CHINS: COMPACT HADRON INTENSE NEUTRON SOURCE

CASE STUDY BY:

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OUTLINE

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- [ ] INTRODUCTION
- [ ] OTHER SOURCES
- [ ] OUR ESS ISS
- [ ] NOVEL CONCEPT
- [ ] GREENOSITY
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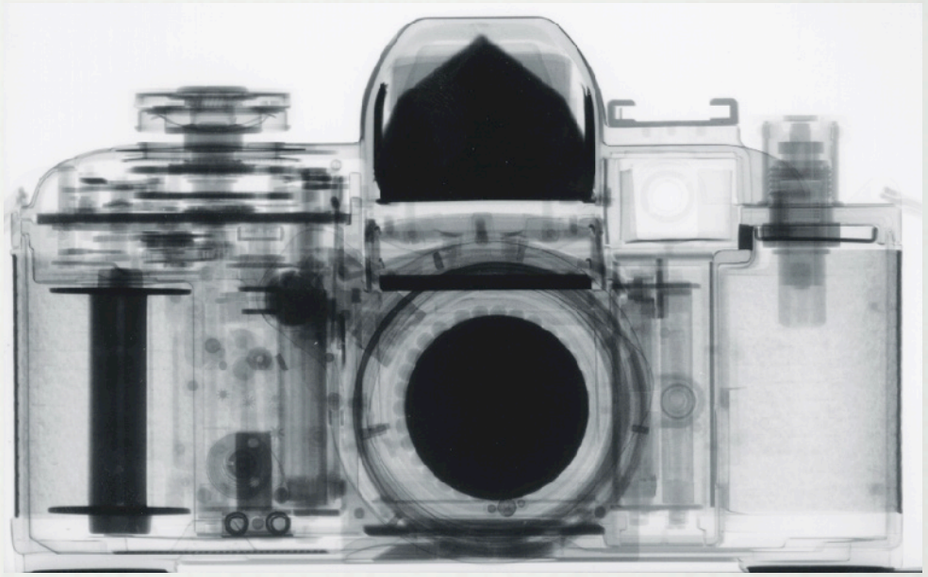
- [ ] LAST SLIDE

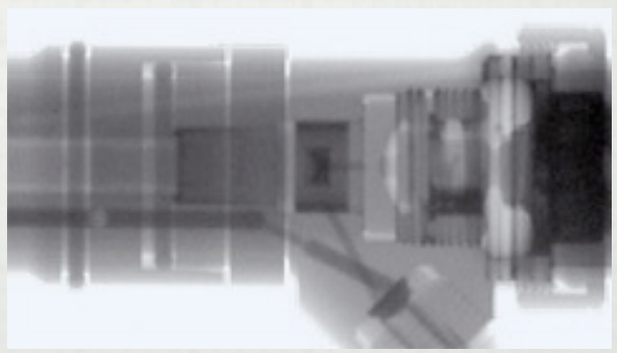
TASK

- [ ] A 2-3 MILLISECOND PULSED POWER PROTON ACCELERATOR
- [ ] 5 MW AVERAGE POWER
- [ ] 10-20 HZ REP RATE
- [ ] 1-8 GEV
- [ ] SMELLS LIKE A LINAC (ESS?)
- [ ] FIND GREENFIELD LOCATION (NOT SOUTHERN SWEDEN) AND WORRY ABOUT THE ENVIRONMENT

INTRO

- ☐ NEUTRONS ARE A BASIC BUILDING BLOCK OF MATTER
- ☐ WEAKLY INTERACTING WITH LIGHT METALS
- ☐ MAKE IT POSSIBLE TO LOOK INTO THE FUNDAMENTALS OF MATERIAL HIDDEN FROM VIEW BY THIN LIGHT METALS
- ☐ EASY DETECTION OF MATERIALS
- ☐ FAST DETECTION OF NUCLEAR MATERIAL



