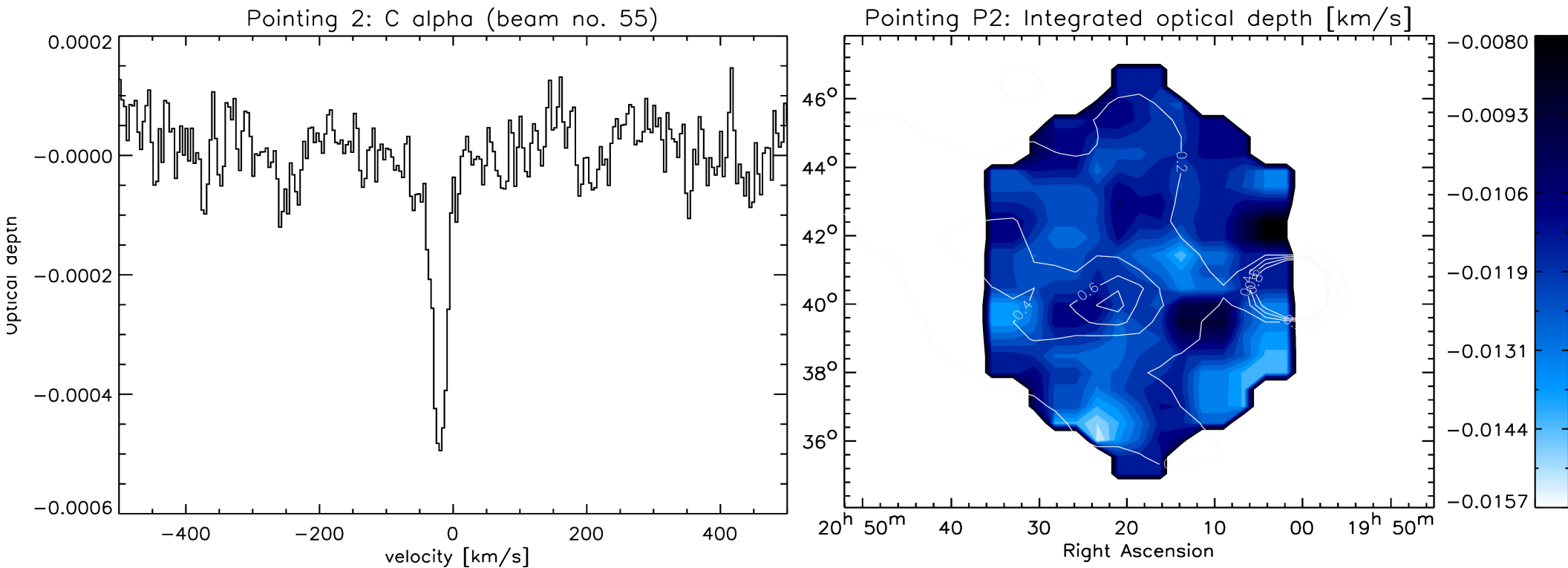


LOFAR Galactic RRL Survey: An update (LC0 028)

TEAM: Raymond Oonk, Reinout van Weeren, Francisco Salgado, Leah Morabito, Carmen Toribio, Wilfred Frieswijk, Xander Tielens, Huub Rottgering, Ashish Asgekar & Glenn White

+ John McKean, Richard Fallows, Jason Hessels



LOFAR Galactic RRL Survey: An update (LC0 028)

Galactic RRLs: “ *Characterizing the Cold neutral Medium*”

Distribution/Morphology of RRL emitting gas

Carbon column density (N_{CII})

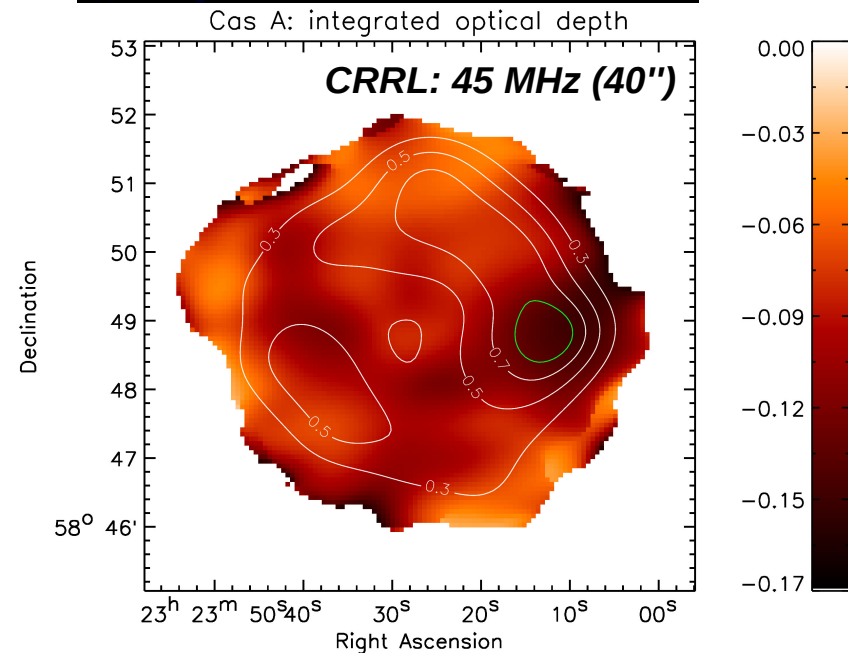
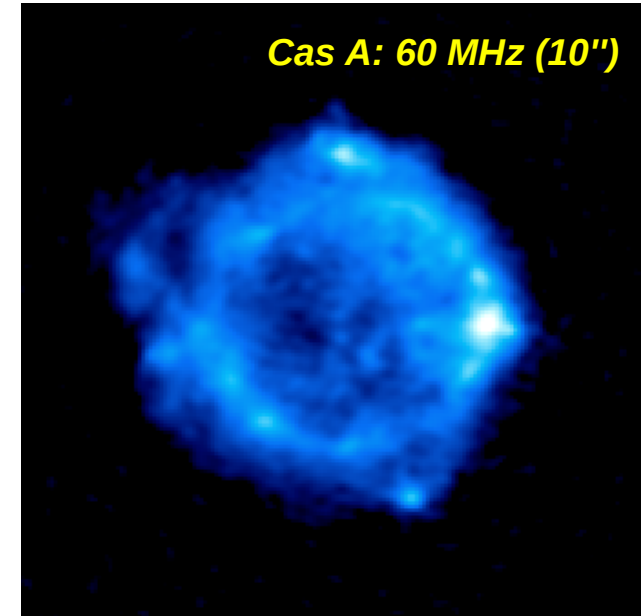
Disentangle CNM, WNM fraction of HI 21cm

Carbon abundance ($[\text{C}/\text{H}]$)

Hydrogen ionization rate (ζ_{H})

Electron density (n_e)

