# Documentation of APS model file format (xml format)

An example of a model file is enclosed. It shows the various elements that is necessary to specify a model for one reservoir zone. The model is specified within the top level keyword: <APSModel>

## Common project data

**Name of RMS project** having the workflow this APS model is a part of:  
 <RMSProjectName> RMSprojectName </RMSProjectName>

**Name of RMS workflow** the APS model is run from:  
 <RMSWorkflowName> RMSWorkflowName </RMSWorkflowName>

Name of IPL script that will be automatic generated for running simulation of Gaussian fields in RMS:

<RMSGaussFieldScriptName> GFScript.ipl </RMSGaussFieldScriptName>

**Name of grid model** in RMS which contain one or more zones which is modelled by the APS model specified in this model file:

<GridModelName> GridModel </GridModelName>

**Name of the 3D discrete grid parameter containing the zone number** in each grid cell:

<ZoneParamName> Zone </ZoneParamName>

**Name of the 3D discrete grid parameter for facies**. This facies realization have one or more zones that are modelled using the APS model specified here:

<ResultFaciesParamName> ResultFacies </ResultFaciesParamName>

**Print info.** A parameter specifying how much info is to be printed to terminal window when running the APS model. The values are integers 0,1,2,3 wher 0 is minimum output and 3 is maximum output (for debug purpose only):

<PrintInfo> 2 </PrintInfo>

**Global facies table**:

**Keyword**: MainFaciesTable

**Parent keyword:** APSModel

**Description:** The global facies table is a table with all facies names that are used for all zones in the facies modelling of the specified grid model. Hence the APS model will in general use a subset of these facies, e.g. if the facies combinations vary from zone to zone or if some zones are not modelled by the APS method. The global facies table is a list of all facies names and their associated facies code that is used in the 3D facies realization parameters (where each grid cell is assigned a facies code).

**Example:** <MainFaciesTable> … </MainFaciesTable>

**Sub keywords:**

* Facies

**Keyword:** Facies

**Parent keyword:** MainFaciesTable

**Attribute:** name

**Description:** Specify a facies in the main or global facies table. The attribute is the name of the facies.

**Example:** <Facies name="F1"> .. </Facies>

**Sub keyword**: Code

**Keyword:** Code

**Parent keyword:** Facies

**Description:** Specify a facies code for the specified facies. The facies code is a positive integer used in the facies realization. Each grid cell in the facies realization for a grid model is assigned a facies code.facies from the main facies table.

**Example:** <Code> 1 </Code>

**Gauss field simulation job names and name of gauss fields**. Specification of which RMS jobs that will create which Gaussian fields. In the example below, the RMS job for petrosim called “Job1” will create 3 different 3D parameters, GF1,GF2,GF3 containing the Gaussian fields. The “job2” will create the 3D parameters GF4,GF5,GF6:

**Keyword:** GaussFieldJobNames

**Parent keyword:** APSModel

**Description:** Specify a RMS jobs for simulation of Gaussian fields.

**Example:** <GaussFieldJobNames> … </GaussFieldJobNames>

**Sub keyword**: Job

**Keyword:** Job

**Parent keyword:** GaussFieldJobNames

**Attribute:** name

**Description:** Specify a RMS job name for simulation of Gaussian fields. The attribute “name” specify the job name.

**Example:** <Job name="Job1"> … </Job>

**Sub keyword**: GFParam

**Keyword:** GFParam

**Parent keyword:** Job

**Description:** Specify a name of the Gaussian field to be generated by the RMS job specified in the parent keyword “Job”.

**Example:** <GFParam> GF1 </GFParam>

## Zone specific model parameters

An APS model can be specified in all or a subset of all zones belonging to a grid model.

The specification of the zones are started by keyword <ZoneModels>

Specification of a given zone is defined by the following hierarchy of keywords:

**Keyword:** Zone

**Parent keyword:** ZoneModels

**Attribute:** number

**Description:** Specify the model parameter for a zone. The attribute is the zone number.

**Example:** <Zone number="1"> … </Zone>

**Sub-keywords:**

* UseConstProb
* SimBoxThickness
* HorizonNameVarioTrend
* FaciesProbForModel
* GaussField
* TruncationRule

**Keyword**: UseConstProb

**Parent keyword:** Zone

**Description:** Integer number 0 or 1 where 0 means that the specified facies probabilities specified under keyword FaciesProbForModel are not constants, but a name of a 3D continuous parameter containing facies probability cube. The value 1 means that the specified facies probabilities are constants (the same value for all grid cells in the zone) and specified by float numbers for the probabilities.

