

CTA 計画 全体報告



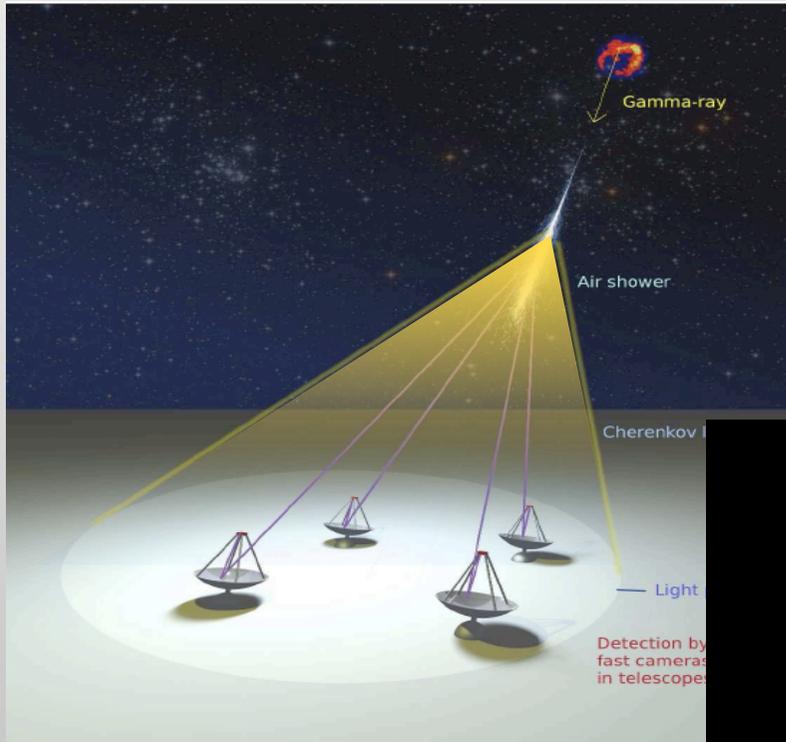
Masahiro Teshima, ICRR, U.Tokyo
for the CTA Japan Consortium

