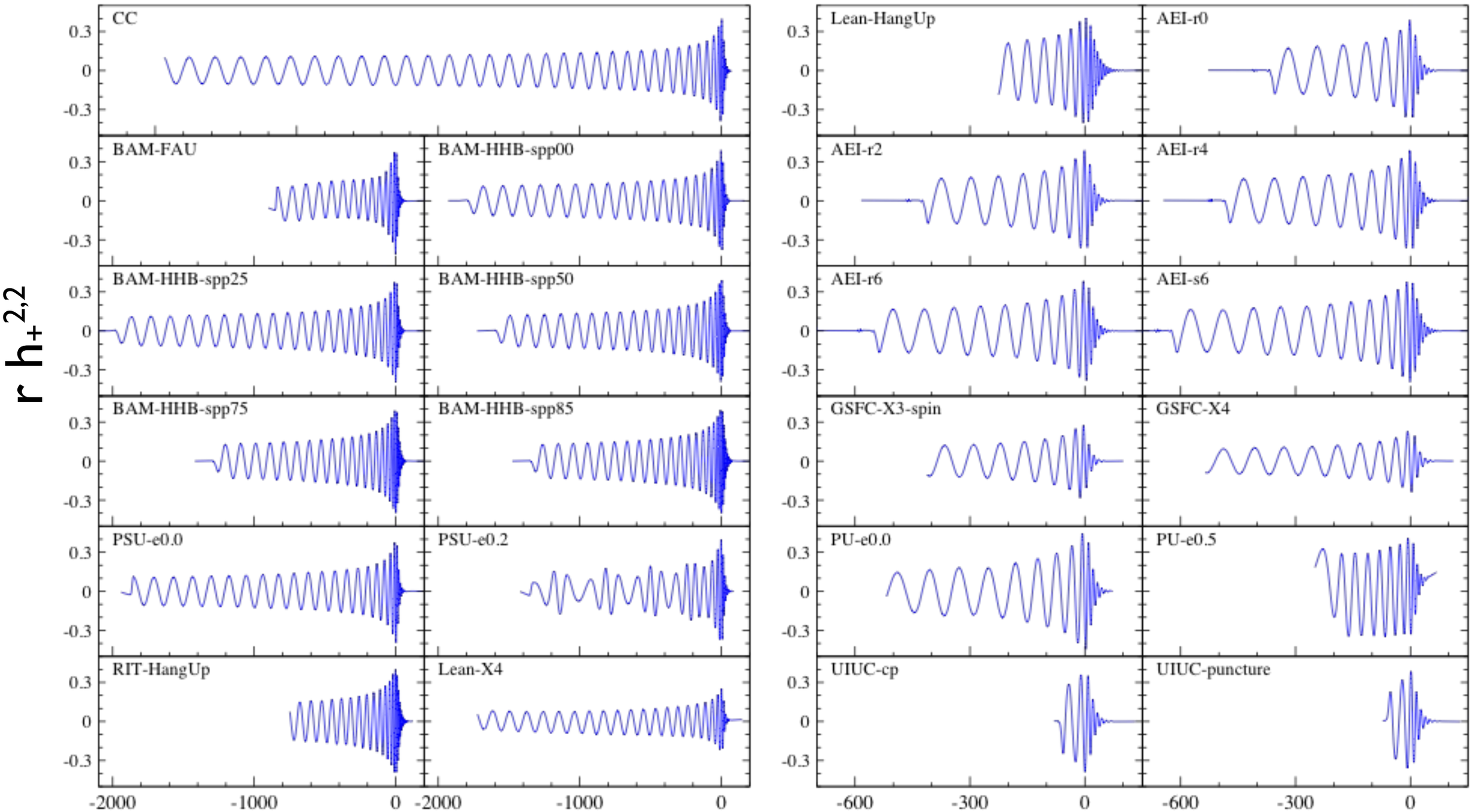
Results from the First NINJA Project

Larne Pekowsky
(Syracuse University)
for the NINJA Project

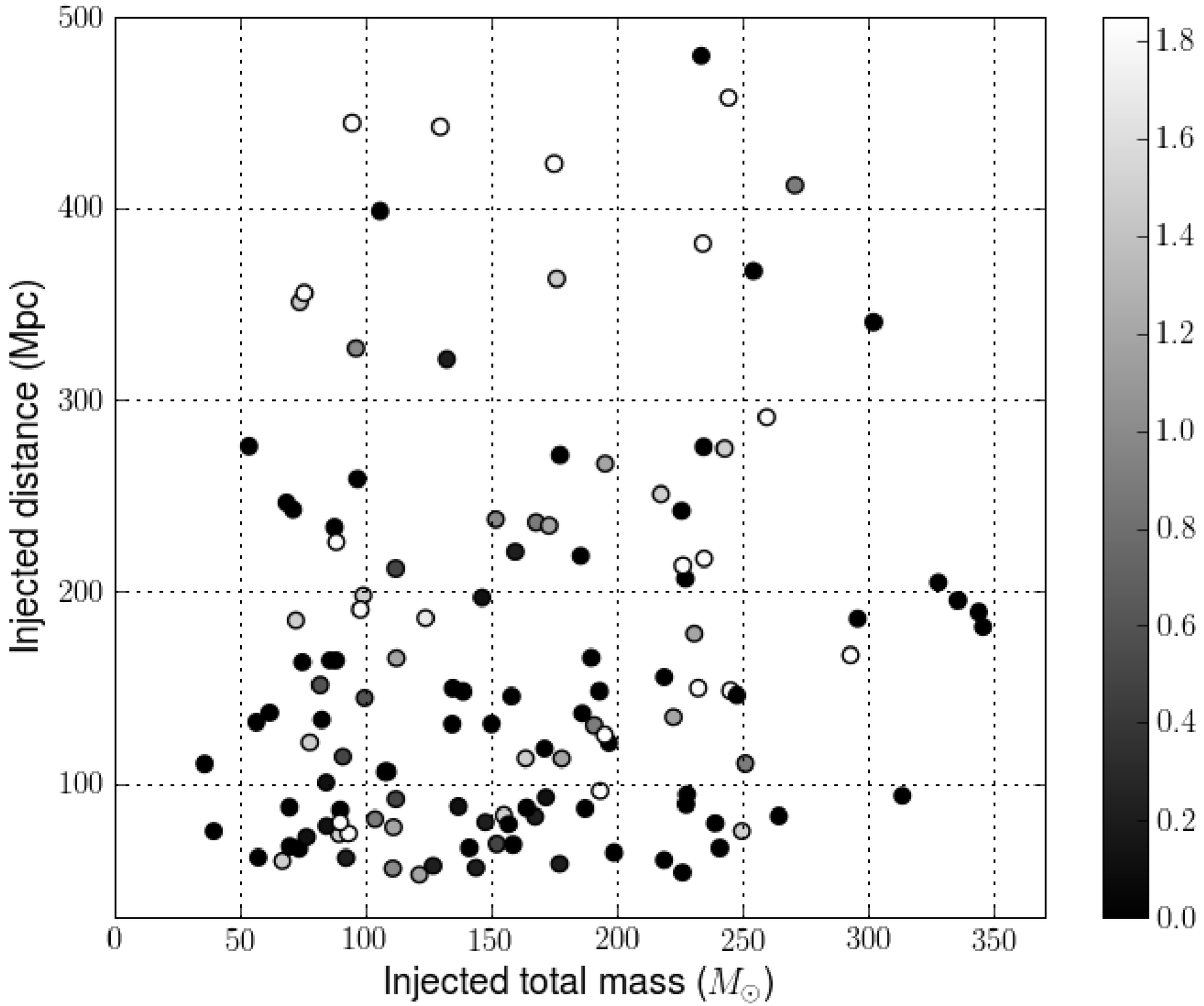
What is NINJA

- Numerical INJection Analysis
- The goals of NINJA are:
  - Study the response of gravitational-wave search pipelines to waveforms from numerical relativity simulations
  - Foster close collaboration between the numerical relativity and data analysis communities

NINJA Waveform Data



126 injections were made into ~ 30 hours of data



Data Analysis

- 9 data analysis groups analyzed the data using a variety of algorithms. Burst searches, inspiral searches and parameter estimation were performed.

- Data analysis groups decide what analysis to perform and how to present the results.

- Guidelines for NINJA analysis contributions:

