

STAR simulations

GSTAR framework

OO geometry/event model

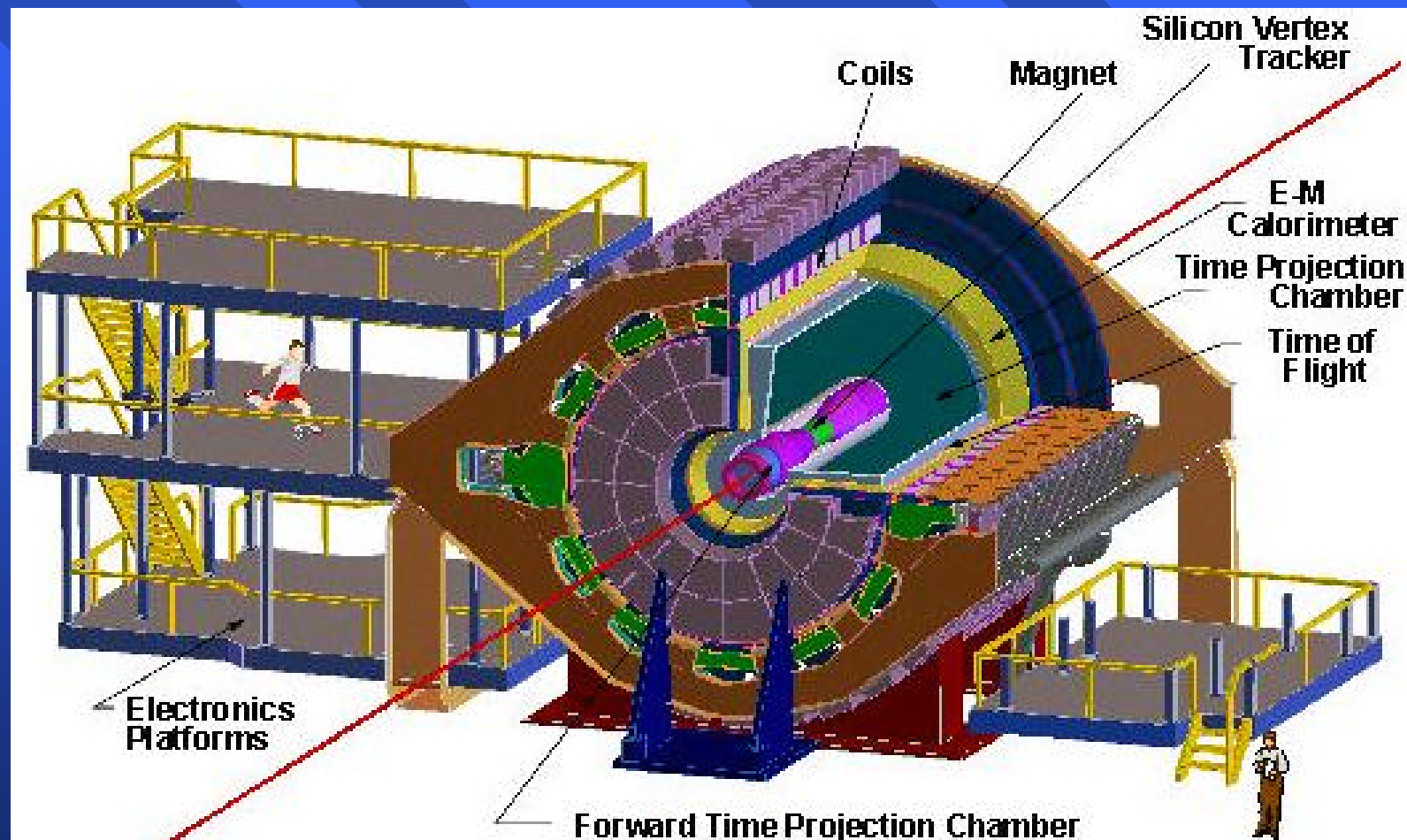
NOVA components



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STAR detector at RHIC



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GSTAR

- STAR simulation framework since 96
- has a hierarchical design to clearly separate user code from implementation details
- has improved memory management
 - » elastic ZEBRA (using malloc)
 - » no limits on number of tracks, vertices, hits etc (apart from physical memory limits)
- has built-in interfaces to implementation
 - » Geant3/PAW, MySQL, ROOT