VHE Gamma Ray Astronomy

A New Window to the Universe and Energy Frontier in Astrophysics

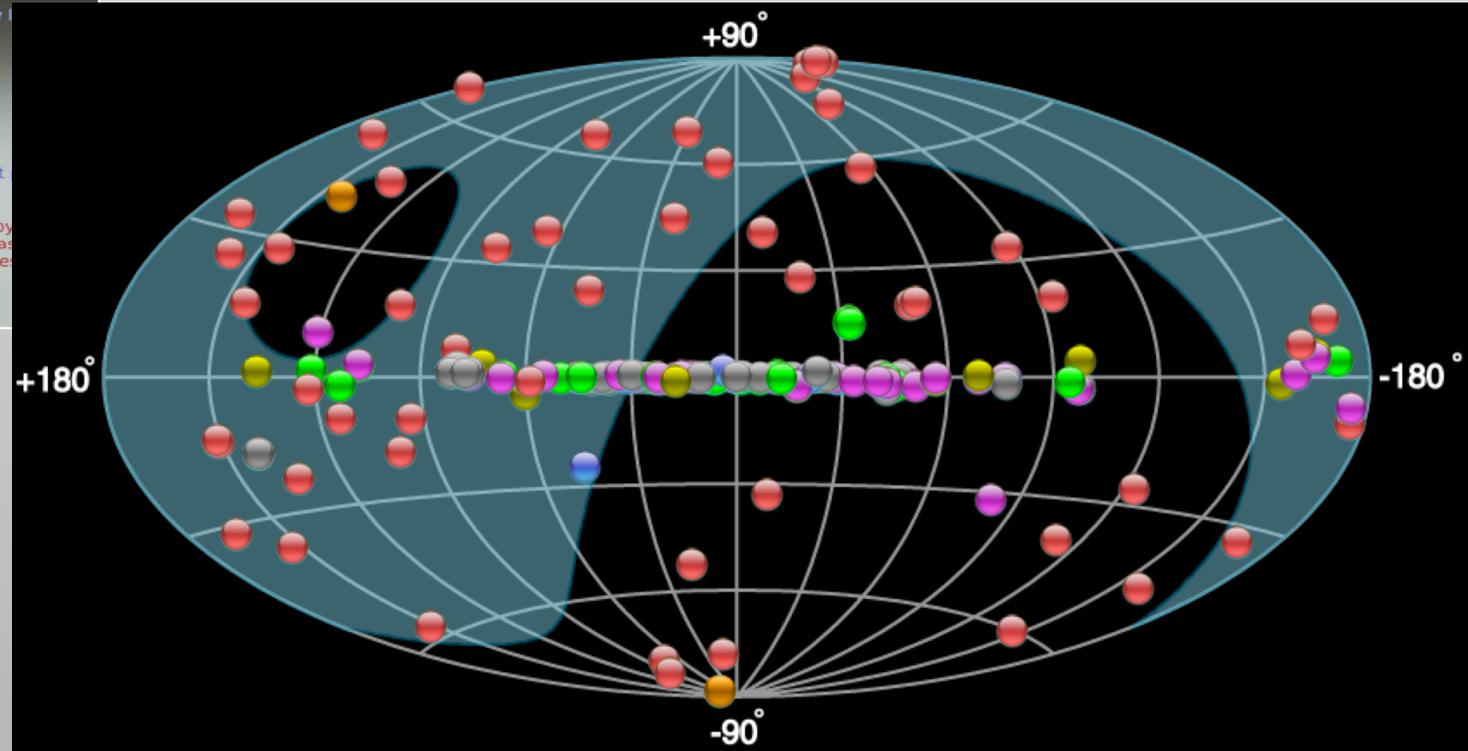


Imaging Air Cherenkov Telescope (IACT) Technique



>100GeV Gamma Ray Sources

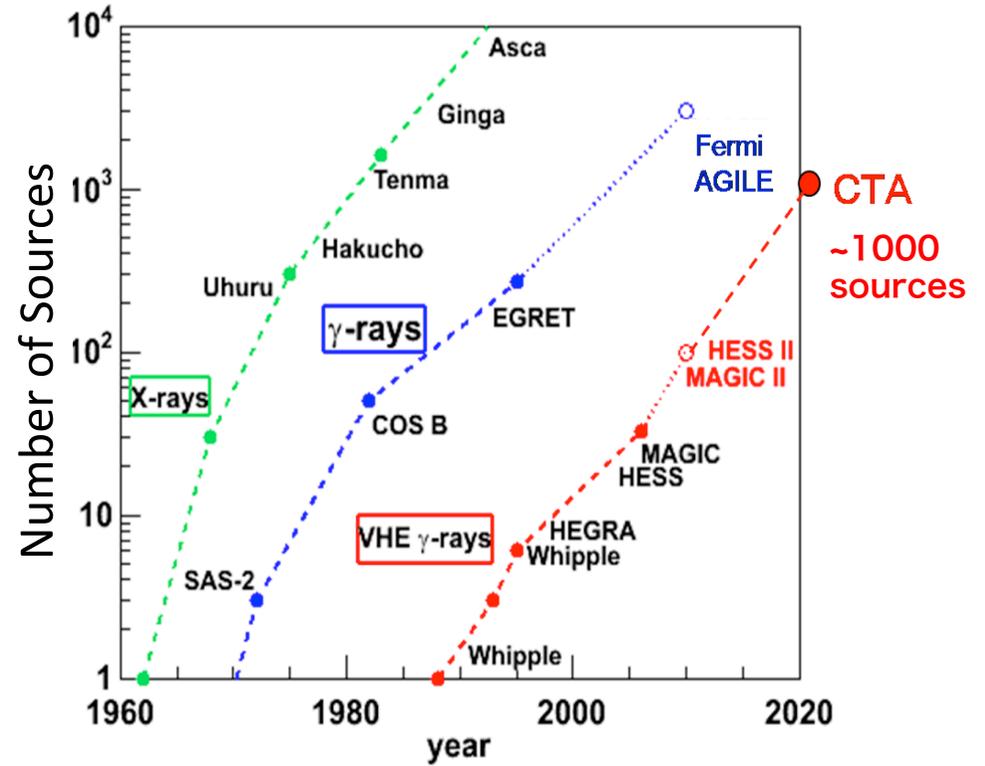
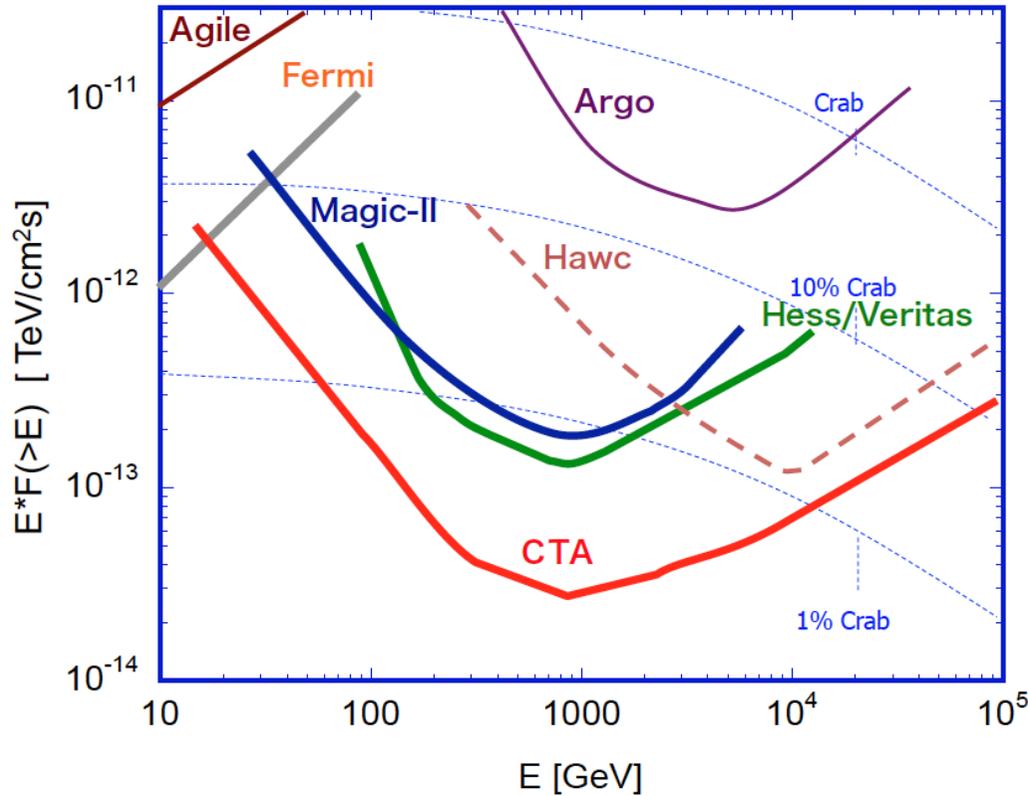
163 sources (>100GeV) → >1,000 sources with CTA



CTA (Cherenkov Telescope Array)

An order of magnitude better sensitivity
Wide energy coverage

More than 1000 sources
will be discovered



H.E.S.S. Simulation

CTA Simulation

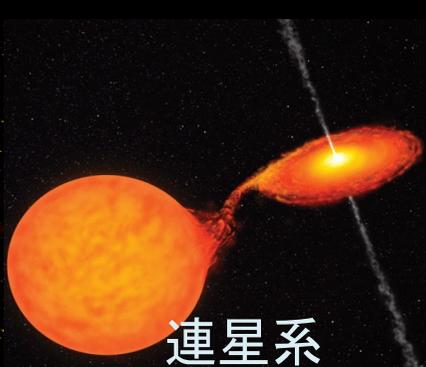
Higher Angular and Energy Resolution

Simulation Galactic Plane scan (HESS and CTA)

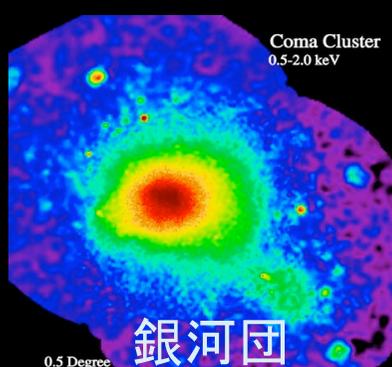
観測天体



超新星残骸



連星系



銀河団



活動銀河核



ガンマ線バースト

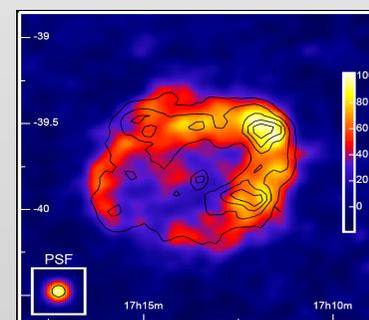
Cherenkov Telescope Array 超高エネルギー宇宙ガンマ線の研究

- 宇宙線の起源
- 銀河系内、系外の高エネルギー天体の研究
- 赤外・可視背景放射(宇宙の星形成史)の研究
- 暗黒物質対消滅からのガンマ線の探索
- 相対論(量子重力理論)の高精度検証

