

# NCSP Technical Briefing

## CEF Abilities for Meeting Epithermal Energy Neutron Data Needs

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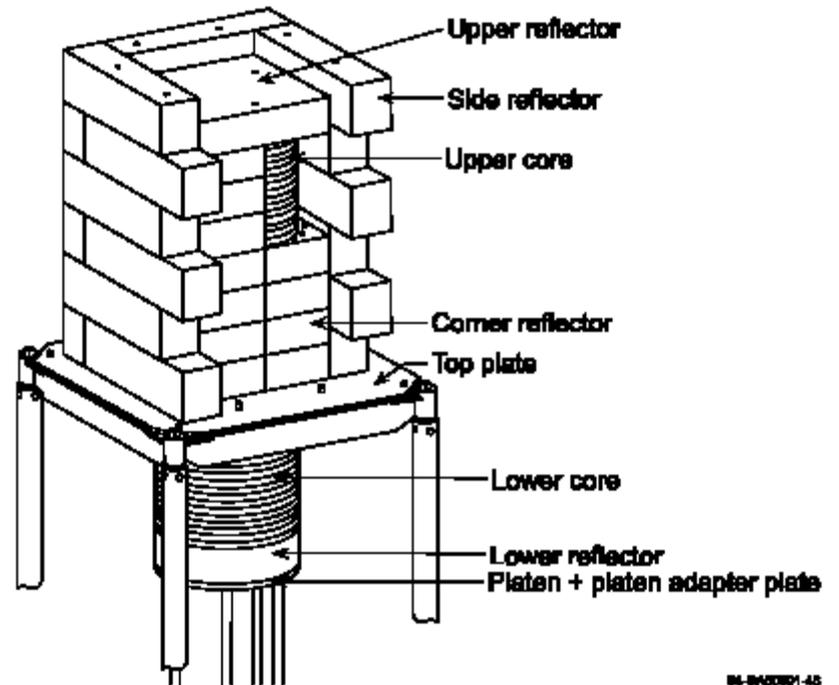
# Characteristics of Intermediate Energy Systems

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- Most neutron interactions in the system are induced by neutrons with energies ranging from 100 eV to 100 keV.
- The system contains a moderate Z non-fissile moderator such as carbon, silicon, or iron.
- These systems are typically in the neighborhood of the maximum critical mass, and hence large.

# ZEUS Series of Experiments performed on the COMET machine

- A subset of the planned ZEUS Experiments were performed at TA-18 In Los Alamos before its closure.



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# The Purpose of the ZEUS Series of Experiments

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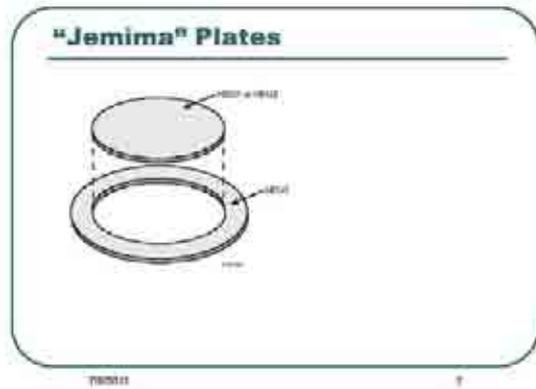
- **The ZEUS series of experiments is intended to provide nuclear criticality benchmarks for a wide variety of fissile and non-fissile materials in an intermediate neutron energy spectrum.**
- **Why an intermediate neutron energy spectrum?**  
**Interest in intermediate neutron energy spectrum systems has grown in recent years due to new and unusual situations in which fissile materials are encountered and handled.**

## Basic ZEUS Configuration

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- **The core consists of a 21 inch diameter cylinder.**
  - **Uranium and non-fissile interstitial material**
- **The reflector has a 21.106 inch inner diameter cavity for the core, 34.76 inch square outside.**
  - **The reflector consists of approximately 14000 lbs of copper**
- **Approximately half of the core resides in the upper half of the reflector, while the other portion rests on a bottom movable platen.**
  - **Excess reactivity of the system is controlled by separation, core loading, or use of positive stops**