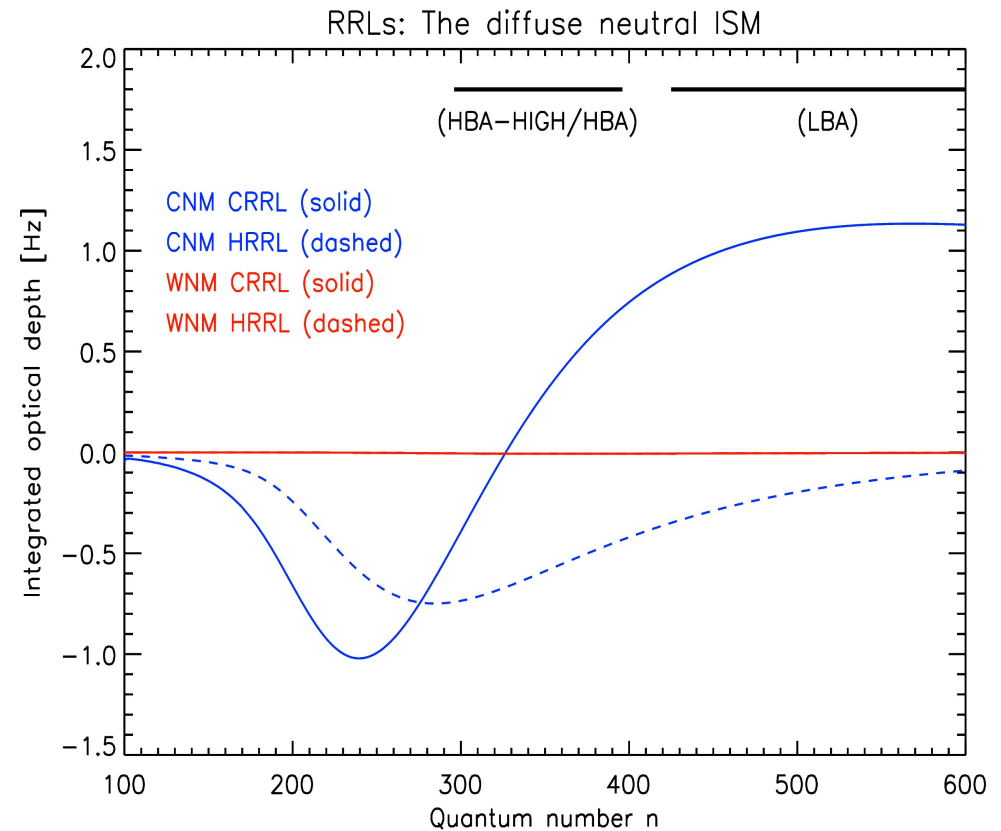
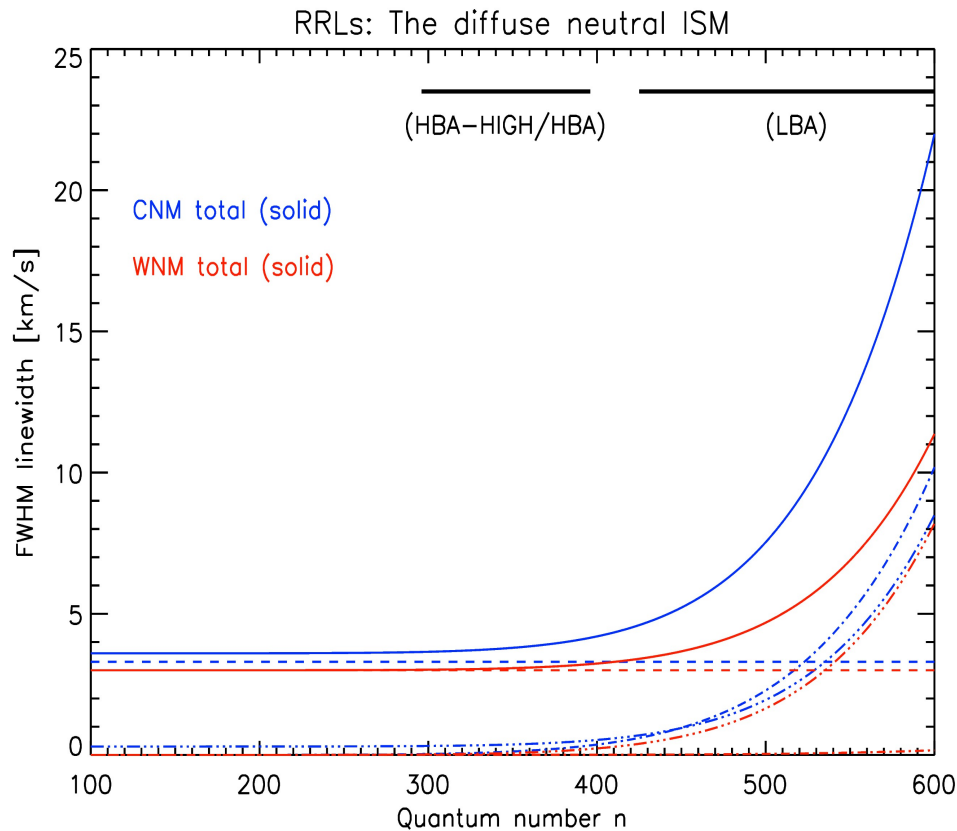
Electron temperature (T_e)



LOFAR Galactic RRL Survey: An update (LC0 028)

RRL models (Salgado et al. in prep., Morabito et al. submitted)

