

A general-purpose polarimeter for the E-ELT

PI: Klaus Strassmeier (AIP)

Swetlana Hubrig, Ilya Ilyin, Katja Janssen (AIP)

Nikolai Piskunov, Oleg Kochukhov (Uppsala)

Ansgar Reiners (Göttingen)

Svetlana Berdyugina (KIS, Freiburg)

Artie Hatzes (Tautenburg)

Christoph Keller (Utrecht)

Thomas Dall, Gaitee Hussain, Heidi Korhonen (ESO)

Outline

- ✦ Make you (incl. ESO) aware of:
 - ✦ The possibility for polarimetry
 - ✦ The need for polarimetry
- ✦ Conceptual (!) design
 - ✦ Scaled model of PEPSI/LBT unit...
 - ✦ ...with significant modifications
 - ✦ Industry studies
- ✦ Instrument interfacing
- ✦ Challenges & plans

From the previous presentation:

...light can be polarized owing to:

- ✦ **cyclotron or synchrotron radiation**
- ✦ **scattering by dust particles**
- ✦ **absorption by aligned, intrinsically asymmetric particles (e.g., dust)**
- ✦ **stellar magnetic fields**
- ✦ **scattering by asymmetrically distributed particles (e.g., a disk)**
- ✦ **asymmetric extinction of a symmetric source**
- ✦ **non-pointsymmetric geometry of a source**

Science cases:

- ✦ Stellar magnetic fields + coupling
- ✦ Earth-mass extrasolar planets
- ✦ Cosmic magnetic field
- ✦ Solar System studies
- ✦ Star formation, disks, jets
- ✦ Black Holes and obscured AGN

Science cases:

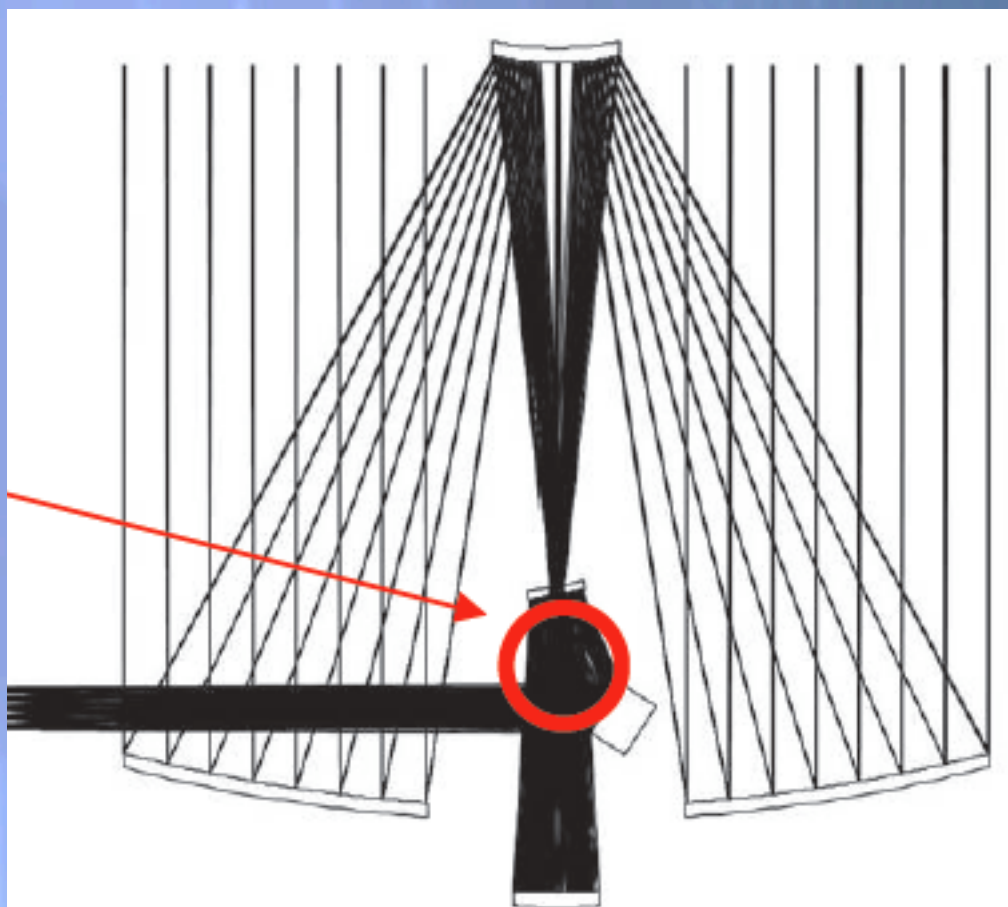
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Requirements:

