3.23 Development of Charged Particle Nuclear Reaction Data Retrieval System on IntelligentPad

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An newly designed database retrieval system of charged particle nuclear reaction database system is developed with IntelligentPad architecture. We designed the network-based(server-client) data retrieval system, and a client system constructs on Windows95, 98/NT with IntelligentPad. We set the future aim of our database system toward the "effective" use of nuclear reaction data **: I**. **"Re-produce, Re-edit, Re-use"**, **II**. **"Circulation, Evolution"**, **III**. **"Knowledge discovery"**. Thus, further developments are under way.

1. Introduction

The systematic information of the nuclear reaction data can't be missed in the development of atomic energy problems. Especially, the needs toward the charged particle nuclear reaction data will rise all the more from now on. Therefore, the main theme of this report is the development of database system of nuclear reaction data. In this report, we develop the retrieval system of Nuclear Reaction Data File (NRDF) compilation[1,5] using IntelligentPad architecture.

NRDF has been constructed as a database mainly connected with nuclear physics. Typical property of the charged particle reaction is varieties of both reaction type and observable that are evolved with the development of the reactor and the accelerator physics. The designation of NRDF is developed with this point of view. Since JCPRG (Japan Charged Particle Reaction data Group) maintained NRDF over 20 years, NRDF have over 20,000 of charged particle nuclear reaction data that originate from Japan[1].In order to distribute NRDF, the data compilation, storage and retrieval system of NRDF was constructed at a main-flame computer of Hokkaido University[2] . Furthermore, a system which transforms the NRDF data to the EXFOR was implemented, thus NRDF contributed as an important part of the charged particle data of EXFOR data compilation[3]. However, as we shown in the Ref.[4], The current system of NRDF on the main-flame computer is out of date. With the following background, Ref.[5] is one of the our recent extension of data retrieval system. In addition, to get benefit of recent computer and network technologies, such as multimedia, object-oriented system construction, graphical user interface, and so on, we select to use the IntelligentPad architecture.

IntelligentPad is a kind of object-oriented “graphical user interface(GUI) based” system construction environment. This architecture is proposed in 1989 by Yuzuru Tanaka at Hokkaido University[6]. In order to develop and enlighten this architecture, over 60 domestic and foreign companies makes the IntelligentPad Consortium(IPC)[7]. Recently, we can get the IntelligentPad as some commercial softwares[8]. A “pad” can be treated as an object of the graphical user interface on the screen of computer, like a view of “real paper pad”, and each “pad” have functions as data control programs, input/output devices between other pads, and so on. On the “pad” environment, programming of any tools on GUI is can be done by ‘intuitively’ cut and paste action of pad.

2. System design of the trial system

Fig.1 shows an image of the basic design of this system. The recent trend of the computer environment is expressed as words “Network”, “Graphical”, “Interactive”, “Reuse of resources”. The fundamental concepts of our data retrieval system are based on them. Using an database management system(DBMS) based on SQL, we construct the NRDF data management server on the UNIX WS. (SUN Ultra1). UniSQL[9] is adopted at the present. Provided that common gateway interface(CGI) on this server, The network communications between the NRDF server and clients are achieved.

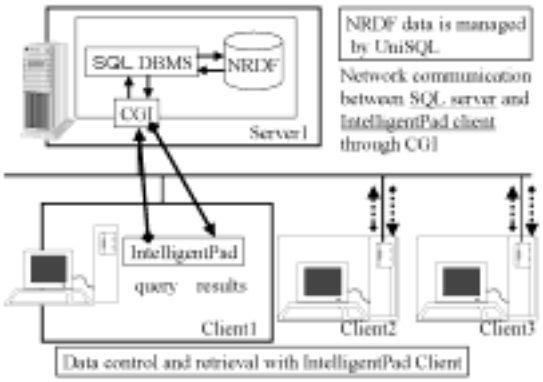

Fig.1 Network-based system.

Once the NRDF server is constructed, data retrieval “client” is constructed with the IntelligentPad architecture. A connection between a server and a client based on CGI through the network connection . Such clients was previously constructed on IntelligentPad by SmallTalk[10-12]. Now, we construct the Windows95, 98/NT-based IntelligentPad[8]. Fig.2 shows the overall appearance of the trial product of the NRDF data retrieval system. Let us show in detail with the next section.

