Benchmark Validation by means of Pulsed Sphere Experiment at OKTAVIAN

Chihiro ICHIHARA[*], *Research Reactor Institute, Kyoto University*
Chi ro rI o Ho CI ARA, esasi scrtnuro snKaynU, cuvyRRakkymrU, avcueasyR
rAsei umrKAMURo RDcpausKc, smtrNi ylcaurU, va, ccua, vRKynsmrU, avcueasyR
Ji , jarHo Mo MOTORDcpausKc, smtrUlcysuayalrU, va, ccua, vRCcsei , a, rU, avcueasyR
o kas1Cii r i o i o IRAR, esac Rt aGuCKyUeResGyt Rkt RRskt RRCUveKeCMt kDRsvkapH
[*]Ben chmac r r kB Vdi h ihk1d t o l c bkkdht y1s1eo lc l bfP

1Benchmrceaner k meVmBli r kc edktohkaonBenbeai nemycsaoBfemdktPkamheBPltmkcehkakebncebPsonB cmtkamher kamcdktueBmPacnBetmk kf nesSmlackebcnr esSi nrcdkteSctnsep nrcner mksPcmhep cai ekeaor mEbbE btcfi aeamli BcxPmePsoBfeai neoBamBsneOKéT mAeBmPacnBesnPclmeL NTAA1ANeoBeai nemBncf yeckBf m bcnr e0.CeaneC5eT mA.eTi neBmPacnBemBncf yesSmlackep nrcnenVakoBmhekseai nekVsntPaneckPm Bncr ktczmheSnrceai nesnPclneBmPacnB.eeTi ner mksPcmhesSmlackep nrcnel nr Skcmhep cai eai ns neVy ai nncmadktelktlPtkaonBePsoBfekeT nBaneCkctneBmPacnBeackBsSncaelnhmeT CNPep cai esmdncckt toVckconseScnlnssmhebcnr eai nemdktPkamheBPltmkcehkakebotns.eCnr SkcosnBeikseVmmBer khmep cai eai m sSmlacPr esikSmeai neC/EedktPnseneBmPacnBeBPr Vncseo Bamf ckamheoBeKemBncf yecnf onBsekBheai m lktlPtkamhesSmlackePBbnthmheVyeai neBPr Vncenbelnttosn Bsuensmlokttyeai nsnekbancekesoBf tm lnttosonB.e

Ti neBmp etoVckconseScmhdlamheai nemySncor mBaebkoctyep nttebnceLoueCcueT BueCPekBheT n.eFnceAtueSou ZcueNVekBheWueBmp ehkakebotnseln Pthef odnebkoceScmhdlaonB.eHnp ndncueC/Eehdbncmher ncneai kBe20 %ebncesndncktecnf onBs.eeFnceLoFueCF$_2$ueT oekBheCnueBnelktlPtkaonBelnPtheScmhdlaeai nemySncor mBa. Ti nehnakotmheh oslPssonBei kseVmmBef odnBebnceCcueT BekBheCPeskr Stnns.eEFFE2elktlPtkaonB ndncnsaor kamheVye2Ke%ebnceai neCcemySncor mBaeVmap mnBeOekBhe5ET mAeBmPacnBenBncf yecnf onBu ScnsPr kVtyeVmlkPsnenbendncnsaor kaonBenbeoBmtksadlecnsses mlaonBekBhe^{52}Cc(Bu2B)elcnsses mlaonB kBheai neScnVtmr eoBenBncf yekBhekBf Ptkcehosaco VPaonBenbesmlnBhkcyeBmPacnBseoBeEFFE2.eeFnceCPu ENDF/BEA1ekBheEFFE2endncnsaor kamheai nemySncor mBaeVyekVnPae20eans30E%eoBeai nemBncf yeckBf m Vmap mnBe5ekBheO2ET mAueScnsPr kVtyebcnr eai neScnVtmr eoBeoBmtksadeslkaancoBfelcnsses mlaonB.e

