

Daksha

On Alert for High Energy Transients

www.dakshasat.in



Shriharsh Tendulkar on behalf of the Daksha Team

Sensitive all-sky monitoring

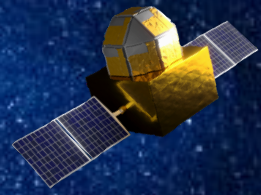


- Counterparts of FRBs
 - Super rare
- Counterparts of GW events

- Need to increase the detection horizon

- Better sensitivity, wide sky + spectral coverage

Daksha



Continuous all-sky coverage

Large effective area

Two satellites

Broadband: 1 keV – 1 MeV

Daksha



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Daksha



Continuous all-sky coverage

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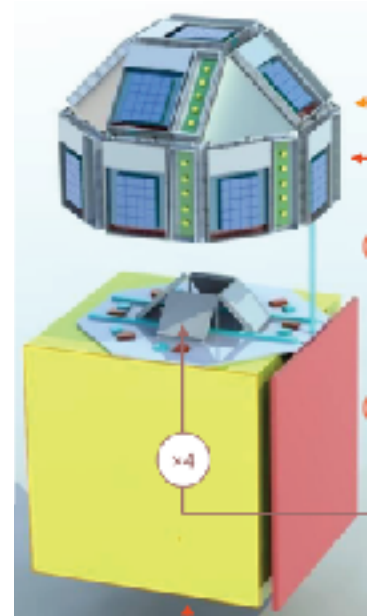
Two satellites

