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## Phosphorylated Tau (T181) (Human) AlphaLISA Detection Kit

Product No.: AL3136HV/C/F

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### Product Information

**Application:** This kit is designed for the quantitative determination of Threonine 181 phosphorylated Tau (pTau (T181)) in buffer, human cerebrospinal fluid (CSF) or serum using a homogeneous no wash AlphaLISA assay.

- Kit contents:** The kit contains 5 components: AlphaLISA Acceptor beads coated with Anti-hTau Antibody, Streptavidin-coated Donor beads, Biotinylated Anti-pTau (T181) Antibody, Lyophilized pTau (T181) and 10X AlphaLISA Immunoassay Buffer.
- Sensitivity:** Lower Detection Limit (LDL): 30 pg/mL  
Lower Limit of Quantification (LLOQ): 58 pg/mL  
EC50: 3.7 ng/mL
- Dynamic Range:** 30 – 30 000 pg/mL

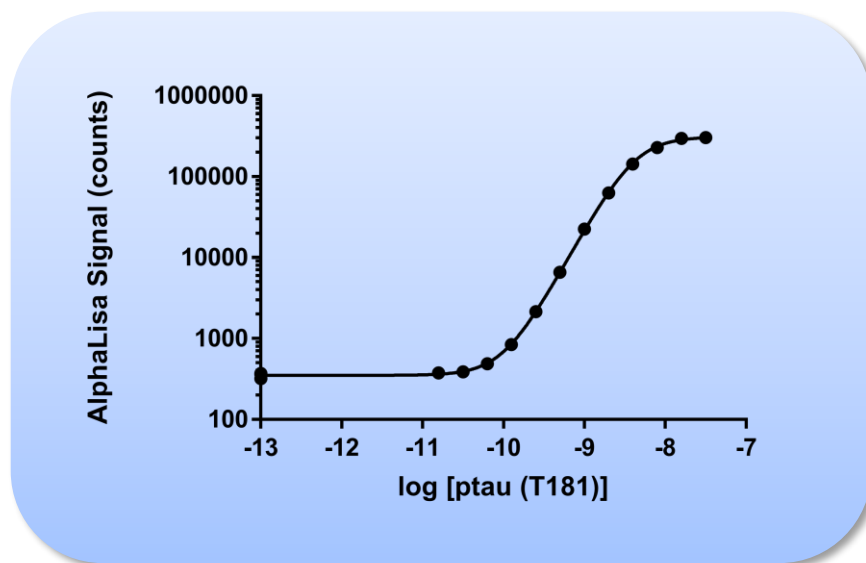


Figure 1. Typical sensitivity curve in AlphaLISA Immunoassay Buffer. The data was generated using a white Optiplate™-384 microplate and the EnVision® Multilabel Plate Reader 2102 with Alpha option.

- Storage:** Store kit in the dark at 4 °C. For reconstituted analyte, aliquot and store at -20 °C. Avoid freeze-thaw cycles.
- Stability:** This kit is stable for at least 6 months from the date of manufacture when stored in its original packaging and the recommended storage conditions.

## Quality Control

Lot to lot consistency is confirmed in an AlphaLISA assay. Maximum and minimum signals, EC<sub>50</sub> and LDL were measured on the EnVision Multilabel Plate Reader with Alpha option using the protocol described in this technical data sheet. We certify that these results meet our quality release criteria. Maximum counts may vary between bead lots and the instrument used, with no impact on LDL measurement.

## Analyte of Interest

Tau is a microtubule-associated protein expressed primarily in neurons of the central neuron system (CNS). Abnormal Tau phosphorylation may result in the self-assembly of tangles of paired helical and/or straight filaments, which are involved in the pathogenesis of Alzheimer's disease (AD) and other neurodegenerative diseases. The phosphorylated Tau in the cerebrospinal fluid (CSF) is considered a core AD biomarker. Quantification of pTau (T181), phosphorylated at threonine 181 in CSF can reflect the Alzheimer's-specific neuropathological changes in the brain (neurofibrillary tangles). The concentrations of pTau (181) in the CSF increase only when patients show advanced neurodegeneration and cognitive impairment.