Oe1NTRI DUCT1I N

eeeelBekeDETebPsonBeemklancueoBanBsneOKET mAeBmPacnBsebcnr eStksr keVmr Vkchekebocsaep ktttuekBhemBancekeVtkB ma anef nBnckaneai nkaeVyedkconPseenklaonBsekBheaneScnhPlneaccaoPr eVyeai ne^{6}Lo(*Cha* 1Benche maer*ChCa* 1Bek nVlaicdt 1Be nchnmarBhkc Vackmlnri Bhdnia Vntce othnakcohdcBa nrcVe lBraohacdnbVnkcorBnhdca ncysohf naRcu nrnSBrnp hnmarBhcaroh kl Braciosimsoa VBhcVkcBSnkkmhaVoscVe lBraohincSBrca ncdnkVhcBSsa ncExucSnkVBhcrnoiaBrkRe ccccOBrncrnoiaVBhci ohhnskpckmi cokcK*ChCin*1Benchnmchnarkh cmVi VdriVlnlc1tclohiie emcneri 1nlcdeo1b e hnVli 1BVocy Vsciseeneri 1nlchd1fedPuSp eEco1b Bh emcy Vscis 1lec1tctVIlVlnc ehoi1 lxOkl1Kdisedi r roir e 1tcTSActrlVlnceoi1 lcVlcrlrhkkIcfe Ico1b BkVohiemcN1 ciselecehl1nlKdisecneri 1nci hnlB1 icohkorkhiVlncVh isedkhnTeict1 chcTSActrlVlnc ehoi1 cshlcb 1 echb dVarVIcishncishicVhchctVIlVlnc ehoi1 x AsVlchb dVarVI VIcb hVnkIcmr eci1clVb BkVVemcb 1mekVnac1tcisec ehkcae1b ei Ichnmci1ckh aecr noe ihVhiIcVncnr okeh cmhihct1 sVase cene aIcneri 1nlxAeoenikIcisechb dVarVIct 1b cisect1 b e cohncdecmhliVohkkIc emr oemdIcrlVnacp 1nie Nh klcohkorkhiVlnKdr icishicohr lemdIcisedkhiie cshlcn1idIeicdeencVb B 1femct1 cldihVnVnadr ttVbVenichoor hoI*o* ccccyndefe hkco1r ni Vel chnmeVhie nhiVlnhkc1 ahnVOhiVlnlKa ehicett1 icshfecdeendcb hmeci1cB eBh ecnr okeh mhihctVkelct1 cisecmelVdncl1tcTSActrlVlnc ehoi1 lcdIchm1BiVnacneykIcb ehlr emcmhihKlr oschlcm1rdke mVte eniVnkco 1llcleoiVlnc.TT5zkkhnmcdIcrlVnacb 1 ecl1BsVriVohiemcneri 1nc ehoiVlncise1 IxccCr oscneey nr okeh cmhihctVkelcshfeci1cdecfhkVnhiemcis 1r asocdenosb h TcePBe Vb enict1 cisechoir hkchBBkVohiVlnci1cise mel Vdncy 1 Txc

ccccAsedBr B1lec1tcisVcy 1 TcVci1cfhkVnhiecor enikIchfhVkhdkecb 1me ncnr okeh cmhihckVl h Vel ct1 cTSActrlVln ehoi1 lcdIcoh IVnac1ricBrkIemdBse eccPBe Vb enix/ Icb hTVnacrlec1tcisecVnienlecPESp eEcneri 1nd1r oeK

FSAOEyOZKhde VelcltoBrklemdBse ecePBe Vb enilcVhokrmVhacPWekeb enildhnmoo1b B1rnmldIlieb hiVbhkkIK dricisecelrkilct1 cisecN Kp nchnmcNrcBVeldh ecaVencVhcis VcBhBe xcHeci Vemci1cb ehlr ecisechdl1kriecfhkre 1tcneri 1ndBeoi hcdIcb hTVhacrlec1tcisechoiVfhiVlncb eis1mc1tchcZdco1fe ct1Vkcy sVbsdr 1rnmemcisecTSA ih aeixycncisec o1b Bh V1nc1tcohlorkhiemdBeoi hcy Vsdb ehlr emclnelKn1iclnkIcisedBeoi rb dshBeKdrichkl1 isecN2%cfhkrelcltcneri 1ncnrb de 1cVhiea hiemcVhcEcene aIceaVlnlcye eco1nlVme emcyncl me ci1chnhkI0ecise etteoilc1tcmVte enicehoiVlnlchnmcise Vdeo1nmh Icneri 1nlKisecohlorkhiemdBeoi hcrnt1kmemcdIcisecnrb de 1tco1kkVVlnlKelBeoVhkkIcis1lechtie chdVhakeco1kkVVlncye ecePhb VhemcoOlcisecnrokeh cmhihct1 cTSActrlVln ehoi1 lKhm1Biemcy e eciy 1cy 1 TVhackVd h Velchiihosemcy Vscp NZ(SEO[1]co1mec./p NNCK%ZT)SDWzKhnmcise 1BcncnBhmarnk hmmhValnki adt 1hcmaVcocalBhmabays f PubSpE[2]xays f PubSpO[3]xays f PuaKtmBkdalBh[3]xaKs f PuTs bEpA[4]x s KKbO[5]paIki haVhocBhVaVBnt mmBkdalkmaNmxaT dacdVaNt amci r1harBhmacnhaABNhdpa

Opas y0s. 5Ts f z CuaKCN5u5z PaCf Pa0. / Ns PE. s

ELaf ht onkdaI kt n h

aaaaz FhahSrhnB hdoaZcmarhnlkni hVacoa/ Wz CH5Cf [6]xaZ FBFaBmacdaBlohdmhaE2bT hHadht onkdamkt n halc BB%akl / mc(caEdBNhmmB%paaz FBma kdmBmmaklaca2AAa(HaFBAFaNk1ocAhaAhdhmcoknacdVacaVt kr1cmi conkdaBkdamkt n h crce1haklaO)ai CaklaVht ohnkdaehci paD hat mhVaoFhart 1mhVaehci aBlhaZ FBFaZcma crce1hakladht onkdart 1mhakl lhZadmaklart 1mhaZ BVoFpa5daoFBmahSrhnB hdoxaoFhaVht ohnkdaehci art 1mhVaZ BVoFacdVaoFhanhrhoBBkdancohaZcmaO dmacdVaO)Aa(B3akma)AAa(B3xanhmrh oBNh1%paaz FhaVht ohnkdaehci aZcmaBlonkVt hVaokaoFha hdohmaklaoFhamrFhnBc1 mci r1harBhaoFnkt AFacaehci aFk1hacdVaeki ecnVhVaoFhaonBBi aocnAhoaokaAhdhmcohaE2bT hHadht onkdmae%aoFh ^{3}z RVxdL[4]Bhanhc oBkdmpaCaSUAbGBqaonBBi aocnAhoakla'AcmbBlbi hoc1'ao%rhaklaSpE8ai aVBi hohmacdVaApA)ai oFB(dhmmakrrhmaec (BlAar1cohpaz FhacNhmcAhadht onkda%Bh1VaZcmacekt oaEA[9]adTmh p

