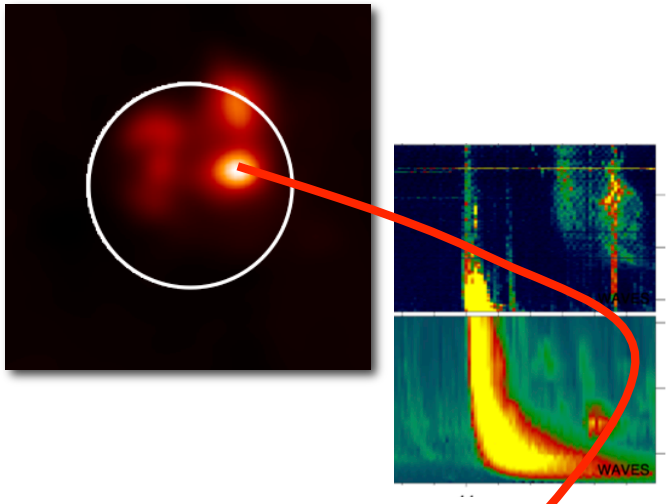
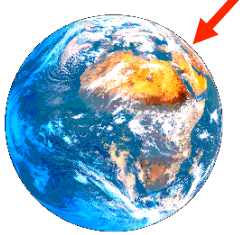
Non-thermal and thermal electron signatures during a type IV burst

Karl-Ludwig Klein

ludwig.klein@obspm.fr,

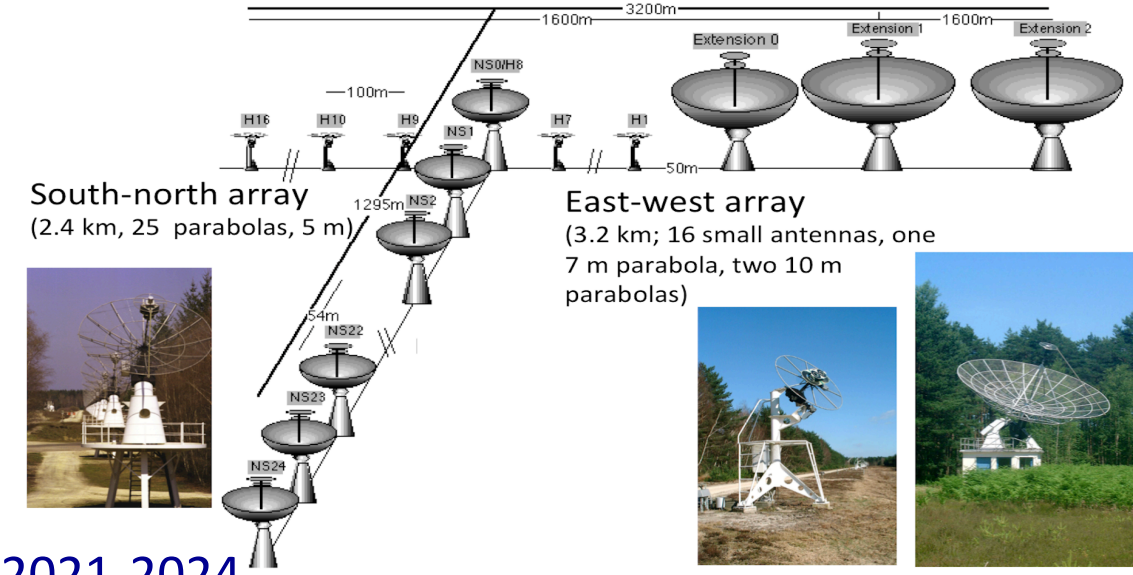
LESIA,
Observatoire
radioastronomique de
Nancay





NRH renovation
Achieved and ongoing work

- Phase 1: 2015-2020
  - Replacement of the correlator (acquisition of 1128 baselines)
  - Replacement of the data acquisition system



- Phase 2: 2021-2024
  - focal systems: EW (done) & SN (underway)
  - antenna pointing system (underway)
  - electricity supply to the arrays (underway)
  - painting (done)

