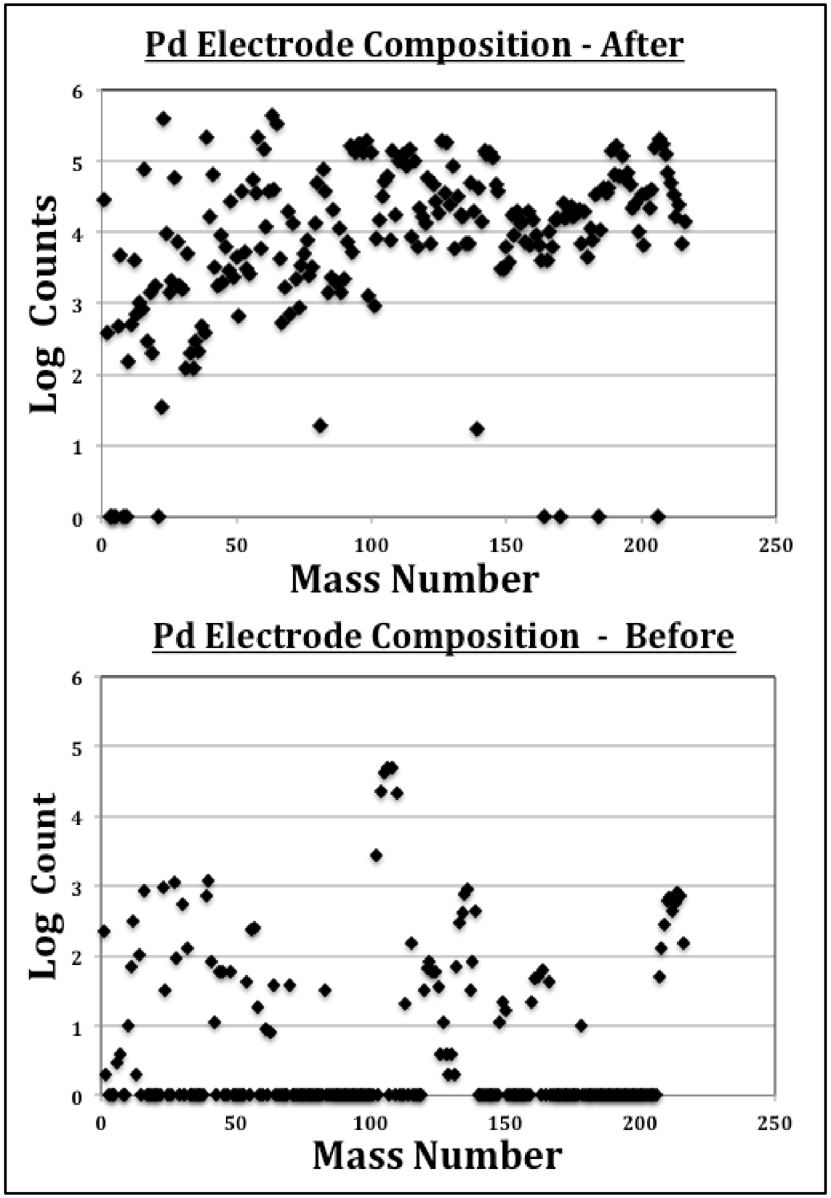
LANP can be used to optimize these applications

