



Full wwPDB X-ray Structure Validation Report ⓘ

Feb 1, 2016 – 07:03 AM GMT

PDB ID : 2ZBD
Title : Crystal Structure of the SR Calcium Pump with Bound Aluminium Fluoride, ADP and Calcium
Authors : Toyoshima, C.; Nomura, H.; Tsuda, T.; Ogawa, H.; Norimatsu, Y.
Deposited on : 2007-10-20
Resolution : 2.40 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
<http://wwpdb.org/validation/2016/XrayValidationReportHelp>
with specific help available everywhere you see the ⓘ symbol.

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

MolProbity : 4.02b-467
Mogul : 1.7 (RC4), CSD as536be (2015)
Xtriage (Phenix) : **NOT EXECUTED**
EDS : **NOT EXECUTED**
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : trunk26865

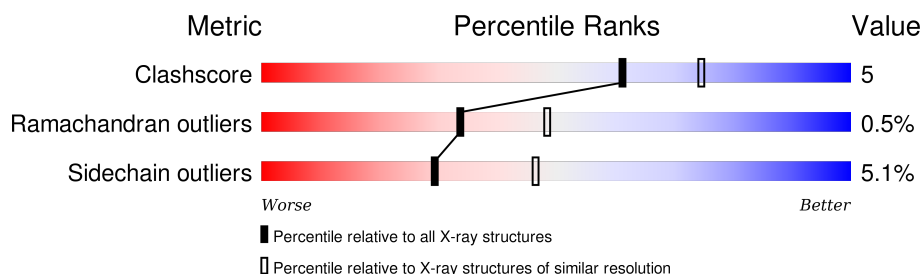
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.40 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))
Clashscore	102246	3407 (2.40-2.40)
Ramachandran outliers	100387	3351 (2.40-2.40)
Sidechain outliers	100360	3352 (2.40-2.40)

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 on the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria. 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.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	995	 84% 14% •

2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 7916 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 Sarcoplasmic/endoplasmic reticulum calcium ATPase 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	995	Total	C	N	O	S	0	0	0
			7674	4878	1287	1452	57			

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	994	GLY	-	SEE REMARK 999	UNP P04191

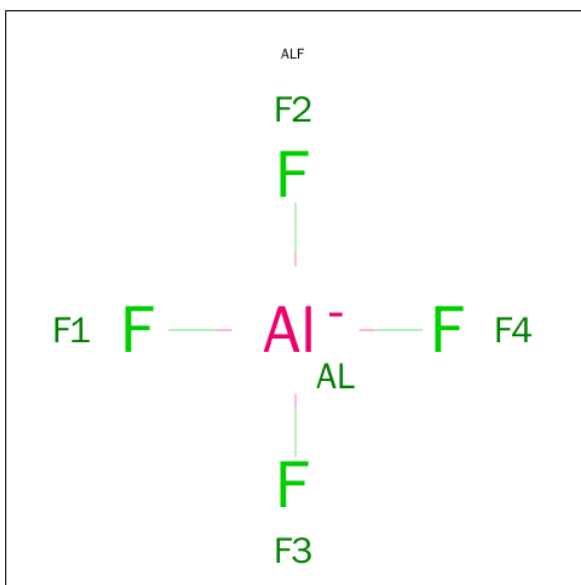
- Molecule 2 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	2	Total	Ca	0	0
			2	2		

- Molecule 3 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

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

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



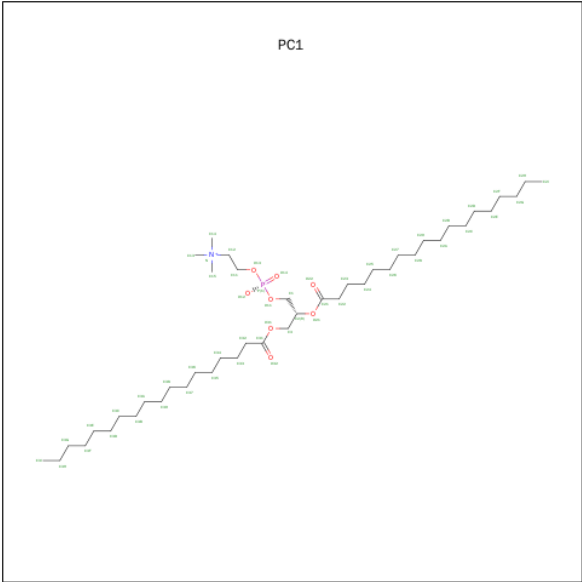
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	Al	F	0	0
			5	1	4		

