



# wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 5, 2026 – 06:41 PM UTC

PDB ID : 3USF / pdb\_00003usf  
Title : Crystal structure of DAVA-4  
Authors : Stetefeld, J.  
Deposited on : 2011-11-23  
Resolution : 2.46 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](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>.

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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

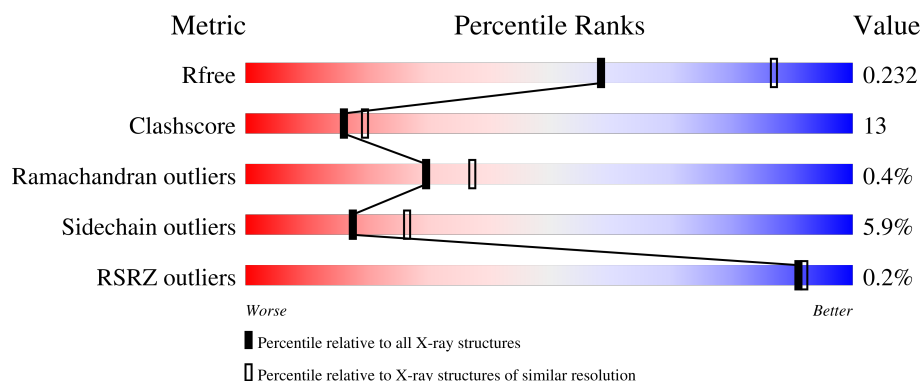
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*



The reported resolution of this entry is 2.46 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	1190 (2.46-2.46)
Clashscore	190562	1229 (2.46-2.46)
Ramachandran outliers	187476	1218 (2.46-2.46)
Sidechain outliers	187428	1218 (2.46-2.46)
RSRZ outliers	180081	1190 (2.46-2.46)

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	A	427	 76% 21% •
1	B	427	 72% 19% • 6%

## 2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 6600 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.

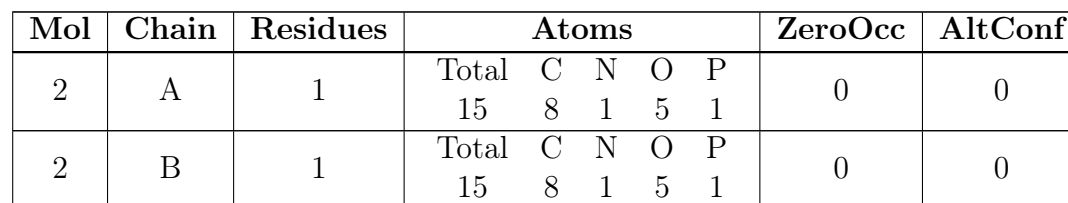
- Molecule 1 is a protein called Glutamate-1-semialdehyde 2,1-aminomutase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	427	Total	C	N	O	S	0	0	0
			3202	2043	535	605	19			
1	B	402	Total	C	N	O	S	0	0	0
			3032	1932	507	575	18			

There are 10 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1108	ASN	ILE	conflict	UNP Q31QJ2
A	1133	ILE	LEU	conflict	UNP Q31QJ2
A	1172	SER	ASP	conflict	UNP Q31QJ2
A	1179	LYS	SER	conflict	UNP Q31QJ2
A	1187	THR	ALA	conflict	UNP Q31QJ2
B	2108	ASN	ILE	conflict	UNP Q31QJ2
B	2133	ILE	LEU	conflict	UNP Q31QJ2
B	2172	SER	ASP	conflict	UNP Q31QJ2
B	2179	LYS	SER	conflict	UNP Q31QJ2
B	2187	THR	ALA	conflict	UNP Q31QJ2

- Molecule 2 is (5-HYDROXY-4,6-DIMETHYLPYRIDIN-3-YL)METHYL DIHYDROGEN PHOSPHATE (CCD ID: PLR) (formula: C<sub>8</sub>H<sub>12</sub>NO<sub>5</sub>P).



