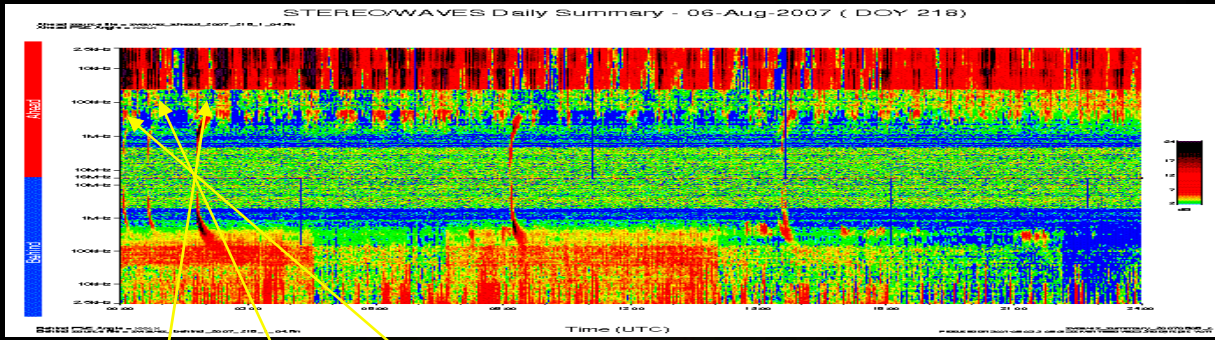


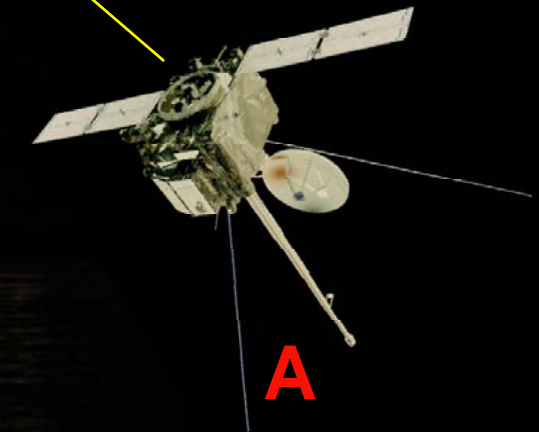
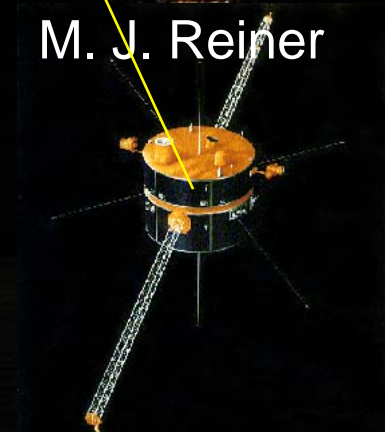
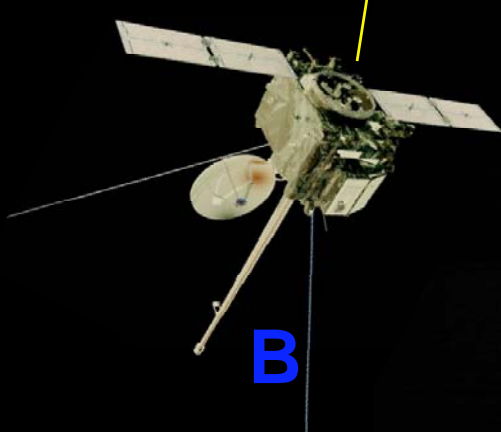
SWG-17

