



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 6, 2026 – 12:13 PM UTC

PDB ID : 1EAK / pdb_00001eak
Title : Catalytic domain of proMMP-2 E404Q mutant
Authors : Bergmann, U.; Tuuttila, A.; Tryggvason, K.; Morgunova, E.
Deposited on : 2001-07-12
Resolution : 2.66 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

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
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

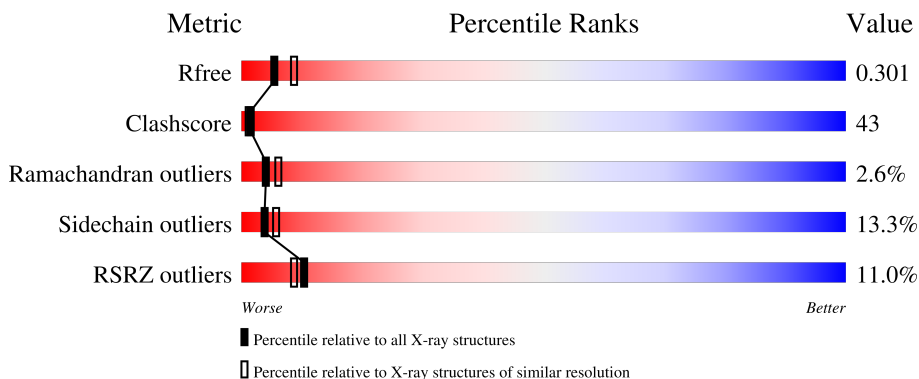
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.66 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	1110 (2.66-2.66)
Clashscore	190562	1141 (2.66-2.66)
Ramachandran outliers	187476	1126 (2.66-2.66)
Sidechain outliers	187428	1126 (2.66-2.66)
RSRZ outliers	180081	1110 (2.66-2.66)

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	A	421	
1	B	421	
1	C	421	
1	D	421	
2	P	8	

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Mol	Chain	Length	Quality of chain
2	R	8	

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
3	SO4	C	850	-	-	X	-
3	SO4	D	857	-	-	X	-

2 Entry composition [i](#)

There are 6 unique types of molecules in this entry. The entry contains 13504 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 72 KDA TYPE IV COLLAGENASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	421	3330	2110	553	644	23	0	0	0
1	B	419	3313	2100	551	639	23	0	0	0
1	C	418	3305	2096	550	636	23	0	0	0
1	D	419	3313	2100	551	639	23	0	0	0

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	404	GLN	GLU	engineered mutation	UNP P08253
B	404	GLN	GLU	engineered mutation	UNP P08253
C	404	GLN	GLU	engineered mutation	UNP P08253
D	404	GLN	GLU	engineered mutation	UNP P08253

- Molecule 2 is a protein called INHIBITOR PEPTIDE.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
2	P	8	44	27	8	9	0	0	0
2	R	8	44	27	8	9	0	0	0

- Molecule 3 is SULFATE ION (CCD ID: SO4) (formula: O₄S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	O	S	0	0
			5	4	1		
3	B	1	Total	O	S	0	0
			5	4	1		
3	B	1	Total	O	S	0	0
			5	4	1		
3	C	1	Total	O	S	0	0
			5	4	1		
3	C	1	Total	O	S	0	0
			5	4	1		
3	D	1	Total	O	S	0	0
			5	4	1		

- Molecule 4 is ZINC ION (CCD ID: ZN) (formula: Zn).

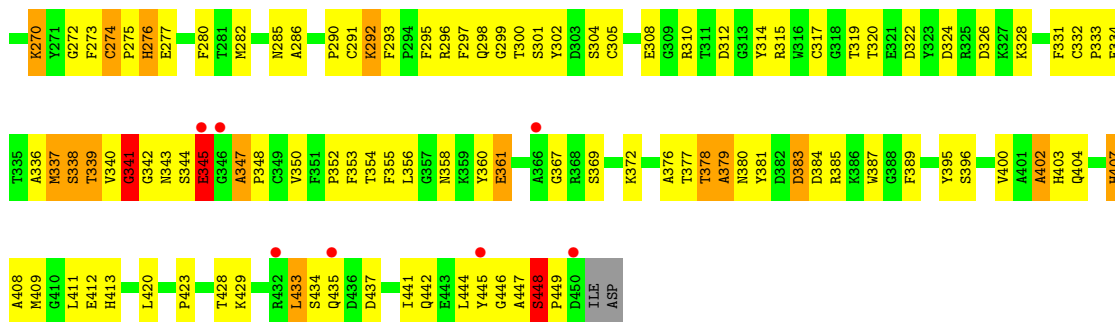
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	2	Total	Zn	0	0
			2	2		
4	B	2	Total	Zn	0	0
			2	2		
4	C	2	Total	Zn	0	0
			2	2		
4	D	2	Total	Zn	0	0
			2	2		