- ✦ High resolution ($R \sim 100,000$)
- ✦ High stability
- ✦ High efficiency
- ✦ IR coverage (splitting $\propto \lambda^2$)
- ✦ No instrumental polarization

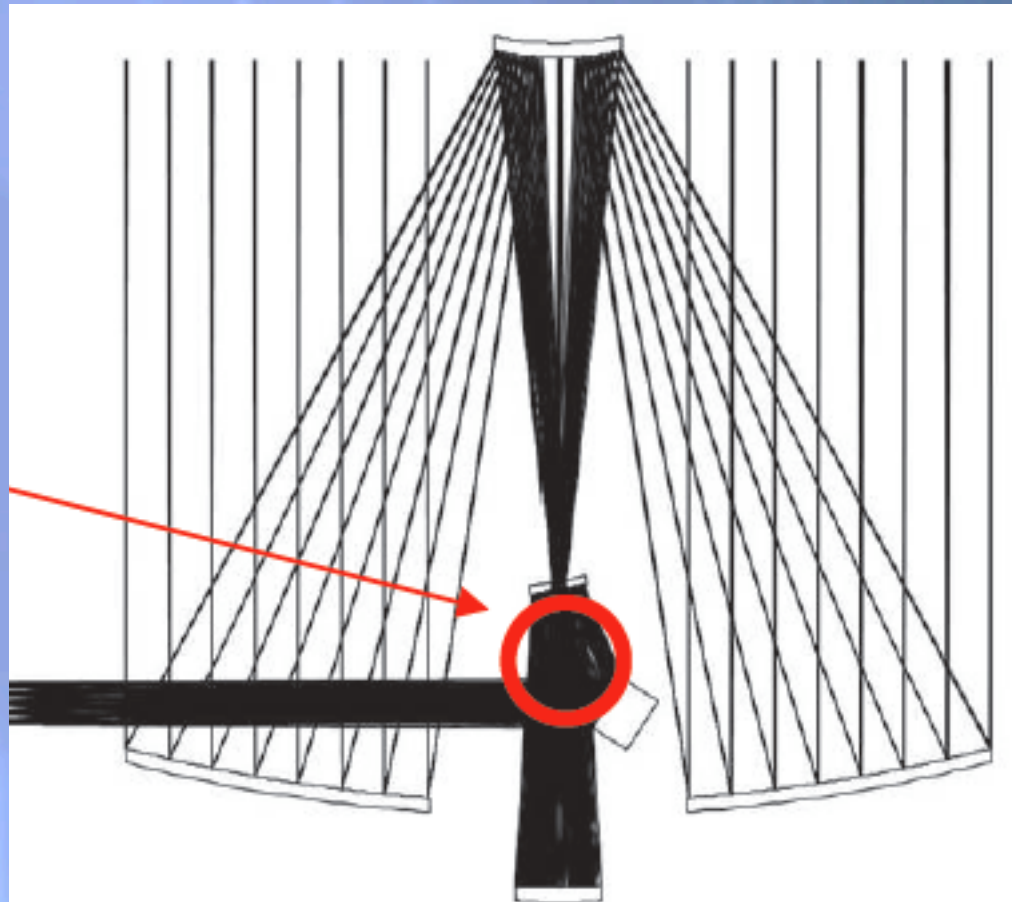
No instrumental polarization

Must be on-axis,
symmetric beam



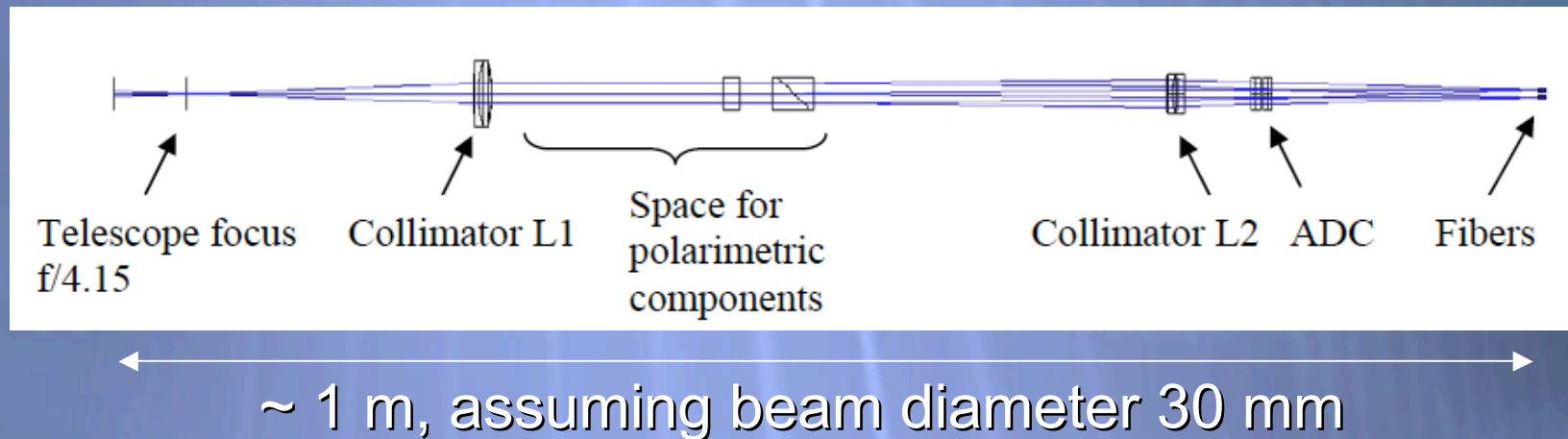
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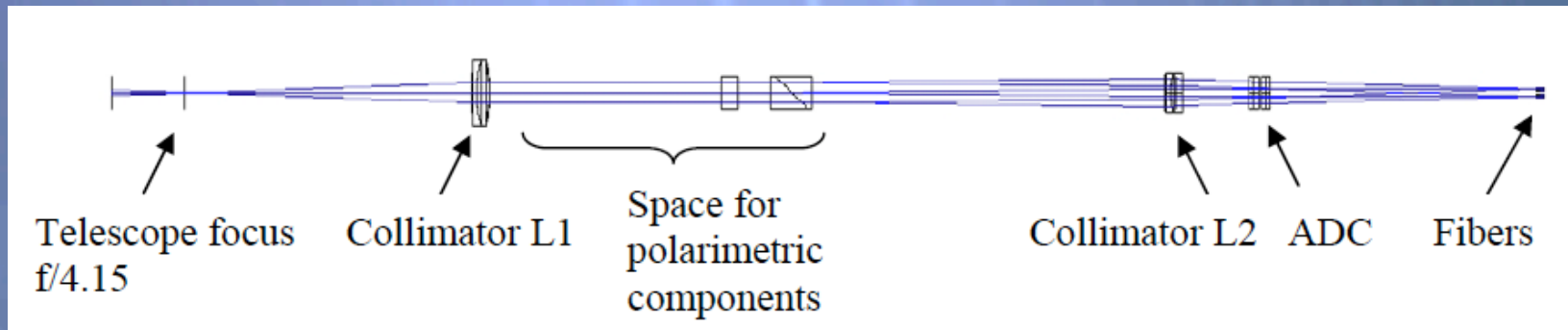
