

Supporting information for

Is the bipyridyl thorium metallocene a low-valent thorium complex? A combined experimental and computational study

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Table of Content:

1. Magnetic Susceptibility Studies on 1 and 2	S2
2. Computational Details	S4

1. Magnetic Susceptibility Studies on Complexes 1 and 2

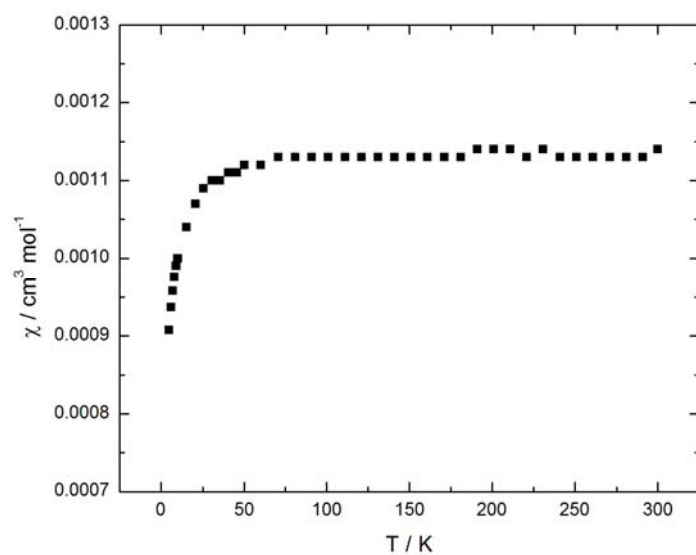


Figure S1. χ vs. T plot for **1** recorded at 1kG (uncorrected for ferromagnetic impurities).

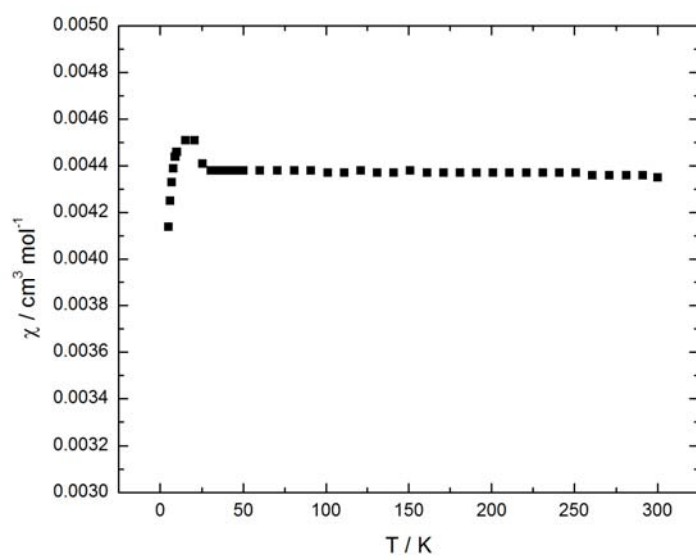


Figure S2. χ vs. T plot for **2** recorded at 1kG (uncorrected for ferromagnetic impurities).

