

Mentor Graphics Corp.

PLS file format definition

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In several Mentor products, such as ELDO/ADMS, S-parameter viewer/fitter, ICX, Hyperlynx, we use a new type of files (PLS) to describe frequency dependent $N \times N$ matrix. This format is an alternative to well-known touchstone data with the difference that the touchstone format describes sampled dependence while PLS describes this dependence fitted.

1. PLS header: general matrix parameters

There are some parameters characterizing the entire matrix, not an individual component. They include type of parameters (currently, we support “S”, “Y” or “Z”), number of ports N , and the port characteristic impedance $R0$. This data is put into a PLS file header, that has a form:

```
[<Type>] <value of N>  
R0: <val port 1> ... <val port N>
```

By default, the type of PLS is “S”, therefore, for S-parameters it is often omitted. Port impedances are defined for every port, because we support simulation with different values of port impedance.

For example, the 4-port S-parameter model may have the following header:

```
S 4  
R0: 50.0 20.0 30.0 50.0
```

Or, simply as

```
4  
R0: 50.0 20.0 30.0 50.0
```

2. Representation of a matrix component

As in touchstone file, PLS describes $N \times N$ frequency dependent matrix. However, this representation is based on poles/residues that gives the name for the file type.

Each matrix entry $A(s)$ can be represented by the following expression:

$$A(s) = \text{Delay}(\tau) * H(s) = e^{-s\tau} H(s),$$

where

$$H(s) = sH_{asymp} + \sum_{m=1}^M \frac{1}{2} \left[\frac{A_{1m} - jA_{2m}}{1 + s/(\alpha_m + j\omega_m)} + \frac{A_{1m} + jA_{2m}}{1 + s/(\alpha_m - j\omega_m)} \right] \quad (1)$$

The number of pole pairs M in (1), and the very set of parameters is (or can be) individual for every matrix component. To define each summand in (1), we use two real parameters α_m, ω_m ($\alpha_m > 0, \omega_m \geq 0$), defining the complex pole (measured in Hz), and a pair of coefficients A_{1m}, A_{2m} that define the complex residue. The above expression also works for real poles. If the m -th root is real ($\omega_m = 0, A_{2m} = 0$) then both summands in brackets become identical.

Very often, when defining the dependence of the type (1) they also introduce an additional constant summand H_∞ . To simplify the format, we do not show this parameter in (1) explicitly. Instead, we add an additional “high-frequency” pole defined as:

$$\alpha_m = 10^{25}, \omega_m = 0, A_{1m} = H_\infty, A_{2m} = 0.$$

In total, to define every matrix component, we need to define 3 numbers: delay, asymptotic factor, and the number of summands M . These numbers are put into the “component’s header”. After that, we define the table of poles/residues as a 4-column table of M rows:

$$\alpha_m \quad \omega_m \quad A_{1m} \quad A_{2m}$$

Formally, the component header and the table can be written as:

$$\begin{array}{l} \langle \text{value of } M \rangle \\ [\text{Delay: } \langle \text{value} \rangle] \\ [\text{Asymp: } \langle \text{value} \rangle] \\ \alpha_1 \quad \omega_1 \quad A_{11} \quad A_{21} \\ \alpha_2 \quad \omega_2 \quad A_{12} \quad A_{22} \\ \dots \\ \alpha_M \quad \omega_M \quad A_{1M} \quad A_{2M} \end{array}$$

The bracketed parameters (delay and asymptotic factor) are optional. That is, if zeros, they are (or can be) omitted.

3. General flow in PLS file

After PLS file header, we describe all the matrix components as shown above; the column cycle is nested into the row cycle. We do not rely on the matrix symmetry (if any) and list all $N \times N$ components.

The general flow can be described as the following script:

```
Output PLS header;
For row=1...N
  For col=1...N
  {
    Output component header for (row, col);
    For m=1...Mrow, col
    {
      output:
      <αm ωm A1m A2m>
    }
  }
}
```

4. Allowed combination of parameters

Some combinations of parameters are not valid. For example, when representing S-parameters, we do not use linear asymptotic since they are bounded (for passive system, the norm of the S-matrix cannot exceed 1). Also, some of the tools do not support particular types of parameters therefore, they will not be able to parse the data that is not allowed. For example, ELDO does not currently support Y or Z-type PLS data.

In future, more types or format entries may become available. When developing the software, we will make efforts to keep backward compatibility and support PLS files created earlier.

