wwPDB X-ray Structure Validation Summary Report (i)

Jan 31, 2016 – 07:30 PM GMT

PDB ID	:	1FUN
Title	:	SUPEROXIDE DISMUTASE MUTANT WITH LYS 136 REPLACED BY GLU, CYS 6 REPLACED BY ALA AND CYS 111 REPLACED BY SER (K136E, C6A, C111S)
Authors	:	Lo, T.P.; Tainer, J.A.; Getzoff, E.D.
Deposited on	:	1998-07-23
Resolution	:	2.85 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
http://wwpdb.org/validation/2016/XrayValidationReportHelp
with specific help available everywhere you see the (i) symbol.

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

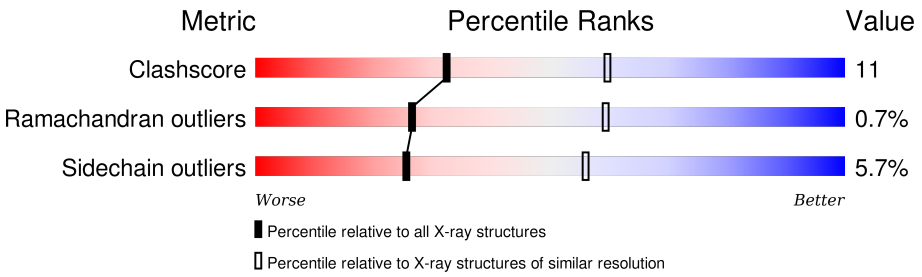
MolProbity	:	4.02b-467
Mogul	:	1.7 (RC4), CSD as536be (2015)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Percentile statistics	:	20151230.v01 (using entries in the PDB archive December 30th 2015)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)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

1 Overall quality at a glance (i)

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

The reported resolution of this entry is 2.85 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	2499 (2.90-2.82)
Ramachandran outliers	100387	2439 (2.90-2.82)
Sidechain outliers	100360	2442 (2.90-2.82)

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 <=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	153	79% 20% •
1	B	153	71% 27% •
1	C	153	84% 14% •
1	D	153	67% 30% •
1	E	153	57% 40% •
1	F	153	86% 12% •
1	G	153	83% 14% • •

Continued on next page...

Continued from previous page...

Mol	Chain	Length	Quality of chain
1	H	153	78% 21% •
1	I	153	82% 18%
1	J	153	65% 35% •

2 Entry composition (i)

There are 5 unique types of molecules in this entry. The entry contains 11354 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 SUPEROXIDE DISMUTASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	153	1109	678	202	227	2	0	0	0
1	F	153	1109	678	202	227	2	0	0	0
1	B	153	1109	678	202	227	2	0	0	0
1	G	153	1109	678	202	227	2	0	0	0
1	C	153	1109	678	202	227	2	0	0	0
1	H	153	1109	678	202	227	2	0	0	0
1	D	153	1109	678	202	227	2	0	0	0
1	I	153	1109	678	202	227	2	0	0	0
1	E	153	1109	678	202	227	2	0	0	0
1	J	153	1109	678	202	227	2	0	0	0

There are 30 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	6	ALA	CYS	ENGINEERED	UNP P00441
A	111	SER	CYS	ENGINEERED	UNP P00441
A	136	GLU	LYS	ENGINEERED	UNP P00441
F	6	ALA	CYS	ENGINEERED	UNP P00441
F	111	SER	CYS	ENGINEERED	UNP P00441
F	136	GLU	LYS	ENGINEERED	UNP P00441
B	6	ALA	CYS	ENGINEERED	UNP P00441
B	111	SER	CYS	ENGINEERED	UNP P00441
B	136	GLU	LYS	ENGINEERED	UNP P00441

Continued on next page...

Continued from previous page...