OLas SrhnB hdoc1aCmncdAhi hdo

aaaaz Fhadht onkdmalhc(BlAalnki aoFhakt ohnamt nlc haklaoFhamrFhnBc1amci r1harBhmaZ hnhaVhoh ohVaZ BoFacalBqt BV mBloB1coBkda kt dohma ki rkmhVaklacaf s bOE8amBloB1cokmaklaEOqUai bVBi pa×a)pA8ai b1kdAacdVaca NC88)2 rFkokai t 1oB1Bhmaot ehpaz FBmaVhoh okmaZcmalk cohVaEEai acrcmoalnki aoFha hdohmaklaoFharBhacdVa))aVhAnhhm FknBkdoc11%acdVab)aVhAnhhmaNhmoBc11%aZ BoFanhmrh oaokaoFhaVht ohnkdaehci acSBmp

aaaaaz Fharnhb k11B cokmaZcmar1c hVaehoZ hhdaoFhamci r1harBhacdVaoFhaVhoh okmaokanhVt haoFhaec (Ankt dV dht onkdmamcoohnhVae%aoFhaZc11macdVakoFhnamont ot nc1ai cohnB1maBlaoFhai hcmt nhi hdoankki akla/ Wz CH5Cf p z FBma kdmBmohVaklai t 1oB1c%hnmaklark1%hoF%1hdhacdVaBkdaZ BoFakt ohmaVBi hohmaklaEpOai acdVacdaBldhmacrhmot nh VBi hohmaklaApSai paz FhacrhmotnhamBhaZcmaVh BVhVamkaoFcoac11adht onkdmalhc(BlAalnki aoFhamt nlc haZ BoFBlaObπ mk1BVacdA1haokaoFhaVhoh okma kt 1VaAkaoFnkt AFaoFBmacrhmot nhp

aaaaz FhaonBAAhnamBAdc1maZ hnhaoc(hdalnki acaehci arB(bt ranBlApaaz Fhadht onkdamBAdc1malnki aoFhaf s bOE8alBqt BV mBloB1coBkda kt dohmaZ hnhaVBmnB BlcohValnki aAci i cbnc%amBAdc1mae%at mBlAaoFhart 1mhamFcrhaVBmnB BlcoBkd oh FdBqt hpaaz ka kNhmadht onkdahdhnA%aVkZdaokaApEbT hHxaoZ kaBVhdoBc1amFcrhaVBmnB BlcoBlAa Bh t BomaZ hnhat mhV Blarcnc11h1aZ BoFaVBlhnhdoaAcBlamhooBlAnaklaoFhaVh1c%b1BlhacI r1BBhmmpa

SLaI ci r1ha0 Bhm

aaaaCmac11aoFhai cohnB1maZ hnhar kZ Vhmakmami c11arh11homxaoFh%aZ hnharc (hVaBlamrFhnBc1amFh11mai cVhaklamocBl1hmm mohh1akmai BVanohh1pau BaNK$_{2}$axaC1xaI Baz BaNmxaNkacdVaD aZ hnha kdocBlhVaBla2Abi aVBi hohmamFh11mai cVhakl mocBl1hmmamohh1xaoFhakt ohmaVBi hohmacdVaoFhaoFB(dhmmaklaZ FBFaZ hnha2Abi acdVaApObi xanhmrh oBNh1%paaz Fh mFh11aklaoFBmao%rhaZcmahqt BrhVaZ BoFaca hdonc1aNkBVamh oBkdaklaOAbi aBlaVBi hohmaokac ki i kVcohaoFhaonBBi ocnAhoacdVaZ BoFacanhhdoncdoaFk1hxaoFhaVBi hohmaklaZ FBFaZcmaEEbi pau BKxaT dxaNt xaZmacdVaT kamci r1haZ hnh kdocBlhVaBla6Ebi aVBi hohmamFh11mxaoFhakt ohmaVBi hohmacdVaoFhaZc11aoFB(dhmmaklaZ FBFaZ hnha6Ebi xacdV Ap)bi xanhmrh oBNh1%paaz FhamFh11aklaoFBmao%rhaFcVaca)bi aVBi hohmanhhdoncdoaFk1halkmaBlonkVt BlAaoFhaonBBi ocnAhoaet oadka hdonc1aNkBVaZcmahqt BrhVpaf eamci r1haZcma kdocBlhVaBlaoFhamB BcmamFh11aoka6Ebi akdhahS hro lkmaoFhakt ohmaVBi hohmaZ FBFaZcmaO8bi alkmaoFBmamFh11paD hat mhVa6Aai aVBi hohmamFh11alkmacdkoFhmaI Bamci r1h rBhpaz FBmaZcmamB Bcmaoka2Abi amFh11ahS hroaoFcoaoFhaVBi hohmacdVaZc11aoFB(dhmmaZ hnha6Abi acdVaAp)bi x nhmrh oBNh1%pa5daoFhaz ce1hbExamFkZdacnhaoFhaVBi hohmmarc (BlAaVhdmB%aR(ATi [3]IacdVaoFhamci r1haoFB(dhmm i hcmt nhVae%aoFhai hcdalnhharcoFalkmaE2bT hHadht onkdmac1t 1cohValnki aoFhaokoc1adht onkda nkmmamh oBkdaco E2bT hHaklahc Fai cohnB1p

