Fortis™
Technologies Ltd.

Strength in Technology

1.7 µm Fortis UHPLC Columns

NEW

Phase Chemistries

- Fortis H2o (polar endcapped)
- Fortis Amino
- Fortis HILIC Diol

Ultra High Pressure Chromatography

8 Chemistry Choices

Increase Efficiency

Increase Speed

Improve Resolution

Greater Sensitivity

1.7µm UHPLC Columns

- **380m2/g Surface Area Provides Increased Peak Capacity**
- **High Efficiency Small Particles**
- **Available in 8 Phase Chemistries**
- **Operate to 18,000psi**
- **Fully Scalable to Analytical and Prep Size**

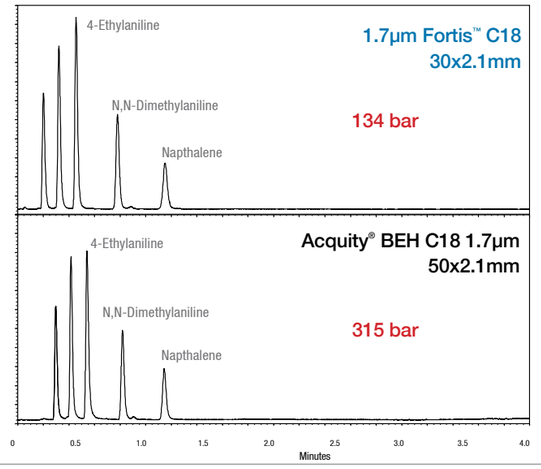
1.7µm Fortis™ particles are designed to provide characteristics, which will aid in increased productivity within ultra high pressure chromatography (UHPLC). Designed to be robust, reproducible and fully scalable with 3µm, 5µm and 10µm particles. 1.7µm Fortis particles will operate upto 1200bar providing high linear velocities, increased efficiency, and allowing speed and sensitivity to be achieved on all the latest UHPLC systems. By choosing a high surface area (S.A.) UHPLC phase the analyst can increase peak capacity using their existing column dimension, or maintain existing capacity whilst lowering backpressure on a shorter column.

Increased Efficiency

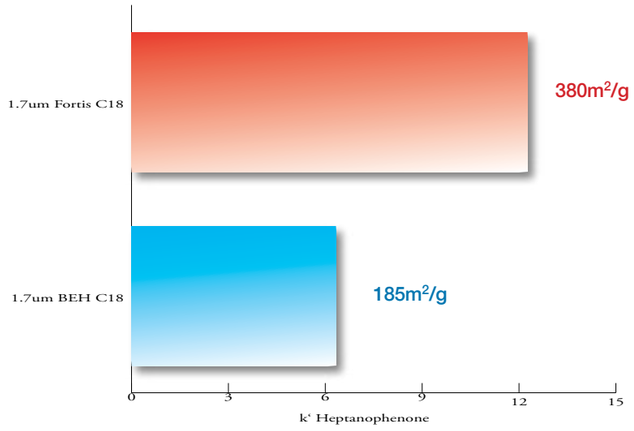
1.7µm Fortis C18 provides increased efficiency over 3µm and 5µm particles. This gives the opportunity to increase resolution or speed of analysis.

A wider linear flow range means that more resolution and peak capacity can be achieved for a given separation.
By having a consistent particle size and high surface area, 1.7µm Fortis C18 ensures pressure is reduced whilst no loss in efficiency is seen.

- **Higher Efficiency**
- **Greater Resolution**
- **Increased Sensitivity**
- **Fully Scalable 380m²/g S.A.**



Comparison of Hydrophobicity and Peak Shape

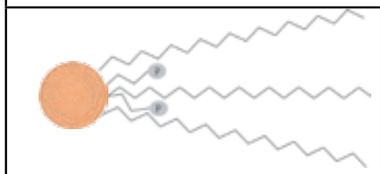
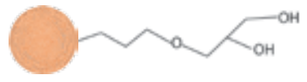
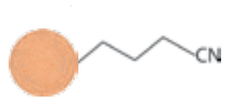