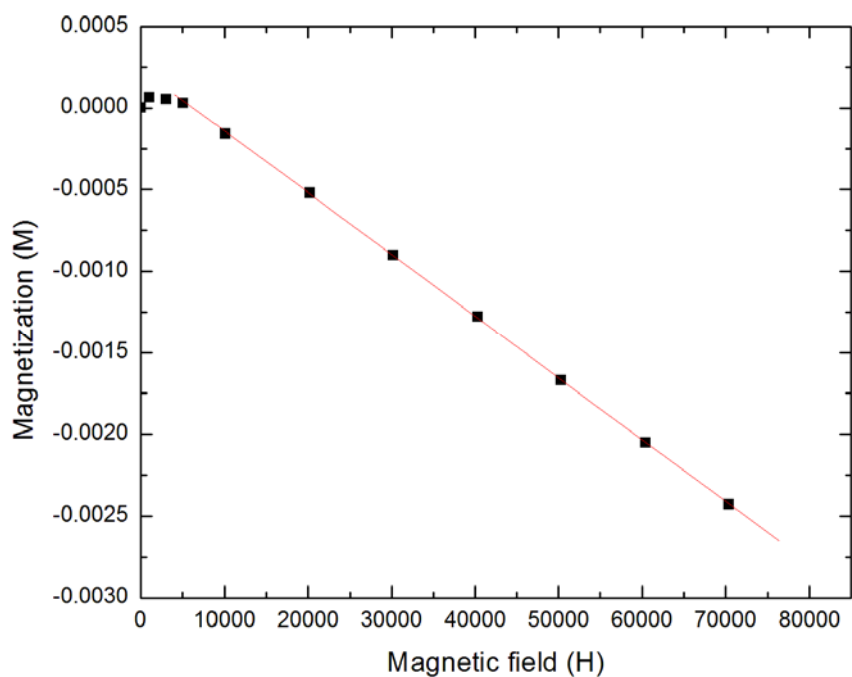


Figure S3. M vs. H plot for **1** recorded at 300 K and at variable magnetic field (H) 0-70 kG. Linear fit results: $\chi_{\text{raw}} = -3.78 \times 10^{-8}$, $M_{\text{ferro}} = 2.37 \times 10^{-4}$.

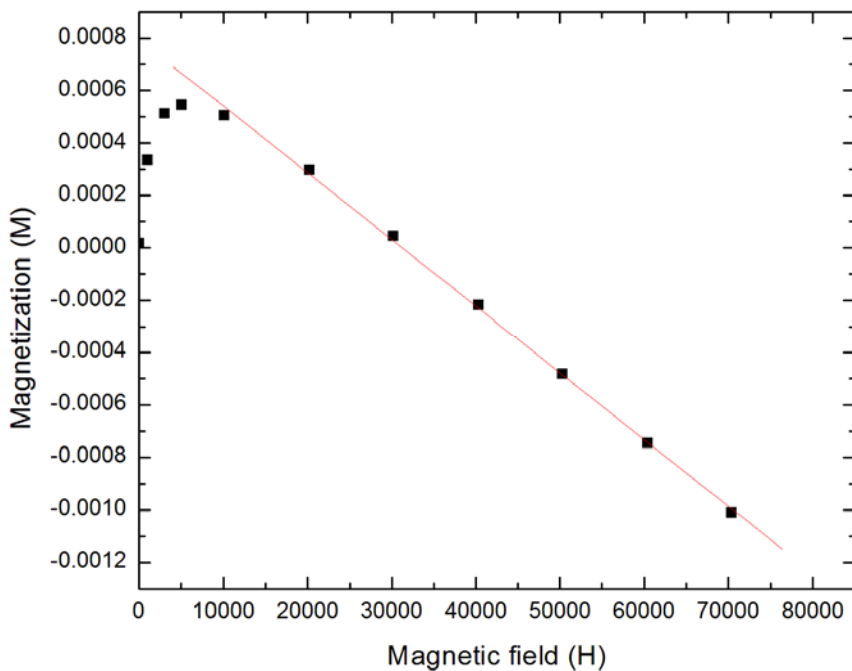


Figure S4. M vs. H plot for **2** recorded at 300 K and at variable magnetic field (H) 0-70 kG. Linear fit results: $\chi_{\text{raw}} = -2.55 \times 10^{-8}$, $M_{\text{ferro}} = 7.94 \times 10^{-4}$.

Table S1. Corrected magnetic susceptibility data for **1**

T (K)	χ_{raw}	MW (g mol ⁻¹)	mass (g)	χ_{mol} (cm ³ mol ⁻¹)	Pascal's constants	χ_{TIP} (cm ³ mol ⁻¹)
200	-3.82 x 10 ⁻⁸	855	0.083	-3.94 x 10 ⁻⁴	-4.82 x 10 ⁻⁴	8.80 x 10 ⁻⁵
250	-3.72 x 10 ⁻⁸	855	0.083	-3.83 x 10 ⁻⁴	-4.82 x 10 ⁻⁴	9.88 x 10 ⁻⁵
300	-3.78 x 10 ⁻⁸	855	0.083	-3.90 x 10 ⁻⁴	-4.82 x 10 ⁻⁴	9.22 x 10 ⁻⁵
Average						9.30 x 10 ⁻⁵
σ_{mean}						3.13 x 10 ⁻⁶