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Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	O	0	0
			9	5	2	2		

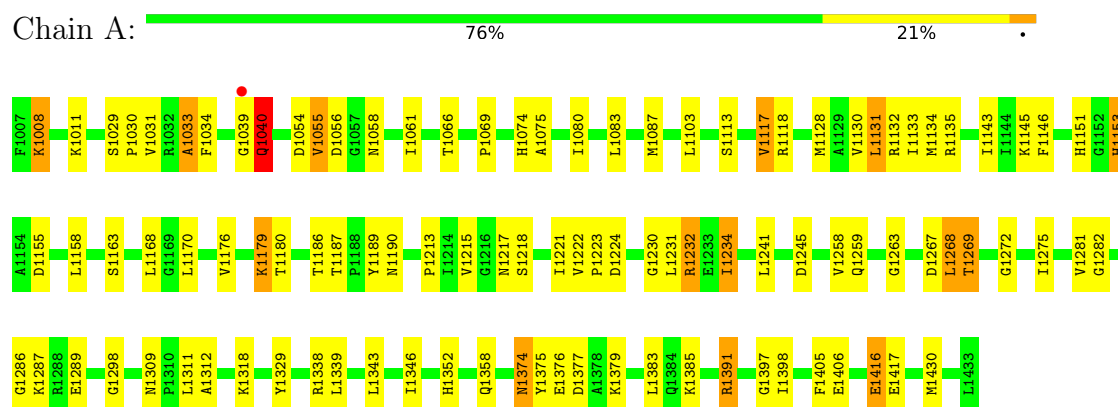
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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	170	Total 170	O 170	0	0
4	B	157	Total 157	O 157	0	0

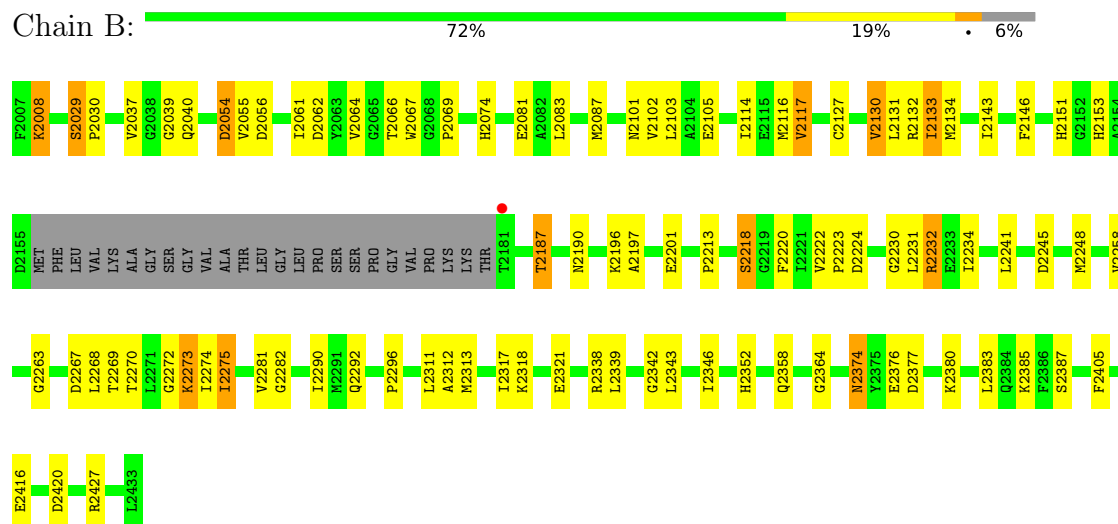
### 3 Residue-property plots

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: Glutamate-1-semialdehyde 2,1-aminomutase



- Molecule 1: Glutamate-1-semialdehyde 2,1-aminomutase



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	68.58Å 108.78Å 124.71Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	8.00 – 2.46 8.00 – 2.46	Depositor EDS
% Data completeness (in resolution range)	93.6 (8.00-2.46) 90.7 (8.00-2.46)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.54 (at 2.47Å)	Xtriage
Refinement program	CNS 1.3	Depositor
R, $R_{free}$	0.178 , 0.232 0.178 , 0.232	Depositor DCC
$R_{free}$ test set	3218 reflections (9.99%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	29.4	Xtriage
Anisotropy	0.441	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.43 , 71.3	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.34$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	6600	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	28.0	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.*

<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: PLR, HOZ

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	0.45	0/3271	0.96	12/4430 (0.3%)
1	B	0.43	0/3096	0.92	9/4191 (0.2%)
All	All	0.44	0/6367	0.94	21/8621 (0.2%)

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

There are no bond length outliers.

