

IPP: INTERACTIVE PHYSICS PACK



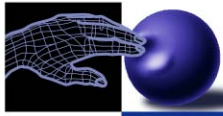
IPP is an add-on for Virtools Dev, dedicated to interactive physics. IPP is based on IPSI (Interactive Physics Simulation Interface), which incorporates algorithms of CEA LIST (mainly XDE and GVM) in a client / server library with an industrial quality, maintained by Haption. Thus integrating a complete physical engine, IPP allows to simulate complex mechanisms such as manikins, robots or any articulated system. Moreover it makes users interact with those mechanisms while proposing force feedback and real-time motion tracking (compatible devices are then required). IPSI is also the basis of other products: IFC (Interactive Fitting for Catia V5), Human RTID (Real-Time Interaction for Human Delmia V5) and IFS (Interactive Fitting for SolidWorks).

IPP has been developed by Haption in collaboration with ENI Tarbes and CLARTE for software specifications and architectural choices. The first version, for Virtools 3.5, was implemented in spring 2007 for training maintenance on electrical equipment at ALSTOM. IPP is also integrated into the company's products REALICON Germany. In CLARTE, it has been used to carry out projects like ERVISTA, SHARING, and PERF-RV2. IPP is available for Virtools 4.0 and 4.1 since 2008 and Virtools 5.0 since 2010.

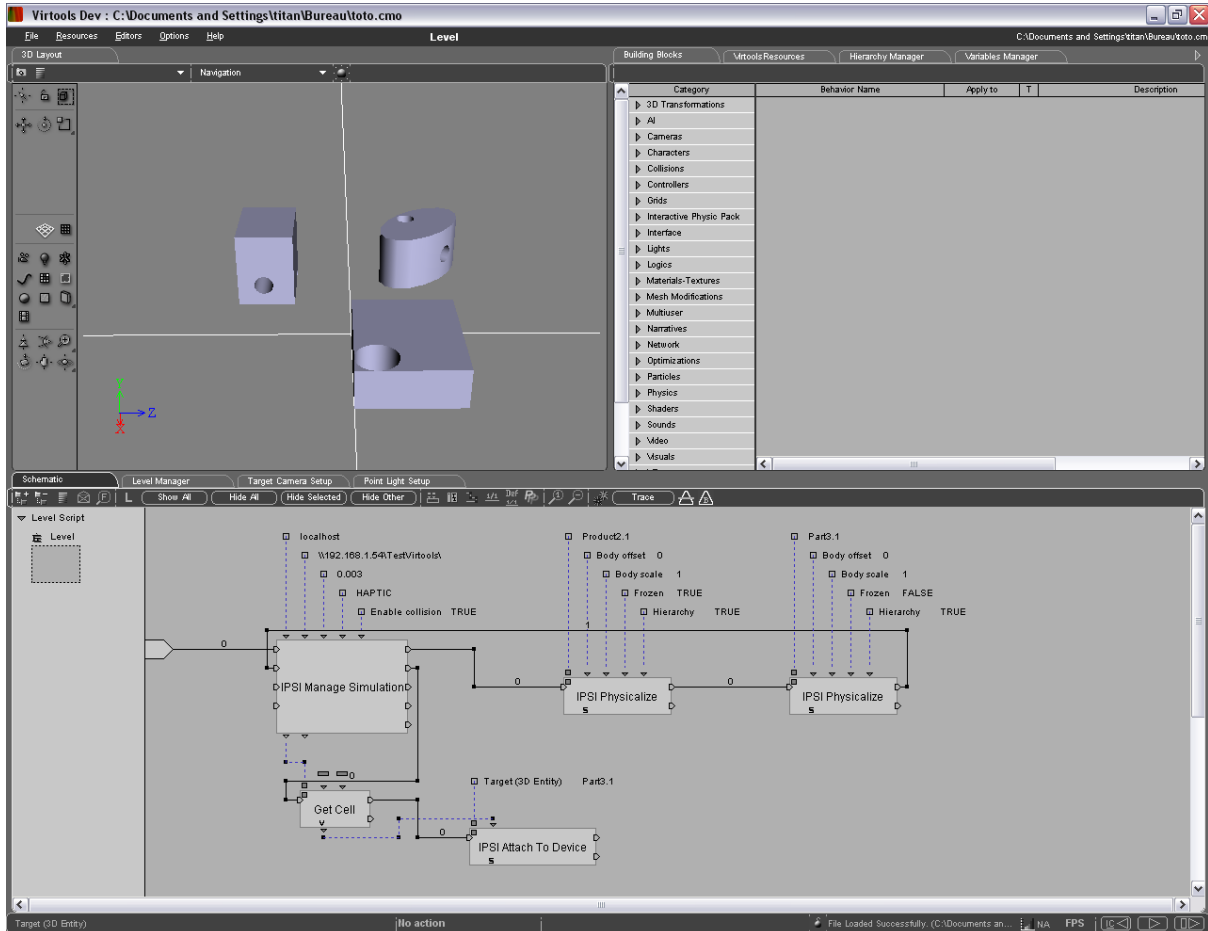
IPP developments are synchronized with the server IPSI. It is worth noting that IPP works very well with a remote server IPSI on 64-bit platform, which can load complex scenes.

