```
(*Nuclear Species Experimental Data*)
isotopeName = "Th-232";
databaseName = "JENDL-5";

atomicNumber = 90;(*Atomic number*)
neutronNumber = 143;(*Compound nucleus neutron number*)
(*Calculation Data Range*)

energyPattern = 5;(*Input required*)(*energyPattern=1;
Data at 0.0253eV*)(*energyPattern=2;
Data at 0.0253eV,500keV*)(*energyPattern=3;
Data at 0.0253eV,500keV,14MeV*)(*energyPattern=4;
Data at 500keV*)(*energyPattern=5;
Data at 500keV,14MeV*)

(*Average Number of Prompt Neutrons*)
promptNeutrons2 = 2.198;(*500 keV*)
promptNeutrons3 = 4.402;(*14 MeV*)

(*Neutron Separation Energy*)
neutronSeparationEnergy = 4786.3 / 1000;

(*Charge Distribution Experimental Data JENDL-5*)
yieldData500keV =
  {{23, 5.1302800 * 10^(-16)}, {24, 6.0705548 * 10^(-12)}, {25, 1.5080662 * 10^(-09)},
   {26, 6.3856791 * 10^(-08)}, {27, 6.3868551 * 10^(-07)}, {28, 6.3164035 * 10^(-06)},
   {29, 3.5692153 * 10^(-05)}, {30, 3.3146509 * 10^(-04)}, {31, 2.5408921 * 10^(-03)},
   {32, 2.1800240 * 10^(-02)}, {33, 6.6833890 * 10^(-02)}, {34, 1.5471604 * 10^(-01)},
   {35, 1.2633852 * 10^(-01)}, {36, 2.1625081 * 10^(-01)}, {37, 1.3732660 * 10^(-01)},
   {38, 1.6151289 * 10^(-01)}, {39, 7.2307462 * 10^(-02)}, {40, 3.1597801 * 10^(-02)},
   {41, 2.0299494 * 10^(-03)}, {42, 1.3958368 * 10^(-03)}, {43, 1.3476724 * 10^(-03)},
   {44, 1.8625504 * 10^(-03)}, {45, 1.6812567 * 10^(-03)}, {46, 1.9331696 * 10^(-03)},
   {47, 1.2461939 * 10^(-03)}, {48, 9.9382289 * 10^(-04)}, {49, 4.5028509 * 10^(-03)},
   {50, 4.1083818 * 10^(-02)}, {51, 6.0725389 * 10^(-02)}, {52, 1.5290921 * 10^(-01)},
   {53, 1.1013894 * 10^(-01)}, {54, 1.8718456 * 10^(-01)}, {55, 1.9654861 * 10^(-01)},
   {56, 1.2999431 * 10^(-01)}, {57, 7.9457878 * 10^(-02)}, {58, 2.8819421 * 10^(-02)},
   {59, 4.2793777 * 10^(-03)}, {60, 2.3967502 * 10^(-04)}, {61, 2.3383145 * 10^(-05)},
   {62, 2.5881603 * 10^(-06)}, {63, 1.9879379 * 10^(-07)}, {64, 2.0513354 * 10^(-08)},
   {65, 1.5432526 * 10^(-09)}, {66, 2.4546986 * 10^(-10)}, {67, 1.7741767 * 10^(-11)},
   {68, 2.9095201 * 10^(-13)}, {69, 1.8348930 * 10^(-16)}, {70, 0}, {71, 0}};

yieldData14MeV = {{23, 6.6277800 * 10^(-12)}, {24, 4.1587948 * 10^(-09)},
   {25, 3.3531745 * 10^(-07)}, {26, 5.7199381 * 10^(-06)},
   {27, 3.7641318 * 10^(-05)}, {28, 1.8899321 * 10^(-04)}, {29, 7.4538013 * 10^(-04)},
   {30, 2.6520471 * 10^(-03)}, {31, 9.3669098 * 10^(-03)}, {32, 2.4974863 * 10^(-02)},
   {33, 6.0675274 * 10^(-02)}, {34, 1.0632529 * 10^(-01)}, {35, 1.3011511 * 10^(-01)},
   {36, 1.4665132 * 10^(-01)}, {37, 1.4683643 * 10^(-01)}, {38, 1.0883794 * 10^(-01)},
   {39, 6.6401896 * 10^(-02)}, {40, 3.9178324 * 10^(-02)}, {41, 3.0545063 * 10^(-02)},
   {42, 3.2603332 * 10^(-02)}, {43, 3.6503612 * 10^(-02)}, {44, 3.5604441 * 10^(-02)},