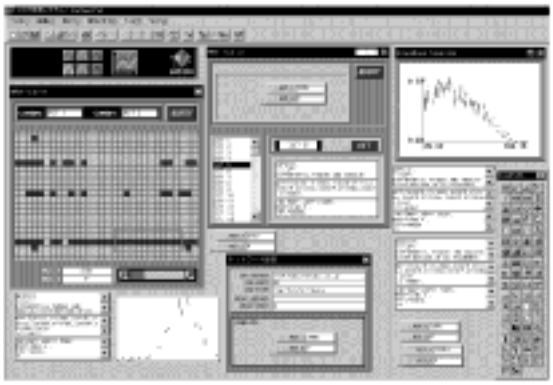

Fig.2 Overview of the system.

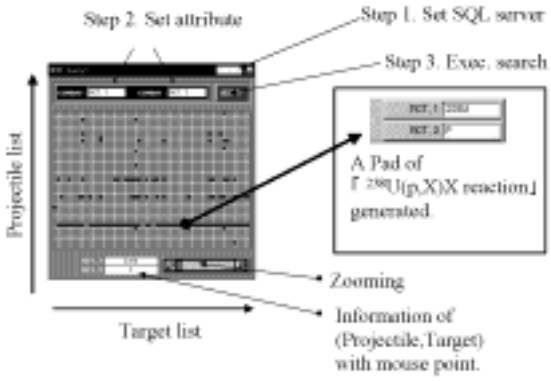

Fig.3. Data navigation.

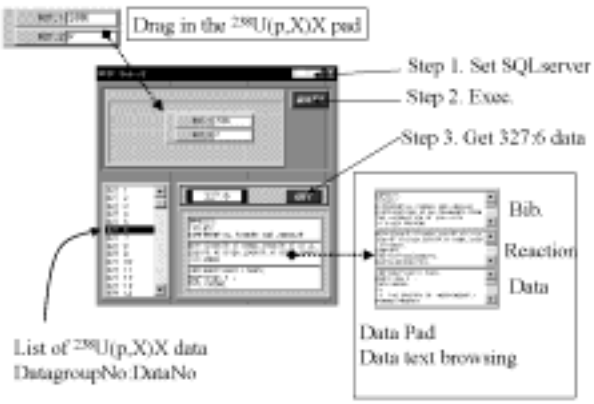

Fig.4. Data retrieval.

3. Reference example and functions of the trial system

Showing some reference example, let us discuss about features of this trial product. Suppose you want to get the data of the ^{238}U(p,X)X reaction, Fig.3-Fig.5 shows the process of data retrieval step by step.

1). Examine the existence of the ^{238}U(p,X) reaction data.

Fig.3. shows the Pad to search whether the ^{238}U(p,X) data is exist or not : i) Set the network address of SQL server. ii) Specify the two attributes of the NRDF database, e.g., Target and Projectile. iii) Execution of a search. As a result, the grid which placed in the middle region of the Pad displays the 2-dimensional information that displays the current status of the NRDF database from a point of view of target and projectile. colored crossing point (X,Y) shows NRDF have some reaction data about target = X, projectile = Y. In this way, we find NRDF have some data about X = ^{238}U, Y = p , thus we get the "^{238}U(p,X)X reaction" Pad using click and drag operation of the Pad.

2). Data retrieval.

Once you get the Pad connected with "^{238}U(p,X)X reaction", you retrieve the data using the Pad shows in Fig.4. We can get the list of "^{238}U(p,X)X reaction" data, and

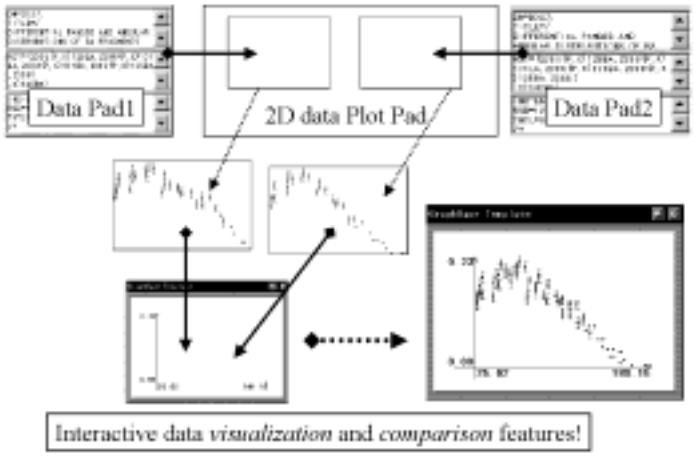

Fig.5. Interactive data visualization and comparison.

generate the specific data as a text browsing Pad. Consequently, we get the "^{238}U(p,X)X reaction" data.

