# STATUS OF THE MAGIC TELESCOPE

Eckart Lorenz (MPI-Munich), for the MAGIC collaboration

## OVERVIEW

* SOME BASIC MAGIC PARAMETERS
* THE PHYSICS GOALS
* TECHNICAL ELEMENTS
* THE CURRENT STATUS OF THE CONSTRUCTION
* SUMMARY

## The MAGIC Collaboration (14 INSTITUTIONS, 74 PHYSICISTS)

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Ashot Chilingarian

# THE MAGIC TELESCOPE

(Major Atmospheric Gamma Imaging Cherenkov Telescope)

A NEW TECHNOLOGY GROUND-BASED 17 m DIAMETER IMAGING TELESCOPE

LOCATED ON LA PALMA 28.8° N, 17.8° W, 2225 m asl (at old HEGRA site)

LOW THRESHOLD: 30 GeV (phase I, classical pmts)
12-15 GeV (phase II, high QE pmt)

First of a multitelescope system (see talk R. Mirzoyan: MAGIC II)

# Brief history of the project

- Summer 1994: 1st feasibility discussions
- 1995: 1st presentations at conferences
- 1995-98: major R&D, at the end proposal
- 1996-98: several int. review committees
- 1997-99: formation of a collaboration
- FALL 2000: funding
- Early 2001: start production
- 2002: construction, assembly & 1st tests

## NOVEL COMPONENTS

* LOW WEIGHT CF SPACE FRAME CONSTRUCTION, 5 TONS OK

* LIGHT WEIGHT ALL-ALU MIRRORS, DIAMOND TURNED, INTERNAL HEATING OK

* ACTIVE MIRROR CONTROL, FULL TEST STILL MISSING (OK)

* HEMISPHERICAL PMTS WITH 6 STAGES, IMPROVED QE OK

* FAST PMT SIGNAL TRANSMISSION IN ANALOG MODE BY OPTICAL FIBERS
  WORKS, BUT MORE DIFFICULT THAN ANTICIPATED
  DYN. RANGE 60 dB
  BW: 230 MHZ

