



MSU SINP CDFE Nuclear Data Activities in the Nuclear Reaction Data Centres Network.

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Progress Report
to the IAEA Technical Meeting on the "Network of Nuclear Reaction Data Centres"
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This report contains the **short review** of the works carried out by the CDFE concern the IAEA Nuclear Reaction Data Centres Network activities for the period of time from the IAEA Technical NRDC Meeting (28 - 30 May 2001, Vienna) till the end of May 2002 and the description of the main results obtained.

1. The **new** CDFE EXFOR **TRANS M031** has been produced and transmitted to the IAEA NDS. The TRANS contains (**Annex 1**) 11 retransmitted and 11 new (M0624 - M0634) ENTRYs with 54 data SUBENTs. A big amount of EXFOR charge particle data ENTRYs has been added (in cooperation with CAJaD (Dr. F.E.Chukreev)) to the CDFE relational "**Nuclear Reaction Database (EXFOR)**".

2. The CDFE photonuclear databases have been put upon the Web-site (<http://depni.npi.msu.ru/cdfe>) before were upgraded significantly by adding a new data and software improvement:

- the "2000" part was added to the "Photonuclear Data Index" (the "2001" and "2002" parts are in processing) as whole the "**Photonuclear Data Index 1955 - 2000**" database was added by a significant amount of entries from /1/; data sets are available in forms of table for articles included into EXFOR;
- the CDFE database "**Giant Dipole Resonance Parameters**" was upgraded significantly: many data sets were added, many integrated cross section and integrated cross section first moment data were calculated and included.

3. The new relational data base "Low ($\hbar\omega \leq 3$ keV) Energy Isomer Transition Internal Conversion Probabilities" was produced in cooperation with CAJaD (Dr. F.E.Chukreev) using the data /2/; conversion of some low-energy transitions of $\Lambda L = E1 - E4, M1 - M3$ multipolarities ($E_1 I_1 \rightarrow E_2 I_2$ ($\hbar\omega = E_1 - E_2 \leq 3$ keV; I_1, I_2 - nucleus initial and final states spins, correspondingly) on the external electronic shells ($4p_{3/2} - 7d_{5/2}$) in the nuclei $^{90}\text{Nb}, ^{99}\text{Tc}, ^{103}\text{Rh}, ^{110}\text{Ag}, ^{140,142}\text{Pr}, ^{153,159}\text{Gd}, ^{160}\text{Tb}, ^{165}\text{Tm}, ^{171}\text{Lu}, ^{183}\text{W}, ^{188}\text{Re}, ^{193}\text{Pt}, ^{201}\text{Hg}, ^{205}\text{Pb}, ^{236}\text{Pa}, ^{250}\text{Bk}$ were investigated for the case of an isolated atom; the probabilities of the conversion transitions were calculated in framework of the Hartri-Fock-Slater method with the electron wave functions, obtained by integrating numerically the Dirac equations in the atomic field; the calculations were carried out for the normal configuration of the valence bands of the above listed atoms; the search is possible (**Annex 2**) for $Z, A, \Lambda L$ and shell (N, L, J); result example is presented in **Annex 3**.

4. The new powerful scientific tool "**Calculator for Nuclear Reaction Threshold and Energy Values**" (**Annex 4**) was produced using the nucleus mass data from other CDFE relational data base "**Nuclear Ground State Parameters**" (all needed mass data from /3/) in addition to previously developed database "**Main Photonuclear Reaction Thresholds**"; using the Calculator one can easily obtain both threshold and energy values (**Annex 5**) for any

reaction with definite incident particle (γ -quantum, neutron, charged particle, ...) and any combinations of outgoing particles for all nuclei contained in atomic nuclei mass table /3/.

5. The content of EXFOR ENTRYs upon 3 Nuclear Reaction Data Centres (NRDC) Network Web-sites (<http://depni.npi.msu.ru/cdfe>, <http://www-nds.iaea.org>, and <http://www.nndc.bnl.gov>) has been checked using the possibilities of the CDFE relational EXFOR database.

