



# Full wwPDB X-ray Structure Validation Report ⓘ

Apr 19, 2026 – 05:09 AM UTC

PDB ID : 6XTJ / pdb\_00006xtj  
Title : The high resolution structure of the FERM domain of human FERMT2  
Authors : Bradshaw, W.J.; Katis, V.L.; Newman, J.A.; von Delft, F.; Arrowsmith, C.H.;  
Edwards, A.; Bountra, C.; Gileadi, O.  
Deposited on : 2020-01-16  
Resolution : 1.60 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](mailto: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

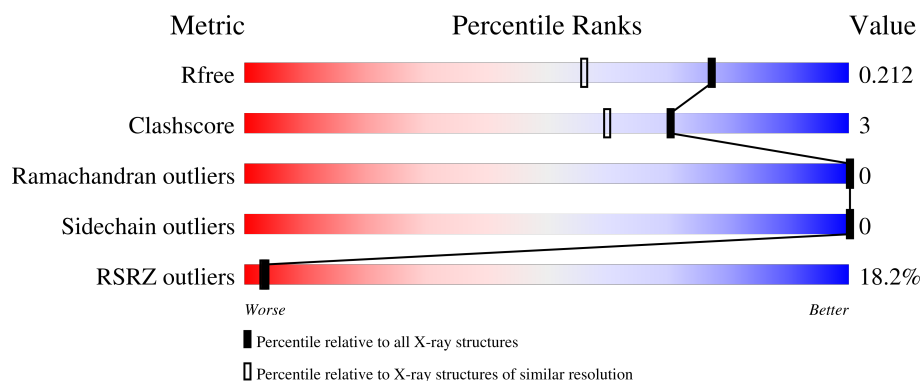
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.60 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	4673 (1.60-1.60)
Clashscore	190562	4931 (1.60-1.60)
Ramachandran outliers	187476	4831 (1.60-1.60)
Sidechain outliers	187428	4830 (1.60-1.60)
RSRZ outliers	180081	4672 (1.60-1.60)

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  $\geq 3$ , 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	AAA	478	<div> <div>17%</div> <div>87%</div> <div>7%</div> <div>6%</div> </div>

## 2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 4344 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.

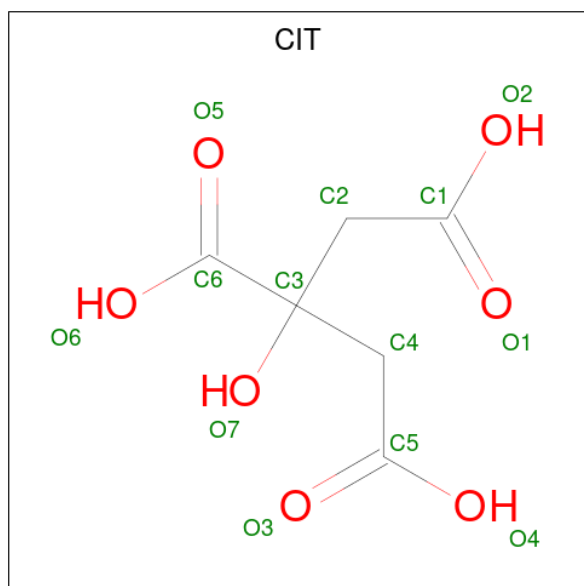
- Molecule 1 is a protein called Fermitin family homolog 2, Fermitin family homolog 2, Fermitin family homolog 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	AAA	451	Total	C	N	O	S	0	35	0
			3927	2531	646	726	24			

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
AAA	7	SER	-	expression tag	UNP Q96AC1

- Molecule 2 is CITRIC ACID (CCD ID: CIT) (formula:  $C_6H_8O_7$ ).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	AAA	1	Total	C	O	0	0
			13	6	7		
2	AAA	1	Total	C	O	0	0
			13	6	7		

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	AAA	1	Total	C	O	0	0
			13	6	7		