Broadband: 1 keV – 1 MeV

Daksha: vital statistics

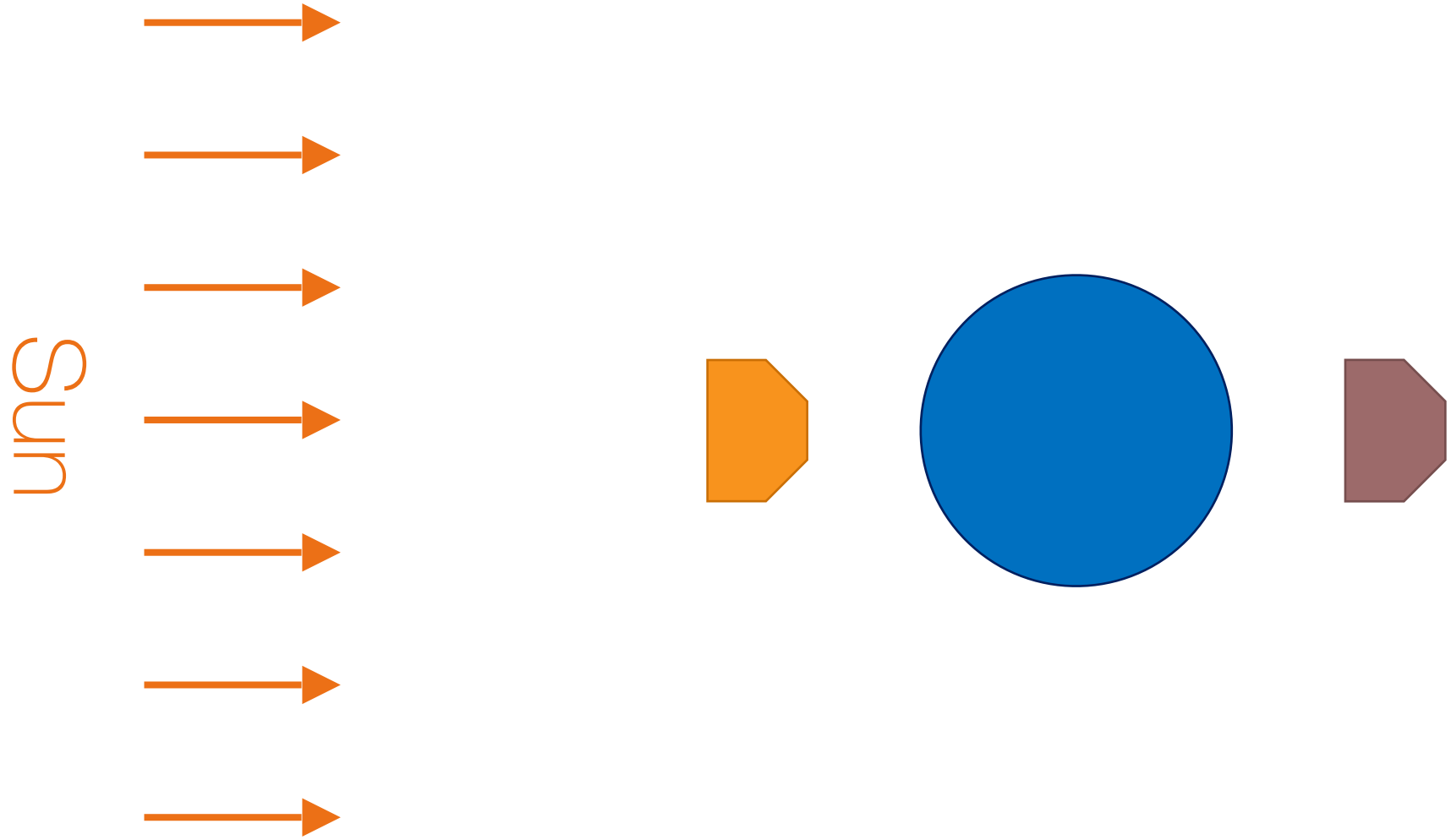


- Broadband energy coverage: 1 keV to > 1 MeV
- Median effective area: 1300 cm^2 (single sat)
- Sky coverage: 1 satellite $\sim 50\%$, two $\sim 87\%$
- Event alert within ~ 1 minute
- Downlink all event mode data
 - 1 microsecond time tagging
 - Offline searches possible

