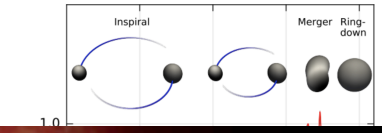
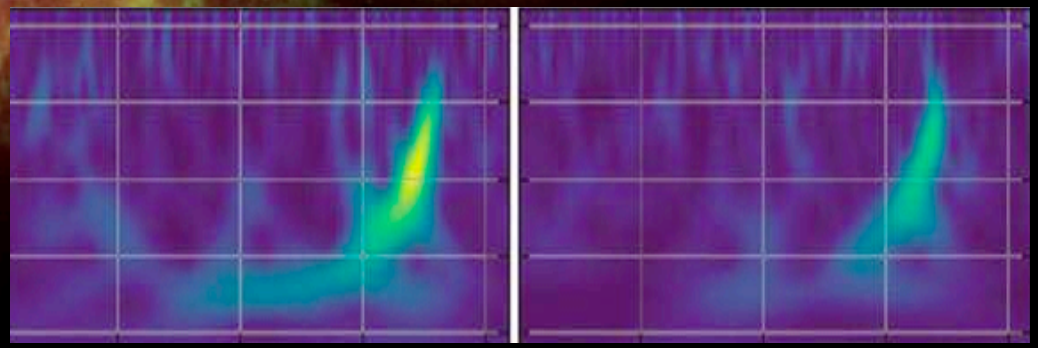
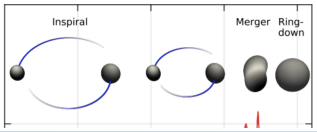


News from AGILE on GW150914

Sandro Mereghetti
for the AGILE Team



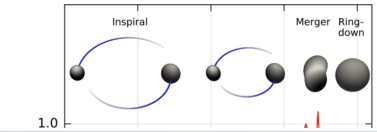
agile

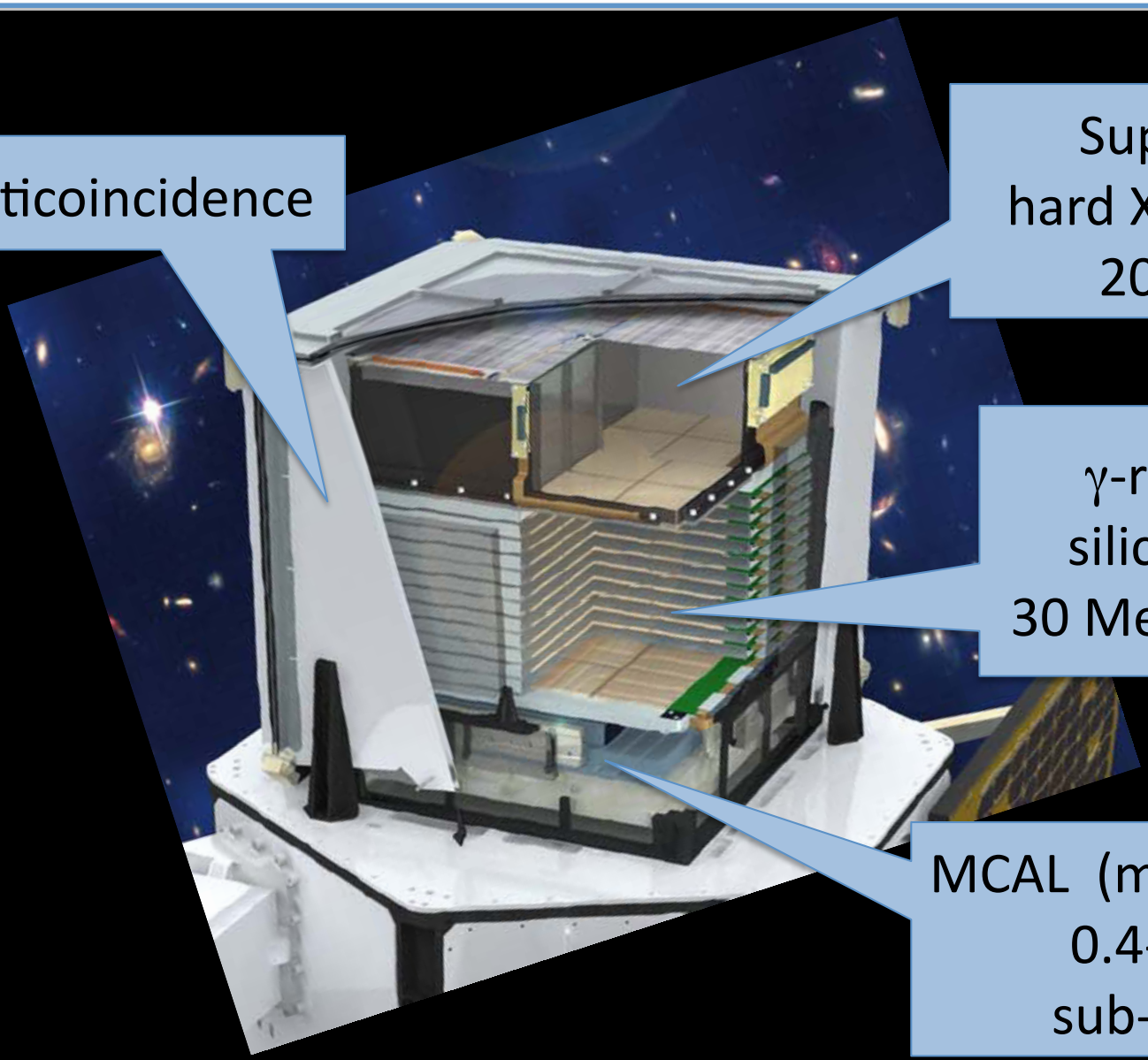


Submitted to the *Astrophysical Journal Letters*, April 1, 2016.