3). Interactive data visualization and comparison.

The data pad shown in Fig.4 have features not only data browsing but visualization(Fig.5). Once you drug in the Data pad to 2D data plot pad, you can see the graph representation of the data. Data comparison is also achieved by just a drug and drop!

4. The aim of nuclear reaction database towards the effective use

In the previous section, we show the features of current trial system. In particular, major features of this system are : i) interactive data visualization and comparison, ii) 2-dimensional display function of the status of database. Furthermore, we determined the aim of the system towards support of the effective use of nuclear reaction data with computer facilities.

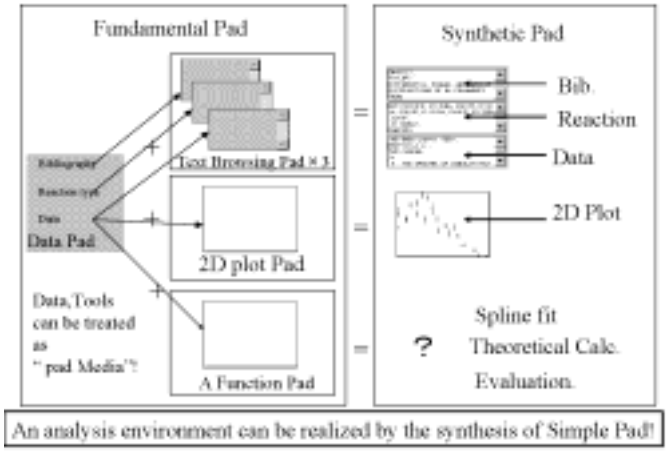

Fig.6. Synthetic feature of IntelligentPad.

I) Re-produce, Re-edit, Re-use.

Once any data and tool can be made by resolved by fundamental pad, we can reuse the existent pad to make new tools. As you see the Fig.6. Synthetic feature of IntelligentPad supports "Re-,produce, edit, use" of nuclear data and tools.

II) Circulation and evolution.

IntelligentPad supports co-operation with web browser software. Once we make an web page to distribute and circulate not only tools but also data. It is already the basis of the circulation field of nuclear data and tools. Fig.7. shows a schematic figure for the circulation system of data and tools as pad media. Constructing such a sharing space on the network, many user can retrieve many tools and data through the pad media

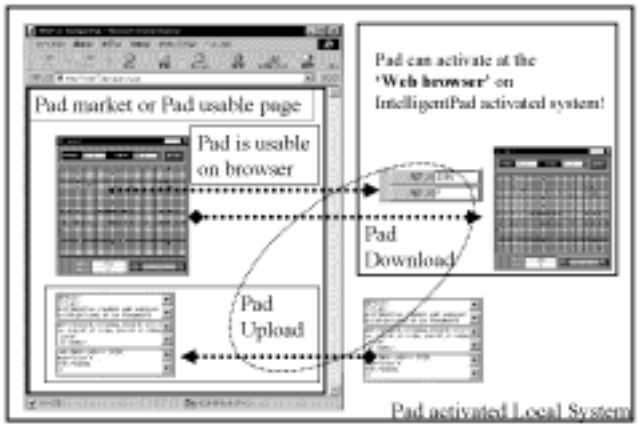

Fig.7. Support of Circulation and Evolution.

III) Knowledge discovery.

The amount of nuclear reaction data is huge, and increasing day by day. In addition, variety of the data will also be complex. We will have many data, but it will be difficult to get essentially important information from huge databases. Fig.8. shows the pad same as we shown in Fig.2. Development of such pad will proceed us to easier navigation to the needed data, and will support something new discovery of knowledge connected with nuclear reaction data.

