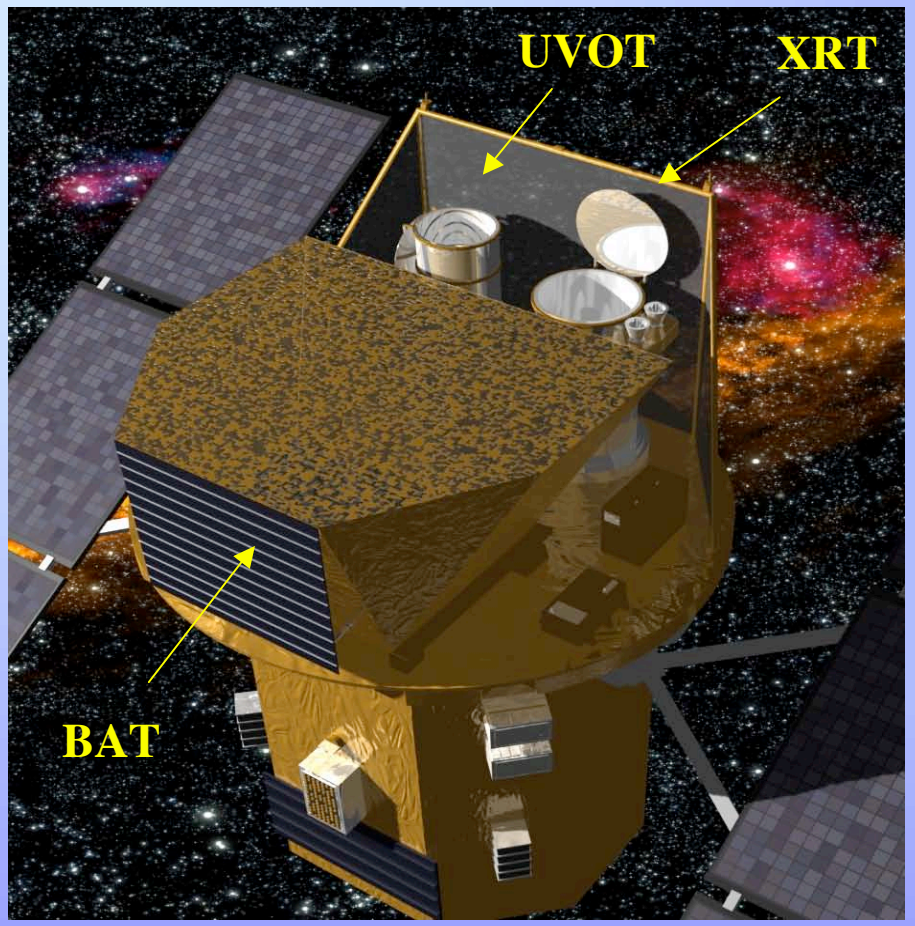
Swift Gamma Ray Bursts

Neil Gehrels

NASA-GSFC

July 10, 2009
David Band Symposium

Swift Mission



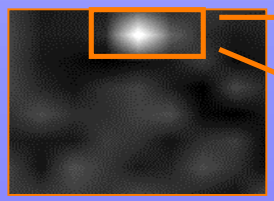
3 instruments, each with:
- lightcurves
- images
- spectra

