



wwPDB X-ray Structure Validation Summary Report

Mar 5, 2026 – 11:41 AM UTC


PDB ID : 8BE5 / pdb_00008be5
Title : Crystal structure of SOS1-KRasG12V-Nanobody22-Nanobody75
Authors : Fischer, B.; Wohlkonig, A.; Steyaert, J.
Deposited on : 2022-10-21
Resolution : 3.13 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  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
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

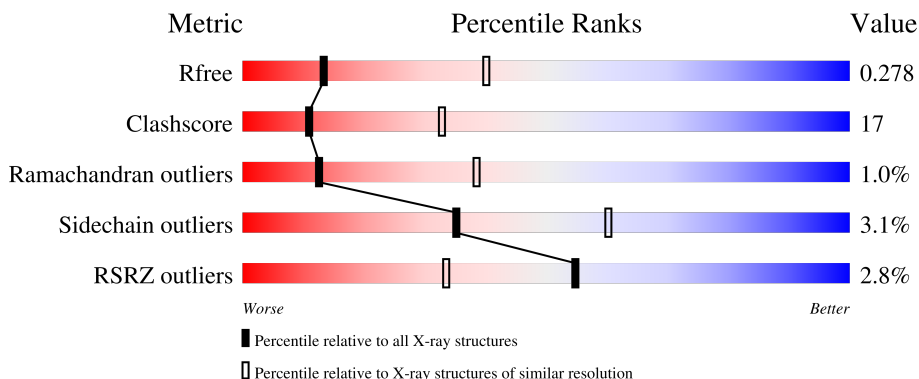
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

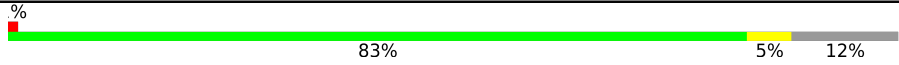
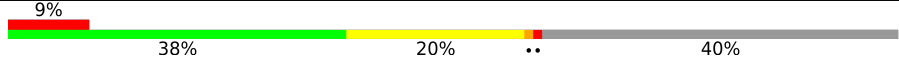


The reported resolution of this entry is 3.13 Å.

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	2351 (3.18-3.10)
Clashscore	190562	2452 (3.18-3.10)
Ramachandran outliers	187476	2324 (3.18-3.10)
Sidechain outliers	187428	2324 (3.18-3.10)
RSRZ outliers	180081	2351 (3.18-3.10)

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 $\leq 5\%$. 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	AAZA	507	
2	C	136	
3	R	190	
4	N	124	

2 Entry composition i

There are 5 unique types of molecules in this entry. The entry contains 6443 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 Son of sevenless homolog 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	AAZA	445	3698	2381	634	671	12	0	0	0

There are 21 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
AAZA	543	MET	-	initiating methionine	UNP Q07889
AAZA	544	GLY	-	expression tag	UNP Q07889
AAZA	545	SER	-	expression tag	UNP Q07889
AAZA	546	SER	-	expression tag	UNP Q07889
AAZA	547	HIS	-	expression tag	UNP Q07889
AAZA	548	HIS	-	expression tag	UNP Q07889
AAZA	549	HIS	-	expression tag	UNP Q07889
AAZA	550	HIS	-	expression tag	UNP Q07889
AAZA	551	HIS	-	expression tag	UNP Q07889
AAZA	552	HIS	-	expression tag	UNP Q07889
AAZA	553	SER	-	expression tag	UNP Q07889
AAZA	554	SER	-	expression tag	UNP Q07889
AAZA	555	GLY	-	expression tag	UNP Q07889
AAZA	556	LEU	-	expression tag	UNP Q07889
AAZA	557	VAL	-	expression tag	UNP Q07889
AAZA	558	PRO	-	expression tag	UNP Q07889
AAZA	559	ARG	-	expression tag	UNP Q07889
AAZA	560	GLY	-	expression tag	UNP Q07889
AAZA	561	SER	-	expression tag	UNP Q07889
AAZA	562	HIS	-	expression tag	UNP Q07889
AAZA	563	MET	-	expression tag	UNP Q07889

- Molecule 2 is a protein called Nanobody75.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	C	81	Total	C	N	O	S	0	0	0
			610	380	110	117	3			

- Molecule 3 is a protein called Isoform 2B of GTPase KRas.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	R	159	Total	C	N	O	S	0	0	0
			1263	791	214	251	7			

