

WFIRST: A Convergence of Parallels

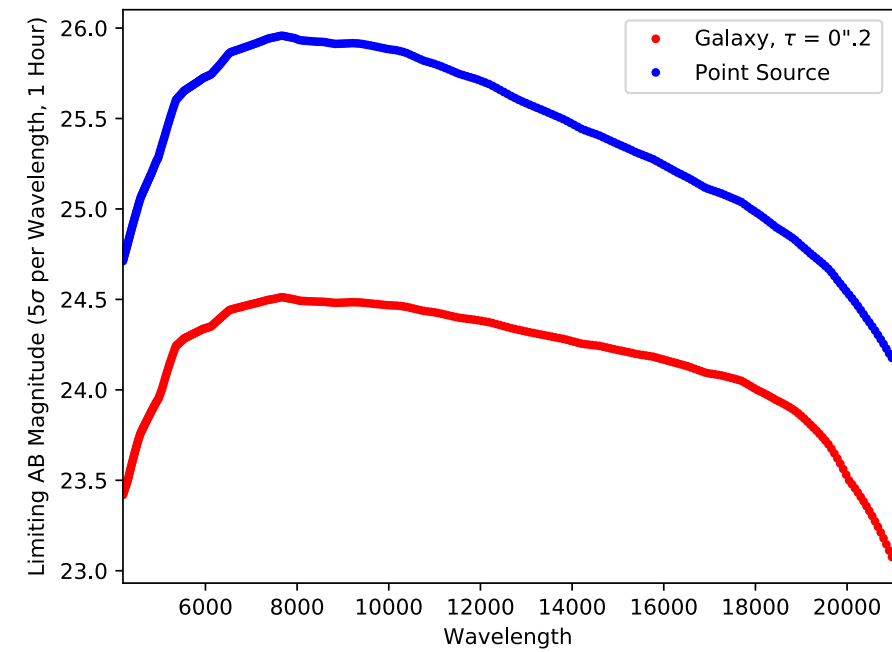
Simultaneous NIR Imaging and Integral-Field Channel (IFC) Spectrophotometry of LSST SNe

D. Rubin, G. Aldering, C. Baltay, K. Barbary, K. Boone, C. Burns, M. Currie, S. Deustua, S. Dixon, P. Fagrelus, O. Fox, W. Freedman, A. Fruchter, E. Hsiao, A. Kim, D. Law, M. McElwain, S. Perlmutter, M. Phillips, K. Ponder, K. Pontoppidan, D. Rabinowitz, M. Sako, C. Stubbs, N. Suntzeff, S. Van Dyk, J.C. Wheeler, M. Wood-Vasey

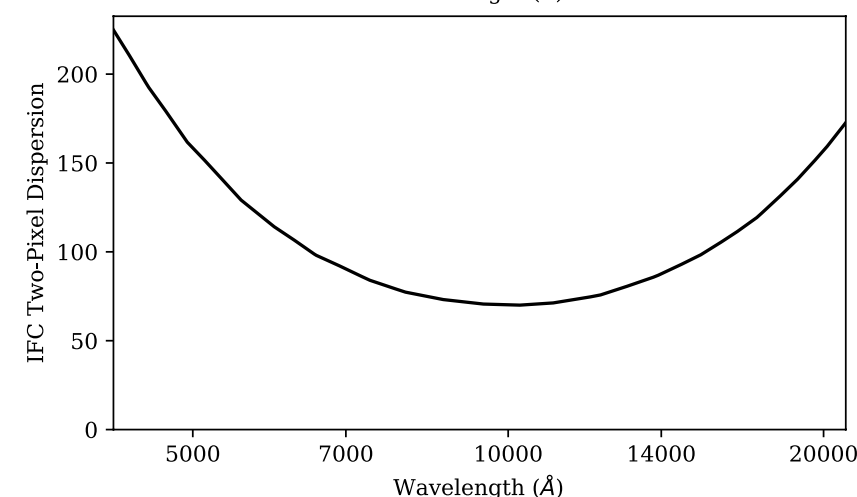
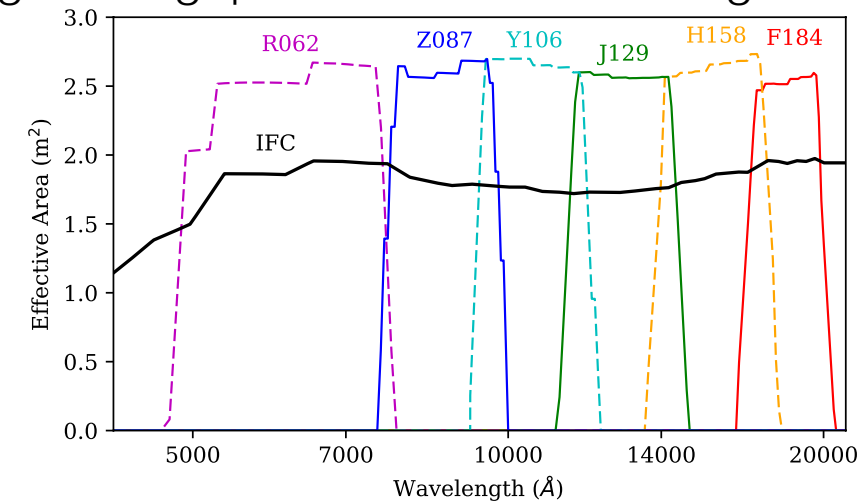
One of the unique proposed capabilities of WFIRST is the ability to conduct wide-field imaging and integral-field spectrophotometry in parallel. For the SN program, this offers the capability to generate spectroscopy while the broadband light curves are being taken, producing a large spectroscopic dataset impossible to obtain otherwise. If the WFIRST SN program operates in parallel with LSST, a powerful dataset of optical/NIR/spectrophotometry would provide unparalleled supernova cosmological constraints. There are additional opportunities for spectroscopic observations of faint galaxies during the galaxy-redshift survey, providing photo-z training to H=25 AB with 0.42 to 2.1 micron coverage. The integral-field channel thus provides key complementary capabilities to reduce systematic uncertainties at low observational cost.

