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Drafting of the ENDF/B-VI Data for Fission Products and Actinides

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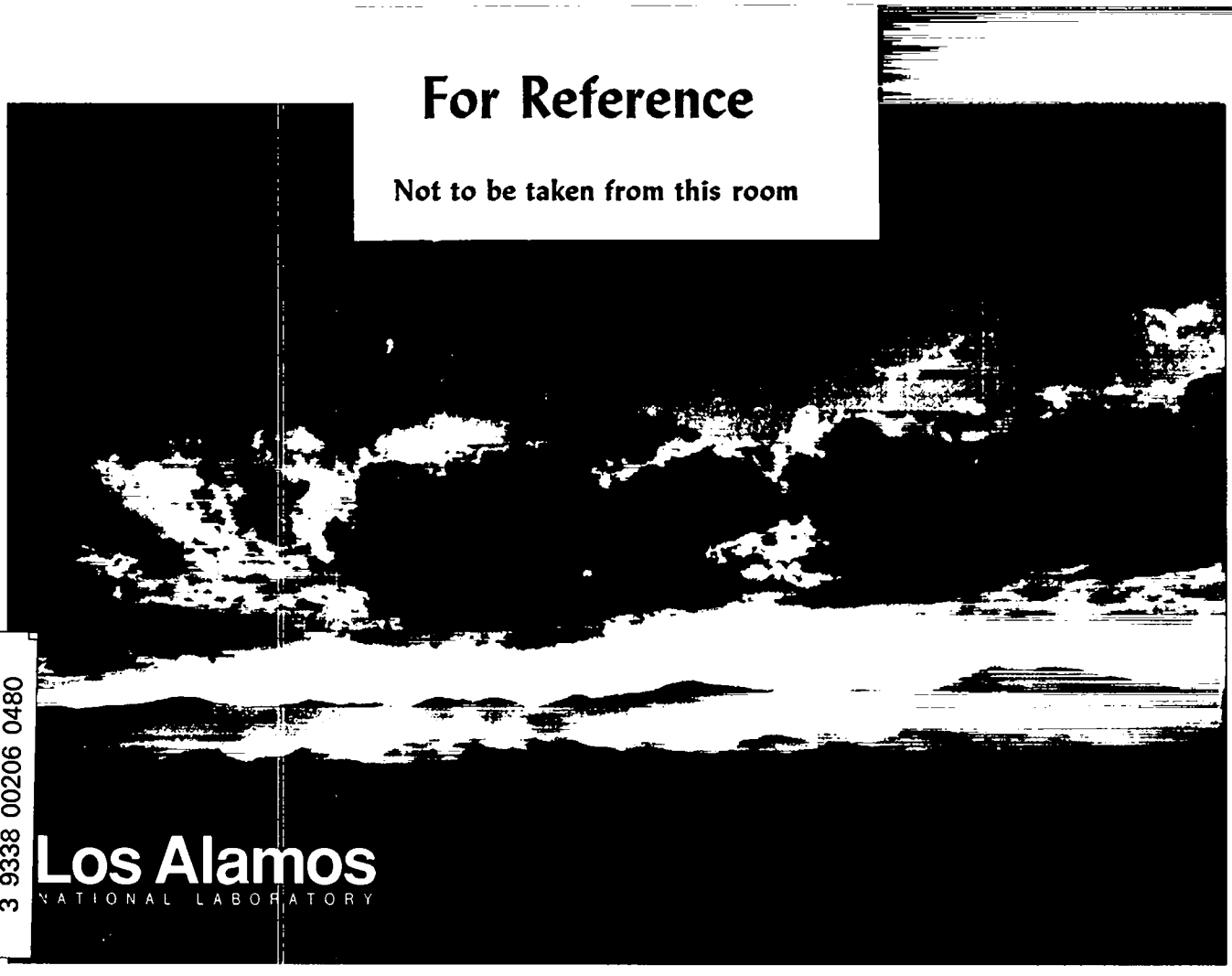

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Drafting of the ENDF/B-VI Data for Fission Products and Actinides

A. K. Martinez

Early in the spring of 1991, the Theoretical Division (T-2) at Los Alamos National Laboratory requested that the ENDF/B-VI data be used to draft the corresponding decay chains on a computer. By having the decay chains in a computer file, one can easily make changes as the data is updated. The format of the diagrams on the computer provides immediate information which is much less obvious in the tabular format of the data.

The decay chains have been drafted using Lightening Textures Version 1.6 on a Macintosh IIx at Los Alamos National Laboratory. Each diagram consists of frame boxes, dash boxes, lines, and vectors. The ENDF/B-VI data is represented with solid lines and frame boxes. The dashed boxes and lines represent data that is not included in ENDF/B-VI, but is relevant to the understanding of the nuclear data. The data in the dashed format came from the JEF-2 Radioactive Decay Data. Thus, each nuclide is represented by a dashed or framed box. In each box, the nuclide is represented by its mass number(A), atomic number(Z), and symbol. Unlike the ENDF/B-VI data file where half-lives are given in seconds, the half-life is shown in seconds(s), minutes(m), hours(h), days(d) or years(a) directly underneath the nuclide identification. Underneath the half-life, the average recoverable decay energy is shown in keV. Above the boxes containing nuclides 66-Cr through 172-Hf, the recommended independent U-235 thermal fission yield is shown. Vectors and lines indicate the decay modes. The branching ratio is located next to the corresponding vector or line. The information for the nuclides with an "sf" (spontaneous fission) in the upper left hand corner, were confirmed using an unpublished CINDER'90 file.

In order to produce the diagrams with the ENDF/B-VI data in an efficient way, the following FORTRAN 77 programs were used to extract data from files and place it into Textures format. The program rdfp2.f, which uses the input file fp (fission products), was written by D. C. George. The program rdfp3.f, which uses the input file dcyf (decay), was written by D. C. George and A. K. Martinez. These files contain the ENDF/B-VI data showing the symbol, Z, A, state, half-life, e-beta, e-gamma, e-alpha, rtyp, rfs, q value, and the

branching ratio for each nuclide. Both programs work similarly by calculating the correct position to place the symbol, Z, A, half-life, decay energy, and branching ratios from the data files into a Textures diagram. The program dash.f was written by A. K. Martinez to calculate the position of many dashed boxes and their half-lives from the ylds (yields) file. The program yields.f, written by A. K. Martinez, was used to extract the recommended independent yield from the ylds file and put it into Textures format. The program half.f was written by A. K. Martinez to convert the half lives (given in seconds) into minutes, hours, days, and years. The program energy.f was written by A. K. Martinez to calculate the average recoverable decay energies by adding the alpha decay(eV), gamma decay(eV), and beta decay(eV) for each nuclide and dividing by one thousand. The result is an average recoverable decay energy in keV. Ri.f was written by A. K. Martinez to extract the recommended independent yield value from the ylds file. Half.f, energies.f, and ri.f were used to proof the final draft. The program jefprog is a UNIX shell script which calls the FORTRAN 77 program jefprog1.f. These programs were written by A. K. Martinez and J. M. Campbell. Jefprog sorts each appropriate Textures program file and prepares it for the program jefprog1.f which calculates the position of the average recoverable decay energy for each nuclide. In addition to using programs to place the data into the diagrams, much of the data from the JEF-2 file had to be entered by hand. All the computer-generated diagrams then had to be checked and adjusted manually.

The motivation for this work is to provide diagrams for a report on ENDF/B-VI data, similar to those in Ref.(1). The diagrams, which includes all the ENDF/B-VI data and the JEF-2 data, consist of 43 pages of decay chains. The final draft of the ENDF/B-VI decay chains was finished in July 1993. This work was completed over three summers at Los Alamos National Laboratory with the guidance of T. R. England, W. B. Wilson, and D. C. George.

References:

1. T. R. England, W. B. Wilson, R. E. Schenter, F. M. Mann, "Summary of ENDF/B-V Data for Fission Products and Actinides," Los Alamos National Laboratory informal document LA-UR 83-1285, EPRI NP-3787 (December 1984).

2. F. W. Walker, J. R. Parrington, F. Feiner, *Nuclides and Isotopes , 14th. Ed.*, (General Electric Company, San Jose, CA 1989).

3. W. B. Wilson, T. R. England, Unpublished decay path data of CINDER'90 accumulated from ENDF/B-VI, HEDL's Master Decay Library, and other sources as described in W. B. Wilson, *et al.*, "Acceleration Transmutation Studies at Los Alamos with LAHET, MCNP, and CINDER'90", *Proc. Workshop on Simulation of Accelerator Radiation Environments*, January 11-15, 1993, Sante Fe, NM.

4. Preliminary JEF-2 Data supplied by M. Konieczny of the OECD Nuclear Energy Agency and described in J. Blachot and C. Nordborg, "Decay Data Evaluation for JEF-2," presented at the *Symposium on Nuclear Data Evaluation Methodology*, October 12-16, 1992, Brookhaven National Laboratory.

5. T. R. England, J. Katakura, F. M. Mann, C. W. Reich, R. E. Schenter, W. B. Wilson, "Decay Data Evaluation for ENDF/B-VI," *Presentation at the Symposium on Nuclear Data Evaluation Methodology*, Brookhaven National Laboratory, Upton, New York, October 12-16, 1992, LA-UR-92-3785.

Programs used to draft ENDF/B-VI Decay Chains

1. rdfp2.f
2. rdfp3.f
3. yields.f
4. ri.f
5. dash.f
6. energy.f
7. halflife.f
8. jefprog
9. jefprog1.f

```
      program rdfp
      logical iup,ibr
      character*1 ic1,ic2,c,ltou,unit,jc1,jc2
      character*4 aform(12)
      data aform/'('\p','ut(''',',f6.','2,'',',''',f6',',.2,''',')'{\t'
     x ,'iny ',''',f4',',.2,a','1,''}',''')'/
c  read fission product file and format nuclide id,z,a, decay energy,
c  half life and branching ratios for tek.
      iup=.false.
      ibr=.false.
      open(unit=1,file='fp1',status='old',form='formatted')
      open(unit=8,file='output',status='unknown',form='formatted')
  4   read(1,*,end=1000) xbox,ybox
      xstart=xbox+.01
      ystart=ybox+.2
  5   read(1,10,end=1000)iz,ic1,ic2,ia,hl,bdec,gdec,adec,rt,br,adj
 12   read(1,10,end=1000)jz,jc1,jc2,ja,xhl,xbdec,xgdec,xadec,xt,xb,xad
 10   format(6x,i3,x,2a1,x,i3,10x,e11.4,3(x,e11.4),f5.2,17x,e11.4,f5.2)
c  test for branching ration only
c      write(8,10) iz,ic1,ic2,ia,hl,bdec,gdec,adec,br,adj
c     write(8,10) jz,jc1,jc2,ja,xhl,xbdec,xgdec,xadec,xb,xad
      if(jz.eq.0) then
        br2=xb
        rt2=xt
        ibr=.true.
        go to 12
      endif
c  test for second of pair coordinates already set
      if(iup) go to 14
c  test for two states of same nuclide
      if(ic1.eq.jc1.and.ic2.eq.jc2) then
        x=xstart+.15
        y=ystart-.16
      else
        x=xstart
        y=ystart
      endif
c  test for end of row
      if(iz.eq.999) go to 4
c  look for coordinate adjustment
 14   x=x+adj
c      write(8,*) adj,x,xad,br,xb
      xstart=xstart+adj
c  calculate total decay in kev -- add gamma, beta and alpha decays
      dec=(bdec+gdec+adec)/1000.
      idec=nint(dec)
      unit='s'
c  convert half life to correct units
      if(hl.gt.60.) then
        unit='m'
        hl=hl/60.
      endif
      if(hl.gt.60.) then
        unit='h'
        hl=hl/60.
      endif
      if(hl.gt.24..and.unit.eq.'h') then
        unit='d'
        hl=hl/24.
      endif
      if(hl.gt.365.2499) then
        unit='a'
        hl=hl/365.25
```

```
      endif
      c=ltou(ic1)
      y1=y
      if(iup) y1=y1-.01
      write(8,20) x,y1,ia,iz,c,ic2
20    format('\put(',f6.2,',',f6.2,'){\tiny $^{',i3,'}_{',i3,'}$'2a1,'}'
     x )
      if(iup) then
         x1=x+.1
         y1=y+.06
         if(ia.ge.100) x1=x1+.05
         write(8,22) x1,y1
22       format('\put(',f6.2,',',f6.2,'){\ttiny m}')
         iup=.false.
      endif
      x=x+.02
      y=y-.11
      if(hl.ge. 0.) then
        aform(9)='',f4'
        aform(10)='.2,a,'
        if(hl.ge.10.0) aform(10)='.1,a'
        if(hl.ge.100.) aform(10)='.0,a'
        if(hl.ge.1000.) then
          aform(9)='',e7'
          aform(10)='.1,a,'
        endif
        write(8,aform) x,y,hl,unit
      else
        write(8,32) x,y
32      format('\put(',f6.2,',',f6.2,'){\tiny stable}')
        go to 55
      endif
      x=x+.04
      y=y-.08
      write(8,40) x,y,idec
40    format('\put(',f6.2,',',f6.2,'){\tiny ',i4'}')
45    if (ibr) then
        xbr1=x+.25
        ybr1=y+.06
        xbr2=x+.1
        ybr2=y+.55
        if(rt.eq.1..and.rt2.eq.1.) then
          xbr1=x+.25
          ybr1=y-.07
          xbr2=x+.12
          ybr2=y+.48
        endif
        if(rt.eq.2..and.rt2.eq.2.) then
          xbr1=x-.17
          ybr1=y-.1
          xbr2=x-.35
          ybr2=y+.5
        endif
        if(rt.eq.1..and.rt2.eq.2.) then
          xbr2=x-.35
          ybr2=y+.06
        endif
        if(rt.eq.1..and.rt2.eq.3.) then
          xbr2=x
          ybr2=y-.11
        endif
        if(rt.eq.2..and.rt2.eq.3.) then
          xbr1=x-.35
```

```
          ybr1=y+.15
          xbr2=x
          ybr2=y-.11
        endif
c       write(8,*)rt,rt2,xbr1,ybr1,x,y,iz,ia
        write(8,50) xbr1,ybr1,br
        write(8,50) xbr2,ybr2,br2
        ibr=.false.
 50     format('\put(',f6.2,',',f6.2,'){\tiny ',f5.4,'}')
      endif
 55   if(jz.eq.999) go to 4
      if(iz.eq.0) go to 60
      if(ic1.eq.jc1.and.ic2.eq.jc2) then
        x=xstart
        y=ystart+.3
        xstart=xstart+.15
        iup=.true.
      else
        xstart=xstart+.6
      endif
60    iz=jz
      ic1=jc1
      ic2=jc2
      ia=ja
      hl=xhl
      bdec=xbdec
      gdec=xgdec
      adec=xadec
      br=xb
      adj=xad
      rt=xt
      go to 12
 1000 stop
      end
      character*1 function ltou(c)
      character*1 lc(26),uc(26),c
      data lc/'a','b','c','d','e','f','g','h','i','j','k','l',
     x 'm','n','o','p','q','r','s','t','u','v','w','x','y','z'/
      data uc/'A','B','C','D','E','F','G','H','I','J','K','L',
     X 'M','N','O','P','Q','R','S','T','U','V','W','X','Y','Z'/
      ltou=' '
      do 10 i=1,26
      if (c.eq.lc(i)) then
          ltou=uc(i)
          return
      endif
 10   continue
      return
      end
```

```
      program rdfp
      logical iup,ibr,ib3
      character*1 ic1,ic2,c,ltou,unit,jc1,jc2,kc1,kc2
      character*4 aform(12)
      data aform/'(''\p','ut(''',',f6.','2,'',',''',f6',',.2,''',','){\t'
     x ,'iny ',''',f4',',.2,a','1,''}',''')'/
c  read fission product file and format nuclide id,z,a, decay energy,
c  half life and branching ratios for tek.
      iup=.false.
      ibr=.false.
      ib3=.false.
      open(unit=1,file='dcy12',status='old',form='formatted')
      open(unit=8,file='output',status='unknown',form='formatted')
  4   read(1,*,end=1000) xbox,ybox
      xstart=xbox+.01
      ystart=ybox+.2
 5    read(1,10,end=1000)iz,ic1,ic2,ia,hl,bdec,gdec,adec,rt,br,adj
 12   read(1,10,end=1000)jz,jc1,jc2,ja,xhl,xbdec,xgdec,xadec,xt,xb,xad
 10   format(6x,i3,x,2a1,x,i3,10x,e11.4,3(x,e11.4),f5.2,17x,e11.4,f5.2)
c  test for branching ratio only
      if(jz.eq.0) then
        br2=xb
        rt2=xt
        ibr=.true.
c  test for branching to two different nuclides
 17     read(1,10,end=1000)kz,kc1,kc2,ka,yhl,ybdec,ygdec,yadec,yt,yb,yad
        if(kz.eq.0) then
          br3=yb
          rt3=yt
          ib3=.true.
          go to 17
        endif
      endif
c  test for second of pair coordinates already set
      if(iup) go to 14
c  test for two states of same nuclide
      if((ic1.eq.jc1.and.ic2.eq.jc2).or.(ibr.and.ic1.eq.kc1.
     x and.ic2.eq.kc2))then
        x=xstart
        y=ystart-0.3
      else
        x=xstart
        y=ystart
      endif
c  test for end of row
      if(iz.eq.999) go to 4
c  look for coordinate adjustment
 14   x=x+adj
c      write(8,*) adj,x,xad,br,xb
      xstart=xstart+adj
c  calculate total decay in kev -- add gamma, beta and alpha decays
      dec=(bdec+gdec+adec)/1000.
      idec=nint(dec)
      unit='s'
c  convert half life to correct units
      if(hl.gt.60.) then
        unit='m'
        hl=hl/60.
      endif
      if(hl.gt.60.) then
        unit='h'
        hl=hl/60.
      endif
```

```
      if(hl.gt.24..and.unit.eq.'h') then
        unit='d'
        hl=hl/24.
      endif
      if(hl.gt.365.2499) then
        unit='a'
        hl=hl/365.25
      endif
      c=ltou(ic1)
      y1=y
      if(iup) y1=y1-.01
      write(8,20) x,y1,ia,iz,c,ic2
 20   format('\put(',f6.2,',',f6.2,'){\tiny $^{',i3,'}_{',i3,'}$'2a1,'}'
     x )
      if(iup) then
         x1=x+.1
         y1=y+.06
         if(ia.ge.100) x1=x1+.05
         write(8,22) x1,y1
 22      format('\put(',f6.2,',',f6.2,'){\ttiny m}')
         iup=.false.
      endif
      x=x+.02
      y=y-.11
      if(hl.ge. 0.) then
        aform(9)='',f4'
        aform(10)='.2,a,'
        if(hl.ge.10.0) aform(10)='.1,a'
        if(hl.ge.100.) aform(10)='.0,a'
        if(hl.ge.1000.) then
          aform(9)='',e7'
          aform(10)='.1,a,'
        endif
        write(8,aform) x,y,hl,unit
      else
        write(8,32) x,y
 32     format('\put(',f6.2,',',f6.2,'){\tiny stable}')
        go to 55
      endif
      x=x+.04
      y=y-.08
      write(8,40) x,y,idec
 40   format('\put(',f6.2,',',f6.2,'){\tiny ',i4'}')
 45   if (ibr) then
        if(.not.ib3) then
c  calculate coordinate for two branching arrows
          xbr1=x+.5
          ybr1=y+.05
          xbr2=x+.2
          ybr2=y+.52
          if(rt.eq.1..and.rt2.eq.1.) then
            xbr1=x+.25
            ybr1=y-.09
            xbr2=x+.12
            ybr2=y+.46
          endif
          if(rt.eq.2..and.rt2.eq.2.) then
            xbr1=x-.17
            ybr1=y-.12
            xbr2=x-.35
            ybr2=y+.48
          endif
          if(rt.eq.1..and.rt2.eq.3.) then
```

```
            xbr2=x
            ybr2=y-.13
          endif
          if(rt.eq.2..and.rt2.eq.3.) then
            xbr1=x-.35
            ybr1=y+.12
            xbr2=x
            ybr2=y-.13
          endif
          if(rt.eq.1..and.rt2.eq.2.) then
          xbr2=x-.7
          ybr2=y+.04
        endif
        if(rt.eq.2..and.rt2.eq.4.) then
          xbr1=x-.6
          ybr1=y+.05
          xbr2=x+.45
          ybr2=y+1.35
         endif
         if(rt.eq.1..and.rt2.eq.4.) then
          xbr1=x+.55
          ybr1=y+.05
          xbr2=x+.4
          ybr2=y+1.11
         endif
         if(rt.eq.4..and.rt2.eq.6.) then
          xbr1=x+.35
          ybr1=y+.31
          xbr2=x+.4
          ybr2=y+1.32
         endif
         if(rt.eq.1..and.rt2.eq.1.5) then
          xbr1=x+.6
          ybr1=y+.05
          xbr2=x+1.05
          ybr2=y+.19
         endif
        else
c  three branchings
          if(rt.eq.1.and.rt2.eq.4..and.rt3.eq.1.4) then
            xbr1=x+.6
            ybr1=y+.05
            xbr2=x+.4
            ybr2=y+1.11
          endif
          if(rt.eq.1.and.rt2.eq.4..and.rt3.eq.6) then
            xbr1=x+.45
            ybr1=y+.18
            xbr2=x+.25
            ybr2=y+.56
            xbr3=x+.07
            ybr3=y+.43
          endif
          if(rt.eq.3.and.rt2.eq.4..and.rt3.eq.6) then
            xbr1=x+.3
            ybr1=y-.04
            xbr2=x+.4
            ybr2=y+.41
            xbr3=x+.07
            ybr3=y+.43
          endif
        endif
        write(8,50) xbr1,ybr1,br
```

```
        write(8,50) xbr2,ybr2,br2
        if(ib3) write(8,50) xbr3,ybr3,br3
 50     format('\put(',f6.2,',',f6.2,'){\tiny ',f5.4,'}')
      endif
 55   if(jz.eq.999) go to 4
      if(iz.eq.0) go to 60
      if((ic1.eq.jc1.and.ic2.eq.jc2).or.(ibr.and.ic1.eq.kc1.
     x and.ic2.eq.kc2))then
        x=xstart-.15
        y=ystart+.15
        xstart=xstart
        ystart=ystart
        iup=.true.
      else
        xstart=xstart+1.2
      endif
 60   if(ibr) then
        iz=kz
        ic1=kc1
        ic2=kc2
        ia=ka
        hl=yhl
        bdec=ybdec
        gdec=ygdec
        adec=yadec
        br=yb
        adj=yad
        ib3=.false.
        ibr=.false.
        rt=yt
      else
        iz=jz
        ic1=jc1
        ic2=jc2
        ia=ja
        hl=xhl
        bdec=xbdec
        gdec=xgdec
        adec=xadec
        br=xb
        adj=xad
        rt=xt
      endif
      if(iz.eq.999) go to 4
      go to 12
 1000 stop
      end
      character*1 function ltou(c)
      character*1 lc(26),uc(26),c
      data lc/'a','b','c','d','e','f','g','h','i','j','k','l',
     x 'm','n','o','p','q','r','s','t','u','v','w','x','y','z'/
      data uc/'A','B','C','D','E','F','G','H','I','J','K','L',
     X 'M','N','O','P','Q','R','S','T','U','V','W','X','Y','Z'/
      ltou=' '
      do 10 i=1,26
      if (c.eq.lc(i)) then
          ltou=uc(i)
          return
      endif
 10   continue
      return
      end
```

```
      program yields
c   a program to read the file YLD and place the ri quanity for
c   u235t in the Textures file.
      character*1 state(12),m,n,g,d
      integer id(12)
      real ri(12)
      data m,n,g,d/'m','n','g','d'/
c   read yield file and format the yields
c   open the file called ylds1 and open a file for the output.
      open(unit=60,file='ylds1',status='old',form='formatted')
      open(unit=90,file='output',status='unknown',form='formatted')
c   read the starting coordinates for each line.
  4   read(60,*,end=1000) xbox,ybox
      if (xbox.eq.0.and.ybox.eq.0) then
        go to 1000
      else
        xstart=xbox+.01
        ystart=ybox+.31
      endif
c   skip a line
        do 15 i=1
        read (60,13,end=1000) dum
c   read the state and z number of each nuclide
c   and store in an array.
  5   read(60,12,end=1000)(id(i),state(i),i=1,12)
 12   format(15x,12(i2,4x,a1,3x))
c   skip 7 lines
      do 15 i=1,7
      read (60,13,end=1000) dum
 13   format (a1)
 15   continue
c   set x and y
      x=xstart
      y=ystart
c   read the ri value and store in array.
      read (60,14,end=1000)(ri(i),i=1,12)
 14   format (13x,12(e8.2,2x))
c   test to see if there is more than one state for each
c   nuclide and adjusting the coordinates.
      do 50 i=1,12
      if (id(i).eq.0) go to 50
      if (state(i).eq.n) then
        x=x-.3
        y=y+.6
        go to 28
      endif
      if (state(i).eq.m) then
        x=x-.15
        y=y+.3
        go to 28
      endif
      if (state(i).eq.g) then
        x=x
        y=y
      endif
      if (state(i).eq.d) then
        goto 50
      endif
c   the x and y coordinates are put into Texture's
c   format.
 28   write (90,30) x,y,ri(i)
 30   format('\put(',f6.2,',',f6.2,'){\tiny '1pe8.2,'}')
      if (state(i).eq.n) then
```

```
        x=x+.3
        y=y-.6
      endif
      if (state(i).eq.m) then
        x=x-.15
        y=y+.3
      endif
      if (state(i).eq.g) then
        x=x
        y=y
      endif
      if (state(i).eq.d) then
        x=x
        y=y
      endif
c   adjusts the starting coordiante for next nuclide
c   in the row.
      if (state(i).eq.n) then
        x=x+.15
        y=y-.45
      endif
      if (state(i).eq.m) then
        x=x+.30
        y=y-.75
      endif
      if ((state(i).eq.g).and.(state(i-1).eq.m)) then
        x=x+.15
        y=y+.15
      endif
      if (state(i).eq.g) then
        x=x+.6
        y=y
      endif
      if (state(i).eq.d) then
        x=x+.6
        y=y
      endif
 50   continue
c   skip 51 lines
      do 60 i=1,50
      read (60,13,end=1000) dum
 60   continue
c   returns to beginning to read coordinates for
c   next line and execute the program for that line.
      go to 4
 1000 stop
      end
```

```
      program yields
c   a program to read the file YLD and place the ri quanity for
c   u235t in the Textures file.
      character*1 state(12),m,n,g,d
      integer id(12)
      real ri(12)
      data m,n,g,d/'m','n','g','d'/
c   read yield file and format the yields
c   open the file called ylds1 and open a file for the output.
      open(unit=60,file='ylds1',status='old',form='formatted')
      open(unit=90,file='output',status='unknown',form='formatted')
c   read the starting coordinates for each line.
  4   read(60,*,end=1000) xbox,ybox
      if (xbox.eq.0.and.ybox.eq.0) then
        go to 1000
      else
        xstart=xbox+.01
        ystart=ybox+.31
      endif
100    read(60,120,end=1000) iz
120    format(21x,i3)
c   read the state and z number of each nuclide
c   and store in an array.
  5   read(60,12,end=1000)(id(i),state(i),i=1,12)
 12   format(15x,12(i2,4x,a1,3x))
c   skip 7 lines
      do 15 i=1,7
      read (60,13,end=1000) dum
 13   format (a1)
 15   continue
c   set x and y
      x=xstart
      y=ystart
c   read the ri value and store in array.
      read (60,14,end=1000)(ri(i),i=1,12)
 14   format (13x,12(e8.2,2x))
c   test to see if there is more than one state for each
c   nuclide and adjusting the coordinates.
      do 50 i=1,12
      if (id(i).eq.0) go to 50
      if (state(i).eq.n) then
        x=x-.3
        y=y+.6
        go to 28
      endif
      if (state(i).eq.m) then
        x=x-.15
        y=y+.3
        go to 28
      endif
      if (state(i).eq.g) then
        x=x
        y=y
      endif
      if (state(i).eq.d) then
        goto 50
      endif
c   the x and y coordinates are put into Texture's
c   format.
 28   write (90,30) iz,id(i),state(i),ri(i)
 30   format(i3,2x,i2,2x,a1,2x,1pe8.2)
      if (state(i).eq.n) then
        x=x+.3
```

```
        y=y-.6
      endif
      if (state(i).eq.m) then
        x=x-.15
        y=y+.3
      endif
      if (state(i).eq.g) then
        x=x
        y=y
      endif
      if (state(i).eq.d) then
        x=x
        y=y
      endif
c   adjusts the starting coordiante for next nuclide
c   in the row.
      if (state(i).eq.n) then
        x=x+.15
        y=y-.45
      endif
      if (state(i).eq.m) then
        x=x+.30
        y=y-.75
      endif
      if ((state(i).eq.g).and.(state(i-1).eq.m)) then
        x=x+.15
        y=y+.15
      endif
      if (state(i).eq.g) then
        x=x+.6
        y=y
      endif
      if (state(i).eq.d) then
        x=x+.6
        y=y
      endif
 50   continue
c   skip 51 lines
      do 60 i=1,50
      read (60,13,end=1000) dum
 60   continue
c   returns to beginning to read coordinates for
c   next line and execute the program for that line.
      go to 4
 1000 stop
      end
```

```
      program dash
      character*2 name(12)
      character*1 state(12), m,n,g,d
      integer iz
      integer ia(12)
      character*7 hl(12)
      data m,n,g,d/'m','n','g','d'/
c     a program to read the file YLD and place the dashed boxes
c     in the Textures file.
c     read yield file and format the yields
c     open the file called ylds1 and open a file for the output.
      open(unit=60,file='ylds1',status='old',form='formatted')
      open(unit=90,file='output',status='unknown',form='formatted')
 4    read (60,*,end=1000) xbox, ybox
      if(xbox.eq.999) go to 1000
c     reading iz in and read ia,name,state, and hl in arrays
 5    read(60,10,end=1000) iz
10    format(21x,i3)
 6    read(60,11,end=1000) (ia(i),name(i),state(i),i=1,12)
11    format(15x,12(i2,1x,a2,1x,a1,3x))
 7    read(60,12,end=1000) (hl(i),i=1,12)
12    format(15x,12(a7,3x))
      xstart= xbox+.01
      ystart= ybox+.2
c     ************************************************************
c     **********************do loop 1*********************************
      do 17 i=1,12
            if (ia(i).eq.0) go to 17
            if (state(i).eq.n) then
                xstart=xstart-.3
                ystart=ystart+.6
                go to 15
            endif
            if (state(i).eq.m) then
                xstart=xstart-.15
                ystart=ystart+.3
                go to 15
             endif
            if (state(i).eq.g) then
                xstart=xstart
                ystart=ystart

            endif
            if (state(i).eq.d) then
                goto 17
            endif
15    write(90,16,end=1000) xstart,ystart,iz,ia(i),name(i)
16    format('\put(',f6.2,',',f6.2,'){\tiny $^{',i3,'}_{',i2,'}$'a2,'}'
     x )

            if (state(i).eq.n) then
                xstart=xstart+.3
                ystart=ystart-.6
            endif
            if (state(i).eq.m) then
                xstart=xstart-.45
                ystart=ystart+.3
            endif
            if (state(i).eq.g) then
                xstart=xstart
                ystart=ystart
            endif
            if (state(i).eq.d) then
```

```
                xstart=xstart
                ystart=ystart
            endif
c   adjusts the starting coordiante for next nuclide
c   in the row.
            if (state(i).eq.n) then
                xstart=xstart+.15
                ystart=ystart-.45
            endif
            if (state(i).eq.m) then
                xstart=xstart+.6
                ystart=ystart-.75
            endif
            if ((state(i).eq.g).and.(state(i-1).eq.m)) then
                xstart=xstart+.6
                ystart=ystart+.15
            elseif (state(i).eq.g) then
                xstart=xstart+.6
                ystart=ystart
            endif
            if (state(i).eq.d) then
                xstart=xstart+.6
                ystart=ystart
            endif
17      continue
c   ****************************************************************
c   ****************************************************************
      xhl=xbox+.02
      yhl=ybox+.09
c   ****************************************************************
c   ***************************do loop 2****************************
      do 20 i=1,12
            if (ia(i).eq.0) go to 20
            if (state(i).eq.n) then
                xhl=xhl-.3
                yhl=yhl+.6
                go to 18
            endif
            if (state(i).eq.m) then
                xhl=xhl-.15
                yhl=yhl+.3
                go to 18
             endif
            if (state(i).eq.g) then
                xhl=xhl
                yhl=yhl
            endif
            if (state(i).eq.d) then
                goto 20
            endif
18      write(90,19) xhl,yhl,hl(i)
19      format('\put(',f6.2,',',f6.2,'){\tiny ',a7,'}'
     x )
            if (state(i).eq.n) then
                xhl=xhl+.3
                yhl=yhl-.6
            endif
            if (state(i).eq.m) then
                xhl=xhl-.45
                yhl=yhl+.3
            endif
            if (state(i).eq.g) then
                xhl=xhl
```

```
                yhl=yhl
            endif
            if (state(i).eq.d) then
                xhl=xhl
                yhl=yhl
            endif
c   adjusts the starting coordiante for next nuclide
c   in the row.
            if (state(i).eq.n) then
                xhl=xhl+.15
                yhl=yhl-.45
            endif
            if (state(i).eq.m) then
                xhl=xhl+.6
                yhl=yhl-.75
            endif
            if ((state(i).eq.g).and.(state(i-1).eq.m)) then
                xhl=xhl+.6
                yhl=yhl+.15
            elseif (state(i).eq.g) then
                xhl=xhl+.6
                yhl=yhl
            endif
            if (state(i).eq.d) then
                xhl=xhl+.6
                yhl=yhl
            endif
20      continue
c   ****************************************************************
c   ****************************************************************
c
c   skip 57 lines
        do 14 i= 1,57
        read (60,13,end=1000) dum
 13     format (a1)
 14     continue
      go to 4
1000  end
```

```
      program energy
       character*2 name
       character*3 iz,ia
       character*1 state
       real adec, gdec, bdec, dec
       open(unit=1,file='dcyf',status='old',form='formatted')
       open(unit=8,file='output',status='unknown',form='formatted')
  5    read(1,10,end=1000)iz,name,ia,state,bdec,gdec,adec
 10    format(6x,a3,x,a2,x,a3,1x,a1,20x,3(x,e11.4))
c  calculate total decay in kev -- add gamma, beta and alpha decays
       dec=(bdec+gdec+adec)/1000.
       idec=nint(dec)
       write(8,20,end=1000) iz,name,ia,state,bdec,gdec,adec,idec,dec
 20    format(5x,a3,5x,a2,5x,a3,2x,a1,5x,3(1pe11.4,5x),10x,i6,5x,1pe11.4)
       goto 5
1000   end
```

```
      program halflife
      character*2 name
      character*3 iz,ia
      character*1 state
      character*1 unit
      open(unit=1,file='dcyf',status='old',form='formatted')
      open(unit=8,file='output',status='unknown',form='formatted')
  5   read(1,10,end=1000)iz,name,ia,state,hl
 10   format(6x,a3,x,a2,x,a3,1x,a1,8x,e11.4)
      unit='s'
c  convert half life to correct units
      if(hl.gt.60.) then
        unit='m'
        hl=hl/60.
      endif
      if(hl.gt.60.) then
        unit='h'
        hl=hl/60.
      endif
      if(hl.gt.24..and.unit.eq.'h') then
        unit='d'
        hl=hl/24.
      endif
      if(hl.gt.365.2499) then
        unit='a'
        hl=hl/365.25
      endif
 15   write(8,20,end=1000) iz,name,ia,state,hl,unit
 20   format(a3,2x,a2,2x,a3,1x,a1,5x,f15.2,1x,a1)
      goto 5
1000  end
```

