4MOST High-Res add-on Science
4MOST add-on surveys: The High-Res fibers

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4MOST add-on surveys

• 4MOST offers unique opportunities to do samples with $10^3$-$10^5$ objects at little or even no cost to the main surveys!

• The current DRS drive the design of the instrument, but there will be opportunities to propose more science before the actual start of the survey(s) – for the consortium and for the community!
Available HR fibers

- HR fiber number needed to address main 4MOST science case and choice of positioner (driven by fiber quantity and sky area coverage filling factor)
- Nevertheless, many fibers unallocated for current design reference surveys, in particular in halo / extragalactic sky
- Ideal opportunity for community surveys (big or small) and consortium internal add-on surveys.
Available HR fibers

4MOST Unassigned Fibers Map
Tele=VISTA Positioner='Echidna-like' Geodesic-N_pnts=10892, FOV=4.059deg², 5 year survey

3950 – 4565 && 5870 – 6730    R=20000
4MOST High-Res add-on Science
Brainstorm over topics

• Solving the Hii region metallicity problem
• The kinematics of the central kpc

• I have no idea about galactic surveys with stars fainter than 16
• Disk-halo interaction
• Lyman alpha forest (although best in LR?)
• An integral field-like survey of M31 (would take 5 years, but would give the entire galaxy plus halo!)
• Add yours here... !!!!
The abundance problem

Real correlation

Predicted correlation from strong line calibrations

Credit: Sanchez et al., 2012
Solving the abundance problem

• ISM metallicities are measured from
  – Weak lines („accurate“, difficult observationally)
  – Strong lines („approximate“, easy observationally)

• Key are the weak lines, OIII 4363 (or NII 5755 or SIII 6312) for Te measurements

• Add-on survey idea:
  – target HII (or even all EL?) regions in background galaxies
  – 5*20 HR (4363) and 1*20 LR (all ELs)
  – 10 km/s intrinsic width is well matched to 15 km/s spectro width
ISM abundances, feasibility

• Line intrinsically narrow (10km/s), HR helps with line sensitivity!

• Compared to SDSS:
  – 4 times more collecting area
  – 10 times better resolution
  – But fiber area about a third
  – Order of magnitude better line sensitivity (~~~~~~3e-18 erg/cm^2/s)

• 12 galaxies per sqdeg out to distances OK for HII regions selection (within volume where 1“<1kpc) -> ~10^5 HII regions
Nuclear spiral

Credits: van de Ven, VLT, HST
Kinematics in the central kpc

- All current surveys have fibers >1“
- Cannot resolve the kinematics in central kpc for large samples spatially
- But could resolve spectrally
  - Gaussian: dispersion supported
  - Double horn: disk
  - Structured: clumpy and chaotic
- Add-on survey idea:
  - Target galaxy centers of all types
  - Make it complementary to on-going IFU surveys (SAMI, MaNGA)
Kinematics feasibility

• Again, 12 useful galaxies per sqdeg -> 10^5 galaxies sample

• Compare to SDSS:
  – 4 times larger collecting area
  – 2.5 times the exposure time
  – ~3 times better S/N per AA
  – But fiber size difference in conjunction with galaxy SBP

• Would give a statistical answer as to what dominates the kinematics in galaxy centers, with break-down by mass, type, etc...
4MOST HR fibers summary

- 4MOST offers unique opportunities to do samples with 1e3-1e5 objects at little or even no cost to the main surveys!
- The current DRS drive the design of the instrument, but there will be opportunities to propose more science before the actual start of the survey(s).
- In particular the availability of HR fibers all over the sky cannot be over-estimated!