EXCESS HEAT PRODUCTION

PRODUCTION OF SPECIFIC ISOTOPES OR ELEMENTS

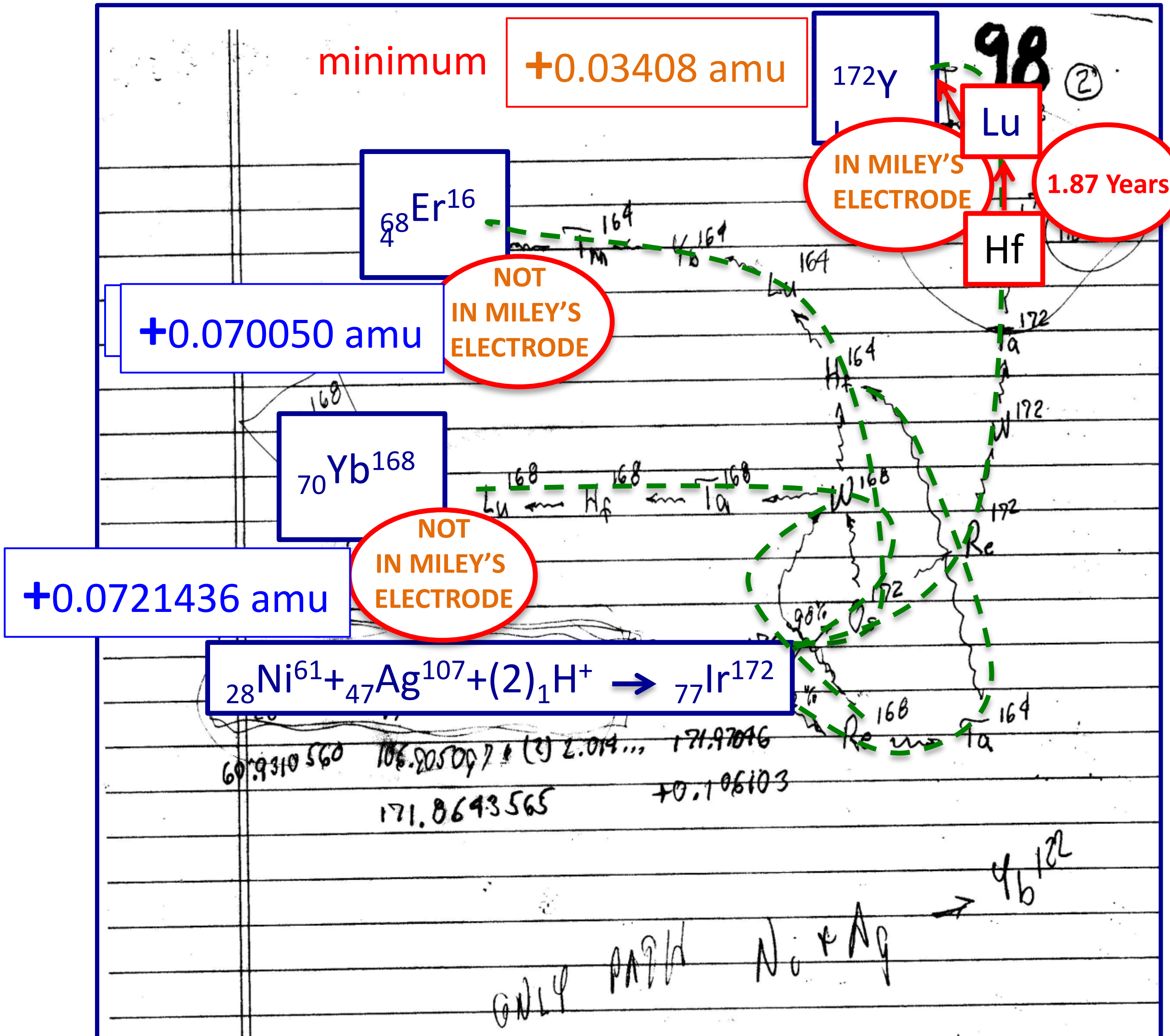
RADIOACTIVE WASTE STABILIZATION

THIS IS AN ELECTRODE THAT PRODUCED NO EXCESS HEAT



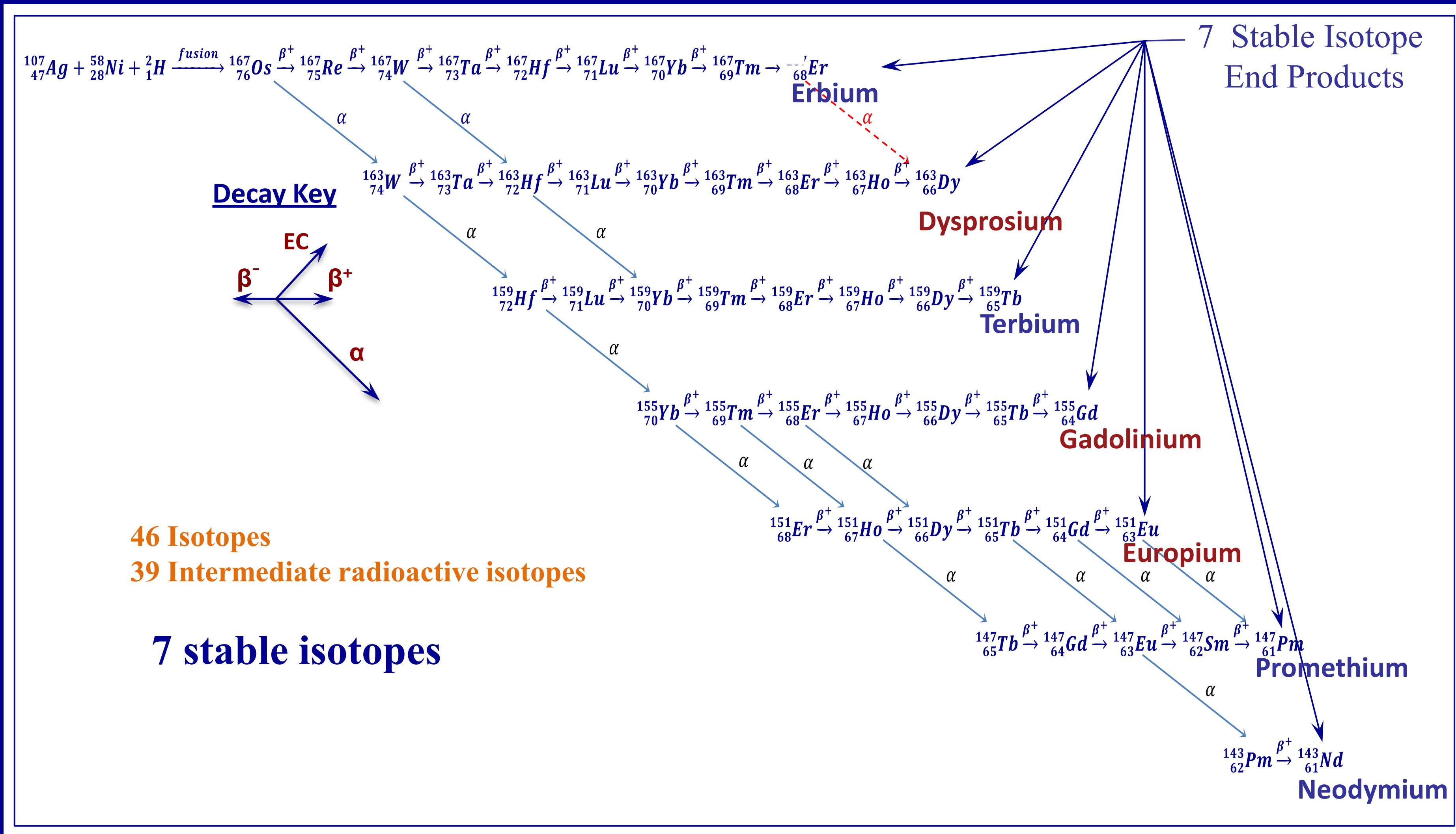
Ref: Tadahiko Mizuno,
Personal communication
Data set 'Before .XLS

$$^{61}_{28}Ni + ^{107}_{47}Ag + (2)^{2}_{1}H \xrightarrow{fusion} ^{172}_{70}Yb$$



