



RACE Plus – A Proposal

ADSS/IAC

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Proposed experimental program -general

- **Multi-phase, as was TRADE**
- **Low power (1 kW) phase**
 - Direct comparison to TRADE Phase I (now christened RACET) with DT neutron generators
 - RACET must be completed by end of 2005
 - Low power RACE consists mostly of PNS, but also could study the effect of asymmetric injection
 - Requires new instrumentation, chambers, etc.



Proposed Experimental Program - general (2)

- **High power (25-30 kW) phase**
 - Core characterization (MSA/MSM)
 - Core characterization (fission chamber traverses)
 - *Requires pierced fuel element and miniature fc*
 - Core characterization (spectral)
 - *Requires foils, piccolo-micromegas*
 - Reactivity measures (PNS)



Proposed Experimental Program - general (3)

- Reactivity monitoring (I/P)
 - *Requires power monitoring chambers*
- Absorber oscillations (with feedback)
- Startup/shutdown scenarios (with feedback)
- Asymmetric injection

Low power phase

- **Find 3 sub-critical configurations (-500, -3000, -5000 pcm) via MSA/MSM, establishing reference reactivity via rod-drop**
 - Taking advantage of Casaccia experience, plan on about 3 weeks to a month – this is a very crucial measurement
 - It will require 4-6 fission chambers (0.01 cps/nv)
- **In each configuration, perform PNS measures at varying frequency**
- **In each configuration, look at asymmetric injection**
 - Compare to Cf source importance



Low power phase (2)

- **Plan on several months of operation in the low power phase, after the core characterization**
 - Minimum of 1 week per configuration
 - 3 sub-critical levels, 2-3 source positions -> 9 weeks
 - (not 100% duty factor however !)
- **This would be a good time to perform feedback transients at critical as required for code validation**
- **Data from this phase could be available towards end of 2005**



High power phase

- **Core characterization (MSA/MSM)**
 - Required to repeat this phase assuming the core configuration must change to accommodate the higher power accelerator/target system
 - RACE could utilize the Casaccia chambers if ENEA agreed
- **Core characterization (fc traverses)**
 - Requires 4 mm fc and a special TRIGA fuel element
 - Likewise RACE could utilize ENEA and CEA equipment if the parties agree
 - Plan on one week per configuration (9 weeks)



High power phase (2)

- **Core characterization (spectral)**
 - Foil irradiation via fast rabbit system (CNRS involvement is not determined yet)
 - Active dosimetry via special chambers (e.g., piccolo-micromegas)
 - Plan on 1 week per configuration (9 weeks)



High power phase (3)

- **Reactivity measures (PNS)**
 - Essentially same as low power phase (9 weeks)
- **Reactivity monitoring (I/P)**
 - Most likely will need maximum frequency long term operation (multiple hours per day)
 - Assume it is done as a subset of above for each configuration
 - Power monitoring chambers are needed
- **Absorber oscillations**
 - To study relation $\delta P = \delta I + \delta \rho$
 - About 1 week per configuration (6-9 weeks)



High power phase (4)

- **Startup/shutdown scenarios**
 - Approach to power at maximum reactivity, approach to reactivity at maximum power, speed of approaches, etc.
 - Need for control rods assessed, as well as role of feedback during approach to power
 - At least 1 week per configuration (9 weeks)
- **Asymmetric injection**
 - Covered in the above time estimates as a “configuration”



High power phase (5)

- **Feedback effects**
 - Feedback will play a role starting from 1-10 kW
 - The effects will be seen in all measures at power
 - *PNS*
 - *I/P*
 - *Startup/shutdown*
 - So, a major part of the experimental program will be to determine the effect of feedback on the above modes of operation/monitoring
 - Automatically investigated in startup/shutdown, vary the power in the other modes



Total experiment time in weeks

- **Low power phase (13 weeks over 1 year)**
 - MSA 4
 - PNS 9
- **High power phase (49 weeks over 2-3 years)**
 - MSA 4
 - FC traverses 9
 - Spectral 9
 - PNS 9
 - Oscillator 9
 - Startup/shutdown 9
- **(maybe 50% duty factor)**



Potential European contributions (experiments only)

- **Loan of fission chambers and special fuel element (ENEA)**
- **Loan of miniature (4 mm) fission chambers (CEA)**
- **Loan of data acquisition equipment (CEA)**
- **Effort in the area of data acquisition and interpretation (ENEA, CEA etc.)**
- **Direct support (effort) to experimentation (CEA, ENEA, etc.)**