Rapid slewing spacecraft

Rapid telemetry to ground

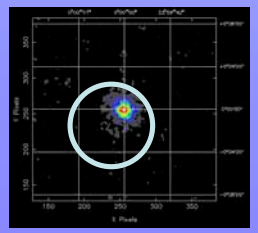
100 GRBs per year

BAT Position - 2 arcmin



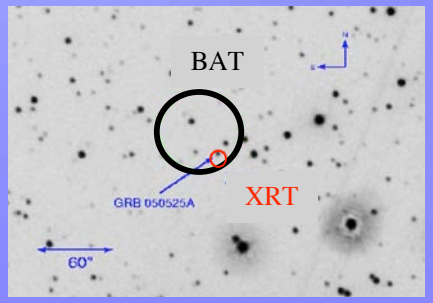
T<10 sec

XRT Position - 5 arcsec

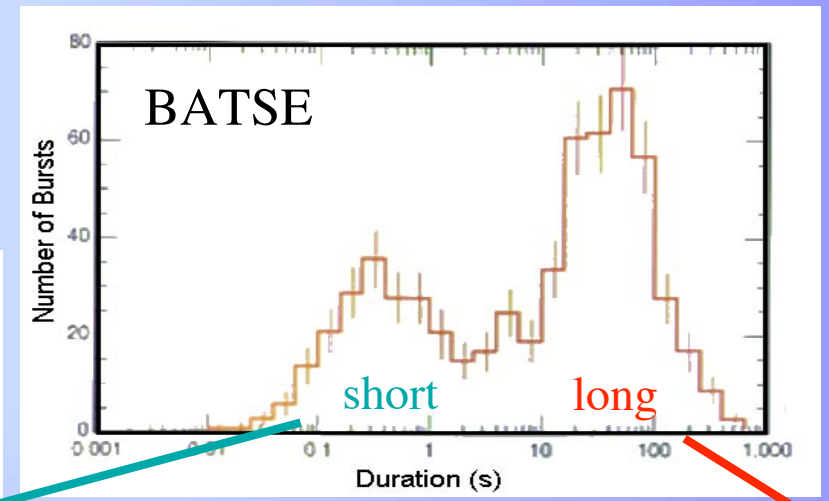


T<90 sec

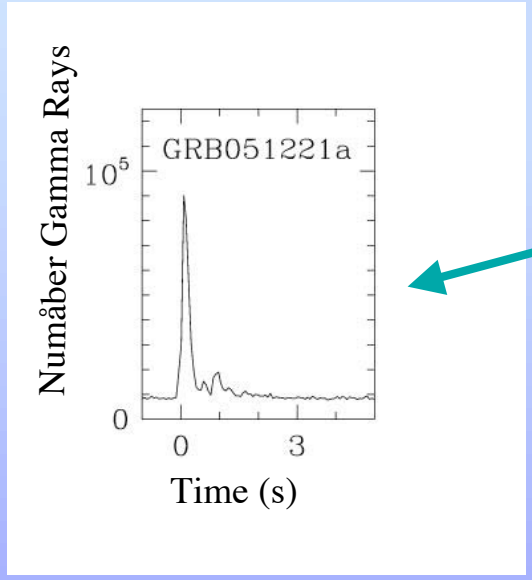
UVOT Position - < 1 arcsec

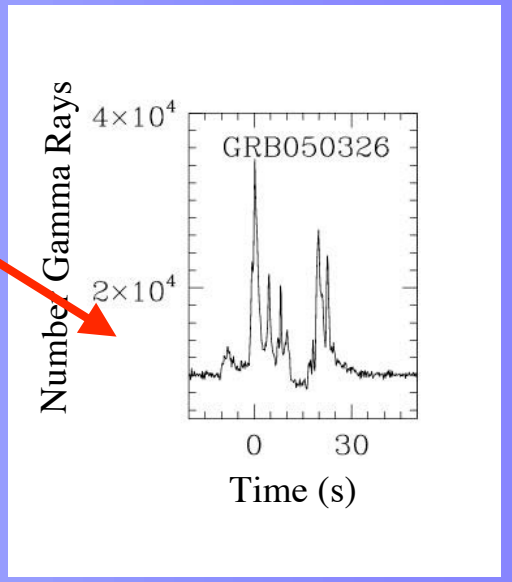


T<2 min

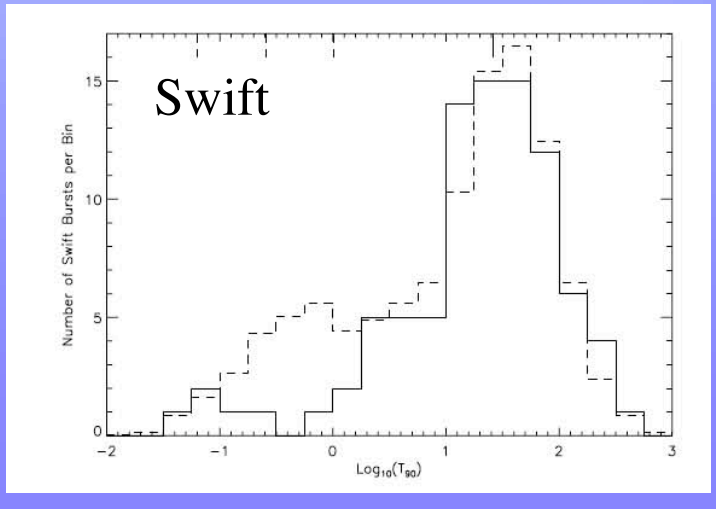


Kouveliotou et al. 2003



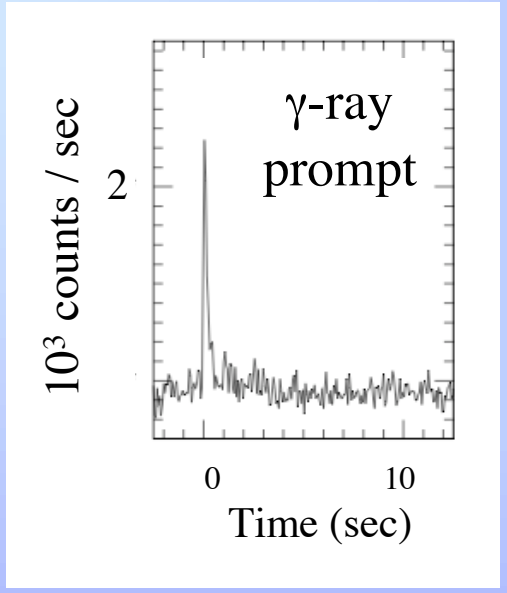


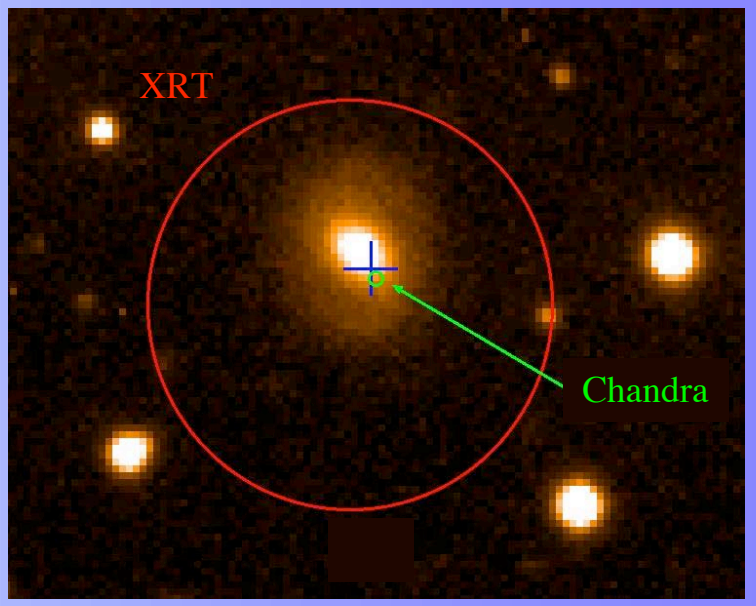
Short vs Long

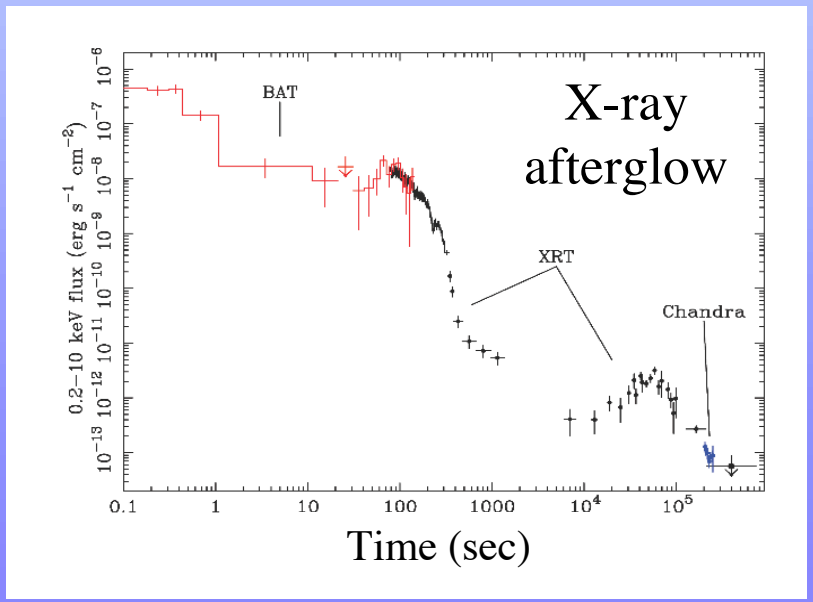


Band 2006

GRB 050724







Host:

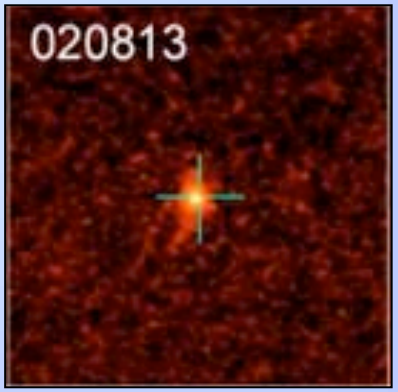
- Elliptical
- $z = 0.258$
- no coincident supernova
- SFR $< 0.02\ M_O\ yr^{-1}$

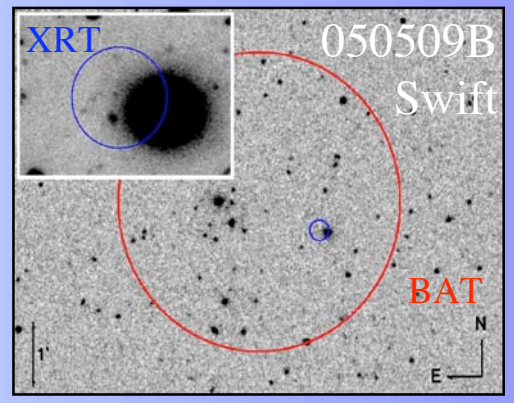
Barthelmy et al. 2005

Long GRBs

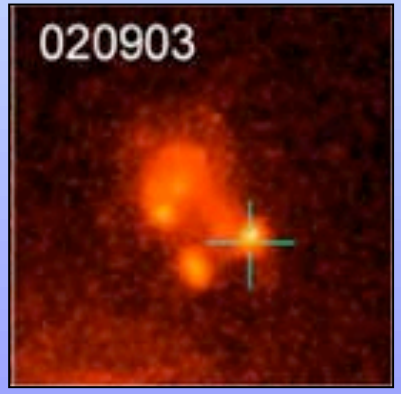
Short GRBs

star forming irregulars

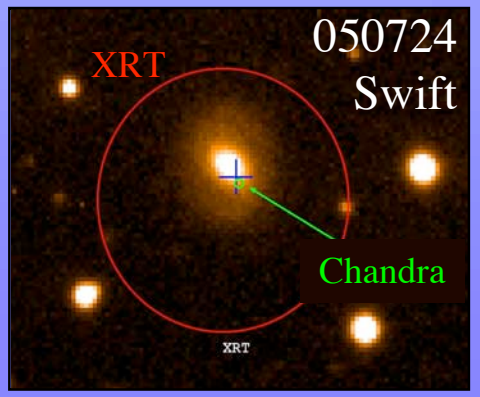




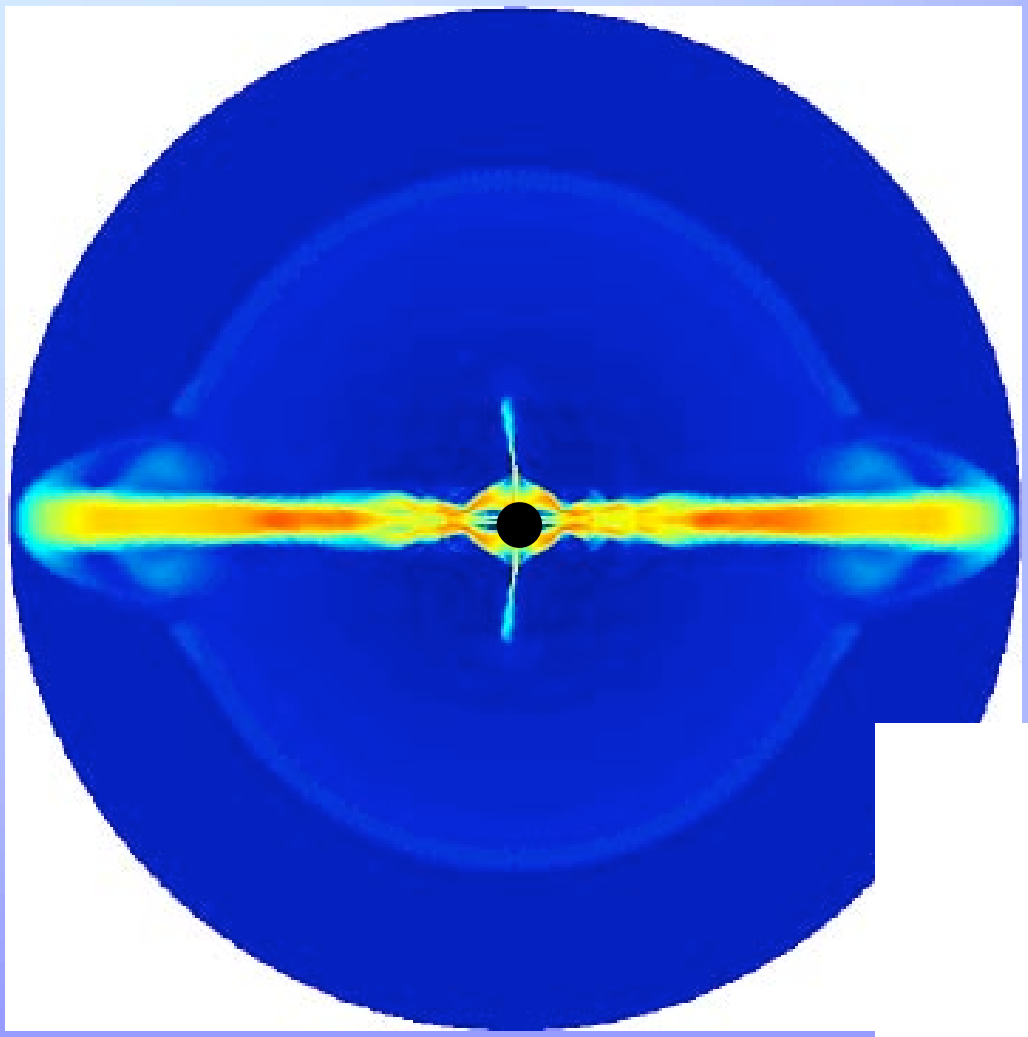
z = 0.225
cD elliptical
SFR < 0.2 M_O yr^{-1}