jefprog 12 lines

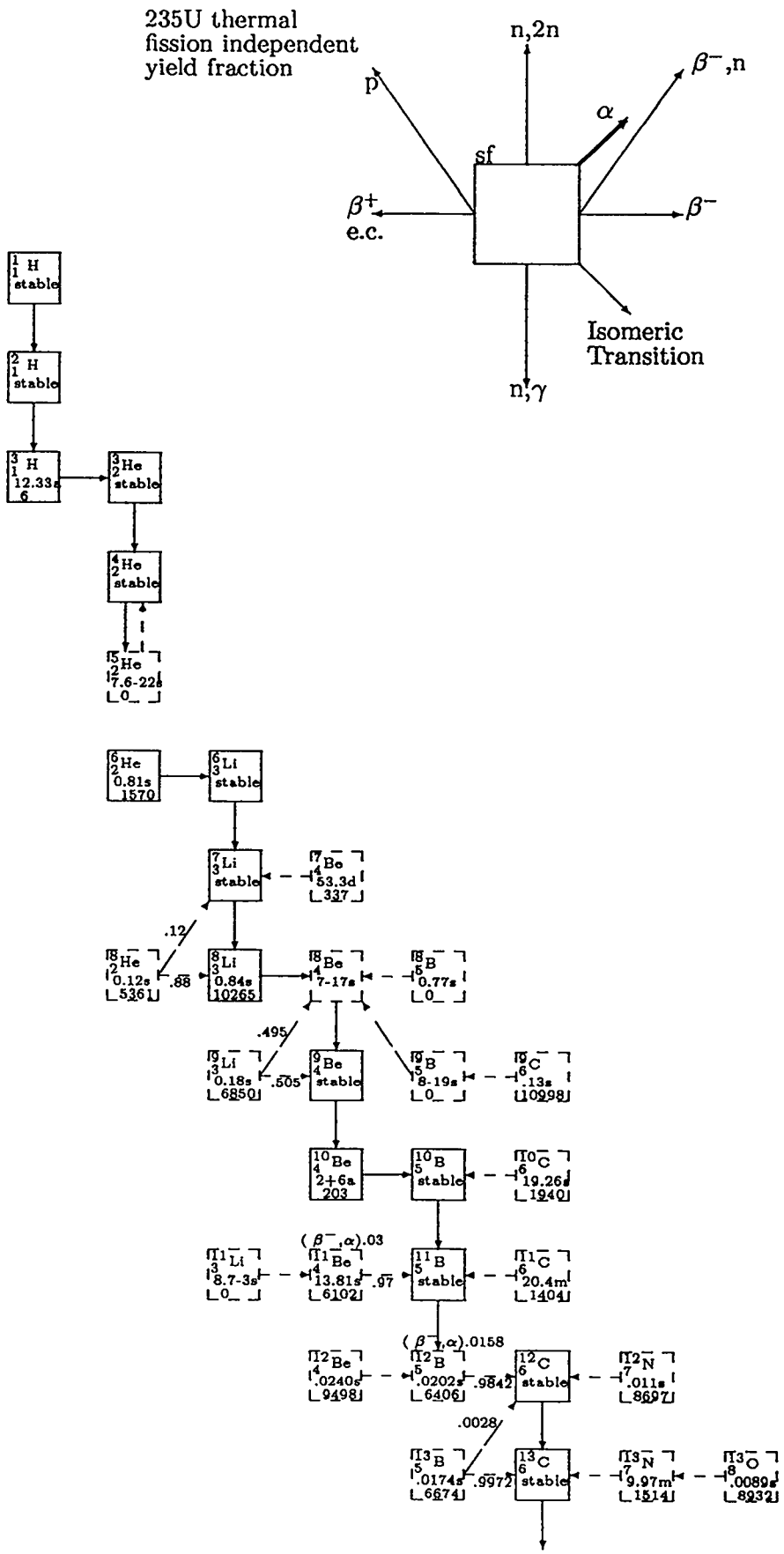
```
#!/bin/sh
sed 's/}_/ }_/g
   s/\^{/\^{ /g
   s/_{/_{ /g
   s/}\$/ }\$/g' $1 >jeftemp
mv jeftemp $1
awk '/\$/{printf("%s\n%s\n%s\n%s\n",$9,$7,$2,$4)}
   END {print "0"}' $1 | jefprog1.x
cat totnot notfound > jeftemp
mv jeftemp totnot
cat totmeta meta > jeftemp
mv jeftemp totmeta
```

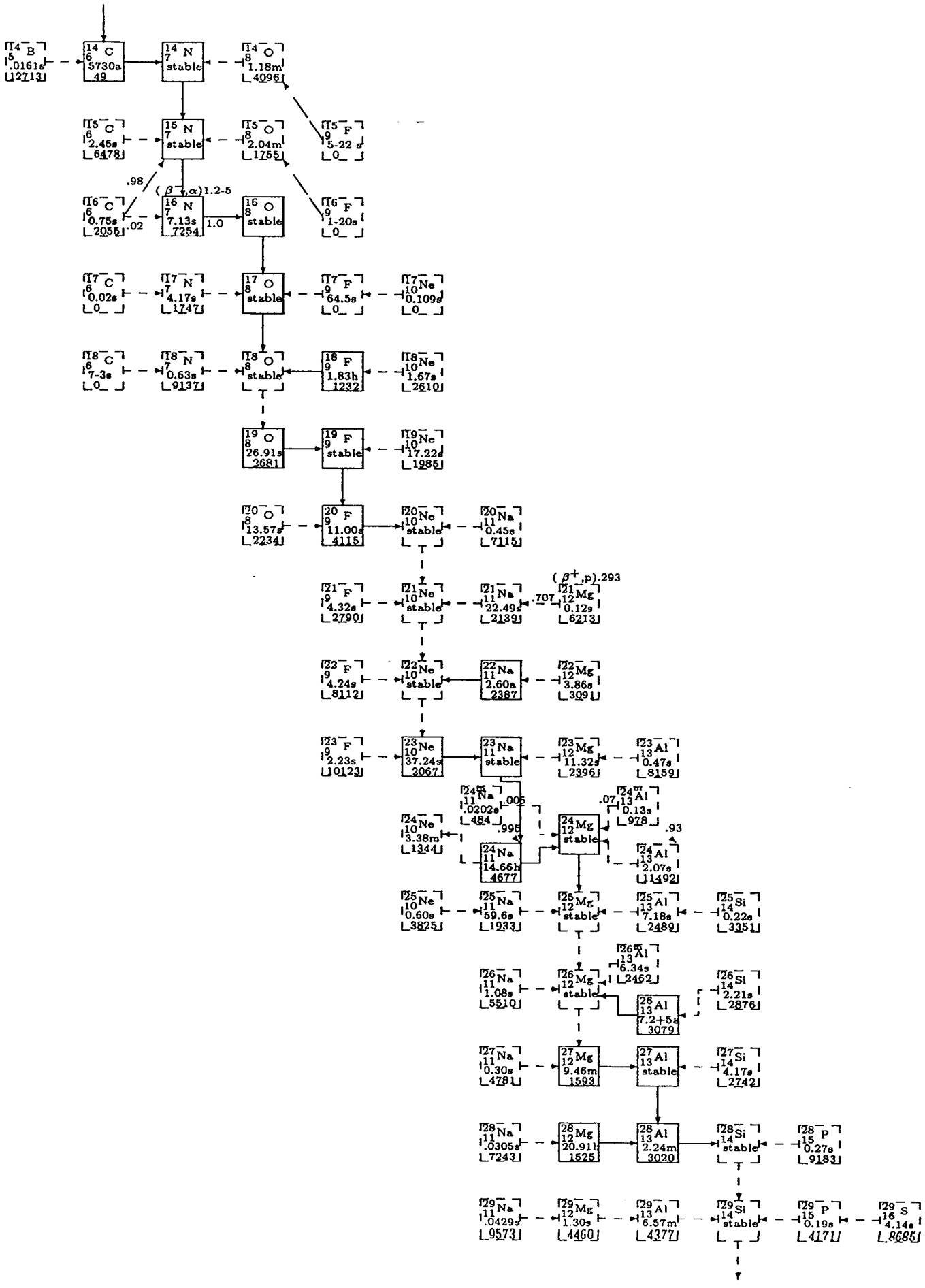
jefprog1.f 77 lines

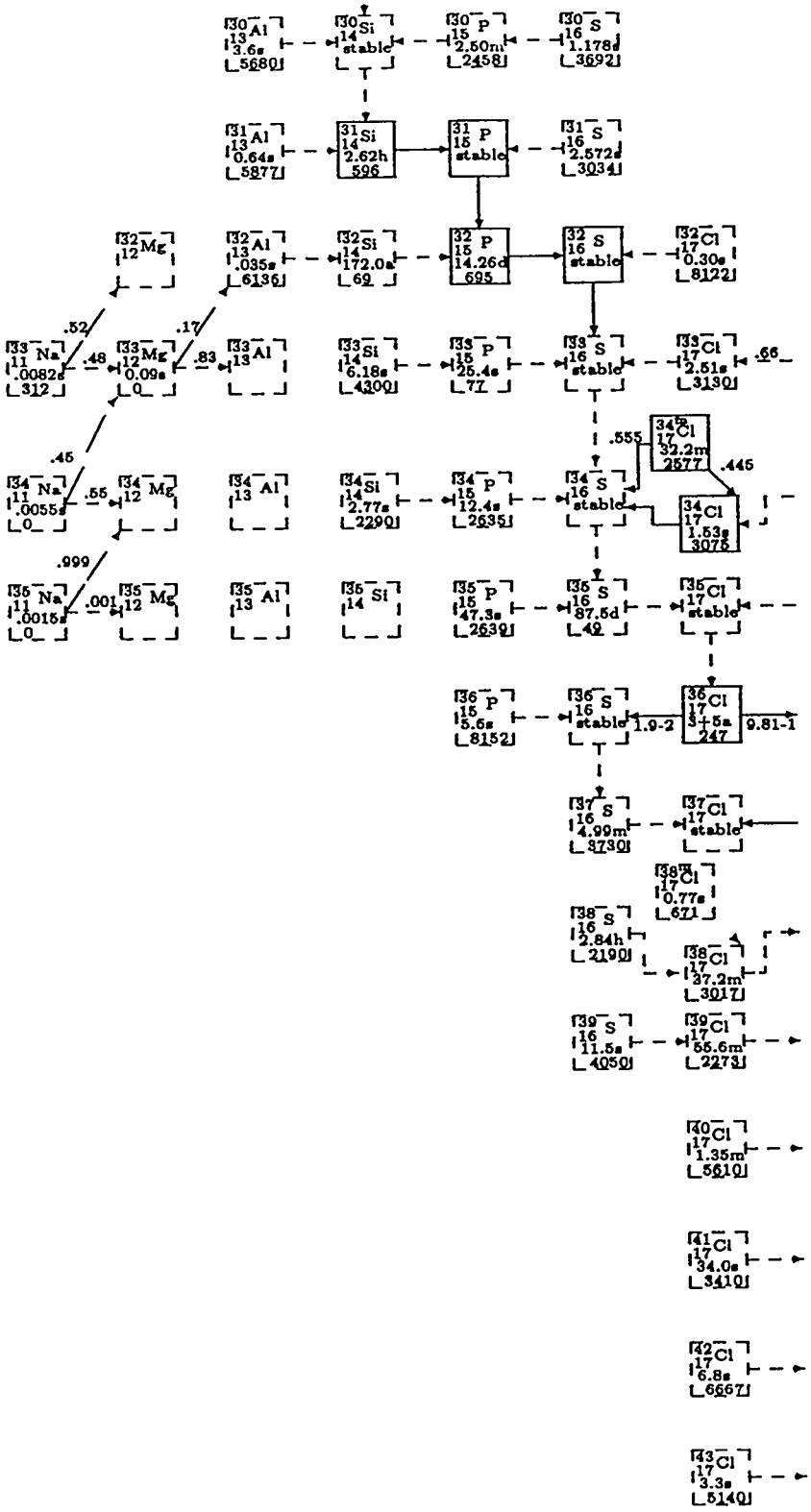
```
   program jefprog1
   integer jefa(3500), jefz(3500), nucnum, i, jefdcy(3500)
   integer dcy(3), howmany
   integer a, z
   real newx, newy, x, y
   logical found
   common /jef/jefa,jefz, jefdcy
   open (unit=1, file='jefdec2',status='old',form='formatted')
   open (unit=12, file='notfound', status='unknown')
   open (unit=25, file='meta', status='unknown')
   do 100 i=1,3500
   read (1,200, end=400) jefz(i), jefa(i), jefdcy(i)
200        format (5x,i3,12x,i3,66x,i7)
100        continue
400        continue
   nucnum=i-1
60 continue
   read (*,450) z
450        format (i3)
   if (z.eq.0) then
           goto 75
   endif
   read (*,500)a,x,y
500        format (i3,1/,f6.3,1/,f6.3)
   call lookup(z,a,dcy, nucnum, found,howmany)
   newx=x+.06
   newy=y-.19
   if (howmany.eq.1) then
           write (*,600) newx,newy,dcy(1)
600        format('\put(',f6.3,',',f6.3,'){\tiny',i6'}')
   else
    if (howmany.gt.1) then
                   do 80 i=1,howmany
                   write (25,90) i, z, a, newx, newy, dcy(i)
90 format(i1,3x,i3,3x,i3,3x,'\put(',f6.3,',',f6.3,'){\tiny'i6'}')
80 continue
           endif
   endif
   goto 60
75         continue
   end
```

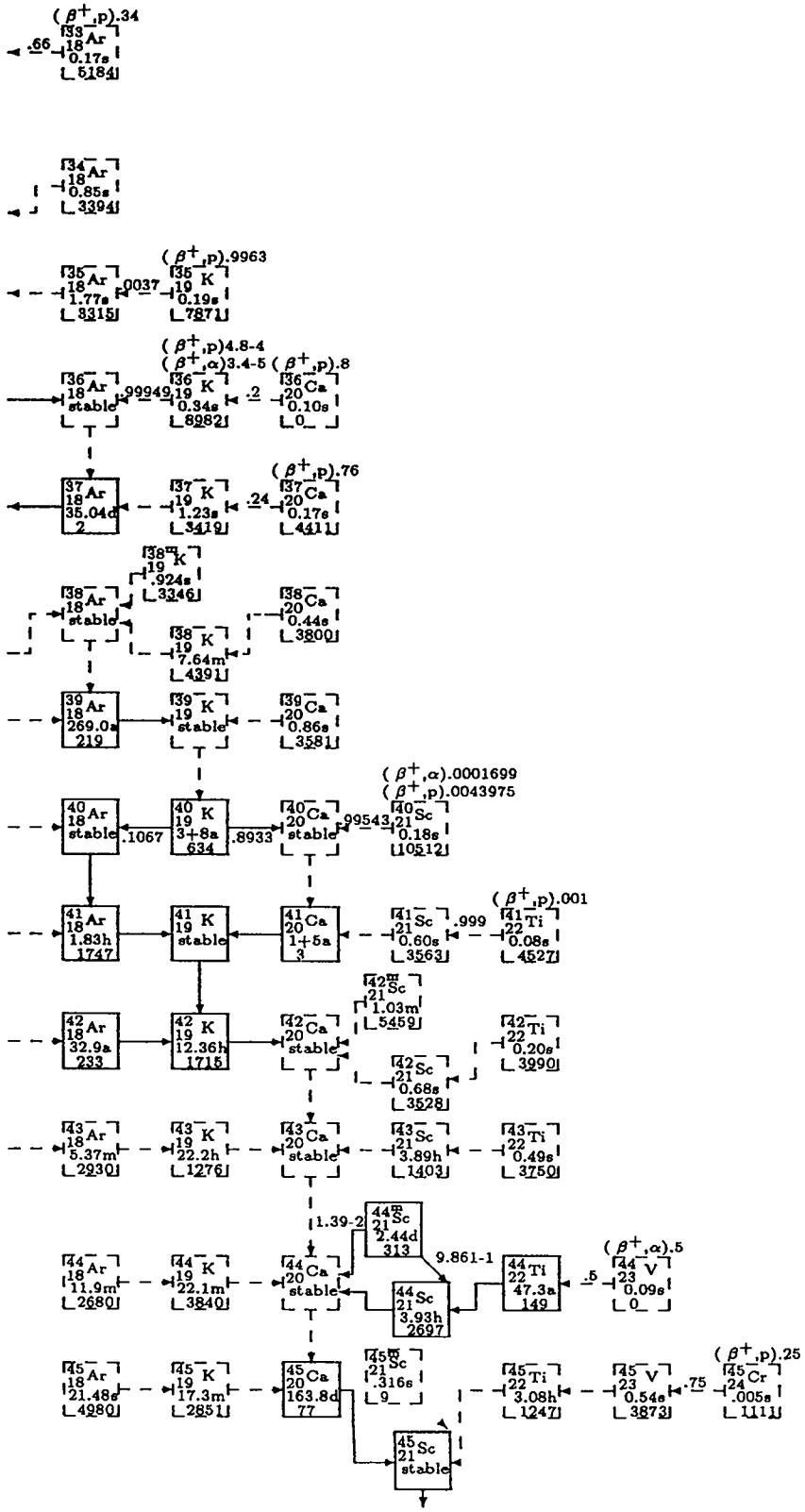
```
42     subroutine lookup (z,a,dcy,nucnum, found,howmany)
43     integer z,a,howmany
44     integer dcy(3), jefa(3500), jefz(3500), jefdcy(3500), nucnum, i
45     logical found, zfound
46     common /jef/jefa,jefz,jefdcy
47     zfound = .false.
48     found= .false.
49     howmany=0
50  c  print *, a,"  ",z
51     do 1000 i = 1, nucnum
52  c  if (zfound) print *,jefz(i),"  ",jefa(i),"    ",i
53             if (jefz(i).eq.z) then
54  c  print *,"a=",jefa(i),"z=",jefz(i),"dcy=",jefdcy(i)
55                     zfound= .true.
56                     if(jefa(i).eq.a) then
57                             dcy(1)=jefdcy(i)
58                             found=.true.
59     howmany=1
60     if((jefz(i+1).eq.z).and.(jefa(i+1).eq.a))then
61             dcy(2)=jefdcy(i+1)
62             howmany=2
63     if((jefz(i+2).eq.z).and.(jefa(i+2).eq.a))then
64             dcy(3)=jefdcy(i+2)
65             howmany=3
66     endif
67     endif
68                             goto 1100
69                     endif
70             else
71                     if (zfound) goto 1200
72             endif
73  1000       continue
74  1200       write (12,1300) z, a
75  1300       format (1x, i3, 5x,i3)
76  1100       continue
77     end
```

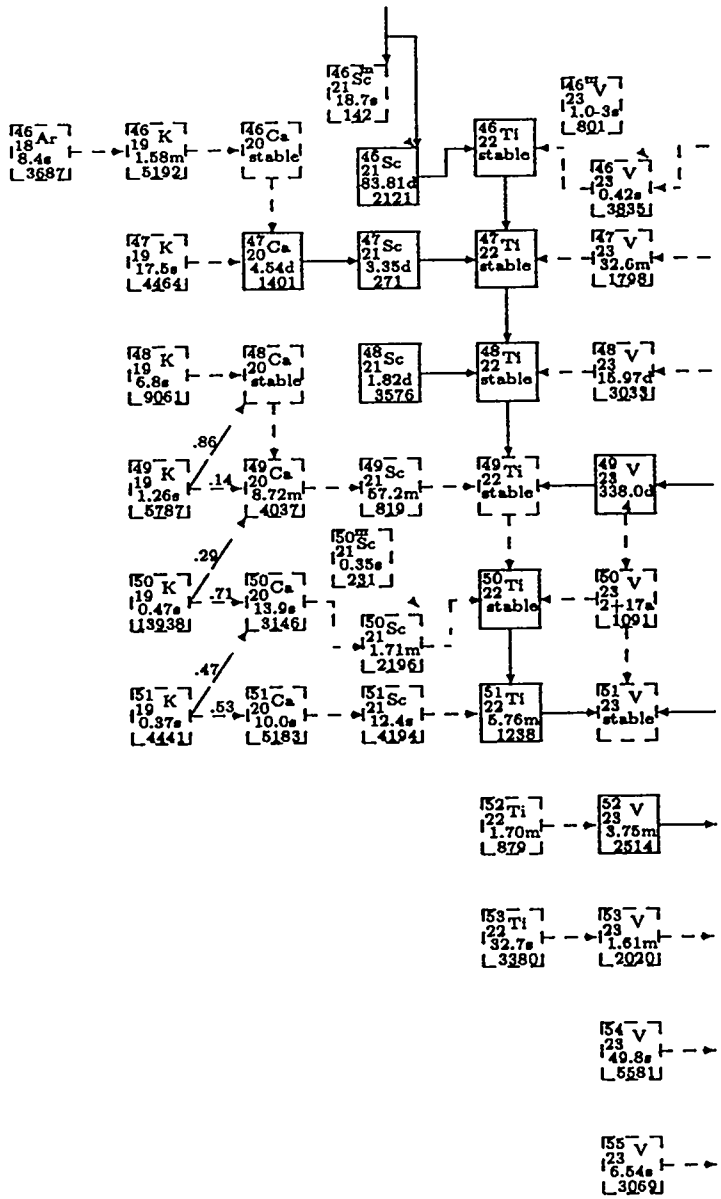
ENDF/B-VI Decay Chains


235U thermal
fission independent
yield fraction
n,2n
p
β⁻,n
α
sf
β⁺
e.c.
β⁻
Isomeric
Transition
n,γ
1 H 1 stable
2 H 1 stable
3 H 1 12.33a 6
3He 2 stable
4He 2 stable
5He 2 7.6-22s 0
6He 2 0.81s 1570
6Li 3 stable
7Li 3 stable
7Be 4 53.3d 337
.12
.88
8He 2 0.12s 5361
8Li 3 0.84s 10265
8Be 4 7-17a
8B 5 0.77s 0
.495
.505
9Li 3 0.18s 6850
9Be 4 stable
9B 5 8-19a 0
9C 6 .13a 10298
10Be 4 2+6a 203
10B 5 stable
10C 6 19.26s 1940
(β⁻,α).03
11Li 3 8.7-3s 0
11Be 4 13.81s 6102
.97
11B 5 stable
11C 6 20.4m 1404
(β⁻,α).0158
12Be 4 .0240s 9498
12B 5 .0202s 6406
.9842
12C 6 stable
12N 7 .011s 8697
.0028
13B 5 .0174s 6674
.9972
13C 6 stable
13N 7 9.97m 1514
13O 8 .0089s 8932