a

SpaP Cz Ca0. / Ns I I 5f G

aaaaz Fhacemk1t ohaNc1t hmaklaoFhadht onkdamrh oncaZ hnhaVhohni BlhVae%a ki eBlBlAacanh1coBNhaVhoh okmah11BBhd %x cant dbokbnt dadht onkdal1t hd hai kdBokmaZ BoFacaf eac oBNcoBkdalkBla kNhmBlAaoFhaocnAhoxacdVacaP bz amkt n h

dht onkdaVhoh oBkdaZ BoFaoFhaoB hbklbl1BAFoai hc mt nhi hdoa Bn t Boxac knVBlAaokaoFhalk11kZ BlAar nk hVt nhp
ElazFhanh1coBNhahl1BBnd %aklaoFhadht onkdaVhoh okmaehoZ hhdaAp8SacdVa8pOaT hHaZ cmaVhohni BlhValnki aoFhaoB hb klbl1BAFoai hc mt nhi hdoaklaoFhadht onkdmalnki aca^{252}Nlamrkdocdhkt malBmmBkdankt n hpazFhar nki roaAci i cbnc%m lnki aoFhamrkdocdhkt malBmmBkdakla^{252}NlaZ hnhat mhVacmaoFhaonBAAhnanBAdc1malknat oBlBBlAaoFhanci ha kt doBlAa Bn t Bo cmaoFhai cBlahSr hnB hdopa
OlazFhanh1coBNhahl1BBnd %aehoZ hhdaApA)bT hHacdVaAp8SbT hHaZ cmaVhohni BlhVae%aoFhaoB hbklbl1BAFo i hc mt nhi hdoaklaoFhalhc(BlAamr h ont i alnki aSAai bVBoi pamrFhnBc1arBlhp
SlazFhacekNk1t ohahl1BBnd %acekNhaApEbT hHaZ cmac1t 1cohVae%t mBlAacaT kdohaNcn1ka kVha(I)pa
2lazFhahl1BBnd %aVhohni BlhValnki aAncr FBohai hc mt nhi hdoacdVaoFhac1t 1cohVahl1BBnd %aZ hnhadkni c1BBhV ehoZ hhdaApSacdVaAp8bT hHpazFhahl1BBnd %aVhohni BlhValnki a^{252}Nlai hc mt nhi hdoacdVaoFhac1t 1cohVahl1BBnd % Z hnhadkni c1BBhVaehoZ hhda2acdVa8bT hHpazFhahl1BBnd %a t nNhaZ cmakeocBlhVae%a ki eBlBlAaoFhacekNh Nc1t hmp
)lazFhaokoc1alhc(cAhadht onkda t mnhdoaZ cmakeocBlhVae%a ki eBlBlAaoFhahl1BBnd %a t nNhacdVaoFhaBlohAncohV kt doaklaoFhaPbzadht onkdankt n hai hc mt nhi hdoaZ BoFaoFhaz/ Ka kt doBlAa Bn t BopazFhaVhocBlhVaVhmnB oBkdakl oFBai hoFkVaBmaABNhdahmhZ Fhnh[7]p

2paNCuNEuCz5/ f I

aaaazFhaoFhknhoBc1ac1t 1coBkdmaZ hnhar hnlkni hVat mBlAacaoFnhhbVB hdmBkdc1a kdoBlt kt mahdhnA%aT kdohaNcn1k oncdmrkmoa kVhxaT Nf 0b2CpaE mhVaZ km(BlAaBncnBmaZ hnhaBT NNI xas f Pub8)xaKs f PuTT NbE[8]axas KKbOacdV oFnhhays f PubSaecmhValBncnBmbaKI y u5BbyS[9]xaKI y u5BbyS. O[10]cdVaKI y u5BbySKK[11]paaBT NNI aBnacdacooc FhV 1BncnB%aZ BoFaT Nf 02CxaZ FBFa kdmBmakdas f PKTBb5H[12]xas f PubUS[13]acdVankakdpaas f Pub8)aZ cmac1nkacooc FhV Z BoFaT Nf 0a kVhacdVaZ cmar nk hmmhValnki aoFhaE98)aNhmmBkdaklau uf uahNc1t coBkdm[15]paKs f PuTT NbEaZ cm r nk hmmhValnki aKs f PuTS bEpAaVcocalBhxaZ FBFa kdmBmhVaklas f PKTBbH5[16]xays f PubSpExas KKbOxaB. / f PbO[17]p KI y u5BbySOxaKI y u5BbyS. OacdVaKI y u5BbyKKaZ hnhar nk hmmhValnki ays f PubSpExays f PubSpOacdVays f Pu Kt mBkdaKBlhae%aVkmc(kxanhmr h oBNh1%paa
aaaazFhankt n hadht onkdmaZ hnhaonhcohVacmacdaBnkonkr Bar kBloankt n hacdVaoFhai hc mt nhVahdhnA%aVBmonBt oBkdm Z cmaABNhdacmaoFhadht onkdankt n hpaCmaoFhahSr hnB hdoc1anhmt 1omaZ hnhanhVt hVacmaoFhaokoc1alhc(cAhat mnhdo r hnankt n hadht onkdxaoFhadht onkdaoc11%acVkr ohVaZ cmacant nlc ha nkmmBlAaoc11%pazFhadht onkdaFBnkknBmaZ hnh oc(hdacmaEA[7]aBlai kmoa cmhmacdVaoFhamoc oBmoBahnnkmaklahmmaoFcdaEa%alkmahc FahdhnA%aeBlaZ cmakeocBlhVp

