Predicting the limits of the ELT

Defensio

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Outline

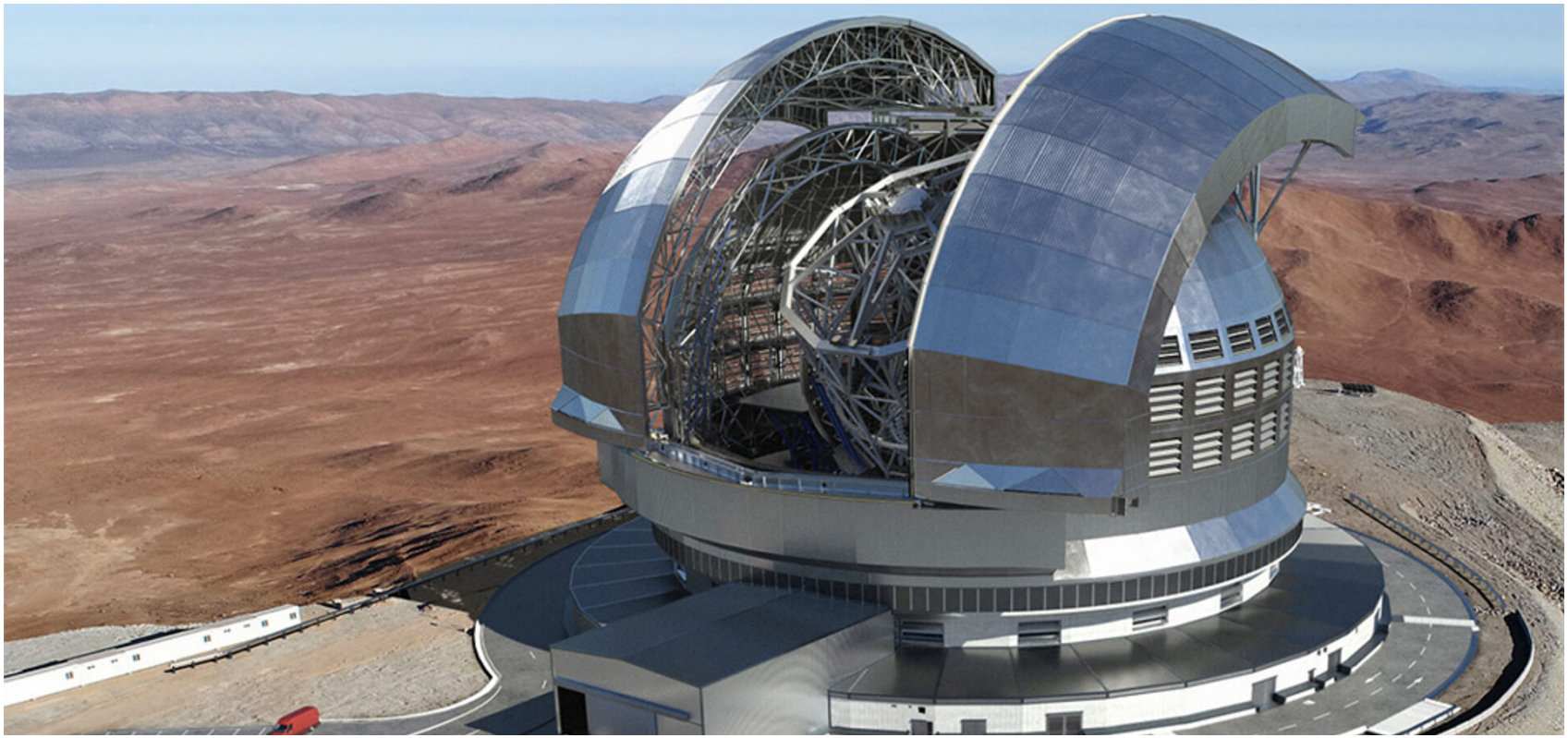
Goals

Primary objective

Estimate reliability limit for future IMF studies in the galactic centre using the ELT!