IPP proposes a set of building blocks that can connect to a IPSI server and drive an interactive simulation from scripts. The development philosophy of IPP can be summarized as follows:

- Full operation mode "play": the simulation can be started and stopped without getting out from the "play" mode of Virtools. IPSI does not perform any action in-apart from this mode;
- Use only native Virtools data: IPP does not call any specific data outside of Virtools (with the exception of the management model, in some cases); physical data are generated from CMO, NMO, or 3DXML 3D models;
- With a resolutely "horizontal" approach, IPP does not include specific functionality to a "trade" especially. On the contrary, it defines generic features that can be implemented for all applications;
- Complementarily with Virtools, IPP does not include features available in Virtools, so the distribution of objects on a PC cluster is available in the VRPack, IPP does not include any specific treatment;
- IPP is divided in 2 products IPP Core and IPP Human. IPP Core proposes the basic physical functionalities (described here after). IPP human is an add-on to IPP Core dedicated to a definition of an animated avatar, in real-time, enabling and disabling collision with the scene.



➤ IPP Core



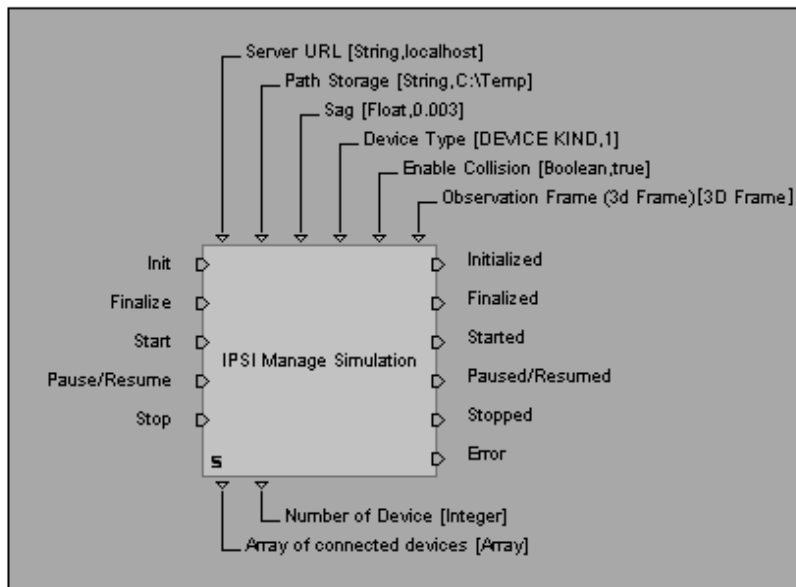
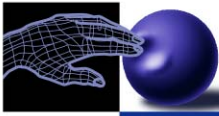
The "Building Blocks" of IPP Core are classified into three categories: Management, Manipulation Constraints and 3D Entity Constraints.

