

PI(5)P 4-Kinase (PIP4KII) Activity Assay

K-5400 (96 tests)

Support: echelon@echelon-inc.com

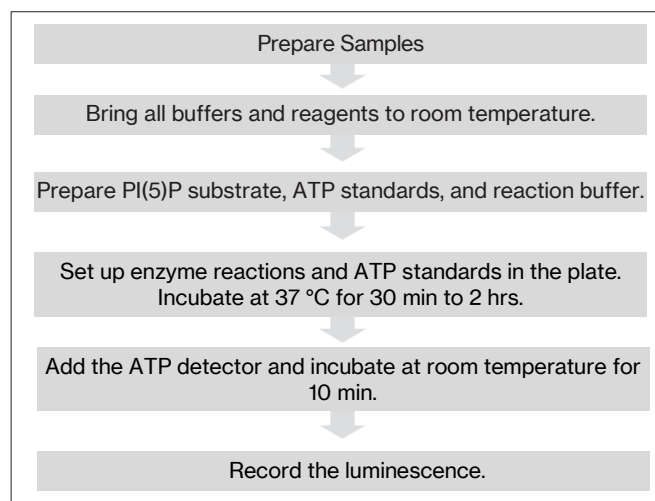
Description: ATP depletion assay for the quantification of PI(5)P 4-kinase *in vitro* or in cell lysate.

Storage: Upon receipt, the kit should be stored at -20°C. Under proper storage conditions, the kit components should remain stable for at least 6 months from the date of receipt. Allow the reagents to warm to room temperature before opening vials.

Materials Provided

Catalog #	Description	Quantity
P-5016	PI(5)P, diC16 (500 µg, 522µmol)	1 vial
K-KBZ	5X KBZ Buffer (4 mL)	1 bottle
K-5403	Diluent (150 µL)	1 vial
K-CF01	Kinase Cofactor (100 µL)	1 vial
K-LUMa	ATP Detector (5 mL)	1 bottle
K-ATP1	10 mM ATP (50 µL)	1 vial
K-DTT1	50 µmol dried dithiothreitol (DTT) powder	1 vial
---	96-well round bottom white plate	1 each
---	Microtiter Plate Seal	1 each

Quick Protocol



Additional Materials Provided by User

- Source of purified PI(5)P 4-Kinase as positive control (optional).
- Plate reader capable of reading luminescence in 96-well microtiter plates.
- Microcentrifuge tubes (0.5 mL or 1.5 mL) or reservoir for standard dilution or sample loading.
- Multichannel pipettes or automatic pipetting station.

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Background

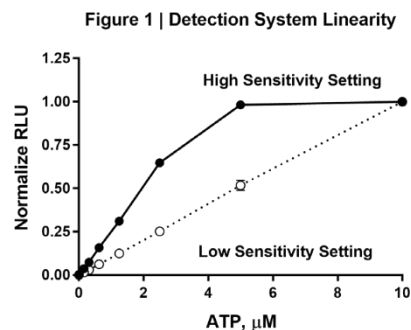
Type II PI(5)P 4-Kinase (PIP4KII) catalyzes the phosphorylation of phosphatidylinositol-5-phosphate [PI(5)P], producing phosphatidylinositol-4,5-bisphosphate [PI(4,5)P₂]. In addition to its role in regulating nuclear PI(5)P levels, PIP4KII has been implicated in several physiological processes, including insulin signaling, cellular stress response, and embryonic development across multiple model organisms. Dysregulation of PIP4KII has also been associated with the progression of certain breast and colon cancers.

Assay Design

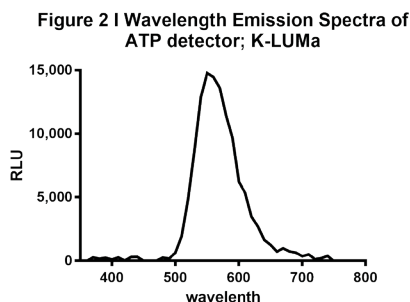
Echelon's PI(5)P 4-Kinase Activity Assay is an ATP depletion assay which quantifies the remaining ATP levels in solution following the kinase reaction. The assay reaction is prepared by the addition of PIP4KII (enzyme), PI(5)P (substrate) in reaction buffer and initiated by the addition of ATP. The reaction is then stopped by adding the ATP detector after the chosen reaction time. The luminescent signal is inversely correlated with the kinase activity. Echelon's PI(5)P 4-Kinase Activity Assay is tested using SignalChem's PIP4KIIA (Cat. # P76-102AG) kinase.