The Smart Focal Plane Polarimeter (SFPP)

SFPP: Conceptual layout



- ✦ Case A: on-axis mounted
- ✦ Case B: polarization-maintaining mono-mode fiber bundle
- ✦ Case A.a: focal extension f/4.15 to f/12

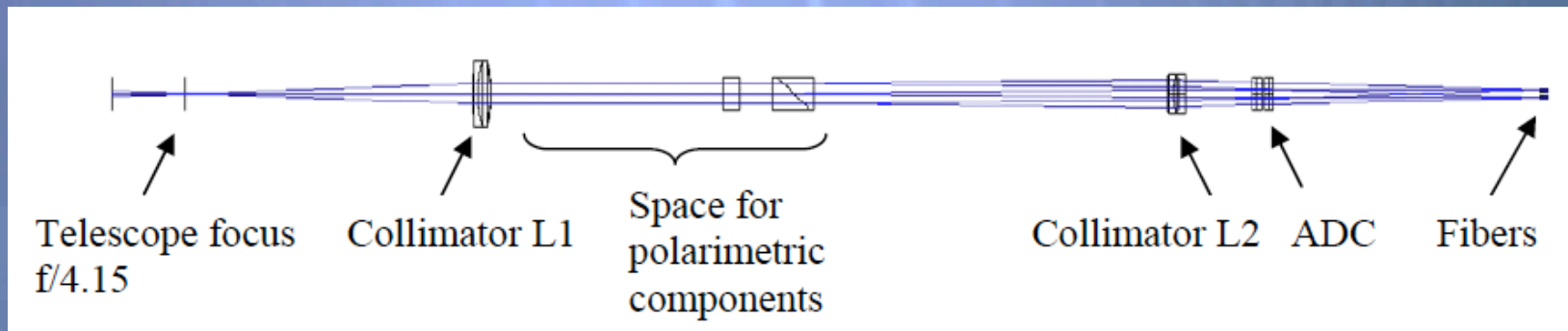
SFPP: Conceptual layout



~ 1 m, assuming beam diameter 30 mm

- ✦ Fiber injection ... (think CODEX)
- ✦ ... or re-propagation of beam
- ✦ FOV could be substantial?

