# Possible Future Strategies for the Code Repository

& other stuff

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# The NuMI-X Effort

- One Beamline - Many Experiments
  - MINOS (+): steel & plastic scintillator sandwich (Near + Far)
  - MiniBooNE: liquid scintillator, off-axis
  - ArgoNeuT: small liquid Ar TPC
  - Minerva: fine grained calorimeter w/ variety of nuclear targets
  - NOvA: large segmented liquid scintillator (off-axis Near + Far)
  - other soon to exist experiments (e.g. off-axis microBooNE)
- The Problem
  - lots of duplicative work was going on concerning the beam
  - people were often confused about the state of our knowledge
  - different experiments put different constraints on the beam
    - needed a means to share data prior to full public release
- Goal: Get all the NuMI experiments "on board" to work on
  - Beam Simulation
  - Beam Analysis (including hadron production studies)

# NuMI Simulation Effort

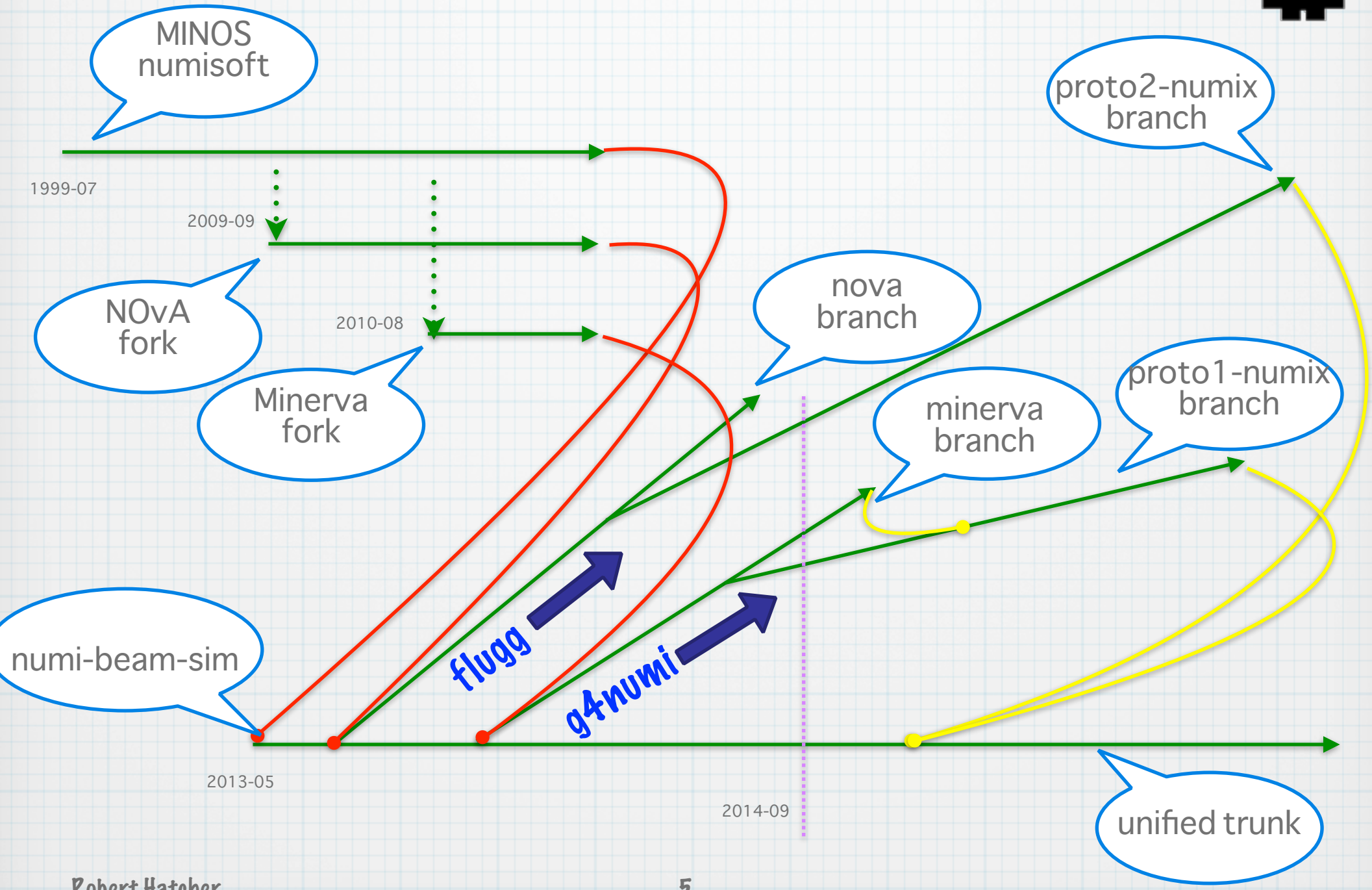
- g4numi_flugg = fluka physics + G4 geometry + flugg "glue"
  - all (recent) MINOS and NOvA analyses to date have used flugg
    - historically it seemed to better represent what was seen in data when used "out of the box"
  - but it is "problematic" code
    - a bit of a black box & persnickety about input specification
    - can be frustrating to get a coherent stable build w/ our own code
- g4numi = pure Geant4
  - primarily used by Minerva for actual expt simulation/analysis
    - interesting new development work being done here
  - more choices of physics models: FTFP_BERT, NuBeam …
  - local experts/development of G4
    - G4 plans for more hooks for tweaking models