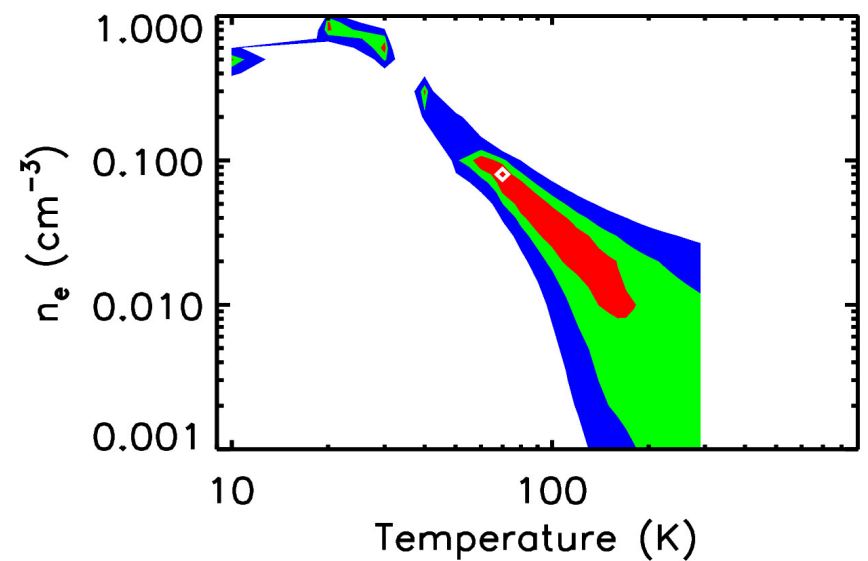
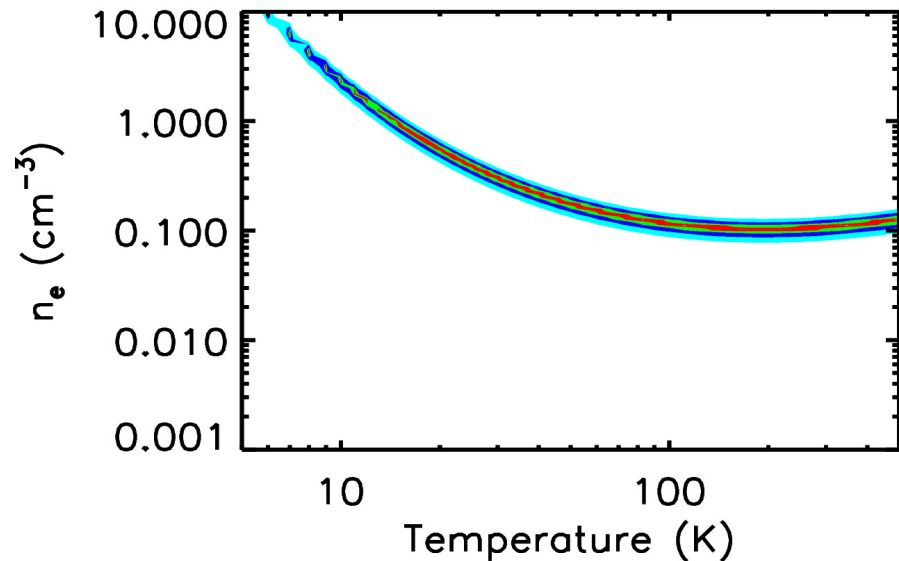
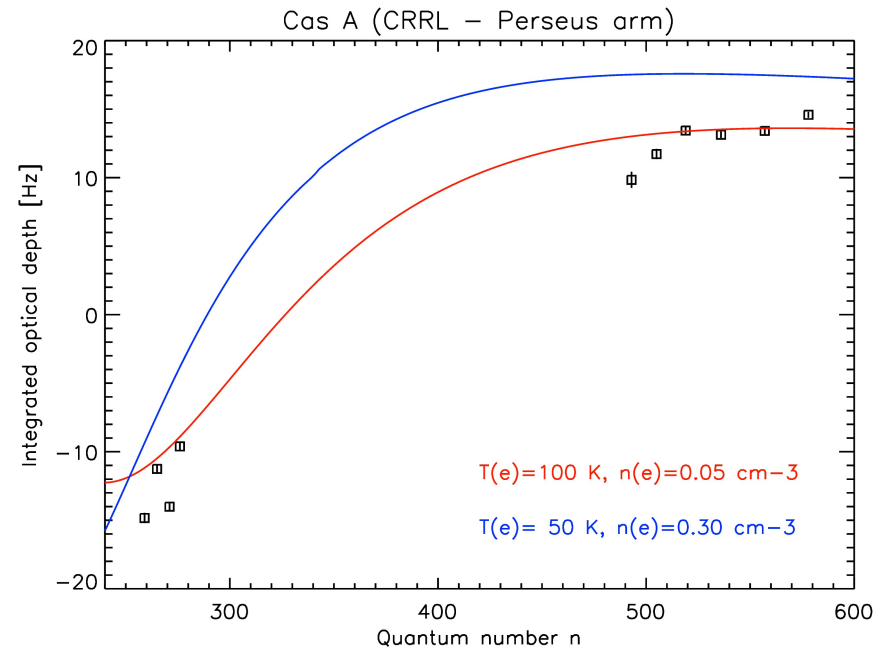
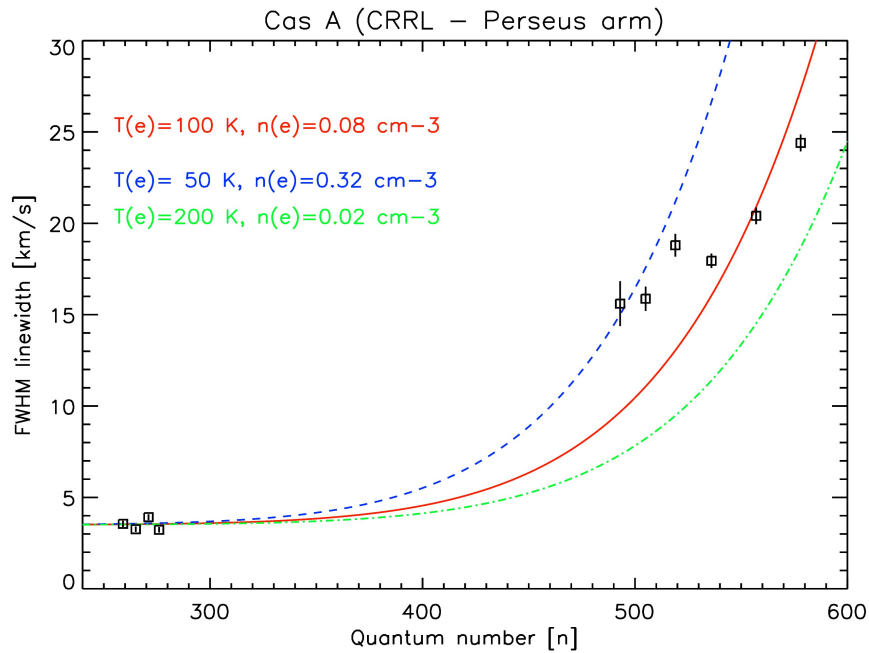
Low-frequency RRL : CNM vs. WNM for $N(\text{HI}) = 1\text{e}20 \text{ cm}^{-2}$



=> For the same $N(\text{HI})$: $\tau(\text{CNM}) = 100 * \tau(\text{WNM})$

LOFAR Galactic RRL Survey: An update (LC0 028)

RRL model fitting : ex. Cas A (key : resolution + frequency coverage)



LOFAR Galactic RRL Survey: An update (LC0 028)

Commissioning : Galactic beamformed observations (Aug. 2012)

Fields P0, P1, P2

P0 (18:26:44 ; -12:11:29)

P1 (18:52:01 ; +00:00:12)

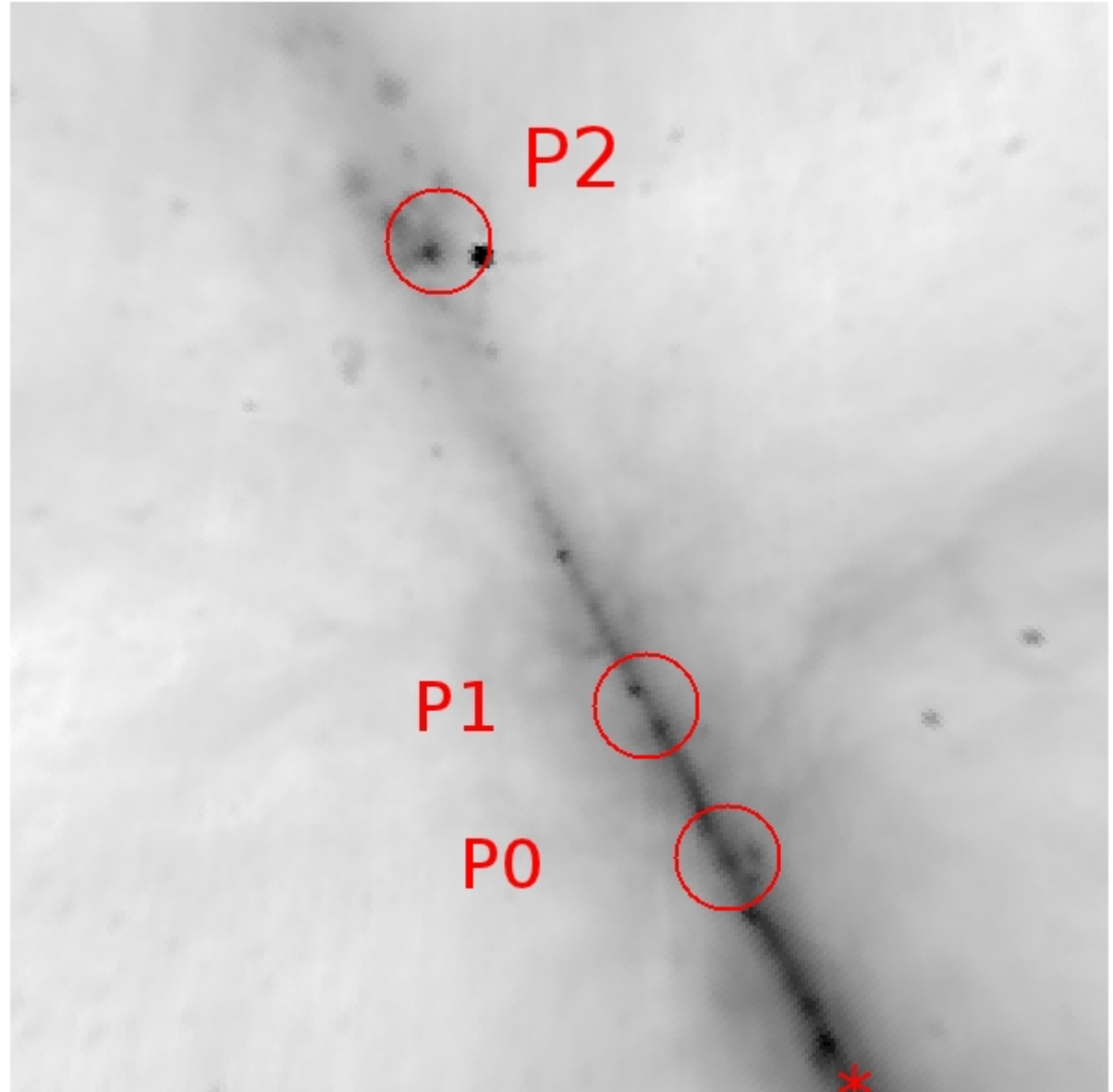
P2 (20:18:36 ; +41:19:14)

