Ignitors

You can control the ignition of some combustion simulations in Simcenter STAR-CCM+ using ignitors.

When combustion models are selected that allow you to control ignition, a **Continuum** > (and then)**Ignitors** node appears. The **Ignitors** node allows you to select a specific type of ignitor according to the combustion physics models that are selected.

Spark ignition models are only available for unsteady simulations and grow a spark from a small kernel until it is sufficiently large enough for the combustion model to take over the flame propagation. For other ignitors, the mesh cells which are contained within the ignitor parts have their properties changed as specified by the ignitor when it is on. For more information about spark ignition models, see Spark Ignition Models Reference.

- **EBU Ignitor (EBU)**: When the EBU Ignitor is on, for the cells which are contained within the EBU ignitor parts, it forces reaction rates to be mixing limited without using products.

- **Fixed Temperature Ignitor (FT)**: When the Fixed Temperature Ignitor is on, the temperature that chemical reactions are evaluated at is set to the constant temperature defined in the **Ignitors** node. Reaction rates typically increase with temperature, so when the fuel and the oxidizer are present, cells evaluated at the fixed ignitor temperature burn reactants to products. Since only the chemical rates are accelerated in the ignitor zone, overall energy is conserved and the cell temperatures tend to the burnt (chemical equilibrium) temperature.

- **Flame Area Density Ignitor (FAD)**: When the Flame Area Density ignitor is on, it sets the method by which the model determines the final Flame Area Density (FAD) that the ignitor applies to its cells. When it is off, this ignitor does not affect the values of flame area density.

- **Progress Variable Ignitor (PV)**: When the Progress Variable Ignitor is on, it sets the value of the cells that are contained within the ignitor parts to that of the Ignitor Variable Value property that is set for the ignitor. When it is off, this ignitor does not affect the values of the progress variable.

- **Subgrid Spark Ignitor (SS)**: The Subgrid Spark Ignitor is available when either the Complex Chemistry model or Flamelet Generated Manifold model are selected along with the Spark Ignition physics model and any Unsteady model.

  See Subgrid Spark Ignition Models Reference.

- **ISSIM Spark Ignitor (ISSIM)**: The ISSIM Spark Ignitor is available when the Complex Chemistry model is selected along with the Spark Ignition physics model and any Unsteady model. This model is also available with Simcenter STAR-CCM+ In-cylinder when modeling internal combustion engines.
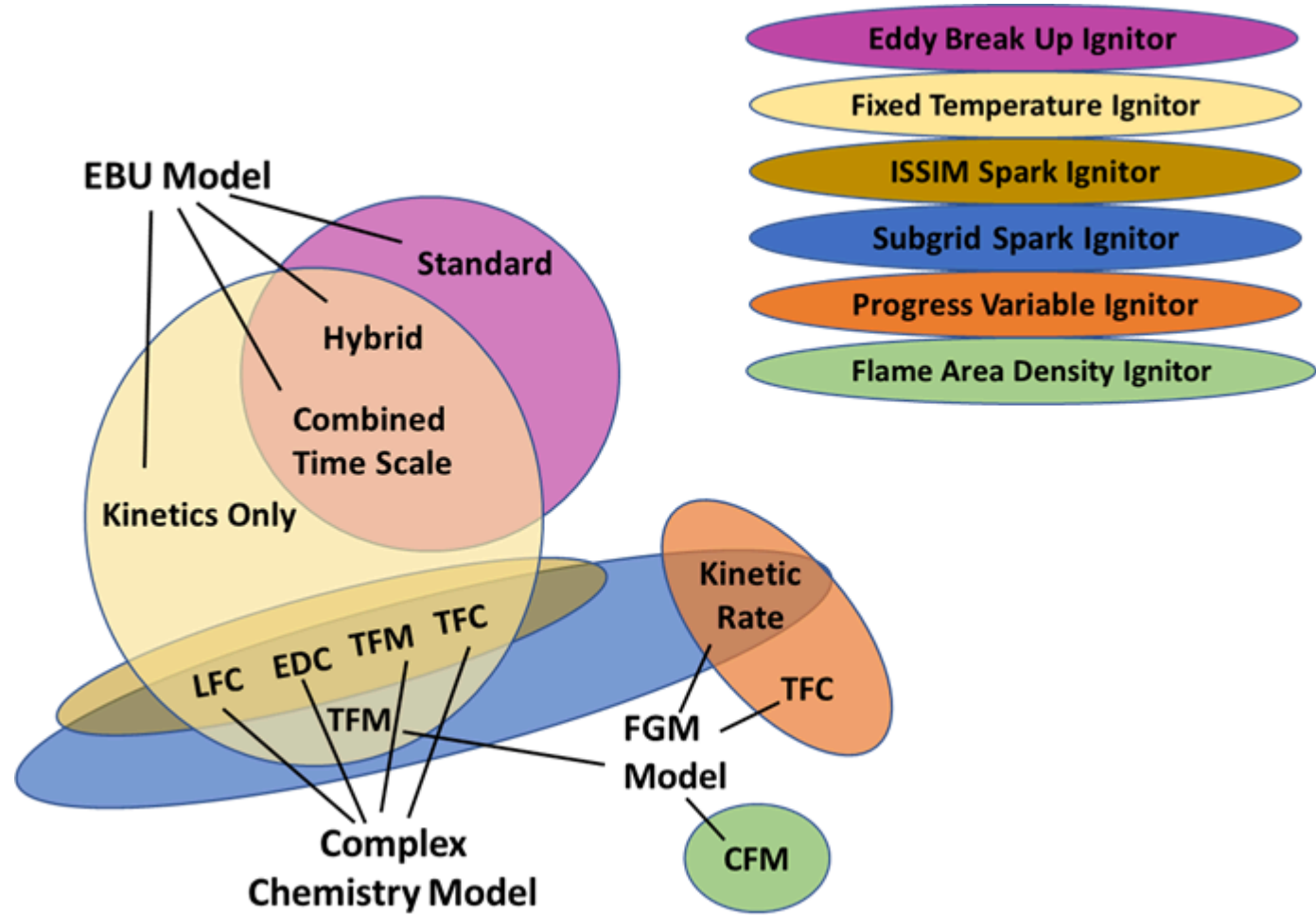
  See ISSIM Spark Ignition Model Reference.