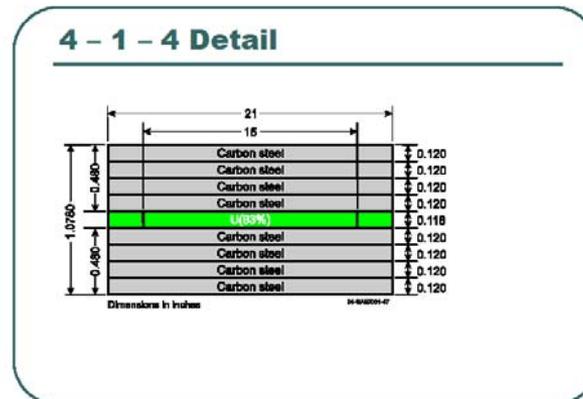
# Jemima Plates Used For ZEUS Experiments available at CEF



▪ ZEUS Experiment plan documentation currently approved to perform experiment on COMET



- HEU metal
- Outer Ring OD 21 inches
- Plate OD 15 inches
- Total mass per pair about 12.5 kg



▪ Diluent Plates  
Currently stored in  
CEF warehouse

# ZPPR Materials To Be Transferred To Nevada for Use at CEF

| Description        | Dimensions (inches) |
|--------------------|---------------------|
| ~98%Pu/1%Al        | 2x $\frac{1}{8}$ x1 |
| ~98%Pu/1%Al        | 2x $\frac{1}{8}$ x2 |
| ~98%Pu/1%Al        | 2x $\frac{1}{8}$ x3 |
| ~97%Pu/1%Al/~3%Ni  | 2x $\frac{1}{8}$ x1 |
| ~97%Pu/1%Al/~3%Ni  | 2x $\frac{1}{8}$ x2 |
| ~97%Pu/1%Al/~3%Ni  | 2x $\frac{1}{8}$ x3 |
| ~28%Pu/69%DU/~3%Mo | 2x $\frac{1}{2}$ x1 |
| ~28%Pu/69%DU/~3%Mo | 2x $\frac{1}{2}$ x4 |
| ~28%Pu/69%DU/~3%Mo | 2x $\frac{1}{2}$ x5 |
| ~28%Pu/69%DU/~3%Mo | 2x $\frac{1}{2}$ x6 |
| ~28%Pu/69%DU/~3%Mo | 2x $\frac{1}{2}$ x7 |
| ~28%Pu/69%DU/~3%Mo | 2x $\frac{1}{2}$ x8 |

| Material Type    | Approximate Weight (pounds) | Approximate Volume (cubic feet) |
|------------------|-----------------------------|---------------------------------|
| Aluminum         | 7,170                       | 42.5                            |
| Beryllium        | 3,660                       | 31.7                            |
| Boron carbide    | 6,350                       | 40.4                            |
| Gadolinium       | 30.0                        | 0.0608                          |
| Graphite         | 4,040                       | 29.0                            |
| Molybdenum       | 908                         | 1.42                            |
| Nichrome (NICR)  | 7,720                       | 5.19                            |
| Nickel           | 24,500                      | 44.0                            |
| Niobium          | 217                         | 0.406                           |
| Rhenium          | 159                         | 0.121                           |
| Sodium carbonate | 11,500                      | 72.8                            |
| Tantalum         | 4,470                       | 4.30                            |
| Thorium          | 5,980                       | 8.13                            |
| Tungsten         | 4,390                       | 3.65                            |
| Vanadium         | 52.7                        | 0.14                            |
| Zirconium        | 1,690                       | 4.06                            |

- U-233 ZPPR Plates To be shipped from ORNL

| Material Type   | Approximate Weight (pounds) | Approximate Volume (cubic feet) |
|-----------------|-----------------------------|---------------------------------|
| Lithium         | 11.9                        | 0.35                            |
| Lithium hydride | 550                         | 10.7                            |
| Sodium          | 16,500                      | 273                             |

## Current ZPPR Material Availability Schedule

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**Another warehouse will most likely need to be stood up for CEF to store all the diluent materials.**

**U-233 ZPPR plates to be shipped in FY 2013 and FY 2014**

**Pu and MOX ZPPR plates to be shipped in FY2015 and FY2016**

**Note: Schedule not “set in stone”, can accommodate changes if required to support a specific experimental need using the CEdT process.**

# Special Diagnostic Needs to support the Benchmarking Process for Intermediate Energy systems?

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- **CEF is currently soliciting input from the data needs community on this Topic.**
- **Input can be sent to:**
- **Bill Myers....[bmyers@lanl.gov](mailto:bmyers@lanl.gov)**