OPTICON WP6
FP7-II Introductory Remarks

Filippo Maria Zerbi

INAF HQ &
Osservatorio di Brera

What do we promise

- Under the auspices of previous EC contracts, we have achieved important goals in transferring new technologies into the field of astronomical instrumentation. This is widely demonstrated by published papers, manufactured devices and the application of concepts into the design of current and future astronomical instruments already produced. This programme moves forward from these achievements in the framework of the new challenges such as the design and construction of the E- ELT and its instrumentation.

Quoted from the contract Annex

Architecture

- Photopol-Based VPHG Manufacturing (WP-6.2)
  - Complete the “Replacing the DCG” process, Injecting the new technology in the market, follow-up of new potential producers, accurate and reproducible simulations (Users Manual)
- VPHGs and Gratings Testing (WP-6.4)
  - Make use (and improve) what we have set-up in FP6 and FP7-I, Assess quality of product and production techniques, feed back to producers, market exploration
- Pol-Based Holo elements for Astronomy (WP 6.5)
  - Synthesis of new Chemical Species, HOE realization, Polymer (non-photo) VPHGs, continuing the productive path

Architecture

- Pol- Fibers for Astronomy and Metrology (WP 6.6)
  - Fibers for signals (spectroscopy), fibers for metrology of large structures.
- Advanced DMD based holo-techniques (WP 6.7)
  - To write HOE for instruments, to write HOE for testing tools.
- Ultra-Fast Laser Inscription of gratings (WP 6.8).
  - Low frequency, far infrared
- Advanced Ruled Gratings for Astronomy (WP 6.3)
  - revisiting the ruling process

VPHG

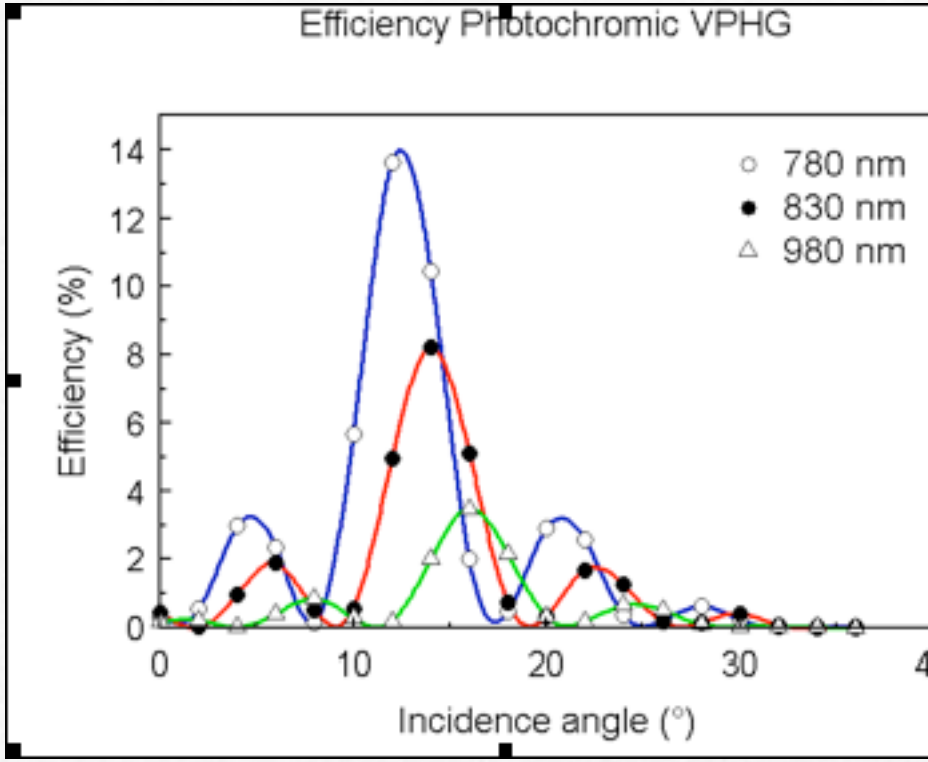
- The Delta-N
  - Polymers are good DCG replacement but they do not have the same phase contrast as DCG (only about 1/4).
  - Broad efficiency range are difficult to design and manufacture. Chemistry work is needed to increase polymer Delta-n
- The Size
  - Large size with controlled surface/WF.
  - The substrate is no longer the issue, the process still is.
- The “User Manual”
  - Make the technology so strightforward that anybody can produce gratings

Holo Elements (Ph.Po

- We have so far explored (partially) the “amplitude” properties of the Ph.Pol.HOE
  - Black-and White Lines - Laser inscripted CGH
  - Complex grey figures reproduced holographically
  - fading figures (black-grey-white) as the PDI shown yesterday
- The use of DMDs (common in anti-thief holography) is promising for complex “amplitude” HOE

Phase HOE

- We plan to explore the “Phase” Properties of the Pho.Pol in the HOE fabrication concept.
  - N changes in Phot-Pol (we manufactuer a VPHG although not efficient as we hope).
  - “Phase” HOEs are well covered in literature (less in applications).It is worth to explore this area
  - “Mixed” phase-amplitude HOEs are also promising



Color HO

- Color HOES for multi-color inteferometry
  - “Traditional” Interferometry is monochromatic. There is the idea (and some prototypes) to make multi-color interferometry (advantages in piston determination, etc....)
  - “Ruled” Amplitude CGH are either monochromatic or acromatic

