Full wwPDB X-ray Structure Validation Report ⓘ

Dec 7, 2023 – 11:48 pm GMT

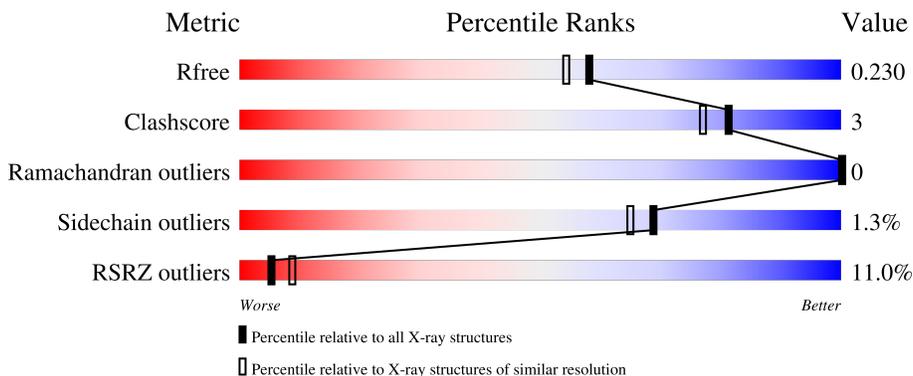|		
PDB ID	:	1W9L
Title	:	Myosin II Dictyostelium discoideum motor domain S456E bound with MgADP-AlF4
Authors	:	Morris, C.A.; Coureux, P.-D.; Wells, A.L.; Houdusse, A.; Sweeney, H.L.
Deposited on	:	2004-10-13
Resolution	:	1.95 Å(reported)

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 1.95 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	Percentile Ranks	Value
Rfree		0.230
Clashscore		3
Ramachandran outliers		0
Sidechain outliers		1.3%
RSRZ outliers		11.0%

Worse   *Better*

▮ Percentile relative to all X-ray structures
▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	2580 (1.96-1.96)
Clashscore	141614	2705 (1.96-1.96)
Ramachandran outliers	138981	2678 (1.96-1.96)
Sidechain outliers	138945	2678 (1.96-1.96)
RSRZ outliers	127900	2539 (1.96-1.96)

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 <=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	770	10% 87% 7% · 6%

2 Entry composition ⓘ

There are 6 unique types of molecules in this entry. The entry contains 6228 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 MYOSIN II HEAVY CHAIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	726	Total 5736	C 3655	N 977	O 1088	S 16	0	1	0

There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	249	SER	ASN	conflict	UNP P08799
A	312	CYS	TYR	conflict	UNP P08799
A	456	GLU	SER	engineered mutation	UNP P08799

- Molecule 2 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total 1	Mg 1	0	0

- Molecule 3 is ADENOSINE-5'-DIPHOSPHATE (three-letter code: ADP) (formula: $C_{10}H_{15}N_5O_{10}P_2$).

ADP
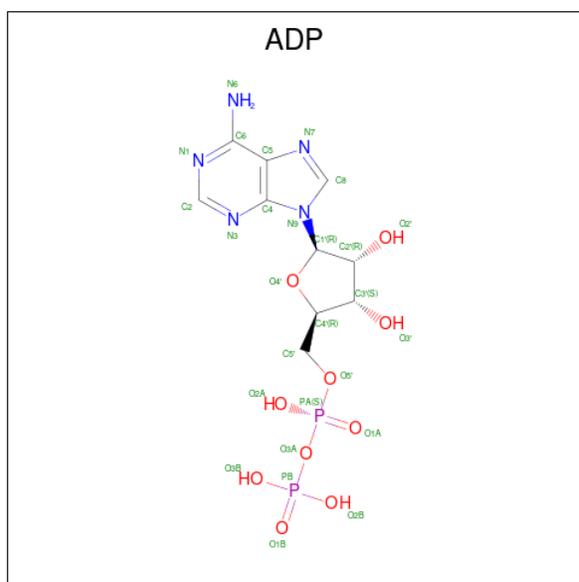
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	A	1	Total	C	N	O	P	0	0
			27	10	5	10	2		

- Molecule 4 is TETRAFLUOROALUMINATE ION (three-letter code: ALF) (formula: AlF_4).