14 B 5 .0161s 2713
14 C 6 5730a 49
14 N 7 stable
14 O 8 1.18m 4096
15 C 6 2.45s 6478
15 N 7 stable
15 O 8 2.04m 1755
15 F 9 5-22 s 0
.98
(β+,α)1.2-5
16 C 6 0.75s 2055
.02
16 N 7 7.13s 7254
1.0
16 O 8 stable
16 F 9 1-20s 0
17 C 6 0.02s 0
17 N 7 4.17s 1747
17 O 8 stable
17 F 9 64.5s 0
17 Ne 10 0.109s 0
18 C 6 7-3s 0
18 N 7 0.63s 9137
18 O 8 stable
18 F 9 1.83h 1232
18 Ne 10 1.67s 2610
19 O 8 26.91s 2681
19 F 9 stable
19 Ne 10 17.22s 1985
20 O 8 13.57s 2234
20 F 9 11.00s 4115
20 Ne 10 stable
20 Na 11 0.45s 7115
(β+,p).293
21 F 9 4.32s 2790
21 Ne 10 stable
21 Na 11 22.49s 2139
.707
21 Mg 12 0.12s 6213
22 F 9 4.24s 8112
22 Ne 10 stable
22 Na 11 2.60a 2387
22 Mg 12 3.86s 3091
23 F 9 2.23s 0123
23 Ne 10 37.24s 2067
23 Na 11 stable
23 Mg 12 11.32s 2396
23 Al 13 0.47s 8159
24m Na 11 .0202s 484
.005
.995
24 Ne 10 3.38m 1344
24 Na 11 14.66h 4677
24 Mg 12 stable
24m Al 13 .07 0.13s 978
.93
24 Al 13 2.07s 1492
25 Ne 10 0.60s 3825
25 Na 11 59.6s 1933
25 Mg 12 stable
25 Al 13 7.18s 2489
25 Si 14 0.22s 3351
26m Al 13 6.34s 2462
26 Na 11 1.08s 5510
26 Mg 12 stable
26 Al 13 7.2+5a 3079
26 Si 14 2.21s 2876
27 Na 11 0.30s 4781
27 Mg 12 9.46m 1593
27 Al 13 stable
27 Si 14 4.17s 2742
28 Na 11 .0305s 7243
28 Mg 12 20.91h 1525
28 Al 13 2.24m 3020
28 Si 14 stable
28 P 15 0.27s 9183
29 Na 11 .0429s 9573
29 Mg 12 1.30s 4460
29 Al 13 6.57m 4377
29 Si 14 stable
29 P 15 0.19s 4171
29 S 16 4.14s 8685


30 Al 13 3.6s 5680
30 Si 14 stable
30 P 15 2.50m 2458
30 S 16 1.178d 3692
31 Al 13 0.64s 5877
31 Si 14 2.62h 596
31 P 15 stable
31 S 16 2.572d 3034
32 Mg 12
32 Al 13 .035s 6136
32 Si 14 172.0s 69
32 P 15 14.26d 695
32 S 16 stable
32 Cl 17 0.30s 8122
.52
.17
33 Na 11 .0082s 312
.48
33 Mg 12 0.09s 0
.83
33 Al 13
33 Si 14 6.18s 4300
33 P 15 25.4s 77
33 S 16 stable
33 Cl 17 2.51s 3130
.66
.555
34 Cl 17 32.2m 2577
.445
.45
34 Na 11 .0055s 0
.55
34 Mg 12
34 Al 13
34 Si 14 2.77s 2290
34 P 15 12.4s 2635
34 S 16 stable
34 Cl 17 1.53s 3075
.999
35 Na 11 .0015s 0
.001
35 Mg 12
35 Al 13
35 Si 14
35 P 15 47.3s 2639
35 S 16 87.5d 42
35 Cl 17 stable
36 P 15 5.6s 8152
36 S 16 stable
1.9-2
36 Cl 17 3+5a 247
9.81-1
37 S 16 4.99m 8730
37 Cl 17 stable
38m Cl 17 0.77s 671
38 S 16 2.84h 2190
38 Cl 17 37.2m 3017
39 S 16 11.5s 4050
39 Cl 17 55.6m 2273
40 Cl 17 1.35m 5610
41 Cl 17 34.0s 3410
42 Cl 17 6.8s 6667
43 Cl 17 3.3s 5140


(β+,p).34
33 Ar 18 0.17s 5184
.66
34 Ar 18 0.85s 3394
(β+,p).9963
35 Ar 18 1.77s 3315
.0037
35 K 19 0.19s 7871
(β+,p)4.8-4
(β+,α)3.4-5
(β+,p).8
36 Ar 18 stable
.99949
36 K 19 0.34s 8982
.2
36 Ca 20 0.10s 0
(β+,p).76
37 Ar 18 35.04d 2
37 K 19 1.23s 3419
.24
37 Ca 20 0.17s 4411
38m K 19 .924s 3346
38 Ar 18 stable
38 K 19 7.64m 4391
38 Ca 20 0.44s 3800
39 Ar 18 269.0a 219
39 K 19 stable
39 Ca 20 0.86s 3581
(β+,α).0001699
(β+,p).0043975
40 Ar 18 stable
.1067
40 K 19 3+8a 634
.8933
40 Ca 20 stable
.99543
40 Sc 21 0.18s 10512
41 Ar 18 1.83h 1747
41 K 19 stable
41 Ca 20 1+5a 3
41 Sc 21 0.60s 3563
.999
(β+,p).001
41 Ti 22 0.08s 4527
42m Sc 21 1.03m 5459
42 Ar 18 32.9a 233
42 K 19 12.36h 1715
42 Ca 20 stable
42 Sc 21 0.68s 3528
42 Ti 22 0.20s 3990
43 Ar 18 5.37m 2930
43 K 19 22.2h 1276
43 Ca 20 stable
43 Sc 21 3.89h 1403
43 Ti 22 0.49s 3750
1.39-2
44m Sc 21 2.44d 313
9.861-1
44 Ar 18 11.9m 2680
44 K 19 22.1m 3840
44 Ca 20 stable
44 Sc 21 3.93h 2697
44 Ti 22 47.3a 149
.5
(β+,α).5
44 V 23 0.09s 0
45 Ar 18 21.48s 4980
45 K 19 17.3m 2851
45 Ca 20 163.8d 77
45m Sc 21 .316s 9
45 Ti 22 3.08h 1247
45 V 23 0.54s 3873
.75
(β+,p).25
45 Cr 24 .005s 1111
45 Sc 21 stable


46 Ar 18 8.4s 3687
46 K 19 1.58m 5192
46 Ca 20 stable
46m Sc 21 18.7s 142
46 Sc 21 83.81d 2121
46 Ti 22 stable
46m V 23 1.0-3s 801
46 V 23 0.42s 3835
47 K 19 17.5s 4464
47 Ca 20 4.54d 1401
47 Sc 21 3.35d 271
47 Ti 22 stable
47 V 23 32.6m 1798
48 K 19 6.8s 9061
48 Ca 20 stable
48 Sc 21 1.82d 3576
48 Ti 22 stable
48 V 23 16.97d 3033
.86
.14
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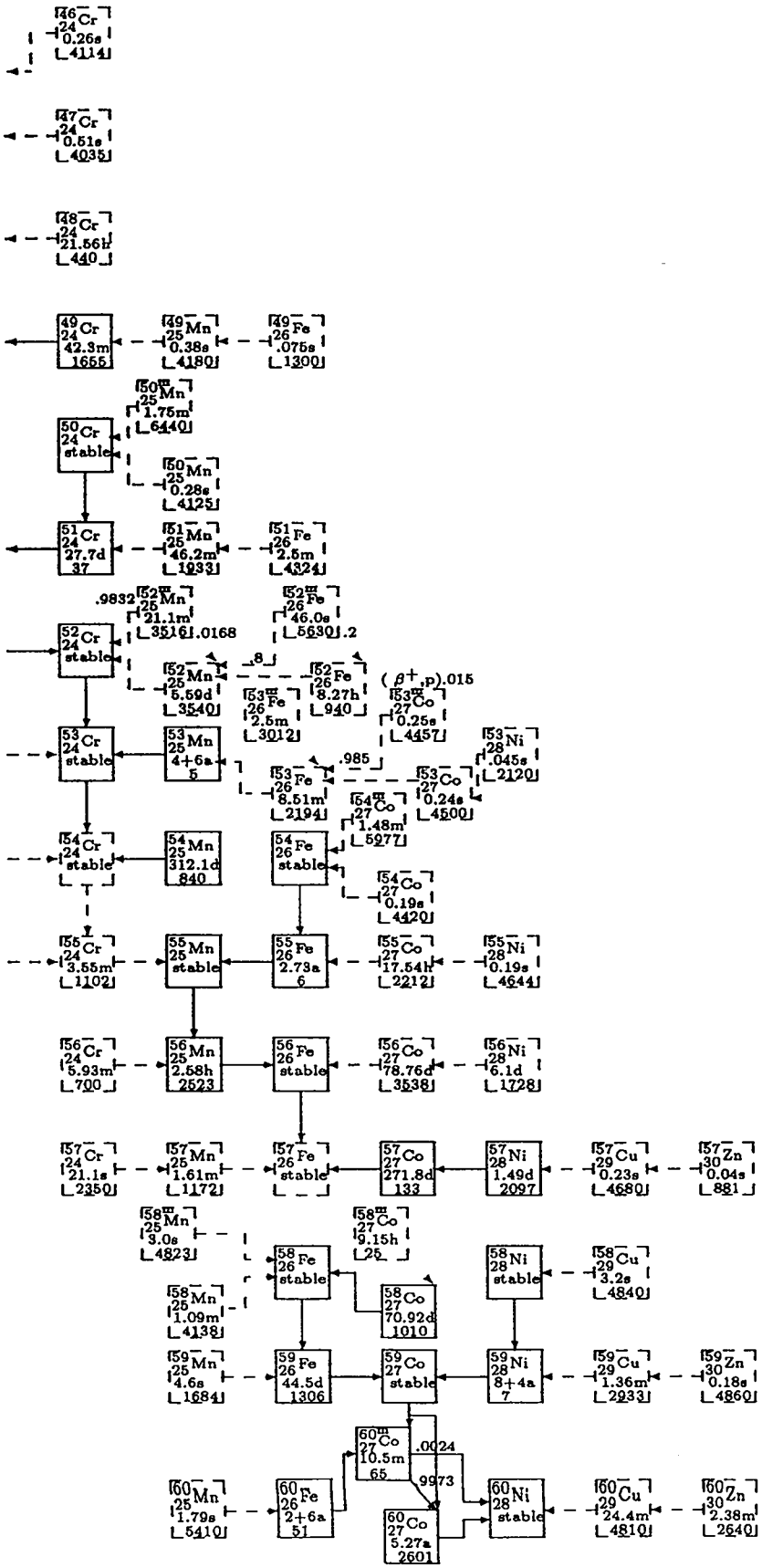
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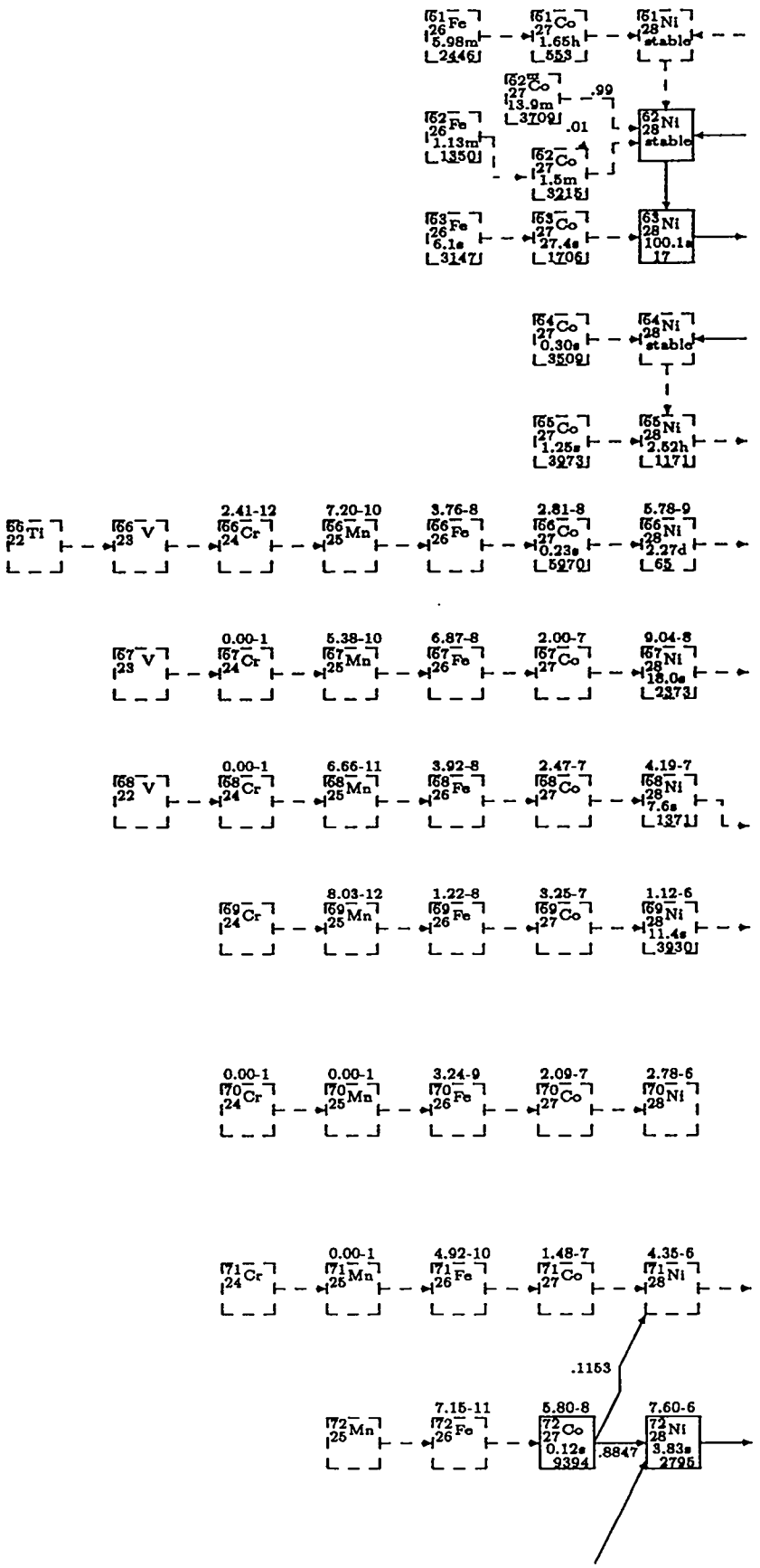
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2.00-7
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3.92-8
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2.47-7
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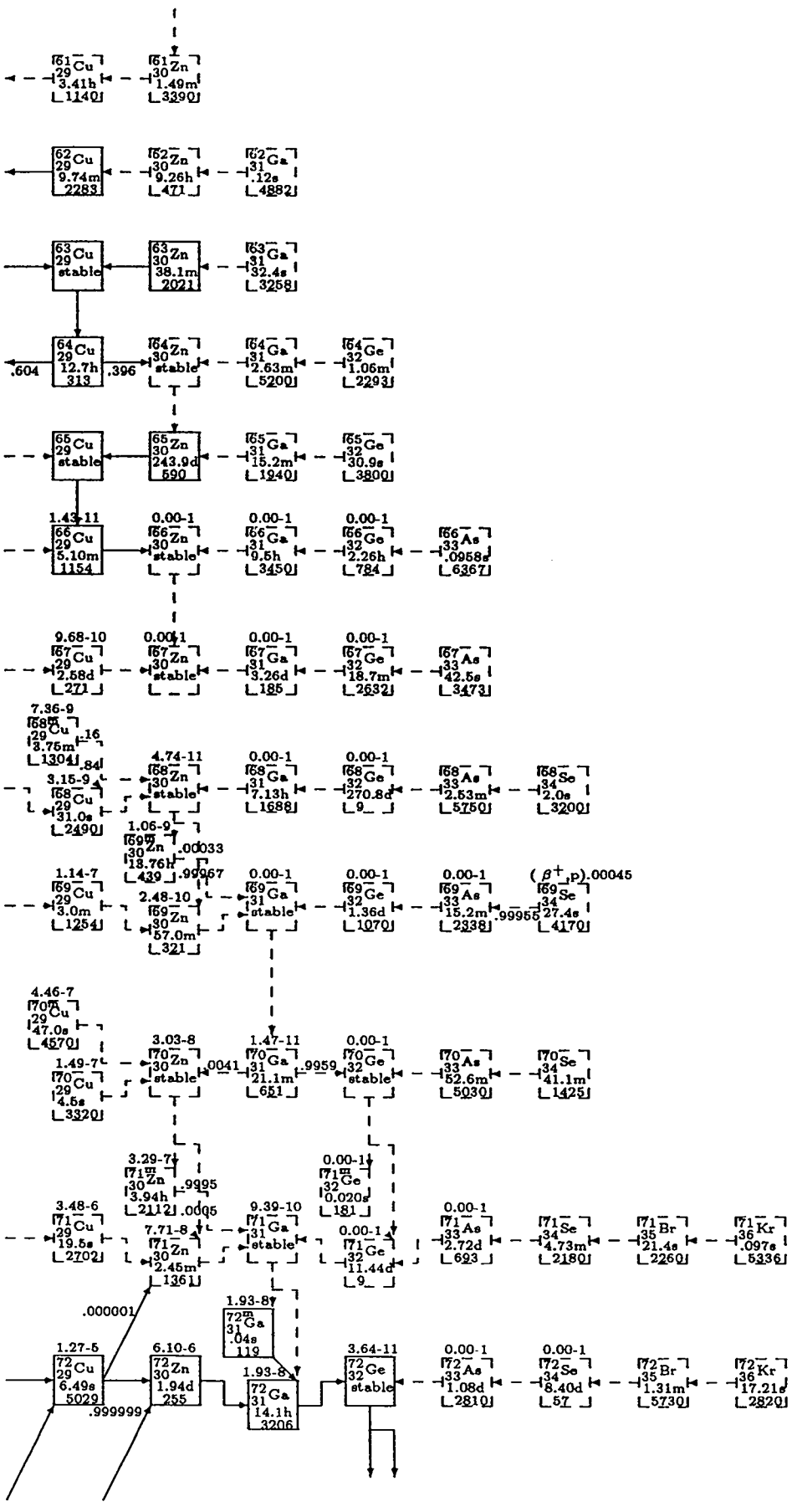
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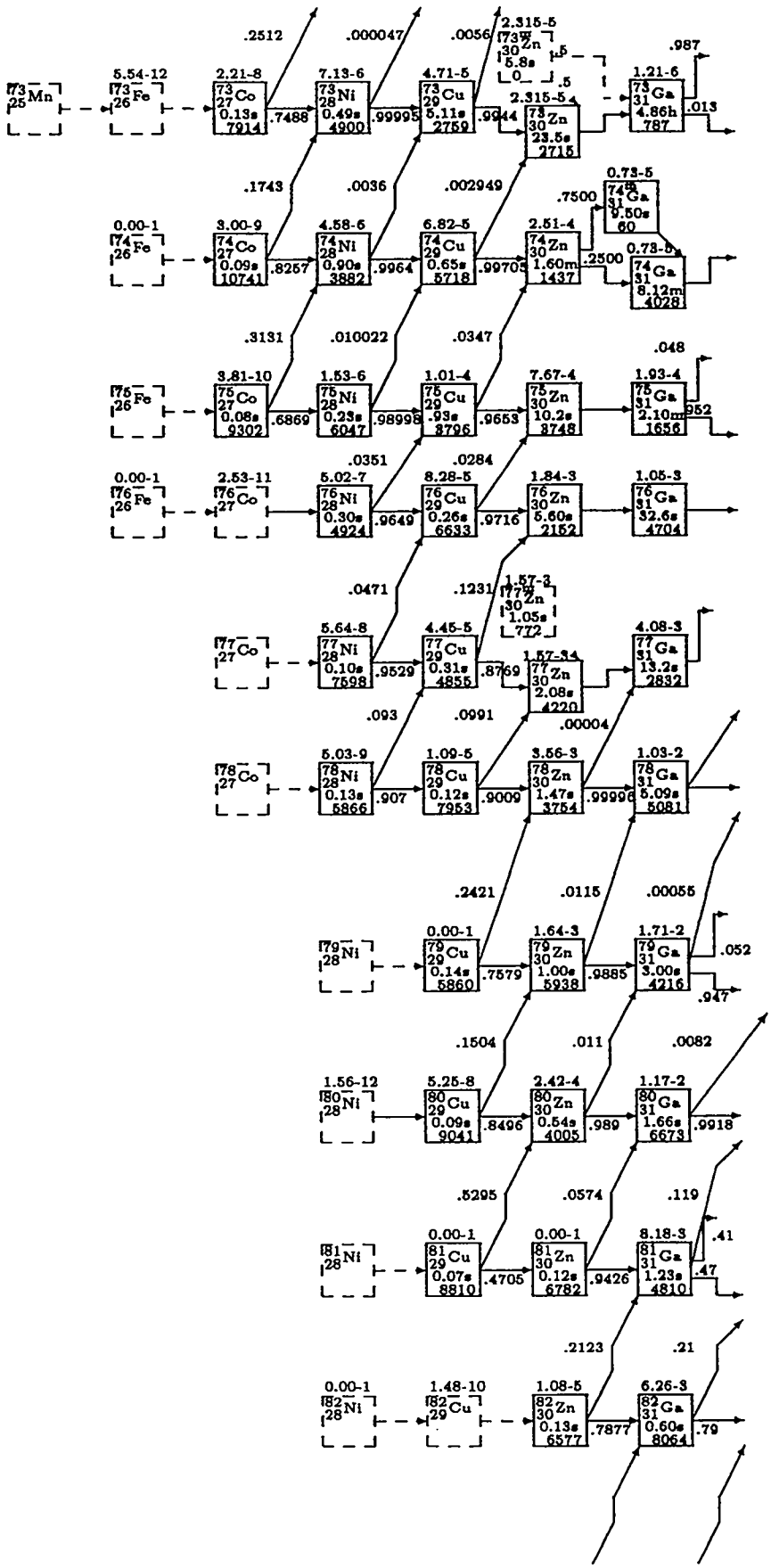
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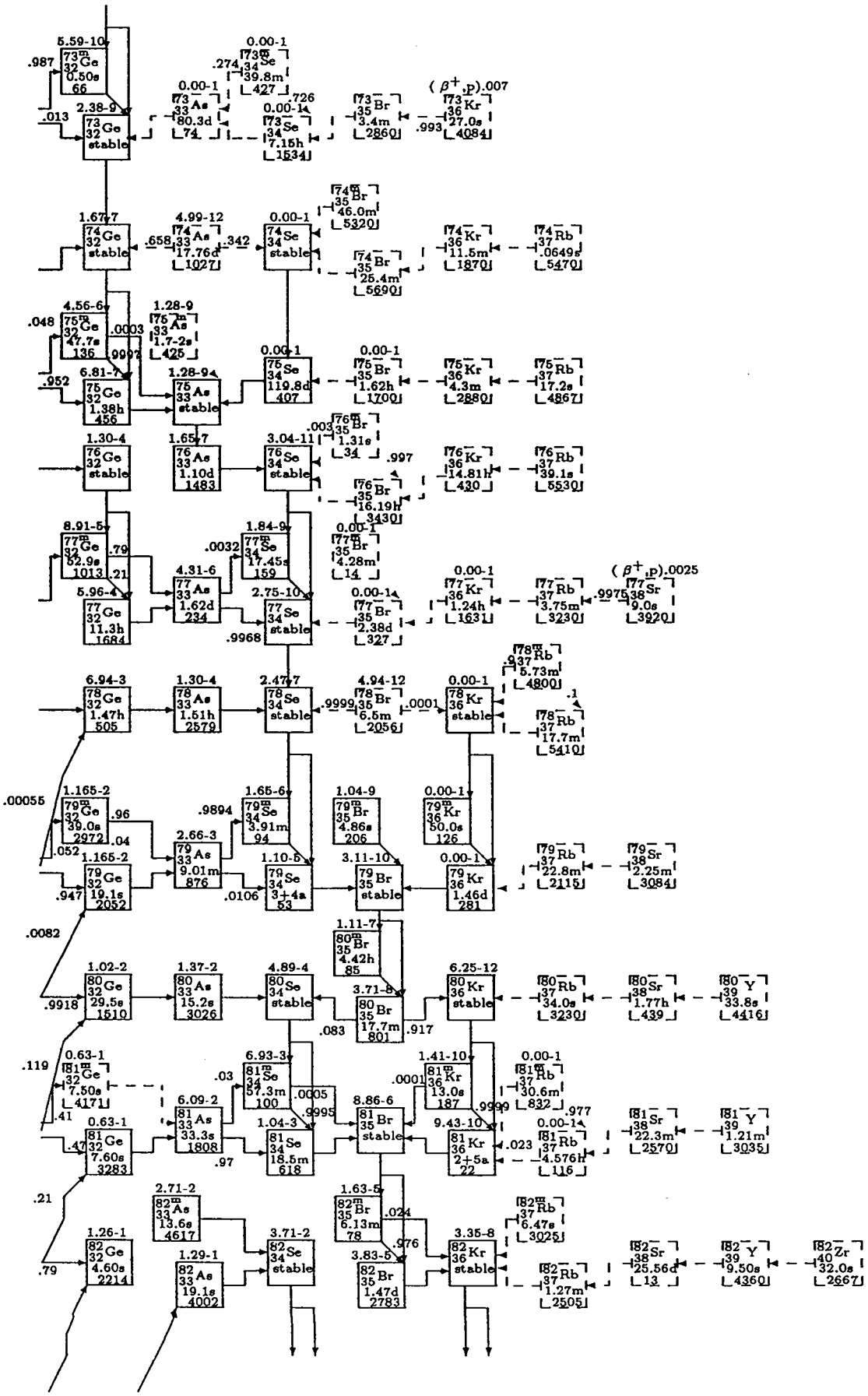
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79 Rb 37 22.8m 2115
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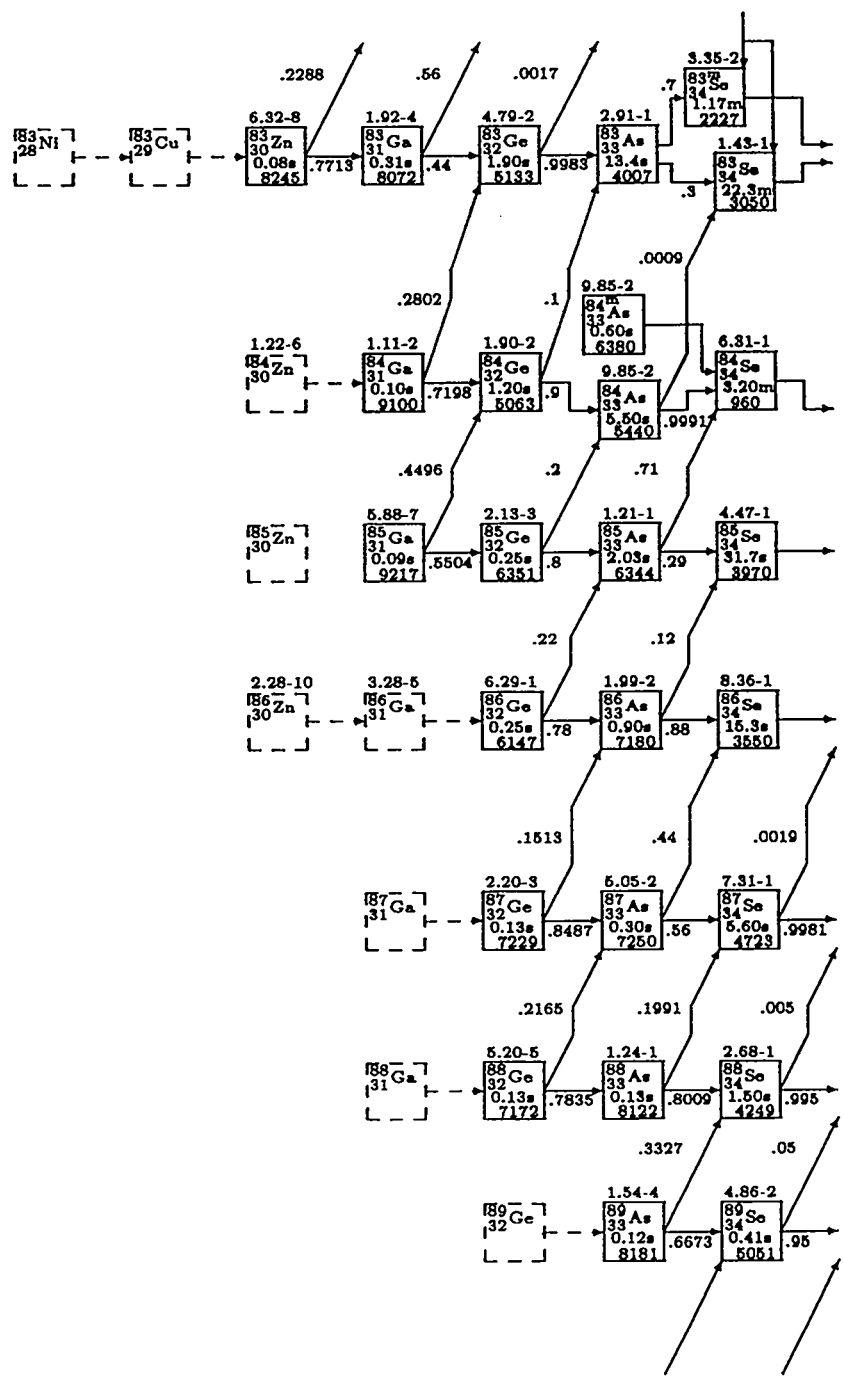
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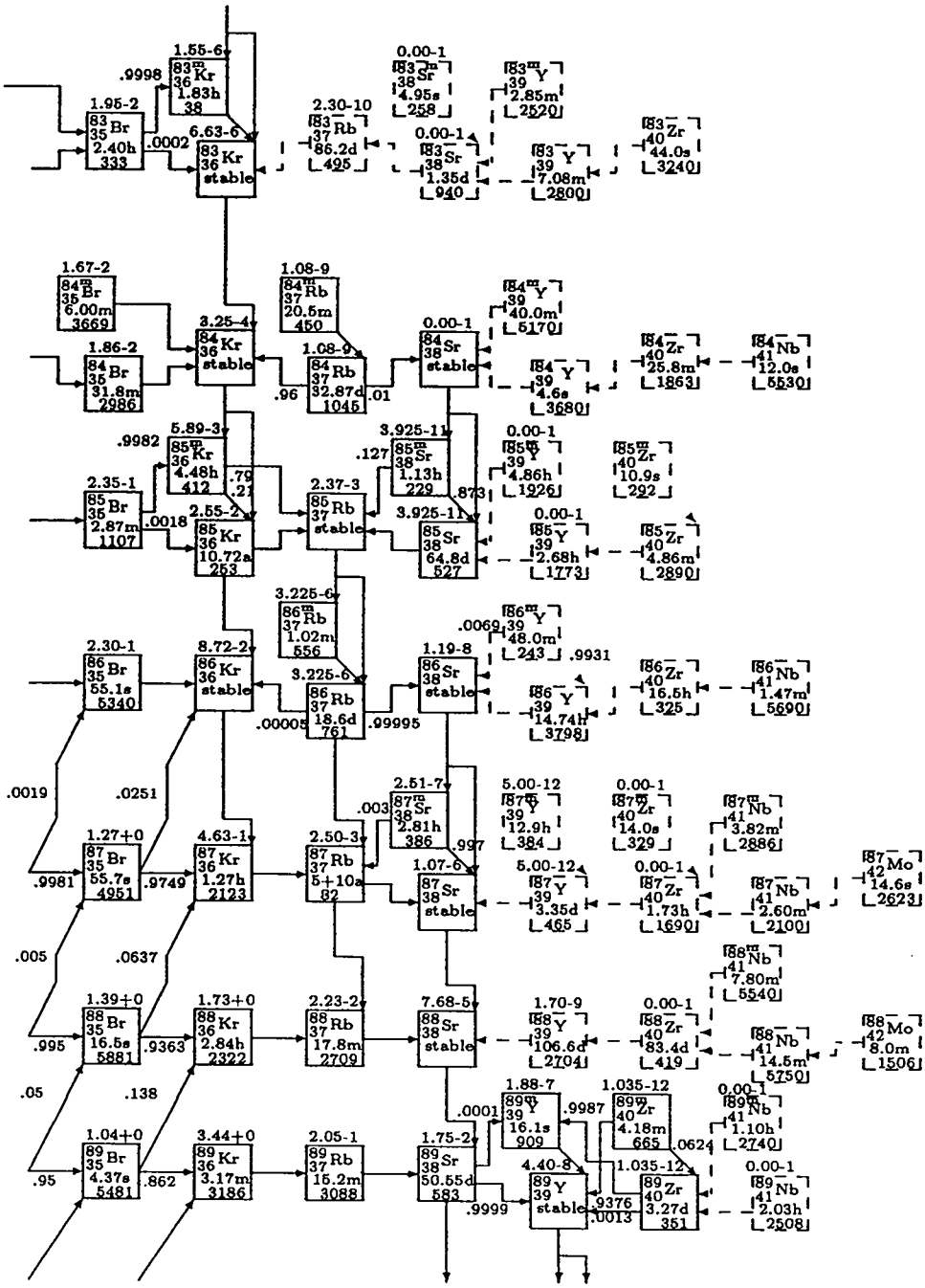
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83 Y 39 7.08m 2800
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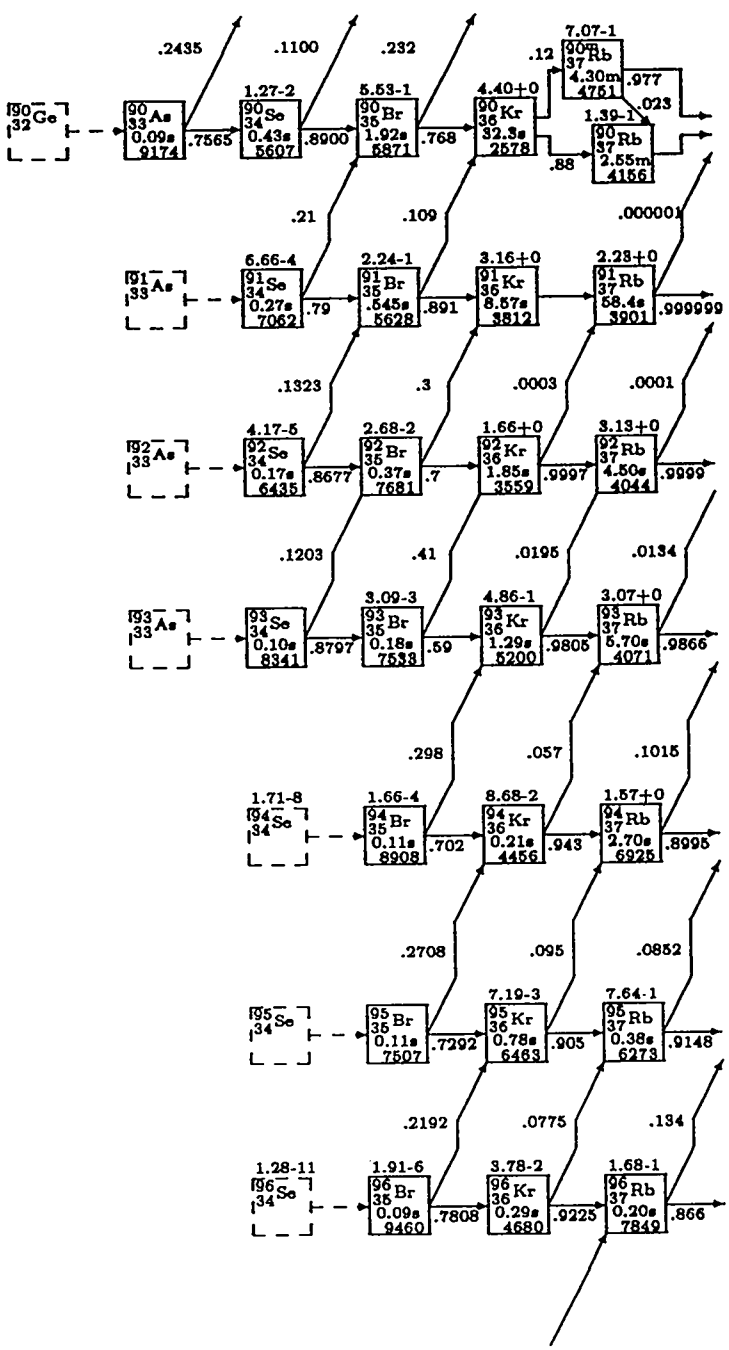
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$^{91}_{35}$Br .545s 5628
$^{91}_{36}$Kr 8.57s 3812
$^{91}_{37}$Rb 58.4s 3901
$^{92}_{33}$As
$^{92}_{34}$Se 0.17s 6435
$^{92}_{35}$Br 0.37s 7681
$^{92}_{36}$Kr 1.85s 3559
$^{92}_{37}$Rb 4.50s 4044
$^{93}_{33}$As
$^{93}_{34}$Se 0.10s 8341
$^{93}_{35}$Br 0.18s 7533
$^{93}_{36}$Kr 1.29s 5200
$^{93}_{37}$Rb 5.70s 4071
$^{94}_{34}$Se
$^{94}_{35}$Br 0.11s 8908
$^{94}_{36}$Kr 0.21s 4456
$^{94}_{37}$Rb 2.70s 6925
$^{95}_{34}$Se
$^{95}_{35}$Br 0.11s 7507
$^{95}_{36}$Kr 0.78s 6463
$^{95}_{37}$Rb 0.38s 6273
$^{96}_{34}$Se
$^{96}_{35}$Br 0.09s 9460
$^{96}_{36}$Kr 0.29s 4680
$^{96}_{37}$Rb 0.20s 7849
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.1100
.232
.12
7.07-1
.977
.023
1.27-2
5.53-1
4.40+0
1.39-1
.7565
.8900
.768
.88
.21
.109
.000001
6.66-4
2.24-1
3.16+0
2.23+0
.79
.891
.999999
.1323
.3
.0003
.0001
4.17-5
2.68-2
1.66+0
3.13+0
.8677
.7
.9997
.9999
.1203
.41
.0195
.0134
3.09-3
4.86-1
3.07+0
.8797
.59
.9805
.9866
.298
.057
.1015
1.71-8
1.66-4
8.68-2
1.57+0
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.943
.8995
.2708
.095
.0852
7.19-3
7.64-1
.7292
.905
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3.78-2
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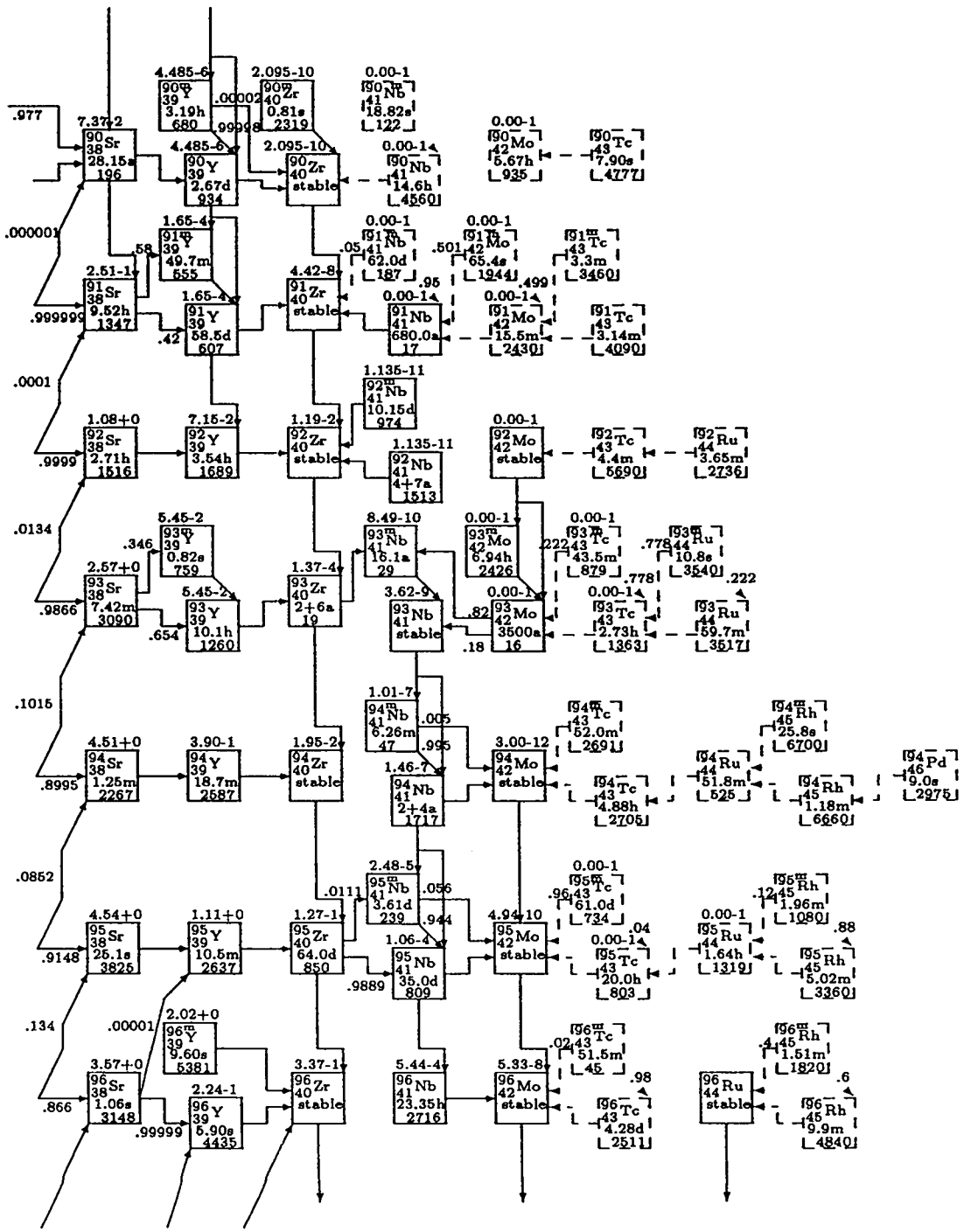