AGILE Observations of the Gravitational Wave Event GW150914

M. Tavani[1,2,3], C. Pittori[4,5], F. Verrecchia[4,5], A. Bulgarelli[6], A. Giuliani[7], I. Donnarumma[1], A. Argan[1], A. Trois[8], F. Lucarelli[4,5], M. Marisaldi[6], E. Del Monte[1], Y. Evangelista[1], V. Fioretti[6], A. Zoli[6], G. Piano[1], P. Munar-Adrover[1], L.A. Antonelli[4,5], G. Barbiellini[9], P. Caraveo[7], P.W. Cattaneo[10], E. Costa[1], M. Feroci[1], A. Ferrari[11], F. Longo[9], S. Mereghetti[7], G. Minervini[12], A. Morselli[13], L. Pacciani[1], A. Pellizzoni[8], P. Picozza[13], M. Pilia [8], A. Rappoldi[10], S. Sabatini[1], S. Vercellone[14], V. Vittorini[1], P. Giommi[4], S. Colafrancesco[15], M. Cardillo[16].



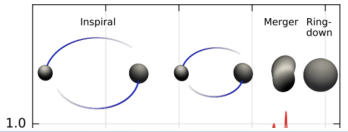


Anticoincidence

SuperAGILE
hard X-ray Imager
20-60 keV

γ-ray imager
silicon tracker
30 MeV – 100 GeV

MCAL (miniCalorimeter)
0.4-100 MeV
sub-ms trigger



AGILE Satellite

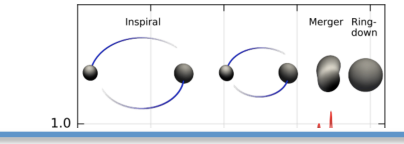
Launched 23 Feb 2007

Low earth equatorial orbit (h~500 km, P ~ 90 min, i ~ 0.2 deg)

Simultaneous γ-ray and X-ray imaging over wide FoV (2.5 sr)
+ nearly omni-directional sensitivity for transients

Since 2010 in **spinning mode** → excellent sky monitoring capability

80% of the sky covered every 7 min (spin period)
Each accessible region covered ~100-150 pass/day
sensitivity each pass (2 min) ~ few x 10^{-8} erg/cm^2/s E>30 MeV