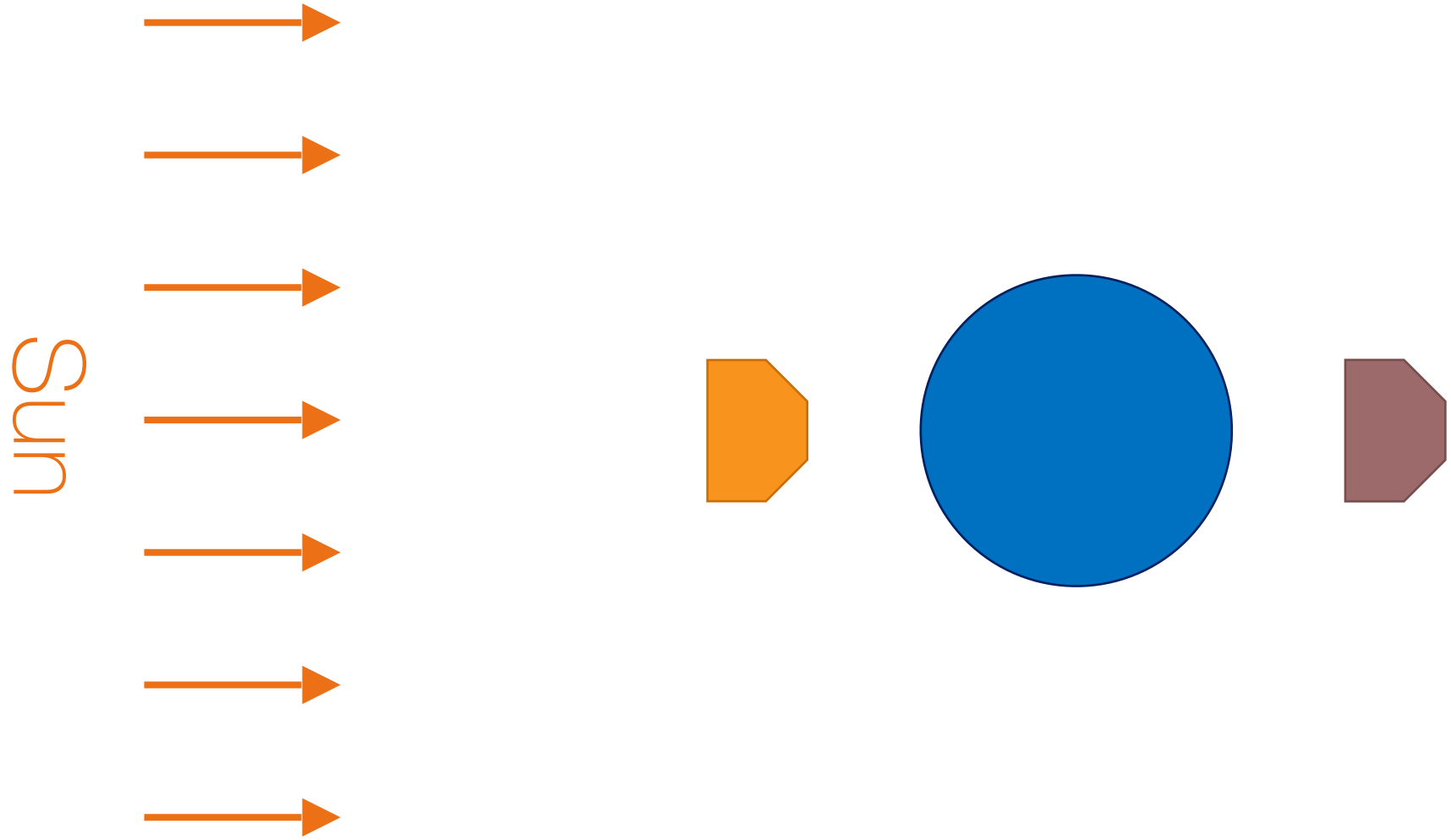


Hemispherical design

Pointing



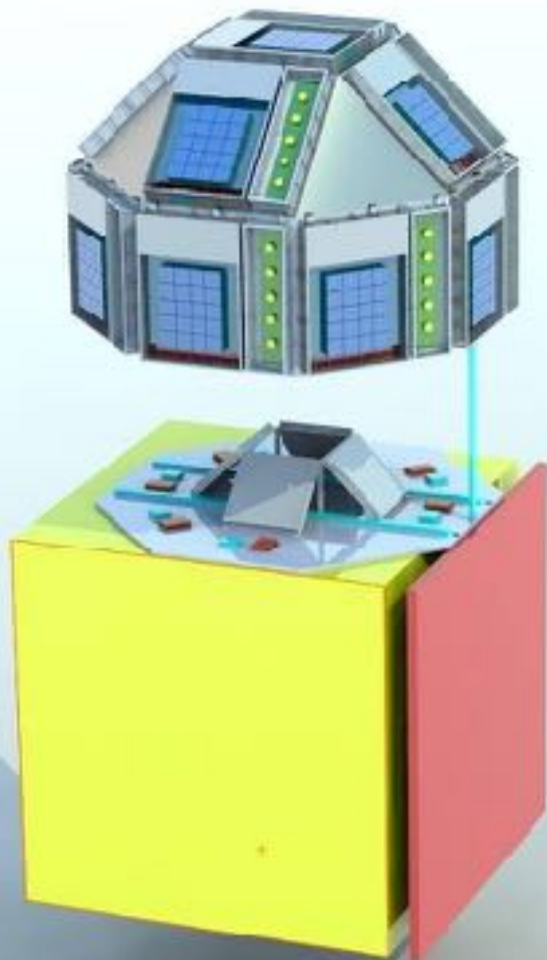
Pointing



Daksha



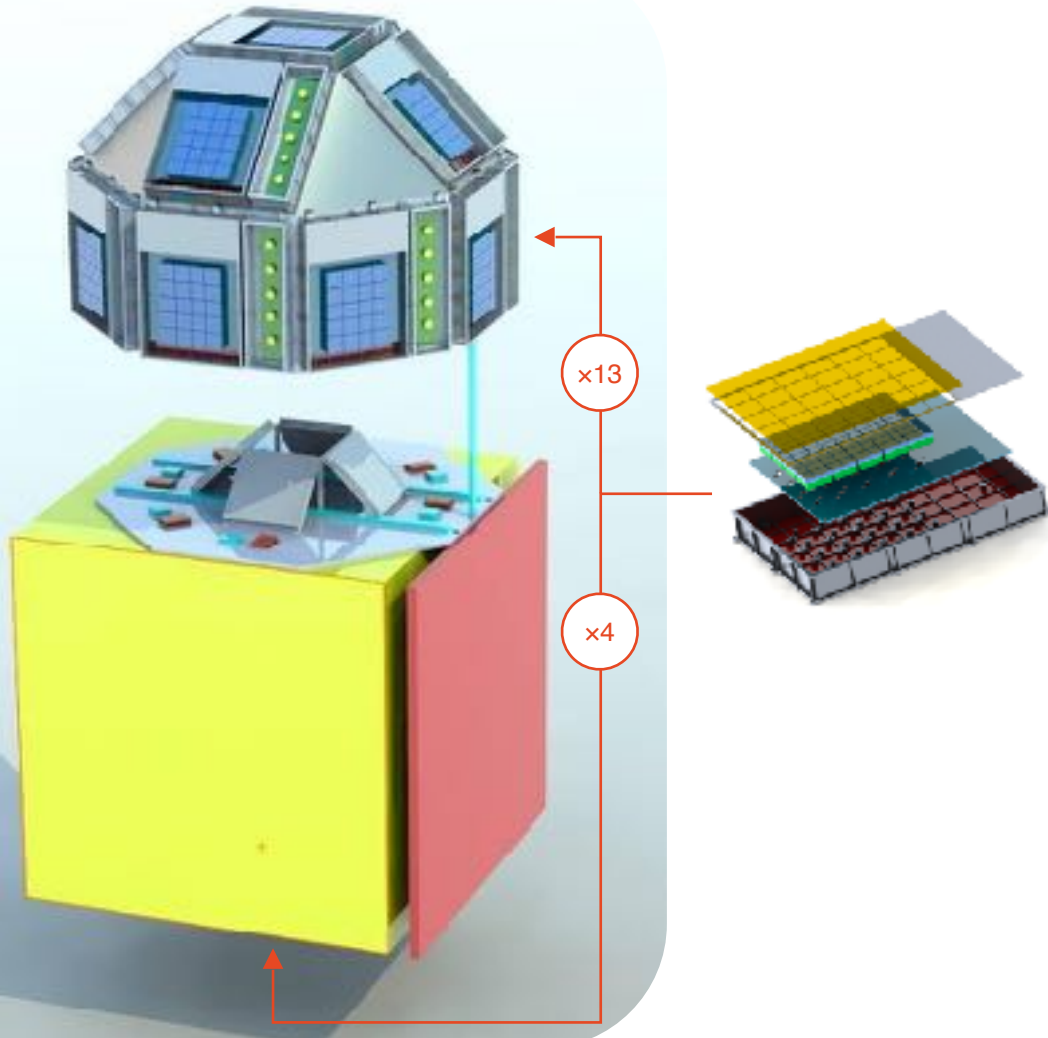
Expanded satellite layout