Assay Kit Notes

1. The linear detection range of the ATP detector (K-LUMa) may vary depending on instrument specifications. Instrument capacity and sensitivity settings influence the optimal performance range, which can reach up to 100 μ M under appropriate conditions (see Figure 1).



2. The luminescent signal, or light, collected by your plate reader is not restricted to a particular wavelength. When setting up your instrument, select the option on your reader that allows the instrument to collect all wavelengths. For most plate readers this setting is labeled "all wavelengths". For BMG Labtech plate readers the "lens" setting will read all wavelengths. Please refer to your plate reader's manual and/or the manufacturer of your reader if you have questions on how



to set up your specific instrument. If your instrument does not have this setting, or is limited to a certain filter, choose a broad filter centered at 550 nm (Figure 2). When the luminescent signal is read at one wavelength, a lower signal may be observed.

3. The buffer of your sample may interfere with the luminescent output. Sample buffers should always be included in the ATP standard curve and as a "buffer only" background control.
4. Two commonly used lysis buffers (figure 3) and common lysis buffer components (figure 4) were tested in the assay. Since some buffers and lysis buffer components affect the assay, we suggest using RIPA lysis buffer. Alternatively, cells can be lysed with sonication and freeze thaw cycles in the complete reaction buffer (step 3 of assay protocol). If you plan to use your own lysis buffer, we suggest testing it in the assay for interference before running samples. If your lysis buffer has a strong effect on the assay, substitute lysis buffer or dilute sample with complete reaction buffer.

Figure 3 | Lysis Buffer Effects

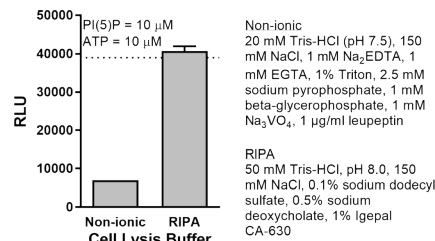
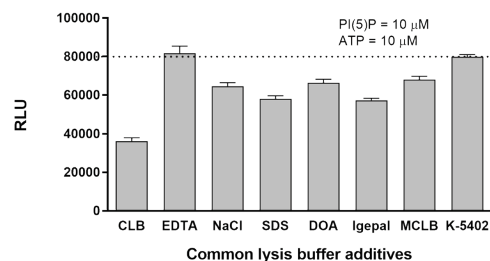


Figure 4 | Lysis Buffer Effects



5. Optimization of the kinase reactions by enzyme concentration, reaction time and temperature may be required.
6. Kinase reactions can be run at either 37°C or at room temperature. Reactions run at 37°C should be allowed to equilibrate to room temperature before the ATP detector is added to avoid a temperature gradient.
7. The provided 5X KBZ Buffer (K-KBZ) and supplements (DTT, Kinase Cofactor) must be used for enzyme reactions.
8. The amount of kinase required per reaction depends on the specific experimental setup. Whether using purified enzyme or cell lysate, optimal conditions should be determined empirically by testing varying enzyme concentrations. When using purified PIP4KII from SignalChem (Cat# P76-102AG), enzyme concentrations of 0.5-2 ng/ μ L are suggested as a starting point. In testing, we found that 5-10 μ g of cell lysate was sufficient to detect significant kinase activity.
9. Sample Reaction: 10 μ L samples (PIP4KII) + 10 μ L PI(5)P + 20 μ L ATP = 40 μ L reaction. ATP Standards: 10 μ L complete reaction buffer or sample buffer of your choice + 10 μ L PI(5)P + 20 μ L ATP standard dilution = 40 μ L solution.

Assay Protocol

Please read this entire section and the assay notes section before beginning the assay.