   {45, 3.4384958 * 10^(-02)}, {46, 3.1908760 * 10^(-02)}, {47, 2.9006468 * 10^(-02)},
   {48, 2.4761801 * 10^(-02)}, {49, 3.1308203 * 10^(-02)}, {50, 5.2131255 * 10^(-02)},
   {51, 8.2946875 * 10^(-02)}, {52, 1.1616048 * 10^(-01)}, {53, 1.4958369 * 10^(-01)},
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    {54, 1.5333004 * 10^(-01)}, {55, 1.4324329 * 10^(-01)}, {56, 9.5816240 * 10^(-02)},
    {57, 4.8019316 * 10^(-02)}, {58, 2.0223687 * 10^(-02)}, {59, 6.5123875 * 10^(-03)},
    {60, 1.7872346 * 10^(-03)}, {61, 4.7894759 * 10^(-04)}, {62, 1.1738239 * 10^(-04)},
    {63, 2.4149526 * 10^(-05)}, {64, 4.0971656 * 10^(-06)}, {65, 6.5094001 * 10^(-07)},
    {66, 9.7128664 * 10^(-08)}, {67, 1.1676663 * 10^(-08)}, {68, 6.4298412 * 10^(-10)},
    {69, 6.2134269 * 10^(-12)}, {70, 5.8500419 * 10^(-15)}, {71, 0}};

optResult500keVRe1 = {3.1703568133935897`*^-12,
   {effectiveDistance500keV[23, 67] -> 0.35943166809273963`,
    effectiveDistance500keV[24, 66] -> 0.6519351029908155,
    effectiveDistance500keV[25, 65] -> 0.807589981802899,
    effectiveDistance500keV[26, 64] -> 0.8552086289677105,
    effectiveDistance500keV[27, 63] -> 0.9023169156697723,
    effectiveDistance500keV[28, 62] -> 0.9531231630583872,
    effectiveDistance500keV[29, 61] -> 0.9803244887950338,
    effectiveDistance500keV[30, 60] -> 1.0047190653397275`,
    effectiveDistance500keV[31, 59] -> 1.0293123320604711`,
    effectiveDistance500keV[32, 58] -> 1.0507739068116455`,
    effectiveDistance500keV[33, 57] -> 1.072116987833061,
    effectiveDistance500keV[34, 56] -> 1.0899356704003849`,
    effectiveDistance500keV[35, 55] -> 1.1076285150213352`,
    effectiveDistance500keV[36, 54] -> 1.121909298011595,
    effectiveDistance500keV[37, 53] -> 1.136120682923907,
    effectiveDistance500keV[38, 52] -> 1.146727209150425,
    effectiveDistance500keV[39, 51] -> 1.1577807259350739`,
    effectiveDistance500keV[40, 50] -> 1.1655624507668245`,
    effectiveDistance500keV[41, 49] -> 1.1744309928745151`,
    effectiveDistance500keV[42, 48] -> 1.180344130103113,
    effectiveDistance500keV[43, 47] -> 1.1865388636117293`,
    effectiveDistance500keV[44, 46] -> 1.1886000606506504`,
    effectiveDistance500keV[45, 45] -> 1.190627528435423,
    effectiveDistance500keV[46, 44] -> 1.1886152413568167`,
    effectiveDistance500keV[47, 43] -> 1.1865069700578974`,
    effectiveDistance500keV[48, 42] -> 1.180206682838138,
    effectiveDistance500keV[49, 41] -> 1.1747519303794096`,
    effectiveDistance500keV[50, 40] -> 1.1656672989255776`,
    effectiveDistance500keV[51, 39] -> 1.1577113746095264`,
    effectiveDistance500keV[52, 38] -> 1.1467056633111046`,
    effectiveDistance500keV[53, 37] -> 1.136034471398015,
    effectiveDistance500keV[54, 36] -> 1.1218535704692616`,