## Description of the AlphaLISA Assay

AlphaLISA technology allows the detection of molecules of interest in buffer, serum, and cerebrospinal fluid (CSF) in a highly sensitive, quantitative, reproducible and user-friendly mode. In this AlphaLISA assay, a biotinylated anti-pTau (T181) antibody binds to the streptavidin coated AlphaLISA Donor beads, while the anti-human Tau (total protein) antibody is conjugated to AlphaLISA Acceptor beads. In the presence of pTau (T181), the beads come into close proximity. The excitation of the Donor beads provokes the release of singlet oxygen molecules that triggers a cascade of energy transfer within the Acceptor beads, resulting in emission at 615 nm (Figure 2).

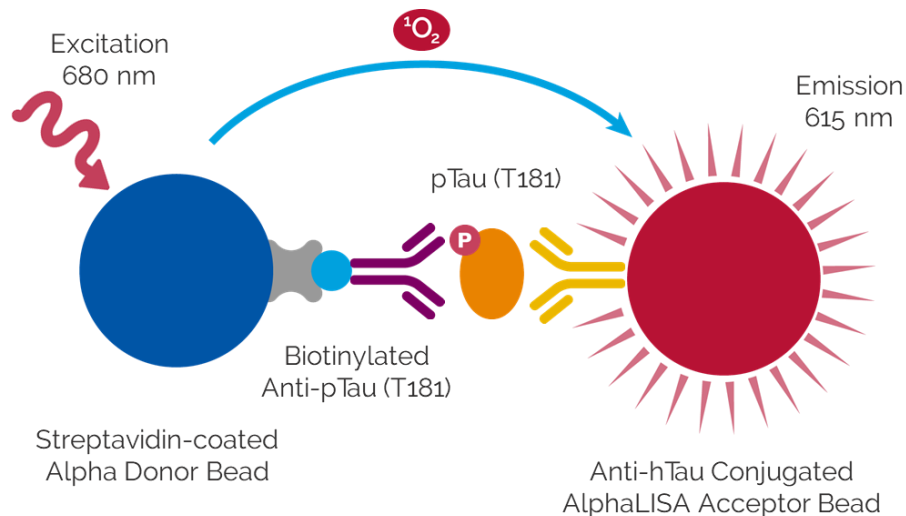


Figure 2. AlphaLISA pTau (T181) Detection Assay Principle.

## Precautions

- The Alpha Donor beads are light-sensitive. All the other assay reagents can be used under normal light conditions. All Alpha assays using the Donor beads should be performed under subdued laboratory lighting (< 100 lux). Green filters (LEE 090 filters (preferred) or Roscolux filters #389 from Rosco) can be applied to light fixtures.
- Take precautionary measures to avoid contamination of the reagent solutions.
- The biotinylated anti-pTau (T181) antibody contains sodium azide. Contact with skin or inhalation should be avoided.

## Kit Content: Reagents and Materials

Kit components	AL3136HV 100 assay points***	AL3136C 500 assay points***	AL3136F 5000 assay points***
AlphaLISA Anti-human Tau Acceptor beads stored in PBS, 0.05% Kathon CG/ICP, pH 7.2	20 µL @ 5 mg/mL (1 brown tube, <u>white</u> cap)	50 µL @ 5 mg/mL (1 brown tube, <u>white</u> cap)	500 µL @ 5 mg/mL (1 brown tube, <u>white</u> cap)
Streptavidin (SA)-coated Donor beads stored in 25 mM HEPES, 100 mM NaCl, 0.05% Kathon CG/ICP, pH 7.4	40 µL @ 5 mg/mL (1 brown tube, <u>black</u> cap)	100 µL @ 5 mg/mL (1 brown tube, <u>black</u> cap)	1000 µL @ 5 mg/mL (1 brown tube, <u>black</u> cap)
Biotinylated Anti-pTau (T181) Antibody stored in PBS, 0.1% Tween-20, 0.05% NaN <sub>3</sub> , pH 7.4	20 µL @ 500 nM (1 tube, <u>black</u> cap)	50 µL @ 500 nM (1 tube, <u>black</u> cap)	500 µL @ 500 nM (1 tube, <u>black</u> cap)
Lyophilized pTau (T181) Analyte*	30 ng (1 tube, <u>clear</u> cap)	30 ng (1 tube, <u>clear</u> cap)	30 ng (1 tube, <u>clear</u> cap)
AlphaLISA Immunoassay Buffer (10X) **	2 mL, 1 small bottle	10 mL, 1 middle bottle	100 mL, 1 large bottle