Many errors of two types:

- format errors (shifts, missing or extra commas etc.) and
 - reaction description errors (CODEs absent in Dictionary 36)
- have been founded (**Annex 6**) and listed in CDFE Memo CP-M/16.

The main result is that we have many ENTRYs in Internet (not only with errors, but without errors also) which exist in two-three versions. Some of them differ quite strongly (for example, CDFE ENTRY A0014 obtained from F.Chukreev contains 7 SUBENTRIES, but the same number ENTRY on NNDC site contains one SUBENTRY only).

Therefore for situation improvement the following questions could be discussed:

- Is it good that we have several versions of the ENTRYs with the same number in Internet? If “not”, how could we improve the situation?
- Must we check all old ENTRYs by today checking codes?
- Must we correct the most obvious (format) errors as soon as possible?
- Must we do this job in coordination? By what procedure?
- Must we additionally discuss the way to correct not obvious reaction description errors?
- What about modification of Dictionary 36?

6. Many errors found out in the CDFE ENTRYs concern the item 5 of this report have been corrected (**Annex 6**) and include into the CDFE TRANS M031 (**Annex 1**).

The main items of CDFE future short-term programmes, priorities and new tasks are listed in **Annex 7**.

References

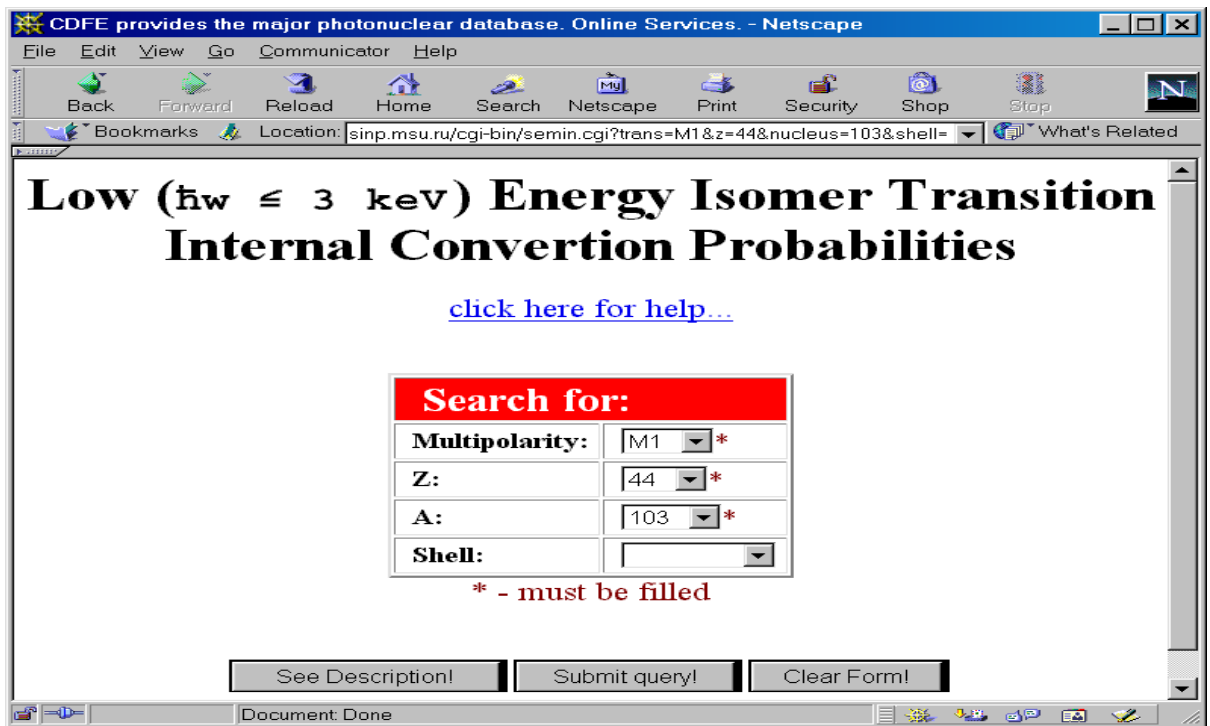
1. E.G.Fuller, H.Gerstenberg. Photonuclear Data - Abstracts Sheets 1955 - 1982. NBSIR 83-2742. U.S.A. National Bureau of Standards, 1986.
2. D.P.Grechukhin, A.A.Soldatov. Conversion of low energy nuclear transitions ($\hbar\omega \leq 3$ keV) on external electronic shells of an isolated atom. Voprosy atomnoj nauki i tekhniki. Seriya: Yadernye Konstanty, 1 (1987) 55.
3. G.Audi, A.H.Wapstra. The 1995 Update to the Atomic Mass Evaluation. Nucl.Phys., A595 (1995) 409.