)pa sIEuzaCf PaP5INEII5/ f

aaaa5daoFhazce1hbExaABNhdacnhaoFhac1t 1cohVbokhSr hnB hdoc1aBNTS lazNc1t hmaklaoFhamr h oncaBlohAncohVakNhma2 hdhnA%anhABkdmalkmaoFhanci r 1harBhmpazFhamr h ont i aBlaoFhaFBAFhmahdhnA%anhABkdaB>EAaT hHlaBmanhl1h ohVae% oFhaVBh oadht onkdmalnki aoFhaocnAhoxadht onkdmah1cmoBc11%amc oohnhValaoFhanci r 1harBhacdVadht onkdmac1ohn Blh1cmoBc11%amc oohnhVaokaoFhaVBnnhohalhNhlmalhZ aoB hmpazFhadhSoahdhnA%anhABkda)<s$_n$<EAbT hHlaBmanhl1h ohV e%aoFhadht onkdmac1ohnaBlh1cmoBc11%amc oohnhVaoka kdoBlt t i anhABkdmacdVanh kdVcn%adht onkdmaAhdhnc ohVae% oFnhmFk1Vanhc oBkdmpazFhaoFBnVanhABkdaEE<s$_n$<)bT hHlaBmanhl1h ohVae%aoFhamr h ont i a ki r kdhdoalnki hVae% NcnBkt maBlohnc oBkdmant FacmaBlh1cmoBamc oohnBlAacdVaRlxOdlanhc oBkdmpazFhalkZ hmoanhABkdaBmanhl1h ohVae%aoFh nhmkdcd hanont ot nhmaklaoFhankmmanh oBkdmaklahc Fahlhi hdopazFhac1t 1coBkdaZ BoFadhZ adt 1hc maVcocaoFnhh ys f PuaVcocalBhmaKs f PubExas KKbOa kt 1VanhVBohVaoFhahSr hnB hdoalcBn1%aZ h11aBlaAhdhnc1paas mr h Bo11%alkn uBaNmxaT dxaNt acdVaT kxac11aVcocalBhma kt 1Vac1t 1cohadhcn1%arhnlh oamr h oncaABNBlAa1hmmaoFcdaEAa% VBncAnhhi hdoaehoZ hhdahSr hnB hdoacdVac1t 1coBkdpaKkmaC1xaI BaZmaf eacdVaD xaoFhaNTS aNc1t hmalkmaZ Fk1h hdhnA%anhABkdaZ hnhalhmmaoFcdaEAa%paB kZ hNmxaVBncAnhhi hdoacmalcnAhacmaOAb2Aa%aZ cmakeocBlhVarcmo1%alkn oFhmhanci r 1hmaZ FBFaB r 1BcohVankiharnke1hi aBlaoFhadt 1hcmaVcocalBhmpaKkmau BKxaNK$_2$xazBacdVaNkxaoFh c1t 1coBkdmaZ BoFac11alBncnBmaFcValcnAhaVBncAnhhi hdoalnki aoFhahSr hnB hdop
5daoFhaNmxaT dacdVaNt anhmt 1omaoFhak1Vadt 1hcmaVcocalBhmas f PKTBb5HalkmaNmacdVaNt acdVas f PubUSalkmaT d VBValkoar nhVBoaoFhahSr hnB hdoamcoBmlc okn B%ahmr h Bo11%aBlaoFhahdhnA%anhABkdaehoZ hhda)bacdVaEAbT hHacm nFkZ daBlaKBAmpbExbOacdVabSpaCoaoFhar hnBkVaZ FhdaoFhmhaVcocalBhmaZ hnhaVki BlcdoI%at mhVxaoFhaBVhcaklar r I%aBlA oFhaVBoh oar nk hmmaoFhkn%aokaoFhadht onkdbdt 1hcmaBlohnc oBkdaZ cmadkoadh hmmcn%pazFhaBlh1cmoBa nkmmanh oBkdm i cBl1%aehcmaoFharnke1hi a ac t mhVae%aoFhaBAdkncd hakl aoFhaVBoh oarnk hmmp5daoFhazce1hbOxaokoc1aBlh1cmoBa nkmm mh oBkdaNc1t hmalkmaNmxaT dacdVaNt acnhalBmohVpazFhanhNhnhakNhnhmoB coBkdacdVat dVhnhmoB coBkdaklaoFhaa zce1hbEalci r 1halBmacdVaoFhaNTS aNc1t hmaklaoFhamr h oncaBlohAncohVakNhma2ahdhnA%anhABkdm