Pasadena,
CA

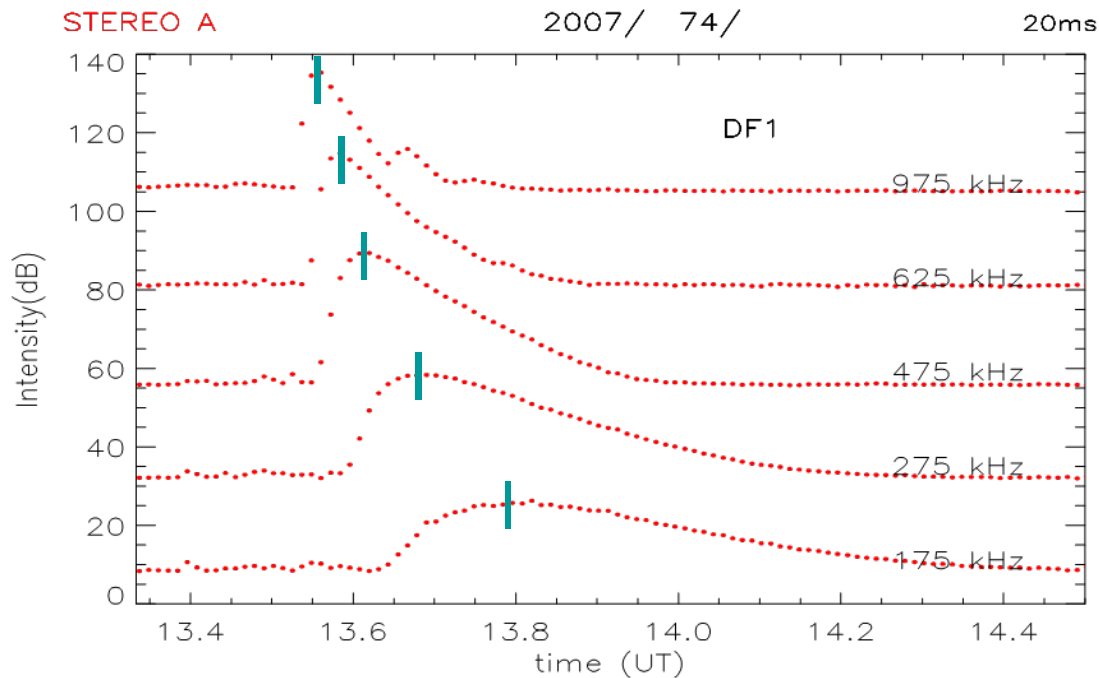
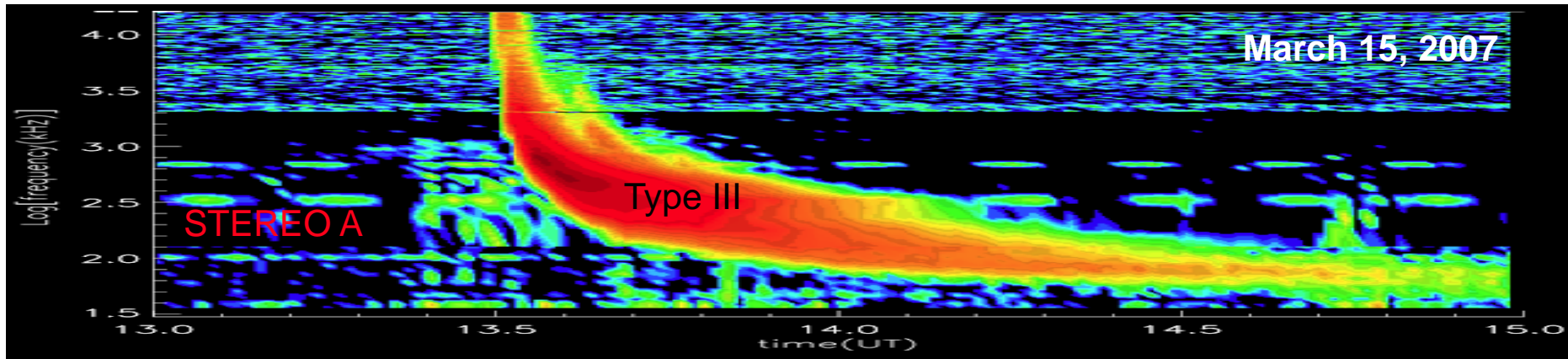


Direction Finding and Triangulation from STEREO & Wind

M. J. Reiner



Type III burst have very characteristic intensity profiles:

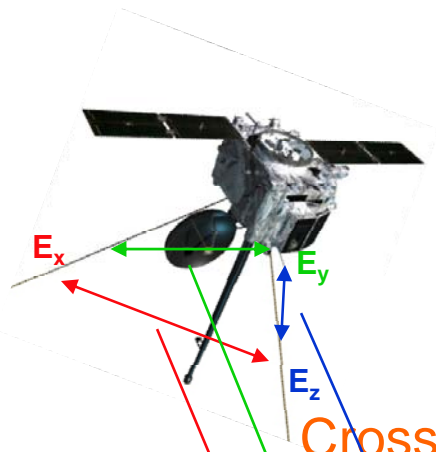
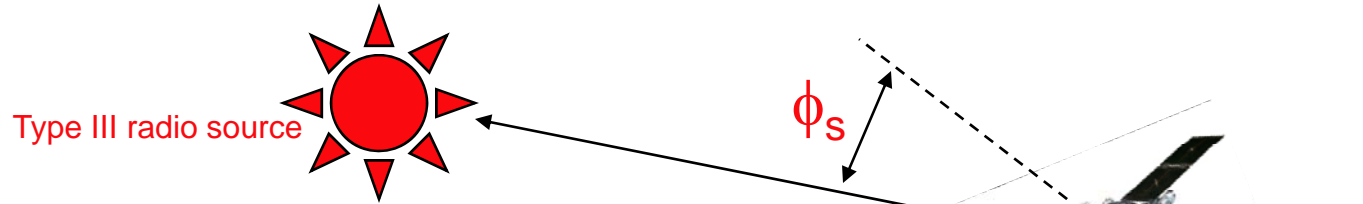


- Rapid rise to a peak, followed by exponential-like decay
- Peak time increases as the frequency decreases (frequency drift)
- Overall duration of the profile increases with decreasing frequency

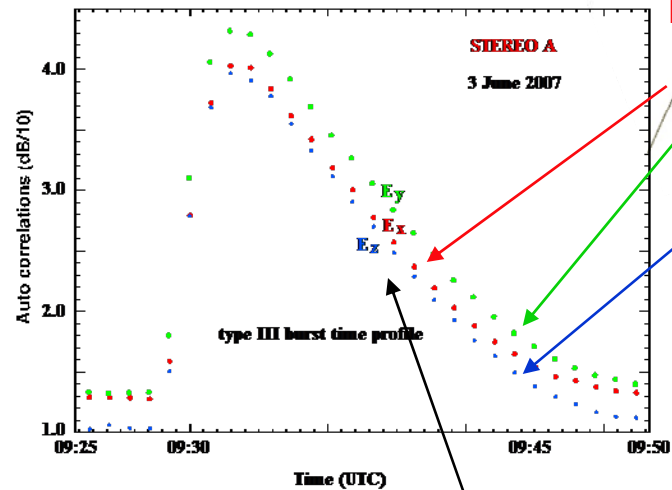
STEREO Direction Finding

Direction finding provides the arrival direction of the radiation from the radio source

Direction finding for STEREO is achieved from an analysis of the amplitudes (**auto correlations**) and phase differences (**cross correlations**) between pairs of antennas

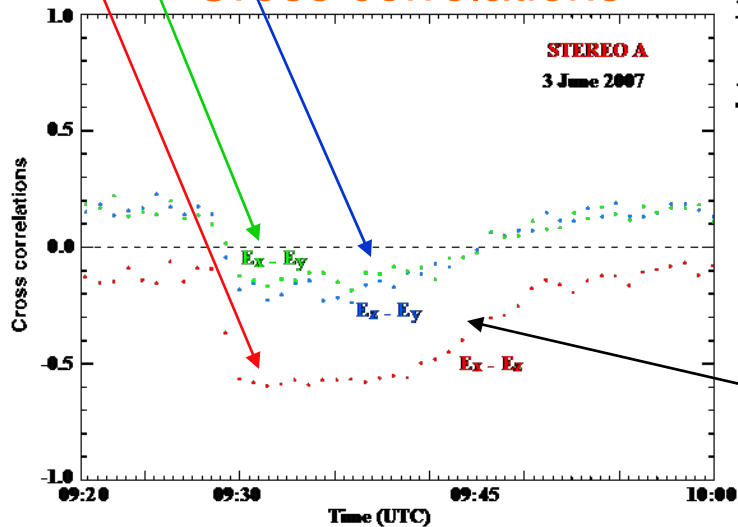


Auto correlations



3 mutually orthogonal antennas

Cross correlations



differences due to the different antenna "electrical lengths" and to the direction of the radio source

