INAF
ISTITUTO NAZIONALE DI ASTROFISICA
NATIONAL INSTITUTE FOR ASTROPHYSICS

POLITECNICO MILANO 1863

Agenzia Spaziale Italiana

HERMES

HERMES-Pathfinder

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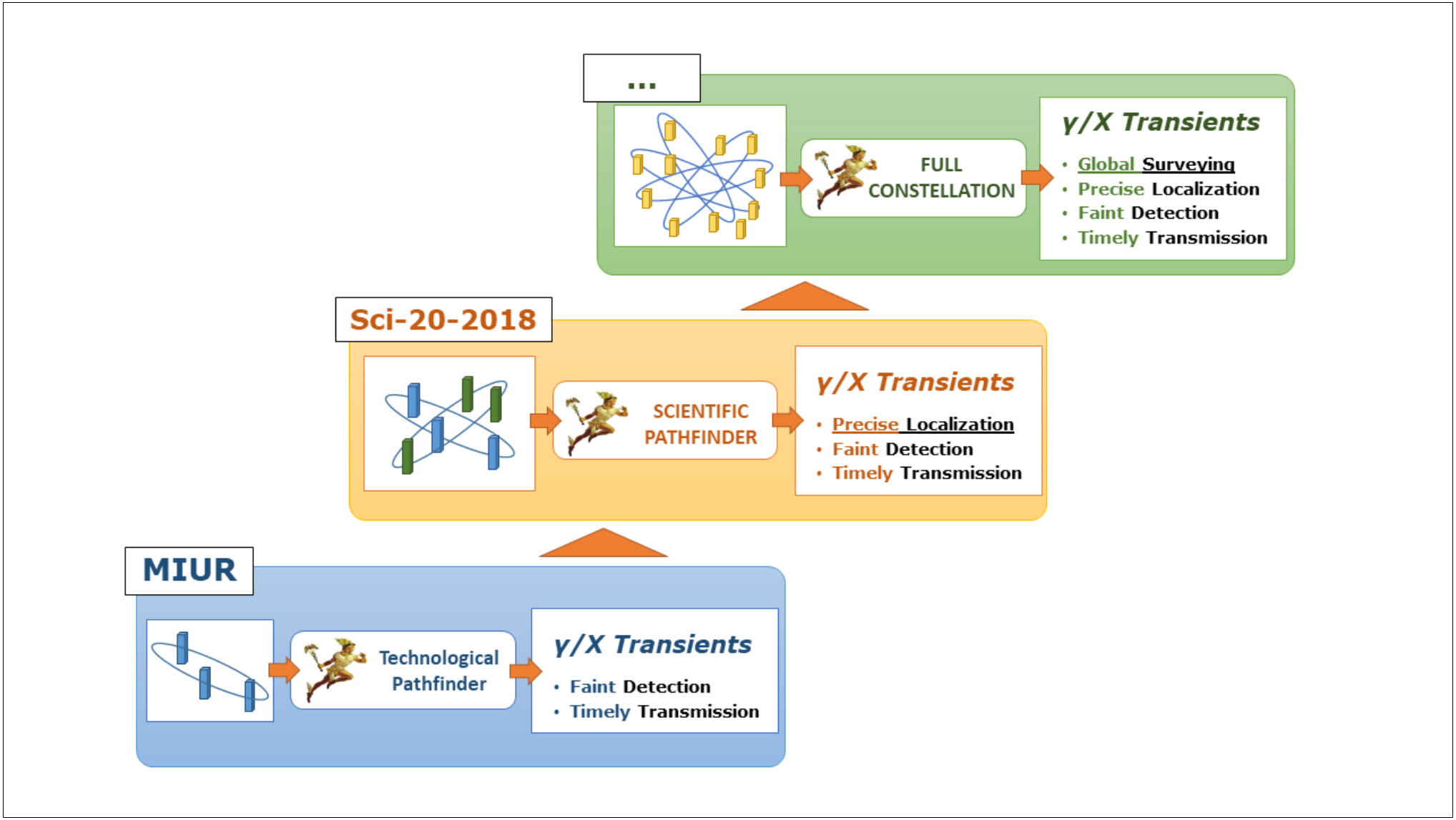
Motivation

- Prove that ***breakthrough science*** can be done with nano-sats. ***"Smaller"*** enables the"***faster, better, cheaper***"[1] mantra, but also ***expand usership,*** increasing competition ***and*** collaborations
- ***Join the multimessenger revolution*** by providing a first mini-constellation for GRB localizations
- Develop miniaturized payload technology for breakthrough science and demonstrate COTS applicability to challenging missions, contribute to Space 4.0 goals
- Push and prepare for a high reliability, large constellation