Typical example (does not correspond to any real model):

4
R0: 5.0e+001 5.0e+001 5.0e+001 5.0e+001
9
2.98380704772990e+009 2.09357554197594e+010 2.23712386645321e-001 -7.25868916904543e-002
1.01182296984143e+009 1.65962631518331e+010 -1.60504690329424e-002 -1.47496546046465e-002
1.37054308580852e+009 1.54111695980707e+010 1.06122005676710e-001 1.10576340099910e-001
6.48363582061785e+008 1.41445219614718e+010 -7.32556939537460e-003 2.90205231329321e-003
3.71074861080845e+009 1.09468669192078e+010 2.06534713670681e-001 -1.05440184251694e+000
8.65536559988776e+008 1.28278525837961e+010 1.95469736589826e-002 5.72471298227251e-003
8.83364324635481e+008 1.21877906435248e+010 -1.84119070168036e-003 7.34433723439218e-003
1.14484861383106e+009 1.13858519461881e+010 3.02874280335399e-002 1.23879127136863e-001
1.00000000000000e+025 0.00000000000000e+000 6.75202758654701e-003 0.00000000000000e+000
5
1.73785002884347e+009 1.84968670164701e+010 1.03869683444664e-001 -3.05871578060609e-002
1.00401584746082e+009 1.64031113872927e+010 8.12425618235376e-003 -1.99939793639210e-002
1.03435533701186e+009 1.54007985551655e+010 3.39144433366006e-003 -4.10294006673841e-002
1.00000000000000e+025 0.00000000000000e+000 1.35392231398578e-001 0.00000000000000e+000
delay: 1.0e-10
7
1.50708675991431e+009 1.60226413097466e+010 1.18305678522662e-001 -1.33747922007776e-002
7.84851974282608e+007 1.52405738517025e+010 -3.42901173788972e-005 3.53033509941125e-005
7.25964101129942e+008 1.43749608927708e+010 -1.97661177089386e-002 -1.46601179282687e-002
1.35071712000403e+009 1.27501853330677e+010 -6.21361430463802e-002 -5.25238425462110e-002
1.01470376911069e+009 1.15302712185060e+010 -5.51429350788163e-002 -7.23097448436395e-002
1.00610374808285e+009 9.81850532563076e+009 -8.15258751571747e-003 8.74302554748350e-003
1.00000000000000e+025 0.00000000000000e+000 2.42296786268810e-002 0.00000000000000e+000
12
4.07733459126613e+008 9.14373429099905e+009 6.00146651942607e-004 4.45400287205199e-003
7.59612744416716e+008 8.65627744840263e+009 -2.84137862369037e-003 -1.20725673365147e-003
7.55220606532125e+008 7.98464365629584e+009 2.01820486778810e-002 -2.73619479506730e-002
1.33368252015247e+009 6.97828044543532e+009 -3.65893641169212e-002 -1.83475226219995e-001
1.59729733280112e+009 4.75290375511790e+009 -2.93888554144492e-001 3.37903953515725e-001
1.67594933627774e+009 2.96741110812777e+009 1.43764744970890e-001 3.47036737381169e-001
1.76281300440078e+009 1.49396688278820e+009 2.42212458019913e-001 -3.23977436216191e-001
1.52194702809670e+009 0.00000000000000e+000 1.19863530029555e-003 0.00000000000000e+000
1.92710101225455e+008 1.21109889766284e+009 -1.79941537199461e-006 -6.40868158585680e-006
1.43816920744026e+008 0.00000000000000e+000 1.42660738971342e-003 0.00000000000000e+000
3.40346956890979e+006 6.59769239711665e+006 -5.98860463793552e-004 6.96599520941301e-004
1.00000000000000e+025 0.00000000000000e+000 -8.99272627657061e-003 0.00000000000000e+000
11
5.21780463341435e+008 8.97037288055002e+009 7.61694558185420e-004 -1.23070034258209e-003
7.66491564978432e+008 7.96576476932017e+009 6.10574727176113e-003 -2.66183195062803e-002
1.34241077820264e+009 6.96177935731956e+009 2.02306028061351e-002 -1.97232693170180e-001
1.60053141579636e+009 4.73576540057685e+009 -2.72900121496674e-002 -4.26725119618206e-001
1.71071217928194e+009 2.95091785600406e+009 -1.13507418296203e-001 -3.12542874195691e-001
1.27965059037531e+009 0.00000000000000e+000 -9.86844726028307e-002 0.00000000000000e+000
8.07600681166085e+008 0.00000000000000e+000 2.17613966944186e-004 0.00000000000000e+000
2.89571241178190e+007 0.00000000000000e+000 4.36150402624336e-002 0.00000000000000e+000
3.03108186915111e+007 0.00000000000000e+000 -4.35162760697729e-002 0.00000000000000e+000
1.11386081993803e+006 9.92278729441668e+006 2.54350500591389e-004 -4.24293268168814e-005
1.00000000000000e+025 0.00000000000000e+000 1.35392231398578e-001 0.00000000000000e+000
12
4.04670120332827e+009 0.00000000000000e+000 -5.88916422149053e-001 0.00000000000000e+000
1.60361913330241e+009 4.77688930544901e+009 -1.39657111311214e-002 -3.23552301780339e-001
1.93433504868484e+009 2.81259082453592e+009 -1.20832582481390e-001 7.85410796326878e-001
4.60815588905237e+008 1.97630278790347e+009 8.29738615184580e-004 1.35827043178325e-003
1.71256309847104e+009 8.48792291045686e+008 6.14387789646831e-001 -1.61252625866142e-001
8.17220404908237e+007 1.07375193016510e+009 -3.73410598300470e-005 -9.52733635994425e-005
3.85315476662389e+008 0.00000000000000e+000 2.95656167216406e-002 0.00000000000000e+000
2.01089543414625e+008 0.00000000000000e+000 -1.12789728847191e-001 0.00000000000000e+000
1.76958978624155e+008 0.00000000000000e+000 8.62675973291343e-002 0.00000000000000e+000
2.70163351513390e+007 0.00000000000000e+000 -1.05579779611894e-002 0.00000000000000e+000
6.81642700476571e+006 0.00000000000000e+000 1.10805109973494e-002 0.00000000000000e+000
1.00000000000000e+025 0.00000000000000e+000 9.21324925133850e-002 0.00000000000000e+000
delay: 0.000000e+000
11
7.57623971459113e+008 7.97920697608112e+009 2.49862345346843e-002 -1.29515841227054e-002