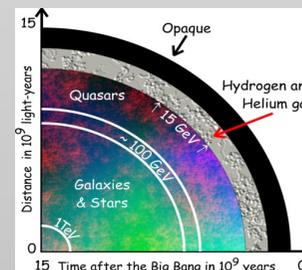
狙うサイエンス



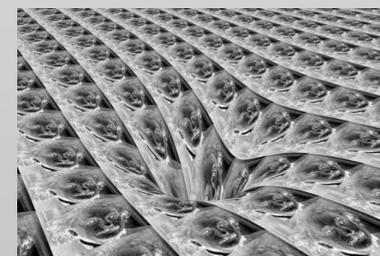
宇宙線の起源



高エネルギー天体



宇宙論・星形成史

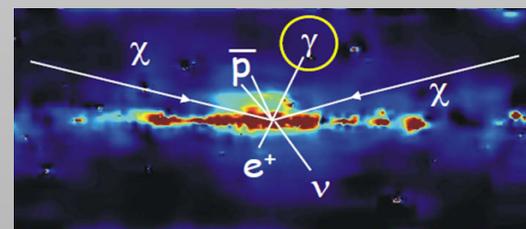
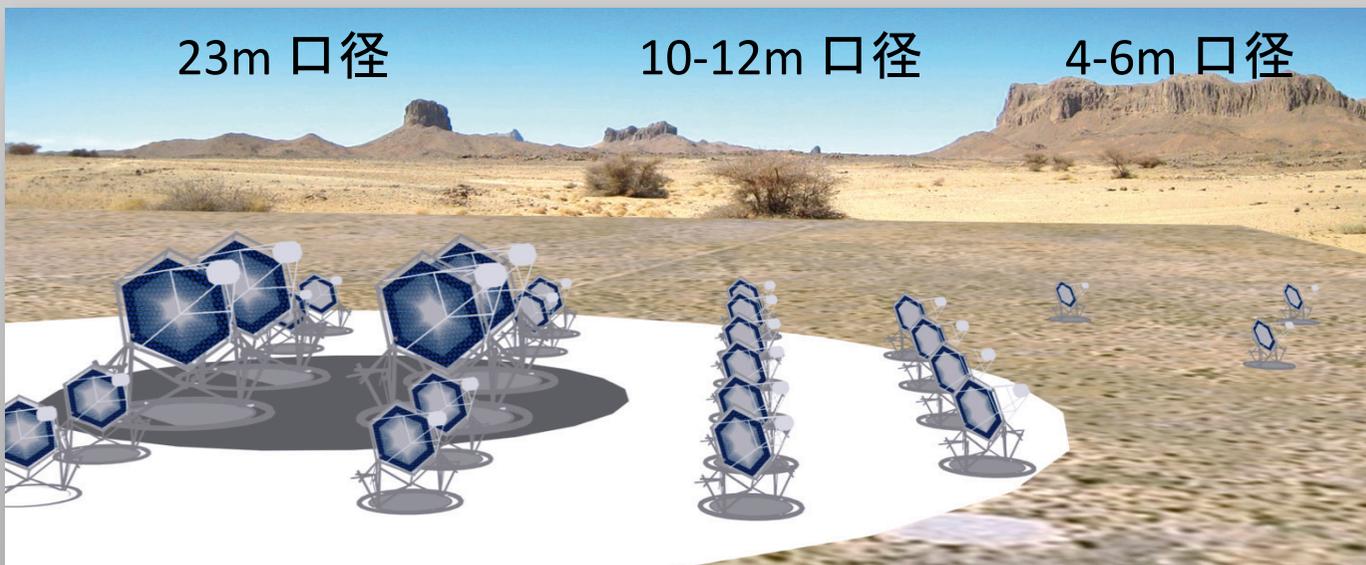


