



# wwPDB X-ray Structure Validation Summary Report ⓘ

Aug 15, 2023 – 04:12 AM EDT

PDB ID : 1TWH  
Title : RNA polymerase II complexed with 2'dATP  
Authors : Westover, K.D.; Bushnell, D.A.; Kornberg, R.D.  
Deposited on : 2004-06-30  
Resolution : 3.40 Å(reported)

This is a wwPDB X-ray Structure Validation Summary Report for a publicly released PDB entry.

We welcome your comments at [validation@mail.wwpdb.org](mailto:validation@mail.wwpdb.org)

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
Xtriage (Phenix) : 1.13  
EDS : 2.35  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Refmac : 5.8.0158  
CCP4 : 7.0.044 (Gargrove)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.35

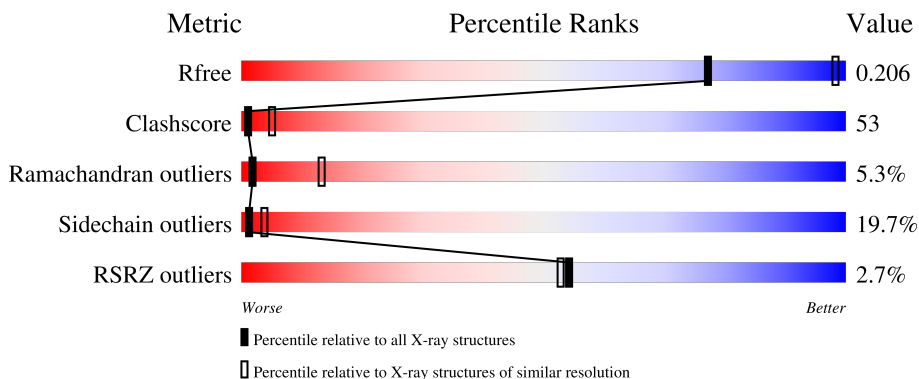
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 3.40 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.







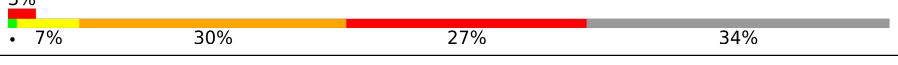
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	130704	1026 (3.48-3.32)
Clashscore	141614	1055 (3.48-3.32)
Ramachandran outliers	138981	1038 (3.48-3.32)
Sidechain outliers	138945	1038 (3.48-3.32)
RSRZ outliers	127900	2173 (3.50-3.30)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions  $\leq 5\%$ . The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	1733	
2	B	1224	
3	C	318	
4	E	215	
5	F	155	

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Mol	Chain	Length	Quality of chain
6	H	146	
7	I	122	
8	J	70	
9	K	120	
10	L	70	

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
12	ZN	C	3002	-	-	X	-
12	ZN	J	3001	-	-	X	-
13	ATP	A	3011	X	-	-	-

## 2 Entry composition

There are 14 unique types of molecules in this entry. The entry contains 27728 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called DNA-directed RNA polymerase II largest subunit.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	1349	10606	6692	1839	2017	58	0	0	0

- Molecule 2 is a protein called DNA-directed RNA polymerase II 140 kDa polypeptide.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	1091	8690	5511	1516	1610	53	0	0	0

- Molecule 3 is a protein called DNA-directed RNA polymerase II 45 kDa polypeptide.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	C	266	2095	1317	348	417	13	0	0	0

- Molecule 4 is a protein called DNA-directed RNA polymerases I, II, and III 27 kDa polypeptide.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
4	E	215	1760	1116	310	322	12	0	0	0

- Molecule 5 is a protein called DNA-directed RNA polymerases I, II, and III 23 kDa polypeptide.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
5	F	83	670	428	114	125	3	0	0	0

- Molecule 6 is a protein called DNA-directed RNA polymerases I, II, and III 14.5 kDa polypeptide.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
6	H	133	1068	673	180	211	4	0	0	0

- Molecule 7 is a protein called DNA-directed RNA polymerase II 14.2 kDa polypeptide.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
7	I	121	990	610	181	188	11	0	0	0

- Molecule 8 is a protein called DNA-directed RNA polymerases I, II, and III 8.3 kDa polypeptide.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
8	J	64	525	334	92	93	6	0	0	0

- Molecule 9 is a protein called DNA-directed RNA polymerase II 13.6 kDa polypeptide.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
9	K	114	919	590	156	171	2	0	0	0

- Molecule 10 is a protein called DNA-directed RNA polymerases I, II, and III 7.7 kDa polypeptide.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
10	L	46	364	224	72	64	4	0	0	0

- Molecule 11 is MANGANESE (II) ION (three-letter code: MN) (formula: Mn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
11	A	2	Total	Mn	0	0
			2	2		

- Molecule 12 is ZINC ION (three-letter code: ZN) (formula: Zn).

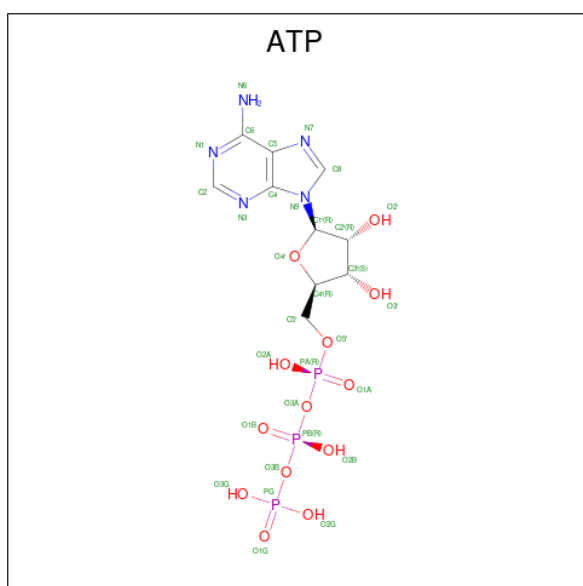
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
12	A	2	Total	Zn	0	0
			2	2		
12	B	1	Total	Zn	0	0
			1	1		

