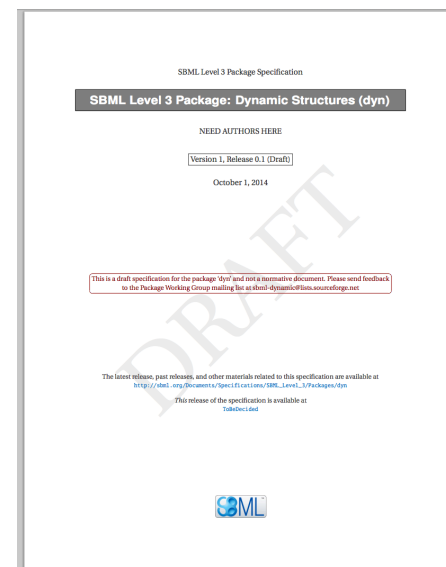
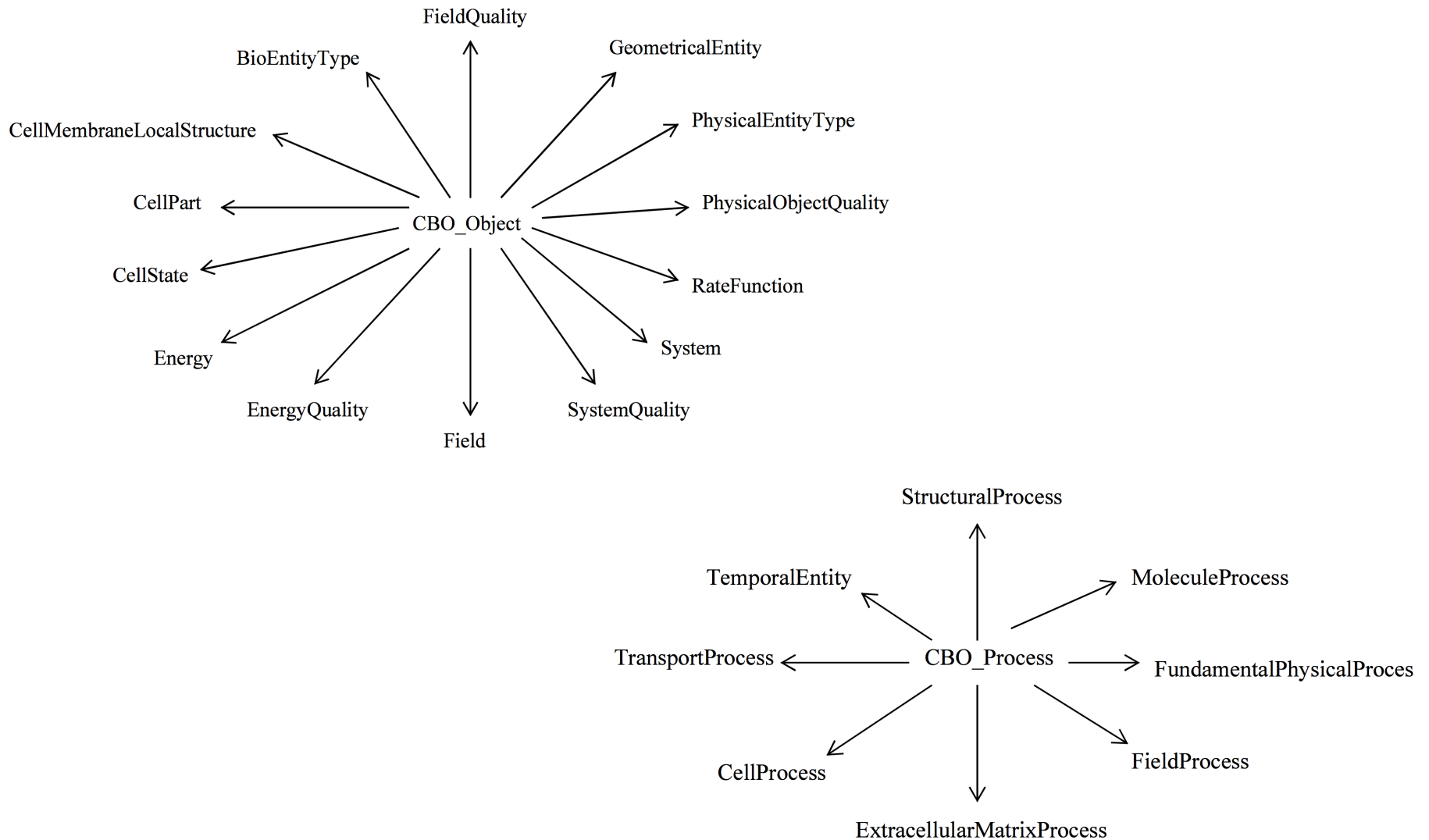