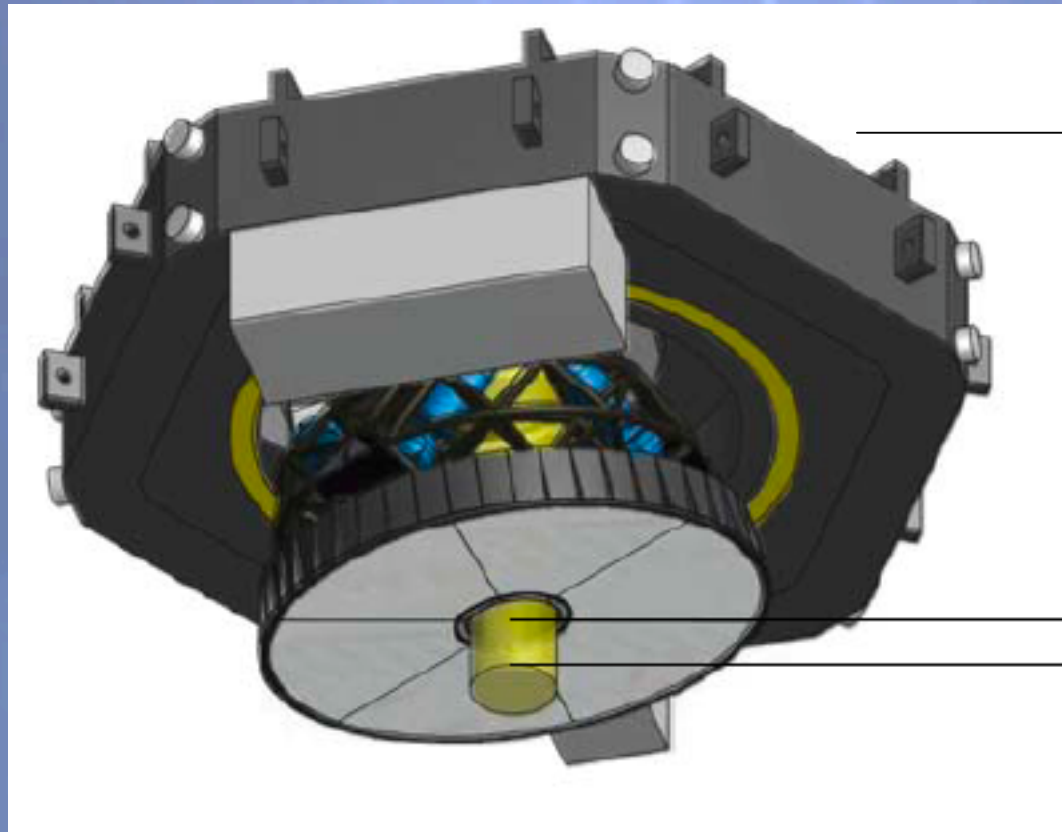
SFPP: Conceptual layout



~ 1 m, assuming beam diameter 30 mm

- ✦ Fiber bundle to preserve polarization
- ✦ Polarimeter off-axis
- ✦ Limited FOV
- ✦ ... uncertain if can be manufactured