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Hierarchical design

- Open System Interconnection (OSI) model as example: functionality in term of layers
 - basic (physical) layer - platform dependant code, system libraries, graphics etc
 - low (logical) layer - ZEBRA, DZDOC, HIGS
 - upper (transport) - G3, Paw+Kuip, DB, ROOT
 - system (session) - AGI, ROOT accessors
 - user (application) - modules in F, AGI, C++



STAR geometry

- Formalized description in specification language, including hits and DB access
- Many developers, very detail geometry (almost 2,000 different volumes)
- Altogether less then 8000 lines including field parameterization , easy to read
- No step routine is needed in most of the detectors, no “if statement” problem



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GSTAR performance

- Fast enough - 30 min/10,000 particles, with a general 1 MeV cuts
- Calorimeter cuts tuned with test beam data down to 50 KeV
- Interfaced to all event generators
- Robust and well debugged production tool



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Requirements for rOOt interface

- Flexible, expandable access to geometry objects from reconstruction program
- Modern visualization and navigation
- Access to hits from a C++ code as if they were normal C++ objects
- fun, and even more fun



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New elements

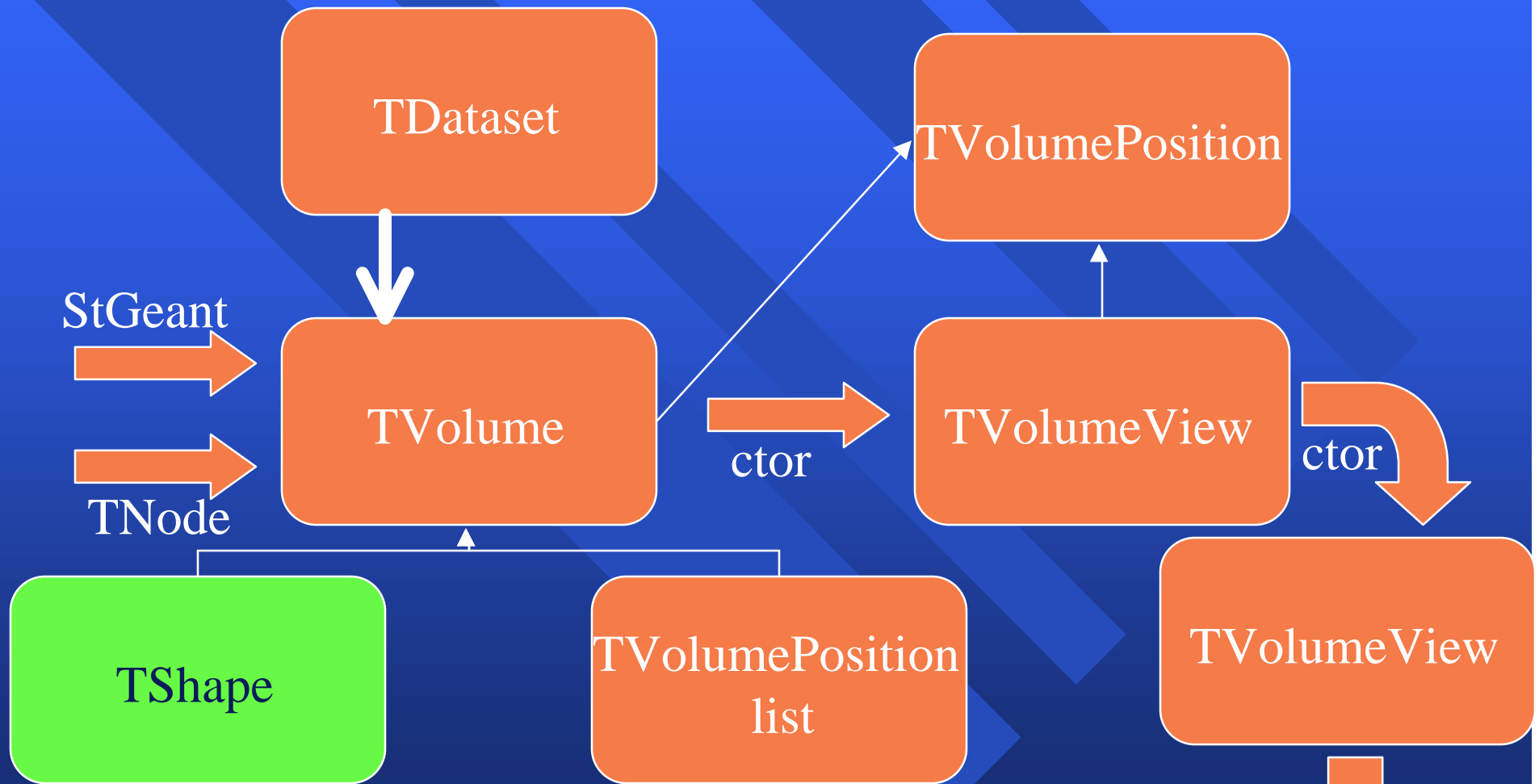
- Initially missing elements
 - Geometry navigator - trivial
 - Geometry decoder - not so trivial, but feasible
 - Volumes and positions separately - TVolume
 - Volumes as position container - TDataset
 - Hit navigator - trivial
 - Hit presenter - StGeantHits