Chain	Residue	Modelled	Actual	Comment	Reference
G	6	ALA	CYS	ENGINEERED	UNP P00441
G	111	SER	CYS	ENGINEERED	UNP P00441
G	136	GLU	LYS	ENGINEERED	UNP P00441
C	6	ALA	CYS	ENGINEERED	UNP P00441
C	111	SER	CYS	ENGINEERED	UNP P00441
C	136	GLU	LYS	ENGINEERED	UNP P00441
H	6	ALA	CYS	ENGINEERED	UNP P00441
H	111	SER	CYS	ENGINEERED	UNP P00441
H	136	GLU	LYS	ENGINEERED	UNP P00441
D	6	ALA	CYS	ENGINEERED	UNP P00441
D	111	SER	CYS	ENGINEERED	UNP P00441
D	136	GLU	LYS	ENGINEERED	UNP P00441
I	6	ALA	CYS	ENGINEERED	UNP P00441
I	111	SER	CYS	ENGINEERED	UNP P00441
I	136	GLU	LYS	ENGINEERED	UNP P00441
E	6	ALA	CYS	ENGINEERED	UNP P00441
E	111	SER	CYS	ENGINEERED	UNP P00441
E	136	GLU	LYS	ENGINEERED	UNP P00441
J	6	ALA	CYS	ENGINEERED	UNP P00441
J	111	SER	CYS	ENGINEERED	UNP P00441
J	136	GLU	LYS	ENGINEERED	UNP P00441

- Molecule 2 is COPPER (II) ION (three-letter code: CU) (formula: Cu).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Cu		
2	G	1	1	1	0	0
2	J	1	1	1	0	0
2	D	1	1	1	0	0
2	E	1	1	1	0	0
2	H	1	1	1	0	0
2	B	1	1	1	0	0
2	I	1	1	1	0	0
2	C	1	1	1	0	0
2	A	1	1	1	0	0

Continued on next page...

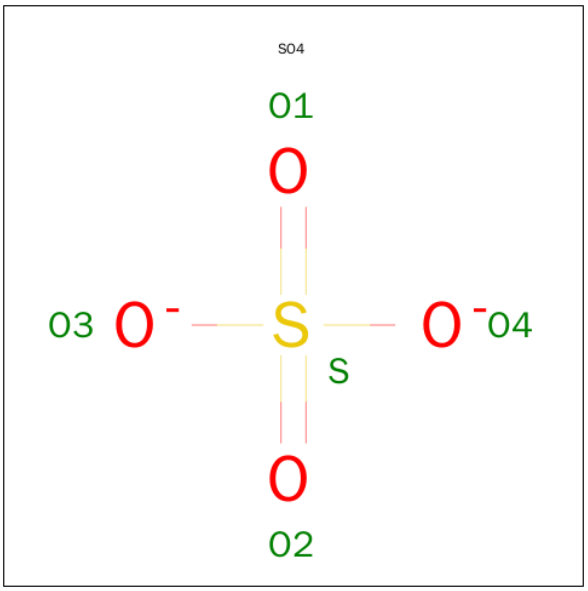
Continued from previous page...

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Cu		
2	F	1	1	1	0	0

- Molecule 3 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Zn		
3	G	1	1	1	0	0
			Total	Zn		
3	J	1	1	1	0	0
			Total	Zn		
3	D	1	1	1	0	0
			Total	Zn		
3	E	1	1	1	0	0
			Total	Zn		
3	H	1	1	1	0	0
			Total	Zn		
3	B	1	1	1	0	0
			Total	Zn		
3	I	1	1	1	0	0
			Total	Zn		
3	C	1	1	1	0	0
			Total	Zn		
3	A	1	1	1	0	0
			Total	Zn		
3	F	1	1	1	0	0

- Molecule 4 is SULFATE ION (three-letter code: SO4) (formula: O_4S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	O	S		
4	F	1	5	4	1	0	0

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
5	A	17	17	17	0	0
5	B	32	32	32	0	0
5	C	21	21	21	0	0
5	D	8	8	8	0	0
5	E	8	8	8	0	0
5	F	37	37	37	0	0
5	G	33	33	33	0	0
5	H	43	43	43	0	0
5	I	25	25	25	0	0
5	J	15	15	15	0	0