z = 0.161
star forming galaxy
with offset



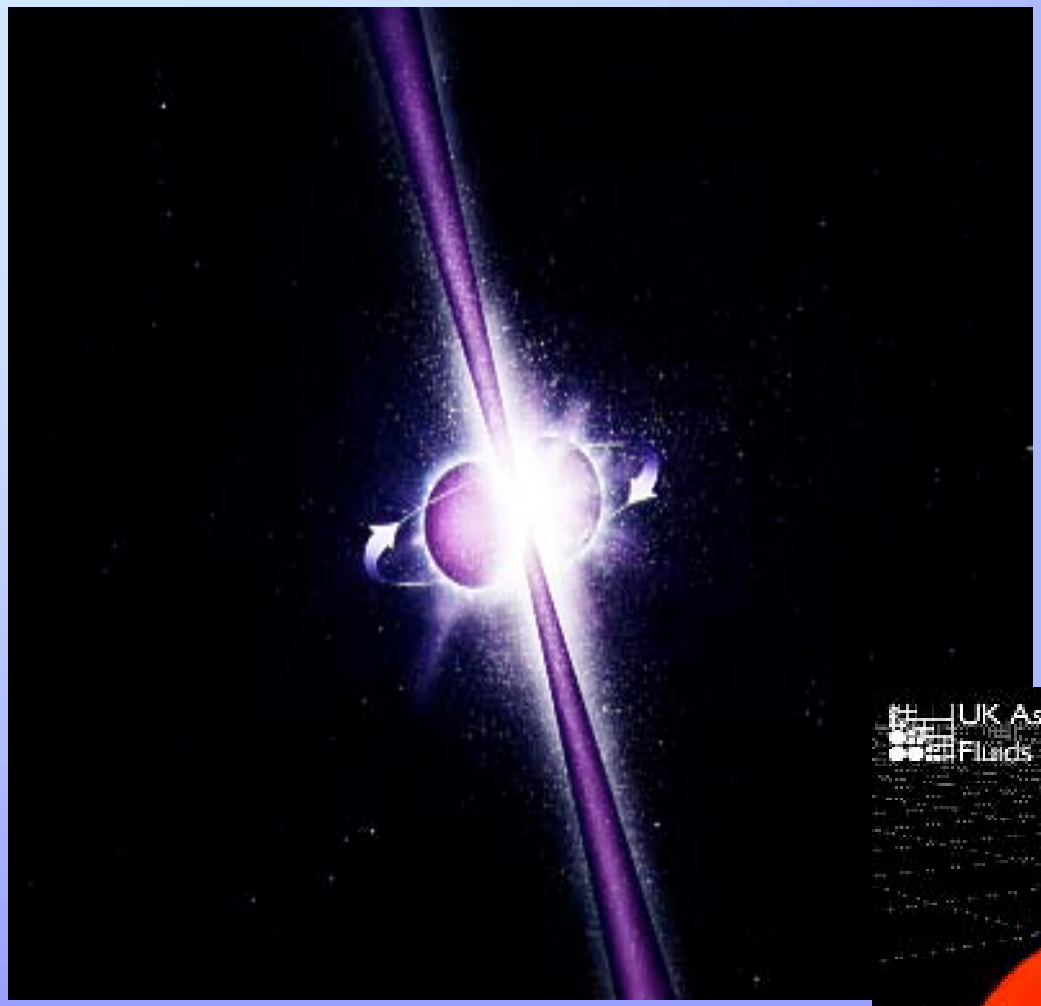
z = 0.258
elliptical
SFR < 0.02 M_O yr^{-1}