What are the basic IFC capabilities?

Two Channels, both 0.42 to 2.1 microns, and both ~100% fill-factor slicer IFUs
 IFC-Fine: 0".05 pixels, 0".15 slices, 3" by 4".5 FoV
 IFC-Coarse: 0.1" pixels, 0".3 slices, 4".2 by 9" FoV

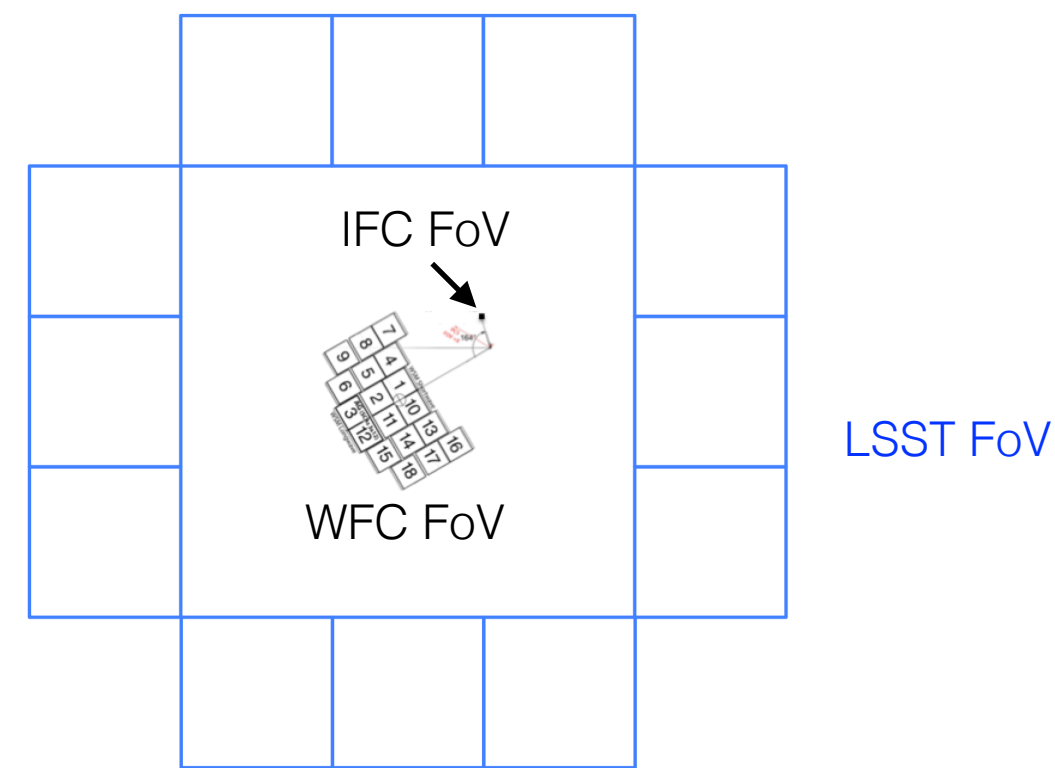


High throughput across the wavelength range

