



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 05:43 PM UTC

PDB ID : 7QYL / pdb_00007qyl
Title : ATAD2 in complex with FragLite23
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Deposited on : 2022-01-28
Resolution : 1.44 Å(reported)

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

We welcome your comments at 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>.

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

MolProbity : 4-5-2 with Phenix2.0
Mogul : 2022.3.0, CSD as543be (2022)
Xtriage (Phenix) : 2.0
EDS : 3.0
Buster-report : wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4 : 9.0.010 (Gargrove)
Density-Fitness : 1.0.12
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

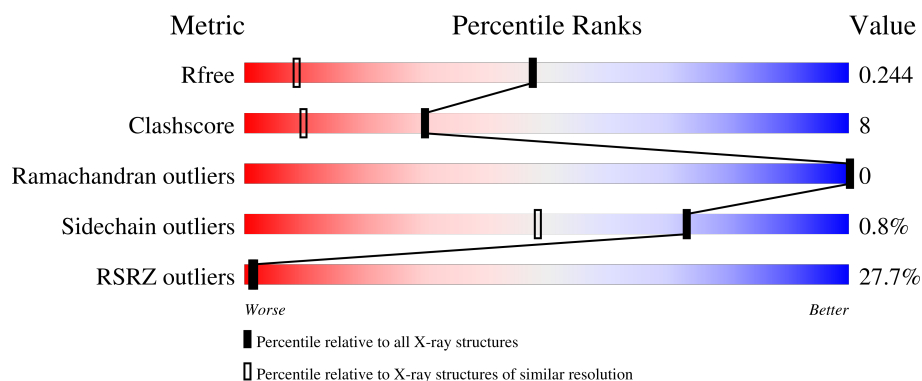
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.44 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}	180053	3234 (1.46-1.42)
Clashscore	190562	3289 (1.46-1.42)
Ramachandran outliers	187476	3248 (1.46-1.42)
Sidechain outliers	187428	3248 (1.46-1.42)
RSRZ outliers	180081	3234 (1.46-1.42)

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 ≥ 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	AAA	130	28% 79% 20%

2 Entry composition [i](#)

There are 6 unique types of molecules in this entry. The entry contains 2509 atoms, of which 1191 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.

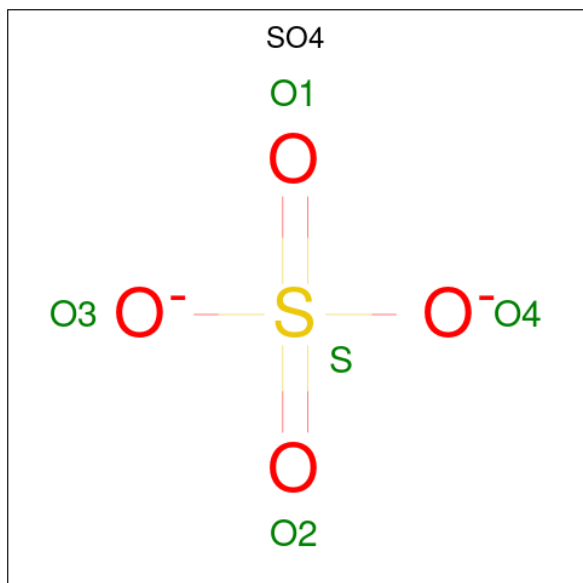
- Molecule 1 is a protein called ATPase family AAA domain-containing protein 2.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	AAA	130	Total	C	H	N	O	S	43	6	0
			2279	711	1141	203	219	5			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
AAA	979	SER	-	expression tag	UNP Q6PL18
AAA	980	MET	-	expression tag	UNP Q6PL18

- Molecule 2 is SULFATE ION (CCD ID: SO4) (formula: O₄S).