\* Reconstitute lyophilized analyte in 100 µL Milli-Q® grade H<sub>2</sub>O. The reconstituted analyte should be used within 60 minutes or aliquoted into screw-capped 0.5 mL polypropylene vials and stored at -20 °C for future experiments. The aliquoted analyte at -20 °C is stable up to 90 days. Avoid freeze-thaw cycles. One vial contains an amount of analyte sufficient for performing 10 standard curves. Additional vials can be ordered separately (cat # AL3136S).

\*\* Extra buffer can be ordered separately (cat # AL000C: 10 mL, cat # AL000F: 100 mL).

\*\*\* The number of assay points is based on an assay volume of 100 µL in 96-well plates or 50 µL in 384-well assay plates using the kit components at the recommended concentrations.

Sodium azide should **not** be added to the stock reagents. High concentrations of sodium azide (> 0.001% final in the assay) might decrease the AlphaLISA signal. Note that sodium azide from the biotinylated anti-pTau (T181) antibody stock solution will not interfere with the AlphaLISA signal (0.0001% final in the assay).

## Specific additional required reagents and materials:

The following materials are recommended:

Item	Suggested source	Catalog #
TopSeal™-A Plus Adhesive Sealing Film	PerkinElmer Inc.	6050185
EnVision®-Alpha Reader	PerkinElmer Inc.	-

## Recommendations

IMPORTANT: PLEASE READ THE RECOMMENDATIONS BELOW BEFORE USE

- The volume indicated on each tube is guaranteed for single pipetting. Multiple pipetting of the reagents may reduce the theoretical amount left in the tube. To minimize loss when pipetting beads, it is preferable not to pre-wet the tip.
- Centrifuge all tubes (including lyophilized analyte) before use to improve recovery of content (2000g, 10-15 sec). Re-suspend all reagents by vortexing before use.
- Use Milli-Q® grade H<sub>2</sub>O to dilute 10X AlphaLISA Immunoassay Buffer and to reconstitute the lyophilized analyte.
- When diluting the standard or samples, change tips between each standard or sample dilution. When loading reagents in the assay microplate, change tips between each standard or sample addition and after each set of reagents.
- When reagents are added to the microplate, make sure the liquids are at the bottom of the well.
- Small volumes may be prone to evaporation. It is recommended to cover microplates with TopSeal-A Adhesive Sealing Films to reduce evaporation during incubation. Microplates can be read with the TopSeal-A Film in place.
- The AlphaLISA signal is detected with an EnVision Multilabel Plate Reader equipped with the Alpha option using the AlphaScreen standard settings (e.g. Total Measurement Time: 550 ms, Laser 680 nm Excitation Time: 180 ms, Mirror: D640as, Emission Filter: M570w, Center Wavelength 570 nm, Bandwidth 100 nm, Transmittance 75%).
- AlphaLISA signal will vary with temperature and incubation time. For consistent results, identical incubation times and temperature should be used for each plate.
- The standard curves shown in this technical data sheet are provided for information only. A standard curve must be generated for each experiment.

## Assay Procedure

- The protocol described below is an example for generating one standard curve in a 50 µL final assay volume (48 wells, triplicate determinations). The protocols also include testing samples in 452 wells. If different amount of samples are tested, the volumes of all reagents have to be adjusted accordingly, as shown in the table below. These calculations do not include excess reagent to account for losses during transfer of solutions or dead volumes.
- The standard dilution protocol is provided for information only. As needed, the number of replicates or the range of concentrations covered can be modified.
- Use of four background points in triplicate (12 wells) is recommended when LDL/LLOQ is calculated. One background point in triplicate (3 wells) can be used when LDL/LLOQ is not calculated.