1.7µm Fortis™ C18 50x2.1mm	
Surface Area	380m²/g
Efficiency	191,670
Peak Shape (N,N-Dimethylaniline)	1.03
Psi - 0.3ml/min (60:40 ACN:Water)	170bar
Psi - 0.4ml/min (60:40 ACN:Water)	225bar

Acquity® BEH 1.7µm C18 50x2.1mm	
Surface Area	185m²/g
Efficiency	167,400
Peak Shape (N,N-Dimethylaniline)	1.28
Psi - 0.3ml/min (60:40 ACN:Water)	221bar
Psi - 0.4ml/min (60:40 ACN:Water)	292bar

Xbridge®, Acquity BEH® and UPLC®, are registered trademarks of Waters Corporation. Fortis is not associated with these companies. Comparative separations/results may not be representative of all applications. All columns are original manufacturers own.

Phase Chemistry Selectivity

	**1.7µm Fortis C18** – **General UHPLC use** – **Method Development from pH 1-12**	Acids Bases Neutrals
	**1.7µm Fortis H2o** – **Polar endcapped** – **Increased polar retention**	Hydrophilic analytes Organic acids Catecholamines
	**1.7µm Fortis Diphenyl** – **Unique di-phenyl structure** – **Metabolite profiling** – **Separate positional isomers**	Metabolites Positional Isomers Hydrophilic / Hydrophobic analytes
	**1.7µm Fortis C8** – **General UHPLC use** – **Method Development**	Lipids Steroids Highly Hydrophobic analytes
	**1.7µm Fortis HILIC** – **High polar retention** – **Homogenous silanol concentration** – **Improve MS sensitivity**	Carboxylic acids Nucleotides Vitamins
	**1.7µm Fortis HILIC Diol** – **Alternate selectivity to bare silica** – **Stable bonding** – **HILIC or Normal phase mode**	Steroids Proteins Metabolites
	**1.7µm Fortis Cyano** – **Cyano functionality** – **Reversed phase or Normal phase**	Explosives Pesticides Steroids
	**1.7µm Fortis Amino** – **Reproducible, Robust bonding** – **Reversed phase, Normal phase or Ion exchange mode**	Saccarides Oligonucleotides Steroids

UHPLC

High Performance

- **Use 1.7µm Fortis particles as a traditional UHPLC column**
- **Use 1.7µm Fortis particles in place of core-shell**
- **Fully pH stable 1-12**

1.7µm Fortis C18 columns can be used in UHPLC systems or in 'standard 400-600bar systems' to produce ultra-high pressure or ultra-high performance chromatography. If you use a high surface area stationary phase (Fortis = 380m^2/g) then in comparison with smaller surface area phases you will gain distinct advantages:

* pH range for gradient

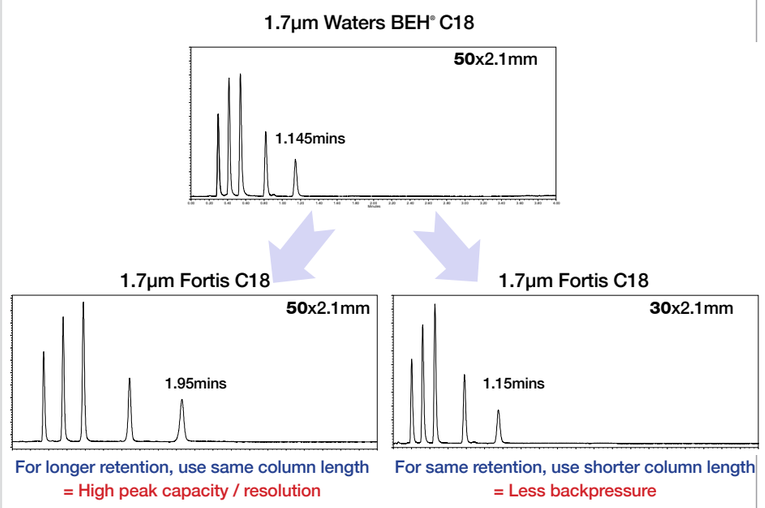
UHPLC

High Performance

1.7µm Fortis C18 vs 1.7µm Acquity® BEH C18

In this example we see the retention profile of five peaks on a Acquity BEH 1.7µm C18 and the same length Fortis 1.7µm column. Retention on the Fortis column is much longer as we would expect due to the higher surface area. This then leads to higher resolution/peak capacity being available for the same column length.
If we then move to the shorter Fortis column the retention profile achievable becomes very similar to that of the Acquity BEH but now the backpressure has been significantly decreased.