Annex 1.

The CDFE EXFOR TRANS M031 contents (*old corrected and new ENTRYs*)

ENTRY's Number	<i>Amount of data SUBENTs</i>
<i>L0005</i>	<i>4</i>
<i>L0006</i>	<i>12</i>
<i>L0036</i>	<i>19</i>
<i>M0064</i>	<i>18</i>
<i>M0067</i>	<i>6</i>
<i>M0071</i>	<i>38</i>
<i>M0169</i>	<i>6</i>
<i>M0242</i>	<i>16</i>
<i>M0274</i>	<i>6</i>
<i>M0382</i>	<i>3</i>
M0525	<i>29</i>
M0624	2
M0625	4
M0626	5
M0627	3
M0628	2
M0629	5
M0630	2
M0631	2
M0632	21
M0633	6
M0634	2
Total: 22	Total: 202

Annex 2.



Annex 3.

The screenshot shows the results page for the search query. The title is "Low ($\hbar\omega \leq 3$ keV) Energy Isomer Transition Internal Conversion Probabilities". The specific isomer is identified as "44-Ru-103" with the configuration $4 \ 3 \ 1$ and transition multipolarity M1. A link "download text file" is provided. The main data is a table of internal conversion probabilities (IC) for various transitions (N L J) across different energy levels (2.500 to 2.900 keV).

