wwPDB X-ray Structure Validation Summary Report (i)

Aug 19, 2023 – 10:07 PM EDT

PDB ID	:	2HDX
Title	:	Crystal structure of the Src homology-2 domain of SH2-B in complex with Jak2 pTyr813 phosphopeptide
Authors	:	Hu, J.; Hubbard, S.R.
Deposited on	:	2006-06-21
Resolution	:	2.35 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 (i) 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 (i)) were used in the production of this report:

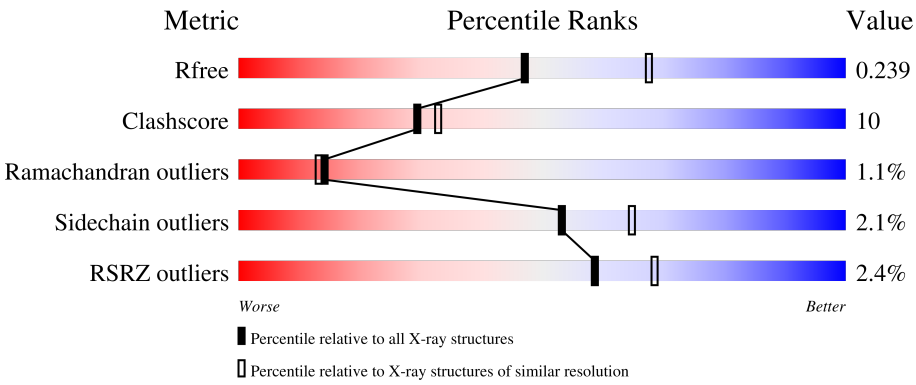
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.35
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.35

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.35 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}	130704	1164 (2.36-2.36)
Clashscore	141614	1232 (2.36-2.36)
Ramachandran outliers	138981	1211 (2.36-2.36)
Sidechain outliers	138945	1212 (2.36-2.36)
RSRZ outliers	127900	1150 (2.36-2.36)

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	111	3% 82% 13% • •
1	B	111	2% 74% 19% • 5%
1	C	111	4% 74% 22% • •
1	D	111	% 77% 18% 5%
1	E	111	5% 80% 15% • •

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Mol	Chain	Length	Quality of chain
1	F	111	74% 18% • 6%
2	G	11	45% 36% 18%
2	H	11	36% 27% 36%
2	I	11	55% 9% 36%
2	J	11	36% 18% 9% 36%
2	K	11	36% 27% 36%
2	L	11	36% 45% 18%

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 5693 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 SH2-B PH domain containing signaling mediator 1 gamma isoform.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	108	837	534	155	144	4	0	0	0
1	B	105	820	526	151	139	4	0	0	0
1	C	108	834	533	154	143	4	0	0	0
1	D	105	820	526	151	139	4	0	0	0
1	E	108	834	533	154	143	4	0	0	0
1	F	104	814	523	150	137	4	0	0	0

There are 30 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	517	GLY	-	cloning artifact	UNP Q9WVM5
A	518	SER	-	cloning artifact	UNP Q9WVM5
A	583	ALA	GLU	engineered mutation	UNP Q9WVM5
A	584	ALA	GLU	engineered mutation	UNP Q9WVM5
A	593	HIS	TRP	engineered mutation	UNP Q9WVM5
B	517	GLY	-	cloning artifact	UNP Q9WVM5
B	518	SER	-	cloning artifact	UNP Q9WVM5
B	583	ALA	GLU	engineered mutation	UNP Q9WVM5
B	584	ALA	GLU	engineered mutation	UNP Q9WVM5
B	593	HIS	TRP	engineered mutation	UNP Q9WVM5
C	517	GLY	-	cloning artifact	UNP Q9WVM5
C	518	SER	-	cloning artifact	UNP Q9WVM5
C	583	ALA	GLU	engineered mutation	UNP Q9WVM5
C	584	ALA	GLU	engineered mutation	UNP Q9WVM5
C	593	HIS	TRP	engineered mutation	UNP Q9WVM5
D	517	GLY	-	cloning artifact	UNP Q9WVM5