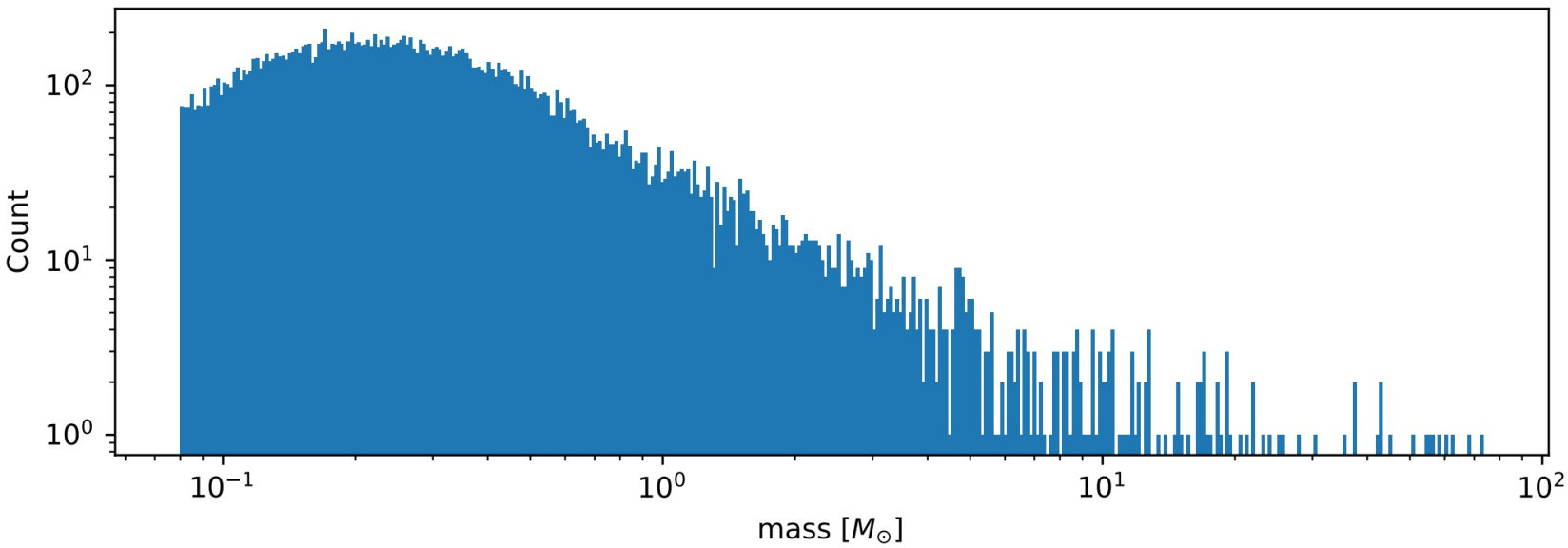
... what?

ELT

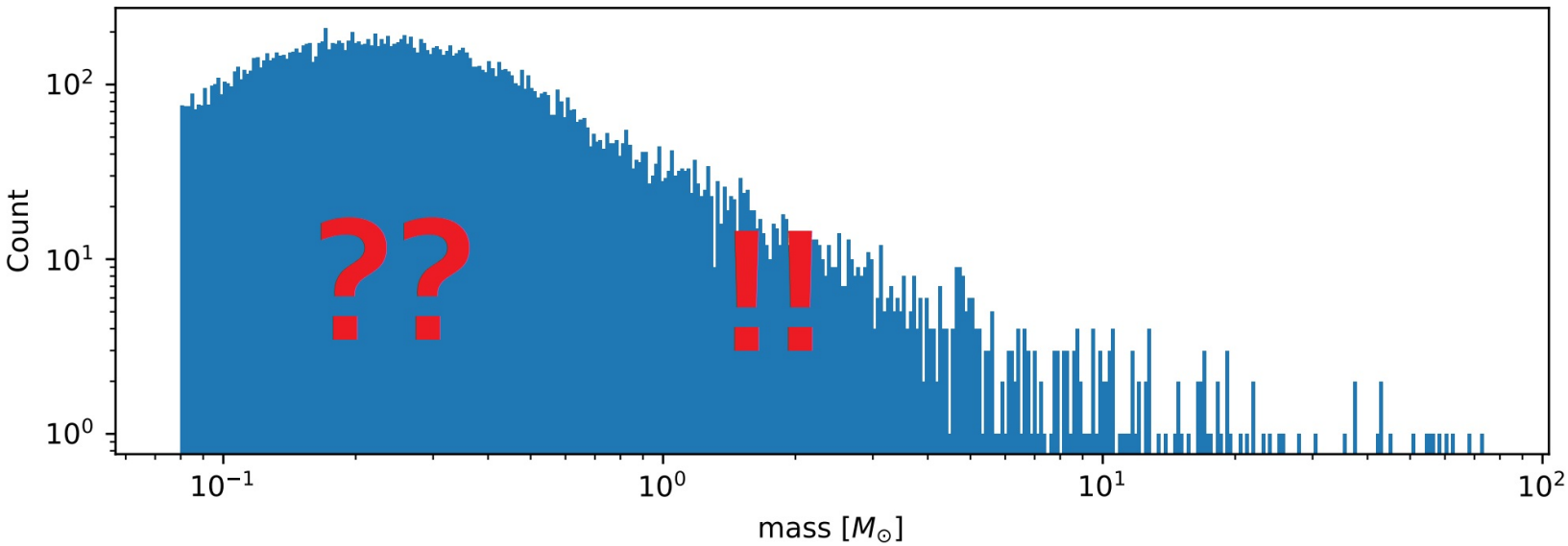


https://cdn.eso.org/images/banner1920/telescope-dome-landing.jpg

IMF



Reliability Limit



Motivation

- Universal IMF?
- estimate number of lower-mass stars
- understand star formation process
- N-body simulation with $N \gg 1$
- Clustering of time-dependent data