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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
12	C	1	Total	Zn	0	0
			1	1		
12	I	2	Total	Zn	0	0
			2	2		
12	J	1	Total	Zn	0	0
			1	1		
12	L	1	Total	Zn	0	0
			1	1		

- Molecule 13 is ADENOSINE-5'-TRIPHOSPHATE (three-letter code: ATP) (formula:  $C_{10}H_{16}N_5O_{13}P_3$ ).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
13	A	1	Total	C	N	O	P	0	0
			30	10	5	12	3		

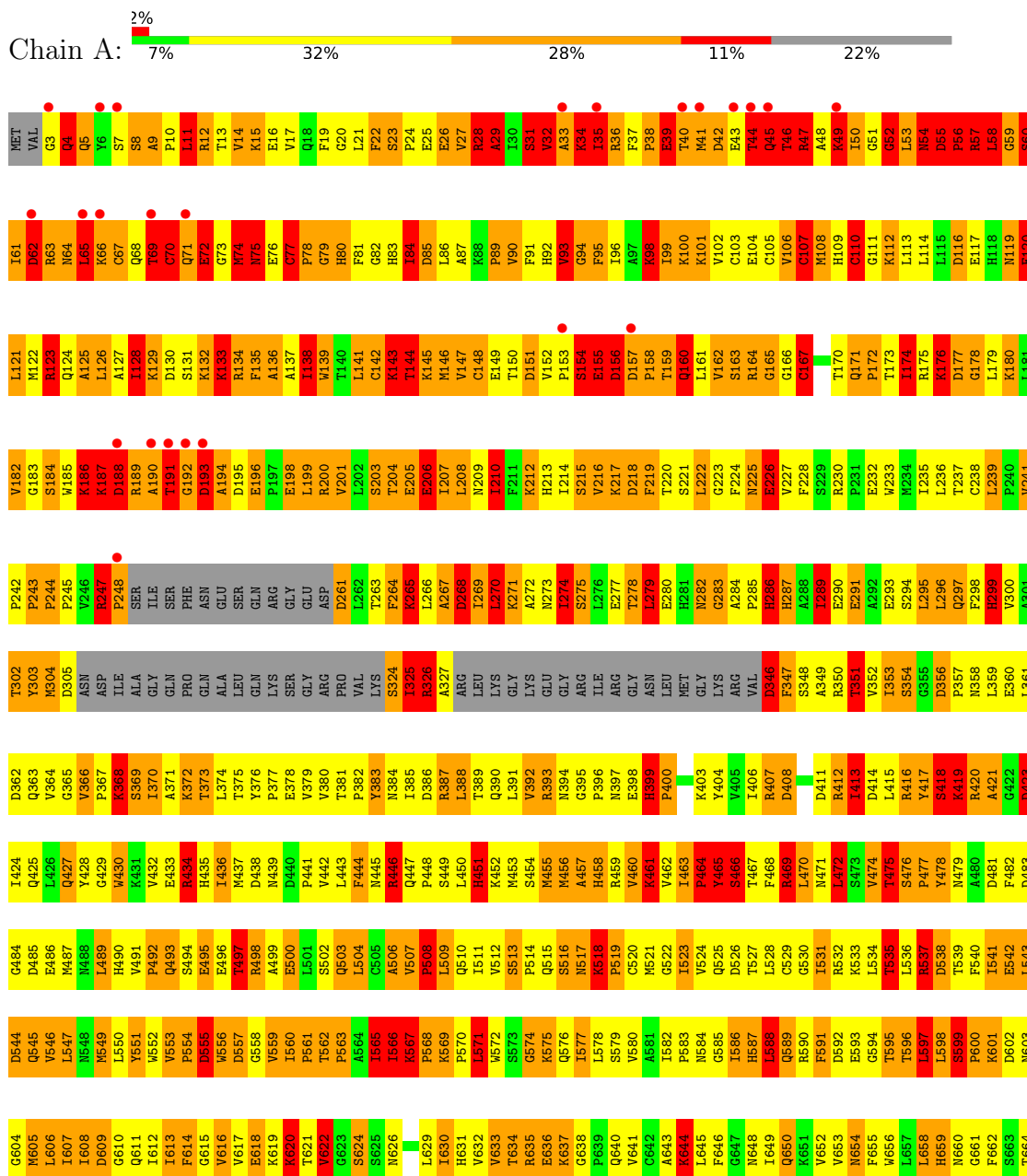
- Molecule 14 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
14	B	1	Total	O	0	0
			1	1		

### 3 Residue-property plots

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density ( $RSRZ > 2$ ). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