**Example:** <UseConstProb> 1 </UseConstProb>

**Keyword:** SimBoxThickness

**Parent keyword:** Zone

**Description:** Float number > 0. This is the thickness of the simulation box used in RMS for the zone. This parameter must be consistent with the simulation box thickness in the RMS project for the zone in the grid model specified. It is used when calculating trends for Gaussian fields.

**Example:** <SimBoxThickness> 4.0 </SimBoxThickness>

**Keyword:** HorizonNameVarioTrend

**Parent keyword:** Zone

**Description:** This keyword specify the name of top horizon for the zone. The name is found in the horizon container in the RMS project. This is used when modelling azimuth angle for direction for variogram main range for Gaussian fields.

**Example**: <HorizonNameVarioTrend>

top\_middle\_Neslen\_1

</HorizonNameVarioTrend>

**Keyword:** FaciesProbForModel

**Parent keyword:** Zone

**Description:** This keyword contains specification of list of facies to be used in the APS model and their facies probabilities.

**Example:** <FaciesProbForModel> … </FaciesProbForModel>

**Sub-keywords:**

* Facies

**Keyword:** Facies

**Parent keyword:** FaciesProbForModel

**Attribute:** name

**Description:** It specify the name of the facies using the name attribute.

**Example:** <Facies name="F1"> … </Facies>

**Sub-keywords:**

* ProbCube

**Keyword:** ProbCube

**Parent keyword:** Facies

**Description:** This keyword is a child of the Facies keyword which is again a child of keyword FaciesProbForModel. It specifies either a float number or a text word containing the name of a 3D parameter for the facies probability for the facies it belongs to.

**Example:** <ProbCube> 0.2 </ProbCube>

**Keyword:** GaussField

**Attribute**: name

**Parent keyword**: Zone

**Description:** Specify name of Gaussian fields and their model parameters through the child keywords.

**Example:** <GaussField name="GF1"> … </GaussField>

**Sub-keywords**:

* Vario
* Trend
* RelStdDev
* SeedForPreview

**Keyword:** Vario

**Attribute**: name

**Parent keyword**: GaussField

**Description:** Specify variogram model parameters for Gaussian field through the child keywords.The attribute “name” specify the variogram type. The possible allowed values are:

* GENERAL\_EXPONENTIAL
* EXPONENTIAL
* SPHERICAL
* GAUSSIAN

**Example:** <Vario name="GENERAL\_EXPONENTIAL"> … </Vario>

**Sub-keywords**:

* MainRange
* PerpRange
* VertRange
* Angle
* Power

**Keyword:** MainRange

**Parent keyword**: Vario

**Description:** Specify correlation length in main correlation direction. Allowed values are positive float numbers.

**Example:** <MainRange> 5000.0 </MainRange>

**Keyword:** PerpRange

**Parent keyword**: Vario

**Description:** Specify correlation length in perpendicular correlation direction. Allowed values are positive float numbers.

**Example:** <PerpRange> 5000.0 </PerpRange>

**Keyword:** VertRange

**Parent keyword**: Vario

**Description:** Specify correlation length in vertical correlation direction. Allowed values are positive float numbers.

**Example:** <VertRange> 2.0 </VertRange>

**Keyword:** Angle

**Parent keyword**: Vario

**Description:** Specify azimuth angle for direction for the main correlation direction. Allowed values are float numbers from 0 to 360 (degrees).

**Example:** <Angle> 2.0 </Angle>

**Keyword:** Power

**Parent keyword**: Vario

**Description:** Specify exponent in general exponential variogram. Only relevant if general exponential variogram is specified as variogram type in the parent keyword.. Allowed values are from 1.0 to 1.99.

**Example:** <Power> 1.8 </Power>

**Keyword:** Trend

**Attribute**: name

**Parent keyword**: GaussField

**Description:** Specify a trend type to be used for the Gaussian field. The possible allowed values for the attribute “name” are:

* Linear3D

**Example:** <Trend name="Linear3D"> … </Trend>

**Sub-keywords**: Depending on the trend type the following sub keywords are:

* For trend type: Linear3D:
  + asimuth
  + directionStacking
  + stackAngle

**For trend type Linear3D:**

**Keyword:** azimuth

**Parent keyword:** Trend

**Description**: Direction (azimuth angle) for the linear trend. This is an angle between 0 and 360 degrees.

**Example:** <asimuth> 125.0 </asimuth>

**Keyword:** directionStacking

**Parent keyword:** Trend

**Description:** This parameter is 1 or -1 depending on stacking type (progradation or retrogradation)

**Example:** <directionStacking> 1 </directionStacking>

**Keyword:** stackAngle

**Parent keyword:** Trend

**Description:** This parameter is the dip angle of facies layers for facies belts that are created. Allowed values are in interval from 0 to 90 degrees.