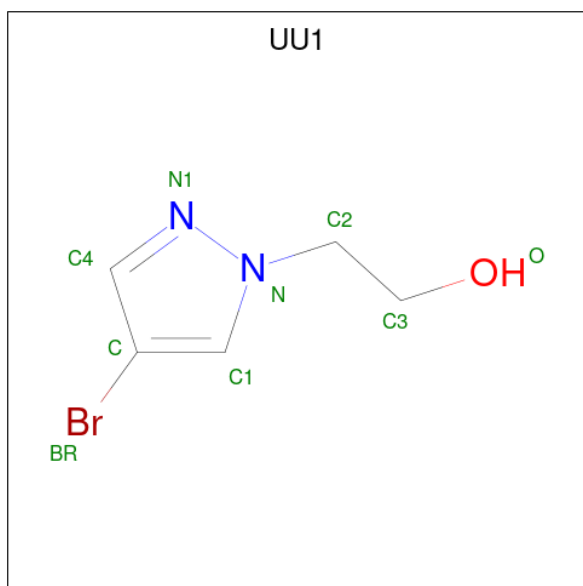


Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	AAA	1	Total	O	S	0	0
			5	4	1		
2	AAA	1	Total	O	S	0	0
			5	4	1		

- Molecule 3 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	AAA	1	Total Cl 1 1	0	0

- Molecule 4 is 2-(4-bromo-1H-pyrazol-1-yl)ethan-1-ol (CCD ID: UU1) (formula: C₅H₇BrN₂O) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
4	AAA	1	Total	Br	C	H	N	O	1	0
			16	1	5	7	2	1		
4	AAA	1	Total	Br	C	H	N	O	1	0
			16	1	5	7	2	1		

- Molecule 5 is 1,2-ETHANEDIOL (CCD ID: EDO) (formula: C₂H₆O₂).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
5	AAA	1	Total	C	H	O	1	0
			10	2	6	2		
5	AAA	1	Total	C	H	O	1	0
			10	2	6	2		
5	AAA	1	Total	C	H	O	1	0
			10	2	6	2		
5	AAA	1	Total	C	H	O	1	0
			10	2	6	2		
5	AAA	1	Total	C	H	O	1	0
			10	2	6	2		

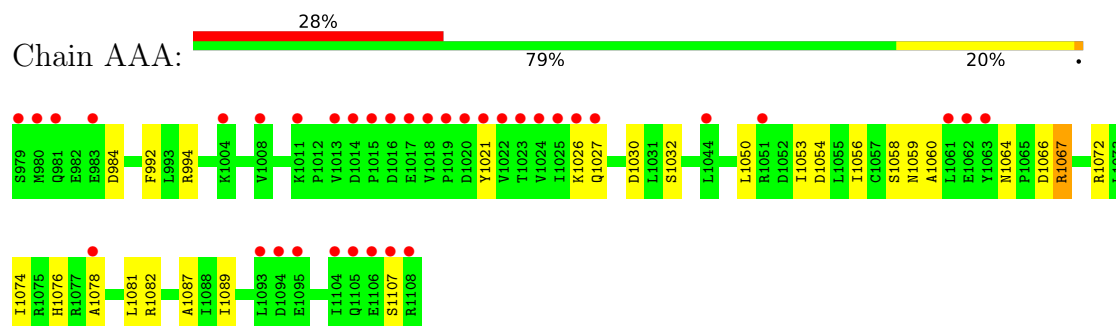
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	AAA	127	Total	O	0	0
			127	127		

3 Residue-property plots [i](#)

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: ATPase family AAA domain-containing protein 2



4 Data and refinement statistics

Property	Value	Source
Space group	P 65 2 2	Depositor
Cell constants a, b, c, α , β , γ	79.52Å 79.52Å 137.41Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	68.87 – 1.44 68.87 – 1.44	Depositor EDS
% Data completeness (in resolution range)	99.8 (68.87-1.44) 99.8 (68.87-1.44)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.07 (at 1.44Å)	Xtriage
Refinement program	REFMAC 5.8.0258, REFMAC 5.8.0258	Depositor
R, R_{free}	0.220 , 0.244 0.221 , 0.244	Depositor DCC
R_{free} test set	2316 reflections (4.76%)	wwPDB-VP
Wilson B-factor (Å ²)	26.6	Xtriage
Anisotropy	0.247	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.43 , 36.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	2509	wwPDB-VP
Average B, all atoms (Å ²)	36.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.41% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical 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