Daksha



Expanded satellite layout

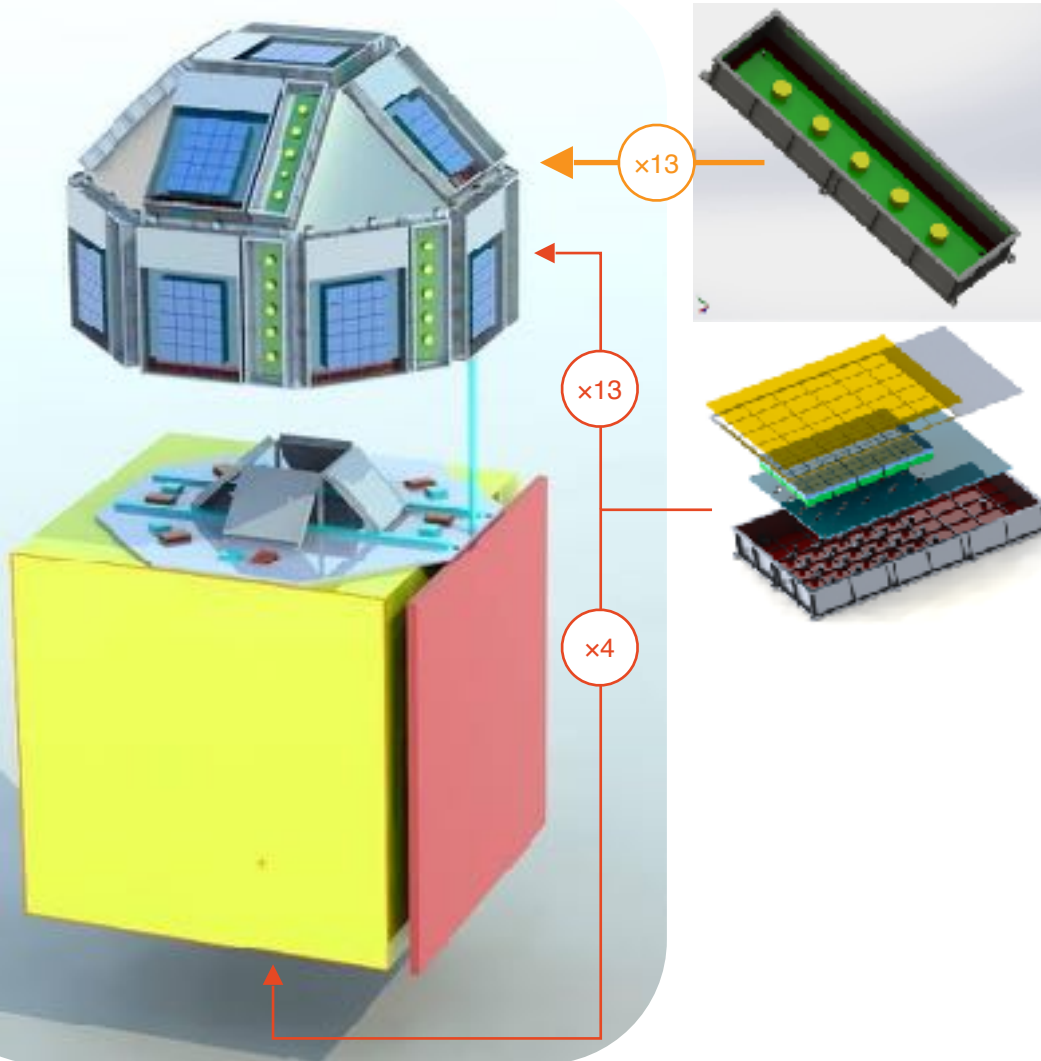


Medium Energy (ME): Cadmium
Zinc Telluride detectors
Range: 20 – 200 keV
17 boxes with 20 detectors each
Used in AstroSat CZTI, RT2, etc