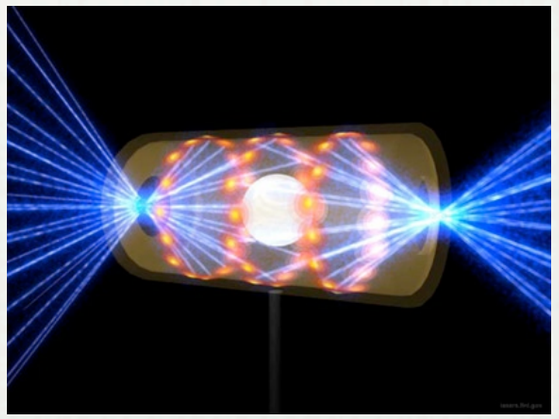


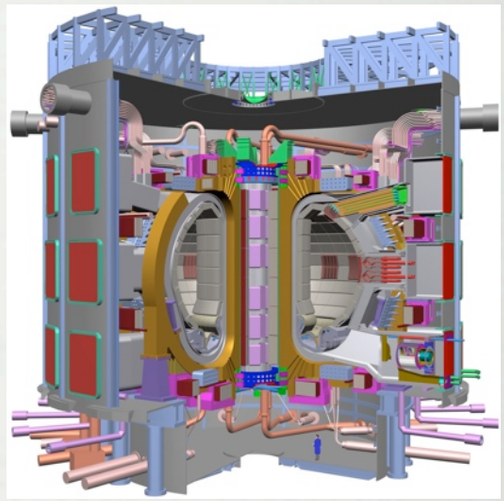
INTRO

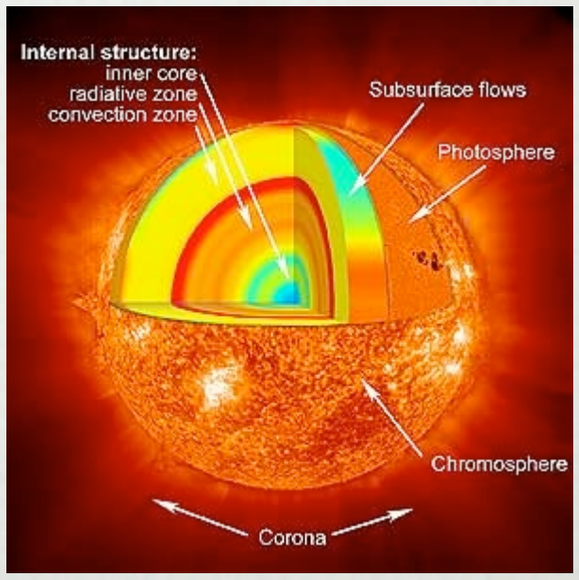
- ☐ NUMBER OF INTENSE NEUTRON SOURCES EXPANDING
- ☐ NEXT GENERATION WILL REQUIRE NEW LEVEL OF INTENSITY (MEANS BACKING ACCELERATORS ARE NEEDED TO INCREASE POWER)
- ☐ MOST SOURCES FIND USE FOR INDUSTRIAL SETTINGS
- ☐ LOCATED AT RESEARCH INSTITUTES

OTHER NEUTRON SOURCES

- [ ] LARGE FISSION REACTORS
- [ ] LARGE FUSION DEVICES (NIF, ITER, AND THE SUN)
- [ ] OUR ACCELERATOR WOULD BE ON THE SAME LEVEL OR LARGER
- [ ] WHAT CONSEQUENCES DOES THIS HAVE ON DESIGN AND COLLABORATION ?

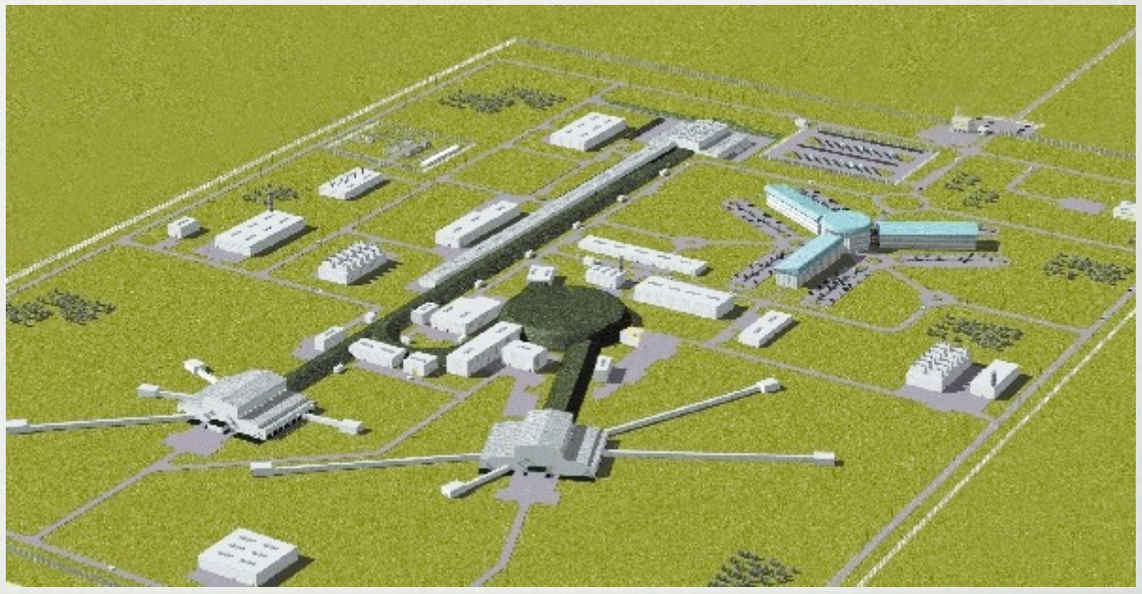






OUR ~~ESS~~ ISS DESIGN: NC+SC LINAC

- ☐ NC FRONT-END: USUAL STUFF (PROTON SOURCE , RFQ, CHOPPER, DTL, PIMS/ SPOKE ?)
- ☐ SWITCH TO SC AROUND 150 MEV
- ☐ STD 2 STAGE RF FREQ - 352 THEN 704 MHZ