- Molecule 1: DNA-directed RNA polymerase II largest subunit



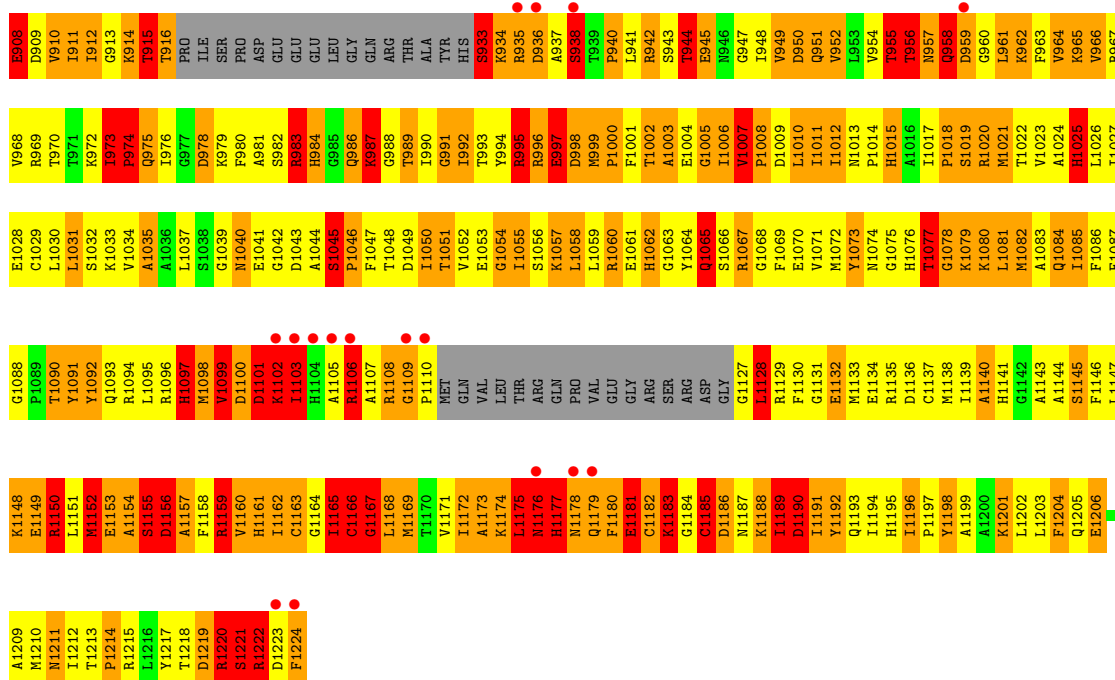




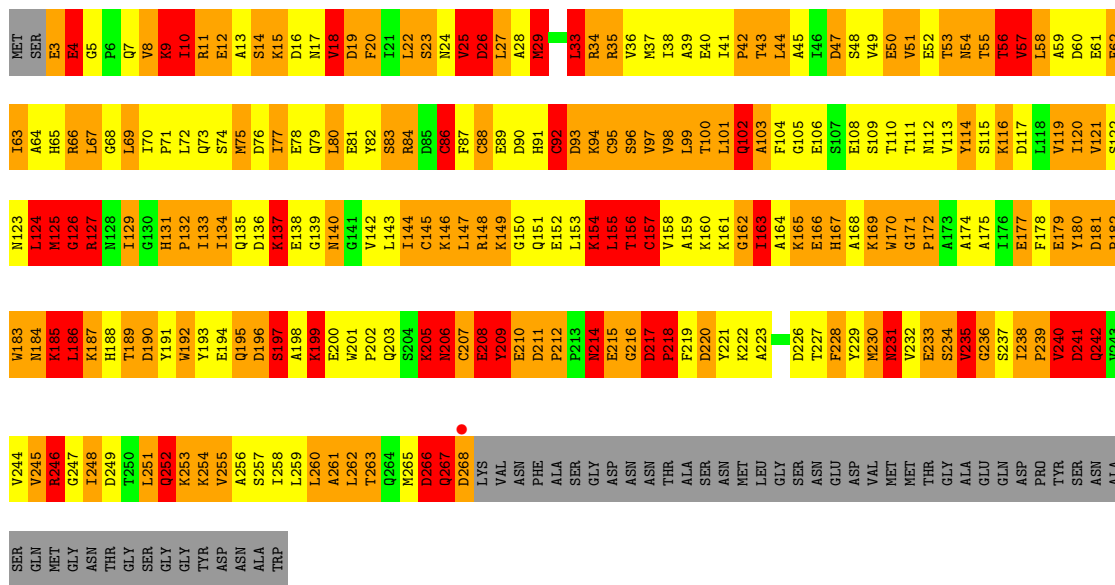
• Molecule 2: DNA-directed RNA polymerase II 140 kDa polypeptide