Daksha



Expanded satellite layout



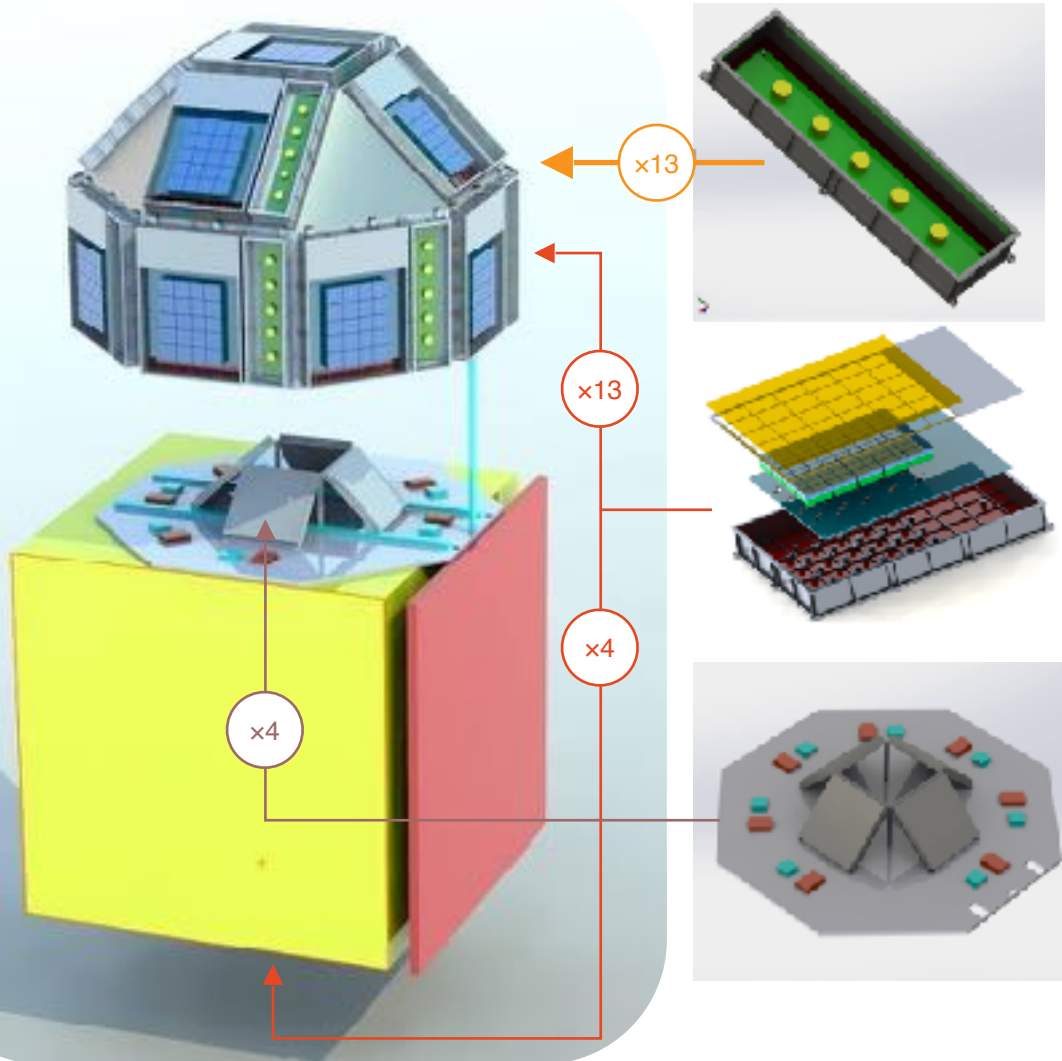
Low Energy (LE): Silicon Drift Detectors
Range: 1 – 25 keV
13 boxes with 5 detectors each
Used for Chandrayaan XSM