LBA-Superterp (BF)

61 TAB (10x10 deg²)

81 SB/L (30-70 MHz)

256 channels



LOFAR Galactic RRL Survey: An update (LC0_028)

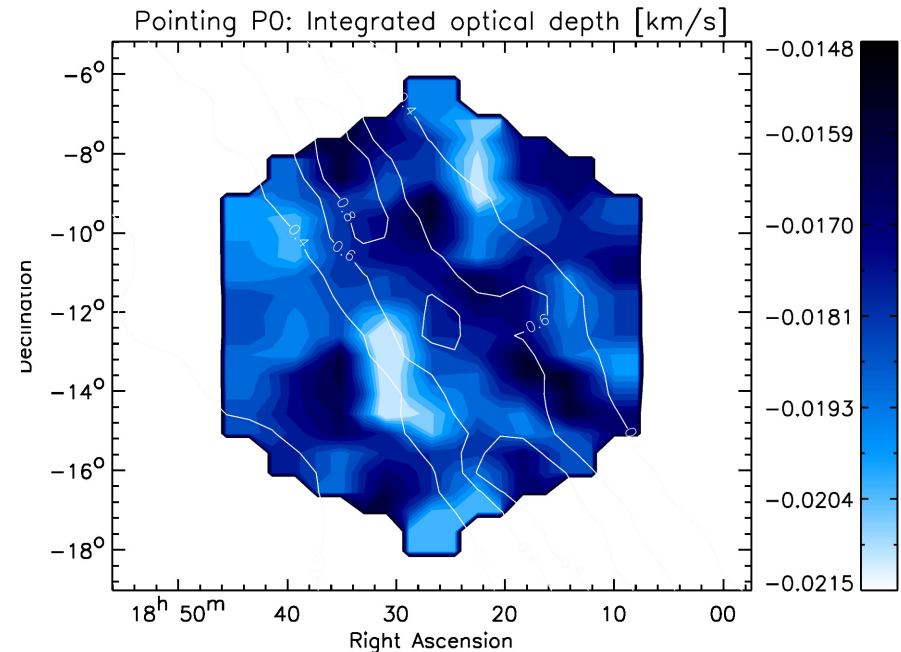
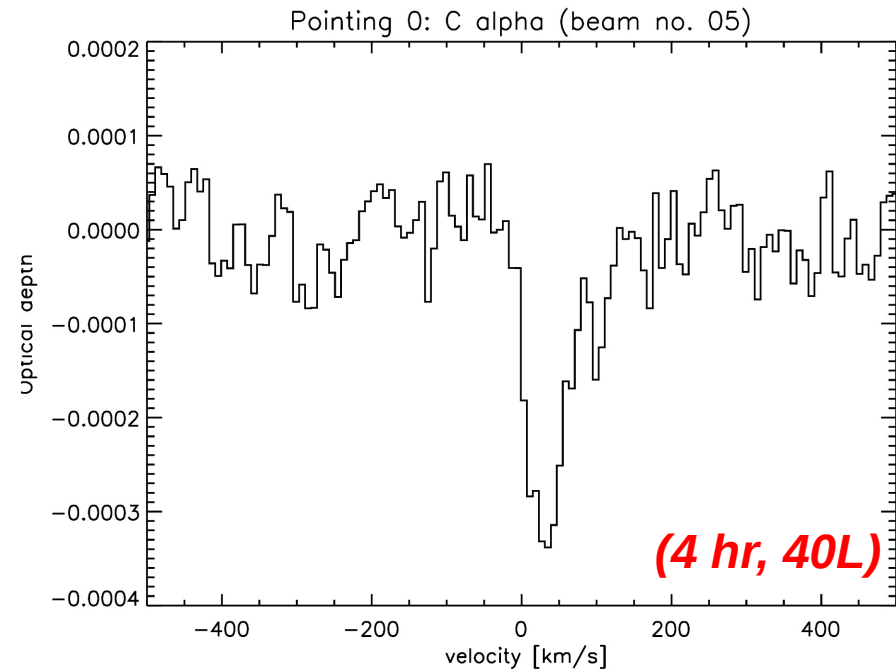
LC0_028: Deeper (4 x 4hr) follow-up of commissioning fields

Good data taken very recently:

- L149446 (26 Jun) reduced
- L157637 (08 Jul) reduced
- L167005 (08 Aug) started
- L173885 (18 Sep) (today)