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Chain	Residue	Modelled	Actual	Comment	Reference
D	518	SER	-	cloning artifact	UNP Q9WVM5
D	583	ALA	GLU	engineered mutation	UNP Q9WVM5
D	584	ALA	GLU	engineered mutation	UNP Q9WVM5
D	593	HIS	TRP	engineered mutation	UNP Q9WVM5
E	517	GLY	-	cloning artifact	UNP Q9WVM5
E	518	SER	-	cloning artifact	UNP Q9WVM5
E	583	ALA	GLU	engineered mutation	UNP Q9WVM5
E	584	ALA	GLU	engineered mutation	UNP Q9WVM5
E	593	HIS	TRP	engineered mutation	UNP Q9WVM5
F	517	GLY	-	cloning artifact	UNP Q9WVM5
F	518	SER	-	cloning artifact	UNP Q9WVM5
F	583	ALA	GLU	engineered mutation	UNP Q9WVM5
F	584	ALA	GLU	engineered mutation	UNP Q9WVM5
F	593	HIS	TRP	engineered mutation	UNP Q9WVM5

- Molecule 2 is a protein called Jak2 protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
2	G	9	79	48	9	21	1	0	0	0
2	H	7	61	37	7	16	1	0	0	0
2	I	7	65	39	7	18	1	0	0	0
2	J	7	65	39	7	18	1	0	0	0
2	K	7	65	39	7	18	1	0	0	0
2	L	9	79	48	9	21	1	0	0	0

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
G	813	PTR	TYR	modified residue	UNP Q7TQD0
H	813	PTR	TYR	modified residue	UNP Q7TQD0
I	813	PTR	TYR	modified residue	UNP Q7TQD0
J	813	PTR	TYR	modified residue	UNP Q7TQD0
K	813	PTR	TYR	modified residue	UNP Q7TQD0
L	813	PTR	TYR	modified residue	UNP Q7TQD0

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
3	A	87	87	87	0	0
			Total	O		
3	B	24	24	24	0	0
			Total	O		
3	C	36	36	36	0	0
			Total	O		
3	D	41	41	41	0	0
			Total	O		
3	E	37	37	37	0	0
			Total	O		
3	F	42	42	42	0	0
			Total	O		
3	G	19	19	19	0	0
			Total	O		
3	H	4	4	4	0	0
			Total	O		
3	I	8	8	8	0	0
			Total	O		
3	J	7	7	7	0	0
			Total	O		
3	K	6	6	6	0	0
			Total	O		
3	L	9	9	9	0	0

3 Residue-property plots (i)

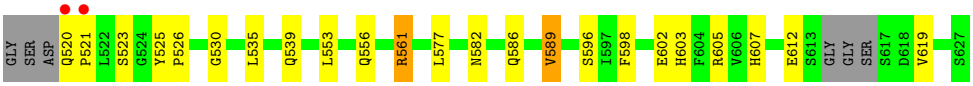
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. 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: SH2-B PH domain containing signaling mediator 1 gamma isoform

Chain A:

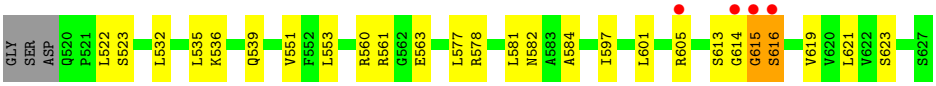
• Molecule 1: SH2-B PH domain containing signaling mediator 1 gamma isoform

Chain B:



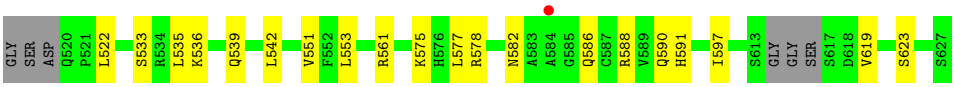
• Molecule 1: SH2-B PH domain containing signaling mediator 1 gamma isoform

Chain C:



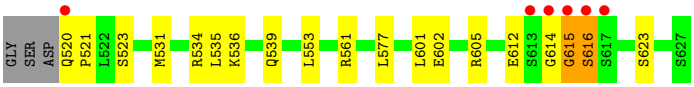
• Molecule 1: SH2-B PH domain containing signaling mediator 1 gamma isoform

Chain D:



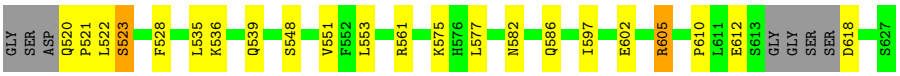
• Molecule 1: SH2-B PH domain containing signaling mediator 1 gamma isoform

Chain E:



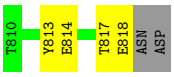
• Molecule 1: SH2-B PH domain containing signaling mediator 1 gamma isoform

Chain F:



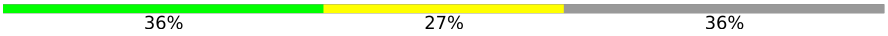
- Molecule 2: Jak2 protein

Chain G:



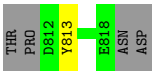
- Molecule 2: Jak2 protein

Chain H:



- Molecule 2: Jak2 protein

Chain I:

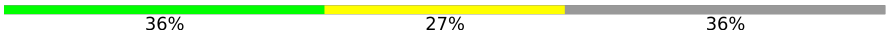


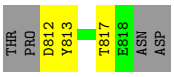
- Molecule 2: Jak2 protein

Chain J:

- Molecule 2: Jak2 protein

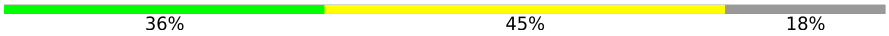
Chain K:





- Molecule 2: Jak2 protein

Chain L:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	44.21Å 74.19Å 239.22Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	30.00 – 2.35 40.21 – 2.35	Depositor EDS
% Data completeness (in resolution range)	(Not available) (30.00-2.35) 95.4 (40.21-2.35)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	6.29 (at 2.34Å)	Xtriage
Refinement program	CNS	Depositor
R, R_{free}	0.210 , 0.240 0.200 , 0.239	Depositor DCC
R_{free} test set	1604 reflections (4.96%)	wwPDB-VP
Wilson B-factor (Å^2)	25.6	Xtriage
Anisotropy	0.424	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.36 , 56.5	EDS
L-test for twinning[2]	$< \|L\| > = 0.48$, $< L^2 > = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.93	EDS
Total number of atoms	5693	wwPDB-VP
Average B, all atoms (Å^2)	27.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.90% of the height of the origin peak. No significant pseudotranslation is detected.*

[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 (i)

5.1 Standard geometry (i)

Bond lengths and bond angles in the following residue types are not validated in this section: PTR

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	0.41	0/858	0.64	0/1158
1	B	0.34	0/841	0.55	0/1136
1	C	0.36	0/856	0.59	0/1157
1	D	0.35	0/841	0.60	0/1136
1	E	0.34	0/856	0.60	0/1157
1	F	0.35	0/835	0.59	0/1128
2	G	0.38	0/62	0.78	0/83
2	H	0.39	0/43	0.66	0/55
2	I	0.36	0/47	0.90	0/61
2	J	0.37	0/47	0.73	0/61
2	K	0.36	0/47	0.64	0/61
2	L	0.36	0/62	0.72	0/83
All	All	0.36	0/5395	0.61	0/7276