**Example:** <stackAngle> 0.1 </stackAngle>

**Keyword:** RelStdDev

**Parent keyword:** GaussField

**Description**: Relative standard deviation. This parameter is used in the following calculations in the algorithm: The maximum and minimum value for the trend within the grid cells belonging to the zone is calculated. This difference is multiplied by the relative standard deviation to get the standard deviation. This standard deviation is multiplied by Gaussian fields with 0 expectation and unit variance to get the Gaussian noise to add to the trend.Direction (azimuth angle) for the linear trend. This is an angle between 0 and 360 degrees.

**Example:** <RelStdDev> 0.01 </RelStdDev>

**Keyword:** SeedForPreview

**Parent keyword:** GaussField

**Description**: Random seed used in preview simulation of the Gaussian field. Large integer number.

**Example:** <SeedForPreview> 276787 </SeedForPreview>

**Keyword:** TruncationRule

**Parent keyword:** Zone

**Attributes:** name nGFields

**Description**: Specify truncation rule. The children keywords specify the details. The attribute “name” specify the type of truncation rule. The attribute nGFields specify the number of Gaussian fields the truncation rule is designed for. The allowed type of truncation rules specified for the “name” attribute are:

* Trunc2D\_Cubic\_Overlay
* Trunc2D\_Angle\_Overlay
* Trunc3D\_Bayfill

**Example:** <TruncationRule nGFields="3" name="Trunc3D\_Bayfill">

…

</TruncationRule>

**For truncation rule type** Trunc3D\_Bayfill:

**Example:**

<UseConstTruncParam>1</UseConstTruncParam>

<Floodplain> F1 </Floodplain>

<Subbay> F2 </Subbay>

<WBF> F3 </WBF>

<BHD> F4 </BHD>

<Lagoon> F5 </Lagoon>

<SF> 0.5 </SF>

<YSF> 0.5 </YSF>

<SBHD> 0.5 </SBHD>

**Description:**

**Keyword** UseConstTruncParam has 0 or 1 as input. Here 1 means that   
 the truncation rule will use constant values for the SF   
 parameter while 0 means that the SF parameter take a name  
 of a 3D parameter as input instead.

**Keyword:** Floodplain, Subbay,WBF,BHD,Lagoon take a facies name as   
 input. This is the name of the facies taking the role as  
 Floodplain,Subbay,etc.

**Keyword:** SF take either a value between 0 and 1 or a 3D parameter   
 name for a trend for this parameter as input.

**Keyword:** YSF and SBHD take a float between 0 and 1 as input.

**For truncation rule type** Trunc2D\_Angle\_Overlay:

**Example:**

<UseConstTruncParam>1</UseConstTruncParam>

<Facies name="F1">

<Angle> 60.0 </Angle>

<ProbFrac> 1.0 </ProbFrac>

</Facies>

<Facies name="F2">

<Angle> 135.0 </Angle>

<ProbFrac> 1.0 </ProbFrac>

</Facies>

<Facies name="F4">

<Angle> -135.0 </Angle>

<ProbFrac> 1.0 </ProbFrac>

</Facies>

<Facies name="F3">

<Angle> -45.0 </Angle>

<ProbFrac> 1.0 </ProbFrac>

</Facies>

<OverLayFacies name="F5">

<TruncIntervalCenter> 1.0 </TruncIntervalCenter>

<Background> F1 </Background>

<Background> F2 </Background>

<Background> F3 </Background>

<Background> F4 </Background>

</OverLayFacies>

**Description:**

**Keyword** UseConstTruncParam

has 0 or 1 as input. Here 1 means that the truncation rule will use constant values for the Angle keywords parameter while 0 means that the Angle parameter take a name of a 3D parameter as input instead.

**Keyword:** Angle

is an angle between -180 and 180 degrees.