Table S2. Corrected magnetic susceptibility data for **2**

T (K)	χ_{raw}	MW (g mol ⁻¹)	mass (g)	χ_{mol} (cm ³ mol ⁻¹)	Pascal's constants	χ_{TIP} (cm ³ mol ⁻¹)
200	-2.53 x 10 ⁻⁸	743	0.061	-3.09 x 10 ⁻⁴	-3.93 x 10 ⁻⁴	8.42 x 10 ⁻⁵
250	-2.54 x 10 ⁻⁸	743	0.061	-3.09 x 10 ⁻⁴	-3.93 x 10 ⁻⁴	8.37 x 10 ⁻⁵
300	-2.55 x 10 ⁻⁸	743	0.061	-3.10 x 10 ⁻⁴	-3.93 x 10 ⁻⁴	8.30 x 10 ⁻⁵
Average						8.36 x 10 ⁻⁵
σ_{mean}						3.71 x 10 ⁻⁷

2. Computational Details

Complex 2 singlet

89

scf done: -1918.852167

C	0.821672	1.482890	9.156080
H	0.437566	0.808368	9.917902
C	1.120828	1.037231	7.905477
H	0.938737	0.003965	7.632727
C	1.768861	1.947353	7.002581
H	2.140771	1.588998	6.046743
C	1.926064	3.251717	7.351144
H	2.415433	3.939624	6.669403
C	1.381757	3.742812	8.600121
C	1.161698	5.110012	8.863315
C	1.370731	6.155428	7.887886
H	1.854961	5.920644	6.946233
C	0.866854	7.402280	8.095869
H	0.979638	8.167748	7.333317
C	0.161438	7.699767	9.308956
H	-0.295493	8.669015	9.473567
C	0.117870	6.741966	10.274888
H	-0.343082	6.930222	11.241747
C	-0.138279	4.555017	13.271341
H	-0.671407	5.497866	13.229370
C	-0.587994	3.344058	12.679087
C	0.365833	2.352695	13.034209
H	0.323509	1.302474	12.769993

C	1.343420	2.942037	13.885609
H	2.155809	2.410128	14.364343
C	1.023562	4.313300	14.057791
C	4.595298	4.989369	10.872291
C	4.519702	4.733705	12.267081
H	4.581409	5.480608	13.050206
C	4.466996	3.332237	12.472427
H	4.464024	2.840064	13.437621
C	4.497455	2.686416	11.208567
C	4.544022	3.720230	10.229562
H	4.592070	3.559197	9.160272
C	4.943640	6.333282	10.239400
C	3.974834	7.438817	10.689821
H	3.957910	7.534299	11.781210
H	2.954362	7.247477	10.342149
H	4.283962	8.408705	10.283005
C	6.369873	6.706601	10.698203
H	6.421314	6.824776	11.785213
H	6.684369	7.651318	10.238936
H	7.087968	5.931622	10.411154
C	4.940063	6.248447	8.708074
H	5.204472	7.221585	8.280111
H	3.954538	5.973341	8.322873
H	5.671921	5.518024	8.347623
C	4.672028	1.188308	10.981700
C	4.630129	0.842974	9.488079
H	5.437518	1.343023	8.943051
H	3.678444	1.128196	9.030204
H	4.758968	-0.236430	9.350665
C	6.049484	0.779717	11.543701
H	6.851407	1.340439	11.052842
H	6.229774	-0.289426	11.379138
H	6.116101	0.973216	12.619163
C	3.582699	0.386136	11.713296
H	3.748761	-0.690905	11.594926
H	2.589611	0.610705	11.306490
H	3.573592	0.603322	12.786786
C	1.601681	5.294461	15.072090
C	0.556190	5.477128	16.193945
H	-0.377766	5.892197	15.802695
H	0.935056	6.159307	16.964275
H	0.323946	4.519064	16.669702
C	2.891081	4.758926	15.708197
H	2.711563	3.814784	16.232982
H	3.273660	5.475408	16.443192
H	3.676165	4.589868	14.966664
C	1.871418	6.665698	14.430551
H	2.614423	6.597719	13.628263
H	2.252408	7.372834	15.176145
H	0.959201	7.096003	14.005112
C	-1.979099	3.125410	12.091508
C	-2.958273	3.081427	13.286735
H	-2.700133	2.271468	13.976941
H	-3.983096	2.916188	12.933636
H	-2.939744	4.020511	13.848953
C	-2.398371	4.263404	11.150028
H	-2.392426	5.233370	11.658253
H	-3.418921	4.092598	10.788906
H	-1.729865	4.329558	10.288308
C	-2.085395	1.796533	11.334783
H	-1.456209	1.799236	10.442625
H	-3.119952	1.634843	11.012788
H	-1.804723	0.945184	11.964540