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: UU1, EDO, CL, SO4

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	AAA	1.36	6/1156 (0.5%)	1.56	9/1558 (0.6%)

All (6) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	AAA	1078	ALA	C-O	6.96	1.32	1.24
1	AAA	1074	ILE	C-O	6.12	1.31	1.24
1	AAA	1053	ILE	C-O	5.76	1.30	1.24
1	AAA	1064	ASN	N-CA	5.55	1.52	1.46
1	AAA	1056	ILE	C-O	5.43	1.30	1.24
1	AAA	992	PHE	C-O	5.19	1.30	1.24

All (9) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	AAA	1078	ALA	CA-C-O	-7.67	112.80	120.70
1	AAA	994	ARG	CG-CD-NE	-6.71	97.24	112.00
1	AAA	1058	SER	CA-C-O	-6.27	113.90	120.55
1	AAA	1060	ALA	CA-C-N	5.67	127.88	120.28
1	AAA	1060	ALA	C-N-CA	5.67	127.88	120.28
1	AAA	1059	ASN	N-CA-C	-5.66	105.11	111.28
1	AAA	984	ASP	CA-CB-CG	5.36	117.96	112.60
1	AAA	1021	TYR	O-C-N	5.26	127.50	122.03
1	AAA	1076	HIS	CA-C-O	-5.08	115.16	120.55

There are no chirality outliers.

There are no planarity outliers.

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	AAA	1138	1141	1131	19	1
2	AAA	10	0	0	0	1
3	AAA	1	0	0	0	0
4	AAA	18	14	0	0	0
5	AAA	24	36	36	2	0
6	AAA	127	0	0	4	1
All	All	1318	1191	1167	20	2

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 8.

All (20) 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)
1:AAA:1054:ASP:OD1	1:AAA:1082:ARG:NH1	1.79	1.15
1:AAA:1027[B]:GLN:OE1	6:AAA:1301:HOH:O	1.87	0.90
5:AAA:1207:EDO:H11	5:AAA:1210:EDO:O2	1.80	0.81
1:AAA:1054:ASP:CG	1:AAA:1082:ARG:NH1	2.43	0.76
1:AAA:1066:ASP:OD1	6:AAA:1302:HOH:O	2.03	0.76
1:AAA:1067[A]:ARG:HB2	1:AAA:1072[A]:ARG:NH2	2.08	0.68
1:AAA:1067[A]:ARG:NH2	1:AAA:1072[A]:ARG:HH12	1.97	0.63
1:AAA:1107[B]:SER:OG	6:AAA:1303:HOH:O	2.12	0.61
1:AAA:1081[B]:LEU:C	1:AAA:1081[B]:LEU:HD23	2.28	0.58
1:AAA:1067[A]:ARG:HB2	1:AAA:1072[A]:ARG:CZ	2.34	0.58
1:AAA:1067[A]:ARG:O	1:AAA:1072[A]:ARG:HD2	2.05	0.56
1:AAA:1027[B]:GLN:OE1	1:AAA:1027[B]:GLN:HA	2.05	0.56
1:AAA:1030:ASP:OD2	1:AAA:1032:SER:OG	2.16	0.51
1:AAA:1054:ASP:CG	1:AAA:1082:ARG:HH12	2.18	0.50
1:AAA:1054:ASP:CG	1:AAA:1082:ARG:HH11	2.11	0.50
1:AAA:1050:LEU:HD21	1:AAA:1089:ILE:HD12	1.93	0.50
1:AAA:1050:LEU:HD21	1:AAA:1089:ILE:CD1	2.44	0.47
1:AAA:1067[A]:ARG:CZ	1:AAA:1072[A]:ARG:HH12	2.30	0.43
1:AAA:1087:ALA:CB	5:AAA:1210:EDO:H22	2.50	0.41
1:AAA:1026[B]:LYS:NZ	6:AAA:1312:HOH:O	2.54	0.41