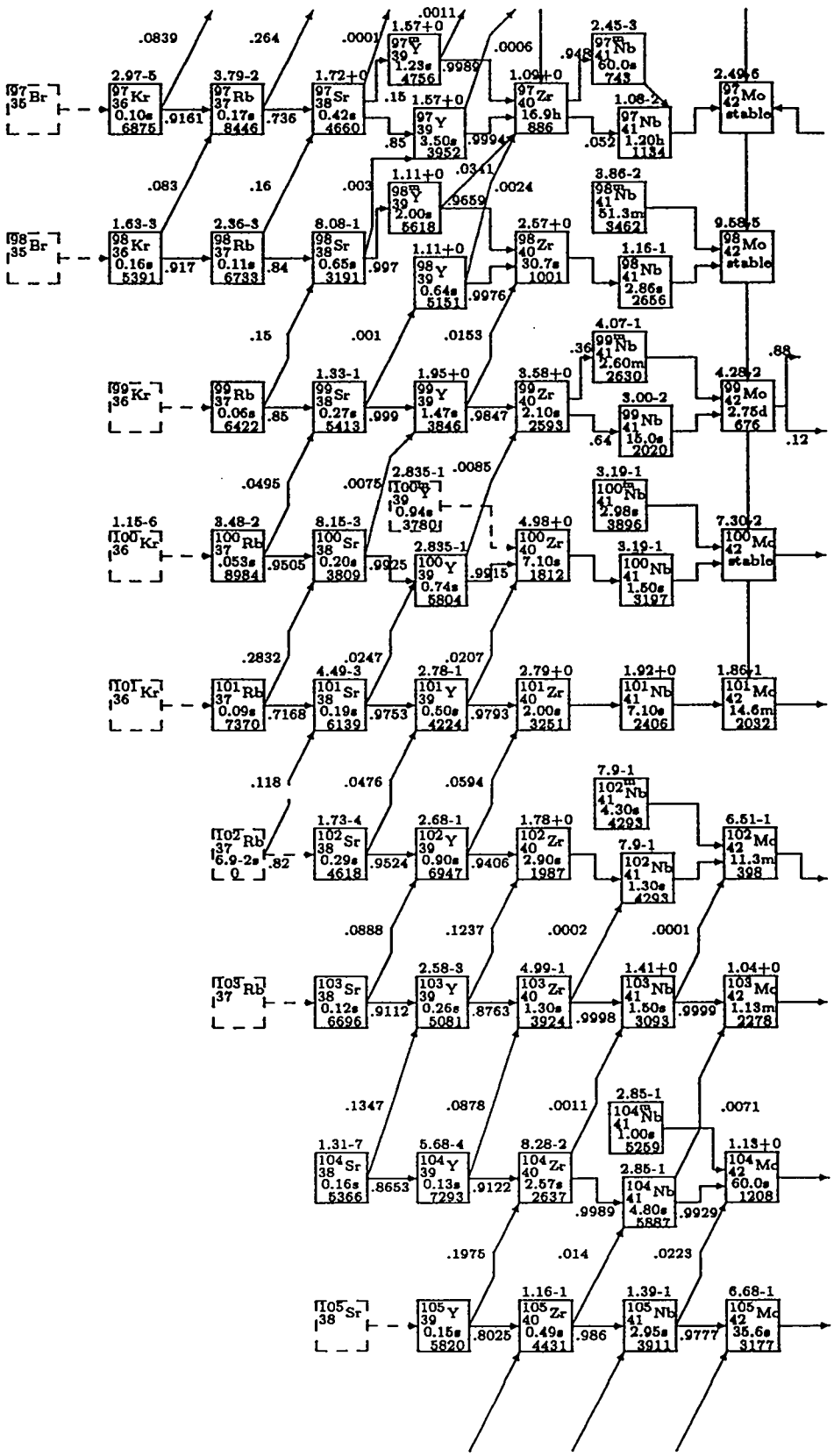
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102Rb
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97Rb 0.17s 8446
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97Y 1.23s 4756
97Y 3.50s 3952
97Zr 16.9h 886
97Nb 60.0s 743
97Nb 1.20h 1134
97Mo stable
98Kr 0.16s 5391
98Rb 0.11s 6733
98Sr 0.65s 3191
98Y 2.00s 5618
98Y 0.64s 5151
98Zr 30.7s 1001
98Nb 2.86s 2656
98Mo stable
99Rb 0.06s 6422
99Sr 0.27s 5413
99Y 1.47s 3846
99Zr 2.10s 2593
99Nb 2.60m 2630
99Nb 15.0s 2020
99Mo 2.75d 676
100Rb .053s 8984
100Sr 0.20s 3809
100Y 0.94s 3780
100Y 0.74s 5804
100Zr 7.10s 1812
100Nb 2.98s 3896
100Nb 1.50s 3197
100Mo stable
101Rb 0.09s 7370
101Sr 0.19s 6139
101Y 0.50s 4224
101Zr 2.00s 3251
101Nb 7.10s 2406
101Mo 14.6m 2032
102Rb 6.9-2s 0
102Sr 0.29s 4618
102Y 0.90s 6947
102Zr 2.90s 1987
102Nb 4.30s 4293
102Nb 1.30s 4293
102Mo 11.3m 398
103Sr 0.12s 6696
103Y 0.26s 5081
103Zr 1.30s 3924
103Nb 1.50s 3093
103Mo 1.13m 2278
104Sr 0.16s 5366
104Y 0.13s 7293
104Zr 2.57s 2637
104Nb 1.00s 5259
104Nb 4.80s 5887
104Mo 60.0s 1208
105Y 0.15s 5820
105Zr 0.49s 4431
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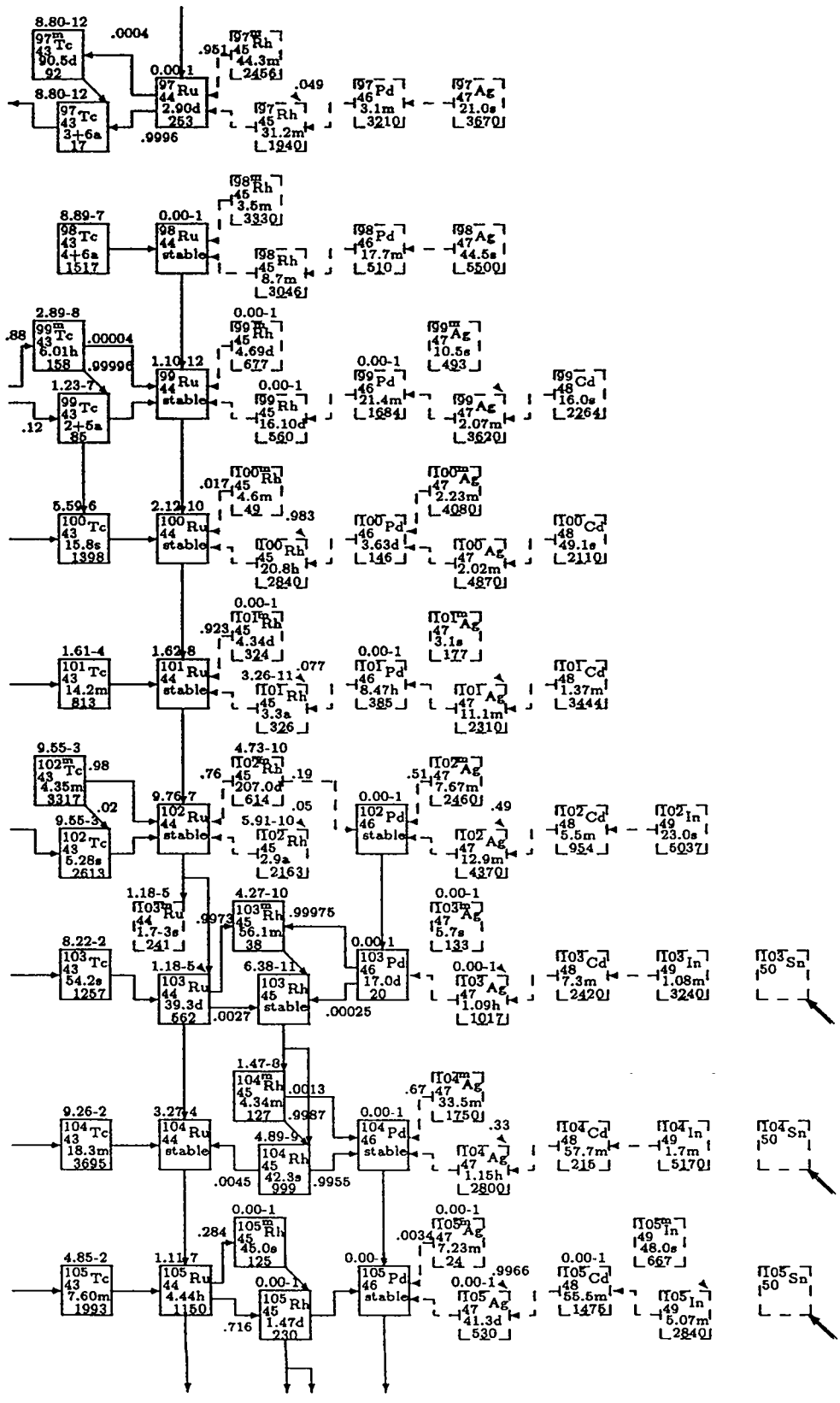
105Mo 35.6s 3177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97mRh 44.3m 2456
97Rh 31.2m 1940
97Pd 3.1m 3210
97Ag 21.0s 3670
98Tc 4+6a 1517
98Ru stable
98mRh 3.5m 3330
98Rh 8.7m 3046
98Pd 17.7m 510
98Ag 44.5s 5500
99mTc 6.01h 158
99Tc 2+5a 85
99Ru stable
99mRh 4.69d 677
99Rh 16.10d 560
99Pd 21.4m 1684
99mAg 10.5s 493
99Ag 2.07m 3620
99Cd 16.0s 2264
100Tc 15.8s 1398
100Ru stable
100mRh 4.6m 49
100Rh 20.8h 2840
100Pd 3.63d 146
100mAg 2.23m 4080
100Ag 2.02m 4870
100Cd 49.1s 2110
101Tc 14.2m 813
101Ru stable
101mRh 4.34d 324
101Rh 3.3a 326
101Pd 8.47h 385
101mAg 3.1s 177
101Ag 11.1m 2310
101Cd 1.37m 3444
102mTc 4.35m 3317
102Tc 5.28s 2613
102Ru stable
102mRh 207.0d 614
102Rh 2.9a 2163
102Pd stable
102mAg 7.67m 2460
102Ag 12.9m 4370
102Cd 5.5m 954
102In 23.0s 5037
103mRu 1.7-3s 241
103Tc 54.2s 1257
103Ru 39.3d 562
103mRh 56.1m 38
103Rh stable
103Pd 17.0d 20
103mAg 5.7s 133
103Ag 1.09h 1017
103Cd 7.3m 2420
103In 1.08m 3240
103Sn
104mRh 4.34m 127
104Tc 18.3m 3695
104Ru stable
104Rh 42.3s 999
104Pd stable
104mAg 33.5m 1750
104Ag 1.15h 2800
104Cd 57.7m 215
104In 1.7m 5170
104Sn
105mRh 45.0s 125
105Tc 7.60m 1993
105Ru 4.44h 1150
105Rh 1.47d 230
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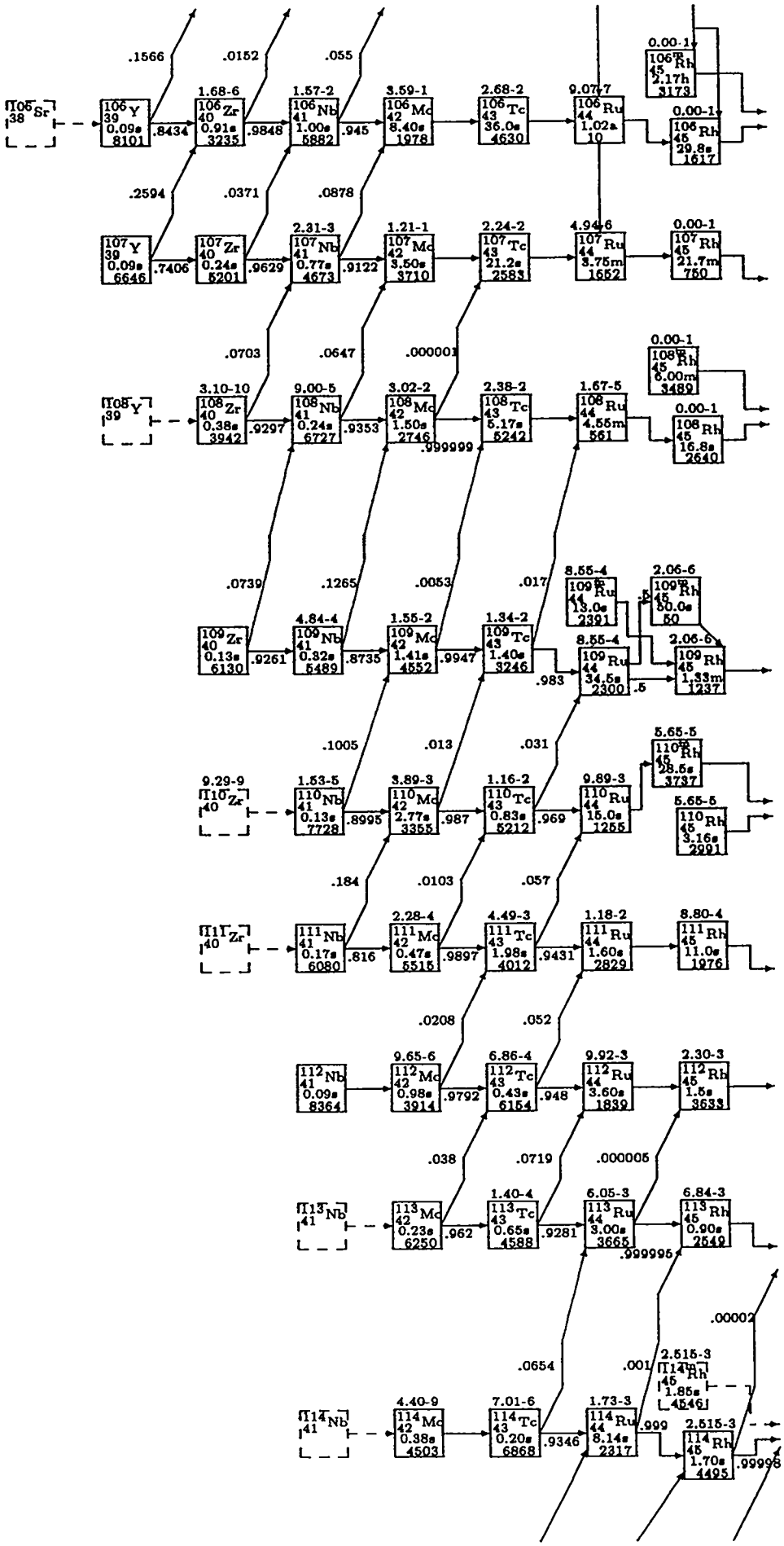
105Ag 41.3d 530
105Cd 55.5m 1476
105mIn 48.0s 667
105In 5.07m 2840
105Sn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106Rh 45 29.8s 1617
106Rh 45 2.17h 3173
107Y 39 0.09s 6646
107Zr 40 0.24s 5201
107Nb 41 0.77s 4673
107Mo 42 3.50s 3710
107Tc 43 21.2s 2583
107Ru 44 3.75m 1652
107Rh 45 21.7m 750
108Y 39
108Zr 40 0.38s 3942
108Nb 41 0.24s 6727
108Mo 42 1.50s 2746
108Tc 43 5.17s 5242
108Ru 44 4.55m 561
108Rh 45 16.8s 2640
108Rh 45 6.00m 3489
109Zr 40 0.13s 6130
109Nb 41 0.32s 5489
109Mo 42 1.41s 4552
109Tc 43 1.40s 3246
109Ru 44 34.5s 2300
109Rh 45 1.33m 1237
109Rh 45 80.0s 50
110Zr 40
110Nb 41 0.13s 7728
110Mo 42 2.77s 3355
110Tc 43 0.83s 5212
110Ru 44 15.0s 1255
110Rh 45 3.16s 2991
110Rh 45 28.5s 3737
111Zr 40
111Nb 41 0.17s 6080
111Mo 42 0.47s 5515
111Tc 43 1.98s 4012
111Ru 44 1.60s 2829
111Rh 45 11.0s 1976
112Nb 41 0.09s 8364
112Mo 42 0.98s 3914
112Tc 43 0.43s 6154
112Ru 44 3.60s 1839
112Rh 45 1.5s 3633
113Nb 41
113Mo 42 0.23s 6250
113Tc 43 0.65s 4588
113Ru 44 3.00s 3665
113Rh 45 0.90s 2549
114Nb 41
114Mo 42 0.38s 4503
114Tc 43 0.20s 6868
114Ru 44 8.14s 2317
114Rh 45 1.70s 4495
114Rh 45 1.85s 4546
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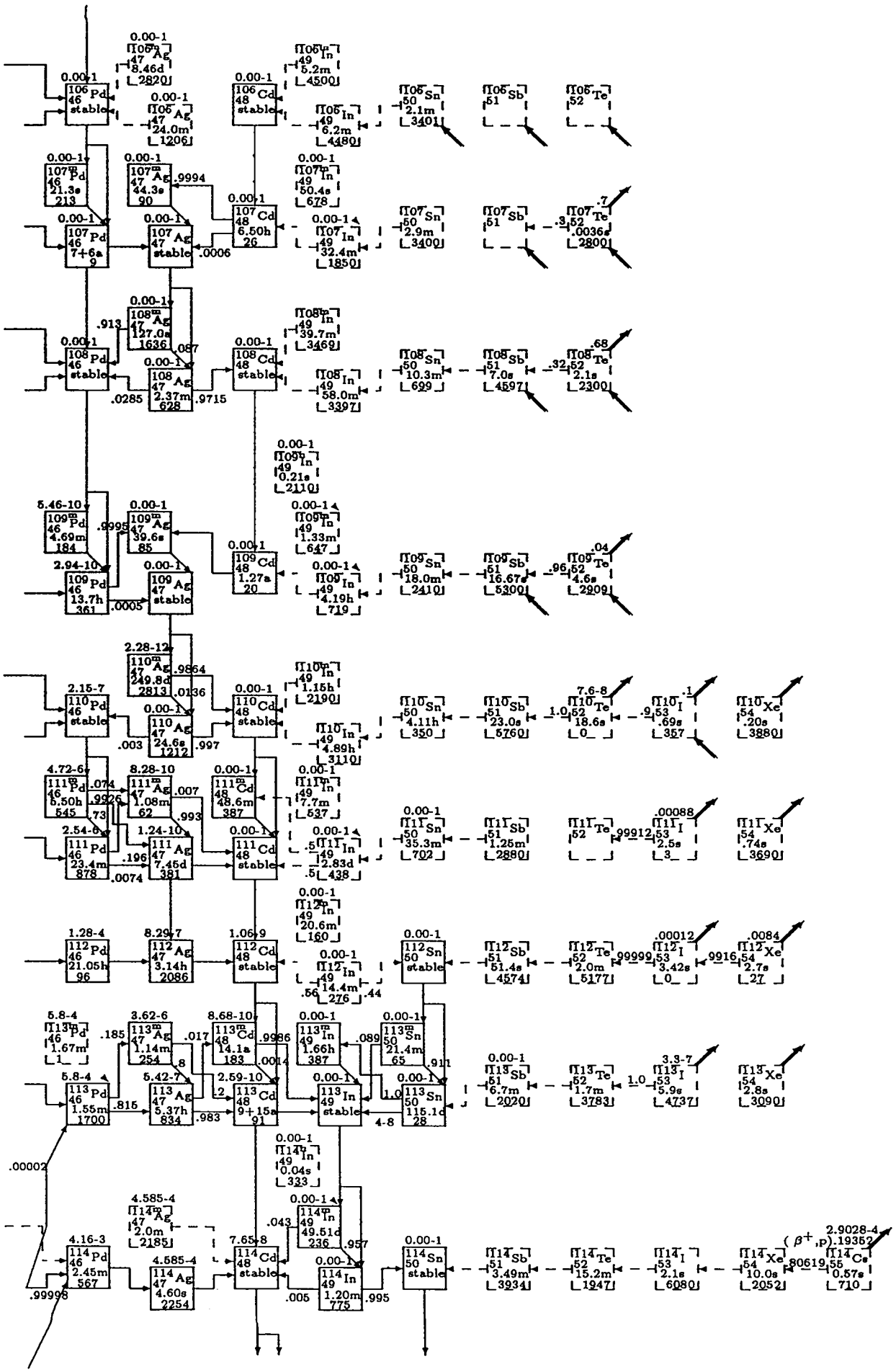
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106 Sb 51
106 Te 52
107m Pd 46 21.3s 213
107m Ag 47 44.3s 90
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107m In 49 50.4s 678
107 Pd 46 7+6a 9
107 Ag 47 stable
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107 Cd 48 6.50h 26
107 In 49 32.4m 1850
107 Sn 50 2.9m 3400
107 Sb 51
107 Te 52 .0036s 2800
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.3
108m Ag 47 127.0s 1636
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.087
108m In 49 39.7m 3469
108 Pd 46 stable
108 Ag 47 2.37m 628
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108 Cd 48 stable
108 In 49 58.0m 3397
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108 Sb 51 7.0s 4597
108 Te 52 2.1s 2300
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109m Ag 47 39.6s 85
109m In 49 1.33m 647
109 Pd 46 13.7h 361
.0005
109 Ag 47 stable
109 Cd 48 1.27a 20
109 In 49 4.19h 719
109 Sn 50 18.0m 2410
109 Sb 51 16.67s 5300
109 Te 52 4.6s 2909
.04
.96
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.9864
.0136
110m In 49 1.15h 2190
110 Pd 46 stable
110 Ag 47 24.6s 1212
.003
.997
110 Cd 48 stable
110 In 49 4.89h 3110
110 Sn 50 4.11h 350
110 Sb 51 23.0s 5760
110 Te 52 18.6s 0
110 I 53 .69s 357
110 Xe 54 .20s 3880
7.6-8
1.0
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.1
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111 Te 52
111 I 53 2.5s 3
111 Xe 54 .74s 3690
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112m In 49 20.6m 160
112 Pd 46 21.05h 96
112 Ag 47 3.14h 2086
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112 In 49 14.4m 276
112 Sn 50 stable
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112 Te 52 2.0m 5177
112 I 53 3.42s 0
112 Xe 54 2.7s 27
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.9916
.0084
113m Pd 46 1.67m 1
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113m Ag 47 1.14m 254
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.8
113m Cd 48 14.1a 183
.9986
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.089
.911
113m Sn 50 21.4m 65
113 Pd 46 1.55m 1700
.815
113 Ag 47 5.37h 834
.983
.2
113 Cd 48 9+15a 91
113 In 49 stable
1.0
113 Sn 50 115.1d 28
4-8
113 Sb 51 6.7m 2020
113 Te 52 1.7m 3783
113 I 53 5.9s 4737
113 Xe 54 2.8s 3090
3.3-7
1.0
.00002
114m In 49 0.04s 333
114m Ag 47 2.0m 2185
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114m In 49 49.51d 236
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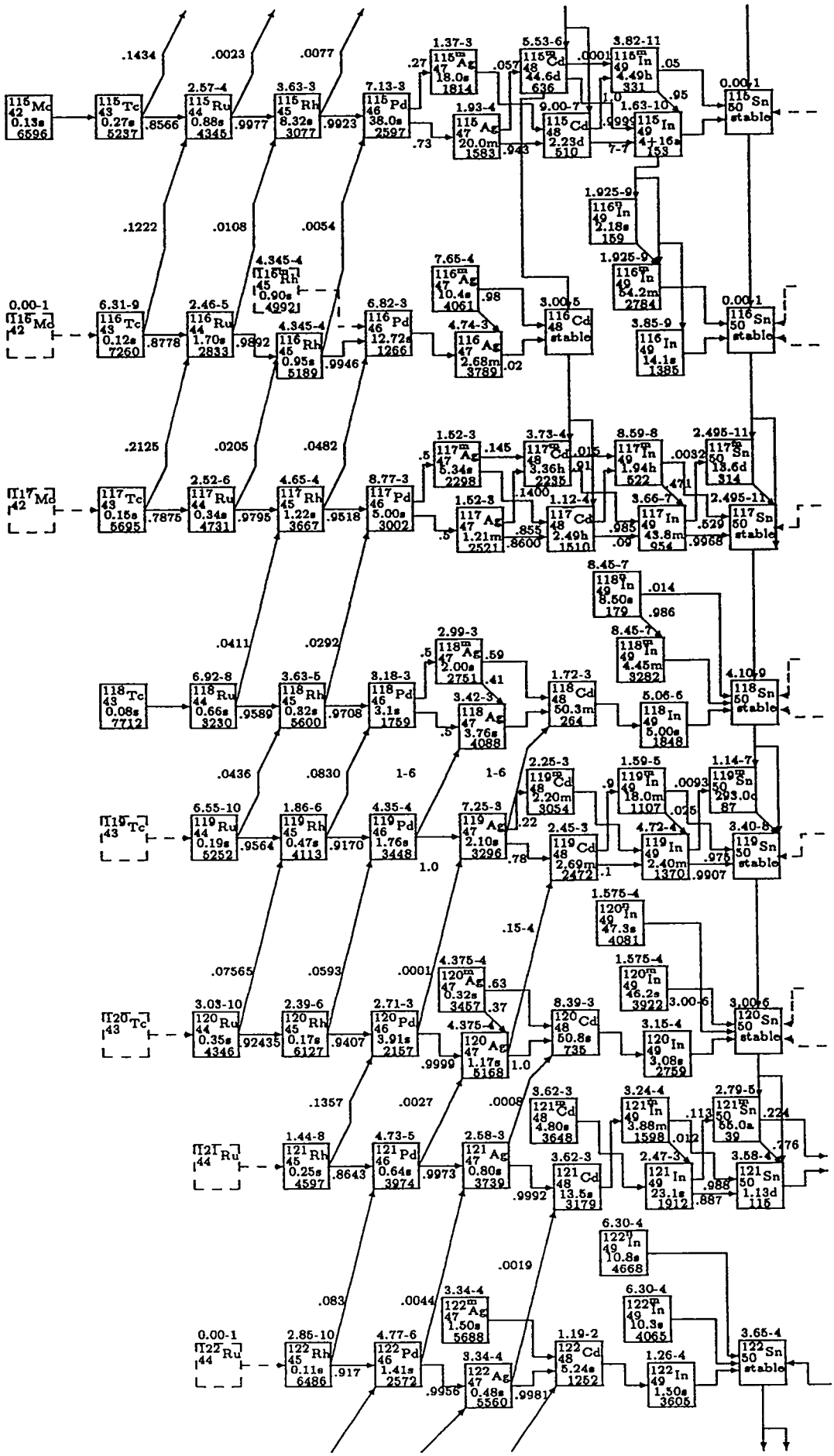
114 Pd 46 2.45m 567
.99998
114 Ag 47 4.60s 2254
114 Cd 48 stable
114 In 49 1.20m 775
.005
.995
114 Sn 50 stable
114 Sb 51 3.49m 3934
114 Te 52 15.2m 1947
114 I 53 2.1s 6080
114 Xe 54 10.0s 2052
114 Cs 55 0.57s 710
(β+,p).19352
.80619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115 Ag 47 20.0m 1583
115m Cd 48 44.6d 636
115 Cd 48 2.23d 510
115m In 49 4.49h 331
115 In 49 4+16s 153
115 Sn 50 stable
116m In 49 54.2m 2784
116 Mo 42 0.12s 7260
116 Tc 43 0.12s 7260
116 Ru 44 1.70s 2833
116 Rh 45 0.95s 5189
116m Rh 45 0.90s 4992
116 Pd 46 12.72s 1266
116m Ag 47 10.4s 4061
116 Ag 47 2.68m 3789
116 Cd 48 stable
116 In 49 14.1s 1385
116 Sn 50 stable
117 Mo 42
117 Tc 43 0.15s 5695
117 Ru 44 0.34s 4731
117 Rh 45 1.22s 3667
117 Pd 46 5.00s 3002
117m Ag 47 5.34s 2298
117 Ag 47 1.21m 2521
117m Cd 48 3.36h 2235
117 Cd 48 2.49h 1510
117m In 49 1.94h 522
117 In 49 43.8m 954
117m Sn 50 13.6d 314
117 Sn 50 stable
118 Tc 43 0.08s 7712
118 Ru 44 0.66s 3230
118 Rh 45 0.32s 5600
118 Pd 46 3.1s 1759
118m Ag 47 2.00s 2751
118 Ag 47 3.76s 4088
118 Cd 48 50.3m 264
118m In 49 4.45m 3282
118 In 49 5.00s 1848
118 Sn 50 stable
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119 Ru 44 0.19s 5252
119 Rh 45 0.47s 4113
119 Pd 46 1.76s 3448
119m Ag 47 2.20m 3054
119 Ag 47 2.10s 3296
119m Cd 48 2.20m 3054
119 Cd 48 2.69m 2472
119m In 49 18.0m 1107
119 In 49 2.40m 1370
119m Sn 50 293.0d 87
119 Sn 50 stable
120 Tc 43
120 Ru 44 0.35s 4346
120 Rh 45 0.17s 6127
120 Pd 46 3.91s 2157
120m Ag 47 0.32s 3457
120 Ag 47 1.17s 5168
120m In 49 46.2s 3922
120 In 49 3.08s 2759
120 Sn 50 stable
121 Ru 44
121 Rh 45 0.25s 4597
121 Pd 46 0.64s 3974
121 Ag 47 0.80s 3739
121m Cd 48 4.80s 3648
121 Cd 48 13.5s 3179
121m In 49 3.88m 1598
121 In 49 23.1s 1912
121m Sn 50 55.0a 39
121 Sn 50 1.13d 115
122 Ru 44
122 Rh 45 0.11s 6486
122 Pd 46 1.41s 2572
122m Ag 47 1.50s 5688
122 Ag 47 0.48s 5560
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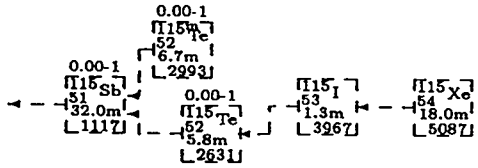
122 In 49 10.3s 4065
122 In 49 1.50s 3605
122 Sn 50 stable