N	1.028348	2.771002	9.579779
N	0.684859	5.501864	10.140149
Th	1.929638	3.959486	11.356786

Complex 2 triplet

89

scf done: -1918.838251

C	1.523333	2.130530	8.632168
H	1.892598	1.410619	9.359574
C	1.238024	1.746301	7.343835
H	1.386755	0.718107	7.033843
C	0.743641	2.730691	6.452890
H	0.503757	2.475933	5.424852
C	0.564868	4.013807	6.908815
H	0.184149	4.773627	6.235247
C	0.876574	4.358021	8.248035
C	0.710891	5.667363	8.797244
C	0.173832	6.764176	8.077288
H	-0.126641	6.630139	7.044006
C	0.021400	7.990821	8.675544
H	-0.393370	8.825437	8.118203
C	0.411160	8.147950	10.028358
H	0.308625	9.095267	10.545679
C	0.936170	7.057101	10.679606
H	1.255933	7.137395	11.715939
C	-0.187352	4.482193	13.121041
H	-0.755757	5.388715	12.946325
C	-0.475285	3.219844	12.536458
C	0.484469	2.304062	13.052884
H	0.515276	1.238077	12.867406
C	1.318290	3.004876	13.971961
H	2.101126	2.551924	14.566983
C	0.898039	4.362897	14.037089
C	4.749361	4.741592	10.824227
C	4.604766	4.780118	12.239153
H	4.663539	5.665140	12.860255
C	4.493485	3.440698	12.712623
H	4.446658	3.151729	13.755780
C	4.569556	2.549414	11.602223
C	4.694458	3.373171	10.447123
H	4.790738	3.005769	9.432409
C	5.153004	5.899261	9.918410
C	4.770793	7.254704	10.529430
H	5.252189	7.410852	11.500427
H	3.688911	7.345254	10.664364
H	5.093708	8.067984	9.870095
C	6.689192	5.848525	9.766568
H	7.182311	5.931737	10.740583
H	7.041883	6.671297	9.132821
H	7.006928	4.905792	9.309741
C	4.516109	5.779213	8.526152
H	4.852469	6.601597	7.884399
H	3.424776	5.820848	8.582271
H	4.794744	4.843092	8.032103
C	4.828803	1.048252	11.689007
C	4.762101	0.381113	10.309575
H	5.510580	0.794297	9.625828
H	3.777637	0.505073	9.848688
H	4.955518	-0.693274	10.401175
C	6.256467	0.855763	12.246624
H	6.994961	1.346209	11.604171
H	6.507993	-0.210082	12.306208
H	6.350143	1.283597	13.249696