1 Dan Goldin 1992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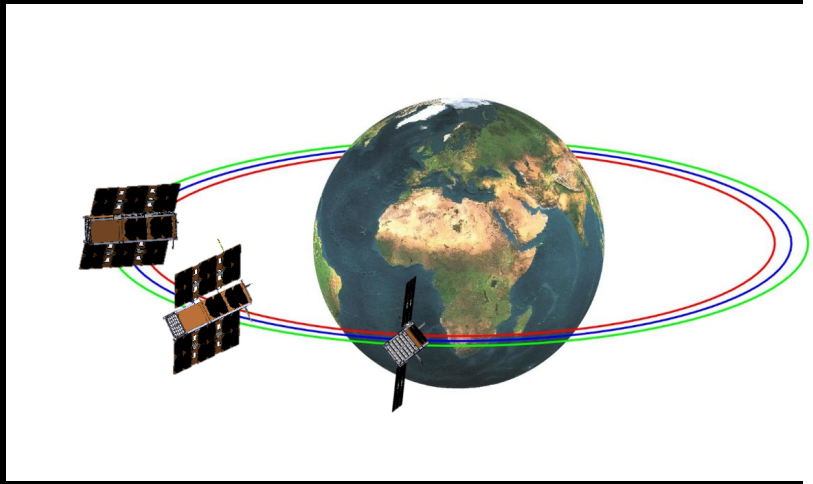
FULL CONSTELLATION
γ/X Transients
• Global Surveying
• Precise Localization
• Faint Detection
• Timely Transmission
Sci-20-2018
SCIENTIFIC PATHFINDER
γ/X Transients
• Precise Localization
• Faint Detection
• Timely Transmission
MIUR
Technological Pathfinder
γ/X Transients
• Faint Detection
• Timely Transmission

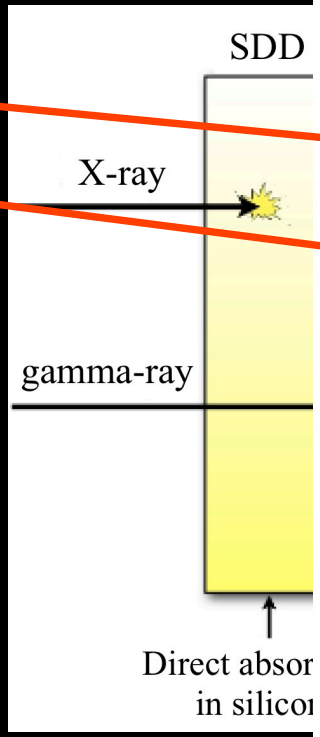
HERMES-PF & SpIRIT in a nutshel

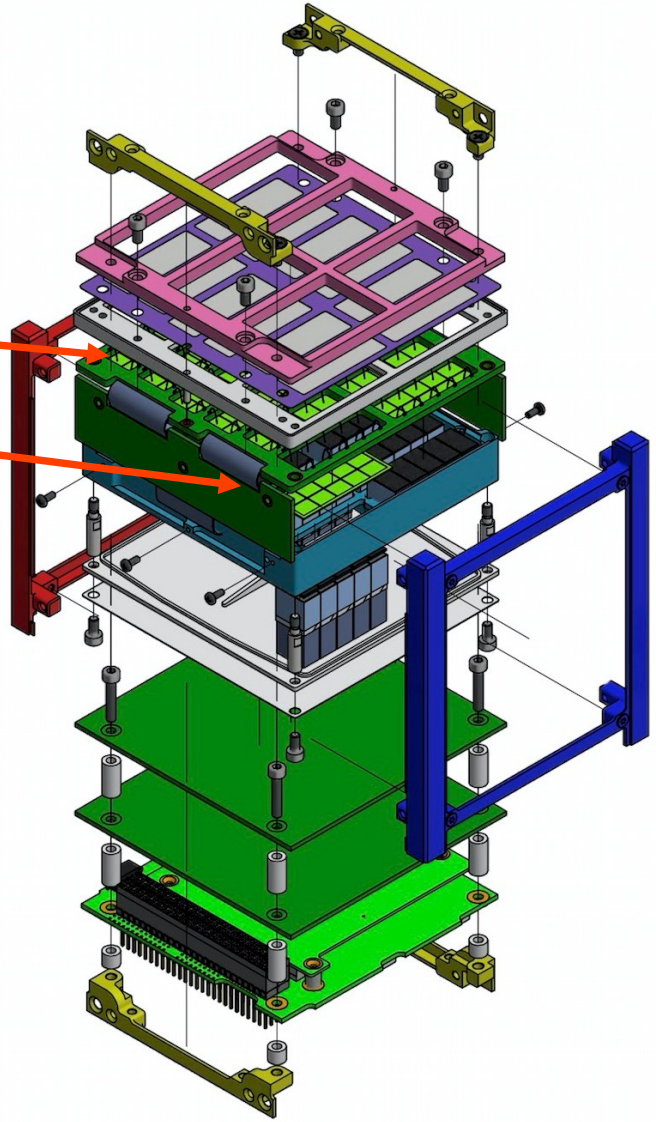
- HERMES Pathfinder: six 3U cubesat equipped with advanced X-ray/gamma/ray wide field detector. Nearly equatorial LEO.
- SpIRIT: 6U cubesat managed by University of Melbourne and funded by ASA. Host 1 HERMES-PF X-ray/gamma-ray payload + S-band system. SSO.