# Ongoing NuMI-X Efforts

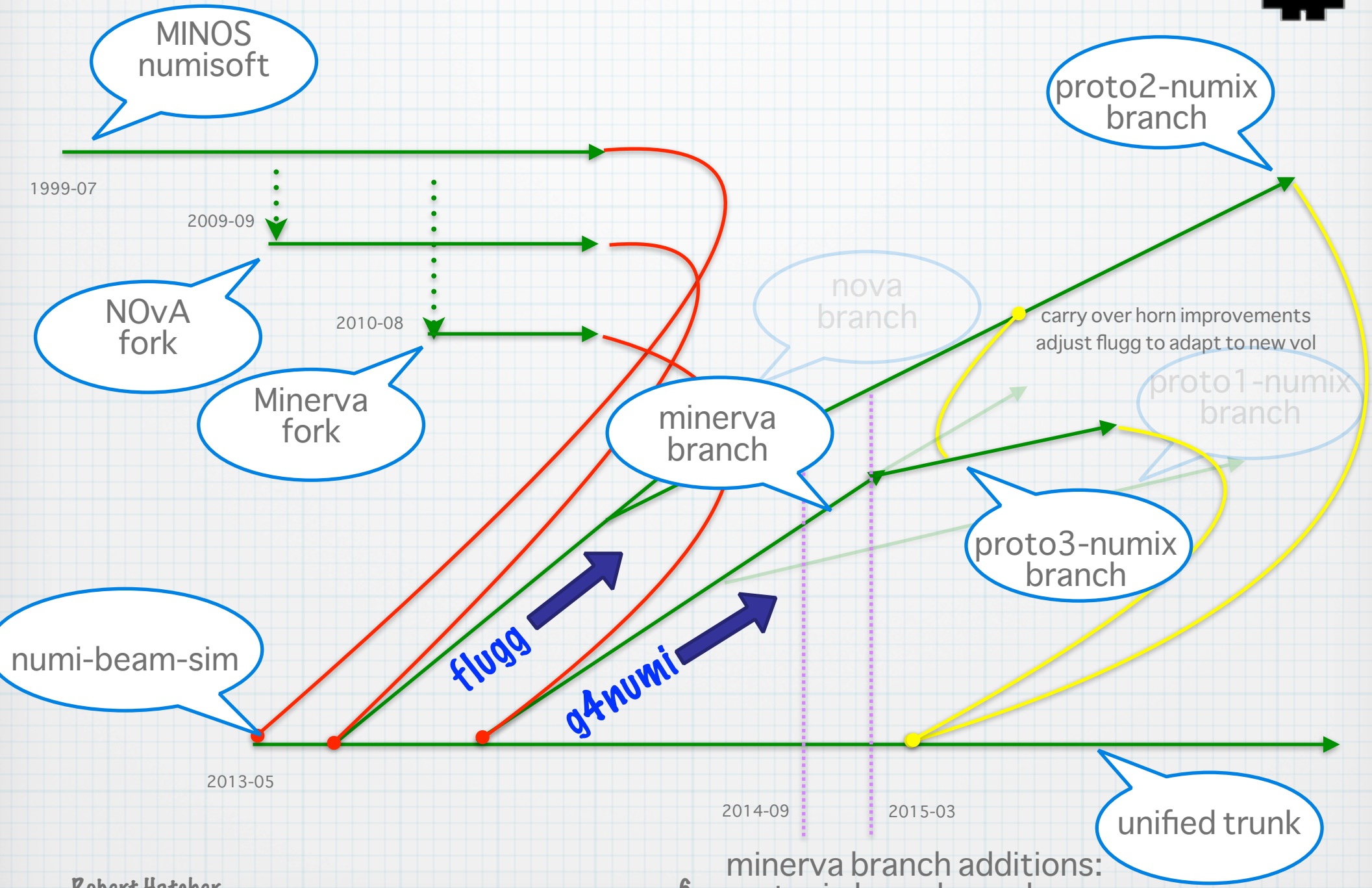
- Unifying disparate code bases
  - baby steps taken … still work to be done
  - `g4numi` and `g4numi_flugg` should use the same geometry
    - — but, sadly, they currently don't
- Unifying the output format — Dk2Nu
  - more structured; standardized naming conventions; flexibility for storing pre-calculated detector location energies and weights
  - carry on Minerva's addition of recording full ancestry
  - non-NuMI specific; LBNE & Booster adoption in progress
- Unifying tools for analysis — FluxReader
  - fast analysis of Dk2Nu files; plotting, × GENIE x-sec, etc
- Studying effects of hadron production models
- Working on more sensible scripts and instructions for building and running the codes
- Working on standardization of file naming + file sharing amongst the experiments