ALF
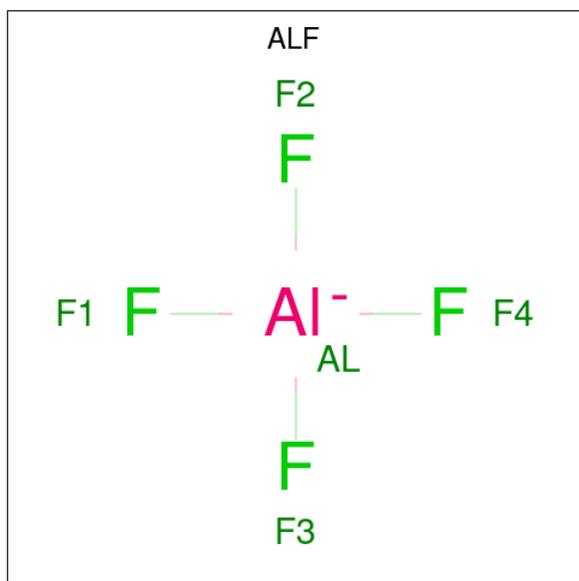
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	Al	F	0	0
			5	1	4		

- Molecule 5 is 1,2-ETHANEDIOL (three-letter code: EDO) (formula: $C_2H_6O_2$).

EDO
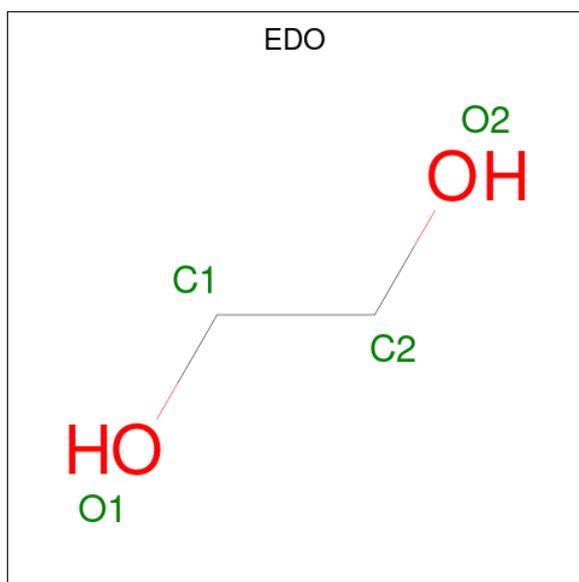
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	A	1	Total 4	C 2	O 2	0	0
5	A	1	Total 4	C 2	O 2	0	0
5	A	1	Total 4	C 2	O 2	0	0
5	A	1	Total 4	C 2	O 2	0	0
5	A	1	Total 4	C 2	O 2	0	0
5	A	1	Total 4	C 2	O 2	0	0

- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	435	Total 435	O 435	0	0

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: MYOSIN II HEAVY CHAIN
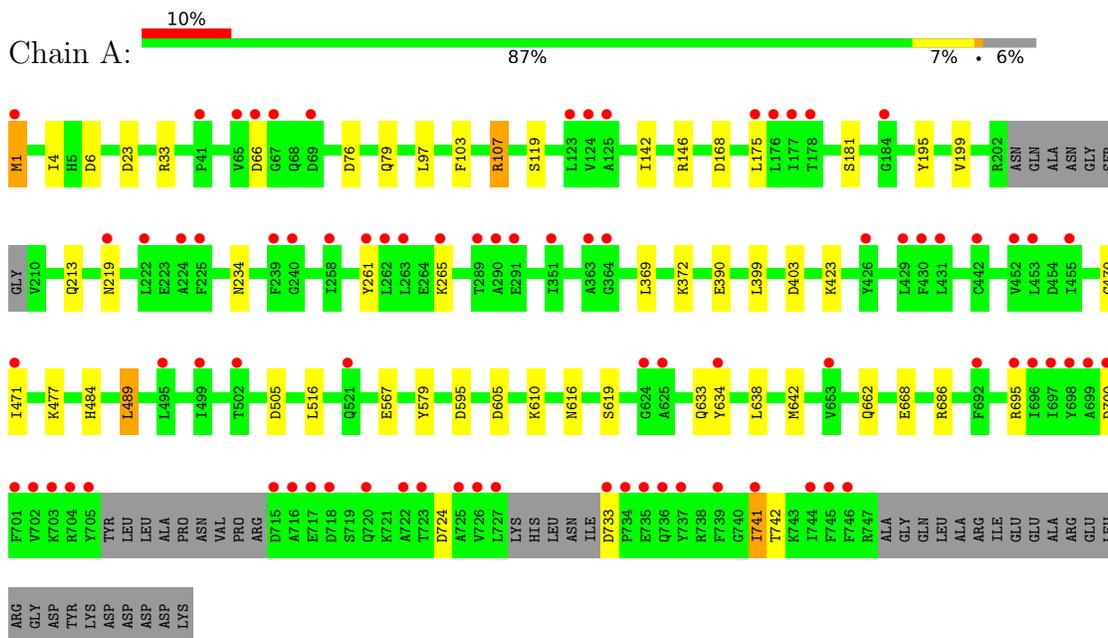
4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, α, β, γ	88.04Å　　145.98Å　　152.37Å 90.00°　　90.00°　　90.00°	Depositor
Resolution (Å)	40.00　–　1.95 35.49　–　1.95	Depositor EDS
% Data completeness (in resolution range)	97.8 (40.00-1.95) 97.8 (35.49-1.95)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	3.14 (at 1.95Å)	Xtriage
Refinement program	REFMAC 5.1.24	Depositor
R, R_{free}	0.193　,　0.225 0.200　,　0.230	Depositor DCC
R_{free} test set	3525 reflections (5.03%)	wwPDB-VP
Wilson B-factor (Å^2)	28.9	Xtriage
Anisotropy	0.693	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.37 , 46.3	EDS
L-test for twinning[2]	$< |L| > = 0.49, < L^2 > = 0.33$	Xtriage
Estimated twinning fraction	0.014 for 1/2*h-1/2*k,-3/2*h-1/2*k,-l 0.025 for 1/2*h+1/2*k,3/2*h-1/2*k,-l	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	6228	wwPDB-VP
Average B, all atoms (Å^2)	39.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.18% of the height of the origin peak. No significant pseudotranslation is detected.*

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[1]Intensities estimated from amplitudes.

[2]Theoretical values of $< |L| >$, $< L^2 >$ 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: ALF, EDO, MG, ADP

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	0.49	1/5850 (0.0%)	0.70	11/7910 (0.1%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	1	MET	SD-CE	-5.05	1.49	1.77

All (11) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	733	ASP	CB-CG-OD2	6.10	123.79	118.30
1	A	724	ASP	CB-CG-OD2	6.04	123.73	118.30
1	A	107	ARG	NE-CZ-NH1	5.98	123.29	120.30
1	A	595	ASP	CB-CG-OD2	5.75	123.47	118.30
1	A	23	ASP	CB-CG-OD2	5.66	123.40	118.30
1	A	605	ASP	CB-CG-OD2	5.63	123.36	118.30
1	A	505	ASP	CB-CG-OD2	5.43	123.19	118.30
1	A	66	ASP	CB-CG-OD2	5.35	123.11	118.30
1	A	76	ASP	CB-CG-OD2	5.25	123.02	118.30
1	A	700	ASP	CB-CG-OD2	5.22	123.00	118.30
1	A	168	ASP	CB-CG-OD2	5.19	122.97	118.30

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	A	5736	0	5566	30	0
2	A	1	0	0	0	0
3	A	27	0	12	0	0
4	A	5	0	0	1	0
5	A	24	0	36	2	0
6	A	435	0	0	8	0
All	All	6228	0	5614	30	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 3.