Integration: T0-205s -- T0-105s Sep14,2015

fov=70, albrad=70; ALL event types

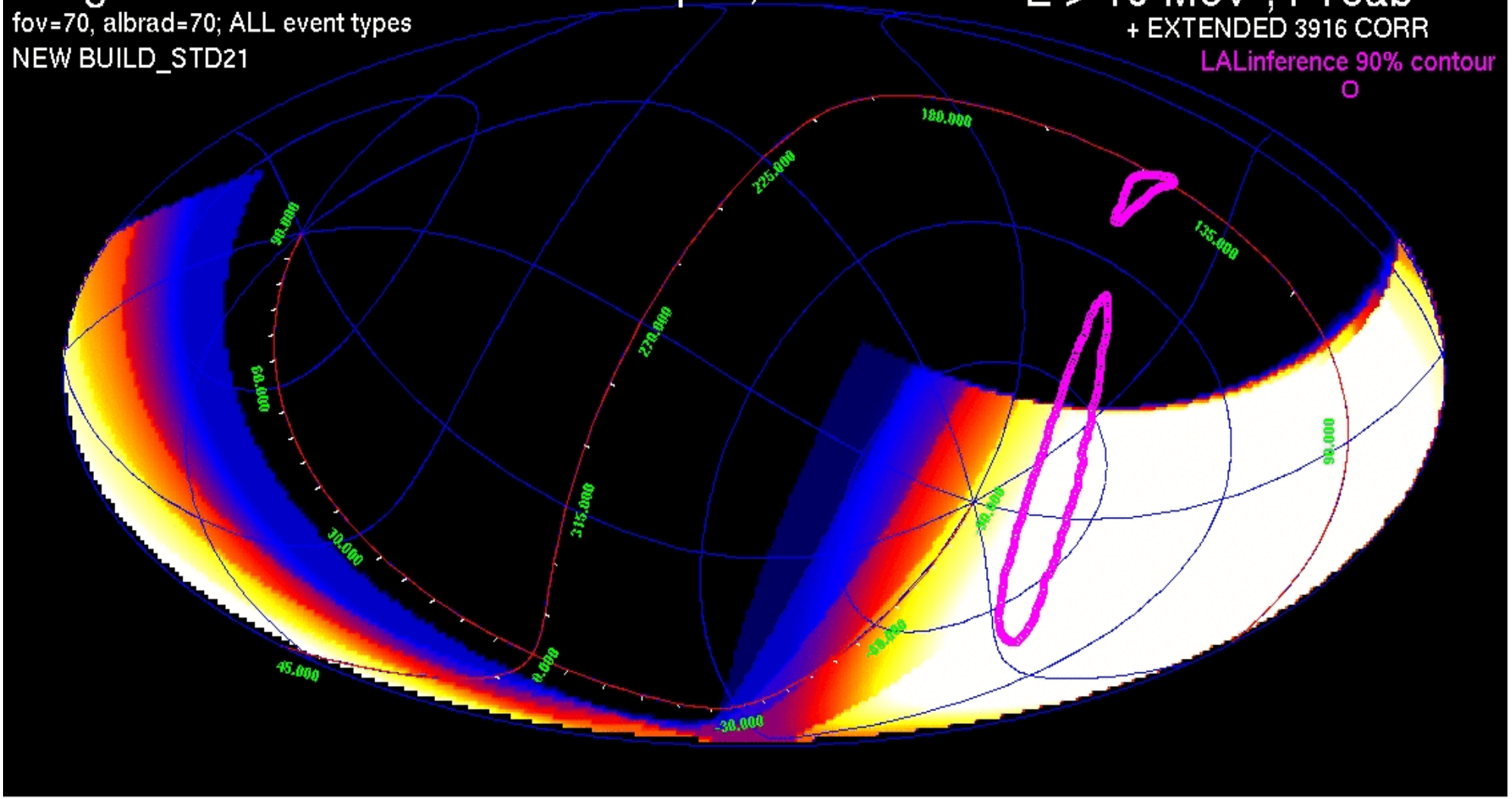
NEW BUILD_STD21

E > 10 MeV ; FT3ab

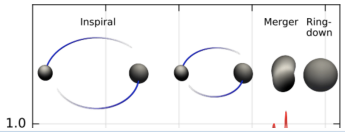
+ EXTENDED 3916 CORR

LALinference 90% contour

O

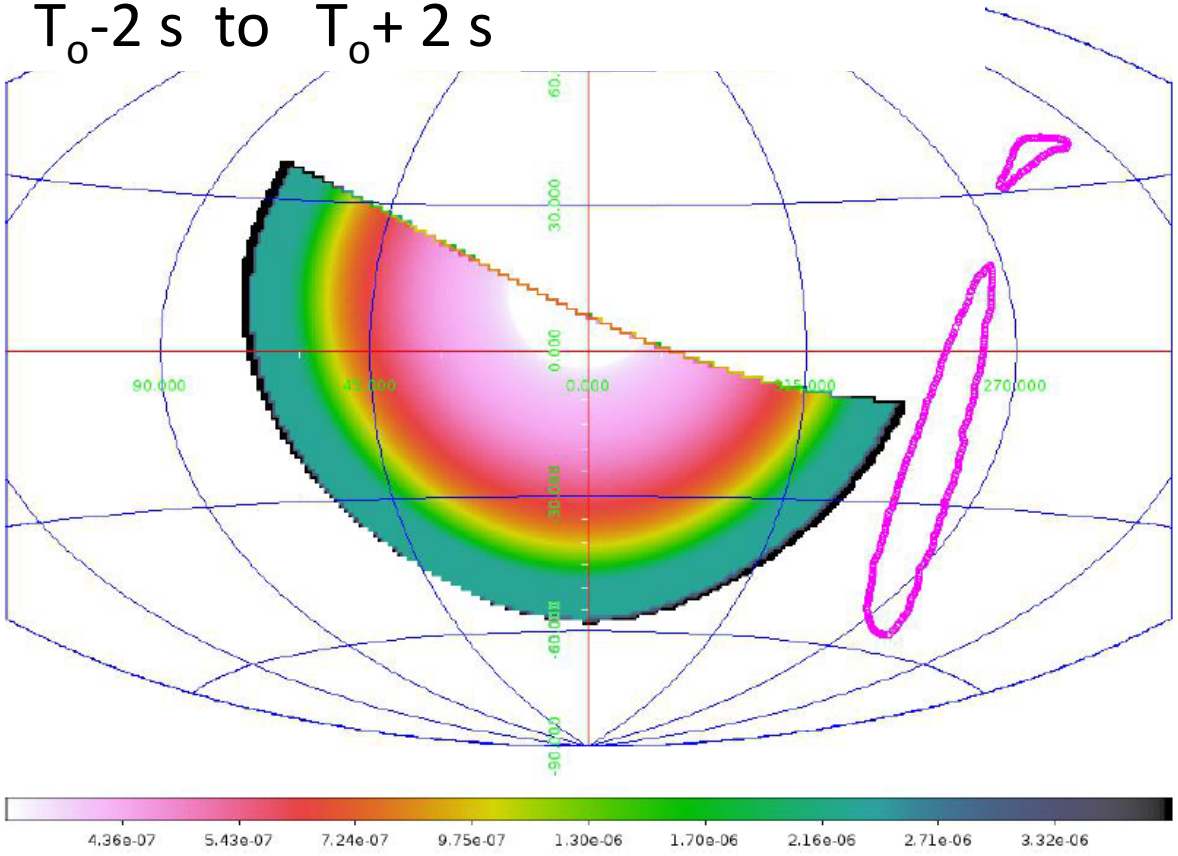


AGILE news on GW150914 *S.Mereghetti*



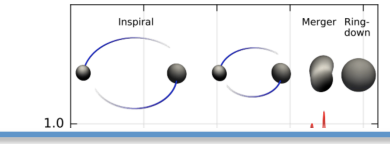
Prompt emission - GRID (30 MeV -30 GeV)