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



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

- Molecule 6 is 1,2-DIACYL-SN-GLYCERO-3-PHOSPHOCHOLINE (three-letter code: PC1) (formula: $C_{44}H_{88}NO_8P$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
6	A	1	Total	C	N	O	P	0	0
			54	44	1	8	1		
6	A	1	Total	C	N	O	P	0	0
			54	44	1	8	1		

- Molecule 7 is water.

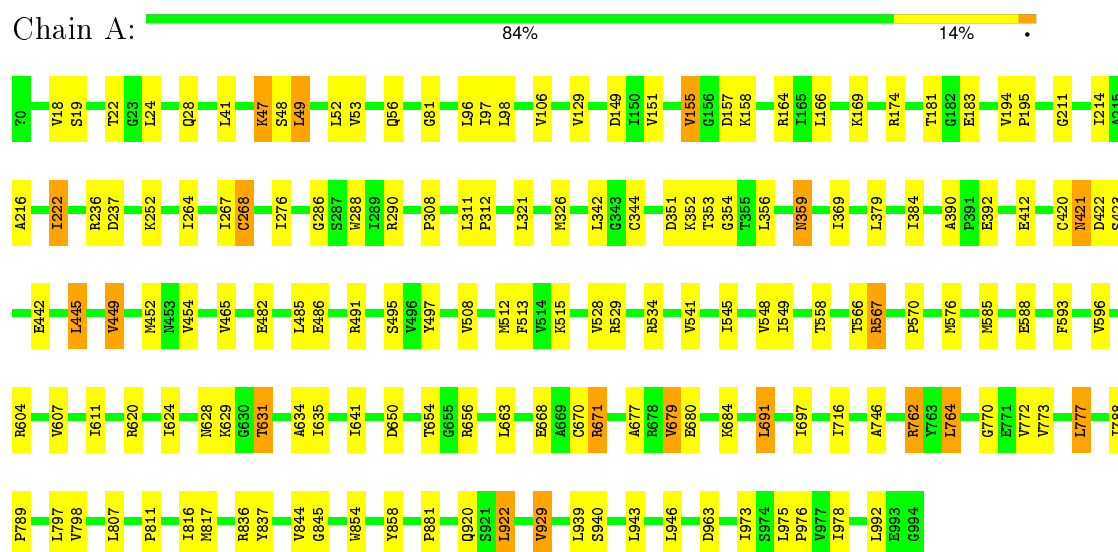
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	98	Total	O	0	0
			98	98		

3 Residue-property plots

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors 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.

Note EDS was not executed.

- Molecule 1: Sarcoplasmic/endoplasmic reticulum calcium ATPase 1



4 Data and refinement statistics

Xtriage (Phenix) and EDS were not executed - this section will therefore be incomplete.

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	162.90 Å 75.10 Å 152.10 Å 90.00° 109.30° 90.00°	Depositor
Resolution (Å)	12.00 – 2.40	Depositor
% Data completeness (in resolution range)	100.0 (12.00-2.40)	Depositor
R_{merge}	0.05	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.246 , 0.271	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	7916	wwPDB-VP
Average B, all atoms (Å ²)	92.0	wwPDB-VP

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: MG, ADP, ACE, ALF, CA, PC1

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	0.35	0/7813	0.51	0/10594

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts [i](#)

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	7674	0	7764	85	0
2	A	2	0	0	0	0
3	A	2	0	0	0	0
4	A	5	0	0	0	0
5	A	27	0	12	1	0
6	A	108	0	176	1	0
7	A	98	0	0	1	0
All	All	7916	0	7952	86	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 5.