All (30) 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:A:4:ILE:HD11	1:A:142:ILE:HG23	1.61	0.83
1:A:234:ASN:H	1:A:662:GLN:HE22	1.44	0.65
1:A:181:SER:HA	4:A:1750:ALF:F1	1.87	0.65
1:A:616:ASN:ND2	6:A:2371:HOH:O	2.30	0.62
1:A:103:PHE:CE2	1:A:107:ARG:NH2	2.78	0.52
1:A:103:PHE:HE2	1:A:107:ARG:NH2	2.08	0.51
1:A:610:LYS:NZ	6:A:2368:HOH:O	2.44	0.50
1:A:265:LYS:HE3	1:A:423:LYS:HB3	1.94	0.49
1:A:97:LEU:HD23	1:A:686:ARG:HG3	1.95	0.48
1:A:638:LEU:O	1:A:642:MET:HG2	2.14	0.48
1:A:33:ARG:HH21	1:A:79:GLN:HE22	1.61	0.47
1:A:741:ILE:HG13	1:A:742:THR:HG23	1.96	0.47
1:A:633:GLN:NE2	6:A:2381:HOH:O	2.45	0.47
1:A:477:LYS:HG3	1:A:638:LEU:HD21	1.97	0.47
1:A:668:GLU:OE1	6:A:2402:HOH:O	2.20	0.46
1:A:1:MET:HE3	1:A:6:ASP:CB	2.46	0.45
1:A:234:ASN:ND2	6:A:2151:HOH:O	2.50	0.44
1:A:261:TYR:C	6:A:2167:HOH:O	2.55	0.44
1:A:369:LEU:O	1:A:372:LYS:NZ	2.50	0.44
1:A:97:LEU:CD2	1:A:686:ARG:HG3	2.48	0.43
1:A:470:CYS:HB3	1:A:634[A]:TYR:CZ	2.54	0.43
1:A:399:LEU:HA	1:A:403:ASP:O	2.19	0.42
1:A:372:LYS:NZ	1:A:390:GLU:OE2	2.51	0.42
1:A:516:LEU:HA	5:A:1755:EDO:H11	2.00	0.42
1:A:213:GLN:HG2	6:A:2135:HOH:O	2.19	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:195:TYR:CZ	1:A:199:VAL:HG11	2.55	0.42
1:A:567:GLU:HA	1:A:579:TYR:O	2.20	0.41
1:A:471:ILE:HG13	5:A:1752:EDO:H12	2.03	0.41
1:A:610:LYS:HD2	6:A:2369:HOH:O	2.21	0.40
1:A:484:HIS:CE1	1:A:489:LEU:HD13	2.56	0.40

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	719/770 (93%)	707 (98%)	12 (2%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains ⓘ

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	608/673 (90%)	600 (99%)	8 (1%)	69	65

All (8) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	119	SER

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Mol	Chain	Res	Type
1	A	146	ARG
1	A	175	LEU
1	A	219	ASN
1	A	489	LEU
1	A	619	SER
1	A	695	ARG
1	A	741	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (9) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	79	GLN
1	A	219	ASN
1	A	234	ASN
1	A	283	GLN
1	A	338	GLN
1	A	500	ASN
1	A	582	GLN
1	A	606	ASN
1	A	662	GLN

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 monosaccharides in this entry.

5.6   Ligand geometry ⓘ

Of 9 ligands modelled in this entry, 1 is monoatomic - leaving 8 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	#$|Z| > 2$
5	EDO	A	1754	-	3,3,3	0.27	0	2,2,2	0.30	0
5	EDO	A	1752	-	3,3,3	0.27	0	2,2,2	0.47	0
5	EDO	A	1755	-	3,3,3	0.27	0	2,2,2	0.42	0
5	EDO	A	1753	-	3,3,3	0.28	0	2,2,2	0.48	0
4	ALF	A	1750	3,6,2	0,4,4	-	-	-		
3	ADP	A	1749	4,2	24,29,29	1.58	2 (8%)	29,45,45	1.67	4 (13%)
5	EDO	A	1751	-	3,3,3	0.26	0	2,2,2	0.20	0
5	EDO	A	1756	-	3,3,3	0.30	0	2,2,2	0.31	0