ANALYSIS OF GEORGE MILEY TRANSMUTATION DATA

$$^{107}_{47}Ag + ^{58}_{28}Ni + ^{2}_{1}H \xrightarrow{fusion} ^{167}_{76}Os$$



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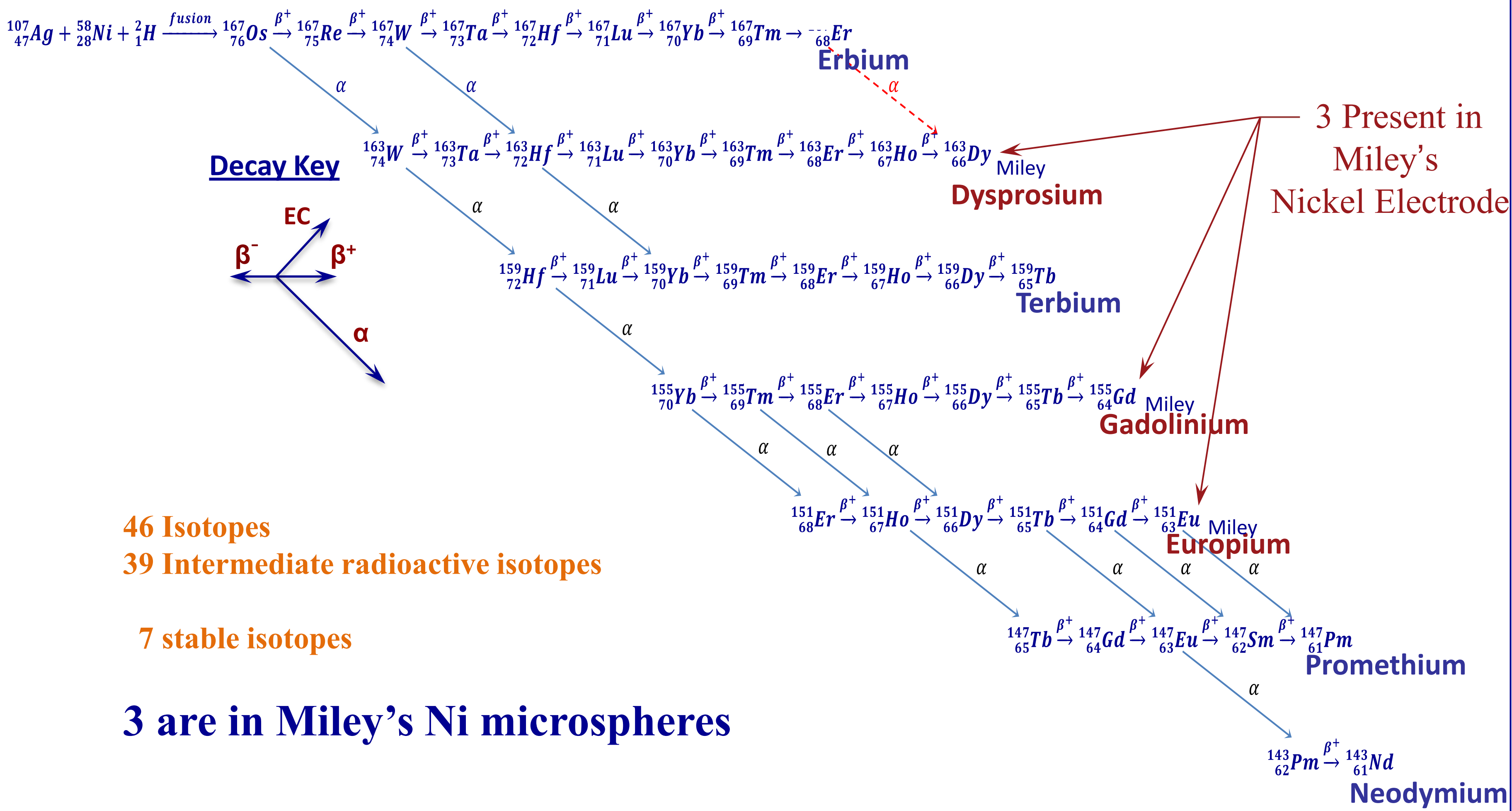


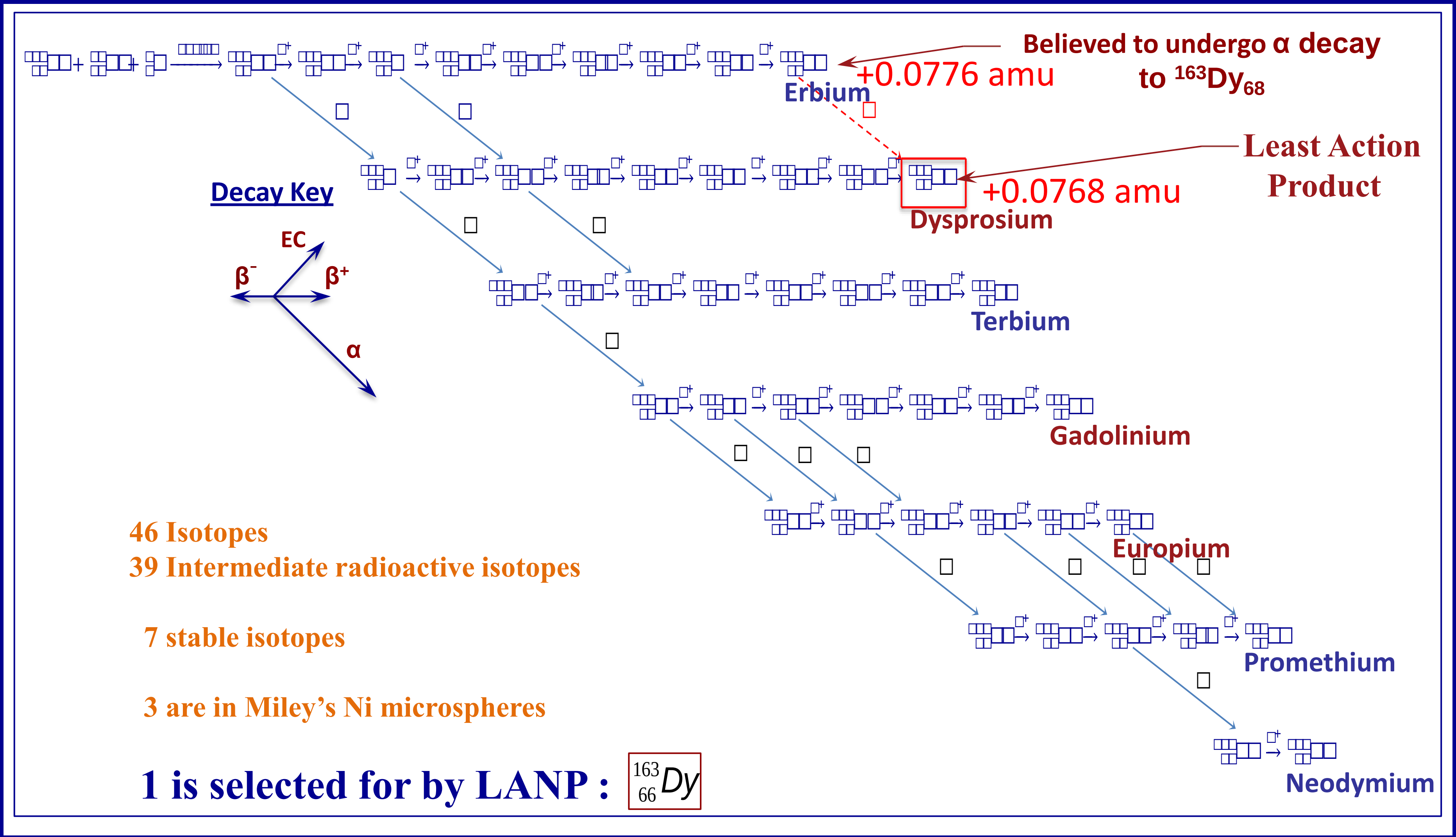
46 Isotopes
39 Intermediate radioactive isotopes