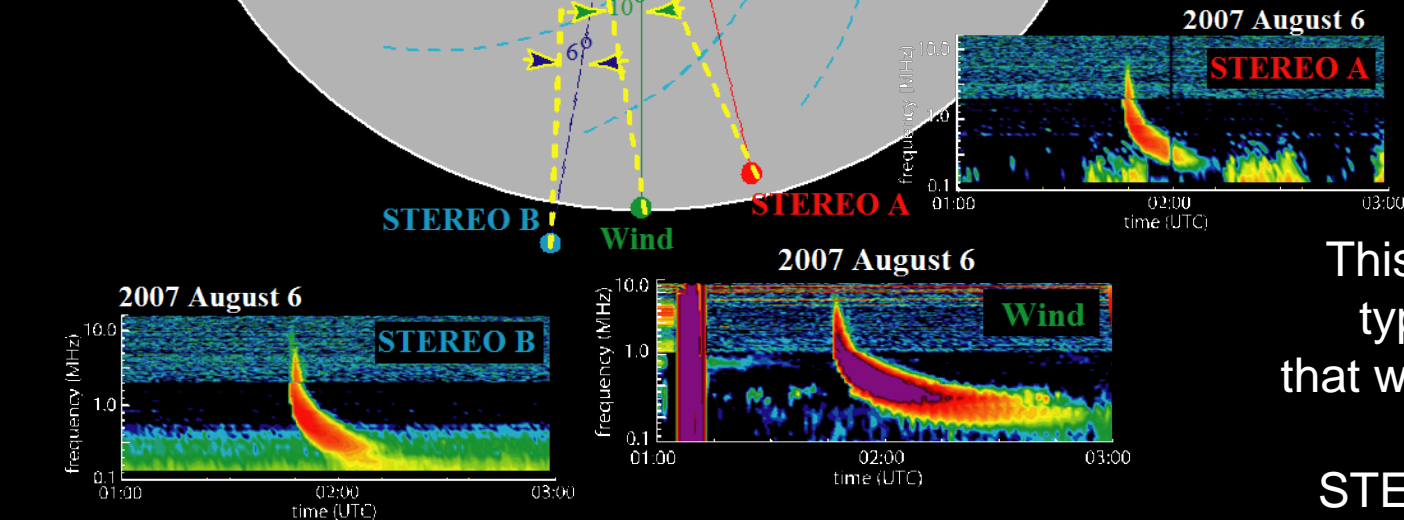
Spatial triangulation of a solar type III radio source

The spatial location of the radio source (0.21 AU, W48°) was determined without using an interplanetary density model

The triangulated source location is consistent with the 27 sec timing difference between the type IIIs as observed at STEREO A and B

Radio source at 425 kHz located by STEREO/Wind triangulation

Lines-of-sight to the radio source from STEREO A, Wind & STEREO B at 425 kHz



STEREO Ahead EUVI 284



2007-08-06 02:06:30 UTC

This flare produced a type III radio burst that was “simultaneously” observed by STEREO A, B & Wind

Why are these measurements important?