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	A	1754	-	-	0/1/1/1	-
5	EDO	A	1752	-	-	0/1/1/1	-
5	EDO	A	1755	-	-	0/1/1/1	-
5	EDO	A	1753	-	-	0/1/1/1	-
3	ADP	A	1749	4,2	-	1/12/32/32	0/3/3/3
5	EDO	A	1751	-	-	0/1/1/1	-
5	EDO	A	1756	-	-	1/1/1/1	-

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	1749	ADP	C8-N7	5.68	1.44	1.34
3	A	1749	ADP	PA-O1A	2.67	1.60	1.50

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	A	1749	ADP	N3-C2-N1	-4.66	121.39	128.68
3	A	1749	ADP	C1'-N9-C4	-3.73	120.09	126.64
3	A	1749	ADP	O2B-PB-O1B	2.38	120.01	110.68
3	A	1749	ADP	C2-N1-C6	2.22	122.56	118.75

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	1749	ADP	PA-O3A-PB-O3B
5	A	1756	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
5	A	1752	EDO	1	0
5	A	1755	EDO	1	0
4	A	1750	ALF	1	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 then 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.

Ligand ADP A 1749

Bond lengths

Bond angles

Torsions

Rings
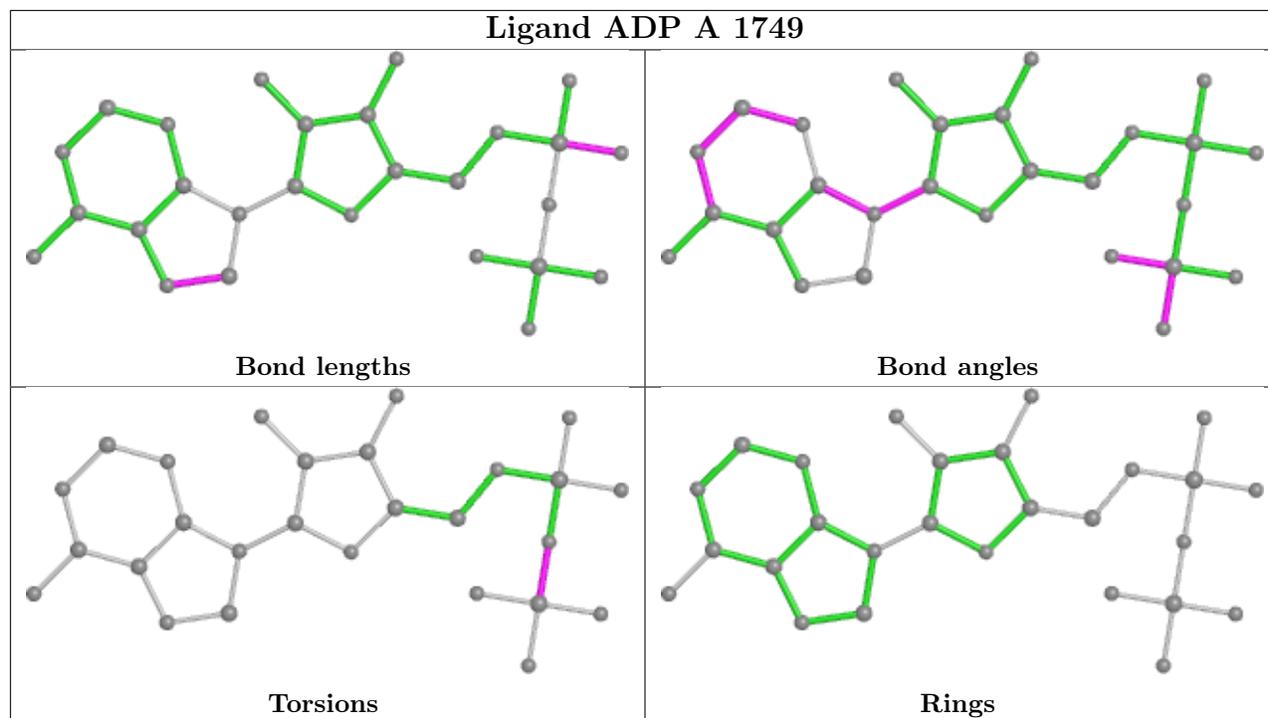
5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