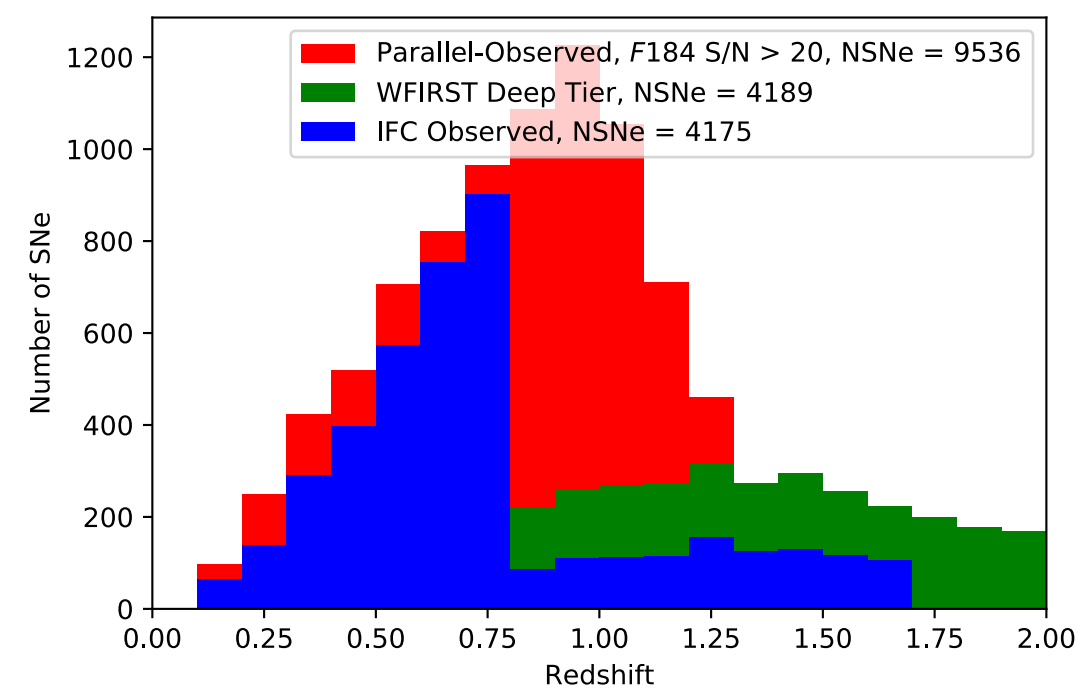


Low dispersion, but higher than NIRSPEC prism

SN Simulations Including Parallel Observations

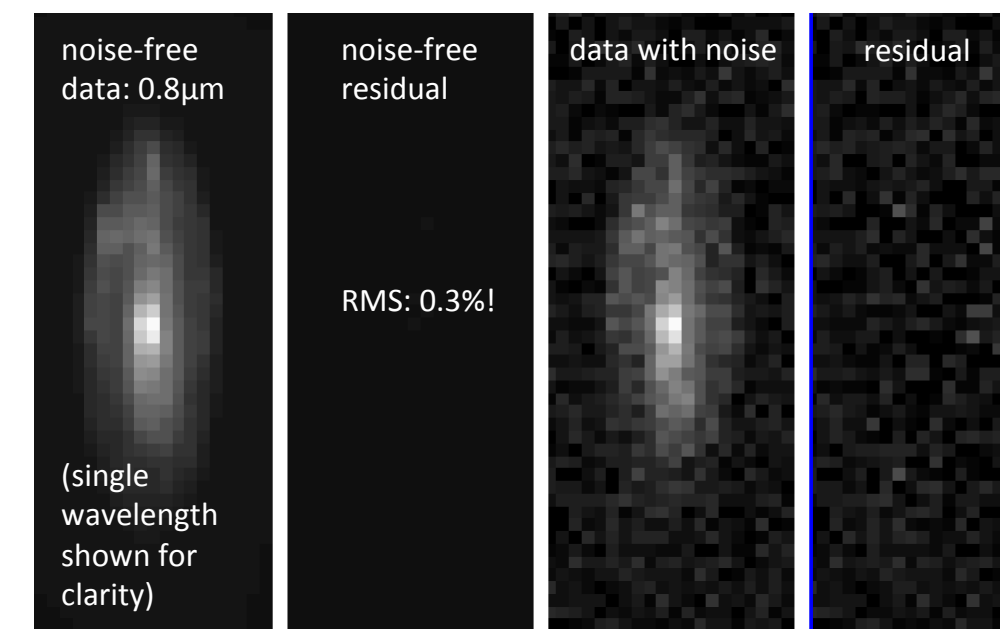


With the WFC and IFC, WFIRST can provide two simultaneous complementary capabilities to the LSST SN program: NIR imaging and spectrophotometry.