**Keyword:** ProbFrac

is a probability fraction. If the same facies is specified multiple times, it means that this facies is associated with multiple polygons in the truncation map. In this case the probability for this facies has to be split into a fraction for each polygon associated with the facies. This means that if the same facies is associated with three polygons, a probability fraction must be specified for each of these three polygons and the sum of the fractions must be 1.0.

**Keyword:** OverLay

is used to specify a facies defined by truncating a third Gaussian field. This facies will have geometry defined by the third Gaussian field and will “overprint” specified facies.

**Keyword:** TruncIntervalCenter

specify that the truncation interval for the overlay facies can be centered at any location between 0 and 1.

**Keyword:** Background

Specify name of facies that will be “overprinted” by the overlaying facies defined by the third Gaussian field. If for instance F1, F2,F3 are facies specified by keyword Facies, the allowed values specified for keyword Background must be all or a subset of these three facies F1,F2 and F3. The overlay facies will be located in areas where the background facies is defined.

**For truncation rule type** Trunc2D\_Cubic\_Overlay:

**Example:**

<L1 direction="H">

<ProbFrac name="F1"> 1.0 </ProbFrac>

<L2>

<ProbFrac name="F2"> 1.0 </ProbFrac>

<L3>

<ProbFrac name="F3"> 0.5 </ProbFrac>

<ProbFrac name="F4"> 1.0 </ProbFrac>

</L3>

<L3>

<ProbFrac name="F3"> 0.5 </ProbFrac>

<ProbFrac name="F5"> 1.0 </ProbFrac>

</L3>

</L2>

</L1>

<OverLayFacies name="F6">

<TruncIntervalCenter> 1.0 </TruncIntervalCenter>

<Background> F1 </Background>

<Background> F2 </Background>

<Background> F3 </Background>

<Background> F4 </Background>

<Background> F5 </Background>

</OverLayFacies>

**Description:** This truncation rule defines a set of rectangular polygons by splitting the unit square in a hierarchical way. The unit square is first split horizontally or vertically. The split can be in two or more rectangles. These rectangles are called level 1 rectangles and there are two possible representations of level 1 rectangles, either they consist of one facies or they are composed. If the rectangle is composed, it means that the rectangle is again composed of sub-rectangles called level 2 rectangles. Level 2 rectangles are created by splitting a level 1 rectangle horizontally if level 1 rectangles were created by splitting the unit square vertically. Level 2 rectangles are created by splitting a level 1 rectangle vertically if the level 1 rectangles were created by splitting the unit square horizontally. Also level 2 rectangles can come in two representations, either a rectangle with one facies or a composed rectangle of sub-rectangles called level 3 rectangles. The split of a level 2 rectangle into level 3 rectangle is done in the same way as described for level 2 rectangles. The split direction is orthogonal to the split direction for the level above. Level 3 rectangles are not composed. There are only one facies per rectangle. The sequence the split into sub-levels are defined, will also define which facies is assigned to each rectangle.

**The example above**: First the unit square is split horizontally into two rectangles since there are two sub-keyword lines. The first is ProbFrac keyword line. The second is L2 keyword. This means that the lowermost of the two rectangles is not composed and has facies F1 as facies. The uppermost level 1 rectangle is composed. The level 1 rectangle is split vertically in three rectangles since the level 1 rectangles were created by splitting unit square horizontally. The first of the level 2 rectangles is not composed and the facies for this rectangle is F2. This is the leftmost rectangle. The next level 2 rectangle is composed and represent the middle of the three level 2 rectangles. This level 2 rectangle is split horizontally again into two rectangles of level 3. The lowermost of these two rectangles is F3 facies while the uppermost is F4 facies. The third level 2 rectangle is also composed and is also split into two level 3 facies where the lowermost is F3 facies while the uppermost is F5 facies. As we can see, the facies F3 is associated with two different rectangles, and the probability fraction is set to 0.5 for each of these two such that the sum is 1.0. For all other facies, they are defined for only one rectangle and hence, the probability fraction is 1.0 for these.

The overlay facies is F6 and may exist everywhere since all specified facies also are defined as background facies for the overprint facies.

**Keywords: L1, L2, L3 and ProbFrac**specify first level rectangles. The sub-keyword is either L2 or ProbFrac. If the sub-keyword is L2, it means that the rectangle is composed of level 2 rectangles. If the sub-keyword is ProbFrac, the rectangle is not composed and consists of one facies only. Sub-keywords L3 under L2 means that the rectangle is composed of level 3 rectangles and if the sub-keyword is ProbFrac, the rectangle consists of only one facies. Sub-keywords under L3 are only ProbFrac which means that each level 3 rectangle belongs to one facies each and are not composed.