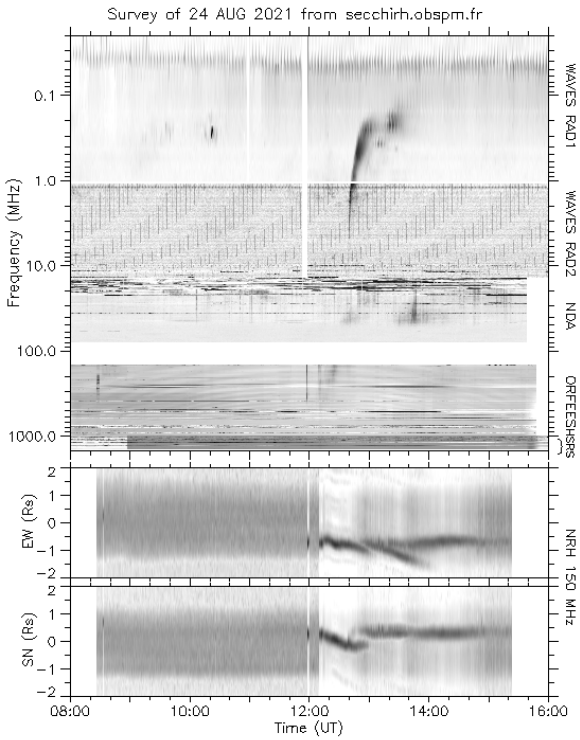
- Scientific and technical responsability:
  S. Masson, A. Hamini, C. Fabrice