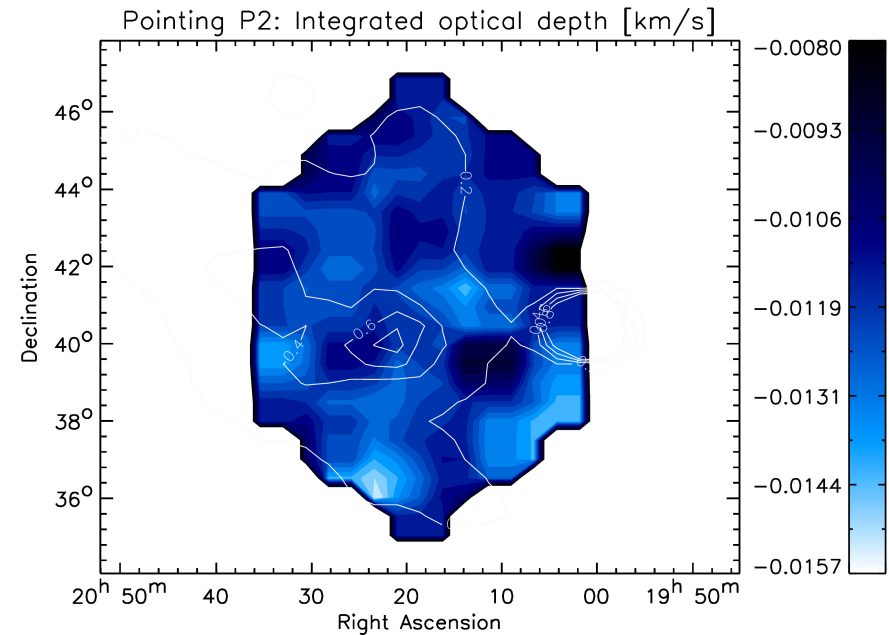
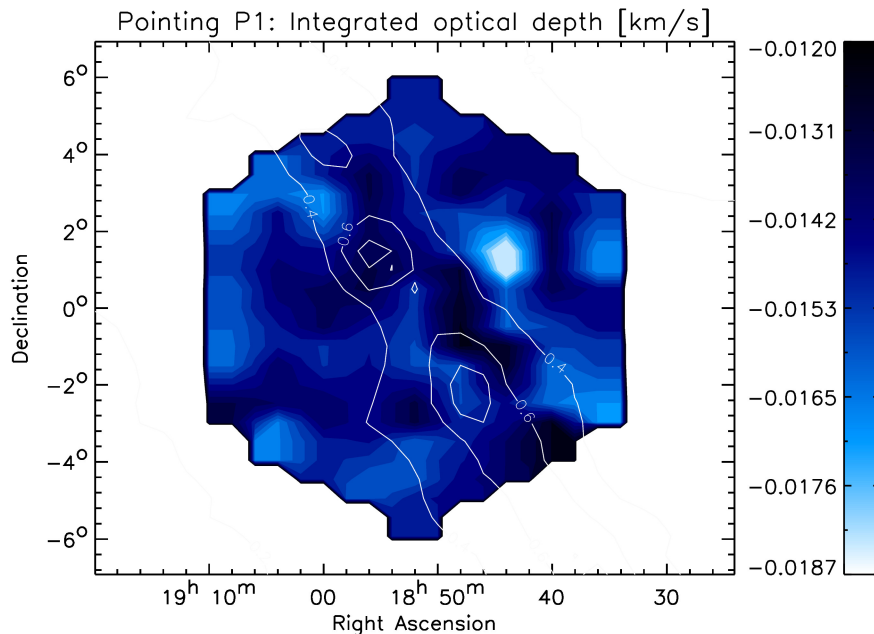
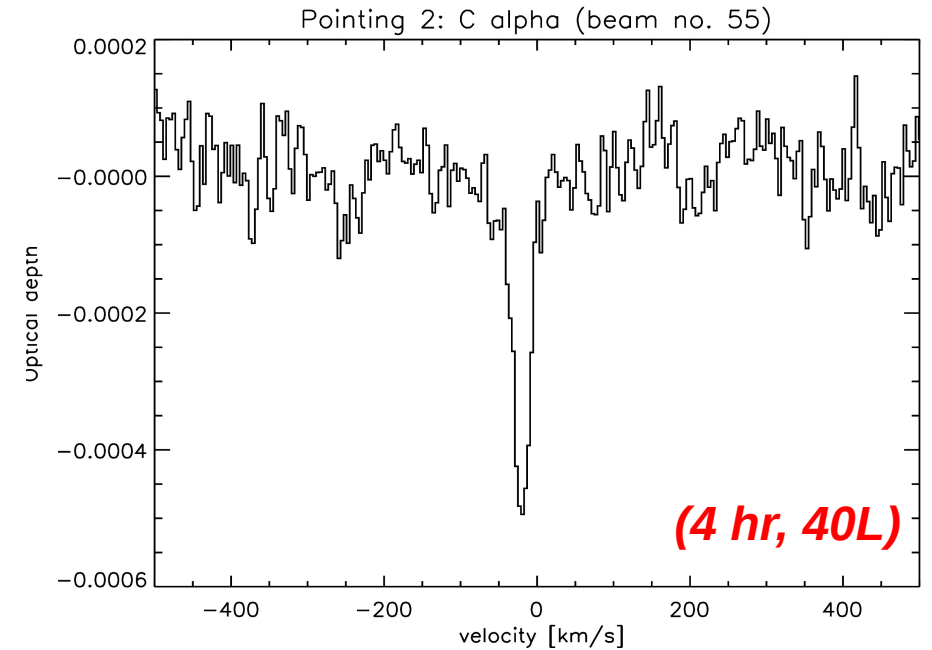
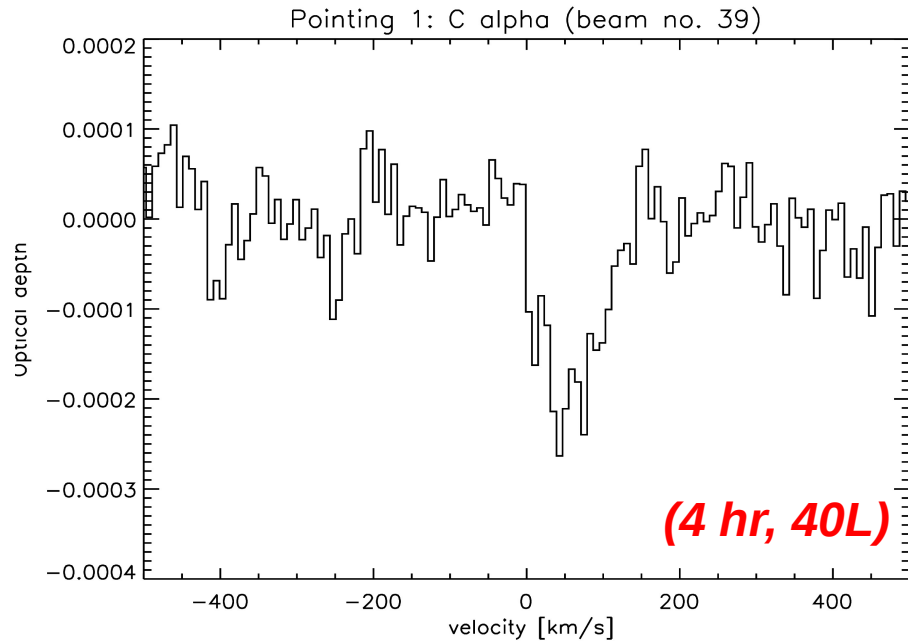
Failures and issues:

- warm weather / 8 bit mode?
- station flagging
- bandpass ripples (PPF?)
- below 40 MHz difficult