Dynamic Processes (dyn)

- SBML Level 3 package
- Draft specification
 - V1 R 0.1 October 2014
- iBioSim implementation
 - <http://pubs.acs.org/doi/abs/10.1021/sb300082b>
- JSBML support
- libSBML support



Cell Behavior Ontology (CBO)



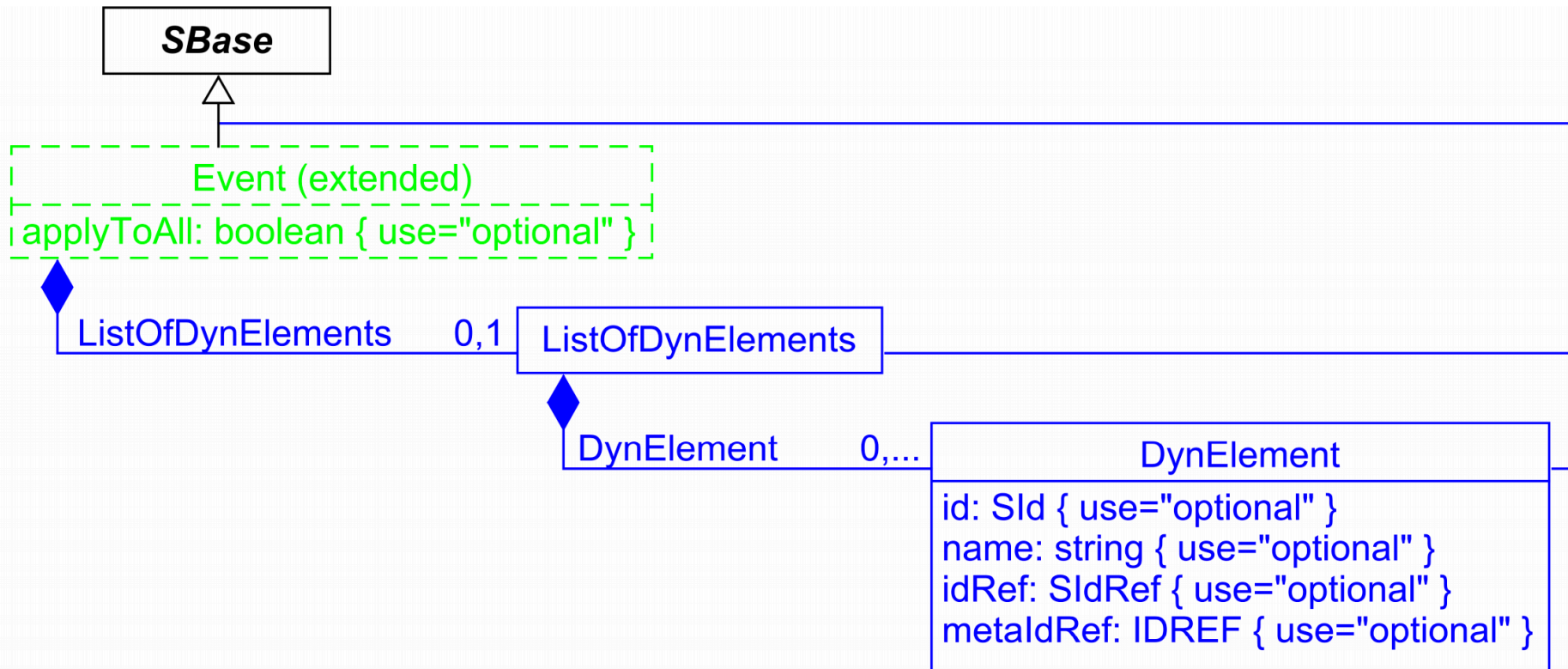
Cell Behavior Ontology terms

- SBase extended to include optional CBO term

```
class SBase (extended)
{
  cboTerm: CBOTerm { use="optional" }
```

- Draft mentions explicit support for:
 - Cell Division
 - Cell Death
 - Cell Movement