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Expanded satellite layout



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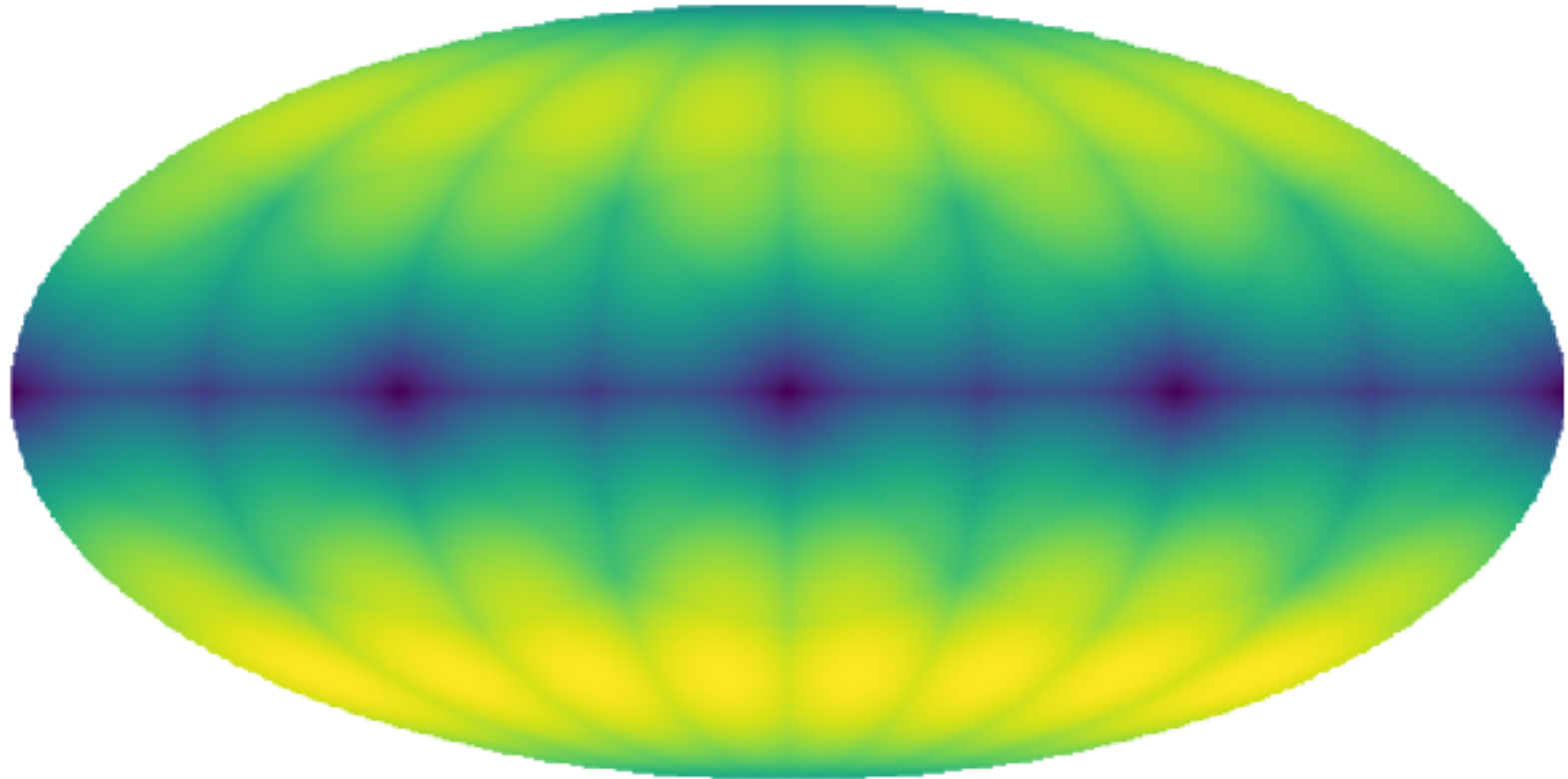
Medium Energy (ME): Cadmium Zinc Telluride detectors
Range: 20 – 200 keV
17 boxes with 20 detectors each
Used in AstroSat CZTI, RT2, etc

High Energy (HE): Sodium Iodide scintillator with Silicon Photo-Multipliers (NaI + SiPM)
Range: 100 keV – > 1 MeV
Four detector units

Single satellite effective area



Effective area



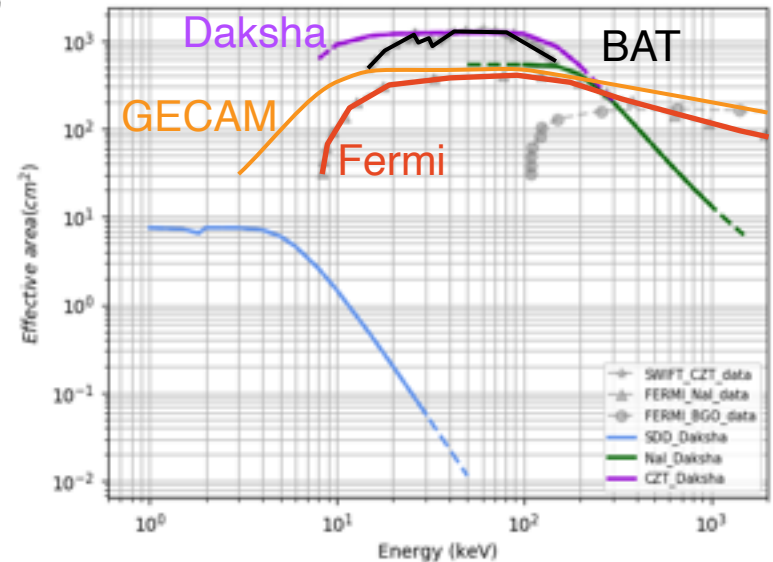
Median: ~ 1300 cm² for single satellite

Comparing missions



Mission name	Energy range (keV)	Effective area (cm ²)	FoV		Grasp (cm ² sr)	Sensitivity (1-s, 5σ)	
			Sky fraction	(sr)		erg cm ⁻² s ⁻¹	ph cm ⁻² s ⁻¹
Daksha (single)	20–200	1300	0.7	8.8	11435	4→10 ⁻⁸	0.6
Daksha (two)	20–200	1700	1	12.6	16336	4→10 ⁻⁸	0.6
Swift-BAT	15–150	1400	0.11	1.4	1960	3→10 ⁻⁸	0.5
Fermi-GBM	50–300	420	0.7	8.8	3695	20→10 ⁻⁸	0.5
GECAM-B	6–5000	480	0.7	8.8	4222	9→10 ⁻⁸	—
SVOM/ ECLAIRs	4–150	400	0.16	2	800	4→10 ⁻⁸	0.8
THESEUS/ XGIS	2–30	500	0.16	2	1000	1.7→10 ⁻⁸	—
THESEUS/ XGIS	30–150	500	0.16	2	1000	5→10 ⁻⁸	—
THESEUS/ XGIS	150–1000	1000	0.5	6.2	6200	45→10 ⁻⁸	—