		Volume				
Format	# of data points	Final	Sample	MIX AlphaLISA AccBeads + biotinylated Ab	SA-Donor beads	Plate recommendation
AL3136HV	100	100 µL	10 µL	10 µL	80 µL	White OptiPlate-96 (cat # 6005290) White ½ AreaPlate-96 (cat # 6005560)
AL3136C	250	100 µL	10 µL	10 µL	80 µL	White OptiPlate-96 (cat # 6005290)
	500	50 µL	5 µL	5 µL	40 µL	½ Area AlphaPlate-96 (cat # 6002350) White OptiPlate-384 (cat # 6007290) Light gray AlphaPlate™-384 (cat # 6005350)
	1 250	20 µL	2 µL	2 µL	16 µL	Light gray AlphaPlate-384 (cat # 6005350) ProxiPlate™-384 Plus (cat # 6008280) White OptiPlate-384 (cat # 6007290)
	2 500	10 µL	1 µL	1 µL	8 µL	Light gray AlphaPlate-1536 (cat # 6004350)
AL3136F	5 000	50 µL	5 µL	5 µL	40 µL	½ Area AlphaPlate-96 (cat # 6002350) White OptiPlate-384 (cat # 6007290) Light gray AlphaPlate-384 (cat # 6005350)
	12 500	20 µL	2 µL	2 µL	16 µL	Light gray AlphaPlate-384 (cat # 6005350) ProxiPlate-384 Plus (cat # 6008280) White OptiPlate-384 (cat # 6007290)
	25 000	10 µL	1 µL	1 µL	8 µL	Light gray AlphaPlate-1536 (cat # 6004350)

**The 2-Step High concentration protocol described below is for 500 assay points including one standard curve (48 wells) and samples (452 wells). If different amount of samples are tested, the volumes of all reagents have to be adjusted accordingly.**

1) Preparation of 1X AlphaLISA Immunoassay Buffer:

Add 5 mL of 10X AlphaLISA Immunoassay Buffer to 45 mL Milli-Q® grade H<sub>2</sub>O.

2) Preparation of pTau (T181) analyte standard dilutions:

- a. Reconstitute lyophilized pTau (T181) (30 ng) in 100 µL Milli-Q® grade H<sub>2</sub>O. The remaining reconstituted analyte should be aliquoted immediately and stored at -20 °C for future assays (see page 4 for more details).
- b. Prepare standard dilutions as follows in 1X AlphaLISA Immunoassay Buffer (change tip between each standard dilution):

Tube	Vol. of pTau (T181) (µL)	Vol. of diluent (µL) *	[pTau (T181)] in standard curve	
			(g/mL in 5 µL)	(pg/mL in 5 µL)
A	10 µL of reconstituted pTau (T181)	90	3.0E-08	30 000
B	50 µL of tube A	50	1.5E-08	15 000
C	50 µL of tube B	50	7.5E-09	7 500
D	50 µL of tube C	50	3.8E-09	3 750
E	50 µL of tube D	50	1.9E-09	1 825
F	50 µL of tube E	50	9.4E-10	937.5
G	50 µL of tube F	50	4.7E-10	468.8
H	50 µL of tube G	50	2.3E-10	234.4
I	50 µL of tube H	50	1.2E-10	117.2
J	50 µL of tube I	50	5.9E-11	58.6
K	50 µL of tube J	50	2.9E-11	29.3
L	50 µL of tube K	50	1.5E-11	14.7
M ** (background)	0	50	0	0
N ** (background)	0	50	0	0
O ** (background)	0	50	0	0
P ** (background)	0	50	0	0

\* Dilute standards in diluent (e.g. 1X AlphaLISA Immunoassay Buffer).

At low concentrations of analyte, a significant amount of analyte can bind to the vial. Therefore, load the analyte standard dilutions in the assay microplate within 60 minutes of preparation.

\*\* Four background points in triplicate (12 wells) are used when LDL is calculated. If LDL does not need to be calculated, one background point in triplicate can be used (3 wells).