All (86) 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:369:ILE:HD11	1:A:545:ILE:HD11	1.66	0.78
1:A:308:PRO:HB3	1:A:764:LEU:HD23	1.67	0.77
1:A:412:GLU:OE1	1:A:529:ARG:HD2	1.86	0.76
1:A:495:SER:HB2	1:A:588:GLU:OE1	1.90	0.72
1:A:770:GLY:HA3	1:A:844:VAL:HG23	1.75	0.67
1:A:354:GLY:HA2	1:A:359:ASN:HB2	1.80	0.64
1:A:286:GLY:HA3	1:A:290:ARG:HD3	1.81	0.63
1:A:421:ASN:HD22	1:A:423:SER:H	1.46	0.63
1:A:421:ASN:ND2	1:A:423:SER:H	1.99	0.60
1:A:129:VAL:HG12	1:A:151:VAL:HG22	1.84	0.59
1:A:19:SER:HB2	1:A:22:THR:HB	1.85	0.58
1:A:798:VAL:HG13	1:A:940:SER:HB3	1.86	0.57
1:A:515:LYS:HE3	5:A:1002:ADP:N1	2.20	0.57
1:A:975:LEU:N	1:A:976:PRO:HD2	2.21	0.56
1:A:549:ILE:HD11	1:A:596:VAL:HG21	1.87	0.56
1:A:52:LEU:HD23	1:A:106:VAL:HG13	1.87	0.55
1:A:491:ARG:NH1	1:A:588:GLU:OE1	2.40	0.54
1:A:513:PHE:HD1	1:A:566:THR:HG22	1.72	0.54
1:A:449:VAL:O	1:A:452:MET:O	2.26	0.53
1:A:157:ASP:HB2	1:A:214:ILE:HD13	1.91	0.53
1:A:670:CYS:HB3	1:A:691:LEU:HD13	1.89	0.53
1:A:56:GLN:HG3	1:A:106:VAL:HG23	1.91	0.53
1:A:773:VAL:HG23	1:A:845:GLY:HA3	1.90	0.53
1:A:788:ILE:HB	1:A:789:PRO:HD2	1.92	0.52
1:A:96:LEU:HD23	1:A:797:LEU:HD11	1.90	0.52
1:A:773:VAL:O	1:A:777:LEU:HB2	2.09	0.52
1:A:267:ILE:HD12	1:A:772:VAL:HG11	1.92	0.52
1:A:679:VAL:HG13	1:A:680:GLU:N	2.25	0.51
1:A:311:LEU:HB3	1:A:312:PRO:HD3	1.94	0.50
1:A:158:LYS:HE3	1:A:211:GLY:HA2	1.94	0.50
1:A:811:PRO:HG2	1:A:929:VAL:HG22	1.93	0.49
1:A:816:ILE:HG23	1:A:817:MET:HG2	1.94	0.49
1:A:47:LYS:HG3	1:A:48:SER:H	1.78	0.49
1:A:166:LEU:HD11	1:A:222:ILE:HB	1.94	0.48
1:A:770:GLY:HA2	1:A:773:VAL:HG22	1.95	0.48
1:A:24:LEU:HG	1:A:28:GLN:HB3	1.95	0.48
1:A:445:LEU:O	1:A:449:VAL:HG12	2.13	0.48
1:A:264:ILE:O	1:A:268:CYS:HB2	2.14	0.47
1:A:620:ARG:NH2	1:A:671:ARG:HA	2.29	0.47
1:A:762:ARG:HG2	1:A:837:TYR:HE1	1.80	0.47
1:A:326:MET:CE	1:A:746:ALA:HB2	2.45	0.47
1:A:558:THR:HG22	1:A:634:ALA:HB1	1.97	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:770:GLY:HA3	1:A:844:VAL:CG2	2.44	0.46
1:A:352:LYS:HA	1:A:356:LEU:HD12	1.97	0.46
1:A:326:MET:HE1	1:A:746:ALA:HB2	1.98	0.46
1:A:369:ILE:CD1	1:A:545:ILE:HD11	2.39	0.46
1:A:420:CYS:SG	1:A:515:LYS:HE2	2.56	0.45
1:A:922:LEU:HD13	1:A:978:ILE:HG23	1.97	0.45
1:A:41:LEU:HD13	1:A:236:ARG:HG2	1.98	0.45
1:A:352:LYS:HD2	1:A:635:ILE:HD12	1.99	0.45
1:A:379:LEU:HD12	1:A:548:VAL:HG21	1.99	0.45
1:A:351:ASP:HA	1:A:624:ILE:O	2.17	0.45
1:A:528:VAL:HG11	1:A:541:VAL:HG11	2.00	0.44
1:A:486:GLU:O	1:A:491:ARG:NH2	2.51	0.44
1:A:567:ARG:HD2	1:A:570:PRO:HA	1.98	0.44
1:A:24:LEU:HD22	1:A:149:ASP:HB3	1.99	0.44
1:A:342:LEU:HG	1:A:716:ILE:HD13	2.00	0.44
1:A:654:THR:HA	1:A:677:ALA:O	2.18	0.44
1:A:545:ILE:HD12	1:A:593:PHE:CE1	2.52	0.44
1:A:194:VAL:HA	1:A:195:PRO:HD2	1.76	0.44
1:A:482:GLU:HG3	1:A:497:TYR:HD1	1.83	0.44
1:A:491:ARG:HG3	1:A:585:MET:HB2	1.99	0.43
1:A:541:VAL:O	1:A:545:ILE:HG12	2.18	0.43
1:A:174:ARG:HB2	1:A:216:ALA:HB3	1.99	0.43
1:A:611:ILE:HD13	1:A:641:ILE:HG13	2.00	0.43
1:A:344:CYS:HB3	1:A:697:ILE:HG13	1.99	0.43
1:A:512:MET:HB2	1:A:567:ARG:HB2	1.99	0.43
1:A:624:ILE:CG2	1:A:684:LYS:HG2	2.49	0.43
1:A:854:TRP:HE1	1:A:858:TYR:HD2	1.67	0.43
1:A:631:THR:HG21	7:A:1074:HOH:O	2.19	0.42
6:A:1011:PC1:H2F2	6:A:1011:PC1:H391	2.01	0.42
1:A:628:ASN:HB3	1:A:631:THR:HG23	2.00	0.42
1:A:49:LEU:O	1:A:53:VAL:HG23	2.19	0.42
1:A:629:LYS:HA	1:A:677:ALA:CB	2.50	0.42
1:A:390:ALA:C	1:A:392:GLU:H	2.24	0.41
1:A:352:LYS:HD2	1:A:635:ILE:CD1	2.49	0.41
1:A:939:LEU:O	1:A:943:LEU:HB2	2.20	0.41
1:A:442:GLU:O	1:A:445:LEU:HB2	2.20	0.41
1:A:485:LEU:HB2	1:A:495:SER:HB3	2.02	0.41
1:A:576:MET:HB2	1:A:576:MET:HE3	1.92	0.41
1:A:421:ASN:HD22	1:A:422:ASP:N	2.19	0.41
1:A:679:VAL:CG1	1:A:680:GLU:N	2.83	0.41
1:A:181:THR:OG1	1:A:183:GLU:HG2	2.20	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:604:ARG:HB2	1:A:607:VAL:HG23	2.03	0.40
1:A:214:ILE:H	1:A:214:ILE:HD12	1.85	0.40
1:A:155:VAL:HG13	1:A:216:ALA:HA	2.04	0.40