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	A	726/770 (94%)	0.65	80 (11%)	5	9	23, 36, 65, 94	0

All (80) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	726	VAL	9.6
1	A	725	ALA	7.7
1	A	722	ALA	7.6
1	A	727	LEU	7.4
1	A	705	TYR	7.3
1	A	704	ARG	7.3
1	A	746	PHE	7.1
1	A	67	GLY	6.9
1	A	717	GLU	5.9
1	A	737	TYR	5.8
1	A	263	LEU	5.8
1	A	699	ALA	5.3
1	A	734	PRO	5.2
1	A	733	ASP	4.8
1	A	723	THR	4.7
1	A	363	ALA	4.0
1	A	736	GLN	4.0
1	A	239	PHE	4.0
1	A	703	LYS	4.0
1	A	696	ILE	3.9
1	A	735	GLU	3.7
1	A	697	ILE	3.7
1	A	700	ASP	3.6
1	A	124	VAL	3.6
1	A	177	ILE	3.6
1	A	455	ILE	3.5
1	A	634[A]	TYR	3.5

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Mol	Chain	Res	Type	RSRZ
1	A	291	GLU	3.5
1	A	290	ALA	3.4
1	A	495	LEU	3.4
1	A	739	PHE	3.4
1	A	41	PRO	3.3
1	A	698	TYR	3.3
1	A	66	ASP	3.2
1	A	430	PHE	3.2
1	A	741	ILE	3.2
1	A	123	LEU	3.2
1	A	65	VAL	3.2
1	A	502	THR	3.1
1	A	718	ASP	3.1
1	A	702	VAL	3.0
1	A	69	ASP	3.0
1	A	625	ALA	3.0
1	A	364	GLY	2.9
1	A	222	LEU	2.8
1	A	499	ILE	2.8
1	A	452	VAL	2.8
1	A	442	CYS	2.8
1	A	653	VAL	2.8
1	A	716	ALA	2.8
1	A	258	ILE	2.7
1	A	125	ALA	2.7
1	A	453	LEU	2.7
1	A	240	GLY	2.7
1	A	715	ASP	2.6
1	A	224	ALA	2.6
1	A	184	GLY	2.6
1	A	289	THR	2.6
1	A	431	LEU	2.6
1	A	624	GLY	2.6
1	A	176	LEU	2.5
1	A	720	GLN	2.5
1	A	429	LEU	2.4
1	A	701	PHE	2.3
1	A	692	PHE	2.3
1	A	745	PHE	2.2
1	A	426	TYR	2.2
1	A	261	TYR	2.1
1	A	265	LYS	2.1

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Mol	Chain	Res	Type	RSRZ
1	A	1	MET	2.1
1	A	262	LEU	2.1
1	A	178	THR	2.1
1	A	225	PHE	2.1
1	A	219	ASN	2.1
1	A	351	ILE	2.1
1	A	471	ILE	2.1
1	A	744	ILE	2.1
1	A	521	GLN	2.0
1	A	175	LEU	2.0
1	A	695	ARG	2.0