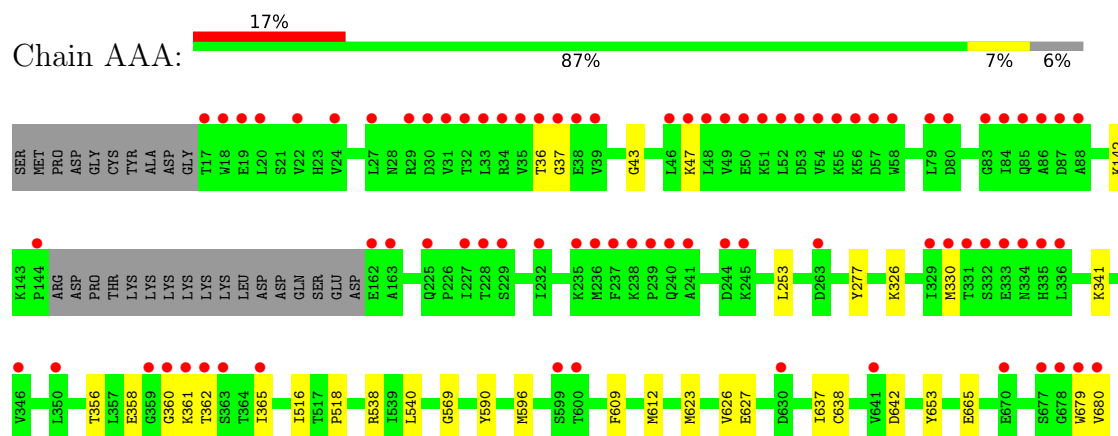
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	AAA	377	Total	O	0	5
			378	378		

### 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: Fermitin family homolog 2, Fermitin family homolog 2, Fermitin family homolog 2



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 32 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	145.17Å 145.17Å 59.63Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	72.70 – 1.60 72.70 – 1.60	Depositor EDS
% Data completeness (in resolution range)	99.7 (72.70-1.60) 99.7 (72.70-1.60)	Depositor EDS
$R_{merge}$	0.28	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.47 (at 1.60Å)	Xtriage
Refinement program	REFMAC 5.8.0258	Depositor
R, $R_{free}$	0.181 , 0.204 0.190 , 0.212	Depositor DCC
$R_{free}$ test set	1876 reflections (1.97%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	18.5	Xtriage
Anisotropy	0.654	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.36 , 36.3	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.028 for -h,-k,l	Xtriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	4344	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	31.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.52% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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: CIT

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	AAA	0.91	0/4057	1.13	1/5473 (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	AAA	0	2

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	AAA	518	PRO	N-CA-C	5.55	120.80	113.86

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	AAA	362[B]	THR	Mainchain
1	AAA	679[B]	TRP	Mainchain

### 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	AAA	3927	0	3978	27	0
2	AAA	39	0	15	0	0
3	AAA	378	0	0	6	0
All	All	4344	0	3993	27	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 3.