    effectiveDistance500keV[55, 35] -> 1.1077973251614697`,
    effectiveDistance500keV[56, 34] -> 1.0898702221517378`,
    effectiveDistance500keV[57, 33] -> 1.0721810847800017`,
    effectiveDistance500keV[58, 32] -> 1.0508752558642183`,
    effectiveDistance500keV[59, 31] -> 1.0294980079244354`,
    effectiveDistance500keV[60, 30] -> 1.0046063927020257`,
    effectiveDistance500keV[61, 29] -> 0.9801808870266865,
    effectiveDistance500keV[62, 28] -> 0.9528286363259723,
    effectiveDistance500keV[63, 27] -> 0.9023169156699242,
    effectiveDistance500keV[64, 26] -> 0.8552086289687052,
    effectiveDistance500keV[65, 25] -> 0.8075899818018479,
    effectiveDistance500keV[66, 24] -> 0.6519351029895333,
    effectiveDistance500keV[67, 23] -> 0.3594316680843655}};

optResult14MeVRe1 =
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  {0.002131669285887386, {effectiveDistance14MeV[23, 67] -> 0.1556396924138345,
    effectiveDistance14MeV[24, 66] -> 0.4033353087117178,
    effectiveDistance14MeV[25, 65] -> 0.6542193080286693,
    effectiveDistance14MeV[26, 64] -> 0.8480973106589458,
    effectiveDistance14MeV[27, 63] -> 0.9579239922404241,
    effectiveDistance14MeV[28, 62] -> 0.9806731648467159,
    effectiveDistance14MeV[29, 61] -> 1.010714048652672,
    effectiveDistance14MeV[30, 60] -> 1.037484375372631,
    effectiveDistance14MeV[31, 59] -> 1.0645113806816309`,
    effectiveDistance14MeV[32, 58] -> 1.0875965863614279`,
    effectiveDistance14MeV[33, 57] -> 1.1108643565092797`,
    effectiveDistance14MeV[34, 56] -> 1.1300574223374327`,
    effectiveDistance14MeV[35, 55] -> 1.1491919000888857`,
    effectiveDistance14MeV[36, 54] -> 1.1643107838427247`,
    effectiveDistance14MeV[37, 53] -> 1.1798697896153816`,
    effectiveDistance14MeV[38, 52] -> 1.1910630674501044`,
    effectiveDistance14MeV[39, 51] -> 1.202683797562557,
    effectiveDistance14MeV[40, 50] -> 1.2106719385542415`,
    effectiveDistance14MeV[41, 49] -> 1.2210366170081555`,
    effectiveDistance14MeV[42, 48] -> 1.2274507088739868`,
    effectiveDistance14MeV[43, 47] -> 1.234145979498164,
    effectiveDistance14MeV[44, 46] -> 1.2360769578322601`,
    effectiveDistance14MeV[45, 45] -> 1.2381943872576764`,
    effectiveDistance14MeV[46, 44] -> 1.2359057621665135`,
    effectiveDistance14MeV[47, 43] -> 1.233787190795689,
    effectiveDistance14MeV[48, 42] -> 1.2270242563165126`,
    effectiveDistance14MeV[49, 41] -> 1.221074673280875,
    effectiveDistance14MeV[50, 40] -> 1.2111074278296132`,
    effectiveDistance14MeV[51, 39] -> 1.2030202845534297`,
    effectiveDistance14MeV[52, 38] -> 1.1911602180303842`,
    effectiveDistance14MeV[53, 37] -> 1.1798971429760423`,
    effectiveDistance14MeV[54, 36] -> 1.1643756109569179`,
    effectiveDistance14MeV[55, 35] -> 1.1493304290535131`,