C	3.835042	0.351749	12.630382
H	4.081966	-0.711491	12.733432
H	2.812455	0.430284	12.244434
H	3.853744	0.793377	13.632242
C	1.293228	5.387421	15.095822
C	0.199506	5.373024	16.185758
H	-0.773809	5.652588	15.770084
H	0.442793	6.078135	16.989922
H	0.101023	4.374959	16.624785
C	2.635603	5.031301	15.748987
H	2.601503	4.050021	16.233117
H	2.886298	5.768581	16.519643
H	3.447102	5.024290	15.014643
C	1.394198	6.804146	14.514299
H	2.188466	6.851533	13.760530
H	1.627527	7.528120	15.303653
H	0.455135	7.118359	14.046701
C	-1.724740	2.868023	11.736196
C	-2.871766	2.662669	12.749775
H	-2.628032	1.864982	13.458981
H	-3.799585	2.389767	12.232567
H	-3.056503	3.576565	13.323377
C	-2.119796	3.992378	10.767336
H	-2.285310	4.939641	11.290067
H	-3.052672	3.734842	10.252771
H	-1.351704	4.156873	10.006303
C	-1.539982	1.567115	10.941905
H	-0.730836	1.652782	10.210534
H	-2.459303	1.327446	10.395978
H	-1.320934	0.719816	11.599772
N	1.371630	3.390438	9.109307
N	1.102624	5.834020	10.117472
Th	2.085986	3.924127	11.489894

SCPh₂ adduct singlet

113

scf done: -2818.201662

N	1.289847	5.156642	10.224563
C	1.434339	4.629359	8.917388
C	1.724370	5.564907	7.855765
C	1.592613	6.903930	8.062970
C	1.210123	7.398812	9.352645
C	1.092188	6.504522	10.372570
C	1.271152	3.243652	8.711643
C	1.472354	2.602042	7.428918
C	0.944518	1.372862	7.188449
C	0.240148	0.679106	8.231159
C	0.263138	1.213598	9.482492
N	0.851045	2.413892	9.791617
Th	2.303160	3.372053	11.324641
C	4.546375	2.432876	9.813111
C	5.019317	3.660378	10.357996
C	5.118460	3.462765	11.760502
C	4.751064	2.127270	12.060728
C	4.406902	1.467910	10.851782
C	5.574012	4.860826	9.597732
C	5.286002	4.751637	8.095625
C	4.164132	-0.030385	10.699396
C	3.041795	-0.510496	11.635118
C	4.997219	6.181949	10.132245
C	7.105041	4.871726	9.796516
C	3.801999	-0.392274	9.253820
C	5.468750	-0.762989	11.076862

C	0.826370	4.502865	13.518509
C	-0.015106	3.448874	13.070448
C	0.695080	2.242987	13.318184
C	1.921278	2.560407	13.968571
C	2.002559	3.968428	14.117550
C	-1.495719	3.596790	12.732917
C	-2.049170	2.372834	11.994439
C	2.974307	4.767132	14.979742
C	3.466143	6.027965	14.250071
C	2.215163	5.203164	16.251967
C	4.177301	3.918859	15.412590
C	-2.239427	3.729745	14.081529
C	-1.776590	4.847506	11.888416
H	-0.155554	0.679002	10.332260
H	-0.236118	-0.278159	8.051880
H	1.062080	0.909083	6.212952
H	2.004826	3.126381	6.641967
H	1.960909	5.192873	6.864836
H	1.757447	7.597905	7.243316
H	1.054728	8.455973	9.533655
H	0.874903	6.830744	11.386305
H	0.560585	5.553652	13.508854
H	0.338572	1.238795	13.120309
H	2.636689	1.836888	14.338480
H	5.493393	4.186725	12.474796
H	4.790660	1.672999	13.043399
H	4.369765	2.242532	8.762208
H	5.202368	6.305917	11.201189
H	3.914663	6.241511	9.979791
H	5.449293	7.035426	9.613735
H	7.369174	4.984417	10.852793
H	7.557337	5.703582	9.243300
H	7.552838	3.939346	9.437294
H	5.704340	5.617533	7.570937
H	4.211664	4.728799	7.895045
H	5.740448	3.852208	7.667012
H	4.611569	-0.128089	8.565429
H	2.890604	0.113355	8.922084
H	3.636785	-1.472278	9.169211
H	6.295818	-0.438317	10.437291
H	5.349395	-1.846647	10.957554
H	5.752018	-0.565397	12.115688
H	2.920477	-1.597997	11.568554
H	2.081734	-0.056541	11.363764
H	3.255443	-0.264637	12.680821
H	1.360496	5.840599	16.005597
H	2.877278	5.766747	16.920080
H	1.838477	4.332453	16.798440
H	3.860891	3.049713	15.998784
H	4.848853	4.513223	16.041518
H	4.752990	3.558403	14.556200
H	4.022329	5.777917	13.340011
H	4.133895	6.610440	14.894864
H	2.635713	6.681093	13.964314
H	-2.074875	2.848221	14.710004
H	-3.318161	3.833685	13.913646
H	-1.894534	4.607171	14.638019
H	-1.449282	5.761877	12.394231
H	-2.853854	4.942620	11.710145
H	-1.268109	4.793636	10.922887
H	-1.595277	2.273578	11.006550
H	-3.131221	2.479040	11.858725
H	-1.882433	1.447084	12.556039