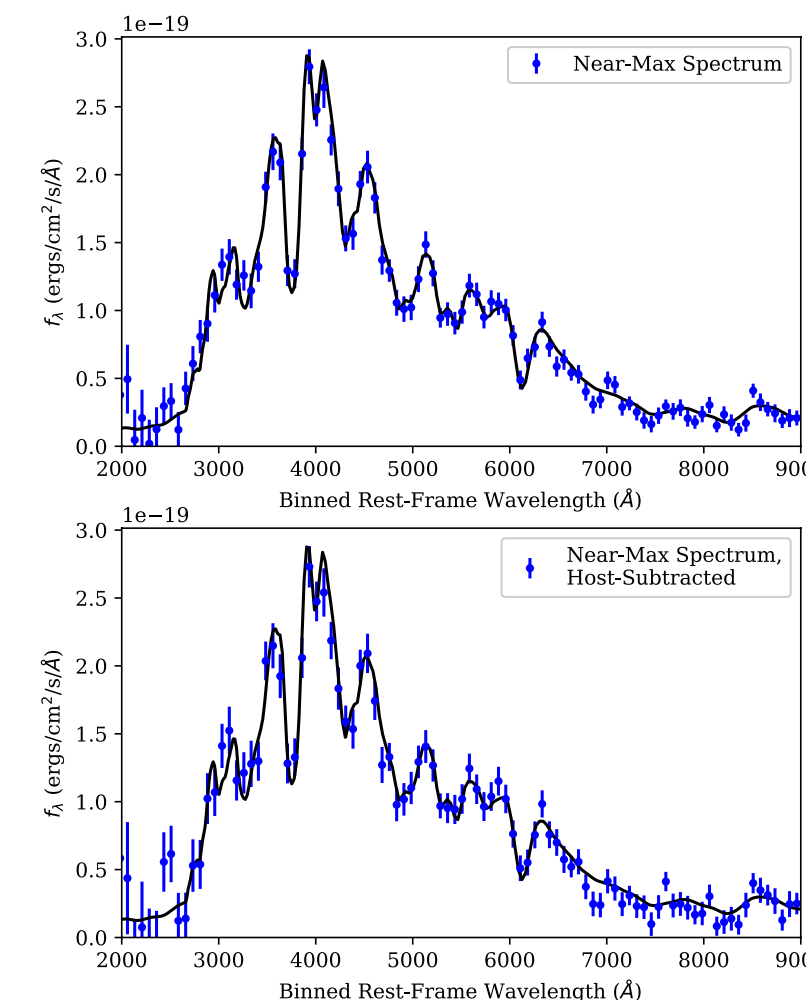


With just 1/3 of the total SN survey time, ~3,000 LSST SNe can be observed with the IFC, with ~9,000 in F184 imaging. These complement a higher-redshift WFIRST-only tier.