ME1	ME2	ME3	ME4	ME5	ME6	ME7	ME8	ME9	ME10	ME11	ME12	ME13	ME14	ME15	ME16	ME17	ME18	ME19	ME20	ME21	ME22	ME23	ME24	ME25	ME26	ME27	ME28	ME29	ME30	ME31	ME32	ME33	ME34	ME35	ME36	ME37	ME38	ME39	ME40	ME41	ME42	ME43	ME44	ME45	ME46	ME47	ME48	ME49	ME50	ME51	ME52	ME53	ME54	ME55	ME56	ME57	ME58	ME59	ME60	ME61	ME62	ME63	ME64	ME65	ME66	ME67	ME68	ME69	ME70	ME71	ME72	ME73	ME74	ME75	ME76	ME77	ME78	ME79	ME80	ME81	ME82	ME83	ME84	ME85	ME86	ME87	ME88	ME89	ME90	ME91	ME92	ME93	ME94	ME95	ME96	ME97	ME98	ME99	ME100	ME101	ME102	ME103	ME104	ME105	ME106	ME107	ME108	ME109	ME110	ME111	ME112	ME113	ME114	ME115	ME116	ME117	ME118	ME119	ME120	ME121	ME122	ME123	ME124	ME125	ME126	ME127	ME128	ME129	ME130	ME131	ME132	ME133	ME134	ME135	ME136	ME137	ME138	ME139	ME140	ME141	ME142	ME143	ME144	ME145	ME146	ME147	ME148	ME149	ME150	ME151	ME152	ME153	ME154	ME155	ME156	ME157	ME158	ME159	ME160	ME161	ME162	ME163	ME164	ME165	ME166	ME167	ME168	ME169	ME170	ME171	ME172	ME173	ME174	ME175	ME176	ME177	ME178	ME179	ME180	ME181	ME182	ME183	ME184	ME185	ME186	ME187	ME188	ME189	ME190	ME191	ME192	ME193	ME194	ME195	ME196	ME197	ME198	ME199	ME200	ME201	ME202	ME203	ME204	ME205	ME206	ME207	ME208	ME209	ME210	ME211	ME212	ME213	ME214	ME215	ME216	ME217	ME218	ME219	ME220	ME221	ME222	ME223	ME224	ME225	ME226	ME227	ME228	ME229	ME230	ME231	ME232	ME233	ME234	ME235	ME236	ME237	ME238	ME239	ME240	ME241	ME242	ME243	ME244	ME245	ME246	ME247	ME248	ME249	ME250	ME251	ME252	ME253	ME254	ME255	ME256	ME257	ME258	ME259	ME260	ME261	ME262	ME263	ME264	ME265	ME266	ME267	ME268	ME269	ME270	ME271	ME272	ME273	ME274	ME275	ME276	ME277	ME278	ME279	ME280	ME281	ME282	ME283	ME284	ME285	ME286	ME287	ME288	ME289	ME290	ME291	ME292	ME293	ME294	ME295	ME296	ME297	ME298	ME299	ME300	ME301	ME302	ME303	ME304	ME305	ME306	ME307	ME308	ME309	ME310	ME311	ME312	ME313	ME314	ME315	ME316	ME317	ME318	ME319	ME320	ME321	ME322	ME323	ME324	ME325	ME326	ME327	ME328	ME329	ME330	ME331	ME332	ME333	ME334	ME335	ME336	ME337	ME338	ME339	ME340	ME341	ME342	ME343	ME344	ME345	ME346	ME347	ME348	ME349	ME350	ME351	ME352	ME353	ME354	ME355	ME356	ME357	ME358	ME359	ME360	ME361	ME362	ME363	ME364	ME365	ME366	ME367	ME368	ME369	ME370	ME371	ME372	ME373	ME374	ME375	ME376	ME377	ME378	ME379	ME380	ME381	ME382	ME383	ME384	ME385	ME386	ME387	ME388	ME389	ME390	ME391	ME392	ME393	ME394	ME395	ME396	ME397	ME398	ME399	ME400	ME401	ME402	ME403	ME404	ME405	ME406	ME407	ME408	ME409	ME410	ME411	ME412	ME413	ME414	ME415	ME416	ME417	ME418	ME419	ME420	ME421	ME422	ME423	ME424	ME425	ME426	ME427	ME428	ME429	ME430	ME431	ME432	ME433	ME434	ME435	ME436	ME437	ME438	ME439	ME440	ME441	ME442	ME443	ME444	ME445	ME446	ME447	ME448	ME449	ME450	ME451	ME452	ME453	ME454	ME455	ME456	ME457	ME458	ME459	ME460	ME461	ME462	ME463	ME464	ME465	ME466	ME467	ME468	ME469	ME470	ME471	ME472	ME473	ME474	ME475	ME476	ME477	ME478	ME479	ME480	ME481	ME482	ME483	ME484	ME485	ME486	ME487	ME488	ME489	ME490	ME491	ME492	ME493	ME494	ME495	ME496	ME497	ME498	ME499	ME500	ME501	ME502	ME503	ME504	ME505	ME506	ME507	ME508	ME509	ME510	ME511	ME512	ME513	ME514	ME515	ME516	ME517	ME518	ME519	ME520	ME521	ME522	ME523	ME524	ME525	ME526	ME527	ME528	ME529	ME530	ME531	ME532	ME533	ME534	ME535	ME536	ME537	ME538	ME539	ME540	ME541	ME542	ME543	ME544	ME545	ME546	ME547	ME548	ME549	ME550	ME551	ME552	ME553	ME554	ME555	ME556	ME557	ME558	ME559	ME560	ME561	ME562	ME563	ME564	ME565	ME566	ME567	ME568	ME569	ME570	ME571	ME572	ME573	ME574	ME575	ME576	ME577	ME578	ME579	ME580	ME581	ME582	ME583	ME584	ME585	ME586	ME587	ME588	ME589	ME590	ME591	ME592	ME593	ME594	ME595	ME596	ME597	ME598	ME599	ME600	ME601	ME602	ME603	ME604	ME605	ME606	ME607	ME608	ME609	ME610	ME611	ME612	ME613	ME614	ME615	ME616	ME617	ME618	ME619	ME620	ME621	ME622	ME623	ME624	ME625	ME626	ME627	ME628	ME629	ME630	ME631	ME632	ME633	ME634	ME635	ME636	ME637	ME638	ME639	ME640	ME641	ME642	ME643	ME644	ME645	ME646	ME647	ME648	ME649	ME650	ME651	ME652	ME653	ME654	ME655	ME656	ME657	ME658	ME659	ME660	ME661	ME662	ME663	ME664	ME665	ME666	ME667	ME668	ME669	ME670	ME671	ME672	ME673	ME674	ME675	ME676	ME677	ME678	ME679	ME680	ME681	ME682	ME683	ME684	ME685	ME686	ME687	ME688	ME689	ME690	ME691	ME692	ME693	ME694	ME695	ME696	ME697	ME698	ME699	ME700	ME701	ME702	ME703	ME704	ME705	ME706	ME707	ME708	ME709	ME710	ME711	ME712	ME713	ME714	ME715	ME716	ME717	ME718	ME719	ME720	ME721	ME722	ME723	ME724	ME725	ME726	ME727	ME728	ME729	ME730	ME731	ME732	ME733	ME734	ME735	ME736	ME737	ME738	ME739	ME740	ME741	ME742	ME743	ME744	ME745	ME746	ME747	ME748	ME749	ME750	ME751	ME752	ME753	ME754	ME755	ME756	ME757	ME758	ME759	ME760	ME761	ME762	ME763	ME764	ME765	ME766	ME767	ME768	ME769	ME770	ME771	ME772	ME773	ME774	ME775	ME776	ME777	ME778	ME779	ME780	ME781	ME782	ME783	ME784	ME785	ME786	ME787	ME788	ME789	ME790	ME791	ME792	ME793	ME794	ME795	ME796	ME797	ME798	ME799	ME800	ME801	ME802	ME803	ME804	ME805	ME806	ME807	ME808	ME809	ME810	ME811	ME812	ME813	ME814	ME815	ME816	ME817	ME818	ME819	ME820	ME821	ME822	ME823	ME824	ME825	ME826	ME827	ME828	ME829	ME830	ME831	ME832	ME833	ME834	ME835	ME836	ME837	ME838	ME839	ME840	ME841	ME842	ME843	ME844	ME845	ME846	ME847	ME848	ME849	ME850	ME851	ME852	ME853	ME854	ME855	ME856	ME857	ME858	ME859	ME860	ME861	ME862	ME863	ME864	ME865	ME866	ME867	ME868	ME869	ME870	ME871	ME872	ME873	ME874	ME875	ME876	ME877	ME878	ME879	ME880	ME881	ME882	ME883	ME884	ME885	ME886	ME887	ME888	ME889	ME890	ME891	ME892	ME893	ME894	ME895	ME896	ME897	ME898	ME899	ME900	ME901	ME902	ME903	ME904	ME905	ME906	ME907	ME908	ME909	ME910	ME911	ME912	ME913	ME914	ME915	ME916	ME917	ME918	ME919	ME920	ME921	ME922	ME923	ME924	ME925	ME926	ME927	ME928	ME929	ME930	ME931	ME932	ME933	ME934	ME935	ME936	ME937	ME938	ME939	ME940	ME941	ME942	ME943	ME944	ME945	ME946	ME947	ME948	ME949	ME950	ME951	ME952	ME953	ME954	ME955	ME956	ME957	ME958	ME959	ME960	ME961	ME962	ME963	ME964	ME965	ME966	ME967	ME968	ME969	ME970	ME971	ME972	ME973	ME974	ME975	ME976	ME977	ME978	ME979	ME980	ME981	ME982	ME983	ME984	ME985	ME986	ME987	ME988	ME989	ME990	ME991	ME992	ME993	ME994	ME995	ME996	ME997	ME998	ME999	ME1000
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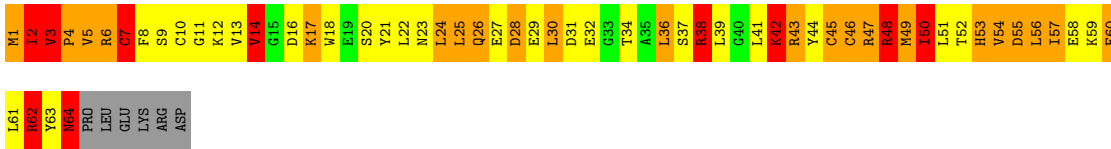
• Molecule 3: DNA-directed RNA polymerase II 45 kDa polypeptide