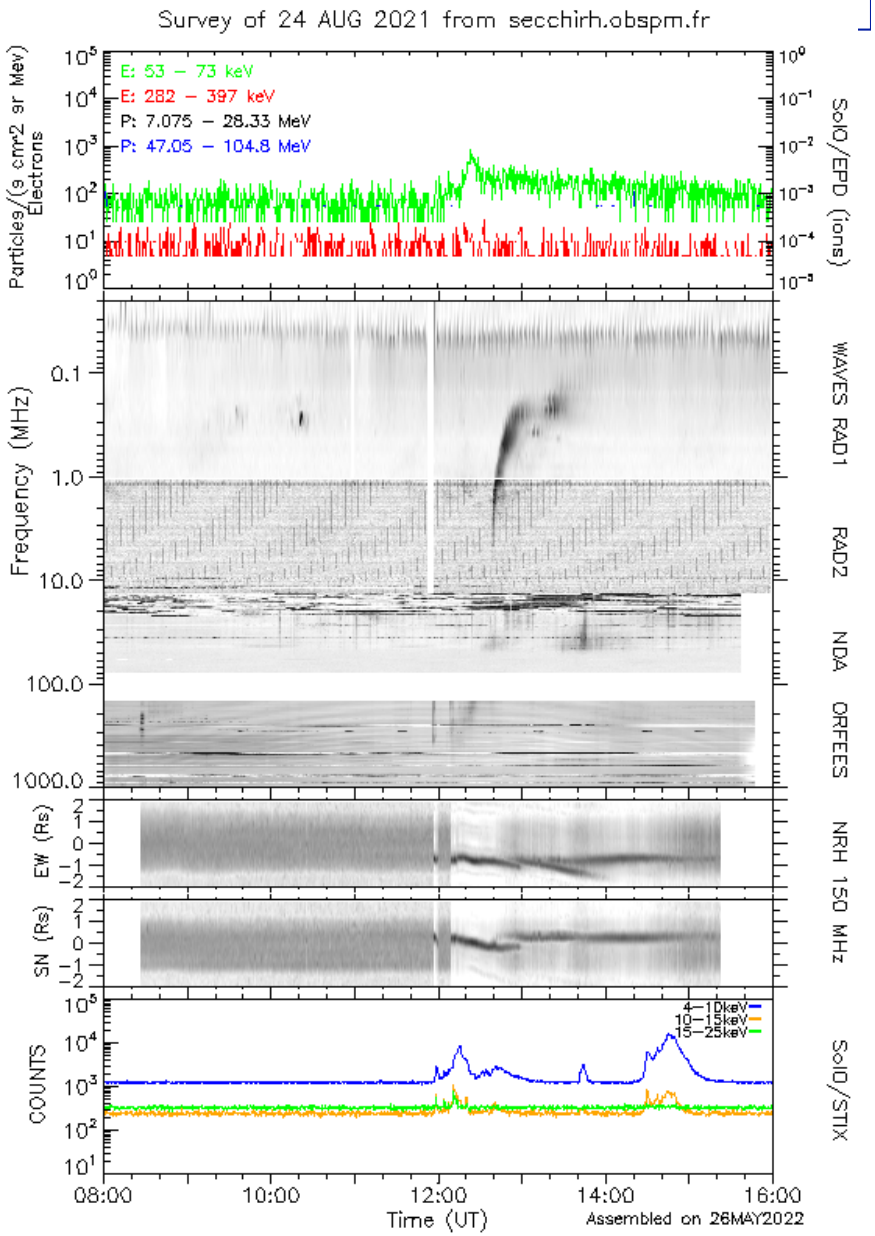
NRH renovation

Achieved and ongoing work

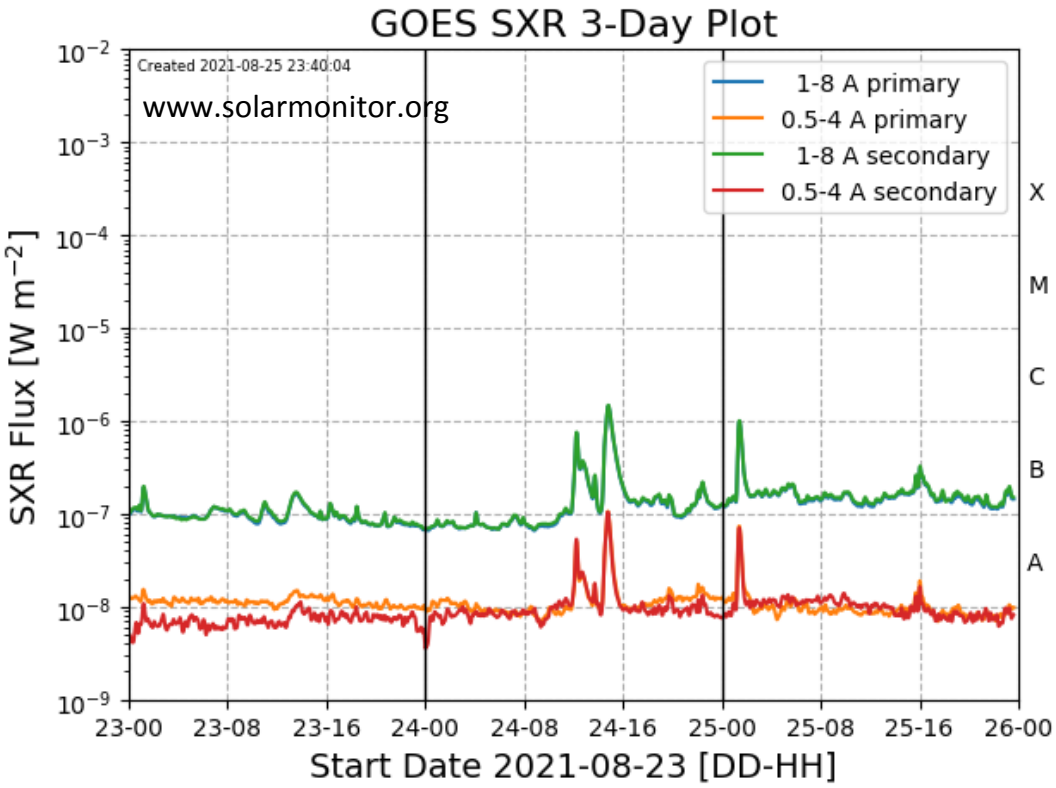
- Since Nov 2020: scientific observations resumed (about 90% of available time; only Stokes *I* until 2024)