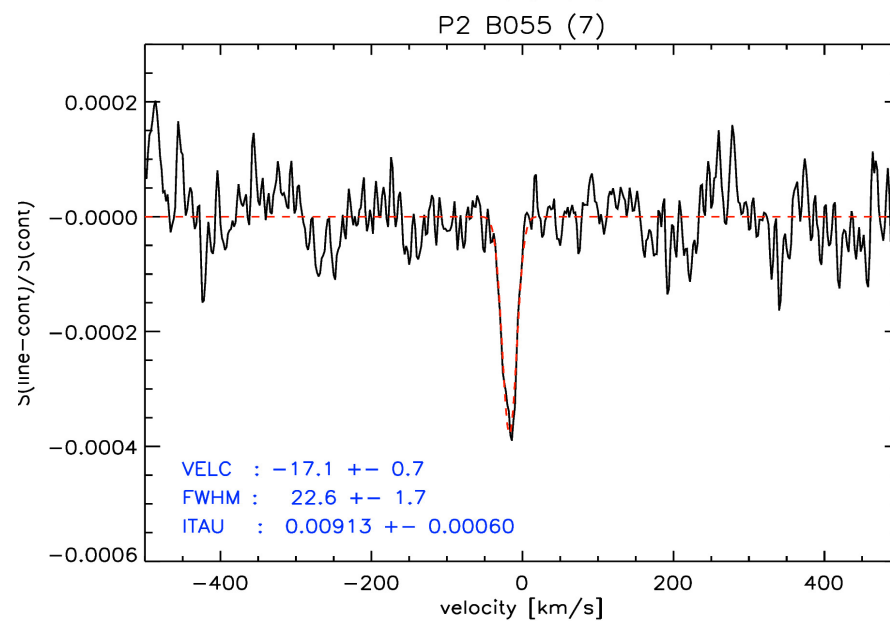
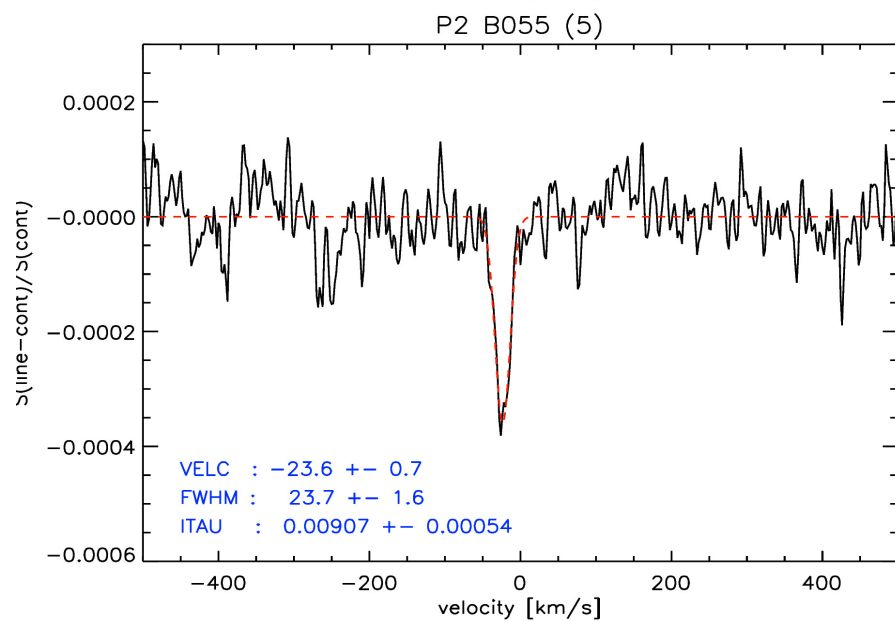
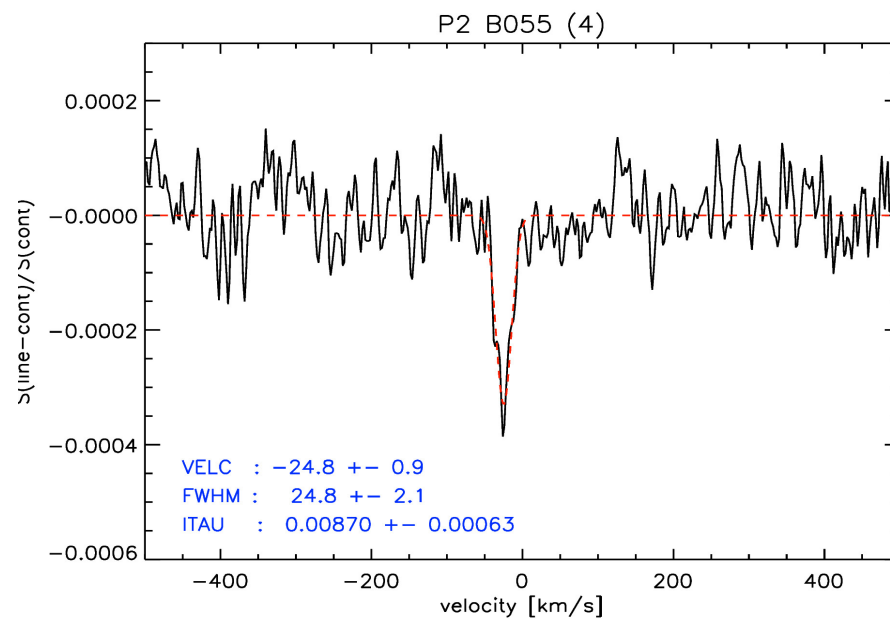
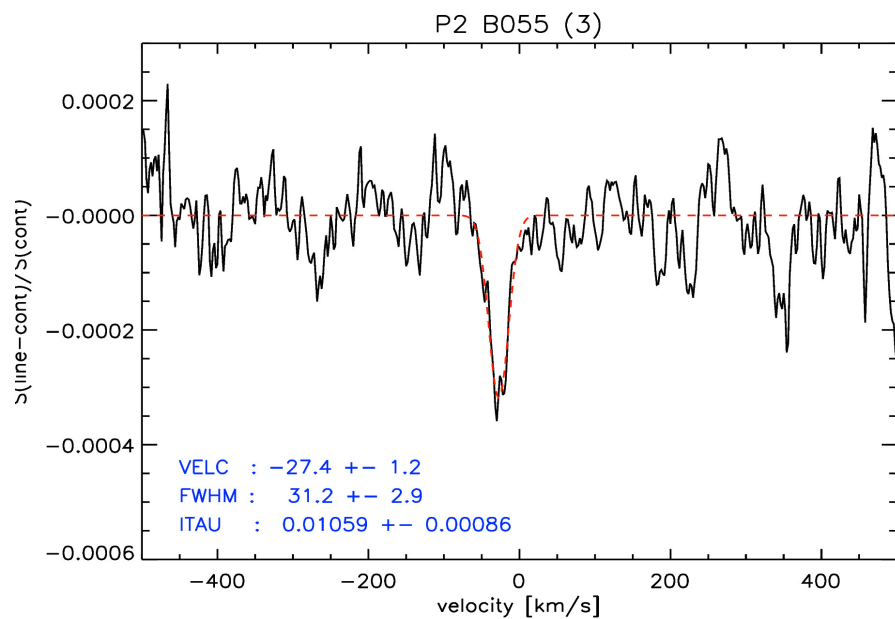
LOFAR Galactic RRL Survey: An update (LC0_028)

LC0_028: Deeper (4 x 4hr) follow-up of commissioning fields (P1,P2)



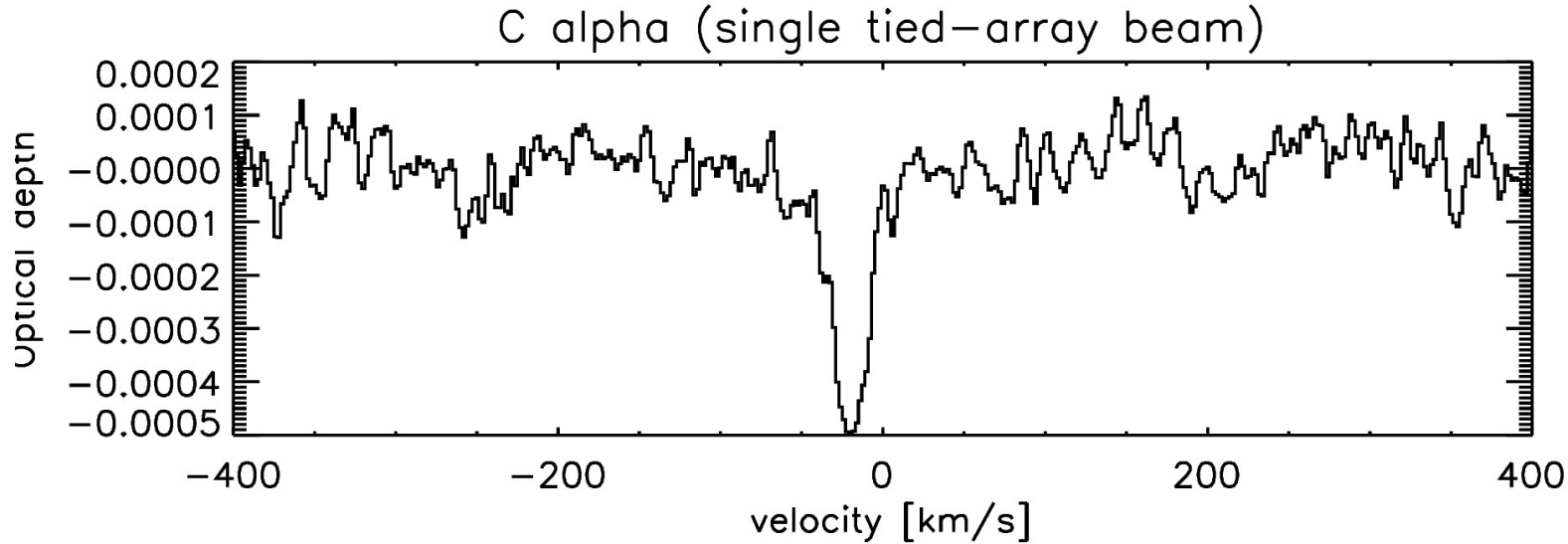
LOFAR Galactic RRL Survey: An update (LC0_028)

LC0_028 : Comparing individual 4 hr runs.