OUR ~~ESS~~ ISS DESIGN: NC+SC LINAC

- ☐ BEAM ENERGY: 3 GEV
  AVERAGE BEAM POWER: 5 MW
  PULSE BEAM CURRENT: 30 MILLIAMP
  REP RATE: 20 HZ
  PULSE LENGTH 3 MILLISECONDS
  CAVITY GRADIENT - 40 MV/METER
  LENGTH ~ 400 METER(500-600 WITH UPGRADE)
  AVERAGE RF POWER: 10 MW
  LOADED Q: 1E8
  PULSE RF POWER ~ 60 MW (AVERAGE 9 MW)
  NEED COOLING POWER AS WELL (DIFFICULT TO ESTIMATE)

PLACE ~~ESS~~ ISS

- ☐ ONE SHOULD USE THE DESIGN OF THE ESS...BUT WHERE TO PLACE SUCH A FACILITY (2-3 BILLION EURO IN 25 YEARS)? WHAT ABOUT OTHER ALTERNATIVES...
- ☐ USA (SNS) NO...EUROPE (ESS) NO...JAPAN (NEUTRINO FACTORY, EARTHQUAKE) NO...
- ☐ ONLY CHINA/INDIA WOULD BE PLACES TO PUT IT...PERHAPS OCEANIA BUT FOR WHAT USERS (KANGAROOS?) - AND HOW MUCH MONEY CAN THESE SMALL ECONOMIES HANDLE MONEY...
- ☐ FOR CHINA/INDIA: HIGH POWER MACHINES BRINGS ALONG THE POSSIBILITY FOR EXPORT CONTROL ISSUES...EVEN FOR EUROPEAN COMPANIES!

NOVEL CHINS!

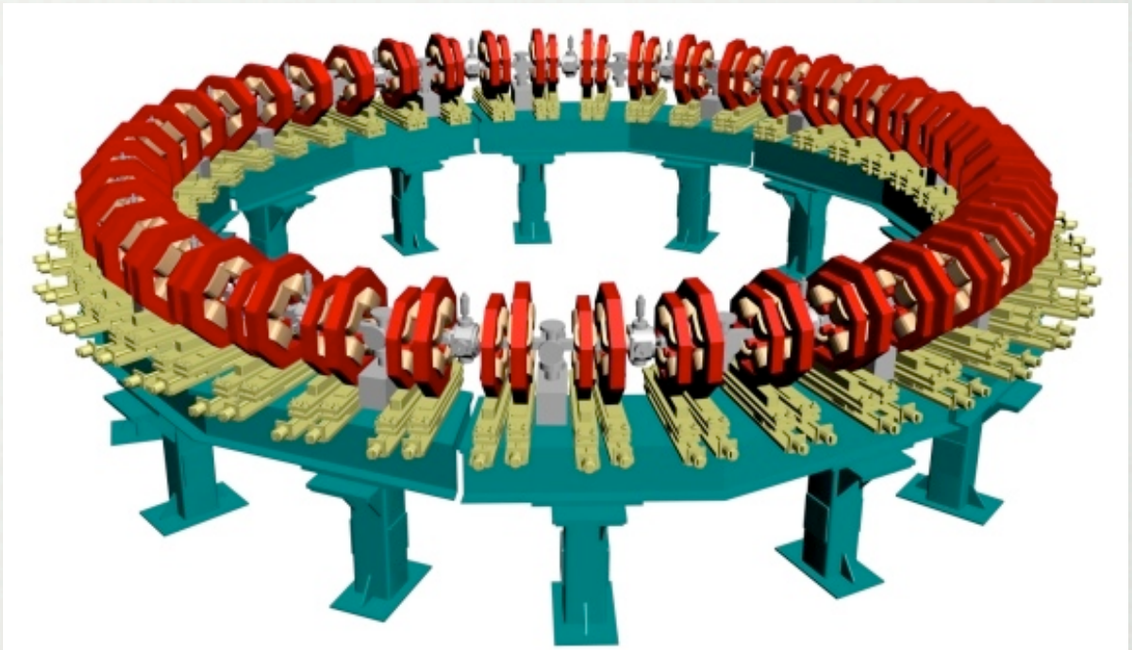
- [ ] INTENSE NEUTRON SOURCE BASED ON A 5 MW INJECTOR NC LINAC -> FFAG COMBINATION
- [ ] COMPACT POWER EFFICIENT DESIGN WITH EYE TOWARDS INDUSTRIALIZATION OF PRODUCT
- [ ] BASE NEEDS SECURITY AND MATERIAL SCIENCE APPLICATIONS - USE AT PORTS FOR HOMELAND SECURITY
- [ ] PLACE IN HIGH TECH AREA WITH SHIPPING AND HIGH SECURITY NEEDS WITH THE RIGHT MIX OF ACADEMIA AND INDUSTRY

NOVEL CHINS!