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

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

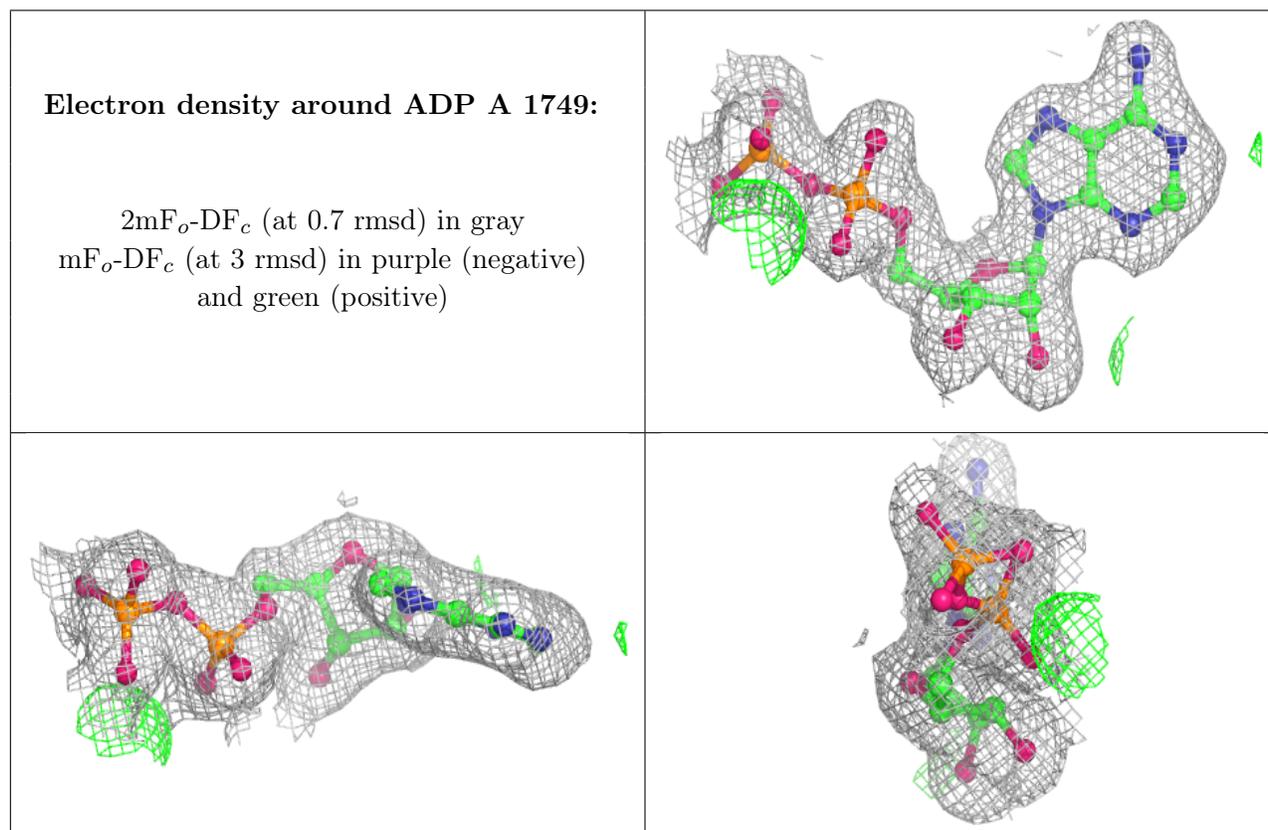## 6.3 Carbohydrates ⓘ

There are no monosaccharides in this entry.

6.4 Ligands ⓘ

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($Å^2$)	Q<0.9
5	EDO	A	1756	4/4	0.73	0.19	69,70,70,71	0
5	EDO	A	1754	4/4	0.84	0.42	58,60,61,62	0
5	EDO	A	1752	4/4	0.91	0.36	59,61,61,62	0
5	EDO	A	1755	4/4	0.93	0.19	58,58,58,60	0
2	MG	A	1748	1/1	0.97	0.17	28,28,28,28	0
5	EDO	A	1751	4/4	0.97	0.17	47,48,48,48	0
5	EDO	A	1753	4/4	0.98	0.09	40,40,41,43	0
3	ADP	A	1749	27/27	0.99	0.11	22,29,31,31	0
4	ALF	A	1750	5/5	0.99	0.13	24,24,25,26	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 ADP A 1749:

$2mF_o$-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.