時空の構造

23m 口径

10-12m 口径

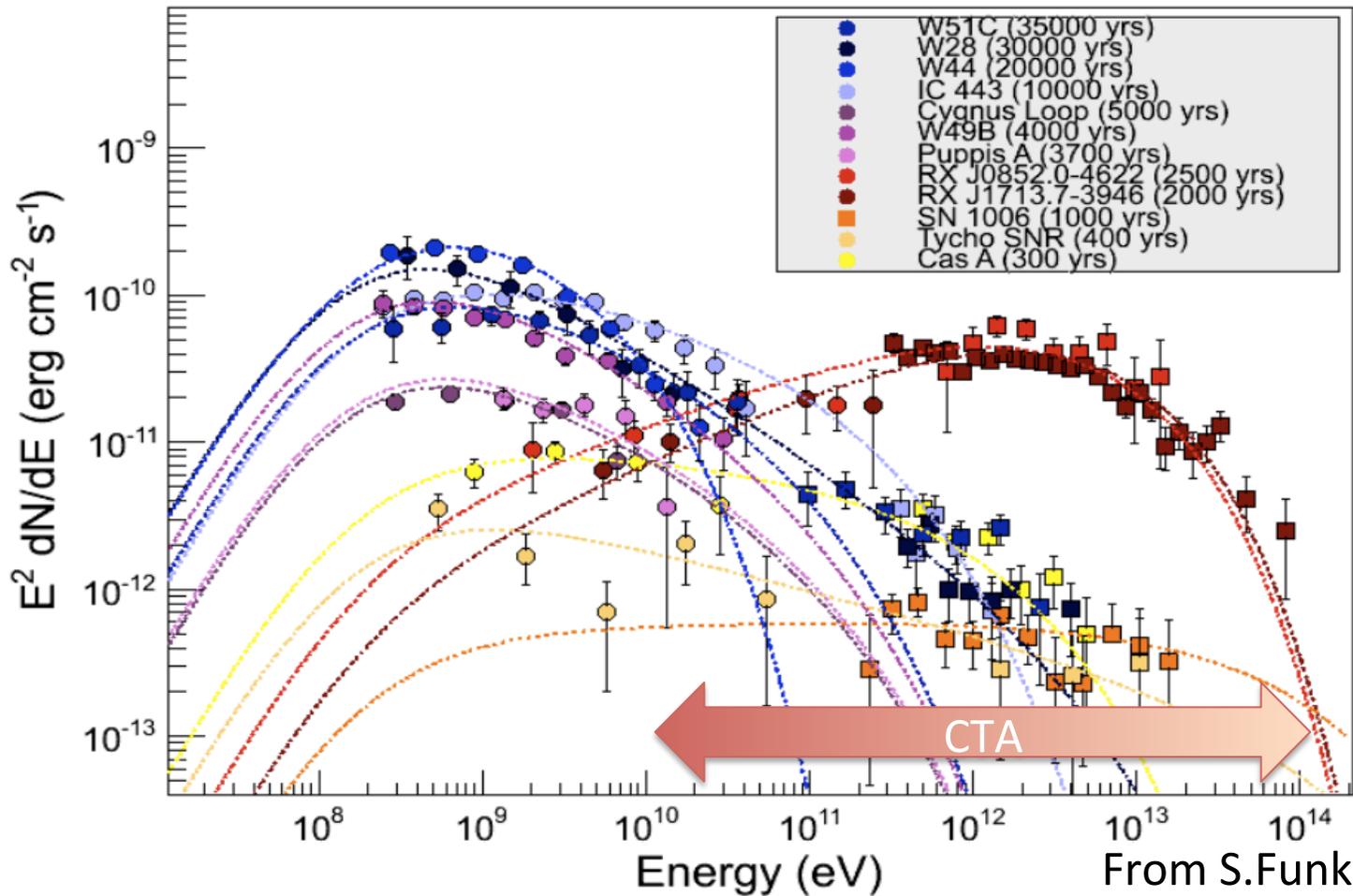
4-6m 口径



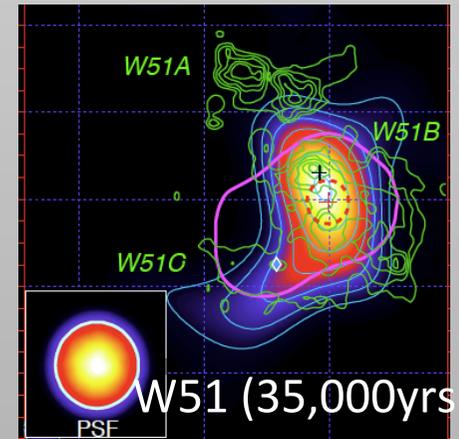
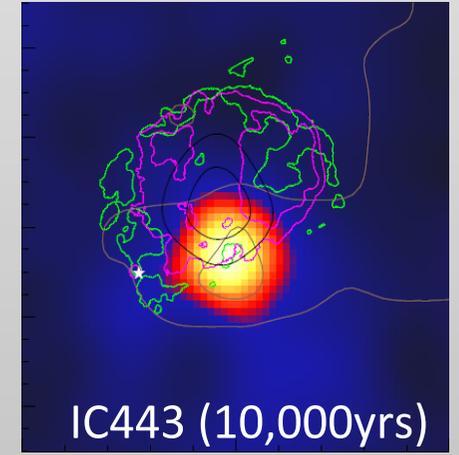
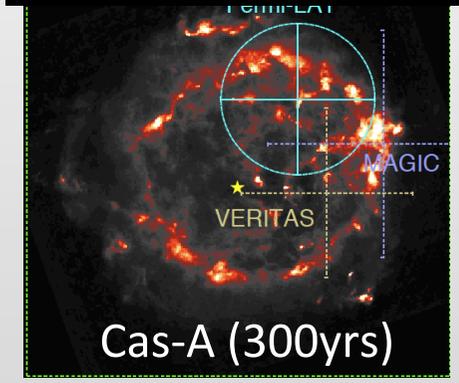
暗黒物質の探索

$E < 10^{15}$ eV Cosmic Rays

Shell type SNRs

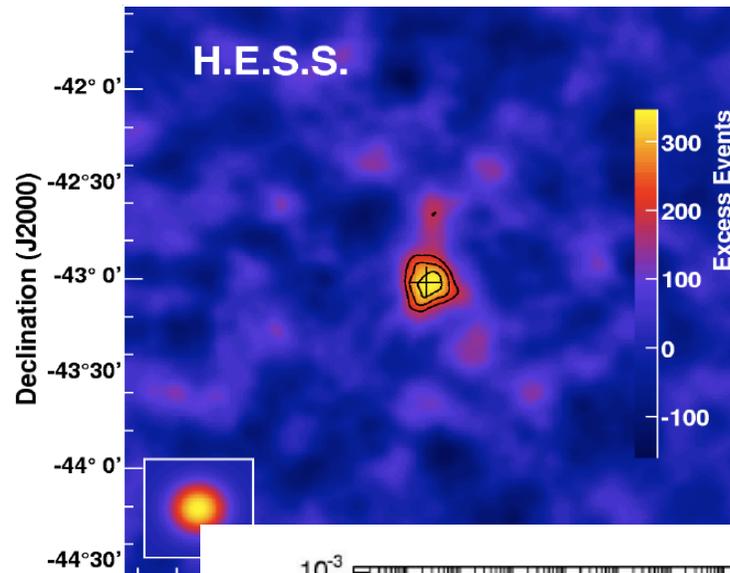
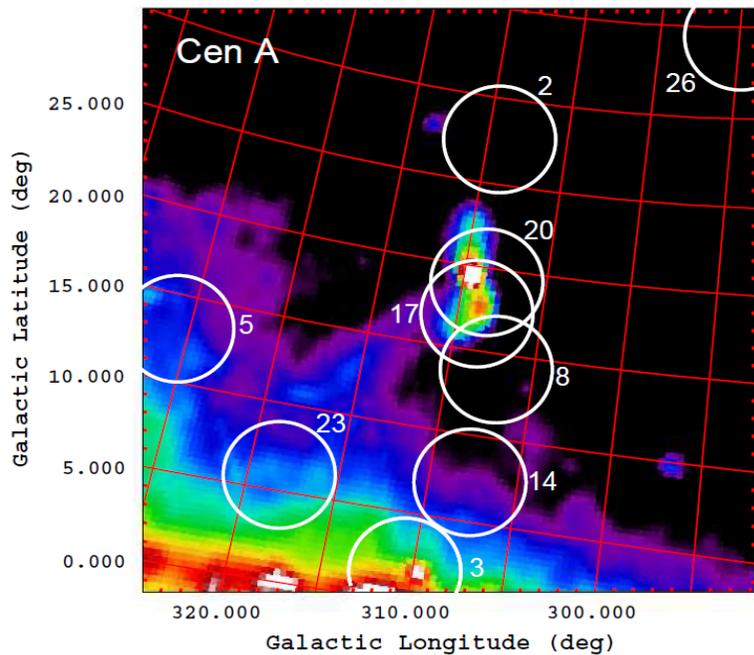


MAGIC Observations



- Different stages of SNRs as cosmic ray accelerator
- CTA will deliver more information on SNRs as cosmic ray accelerators
- We can survey most of SNRs in our galaxy → C.R. energetics

Cen A is hadron accelerator?



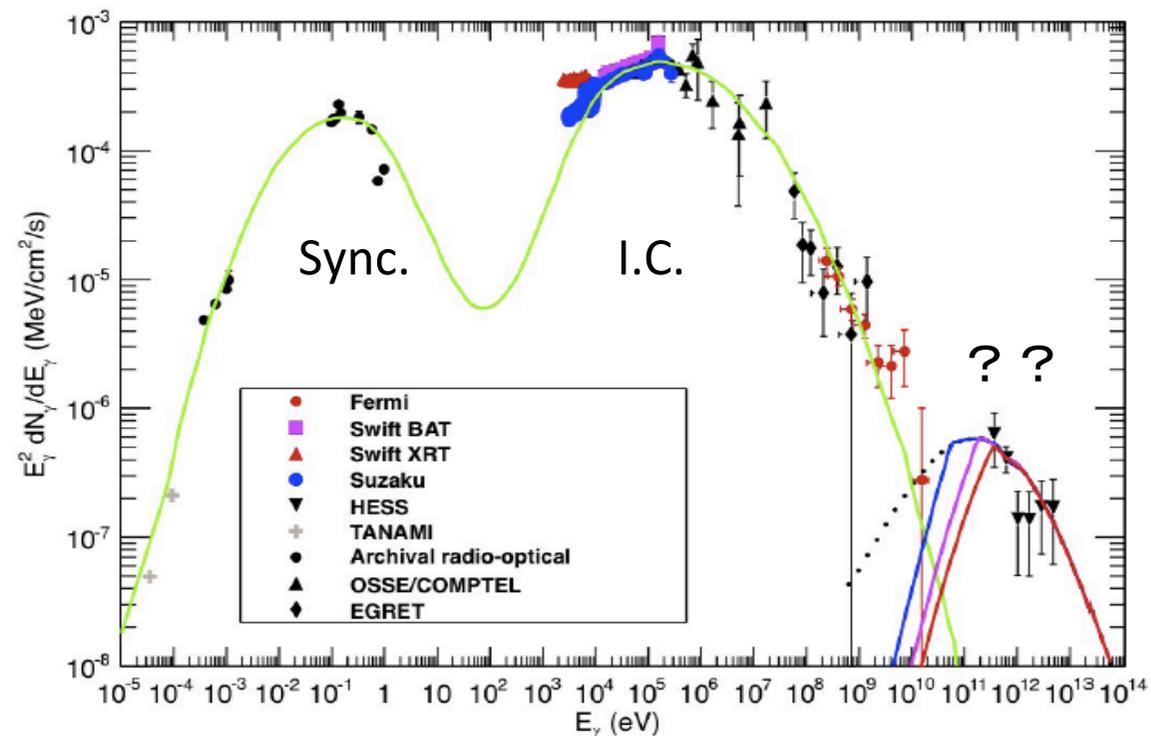
Distance: 3.8Mpc
 Flux: 0.8% in Crab Unit
 Spectral Index: -2.7

