Total time required (in years of dark nights) for the baseline photometric redshift survey from Newman et al. 2015 on various telescopes/instruments

Instrument / Telescope	Collecting Area (sq. m)	Field area (sq. arcmin)	Multiplex	Total time (dark-years)
4MOST	10.7	14,400	1,400	5.4
Mayall 4m / DESI	11.4	25,500	5,000	5.1
WHT / WEAVE	13.0	11,300	1,000	6.0
Subaru / PFS	53.0	4,500	2,400	1.1
VLT / MOONS	58.2	500	500	2.7
Keck / DEIMOS	76.0	54	150	6.8
Keck / FOBOS	76.0	314	1,800	0.8
ESO SpecTel	87.9	17,676	3,333	0.7
MSE	97.6	6,359	3,249	0.6
GMT/MANIFEST + GMACS	368.0	314	420	0.5
TMT / WFOS	655.0	25	100	1.2
E-ELT / Mosaic Optical	978.0	39	200	0.5
E-ELT / MOSAIC NIR	978.0	46	100	+ 0.8

Updated from Newman et al. 2015, *Spectroscopic Needs for Imaging Dark Energy Experiments*. See following slides for details.

For E-ELT, both optical + NIR settings are required to meet required wavelength coverage.

Basic requirements for LSST photometric redshift training surveys were estimated in Newman et al. 2015, *Spectroscopic Needs for Imaging Dark Energy Experiments*

- **Sensitive spectroscopy of ~20-30,000 faint objects (to *i*=25.3 for LSST)**

  - Requires a combination of large aperture and long exposure times: to reach the S/N at which DEEP2 had 75% redshift success in 1 hour at *i*=22.5, but at *i*=25.3 instead, requires the equivalent of 175 hours' exposure time on Keck/DEIMOS

- **High multiplexing**

  - Needed to get large numbers of spectra

- **Coverage of full ground-based spectral window**

  - Minimum: 0.37-1 micron, 0.35-1.3 microns preferred

- **Significant resolution ($R=\lambda/\Delta\lambda>\sim4000$) at red end of spectra**

  - Allows secure redshifts from [OII] 3727 Å line at z>1

- **Field diameters > ~20 arcmin**

  - Need to span several correlation lengths for accurate clustering

- **Many fields, >~15**

  - To mitigate sample/cosmic variance

- **Ideally, a Southern hemisphere site**

  - To enable sampling across the LSST (or WFIRST) footprint

Assumptions made for survey time calculations

- **Time requirements are given in years' worth of dark nights (365 dark nights = 1 dark-year). All open-shutter time is assumed to be dark time, as this will generally be required to detect rest-UV features at faint magnitudes, an important factor at *z*≳1.5.**
- **Average losses of time due to instrumental effects, weather and overheads are assumed to be one-third in total. Dark nights are assumed to average 8 hours of total observation time each (so 5 1/3 hours after overheads + weather) to account for somewhat-grey nights with partial moon.**
- **All instrumental efficiencies are assumed to be identical; differences between instruments in seeing/image quality and fiber/slitlet size are ignored.**
- **An equivalent number of photons will yield equal noise (so that exposure time required to reach a given S/N varies inversely with aperture area)**
- **Only medium-resolution fibers are included in calculations (e.g., for MSE)**
- **Full spectral range can be covered simultaneously (likely not true for E-ELT, for which the separate breakdown per instrument is given).**
- **15 fields assumed to be the minimum required regardless of field of view. In practice, ~10 fields with >1 sq. deg. FoV would offer comparable or better sample/cosmic variance as the baseline survey and still allow acceptable characterization of field-to-field variations (5-6 fields would fail that requirement due to instability of standard deviations at small N).**
- **These effects could easily lead to a factor of two variations about these estimates.**
- **For details see Newman et al. 2015, *Spectroscopic Needs for Imaging Dark Energy Experiments,*** https://ui.adsabs.harvard.edu/#abs/2015APh....63...81N/abstract