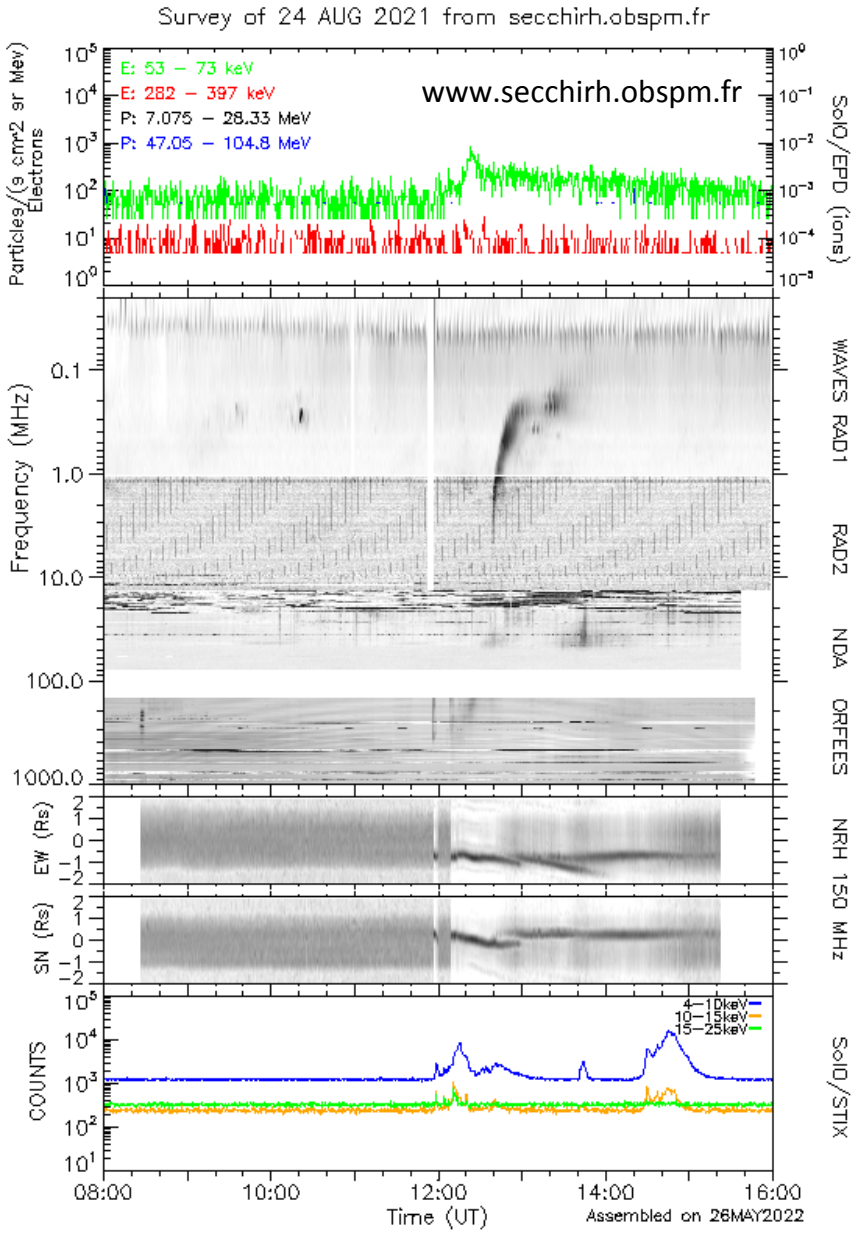
- New data products on secchirh.obspm.fr: Solar Orbiter STIX, EPD





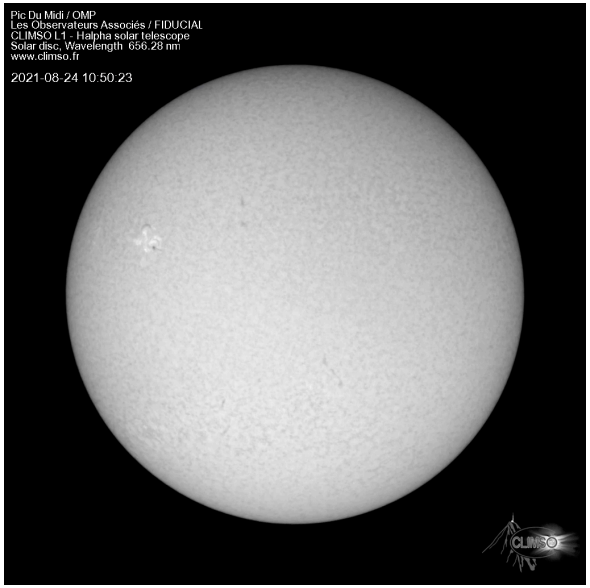
Case study of a moving type IV burst
2021 Aug 24