Evidence of P- γ ?
 Sahu et al 2012

Moskalenko et al.

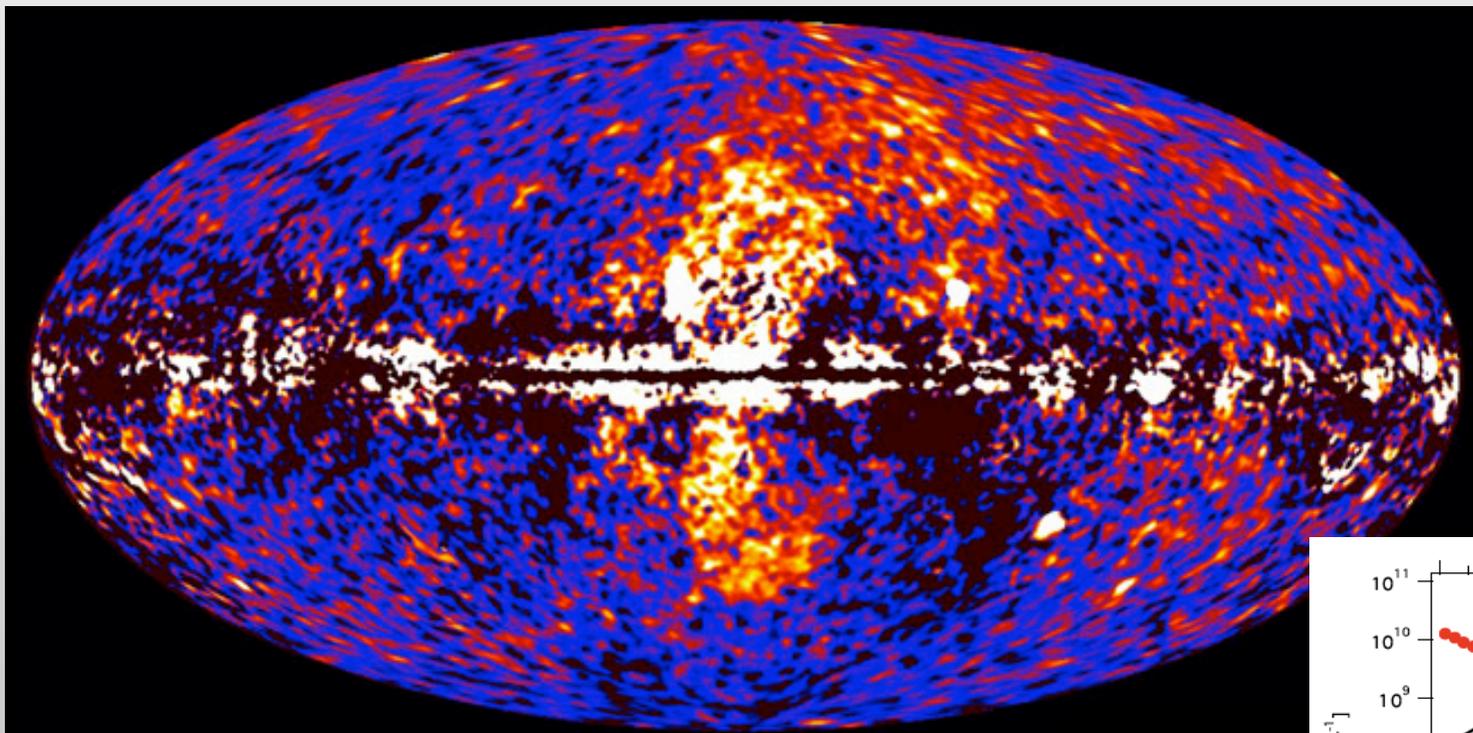
$$L_{\text{VHE}} \sim 2.6 \times 10^{39} \text{ erg s}^{-1}$$

$$L_{\text{UHECR}} \sim 10^{40} \text{ erg s}^{-1}$$



Large structure in our galaxy

Fermi bubble

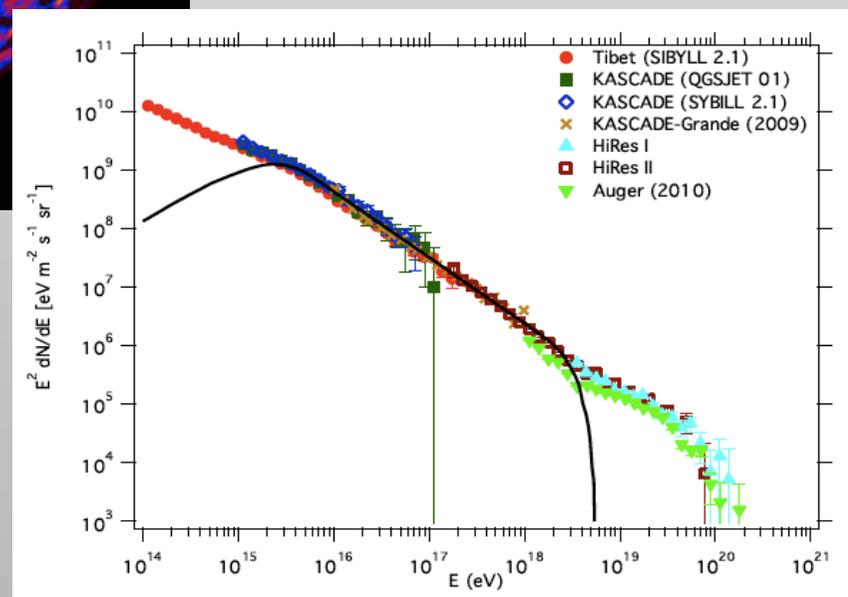


Source for Cosmic rays
above knee??