Extending Event



Event examples

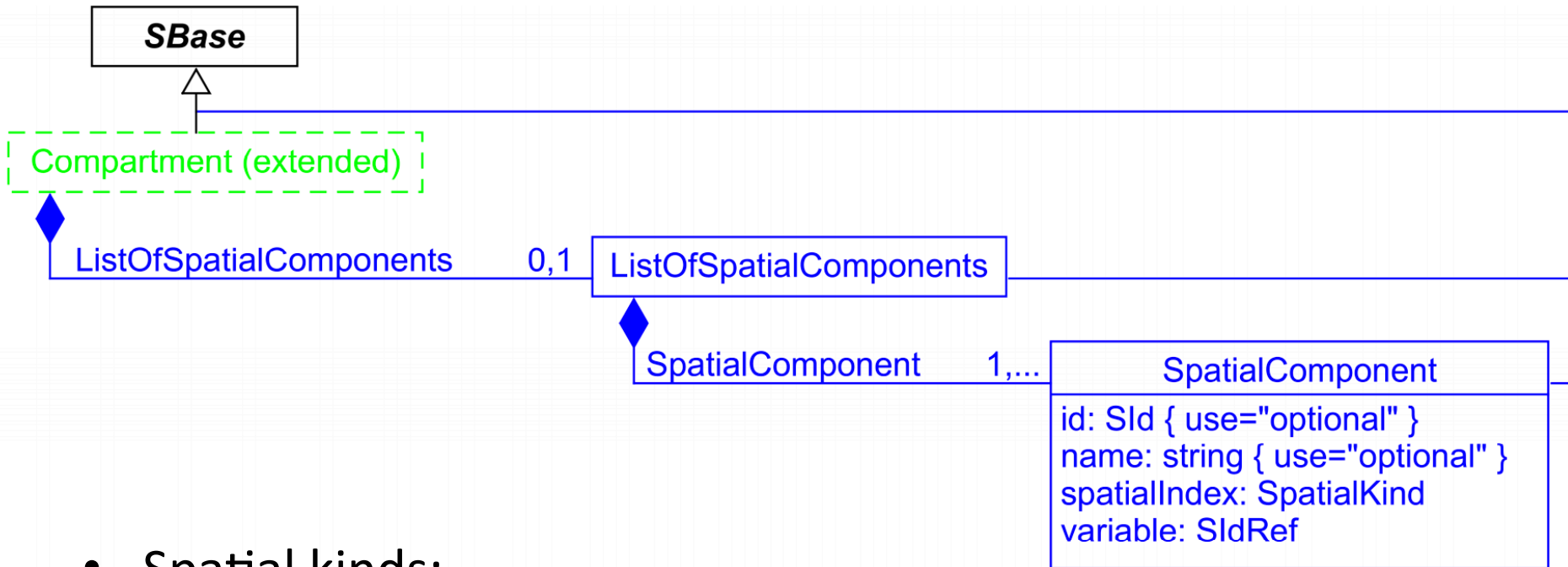
```
<listOfEvents>
  <event id="event0" useValuesFromTriggerTime="false" dyn:applyToAll= "true"
    dyn:cboTerm="http://cbo.biocomplexity.indiana.edu/svn/cbo/trunk/CBO_1_0.owl#CellDivision">
    <trigger initialValue="false" persistent="false">
      <math xmlns="http://www.w3.org/1998/Math/MathML">
        <true/>
      </math>
    </trigger>
  </event>
</listOfEvents>
```

```
<listOfEvents>
  <event useValuesFromTriggerTime="true" dyn:applyToAll= "false"
    dyn:cboTerm="http://cbo.biocomplexity.indiana.edu/svn/cbo/trunk/CBO_1_0.owl#CellDeath">
    <trigger initialValue="false" persistent="true">
      <math xmlns="http://www.w3.org/1998/Math/MathML">
        <apply> <lt/> <ci> EP </ci> <ci> T </ci> </apply>
      </math>
    </trigger>
    <dyn:listOfDynElements>
      <dyn:dynElement dyn:idRef="cellGroup"/>
    </dyn:listOfDynElements>
  </event>
</listOfEvents>
```