	Energy	JENDL-3.2	JENDL-FF	JENDL-3.1	EFF-2	FENDL-1	BMCCS
Li	10<En<20	0.961	0.961	0.960		0.968	0.955
40cm	5<En<10	0.751	0.752	0.744		0.675	0.758
ρ=0.534	1<En<5	0.975	0.973	0.982	NA	0.981	0.958
1.3 MFP	.1<En<1	1.012	1.013	1.017		0.972	1.053
	total	0.948	0.948	0.948		0.944	0.945
LiF	10<En<20	1.137	1.141	0.900		1.076	0.891
60cm	5<En<10	0.932	0.970	0.632		0.834	0.769
ρ=1.79	1<En<5	0.856	0.858	0.862	NA	0.856	0.881
3.5 MFP	.1<En<1	0.597	0.590	0.658		0.680	0.719
	total	0.861	0.864	0.781		0.860	0.819
CF	10<En<20	0.767	0.768	0.709		0.761	0.724
40cm	5<En<10	0.545	0.555	0.521		0.606	0.578
ρ=1.30	1<En<5	0.625	0.624	0.804	NA	0.617	0.770
0.7 MFP	.1<En<1	0.611	0.605	0.726		0.645	0.704
	total	0.713	0.714	0.711		0.715	0.719
Al	10<En<20	1.060	1.062	1.051	1.052	1.051	1.020
40cm	5<En<10	0.792	0.819	0.644	0.814	0.644	0.916
ρ=1.22	1<En<5	0.893	0.889	1.010	0.992	1.010	1.006
0.5 MFP	.1<En<1	1.260	1.244	1.217	1.147	1.217	1.357
	total	1.034	1.035	1.036	1.037	1.036	1.037
Si	10<En<20	0.974	0.936	0.974	0.974	0.861	0.966
40cm	5<En<10	0.685	0.648	0.689	0.707	0.655	0.579
ρ=1.30	1<En<5	0.776	0.857	0.774	0.735	0.741	0.646
0.55 MFP	.1<En<1	0.847	1.101	0.853	0.728	1.797	1.018
	total	0.927	0.922	0.927	0.915	0.891	0.909
Si	10<En<20	1.096	1.104	1.095	0.888	0.920	1.073
60cm	5<En<10	0.764	0.789	0.755	0.887	0.712	0.607
ρ=1.30	1<En<5	0.976	0.995	0.975	1.069	0.791	0.755
1.1 MFP	.1<En<1	1.163	1.045	1.171	1.170	1.931	1.387
	total	1.058	1.055	1.058	0.961	0.999	1.013
Ti	10<En<20	1.193	1.195	1.154	1.155	1.186	1.207
40 cm	5<En<10	1.006	1.023	0.993	1.008	0.970	0.856
ρ=1.54	1<En<5	1.160	1.154	1.414	1.418	1.377	1.342
0.5 MFP	.1<En<1	1.560	1.562	1.508	1.469	1.408	1.279
	total	1.216	1.216	1.227	1.225	1.232	1.222
Cr	10<En<20	0.993	1.025	1.024	0.972	0.987	1.040
40cm	5<En<10	0.998	1.014	0.998	0.965	1.127	2.171
ρ=3.72	1<En<5	1.080	1.056	1.053	1.236	1.118	0.969
0.7 MFP	.1<En<1	1.131	1.062	1.072	1.069	1.068	0.897
	total	1.041	1.039	1.039	1.049	1.037	1.041
Mn	10<En<20	0.982	0.985	0.936	0.749	0.942	0.955
60cm	5<En<10	1.104	1.085	0.880	0.967	0.982	0.501
ρ=4.37	1<En<5	1.097	1.111	1.116	1.121	1.127	0.685
3.4 MFP	.1<En<1	1.080	1.077	1.088	1.079	1.072	1.135
	total	1.071	1.073	1.068	1.041	1.065	0.985
Co	10<En<20	0.982	0.969	0.959	0.998	0.986	0.997
40cm	5<En<10	0.694	0.667	0.751	0.516	0.529	0.458
ρ=1.94	1<En<5	0.650	0.677	0.670	0.637	0.650	0.658
0.5 MFP	.1<En<1	0.650	0.678	0.707	0.643	0.681	0.606
	total	0.834	0.838	0.839	0.831	0.835	0.827
Cu	10<En<20	1.074	1.165	1.064	1.034	1.127	0.938
60cm	5<En<10	0.993	1.082	0.915	1.263	1.365	0.533
ρ=6.01	1<En<5	0.974	1.050	0.964	1.067	1.133	0.870
4.7 MFP	.1<En<1	1.088	1.060	1.074	1.085	1.094	1.076
	total	1.067	1.068	1.053	1.080	1.107	1.023
Zr	10<En<20	1.149	1.153	0.961	1.129	1.200	1.132
60cm	5<En<10	0.965	0.986	1.374	1.636	1.196	1.644
ρ=2.84	1<En<5	1.087	1.071	1.238	1.545	1.217	1.541
2.0 MFP	.1<En<1	1.245	1.233	1.223	0.998	1.107	0.992
	total	1.165	1.157	1.157	1.209	1.167	1.206
Nb	10<En<20	1.040	1.039	1.051	1.040	1.038	1.056
28cm	5<En<10	0.930	0.954	1.187	1.163	1.110	0.904
ρ=4.39	1<En<5	1.035	1.041	1.035	1.450	1.244	0.996
1.1 MFP	.1<En<1	1.340	1.350	1.256	1.110	1.244	1.304
	total	1.127	1.132	1.115	1.147	1.144	1.114
Mo	10<En<20	0.857	0.859	0.890	0.889	0.894	0.824
60cm	5<En<10	0.835	0.854	0.664	0.809	0.709	0.688
ρ=2.15	1<En<5	0.918	0.921	0.991	1.015	0.993	1.296
1.5 MFP	.1<En<1	0.937	0.933	0.940	0.866	0.928	0.945
	total	0.899	0.900	0.923	0.904	0.922	0.965

W 40cm ρ=4.43 0.8 MFP	10<En<20	0.906	0.908	0.920	0.920	0.920	0.902
	5<En<10	0.604	0.614	0.643	0.656	0.720	0.740
	1<En<5	0.788	0.786	0.876	0.882	0.879	1.106
	.1<En<1	1.003	0.992	0.878	0.869	0.843	0.717
	total	0.901	0.900	0.892	0.891	0.886	0.884