Payload concept

- Photo detector, SDD
  Scintillator crystal GAGG
- 5-300 keV (3-1000 keV)
- ≥50 cm^2 coll. area
- a few st FOV
- Temporal res. ≤300 nsec
- ~1.6kg

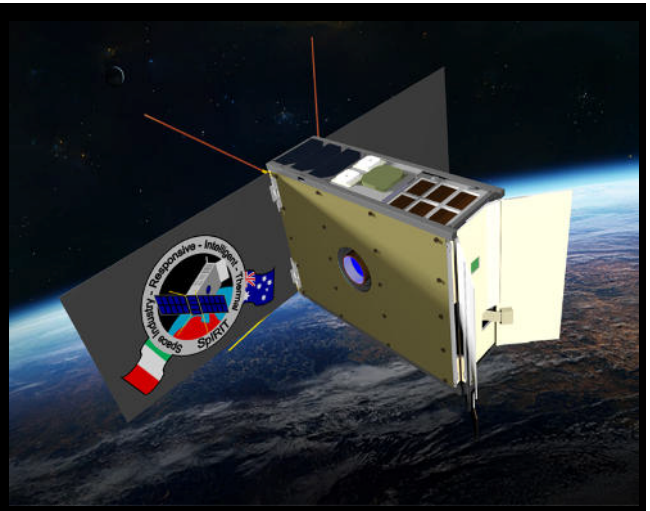


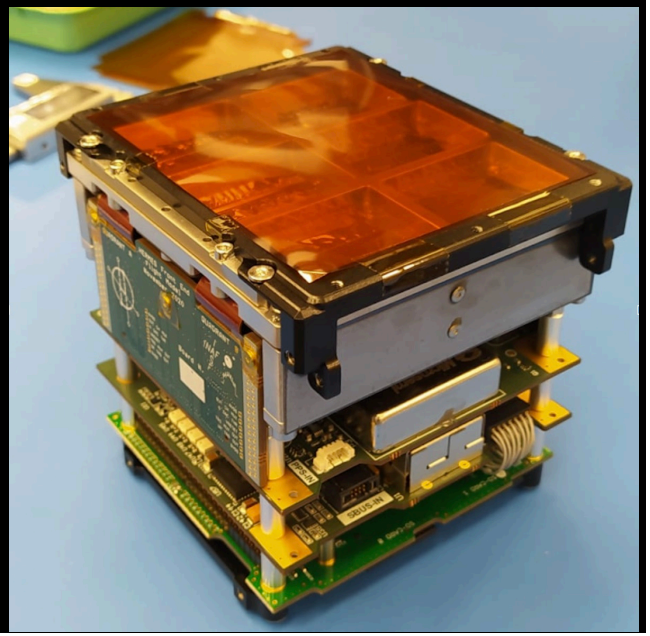


Fuschino+2018, 2020, Evangelista+2020,2022, Campana+2020,2022

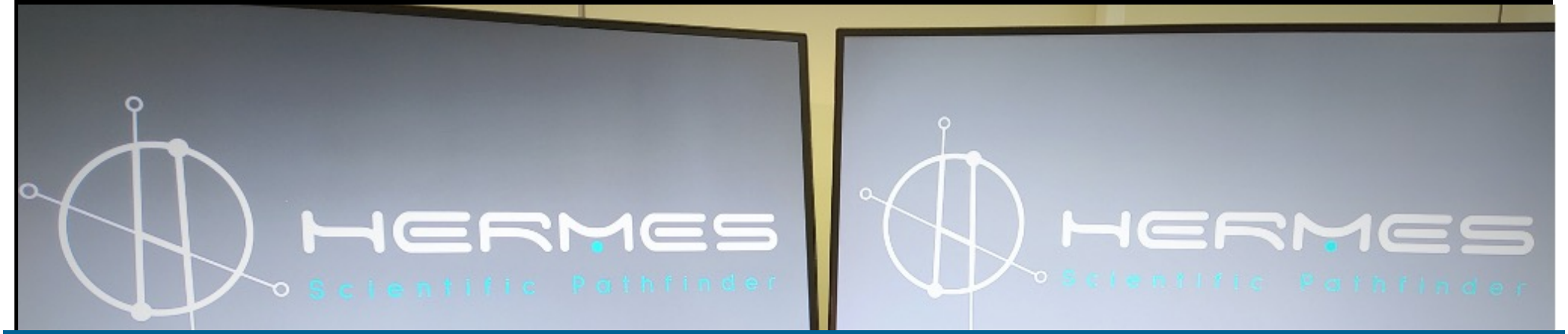
Where we are: SpIRIT

- SpIRIT paylod FM delivered to UoM on July 2022 after calibration and qualification (evironmental tests @ SERMS on June 2022).
- SpIRIT S-band system delivered to UoM Q2 2022
- Integration tests (mechanical, electrical, electronic) performed in July 2022
- S/M payload integration planned for October 2022, full system acceptance tests planned for November-December 2022, launch October 2023