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	837	0	824	17	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	B	820	0	810	20	0
1	C	834	0	822	22	0
1	D	820	0	810	16	0
1	E	834	0	822	17	0
1	F	814	0	805	19	0
2	G	79	0	65	5	0
2	H	61	0	48	2	0
2	I	65	0	51	0	0
2	J	65	0	51	3	0
2	K	65	0	51	2	0
2	L	79	0	65	5	0
3	A	87	0	0	1	0
3	B	24	0	0	0	0
3	C	36	0	0	0	0
3	D	41	0	0	1	0
3	E	37	0	0	1	0
3	F	42	0	0	2	0
3	G	19	0	0	0	0
3	H	4	0	0	0	0
3	I	8	0	0	0	0
3	J	7	0	0	0	0
3	K	6	0	0	0	0
3	L	9	0	0	1	0
All	All	5693	0	5224	101	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 10.

The worst 5 of 101 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:C:605:ARG:HH21	1:E:531:MET:HB3	1.15	1.07
1:C:605:ARG:NH2	1:E:531:MET:HB3	1.71	1.03
1:B:582:ASN:HD21	1:B:586:GLN:HB2	1.36	0.90
1:A:571:GLN:CB	1:A:571:GLN:CD	2.50	0.80
1:C:581:LEU:HD11	1:C:597:ILE:HD11	1.65	0.76

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	106/111 (96%)	101 (95%)	3 (3%)	2 (2%)	8	6
1	B	101/111 (91%)	96 (95%)	5 (5%)	0	100	100
1	C	106/111 (96%)	96 (91%)	8 (8%)	2 (2%)	8	6
1	D	101/111 (91%)	94 (93%)	7 (7%)	0	100	100
1	E	106/111 (96%)	99 (93%)	5 (5%)	2 (2%)	8	6
1	F	100/111 (90%)	94 (94%)	5 (5%)	1 (1%)	15	15
2	G	6/11 (54%)	6 (100%)	0	0	100	100
2	H	4/11 (36%)	4 (100%)	0	0	100	100
2	I	4/11 (36%)	4 (100%)	0	0	100	100
2	J	4/11 (36%)	4 (100%)	0	0	100	100
2	K	4/11 (36%)	4 (100%)	0	0	100	100
2	L	6/11 (54%)	6 (100%)	0	0	100	100
All	All	648/732 (88%)	608 (94%)	33 (5%)	7 (1%)	14	13

5 of 7 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	616	SER
1	C	616	SER
1	E	616	SER
1	A	615	GLY
1	C	615	GLY

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	89/94 (95%)	87 (98%)	2 (2%)	52	63
1	B	88/94 (94%)	85 (97%)	3 (3%)	37	46
1	C	89/94 (95%)	87 (98%)	2 (2%)	52	63
1	D	88/94 (94%)	87 (99%)	1 (1%)	73	84
1	E	89/94 (95%)	88 (99%)	1 (1%)	73	84
1	F	87/94 (93%)	85 (98%)	2 (2%)	50	61
2	G	8/10 (80%)	8 (100%)	0	100	100
2	H	5/10 (50%)	5 (100%)	0	100	100
2	I	6/10 (60%)	6 (100%)	0	100	100
2	J	6/10 (60%)	5 (83%)	1 (17%)	2	1
2	K	6/10 (60%)	6 (100%)	0	100	100
2	L	8/10 (80%)	8 (100%)	0	100	100
All	All	569/624 (91%)	557 (98%)	12 (2%)	53	65

5 of 12 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	D	577	LEU
1	E	577	LEU
2	J	818	GLU
1	F	577	LEU
1	B	577	LEU

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

Mol	Chain	Res	Type
1	A	591	HIS
1	A	595	GLN
1	A	603	HIS
1	D	539	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)