1.33539791850434e+009 6.96144494080160e+009 3.40950999532263e-002 -1.97341889042880e-001
1.60811916851146e+009 4.75380977838706e+009 -2.60687218479473e-001 2.21227805555186e-001
1.72591036708779e+009 2.89845123226156e+009 -3.26530879125307e-002 3.09718993183749e-001
1.89958192641513e+009 1.40409903248392e+009 2.94389616073662e-001 -2.32065678579997e-001
1.33350494415607e+009 0.00000000000000e+000 1.43206428241765e-003 0.00000000000000e+000
5.45821192854776e+007 1.13666071687842e+009 6.43739207544160e-006 4.02715432814956e-006
3.96515086646079e+008 0.00000000000000e+000 2.53827182665503e-003 0.00000000000000e+000
5.28772390540590e+007 0.00000000000000e+000 8.07051355505001e-004 0.00000000000000e+000
2.05269087508057e+006 0.00000000000000e+000 -8.70533786230636e-004 0.00000000000000e+000
1.00000000000000e+025 0.00000000000000e+000 -5.79167290552557e-003 0.00000000000000e+000
delay: 0.000000e+000

18

1.52962469446294e+009 3.40221480229661e+009 1.43452998095651e-001 7.28237309933830e-002
2.65198323067121e+009 2.56042867466286e+009 -7.52264648627767e+000 4.36084661172180e-001
6.69075755725907e+007 9.05741050459144e+008 -2.06451806076091e-004 -1.09527749163719e-004
2.80670064071581e+008 0.00000000000000e+000 -5.05335210975591e+001 0.00000000000000e+000
1.60015194216884e+007 1.06460614796368e+007 -2.10803122740955e-002 -2.12858172937520e-002
1.63031102001636e+007 2.45251907466487e+007 4.48384082058463e-003 -6.82395656245267e-003
7.04711790864360e+007 0.00000000000000e+000 7.60000674575969e-002 0.00000000000000e+000
1.24569531514376e+009 1.00138604832785e+009 -2.30889738020051e+002 8.33051532732522e+002
1.63999999999999e+009 8.19999999999999e+008 -2.26565754670169e+003 3.05052971852918e+003
3.62273953909713e+008 1.75264357668850e+008 6.21235443501936e+002 7.20189874301835e+002
5.21526663974944e+008 3.67930862623260e+008 -4.81994057450111e+002 1.03113191957849e+003
4.10000000000001e+008 2.05000000000001e+008 -2.22004111306039e+003 4.96607570949064e+002
1.46925618692045e+009 5.07018495190106e+008 3.14879692351885e+003 -9.12469546007686e+003
8.45939414340113e+008 6.45634056811010e+008 -2.90170462732244e+002 -1.16756939253157e+003
6.22329873968752e+008 2.00073935060605e+008 1.72470142884772e+003 -5.36468292345729e+003
7.09999999999999e+008 3.55000000000000e+008 -3.23933718490923e+003 -1.61966859245462e+003
1.19000000000000e+009 5.95000000000000e+008 3.29198483596878e+003 1.64599241798439e+003
1.00000000000000e+025 0.00000000000000e+000 7.03424066705338e-002 0.00000000000000e+000
delay: 0.000000e+000