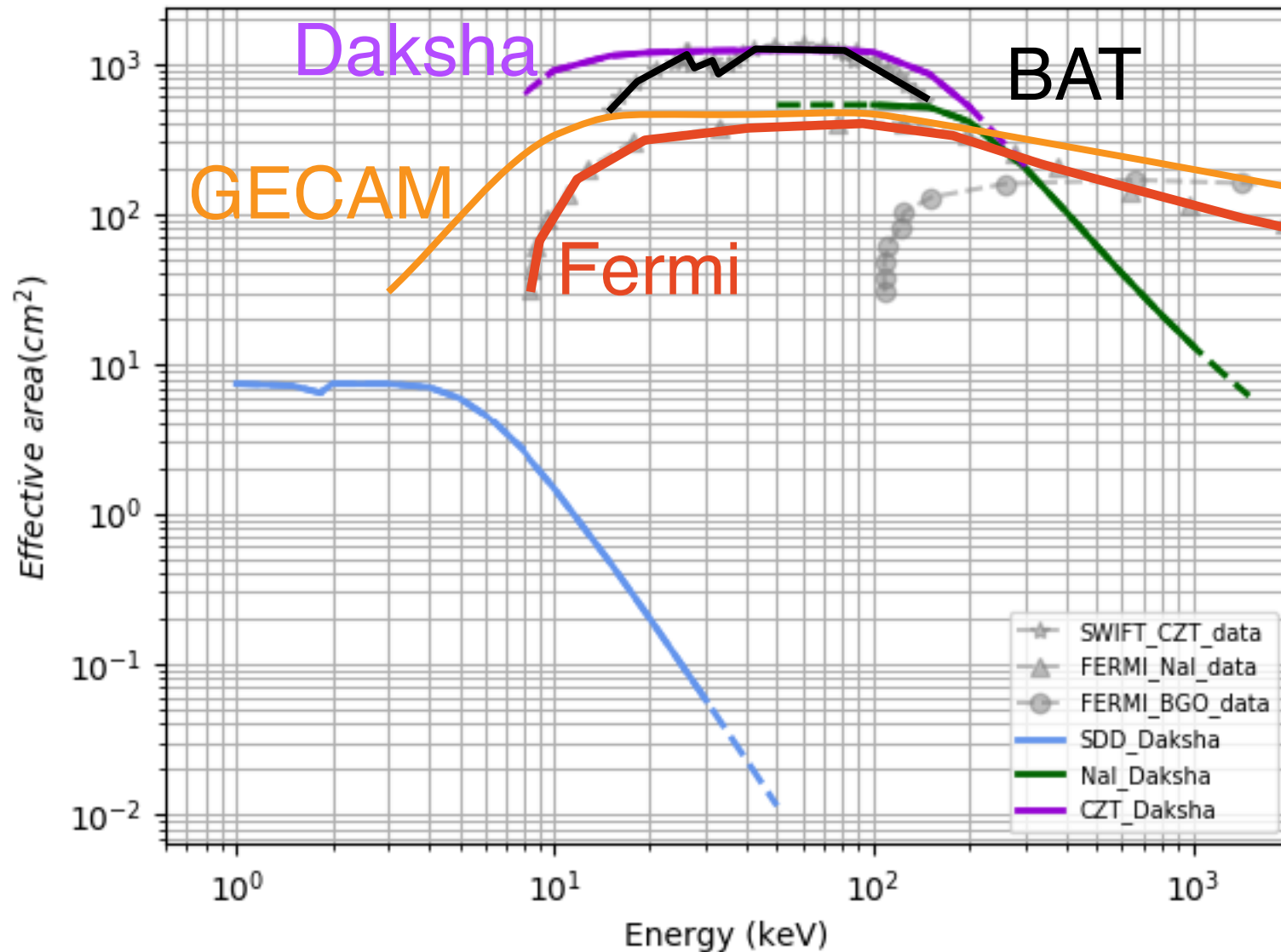
- Daksha has the highest grasp of any mission
- BAT-like sensitivity over the entire sky
- Wider spectral band