6 non-standard protein/DNA/RNA residues 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	PTR	J	813	2	15,16,17	0.78	0	19,22,24	0.86	1 (5%)
2	PTR	K	813	2	15,16,17	0.90	0	19,22,24	1.14	1 (5%)
2	PTR	L	813	2	15,16,17	0.83	0	19,22,24	1.01	3 (15%)
2	PTR	I	813	2	15,16,17	0.77	0	19,22,24	1.07	2 (10%)
2	PTR	G	813	2	15,16,17	0.74	0	19,22,24	1.03	2 (10%)
2	PTR	H	813	2	15,16,17	0.89	0	19,22,24	0.92	1 (5%)

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	PTR	J	813	2	-	0/10/11/13	0/1/1/1
2	PTR	K	813	2	-	0/10/11/13	0/1/1/1
2	PTR	L	813	2	-	0/10/11/13	0/1/1/1
2	PTR	I	813	2	-	2/10/11/13	0/1/1/1
2	PTR	G	813	2	-	0/10/11/13	0/1/1/1
2	PTR	H	813	2	-	0/10/11/13	0/1/1/1

There are no bond length outliers.

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

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	K	813	PTR	P-OH-CZ	3.86	136.12	123.75
2	I	813	PTR	P-OH-CZ	2.92	133.10	123.75
2	I	813	PTR	OH-P-O1P	-2.63	99.41	109.31
2	G	813	PTR	P-OH-CZ	2.37	131.35	123.75
2	J	813	PTR	O3P-P-O2P	2.33	116.53	107.64

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	I	813	PTR	O-C-CA-CB
2	I	813	PTR	CZ-OH-P-O1P

There are no ring outliers.

No monomer is involved in short contacts.

5.5 Carbohydrates (i)

There are no monosaccharides in this entry.

5.6 Ligand geometry (i)

There are no ligands in this entry.

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	108/111 (97%)	-0.16	3 (2%)	53	64	5, 15, 31, 48	0
1	B	105/111 (94%)	0.17	2 (1%)	66	76	16, 34, 52, 59	0
1	C	108/111 (97%)	0.01	4 (3%)	41	54	10, 27, 48, 64	0
1	D	105/111 (94%)	-0.03	1 (0%)	82	88	11, 28, 42, 51	0
1	E	108/111 (97%)	0.06	6 (5%)	24	35	15, 27, 52, 68	0
1	F	104/111 (93%)	-0.01	0	100	100	14, 29, 43, 46	0
2	G	8/11 (72%)	-0.44	0	100	100	12, 16, 23, 25	0
2	H	6/11 (54%)	0.49	0	100	100	35, 40, 49, 60	0
2	I	6/11 (54%)	0.28	0	100	100	28, 31, 44, 47	0
2	J	6/11 (54%)	0.09	0	100	100	30, 33, 40, 46	0
2	K	6/11 (54%)	0.30	0	100	100	29, 34, 40, 42	0
2	L	8/11 (72%)	0.38	0	100	100	29, 36, 48, 60	0
All	All	678/732 (92%)	0.02	16 (2%)	59	68	5, 27, 49, 68	0

The worst 5 of 16 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	616	SER	5.0
1	E	615	GLY	4.6
1	E	616	SER	4.2
1	B	520	GLN	4.1
1	E	617	SER	4.0

6.2 Non-standard residues in protein, DNA, RNA chains (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
2	PTR	H	813	16/17	0.96	0.14	25,32,33,33	0
2	PTR	J	813	16/17	0.97	0.12	17,25,30,31	0
2	PTR	K	813	16/17	0.97	0.13	22,25,29,29	0
2	PTR	L	813	16/17	0.97	0.11	23,25,27,27	0
2	PTR	I	813	16/17	0.98	0.11	18,22,27,28	0
2	PTR	G	813	16/17	0.98	0.11	8,10,13,15	0

6.3 Carbohydrates (i)

There are no monosaccharides in this entry.

6.4 Ligands (i)

There are no ligands in this entry.

6.5 Other polymers (i)

There are no such residues in this entry.