0.00-1
115m Te
52
6.7m
2293
0.00-1
115 Sb
51
32.0m
1117
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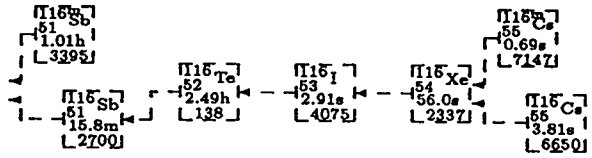
52
5.8m
2631
115 I
53
1.3m
3967
115 Xe
54
18.0m
5087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3395
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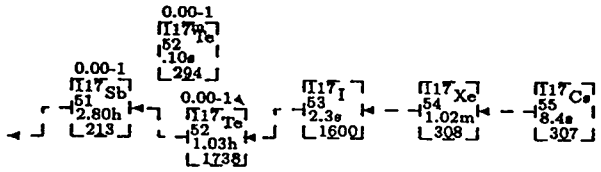
51
15.8m
2700
116 Te
52
2.49h
138
116 I
53
2.91s
4075
116 Xe
54
56.0s
2337
116m Cs
55
0.69s
7147
116 Cs
55
3.81s
6650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51
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213
0.00-1
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1738
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53
2.3s
1600
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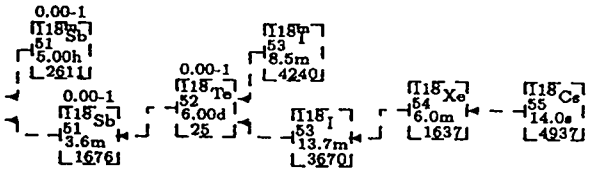
1.02m
308
117 Cs
55
8.4s
307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51
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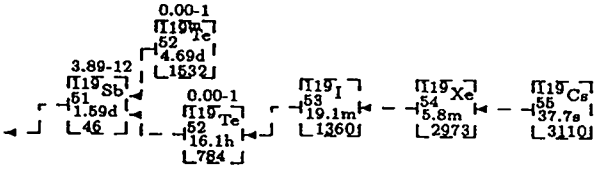
2611
118m I
53
8.5m
4240
0.00-1
118 Te
52
6.00d
25
0.00-1
118 Sb
51
3.6m
1676
118 I
53
13.7m
3670
118 Xe
54
6.0m
1637
118 Cs
55
14.0s
4937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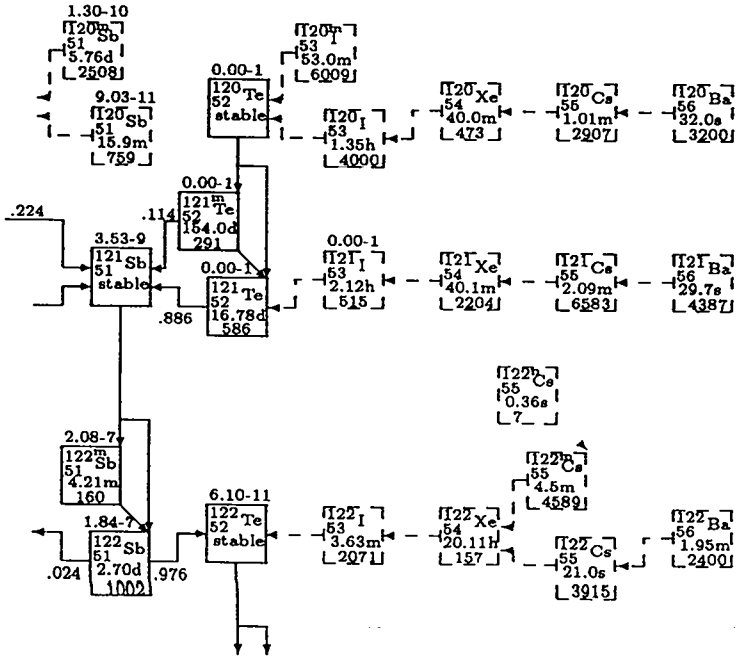
52
4.69d
1532
3.89-12
119 Sb
51
1.59d
46
0.00-1
119 Te
52
16.1h
784
119 I
53
19.1m
1360
119 Xe
54
5.8m
2973
119 Cs
55
37.7s
3110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120m Sb
51
5.76d
2508
120m I
53
53.0m
6009
0.00-1
120 Te
52
stable
9.03-11
120 Sb
51
15.9m
759
120 I
53
1.35h
4000
120 Xe
54
40.0m
473
120 Cs
55
1.01m
2907
120 Ba
56
32.0s
3200
.224
.114
0.00-1
121m Te
52
154.0d
291
3.53-9
121 Sb
51
stable
0.00-1
121 Te
52
16.78d
586
.886
121 I
53
2.12h
515
121 Xe
54
40.1m
2204
121 Cs
55
2.09m
6583
121 Ba
56
29.7s
4387
122m Cs
55
0.36s
7
2.08-7
122m Sb
51
4.21m
160
122m Cs
55
4.5m
4589
6.10-11
122 Te
52
stable
1.84-7
122 Sb
51
2.70d
1002
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122 I
53
3.63m
2071
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20.11h
157
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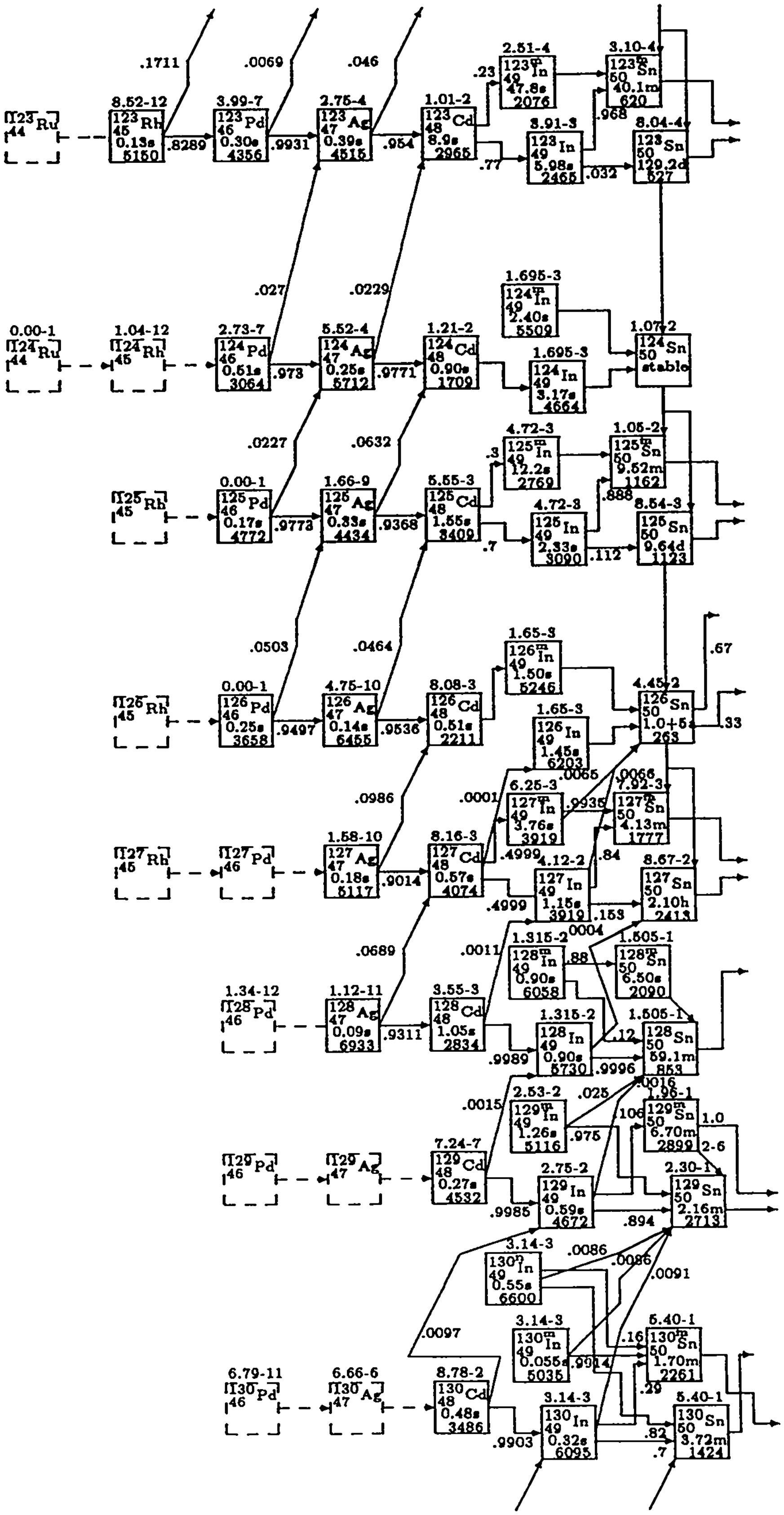
21.0s
3915
122 Ba
56
1.95m
2400



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2.75-4 123 Ag 47 0.39s 4515
1.01-2 123 Cd 48 8.9s 2965
2.51-4 123m In 49 47.8s 2076
3.91-3 123 In 49 5.98s 2465
3.10-4 123m Sn 50 40.1m 620
8.04-4 123 Sn 50 129.2d 527
.1711 .8289 .0069 .9931 .046 .954 .23 .77 .968 .032
0.00-1 124 Ru 44
1.04-12 124 Rh 45
2.73-7 124 Pd 46 0.51s 3064
5.52-4 124 Ag 47 0.25s 5712
1.21-2 124 Cd 48 0.90s 1709
1.695-3 124m In 49 2.40s 5509
1.695-3 124 In 49 3.17s 4664
1.07-2 124 Sn 50 stable
.027 .973 .0229 .9771
125 Rh 45
0.00-1 125 Pd 46 0.17s 4772
1.66-9 125 Ag 47 0.33s 4434
5.55-3 125 Cd 48 1.55s 3409
4.72-3 125m In 49 12.2s 2769
4.72-3 125 In 49 2.33s 3090
1.05-2 125m Sn 50 9.52m 1162
8.54-3 125 Sn 50 9.64d 1123
.0227 .9773 .0632 .9368 .3 .7 .888 .112
126 Rh 45
0.00-1 126 Pd 46 0.25s 3658
4.75-10 126 Ag 47 0.14s 6455
8.08-3 126 Cd 48 0.51s 2211
1.65-3 126m In 49 1.50s 5246
1.65-3 126 In 49 1.45s 6203
4.45-2 126 Sn 50 1.0+5y 263
.0503 .9497 .0464 .9536 .67 .33
127 Rh 45
127 Pd 46
1.58-10 127 Ag 47 0.18s 5117
8.16-3 127 Cd 48 0.57s 4074
6.25-3 127m In 49 3.76s 3919
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7.92-3 127m Sn 50 4.13m 1777
8.67-2 127 Sn 50 2.10h 2413
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1.34-12 128 Pd 46
1.12-11 128 Ag 47 0.09s 6933
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1.315-2 128m In 49 0.90s 6058
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2.53-2 129m In 49 1.26s 5116
2.75-2 129 In 49 0.59s 4672
1.96-1 129m Sn 50 6.70m 2899
2.30-1 129 Sn 50 2.16m 2713
.0015 .9985 .025 .975 .106 .894 1.0 2-6
6.79-11 130 Pd 46
6.66-6 130 Ag 47
8.78-2 130 Cd 48 0.48s 3486
3.14-3 130n In 49 0.55s 6600
3.14-3 130m In 49 0.055s 5035
3.14-3 130 In 49 0.32s 6095
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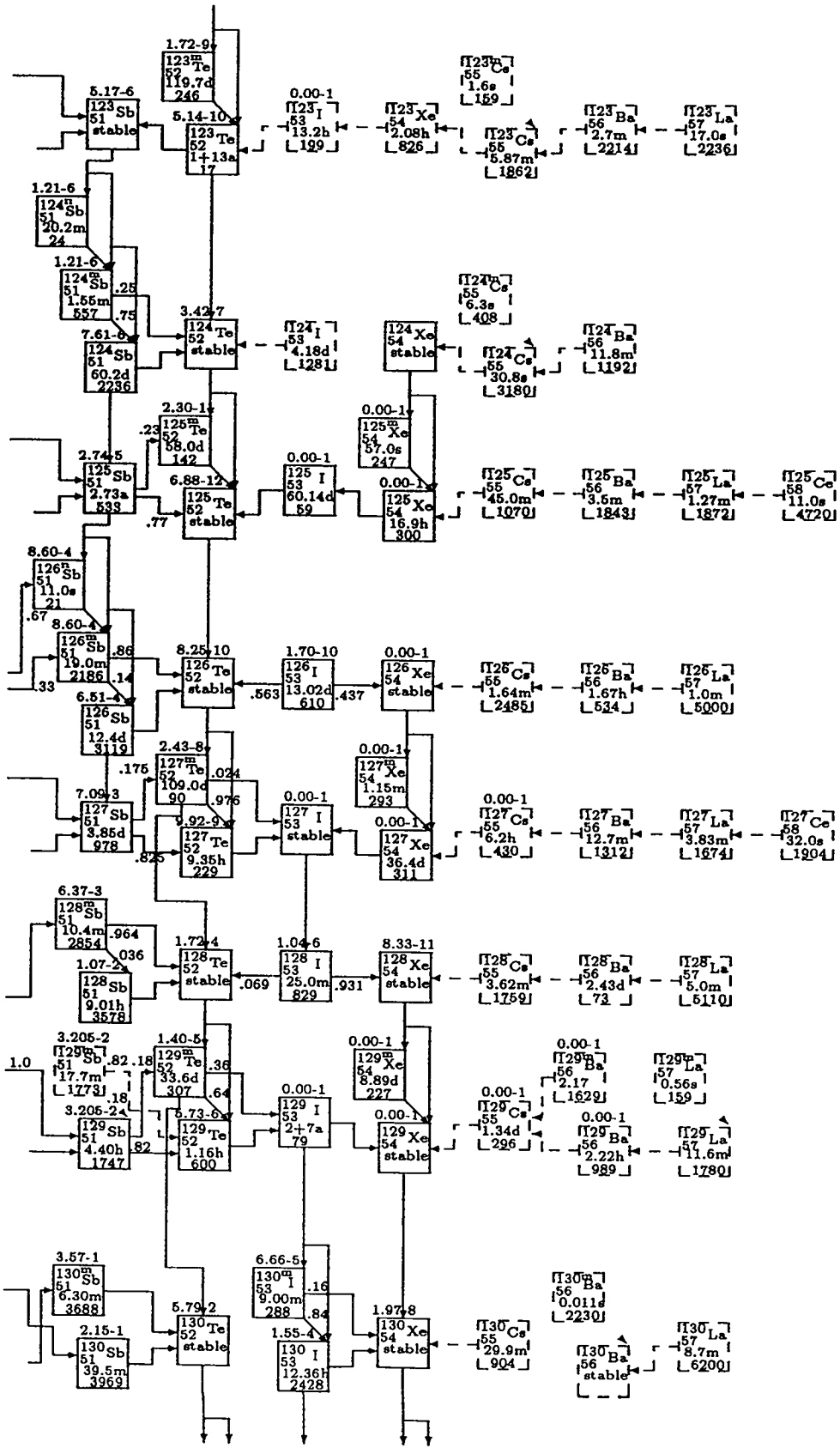
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123La 57 17.0s 2236
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125La 57 1.27m 1872
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126Sb 51 12.4d 3119
126Te 52 stable
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126Xe 54 stable
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126Ba 56 1.67h 534
126La 57 1.0m 5000
127mTe 52 109.0d 90
127Sb 51 3.85d 978
127Te 52 9.35h 229
127I 53 stable
127Xe 54 36.4d 311
127mXe 54 1.15m 293
127Cs 55 6.2h 430
127Ba 56 12.7m 1312
127La 57 3.83m 1674
127Ce 58 32.0s 1904
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128Sb 51 9.01h 3578
128Te 52 stable
128I 53 25.0m 829
128Xe 54 stable
128Cs 55 3.62m 1759
128Ba 56 2.43d 73
128La 57 5.0m 5110
129mSb 51 17.7m 1773
129Sb 51 4.40h 1747
129Te 52 1.16h 600
129mTe 52 33.6d 307
129I 53 2+7a 79
129Xe 54 stable
129mXe 54 8.89d 227
129Cs 55 1.34d 296
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129La 57 11.6m 1780
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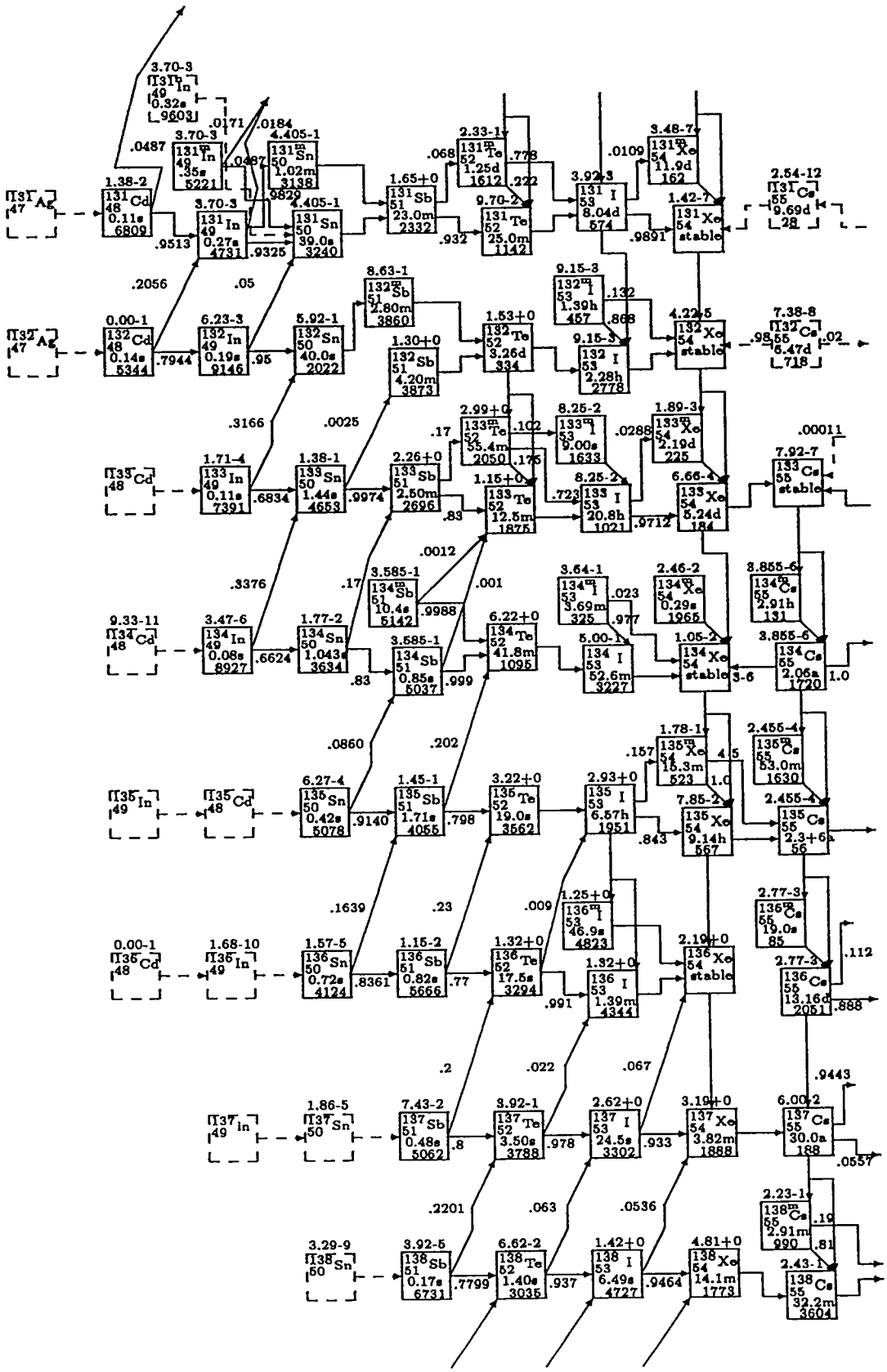