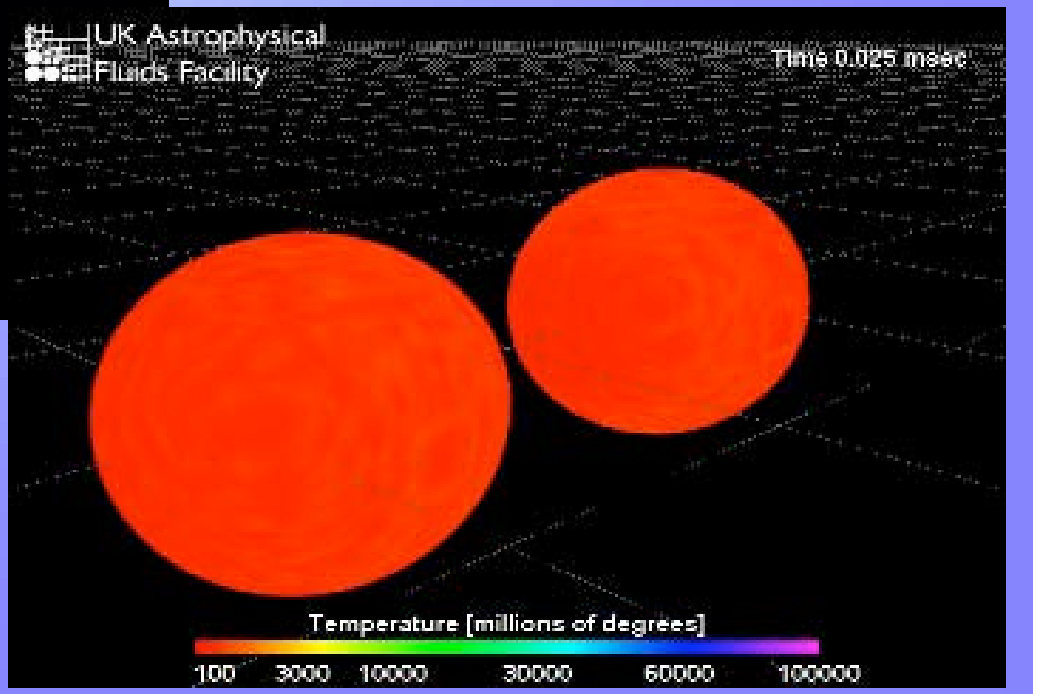


Long GRBs
Collapsar Model

Barkov & Komissarov

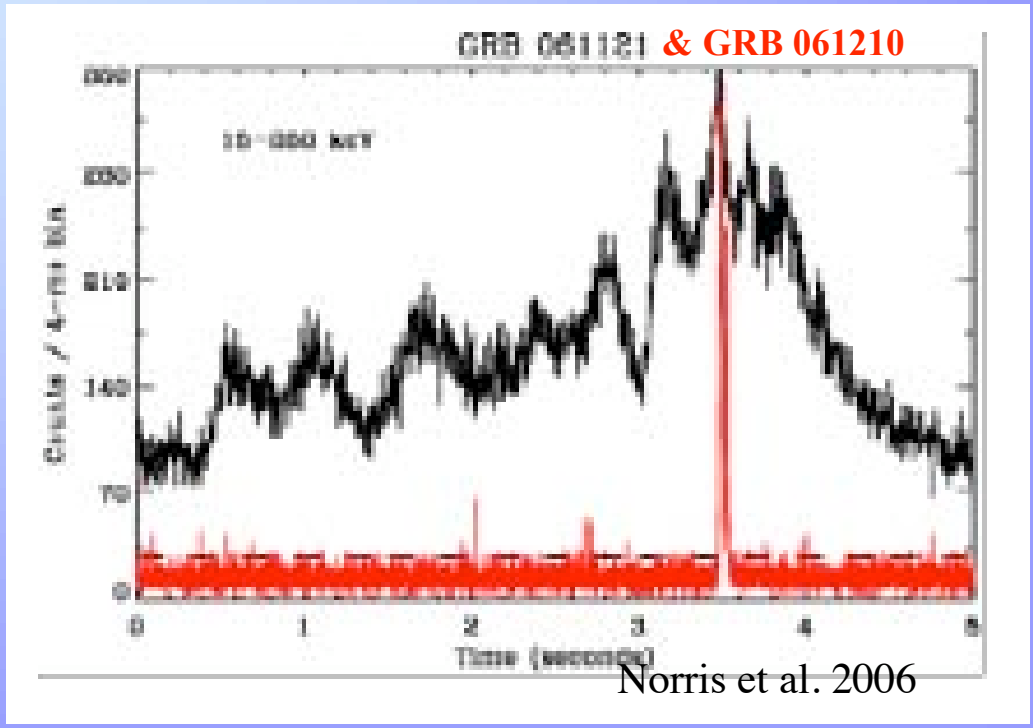
Short GRBs
Merger Model





Roswog et al.