* 300 MHZ F-ADC WITH HIGH, LOW RANGE SWITCHING, IN PRODUCTION

* 3 LEVEL TRIGGER: STILL SOME DEVELOPMENT OF THE 2. LEVEL TRIGGER

* ≈ 1 KHZ DATA RATE, PROOF STILL MISSING

## THE MIRROR

17 m DIAMETER, 234 m**2

TESSALETED, PARABOLIC PROFILE

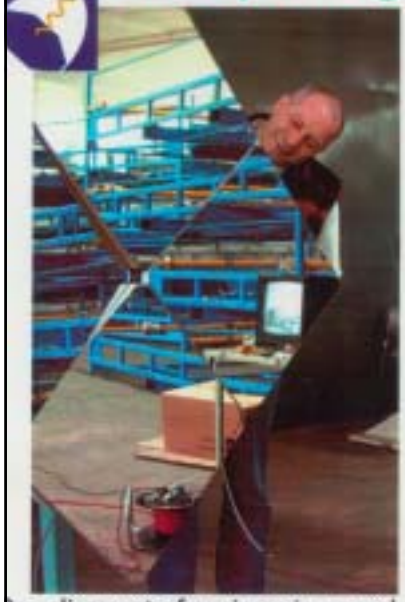
934 SMALL MIRRORS 49.5x 49.5 cm,

All raw blanks made,

700 mirrrors diamond turned

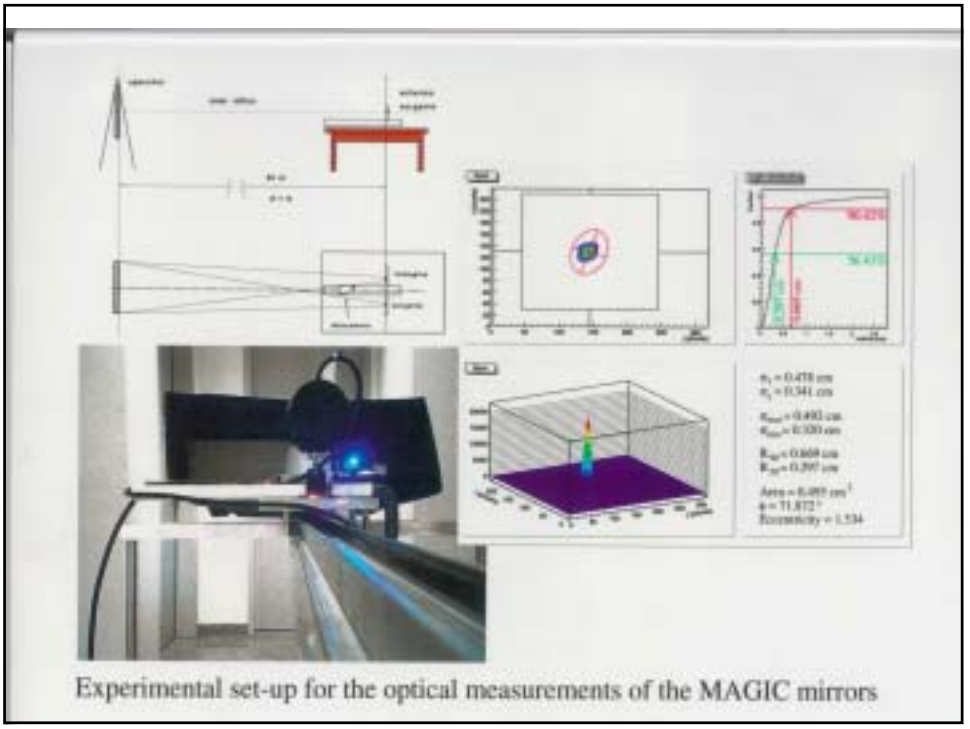
45 m** 2 installed -> 100 m**2 in October

## Panel pre-alignment



Pre-alignment of a mirror in a panel

Panel in the alignment tripod



Experimental set-up for the optical measurements of the MAGIC mirrors

## MIRRORS

Zur Anzeige wird der QuickTime™ Dekompressor “Foto - JPEG” benötigt.

TEST SURFACE ROUGHNESS OF DIAMOND TURNED MIRRORS

Zur Anzeige wird der QuickTime™ Dekompressor “Foto - JPEG” benötigt.



## CAMERA IMPROVEMENTS

(4° DIAMETER :394 PIXELS 0.1°, 180 PIXELS 0.2°
6 DYNODE , HEMISPHERICAL CATHODE PMTS,
GAIN≈ 2X10**4 + FAST PREAMP -> OPERATION DURING MOONSHINE POSSIBLE)

SPECIAL GEOMETRY WINSTON CONES IN CENTRAL REGION: OFTEN PHOTON TRAJECTORY PASSES 2x CATHODE

SPECIAL TREATMENT OF CATHODE WINDOW WITH LAQUER LOADED WITH WLS, FROSTED SURFACE
-> QE INCREASE BY 20-30 %

NEXT: LINING WINSTON CONES WITH 98% REFLECTIVITY FOIL
-> GAIN ≈ 13-20%

CAMERA TO TELESCOPE IN OCT/NOV

**A METHOD TO INCREAS E THE QE:COAT WINDOW WITH A LAQUER LOADED WITH WLS AND USING A FAST EVAPORATING SOLVENT -> FORMS FROSTED WINDOW SURFACE LAYER**

Zur Anzeige wird der QuickTime™ Dekompressor "Foto - JPEG" benötigt.

CAMERA

Zur Anzeige wird der QuickTime™ Dekompressor "Foto - JPEG" benötigt.

CAMERA

Zur Anzeige wird der QuickTime™ Dekompressor "Foto - JPEG" benötigt.

CAMERA

## A NEW LINING MATERIAL FOR THE WINSTON CONES: DIELECTRIC MIRROR FOIL FROM 3 M, STILL EXPERIMENTAL PRODUCTION

**MAGIC USES OPTICAL FIBERS FOR THE ANALOG SIGNAL TRANSFER FROM CAMERA PMTS TO THE 100 M AWAY COUNTING HOUSE**

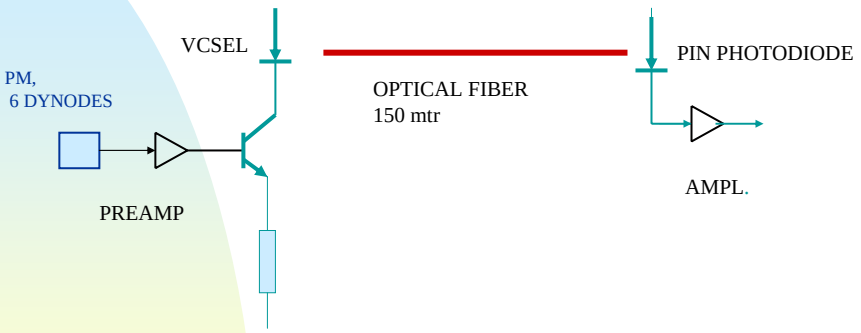
**PROS: LOW WEIGHT OF CAMERA (OSCILLATIONS REDUCED)**
**REDUCED ELECTRONICS IN CAMERA -> LESS DOWNTIME DUE TO DEFECTS**
**LOW POWER CONSUMPTION IN CAMERA**
**EASIER TO MODIFY ELECTRONICS (TRIGGER…)**
**EASIER TO IMPLEMENT TRIGGER FOR MULTITELESCOPESYSTEM**

