WORLDWIDE wwPDB
PROTEIN DATA BANK

wwPDB X-ray Structure Validation Summary Report ⓘ

Apr 29, 2025 – 12:36 PM EDT

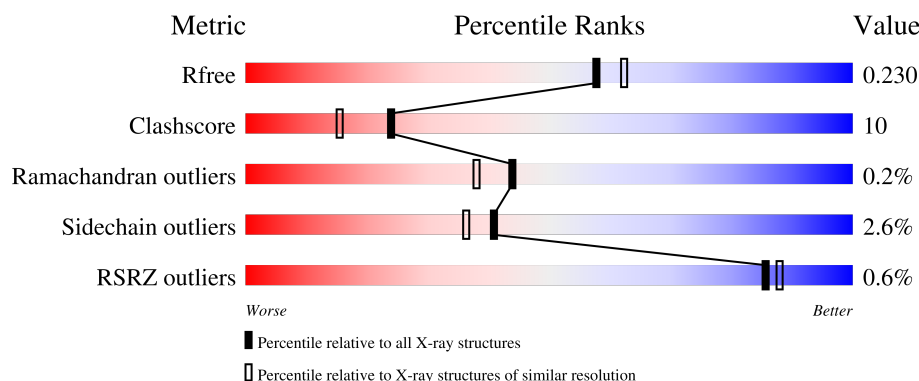|		
PDB ID	:	3NBU / pdb_00003nbu
Title	:	Crystal structure of pGI glucosephosphate isomerase
Authors	:	Alber, T.; Zubieta, C.; Totir, M.; May, A.; Echols, N.
Deposited on	:	2010-06-04
Resolution	:	2.05 Å(reported)

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 2.05 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		10
Ramachandran outliers		0.2%
Sidechain outliers		2.6%
RSRZ outliers		0.6%

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$_{free}$	164625	2096 (2.04-2.04)
Clashscore	180529	2229 (2.04-2.04)
Ramachandran outliers	177936	2217 (2.04-2.04)
Sidechain outliers	177891	2217 (2.04-2.04)
RSRZ outliers	164620	2096 (2.04-2.04)

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	549	83% — 14% ··
1	B	549	90% — 9%
1	C	549	81% — 17% ·
1	D	549	80% — 18% ·
1	E	549	80% — 18% ·

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Mol	Chain	Length	Quality of chain
1	F	549	83% 15% ·

2 Entry composition ⓘ

There are 3 unique types of molecules in this entry. The entry contains 29247 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 Glucose-6-phosphate isomerase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	545	Total 4309	C 2753	N 732	O 808	S 16	0	0	0
1	B	549	Total 4343	C 2775	N 738	O 814	S 16	0	0	0
1	C	549	Total 4333	C 2768	N 736	O 813	S 16	0	0	0
1	D	549	Total 4333	C 2768	N 736	O 813	S 16	0	0	0
1	E	549	Total 4333	C 2768	N 736	O 813	S 16	0	0	0
1	F	549	Total 4333	C 2768	N 736	O 813	S 16	0	0	0

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	241	THR	ALA	variant	UNP P0A6T1
B	241	THR	ALA	variant	UNP P0A6T1
C	241	THR	ALA	variant	UNP P0A6T1
D	241	THR	ALA	variant	UNP P0A6T1
E	241	THR	ALA	variant	UNP P0A6T1
F	241	THR	ALA	variant	UNP P0A6T1

- Molecule 2 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	D	1	Total 1	Cl 1	0	0