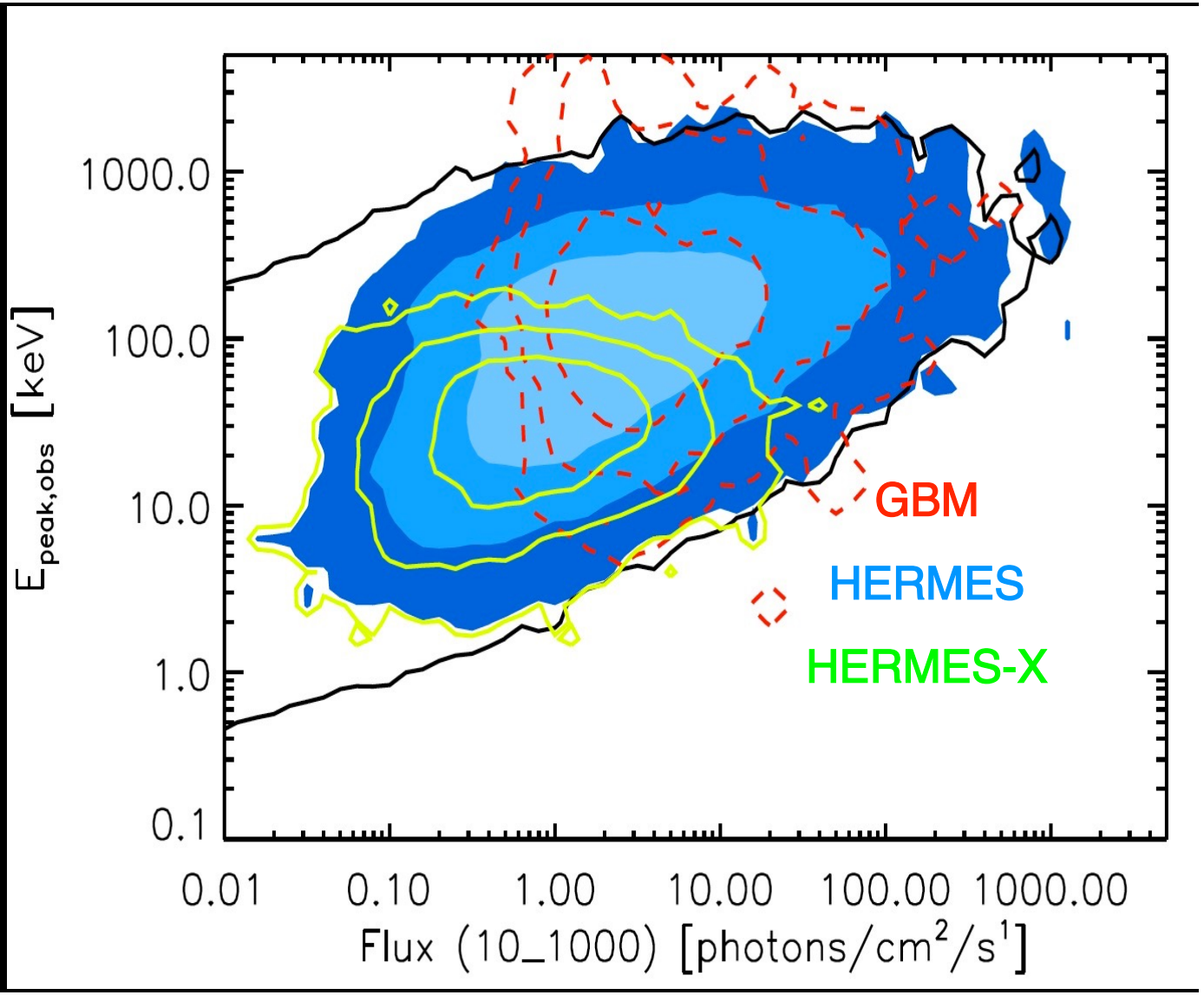
Where we are: HERMES pathfinder



- PFM ready for integration in the S/M after calibration. Integration planned for Q4 2022. QR planned for February 2023
- Payload FM2, FM3 ready. FM4, FM5 and FM6 integration and test planned for October-December 2022
- FAR Q2-Q4 2023 Launch with Virgin Orbit Q2 2024

Performances

Ghirlanda & Nava



Localization performances

$\sigma_{Pos} = 2.4°[(\sigma_{CCF}^2 + \sigma_{sys}^2)/(N-3)]^{0.5}$

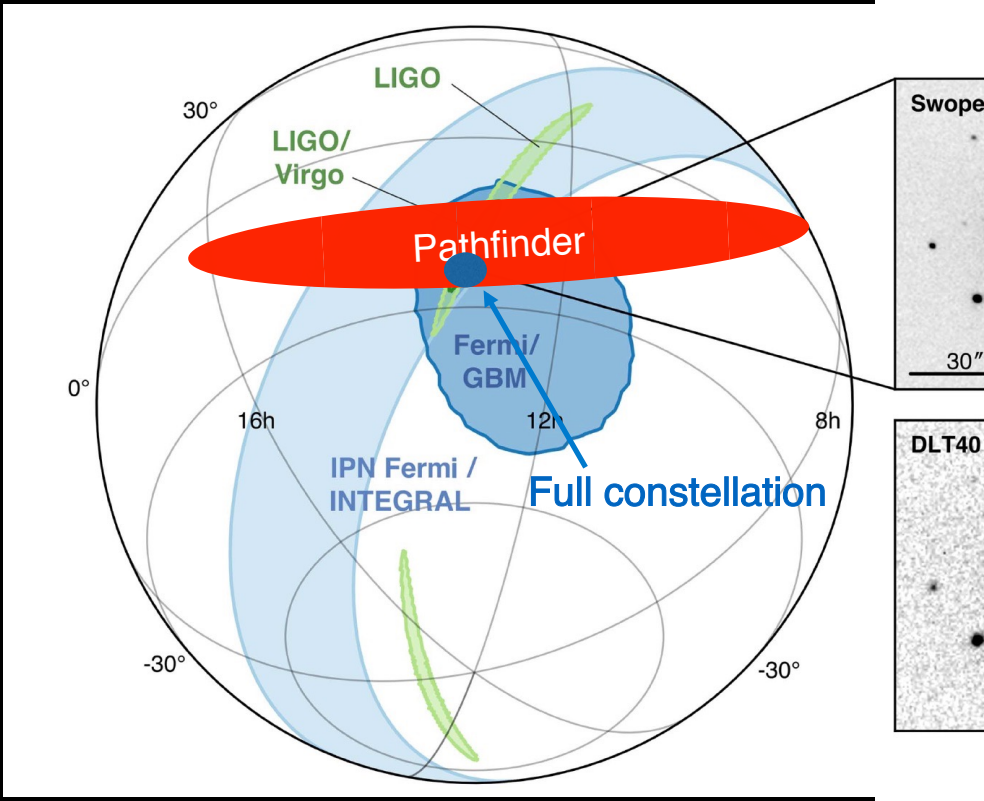
<B>~7000km

N(pathfinder)~6-8, active simultaneously 3-4

σ_{Pos}~ 2.4 deg if **$\sigma_{CCF},\sigma_{sys}$~1ms**

Goal for a real observatory (more units, longer baseline)

$\sigma_{Pos(FC)}$ ~ 15 arcmin **if $\sigma_{CCF},\sigma_{sys}$~1ms**



HERMES PF Institutes

- INAF, ASI, PoliMi, UniCagliari, UniPalermo, UniUdine, INFN, UniTrieste, UniPavia, UniFedericoII, UniFerrara, FBK, FPM
- University of Tubingen (Germany)
- University of Eotvos Budapest, C3S (Hungary), MUNI (CZ)
- University of Nova Gorica, Skylabs, AALTA (Slovenia)
- Deimos (Spain)
- Institute of High Energy Physics, Chinese Academy of Science