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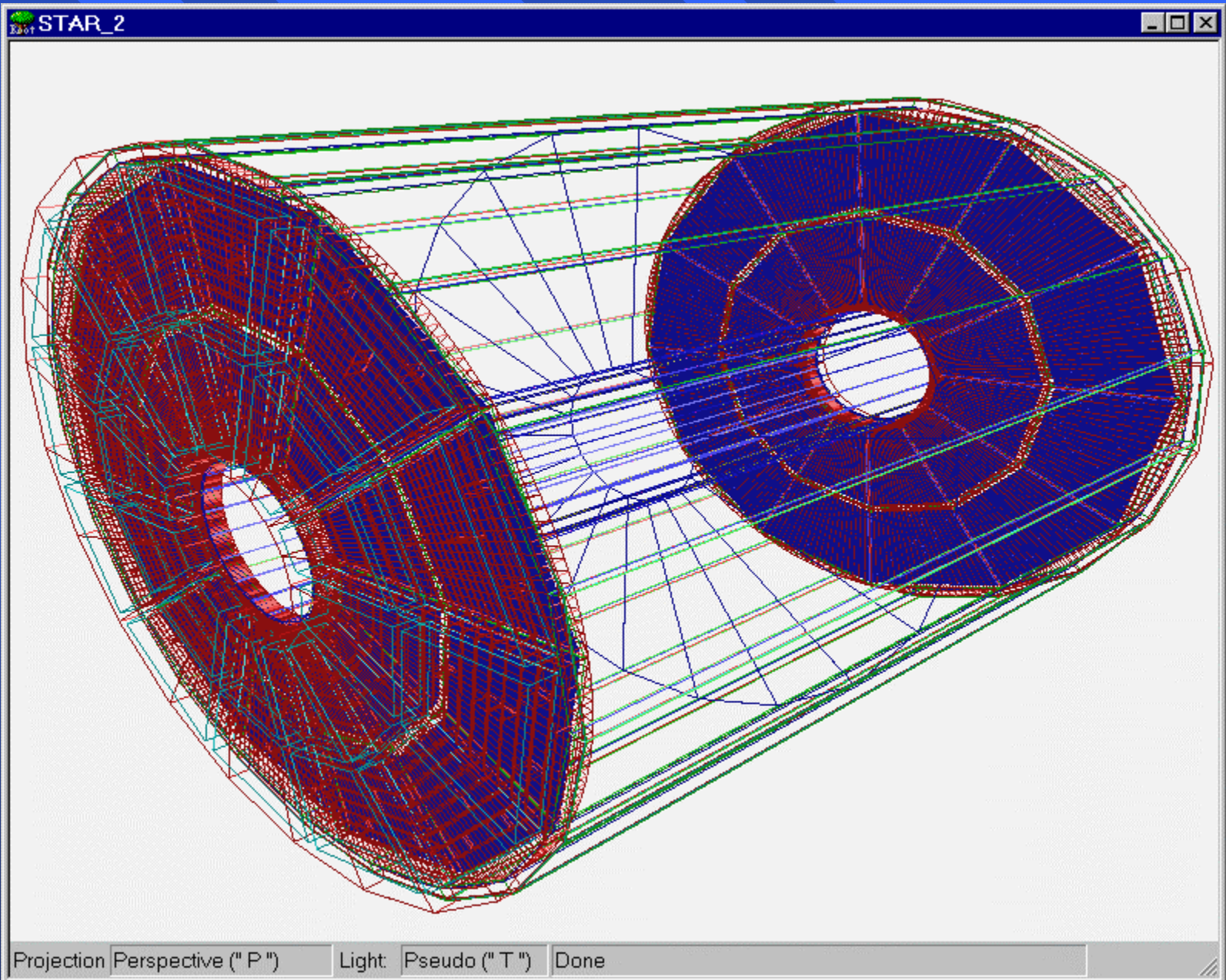


G3 geometry model



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Geant Hit Access Class

```
class TPoints3DABC  
  (from ROOT G3D)
```

StGeantHits3D

StGeantHits()

...