Variability Comparing Short & Long



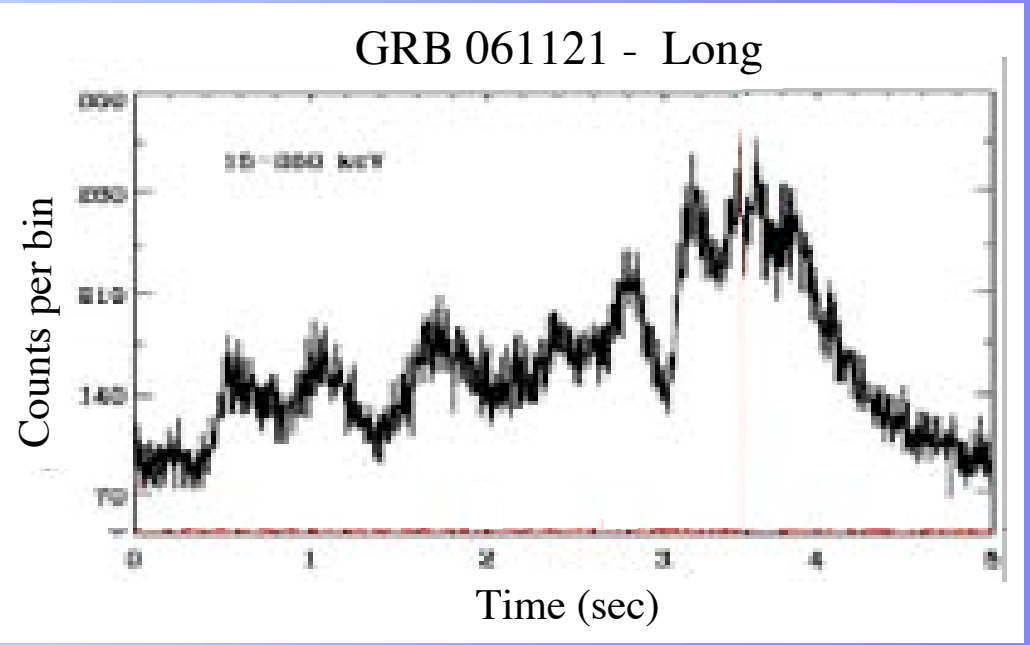
Norris et al. 2006

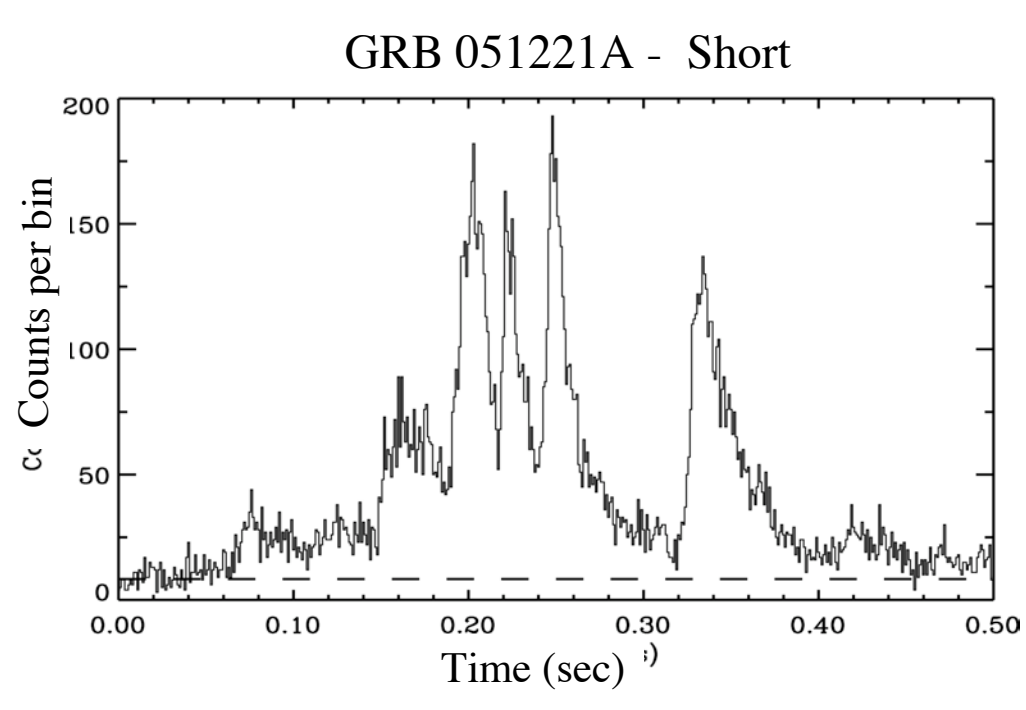
GRB 061121 = brightest long GRB

GRB 061210 = brightest short GRB

Variability

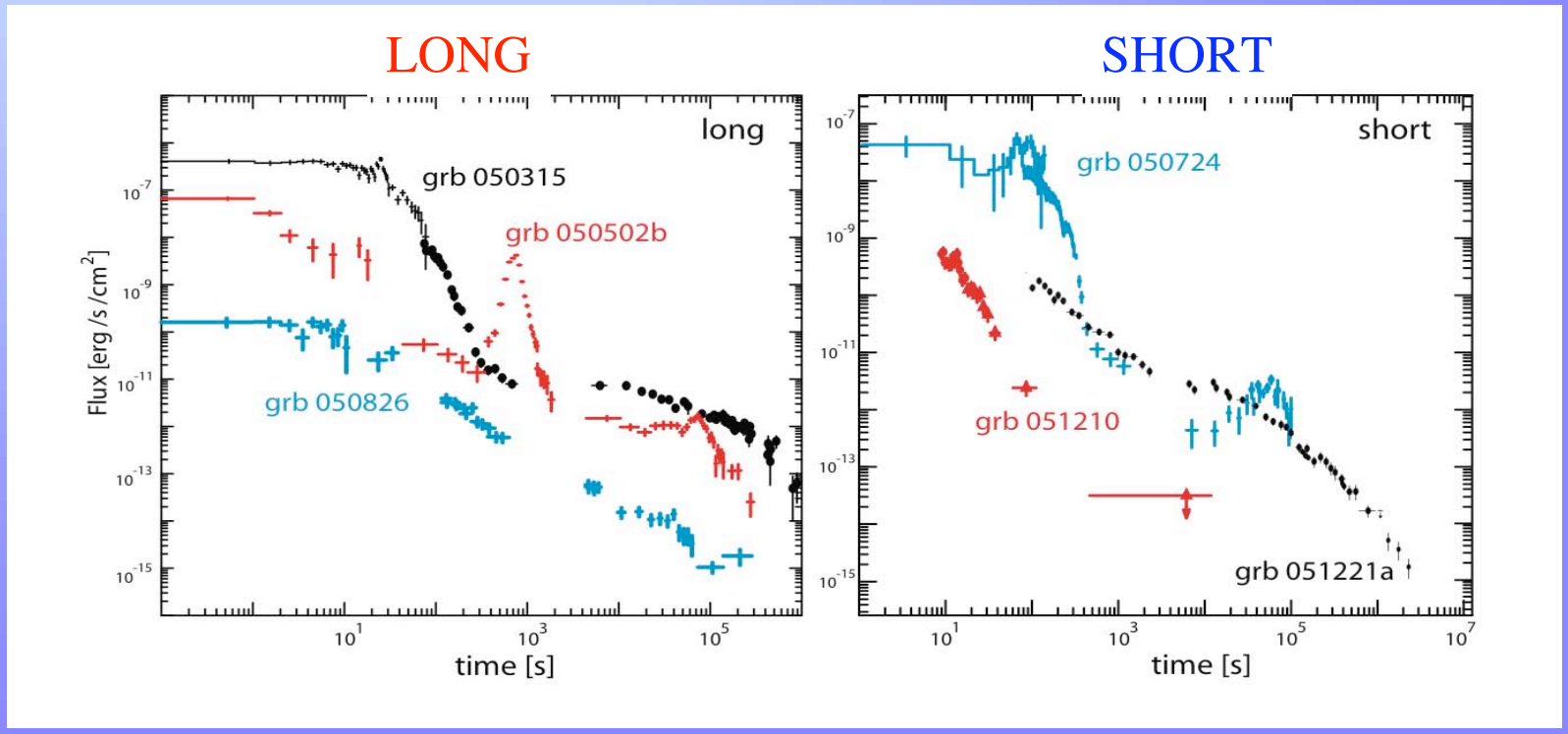
Short & long burst
both have highly variable
prompt emission





X-ray Afterglows

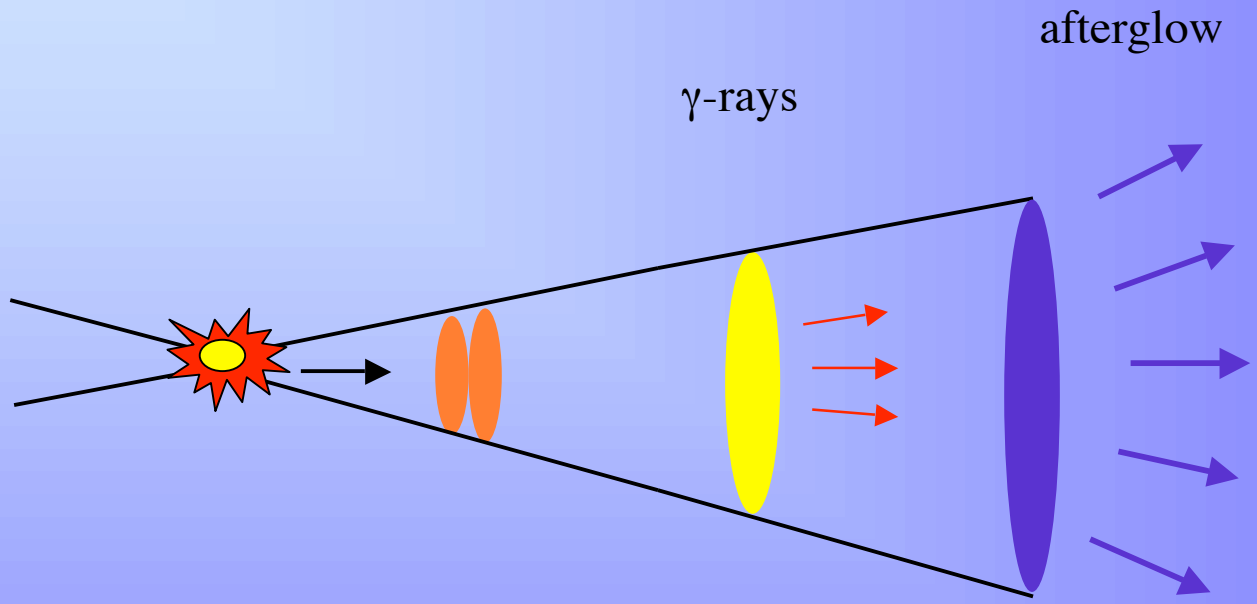
- There are various types of light curves for both long and short
- X-ray afterglow is weaker on average for shorts
  but light curves are generally similar