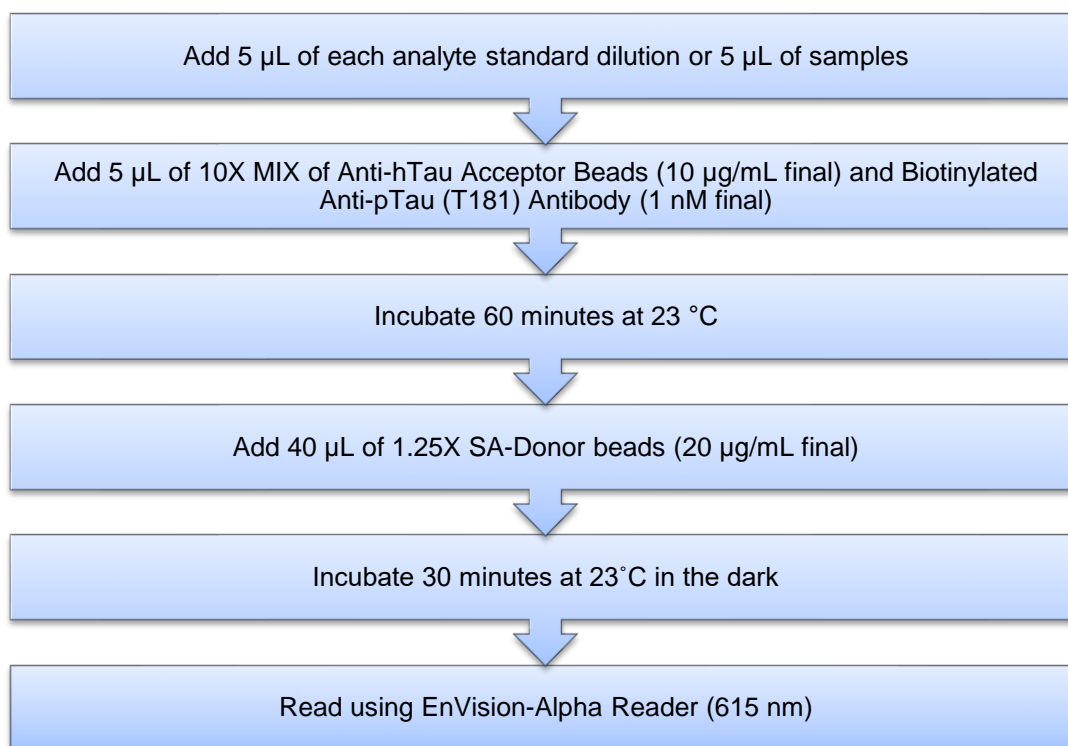
3) Preparation of 10X MIX AlphaLISA Anti-hTau Acceptor beads (100 µg/mL) + Biotinylated Anti-pTau (T181) Antibody (10 nM):

- a. Prepare just before use.
- b. Add 50 µL of 5 mg/mL AlphaLISA Anti-hTau Acceptor Bead and 50 µL of 500 nM Biotinylated Anti-pTau (T181) Antibody to 2400 µL of 1X AlphaLISA Immunoassay Buffer.

4) Preparation of 1.25X Streptavidin (SA) Donor beads (25 µg/mL):

- a. Prepare just before use.
- b. Keep the beads under subdued laboratory lighting.
- c. Add 100 µL of 5 mg/mL SA-Donor beads to 19 900 µL of 1X AlphaLISA Immunoassay Buffer.

5) In a white Optiplate (384 wells):



## Data Analysis

- Calculate the average count value for the background wells.
- Generate a standard curve by plotting the AlphaLISA counts versus the concentration of analyte. A log scale can be used for either or both axes. No additional data transformation is required.
- Analyze data according to a nonlinear regression using the 4-parameter logistic equation (sigmoidal dose-response curve with variable slope) and a  $1/Y^2$  data weighting (the values at maximal concentrations of analyte after the hook point should be removed for correct analysis).
- The LDL is calculated by interpolating the average background counts (12 wells without analyte) + 3 x standard deviation value (average background counts + (3xSD)) on the standard curve.
- The LLOQ as measured here is calculated by interpolating the average background counts (12 wells without analyte) + 10 x standard deviation value (average background counts + (10xSD)) on the standard curve. Alternatively, the true LLOQ can be determined by spiking known concentrations of analyte in the matrix and measuring the percent recovery, and then determining the minimal amount of spiked analyte that can be quantified within a given limit (usually +/- 20% or 30% of the real concentration).
- Read from the standard curve the concentration of analyte contained in the samples.
- If samples have been diluted, the concentration read from the standard curve must be multiplied by the dilution factor.



## Assay Performance Characteristics

AlphaLISA assay performance described below was determined a 2-step high concentration protocol using AlphaLISA Immunoassay Buffer (IAB) as assay buffer. The analytes (standards) were prepared in IAB, 100% FBS, DMEM + 10% FBS, and RPMI + 10% FBS. All other components were prepared in IAB.