Gamma-ray imager exposure from
T_o-2 s to T_o+ 2 s



T_o = 9:50:45 UT

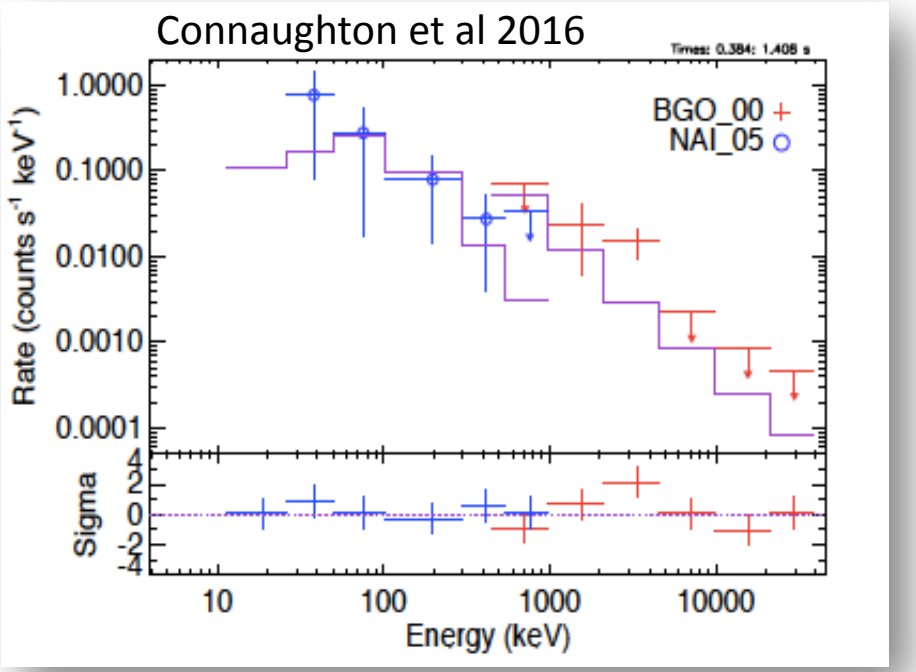
GW position just missed for a few seconds



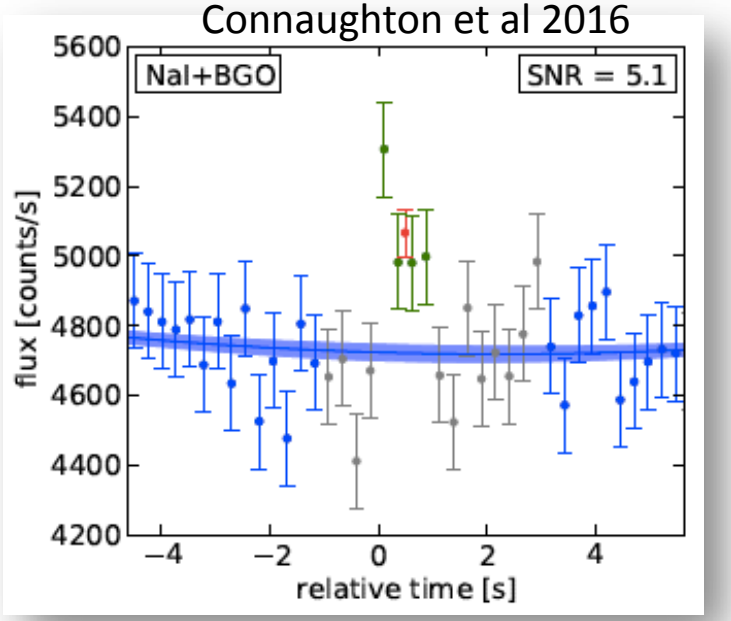
Prompt emission – MCAL (0.4-100 MeV)

No triggers in [T_o-100 s, T_o+100 s]

