



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2018 – 07:39 am GMT

PDB ID : 3F9M
Title : Human pancreatic glucokinase in complex with glucose and activator showing a mobile flap
Authors : Petit, P.; Gluais, L.; Lagarde, A.; Vuillard, L.; Boutin, J.A.; Ferry, G.
Deposited on : 2008-11-14
Resolution : 1.50 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 following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.7.3 (157068), CSD as539be (2018)
Xtriage (Phenix) : 1.13
EDS : trunk30967
Percentile statistics : 20171227.v01 (using entries in the PDB archive December 27th 2017)
Refmac : 5.8.0158
CCP4 : 7.0 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : trunk30967

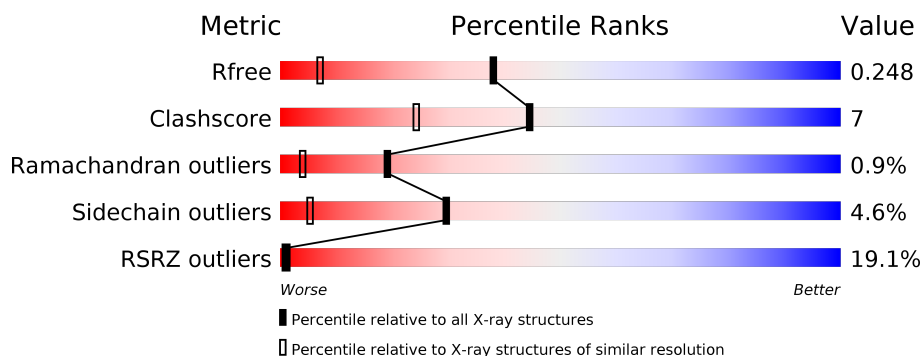
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.50 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}	111664	2534 (1.50-1.50)
Clashscore	122126	2727 (1.50-1.50)
Ramachandran outliers	120053	2661 (1.50-1.50)
Sidechain outliers	120020	2659 (1.50-1.50)
RSRZ outliers	108989	2481 (1.50-1.50)

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.

Mol	Chain	Length	Quality of chain
1	A	470	

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 4065 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 Glucokinase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	451	3590	2239	620	698	33	26	8	0

There are 16 discrepancies between the modelled and reference sequences:

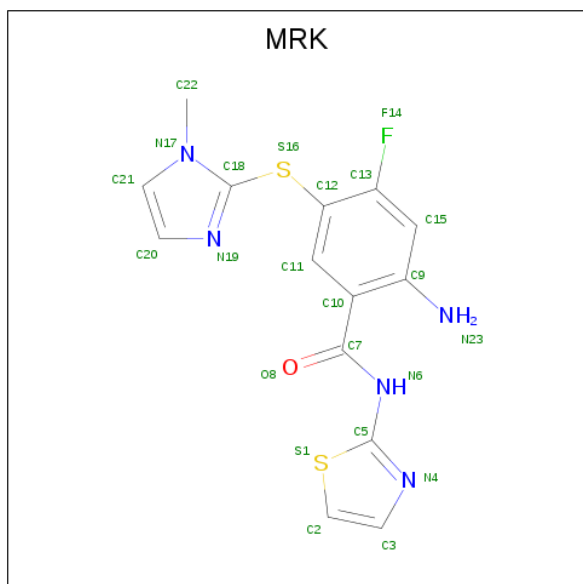
Chain	Residue	Modelled	Actual	Comment	Reference
A	-4	MET	-	EXPRESSION TAG	UNP P35557
A	-3	GLY	-	EXPRESSION TAG	UNP P35557
A	-2	HIS	-	EXPRESSION TAG	UNP P35557
A	-1	HIS	-	EXPRESSION TAG	UNP P35557
A	0	HIS	-	EXPRESSION TAG	UNP P35557
A	1	HIS	-	EXPRESSION TAG	UNP P35557
A	2	HIS	-	EXPRESSION TAG	UNP P35557
A	3	HIS	-	EXPRESSION TAG	UNP P35557
A	4	GLU	-	EXPRESSION TAG	UNP P35557
A	5	ASN	-	EXPRESSION TAG	UNP P35557
A	6	LEU	-	EXPRESSION TAG	UNP P35557
A	7	TYR	-	EXPRESSION TAG	UNP P35557
A	8	PHE	-	EXPRESSION TAG	UNP P35557
A	9	GLN	-	EXPRESSION TAG	UNP P35557
A	10	GLY	-	EXPRESSION TAG	UNP P35557
A	11	MET	-	EXPRESSION TAG	UNP P35557

- Molecule 2 is ALPHA-D-GLUCOSE (three-letter code: GLC) (formula: C₆H₁₂O₆).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	C	O	0	0
			12	6	6		

- Molecule 3 is 2-AMINO-4-FLUORO-5-[(1-METHYL-1H-IMIDAZOL-2-YL)SULFANYL]-N-(1,3-THIAZOL-2-YL)BENZAMIDE (three-letter code: MRK) (formula: $C_{14}H_{12}FN_5OS_2$).



Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
3	A	1	Total	C	F	N	O	S	0	0
			23	14	1	5	1	2		

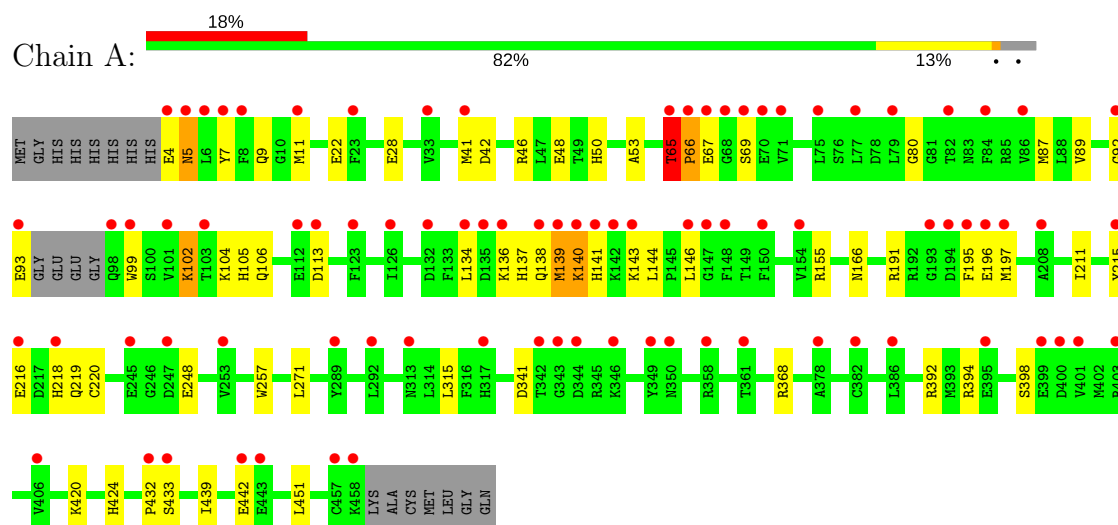
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	440	Total 440	O 440	0	0

3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA 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: Glucokinase



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	65.70Å 81.20Å 85.60Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	19.74 – 1.50 19.74 – 1.50	Depositor EDS
% Data completeness (in resolution range)	100.0 (19.74-1.50) 99.2 (19.74-1.50)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.50 (at 1.50Å)	Xtriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.190 , 0.222 0.227 , 0.248	Depositor DCC
R_{free} test set	3664 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å ²)	18.7	Xtriage
Anisotropy	0.201	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.39 , 44.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	4065	wwPDB-VP
Average B, all atoms (Å ²)	18.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.80% 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: GLC, MRK

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	0.62	2/3665 (0.1%)	0.81	6/4921 (0.1%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	191	ARG	CZ-NH2	-5.54	1.25	1.33
1	A	394	ARG	C-N	-5.22	1.22	1.34

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	191	ARG	NE-CZ-NH2	-17.90	111.35	120.30
1	A	191	ARG	NE-CZ-NH1	17.85	129.23	120.30
1	A	394	ARG	NE-CZ-NH1	-9.93	115.34	120.30
1	A	191	ARG	O-C-N	-6.70	111.98	122.70
1	A	394	ARG	NE-CZ-NH2	6.46	123.53	120.30
1	A	191	ARG	CD-NE-CZ	5.09	130.72	123.60

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	3590	0	3546	50	0
2	A	12	0	12	0	0
3	A	23	0	12	3	0
4	A	440	0	0	7	0
All	All	4065	0	3570	51	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 7.