7 stable isotopes

3 are in Miley's Ni microspheres

Example Analysis of George Miley Data

$$^{107}_{47}Ag + \, ^{58}_{28}Ni + \, ^{2}_{1}H \xrightarrow{fusion} \, ^{167}_{76}Os$$



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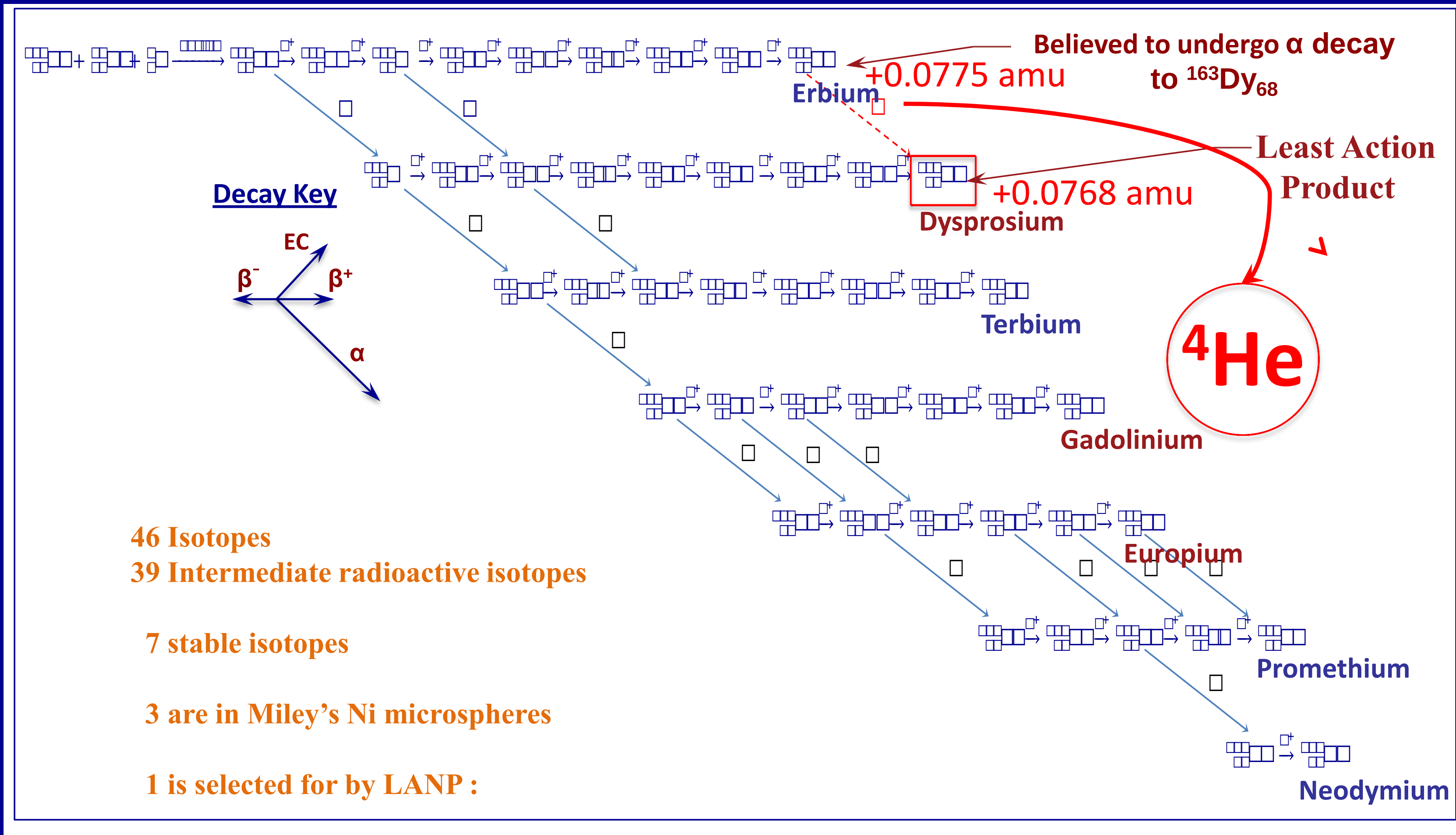