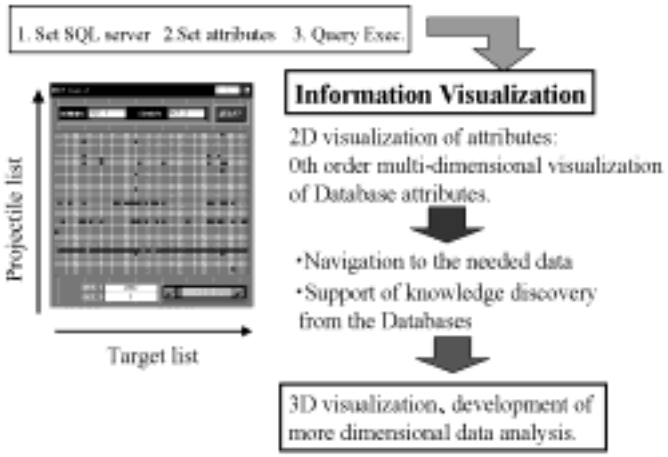

Fig.8. Support of knowledge discovery.

You will find the fundamental concepts of IntelligentPad is quite matched with above three aims. Consequently, we decide that our development will proceed to embody them through IntelligentPad. If it will be done, such as Fig.9. , we believe that quite "effective" use of nuclear reaction data is promising.

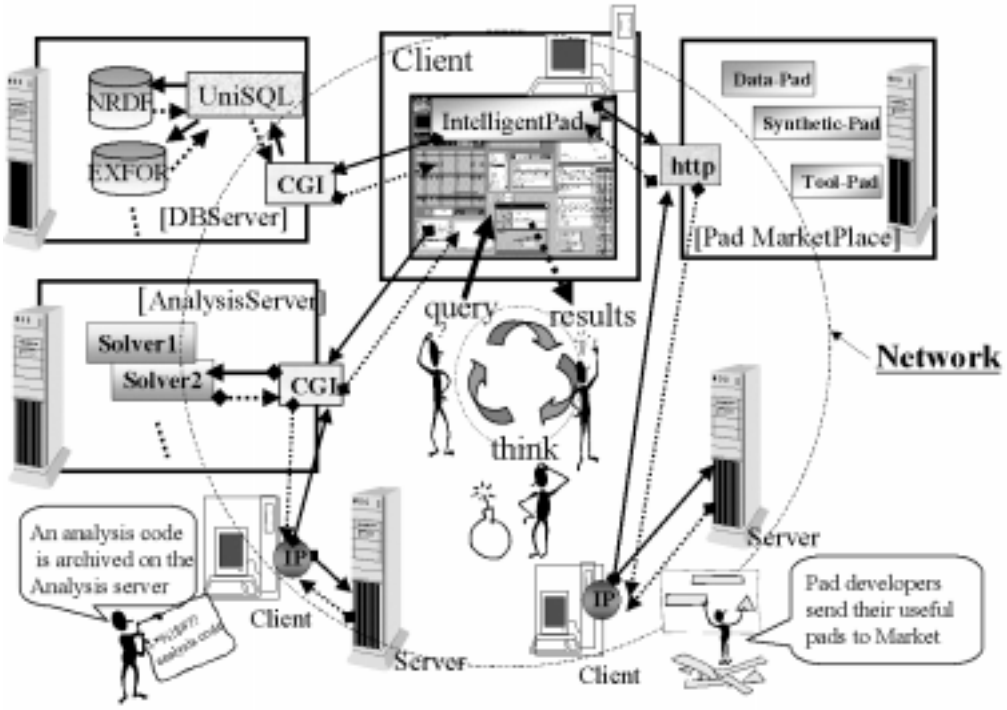

Fig.9. An ideal system of nuclear reaction database. Exp. data, evaluated data, theoretical solver, ...etc. ,are treated with this system as "pad media".

5. Summary and future extension

We developed the "NRDF" charged particle database system on IntelligentPad. In this report, the current trial system products are shown. Major features of this system are i) interactive data visualization and comparison, ii) 2D database survey. From now on, we will include the EXFOR data in this system , distribute the system to researchers, repeat test use and blush-up of the trial system. Furthermore, we will proceed to develop the system to embody the aim of "effective" use of nuclear reaction data, such as Fig.9.

Acknowledgment

This work is supported by Meme Media Laboratory, Hokkaido University. To develop the retrieval system on Windows95,98/NT, essential pad modules are constructed by C'sLab. LTD that is based on the SmallTalk-based trial production by one of the authors(C. M.) [10-12]. The authors would like to express their thanks to Prof. Y. Tanaka for helpful discussions and suggestions.

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