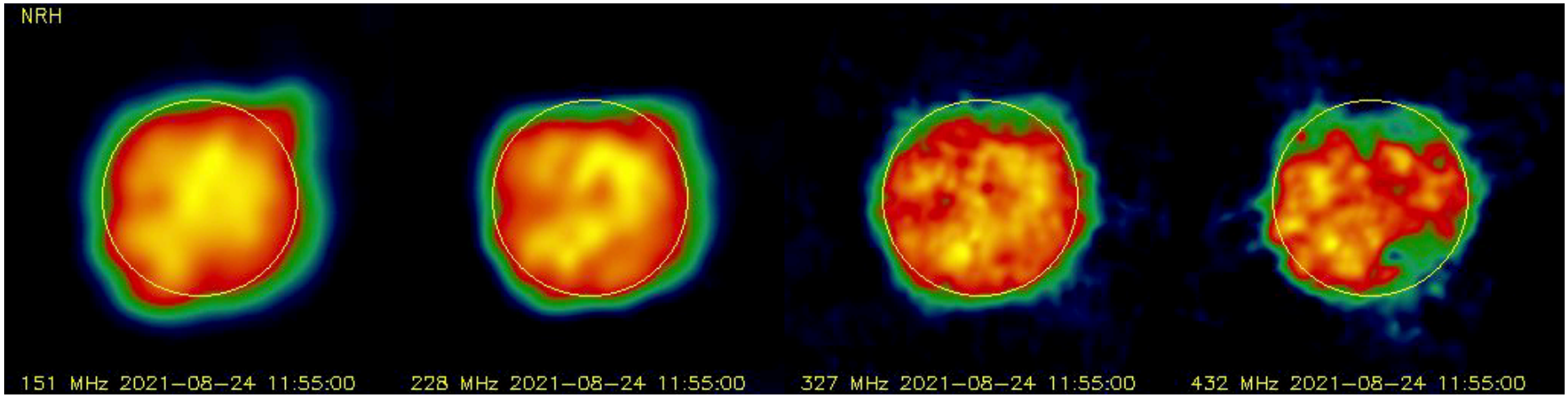
- A succession of weak solar flares (SXR)
- Radio: impulsive phase + several (2) phases of moving sources + stationary long-lived source
- Late DH III burst
- Weak electron event (Solar Orbiter)

Case study of a moving type IV burst
Parent activity: flares, filament eruption, CME



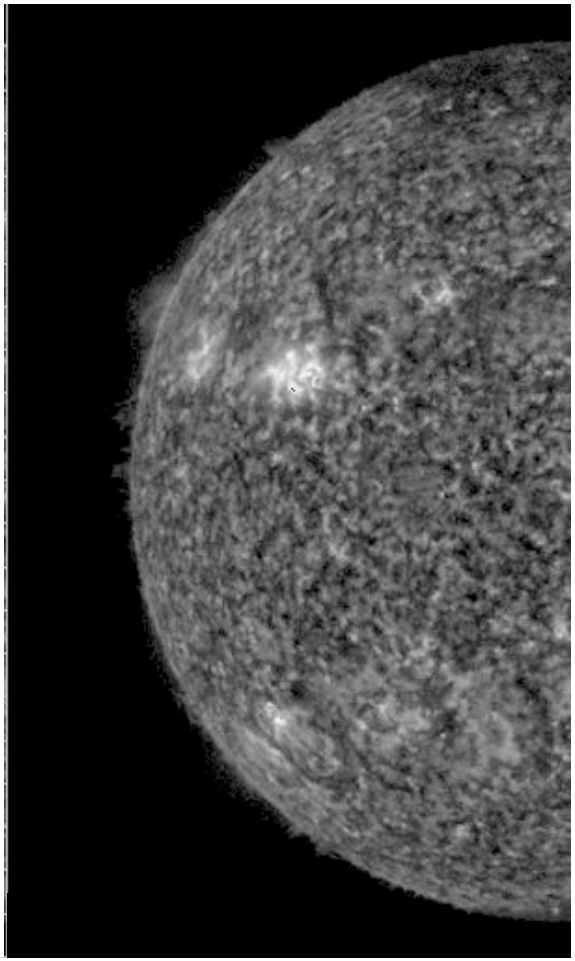
Pic du Midi CLIMSO H alpha
http://climso.irap.omp.eu/data/index.html)
10:50-14:07: filament eruption

Nançay Radioheliograph
11:55-14:07 (1 min. integration)



Case study of a moving type IV burst
Moving type IV source and the erupting filament

Klein, Salas Matamoros & Hamini, in prep.