All (51) 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:GLU:HA	1:A:9[A]:GLN:HE21	1.13	1.13
1:A:65:THR:H	1:A:66:PRO:HA	0.93	1.09
1:A:4:GLU:HG2	1:A:5:ASN:N	1.64	1.08
1:A:4:GLU:HG2	1:A:5:ASN:H	0.91	1.06
1:A:139:MET:HE1	4:A:898:HOH:O	1.63	0.98
1:A:65:THR:H	1:A:66:PRO:CA	1.77	0.97
1:A:65:THR:N	1:A:66:PRO:HA	1.74	0.93
1:A:4:GLU:HA	1:A:9[A]:GLN:NE2	1.84	0.92
1:A:106:GLN:HE22	1:A:136:LYS:HD2	1.35	0.90
1:A:4:GLU:O	1:A:9[B]:GLN:HG2	1.75	0.86
1:A:439:ILE:HD11	4:A:777:HOH:O	1.90	0.72
1:A:4:GLU:O	1:A:5:ASN:C	2.29	0.71
1:A:146:LEU:HB2	1:A:197:MET:HE3	1.74	0.68
1:A:106:GLN:NE2	1:A:136:LYS:HD2	2.13	0.60
1:A:140:LYS:HB2	1:A:195:PHE:HB3	1.83	0.60
1:A:65:THR:N	1:A:66:PRO:CA	2.47	0.57
1:A:106:GLN:HE22	1:A:136:LYS:CD	2.13	0.56
1:A:140:LYS:HB2	1:A:195:PHE:CB	2.35	0.56
3:A:501:MRK:O8	3:A:501:MRK:S1	2.63	0.56
1:A:146:LEU:HD12	1:A:197:MET:HE2	1.88	0.55
1:A:341:ASP:O	1:A:368:ARG:NH2	2.42	0.53
1:A:87:MET:HG2	1:A:89:VAL:HG12	1.89	0.53
1:A:4:GLU:CG	1:A:5:ASN:N	2.49	0.52
1:A:102:LYS:HD3	1:A:105:HIS:CD2	2.45	0.51
1:A:28:GLU:HG3	4:A:618:HOH:O	2.11	0.51
1:A:215:TYR:CE2	1:A:451:LEU:HD13	2.46	0.50
1:A:137:HIS:O	1:A:139:MET:HG2	2.12	0.50
1:A:4:GLU:O	1:A:5:ASN:O	2.29	0.50
1:A:420:LYS:HG2	1:A:424:HIS:CE1	2.47	0.49
1:A:92:GLY:HA3	1:A:99:TRP:CZ2	2.48	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:219:GLN:HG3	4:A:819:HOH:O	2.12	0.49
1:A:50:HIS:NE2	1:A:155[A]:ARG:NH1	2.61	0.48
1:A:46[A]:ARG:NH2	1:A:48[A]:GLU:HG3	2.29	0.47
1:A:138:GLN:C	1:A:139:MET:HG2	2.36	0.46
1:A:144:LEU:HB2	1:A:197:MET:HE1	1.99	0.45
1:A:137:HIS:HE1	4:A:858:HOH:O	2.00	0.44
1:A:146:LEU:HB2	1:A:197:MET:CE	2.42	0.44
1:A:420:LYS:CG	1:A:424:HIS:CE1	3.00	0.44
1:A:432:PRO:O	1:A:433:SER:HB2	2.18	0.44
1:A:4:GLU:O	1:A:9[A]:GLN:HG3	2.17	0.44
1:A:134:LEU:HB3	1:A:140:LYS:HB3	2.01	0.43
1:A:22:GLU:HG2	1:A:271:LEU:HD22	2.00	0.43
1:A:220:CYS:O	3:A:501:MRK:H221	2.19	0.42
1:A:7:TYR:O	1:A:11:MET:HG2	2.19	0.42
1:A:5:ASN:OD1	1:A:5:ASN:C	2.58	0.42
1:A:139:MET:CE	4:A:898:HOH:O	2.43	0.42
1:A:42[B]:ASP:OD1	1:A:392:ARG:NH1	2.53	0.42
1:A:53:ALA:HB1	4:A:852:HOH:O	2.19	0.41
1:A:211:ILE:HD12	3:A:501:MRK:C13	2.50	0.41
1:A:143:LYS:HE2	1:A:196:GLU:HB3	2.02	0.41
1:A:41:MET:HB3	1:A:41:MET:HE2	1.81	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	454/470 (97%)	442 (97%)	8 (2%)	4 (1%)	19 4

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	66	PRO
1	A	5	ASN
1	A	80	GLY
1	A	65	THR

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	396/403 (98%)	378 (96%)	18 (4%)	30 5

All (18) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	65	THR
1	A	67	GLU
1	A	69	SER
1	A	93	GLU
1	A	102	LYS
1	A	104	LYS
1	A	113	ASP
1	A	139	MET
1	A	140	LYS
1	A	141	HIS
1	A	166	ASN
1	A	216	GLU
1	A	218	HIS
1	A	248	GLU
1	A	257	TRP
1	A	315	LEU
1	A	398	SER
1	A	442	GLU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	106	GLN
1	A	137	HIS
1	A	317	HIS
1	A	337	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](#)

2 ligands are modelled in this entry.