All (27) 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:AAA:538[B]:ARG:HG2	1:AAA:538[B]:ARG:HH21	1.08	1.07
1:AAA:361[B]:LYS:HE2	3:AAA:1110:HOH:O	1.62	0.98
1:AAA:538[B]:ARG:HH21	1:AAA:538[B]:ARG:CG	1.93	0.80
1:AAA:538[B]:ARG:HG2	1:AAA:538[B]:ARG:NH2	1.89	0.79
1:AAA:361[B]:LYS:CE	3:AAA:1110:HOH:O	2.30	0.69
1:AAA:358[B]:GLU:N	1:AAA:358[B]:GLU:OE1	2.27	0.67
1:AAA:680[B]:VAL:CG1	1:AAA:680[B]:VAL:O	2.44	0.65
1:AAA:680[B]:VAL:O	1:AAA:680[B]:VAL:HG13	2.00	0.62
1:AAA:590:TYR:HA	1:AAA:653:TYR:CD1	2.46	0.51
1:AAA:612[B]:MET:HE2	1:AAA:626:VAL:HG11	1.92	0.50
1:AAA:365[A]:ILE:HG23	1:AAA:365[A]:ILE:O	2.12	0.47
1:AAA:142:LYS:HE3	1:AAA:253:LEU:CD2	2.45	0.47
1:AAA:330:MET:HG2	1:AAA:341[A]:LYS:HE3	1.99	0.44
1:AAA:638[B]:CYS:HB2	1:AAA:642:ASP:HB2	1.98	0.44
1:AAA:596:MET:HE1	3:AAA:913:HOH:O	2.18	0.44
1:AAA:277:TYR:CG	1:AAA:569:GLY:HA2	2.53	0.43
1:AAA:538[B]:ARG:CG	1:AAA:538[B]:ARG:NH2	2.63	0.43
1:AAA:43:GLY:O	1:AAA:47:LYS:HG3	2.19	0.43
1:AAA:665[B]:GLU:HG3	3:AAA:1097:HOH:O	2.18	0.43
1:AAA:356:THR:HG21	1:AAA:360[B]:GLY:HA3	2.01	0.42
1:AAA:609:PHE:HD1	1:AAA:612[B]:MET:HE3	1.85	0.42
1:AAA:36:THR:HG22	1:AAA:37:GLY:N	2.35	0.41
1:AAA:326:LYS:HG2	3:AAA:1080:HOH:O	2.20	0.41
1:AAA:623[B]:MET:HE3	1:AAA:637:ILE:HD11	2.03	0.41
1:AAA:516:ILE:HD12	1:AAA:540:LEU:HD23	2.03	0.41
1:AAA:627[A]:GLU:HG3	3:AAA:1068:HOH:O	2.20	0.40
1:AAA:365[A]:ILE:O	1:AAA:365[A]:ILE:CG2	2.69	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	AAA	481/478 (101%)	466 (97%)	15 (3%)	0	100	100

There are no Ramachandran outliers to report.

### 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	AAA	439/431 (102%)	439 (100%)	0	100	100

There are no protein residues with a non-rotameric sidechain to report.

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

### 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](#)

3 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	CIT	AAA	702	-	12,12,12	1.18	1 (8%)	17,17,17	1.25	2 (11%)
2	CIT	AAA	703	-	12,12,12	1.22	1 (8%)	17,17,17	1.12	2 (11%)
2	CIT	AAA	701	-	12,12,12	1.55	3 (25%)	17,17,17	1.00	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	CIT	AAA	702	-	-	0/16/16/16	-
2	CIT	AAA	703	-	-	7/16/16/16	-
2	CIT	AAA	701	-	-	0/16/16/16	-

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	AAA	701	CIT	C3-C6	3.48	1.57	1.53
2	AAA	703	CIT	C3-C6	2.39	1.55	1.53
2	AAA	702	CIT	C3-C6	2.15	1.55	1.53
2	AAA	701	CIT	O3-C5	2.07	1.28	1.22
2	AAA	701	CIT	O2-C1	-2.07	1.24	1.30

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	AAA	702	CIT	O5-C6-C3	-2.94	116.40	122.09
2	AAA	702	CIT	O6-C6-C3	2.83	118.56	113.14
2	AAA	703	CIT	O5-C6-C3	-2.46	117.33	122.09
2	AAA	703	CIT	O6-C6-C3	2.26	117.47	113.14
2	AAA	701	CIT	O7-C3-C6	2.03	111.83	108.96

There are no chirality outliers.

