Project Improvement:
“A unified developer's version”

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Merging of closures

- NIMROD has had closures in the nimdevel version for a long time
  - Has lead to considerable difficulty to maintain/merge
  - Initial attempts at clean separation of integral closures/hot particles was done, but not completely
  - Introduction of KPRAD introduces even more difficulties because of changes in definitions of meanings of *rho* in momentum equation.
- Over the past year, development has all been in branches and no unified approach was used

Goals of Recent Coding Camp and Subsequent Development

- Unify various and sundry branches of NIMROD loosely associated with “developer's version”.
- Develop programming techniques for adding hot particles, impurity species, integral closures etc ... into NIMROD that decouples two fluid and closure calculations as much as possible.
- Improve method by which *nimdevel* is synced with *nimuw*.
- Release new version that incorporates all of the new physics, is stable, …

nimdevel-nimpsi merge.

- Kruger and Kim merge existing *nimdevel* with *nimlite*, scaled down and reorganized version o NIMROD.
- Attempt to leverage more F90 objectness
- Improve compartmentalization of derived datatypes and associated operations
- ease compilation by reducing redundant or unnecessary dependencies

nimdevel-(nimrod+kprad) merge

- Added ion (*nion*) and impurity (*nimp*) density and heat source terms to integrands routines.
- Wrote adv_kprad.f which contains 2D and 3D advance routines for *nion* and *nimp*.
- Incorporated mass densities, *rho, rho_sym, rho_tot,* which are computed in rho_from_mn field_comps.f routine into **V** integrand routines.
- Added main program nimrod_kprad.f which controls impurity physics.

Development of closures.f module.

- Heat flow computation and addition of heat sources put in tirhs_close and terhs_close.

```
      CALL tirhs_close(ncx,ncy,inode,rb,tb,grad_ti,
     $                 heat_source,heat_flux)
```

- Stress computations and addition of hot particle tensor put in vrhs_close.

```
      CALL vrhs_close(ncx,ncy,inode,bigr,rb,tb,piten)
```

nimdevel-nimuw merge

- nimuw maintained at UW in a CVS repository
- Procedure for merging:
  - Carl syncs CVS repo to nimrodteam.org
  - CVS repo converted to svn repo (available for checkout separately from nimdevel branch)
  - Python script converts it to “nimdevel” format (different directory structure, file names, etc.)
  - Merge

Recent additions to nimdevel from nimuw

- Adoption of *nimuw*'s centering of n, **B**, and T at **V**'s time step for diagnostic calculations.
- Solver improvements including bug fix in seaming
- …

Successful tests of *nimdevel*.

- *nimdevel* successfully does

  (1) Carl's JCP anisotropic heat conduction test,
  (2) sound wave damping due to ion stress,
  (3) linear tearing modes from '83 Holmes pape
  (4) kink mode benchmark & RFP tearing mode
  (5) Val's KPRAD calculations
  (6) others ...

Next coding camp

- Currently discussing having a coding camp devoted to improving regression tests
  - Improve coverage of cases
  - Teach developer's how to use and modify
  - Come up with documentation standard
- Timing?
  - Possibly May, or in conjunction with summer NIMROD meeting

Other possible improvement

- Kruger currently has WebEx account for unlimited “Web Conferencing”
- This allows desktop sharing, presentations, and whiteboarding, but not videoconferencing
- Audio can be separate, but has advantages for large groups if used
- Have tested and works well.