  - The use of different kinds of data analysis algorithms was encouraged

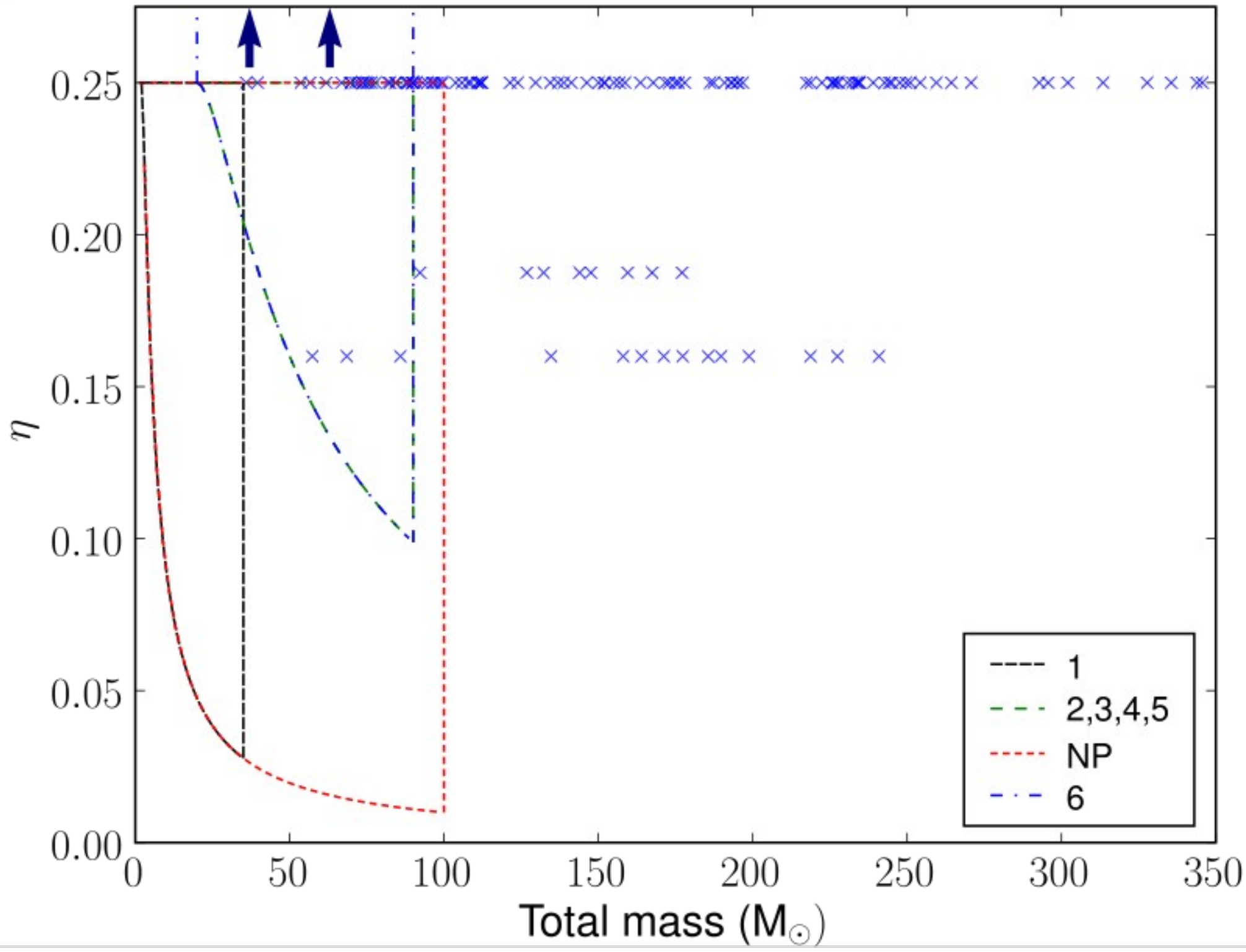
  - Format of results was left to the contributing groups

  - Encouraged comparisons between methods, where possible

LSC-Virgo CBC Matched-filter search

- Standard “low mass” search (Cardiff, UWM)
- Extended stationary-phase templates (Cardiff, Syracuse)
- Effective One Body inspiral-merger-ringdown templates (Cardiff, Maryland)
- Phenomenological inspiral-merger-ringdown templates (AEI)

Banks used by Inspiral Searches and NINJA signals



Summary of inspiral results I

Search	"Low mass" CBC	2 pN TaylorF2 ISCO	3.5 pN TaylorF2 ERD	EOBNR waveforms
Template Bank Range (solar masses)	2 < M < 35	20 < M < 90	20 < M < 90	30 < M < 200
Coincident Candidates	48	59	81	85

Summary of inspiral results II

Search	3.5 pN TaylorF2 "WRD"	3.5 pN TaylorF2 "WRD" $0.1 < \eta < 1$	EOB Lightring ERD	Phenom. waveforms
Template Bank Range (solar masses)	$20 < M < 90$	$20 < M < 90$	$20 < M < 90$	$40 < M < 160$
Coincident Candidates	81	81	80	80

Conclusions

- The NINJA project has been a great success
- Data analysts and numerical relativists are communicating and working together
- This is only a first step, however...
- The limited scope of the first NINJA project makes it dangerous to draw too many conclusions about the performance of searches

Next Steps

- We have begin discussing a follow-on NINJA analysis to broaden the scope of the project:
  - Expanding the waveform parameter space
    - Stitching of PN waveforms onto NR data
    - Data containing non-Gaussian noise transients
- Lots more work needs to be done!