1) Management

This category is also divided in three: Simulation management, Device management, and Object management.

a) Simulation Management

- i) The BB "IPSI Manage Simulation" centralizes all access, at the meta level, to the IPSI server. It is used for:
 - (1) Initializing of the connexion with the server
 - (2) Physicalisation of the data
 - (3) Launch of the simulation
 - (4) Pause/resume of the simulation
 - (5) Stop of the simulation
 - (6) Update the position of physical objects in the Virtools scene.



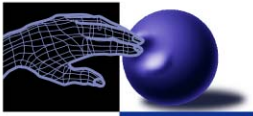
- ii) The BB "IPSI Physicalize" adds a physical object in the scene: it get the Virtools 3D object from the composition and convert it into a IPSI physical bodies. It is possible to add this object to a rigid composite including its hierarchy.
- iii) The BB "IPSI Enable/Disable Collision Pair" manages accurately collisions, pairs of objects.
- iv) The BB "IPSI Get Collision Info" shows the objects in contact and gives a list of contact points.

b) Device Management

- i) The BB "IPSI Attach To/Detach From Device" are used to manage the allocation of manipulation peripheral (haptic arm, target from an optical tracking system, SpaceMouse) to move objects.
- ii) The BB "IPSI Get Devices Info" provides the position, orientation and button status of a manipulation device.

c) Object Management

- i) The BB "IPSI Freeze/Un-Freeze Object" are used to change the state of an object between: "mobile" and "fixed" and vice versa.
- ii) The BB "IPSI Move Object" allows to move explicitly an object to a precise position.



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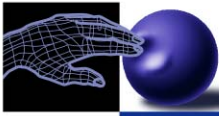
- iii) The BB « IPSI Add Effort On Object » applied a constant 6D effort to a selected object, which can simulate a weight for example.

2) Manipulation Constraints

- a) The BB “IPSI Set Ball/Hinge/Plane/Prismatic/Translation Manipulation Constraint” can create constraint at the level of manipulation devices. This constraint, which can be applied at any time of the simulation, creates kinematic link between objects.
- b) The BB “IPSI Release Manipulation Constraint” deletes the constraints previously created.