GetNextHit(Int_t indx)

aghitset()

aghitget()

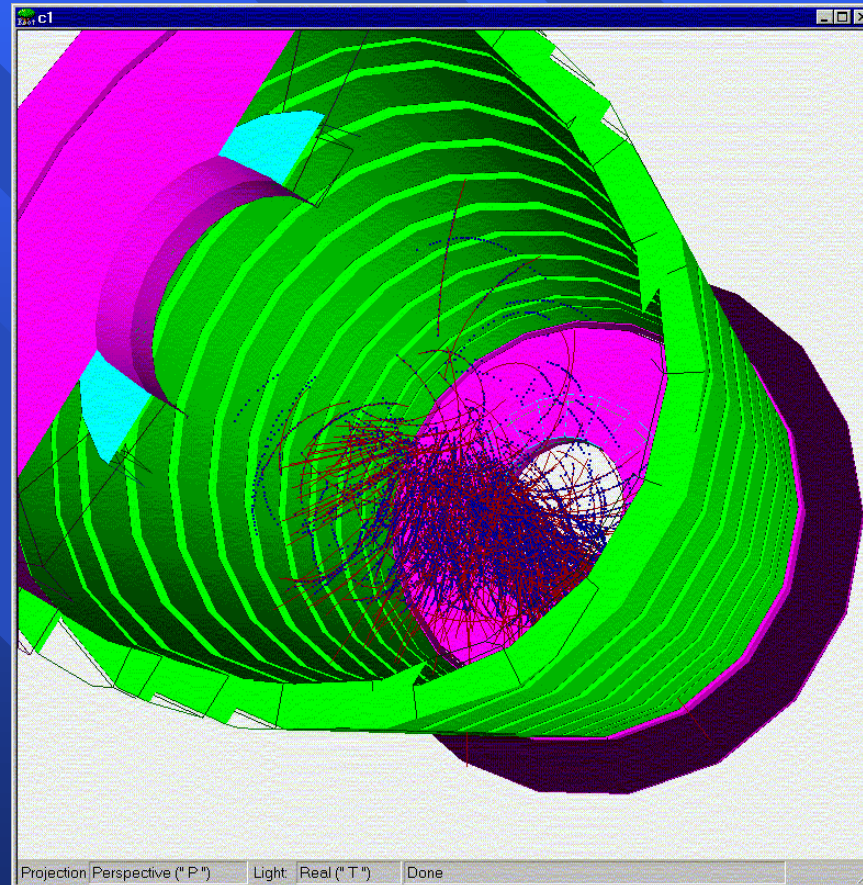
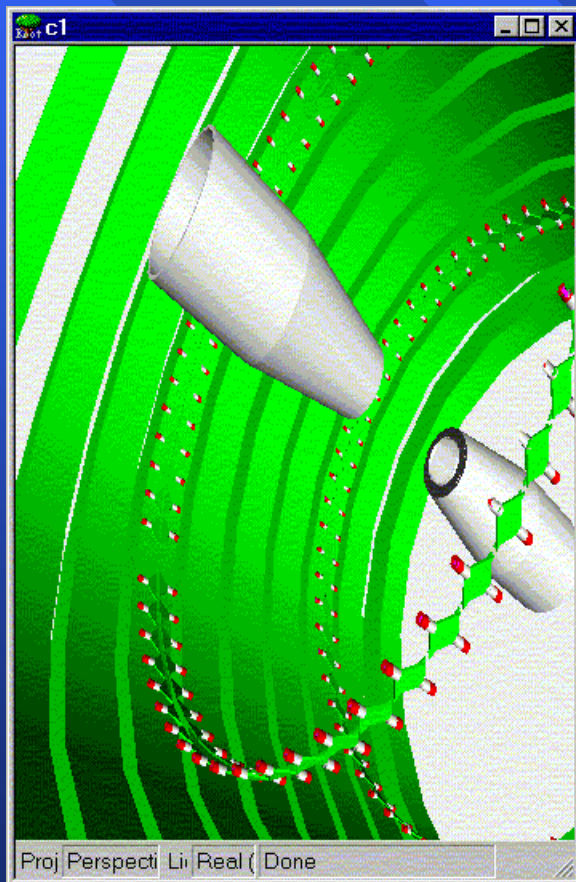
GENERATOR