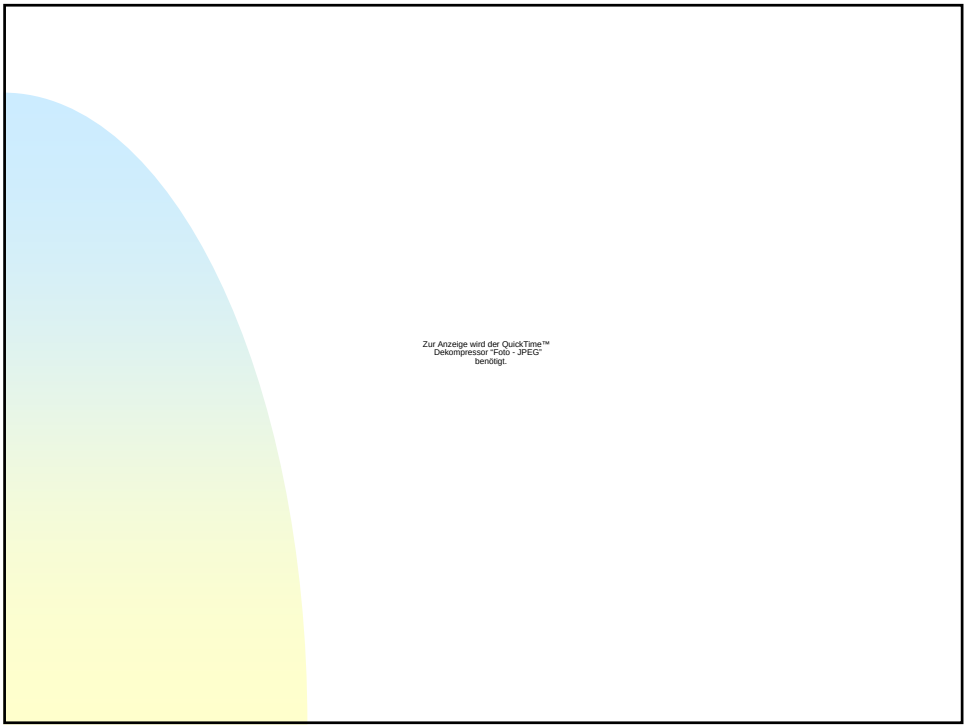
**CONS: NEW PRINCIPLE, NO EXPERIENCE**
**EXTRA COSTS**

USE OF VCSELS AS LIGHT EMITTER (CAN DRIVE TO 200 MA PULSE CURRENT FOR LOW DUTY CYCLE.
HIGH BANDWIDTH (> 1 GHZ POSSIBLE, NOW 230 MHZ BW)
NO ATTENUATION OVER 165 M LENGTH

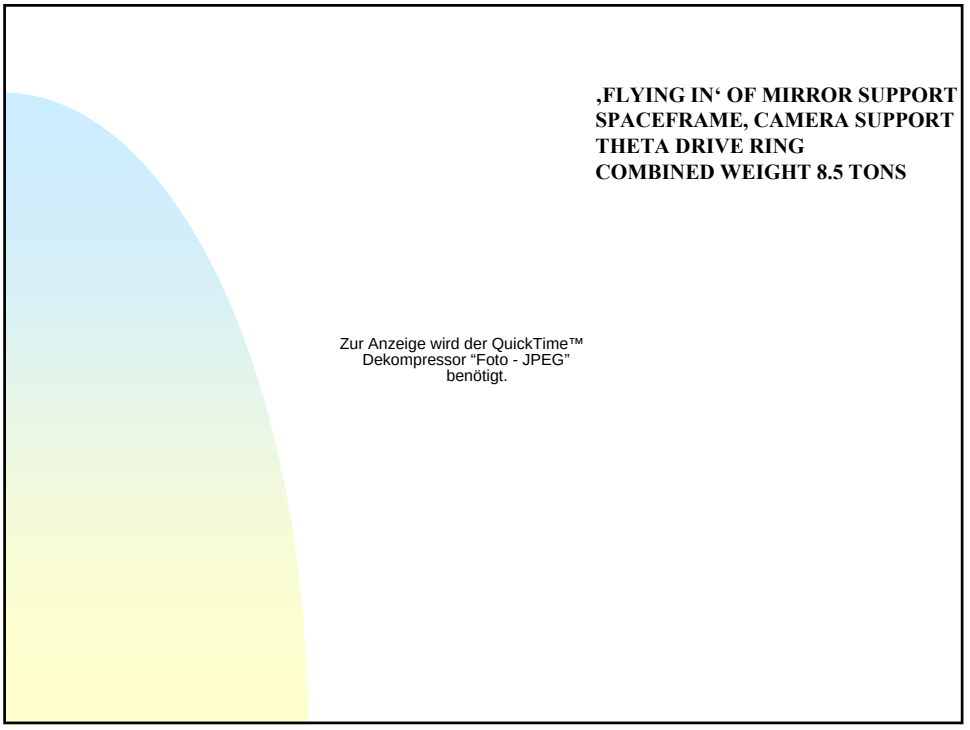
**PROBLEM AT THE BEFGINNING: WE WERE TOO ABITIOUS ABOUT DYN RANGE: 72 dB TRIED BUT OSCILLATIONS AND INSTABILITY FOR SMALL SIGNALS**
**SOLUTION: SELECT VCSELS**
**BW 230 Mhz**
**INCREASE INPUT GAIN x4 -> DYNAMIC GAIN ≈ 1000**