All (2) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
6:AAA:1360:HOH:O	6:AAA:1399:HOH:O[8_565]	2.12	0.08
1:AAA:1067[A]:ARG:HE	2:AAA:1201:SO4:O4[5_455]	1.53	0.07

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	AAA	134/130 (103%)	134 (100%)	0	0	100	100

There are no Ramachandran outliers to report.

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	AAA	129/123 (105%)	127 (98%)	2 (2%)	55	21

All (2) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	AAA	1067[A]	ARG
1	AAA	1067[B]	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

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

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 11 ligands modelled in this entry, 1 is monoatomic - leaving 10 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	$\# Z > 2$
2	SO4	AAA	1201	-	4,4,4	0.73	0	6,6,6	0.52	0
5	EDO	AAA	1207	-	3,3,3	0.06	0	2,2,2	0.13	0
5	EDO	AAA	1208	-	3,3,3	0.32	0	2,2,2	0.46	0
5	EDO	AAA	1205	-	3,3,3	0.48	0	2,2,2	0.30	0
5	EDO	AAA	1206	-	3,3,3	0.34	0	2,2,2	0.31	0
2	SO4	AAA	1211	-	4,4,4	0.33	0	6,6,6	0.08	0
4	UU1	AAA	1203	-	9,9,9	0.37	0	10,11,11	0.78	0
5	EDO	AAA	1209	-	3,3,3	0.40	0	2,2,2	0.17	0
5	EDO	AAA	1210	-	3,3,3	0.14	0	2,2,2	0.35	0
4	UU1	AAA	1204	-	9,9,9	0.42	0	10,11,11	1.20	1 (10%)

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
5	EDO	AAA	1207	-	-	1/1/1/1	-
5	EDO	AAA	1208	-	-	1/1/1/1	-
5	EDO	AAA	1205	-	-	0/1/1/1	-
5	EDO	AAA	1206	-	-	1/1/1/1	-
4	UU1	AAA	1203	-	-	3/3/3/3	0/1/1/1
5	EDO	AAA	1209	-	-	1/1/1/1	-
5	EDO	AAA	1210	-	-	0/1/1/1	-
4	UU1	AAA	1204	-	-	2/3/3/3	0/1/1/1

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	AAA	1204	UU1	BR-C-C4	2.45	130.16	127.03

There are no chirality outliers.

All (9) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	AAA	1203	UU1	C3-C2-N-N1
4	AAA	1203	UU1	N-C2-C3-O
4	AAA	1204	UU1	C3-C2-N-N1
5	AAA	1208	EDO	O1-C1-C2-O2
4	AAA	1203	UU1	C3-C2-N-C1
4	AAA	1204	UU1	C3-C2-N-C1
5	AAA	1207	EDO	O1-C1-C2-O2
5	AAA	1206	EDO	O1-C1-C2-O2
5	AAA	1209	EDO	O1-C1-C2-O2