Action Plan

I. Simulate stars
II. Observe stars
III. Analyze
IV. Measure performance

Parameters

using McLuster

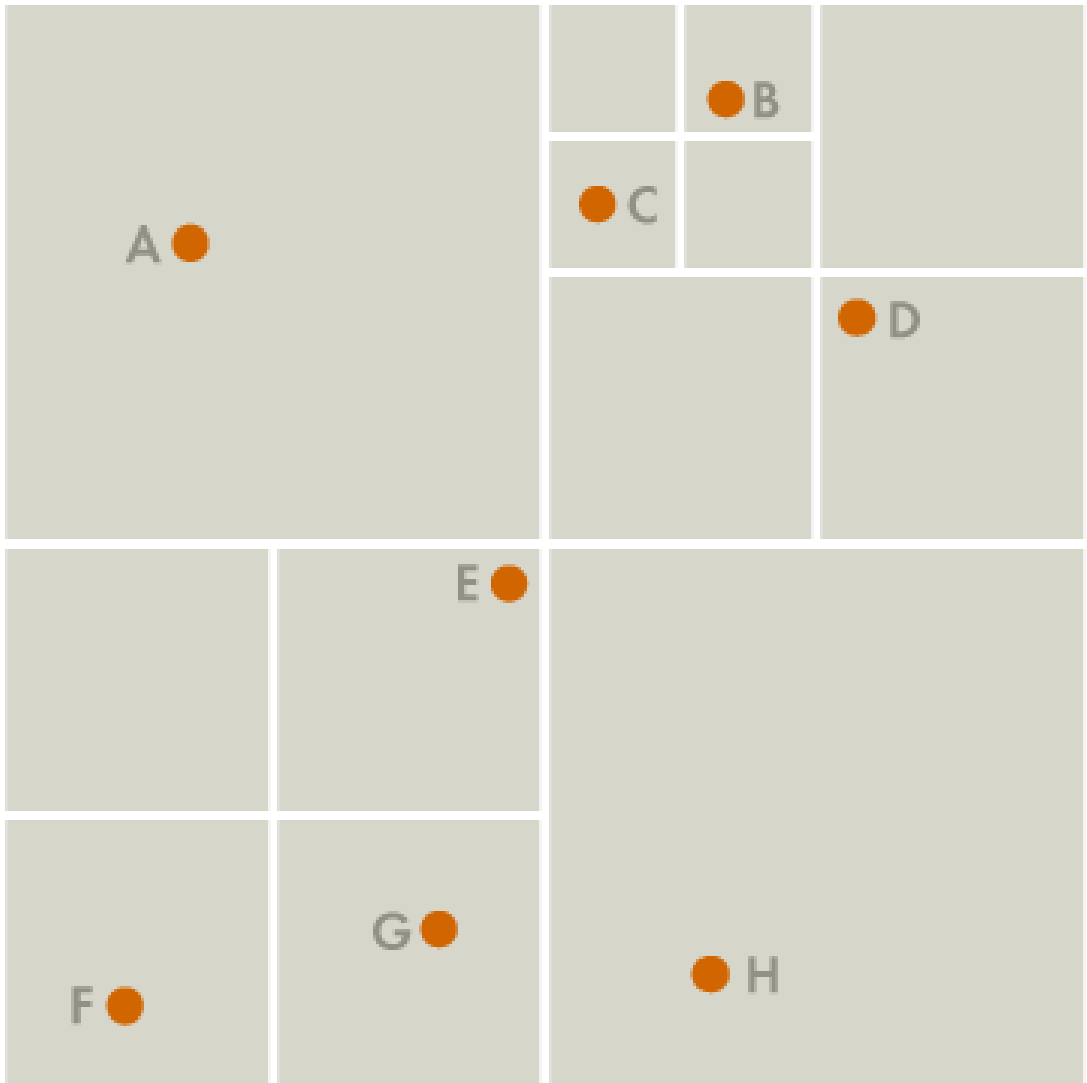
- Plummer density profile
- virial equilibrium
- Kroupa IMF $0.08\,M_\odot$ to $100\,M_\odot$
- Metallicity in range 0.5 - 2 solar
- No binaries
- N 1.3k - 40.4k