18

2.05633146649463e+009 2.87462474988285e+009 -7.30970418210429e-001 -1.46981737252131e+000
6.69342479457709e+008 5.65845515363485e+008 -5.97862374960197e+001 -1.14364941136602e+003
4.55067852920467e+007 9.22540479706049e+008 5.54558949650614e-005 -3.12986921513801e-007
1.58017570747517e+009 1.15444011003429e+009 1.89614375230576e+002 -2.99739608375748e+002
1.30889007144458e+008 0.00000000000000e+000 3.41570155723166e-001 0.00000000000000e+000
8.11334599358421e+005 7.62742820384227e+006 6.80833971558634e-004 -1.52143649731431e-003
5.29742656121116e+007 5.59618565234347e+007 -1.50304348710650e-002 1.50228748577535e-002
9.46867293055152e+008 8.44166436400316e+008 -3.99668004689310e+002 8.57665562735155e+001
1.58000000000000e+009 7.89999999999998e+008 1.60533132240254e+002 2.82704850998023e+003
3.05331186438474e+008 1.85884669875980e+008 -1.03698432142588e+001 -4.62842813266242e+000
2.98219196774469e+008 0.00000000000000e+000 -8.70847956751165e+000 0.00000000000000e+000
4.06518139759920e+008 3.06209293625134e+008 -4.13220779552716e+001 -1.79868452329637e+001
6.40087880415995e+008 5.20779258973052e+008 -6.87340187920690e+002 8.44807308337239e+002
8.80904152834363e+008 1.78363886615546e+008 -3.94351008590242e+001 1.06324795508766e+002
1.35371670769706e+009 0.00000000000000e+000 -1.04455072372394e+003 0.00000000000000e+000
1.28000000000000e+009 6.40000000000000e+008 2.11729850505970e+003 -4.23459701011940e+003
7.10000000000000e+008 3.55000000000001e+008 -1.74560015194534e+002 3.49120030389067e+002
1.00000000000000e+025 0.00000000000000e+000 2.42296786268810e-002 0.00000000000000e+000
delay: 0.000000e+000

11

7.57623971459113e+008 7.97920697608112e+009 2.49862345346843e-002 -1.29515841227054e-002
1.33539791850434e+009 6.96144494080160e+009 3.40950999532263e-002 -1.97341889042880e-001
1.60811916851146e+009 4.75380977838706e+009 -2.60687218479473e-001 2.21227805555186e-001
1.72591036708779e+009 2.89845123226156e+009 -3.26530879125307e-002 3.09718993183749e-001
1.89958192641513e+009 1.40409903248392e+009 2.94389616073662e-001 -2.32065678579997e-001
1.33350494415607e+009 0.00000000000000e+000 1.43206428241765e-003 0.00000000000000e+000
5.45821192854776e+007 1.13666071687842e+009 6.43739207544160e-006 4.02715432814956e-006
3.96515086646079e+008 0.00000000000000e+000 2.53827182665503e-003 0.00000000000000e+000
5.28772390540590e+007 0.00000000000000e+000 8.07051355505001e-004 0.00000000000000e+000
2.05269087508057e+006 0.00000000000000e+000 -8.70533786230636e-004 0.00000000000000e+000
1.00000000000000e+025 0.00000000000000e+000 -5.79167290552557e-003 0.00000000000000e+000
delay: 0.000000e+000

14

1.15935247578579e+009 1.10129563397508e+010 2.01199576326782e-002 -1.56191548051150e-001
1.43979398303696e+008 9.41793358512432e+009 2.51991141216389e-004 6.59276226774860e-004
4.27707001511094e+008 9.13020362058415e+009 -1.52649306684289e-004 1.62243642776697e-003
7.72030651462647e+008 7.96742686088019e+009 4.92435375369596e-002 9.05792840080502e-003
1.35249843555100e+009 6.95323655234158e+009 -3.88389846288434e-002 1.77882825136888e-001