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OpenGL viewer



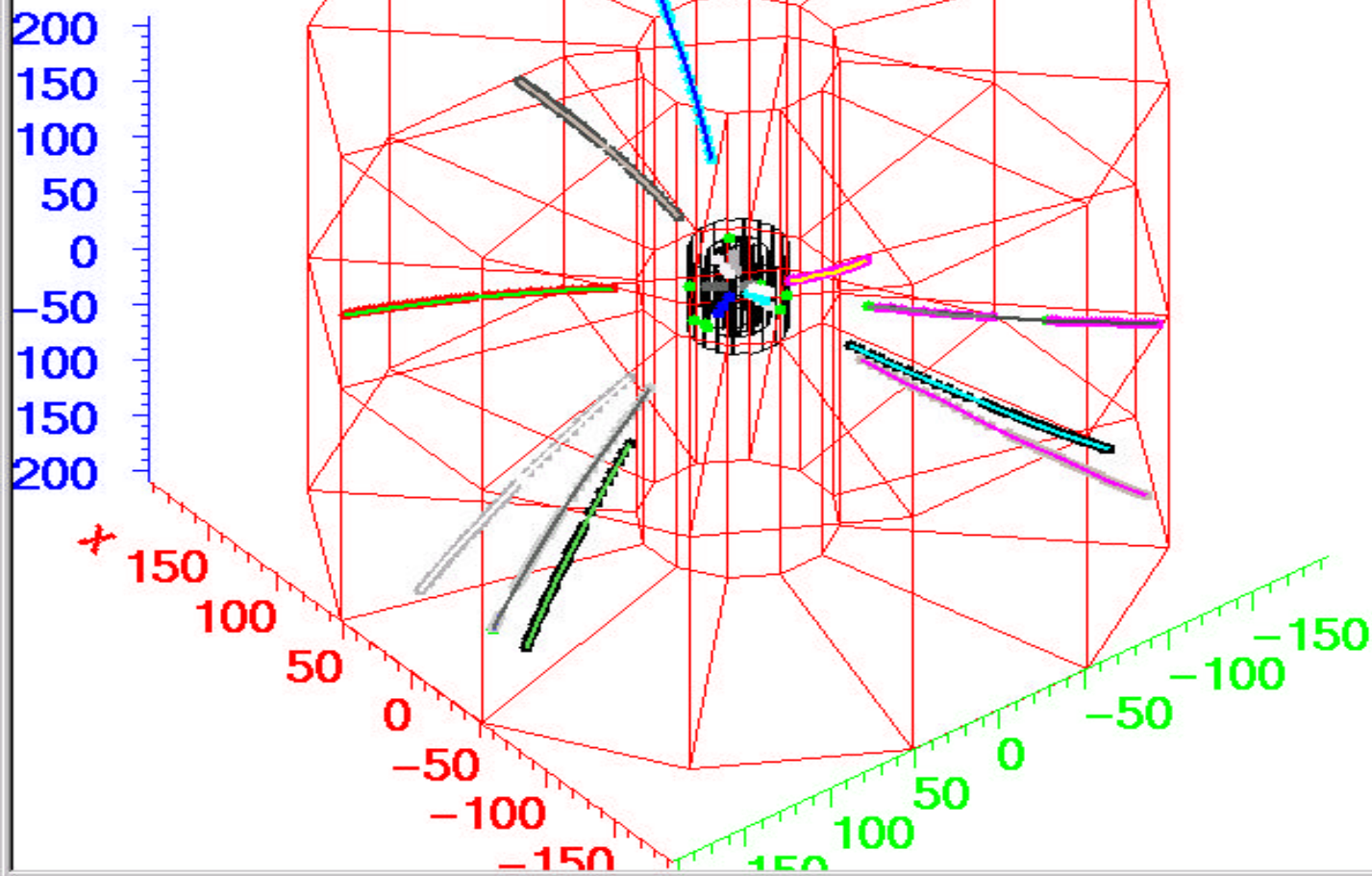