Connaughton et al 2016



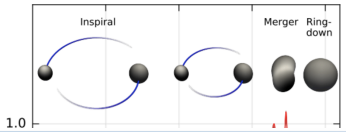
Connaughton et al 2016



Fluence u.l. ~10^{-6} erg/cm^2

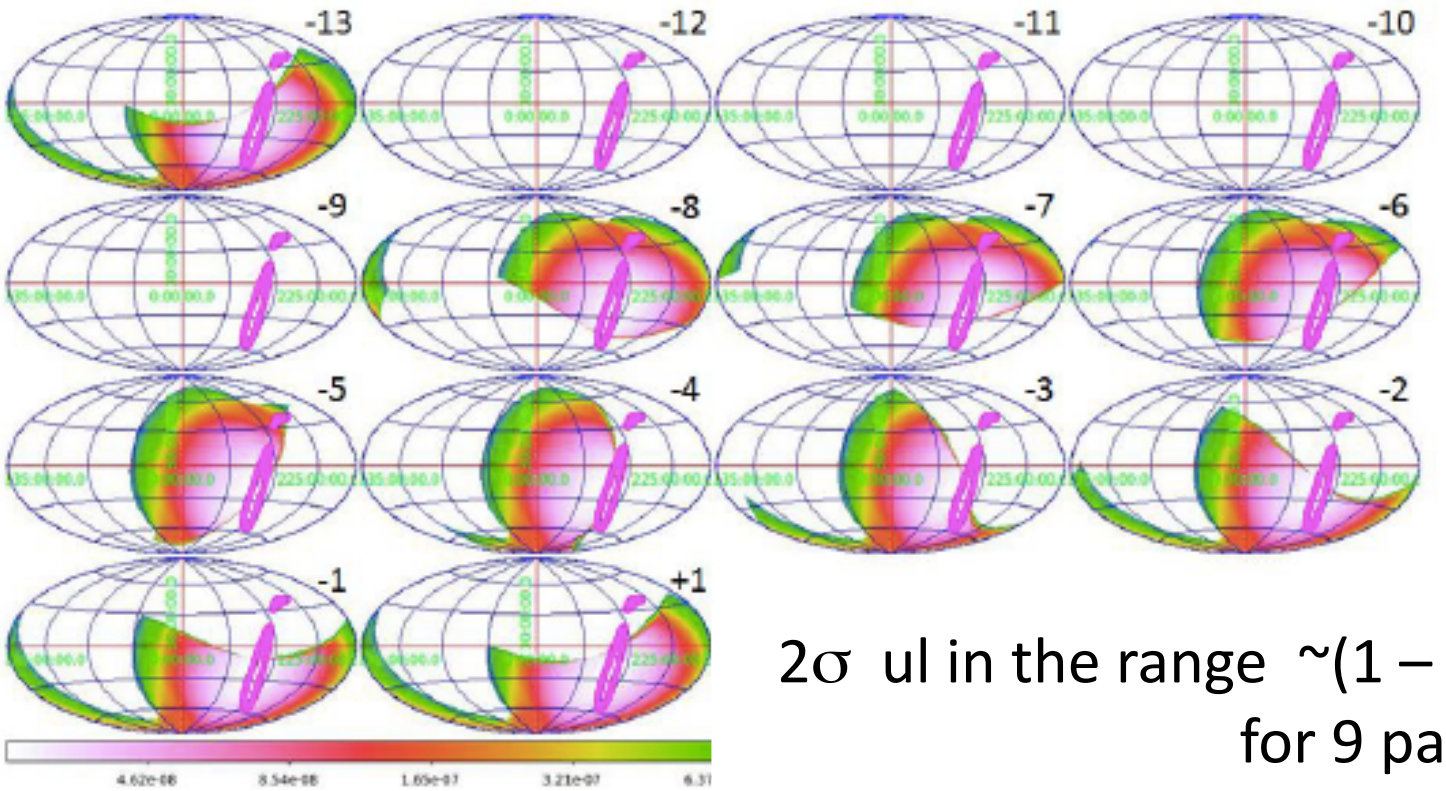
slightly above extrapolation of Fermi-GBM

GBM $F_{10\ keV\text{-}1MeV} = 2.4\ 10^{-7}$ → 0.9×10^{-6} [for power law photon index Γ=-1.4]

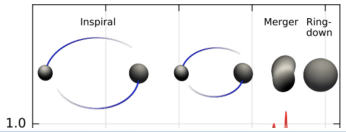


GRID upper limits on precursor (50 MeV – 10 GeV)