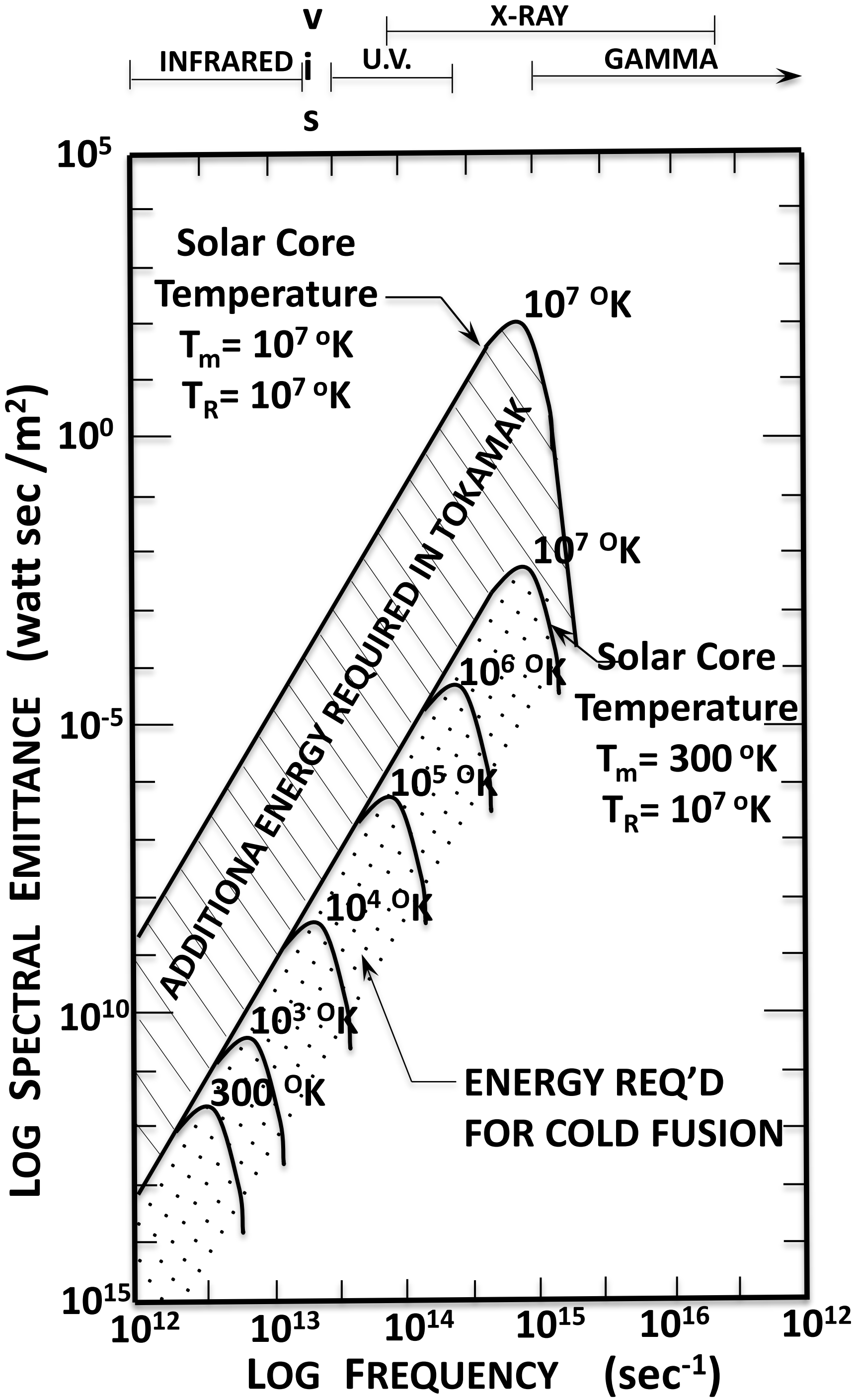
46 Isotopes

39 Intermediate radioactive isotopes

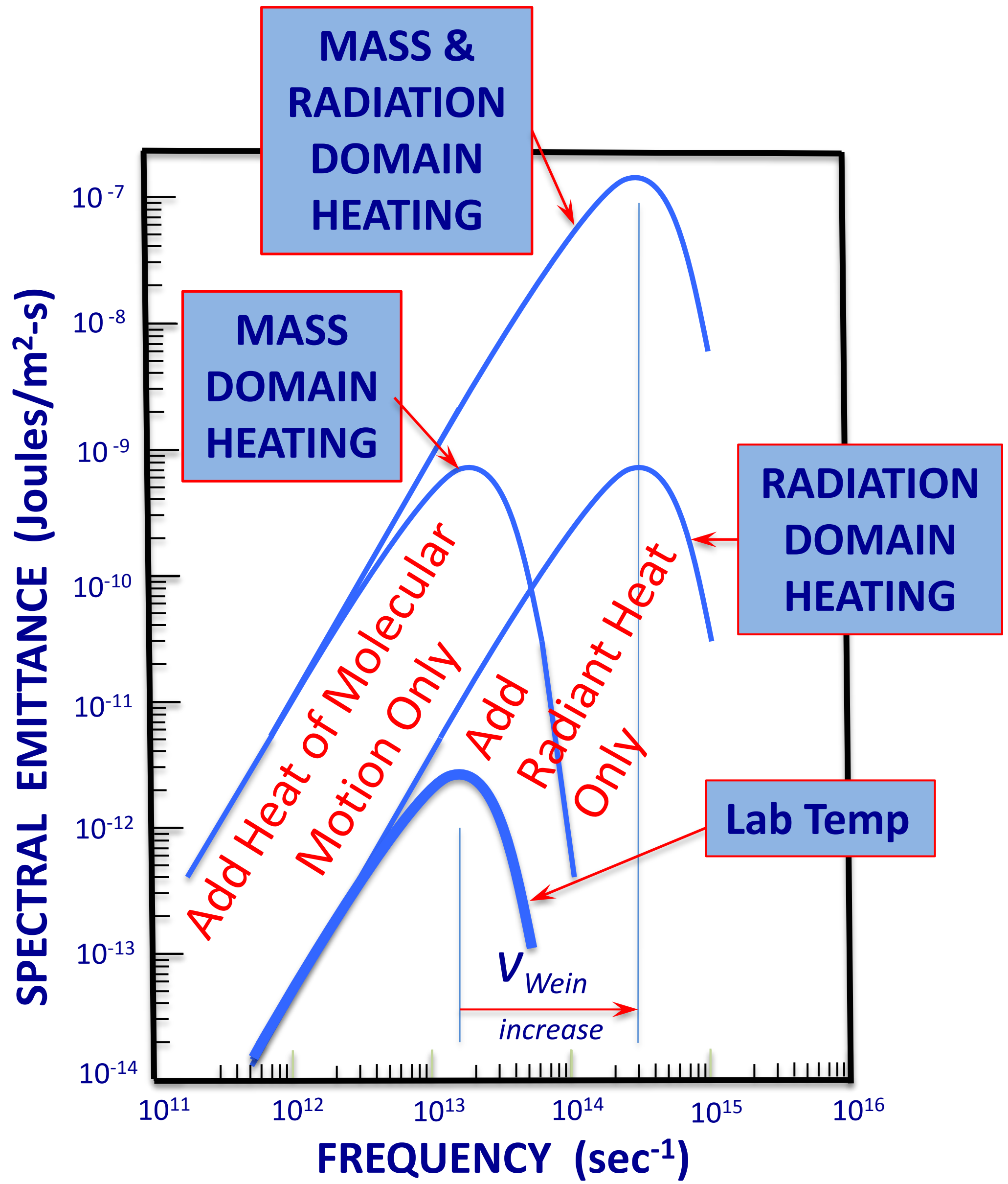
7 stable isotopes

3 are in Miley's Ni microspheres

1 is selected for by LANP :


INFRARED
V
i
s
U.V.
X-RAY
GAMMA
Solar Core
Temperature
T_m= 10^7 ºK
T_R= 10^7 ºK
10^7 ºK
ADDITIONA ENERGY REQUIRED IN TOKAMAK
10^7 ºK
Solar Core
Temperature
T_m= 300 ºK
T_R= 10^7 ºK
10^6 ºK
10^5 ºK
10^4 ºK
10^3 ºK
300 ºK
ENERGY REQ'D
FOR COLD FUSION
10^5
10^0
10^-5
10^10
10^15
LOG SPECTRAL EMITTANCE (watt sec /m^2)
10^12
10^13
10^14
10^15
10^16
10^12
LOG FREQUENCY (sec^-1)