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	580	Total 580	O 580	0	0
3	B	643	Total 643	O 643	0	0
3	C	522	Total 522	O 522	0	0
3	D	509	Total 509	O 509	0	0
3	E	480	Total 480	O 480	0	0
3	F	528	Total 528	O 528	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: Glucose-6-phosphate isomerase
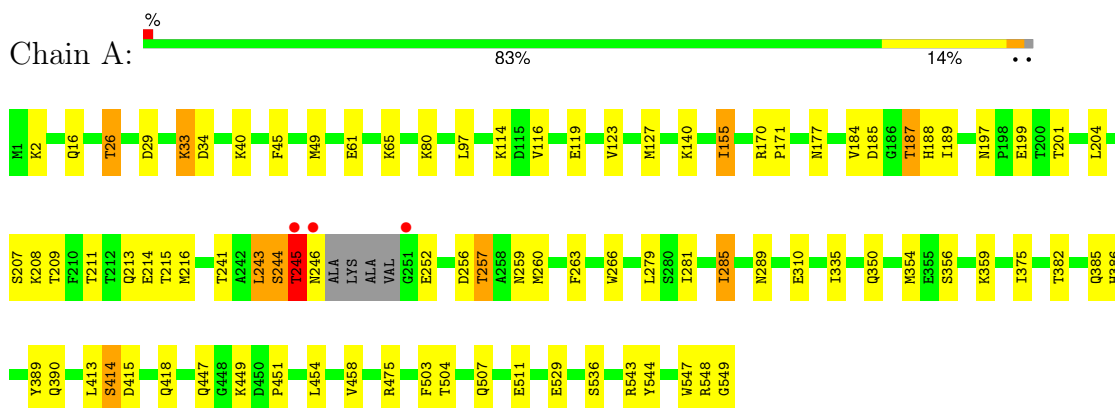
Chain A:

• Molecule 1: Glucose-6-phosphate isomerase

Chain B:

• Molecule 1: Glucose-6-phosphate isomerase

Chain C:

H533 I541 Y544 G549
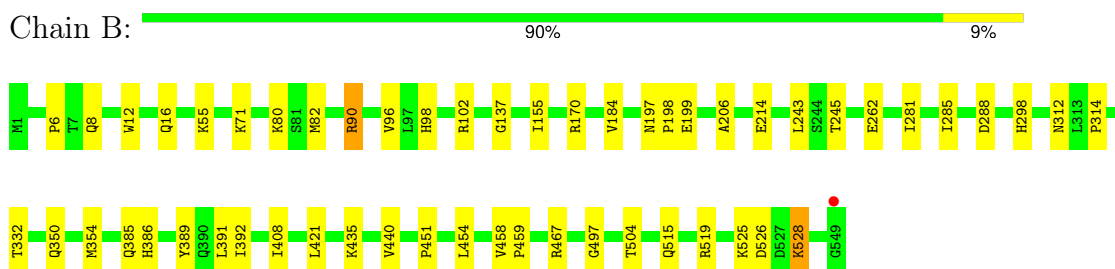
● Molecule 1: Glucose-6-phosphate isomerase

Chain D:

80%   18%

M1 Q8 A11 Q16 A43 T44 D47 E61 T62 L63 A64 K65 L66 Q67 K71 E72 K80 S81 M82 K87 A95 A100 T107 V111 V116 M117 V123 L124 E125 K126 M127 K128 T129 E132 K140 I153 G154 I155 Y163 M164 V165
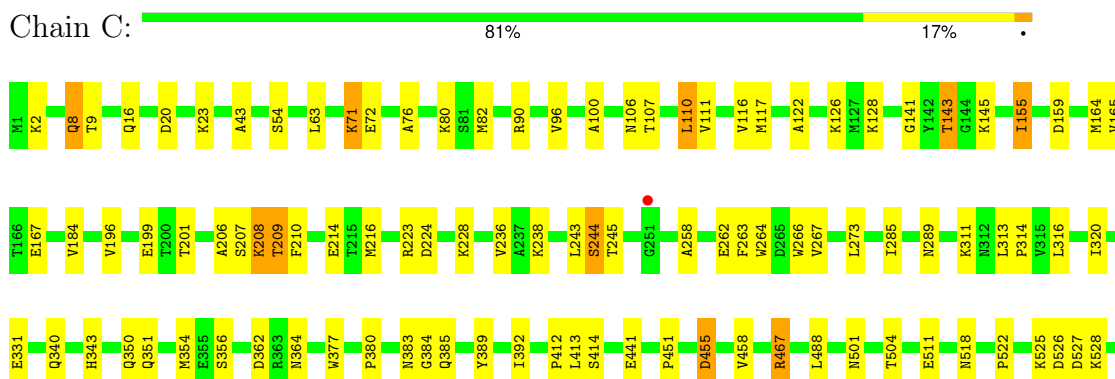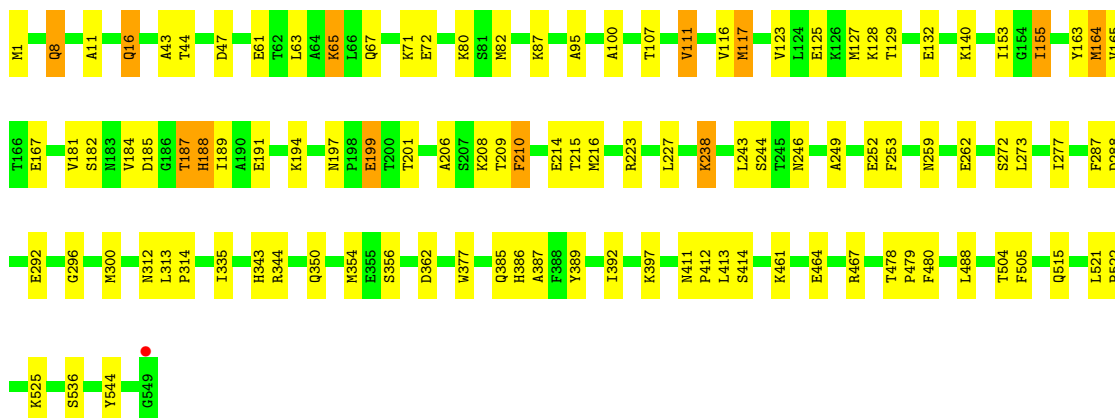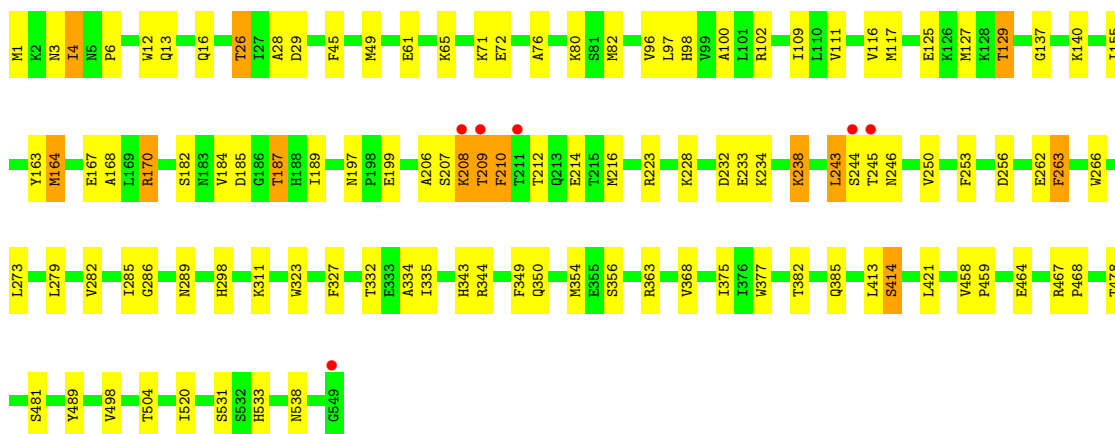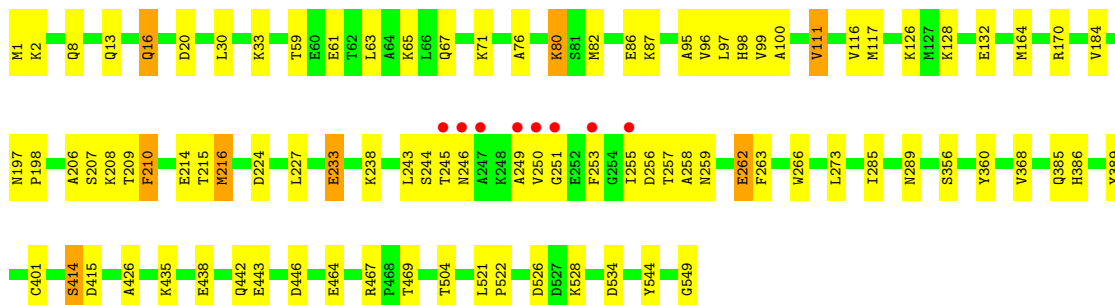
T166 E167 V181 S182 N183 V184 D185 G186 T187 H188 I189 A190 E191 K194 N197 P198 E199 T200 T201 A206 S207 K208 T209 F210 E214 T215 M216 R223 L227 K238 L243 S244 T245 N246 A249 E252 F253 N259 E262 S272 L273 I277 F287 D288