1. Bring reagents to room temperature before use. Place enzyme samples, and ATP on ice until use. All steps are performed at room temperature unless noted.
2. Add 50 μ L deionized water to 50 μ mol dried DTT (K-DTT1). Vortex to mix. This is the 1 M DTT stock. Keep on ice. The 1 M DTT stock is stable for at least 1 month when stored at -20 °C.
3. Prepare the complete reaction buffer by diluting the 5X KBZ Buffer (K-KBZ) to 1X and supplement with 1:1000 dilution of DTT stock and 1:500 dilution of Kinase Cofactor. Dilute only what is needed. The 1X KBZ buffer, DTT and Kinase Cofactor are not stable as complete reaction buffer.
4. Prepare a 5 mM stock of PI(5)P Substrate by adding 105 μ L of Diluent (K-5403) to the vial of PI(5)P (P-5016). Vortex solution for a full two minutes followed by a 5-minute incubation at 37°C to fully suspend the lipid. From the 5 mM stock prepare a 4X PI(5)P working solution by diluting the 5 mM PI(5)P stock in the complete reaction buffer (step 3). Suggested PI(5)P concentration is 100 μ M (4X at 400 μ M).
5. Prepare a 2X ATP solution by diluting the 10 mM ATP stock (K-ATP1) in the complete reaction buffer (step 3). Suggested ATP concentration is 10 μ M (2X at 20 μ M).
6. Prepare a 2-fold dilution series of ATP standards by diluting 10 mM ATP stock (K-ATP1) in 0.5 mL centrifuge tubes. A sample of a 10 μ M ATP 2X dilution standard curve is shown in Table 1.
7. Using the provided 96-well plate, add 10 μ L of the 4X PI(5)P solution per well. Then, add 10 μ L of the kinase samples per well. For the ATP standard wells, add 10 μ L of the complete reaction buffer or sample buffer. Suggested plate layout in duplicates is shown in Table 2.
8. Start the reaction by adding 20 μ L of the 2X ATP solution to the kinase sample wells. Add 20 μ L of the 2-fold ATP dilution series (prepared in step 6) to the standard wells. Cover with plate seal. Mix briefly by tapping the plate or by plate shaker. Incubate the reaction at 37°C. Incubation times may vary depending on the PIP4KII activity within samples. Suggested incubation time – 30 minutes to 2 hours. Note – The last 10 minutes of the incubation should be done at room temperature to allow the plate temperature to equilibrate.
9. After incubation, add 40 μ L of ATP Detector (K-LUMa) per well. Mix briefly by tapping the plate or by plate shaker. Incubate at room temperature for at least 10 minutes to stabilize the luminescent signal. Protect from the light. Note: if K-LUMa shows precipitate centrifuge at 1,000 RPM for 15 minutes.
10. Record luminescence.

Support Protocol: Cell Lysate Preparation

The following cell lysate protocol has been validated for use in the PIP4KII Activity Assay. Further optimization of this protocol, or substitution with alternative protocols, may be appropriate depending on the user's specific needs.

Materials Needed	Company	Catalog Number
1.5 mL Centrifuge Tubes	N/A	N/A
RIPA Lysis Buffer (50 mM Tris-HCl pH 8.0, 150 mM NaCl, 0.1% SDS, 1% Igepal CA-630, 0.5% Na deoxycholate)	Sigma	R0278
Protease Inhibitor Cocktail	Sigma	P8340
PBS	N/A	N/A

This protocol is optimized for a 100 mm dish of HEK 293 cells at ~90% confluency, yielding ~10-15 mg/mL of cellular protein. To preserve maximal kinase activity, keep all solutions ice cold, perform all reactions on ice or at 4°C, and use a centrifuge that is pre-equilibrated to 4 °C.

Reagent Preparation

Lysis Buffer: Use a commercially available RIPA Lysis Buffer or prepare according to the recipe listed in the materials. Add the protease inhibitor cocktail fresh at 1:100 dilution. Place buffer on ice and chill until ice cold.

Cell Lysis

1. Place cell culture dish on ice and wash cells twice with ice cold PBS.
2. Add 0.5 mL of ice-cold Lysis Buffer to cells. Scrape cells and transfer mixture into a cooled 1.5 mL centrifuge tube.
3. Incubate cells for 15 minutes with constant agitation at 4°C.
4. Centrifuge cells for 10 minutes at 14,000 x g to pellet cells.
5. Transfer supernatant to a fresh, cooled 1.5 mL centrifuge tube and freeze immediately at -80°C or proceed with the kinase reactions.