# NuMI-X Code Base

Plans circa 2014-10



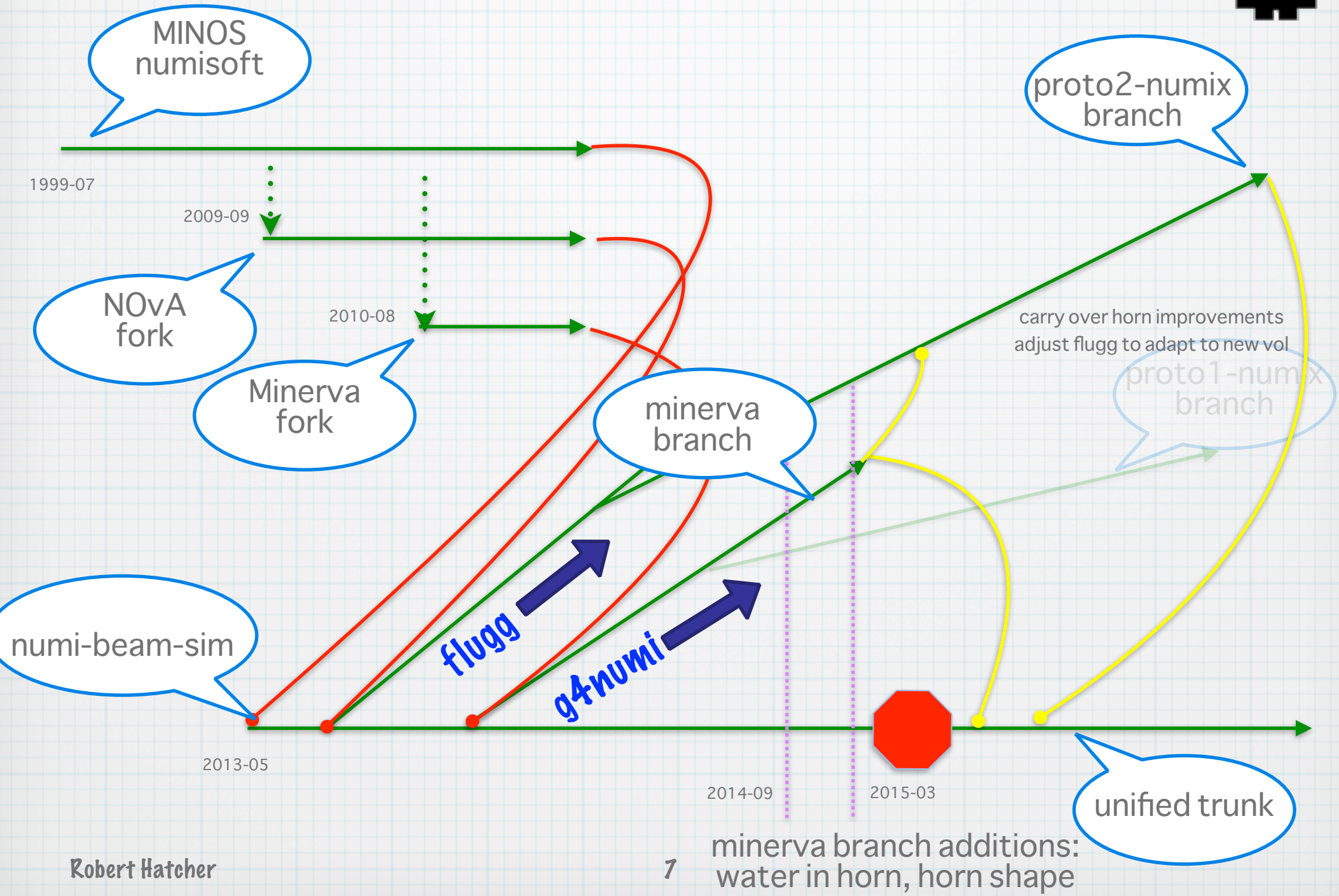
# NuMI-X Code Base Plans circa 2015-03




minerva branch additions:
water in horn, horn shape

# NuMI-X Code Base

Radical Alternative Plan



# New flugg Plans:

- Migrate horn shape & horn water changes
  - adapt flugg setup to handle new volumes
  - deal w/ lack of G4UI for configuring
- New tag: “crow” (alphabetical birds)
- Validation and comparison w/ & w/out additions
- Extraction of ancestor history
  - possible candidate for work to appear “soon”
  - initiating contact w/ T2K who have managed to do so

# Either of New g4numi Plans:

- Need documentation in NuMI-X wiki
  - how to build the code
  - how to run the code (both “le” and “mn” era)
- Generalization of driving script to work for all NuMI-X users