1Be 1nch 1mark 1n1r Vl 1ni 1drt mo mbmdro ysn1l e 1f aci 1RuSp Ed rf yRdrV1r1Be Pbcm1drVuraE1rdctt1n1nf1r traE1ra abP cm1Pbl acfrfn 1l rl 1f ac mi bPy1lrtn h raE 1 1r trxOKT AINSTSrp E yAEraE1rfn 1l rl 1f ac mi bPy1lr trN mcmV aE xOKT AINSTrbmdry N o o 0rbn1rl ch cPbnsrcaray nm1dr yaraEbary N o o 0rEbdrm rcm1Pbl acfrPli 1Pcm1Pbl acfrfn 1l 1l 1f ac msrc1srbPPraE1rcm1Pbl acfrl fbaa1ncmArfn 1l rl 1f ac mrk bl rf ml cd1n1drbl rf macnyy h SrpEd rl E yRdrV1rb d h cnbmarfbyl 1rt mraE1r ddrl Ebe 1rcmraE1rfbPyPba1drN mde 1f any h S

mrrO. . ITrfbPyPbac mt mo nr i 1n1l ach ba1draE1r1Be 1nch 1marVurbV yarT5rz srk E1n1bl raE1r aE1nrdbabrtcPll f yRdren1dcfa1draE1r1Be 1nch 1mark caEcmrbV yarCPrz Sr/ l raE1rdctt1n1nf1r V1ak 11mrO. . ITrbmdr aE1n fbPyPbac nl rh l aRut ymdrcmraE1rle 1f anbrbta1nd cmAP1rf HPdc mr mTrf HPdc ml rbl rl E k mcmr. cAI5sraE1rfbyl 1 t mraEd rdctt1n1nf 1rf yRdrV1rf ml cd1n1drbl raE1rdctt1n1nf1r traE1rEnsTmLn1bf ac mr trO. . ITS

FSo S Ko AZ 0WS K

y 1nfEh bnHd aydura ri bPdba1r1Bd acmAmyfP1bmdbabrtcPllrV1ak 11m PSCrbmdr C2rN 1%rm1yan mr1m1nAuSrpE1rm1k rdbabrtcPllrf yRd en1dcfaraE1r1Be 1nch 1mark 1PPcmrA1m1nbPt mrAcsro nsrN msro yrbmd N S: m/ Ps0csr(nsKVibmdr) srCPITPrz rdd bAn11h 1mark bl rpE1r Rd RVnbncl l srcS1S OKT. Dy IWrbmdr OKT AIBNrd r m aren1dcfaraE1 1Be 1nch 1mart mo nsrN mbmdro yrbn ymdrCPrN 1%rm1yan mr1m1nAuS pEd rh burV1rh bcnRurfbyl 1drVuraE1ren VP1h rcmraE1rddfn1a1 cm1Pbl acfrfn 1l r1 1f ac ml Sr3 k 1i 1nsraE1ren1dcfac mrd rbPh l a l bad tbfa nurcmraE1r aE1nr1m1nAurn1Ac mSrpE1rm1k rRVnbncl l I xOKT AINSTsrxOKT Ar. yl c mrtcPlsrO. . ITrbmdrOKT. Dy I%Wf yRd en1dcfaraE1r1Be 1nch 1mark caEcmrNa rCPrz S

	JENDL-3.2	BMCCS
Cr	707	808
Mn	526	520
Cu	560	456

Table-2 Total elastic cross section values at 14-MeV (mb)

mRO. OROKo O0

nCLry RW00N OWpORsxS SE1dSLrA/ ICTF2IN rECGGNL
nTLr03 Wy/ p/ srp Sr1arbPSUx/ ORWCNCGsrECGGPL
nNLrK/ B/ xWN/ srp Sr1arbPSUxSKyfP1bm0fc1nf1rbmdrp1fEm P AusrNTqCT'srCT2GrECGG2IS
n5Lr8/ 03 o 3 OKo S sr/ Sy Sr1arbPSU OKT AI0ICSPsrW O/ IKT 0ICTZrR1i rTSsrECGG2
n2LrAON N OAsr3 ST Sr1arbPSUW O/ IKT 0ICBPsrECGG2L
nFLr0Z N Wp/ rsB Sr1arbPSUKyfP1bm0fc1nf1rbmdrOmAcm11ncmASrCPFsrT5GrECGGPIS
nBLrp/ B/ 3 / 03 Wr1arbPSUS Bp/ %W KrR1e naro IZNIPTsrECGZNL
nZLrN/ o. / RA/ KOsrRSOSr1arbPSUW O/ IKT 0ICFGsrECGG2IS
nGLrB S 0/ B S srB Sr1arbPSUx/ ORWN rGCICZBsrECGGCIS
CPLrB S 0/ B S srB Sr1arbPSUx/ ORWT babD d1rG5IPTPsrECGG5IS
CCLrB S 0/ B S srB Sr1arbPSUx/ ORWo mtrGFIPP2srECGGFL
CTLry KAIKo 0ICB25CsrECGB2L
CNLr3 S) ORpS KsrRSxSr1arbPSUZ o RAI2P5PPsri HC2srECGB2L
C5Lr3 S) ORpS KsrRSxSr1arbPSUZ o RAI2P5PPsri HC2srECGZFL
C2LrRS 0 Osr8 S SE1dSLr5aErOdcac mr try KAIKo 0ICB25CsrECGGCIS
CFLrN/ KS B 3 WKsr%SKSr1arbPSUW O/ IKT 0IGPrR1i SZsrECGG5L