**Keyword:** OverLayFacies  
specify overlay facies in the same way as described for Trunc2D\_Angle\_Overlay

## Example of a APS model file containing specification for one zone

<APSModel>

<RMSProjectName> RMSprosjekt </RMSProjectName>

<RMSWorkflowName> RMSWorkflow </RMSWorkflowName>

<RMSGaussFieldScriptName> GFScript.ipl </RMSGaussFieldScriptName>

<GridModelName> GridModel </GridModelName>

<ZoneParamName> Zone </ZoneParamName>

<ResultFaciesParamName> ResultFacies </ResultFaciesParamName>

<PrintInfo> 2 </PrintInfo>

<MainFaciesTable>

<Facies name="F1">

<Code> 1 </Code>

</Facies>

<Facies name="F2">

<Code> 2 </Code>

</Facies>

<Facies name="F3">

<Code> 3 </Code>

</Facies>

<Facies name="F4">

<Code> 4 </Code>

</Facies>

<Facies name="F5">

<Code> 5 </Code>

</Facies>

<Facies name="F6">

<Code> 6 </Code>

</Facies>

<Facies name="F7">

<Code> 7 </Code>

</Facies>

<Facies name="F8">

<Code> 8 </Code>

</Facies>

<Facies name="F9">

<Code> 9 </Code>

</Facies>

<Facies name="F10">

<Code> 10 </Code>

</Facies>

</MainFaciesTable>

<GaussFieldJobNames>

<Job name="Job1">

<GFParam> GF1 </GFParam>

<GFParam> GF2 </GFParam>

<GFParam> GF3 </GFParam>

</Job>

<Job name="Job2">

<GFParam> GF4 </GFParam>

<GFParam> GF5 </GFParam>

<GFParam> GF6 </GFParam>

</Job>

</GaussFieldJobNames>

<ZoneModels>

<Zone number="1">

<UseConstProb> 1 </UseConstProb>

<SimBoxThickness> 4.0 </SimBoxThickness>

<FaciesProbForModel>

<Facies name="F1">

<ProbCube> 0.2 </ProbCube>

</Facies>

<Facies name="F3">

<ProbCube> 0.2 </ProbCube>

</Facies>

<Facies name="F4">

<ProbCube> 0.3 </ProbCube>

</Facies>

<Facies name="F5">

<ProbCube> 0.15 </ProbCube>

</Facies>

<Facies name="F9">

<ProbCube> 0.15 </ProbCube>

</Facies>

</FaciesProbForModel>

<GaussField name="GF1">

<Vario name="GENERAL\_EXPONENTIAL">

<MainRange> 5000.0 </MainRange>

<PerpRange> 750.0 </PerpRange>

<VertRange> 2.0 </VertRange>

<Angle> 35.0 </Angle>

<Power> 1.8 </Power>

</Vario>

<SeedForPreview> 276787 </SeedForPreview>

</GaussField>

<GaussField name="GF2">

<Vario name="SPHERICAL">

<MainRange> 2000.0 </MainRange>

<PerpRange> 3750.0 </PerpRange>

<VertRange> 1.5 </VertRange>

<Angle> 0.0 </Angle>

</Vario>

<SeedForPreview> 75151556 </SeedForPreview>

</GaussField>

<GaussField name="GF3">

<Vario name="EXPONENTIAL">

<MainRange> 1000.0 </MainRange>

<PerpRange> 500.0 </PerpRange>

<VertRange> 2.5 </VertRange>

<Angle> 90.0 </Angle>

</Vario>

<SeedForPreview> 7772627 </SeedForPreview>

</GaussField>

<TruncationRule nGFields="3" name="Trunc2D\_Cubic\_Overlay">

<L1 direction="H">

<L2>

<L3>

<ProbFrac name="F1"> 1.0 </ProbFrac>

<ProbFrac name="F3"> 1.0 </ProbFrac>

</L3>

<ProbFrac name="F4"> 1.0 </ProbFrac>

</L2>

<ProbFrac name="F5"> 1.0 </ProbFrac>

</L1>

<OverLayFacies name="F9">

<TruncIntervalCenter> 0.5 </TruncIntervalCenter>

<Background> F3 </Background>

<Background> F5 </Background>

</OverLayFacies>

</TruncationRule>

</Zone>

</ZoneModels>

</APSModel>