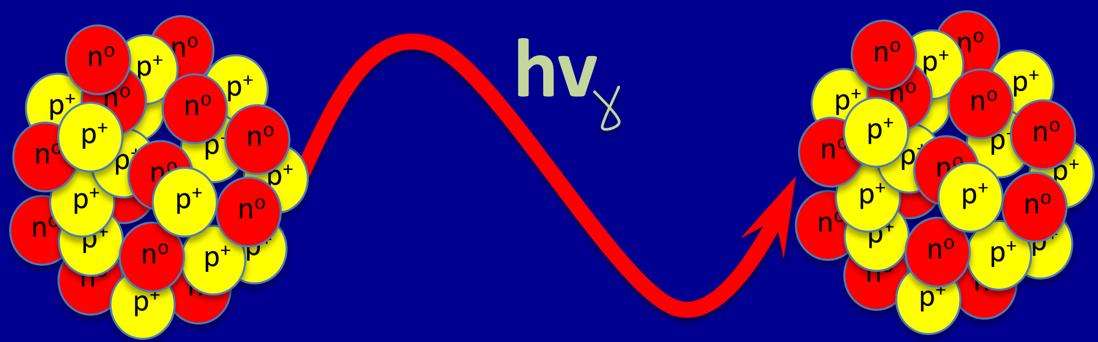
MASS & RADIATION DOMAIN TEMPERATURES



SOLAR TEMPERATURES ARE POSSIBLE

CONSIDER TWO NUCLEI IN MOSSBAUER RESONANCE:

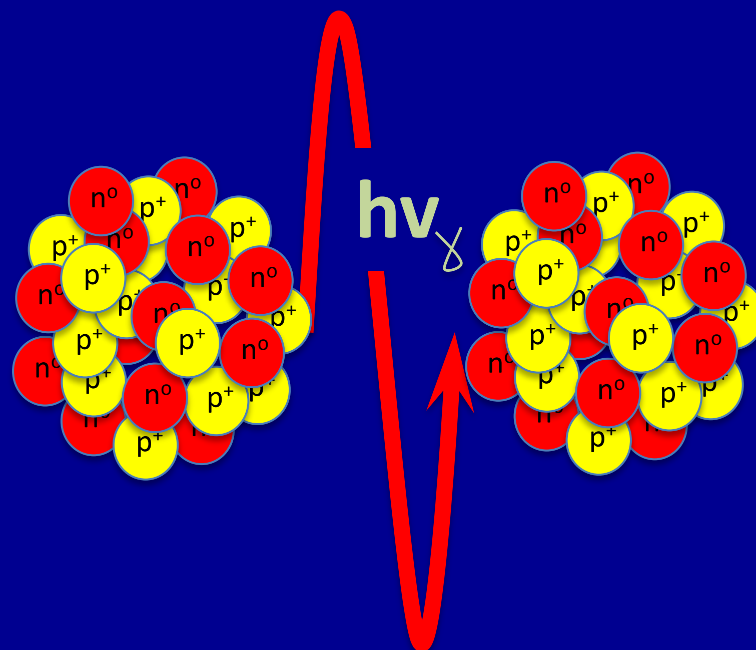
(a)



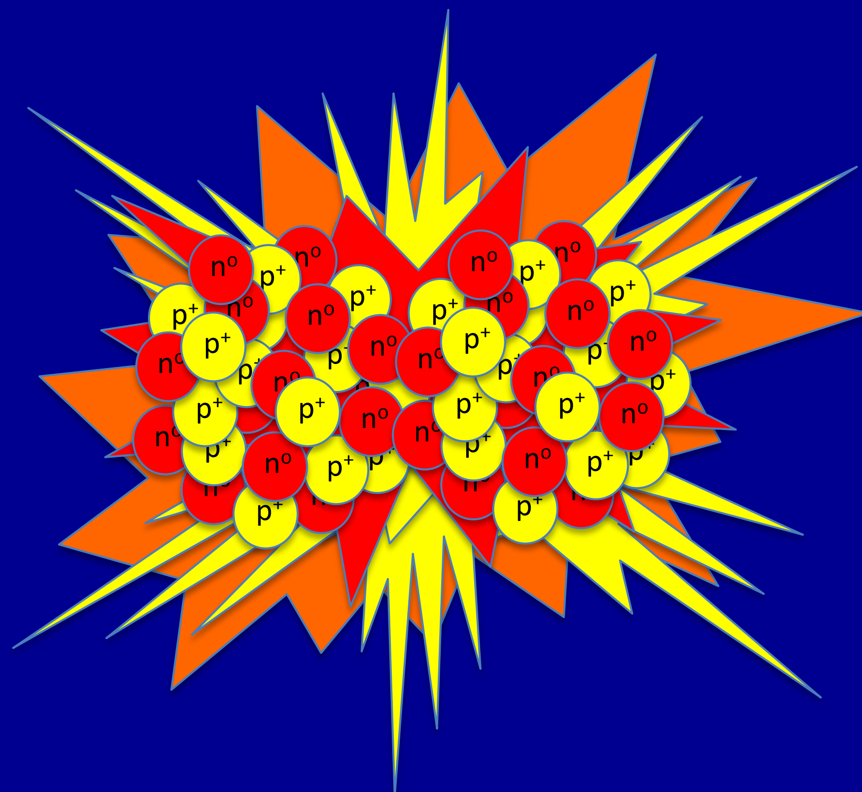
EMITTANCE: $K(v_\gamma) = hv_\gamma$ (joules)

DERIVATIVE: $T \propto \dfrac{dK(v_\gamma)}{dt} = hv_\gamma^2$ (joules/sec)

(b)



(c)



The Reversible Thermodynamic Process

Perfect Reversible Process

1. No particle movement
2. It accomplishes work
3. No kinetic energy
4. No renewal required
5. No change in nature as a result of its operation
   No external manifestation
   It is hidden from observation

Imperfect Reversible Process

1. Involves mass (Deuteron) motion
   This introduces:
   Heisenberg uncertainty,
   Statistical behavior, and
   Irreversibility
2. It accomplishes work
3. Process allows a minute [mīˈno͞ot] amount of kinetic energy at each NEXT STEP
4. During that STEP a minute amount of energy must be restored so that there is no entropy increase or energy change
5. No detectable change in nature as a results of its operation
   it has no external manifestation.
   Its is hidden from observation.