The correct use of 1.7µm Fortis UHPLC particles with a high surface area can allow the analyst to use the column as a UHPLC high pressure column with good peaks shapes and high resolution, or as an alternative to core-shell particles, high efficiency, lower pressure.

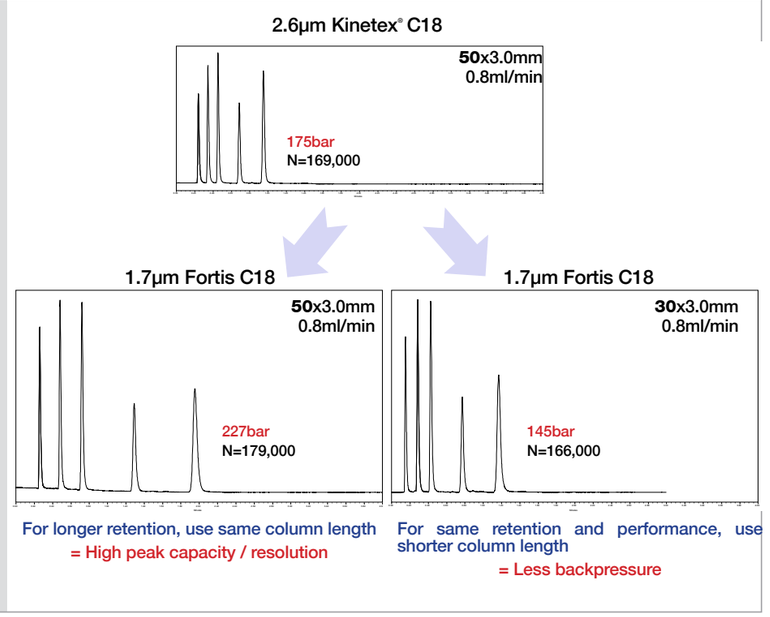


1.7µm Fortis C18 vs 2.6µm Kinetex® C18

Discussions around the use of core-shell vs UHPLC have suggested that the two are mutually exclusive due to the instrumentation required, but with careful consideration and the use of a high surface area porous particle you can achieve high performance with a simple short, small particle column.

Fortis C18 (380m^2/g surface area) vs 150-200m^2/g typical for core-shell particles, means that the lower surface area range will compromise peak capacity, loadability and scaleability, whilst the 1.7µm Fortis C18 will not.