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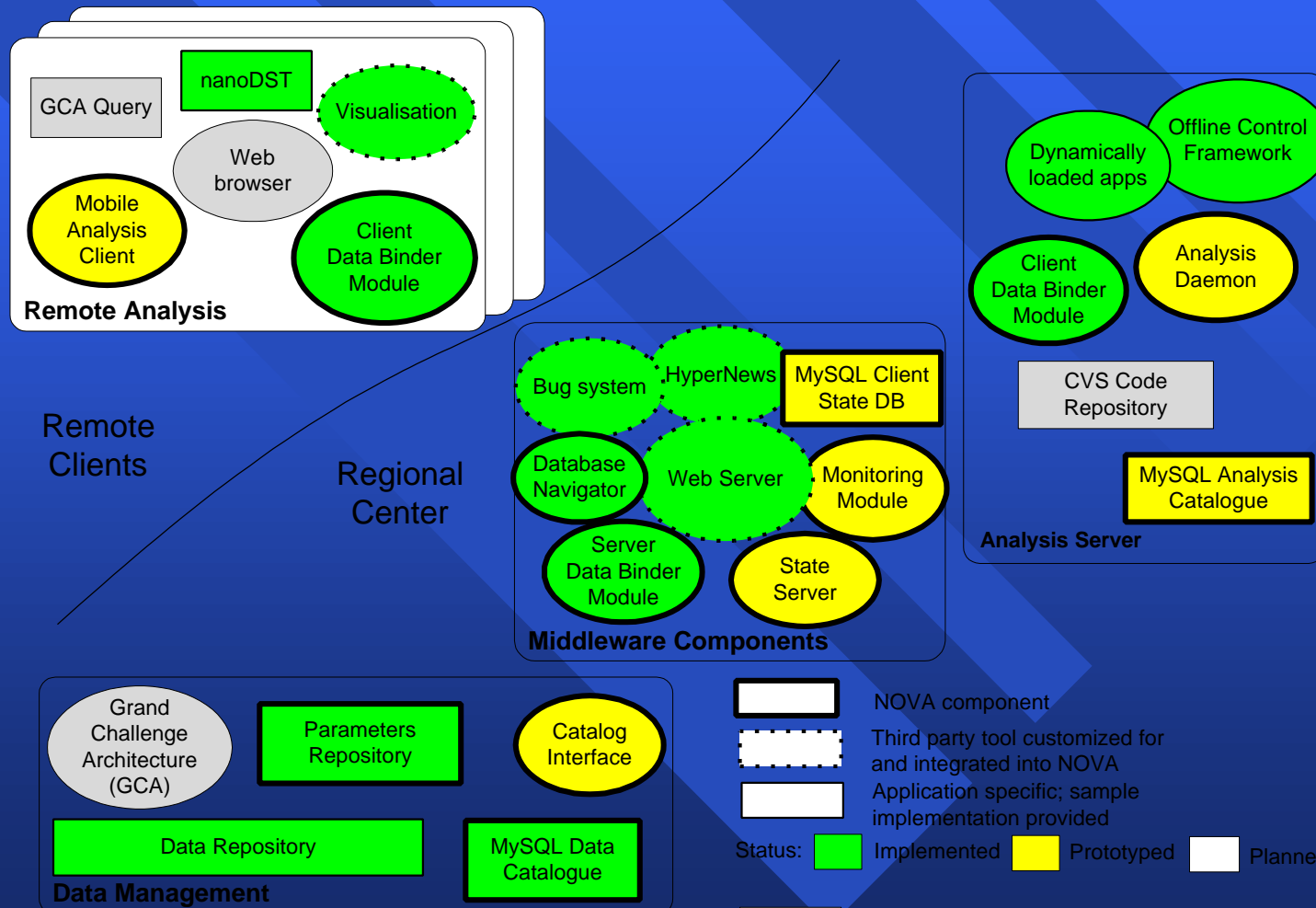
Event Display