The worst 5 of 21 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	1033	ALA	N-CA-C	8.35	120.08	110.97
1	B	2274	ILE	N-CA-C	7.02	117.78	110.62
1	A	1055	VAL	N-CA-C	-6.98	103.57	113.07
1	B	2029	SER	CA-C-N	6.64	128.14	119.84
1	B	2029	SER	C-N-CA	6.64	128.14	119.84

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	1329	TYR	Sidechain

## 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	3202	0	3182	90	0
1	B	3032	0	2992	82	0
2	A	15	0	10	0	0
2	B	15	0	10	1	0
3	A	9	0	11	3	0
4	A	170	0	0	1	0
4	B	157	0	0	8	0
All	All	6600	0	6205	163	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 13.

The worst 5 of 163 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:1338:ARG:HH21	1:A:1416:GLU:HG3	1.32	0.95
1:A:1153:HIS:HD2	1:B:2132:ARG:HH12	1.21	0.85
1:B:2196:LYS:HD3	1:B:2234:ILE:HD12	1.59	0.84
1:A:1338:ARG:NH2	1:A:1416:GLU:HG3	1.93	0.82
1:A:1190:ASN:HD21	1:A:1224:ASP:H	1.26	0.81

There are no symmetry-related clashes.

## 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	425/427 (100%)	404 (95%)	20 (5%)	1 (0%)	43	54
1	B	398/427 (93%)	371 (93%)	25 (6%)	2 (0%)	24	32
All	All	823/854 (96%)	775 (94%)	45 (6%)	3 (0%)	30	37

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	2273	LYS
1	B	2218	SER
1	A	1040	GLN

### 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	330/330 (100%)	309 (94%)	21 (6%)	16	22
1	B	311/330 (94%)	294 (94%)	17 (6%)	19	28
All	All	641/660 (97%)	603 (94%)	38 (6%)	18	26

5 of 38 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	2241	LEU
1	B	2374	ASN
1	B	2269	THR
1	B	2339	LEU
1	B	2416	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 25 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	2151	HIS
1	B	2190	ASN
1	B	2374	ASN

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Mol	Chain	Res	Type
1	B	2183	ASN
1	B	2259	GLN

### 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 ⓘ

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	PLR	A	5000	-	15,15,15	1.39	1 (6%)	21,22,22	1.08	2 (9%)
2	PLR	B	6000	-	15,15,15	1.51	1 (6%)	21,22,22	1.10	2 (9%)
3	HOZ	A	1	-	8,8,8	2.02	2 (25%)	9,9,9	1.73	2 (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	PLR	A	5000	-	-	0/6/6/6	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	PLR	B	6000	-	-	0/6/6/6	0/1/1/1
3	HOZ	A	1	-	-	4/7/7/7	-

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	1	HOZ	CB-CA	3.90	1.58	1.53
2	B	6000	PLR	C3-C2	-3.62	1.37	1.41
3	A	1	HOZ	C-CA	3.30	1.56	1.53
2	A	5000	PLR	C3-C2	-3.03	1.37	1.41

The worst 5 of 6 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	1	HOZ	CG-CB-CA	3.51	120.36	112.87
3	A	1	HOZ	CB-CA-C	3.15	115.01	109.50
2	A	5000	PLR	O2P-P-O1P	2.37	120.05	110.83
2	B	6000	PLR	O2P-P-O1P	2.36	120.02	110.83
2	A	5000	PLR	C5-C6-N1	-2.17	120.31	123.83

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	1	HOZ	N-CA-CB-CG
3	A	1	HOZ	C-CA-CB-CG
3	A	1	HOZ	OE2-CD-CG-CB
3	A	1	HOZ	OE1-CD-CG-CB

There are no ring outliers.

2 monomers are involved in 4 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	6000	PLR	1	0
3	A	1	HOZ	3	0

## 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 [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, 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	A	427/427 (100%)	-0.68	1 (0%) 91 92	13, 25, 43, 51	0
1	B	402/427 (94%)	-0.64	1 (0%) 91 92	14, 28, 44, 70	0
All	All	829/854 (97%)	-0.66	2 (0%) 91 92	13, 26, 44, 70	0

All (2) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	1039	GLY	3.6
1	B	2181	THR	3.0

### 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 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(Å <sup>2</sup> )	Q<0.9
3	HOZ	A	1	9/9	0.56	0.20	62,64,68,68	0
2	PLR	B	6000	15/15	0.97	0.06	18,21,23,23	0
2	PLR	A	5000	15/15	0.98	0.05	15,22,26,28	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.