SFPP: Conceptual layout

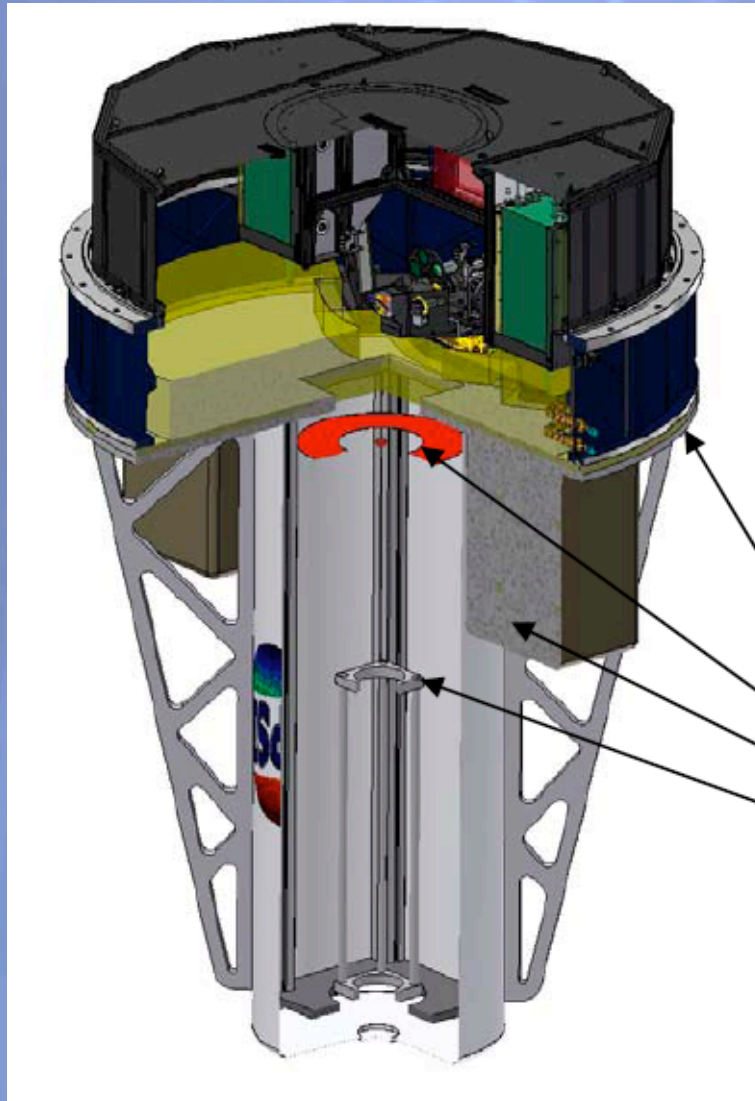


M4 unit

Location of $f/4.15$ focus

SFPP location

SFPP: Conceptual layout



Based on
PEPSI (LBT)
unit

AGW+cal unit

Location of focal plane

Electronics

Polarimeter

SFPP: Conceptual layout

✦ Problems:

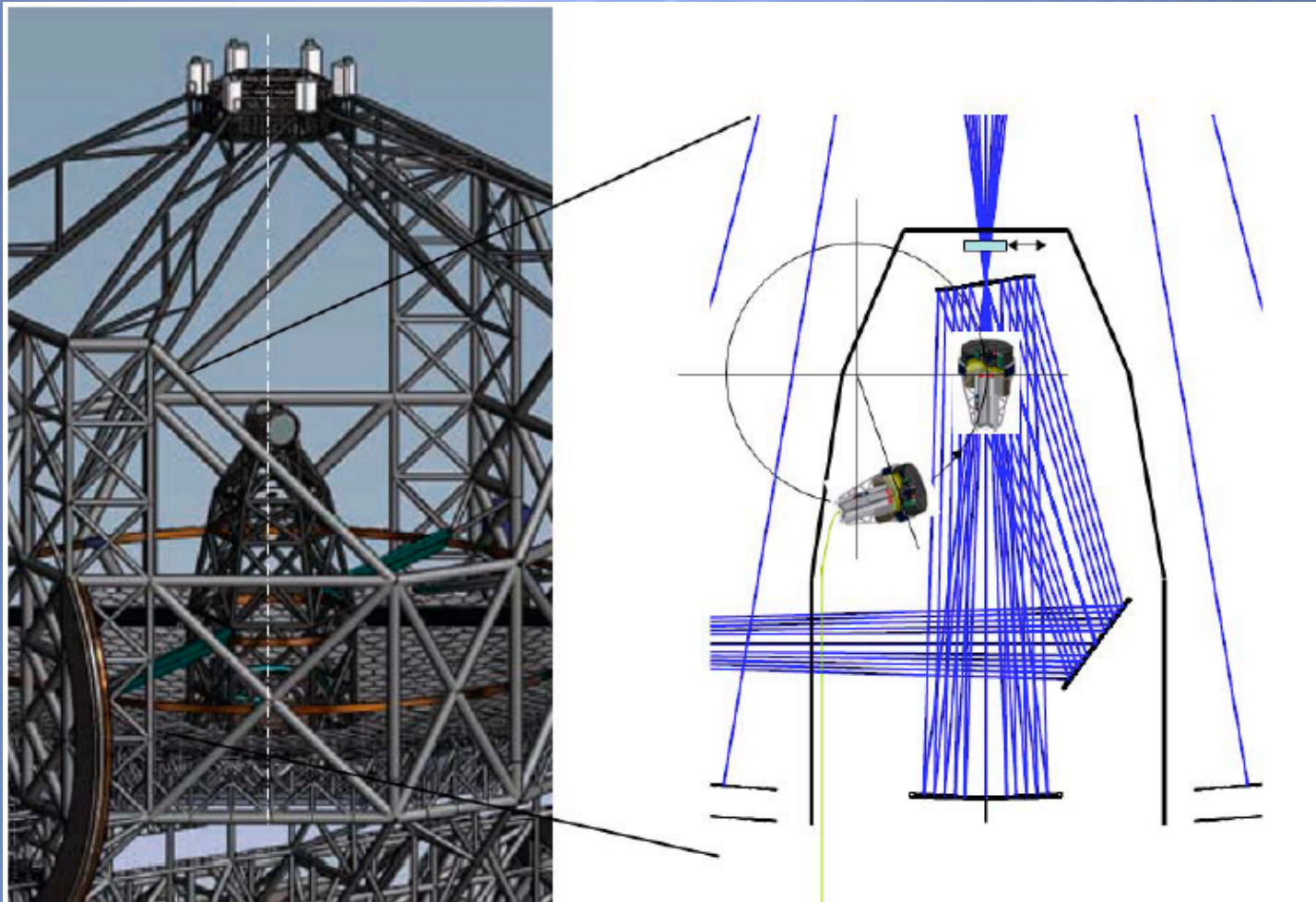
- ✦ Limited space
- ✦ Weight?