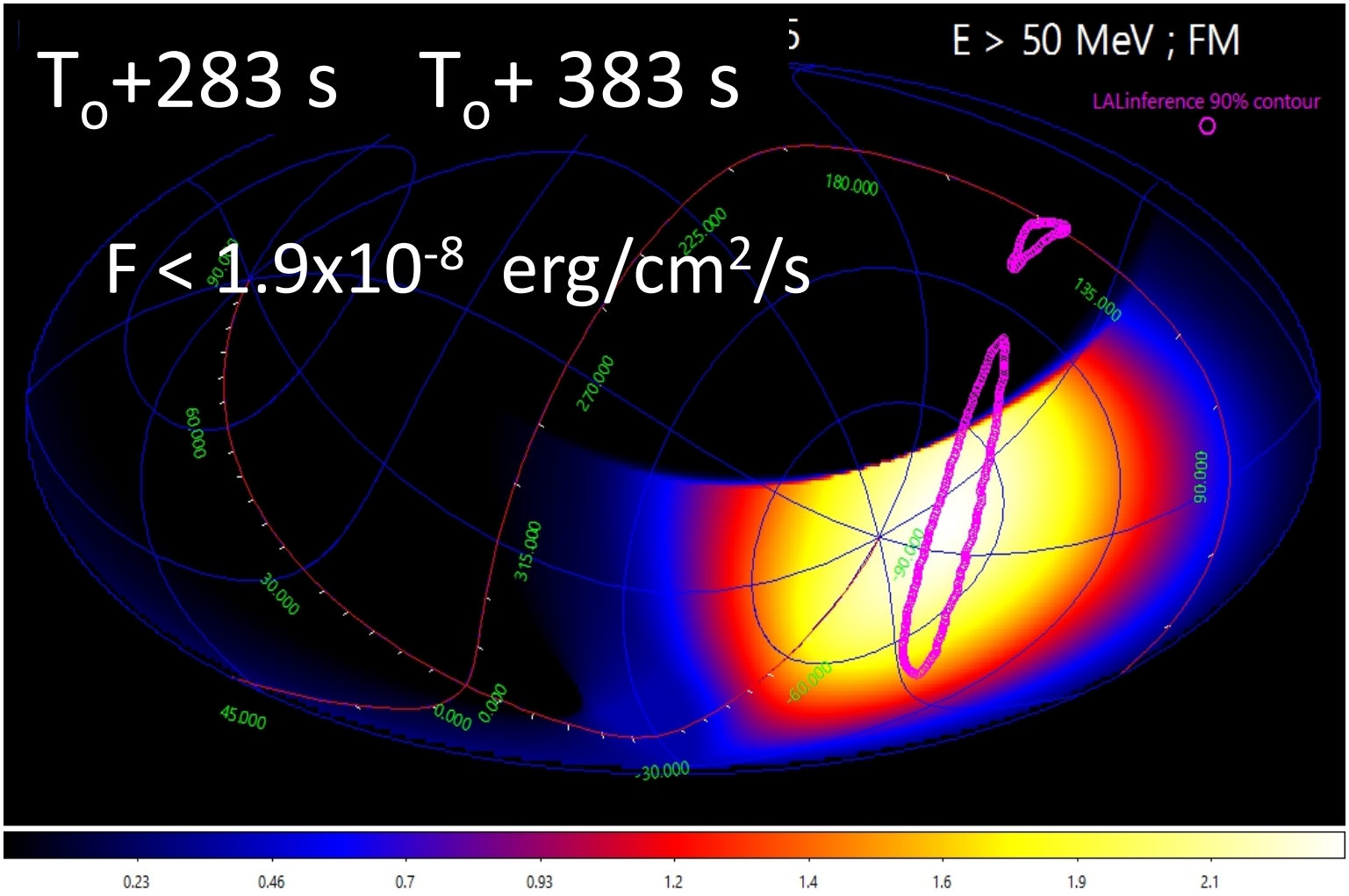
Passes from -13 to +1



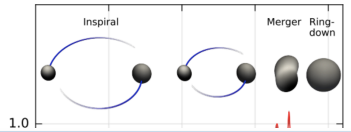
2σ ul in the range ~(1 – 5)x10^{-8} erg/cm^2/s
for 9 passes (~100 s each)
in the ~1.5 hr before GW



GRID ul on delayed emission (50 MeV – 10 GeV)