Spatial information

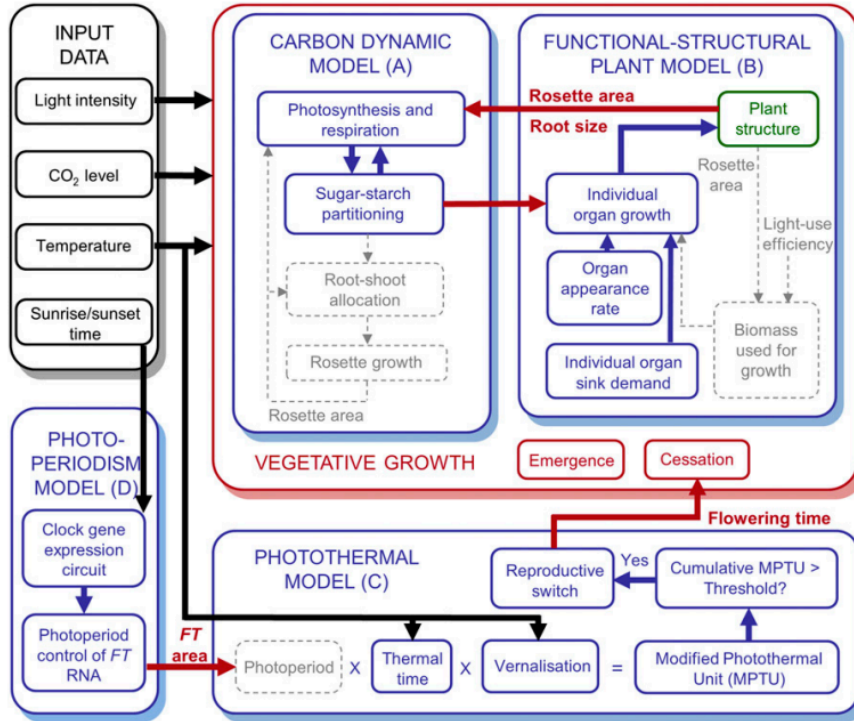
- Required to describe properties of cellular components
 - Location
 - Orientation
 - How they move in space

Extending Compartment

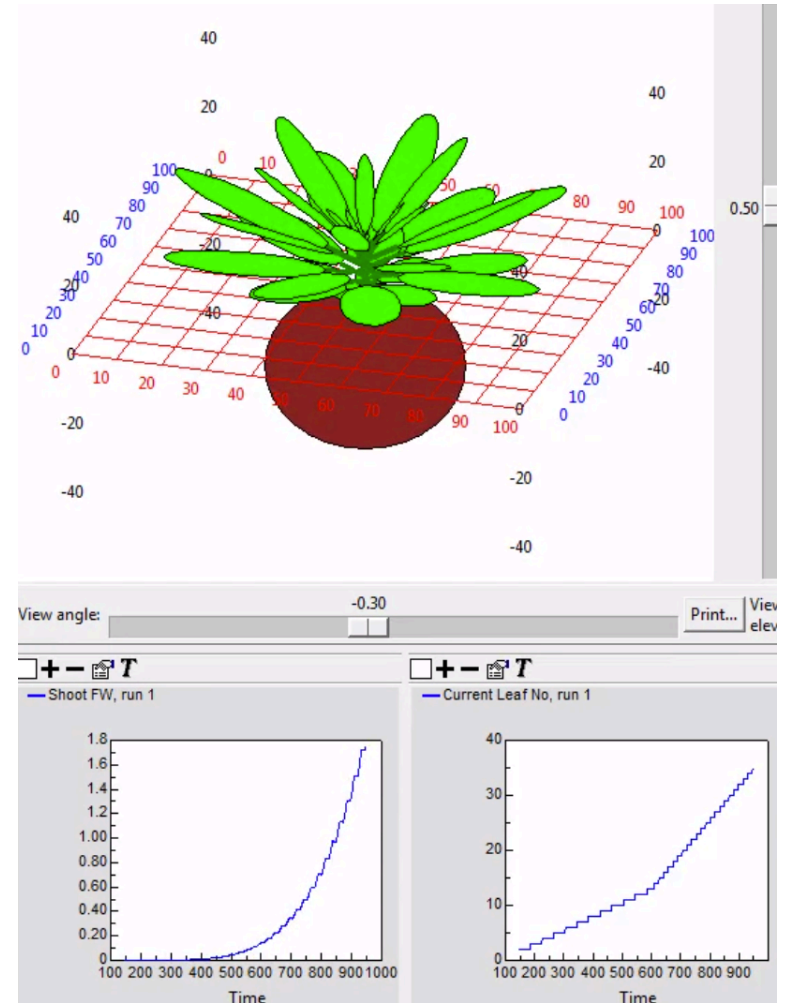


- Spatial kinds:
 - Position (cartesianX,Y,Z)
 - Orientation (alpha, beta, gamma)
 - Force (F_x, F_y, F_z)

Whole Plant Framework Model



Multi-scale model



Rendering Framework Model in Systems Biology standards

Requires:

- Support for external data
 - E.g. air temperature data
- Sub-model composition
- Dynamic creation of sub-models
- Aggregation over dynamically created sub-models

Google Doc to record discussion

- <http://tinyurl.com/ps8ccnt>