✦ Solutions:

- ✦ Change the focus - $f/4.15$ to $f/12$
- ✦ Materials, simplify,...

Case A

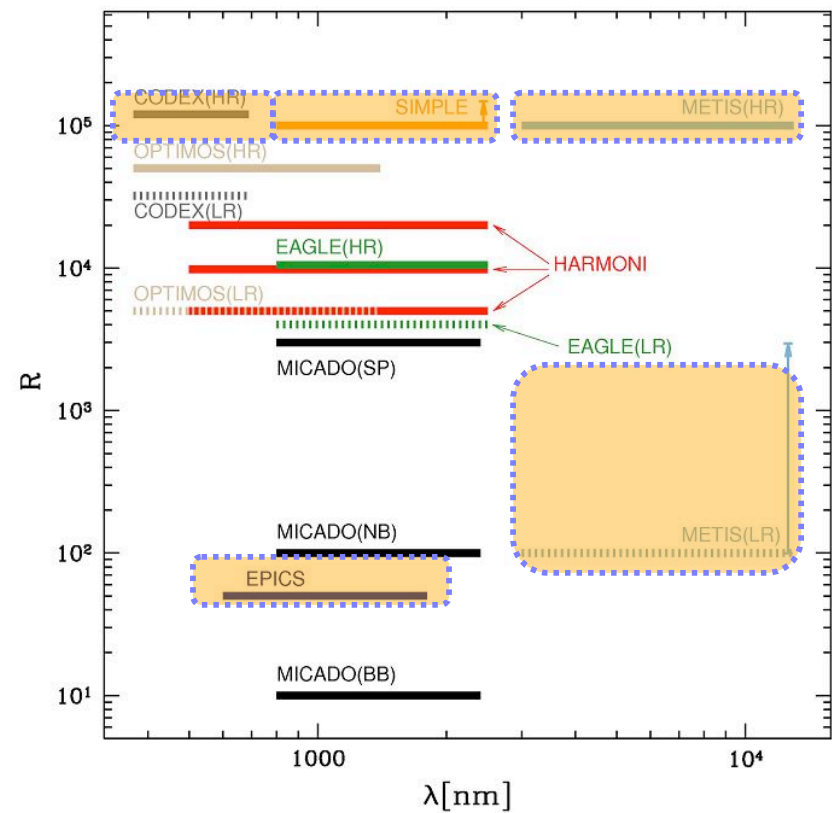
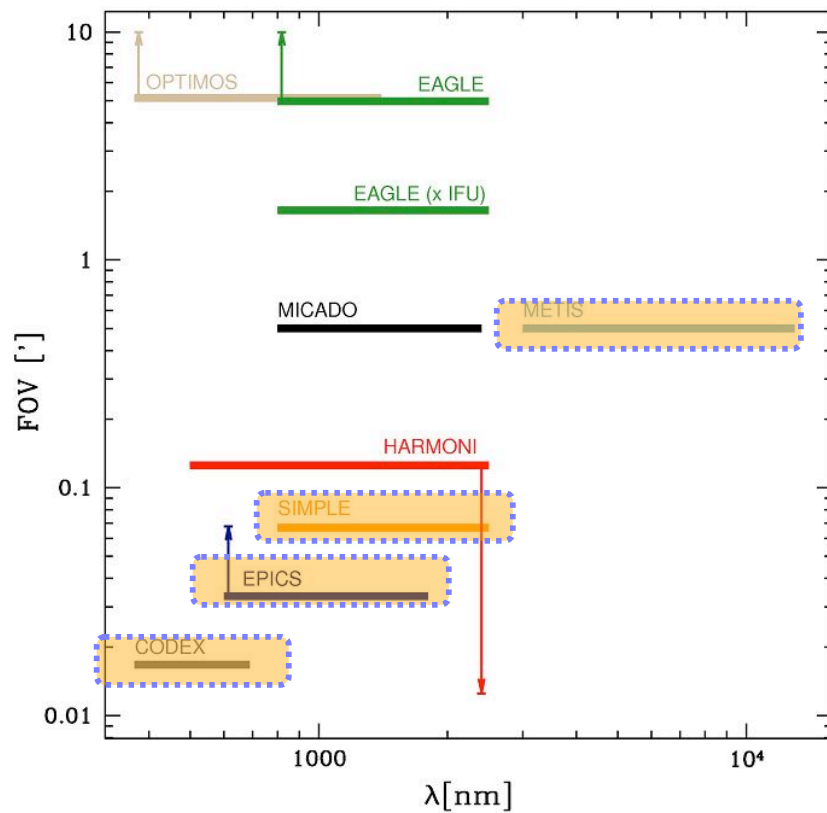
SFPP: Conceptual layout