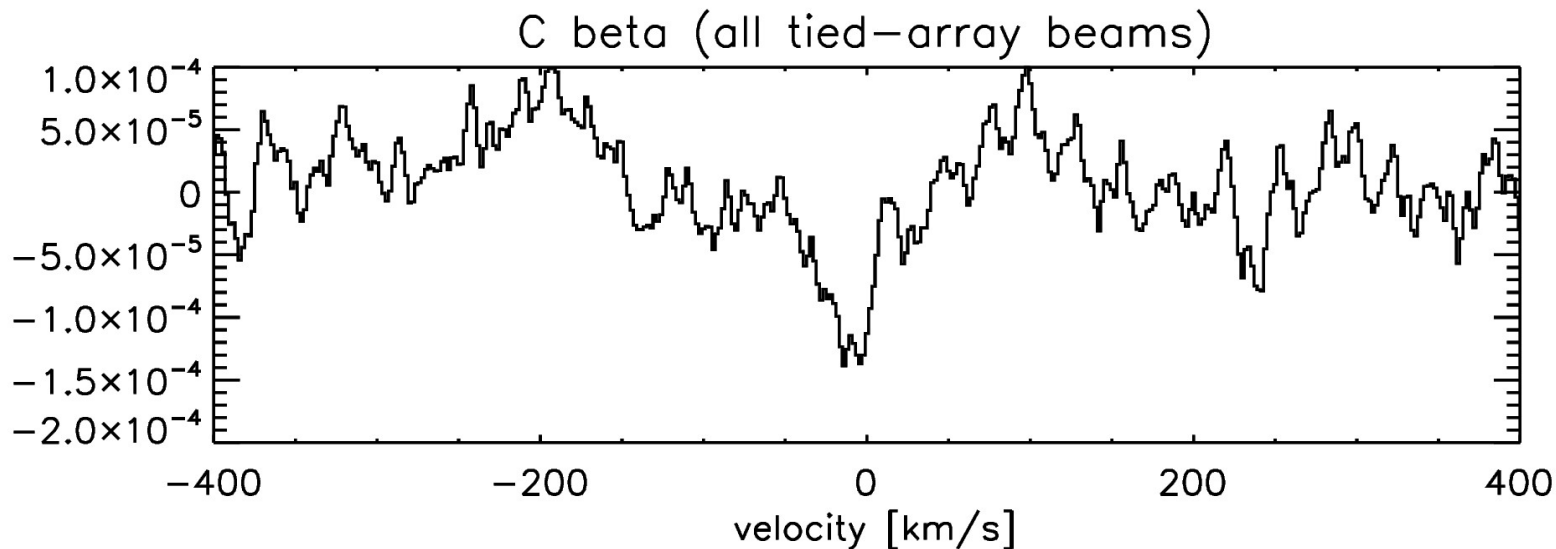


LOFAR Galactic RRL Survey: An update (LC0_028)

LC0_028 : CRRL-alpha and CRRL-beta (spatial stacking)



(50 MHz: n=508)

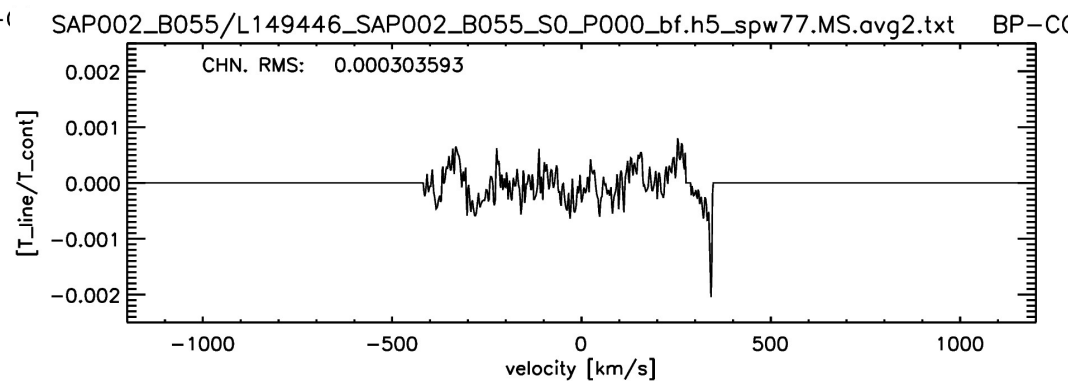
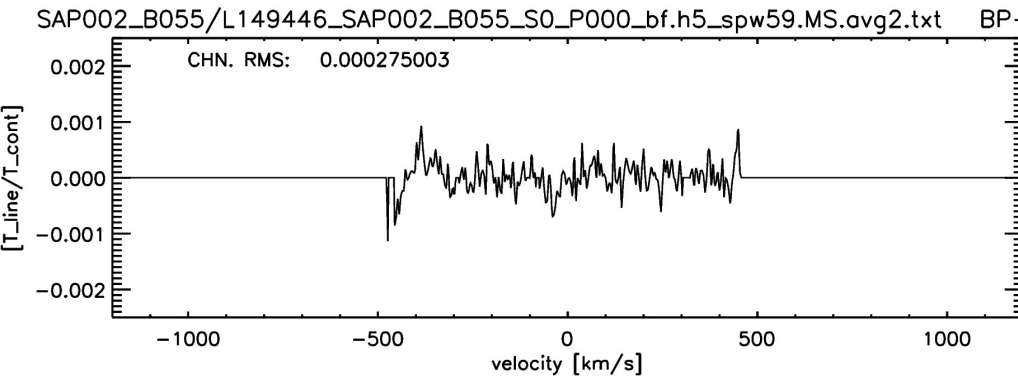
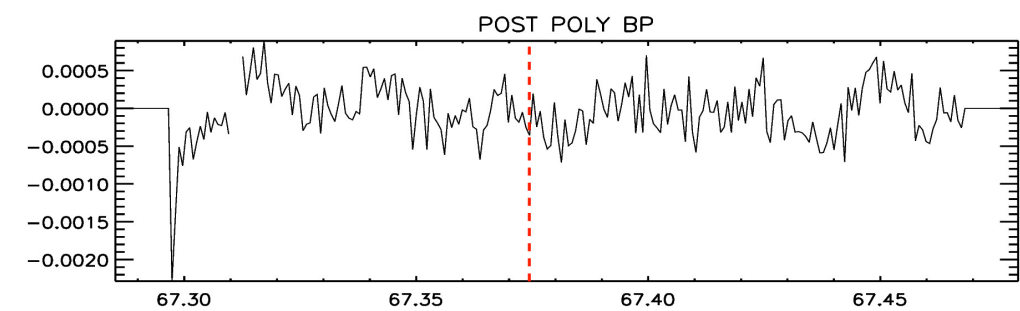
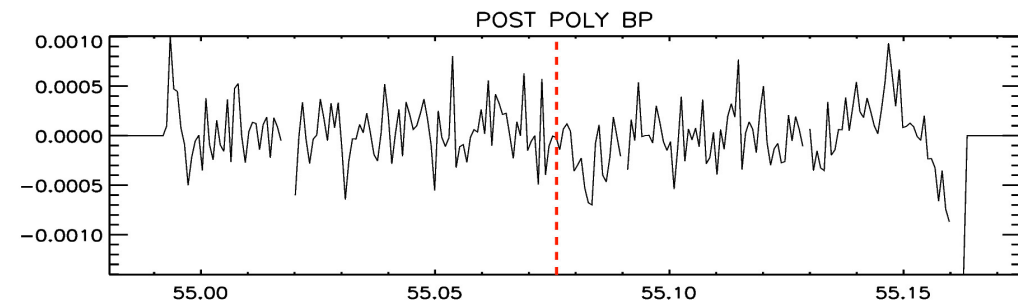
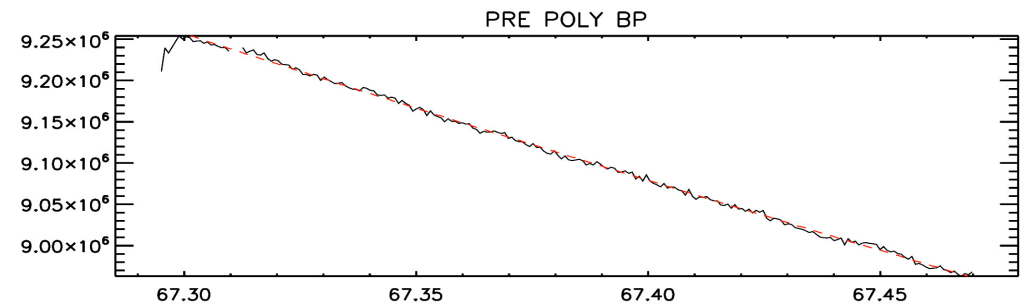
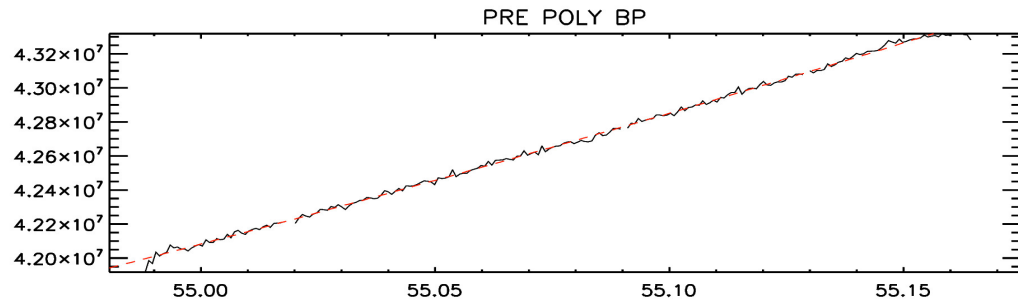