The Reversible Thermodynamic Process

Perfect Reversible Process

1. No particle movement
2. It accomplishes work
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   it has no external manifestation

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3. Process allows a **minute** [mīˈno͞ot] amount of kinetic energy at each NEXT STEP
4. A **minute** amount of energy must be restored at each step so that there is no entropy increase or energy change
5. No **detectable** change in nature as a results of its operation

   It has no external manifestation

Three levels of Cause/Effect Variability in the Cold Fusion Process

Primary Independent variables

Energy storage in chemical or Mossbauer bonds

Temperature (Thermonuclear is required)

Secondary Variables

Nuclear Transmutations

Tertiary Variables

Excess heat

RAW DATA IMPORTED FROM WIKIPEDIA

WORD TEXT FILE – FORMAT NIGHTMARE, LOTS OF ERRORS/INCONSISTENCIES

MY RECORD NUMBER	PROTON	NEUTRON	SYMBOL	DAUGHTER	ISOTOPE MASS -amu
2	1	0	1H		1.007825032
3	1	1	2H		2.01410177784
4	1	2	3H	3He	3.016049277725
5	1	3	4H	3H	4.0278111
6	1	4	5H	3H	5.0353111
7	1	5	6H	3H	6.0449428
8				2H	
9	1	6	7H	3H	7.05275108
10	2	0	2He	1H	2.0158942
11	2	1	3He		3.016029319126
12	2	2	4He		4.002603254156
13	2	3	5He	4He	5.012225
14	2	4	6He	6Li	6.01888918
15				4He	
16				2H	
17	2	5	7He	6He	7.02802118
18	2	6	8He	8Li	8.0339227
19				7Li	
20				5He	
21				3H	
22	2	7	9He	8He	9.043953
23	2	8	10He	8He	10.052408
24	3	1	4Li	3He	4.0271923
25	3	2	5Li	4He	5.012545
26	3	3	6Li		6.01512279516
27	3	4	7Li		7.016004558
28	3	5	8Li	8Be	8.0224873610
29	3	6	9Li	8Be	9.026789521
30				9Be	

LANP COMPUTER PROGRAM: FORTRAN70/95

```
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C     ========================================================================
C
C                                                   HHHHHHHHHHHHHHHHHHHHHH
                  PROGRAM LANPPROGRAM   !   HHHHHHH   SEE FILE 'STATUS'   HHHHHHH
C                                                   HHHHHHHHHHHHHHHHHHHHHH
C
C       READ ISOTOPE DATA AND CREATE MASTER FILE OF ISOTOPE DECAY
C       THEN CALCULATE THE LEAST ACTION NUCLEAR PROCESS' FINAL ISOTOPES
C            WRITTEN BY DAN SZUMSKI, INDEPENDENT SCHOLAR
C
C     ========================================================================
C
C      INCLUDE 'LANPCOMMON.FOR'
C
C     LANPPROGRAM COMMON BLOCK
C
      REAL*8  AMASS(3600),AMASSR,AMASSD,DELMASS,ADUMMY,NEWMASS
      REAL*8  ADM,MINDELMASS,DELTAMASS(3600),DMASS(210),BDUMMY
      REAL*8  DELMASS1(3600),SUMMASS(3600),SUMDELMASS,DELTMASS
      REAL*8  SUMMASSR,SUMDELMASS1,DUMMY,ZERO,DELTAMASSR
C
      INTEGER IN,OUT,J,K,L,MESS
      INTEGER ISTEP,INODE,IREC,JREC
      INTEGER PR,NR,NBRANCH,P1,N1,PY,NY
      INTEGER PINDEX(3600),NINDEX(3600),ISTABLE(3600)
```

P	N	ROOT	DAUGHT	MASSR	MASSD	TOTEMISSION	MASS CHANGE	MINDELMASS	MINDAU	DECAY SEQUENCE
1	0	1H		1.00782503	1.00782503	0.00000000	0.00000000	0.00000000	1H	
1	1	2H		2.01410178	2.01410178	0.00000000	0.00000000	0.00000000	2H	
1	2	3H	3He	3.01604928	3.01602932	-0.00054858	-0.00052862	-0.00052862	3He	,B-
1	3	4H	3H	4.02781110	3.01602932	-1.00919362	0.00258816	0.00258816	3He	,1N,B-
1	4	5H	3H	5.03531110	3.01602932	-2.01785852	0.00142326	0.00142326	3He	,2N,B-
1	5	6H	3H	6.04494280	3.01602932	-3.02652342	0.00239006	0.00239006	3He	,3N,B-
1	5	6H	2H	6.04494286	2.01410178	-4.03465990	-0.00381882	-0.00381882	2H	,4N
1	6	7H	3H	7.05275108	1.00782503	-4.03465990	2.01026615	2.01026615	1H	,4N
2	1	3He		3.01602932	3.01602932	0.00000000	0.00000000	0.00000000	3He	
2	2	4He		4.00260325	4.00260325	0.00000000	0.00000000	0.00000000	4He	
2	3	5He	4He	5.01222500	4.00260325	-1.00866500	0.00095675	0.00095675	4He	,1N
2	4	6He	6Li	6.01888918	6.01512279	-0.00054858	0.00321781	0.00321781	6Li	,B-
2	4	6He	4He	6.01888895	4.00260325	-0.00054858	2.01573712	2.01573712	4He	,B+
2	5	7He	6He	7.02802118	6.01512279	-1.00544719	0.00745120	0.00745120	6Li	,1N,B-
2	6	8He	8Li	8.03392270	4.00260325	-0.00109716	4.03022229	4.03022229	4He	,B-,B-,FF
2	6	8He	7Li	8.03392315	7.01600456	-1.00921350	0.00870509	0.00870509	7Li	,B-,1N
2	6	8He	5He	8.03392315	4.00260325	0.00040817	4.03172807	4.03172807	4He	,B-,1N
2	7	9He	8He	9.04395300	4.00260325	3.02100871	8.06235846	8.06235846	4He	,1N,B-,B-,FF
2	8	10He	8He	10.05240800	4.00260325	2.01234381	8.06214856	8.06214856	4He	,2N,B-,B-,FF
3	1	4Li	3He	4.02719230	3.01602932	-1.00727640	0.00388658	0.00388658	3He	,1P
3	3	6Li		6.01512279	6.01512279	0.00000000	0.00000000	0.00000000	6Li	
3	4	7Li		7.01600456	7.01600456	0.00000000	0.00000000	0.00000000	7Li	
3	5	8Li	8Be	8.02248736	4.00260325	-0.00054858	4.01933553	4.01933553	4He	,B-,FF
3	6	9Li	8Be	9.02678952	4.00260325	-1.00921350	4.01497277	4.01497277	4He	,B-,1N,FF
3	6	9Li	9Be	9.02678967	9.01218224	-0.00054858	0.01405885	0.01405885	9Be	,B-
3	7	10Li	9Li	10.03548116	4.00260325	3.00630777	9.03918568	9.03918568	4He	,1N,B-,1N,FF
3	8	11Li	10Be	11.04379821	10.01293704	-1.00976208	0.02109909	0.02109909	10B	,B-,1N,B-
3	8	11Li	11Be	11.04379845	11.00930544	-0.00109716	0.03339585	0.03339585	11B	,B-,B-
3	8	11Li	9Be	11.04379845	9.01218224	-2.01787850	0.01373771	0.01373771	9Be	,B-,2N
3	8	11Li	8Be	11.04379845	4.00260325	-3.02654340	4.01465180	4.01465180	4He	,B-,3N,FF
3	9	12Li	11Li	12.05378107	10.01293704	-0.98811449	1.05272954	1.05272954	10B	,1N,B-,1N,B-
4	1	5Be	4Li	5.04079429	3.01602932	-1.00338982	1.02137515	1.02137515	3He	,1P,1P