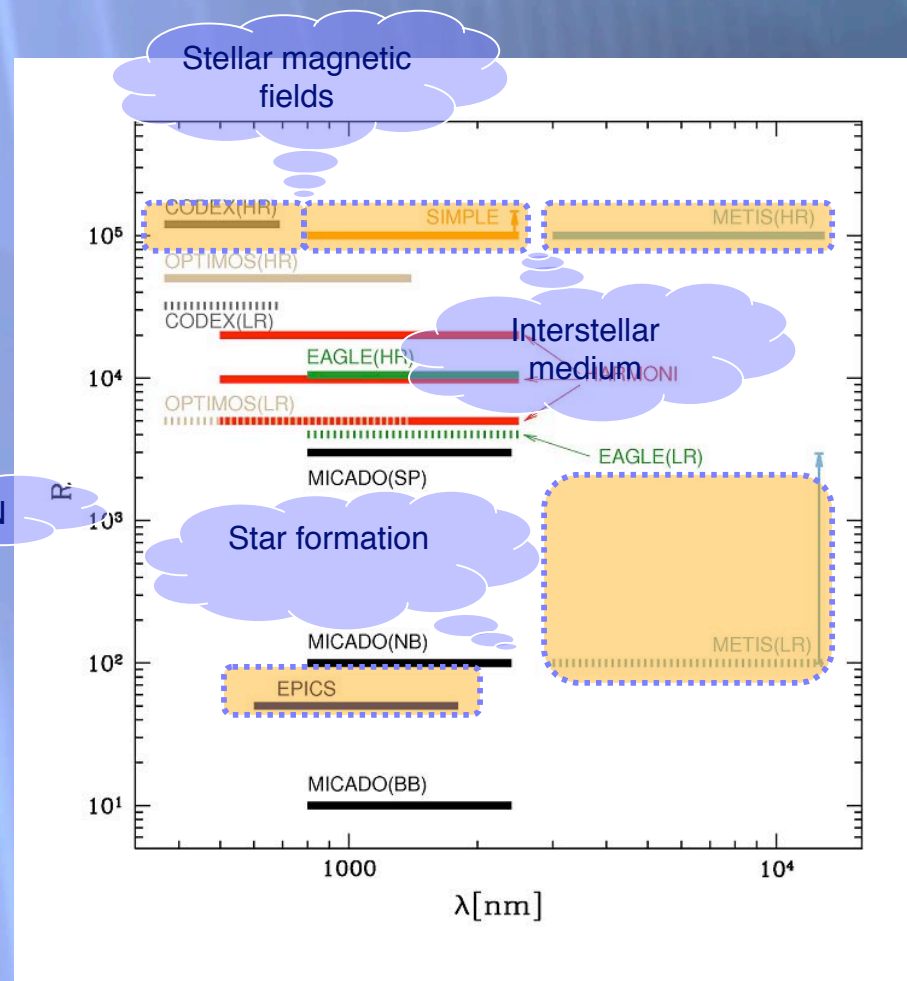
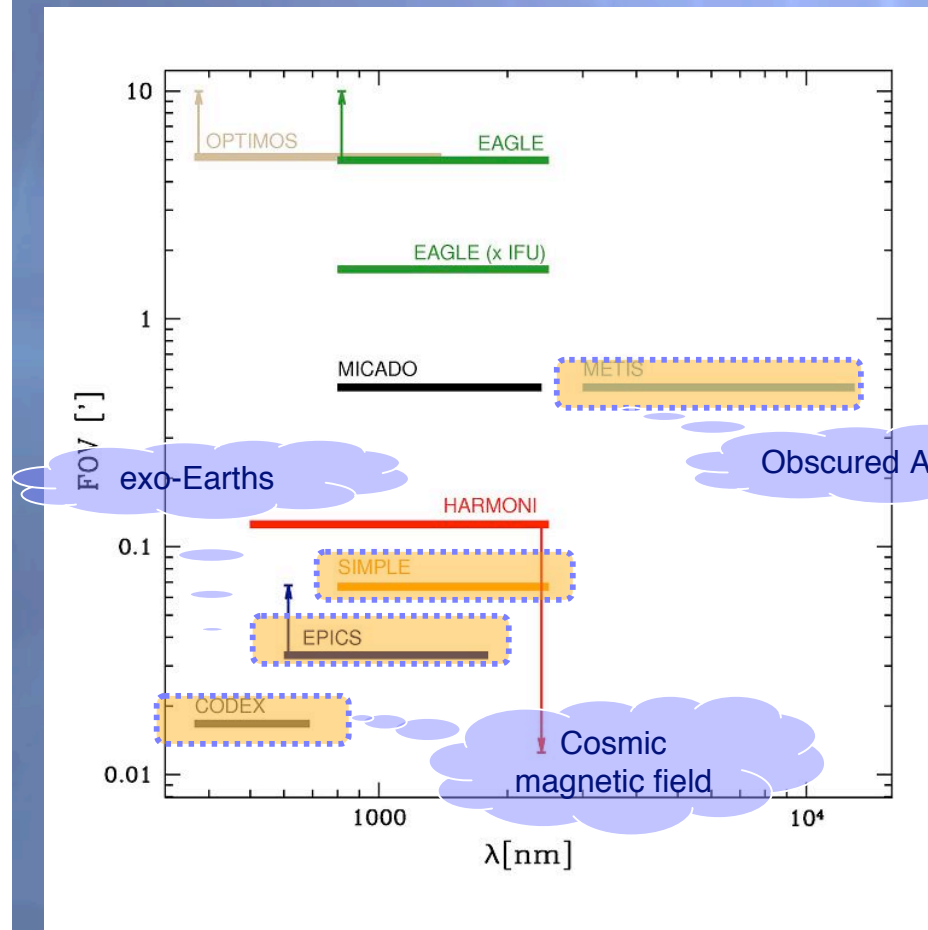
SFPP: Not just for CODEX

- ✦ CODEX ($0.37\text{-}0.69\mu$, $R > 120,000$)
- ✦ EPICS ($0.6\text{-}1.8\mu$, $R > 50$)
- ✦ SIMPLE ($0.8\text{-}2.5\mu$, $R > 100,000$)
- ✦ METIS ($3\text{-}13\mu$, $R \sim 100,000$)

SFPP: Not just for CODEX



SFPP: Not just for CODEX



Technical challenges

- ✦ Space constraints in/around M4
- ✦ Stability concerns (weight)
- ✦ Size and uniformity of polarimetric components?
- ✦ Wavelength coverage of components?
- ✦ Polarization conserving fiber bundles?

Plans & studies

- ✦ Science Requirements
- ✦ Technical Requirements

... then:

- ✦ Refined Design Study
- ✦ Industrial contracts (some already running)

Main points...

- ✦ (Spectro-)Polarimetry ...
 - ✦ ... provides great science cases
 - ✦ ... is a realistic option for E-ELT
 - ✦ ... can be an integrated facility
- ✦ So ...
 - ✦ Submit your science cases to DRSP!
(pls. reference **SFPP**)