- Molecule 5 is CALCIUM ION (CCD ID: CA) (formula: Ca).

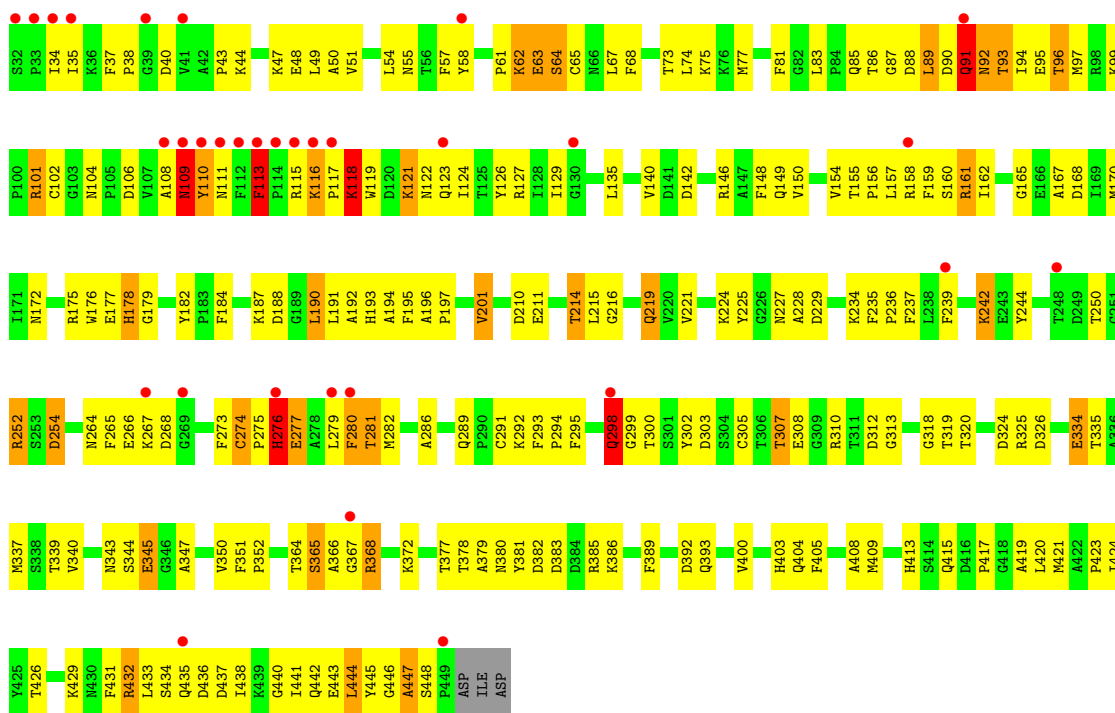
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	2	Total Ca 2 2	0	0
5	B	2	Total Ca 2 2	0	0
5	C	2	Total Ca 2 2	0	0
5	D	2	Total Ca 2 2	0	0

- Molecule 6 is water.