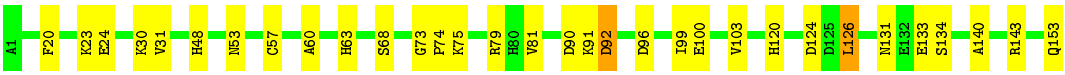
3 Residue-property plots (i)

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

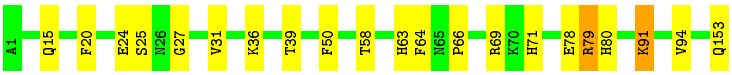
- Molecule 1: SUPEROXIDE DISMUTASE

Chain A:



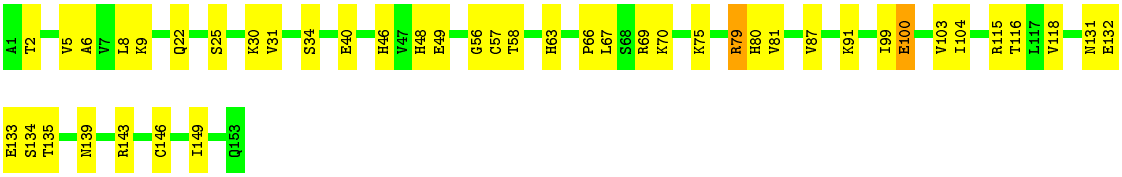
- Molecule 1: SUPEROXIDE DISMUTASE

Chain F:



- Molecule 1: SUPEROXIDE DISMUTASE

Chain B:



- Molecule 1: SUPEROXIDE DISMUTASE

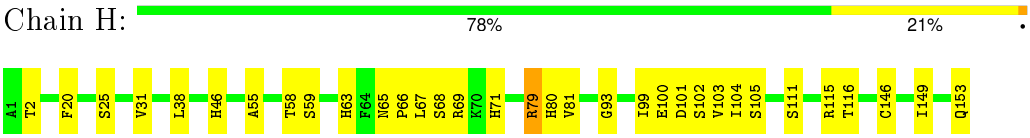
Chain G:

- Molecule 1: SUPEROXIDE DISMUTASE

Chain C:

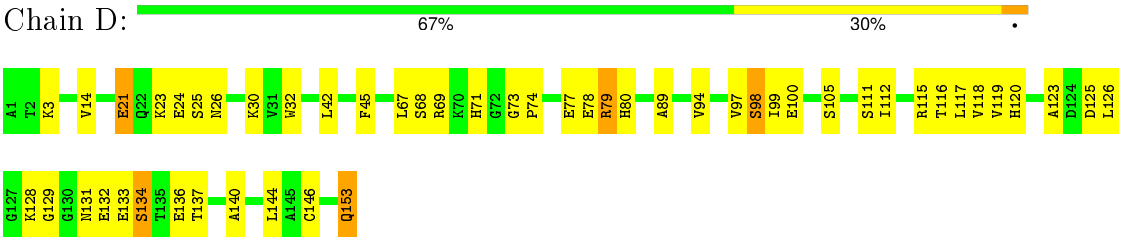
- Molecule 1: SUPEROXIDE DISMUTASE

Chain H:



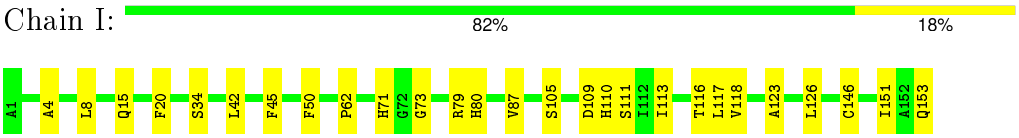
- Molecule 1: SUPEROXIDE DISMUTASE

Chain D:



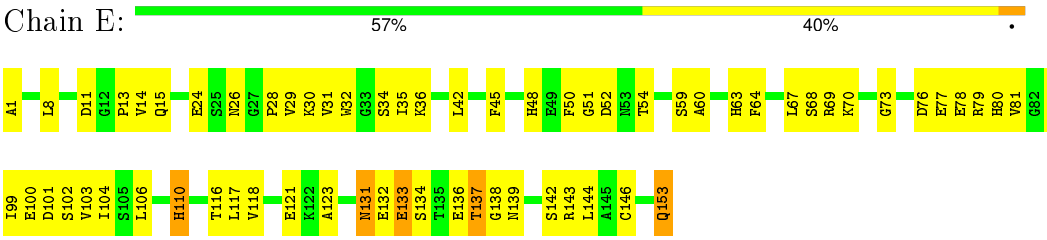
- Molecule 1: SUPEROXIDE DISMUTASE

Chain I:



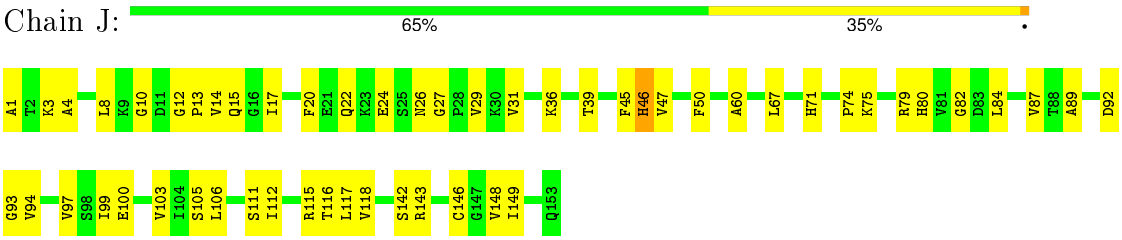
- Molecule 1: SUPEROXIDE DISMUTASE

Chain E:



- Molecule 1: SUPEROXIDE DISMUTASE

Chain J:



4 Data and refinement statistics (i)

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

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, α, β, γ	205.20Å 167.00Å 145.50Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	8.00 – 2.85	Depositor
% Data completeness (in resolution range)	100.0 (8.00-2.85)	Depositor
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	X-PLOR	Depositor
R, R_{free}	0.189 , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	11354	wwPDB-VP
Average B, all atoms (Å^2)	28.0	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: ZN, SO4, CU

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	0.56	0/1127	0.75	0/1520
1	B	0.61	0/1127	0.79	0/1520
1	C	0.59	0/1127	0.78	1/1520 (0.1%)
1	D	0.57	0/1127	0.75	0/1520
1	E	0.56	0/1127	0.74	0/1520
1	F	0.62	0/1127	0.81	0/1520
1	G	0.65	0/1127	0.85	3/1520 (0.2%)
1	H	0.61	0/1127	0.81	0/1520
1	I	0.56	0/1127	0.79	0/1520
1	J	0.52	0/1127	0.78	0/1520
All	All	0.59	0/11270	0.79	4/15200 (0.0%)

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	G	79	ARG	CG-CD-NE	5.64	123.65	111.80
1	G	79	ARG	NE-CZ-NH2	-5.35	117.62	120.30
1	G	79	ARG	NE-CZ-NH1	5.07	122.83	120.30
1	C	49	GLU	N-CA-C	5.05	124.65	111.00

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	1109	0	1070	18	0
1	B	1109	0	1070	29	0
1	C	1109	0	1070	13	0
1	D	1109	0	1070	37	0
1	E	1109	0	1070	45	0
1	F	1109	0	1070	14	0
1	G	1109	0	1070	15	0
1	H	1109	0	1070	17	0
1	I	1109	0	1070	18	0
1	J	1109	0	1070	33	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
2	C	1	0	0	0	0
2	D	1	0	0	0	0
2	E	1	0	0	0	0
2	F	1	0	0	0	0
2	G	1	0	0	0	0
2	H	1	0	0	0	0
2	I	1	0	0	0	0
2	J	1	0	0	0	0
3	A	1	0	0	0	0
3	B	1	0	0	0	0
3	C	1	0	0	0	0
3	D	1	0	0	0	0
3	E	1	0	0	0	0
3	F	1	0	0	0	0
3	G	1	0	0	0	0
3	H	1	0	0	0	0
3	I	1	0	0	0	0
3	J	1	0	0	0	0
4	F	5	0	0	0	0
5	A	17	0	0	0	0
5	B	32	0	0	0	0
5	C	21	0	0	0	0
5	D	8	0	0	0	0
5	E	8	0	0	1	0
5	F	37	0	0	1	0
5	G	33	0	0	0	0
5	H	43	0	0	0	0
5	I	25	0	0	0	0
5	J	15	0	0	0	0