    effectiveDistance14MeV[56, 34] -> 1.1299095029046096`,
    effectiveDistance14MeV[57, 33] -> 1.1105356513759708`,
    effectiveDistance14MeV[58, 32] -> 1.0873056680393138`,
    effectiveDistance14MeV[59, 31] -> 1.0640200025385231`,
    effectiveDistance14MeV[60, 30] -> 1.0369650071005232`,
    effectiveDistance14MeV[61, 29] -> 1.010146993573996,
    effectiveDistance14MeV[62, 28] -> 0.9800818437294447,
    effectiveDistance14MeV[63, 27] -> 0.9579239922404199,
    effectiveDistance14MeV[64, 26] -> 0.8480973106586828,
    effectiveDistance14MeV[65, 25] -> 0.6542193080275995,
    effectiveDistance14MeV[66, 24] -> 0.4033353087099616,
    effectiveDistance14MeV[67, 23] -> 0.15563969240985245`}};

optResult500keVRe2 = {2.897190057661027*^-12,
   {fermiEnergy500keV[23, 67] -> 1., fermiEnergy500keV[24, 66] -> 0.999999999999998,
    fermiEnergy500keV[25, 65] -> 0.9999999999997882,
    fermiEnergy500keV[26, 64] -> 0.9999999992437244,
    fermiEnergy500keV[27, 63] -> 0.9999999923324739, fermiEnergy500keV[28, 62] ->
     0.6347500207849432, fermiEnergy500keV[29, 61] -> 1.6650705076459913`,
    fermiEnergy500keV[30, 60] -> -0.4039589545272864, fermiEnergy500keV[31, 59] ->
     2.1912088717574716`, fermiEnergy500keV[32, 58] -> 0.9966220297985487,
    fermiEnergy500keV[33, 57] -> 3.4178816436763726`,
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    fermiEnergy500keV[34, 56] -> 1.3519502293546604`,
    fermiEnergy500keV[35, 55] -> 2.7622631049548567`,
    fermiEnergy500keV[36, 54] -> 0.1543519251804202,
    fermiEnergy500keV[37, 53] -> 1.0347341788117346`,
    fermiEnergy500keV[38, 52] -> -2.3868775908907254`,
    fermiEnergy500keV[39, 51] -> -1.3015482893423818`,
    fermiEnergy500keV[40, 50] -> -3.7296643569050207`,
    fermiEnergy500keV[41, 49] -> -0.4259510810884591,
    fermiEnergy500keV[42, 48] -> 0.05199514031602031,
    fermiEnergy500keV[43, 47] -> 4.471498847403961,
    fermiEnergy500keV[44, 46] -> 3.6871000465259365`,
    fermiEnergy500keV[45, 45] -> 6.188206630857658,
    fermiEnergy500keV[46, 44] -> 3.7227629608293697`,
    fermiEnergy500keV[47, 43] -> 4.4142829655989475`,
    fermiEnergy500keV[48, 42] -> -0.22130953817696944`,
    fermiEnergy500keV[49, 41] -> 0.26462125273304704`,
    fermiEnergy500keV[50, 40] -> -3.4852214515891613`,
    fermiEnergy500keV[51, 39] -> -1.4228462057755045`,
    fermiEnergy500keV[52, 38] -> -2.401752851027533,
    fermiEnergy500keV[53, 37] -> 0.8828979945040055,
    fermiEnergy500keV[54, 36] -> 0.07244531881050839,
    fermiEnergy500keV[55, 35] -> 3.1911790708008145`,
    fermiEnergy500keV[56, 34] -> 1.254261219532366,
    fermiEnergy500keV[57, 33] -> 3.6284622636711634`,
    fermiEnergy500keV[58, 32] -> 1.3080583228110425`,
    fermiEnergy500keV[59, 31] -> 2.7259070326149475`,