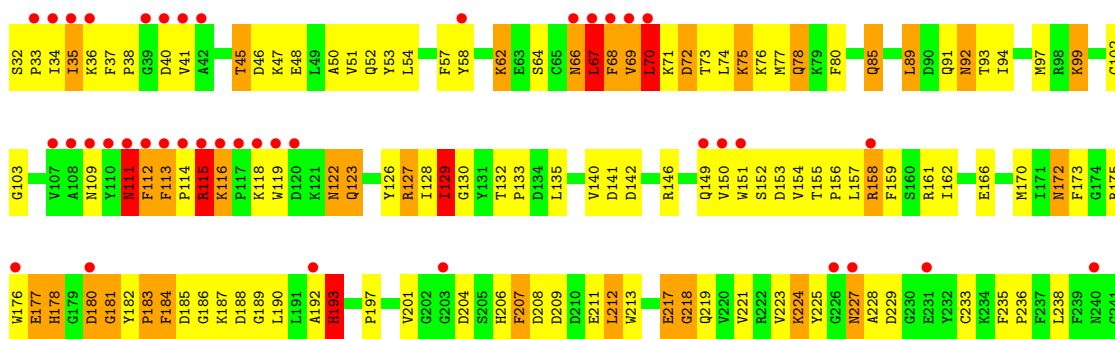
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	A	34	Total O 34 34	0	0
6	B	36	Total O 36 36	0	0
6	C	27	Total O 27 27	0	0
6	D	12	Total O 12 12	0	0

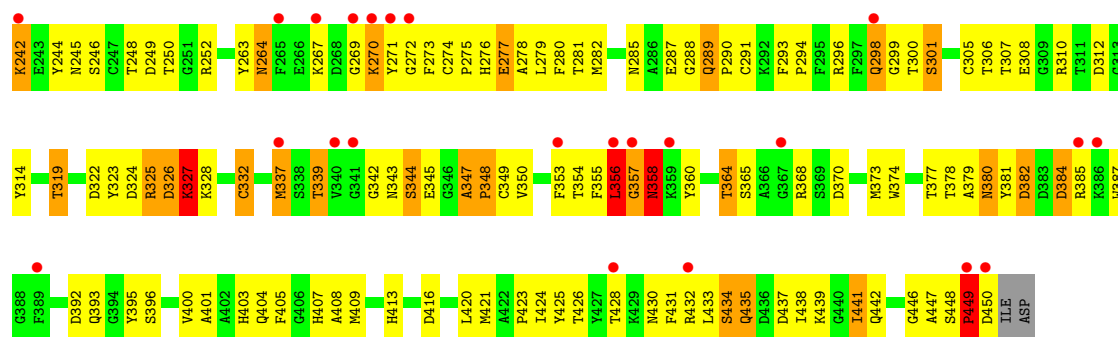


● Molecule 1: 72 KDA TYPE IV COLLAGENASE

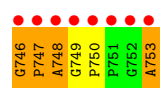
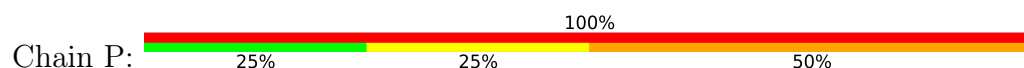


● Molecule 1: 72 KDA TYPE IV COLLAGENASE

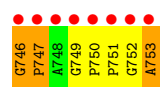
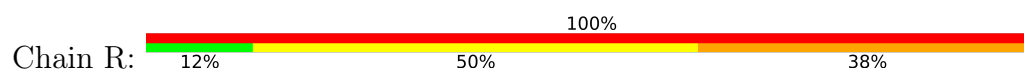




● Molecule 2: INHIBITOR PEPTIDE



● Molecule 2: INHIBITOR PEPTIDE



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	117.67Å 166.15Å 170.13Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	35.58 – 2.66 35.58 – 2.66	Depositor EDS
% Data completeness (in resolution range)	80.2 (35.58-2.66) 80.5 (35.58-2.66)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.00 (at 2.65Å)	Xtrriage
Refinement program	CNS 1.0	Depositor
R, R_{free}	0.271 , 0.303 0.270 , 0.301	Depositor DCC
R_{free} test set	3899 reflections (5.03%)	wwPDB-VP
Wilson B-factor (Å ²)	47.2	Xtrriage
Anisotropy	0.021	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 37.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.43$, $\langle L^2 \rangle = 0.27$	Xtrriage
Estimated twinning fraction	0.000 for -h,l,k	Xtrriage
F_o, F_c correlation	0.87	EDS
Total number of atoms	13504	wwPDB-VP
Average B, all atoms (Å ²)	41.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.71% 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 [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: CA, SO4, ZN