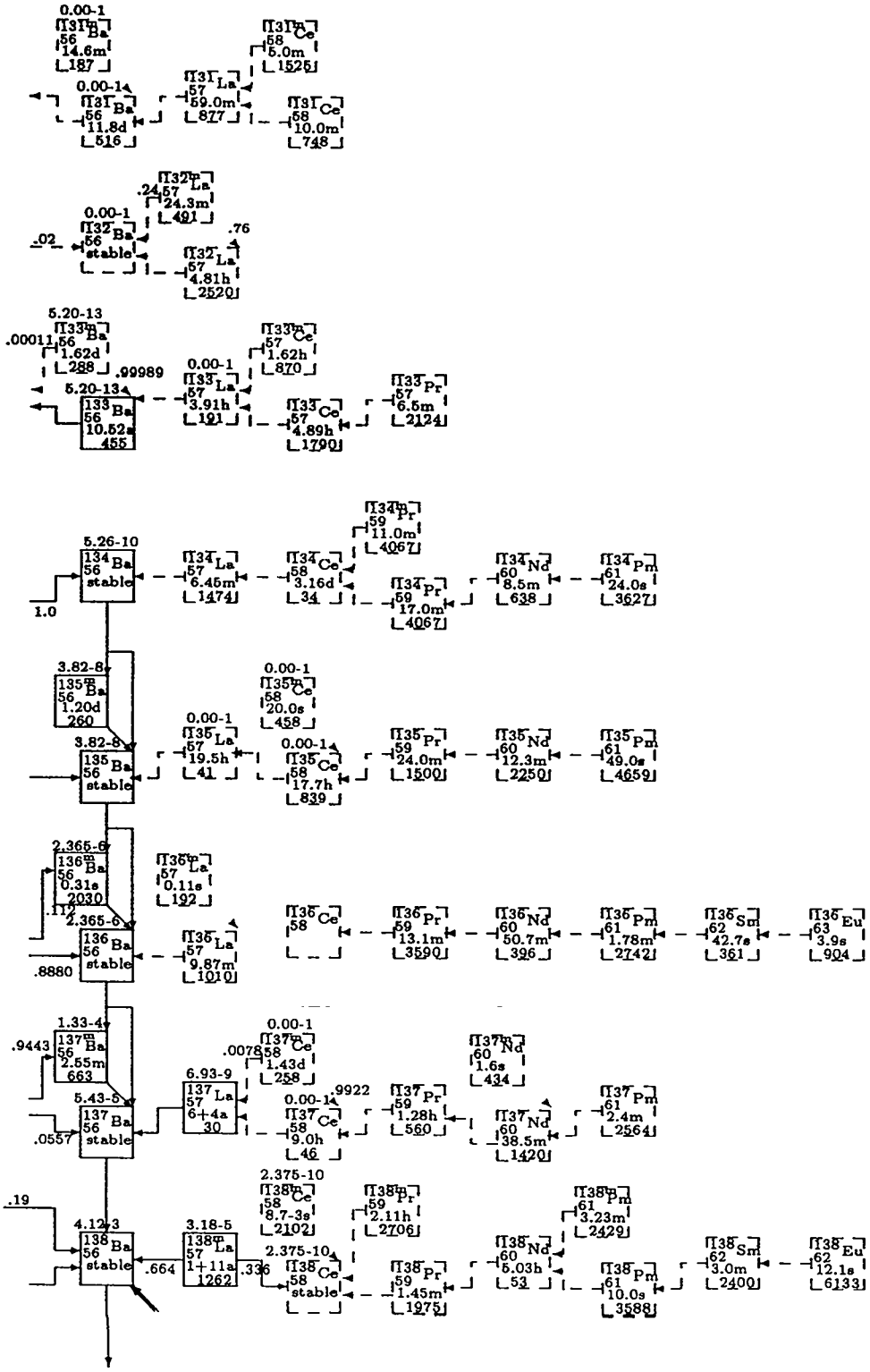
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.02
.76
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5.20-13
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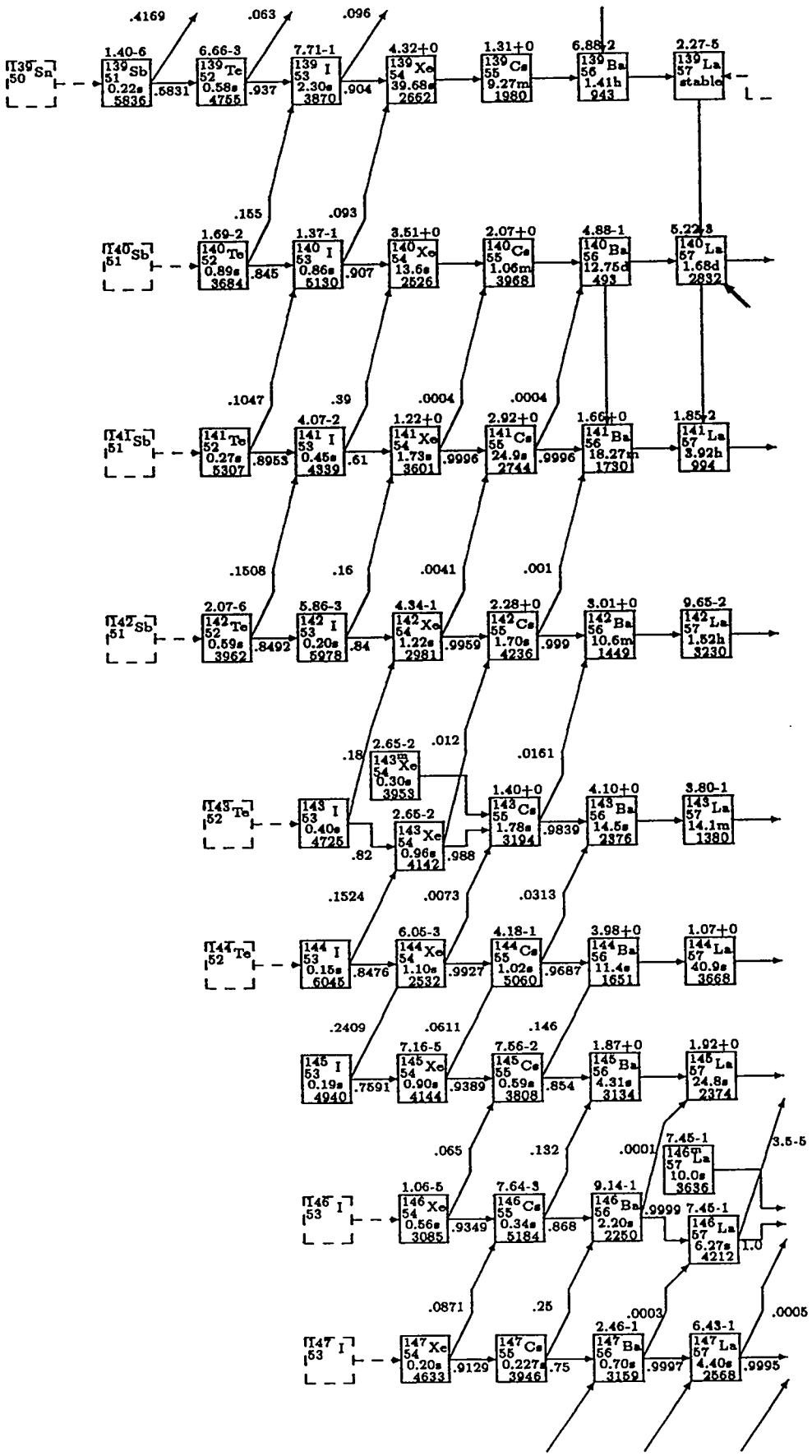
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1.31+0
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2.27-5
139 La 57 stable
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.155
.093
1.69-2
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140 I 53 0.86s 5130
3.51+0
140 Xe 54 13.6s 2526
2.07+0
140 Ce 55 1.06m 3968
4.88-1
140 Ba 56 12.75d 493
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.1047
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141 Xe 54 1.73s 3601
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1.66+0
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.16
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1.07+0
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.0611
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7.16-5
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1.06-5
146 Xe 54 0.56s 3085
7.64-3
146 Ce 55 0.34s 5184
9.14-1
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7.45-1
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6.43-1
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147 I 53
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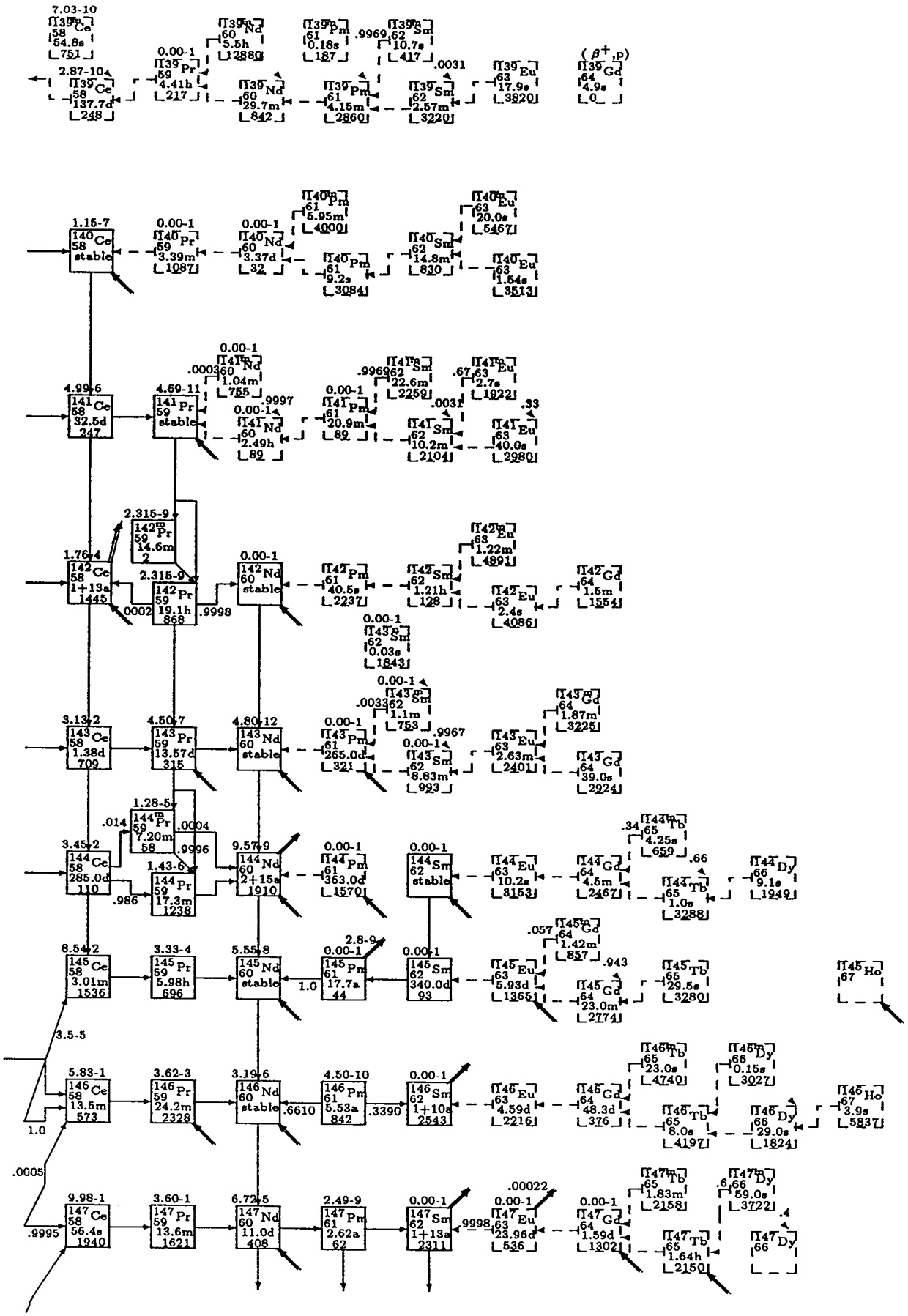
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139 Sm 62 2.57m 3220
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(β+,p)
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4.69-11
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0.00-1
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141 Sm 62 22.6m 2250
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141 Sm 62 10.2m 2104
.67
141 Eu 63 2.7s 1922
.33
141 Eu 63 40.0s 2980
1.76-4
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2.315-9
142m Pr 59 14.6m 2
2.315-9
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142 Eu 63 2.4s 4086
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0.00-1
143 Sm 62 0.03s 1843
3.13-2
143 Ce 58 1.38d 709
4.50-7
143 Pr 59 13.57d 315
4.80-12
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144 Pr 59 17.3m 1238
9.57-9
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144 Gd 64 4.5m 2467
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145 Pr 59 5.98h 696
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145 Nd 60 stable
2.8-9
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0.00-1
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145m Gd 64 1.42m 857
145 Eu 63 5.93d 1365
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3.5-5
5.83-1
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146 Gd 64 48.3d 376
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0.00-1
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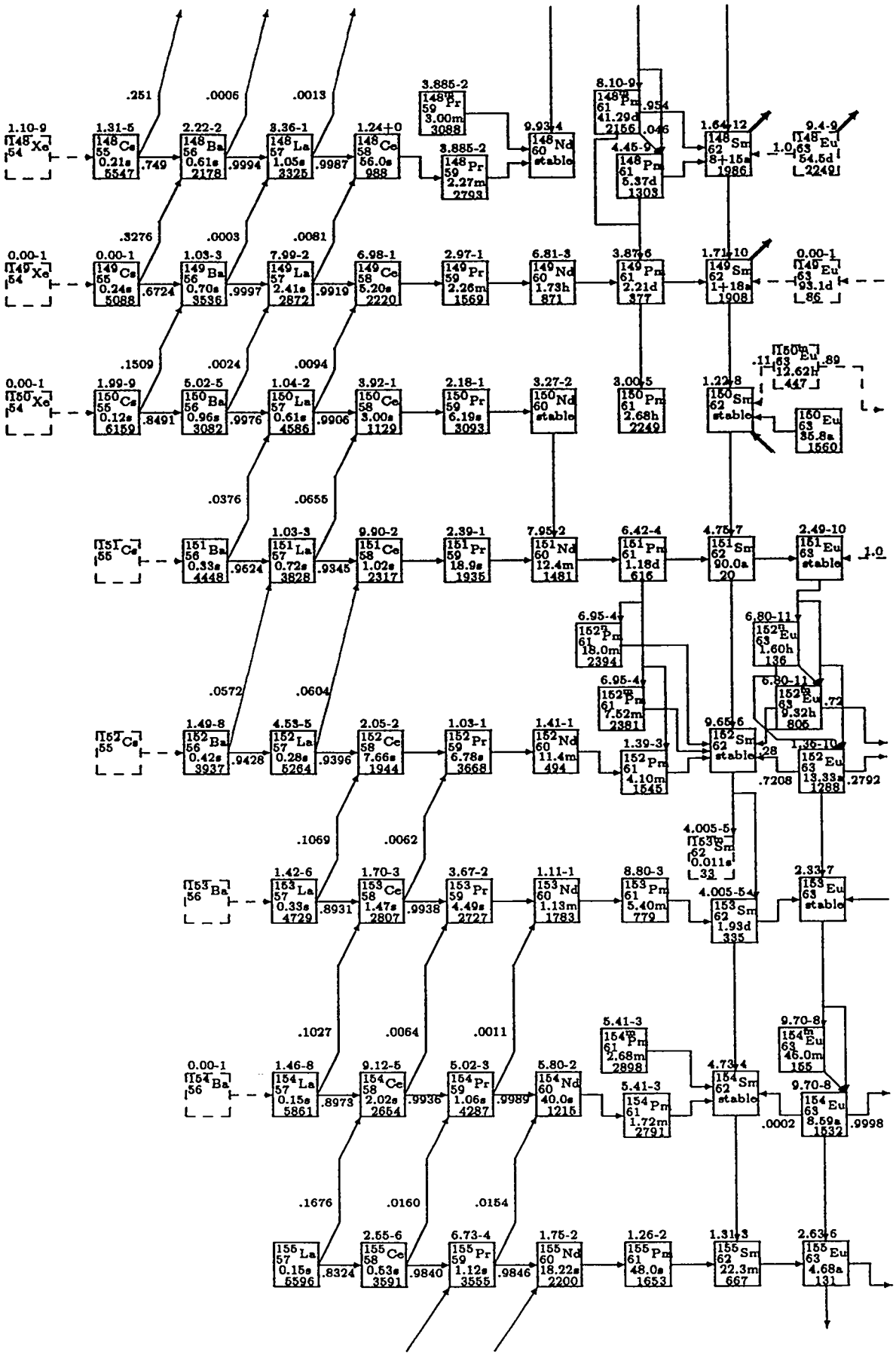

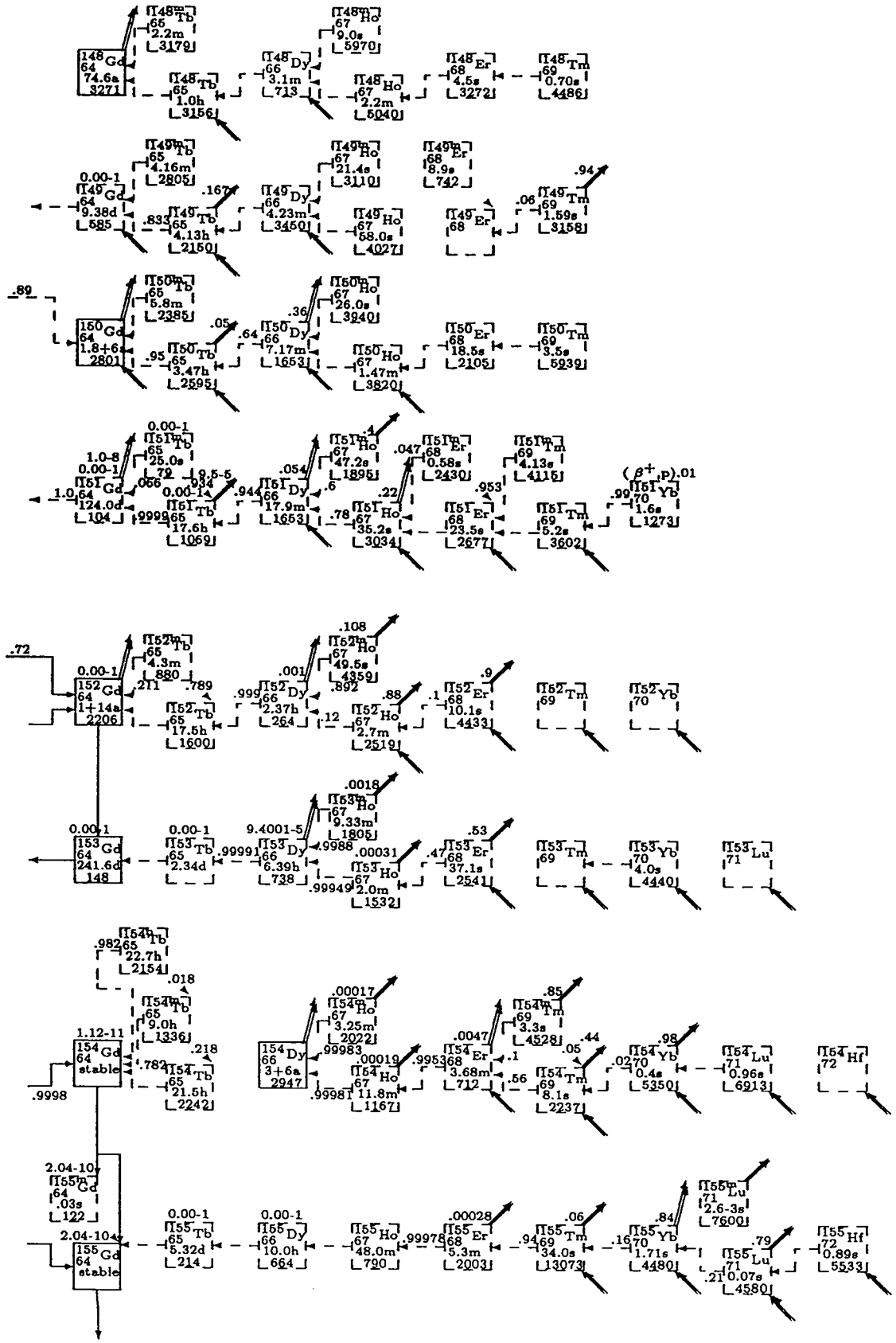

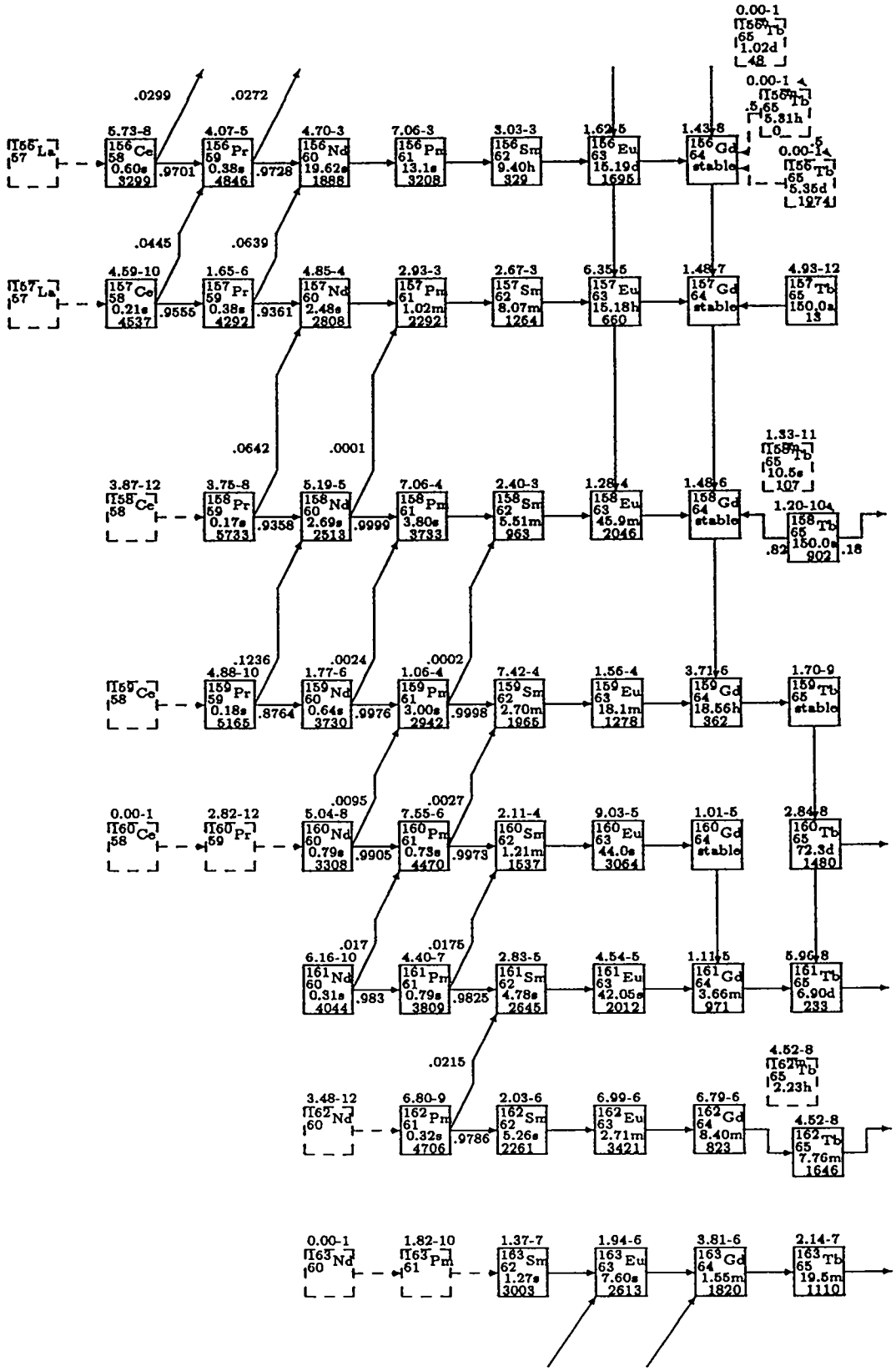
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157Eu 63 15.18h 660
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158Eu 63 45.9m 2046
158Gd 64 stable
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161Pm 61 0.79s 3809
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161Eu 63 42.05s 2012
161Gd 64 3.66m 971
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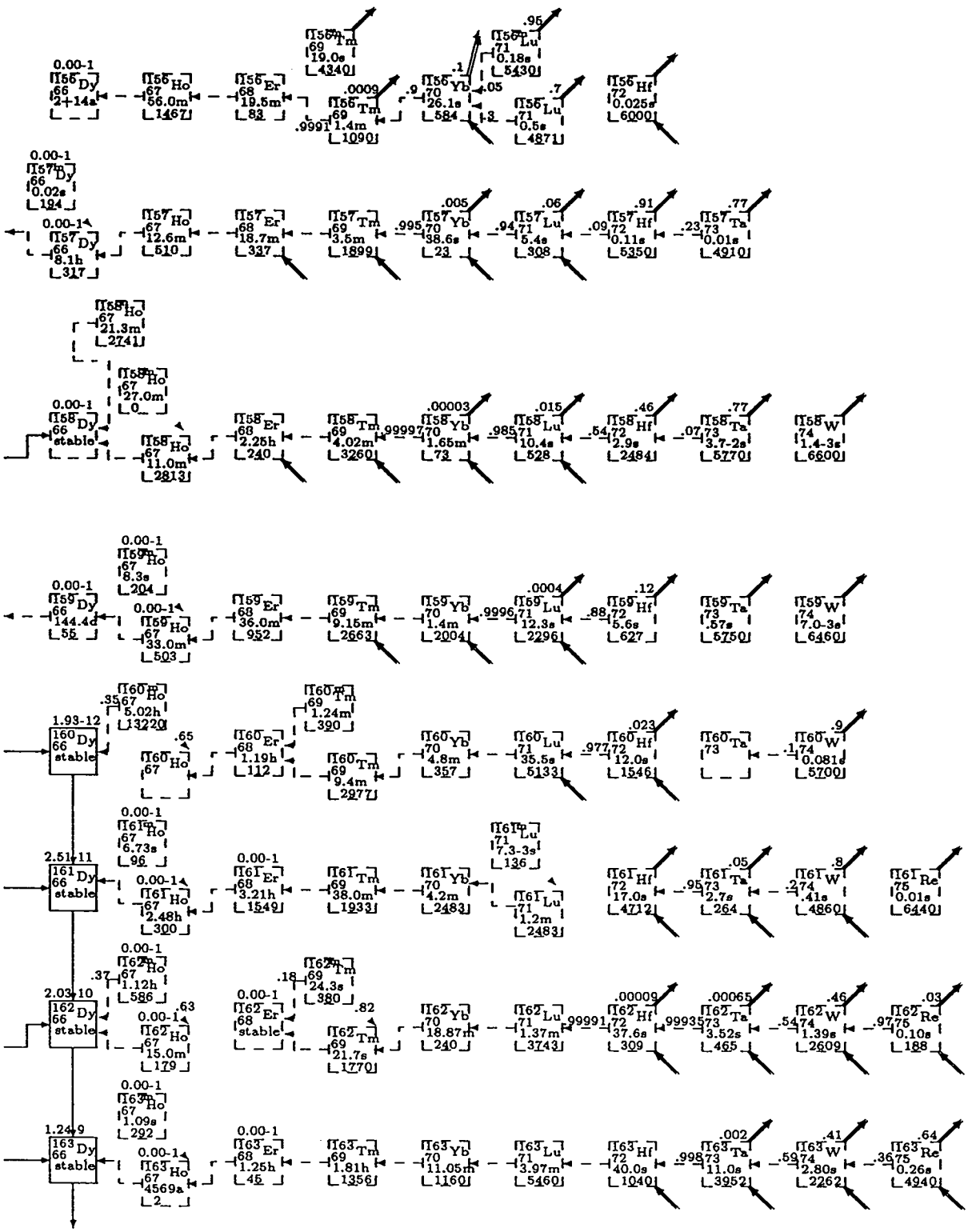