All (7) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	AAA	703	CIT	C1-C2-C3-O7
2	AAA	703	CIT	C1-C2-C3-C6
2	AAA	703	CIT	C1-C2-C3-C4
2	AAA	703	CIT	C2-C3-C6-O5
2	AAA	703	CIT	C2-C3-C6-O6
2	AAA	703	CIT	C4-C3-C6-O5
2	AAA	703	CIT	C4-C3-C6-O6

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 ⓘ

### 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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	AAA	451/478 (94%)	0.74	82 (18%) 3 3	11, 24, 65, 91	35 (7%)

All (82) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	AAA	680[A]	VAL	9.8
1	AAA	18[A]	TRP	7.7
1	AAA	679[A]	TRP	7.5
1	AAA	54	VAL	5.8
1	AAA	48	LEU	5.5
1	AAA	365[A]	ILE	5.5
1	AAA	17	THR	5.5
1	AAA	329	ILE	5.2
1	AAA	331	THR	5.2
1	AAA	31	VAL	5.1
1	AAA	55	LYS	4.8
1	AAA	350	LEU	4.6
1	AAA	144	PRO	4.6
1	AAA	86	ALA	4.5
1	AAA	332	SER	4.5
1	AAA	52	LEU	4.5
1	AAA	330	MET	4.5
1	AAA	49	VAL	4.3
1	AAA	237	PHE	4.3
1	AAA	239	PRO	4.2
1	AAA	47	LYS	4.1
1	AAA	84	ILE	4.1
1	AAA	33	LEU	4.0
1	AAA	360[A]	GLY	4.0
1	AAA	36	THR	4.0
1	AAA	34	ARG	3.9
1	AAA	228	THR	3.8

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Res	Type	RSRZ
1	AAA	27	LEU	3.8
1	AAA	46	LEU	3.7
1	AAA	241	ALA	3.7
1	AAA	361[A]	LYS	3.7
1	AAA	35	VAL	3.6
1	AAA	240	GLN	3.5
1	AAA	51	LYS	3.4
1	AAA	163	ALA	3.4
1	AAA	678[A]	GLY	3.4
1	AAA	58	TRP	3.3
1	AAA	225	GLN	3.2
1	AAA	333	GLU	3.2
1	AAA	85	GLN	3.1
1	AAA	227	ILE	3.1
1	AAA	336	LEU	3.1
1	AAA	56	LYS	3.1
1	AAA	235	LYS	3.0
1	AAA	238	LYS	2.9
1	AAA	20	LEU	2.9
1	AAA	599	SER	2.9
1	AAA	39	VAL	2.9
1	AAA	32	THR	2.8
1	AAA	263	ASP	2.8
1	AAA	38	GLU	2.8
1	AAA	162	GLU	2.7
1	AAA	245	LYS	2.6
1	AAA	30	ASP	2.6
1	AAA	87	ASP	2.6
1	AAA	359[A]	GLY	2.6
1	AAA	88	ALA	2.6
1	AAA	19	GLU	2.6
1	AAA	37	GLY	2.5
1	AAA	363	SER	2.5
1	AAA	346	VAL	2.5
1	AAA	335	HIS	2.5
1	AAA	79	LEU	2.5
1	AAA	53	ASP	2.4
1	AAA	50	GLU	2.4
1	AAA	229	SER	2.4
1	AAA	57	ASP	2.4
1	AAA	244	ASP	2.4
1	AAA	83	GLY	2.3

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Res	Type	RSRZ
1	AAA	334	ASN	2.3
1	AAA	362[A]	THR	2.3
1	AAA	677	SER	2.3
1	AAA	670	GLU	2.3
1	AAA	24	VAL	2.2
1	AAA	29	ARG	2.2
1	AAA	641	VAL	2.2
1	AAA	80	ASP	2.2
1	AAA	630	ASP	2.1
1	AAA	232	ILE	2.1
1	AAA	236	MET	2.1
1	AAA	600	THR	2.1
1	AAA	22	VAL	2.1

## 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, 95<sup>th</sup> 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( $\text{\AA}^2$ )	Q<0.9
2	CIT	AAA	703	13/13	0.72	0.19	51,75,88,93	0
2	CIT	AAA	701	13/13	0.83	0.14	32,42,48,53	0
2	CIT	AAA	702	13/13	0.87	0.13	32,49,54,60	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.