Summary

• Infrastructure reminder
• Current instruments: MIDI, AMBER, PIONIER
• Under test & commissioning: PRIMA
• 2nd generation instruments/infrastructure
• Prospective
Infrastructure
Infrastructure

- 4 Unit Telescopes (8m ø)
  - with Adaptive Optics (60 element curvature systems)
  - used on average 3-4 nights per month (bright time)
  - baselines: 47m to 130m

- 4 Auxiliary Telescopes (1.8m ø)
  - with tip-tilt field stabilisation at telescope
  - movable (max. 2 movements per day, daytime) on many stations (9 offered or 4 different quadruplets)
  - baselines: from 8m to 128m
  - used 50% of the time (rest = UT nights and technical time / commissioning of new systems)
Infrastructure

• 6 Delay Lines
  – range: OPD from 0 to 120m, resolution: 5nm
  – pupil relay (continuous) through Variable Curvature Mirror
  – compatible with dual-feed

• Infra-red tip-tilt sensor IRIS
  – J, H or K-band, up to 4 beams
  – fast tip-tilt guiding

• 3 telescope fringe tracker FINITO
  – H-band, used with AMBER

• Alignment tools (pupil viewer, calibration source….)
Current Instruments: AMBER

- Bands: (J) H and K (1.5 to 2.5µm)
- Spectral resolution: up to 12000 – Spatial res.: 3mas
- 3 telescopes => phase closure => some imaging
- Limiting magnitudes:
  - low resolution =>
    \( H_{\text{corr}}, K_{\text{corr}} = 8.0 \) (UT)
    and 5.5 (AT)
  - high resolution =>
    \( K_{\text{corr}} = 6.5 \) (UT)
    and 5 (AT) with fringe tracking
Current instruments: MIDI

- Band: N (8-13\(\mu\)m)
- Spectral resolution: 30 or 230 – Spatial res. = 15mas
- 2 telescopes => squared visibilities + differential phase (as a function of the wavelength)
- Limiting magnitudes:
  - high-sensitivity mode (prism) => N=4 =1Jy (UT) and N=0.74 =20Jy (AT)
  - correlated flux mode => N=5.7 =0.2Jy (UT)
  - with FSU fringe tracker => UT sensitivity on AT
Current instrument: PIONIER

- Band: H (1.5-1.8 μm)
- Low spectral resolution (up to R~ 40)
- 4 telescopes – 6 baselines
- lim. mag. H>7
- Visitor instrument
PRIMA (1/2)

- Three components projects:
  - Narrow-angle astrometry (ExoP)
  - Off-axis fringe tracking for MIDI and AMBER
  - Phase-referencing for MIDI and AMBER

- Narrow-angle astrometry achieved 160 uas in Oct. 2013
  - x20 improvement over fall 2011 (improved baseline configuration)
  - Short of the 20 uas goal

- PRIMA project review held in January 2014
  - Reaching 20 uas should be possible, but with risk, significant resources, and delays (+3 yrs).
  - ExoP science case threatened by GAIA: transformational to niche.

- ESO management proposal to governing bodies: cancellation, focus on GRAVITY and MATISSE
PRIMA (2/2)

• Instrumental operation legacy
  – Distributed and real-time data recording infrastructure
  – Dual interferometry

• Instrumental performance legacy
  – Baseline stability for narrow angle astrometry
    • Benefits GRAVITY-Astrometry
  – Impact of polarization on stellar/metrology (2012/2013)
    • Wollaston on PIONIER/AMBER, STS derotator, AT/UT hybrid
  – Strehl fluctuations and fringe tracking
    • New views on UT performance
2\textsuperscript{nd} generation instruments

- **GRAVITY (2015)** in testing phase
  - 2 to 2.5 μm (K-band), R= 22 to 4000
  - IR WFS at UT coudé
  - 4 telescopes simultaneously
  - high-accuracy astrometry (30μas) and faint imaging (K>15)
  - Galactic Center, AGNs, stellar environment & dynamics…

- **MATISSE (2016)** under manufacturing
  - 3 to 13 μm (L, M & N-bands), R= 30 to 1000
  - 4 telescopes simultaneously
  - imaging
  - star & planet formation (dust), evolved stars, AGNs, minor solar system bodies, Galactic center, extra-solar planets …
Infrastructure for 2\textsuperscript{nd} generation

• Installation of Star Separators on ATs and UTs
  – AT3 and AT4 are complete (PRIMA astrometry)
  – AT1 and AT2: take apart, modify, re-assemble.
  – UT1, UT3 partially, UT2/UT4 to be done

• Laboratory reorganization
  – Out: MIDI, PRIMA FSU
  – Move: PIONIER
  – In: GRAVITY, MATISSE
Performance for 2\textsuperscript{nd} generation

- **AT: NAOMI adaptive optics**
  - Post PDR, 4x4 SH WFS with off-the-shelf DM
  - Scheduled for operation in 2017

- **UT: MACAO, Vibrations**
  - Project under formulation
  - Expected to deploy on-axis end-to-M2 laser metrology

- **VLTI: FT for MATISSE**
  - Current option: GRAVITY as FT for MATISSE
  - Starting system analysis of the option
Prospective

- Started by VLTI program scientist with community at VLTI Community days
  - Upgrade of PIONIER (detector and high resolution)
  - High dynamic range visitor instrument
  - Visible instrument with high spectral resolution
  - Extension to 6-8 telescopes