  - look for “minerva” specific issues
- Standardized central builds for “reference” versions
- Tagging scheme (mammals? insects?); regular tags

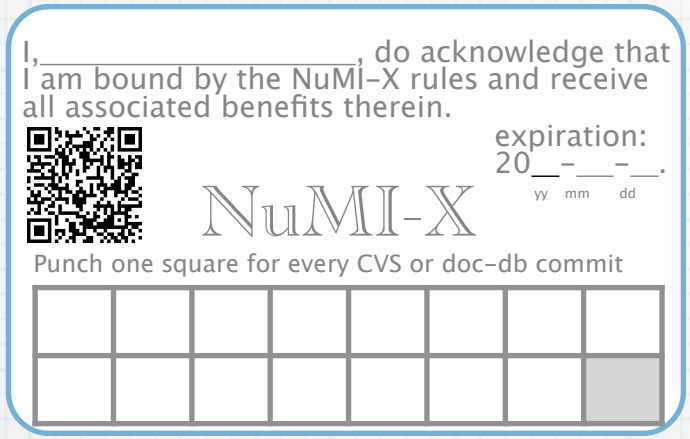
# Common Plans:

- Continue migration to universal “dk2nu” output
- Continue to work towards standardized file names
- Data Storage solution for common files visible to all
  - dCache is available to NuMI-X
    - but details for use need to be shared/documented
    - policy of which are what files are “common”
      - remember: file names must be unique
      - personally I think we could do with more sharing
        - but need to not be a chaotic dumping ground
  - need effort on cataloguing and metadata
    - recent small setback of long delayed SAM system for us

Questions?

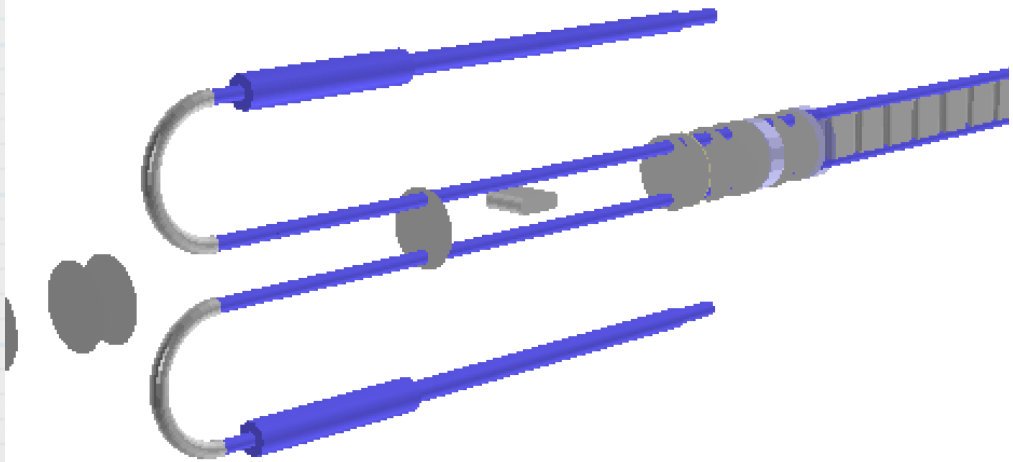
# Sign up now!