N L J	$\hbar\omega$ (keV) EI (eV)	2.500	2.540	2.580	2.620	2.660	2.700	2.740	2.780	2.820	2.860	2.900
2P3/2	2838.	0.000E+0	0.000E+0	0.000E+0	0.000E+0	0.000E+0	0.000E+0	0.000E+0	0.000E+0	0.000E+0	9.680E+0	9.779E+0
3S1/2	574.1	1.298E+2	1.298E+2	1.298E+2	1.298E+2	1.298E+2	1.298E+2	1.298E+2	1.298E+2	1.298E+2	1.298E+2	1.299E+2
3P1/2	482.1	1.206E+1	1.206E+1	1.205E+1	1.205E+1	1.204E+1	1.203E+1	1.203E+1	1.202E+1	1.201E+1	1.201E+1	1.200E+1
3P3/2	459.2	1.777E+0	1.776E+0	1.775E+0	1.773E+0	1.772E+0	1.771E+0	1.769E+0	1.768E+0	1.767E+0	1.766E+0	1.764E+0
3D3/2	294.4	2.296E-1	2.282E-1	2.269E-1	2.255E-1	2.242E-1	2.230E-1	2.217E-1	2.204E-1	2.192E-1	2.180E-1	2.168E-1
3D5/2	289.9	9.661E-2	9.610E-2	9.559E-2	9.509E-2	9.460E-2	9.411E-2	9.364E-2	9.317E-2	9.270E-2	9.225E-2	9.180E-2
4S1/2	82.12	2.347E+1	2.347E+1	2.348E+1	2.348E+1	2.348E+1	2.348E+1	2.348E+1	2.348E+1	2.349E+1	2.349E+1	2.349E+1
4P1/2	54.17	1.905E+0	1.905E+0	1.904E+0	1.903E+0	1.902E+0	1.901E+0	1.900E+0	1.899E+0	1.898E+0	1.897E+0	1.896E+0
4P3/2	50.59	2.779E-1	2.777E-1	2.775E-1	2.773E-1	2.771E-1	2.769E-1	2.768E-1	2.766E-1	2.764E-1	2.762E-1	2.760E-1
4D3/2	9.104	2.090E-2	2.079E-2	2.068E-2	2.057E-2	2.046E-2	2.035E-2	2.024E-2	2.014E-2	2.004E-2	1.994E-2	1.984E-2
4D5/2	8.73	8.623E+0	8.582E+0	8.541E+0	8.501E+0	8.461E+0	8.422E+0	8.383E+0	8.345E+0	8.307E+0	8.270E+0	8.233E+0
5S1/2	6.379	1.689E+0	1.689E+0	1.689E+0	1.689E+0	1.690E+0	1.690E+0	1.690E+0	1.690E+0	1.690E+0	1.690E+0	1.690E+0
5P1/2	3.275	4.790E-2	4.787E-2	4.785E-2	4.783E-2	4.781E-2	4.778E-2	4.776E-2	4.774E-2	4.772E-2	4.769E-2	4.767E-2
5P3/2	3.188	6.602E-3	6.598E-3	6.593E-3	6.589E-3	6.585E-3	6.580E-3	6.576E-3	6.572E-3	6.568E-3	6.563E-3	6.559E-3
5D3/2	1.468	1.332E-4	1.325E-4	1.318E-4	1.311E-4	1.304E-4	1.297E-4	1.290E-4	1.284E-4	1.277E-4	1.271E-4	1.264E-4
5D5/2	1.466	5.927E-5	5.899E-5	5.871E-5	5.843E-5	5.816E-5	5.789E-5	5.762E-5	5.736E-5	5.710E-5	5.685E-5	5.660E-5

Annex 4.

CDFE => Online Services => Calculator for Nuclear Reaction Threshold and Energy Values - Microsoft Internet Explorer

Address: http://depni.sinp.msu.ru/cdfe/muh/calc_thr_more.shtml

Calculator for Nuclear Reaction Threshold and Energy Values

Each field in this form is optional - may be blank. [\[Click here for help... \]](#)

Calculation for :	Z:	A:	Number of Particles
• Target Nucleus:	<input type="text" value="3"/>	<input type="text" value="7"/>	1
• Incident Particle:	<input type="text" value="G(gamma)"/> (for nucleus >>) >>>		
• Outgoing Particle 1:	<input type="text" value="0"/>	<input type="text" value="1"/>	<input type="text" value="2"/>
• Outgoing Particle 2:	<input type="text" value="1"/>	<input type="text" value="1"/>	<input type="text" value="1"/>
• Outgoing Particle 3:	<input type="text" value="2"/>	<input type="text" value="4"/>	<input type="text" value="1"/>
• Outgoing Particle 4:	<input type="text"/>	<input type="text"/>	<input type="text" value="1"/>
• Outgoing Particle 5:	<input type="text"/>	<input type="text"/>	<input type="text" value="1"/>
• Outgoing Particle 6:	<input type="text"/>	<input type="text"/>	<input type="text" value="1"/>
• Final Nucleus :	<input type="text" value="0"/>	<input type="text" value="0"/>	1

Annex 5.

Calculator for Nuclear Reaction Threshold and Energy Values - Microsoft Internet Explorer

Address: &Input6Z=&Input6A=&Input6N=1&Input7Z=&Input7A=&Input7N=1&Input9Z=&Input9A=&Input9N=1&RecNucZ=0&RecNucA=0

Calculator for Nuclear Reaction Threshold and Energy Values

[Help ?](#)

Request:	Name:	Z:	A:	Mass (Mass Error), u:
• Target Nucleus:	LI	3	7	7.0143582(25)
• Incident Particle:	gamma	0	0	0(0)
• Outgoing Particle 1:	2_n	2*0	2*1	2.017329846(20)
• Outgoing Particle 2:	H	1	1	1.00727644(82)
• Outgoing Particle 3:	HE	2	4	4.0015060(16)
• Final Nucleus :		0		0(0)

Result:

Reaction Threshold: 10.9580(29) MeV
Reaction Energy: - 10.9488(29) MeV

Готово My Computer

Annex 6.