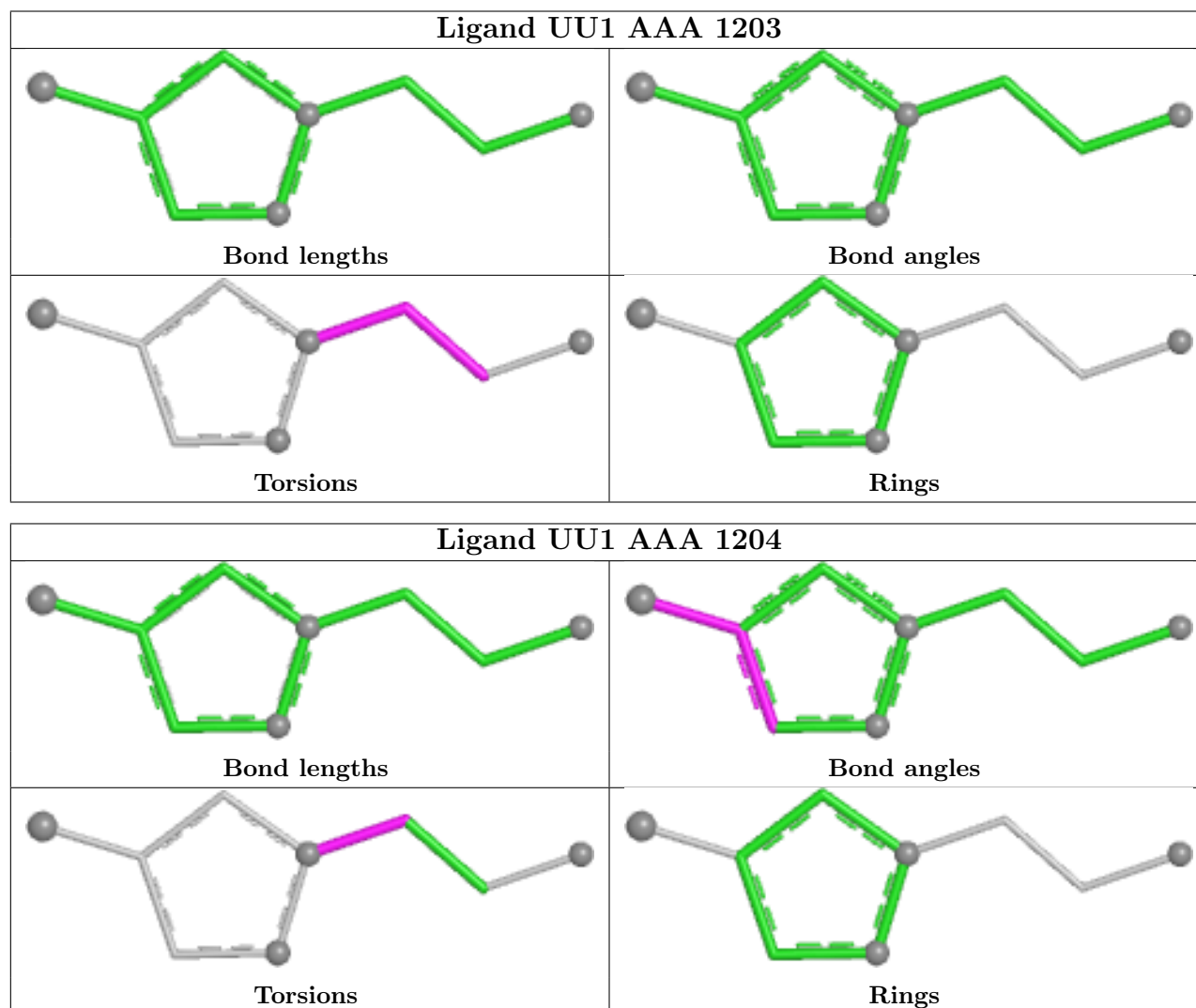
There are no ring outliers.

3 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	AAA	1201	SO4	0	1
5	AAA	1207	EDO	1	0
5	AAA	1210	EDO	2	0

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](#)

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

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, 95th 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 ²)	Q<0.9
1	AAA	130/130 (100%)	1.35	36 (27%) 1 1	12, 28, 66, 95	6 (4%)