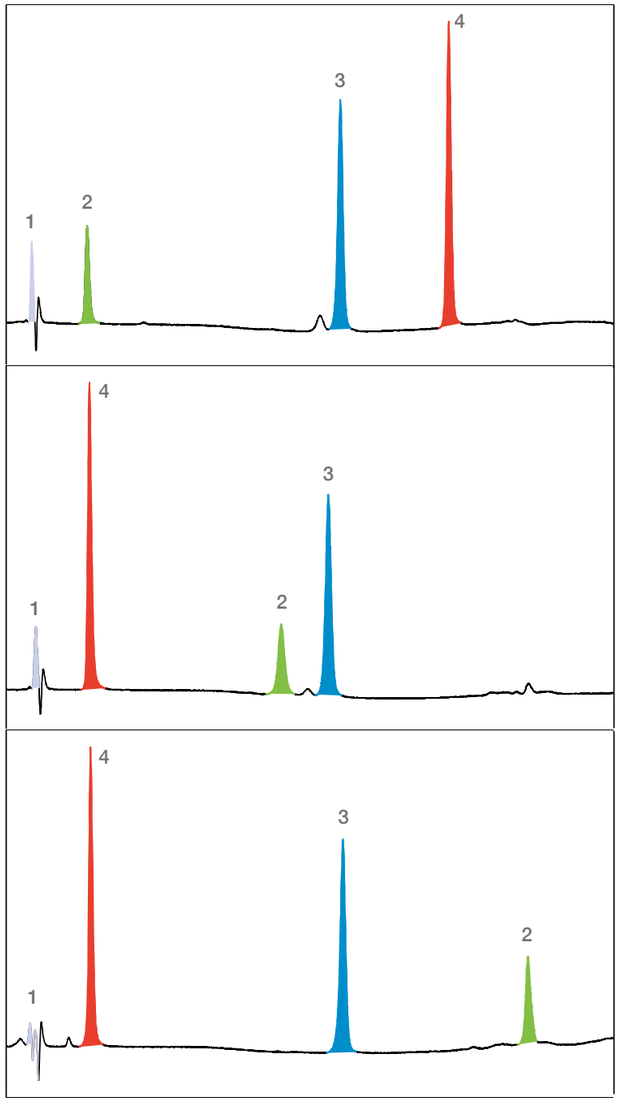
We can choose either extra peak capacity or to perform in a similar manner with potentially lower back pressure (even when the particle size is smaller).



1.7µm Fortis C18 pH options

- **pH selectivity for method development**
- **pH stable 1-12**
- **Gives high speed of equilibration**

1.7µm Fortis C18 will operate across the pH spectrum giving the analyst the ability to optimise the correct pH region for their separation. Quickly equilibrating from formic acid to ammonium acetate through to ammonia allows pH, as a method variable, to be rapidly evaluated. Resolution of compounds can be changed radically by altering pH to optimise separation between compound classes.



Column: 1.7µm Fortis C18 30x2.1mm
p/n: F18-020201
Gradient: 10 - 50% in 5min
Flow: 0.4ml/min
Temp: 20°C
Wavelength: 254nm

1. Uracil
2. Procaine
3. Fenuron
4. 3-Nitrobenzoic acid

pH 2.2

pH 7.2

pH 11.2

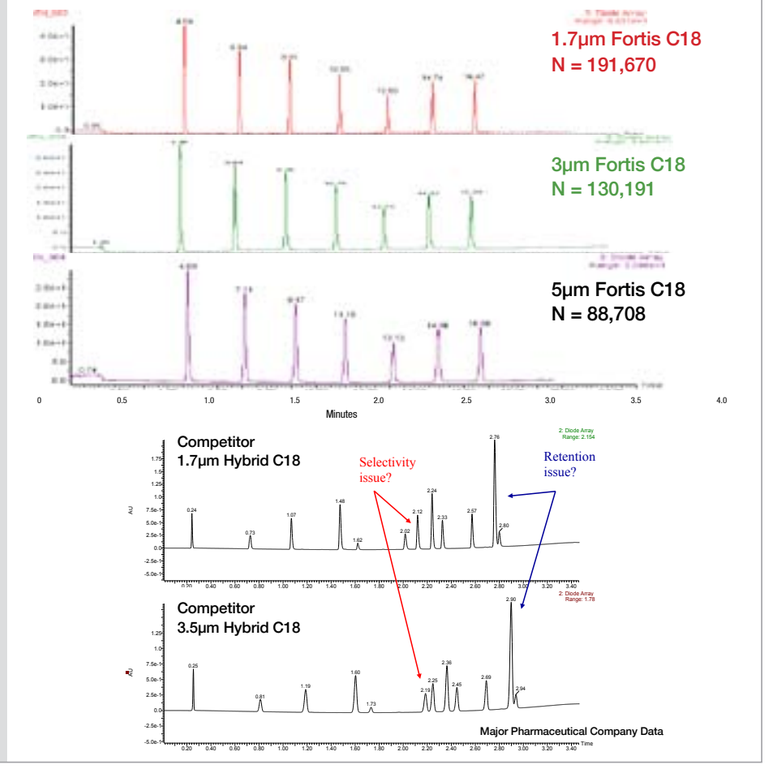
Fully Scaleable

Critically important to the analyst is the ability to have a fully scalable separation. Fortis C18 can be scaled from 1.7µm all the way through analytical 3 and 5µm particles to prep size without any change in retention profile.