1.65027592792897e+009 4.79230993332397e+009 3.89572213484844e-001 -9.94169461070986e-003
3.16889845449974e+009 0.00000000000000e+000 9.45658199562391e-001 0.00000000000000e+000
1.32771450690480e+009 3.45668040327389e+009 6.84123512977020e-002 1.69991025600332e-002
1.92390061618100e+009 0.00000000000000e+000 -6.49269043080150e-002 0.00000000000000e+000
5.91378682543121e+008 1.78710870158884e+009 3.92885450221706e-004 -3.40377297517302e-003
3.11392667035657e+008 0.00000000000000e+000 -1.25239044837834e-002 0.00000000000000e+000
2.32477799772940e+007 0.00000000000000e+000 -1.21850406687916e-002 0.00000000000000e+000
9.33552700088516e+006 0.00000000000000e+000 1.39008875664899e-002 0.00000000000000e+000
1.00000000000000e+025 0.00000000000000e+000 3.22404190099127e-001 0.00000000000000e+000
delay: 0.000000e+000

14

7.80825410629799e+008 7.96282910805460e+009 4.13860489277933e-002 7.35731926245537e-003
1.34855992741747e+009 6.94199393628888e+009 5.72901969166450e-003 -1.89904808389284e-001
3.95770861002918e+009 0.00000000000000e+000 -4.84902569052414e-002 0.00000000000000e+000
1.61167429787139e+009 4.78553570369065e+009 3.61933385142373e-001 1.39008965298186e-002
6.10712490637895e+008 2.81970563519689e+009 1.98392352969592e-004 -1.80797957410603e-005
2.17035945985765e+009 2.64598174819533e+009 -2.36302289508870e-001 -1.76521984287376e+000
1.53271784111296e+009 2.68167085670959e+009 7.51556317473651e-002 1.66499835850601e-002
2.17959210177953e+009 0.00000000000000e+000 -1.09354111907253e+000 0.00000000000000e+000
1.00292055231125e+008 9.97729813337718e+008 -1.07213447544344e-006 5.44226543292402e-006
3.52609697878899e+008 0.00000000000000e+000 -3.54088414038420e-003 0.00000000000000e+000
9.23010673690703e+007 0.00000000000000e+000 -3.16479521344230e-004 0.00000000000000e+000
6.10620805891089e+006 3.24299236625358e+007 6.26984583099065e-005 -1.51054409176980e-004
6.41871867022293e+006 0.00000000000000e+000 -2.79119992009199e-003 0.00000000000000e+000
1.00000000000000e+025 0.00000000000000e+000 -1.91515184183130e-001 0.00000000000000e+000
delay: 0.000000e+000

12

4.07733459126613e+008 9.14373429099905e+009 6.00146651942607e-004 4.45400287205199e-003
7.59612744416716e+008 8.65627744840263e+009 -2.84137862369037e-003 -1.20725673365147e-003
7.55220606532125e+008 7.98464365629584e+009 2.01820486778810e-002 -2.73619479506730e-002
1.33368252015247e+009 6.97828044543532e+009 -3.65893641169212e-002 -1.83475226219995e-001
1.59729733280112e+009 4.75290375511790e+009 -2.93888554144492e-001 3.37903953515725e-001
1.67594933627774e+009 2.96741110812777e+009 1.43764744970890e-001 3.47036737381169e-001
1.76281300440078e+009 1.49396688278820e+009 2.42212458019913e-001 -3.23977436216191e-001
1.52194702809670e+009 0.00000000000000e+000 1.19863530029555e-003 0.00000000000000e+000
1.92710101225455e+008 1.21109889766284e+009 -1.79941537199461e-006 -6.40868158585680e-006
1.438169207440226e+008 0.00000000000000e+000 1.42660738971342e-003 0.00000000000000e+000
3.40346956890979e+006 6.59769239711665e+006 -5.98860463793552e-004 6.96599520941301e-004
1.00000000000000e+025 0.00000000000000e+000 -8.99272627657061e-003 0.00000000000000e+000
delay: 0.000000e+000