76	91	167Os	163W	166.97155800	162.92873122	-
76	91	167Os	167Re	166.97155762	162.92873122	

162.92873122	-3.53073297	0.51209381	0.512093
162.92873122	0.46934703	4.51217343	4.512173

2739	75	111	186Re	186W	185.95498657	185.95436411	0.00054858	0.00117104	0.00117104	186W	,EC
2740	75	111	186Re	186Os	185.95498611	181.94820429	-4.00205488	0.00472694	0.00472694	182W	,B-,AA
2741	75	112	187Re	187Os	186.95575311	186.95575051	-0.00054858	-0.00054598	-0.00054598	187Os	,B-
2742	75	112	187Re	183Ta	186.95574951	182.95022309	-4.00090536	0.00462106	0.00462106	183W	,AA,B-
2743	75	113	188Re	188Os	187.95811441	187.95583821	-0.00054858	0.00172762	0.00172762	188Os	,B-
2744	75	114	189Re	189Os	188.95922990	188.95814751	-0.00054858	0.00053381	0.00053381	189Os	,B-
2745	75	115	190Re	190Os	189.96182160	189.95844701	-0.00054858	0.00282601	0.00282601	190Os	,B-
2746	75	116	191Re	191Os	190.96312511	190.96059401	-0.00109716	0.00143394	0.00143394	191Ir	,B-,B-
2747	75	117	192Re	192Os	191.96596210	191.96148072	-0.00054858	0.00393280	0.00393280	192Os	,B-
2748	76	86	162Os	158W	161.98443540	141.90772332	3097.39636818	161.98443540	3117.47308026		,AA,AA,B+,B+,AA,B+,B+,B+,B+,AA,AA
2749	76	87	163Os	159W	162.98269430	142.90981432	6162.59358492	162.98269430	6182.66646490		,AA,AA,B+,AA,B+,B+,B+,B+,B+,EC,AA,B-,AA
2750	76	87	163Os	162W	162.98269653	161.92877840	-0.48204786	0.57187027	0.57187027	162Er	,B+,1P,B+,B+,B+,B+,B+,B+
2751	76	87	163Os	163Re	162.98269653	162.92873122	0.98379948	1.03776479	1.03776479	163Dy	,B+,B+,B+,B+,B+,B+,B+,B+,B+,EC
2752	76	88	164Os	160W	163.97804220	143.91199930	570.70358015	163.97804220	590.76962305		,AA,AA,AA,B+,B+,AA,B+,B+,AA
2753	76	88	164Os	164Re	163.97804260	143.91199930	586.71778729	163.97804260	606.78383059		,B+,AA,AA,AA,B+,AA,B+,B+,AA
2754	76	89	165Os	161W	164.97676220	148.91718472	13.89967622	29.95925370	29.95925370	149Sm	,AA,AA,AA,AA,B+,B+,B+,B+,B+,EC
2755	76	89	165Os	165Re	164.97676086	164.93032212	0.65763721	0.70407595	0.70407595	165Ho	,B+,B+,B+,B+,B+,B+,B+,B+,EC
2756	76	90	166Os	162W	165.97269120	161.92877840	-3.47572916	0.56818364	0.56818364	162Er	,AA,B+,B+,B+,B+,B+,B+
2757	76	90	166Os	166Re	165.97268677	165.93029312	0.70257899	0.74497264	0.74497264	166Er	,B+,B+,B+,B+,B+,B+,EC,B+
2758	76	91	167Os	163W	166.97155800	162.92873122	-3.53073297	0.51209381	0.51209381	163Dy	,AA,B+,B+,B+,B+,B+,B+,B+,EC
2759	76	91	167Os	167Re	166.97155762	162.92873122	0.46934703	4.51217343	4.51217343	163Dy	,B+,AA,B+,B+,B+,B+,B+,B+,EC
2760	76	92	168Os	168Re	167.96780413	167.93389750	0.23352828	0.26743491	0.26743491	168Yb	,B+,B+,B+,B+,B+,B+
2761	76	92	168Os	164W	167.96780396	163.92920030	-3.55805545	0.48054821	0.48054821	164Er	,AA,B+,B+,B+,B+,EC,B+
2762	76	93	169Os	169Re	168.96701927	168.93421332	0.21832002	0.25112597	0.25112597	169Tm	,B+,B+,B+,B+,B+,B+,EC
2763	76	93	169Os	165W	168.96702576	164.93032212	-3.69052270	0.34618094	0.34618094	165Ho	,AA,B+,B+,B+,B+,B+,B+,EC
2764	76	94	170Os	170Re	169.96357712	169.93476182	0.18752178	0.21633708	0.21633708	170Yb	,B+,B+,B+,B+,EC,B+
2765	76	94	170Os	176W	169.96357727	175.94140862	-3.99092174	-9.96875309	-9.96875309	176Hf	,AA,EC,B+
2766	76	95	171Os	171Re	170.96318520	170.93632582	0.11946010	0.14631948	0.14631948	171Yb	,B+,B+,B+,B+,B+,B+
2767	76	95	171Os	167W	170.96318054	166.93204822	-3.85000569	0.18112663	0.18112663	167Er	,AA,B+,B+,B+,B+,B+,EC
2768	76	96	172Os	172Re	171.96002316	171.93638150	0.13398710	0.15762876	0.15762876	172Yb	,B+,B+,B+,B+,EC,B+
2769	76	96	172Os	168W	171.96002197	167.93389750	-3.89803133	0.12809314	0.12809314	168Yb	,AA,B+,B+,B+,B+
2770	76	97	173Os	173Re	172.95980816	172.93821082	0.08609950	0.10769684	0.10769684	173Yb	,B+,B+,B+,B+,B+,EC
2771	76	97	173Os	169W	172.95980835	168.93421332	-3.90408755	0.12150748	0.12150748	169Tm	,AA,B+,B+,B+,B+,EC