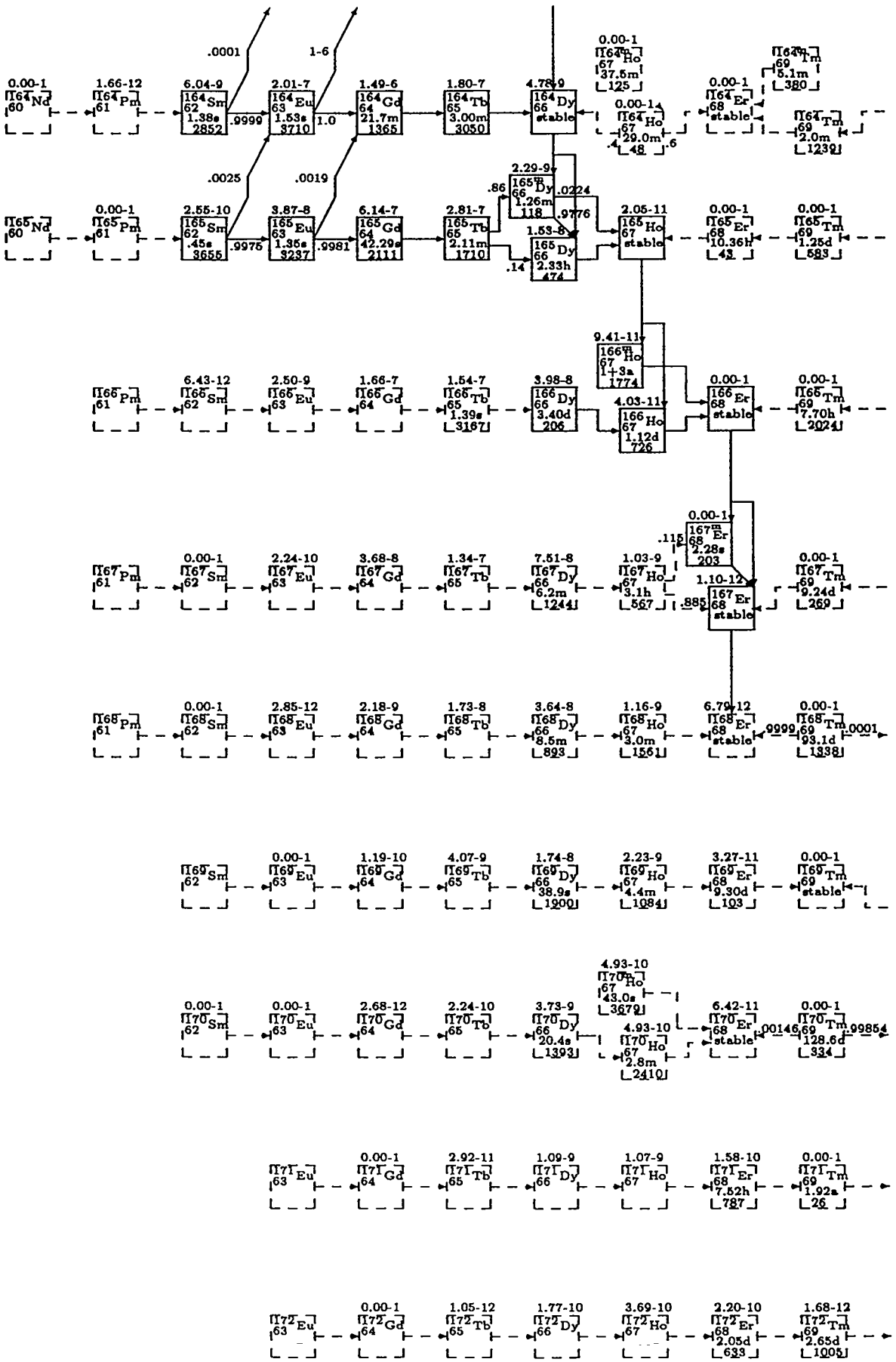
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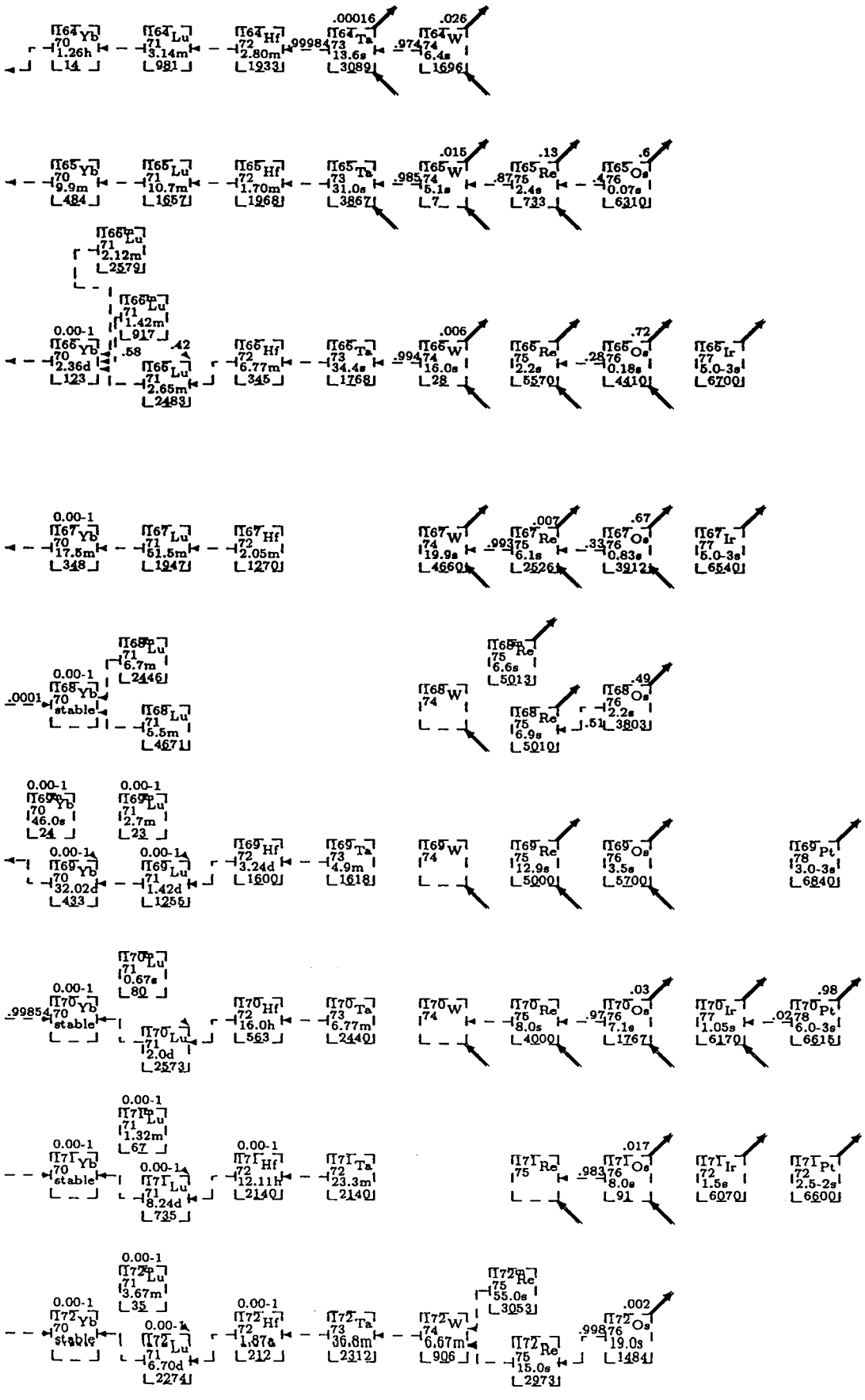
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.026
Yb 70 9.9m 484
Lu 71 10.7m 1657
Hf 72 1.70m 1968
Ta 73 31.0s 3867
.985 W 74 6.1s 7
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.87775 Re 75 2.4s 733
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.476 Os 76 0.07s 6310
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Lu 71 2.12m 2579
Lu 71 1.42m 917
0.00-1
Yb 70 2.36d 123
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Lu 71 2.65m 2483
Hf 72 6.77m 345
Ta 73 34.4s 1768
.994 W 74 16.0s 28
.006
Re 75 2.2s 5570
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.72
Ir 77 5.0-3s 6700
0.00-1
Yb 70 17.5m 348
Lu 71 51.5m 1947
Hf 72 2.05m 1270
W 74 19.9s 4660
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.007
.33 Os 76 0.83s 3912
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Ir 77 6.0-3s 6540
Lu 71 6.7m 2446
0.00-1
.0001 Yb 70 stable
Lu 71 6.5m 4671
W 74
Re 75 6.6s 5013
Re 75 6.9s 5010
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.49
0.00-1
Yb 70 46.0s 24
0.00-1
Lu 71 2.7m 23
0.00-1
Yb 70 32.02d 433
0.00-1
Lu 71 1.42d 1255
Hf 72 3.24d 1600
Ta 73 4.9m 1618
W 74
Re 75 12.9s 5000
Os 76 3.5s 5700
Pt 78 3.0-3s 6840
Lu 71 0.67s 80
0.00-1
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Lu 71 2.0d 2573
Hf 72 16.0h 563
Ta 73 6.77m 2440
W 74
Re 75 8.0s 4000
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.03
Ir 77 1.05s 6170
.02 Pt 78 6.0-3s 6615
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0.00-1
Lu 71 1.32m 67
0.00-1
Yb 70 stable
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Lu 71 8.24d 735
0.00-1
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Ta 72 23.3m 2140
Re 75
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Ir 72 1.5s 6070
Pt 72 2.5-2s 6600
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Lu 71 3.67m 35
0.00-1
Yb 70 stable
0.00-1
Lu 71 6.70d 2274
0.00-1
Hf 72 1.87a 212
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Re 75 55.0s 3053
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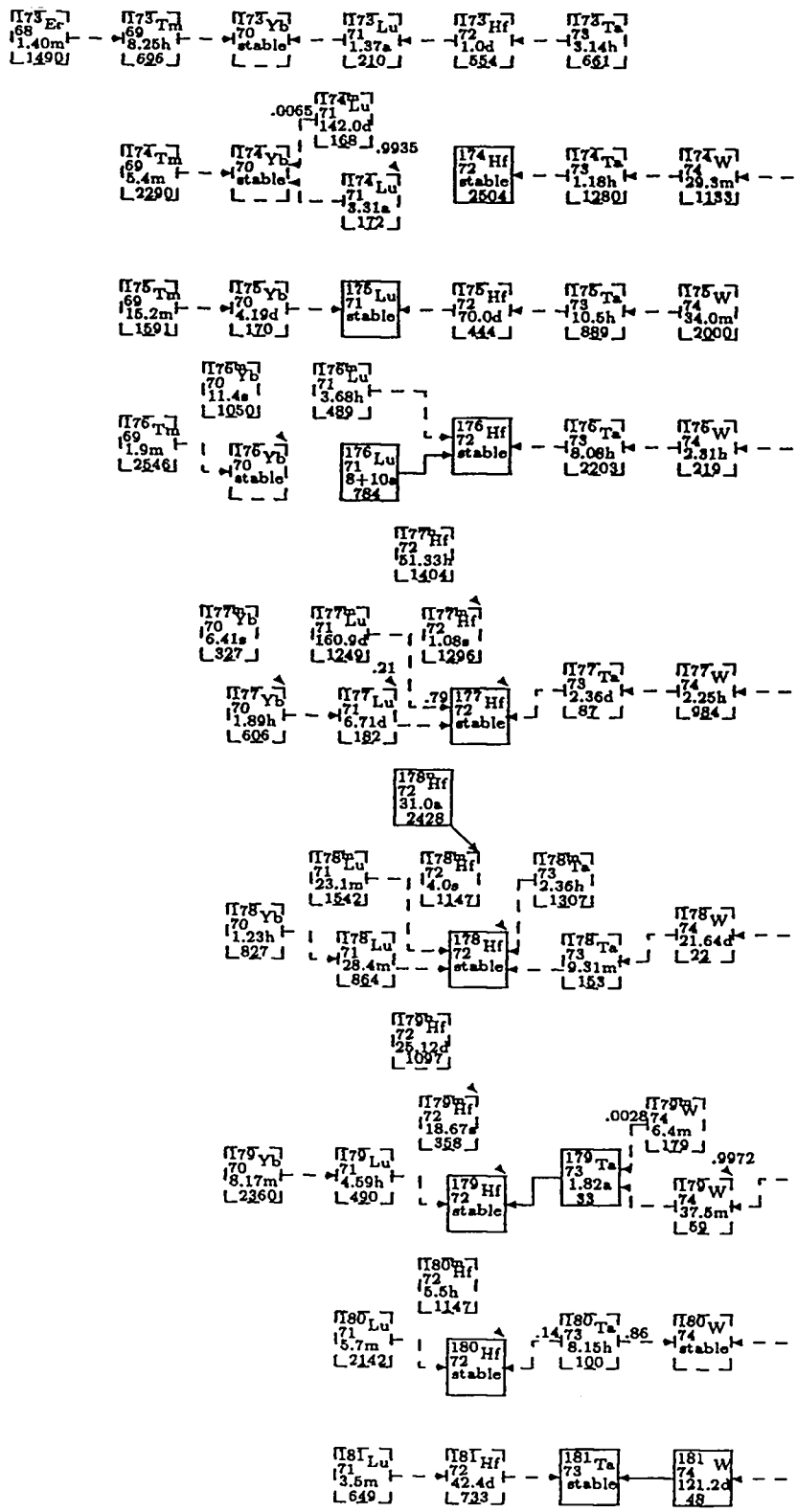
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174 Lu 71 142.0d 168
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174 Yb 70 stable
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174 Hf 72 stable 2504
174 Ta 73 1.18h 1280
174 W 74 29.3m 1133
175 Tm 69 15.2m 1591
175 Yb 70 4.19d 170
175 Lu 71 stable
175 Hf 72 70.0d 444
175 Ta 73 10.5h 889
175 W 74 34.0m 2000
176 Yb 70 11.4s 1050
176 Lu 71 3.68h 489
176 Tm 69 1.9m 2546
176 Yb 70 stable
176 Lu 71 8+10a 784
176 Hf 72 stable
176 Ta 73 8.08h 2203
176 W 74 2.31h 219
177 Hf 72 51.33h 1404
177 Yb 70 6.41s 327
177 Lu 71 160.9d 1249
177 Hf 72 1.08s 1296
177 Yb 70 1.89h 606
177 Lu 71 6.71d 182
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177 Hf 72 stable
177 Ta 73 2.36d 87
177 W 74 2.25h 984
178 Hf 72 31.0a 2428
178 Lu 71 23.1m 1542
178 Hf 72 4.0s 1147
178 Ta 73 2.36h 1307
178 Yb 70 1.23h 827
178 Lu 71 28.4m 864
178 Hf 72 stable
178 Ta 73 9.31m 153
178 W 74 21.64d 22
179 Hf 72 25.12d 1097
179 Hf 72 18.67s 358
179 W 74 6.4m 179
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179 Yb 70 8.17m 2360
179 Lu 71 4.59h 490
179 Hf 72 stable
179 Ta 73 1.82a 33
.9972
179 W 74 37.5m 52
180 Hf 72 5.5h 1147
180 Lu 71 5.7m 2142
180 Hf 72 stable
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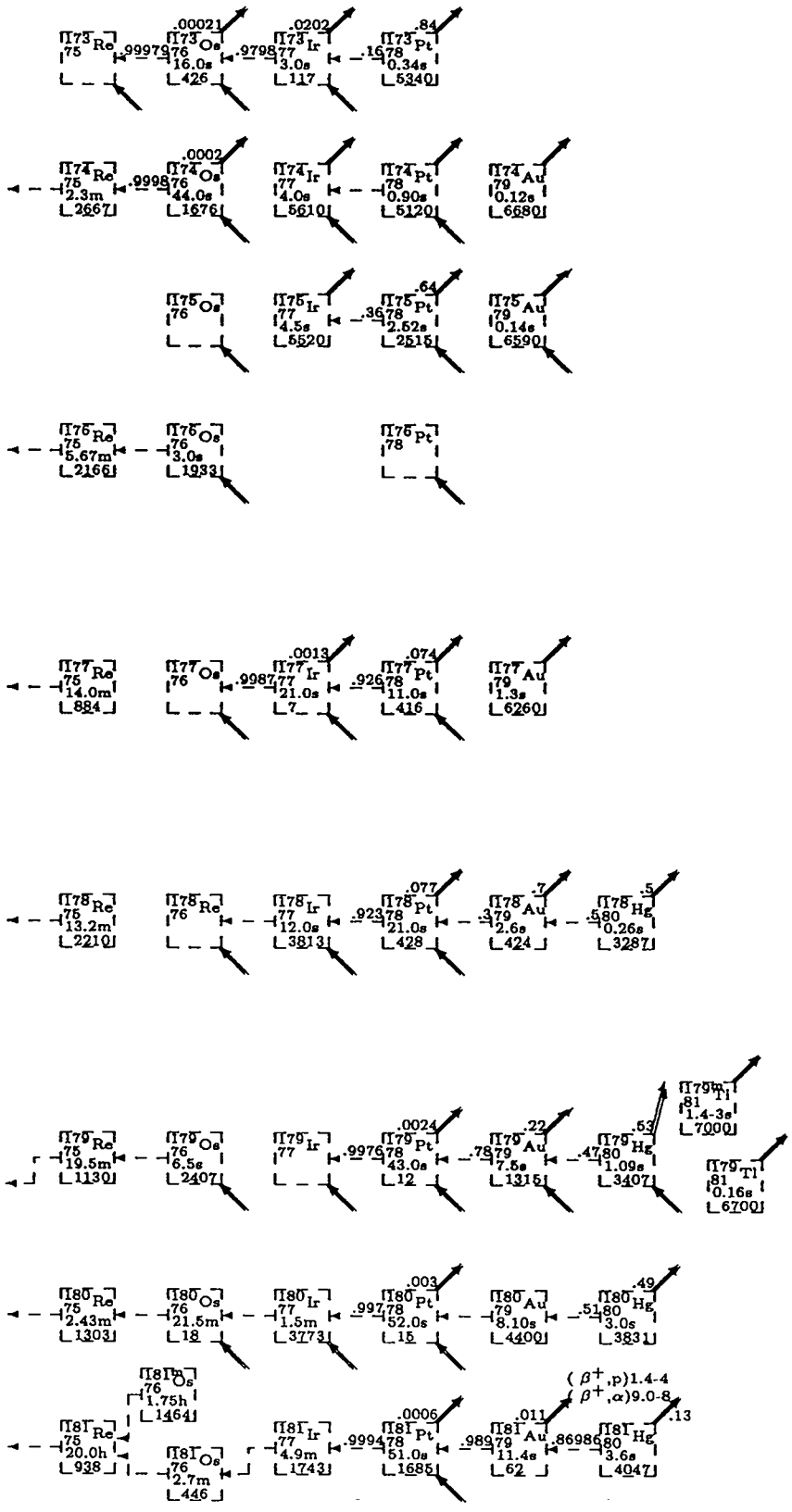
181 Hf 72 42.4d 723
181 Ta 73 stable
181 W 74 121.2d 48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174 Os 76 44.0s 1676
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174 Pt 78 0.90s 5120
174 Au 79 0.12s 6680
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175 Os 76
175 Ir 77 4.5s 5520
175 Pt 78 2.62s 2515
175 Au 79 0.14s 6590
.64
.36
176 Re 75 5.67m 2166
176 Os 76 3.0s 1933
176 Pt 78
177 Re 75 14.0m 884
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177 Ir 77 21.0s 7
177 Pt 78 11.0s 416
177 Au 79 1.3s 6260
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178 Re 76
178 Ir 77 12.0s 3813
178 Pt 78 21.0s 428
178 Au 79 2.6s 424
178 Hg 80 0.26s 3287
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179 Re 75 19.5m 1130
179 Os 76 6.5s 2407
179 Ir 77
179 Pt 78 43.0s 12
179 Au 79 7.5s 1315
179 Hg 80 1.09s 3407
179m Tl 81 1.4-3s 7000
179 Tl 81 0.16s 6700
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.78
.63
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180 Os 76 21.5m 18
180 Ir 77 1.5m 3773
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180 Au 79 8.10s 4400
180 Hg 80 3.0s 3831
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181 Ir 77 4.9m 1743
181 Pt 78 51.0s 1685
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(β+,α)9.0-8
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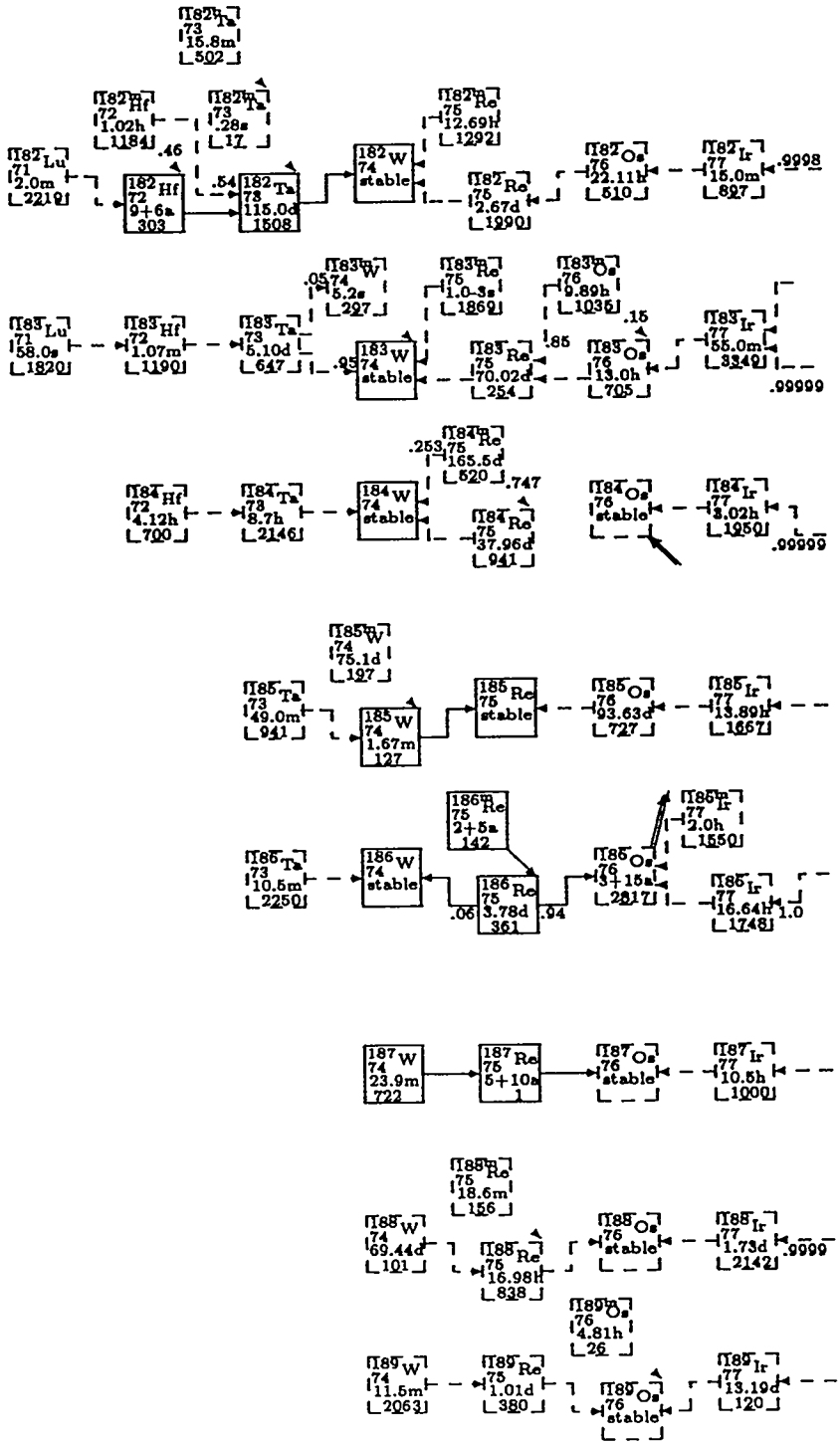
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182Os 76 22.11h 510
182Ir 77 15.0m 827
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183W 74 5.2s 227
183Re 75 1.0-3s 1869
183Os 76 9.89h 1035
183Lu 71 58.0s 1820
183Hf 72 1.07m 1190
183Ta 73 5.10d 647
183W 74 stable
183Re 75 70.02d 254
183Os 76 13.0h 705
183Ir 77 55.0m 3342
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184Re 75 165.5d 620
184Hf 72 4.12h 700
184Ta 73 8.7h 2146
184W 74 stable
184Re 75 37.96d 941
184Os 76 stable
184Ir 77 3.02h 1950
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185W 74 75.1d 197
185Ta 73 49.0m 941
185W 74 1.67m 127
185Re 75 stable
185Os 76 93.63d 727
185Ir 77 13.89h 1657
186mRe 75 2+5a 142
186Ir 77 2.0h 1550
186Ta 73 10.5m 2250
186W 74 stable
186Re 75 3.78d 361
186Os 76 3+15a 2817
186Ir 77 16.64h 1748
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.94
1.0
187W 74 23.9m 722
187Re 75 5+10a
187Os 76 stable
187Ir 77 10.5h 1000
188mRe 75 18.6m 156
188W 74 69.44d 101
188Re 75 16.98h 838
188Os 76 stable
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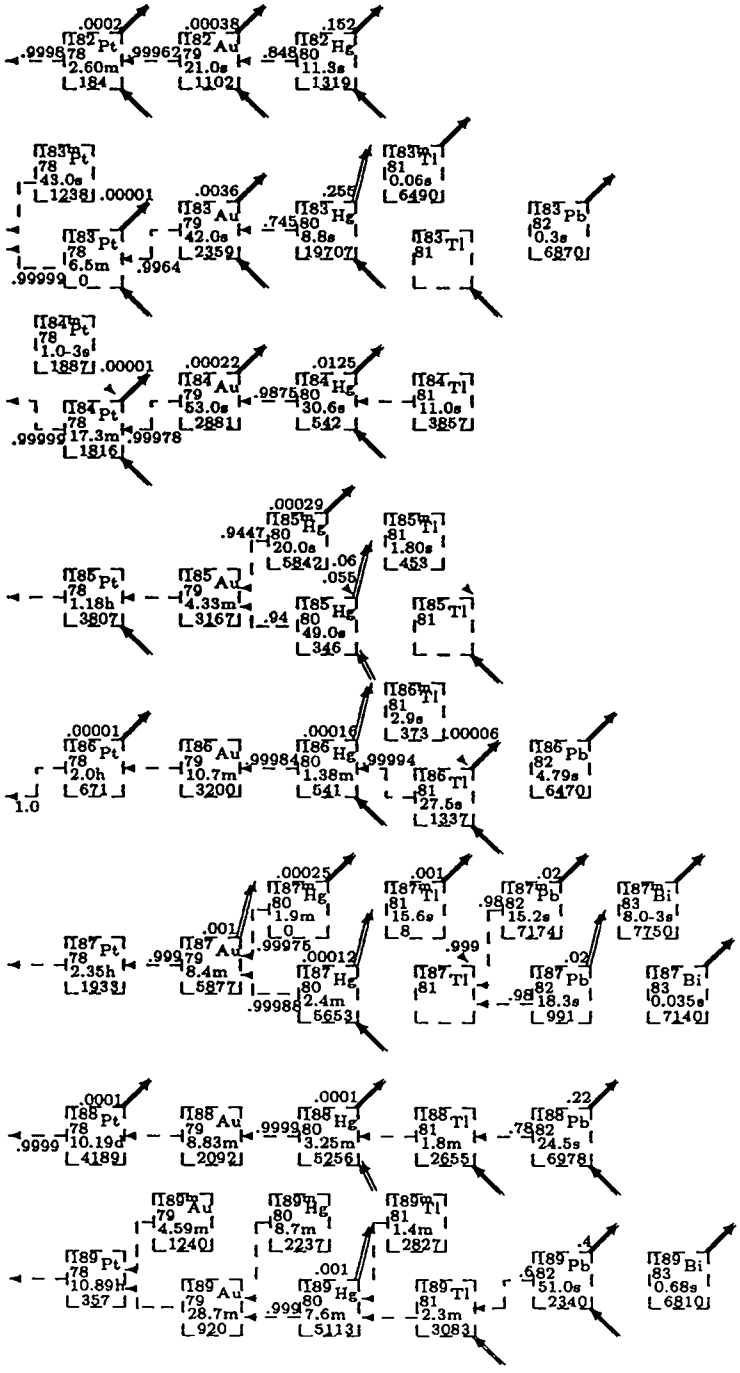
189W 74 11.5m 2063
189Re 75 1.01d 380
189Os 76 stable
189Ir 77 13.19d 120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80
11.3s
1319
183m Pt
78
43.0s
1238
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78
6.5m
0
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183 Au
79
42.0s
2359
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183 Hg
80
8.8s
1970
183m Tl
81
0.06s
6490
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81
183 Pb
82
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6870
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78
1.0-3s
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17.3m
1816
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53.0s
2881
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80
30.6s
542
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11.0s
3857
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80
20.0s
5842
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81
1.80s
453
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78
1.18h
3807
185 Au
79
4.33m
3167
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80
49.0s
346
185 Tl
81
185m Tl
81
2.9s
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2.0h
671
1.0
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79
10.7m
3200
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186 Hg
80
1.38m
541
.99994
186 Tl
81
27.5s
1337
186 Pb
82
4.79s
6470
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187m Hg
80
1.9m
0
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187m Tl
81
15.6s
8
.02
187m Pb
82
15.2s
7174
.9882
187m Bi
83
8.0-3s
7750
187 Pt
78
2.35h
1933
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79
8.4m
5877
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187 Hg
80
2.4m
5653
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187 Tl
81
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187 Pb
82
18.3s
991
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187 Bi
83
0.035s
7140
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78
10.19d
4189
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79
8.83m
2092
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188 Hg
80
3.25m
5256
188 Tl
81
1.8m
2655
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.22
188 Pb
82
24.5s
6978
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79
4.59m
1240
189m Hg
80
8.7m
2237
189m Tl
81
1.4m
2827
189 Pt
78
10.89h
357
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79
28.7m
920
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80
7.6m
5113
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189 Bi
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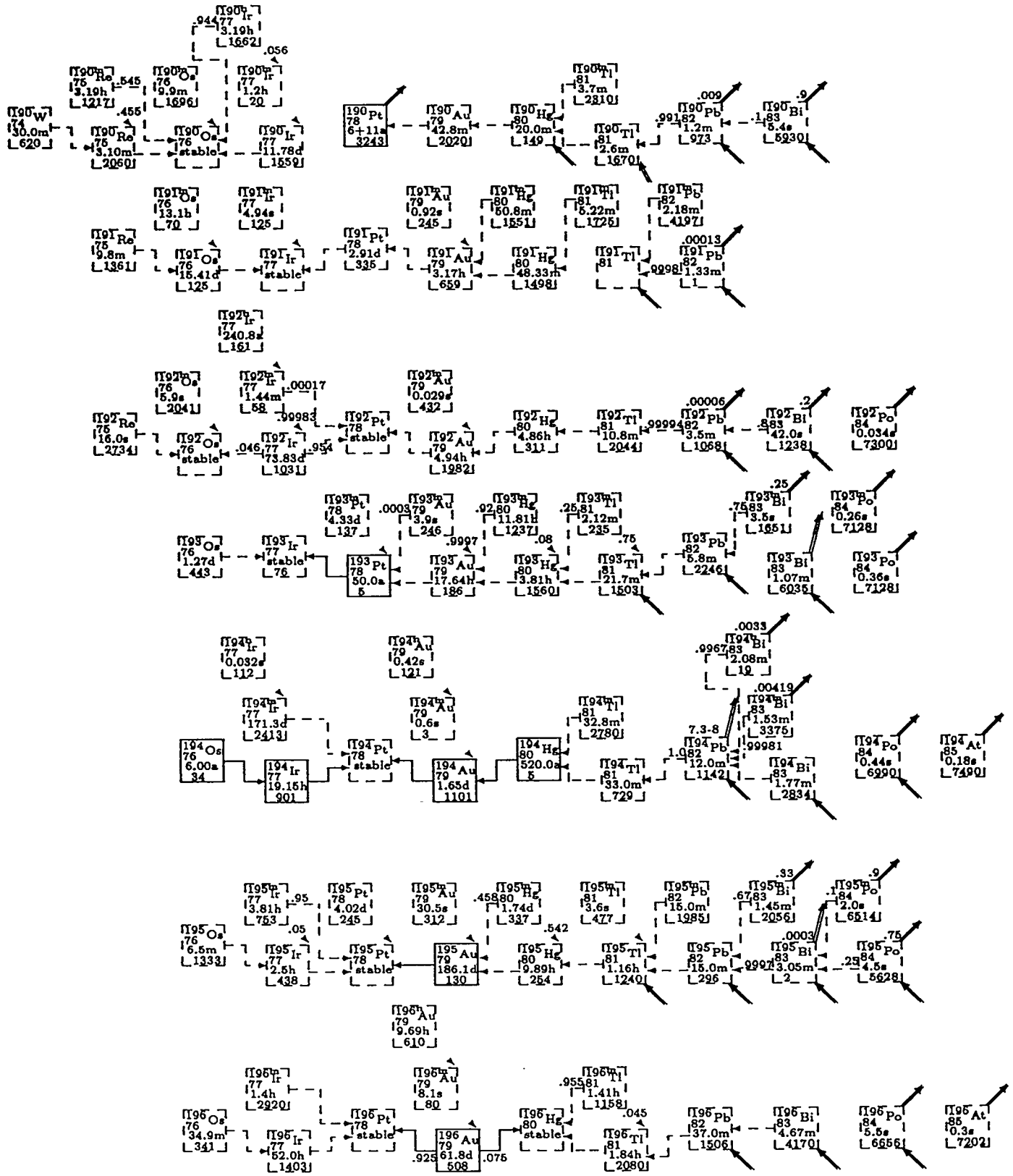