Re-acceleration of CR?

$\sim 10^{52}$ erg / 30,000 yrs

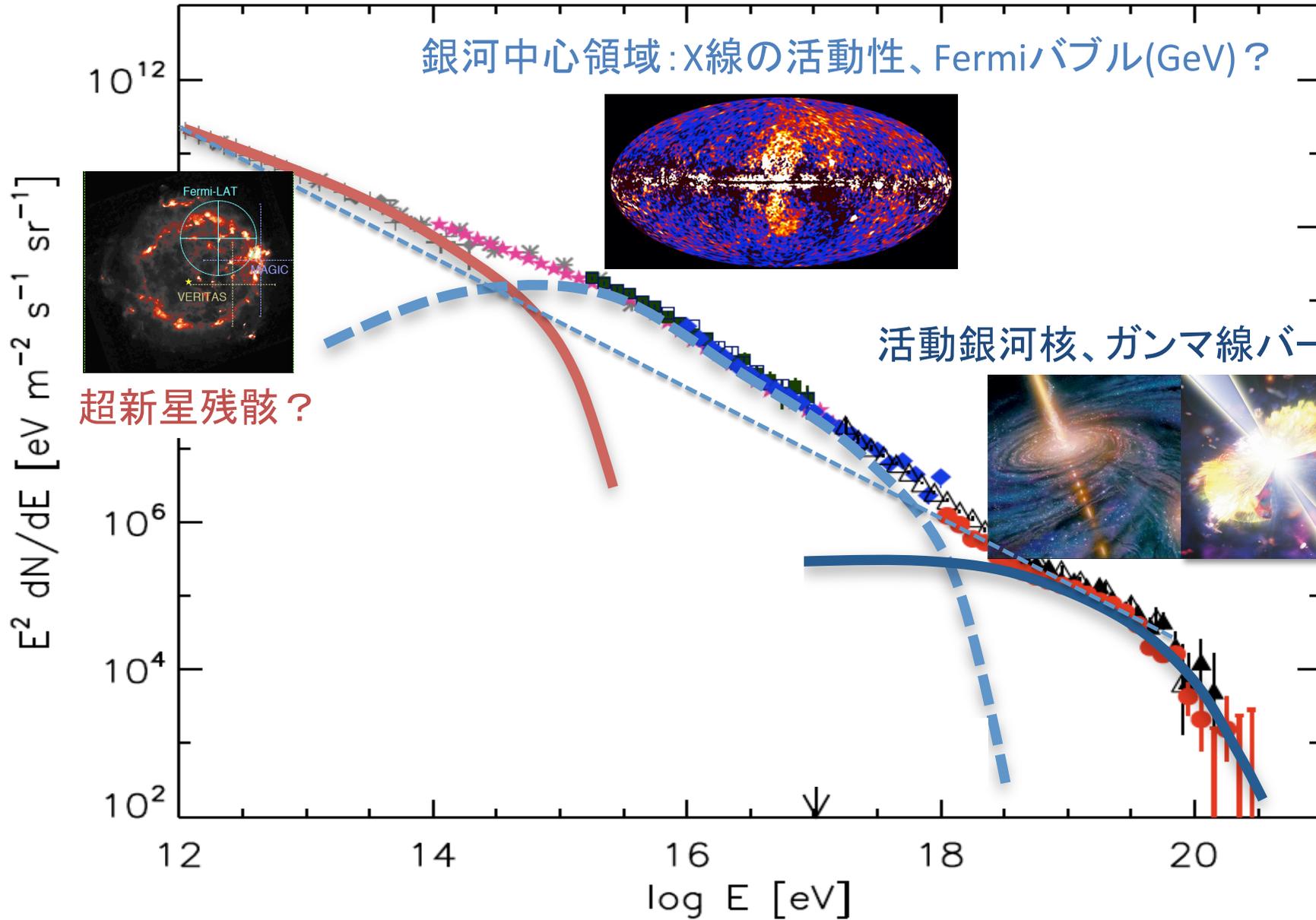
Symmetry suggests relation to Galactic Center
Hard Energy Spectrum ($dN/dE \sim E^{-2}$)
Extends up to 10kpc above the disk (cooling time problem)
Edges are not clear



Chernyshov et al. 2011

宇宙線のミッシングリンクはつながったか？

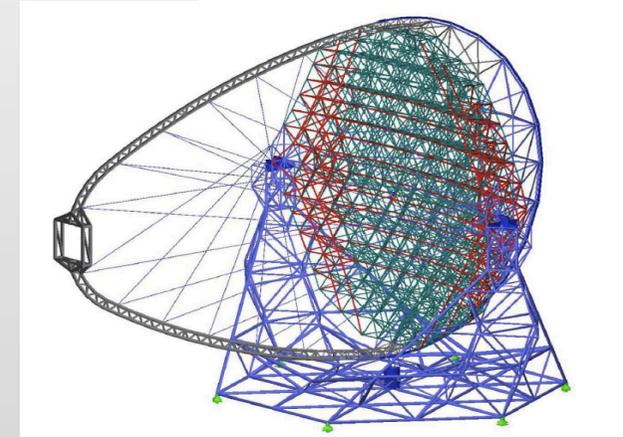
宇宙線の起源を総括的に理解したい



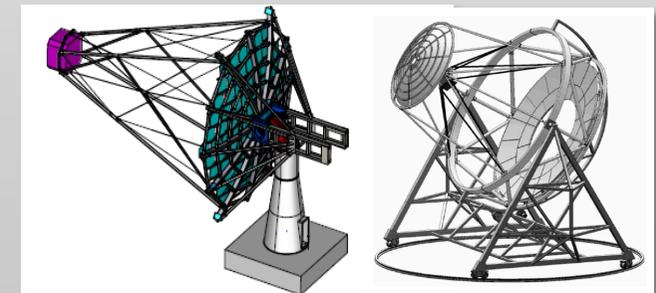
Possible array configuration



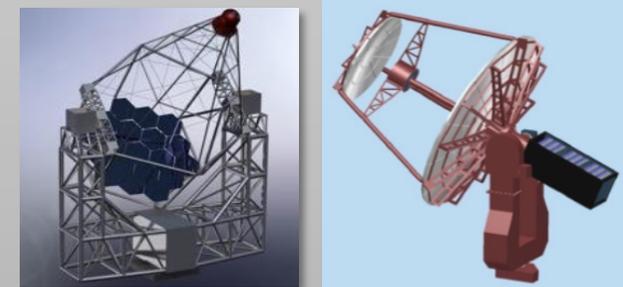
CTA is all sky observatory
consisting of North and South Arrays