Spectrophotometry Simulations

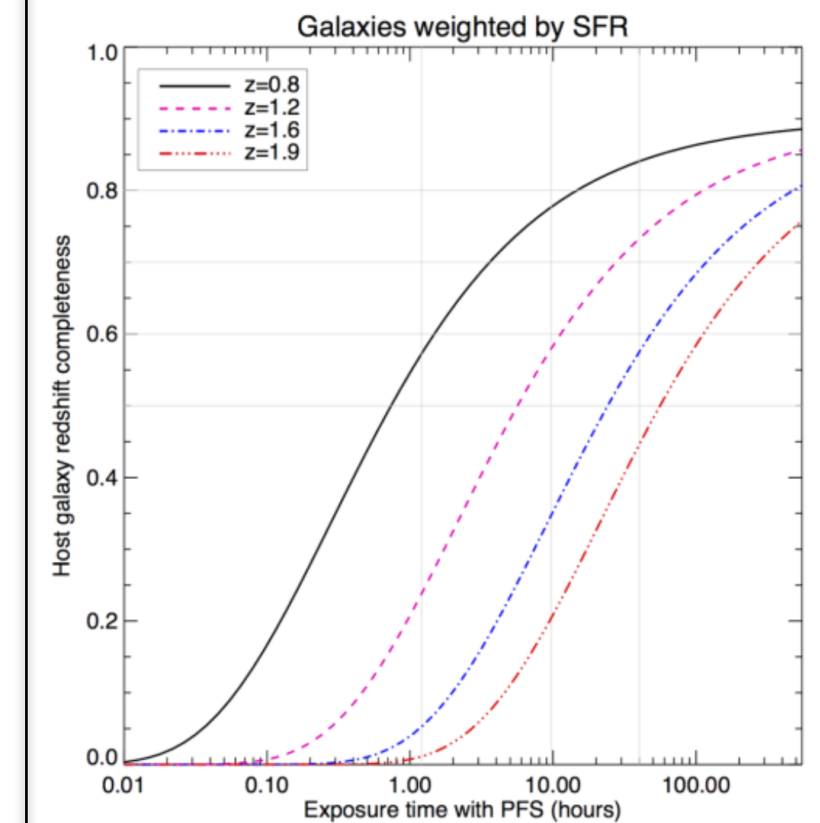


We have demonstrated excellent host-galaxy modeling and subtraction in 3D using a novel forward-model approach.



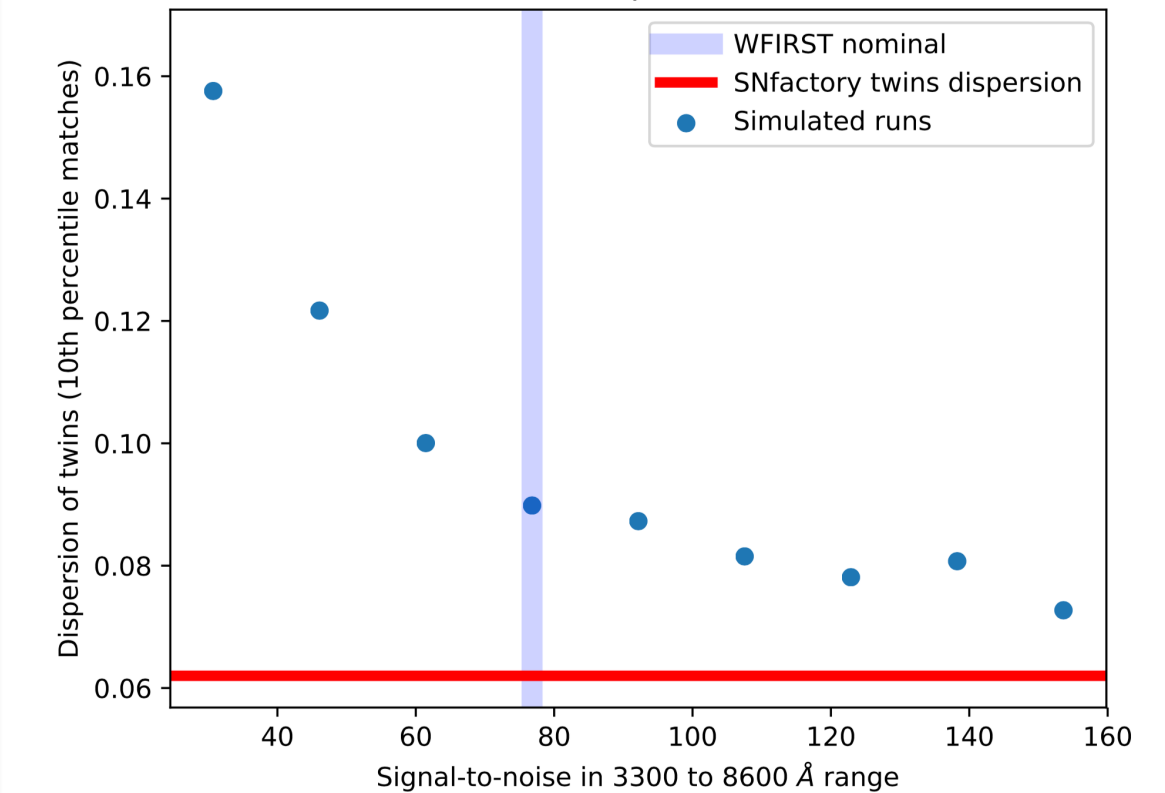
In 45 minutes, the IFC can take a high S/N spectrum of a z = 1.2 SN Ia. If desired, SN-free references can be taken at a later date.

IFC SN Cosmology Applications



Even with nights of time per pointing, some host galaxies will be out of reach for Subaru PFS. The IFC can target SNe that would otherwise not have redshifts.

Simulated twins dispersion with WFIRST



The IFC spectra would be capable of controlling SN population drift by matching against nearby SNe ("twins"). This enables a lower Hubble diagram dispersion and likely lower systematic uncertainties.