- **FI Spark Ignitor**: The FI Spark Ignitor is only available with Simcenter STAR-CCM+ In-cylinder when modeling internal combustion engines.

  See FI Spark Ignition Model Reference.

Model		EBU	FT	FAD	PV	SS	ISSIM
Eddy Break-Up	Standard EBU	Yes	No	No	No	No	No
	Hybrid	Yes	Yes	No	No	No	No
	Combined Time-Scale	Yes	Yes	No	No	No	No
	Kinetics Only	No	Yes	No	No	No	No

Model		EBU	FT	FAD	PV	SS	ISSIM
Complex Chemistry	Laminar Flame Concept (LFC)	No	**Yes**	No	No	**Yes***	**Yes***
	Eddy Dissipation Concept (EDC)	No	**Yes**	No	No	**Yes***	**Yes***
	Thickened Flame Model (TFM)	No	**Yes**	No	No	**Yes***	**Yes***
	Turbulent Flame Speed Closure (TFC)	No	**Yes**	No	No	**Yes***	**Yes***
Flamelet Generated Manifold	FGM Kinetic Rate	No	No	No	**Yes**	**Yes***	No
	Coherent Flame Model (CFM)	No	No	**Yes**	No	No	No
	Turbulent Flame Speed Closure (TFC)	No	No	No	**Yes**	No	No
	Thickened Flame Model (TFM)	No	**Yes**	No	No	**Yes***	No

* When the Unsteady model is also used.

Ignitor Properties Lookup

Property	EBU Ignitor	Fixed Temperature Ignitor	Flame Area Density ignitor	Progress Variable Ignitor	All Spark Ignitors
Activator	✔	✔	✔	✔	See [Spark Ignition Models Reference](#).
Ignitor Set Method			✔	✔	
Ignitor Variable Value			✔	✔	
Shapes	✔	✔	✔	✔	
Temperature	✔	✔			

Properties

Parts

Allows you to select the geometry parts that represent the ignitor.

Ignitor Variable Value

A floating point value for the progress variable.

Ignitor Set Method

Sets the method to determine the value of flame area density (FAD) in each cell.

> Maximum of Cell FAD or Ignitor Constant

> > Uses the greater of the cell FAD that is obtained from the transport equation and the ignitor constant that is set with the Ignitor Variable Value property.

> Ignitor Constant

> > Overrides the cell value of FAD using the Ignitor Variable Value. This option is helpful when you know the exact FAD value for one cell.

Activator

Selects between options that define when the ignitor is active (on).

- Always : Indicates that the Ignitor is always on.

- Pulse : Applies the ignition condition for the duration of a pulse that you specify using the properties of the **Pulse** child node:

    - *Ignitor Enabled Trigger*: For steady-state simulations, iterations are specified, and for unsteady simulations, physical time (s) is specified.

    - *Ignitor Starting Iteration/Time* : Iteration or time after which the ignitor is activated.

    - *Ignitor Ending Iteration/Time* : Iteration or time after which the ignitor is de-activated.