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	GLC	A	500	-	12,12,12	0.58	0	17,17,17	0.74	0
3	MRK	A	501	-	22,25,25	1.41	2 (9%)	22,35,35	1.98	5 (22%)

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
2	GLC	A	500	-	-	0/2/22/22	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	MRK	A	501	-	-	0/8/12/12	0/3/3/3

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	501	MRK	C12-S16	-4.55	1.71	1.78
3	A	501	MRK	C18-N17	-3.27	1.33	1.36

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	501	MRK	C21-N17-C18	-4.44	104.34	108.56
3	A	501	MRK	C15-C13-C12	-2.99	120.34	122.76
3	A	501	MRK	C22-N17-C18	2.86	128.34	125.62
3	A	501	MRK	C9-C10-C7	2.94	121.97	120.14
3	A	501	MRK	C18-S16-C12	5.12	110.54	101.85

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

1 monomer is involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	501	MRK	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 ⓘ

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	450/470 (95%)	1.04	86 (19%) 1 1	6, 15, 28, 40	5 (1%)

All (86) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	457	CYS	7.0
1	A	99	TRP	7.0
1	A	82	THR	6.5
1	A	141	HIS	6.3
1	A	215	TYR	5.9
1	A	65	THR	5.5
1	A	195	PHE	5.2
1	A	194	ASP	5.1
1	A	93	GLU	4.3
1	A	193	GLY	4.3
1	A	216	GLU	4.2
1	A	358	ARG	4.1
1	A	346	LYS	3.9
1	A	66	PRO	3.9
1	A	8	PHE	3.8
1	A	196	GLU	3.8
1	A	77	LEU	3.7
1	A	343	GLY	3.7
1	A	400	ASP	3.7
1	A	349	TYR	3.6
1	A	395	GLU	3.6
1	A	113	ASP	3.5
1	A	344	ASP	3.5
1	A	139	MET	3.5
1	A	134	LEU	3.4
1	A	140	LYS	3.4
1	A	7	TYR	3.3

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Mol	Chain	Res	Type	RSRZ
1	A	399	GLU	3.3
1	A	138	GLN	3.3
1	A	458	LYS	3.3
1	A	6	LEU	3.1
1	A	92	GLY	3.1
1	A	432	PRO	3.1
1	A	361	THR	3.1
1	A	68	GLY	3.1
1	A	71	VAL	3.1
1	A	146	LEU	3.0
1	A	342	THR	3.0
1	A	79	LEU	3.0
1	A	147	GLY	2.9
1	A	143	LYS	2.9
1	A	148	PHE	2.9
1	A	67	GLU	2.9
1	A	197	MET	2.9
1	A	401	VAL	2.9
1	A	70	GLU	2.9
1	A	136	LYS	2.9
1	A	442	GLU	2.8
1	A	123	PHE	2.8
1	A	103	THR	2.7
1	A	142	LYS	2.7
1	A	378	ALA	2.7
1	A	98	GLN	2.7
1	A	135	ASP	2.7
1	A	101	VAL	2.6
1	A	69	SER	2.6
1	A	386	LEU	2.6
1	A	33	VAL	2.6
1	A	403	ARG	2.5
1	A	84	PHE	2.5
1	A	350	ASN	2.5
1	A	150	PHE	2.5
1	A	4	GLU	2.5
1	A	5	ASN	2.5
1	A	433	SER	2.5
1	A	112	GLU	2.4
1	A	86	VAL	2.4
1	A	382	CYS	2.4
1	A	126	ILE	2.4

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Mol	Chain	Res	Type	RSRZ
1	A	247	ASP	2.4
1	A	313	ASN	2.4
1	A	317	HIS	2.4
1	A	218	HIS	2.3
1	A	406	VAL	2.3
1	A	443	GLU	2.3
1	A	154	VAL	2.3
1	A	75	LEU	2.2
1	A	292	LEU	2.2
1	A	289	TYR	2.2
1	A	253	VAL	2.2
1	A	23	PHE	2.1
1	A	11	MET	2.1
1	A	41	MET	2.1
1	A	132	ASP	2.1
1	A	245	GLU	2.0
1	A	208	ALA	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 carbohydrates 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(\AA^2)	Q<0.9
3	MRK	A	501	23/23	0.95	0.13	18,23,28,29	0
2	GLC	A	500	12/12	0.96	0.13	10,11,13,14	0

6.5 Other polymers [i](#)

There are no such residues in this entry.