

# Release Notes

## Multi-Band EPI C2P

Release HCP\_v1

10 February 2014



Center for Magnetic  
Resonance Research

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**Driven to Discover<sup>SM</sup>**

## Installation

1. Restart the system (reboot host and MRIR)
2. Extract the .zip file to a temporary directory
3. Run the installer .bat file
4. If a sample protocol is available for your system, it will appear at the end of the USER tree in the Exam Explorer. If a sample protocol is not available, create a default protocol in Exam Explorer by selecting Insert Sequence, USER, then cmrr\_mbep2d\_\* for the desired sequence variant.

## Usage

These sequences are based on the Siemens product ep2d\_\* family of sequences; most of the protocol parameters are the same.

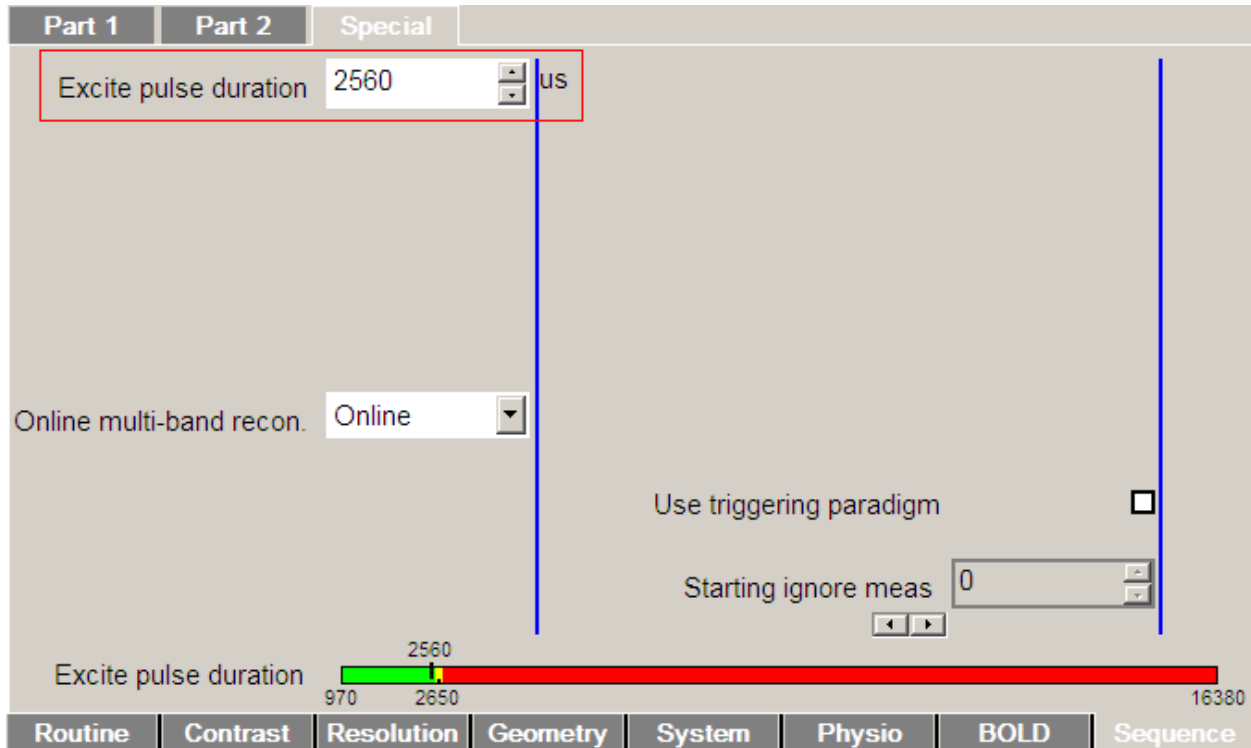
To activate multi-band acceleration, the number of slices must be set to >1. The multi-band acceleration parameter box will then automatically appear on the Routine card:

The screenshot displays the 'Routine' card of an MRI protocol configuration interface. The 'Multi-band accel. factor' parameter is highlighted with a red box and set to 8. A slider below the parameter shows the range from 1 to 8. The 'Slices' parameter is set to 8. Other parameters include Slice group (1), Dist. factor (38%), Position (Isocenter), Orientation (Transversal), Phase enc. dir. (A >> P), AutoAlign (---), Phase oversampling (0%), FoV read (192 mm), FoV phase (100.0%), Slice thickness (3.0 mm), TR (578 ms), TE (36 ms), Averages (1), Filter (None), and Coil elements.

The number of slices must be an integer multiple of the multi-band acceleration factor.

**Important Note:** The required RF pulse voltage increases linearly with the multi-band acceleration factor. Verify on the System|Transmitter/Receiver card that the voltage of all pulses, especially those with names similar to “MBExcPulse” and “MBRefocRF” (diffusion only) are below the system maximum value. Otherwise, the pulse(s) will be clipped and the flip angle(s) will be less than expected.