- USE MULTI-CUSP H- (LANL WITH MANY BACKUP FILAMENTS) SOURCE (100 MILLIAMP DC) EQUIPPED NC LINAC AS AN INPUT TO A NS-FFAG

- NEED BEAM INPUT OF FFAG (~10 METERS) TO BE APPROX. 30 MILLIAMPS NO PROBLEM WITH H- BEAM PAINTING...

- LINAC AND INJECTOR USED ALREADY...ONLY FFAG NEEDS TO BE PROVEN!



EVEN ROOM FOR BEAM DIAGNOSTICS!

NOVEL CHINS!

- ☐ SMALLER BUILDING AND PLUG TO BEAM EFFIC. INCREASE
- ☐ OPERATE 3 MILLISECOND PULSE AT 20 HZ WITH AVERAGE POWER OF 5MW BEAM ON TARGET (~2-3 GEV PROTON BEAM)
- ☐ USE COMPACT SOLID STATE RF POWER GENERATORS USED IN "SPECIALIZED" SETTINGS - TOTAL AVERAGE RF POWER 7 MW (AT LEAST 30% SAVINGS FOR RF POWER ALONE!)

CHINS IN SAN DIEGO?

- ☐ LOCATED AT HIGH DENSITY SHIPPING PORT!
- ☐ SPECIALIZED INDUSTRY (LOCKHEED MARTIN, GENERAL ATOMIC ETC.) ALREADY LOCATED THERE!
- ☐ HYDROELECTRIC POWER AND GREEN ENERGY INITIATIVES HELP TO OFFSET ENVIRONMENTAL COSTS!
- ☐ NICE LOCATION BRINGS IN MORE (NICE) PEOPLE!
- ☐ GREEN FIELD (EXCEPT OUT IN THE DESERT THERE IT IS MOSTLY BROWN)!
- ☐ MEXICO IS VERY CHEAP!

ENERGY SAVINGS

- ☐ RF POWER GENERATION SMALLISH AND EFFICIENT!
- ☐ WIND FARMS, TIDAL AND SOLAR PLANTS (WORK WELL IN COASTAL SUNNY SOUTHERN CALIFORNIA) OFFSET TOTAL GREENHOUSE EMISSION!
- ☐ SMALLER SC PART SO COOLING IS REDUCED!
- ☐ SMALL BUILDING AND SMART USE OF COOLING AND HEATING CREATE GREEN BUILDING!
- ☐ "ORGANIC OUTSOURCING" - COMPONENTS LOCAL = LESS SHIPPING COSTS!

PRIVATE PARTNERSHIP

- [ ] SMALL DESIGN COULD BE TRANSFERRED TO INDUSTRY AS A NEW PORT SECURITY APPARATUS - LOCAL SUPPORT FOR INCREASE OF ECONOMY!

- [ ] MAKE USE OF MASSIVE CONCENTRATION OF HIGH POWER RF FIRMS AS WELL AS ACCELERATOR COMPANIES AND LARGE POPULATION OF HIGHLY SKILLED WORKFORCE - HIGHER GOV. INCOME FROM INCREASED TAXES!

- [ ] DARPA (RF POWER GAIN), DOE, HOMELAND SECURITY, AND CA STATE GREEN ENERGY GRANTS BRINGS TOTAL COST DOWN - BRING IN EXTERNAL MONEY!

WHERE TO GET MONEY

- ☐ COULD KEEP COST UNDER A BILLION (OR IF SMALL DESIGN DOESN'T WORK SEVERAL BILLION)

- ☐ IF DESIGN WORKS REVENUE NEUTRAL OR EVEN MAKE MONEY!!! (LICENSE FEES)...HIGH THROUGHPUT OF "SAMPLES"

- ☐ A LOT FOR SCIENTIFIC RESEARCH IN CURRENT CLIMATE...NOT MUCH FOR SECURITY USES

- ☐ IF BUDGET IS CUT, NEW NAME "SHAVED CHINS"

CONCLUSION

- [ ] A LARGE STEP FOR MANKIND TOWARDS GREEN AND AFFORDABLE NEUTRONS

THANKS FOR YOUR ATTENTION !