Gehrels, Ramirez-Ruiz & Fox, ARAA 2009 based on Sakamoto 2008

Fireball Model

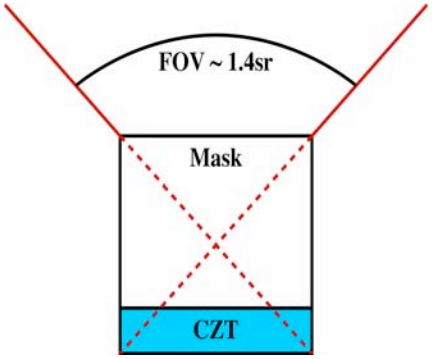
(Meszaros & Rees 1997)

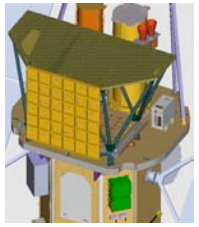


Conclusion: Given their very different origins, the observed characteristics of short & long bursts are remarkably similar.

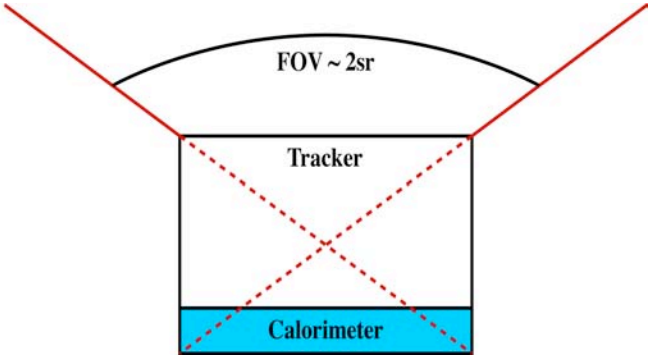
David's Idea:
Fermi & Swift Working Together