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	993/995 (100%)	946 (95%)	42 (4%)	5 (0%)	34 48

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	81	GLY
1	A	992	LEU
1	A	47	LYS
1	A	508	VAL
1	A	881	PRO

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	840/840 (100%)	797 (95%)	43 (5%)	29 46

All (43) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	18	VAL
1	A	49	LEU
1	A	97	ILE
1	A	98	LEU
1	A	155	VAL
1	A	164	ARG
1	A	169	LYS
1	A	222	ILE
1	A	237	ASP
1	A	252	LYS
1	A	268	CYS
1	A	276	ILE
1	A	288	TRP
1	A	321	LEU
1	A	353	THR
1	A	359	ASN
1	A	384	ILE
1	A	421	ASN
1	A	445	LEU
1	A	449	VAL
1	A	454	VAL
1	A	465	VAL
1	A	534	ARG
1	A	567	ARG
1	A	631	THR
1	A	650	ASP
1	A	656	ARG
1	A	663	LEU
1	A	668	GLU
1	A	671	ARG
1	A	679	VAL
1	A	691	LEU
1	A	762	ARG
1	A	764	LEU
1	A	777	LEU
1	A	807	LEU
1	A	836	ARG
1	A	920	GLN
1	A	922	LEU
1	A	929	VAL
1	A	946	LEU
1	A	963	ASP