File Edit View Options Inspect Classes Help

Star Event Display



NOVA Architecture

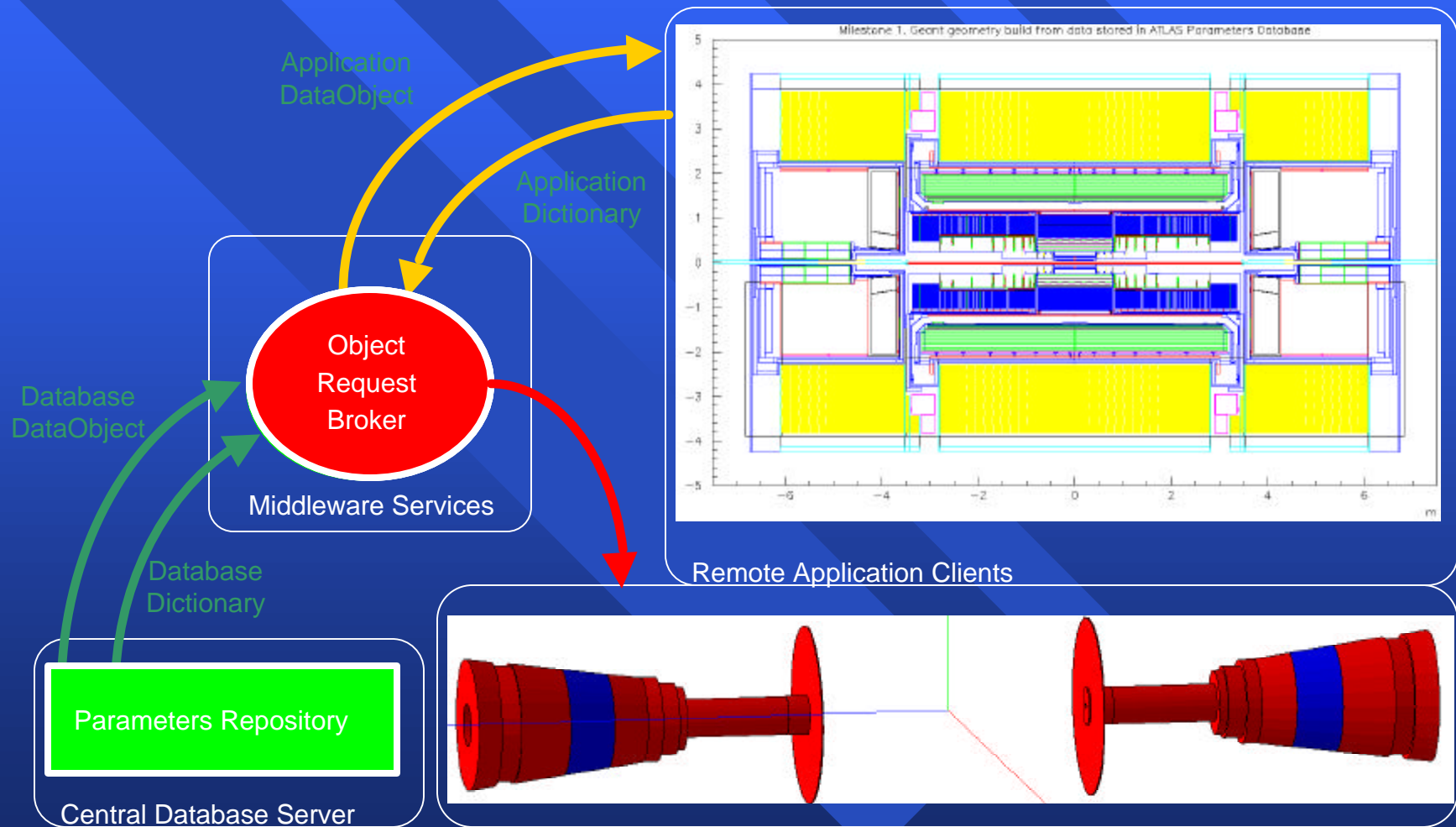


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Existing third party tool employed by NOVA



Dynamic Object Broker



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STAR geometry

- Modules: 14
- Structures: 34
- Instances: 45
- Parameter values: 841



NOVA Database Browser - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites History Mail Print Edit

