Report on the construction of the CANGAROO-III second 10m telescope

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CANGAROO-III collaboration

Collaboration of **A**ustralia and **N**ippon for a **GA**mma **R**ay **O**bservatory in the **O**utback

- University of Adelaide
- Australian National University
- University of Sydney
- Ibaraki University
- Ibaraki Prefectual University
- Konan University
- Kyoto University
- Nagoya University
- National Astronomical Observatory of Japan
- Osaka city University
- Shinshu University
- Institute for Space and Aeronautical Science
- Tokai University
- ICRR, University of Tokyo
- Tokyo Institute of Technology
- Yamagata University
- Yamanashi Gakuin University

CANGAROO-III project

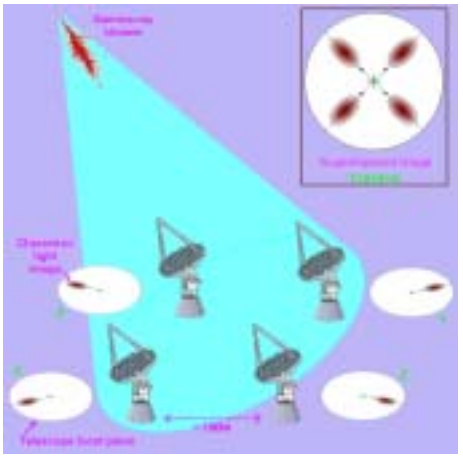
Sub-TeV gamma-ray astrophysics with an array of four imaging Cherenkov telescopes in Woomera, South Australia

- FY2000: production of the 2nd telescope
- FY2001: installation of the 2nd telescope / start of stereo observation / production of the 3rd telescope
- FY2002: installation of the 3rd telescope / production of the 4th telescope
- FY2003: installation of the 4th telescope / start of observation by the full array

Supported by MEXT, Japan, and ARC, Australia

Stereo observation

- Stereoscopic observation of Cherenkov images
  - Better $\Delta\theta$, better ΔE
- An array of four 10 m imaging Cherenkov telescopes will be completed in early 2004



Improvement for CANGAROO-III

- Refinement of mirror optical quality
- Wider FOV camera with individually HV-controlled PMTs
- Electronics on verandah – shorter signal cables
- Front-end electronics in VME-9U
- Faster data readout
- Pattern trigger circuit using PLD
- Flexible, centralized telescope control
- Total monitor system (calibration light source, environment etc.)

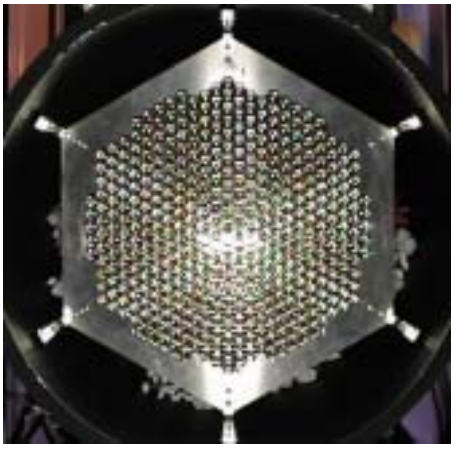
Optical reflector

- 114 x 80cmϕ segmented mirrors (57m^2)
- Further development from 1st telescope
  - Carbon Fiber Reinforced Plastic (CFRP) ⇒ GFRP (Glass Fiber)
  - Improved manufacturing accuracy (mirror surface, curvature radius)
  - Increased yield rate (~80%)
- Light weight (~6.7kg/mirror)
  - gravitational deformations is negligible
- Robust and durable for outdoor usage
  - tested with 1st telescope

A.Kawachi et al
Astropart. Phys. 14 261 (2000)

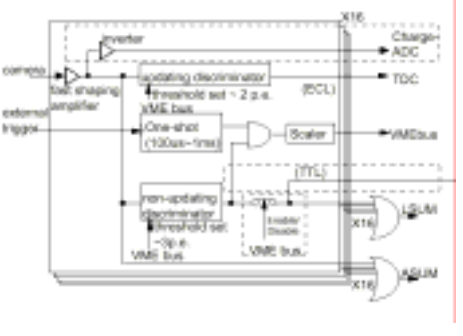
New imaging camera

- 427 PMTs (3/4") arranged in hexagonal shape
- 0.17 ° pixel
- FOV ~4 °
- Light weight (<100kg)



New electronics

- VME-based module
  - Frontend (Discriminator and summing) module
  - Charge ADC
    - 16bit ADC chip for each channel
    - 150ns internal delay
  - TDC
    - 1nsec resolution
    - 256nsec window
- Electronics hut on telescope verandah
  - remote controllable



Construction of 2nd 10m telescope (1)

Construction of the telescope pedestal base (Jan.'02)

Formwork for the telescope pedestal base (Feb.'02)

Construction of 2nd 10m telescope (2)

Unloading cargos sent from Japan (Feb.'02)

Assembly of the backing structure (Feb.'02)

Construction of 2nd 10m telescope (3)

Assembly of the backing structure (Feb.'02)

Setting mirror panels (Mar.'02)

Construction of 2nd 10m telescope (4)

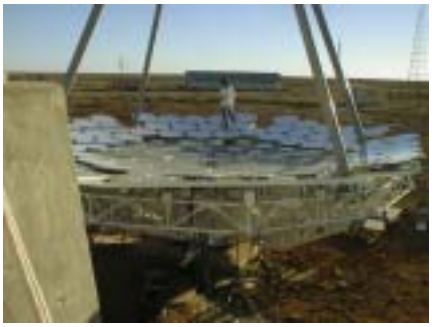
Setting the top plate on the telescope pedestal (Feb.'02)

Craning up the AZ structure (Mar.'02)

Construction of 2nd 10m telescope (5)

Craning up the EL structure (Mar.'02)

Setting small spherical mirrors (Mar.'02)



Construction of 2nd 10m telescope (6)

Craning up the reflector (Mar.'02)

Completion of the telescope (Mar.'02)

Construction of 2nd 10m telescope (7)

Completed telescope and a control hut (Mar.'02)

Assembly of the camera (Mar.'02)

Summary

- The 2nd 10m telescope of the CANGAROO-III project has been constructed in Woomera, 100m apart from the 1st one.
- Now we are assembling the camera.
- Electronics circuits will be installed in April.
- Stereo observations start in May-June (hopefully).