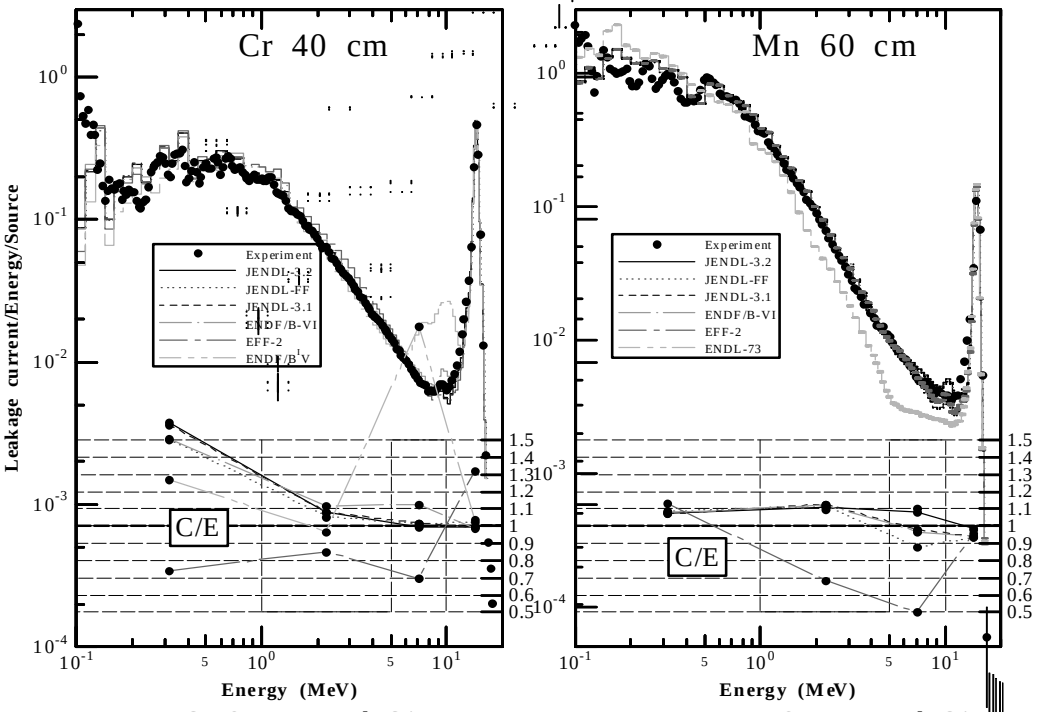

Fig.1 Cr Spectra and C/E

Fig.2 Mn Spectra and C/E

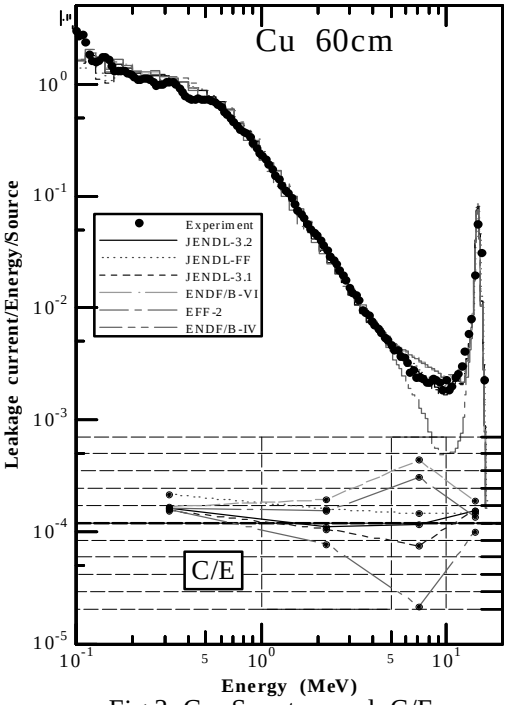

Fig.3 Cu Spectra and C/E

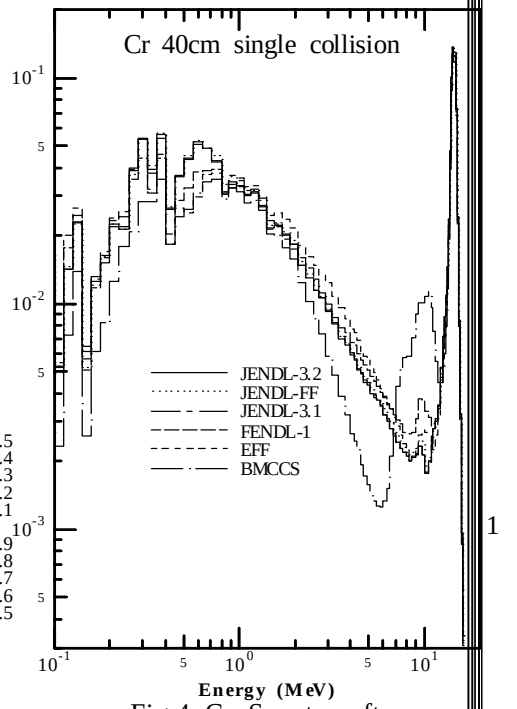

Fig.4 Cr Spectra after single collision

F

B