13

1.63031102001636e+007 2.45251907466487e+007 4.48384082058463e-003 -6.82395656245267e-003
7.04711790864360e+007 0.00000000000000e+000 7.60000674575969e-002 0.00000000000000e+000
1.24569531514376e+009 1.00138604832785e+009 -2.30889738020051e+002 8.33051532732522e+002
1.63999999999999e+009 8.19999999999999e+008 -2.26565754670169e+003 3.05052971852918e+003
3.62273953909713e+008 1.75264357668850e+008 6.21235443501936e+002 7.20189874301835e+002
5.21526663974944e+008 3.67930862623260e+008 -4.81994057450111e+002 1.03113191957849e+003
4.10000000000001e+008 2.05000000000001e+008 -2.22004111306039e+003 4.96607570949064e+002
1.46925618692045e+009 5.07018495190106e+008 3.14879692351885e+003 -9.12469546007686e+003
8.45939414340113e+008 6.45634056811010e+008 -2.90170462732244e+002 -1.16756939253157e+003
6.22329873968752e+008 2.00073935060605e+008 1.72470142884772e+003 -5.36468292345729e+003
7.09999999999999e+008 3.55000000000000e+008 -3.23933718490923e+003 -1.61966859245462e+003
1.19000000000000e+009 5.95000000000000e+008 3.29198483596878e+003 1.64599241798439e+003
1.00000000000000e+025 0.00000000000000e+000 7.03424066705338e-002 0.00000000000000e+000
delay: 0.000000e+000

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7.80825410629799e+008 7.96282910805460e+009 4.13860489277933e-002 7.35731926245537e-003
1.34855992741747e+009 6.94199393628888e+009 5.72901969166450e-003 -1.89904808389284e-001
3.95770861002918e+009 0.00000000000000e+000 -4.84902569052414e-002 0.00000000000000e+000
1.61167429787139e+009 4.78553570369065e+009 3.61933385142373e-001 1.39008965298186e-002
6.10712490637895e+008 2.81970563519689e+009 1.98392352969592e-004 -1.80797957410603e-005
2.17035945985765e+009 2.64598174819533e+009 -2.36302289508870e-001 -1.76521984287376e+000
1.53271784111296e+009 2.68167085670959e+009 7.51556317473651e-002 1.66499835850601e-002
2.17959210177953e+009 0.00000000000000e+000 -1.09354111907253e+000 0.00000000000000e+000
1.00292055231125e+008 9.97729813337718e+008 -1.07213447544344e-006 5.44226543292402e-006
3.52609697878899e+008 0.00000000000000e+000 -3.54088414038420e-003 0.00000000000000e+000
9.23010673690703e+007 0.00000000000000e+000 -3.16479521344230e-004 0.00000000000000e+000
6.10620805891089e+006 3.24299236625358e+007 6.26984583099065e-005 -1.51054409176980e-004
6.41871867022293e+006 0.00000000000000e+000 -2.79119992009199e-003 0.00000000000000e+000
1.00000000000000e+025 0.00000000000000e+000 -1.91515184183130e-001 0.00000000000000e+000

delay: 0.000000e+000

15

7.73222385296524e+008	7.96698057394505e+009	3.22201001273576e-002	4.80227023651564e-003
1.35765495788926e+009	6.95939664329363e+009	6.42505253823500e-002	2.15833441893068e-001
4.69935566211529e+009	2.54607420142406e+009	-5.67801073962015e-001	-4.81312335225351e+000
3.04947420512359e+009	0.00000000000000e+000	-4.25983121083397e-001	0.00000000000000e+000
1.58946056727787e+009	4.78393562481038e+009	3.19629751490605e-001	3.64765413944814e-002
5.83485393843300e+008	4.29922859495853e+009	-3.01115795087128e-004	1.13271675567387e-003
1.73351081992791e+009	2.87819416671825e+009	1.44400782198461e-002	4.37265627171212e-001
6.53799374680755e+008	1.96683099209730e+009	-3.45384794976892e-003	-9.33800981521645e-004
3.14098068332241e+008	7.55827395248230e+008	1.48124939077786e-003	1.18394230222644e-003
3.48412722452293e+008	0.00000000000000e+000	2.86420141074907e-002	0.00000000000000e+000
2.69874045038840e+008	0.00000000000000e+000	-3.41394765646227e-002	0.00000000000000e+000
3.14207894627279e+007	0.00000000000000e+000	-1.37961130013749e-002	0.00000000000000e+000
4.82606456885920e+007	0.00000000000000e+000	7.15860639116120e-003	0.00000000000000e+000
6.37195385660177e+006	0.00000000000000e+000	8.37297691787421e-003	0.00000000000000e+000
1.00000000000000e+025	0.00000000000000e+000	2.79168598792076e-001	0.00000000000000e+000