By combining the same surface area, pore size characteristics with the identical bonding the analyst can be ensured of having the ability to either scale up methods to 'traditional' LC systems, or to be confident that a method can be transferred to another laboratory with the same selectivity being achieved.

If a small particle used in UHPLC is not the same as its larger 3um and 5um particle then changes in resolution and retention can occur, both of which can cause problems in method validity.

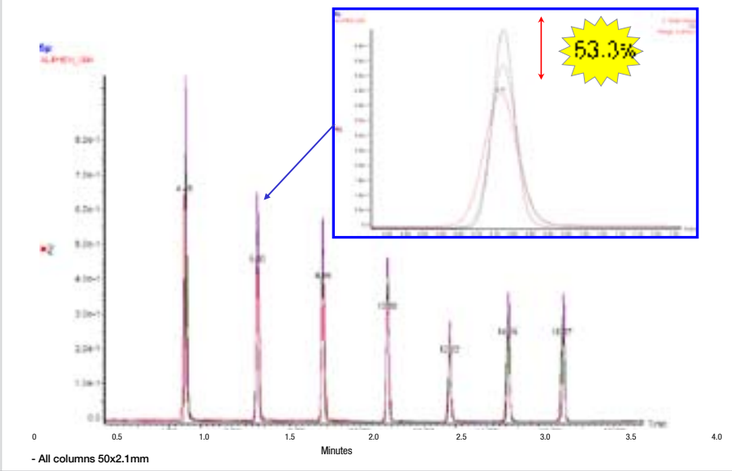
1.7µm Fortis C18 will alleviate all these potential issues, leaving the analyst confident in method transfer.



Sensitivity Gains

Critically peak height increases in UHPLC mode due to the rise in efficiency (N) from the smaller particle, but also it is also inversely proportional to peak width, so symmetrical peaks will lead to increased sensitivity.

By moving from a 3µm Fortis C18 particle size to 1.7µm Fortis C18 sensitivity can be increased. In this example peak height goes up by over 27%. The increase from 5um particles is even greater.



UHPLC

UHPLC Sample Filter

- **Low volume in-line filter for all UHPLC columns**
- **No backpressure increase**
- **Increase lifetime of UHPLC columns**
- **Change over time seconds not minutes**

Fortis UHPLC in-line filters are direct connect design, fitting in between the UHPLC column and the conventional system fitting to filter out particulate matter. They contain low dead volume and pressure. In-line filters are ideal for 1.7µm Fortis UHPLC columns where extra packed bed from a guard would be detrimental. UHPLC in-line filters are manufactured to withstand 20,000psi.

UHPLC Fittings

- **Perfect fit every time**
- **No dead volume**
- **No tools required**
- **Change over time seconds not minutes**

Fortis UHPLC fittings are designed to offer the perfect fit for all UHPLC columns. Quickly change the ferrule depth to adapt to any column. Hand-tight fitting requires no tools. Fitting is ideal for 1.7µm Fortis UHPLC columns as they are manufactured to withstand 20,000psi.

1.7µm UHPLC part numbers

1.7um Fortis C18	
xxx-020701	1.7µm Fortis C18 150x2.1mm
xxx-020501	1.7µm Fortis C18 100x2.1mm
xxx-020301	1.7µm Fortis C18 50x2.1mm
xxx-020201	1.7µm Fortis C18 30x2.1mm
xxx-020101	1.7µm Fortis C18 20x2.1mm
xxx-030501	1.7µm Fortis C18 100x3.0mm
xxx-030301	1.7µm Fortis C18 50x3.0mm
xxx-030201	1.7µm Fortis C18 30x3.0mm

Replace xxx with :

F18 = Fortis C18
F08 = Fortis C8
FHO = Fortis H2o
FHI - Fortis HILIC
FPH = Fortis Diphenyl
FNH = Fortis Amino
FCN = Fortis Cyano
FDI = Fortis HILIC Diol

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