Continued on next page...

Continued from previous page...

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
All	All	11354	0	10700	230	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 11.

The worst 5 of 230 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:E:70:LYS:HE2	1:E:78:GLU:HG2	1.52	0.91
1:E:81:VAL:HG13	1:E:103:VAL:HG12	1.51	0.90
1:D:69:ARG:HB3	1:D:78:GLU:HG3	1.57	0.85
1:C:8:LEU:O	1:C:9:LYS:HD2	1.80	0.82
1:E:131:ASN:O	1:E:134:SER:HB3	1.84	0.78

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	151/153 (99%)	141 (93%)	9 (6%)	1 (1%)	26 59
1	B	151/153 (99%)	136 (90%)	13 (9%)	2 (1%)	15 42
1	C	151/153 (99%)	143 (95%)	8 (5%)	0	100 100
1	D	151/153 (99%)	136 (90%)	12 (8%)	3 (2%)	9 30
1	E	151/153 (99%)	141 (93%)	10 (7%)	0	100 100
1	F	151/153 (99%)	143 (95%)	7 (5%)	1 (1%)	26 59
1	G	151/153 (99%)	140 (93%)	8 (5%)	3 (2%)	9 30
1	H	151/153 (99%)	146 (97%)	5 (3%)	0	100 100
1	I	151/153 (99%)	144 (95%)	7 (5%)	0	100 100

Continued on next page...

Continued from previous page...

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	J	151/153 (99%)	135 (89%)	15 (10%)	1 (1%)	26	59
All	All	1510/1530 (99%)	1405 (93%)	94 (6%)	11 (1%)	26	59

5 of 11 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	126	LEU
1	G	25	SER
1	D	25	SER
1	D	68	SER
1	F	25	SER

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	117/117 (100%)	108 (92%)	9 (8%)	16	39
1	B	117/117 (100%)	109 (93%)	8 (7%)	20	46
1	C	117/117 (100%)	111 (95%)	6 (5%)	29	62
1	D	117/117 (100%)	109 (93%)	8 (7%)	20	46
1	E	117/117 (100%)	107 (92%)	10 (8%)	13	34
1	F	117/117 (100%)	112 (96%)	5 (4%)	35	69
1	G	117/117 (100%)	111 (95%)	6 (5%)	29	62
1	H	117/117 (100%)	110 (94%)	7 (6%)	24	53
1	I	117/117 (100%)	114 (97%)	3 (3%)	54	83
1	J	117/117 (100%)	112 (96%)	5 (4%)	35	69
All	All	1170/1170 (100%)	1103 (94%)	67 (6%)	25	56

5 of 67 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	59	SER

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	H	67	LEU
1	E	153	GLN
1	C	79	ARG
1	H	2	THR

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 17 such sidechains are listed below:

Mol	Chain	Res	Type
1	D	153	GLN
1	I	53	ASN
1	E	63	HIS
1	D	65	ASN
1	E	110	HIS

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 21 ligands modelled in this entry, 20 are monoatomic - leaving 1 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	$\#\|Z\| > 2$
4	SO4	F	200	-	4,4,4	0.39	0	6,6,6	0.20	0

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
4	SO4	F	200	-	-	0/0/0/0	0/0/0/0

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.

No monomer is involved in short contacts.

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.