- .
  - Be a NuMI-X member!
  - Once you've signed off on the rules print out this card and put it in your wallet:

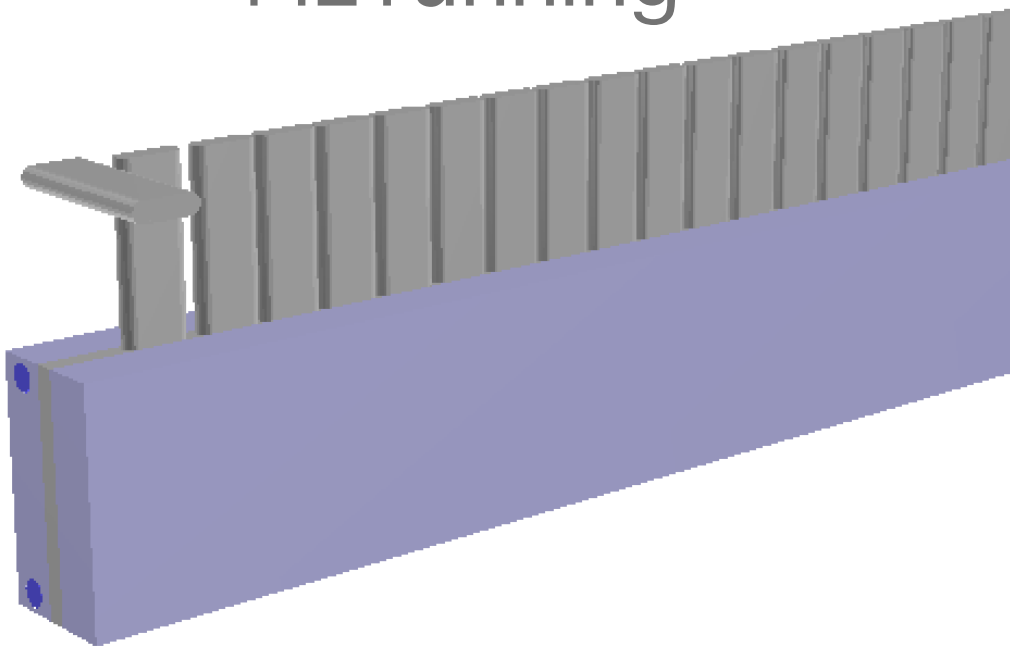


# Targets

MINOS-era
mostly LE running



NOvA-era
ME running



# NuMI-X flugg scripts

- https://cdcvs.fnal.gov/redmine/projects/numi-beam-sim/wiki/How_to_build_the_FLUGG_code
- Standardized script to build g4numi_flugg
  - avoid confusion about the build which requires copying “le” or “me” version of files into place before building
  - build now records information about how it was built (fluka, flugg, geant4 versions, scripted modifications)
- Standardized script to run g4numi_flugg
  - command line switches for:
    - horn current (+ target position for MINOS-era target)
      - default linear model, optional exponential w/ user specified skin depth
    - beam spot size (x & y) and position on target
    - “peanut”, “lowth”, “stepl” (“stepm”)
    - option for target files (not by default), generating dk2nu files (default)
  - found in g4numi_flugg/scripts
- Standardized script managing files that come back from grid
    - weed out failed runs (about 2%)
    - make single directory of root (h10, dk2nu) files
    - reap_the_whirlwind.sh

```
$ flugg_scripts/create_flugg_version.sh -h

create_flugg_version.sh -b BASEPATH -n NAME -e ERA -t NUMITAG -f FLUGGVER

Create a g4numi_flugg release by fetching FLUGG, and checking out
g4numi, g4numi_flugg from the repository, configuring the code (including
necessary selection/editing of files), and building the executable.

   -h | --help                 print this message and quite
   -v                          increase verbosity
   -b | --basepath  BASEPATH   base installation
                               [/minos/app/user/rhatcher/g4numi_flugg_build]
   -n | --vername   VERNAME    version name under base [myversion]
                               will have '_le' or '_mn' appended
   -e | --era       ERA        minos / nova era (ie. le or mn beam) [minos]
   -d | --detloc    DETLOC     detector location ( "minos" or "nova" )
                               for h10 style ntuple
   -t | --numitag   NUMITAG    cvs tag for numi-x cvs checkout [proto2-numix]
   -r | --remake               allow "remake"
                               (no checkout, no refetch of flugg tarball)
   -2 | --cout2cerr=true|false convert NuMI code use of G4cout to G4cerr
                               FLUGG mashes lots of things into g4numi001.log
                               that overwrite each other, losing output
                               attempt to alleviate that [false]
   -g | --gcc       WHICH_GCC  setup what gcc [v3_4_3]
   -f | --fluggver  FLUGGVER   flugg version to fetch [2009_3]
                               e.g. 2009_3 or 2009_4
   -F | --flukapro  FLUPRO     fluka installation path
                               [/grid/fermiapp/nusoft/products/prd/fluka/fluka2011.2b.6/gcc_3_4_3_g77]
                               special cases: see below
   -G | --g4install G4INSTALL  geant4 installation
                               [/grid/fermiapp/nusoft/products/prd/geant4/4.9.3/Linux+2.6-GCC_3_4]
   -C | --clhep     CLHEPDIR   CLHEP installation
                               [/grid/fermiapp/nusoft/products/prd/clhep/2.0.3.2/Linux32bit+2.6]
   -H | --cernlib   CERNLIB    CERNLIB installation (for ascii2hbook_beam)
                               [/grid/fermiapp/minos/products/prd/cern/2004/Linux-2-6/lib/]

--flukapro=2008_3d = /grid/fermiapp/nusoft/products/prd/fluka/2008.3d/Linux+2.6-GCC_3_4
--flukapro=2011_2b = /grid/fermiapp/nusoft/products/prd/fluka/fluka2011.2b.6/gcc_3_4_3_g77
```