All (36) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	AAA	1023	THR	7.8
1	AAA	1022	VAL	7.4
1	AAA	1018	VAL	7.2
1	AAA	1015	PRO	6.1
1	AAA	1019	PRO	5.0
1	AAA	1024	VAL	4.6
1	AAA	1025	ILE	3.9
1	AAA	980	MET	3.9
1	AAA	1021	TYR	3.5
1	AAA	981	GLN	3.5
1	AAA	1016	ASP	3.3
1	AAA	1107[A]	SER	3.2
1	AAA	1108	ARG	3.1
1	AAA	1014	ASP	3.1
1	AAA	1017	GLU	3.0
1	AAA	1027[A]	GLN	2.9
1	AAA	1020	ASP	2.7
1	AAA	1106	GLU	2.6
1	AAA	1026[A]	LYS	2.6
1	AAA	1078	ALA	2.6
1	AAA	1044	LEU	2.5
1	AAA	1004	LYS	2.5
1	AAA	1062	GLU	2.5
1	AAA	1013	VAL	2.5
1	AAA	1008	VAL	2.2
1	AAA	1093	LEU	2.2
1	AAA	1051	ARG	2.2

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Mol	Chain	Res	Type	RSRZ
1	AAA	979	SER	2.2
1	AAA	1104	ILE	2.1
1	AAA	1061	LEU	2.1
1	AAA	1105	GLN	2.1
1	AAA	983	GLU	2.1
1	AAA	1011	LYS	2.0
1	AAA	1094	ASP	2.0
1	AAA	1095	GLU	2.0
1	AAA	1063	TYR	2.0

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 oligosaccharides in this entry.

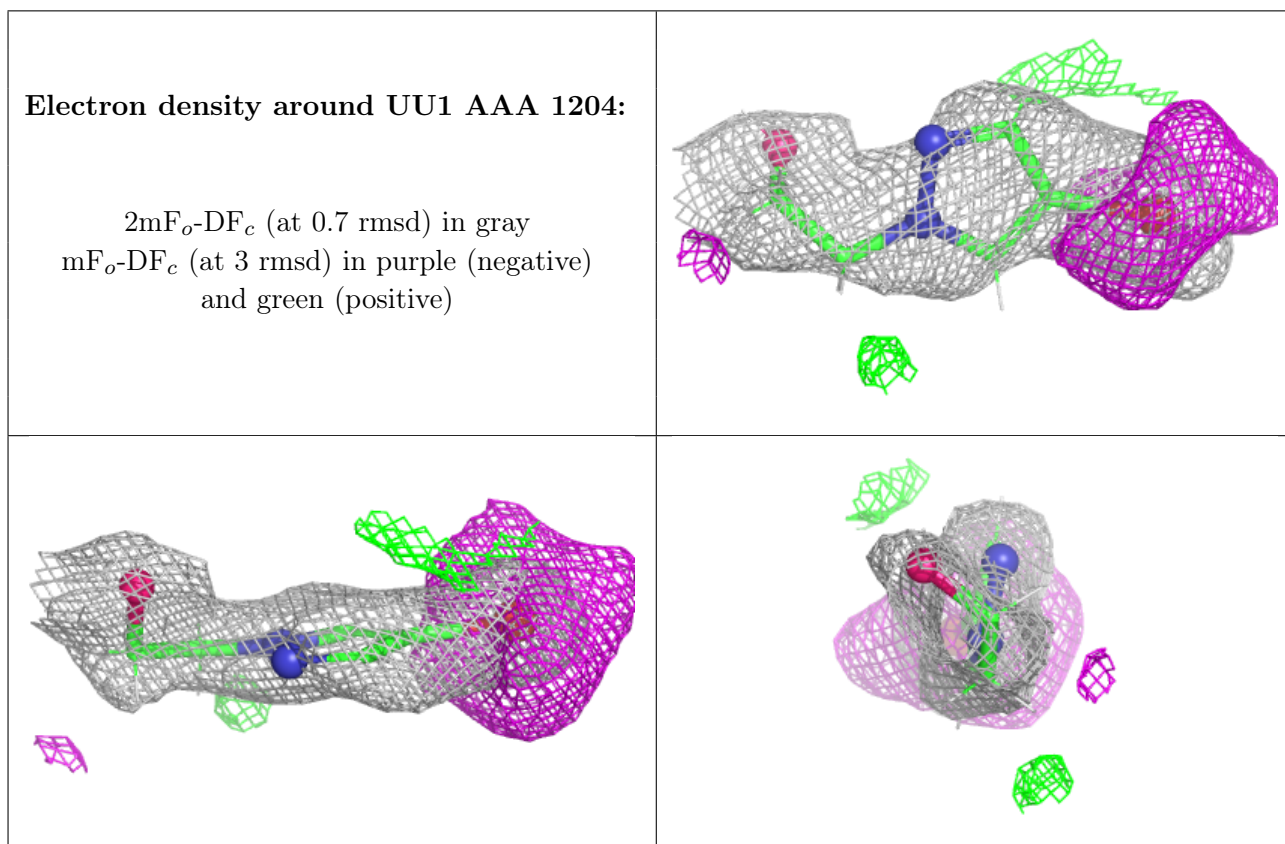
6.4 Ligands [i](#)