1. Issue with large N

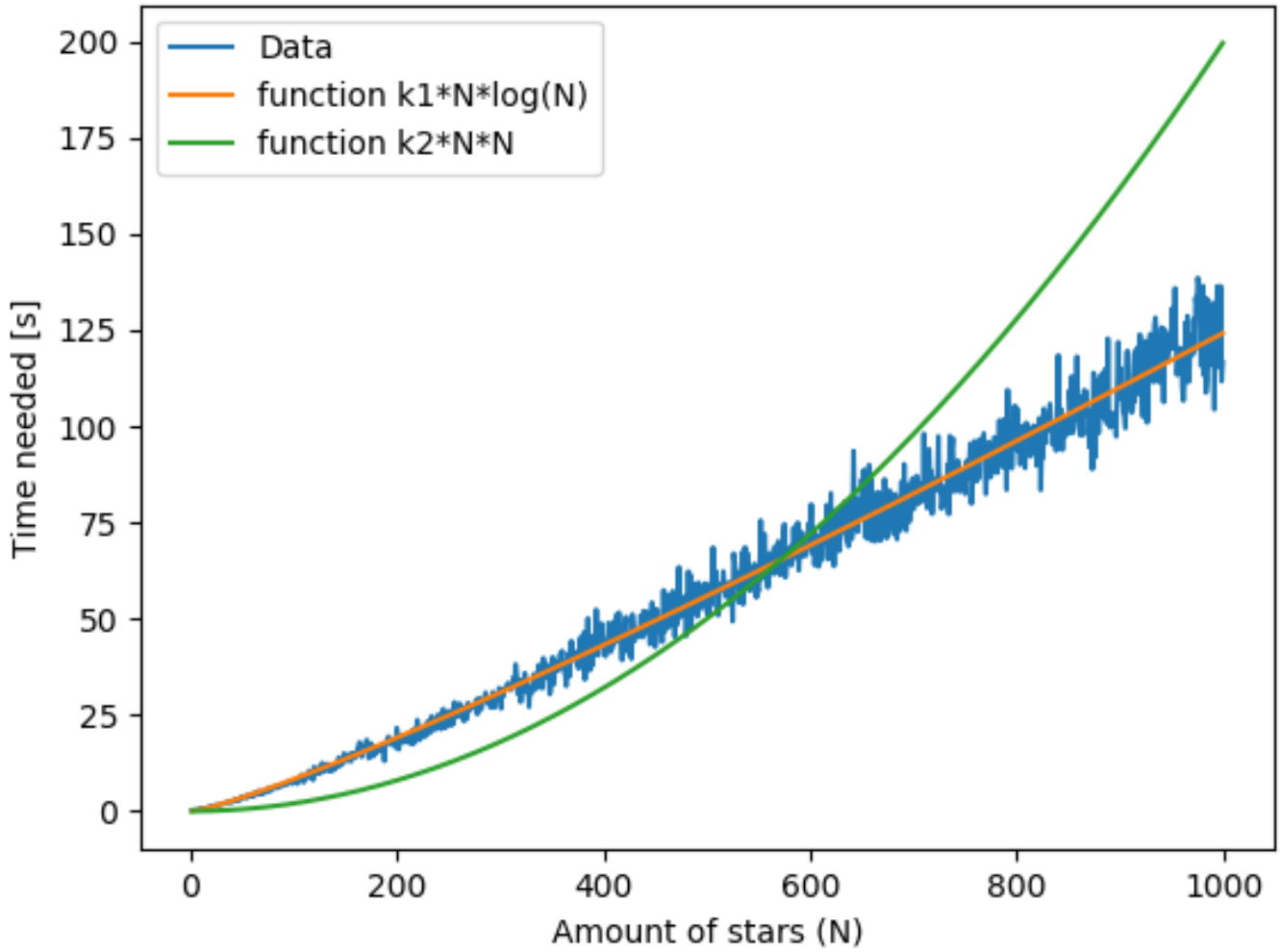
Direct summation $O(N^2)$

Barnes-Hut Algorithm $O(N \log(N))$

- approximate with macro particles
- $\frac{width}{distance} < \theta_{max}$



http://arborjs.org/docs/img/example-space.png


Data
function k1*N*log(N)
function k2*N*N
Time needed [s]
Amount of stars (N)
0
25
50
75
100
125
150
175
200
0
200
400
600
800
1000

Multi-component axis-symmetric potential

- components
  - Black hole: Keplerian potential
  - Disk: Miyamoto Nagai potential
  - Bulge: Hernquist potential
  - Dark matter halo: Navarro–Frenk–White potential
- needed for
  - Force from analytic derivatives
  - Initial conditions for field stars