It is possible to increase the length of the RF pulse(s) on the Sequence|Special card to reduce the required voltage at the cost of increased minimum  $T_E$ :



## Known Issues

***This release will expire on 1 March 2016!***

- Only diffusion modes “MDDW” and “Free” are compatible with MB
  - UI will allow selection of other modes, but recon will fail.
- Demanding diffusion acquisitions with high b values may fail with gradient duty cycle errors if the highest gradient amplitudes are requested on the same axis over several consecutive TRs. This can be avoided by using e.g. a randomized vector table (in “Free” mode) to distribute the gradient demand more evenly over time. (This issue is not specific to MB.)
- Enabling iPAT with MB decreases image quality more than expected
  - iPAT support has been enabled for evaluation, but is not currently recommended for regular use
    - iPAT=2 is generally acceptable with low MB factors at 3 T with 32-channel head coil
    - *Always select the maximum number of iPAT reference lines*
  - MB+iPAT image quality will continue to be addressed in future releases
- Multi-band acceleration factor is limited in the UI to 8X
  - Combined MB+iPAT factors are further limited
  - Limits may be raised in future releases as recon performance improves
- Monopolar+ and bipolar+ diffusion schemes are not currently available
  - Addition of these modes will require cooperation from Siemens
    - Anticipated date of completion: <http://bit.ly/tH7LiP>
- Reconstruction is slow
  - VD11+MARS (8-core) performs well
    - 32-channel data may not reconstruct in real time depending on the sequence parameters
    - GPU acceleration is not currently enabled
  - VB17+Step4 (8-core) MRIR is acceptable
    - 32-channel data will not reconstruct in real time
  - VB17+Step2 (2-core) MRIR is **NOT RECOMMENDED**
    - 32-channel reconstructions may take many hours!

## Change Log

Release HCP\_v1 (1.1), 3 March 2014 (eja: VB17A R007/3cc6196)

- VB17: Fixed ICE startup.

Release HCP\_v1, 10 February 2014 (eja: VB17A R007/7c1ae86; VD11D R007/18fe171)

- Renamed sequences and ICE from CMRR\_\* to HCP\_v1\_\* to allow for concurrent installation of historic and current development releases on the same scanner. NOTE: protocols will need to be recreated to use this release due to the new sequence names.
- The default reconstruction option has been updated to use the improved scheme introduced in R009. This matches the 3T HCP protocol. The old, blurred reconstruction can be reactivated by selecting the OLD recon option(s), but this is strongly discouraged.

Release 008a, 23 April 2013 (eja: seq/ICE VB17A r121/r122; VD11D r224/r205)

- VD11 only: disabled frequency feedback when acquiring single-band data (was causing crashes)

Release 008, 13 February 2013 (eja: seq/ICE VB17A r121/r122; VD11D r206/r205)

- Added options for reconstructing phase images
- MB+iPAT reconstruction improvements

Release 007, 21 November 2012 (eja: VB17A r113; VD11D r195)

- Reconstruction speed improvements
- Fixed occasional occurrence of intensity variations between bands in some (mostly diffusion) protocols
- VD11: Siemens product frequency feedback/update enabled
- VD11: Checkbox added to invert readout and phase encoding gradient polarity (useful for post-processing eddy current corrections)
- SENSE1: image comment now indicates whether SENSE1 has been applied
- SENSE1: susceptibility-induced signal loss reduced

Release 006b, 21 June 2012 (eja: VB17A r92)

- VB17: fixed cases in monopolar diffusion where spoiler gradients failed to be played out for single-band b=0 reference scan

Release 006a, 23 May 2012 (eja: VB17A r91; VD11D r154)

- Fixed memory leak which caused recon to eventually crash for long series
- VB17: fixed FFT scaling factor for SENSE1
- Minor improvements to exported physiological log data

Release 006, 18 May 2012 (eja: VB17A r88; VD11D r151)

- Expiration date extended to 1 December 2012

- Added spin-echo EPI sequence variant
- Fixed clipped RF pulse dialog false alarms (for real this time...)
- VD11: fixed crash when physiological logging is enabled
- VB17: improved EPI ghost correction for BOLD variant
- VB17: fixed DTI recon preparation failure for certain syngo patch levels
- Limited max. MB factor to 3 for diffusion
- Removed non-working “free echo spacing” checkbox
- Misc. UI improvements

Release 005, 6 April 2012 (eja: VB17A r75; VD11D r125)

- Image quality improvements for MB7 and MB8
- Added SENSE1 coil combination option
- Restored option to save single-band reference images to a separate series
- Fixed clipped RF pulse dialog for VB17 diffusion refocusing pulses
- Further reconstruction speed improvements

Release 004a, 20 March 2012 (eja: VB17A r72; VD11D r111)

- Fixed incompatibility with protocols created with earlier revisions
- Reconstruction speed improvements

Release 004, 20 March 2012 (eja: VB17A r71; VD11D r110)

- Fixed DTI recon crash when postprocessing was explicitly not selected
- Added warning dialog on host if (MB) RF pulses will be clipped
- Fixed crash when creating new DTI protocols
- Fixed gradient errors on systems with lower slew rates (e.g., Verio)
- UI responsiveness, stability improvements
- Removed “single-band images” option due to unresolved ICE crashes; will restore in a later release

Release 003, 27 January 2012 (eja: VB17A r64; VD11D r78)

- Reconstruction speed improvements
- MB+iPAT image quality improvements
- Added option to save single-band reference images to a separate series
- Reduced number of prep scans at start of BOLD measurement
- Adaptive coil combine now compatible with MB (VD11D only)

Release 002a, 4 January 2012 (eja: VB17A r60; VD11D r61)

- VB17A ICE program expiration date fixed

Release 002, 18 November 2011 (eja: VB17A r58; VD11D r61)

- Diffusion variant (ep2d\_diff) released
- iPAT (GRAPPA only) enabled
- Option to log physiological data to file added
- Additional FFT scale factor UI parameter added (VB17 only)

- Bug fixes

Release 001, 26 September 2011 (eja: VB17A r50; VD11D r36)

- Initial public release