FORMAT ERRORS (left column)

Shifts in DATA/COMMON

& pointers in DATA-UNITS lines

err:40324006::data
 err:O0219013::common
 err:22205003::data
 err:F0167012::common
 err:A0557041::data
 err:D4076003-017::data

"(" from free text in column 12

err:F0175001::SAMPLE

"-" from free text in column 11

err:A0126001::COMMENT:-

". " from free text in column 11

err:20822001::CORRECTION:.

"Not correct pointers": shift of "(" into column 11

err:O0166011::LEVEL-PROP:(
 err:F0378002::STATUS:(
 err:F0378004::STATUS:(
 err:F0378008::STATUS:(
 err:10729005::HISTORY:(
 err:11659006::STATUS:(
 err:40156005::MONITOR:(

err:40161016::STATUS:(

err:40161018::STATUS:(
 err:40161019::STATUS:(
 err:40161020::STATUS:(
 err:40161021::STATUS:(
 err:40161022::STATUS:(
 err:40161023::STATUS:(
 err:40858007::MONITOR:(

Not correct code in DATA-HEAD

err:40046002::ENERGY
 err:40046003::ENERGY
 err:40046004::ENERGY

Shift in DATA-HEAD line

err:M0169006::ASS-MIN (Corr. M031)
 err:M0169007::ASS-MIN (Corr. M031)

CODE ERRORS (right column)

Number:Pointers:Codes

err:A0014002::PR,DA,,LEG
 err:A0014003:1:PR,DA
 err:A0014004:1:PR,DA
 err:A0014005:1:PR,DA
 err:A0014006:1:PR,DA
 err:A0014007:1:PR,DA
 err:A0014008:1:PR,DA
 err:A0060002::PAR,DE,G
 err:A0237011::PAR/UND,DA
 err:A0237014::PAR/UND,DA
 err:A0388002::PAR,TTY/DA,G
 err:A0388003::PAR,TTY/DA,G
 err:A0388004::PAR,TTY/DA,G
 err:A0388005::PAR,TTY/DA,G
 err:A0388006::PAR,TTY/DA,G
 err:A0388007::PAR,TTY/DA,G
 err:A1389002::PAR,DA,,COS/RS
 err:A1389003::PAR,DA,,COS/RS
 err:B0098003:2:(CUM)/UND,TTY
 err:B0098003:3:(CUM)/UND,TTY
 err:B0098008:2:(CUM)/UND,TTY
 err:C0025003::,DA,,ASY
 err:F0263003::PAR,DA,,COS/RS
 err:13698002::TER,FY/CRL,HF/LF -
 - added by Memo CP-C/300
 err:13698007::PRE/TER,FY/CRL,A/LF -
 - added by Memo CP-C/300
 err:20582002:2:TEM,SIG
 err:20616002::PAR,AKE,N
 err:20616004::PAR,AKE,N
 err:20616006::PAR,AKE,N
 err:20836004::SEQ,DA,A
 err:20836016::SEQ,DA,A
 err:20837009::SEQ,DA,A
 err:20837010::SEQ,DA,A
 err:21016003::TEM,SIG
 err:21095005::PR,NU,HF
 err:21146013::TEM,SIG
 err:21146016::TEM,SIG
 err:21146017::TEM,SIG
 err:21146018::TEM,SIG
 err:21146019::TEM,SIG
 err:21146020::TEM,SIG

Missing comma
err:R0019001::AUTHOR
err:A0055001::AUTHOR
err:20910001::AUTHOR
err:40033001::AUTHOR
err:M0502001::AUTHOR

"(" instead of ")"
err:11127001::HISTORY

Extra "C" in column 23
err:P0025002::COMMON

Missing ")"
err:M0274007::INC_SOURCE (*Corr. M031*)