- Assay Sensitivity:

The LDL was calculated as described above. The values correspond to the lowest concentration of analyte that can be detected in a volume of 5 µL sample using the recommended assay conditions.

LDL (pg/mL)	(Analyte diluent)	# of experiments
30.1	IAB	6
38.7	100% FBS	6
31.1	DMEM + 10% FBS	6
186	RPMI* + 10% FBS	6

\*It is not recommended to use RPMI media.

- Assay Precision:

The following assay precision data were calculated from the three independent assays using two different kit lots. In each lot, the analytes were prepared in IAB, 100% FBS, DMEM + 10% FBS, and RPMI + 10% FBS. All other components were prepared in IAB. Each assay consisted of one standard curve comprising 12 data points (each in triplicate) and 12 background wells (no analytes). The assays were performed in 384-well plate format.

- Intra-assay precision:

The intra-assay precision was determined using a total of 16 independent determinations in triplicate. Shown as CV%.

pTau (T181)	IAB	100% FBS	DMEM + 10% FBS	RPMI + 10% FBS
CV (%)	6	6	6	10

- Inter-assay precision:

The inter-assay precision was determined using a total of 3 independent determinations with 9 measurements for 1.9 ng/mL sample. Shown as CV%.

pTau (T181)	IAB	100% FBS	DMEM + 10% FBS	RPMI + 10% FBS
CV (%)	5	4	4	14

- Spike Recovery:

Three known concentrations of analyte were spiked into IAB, 100% FBS, and DMEM + 10% FBS. All samples, including non-spiked diluents were measured in the assay. Note that the analytes for the respective standard curves were prepared in IAB, 100% FBS and DMEM + 10% FBS. All other assay components were diluted in IAB.

Spiked pTau (ng/mL)	% Recovery		
	IAB	100% FBS	DMEM + 10% FBS
3	100	92	92
1	106	91	93
0.3	102	88	92

- Specificity:

Cross-reactivity of the pTau (T181) AlphaLISA Detection Kit was tested using the following proteins at 3 ng/mL in IAB. The cross reactivities were calculated using the signals of 3 ng/mL pTau (T181) as 100%. No unwanted cross-reactions with related tau protein or other non-tau proteins were observed.

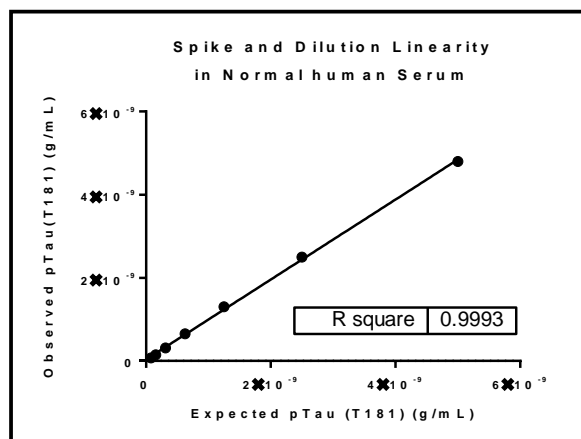
Proteins	Cross Reactivity (%)
Tau381	0.02
Tau 383	0.00
Tau 410	0.00
Tau 412	0.00
Tau 441	0.00
alpha Synuclein	0.00
beta-Amyloid (1-38)	0.00
beta-Amyloid (1-40)	0.00
beta-Amyloid (1-42)	0.00
BACE1	0.01
BACE2	0.00
pNf-H	0.00

- Human Serum Experiments:

- Dilution Linearity

Normal human serum and pTau (T181)-spiked (10 ng/mL) normal human serum samples were diluted with 100% FBS and the assay was performed along with a standard curve prepared in 100% FBS. Concentrations of pTau (T181) in diluted samples were determined by interpolating to the standard curve. The other components (anti-hTau acceptor beads, biotinylated anti-pTau (T181) antibody, and SA-Donor beads) of the assays were prepared in AlphaLISA Immunoassay Buffer. pTau (T181) was not detected in normal human serum. Excellent dilution linearity ( $R^2 > 0.999$ ) was achieved in the pTau (T181)-spiked human serum samples (2- to 128-fold dilution). The results are shown in the table and the figure below.