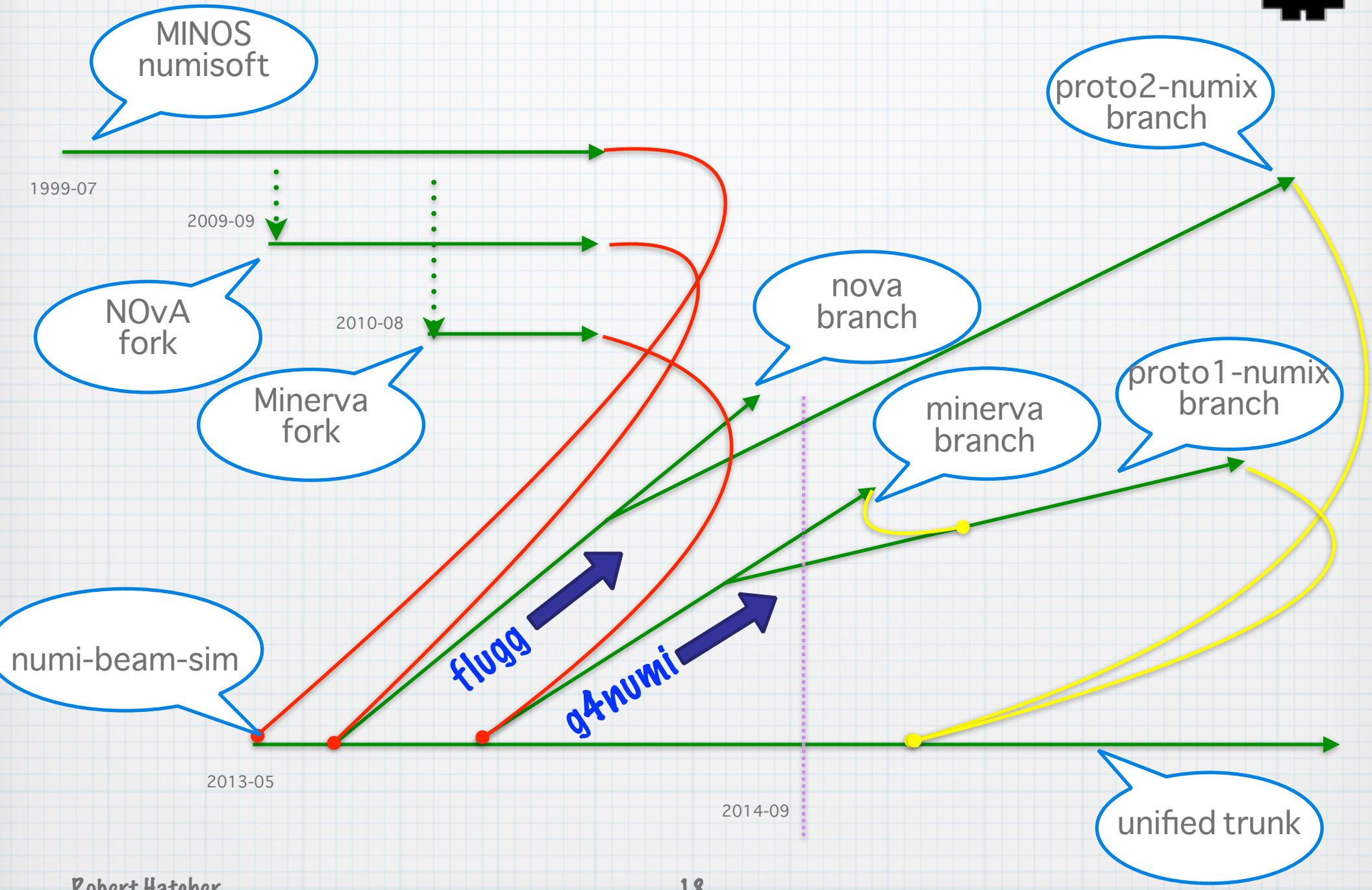
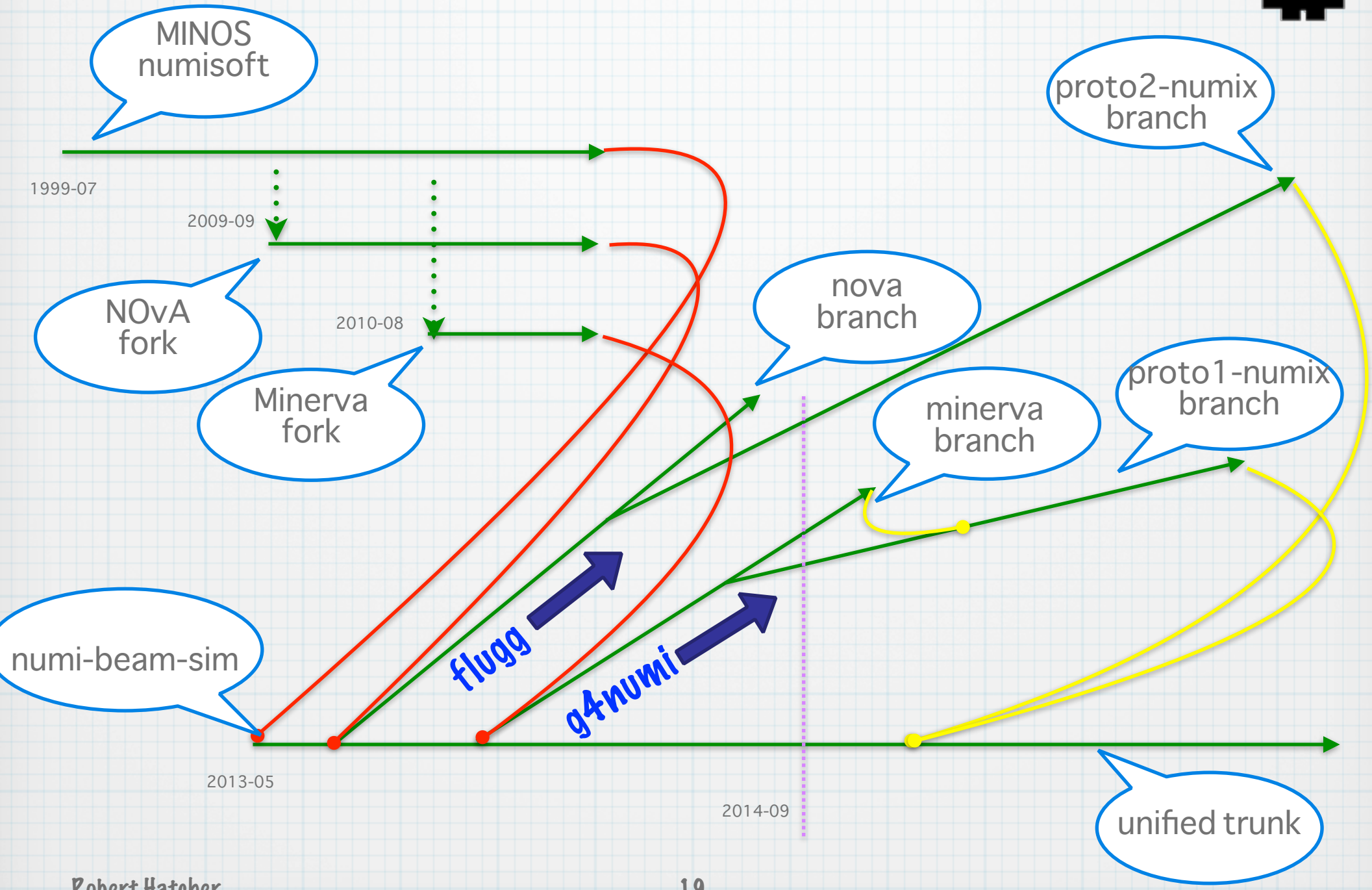
```
run_flugg_grid.sh -p RUNPERIOD -j JOB -e EVTS [ -F FLUGGINSTALL ]
      [-o OUTPATH] [ --fakeinfo "FAKEINFO" ]
Run a FLUGG job, copy files back
   -p | --period=RUNPERIOD    run period (e.g. 3,  nova=11 ...) [11]
   -j | --job=JOBNUMBASE      first job # [0=0+(unset)]
                              if on cluster JOB # = JOBNUMBASE + PROCESS
   -r | --run=JOBNUMBASE      synonym for job
   -e | --events=EVTS         # events (protons-on-target) [500000]
   -i | --horncur=CURRENT     horn current [200]
   -z | --targetz=TARGETZ     target pull-back [0]
   -s | --stepl=STEPL         max step length (needs 3 char w/ decimal point)
                              [1.0]
   -S | --stepm=STEPM         min step (>0) or boundary uncertainty (<0) (cm)
                              [-0.005]
   -b | --beamspot=BSSIGMA    beam spot sigma (mm) currently NOvA-era ONLY
                              1 or 2 values ala:  "1.3" or "1.3x1.1"
   -B | --beampos=BSPOT       beam spot position (mm) use "<x>,<y>[,<z>]"
                              z optional; default = 0,0,-6000
   -T | --targfile=true|false enable target file production [false]
   -l | --lowth=true|false    enable low threshold [true]