• Molecule 4: DNA-directed RNA polymerases I, II, and III 27 kDa polypeptide

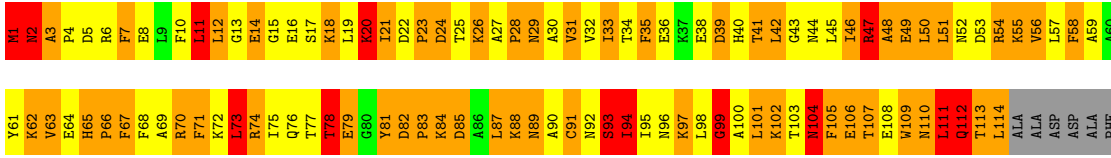






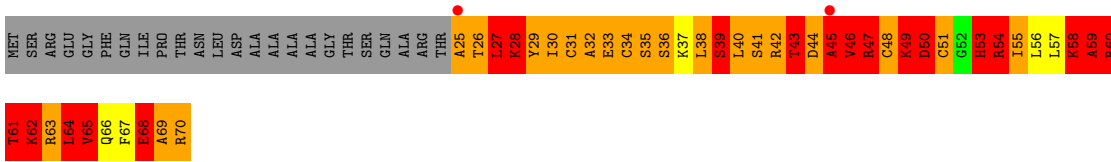
- Molecule 9: DNA-directed RNA polymerase II 13.6 kDa polypeptide

Chain K: 35% 45% 11% 5%



- Molecule 10: DNA-directed RNA polymerases I, II, and III 7.7 kDa polypeptide

Chain L: 3% 7% 30% 27% 34%



## 4 Data and refinement statistics

Property	Value	Source
Space group	I 2 2 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	123.00Å 223.00Å 374.00Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	40.00 – 3.40 39.69 – 3.30	Depositor EDS
% Data completeness (in resolution range)	(Not available) (40.00-3.40) 97.3 (39.69-3.30)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	0.00 (at 3.32Å)	Xtrriage
Refinement program	CNS	Depositor
R, $R_{free}$	0.222 , 0.262 0.191 , 0.206	Depositor DCC
$R_{free}$ test set	2319 reflections (2.99%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	57.9	Xtrriage
Anisotropy	0.559	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.26 , 50.1	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.91	EDS
Total number of atoms	27728	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	35.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 1.85% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical values of  $\langle |L| \rangle$ ,  $\langle L^2 \rangle$  for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

## 5 Model quality i

### 5.1 Standard geometry i

Bond lengths and bond angles in the following residue types are not validated in this section: ATP, ZN, MN

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with  $|Z| > 5$  is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	# Z  >5	RMSZ	# Z  >5
1	A	4.62	2331/10792 (21.6%)	3.06	1145/14601 (7.8%)
2	B	4.57	1918/8860 (21.6%)	3.01	930/11945 (7.8%)
3	C	4.57	476/2133 (22.3%)	2.99	227/2891 (7.9%)
4	E	4.64	405/1796 (22.6%)	2.92	193/2416 (8.0%)
5	F	4.01	117/682 (17.2%)	3.01	56/922 (6.1%)
6	H	4.54	246/1086 (22.7%)	2.94	113/1470 (7.7%)
7	I	5.00	250/1009 (24.8%)	3.19	124/1357 (9.1%)
8	J	4.42	116/533 (21.8%)	3.66	79/715 (11.0%)
9	K	4.36	210/937 (22.4%)	3.12	108/1265 (8.5%)
10	L	5.55	101/366 (27.6%)	3.72	71/485 (14.6%)
All	All	4.60	6170/28194 (21.9%)	3.05	3046/38067 (8.0%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	57
2	B	0	55
3	C	0	15
4	E	1	9
5	F	0	1
6	H	0	12
7	I	0	6
9	K	0	2
10	L	0	2
All	All	1	159