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Mol	Chain	Res	Type
1	A	973	ILE

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (11) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	111	ASN
1	A	114	ASN
1	A	250	GLN
1	A	359	ASN
1	A	380	ASN
1	A	421	ASN
1	A	526	ASN
1	A	628	ASN
1	A	875	GLN
1	A	919	ASN
1	A	920	GLN

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 carbohydrates in this entry.

5.6 Ligand geometry [i](#)

Of 8 ligands modelled in this entry, 4 are monoatomic - leaving 4 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	ADP	A	1002	3	22,29,29	0.99	1 (4%)	27,45,45	1.93	4 (14%)
6	PC1	A	1011	-	53,53,53	1.43	5 (9%)	57,61,61	1.27	6 (10%)
6	PC1	A	1012	-	53,53,53	1.43	5 (9%)	57,61,61	1.25	4 (7%)
4	ALF	A	998	-	0,4,4	0.00	-	0,6,6	0.00	-

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	ADP	A	1002	3	-	0/12/32/32	0/3/3/3
6	PC1	A	1011	-	-	0/57/57/57	0/0/0/0
6	PC1	A	1012	-	-	0/57/57/57	0/0/0/0
4	ALF	A	998	-	-	0/0/0/0	0/0/0/0

All (11) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	A	1012	PC1	C3A-C39	-2.99	1.34	1.51
6	A	1012	PC1	C2A-C29	-2.98	1.34	1.51
6	A	1011	PC1	C2A-C29	-2.96	1.34	1.51
6	A	1011	PC1	C3A-C39	-2.95	1.34	1.51
6	A	1011	PC1	O21-C21	3.02	1.43	1.34
5	A	1002	ADP	C5-C4	3.03	1.47	1.40
6	A	1012	PC1	O21-C21	3.11	1.43	1.34
6	A	1012	PC1	O31-C31	4.40	1.46	1.33
6	A	1011	PC1	O31-C31	4.47	1.46	1.33
6	A	1012	PC1	O22-C21	7.09	1.43	1.22
6	A	1011	PC1	O22-C21	7.11	1.43	1.22

All (14) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	A	1002	ADP	N3-C2-N1	-8.04	122.74	128.89
6	A	1012	PC1	O21-C21-O22	-5.49	108.94	123.67
6	A	1011	PC1	O21-C21-O22	-5.33	109.36	123.67
6	A	1012	PC1	O22-C21-C22	-3.55	109.52	123.72
6	A	1011	PC1	O22-C21-C22	-3.54	109.58	123.72
5	A	1002	ADP	C4-C5-N7	-2.34	107.33	109.48
6	A	1011	PC1	C2-O21-C21	-2.20	112.62	117.89

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	A	1002	ADP	PA-O3A-PB	-2.15	125.47	132.67
6	A	1012	PC1	C2-O21-C21	-2.00	113.08	117.89
6	A	1011	PC1	C3A-C39-C38	2.03	125.03	114.53
6	A	1011	PC1	C3-O31-C31	2.37	123.48	116.85
6	A	1012	PC1	O31-C31-C32	2.60	119.82	111.90
5	A	1002	ADP	O3B-PB-O2B	2.65	117.47	107.38
6	A	1011	PC1	O31-C31-C32	2.83	120.52	111.90

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	A	1002	ADP	1	0
6	A	1011	PC1	1	0

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 [i](#)

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

EDS was not executed - this section will therefore be empty.

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

EDS was not executed - this section will therefore be empty.

6.3 Carbohydrates [i](#)

EDS was not executed - this section will therefore be empty.

6.4 Ligands [i](#)

EDS was not executed - this section will therefore be empty.

6.5 Other polymers [i](#)

EDS was not executed - this section will therefore be empty.