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	0.61	2/3431 (0.1%)	1.30	28/4646 (0.6%)
1	B	0.66	0/3414	1.37	32/4624 (0.7%)
1	C	0.63	1/3406 (0.0%)	1.35	40/4613 (0.9%)
1	D	0.64	4/3414 (0.1%)	1.37	36/4624 (0.8%)
2	P	25.75	1/46 (2.2%)	1.62	2/62 (3.2%)
2	R	37.99	2/46 (4.3%)	1.54	0/62
All	All	2.73	10/13757 (0.1%)	1.35	138/18631 (0.7%)

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	1
1	B	0	1
1	D	0	3
All	All	0	5

The worst 5 of 10 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	R	753	ALA	C-OXT	257.55	6.38	1.23
2	P	753	ALA	C-OXT	174.54	4.72	1.23
1	D	449	PRO	C-N	12.86	1.51	1.33
1	C	435	GLN	CB-CG	-7.83	1.28	1.52
1	A	417	PRO	N-CD	7.54	1.58	1.47

The worst 5 of 138 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	449	PRO	O-C-N	-25.49	88.23	122.64
1	D	193	HIS	CA-CB-CG	23.60	137.40	113.80
1	C	435	GLN	CB-CG-CD	16.92	141.37	112.60
1	A	112	PHE	CA-CB-CG	13.13	126.93	113.80
1	A	112	PHE	CA-C-O	-10.98	104.81	120.51

There are no chirality outliers.

All (5) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	112	PHE	Mainchain
1	B	341	GLY	Mainchain
1	D	183	PRO	Mainchain
1	D	357	GLY	Mainchain
1	D	449	PRO	Mainchain

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	3330	0	3066	318	0
1	B	3313	0	3048	231	2
1	C	3305	0	3045	281	0
1	D	3313	0	3049	303	1
2	P	44	0	39	33	0
2	R	44	0	39	22	0
3	A	5	0	0	0	0
3	B	10	0	0	2	0
3	C	10	0	0	3	0
3	D	5	0	0	2	0
4	A	2	0	0	0	0
4	B	2	0	0	0	0
4	C	2	0	0	0	0
4	D	2	0	0	0	0
5	A	2	0	0	0	0
5	B	2	0	0	0	0
5	C	2	0	0	0	0
5	D	2	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
6	A	34	0	0	4	0
6	B	36	0	0	6	0
6	C	27	0	0	7	1
6	D	12	0	0	2	1
All	All	13504	0	12286	1104	3

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 43.

The worst 5 of 1104 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:112:PHE:CE1	1:A:115:ARG:NH1	1.81	1.48
1:C:58:TYR:OH	1:C:77:MET:CG	1.72	1.36
1:A:176:TRP:CZ2	1:C:325:ARG:HA	1.61	1.32
1:A:176:TRP:CH2	1:C:325:ARG:HG3	1.64	1.31
1:A:176:TRP:CZ2	1:C:325:ARG:CB	2.16	1.28

All (3) 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:C:2007:HOH:O	6:D:2007:HOH:O[4_555]	1.89	0.31
1:B:67:LEU:CD1	1:B:290:PRO:CG[4_465]	2.16	0.04
1:B:361:GLU:O	1:D:68:PHE:CE1[4_465]	2.19	0.01

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	419/421 (100%)	376 (90%)	33 (8%)	10 (2%)	4 7

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	B	417/421 (99%)	374 (90%)	31 (7%)	12 (3%)	3	5
1	C	416/421 (99%)	378 (91%)	31 (8%)	7 (2%)	7	12
1	D	417/421 (99%)	370 (89%)	35 (8%)	12 (3%)	3	5
2	P	6/8 (75%)	4 (67%)	0	2 (33%)	0	0
2	R	6/8 (75%)	1 (17%)	4 (67%)	1 (17%)	0	0
All	All	1681/1700 (99%)	1503 (89%)	134 (8%)	44 (3%)	4	6

5 of 44 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	67	LEU
1	A	120	ASP
1	B	67	LEU
1	B	108	ALA
1	B	379	ALA