The DF & triangulation measurements provide:

- 3D source location - independent of a density model
 - information on the size of the radio source
 - information on the intrinsic source intensity
(needed to constrain theoretical models of type III radio generation)
- information on the beaming characteristics of the type III radiation
(also needed to constrain theoretical models of type III radio generation)
- tracking of the electron beams through the interplanetary medium to 1 AU and beyond
(by performing the triangulation at consecutively lower frequencies)

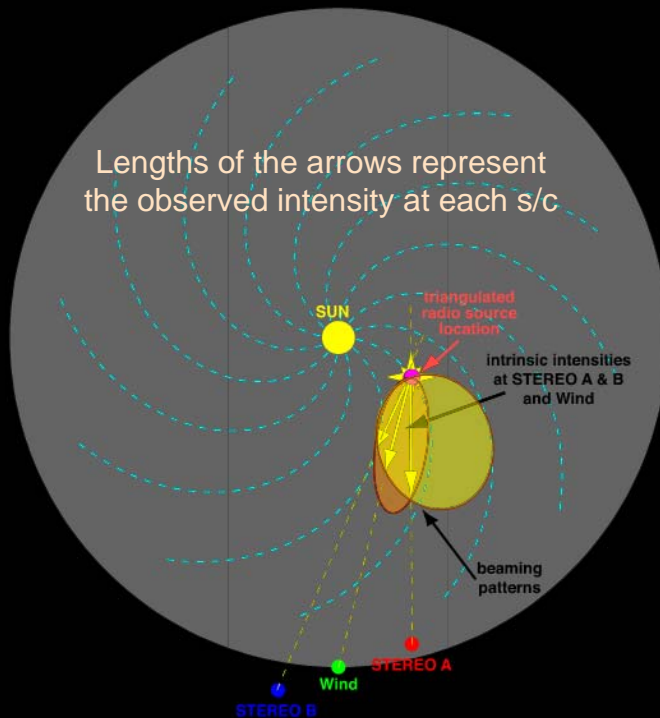
Determining the Beaming Pattern

STEREO + Wind observations can provide the first quantitative measure of the radiation beaming

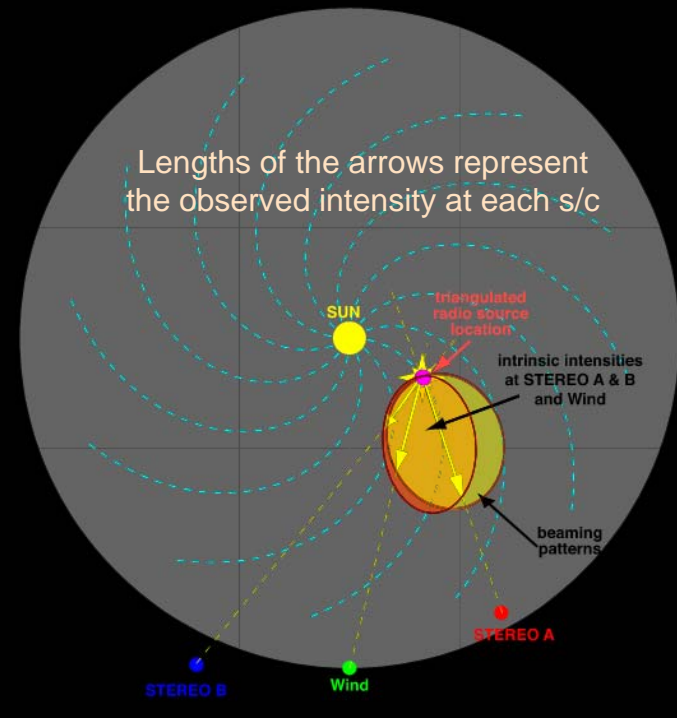
To deduce the intrinsic beaming pattern of the radio source, we must first factor out the $1/R^2$ falloff of the radiation intensity in propagating from the source to each observing s/c

To do this, we obviously need to know the location of the source from the triangulation

Since the radio source beaming pattern is a “curved surface”, we need at least 3 s/c observations



The third observation at Wind is important for distinguishing between the two possible beaming patterns that are consistent with the STEREO observations



A wider separation between the two STEREO s/c provides a more accurate determination of the overall beaming pattern, but in this case the third observation at Wind is even more critical



Conclusions



- STEREO & Wind observations can be used to remotely locate radio sources in the 3D heliosphere, independently of a density model, using both timing and spatial triangulation



- STEREO & Wind observations of type III bursts can be used to deduce intrinsic radiation characteristic of the radio source, such as the beaming characteristics