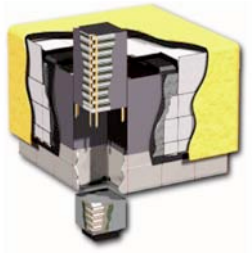
Swift/BAT





Fermi/LAT

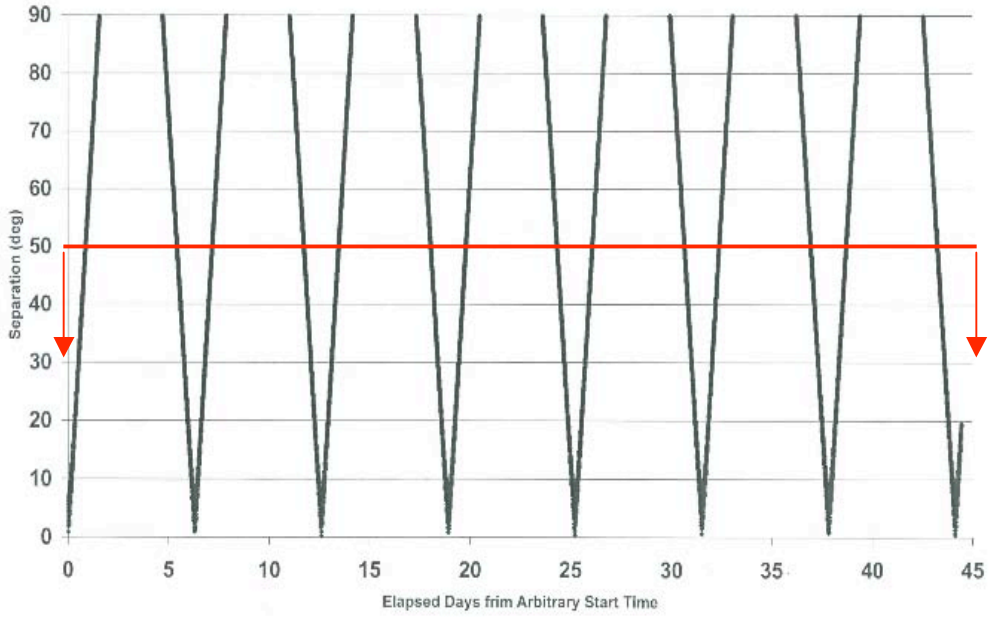




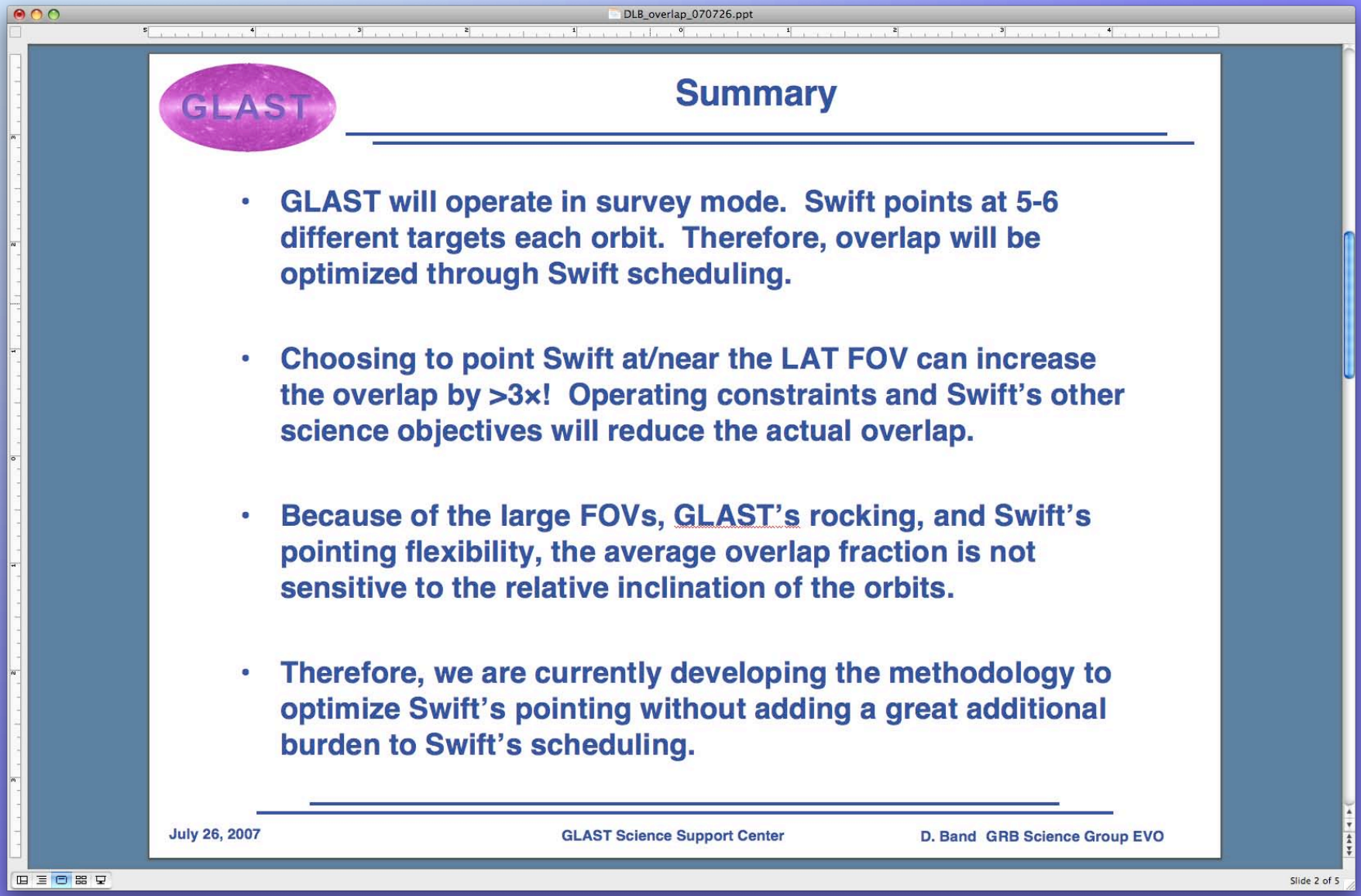
David's Calculation of Pointing Overlap

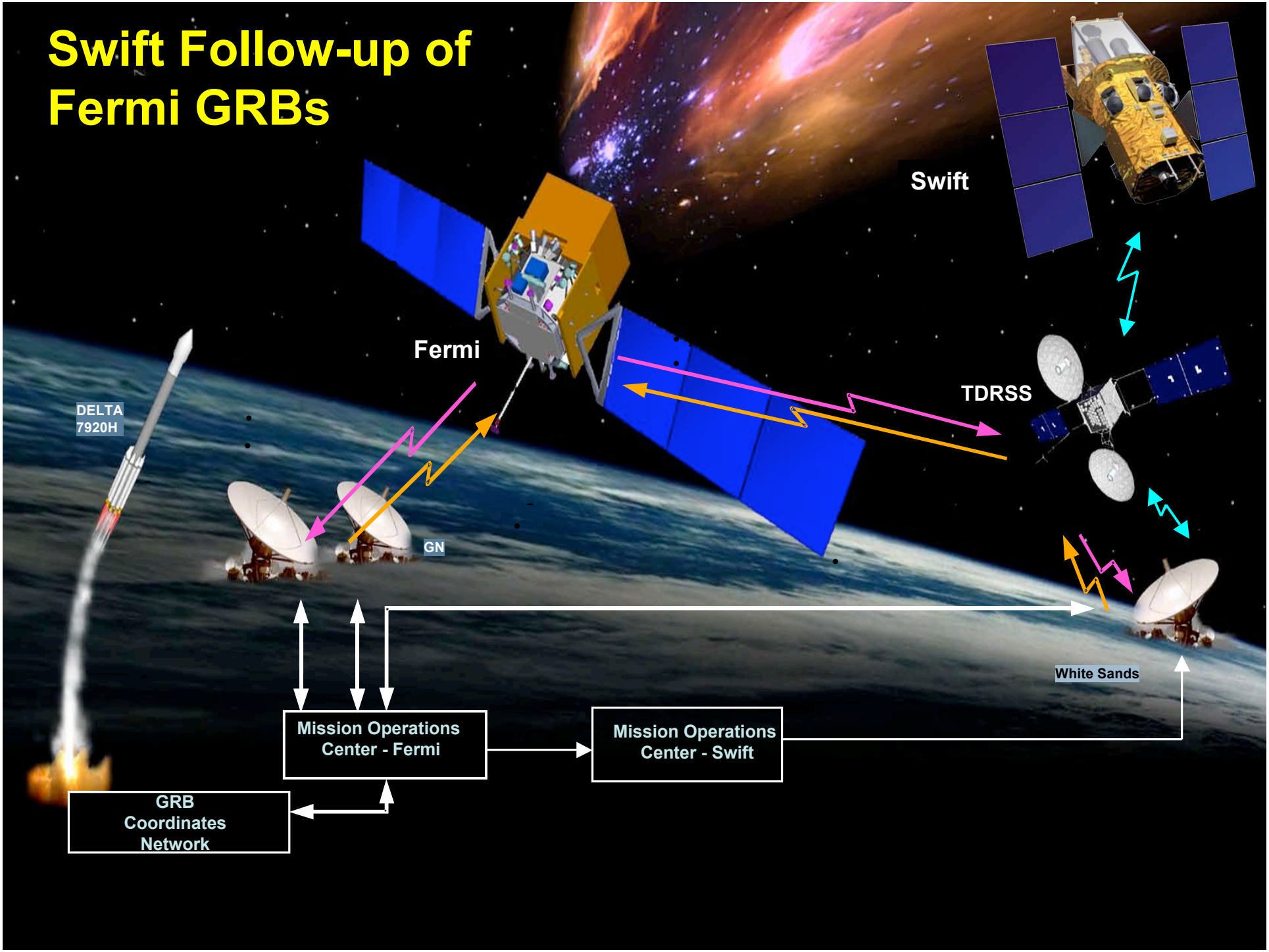
BAT - LAT Joint Pointing

Orbit Assumption: Swift = 21˚ x 600 km
GLAST= 28˚ x 550 km



David's Conclusions




Swift Follow-up of Fermi GRBs
Swift
Fermi
TDRSS
DELTA 7920H
GN
White Sands
Mission Operations Center - Fermi
Mission Operations Center - Swift
GRB Coordinates Network