The worst 5 of 6170 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	1064	VAL	C-O	33.98	1.88	1.23
10	L	68	GLU	CG-CD	32.08	2.00	1.51
1	A	1064	VAL	CA-C	31.22	2.34	1.52
1	A	734	GLU	CD-OE2	30.34	1.59	1.25
2	B	552	MET	CG-SD	28.64	2.55	1.81

The worst 5 of 3046 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	1064	VAL	CA-C-O	-35.84	44.85	120.10
5	F	136	ARG	NE-CZ-NH1	-34.13	103.24	120.30
1	A	774	ARG	NE-CZ-NH1	32.04	136.32	120.30
1	A	1064	VAL	O-C-N	-31.34	69.93	123.20
1	A	821	ARG	NE-CZ-NH2	-29.52	105.54	120.30

All (1) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
4	E	204	THR	CB

5 of 159 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	31	SER	Peptide
1	A	44	THR	Peptide
1	A	52	GLY	Peptide
1	A	60	SER	Peptide
1	A	74	MET	Peptide

## 5.2 Too-close contacts

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	10606	0	10662	1054	0
2	B	8690	0	8707	918	0
3	C	2095	0	2054	226	0
4	E	1760	0	1788	222	0
5	F	670	0	689	58	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
6	H	1068	0	1040	220	0
7	I	990	0	948	101	0
8	J	525	0	537	61	0
9	K	919	0	928	108	0
10	L	364	0	387	92	0
11	A	2	0	0	0	0
12	A	2	0	0	1	0
12	B	1	0	0	0	0
12	C	1	0	0	3	0
12	I	2	0	0	0	0
12	J	1	0	0	2	0
12	L	1	0	0	1	0
13	A	30	0	9	0	0
14	B	1	0	0	0	0
All	All	27728	0	27749	2914	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 53.

The worst 5 of 2914 close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:137:TYR:CB	2:B:137:TYR:CG	1.77	1.66
9:K:26:LYS:CD	9:K:26:LYS:CE	1.74	1.66
1:A:1225:PHE:CB	1:A:1225:PHE:CG	1.78	1.65
1:A:977:LYS:CG	1:A:977:LYS:CD	1.74	1.64
2:B:884:ARG:CD	2:B:884:ARG:CG	1.75	1.64

There are no symmetry-related clashes.

## 5.3 Torsion angles [i](#)

### 5.3.1 Protein backbone [i](#)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.



Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	1332/1733 (77%)	1173 (88%)	93 (7%)	66 (5%)	2	14
2	B	1071/1224 (88%)	914 (85%)	110 (10%)	47 (4%)	2	16
3	C	264/318 (83%)	230 (87%)	22 (8%)	12 (4%)	2	16
4	E	213/215 (99%)	182 (85%)	20 (9%)	11 (5%)	2	13
5	F	81/155 (52%)	72 (89%)	7 (9%)	2 (2%)	5	26
6	H	129/146 (88%)	82 (64%)	21 (16%)	26 (20%)	0	0
7	I	119/122 (98%)	107 (90%)	11 (9%)	1 (1%)	19	51
8	J	62/70 (89%)	58 (94%)	3 (5%)	1 (2%)	9	34
9	K	112/120 (93%)	99 (88%)	9 (8%)	4 (4%)	3	21
10	L	44/70 (63%)	24 (54%)	9 (20%)	11 (25%)	0	0
All	All	3427/4173 (82%)	2941 (86%)	305 (9%)	181 (5%)	2	13

5 of 181 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	35	ILE
1	A	38	PRO
1	A	45	GLN
1	A	47	ARG
1	A	59	GLY

### 5.3.2 Protein sidechains [i](#)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	1181/1520 (78%)	971 (82%)	210 (18%)	2	6
2	B	947/1061 (89%)	788 (83%)	159 (17%)	2	8
3	C	234/274 (85%)	194 (83%)	40 (17%)	2	8
4	E	197/197 (100%)	145 (74%)	52 (26%)	0	1
5	F	73/137 (53%)	62 (85%)	11 (15%)	3	12
6	H	117/128 (91%)	71 (61%)	46 (39%)	0	0

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
7	I	115/116 (99%)	82 (71%)	33 (29%)	0	1
8	J	59/65 (91%)	45 (76%)	14 (24%)	1	2
9	K	99/102 (97%)	81 (82%)	18 (18%)	1	6
10	L	40/57 (70%)	21 (52%)	19 (48%)	0	0
All	All	3062/3657 (84%)	2460 (80%)	602 (20%)	1	4

5 of 602 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
5	F	81	THR
9	K	54	ARG
6	H	13	SER
5	F	77	ASP
7	I	4	PHE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 78 such sidechains are listed below:

Mol	Chain	Res	Type
2	B	1193	GLN
7	I	12	ASN
3	C	112	ASN
4	E	104	ASN
9	K	2	ASN

### 5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

### 5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

### 5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 11 ligands modelled in this entry, 10 are monoatomic - leaving 1 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with  $|Z| > 2$  is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
13	ATP	A	3011	11	26,32,33	1.05	2 (7%)	30,50,52	1.51	6 (20%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
13	ATP	A	3011	11	1/1/6/7	5/18/34/38	0/3/3/3

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
13	A	3011	ATP	C4-N3	3.60	1.40	1.35
13	A	3011	ATP	C8-N7	-2.60	1.30	1.34