There are 22 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
R	-20	MET	-	initiating methionine	UNP P01116-2
R	-19	GLY	-	expression tag	UNP P01116-2
R	-18	SER	-	expression tag	UNP P01116-2
R	-17	SER	-	expression tag	UNP P01116-2
R	-16	HIS	-	expression tag	UNP P01116-2
R	-15	HIS	-	expression tag	UNP P01116-2
R	-14	HIS	-	expression tag	UNP P01116-2
R	-13	HIS	-	expression tag	UNP P01116-2
R	-12	HIS	-	expression tag	UNP P01116-2
R	-11	HIS	-	expression tag	UNP P01116-2
R	-10	SER	-	expression tag	UNP P01116-2
R	-9	SER	-	expression tag	UNP P01116-2
R	-8	GLY	-	expression tag	UNP P01116-2
R	-7	GLU	-	expression tag	UNP P01116-2
R	-6	ASN	-	expression tag	UNP P01116-2
R	-5	LEU	-	expression tag	UNP P01116-2
R	-4	TYR	-	expression tag	UNP P01116-2
R	-3	PHE	-	expression tag	UNP P01116-2
R	-2	GLN	-	expression tag	UNP P01116-2
R	-1	GLY	-	expression tag	UNP P01116-2
R	0	SER	-	expression tag	UNP P01116-2
R	12	VAL	GLY	engineered mutation	UNP P01116-2

- Molecule 4 is a protein called Nanobody22.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	N	109	Total	C	N	O	S	0	0	0
			853	528	158	163	4			

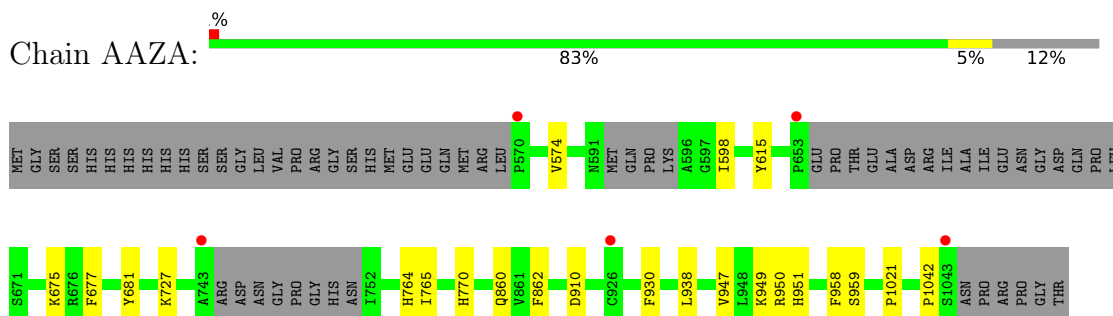
- Molecule 5 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	AAZA	10	Total O 10 10	0	0
5	C	2	Total O 2 2	0	0
5	R	6	Total O 6 6	0	0
5	N	1	Total O 1 1	0	0

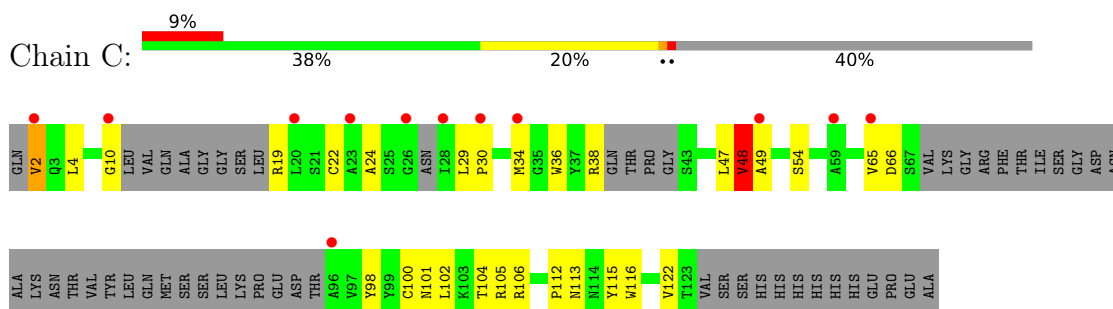
3 Residue-property plots [i](#)

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.

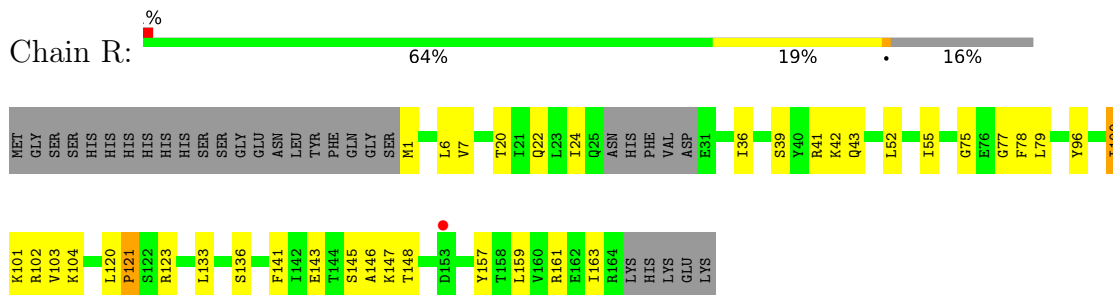
- Molecule 1: Son of sevenless homolog 1