E292 G296 M300 N312 L313 P314 I335 H343 R344 Q350 M354 E355 S356 D362 W377 Q385 H386 A387 F388 Y389 I392 K397 N411 P412 L413 S414 K461 E464 R467 T478 P479 F480 L488 T504 F505 Q515 L521 P522

K525 S536 Y544 G549

● Molecule 1: Glucose-6-phosphate isomerase

Chain E:

%
80%   18%

M1 K2 N3 I4 N5 P6 W12 Q13 Q16 T26 I27 A28 D29 F45 M49 E61 K65 K71 E72 A76 K80 S81 M82 V96 L97 H98 V99 A100 L101 R102 I109 L110 V111 V116 M117 E125 K126 M127 K128 T129 G137 K140 I155

Y163 M164 E167 A168 L169 R170 S182 N183 V184 D185 G186 T187 H188 I189 N197 P198 E199 A206 S207 K208 T209 F210 I211 T212 Q213 E214 T215 M216 R223 K228 D232 E233 K234 K238 L243 S244 T245 N246 V250 F253 D256 E262 F263 W266

L273 L279 V282 I285 G286 N289 H298 K311 W323 F327 T332 E333 A334 I335 H343 R344 F349 Q350 M354 E355 S356 R363 V368 I375 I376 W377 T382 Q385 L413 S414 L421 V458 P459 E464 R467 P468 T478

S481 Y489 V498 T504 I520 S531 S532 H533 N538 G549

● Molecule 1: Glucose-6-phosphate isomerase

Chain F:

%
83%   15%

M1 K2 Q8 Q13 Q16 D20 L30 K33 T59 E60 E61 T62 L63 A64 K65 L66 Q67 K71 A76 K80 S81 M82 E86 K87 A95 V96 L97 H98 V99 A100 V111 V116 M117 K126 M127 K128 E132 M164 R170 V184

N197 P198 A206 S207 K208 T209 F210 E214 T215 M216 D224 L227 E233 K238 L243 S244 T245 N246 A247 K248 A249 V250 G251 E252 F253 G254 I255 D256 T257 A258 N259 E262 F263 W266 L273 I285 N289 S356 Y360 V368 Q385 H386 Y389

C401 S414 D415 A426 K435 E438 Q442 E443 D446 E464 R467 P468 T469 T504 L521 P522 D526 S527 K528 D534 Y544 G549

4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α, β, γ	69.81Å 72.87Å 181.85Å 92.47° 97.82° 114.57°	Depositor
Resolution (Å)	89.00 – 2.05 89.00 – 2.05	Depositor EDS
% Data completeness (in resolution range)	94.9 (89.00-2.05) 94.9 (89.00-2.05)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	0.10	Depositor
$< I/\sigma(I) >$ [1]	1.92 (at 2.05Å)	Xtriage
Refinement program	REFMAC 5.5.0102	Depositor
R, R_{free}	0.169 , 0.230 0.171 , 0.230	Depositor DCC
R_{free} test set	9609 reflections (5.03%)	wwPDB-VP
Wilson B-factor (Å^2)	22.0	Xtriage
Anisotropy	0.041	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.33 , 44.0	EDS
L-test for twinning[2]	$< |L| > = 0.49, < L^2 > = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	29247	wwPDB-VP
Average B, all atoms (Å^2)	23.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.61% 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: CL

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	0.73	1/4413 (0.0%)	0.87	2/5981 (0.0%)
1	B	0.72	0/4448	0.90	1/6028 (0.0%)
1	C	0.69	0/4438	0.91	6/6017 (0.1%)
1	D	0.68	0/4438	0.88	0/6017
1	E	0.68	0/4438	0.89	3/6017 (0.0%)
1	F	0.71	0/4438	0.89	2/6017 (0.0%)
All	All	0.70	1/26613 (0.0%)	0.89	14/36077 (0.0%)

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

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	458	VAL	CA-CB	5.48	1.56	1.54

