Supplemental methods
Label free quantification (LFQ) analysis of phospho-peptides

Label free quantification (LFQ) was performed on 33 tumor samples (OC01, OC02, OC04, OC05, OC07, OC08, OC09, OC10, OC11, OC13, OC14, OC16, OC22, OC24, OC26, OC26a, OC27, OC28, OC29, OC29a, OC31, OC34, OC35) and 10 normal samples (B20, B22, B24, B25, B26, B26a, B27, B28, B29, B30) that were run back to back on the LTQ-Orbitrap mass spectrometer. Peptide m/z values between runs were used in order to define retention time (RT) differences from run to run by simple linear regression. Once RT drift was established, the maximum intensity for an m/z value was extracted from MS1 scans using predicted RT values and a mass tolerance of 10 ppm. An intensity value was considered valid if at least 3 consecutive MS1 scans contained the target m/z. To compare the abundance of phospho-peptides in tumor samples, we calculated the MS1 peak intensity ratios based on the raw intensity in tumor samples and the basal intensity. The basal intensity is represented by the average raw intensities of MS1 peaks in the 10 normal samples. An intensity of 20,000 (estimated noise level) was used as raw intensities for normal samples that had no MS1 intensity value. The MS1 intensity ratio of a phospho-peptide is calculated as the following:

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\text{Intensity ratio} = \frac{\text{Raw intensity in a tumor}}{\text{Basal Intensity}}
\]

Immunohistochemical staining.

4 μm ovarian tissue sections or FFPE TMA slides were deparaffinized and rehydrated through xylene and graded ethanol, respectively. Antigen retrieval was performed in a Decloaking Chamber (Biocare Medical, Concord, CA) using 1.0 mM EDTA, pH 8.0. Slides were then quenched in 3% H₂O₂ for 10 minutes, washed in deionized H₂O and blocked with Tris buffered saline /0.5% Tween-20 (TBST)/5% goat serum in a humidified chamber for 60 minutes. Sections were then exposed to ALK (D5F3) XPTM Rabbit mAb overnight at 4°C. Detection was performed with SignalStain® Boost IHC Detection Reagent (Cell Signaling Technology) for 30 minutes. All slides were exposed to NovaRed (Vector Laboratories, Inc., Burlingame, CA) for 1 minute before they were
rinsed, dehydrated, cleared and cover-slipped.

Immunofluorescent (IF) analysis.
Transfected NIH3T3 cells on 8 well culture slide (BD Falcon™) were stained with ALK (D5F3) XP™ Rabbit mAb, a DNA dye DRAQ5® (Cell Signaling Technology), and DY-554 phalloidin (Dyomics GmbH, Jena, Germany) that binds to actin filament following standard IF protocol (www.cellsignal.com).

Transfection of 293T cells and down stream signaling analysis
293T cells were transfected with MSCV-Neo, MSCV-Neo/ALK and MSCV-Neo/FN1ALK using FuGENE 6 Transfection Reagent (Roche). 24 hours later, cells were serum starved for 24 hours and either left untreated or treated with 2μM Crizotinib or 0.1μM TAE684 for 2 hours. The cells were then lysed in 1X Cell Lysis Buffer with sonication. Cell lysates containing equal amount of protein were analyzed by western blot assay.

Supplemental Figure 1. Detection of two common ALK peptides containing phospho-Y1507 in 4 patients.
A, Extracted ion chromatograms (EICs) of two m/z (mass/charge) values corresponding to the two peptides containing ALK phospho-Y1507 (NKPTSLWNPTyGSWFTEKPTK and NKPTSLWNPTyGSWFTEKPTKK) in OC07, OC16, OC19 and OC26. Arrows indicate MS1 peaks (±3ppm) correspondent to the two ALK peptides. The MS1 peak intensities in each sample are indicated. B, Examples of MS2 spectra matched to ALK phospho-Y1507 peptides. The two spectra have normalized intensities of 1-2 x10^4. Blue lines indicate MS2 peaks matched to theoretical y ion peaks and red lines, b ion peaks. For example, in the left spectrum, the blue line labeled as y19++ is a peak matched to the
y19 ion with a charge of 2+, the red line labeled as b8+ is a peak matched to the b8 ion with a charge of 1+.

**Supplemental Figure 2. Hyperphosphorylation of signaling molecules in serous carcinomas bearing ALK**

LFQ analysis was performed as described in Materials and Methods. The MS1 peak intensity ratios of 13 phospho-peptides representing tyrosine phosphorylation of 12 signaling molecules across 23 serous carcinoma samples are shown in the 3D graph. The three serous carcinomas bearing phosphorylated ALK (OC07, OC16 and OC26) are grouped together to facilitate the comparison with other serous carcinomas. Peptide sequences and the values of MS1 peak intensity ratio are listed in Supplemental Table 3.

**Supplemental Figure 3. A novel fusion: FN1-ALK.**

*A*, Schematic diagram of genomic DNA fusion of FN1 and ALK genes. Gene structure diagram (exons, black boxes; introns, lines), location and orientation of FN1 and ALK genes are shown. Exons and joint sequences in FN1 (blue) and ALK (red), positions of the novel breakpoint (Novel BP) and the common breakpoint (Common BP) are indicated. A single PCR product of ~1kb amplified from OC19 gDNA using PCR primers annealing to FN1 Exon23 and ALK Exon 19 is detected by agarose electrophoresis. 

*B*, Predicted amino acid sequence of the FN1-ALK fusion protein (198.82 kd). Residues corresponding to FN1 or ALK are indicated in blue and red, respectively. Peptide sequence encoded by ALK Exon 19 is underlined. Amino acid sequence spanning the trans-membrane domain is highlighted in yellow.

**Supplemental Figure 4. Activation and ALK inhibitor sensitivity of down stream molecules in 293T cells expressing ALK and FN1-ALK.**

Whole cell lysates of untreated or Crizotinib treated 293T cells transfected with MSCV-Neo, MSCV-Neo/ALK and MSCV-Neo/FN1-ALK were analyzed by western blot assay using indicated antibodies. The positions of full length ALK/FN1-ALK (220 kd), cleaved ALK (140 kd) and FN1-ALK fragment (~78 kd) are indicated by arrows for ALK and
phospho-ALK (Y1278/1282/1283) blots on the left. Blot with β-Actin antibody was used as a loading control.

**Supplemental Figure 5. ALK and FN1-ALK tumors are sensitive to TAE684 treatment.**
Four to six nude mice carrying 3T3 tumors expressing Src, ALK or FN1-ALK are treated with vehicle or 10mg/kg/day TAE684 by oral gavage when tumors are palpable. The tumors are measured every other day until the mean tumor size of the vehicle treated mice reaches 1500 mm³.

**Supplemental Table 1. Patient Diagnostic Information**

**Supplemental Table 2. Phospho-tyrosine Peptides of Tyrosine Kinases Identified by LC-MS/MS in Ovarian Tissues**

**Supplemental Table 3. Abundance of phospho-peptides corresponding to specific signaling molecules in selective serous carcinoma patients**