Replaced DATA HEADINGS:
ELEM instead of MASS and vice versa
err:A0031003::DATA

err:21274002::TEM,SIG
err:21274003::TEM,SIG
err:21274004::TEM,SIG
err:21274005::TEM,SIG
err:21274006::TEM,SIG
err:21274008::TEM,SIG
err:21297004:3:STF
err:21628003::,PAR,DA
err:21643002::PAR/DL,NU
err:21689002::IND/PAR,FY
err:21689003::PAR,ZP
err:21689004::IND/PAR,FY
err:21689005::PAR,ZP
err:21689006::IND/PAR,FY
err:21689007::PAR,ZP
err:21689008::IND/PAR,FY
err:21689009::PAR,ZP
err:21689010::IND/PAR,FY

err:21689011::PAR,ZP
err:21689014::IND/PAR,FY
err:21689015::IND/PAR,FY
err:21689016::IND/PAR,FY
err:21689017::IND/PAR,FY
err:21689018::IND/PAR,FY
err:21699002::TER,AKE
err:21699003::TER,AKE
err:21701002::PAR/IND,FY
err:21701002::PAR/CUM,FY
err:21701005::PAR/IND,FY
err:21701005::PAR/CUM,FY
err:21723003::CUM,FY/SUM
err:21929004::,DA/DE,,LEG
err:22250002::,AH
err:22250003::,AH
err:22250004::,AH
err:22250005::,AH
err:22250006::,AH
err:22250007::,AH
err:22308003::TER/BIN,FY
err:30323005::,SIG,,RAT
err:30326002::TER/BIN,DA/RAT,FF
err:30326002::TER/BIN,DA/RAT,FF
err:30326003::TER/BIN,DA/RAT,FF
err:30326003::TER/BIN,DA/RAT,FF
err:30521002:L:TER,CRL,FF/FF
err:30521002:L:TER,CRL,A/FF
err:30521002:H:TER,CRL,FF/FF
err:30521002:H:TER,CRL,A/FF
err:30916002::,CRL,A/FF

err:40386002::,SPC,G
err:40387002::,SPC,G
err:40593002::,PRE,DA,,RSD
err:40593003::,PRE,KE/DA
err:M0030005::,DE,N/P
err:M0030006::,DE,P/D
err:M0030007::,DE,N/D
err:M0030008::,PAR,DA,N/P
err:M0033002::,DE,N/P
err:M0035002::,DE,N/P
err:M0035005::,DE,P/D
err:M0035008::,DE,N/D
err:M0035020::,DE,N/P
err:M0051011::,DE,N/P
err:M0051014::,DE,P/D
err:M0051017::,DE,N/D
err:M0054002::,PAR,MCO,N/P
err:M0064014::,DA,RSD (*Corr. M031*)
err:M0065003::,DE,N/P
err:M0065004::,DE,P/A
err:M0065005::,DE,P/RSD
err:M0065006::,DE,A/RSD
err:M0071018::,DA,RSD (*Corr. M031*)
err:M0071021::,DA,RSD (*Corr. M031*)
err:M0071024::,DA,RSD (*Corr. M031*)
err:M0071027::,DA,RSD (*Corr. M031*)
err:M0071030::,DA,RSD (*Corr. M031*)
err:M0071033::,DA,RSD (*Corr. M031*)
err:M0071036::,DA,RSD (*Corr. M031*)
err:M0071039::,DA,RSD (*Corr. M031*)
err:M0133007::,DA,,CS2/RS
err:M0179002::,DA,,SN2/RS
err:M0184002::,DA,,SN2/RS
err:M0184003::,DA,,SN2/RS
err:M0184004::,DA,,SN2/RS
err:M0184005::,DA,,SN2/RS
err:M0186012::,DA,,SN2/RS
err:M0186013::,DA,,SN2/RS
err:M0186014::,DA,,SN2/RS
err:M0186015::,DA,,SN2/RS
err:M0186016::,DA,,SN2/RS
err:M0191002::,DA,,SN2/RS
err:M0225029::,DA,A,LEG/RS
err:M0225030::,DA,A,LEG/RS