The worst 5 of 14 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	C	209	THR	N-CA-C	-7.88	99.12	110.24
1	C	244	SER	N-CA-C	6.19	116.02	107.73
1	E	170	ARG	CA-C-N	-5.73	113.77	119.56
1	E	170	ARG	C-N-CA	-5.73	113.77	119.56
1	B	90	ARG	N-CA-C	5.57	118.28	111.82

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	548	ARG	Peptide

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	4309	0	4200	74	0
1	B	4343	0	4248	50	0
1	C	4333	0	4221	100	0
1	D	4333	0	4221	105	0
1	E	4333	0	4221	102	0
1	F	4333	0	4221	96	1
2	D	1	0	0	0	0
3	A	580	0	0	15	0
3	B	643	0	0	17	0
3	C	522	0	0	20	0
3	D	509	0	0	41	1
3	E	480	0	0	27	0
3	F	528	0	0	34	0
All	All	29247	0	25332	507	1

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 10.

The worst 5 of 507 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:D:44:THR:HG22	3:D:2225:HOH:O	1.22	1.38
1:D:16:GLN:HG3	3:D:1430:HOH:O	1.19	1.35
1:F:224:ASP:HB3	3:F:2829:HOH:O	1.27	1.25
1:F:233:GLU:CD	3:F:564:HOH:O	1.84	1.21
1:D:117:MET:HA	1:D:117:MET:HE2	1.23	1.13

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the sym-

metry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:F:13:GLN:OE1	3:D:1089:HOH:O[1_544]	1.82	0.38

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	541/549 (98%)	511 (94%)	26 (5%)	4 (1%)	19	11
1	B	547/549 (100%)	529 (97%)	18 (3%)	0	100	100
1	C	547/549 (100%)	516 (94%)	29 (5%)	2 (0%)	30	23
1	D	547/549 (100%)	525 (96%)	22 (4%)	0	100	100
1	E	547/549 (100%)	519 (95%)	26 (5%)	2 (0%)	30	23
1	F	547/549 (100%)	520 (95%)	27 (5%)	0	100	100
All	All	3276/3294 (100%)	3120 (95%)	148 (4%)	8 (0%)	44	38

5 of 8 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	E	208	LYS
1	A	244	SER
1	A	257	THR
1	C	208	LYS
1	A	245	THR

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	458/463 (99%)	445 (97%)	13 (3%)	38	34
1	B	462/463 (100%)	456 (99%)	6 (1%)	65	66
1	C	459/463 (99%)	451 (98%)	8 (2%)	56	55
1	D	459/463 (99%)	443 (96%)	16 (4%)	31	25
1	E	459/463 (99%)	444 (97%)	15 (3%)	33	27
1	F	459/463 (99%)	445 (97%)	14 (3%)	35	30
All	All	2756/2778 (99%)	2684 (97%)	72 (3%)	41	36

5 of 72 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	E	263	PHE
1	F	438	GLU
1	F	8	GLN
1	F	209	THR
1	C	155	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 9 such sidechains are listed below:

Mol	Chain	Res	Type
1	E	8	GLN
1	E	16	GLN
1	C	177	ASN
1	D	93	ASN
1	D	386	HIS

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 1 ligands modelled in this entry, 1 is monoatomic - leaving 0 for Mogul analysis.

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.

No monomer is involved in short contacts.

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(Å²)	Q<0.9
1	A	545/549 (99%)	-0.71	3 (0%)	85	88	11, 18, 33, 59	0
1	B	549/549 (100%)	-0.79	1 (0%)	92	93	10, 18, 29, 45	0
1	C	549/549 (100%)	-0.53	1 (0%)	92	93	11, 22, 37, 50	0
1	D	549/549 (100%)	-0.57	1 (0%)	92	93	13, 21, 36, 44	0
1	E	549/549 (100%)	-0.48	6 (1%)	77	80	12, 23, 43, 53	0
1	F	549/549 (100%)	-0.59	8 (1%)	71	74	12, 20, 39, 61	0
All	All	3290/3294 (99%)	-0.61	20 (0%)	85	88	10, 20, 37, 61	0

The worst 5 of 20 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	251	GLY	4.8
1	F	250	VAL	3.7
1	F	251	GLY	3.5
1	E	209	THR	3.3
1	F	245	THR	3.3

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
2	CL	D	550	1/1	0.99	0.04	27,27,27,27	0

6.5   Other polymers ⓘ

There are no such residues in this entry.