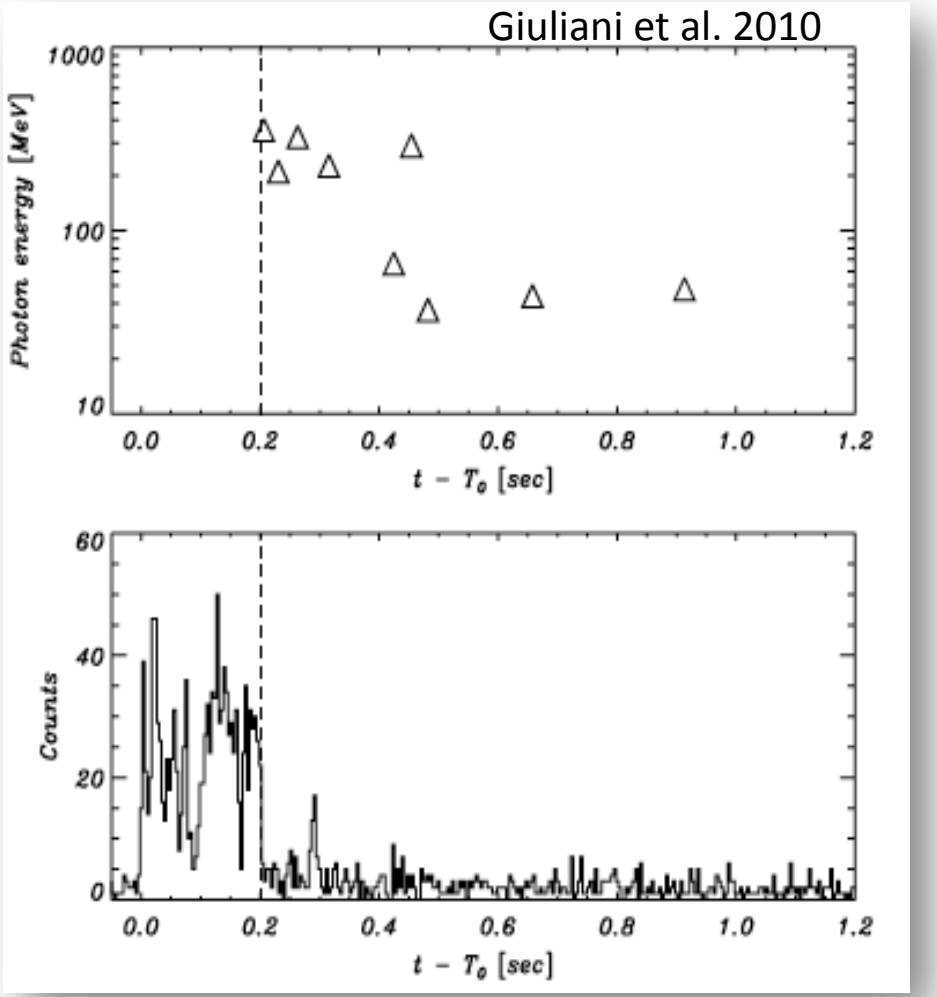


70% of error region covered



Comparison with GRB 090510

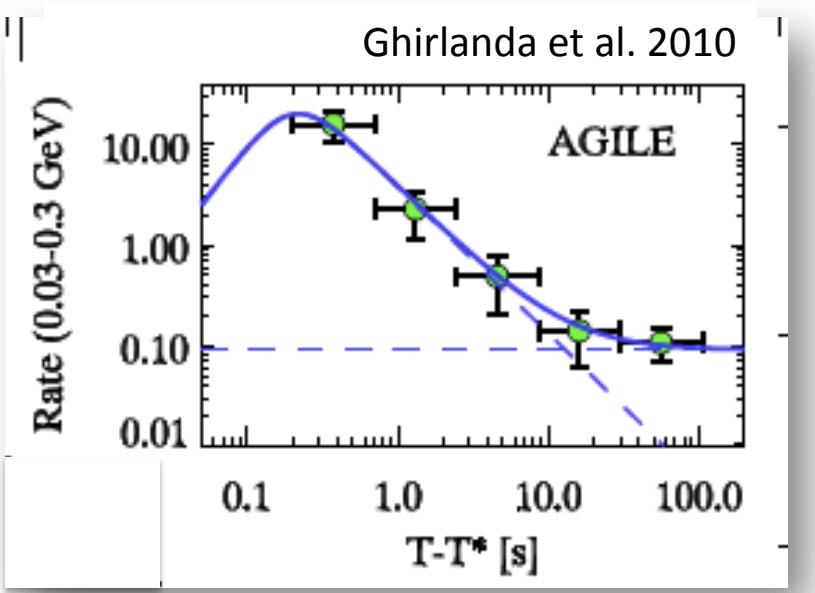
Giuliani et al. 2010

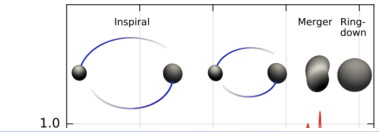


Energetic short GRB with long γ-ray tail

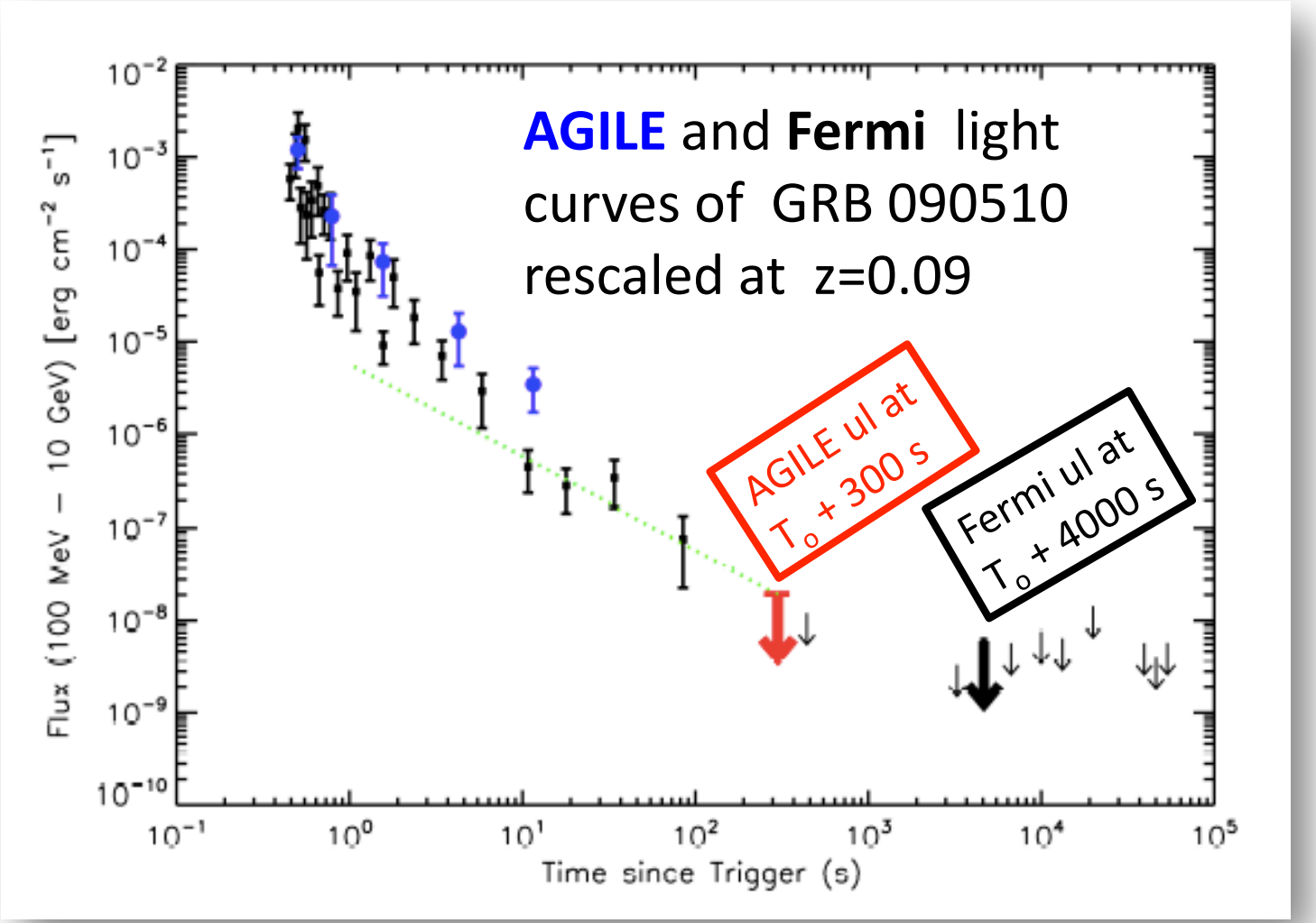
(E_{iso}~4 10^{52} erg, z=0.9)