S	2.190880	9.866435	12.790999
C	1.335624	11.246813	12.478263
C	2.029469	12.527819	12.219774
C	-0.143649	11.236772	12.446189
C	-0.848483	12.043814	11.534435
C	-2.236975	11.982114	11.458888
C	-2.947386	11.135659	12.308277
C	-2.260680	10.338186	13.226175
C	-0.873905	10.379078	13.286727
H	-0.300126	12.696517	10.862486
H	-2.763912	12.595315	10.733377
H	-4.031809	11.095435	12.255629
H	-2.810167	9.681740	13.894898
H	-0.331094	9.755172	13.989946
C	1.478612	13.745698	12.659020
C	2.164275	14.942483	12.471985
C	3.397285	14.948238	11.821932
C	3.950438	13.747458	11.372229
C	3.280341	12.548832	11.578961
H	0.524369	13.745398	13.176272
H	1.734705	15.871374	12.836301
H	3.926941	15.884095	11.666418
H	4.908413	13.747548	10.860028
H	3.707904	11.609262	11.243346

SCPh₂ adduct triplet

113

scf done: -2818.223956

N	1.274190	5.657554	9.270235
C	1.084338	4.891122	8.129270
C	0.715939	5.505371	6.907448
C	0.490171	6.858092	6.841653
C	0.627233	7.626961	8.019557
C	1.018069	6.990108	9.173381
C	1.240063	3.482498	8.284084
C	0.993935	2.539253	7.255472
C	1.053868	1.191215	7.506393
C	1.366644	0.755258	8.818675
C	1.632412	1.711027	9.768275
N	1.600662	3.047083	9.547806
Th	2.257015	4.632810	11.400327
C	4.737453	3.457663	10.368544
C	5.034717	4.828279	10.608200
C	4.965981	5.008029	12.017046
C	4.664393	3.760911	12.619381
C	4.577401	2.768787	11.602054
C	5.630611	5.781146	9.571602
C	4.654562	6.063917	8.419776
C	4.823240	1.270307	11.822762
C	3.831136	0.603519	12.785871
C	6.056979	7.104738	10.220467
C	6.892302	5.107276	8.989235
C	4.857486	0.490447	10.500170
C	6.231653	1.160448	12.454940
C	0.271847	5.095687	13.398490
C	-0.436131	4.417007	12.365021
C	0.095788	3.102925	12.313443
C	1.073148	2.966040	13.330967
C	1.172118	4.192622	14.039778
C	-1.732018	4.865897	11.695866
C	-1.939424	4.190043	10.333177
C	1.821116	4.395010	15.410778
C	2.849234	5.534256	15.430448