    fermiEnergy500keV[60, 30] -> -0.6124427734006811,
    fermiEnergy500keV[61, 29] -> 1.3735559207363033`,
    fermiEnergy500keV[62, 28] -> -0.07768543653871124,
    fermiEnergy500keV[63, 27] -> 0.9999999931860415,
    fermiEnergy500keV[64, 26] -> 0.9999999993351018,
    fermiEnergy500keV[65, 25] -> 0.999999999999816, fermiEnergy500keV[66, 24] ->
     0.9999999999999983, fermiEnergy500keV[67, 23] -> 1.}};

optResult14MeVRe2 =
  {9.652201209894496*^-11, {fermiEnergy14MeV[23, 67] -> 0.999999998452384,
    fermiEnergy14MeV[24, 66] -> 0.9999998682831353,
    fermiEnergy14MeV[25, 65] -> 0.9999985737410946, fermiEnergy14MeV[26, 64] ->
     0.9999677698926537, fermiEnergy14MeV[27, 63] -> 0.9998732883784269,
    fermiEnergy14MeV[28, 62] -> -1.5898980595332322`,
    fermiEnergy14MeV[29, 61] -> 1.0282176000557668`, fermiEnergy14MeV[30, 60] ->
     -0.18026162579407926`, fermiEnergy14MeV[31, 59] -> 3.3854845343296347`,
    fermiEnergy14MeV[32, 58] -> 1.8152152813813696`, fermiEnergy14MeV[33, 57] ->
     4.608665606468554, fermiEnergy14MeV[34, 56] -> 2.309479076056337,
    fermiEnergy14MeV[35, 55] -> 3.6813746570624546`, fermiEnergy14MeV[36, 54] ->
     0.3519091956298058, fermiEnergy14MeV[37, 53] -> 1.5964838645133879`,
    fermiEnergy14MeV[38, 52] -> -2.4238928184699207`,
    fermiEnergy14MeV[39, 51] -> -2.0181186609933883`,
    fermiEnergy14MeV[40, 50] -> -5.296361242554499,
    fermiEnergy14MeV[41, 49] -> -0.47391085013920486`,
    fermiEnergy14MeV[42, 48] -> 0.044919757189256004`,
    fermiEnergy14MeV[43, 47] -> 4.463578576774748,
    fermiEnergy14MeV[44, 46] -> 3.12156401475281,
    fermiEnergy14MeV[45, 45] -> 5.495291609010415,
    fermiEnergy14MeV[46, 44] -> 2.834608513394533,
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fermiEnergy14MeV[47, 43] -> 3.85734754667666,
fermiEnergy14MeV[48, 42] -> -0.6561887274657567,
fermiEnergy14MeV[49, 41] -> -0.23435842555028624`,
fermiEnergy14MeV[50, 40] -> -4.228377010069391,
fermiEnergy14MeV[51, 39] -> -1.0939607423618936`,
fermiEnergy14MeV[52, 38] -> -1.9279451372040082`,
fermiEnergy14MeV[53, 37] -> 1.9994020514031787`,
fermiEnergy14MeV[54, 36] -> 0.8843482196711501,
fermiEnergy14MeV[55, 35] -> 4.425246160895592,
fermiEnergy14MeV[56, 34] -> 2.4933125307915622`,
fermiEnergy14MeV[57, 33] -> 4.4469444365349595`,
fermiEnergy14MeV[58, 32] -> 1.7837246658614854`,
fermiEnergy14MeV[59, 31] -> 2.9380277511699564`,
fermiEnergy14MeV[60, 30] -> -0.661357590270363,
fermiEnergy14MeV[61, 29] -> 0.46521040553228443`,
fermiEnergy14MeV[62, 28] -> -2.1862919122981705`,
fermiEnergy14MeV[63, 27] -> 0.999907910503178,
fermiEnergy14MeV[64, 26] -> 0.9999772762795718,
fermiEnergy14MeV[65, 25] -> 0.9999990276944719,
fermiEnergy14MeV[66, 24] -> 0.9999999135272113,
fermiEnergy14MeV[67, 23] -> 0.9999999990264163}};
```