Address <http://lemmon.star.bnl.gov/Params/> Go Links »

params

- StMagF
- calb
- ctf
- ebye
- emc
- ftpc
- geant
- geometry**
 - cavegeo
 - btofgeo
 - calbgeo
 - ecalgeo
 - ftpcgeo
 - magpgeo
 - pipegeo
 - PIPG
 - PIPG
 - richgeo
 - svtgeo
 - tpcegeo
 - upstgeo
 - vpddgeo
 - zcalgeo
- global
- I3
- mwc
- svt
- tpc
- trg
- Geometry
 - tpc
 - tpcdimensions
 - tpcelectronics

Table names: 121
Tables having more than one version: 3
Types of structures: 177
Total structures: 177
Unique parameters: 4338

To browse parameters use left frame

<- click in left frame on closed folder **name** to see dataset content
<- click in left frame on table **name** to fetch structures
<- click in left frame on opened folder **name** to hide dataset content
<- click at the top of left frame on **Params** to return to welcome screen

Select datasets/tables (matching selection text in the name or comment)

Enter selection text:

☐ Limit selection to current path

Start navigation through database hierarchy (click on **name** to add dataset to path)

[StDb](#)

Credits:

- [NOVA: Networked Object-based Environment for Analysis](#)
- [phpMyAdmin: MySQL Database Administration](#)
- [PHP: Hypertext Preprocessor](#)
- [Apache: HTTP Server](#)
- [MySQL: Database Server](#)

<http://duvall.star.bnl.gov/nova/> Internet

Database Browser

■ Versioned geometries



NOVA Database Browser - Microsoft Internet Explorer

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params

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 - vpddgeo
 - zcalgeo
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- mwc
- svt
- tpc
- trg
- Geometry
 - tpc
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 - tpcelectronics

Database dataset pipegeo - table PIPG

Table entered database on Thu Jun 17 12:51:17 PM 1999
Table contains structure **PIPG BEAM PIPE DATA**
This is **version 2** of a PIPG table
Total number of structures in this table is 1
contents of row 0:

type	name	value	comment
float	VERSION	1	GEOMETRY VERSION
float	BEINNR	3.9	BERILLIUM SECTION INNER RADIUS
float	BEOUTR	4	BERILLIUM SECTION OUTER RADIUS
float	BELENG	76.2	BERILLIUM SECTION HALF LENGTH
text	MATERIAL	IRON	MATERIAL IS STEEL
float	S1INNR	3.875	FIRST ALUMINUM SECTION INNER RADIUS
float	S1OUTR	4	FIRST ALUMINUM SECTION OUTER RADIUS
float	S1LENG	153.4	FIRST ALUMINUM SECTION HALF LENGTH
float	S2INNR	3.875	SECOND ALUMINUM SECTION INNER RADIUS
float	S2OUTR	4	SECOND ALUMINUM SECTION OUTER RADIUS
float	S2LENG	18	SECOND ALUMINUM SECTION HALF LENGTH
float	S3INNR	3.875	TRANSITION STUB ALUMINUM SECTION INNER R
float	S3OUTR	4	TRANSITION STUB ALUMINUM SECTION OUTER R
float	S3LENG	1	TRANSITION STUB ALUMINUM SECTION HALF LE
float	S4INNR	6.2	LARGE OD ALUMINUM SECTION INNER RADIUS
float	S4OUTR	6.35	LARGE OD ALUMINUM SECTION OUTER RADIUS
float	S4LENG	150	LARGE OD ALUMINUM SECTION HALF LENGTH
float	FLANGE1T	2	FLANGE SET HALF THICKNESS
float	FLANGE1R	5.85	FLANGE OUTER RADIUS
float	CONELN	12.5	HALF LENGTH OF THE BELL REDUCER CONE
float	RIBNUM	8	NUMBER OF RIBS
float	PIPCDA	4.75	CRACKING BETWEEN RIBS

http://lemmon.star.bnl.gov/Params/st_tbl_show.php?db=pipegeo&table=PIPG&v=2 Internet

Simulation Production

- Multilayer model (NOVA component)
 - universal Simulators (smart cockroaches)
 - common Dispatcher - token coordinator
 - output/QA Filter
 - HPSS Sinker
- Open system - extendable functionality



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Production bandwidth

- simulation - 50 ev/day/processor - scales well
- dispatcher - scalability tested up to 10K ts/day
- filtering - local disk I/O - no limit at 1 TB/day
- sinking - stable up to 1 GB/day



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Conclusions

- GSTAR is a stable production tool
- G3 geometry is based on MySQL DB
- G3 geometry is available as ROOT classes
- Looking for a G4 interface



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