   -P | --peanut=true|false   enable PEANUT for all energies [true]
   -u | --unique=UNIQUENESS   string to make file unique [""]
        --special=SPECIAL     "" or _airhrn _fins78 _fins6789 _mipp _mudecay
                              [""]
   -t | --test                run wrapper as test, but don't invoke subscript
        --hbook               generate hbook .ntp file [false]
        --keepdat             keep g4numi001_flux.dat file [false]
   -A | --altrfluka[=false]   turn on/off alt "rfluka" that better merges
                              sys-err into sys-out [true]
                              (still might be mangled, but early output
                              should no longer get completely lost)
   -D | --dk2nu[=false]       copy/convert file into dk2nu format
                              use "version%qualifiers"
                              [v01_01_02%e5:debug]  true=v01_01_02%e5:debug
   -F | -f | --flugg=FLUGGINSTALL  where FLUGGINSTALL installed,
                              should have subdir {bin|lib}/Linux-g++
                              if not given, 2-3 dir up + FLUGG from this script  []
   -o | --output=OUTPATH      top of hierarchy where output will go
                    [/minos/data/condor-tmp/rhatcher/FLUGG]
   -R | --rootsys=ROOTSYS     where ROOT is installed
                    [/grid/fermiapp/minos/products/prd/MINOS_ROOT/Linux2.4-GCC_3_4/v5-28-00]
        --skindepth=0.77      use exponential horn skin depth of 0.77cm
                              [""] ""=use linear model
```

# NuMI “blackbird”

- Named tags of flugg-based NuMI simulation: birds
  - alphabetical ordering, this one “numix-blackbird”
  - all prior versions untagged, lumped as “albatross”

    a source of frustration or guilt; an encumbrance
    (in allusion to Coleridge's *The Rime of the Ancient Mariner*):
- A given build of flugg is only for one target config
  - need separate builds for MINOS “le” vs. NOvA “mn” eras
- Three current builds:
  - under `/nusoft/app/externals/flugg/blackbird-numix/Linux64bit+2.6-2.5/`
    - fluka11flugg093_mn — fluka 2011.2b.6 flugg 2009_3 NOvA-era “mn”
    - fluka11flugg093_le
    - fluka08flugg093_le — fluka 2008.3d.0 flugg 2009_3 MINOS-era “le”
- Files generated for NOvA production using the first (& 2nd)
  - under `/nusoft/data/flux/blackbird-numix/`
  - primarily: `flugg_mn000z200i_rp11_lowth_pnut_fl1f093bbird/` .
  - Raphael is generating additional configs: mn RHC + le FHC files

# NuMI-X Code Base Plans circa 2014-10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