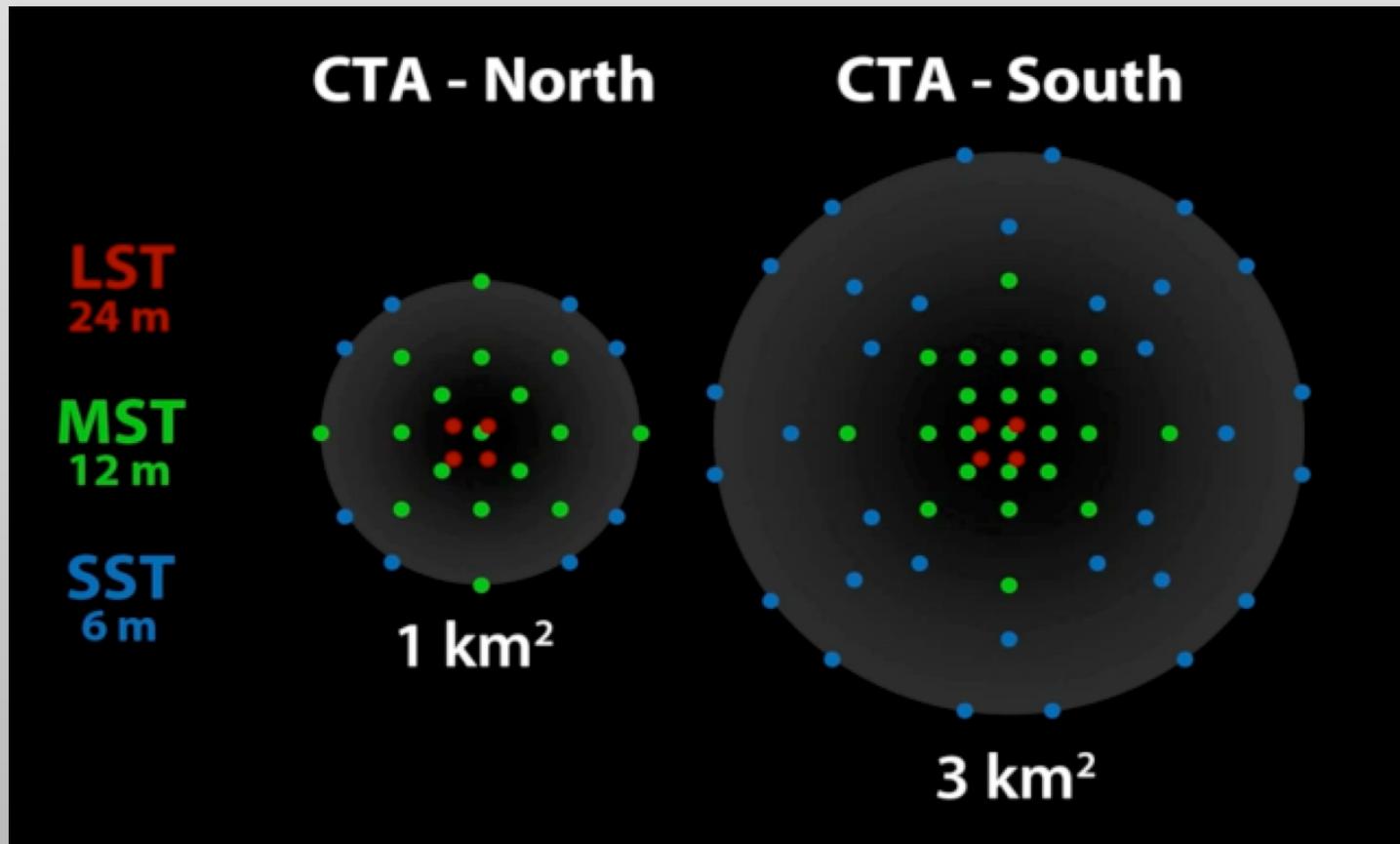
LST 23m



MST 10-12m

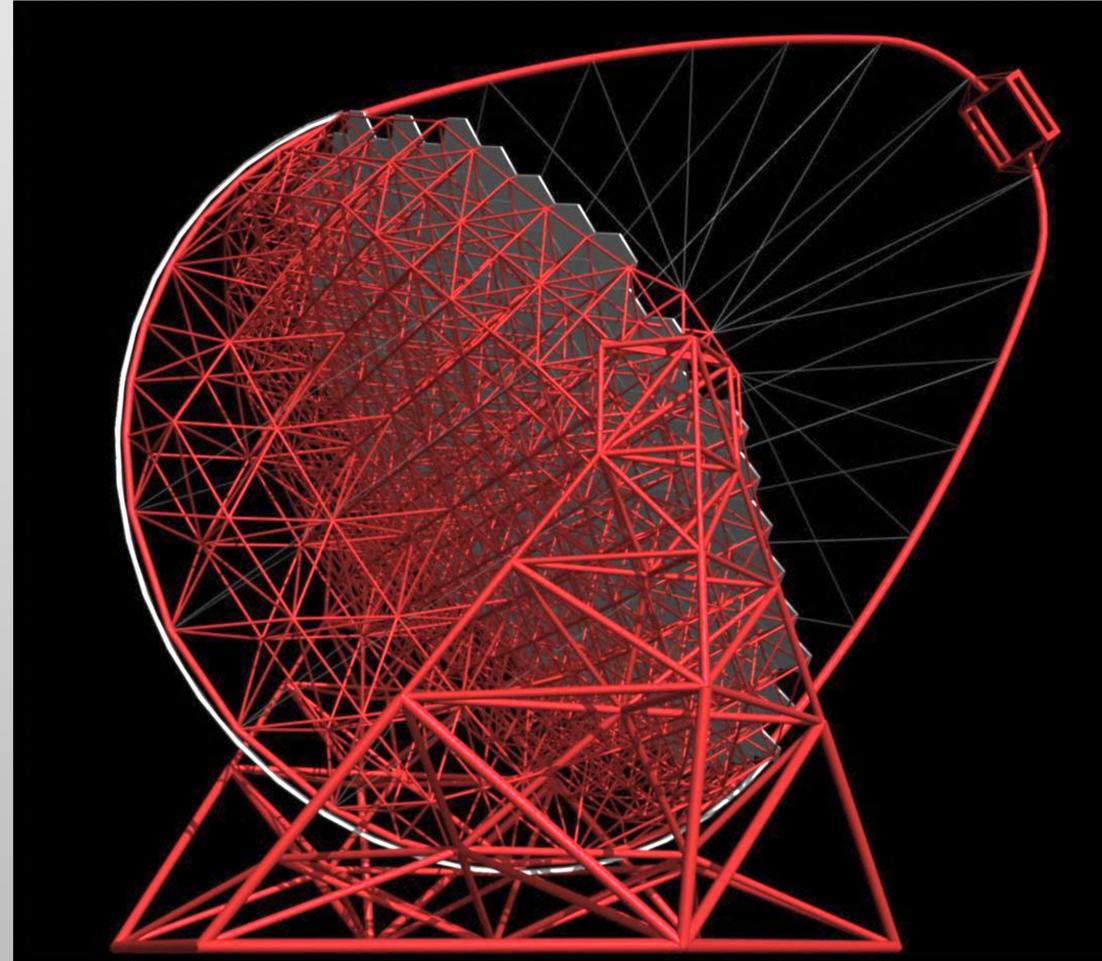


SST 4-6m



Specifications

- **The Threshold Energy**
 - 20GeV
- **Telescope Structure**
 - Diameter: 23m
 - Dish area: 400 m²
 - F/D = 1.2, F=28m
 - Dish profile: Parabolic
 - → Isochronicity < 0.6 nsec in RMS
 - Single mast supporting the camera
 - → Reduce the shadow
 - Total weight: ~70 tons
 - Fast rotation: 180 deg/ 20sec
 - Deformation of mirror dish: <~10mm
 - Active mirror Control
 - Tracking accuracy: 20 arcsec