Note: ATP, DTT, Kinase Cofactor and PI(5)P Substrate levels should be kept consistent when setting up kinase reactions containing cell lysate. Depending on how much lysate is added to the reaction it may be necessary to supplement the lysate with these components.

Figure 5 | 10 μ M ATP Standard Curve

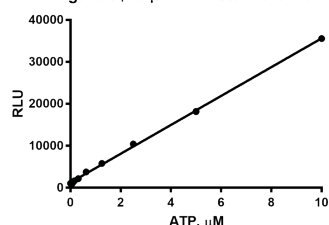


Figure 6 | PIP4KII Titration

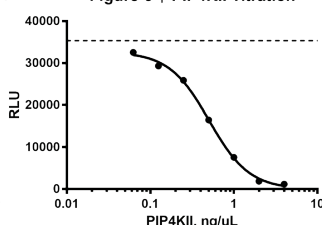


Figure 7 | Cell Lysate Titration
HEK 293 Lysate, 2 Hour Incubation

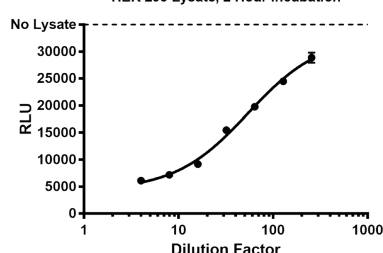


Table 1. ATP Standard curve

Final ATP Conc. in Reaction (1X)	2X ATP Solutions	ATP stock (K-ATP1) or previous dilution	Complete Reaction Buffer (step 3)
10 μ M	20 μ M	1 μ L of K-ATP1	499 μ L
5 μ M	10 μ M	100 μ L of 20 μ M soln.	100 μ L
2.5 μ M	5 μ M	100 μ L of 10 μ M soln.	100 μ L
1.25 μ M	2.5 μ M	100 μ L of 5 μ M soln.	100 μ L
0.625 μ M	1.25 μ M	100 μ L of 2.5 μ M soln.	100 μ L
0.3125 μ M	0.625 μ M	100 μ L of 1.25 μ M soln.	100 μ L
0.15625 μ M	0.3125 μ M	100 μ L of 0.625 μ M soln.	100 μ L

Table 2. Plate Layout

	1	2	3	4	5	6	7	8	9	10	11	12
A	10 μ M ATP	10 μ M ATP	Sample 1	Sample 1	Sample 9	Sample 9	Sample 17	Sample 17	Sample 25	Sample 25	Sample 33	Sample 33
B	5 μ M ATP	5 μ M ATP	Sample 2	Sample 2	Sample 10	Sample 10	Sample 18	Sample 18	Sample 26	Sample 26	Sample 34	Sample 34
C	2.5 μ M ATP	2.5 μ M ATP	Sample 3	Sample 3	Sample 11	Sample 11	Sample 19	Sample 19	Sample 27	Sample 27	Sample 35	Sample 35
D	1.25 μ M ATP	1.25 μ M ATP	Sample 4	Sample 4	Sample 12	Sample 12	Sample 20	Sample 20	Sample 28	Sample 28	Sample 36	Sample 36
E	0.63 μ M ATP	0.63 μ M ATP	Sample 5	Sample 5	Sample 13	Sample 13	Sample 21	Sample 21	Sample 29	Sample 29	Sample 37	Sample 37
F	0.31 μ M ATP	0.31 μ M ATP	Sample 6	Sample 6	Sample 14	Sample 14	Sample 22	Sample 22	Sample 30	Sample 30	Sample 38	Sample 38
G	0.16 μ M ATP	0.16 μ M ATP	Sample 7	Sample 7	Sample 15	Sample 15	Sample 23	Sample 23	Sample 31	Sample 31	Sample 39	Sample 39
H	0 μ M ATP	0 μ M ATP	Sample 8	Sample 8	Sample 16	Sample 16	Sample 24	Sample 24	Sample 32	Sample 32	Sample 40	Sample 40

Related Products

Products	Catalog Number
Substrates	
diC16 PI(5)P	P-5016
diC8 PI(5)P	P-5008
Enzymes	
PI3K α	E-2000
PTEN	E-3000
SHIP2	E-1000
Assays	
PI(4)P 5-Kinase Activity Assay	K-5700
PI3-Kinase Activity ELISA: Pico	K-1000s
PTEN Activity ELISA	K-4700