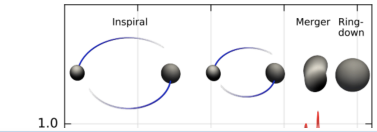
Ghirlanda et al. 2010



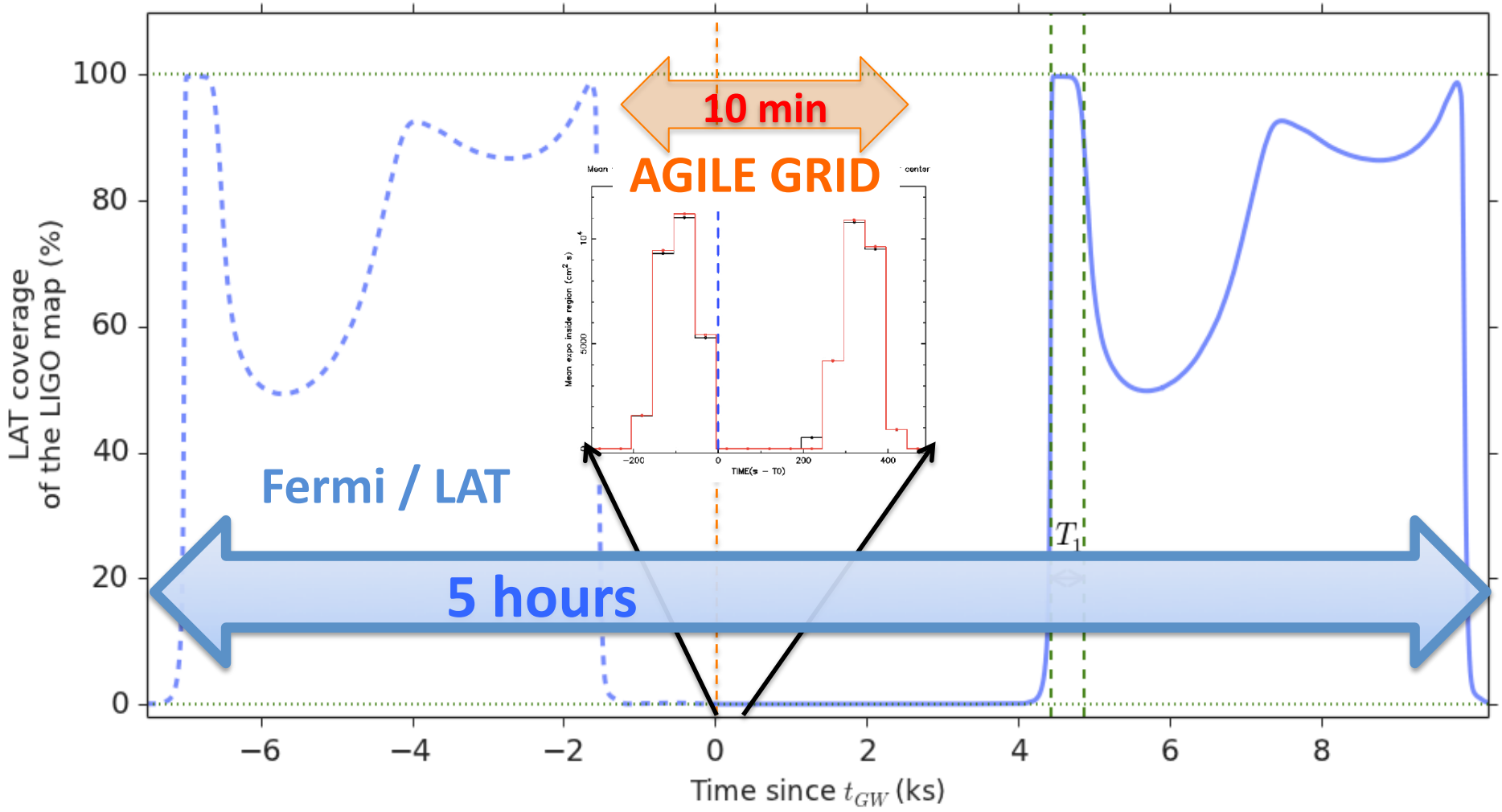


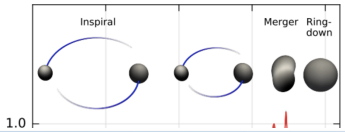
Comparison with GRB 090510





Coverage of GW error region as a function of time





Conclusions

- **Unique AGILE features**
  - γ-ray imager: covers 80% of the sky with 100-150 useful passes/day of ~150 s → sensitivity ~ (1-2) 10^{-8} erg cm^{-2} s^{-1} in 100 sec.
  - GRB–like searches, MCAL, AC
  - Very fast processing and alert system

- **Very unlucky for GW150914**
  - GRID missed it in FOV by just a few seconds (worst case!)
  - Fastest u.l. for >30 MeV emission after ~300 s
  - MCAL sensitivity at ~MeV just above claimed Fermi/GBM event