err:M0242004::,DA,LEG (Corr. M031)
err:M0242005::,DA,LEG (Corr. M031)
err:M0242006::,DA,LEG (Corr. M031)
err:M0242007::,DA,LEG (Corr. M031)
err:M0242009::,DA,LEG (Corr. M031)
err:M0242010::,DA,LEG (Corr. M031)
err:M0242013::,DA,LEG (Corr. M031)
err:M0242014::,DA,LEG (Corr. M031)
err:M0242016::PAR/EP,SIG (Corr. M031)
err:M0242017::PAR/EP,SIG (Corr. M031)
err:M0256002::,DA,N/P
err:M0256003::,DA,N/P
err:M0256004::,DA,N/P
err:M0350016::PAR,DA,,COS/RS
err:M0350017::PAR,DA,,COS/RS
err:M0382002::PAR,INT,G,4PI (M031)
err:M0382003::PAR,INT,G,4PI (M031)
err:M0382004::PAR,INT,G,4PI (M031)
err:M0393002::,DE,BRA/REL
err:M0435003::PAR,INT
err:M0435004::PAR,INT
err:M0435007::PAR,INT
err:M0435008::PAR,INT
err:M0435008::PAR,INT
err:M0435009::PAR,INT
err:M0436003::PAR,INT
err:M0437003::PAR,INT
err:M0446003::PAR,INT,G
err:M0448004::PAR,INT
err:M0448005::PAR,INT
err:M0499004::PAR,INT
err:M0499005::PAR,INT
err:M0500003::PAR,INT
err:M0525020::,DA,RSD (Corr. M031)
err:M0525021::,DA,RSD (Corr. M031)
err:M0525022::,DA,RSD (Corr. M031)
err:M0525023::,DA,RSD (Corr. M031)
err:M0525024::,DA,RSD (Corr. M031)
err:M0525025::,DA,RSD (Corr. M031)
err:M0525026::,DA,RSD (Corr. M031)
err:M0525027::,DA,RSD (Corr. M031)
err:M0525028::,DA,RSD (Corr. M031)
err:M0536004::,POL/DA,,AZI
err:O0132122::IND/UND,SIG,,G

Annex 7.

The main items of the CDFE future short-term programmes, priorities and new tasks

1. Upgrading and addition of the CDFE bibliographical data collection. Including the 2001 - 2002 photonuclear data into the relational database "Photonuclear Data Index" (PNI). Participation the joint (CDFE - NDS - NNDC - CNPD - CAJaD - CJD) program of development of the joint (EXFOR - CSISRS - CINDA - NSR - PNI - ...) Relational Nuclear Reaction Database.

2. Continuation of photonuclear data compilation using EXFOR format. Investigation (together with Institute of Nuclear Research of Russia Academy of Science) of including the data on meson photoproduction data, first of all for cross sections and angular distributions. Addition and correction of the existed CDFE EXFOR relevant databases:

- "Relational Nuclear Reaction Database (EXFOR)";
- "Giant Dipole Resonance Parameters. Photonuclear Reaction Cross Sections".

3. Improvement (in cooperation with CAJaD, Dr. F.E.Chukreev) of the CDFE Relational Nuclear Reaction Database (EXFOR) Search Engine. Development of special software for so-called "inverse geometry" charge particle reaction data search (any "incident particle - target nucleus" combinations without fixing for REACTION SF1 - SF2 and correspondent recalculation of energy values).

4. Improvement of the CDFE relational nuclear spectroscopy database NESSY (New ENSDF Search SYstem). Addition to the NESSY Search Engine several new available queries (standard or typical requests), for example, "Show Transitions with Equivalent Energies", Chains of queries", etc. Investigation of the possibilities of joint (CDFE - NNDC - NDS) program of development of advanced "Relational ENSDF" database.