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, 95th 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
4	UU1	AAA	1204	9/9	0.79	0.28	74,79,81,85	1
5	EDO	AAA	1208	4/4	0.82	0.19	48,53,62,64	1
4	UU1	AAA	1203	9/9	0.83	0.29	55,84,91,91	1
5	EDO	AAA	1207	4/4	0.84	0.23	57,60,66,67	1
2	SO4	AAA	1211	5/5	0.85	0.15	91,91,93,97	5
5	EDO	AAA	1209	4/4	0.86	0.13	33,47,57,58	1
5	EDO	AAA	1210	4/4	0.86	0.18	20,56,64,67	1
3	CL	AAA	1202	1/1	0.87	0.20	72,72,72,72	0
5	EDO	AAA	1206	4/4	0.89	0.12	39,44,48,48	1
5	EDO	AAA	1205	4/4	0.93	0.10	28,31,37,39	1
2	SO4	AAA	1201	5/5	0.97	0.09	34,34,39,41	0

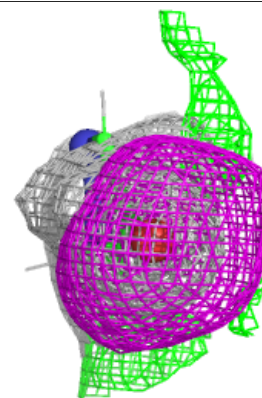
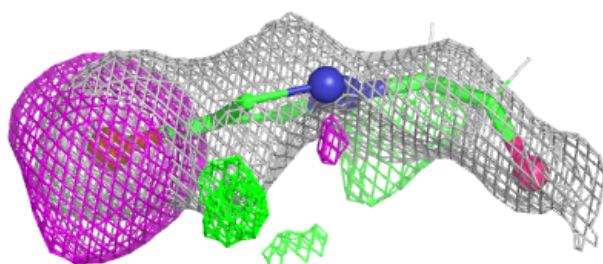
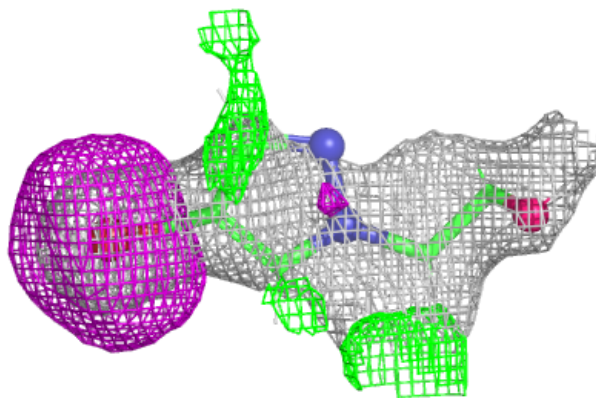
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers

as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.



Electron density around UU1 AAA 1203:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



6.5 Other polymers ⓘ

There are no such residues in this entry.