(50MHz: n=640)

*use Cb to extend
the RRL n-range.*

LOFAR Galactic RRL Survey: An update (LC0_028)

LC0_028 : Sub-band bandpass ripples – PPF? (esp. visible above 60 MHz)



LOFAR Galactic RRL Survey: An update (LC0 028)

Conclusions:

- (1) CRRL's are widespread throughout the Galactic plane
 - *FWHM, τ decrease with increasing Galactic longitude*
 - *On 1 degree scales, in $10 \times 10 \text{ deg}^2$ fields, τ varies by ca. factor 2*
- (2) BF observations below 40 MHz challenging (IF possible)
 - *C beta may provide a solution to extend n-range*
- (3) LC1 : full degree-scale CRRL Galactic plane survey (40 hrs)
 - => *Stepping stone : full 10'-scale Galactic RRL survey*

Commissioning:

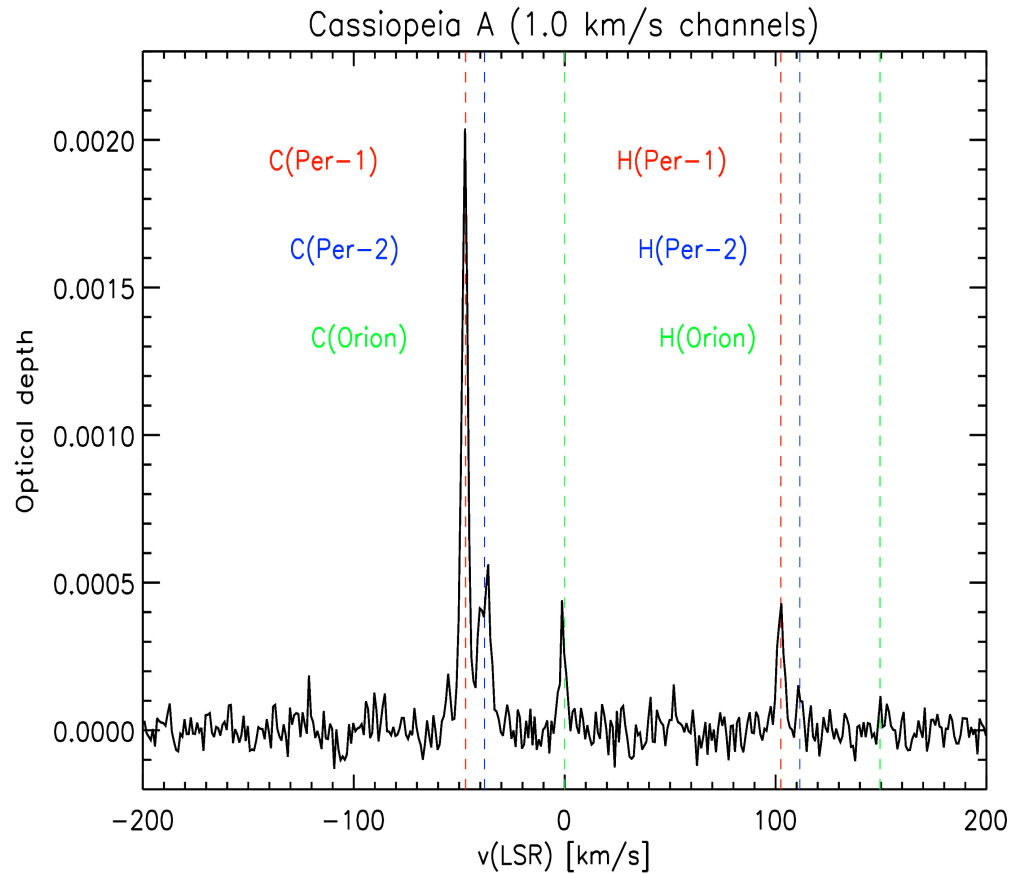
- (a) IF2BF , sim. obsv. (COBALT)
- (d) 8 vs. 16 bit IF/BF
- (e) Bandpass wiggles (PPF/weather?)
- (b) BF LBA full-core / HBA superterp



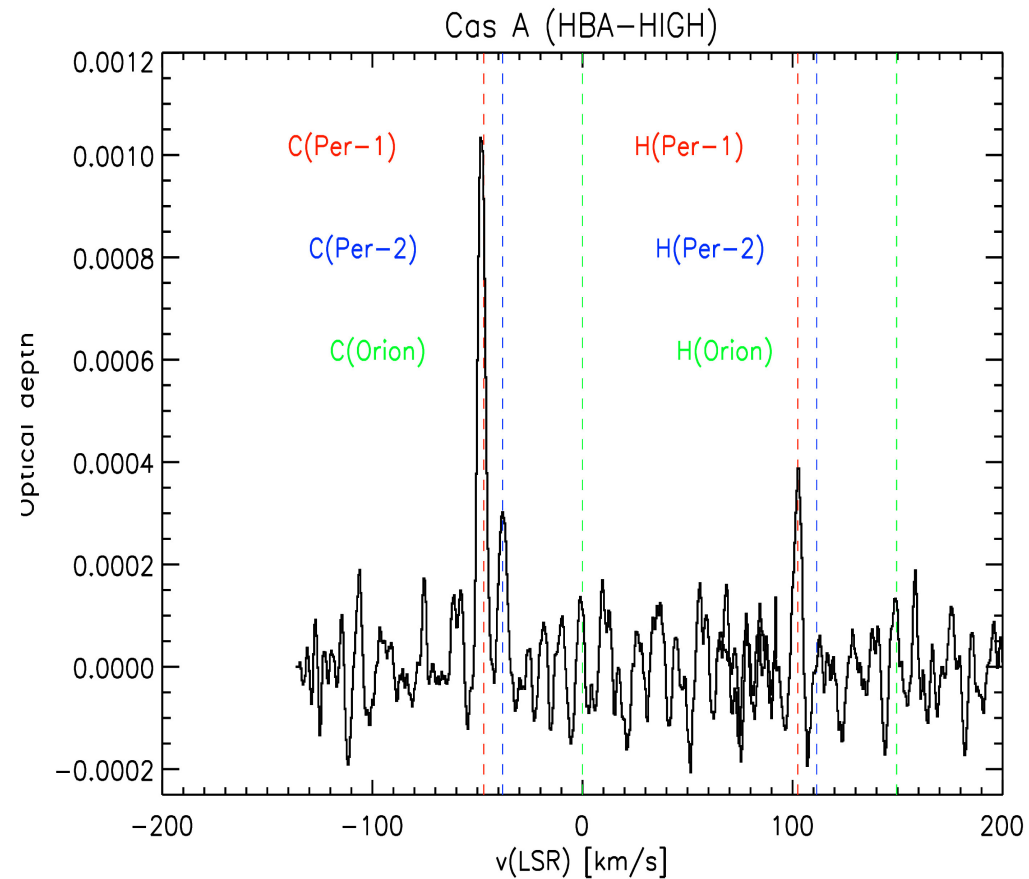
LOFAR

LOFAR Galactic RRL Survey: An update (LC0 028)

Hydrogen and Carbon RRLs towards Cas A : H ion.rate = $1e-16 \text{ s}^{-1}$



IF WSRT 350 MHz (12hr, 20L)



BF HBA-HIGH 350 MHz (3hr, 6L)