- Molecule 2: Nanobody75

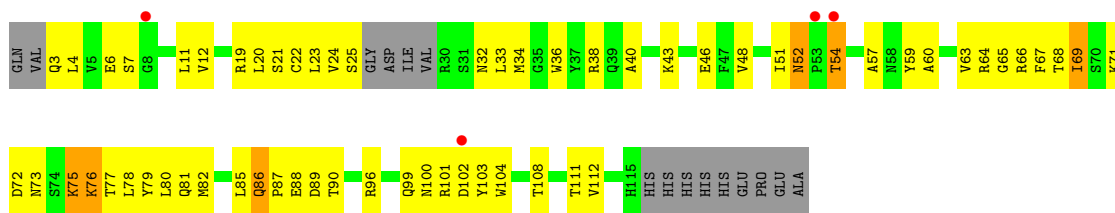


- Molecule 3: Isoform 2B of GTPase KRas



- Molecule 4: Nanobody22





4 Data and refinement statistics

Property	Value	Source
Space group	I 4 2 2	Depositor
Cell constants a, b, c, α , β , γ	124.08Å 124.08Å 408.81Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	29.91 – 3.13 29.91 – 3.13	Depositor EDS
% Data completeness (in resolution range)	99.5 (29.91-3.13) 99.3 (29.91-3.13)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	0.96 (at 3.11Å)	Xtrriage
Refinement program	PHENIX 1.20.1_4487	Depositor
R, R_{free}	0.226 , 0.278 0.226 , 0.278	Depositor DCC
R_{free} test set	1427 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å ²)	99.4	Xtrriage
Anisotropy	0.296	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 67.9	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	6443	wwPDB-VP
Average B, all atoms (Å ²)	93.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.20% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical 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](#)

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	AAZA	0.56	0/3787	0.84	8/5120 (0.2%)
2	C	0.67	0/619	0.96	1/839 (0.1%)
3	R	0.57	0/1280	0.79	1/1727 (0.1%)
4	N	0.66	0/867	1.01	1/1168 (0.1%)
All	All	0.58	0/6553	0.87	11/8854 (0.1%)

There are no bond length outliers.

The worst 5 of 11 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	AAZA	958	PHE	N-CA-C	-11.51	99.34	113.50
1	AAZA	765	ILE	N-CA-C	-8.66	103.34	111.48
1	AAZA	764	HIS	N-CA-C	8.29	123.62	111.02
1	AAZA	958	PHE	CA-CB-CG	-7.38	106.42	113.80
2	C	48	VAL	N-CA-C	-6.92	107.14	113.71

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	AAZA	3698	0	0	0	0
2	C	610	0	586	24	0
3	R	1263	0	1252	27	0
4	N	853	0	835	51	0

Continued on next page...

Continued from previous page...

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	AAZA	10	0	0	0	0
5	C	2	0	0	0	0
5	N	1	0	0	0	0
5	R	6	0	0	0	0
All	All	6443	0	2673	102	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 17.

The worst 5 of 102 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)
2:C:65:VAL:HG13	2:C:66:ASP:H	1.34	0.92
3:R:120:LEU:HB2	3:R:121:PRO:HD3	1.51	0.92
2:C:65:VAL:HG13	2:C:66:ASP:N	1.93	0.83
2:C:29:LEU:HD12	2:C:104:THR:HB	1.60	0.81
4:N:57:ALA:CB	4:N:69:ILE:HD11	2.15	0.75

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	AAZA	437/507 (86%)	396 (91%)	37 (8%)	4 (1%)	14	41
2	C	71/136 (52%)	56 (79%)	14 (20%)	1 (1%)	9	31
3	R	155/190 (82%)	142 (92%)	11 (7%)	2 (1%)	9	32
4	N	105/124 (85%)	90 (86%)	14 (13%)	1 (1%)	12	38
All	All	768/957 (80%)	684 (89%)	76 (10%)	8 (1%)	12	38

5 of 8 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
4	N	76	LYS
1	AAZA	677	PHE
3	R	147	LYS
2	C	54	SER
1	AAZA	727	LYS

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	AAZA	416/469 (89%)	402 (97%)	14 (3%)	32	58
2	C	64/111 (58%)	62 (97%)	2 (3%)	35	60
3	R	140/168 (83%)	140 (100%)	0	100	100
4	N	92/105 (88%)	86 (94%)	6 (6%)	15	40
All	All	712/853 (84%)	690 (97%)	22 (3%)	35	60

5 of 22 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	C	2	VAL
4	N	52	ASN
4	N	33	LEU
4	N	54	THR
1	AAZA	910	ASP

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

Mol	Chain	Res	Type
2	C	61	ASN
3	R	150	GLN
4	N	13	GLN
4	N	73	ASN

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](#)

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	AAZA	445/507 (87%)	-0.28	5 (1%) 78 59	54, 84, 133, 158	0
2	C	81/136 (59%)	1.02	12 (14%) 5 3	83, 131, 147, 166	0
3	R	159/190 (83%)	-0.24	1 (0%) 85 70	56, 76, 108, 131	0
4	N	109/124 (87%)	0.34	4 (3%) 45 25	77, 108, 129, 136	0
All	All	794/957 (82%)	-0.06	22 (2%) 55 33	54, 89, 139, 166	0

The worst 5 of 22 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	C	20	LEU	3.6
1	AAZA	1043	SER	3.6
2	C	23	ALA	3.4
2	C	96	ALA	3.3
4	N	102	ASP	3.3

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](#)

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.