Oth

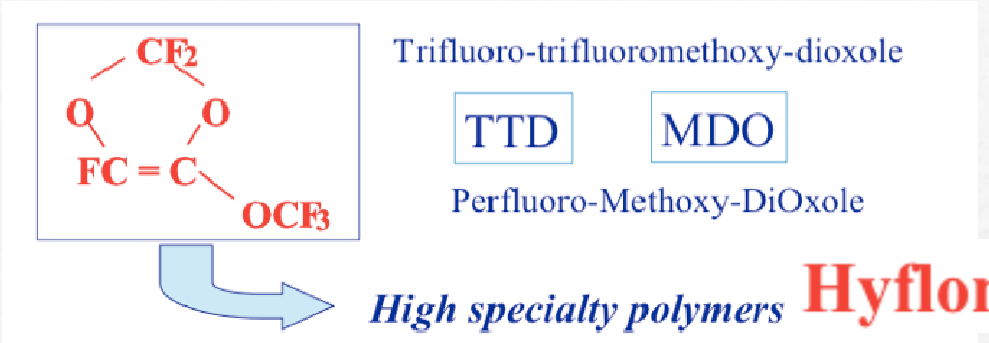
- Laser Inscription Gratings
  - ULI generates complex 3D structures in glass, including a VPHG.
  - Infrared Material, no l/mm limits
  - tilted fringes or irregular groove spacing (slanted)
- Traditional Gratings
  - Differentiate the quality, quantity and geographical location of traditional gratings rulers (newport)
  - Direct ruling, ion etching, etc.

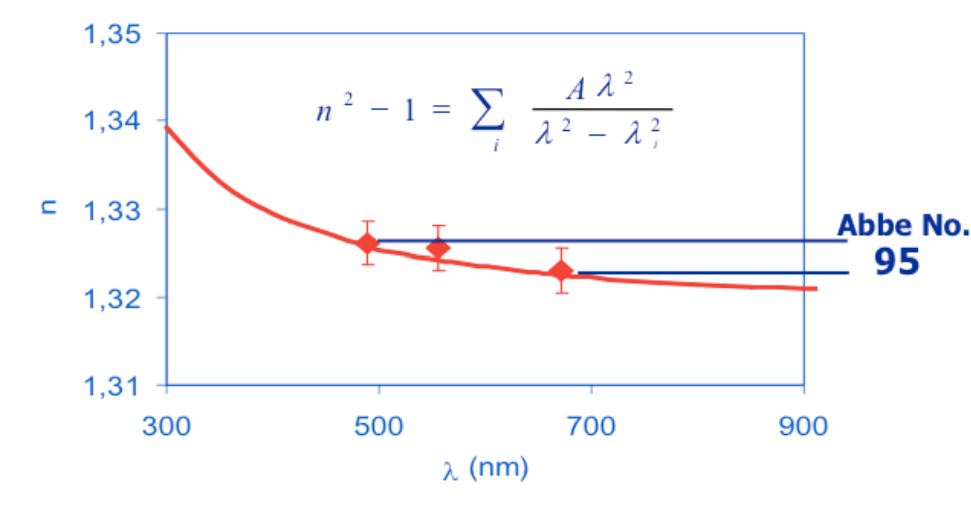
Pol. Fibers for instruments

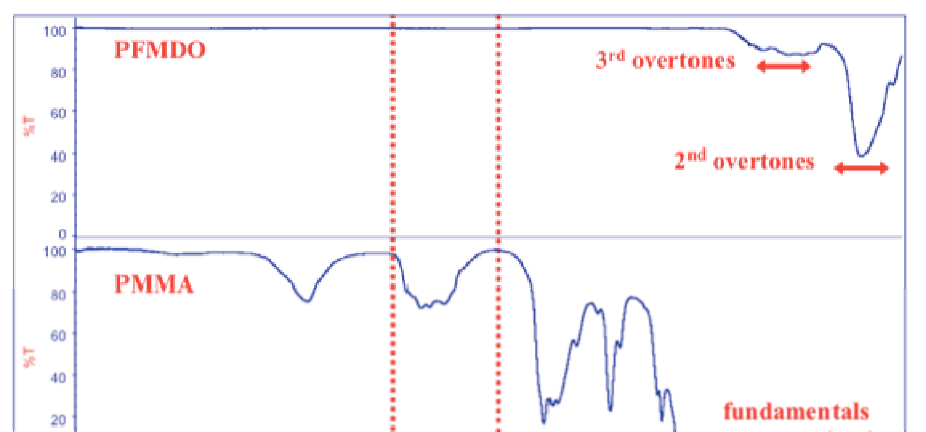
- Very good for telecon, very bad (for the moment) for Astronomical signal transmission

Pol.Fibers for metrology

- Superior stress-and-strain properties with respect to glass fiber
- Potential breakthrough in coherent and semi-coherent real-time monitoring of flexures







Tea

- INAF
  - Zerbi (Man), Bianco (VPHG), Bortoletto (FIbers)....
- POLIMI
  - Beraterelli (Chem), Zanutta (Holo),.....
- IAC
  - Garzon (VPHG), Insausti (Lab), ...
- LAM
  - Zamkotsian (DMDs), Ferrari (Gratings) ....
- STFC
  - Lee (las Ins.)

Mon

- 4 Contractors:
  - INAF, POLIMI, iAC, LAM + LAM2, STFC
- 560 K /4= 140 ----> 140/4= 35 K/yr per partner
- Support for consumables, travels and very minor equipment… close to the limit to justify the accounting and auditing mess it comes along with.
- There is <u>NO</u> room for reduction and limited room for re-distribution.