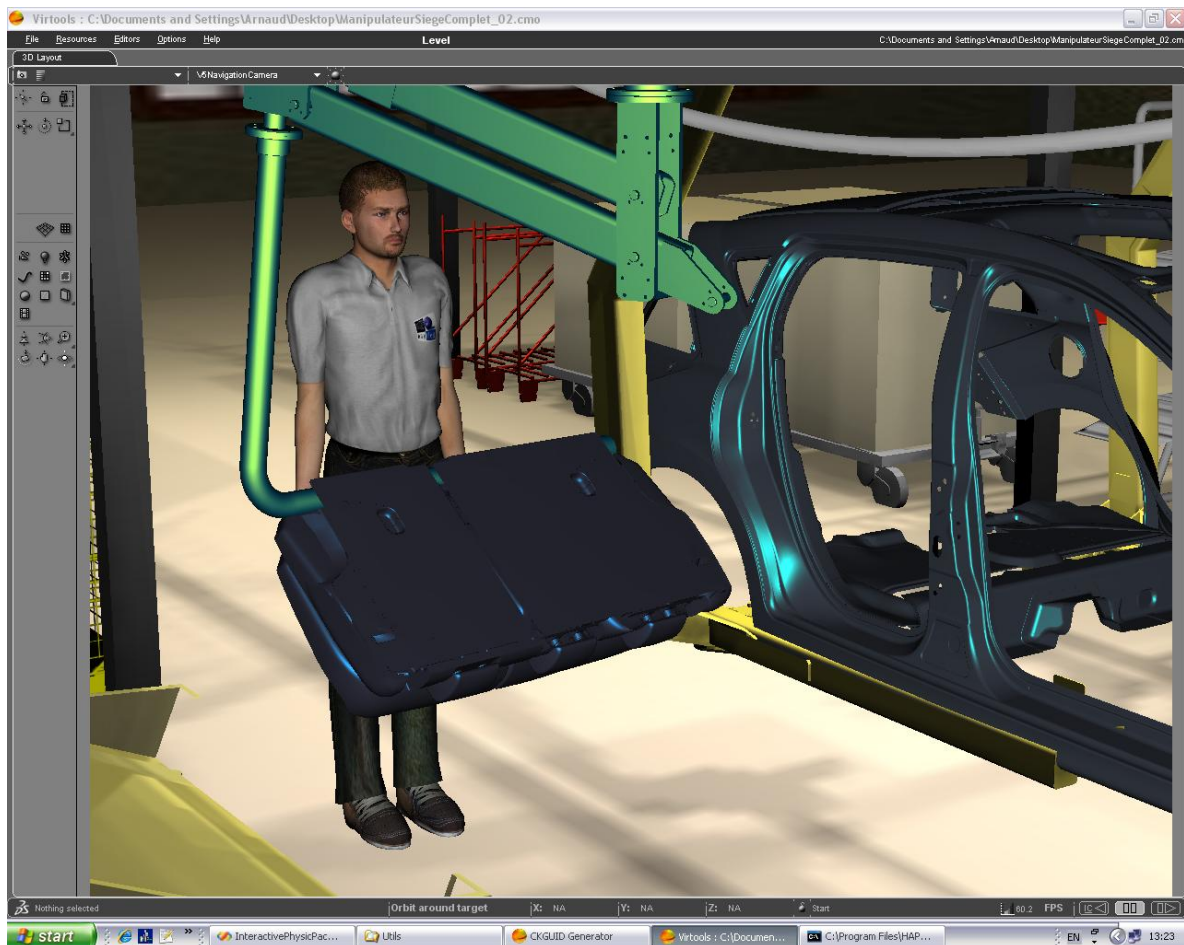
3) 3D Entity Constraints

- a) The BB “IPP Create Mechanism” creates a new object called "mechanism", which is dedicated to the management of constraints between objects.
- b) The BB “IPP Create Hing/Prismatic/Cylindric/Weld Constraint” creates a constraint between 2 objects. It is then possible to create many constraints between the same objects.



➤ IPP Human

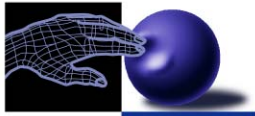
IPP Human has only one category: « Manikin ».



The BB “IPPHuman Simulation Add Character” adds a virtual human in the physical scene. The virtual human is defined as a Virtools “character”.

The BB “IPPHuman Insert A Manikin” adds a manikin in the virtual scene. The manikin is defined as a hierarchy of 3D objects, and its kinematics is defined in a separate XML file.

The BB “IPPHuman Calibrate Suit” does the calibration of the motion capture system for the virtual human choice. Calling this BB presupposes that the operator has previously taken the same position as the virtual human in the scene.



Product | Software

The BB “IPPHuman Attach Suit” triggers the simultaneous commitment of all targets from the motion tracking system to corresponding segments of the virtual human, thus allowing its animation in real time.

The BB “IPPHuman Save Suit” saves the suit associated to the manikin, very useful to save the data after the calibration.

The BB “IPPHuman Freeze/UnFreeze Segment” freezes and unfreezes segment of the manikin.

The BB “IPPHuman Attach/Detach Segment To Manipulator” is used to manage precisely the manipulation of the segment of the manikin. It allows to attach or detach segments independently.

The BB “IPPHuman Attach/Detach Body To/From Segment » allows to attach or detach a physical object to a segment of a manikin. For example, it could be useful to simulated an object grasping.

The BB “IPPHuman Enable/Disable External Collisions” and “IPPHuman Enable Ext Collisions On Segment” allows to manage the collision detection between segments of a manikin and physical objects in the scene.