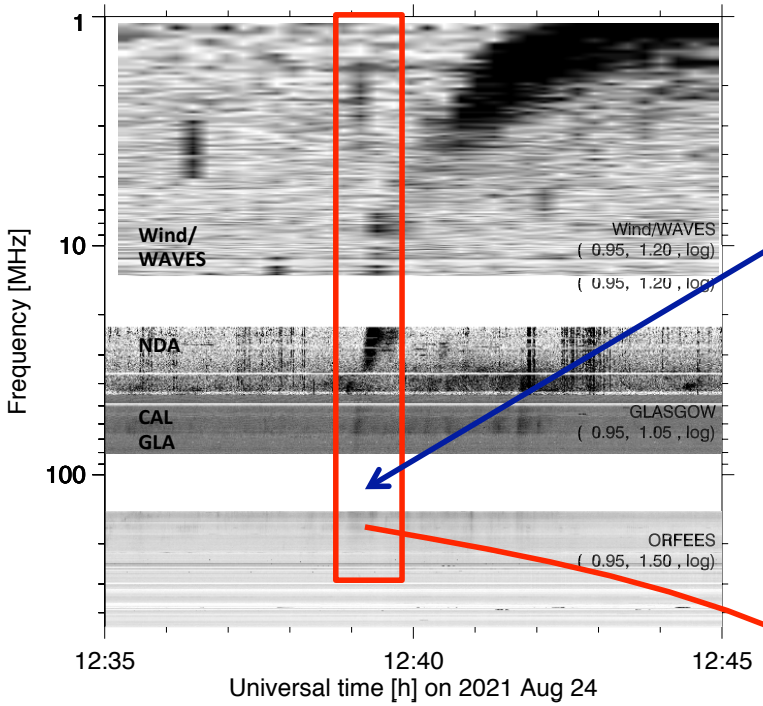


SDO/AIA 30.4 nm & Nançay Radioheliograph
11:50-14:00 (1 min. cadence or integration)

- Moving IV:
  - speed 100-200 km/s
  - summit of the erupting filament (flux rope)
  - frequency-dispersed source location
  - confined source (=> trapped electrons, pitch angles around 90°)
- Ongoing activity in the parent AR
- T_b-depression about cospatial with filament material

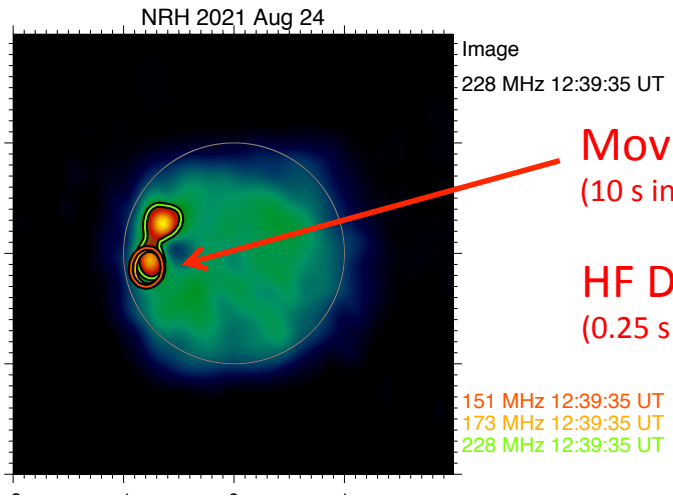
Radio evidence on electron trapping and escape