C	0.691537	4.742589	16.405147
C	2.492169	3.103670	15.899244
C	-2.882497	4.438228	12.635262
C	-1.793232	6.386353	11.519140
H	1.893749	1.415011	10.779871
H	1.407515	-0.296754	9.077659
H	0.853320	0.473882	6.716614
H	0.733120	2.888719	6.262942
H	0.605467	4.897271	6.016768
H	0.207149	7.323904	5.902433
H	0.456590	8.697019	8.031740
H	1.153304	7.557610	10.085973
H	0.094485	6.117697	13.711703
H	-0.237650	2.312540	11.654194
H	1.597426	2.052276	13.576192
H	5.153716	5.931517	12.549430
H	4.636758	3.576028	13.685888
H	4.747551	2.983992	9.394603
H	6.827299	6.940872	10.981951
H	5.214276	7.615003	10.695314
H	6.479696	7.771380	9.460539
H	7.606371	4.859282	9.781352
H	7.388658	5.783279	8.283082
H	6.648610	4.184193	8.453788
H	5.137808	6.679608	7.652185
H	3.769800	6.600952	8.772066
H	4.318775	5.138509	7.939285
H	5.659602	0.852595	9.849232
H	3.918636	0.559168	9.945885
H	5.052057	-0.568748	10.702288
H	6.980902	1.646765	11.822575
H	6.513724	0.107302	12.573139
H	6.265361	1.634300	13.440540
H	4.154368	-0.419894	13.007622
H	2.822681	0.539903	12.366270
H	3.770938	1.141305	13.736805
H	0.214803	5.693208	16.149790
H	1.095933	4.830483	17.420604
H	-0.079867	3.965536	16.410905
H	1.774946	2.279645	15.975261
H	2.923065	3.263358	16.893405
H	3.304462	2.787147	15.237630
H	3.716467	5.312916	14.802284
H	3.209344	5.699656	16.452983
H	2.411206	6.463780	15.065031
H	-2.888131	3.353206	12.781915
H	-3.850272	4.730616	12.210285
H	-2.783941	4.911089	13.617610
H	-1.695548	6.909275	12.473955
H	-2.756105	6.673008	11.081131
H	-1.005371	6.745323	10.851669
H	-1.153637	4.464603	9.624978
H	-2.900303	4.500765	9.908111
H	-1.958835	3.098725	10.416685
S	2.832595	7.372571	12.100907
C	1.808423	8.802880	12.143890
C	2.010111	9.877192	11.193941
C	0.888805	8.980246	13.286231
C	-0.463318	9.320305	13.093572
C	-1.322518	9.497701	14.176063
C	-0.852036	9.350827	15.480654
C	0.489283	9.028375	15.690493
C	1.346014	8.843840	14.608649

H	-0.839968	9.434180	12.081149
H	-2.364814	9.749204	13.997565
H	-1.521412	9.492769	16.324543
H	0.874087	8.930615	16.702295
H	2.394882	8.617888	14.774728
C	1.415300	11.155060	11.380670
C	1.619952	12.188602	10.478062
C	2.431064	12.008188	9.354624
C	3.046352	10.769053	9.160592
C	2.845851	9.729239	10.056913
H	0.805648	11.335820	12.258956
H	1.150739	13.152328	10.659937
H	2.590472	12.821069	8.651860
H	3.693080	10.611914	8.300964
H	3.340378	8.777631	9.899701

Product- Complex 4

113

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C	3.801461	-1.984191	16.977367
H	4.075639	-1.157806	16.331231
C	2.495469	-2.151467	17.397070
H	1.725620	-1.456785	17.079620
C	2.216523	-3.222137	18.253564
H	1.213895	-3.373216	18.642811
C	3.233615	-4.093760	18.595556
H	3.036563	-4.925417	19.260098
C	4.530490	-3.895207	18.089756
C	5.636035	-4.842142	18.291155
C	5.344962	-6.117609	18.717096
H	4.331776	-6.410628	18.956673
C	6.388190	-7.102839	18.711177
H	6.151328	-8.134259	18.959211
C	7.640406	-6.752210	18.368939
H	8.430186	-7.494023	18.314186
C	8.021519	-5.341001	18.001868
H	8.481551	-5.389878	17.000739
C	9.228101	-4.779428	18.857838
C	8.986618	-4.574575	20.352787
C	7.784378	-4.869690	21.001195
H	6.939527	-5.255910	20.446217
C	7.648776	-4.685141	22.380945
H	6.701739	-4.926855	22.857109
C	8.709617	-4.206826	23.140937
H	8.602765	-4.070420	24.213836
C	9.916126	-3.904022	22.505666
H	10.757236	-3.526144	23.081144
C	10.047916	-4.083254	21.134373
H	10.988471	-3.840189	20.648599
C	10.406607	-5.743514	18.640173
C	10.713725	-6.731553	19.588011
H	10.162495	-6.769270	20.521702
C	11.718900	-7.668619	19.352563
H	11.938643	-8.417388	20.109312
C	12.438620	-7.646343	18.160145
H	13.226765	-8.372268	17.978995
C	12.137222	-6.677854	17.204606
H	12.690660	-6.642426	16.269678
C	11.134158	-5.741258	17.444264
H	10.919411	-4.978156	16.705102
C	7.042834	-0.230613	18.885924
C	6.094585	0.198469	17.913020
H	5.026964	0.267871	18.089967