Comparing missions



M
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Si
Fe
G
Si
Ti
Ti
Ti



Science goals



Key Science

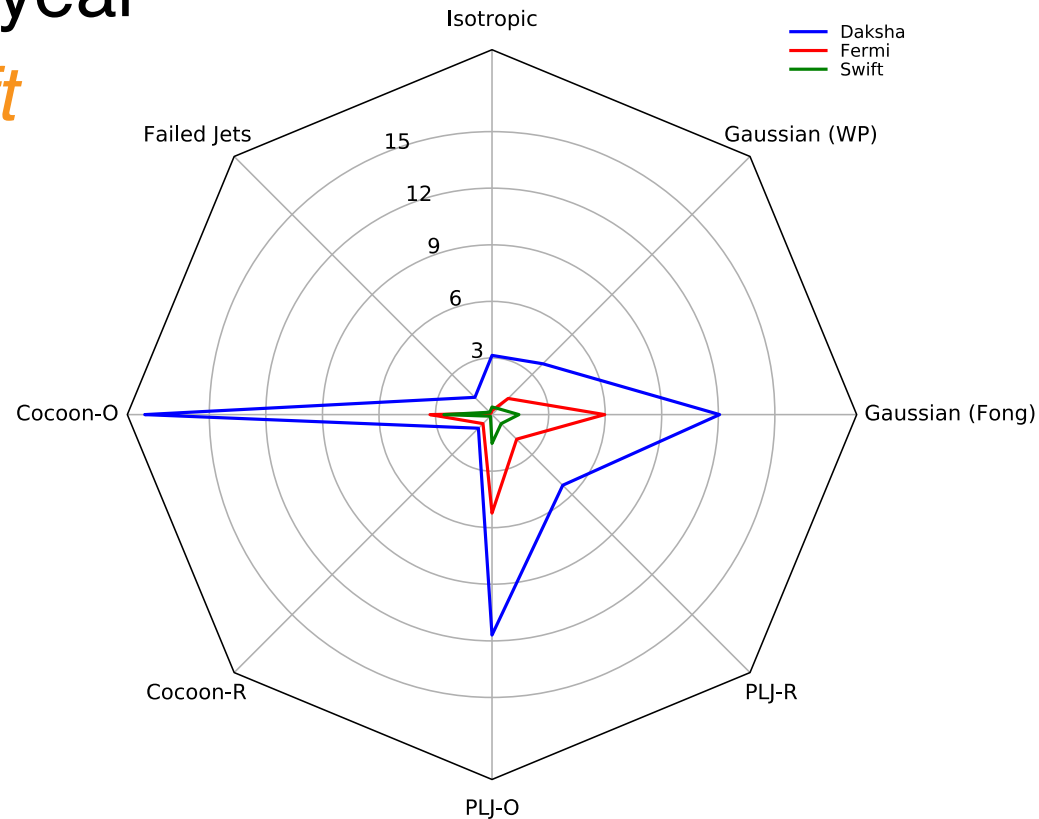
Highest “grasp” of any mission

- EMGW
- GRBs (~700 per year)
 - High redshift
 - Prompt soft spectra
 - Fine time-resolved study
- Polarimetry
 - 10+ bursts / year at 0.3 MDP
- X-ray pulsars
- Magnetars / SGRs
- TGFs
- FRB counterparts
- Earth Occultation imaging
- Solar Flares

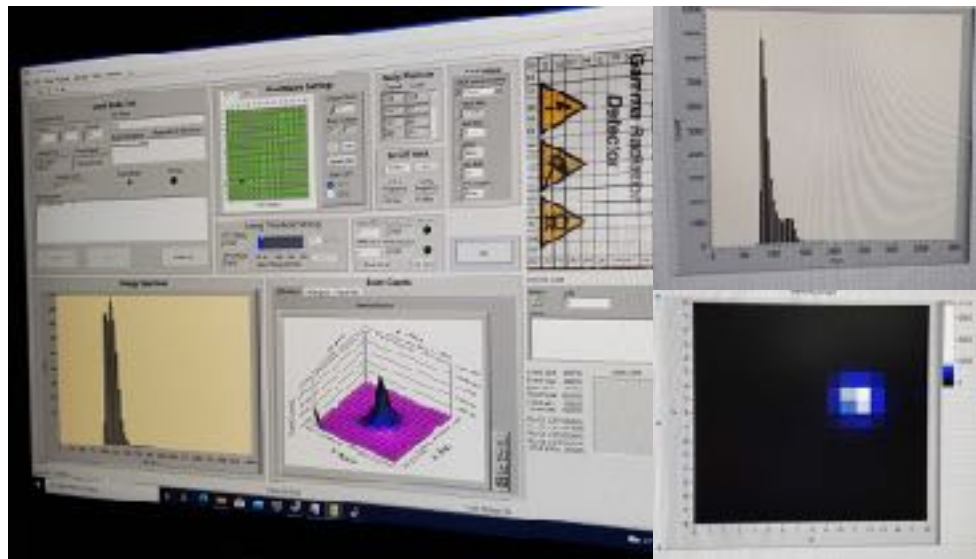
Daksha + EMGW



- Rates: ~ 10 events / year
 - EMGW Range 1–20/year
 - *2-15 \times Fermi, 8 \times Swift*
- Subthreshold events
 - *Increase GW rates!*



Daksha Status



Daksha – On Alert for High Energy Transients

What's next?



- Vibration testing ~ this month
- Thermal cycling: ~ Oct end
- *Next: Proposal evaluation for full mission*
- Post approval:
 - Massive effort to screen, build, calibrate...
 - Launch timescale: before O5 (2025 – 2026)

Thank you!

Express your support:
www.dakshasat.in