Case study 2021 Aug 24



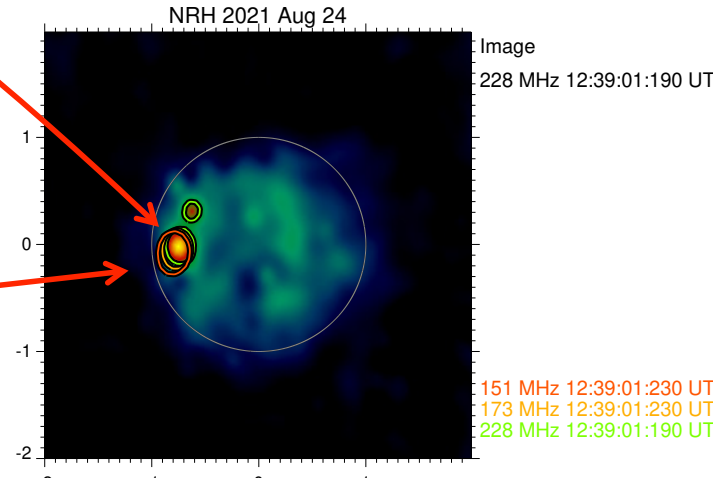
- Delayed DH type III burst (40 min after start)
- starts between 80 and 144 MHz
- counterparts at NRH frequencies (≠ III)

- Imaging (peak in the 0.25 s records):
  - source near moving type IV source
  - consistent with escape of confined electrons from the erupting flux rope (cf. MHD modelling S. Masson et al. 2013, 2019 ApJ)



Moving type IV
(10 s integration)

HF DH III counterpart
(0.25 s integration)



Klein, Salas Matamoros & Hamini, in prep.

Case study of a moving type IV burst
A very preliminary summary

- One more case study of a moving type IV burst:
  - recent work Ramesh et al. 2013; Bain et al. 2014, Vasanth et al. 2019; Morosan et al. 2019, 2020, 2021; Liu et al. 2022; Vrsnak et al. 2003; Klein & Mouradian 2002 …)
  - earlier work Stewart 1985 – summary of many years of Culgoora observations; Duncan; Trottet et al.; Gergely; Gopalswamy & Kundu)
- Dynamic spectrum and imaging
- Eruption too slow to drive a shock wave
- Electrons around summit of the erupting flux rope
- Spectrum consistent gyrosynchrotron, but: frequency-dispersed source locations (no *V*-data)
- Evidence that late III due to reconnection between erupting flux rope and ambient magnetic field

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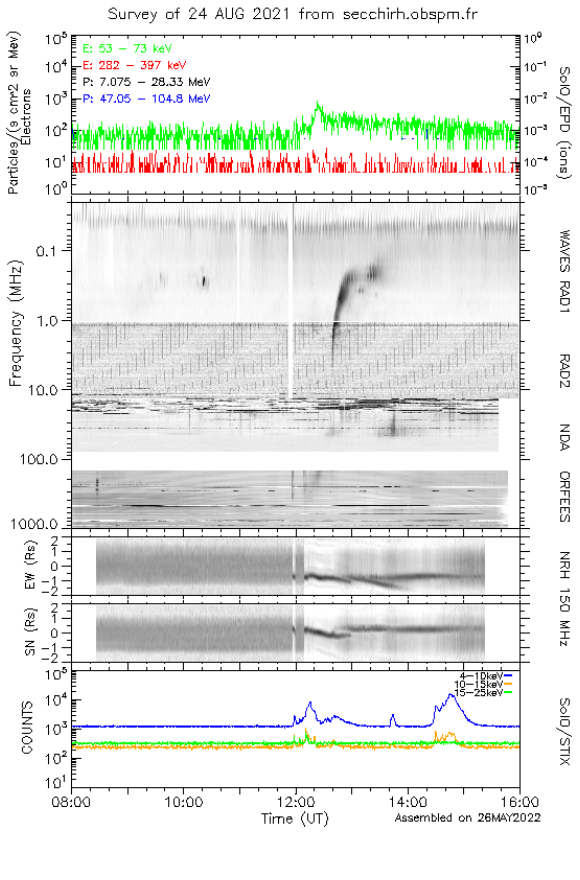

- T_b-depression by multi-*T* material from the erupting filament and cavity (cf. Marqué et al. 2001 AA 374, 316; 2002 AA 387, 317)