C	6.768603	0.720686	16.772922
C	8.152050	0.518313	17.010442
H	8.957222	0.819390	16.353991
C	8.321789	-0.047091	18.299254
H	9.271237	-0.266142	18.768788
C	6.732510	-0.516209	20.352764
C	6.139194	0.769467	20.967045
H	6.832256	1.610152	20.858730
H	5.944077	0.623974	22.036256
H	5.195192	1.047381	20.486550
C	5.710366	-1.651688	20.507128
H	4.787738	-1.441035	19.955360
H	5.444986	-1.785593	21.562039
H	6.124041	-2.601318	20.152785
C	8.008598	-0.879187	21.120575
H	8.500190	-1.757444	20.694245
H	7.767247	-1.104194	22.164524
H	8.722876	-0.048748	21.115460
C	6.157105	1.681450	15.750877
C	5.661857	2.918266	16.535534
H	4.881344	2.648029	17.253380
H	5.248585	3.668953	15.850942
H	6.483002	3.379262	17.093190
C	4.958706	1.087093	14.996510
H	5.240758	0.203931	14.416076
H	4.541048	1.823678	14.300416
H	4.154677	0.811406	15.687530
C	7.199464	2.173953	14.736532
H	8.029940	2.680975	15.237300
H	6.739453	2.891226	14.048235
H	7.615762	1.362626	14.133365
C	8.713656	-2.480553	14.350071
C	8.202385	-3.796382	14.542348
H	8.811850	-4.680915	14.678481
C	6.788998	-3.796174	14.399785
C	6.409874	-2.439993	14.207321
H	5.402232	-2.084793	14.024063
C	7.584143	-1.642446	14.161935
H	7.610178	-0.582287	13.952960
C	10.160746	-2.110057	14.029118
C	10.273256	-2.060433	12.488654
H	9.998689	-3.023326	12.045920
H	11.301707	-1.827172	12.187864
H	9.612466	-1.296754	12.065771
C	11.154258	-3.149707	14.559079
H	11.111992	-3.204105	15.650467
H	12.173599	-2.871008	14.269792
H	10.958821	-4.144978	14.146590
C	10.554854	-0.738168	14.593478
H	9.877152	0.052836	14.256271
H	11.563420	-0.470587	14.258696
H	10.562434	-0.749542	15.688047
C	5.926642	-5.019169	14.098784
C	6.066934	-5.278086	12.580069
H	5.725405	-4.414871	11.999417
H	5.469258	-6.148668	12.283923
H	7.109625	-5.473088	12.310019
C	6.400311	-6.270312	14.848207
H	7.446597	-6.503336	14.625734
H	5.803919	-7.136802	14.540778
H	6.295743	-6.157761	15.929207
C	4.441751	-4.783079	14.406172
H	4.268748	-4.637298	15.474753

H	3.854803	-5.652068	14.088422
H	4.047965	-3.912879	13.870473
N	4.805730	-2.808658	17.330557
N	6.876594	-4.400519	17.913125
S	9.611939	-3.093178	18.136980
Th	7.307266	-2.257497	16.868389