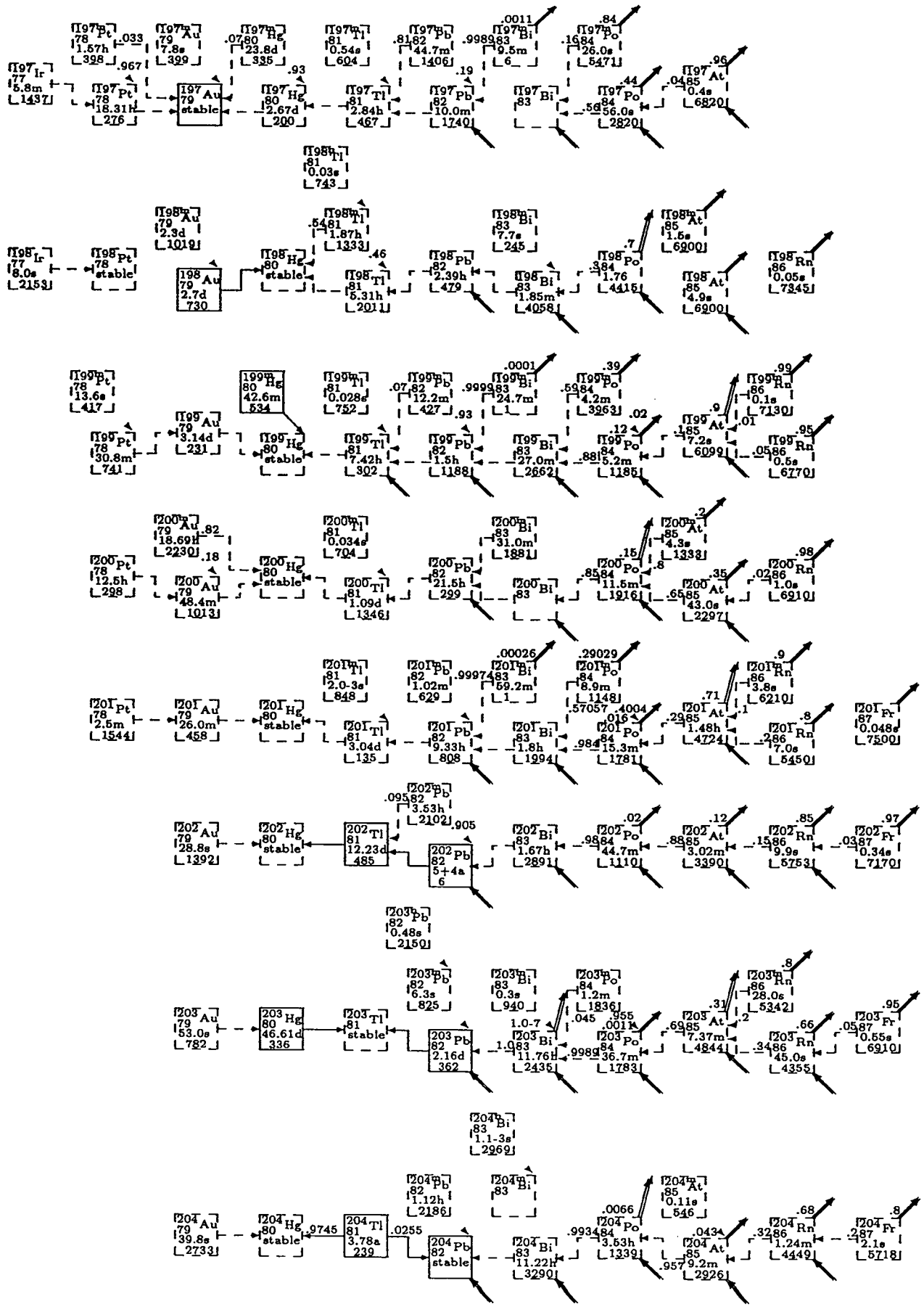
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197Po 84 56.0s 2820
197At 85 0.4s 6820
198Tl 81 0.03s 743
198Au 79 2.3d 1019
198Ir 77 8.0s 2153
198Pt 78 stable
198Au 79 2.7d 730
198Hg 80 stable
198Tl 81 5.31h 2011
198Pb 82 2.39h 479
198Bi 83 1.85m 4058
198Po 84 1.76 4415
198At 85 4.9s 6900
198Rn 86 0.05s 7345
199Pt 78 13.6s 417
199Hg 80 42.6m 534
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199Pt 78 30.8m 741
199Hg 80 stable
199Tl 81 7.42h 302
199Pb 82 1.5h 1188
199Bi 83 27.0m 2662
199Po 84 5.2m 1185
199At 85 7.2s 6099
199Rn 86 0.1s 7130
199Fr 87 0.5s 6770
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200Au 79 48.4m 1013
200Hg 80 stable
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200Bi 83
200Po 84 11.5m 1916
200At 85 43.0s 2297
200Rn 86 1.0s 6910
201Tl 81 2.0-3s 848
201Pb 82 1.02m 629
201Bi 83 69.2m 1
201Po 84 8.9m 1148
201At 85 4.3s 1338
201Rn 86 3.8s 6210
201Fr 87 0.048s 7500
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201Hg 80 stable
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201Bi 83 1.8h 1994
201Po 84 15.3m 1781
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201Rn 86 7.0s 5450
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202Au 79 28.8s 1392
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202Pb 82 5+4a 6
202Bi 83 1.67h 2891
202Po 84 44.7m 1110
202At 85 3.02m 3390
202Rn 86 9.9s 5753
202Fr 87 0.34s 7170
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203Bi 83 0.3s 940
203Po 84 1.2m 1836
203At 85 7.37m 4844
203Rn 86 28.0s 5342
203Fr 87 0.55s 6910
203Au 79 53.0s 782
203Hg 80 46.61d 336
203Tl 81 stable
203Pb 82 2.16d 362
203Bi 83 11.76h 2435
203Po 84 36.7m 1783
203At 85
203Rn 86 45.0s 4355
204Bi 83 1.1-3s 2969
204Pb 82 1.12h 2186
204Bi 83
204At 85 0.11s 546
204Au 79 39.8s 2733
204Hg 80 stable
204Tl 81 3.78a 239
204Pb 82 stable
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204Po 84 3.53h 1339
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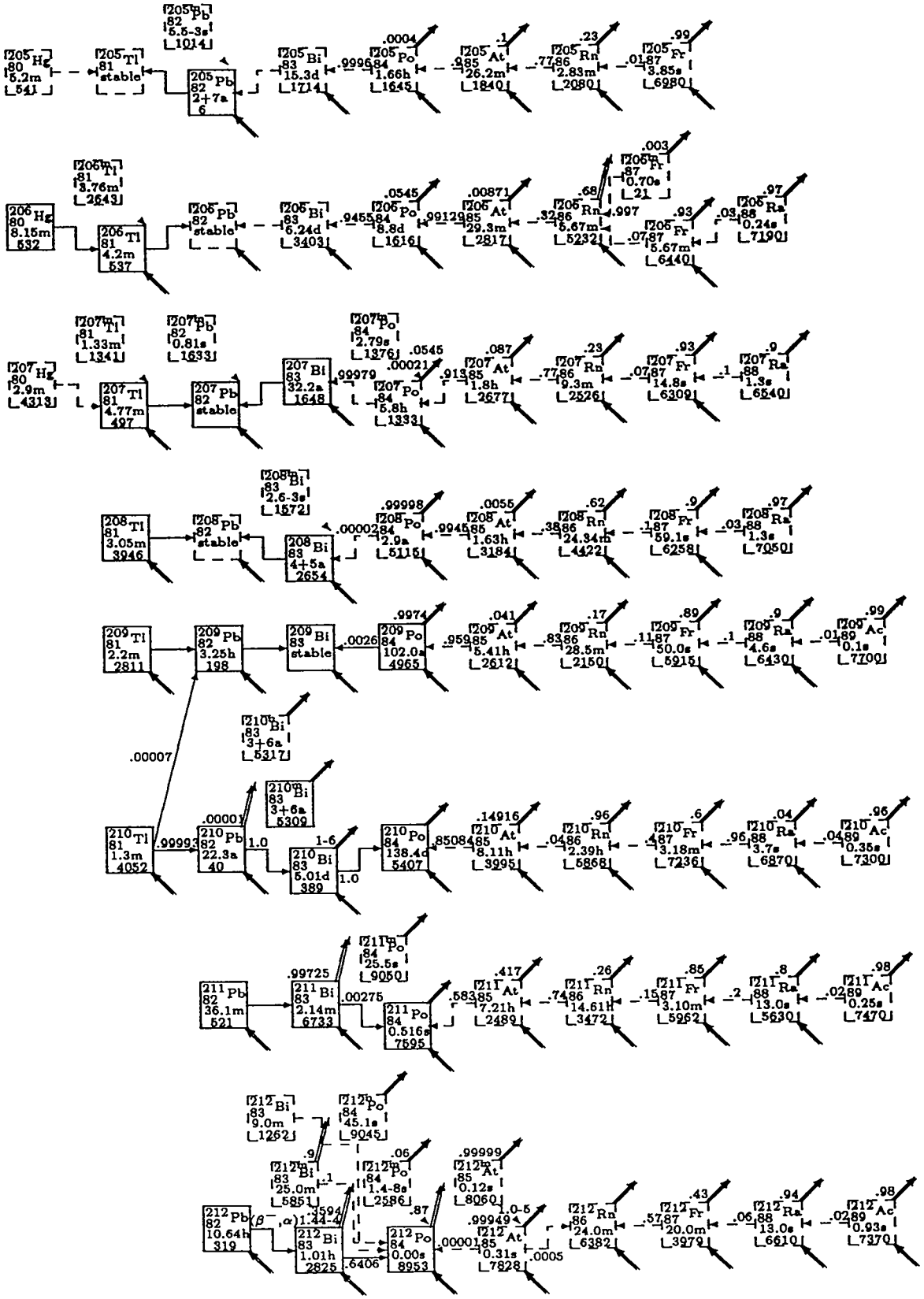

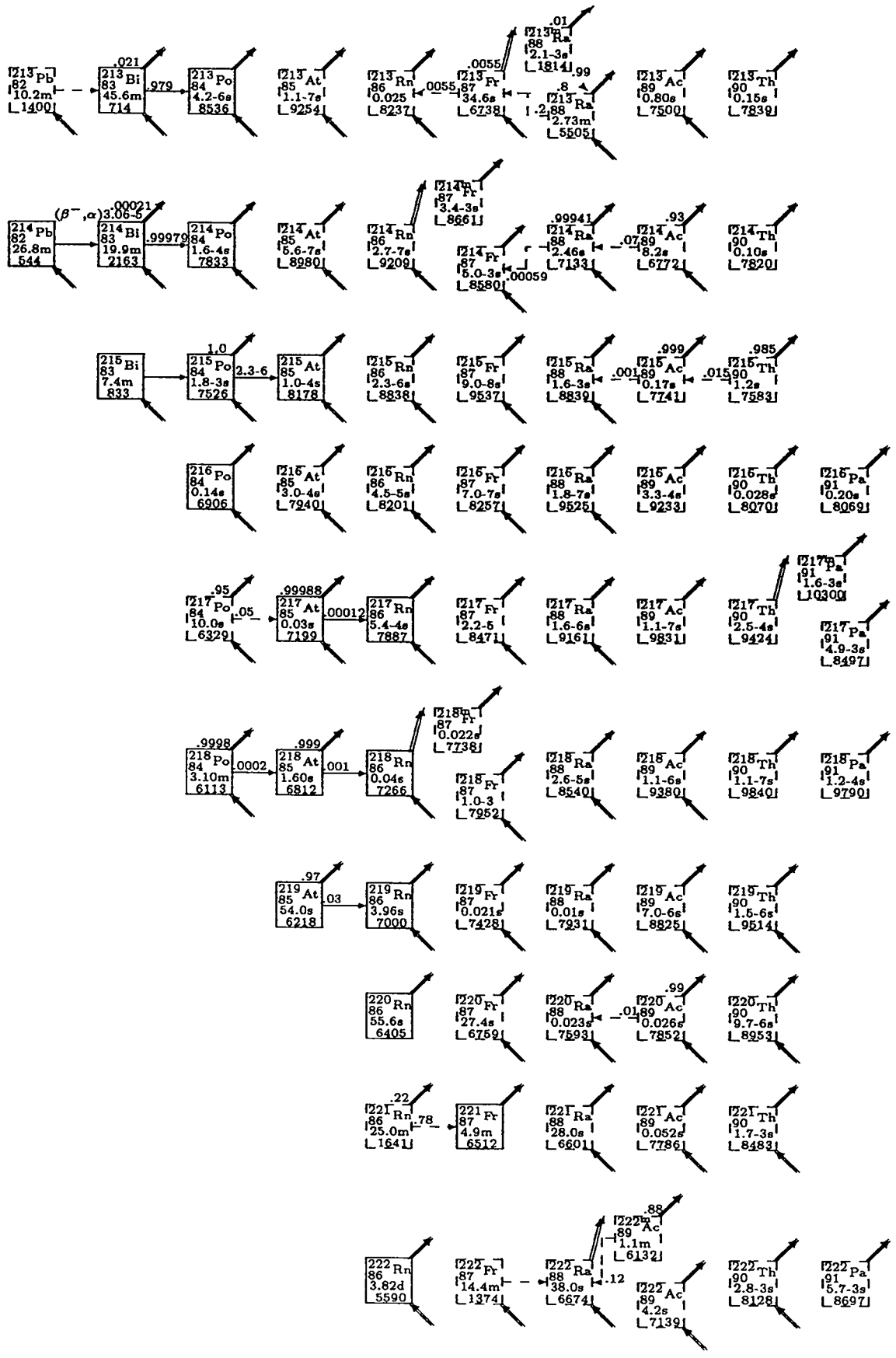
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215Th 90 1.2s 7583 .985
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216At 85 3.0-4s 7940
216Rn 86 4.5-5s 8201
216Fr 87 7.0-7s 8257
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216Ac 89 3.3-4s 9233
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216Pa 91 0.20s 8069
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217At 85 0.03s 7199 .99988 .00012
217Rn 86 5.4-4s 7887
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217Th 90 2.5-4s 9424
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218At 85 1.60s 6812 .999 .001
218Rn 86 0.04s 7266
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218Fr 87 1.0-3 7952
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218Ac 89 1.1-6s 9380
218Th 90 1.1-7s 9840
218Pa 91 1.2-4s 9790
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219Fr 87 0.021s 7428
219Ra 88 0.01s 7931
219Ac 89 7.0-6s 8825
219Th 90 1.5-6s 9514
220Rn 86 55.6s 6405
220Fr 87 27.4s 6759
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221Ra 88 28.0s 6601
221Ac 89 0.052s 7786
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222Rn 86 3.82d 5590
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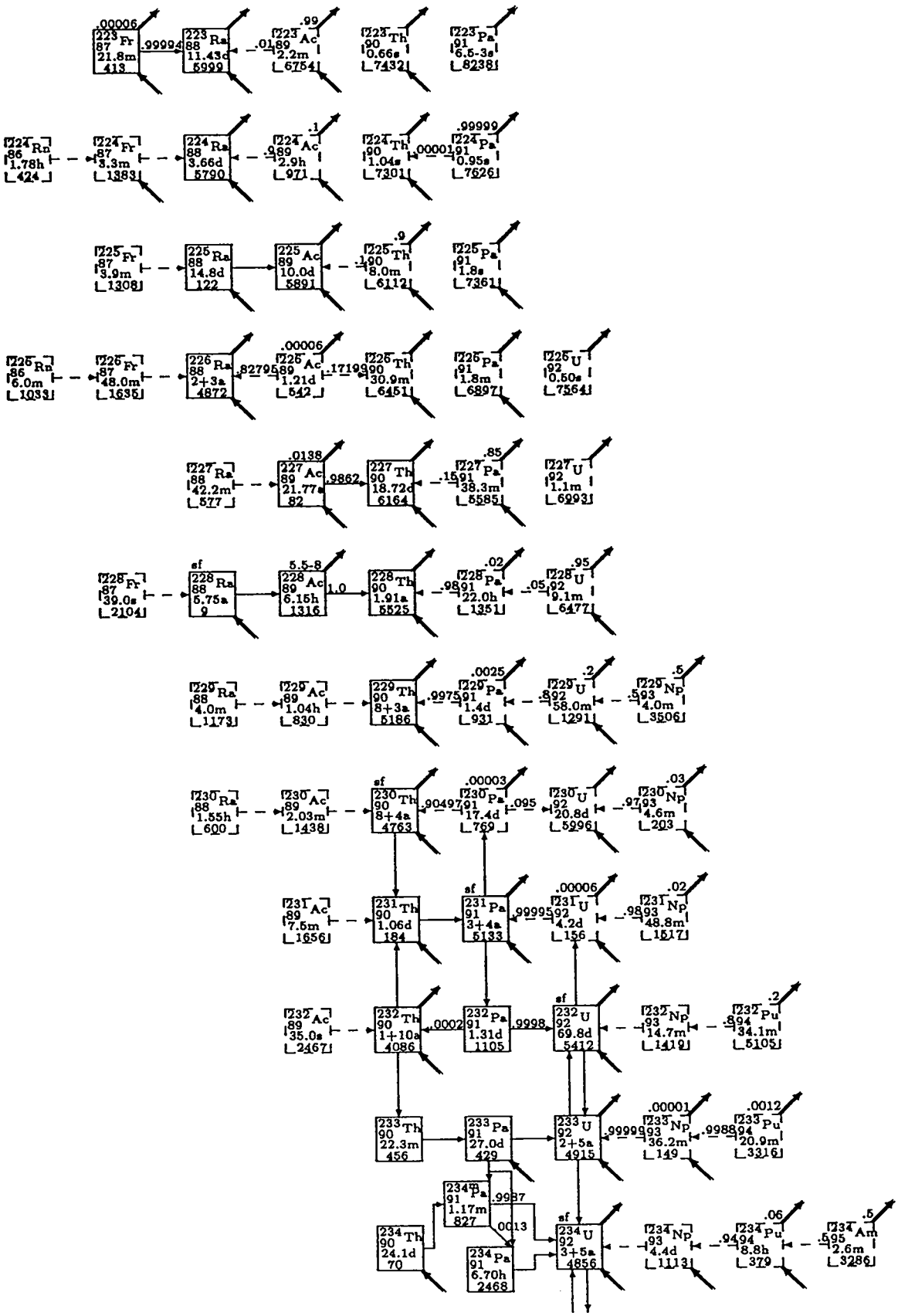
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224Pa 91 0.95s 7626 .99999 .00001
225Fr 87 3.9m 1308
225Ra 88 14.8d 122
225Ac 89 10.0d 5891
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229Ra 88 4.0m 1173
229Ac 89 1.04h 830
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230Ac 89 2.03m 1438
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232Th 90 1+10a 4086 .0002
232Pa 91 1.31d 1105 .9998
232U 92 69.8d 5412 sf
232Np 93 14.7m 1419
232Pu 94 34.1m 5105 .2 .894
233Th 90 22.3m 456
233Pa 91 27.0d 429
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233Np 93 36.2m 149 .00001 .9988
233Pu 94 20.9m 3316 .0012
234mPa 91 1.17m 827 .9987 .0013
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234Pa 91 6.70h 2468
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234Np 93 4.4d 1113
234Pu 94 8.8h 379 .06 .9494
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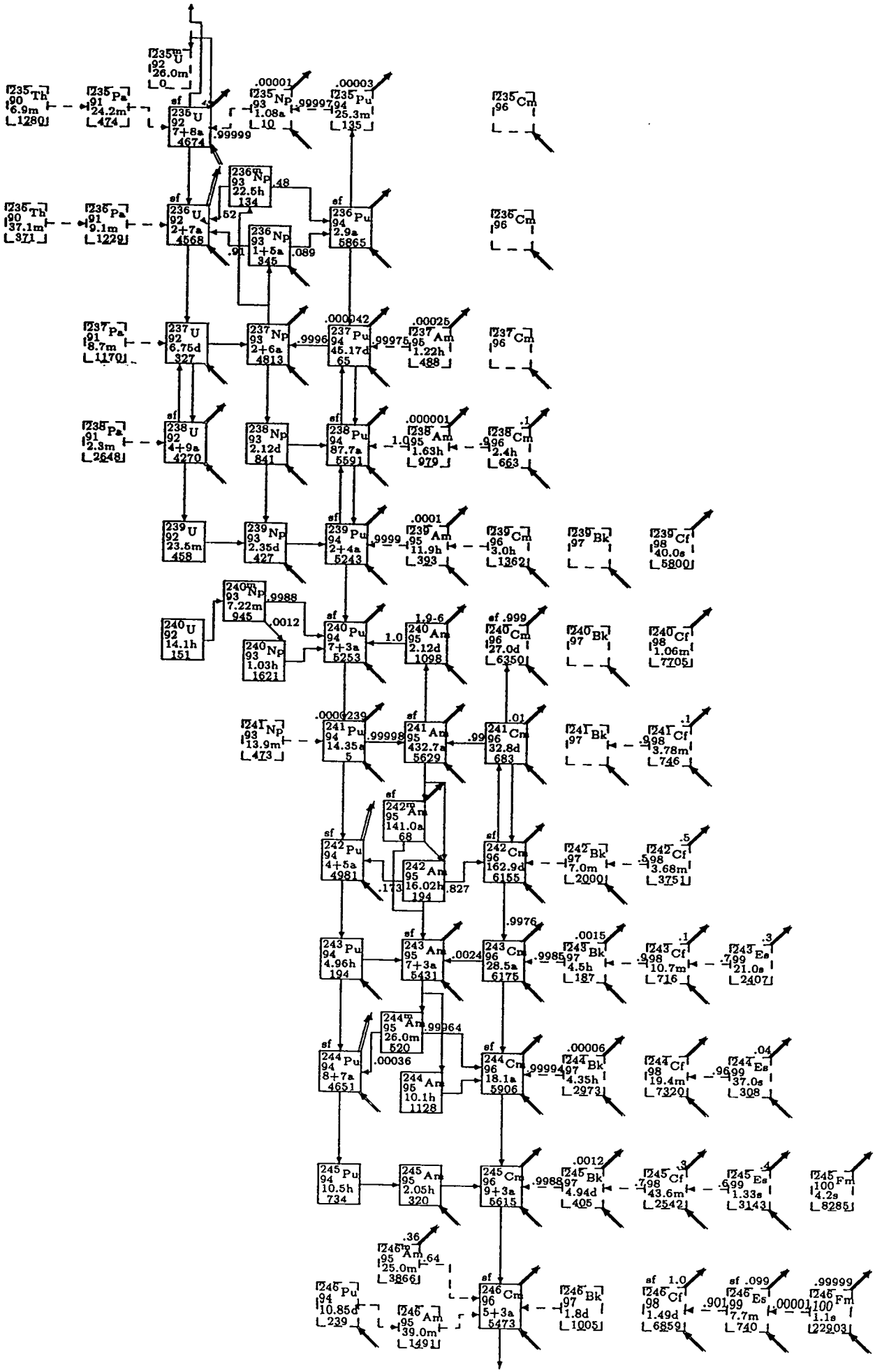
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