The worst 5 of 6 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
13	A	3011	ATP	O4'-C1'-C2'	3.62	113.08	106.25
13	A	3011	ATP	PA-O3A-PB	-3.55	120.63	132.83
13	A	3011	ATP	PB-O3B-PG	-3.43	121.06	132.83
13	A	3011	ATP	C2'-C1'-N9	2.67	120.42	114.27
13	A	3011	ATP	C4-C5-N7	2.59	112.10	109.40

All (1) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
13	A	3011	ATP	C1'

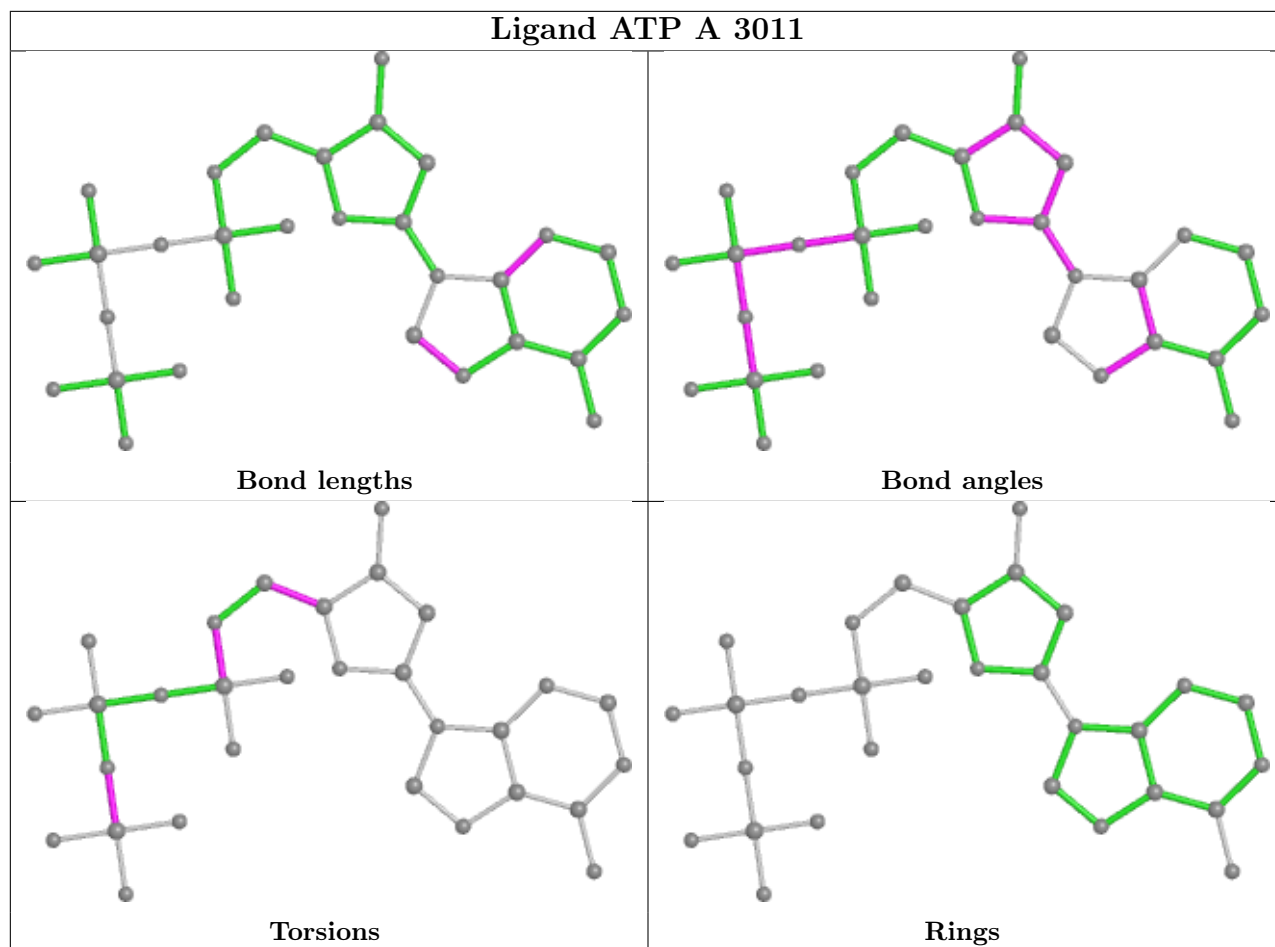
All (5) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
13	A	3011	ATP	O4'-C4'-C5'-O5'
13	A	3011	ATP	C3'-C4'-C5'-O5'
13	A	3011	ATP	PB-O3B-PG-O2G
13	A	3011	ATP	PB-O3B-PG-O3G
13	A	3011	ATP	C5'-O5'-PA-O3A

There are no ring outliers.

No monomer is involved in short contacts.

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.



## 5.7 Other polymers [i](#)

There are no such residues in this entry.

## 5.8 Polymer linkage issues [i](#)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
2	B	12
1	A	8
3	C	2
7	I	2
5	F	1
9	K	1
8	J	1

The worst 5 of 27 chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	A	1014:ALA	C	1015:VAL	N	1.20
1	A	1378:GLN	C	1379:GLY	N	1.20
1	B	49:ASP	C	50:SER	N	1.20
1	B	586:TRP	C	587:HIS	N	1.20
1	B	724:ASP	C	725:PRO	N	1.20