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	351/351 (100%)	301 (86%)	50 (14%)	3	5
1	B	349/351 (99%)	311 (89%)	38 (11%)	6	9
1	C	348/351 (99%)	307 (88%)	41 (12%)	5	7
1	D	349/351 (99%)	292 (84%)	57 (16%)	2	3
2	P	3/3 (100%)	3 (100%)	0	100	100
2	R	3/3 (100%)	3 (100%)	0	100	100
All	All	1403/1410 (100%)	1217 (87%)	186 (13%)	4	6

5 of 186 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	268	ASP

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Mol	Chain	Res	Type
1	D	92	ASN
1	C	298	GLN
1	D	35	ILE
1	D	127	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 36 such sidechains are listed below:

Mol	Chain	Res	Type
1	D	85	GLN
1	D	442	GLN
1	D	92	ASN
1	D	172	ASN
1	B	240	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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 22 ligands modelled in this entry, 16 are monoatomic - leaving 6 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
3	SO4	B	853	-	4,4,4	1.03	0	6,6,6	0.36	0
3	SO4	B	852	-	4,4,4	0.69	0	6,6,6	0.26	0
3	SO4	C	856	-	4,4,4	0.66	0	6,6,6	0.43	0
3	SO4	A	851	-	4,4,4	0.60	0	6,6,6	0.19	0
3	SO4	D	857	-	4,4,4	0.80	0	6,6,6	0.46	0
3	SO4	C	850	-	4,4,4	0.64	0	6,6,6	0.41	0

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

4 monomers are involved in 7 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	B	853	SO4	1	0
3	B	852	SO4	1	0
3	D	857	SO4	2	0
3	C	850	SO4	3	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](#)

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	421/421 (100%)	0.64	51 (12%) 8 7	16, 34, 78, 100	0
1	B	419/421 (99%)	0.32	25 (5%) 27 21	15, 31, 60, 100	0
1	C	418/421 (99%)	0.62	32 (7%) 19 14	17, 37, 71, 100	0
1	D	419/421 (99%)	1.02	63 (15%) 5 4	21, 47, 83, 100	0
2	P	8/8 (100%)	8.31	8 (100%) 0 0	78, 81, 90, 94	0
2	R	8/8 (100%)	5.22	8 (100%) 0 0	71, 74, 78, 80	0
All	All	1693/1700 (99%)	0.71	187 (11%) 10 9	15, 38, 78, 100	0

The worst 5 of 187 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	P	746	GLY	12.8
2	P	753	ALA	10.9
2	P	748	ALA	9.1
2	P	751	PRO	8.6
2	P	747	PRO	8.1

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(Å ²)	Q<0.9
5	CA	D	999	1/1	0.60	0.17	100,100,100,100	0
3	SO4	C	856	5/5	0.70	0.19	75,77,77,79	0
5	CA	B	999	1/1	0.76	0.23	100,100,100,100	0
5	CA	C	999	1/1	0.81	0.15	94,94,94,94	0
5	CA	A	999	1/1	0.81	0.16	76,76,76,76	0
3	SO4	B	853	5/5	0.82	0.16	72,72,74,75	0
3	SO4	B	852	5/5	0.89	0.14	64,65,66,67	0
5	CA	B	998	1/1	0.92	0.05	20,20,20,20	0
3	SO4	A	851	5/5	0.92	0.14	40,41,44,45	0
3	SO4	D	857	5/5	0.94	0.09	46,47,48,49	0
3	SO4	C	850	5/5	0.95	0.08	41,41,43,44	0
5	CA	D	998	1/1	0.96	0.06	34,34,34,34	0
4	ZN	D	996	1/1	0.96	0.05	35,35,35,35	0
5	CA	A	998	1/1	0.97	0.04	20,20,20,20	0
4	ZN	A	996	1/1	0.97	0.04	26,26,26,26	0
5	CA	C	998	1/1	0.97	0.03	30,30,30,30	0
4	ZN	B	997	1/1	0.98	0.05	23,23,23,23	0
4	ZN	D	997	1/1	0.98	0.07	40,40,40,40	0
4	ZN	C	996	1/1	0.99	0.04	32,32,32,32	0
4	ZN	C	997	1/1	0.99	0.05	26,26,26,26	0
4	ZN	B	996	1/1	0.99	0.05	24,24,24,24	0
4	ZN	A	997	1/1	1.00	0.04	20,20,20,20	0

6.5 Other polymers [i](#)

There are no such residues in this entry.