Serum Dilution Factor (x)	Expected pTau (T181) (g/mL)	Observed pTau (T181) (g/mL)
2	5.00E-09	4.79E-09
4	2.50E-09	2.49E-09
8	1.25E-09	1.27E-09
16	6.25E-10	6.45E-10
32	3.13E-10	3.08E-10
64	1.56E-10	1.54E-10
128	7.81E-11	7.54E-11



- Spike Recovery

Three known amounts of pTau (T181) were spiked into normal human serum (3 ng/mL, 1.5 ng/mL and 0.75 ng/mL). The spiked serum samples were diluted to 2- fold, using 100% FBS, resulting in 1.5, 0.75, and 0.375 ng/mL in 2x diluted serum samples. The samples were assayed along the standard prepared in 100% FBS. Other components (anti-hTau acceptor beads, biotinylated anti-pTau (T181) antibody, and SA-Donor beads) of the assays were prepared in AlphaLISA Immunoassay Buffer. The spike recoveries of pTau (T181) were determined. The results shown in the table below indicating that excellent recoveries were achieved for all three spikes tested.

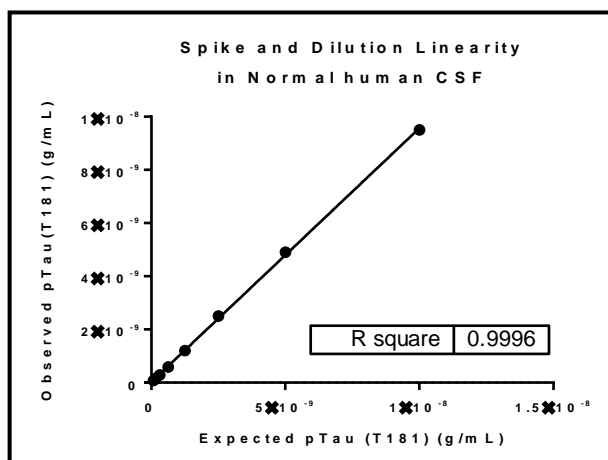
pTau (T181)	Diluent: 100% FBS	
	Spiked sample (Normal Human Serum)	
Spike (ng/mL)	Concentration (ng/mL)	Recovery (%)
No spike	0	N/A
1.5	1.52	102
0.75	0.771	103
0.375	0.342	91

- Human Cerebrospinal Fluid (CSF) Experiments:

- Dilution Linearity

Normal human CSF and pTau (T181)-spiked (10 ng/mL) normal human CSF samples were diluted with IAB and the assay was performed along with a standard curve prepared in IAB. Concentrations of pTau (T181) in diluted samples were determined by interpolating to the standard curve. pTau (T181) level was under Lower Limit of Quantification in CSF. Excellent dilution linearity ( $R^2 > 0.999$ ) was achieved in the pTau (T181)-spiked CSF samples. The results are shown in the table and the figure below.

CSF Dilution Factor (x)	Expected pTau (T181) (g/mL)	Observed pTau (T181) (g/mL)
1	1.00E-08	9.51E-09
2	5.00E-09	4.95E-09
4	2.50E-09	2.47E-09
8	1.25E-09	1.21E-09
16	6.25E-10	5.87E-10
32	3.13E-10	2.95E-10
64	1.56E-10	1.51E-10
128	7.81E-11	7.72E-11



- Spike Recovery

Three known amounts of pTau (T181) were spiked into normal human CSF. The samples were assayed along the standard prepared in IAB. No spiked pTau (T181) was used to measure basal level. The spike recoveries of pTau (T181) were determined with corrected concentrations. The results shown in the table below indicating that excellent recoveries were achieved for all three spikes tested.

pTau (T181)	Spiked sample (CSF)		
Spike (pg/mL)	Observed Concentration (pg/mL)	Corrected Concentration (pg/mL)	Recovery (%)
No spike	34	N/A	N/A
300	305	271	90
150	176	142	94
75	104	70	93

## Troubleshooting Guide

You will find detailed recommendations for common situations you might encounter with your AlphaLISA Assay kit at:

<http://www.perkinelmer.com/lab-products-and-services/application-support-knowledgebase/alphalisa-alphascreen-no-wash-assays/alpha-troubleshooting.html>

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