## FAST PM SIGNAL TRANSMISSION BY OPTICAL FIBER SYSTEM WORKING IN ANALOG MODE






**‚FLYING IN' OF MIRROR SUPPORT SPACEFRAME, CAMERA SUPPORT THETA DRIVE RING COMBINED WEIGHT 8.5 TONS**



THE TELESCOPE FRAME BEFORE THE MIRROR INSTALLATION

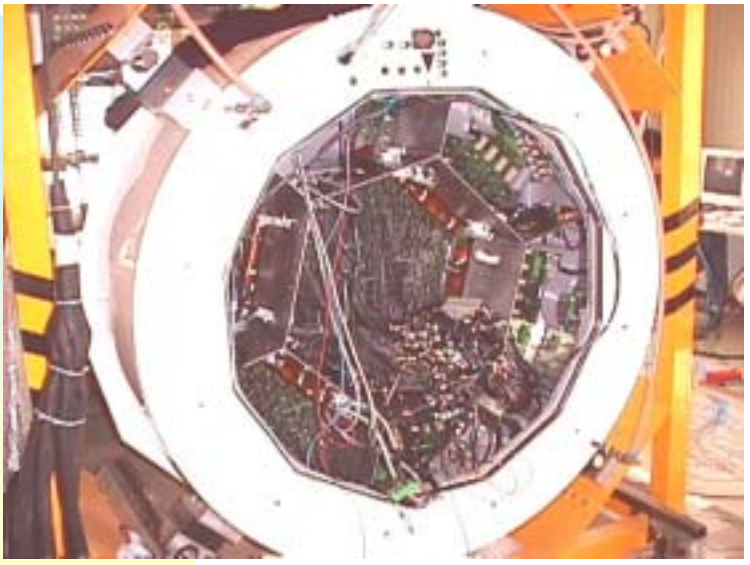
## INSTALLATION OF MIRROR PANELS

## THETA DRIVE INSTALLATION

PHOTOGRAPH OF CAMEREA, PMT SIDE, WITHOUT WINSTON CONE PLATE

## Camera in temporary frame, front side

## Camera in temporary frame, backside



**FIRST TEST RUNS WITH 100 m**2 MIRROR STILL THIS YEAR**

**COMPLETION FULL MIRROR: SPRING 2003**

**PHYSICS RUNS BEGIN IN 2003**

**COUNTING HOUSE LATE, BACKUP OLD HEGRA CONT.**

**TELESCOPE WEIGHT ≈ 60 TONS**

**COSTS: 3.5 m $ (ONLY TELESCOPE)**

## CONCLUSIONS

* MAGIC INSTALLATION PROCEEDS WELL , TO BE COMPLETED EARLY 2003
  1 YEAR BEHIND ORIGINAL PLANS
  BUT FUNDING WAS DELAYED BY ≈ 2 YEARS

* ALL‘ NEW TECHNOLOGY‘ ELEMENTS WORK AS EXPECTED
  HARD FIELD TESTS STILL MISSING

* MAGIC FULLY OPERATIONAL FOR PHYSICS IN 2003
  (IF NO LATE SURPRISES)

* NO UPDATE ON SENSITIVITY OR PERFORMANCE
  BECAUSE SOON EXPERIMENTAL VERIFICATION
  30 GEV THRESHOLD STILL STANDING ( SOME IMPROVEMENTS
  IN LIGHT COLLECTION)

* NOW PLANNING OF UPGRADE PATH TO MULTIPLE/STEREO TELESCOPES:
  MAGICII