Designed by MPI Munich and MERO

研究組織

(CTA-Japan Member 84名)

Cherenkov telescope array

サイエンス PHYS WG

責任者: 井岡 (KEK)

KEK, 京大、青学、茨城、他



CTA 計画推進責任者

手嶋政廣 (東京大学・宇宙線研究所)

マネージメント

CTA Japan PI 手嶋 (東京大)

CTA Japan Co-PI 窪 (京都大)

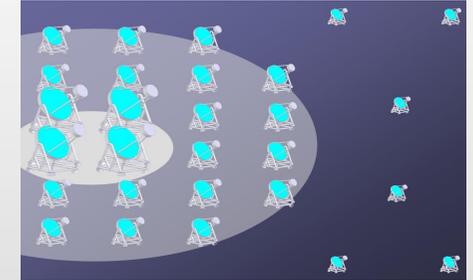
CTA Japan Chair 戸谷 (京都大)

CTA Japan SBO 吉田 (茨城大)

シミュレーション MC WG

責任者: 吉越 (東大)

東大、甲南大、東海大、他



ミラー MIR WG

責任者: 手嶋 (東大)

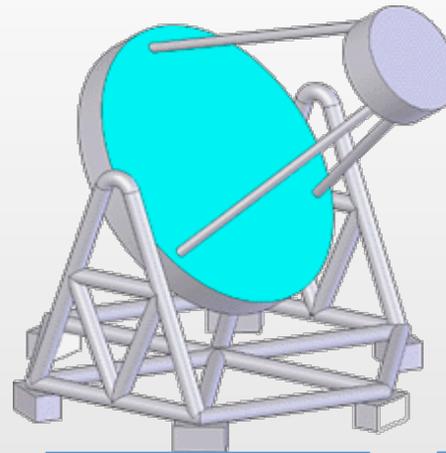
東大、近畿大、甲南大

茨城大、三光精衡所、他

CTA LST(大口径望遠鏡) Prototyping

Project Coordinator

手嶋 (東大)



光検出器 FPI / CAL WG

責任者: 山本 (甲南大)

東大、茨城大、広大、甲南、
埼玉、青学、浜松ホトニクス、
他

アンプ、スロー制御

東大、徳島、京大、茨城大、他

読み出し電子回路 ELEC WG

責任者: 窪 (京都大)

京大、KEK、山形大、他

Dual Mirror Cam

責任者: 田島 (名古屋)

望遠鏡ドライブ

スペインバルセロナ

IFAE

望遠鏡構造

ドイツミュンヘン

MPI

カメラサポート構造

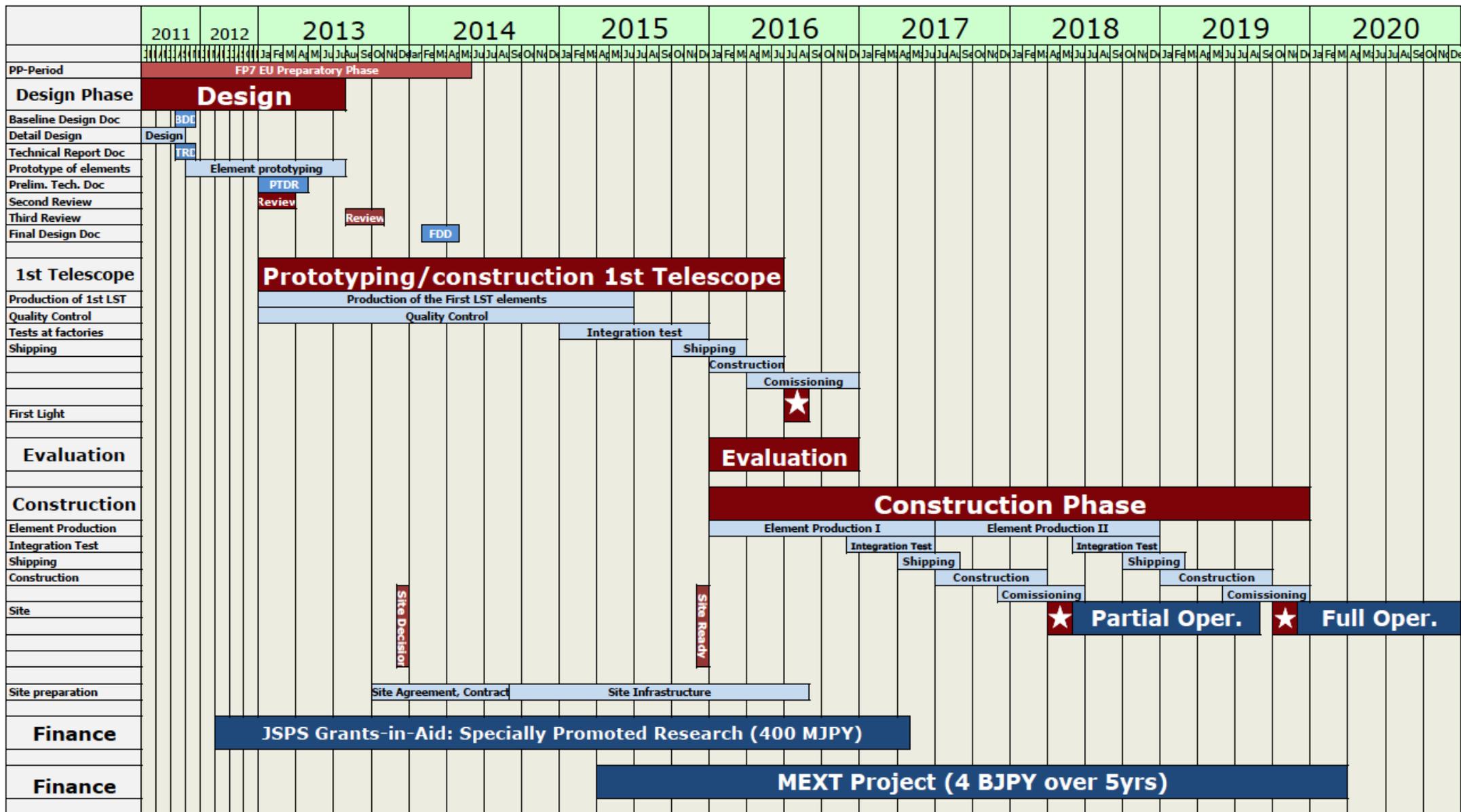
フランスアネシー

LAPP

Time Schedule for LST construction



LST construction (Jan 2013)



Thank you