## 6 Fit of model and data [i](#)

### 6.1 Protein, DNA and RNA chains [i](#)

In the following table, the column labelled ‘#RSRZ > 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95<sup>th</sup> percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q < 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å <sup>2</sup> )	Q<0.9
1	A	1349/1733 (77%)	-0.34	27 (2%) 65 64	1, 22, 99, 165	0
2	B	1091/1224 (89%)	-0.31	47 (4%) 35 35	1, 22, 107, 155	0
3	C	266/318 (83%)	-0.53	1 (0%) 92 92	1, 22, 72, 145	0
4	E	215/215 (100%)	-0.30	4 (1%) 66 65	1, 40, 102, 138	0
5	F	83/155 (53%)	-0.33	1 (1%) 79 77	1, 21, 63, 88	0
6	H	133/146 (91%)	0.17	7 (5%) 26 27	14, 65, 120, 167	0
7	I	121/122 (99%)	-0.17	4 (3%) 46 45	1, 30, 79, 120	0
8	J	64/70 (91%)	-0.50	0 100 100	3, 18, 64, 91	0
9	K	114/120 (95%)	-0.32	0 100 100	1, 32, 72, 103	0
10	L	46/70 (65%)	0.10	2 (4%) 35 35	16, 72, 123, 140	0
All	All	3482/4173 (83%)	-0.31	93 (2%) 54 53	1, 25, 103, 167	0

The worst 5 of 93 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	69	THR	7.8
2	B	882	THR	6.9
2	B	1109	GLY	6.6
1	A	1450	LEU	6.2
1	A	1449	SER	6.2

### 6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

### 6.3 Carbohydrates [i](#)

There are no monosaccharides in this entry.

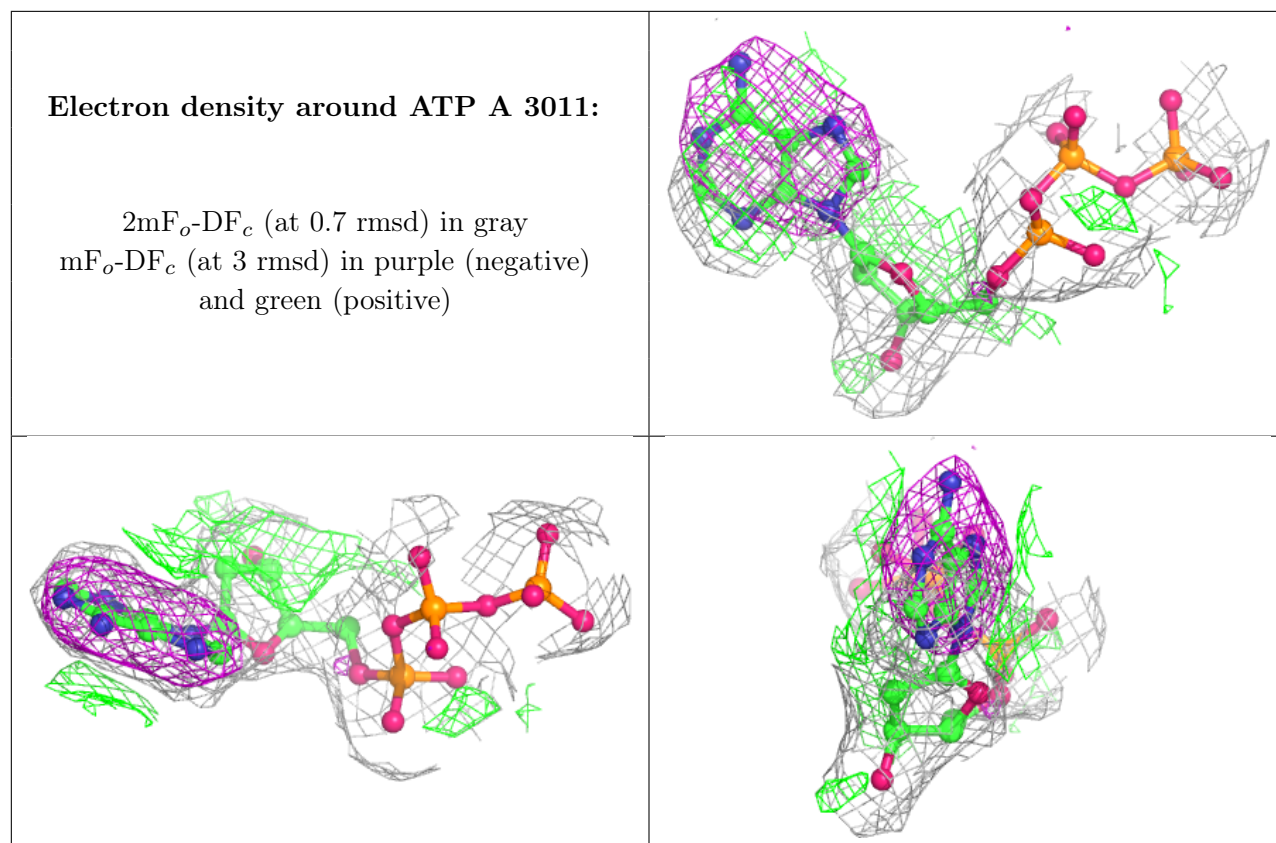
### 6.4 Ligands [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
13	ATP	A	3011	30/31	0.80	0.30	5,46,82,85	0
12	ZN	I	3004	1/1	0.94	0.08	66,66,66,66	0
11	MN	A	3009	1/1	0.94	0.09	4,4,4,4	0
12	ZN	A	3006	1/1	0.95	0.05	47,47,47,47	0
12	ZN	J	3001	1/1	0.95	0.06	34,34,34,34	0
12	ZN	A	3008	1/1	0.95	0.05	91,91,91,91	0
12	ZN	L	3005	1/1	0.96	0.11	90,90,90,90	0
11	MN	A	3010	1/1	0.97	0.05	12,12,12,12	0
12	ZN	C	3002	1/1	0.98	0.07	42,42,42,42	0
12	ZN	I	3003	1/1	0.98	0.03	46,46,46,46	0
12	ZN	B	3007	1/1	0.98	0.06	57,57,57,57	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.





## 6.5 Other polymers [i](#)

There are no such residues in this entry.