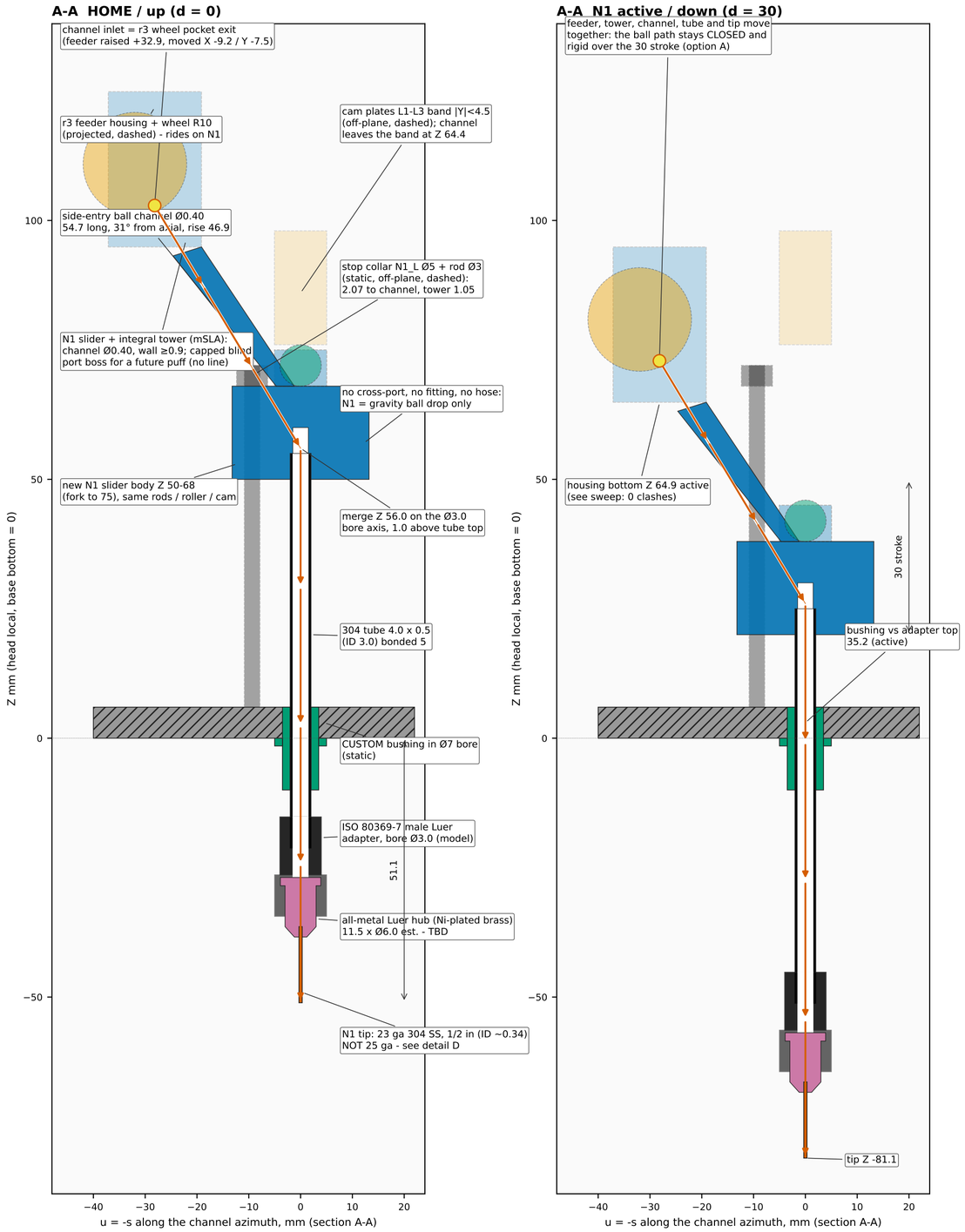
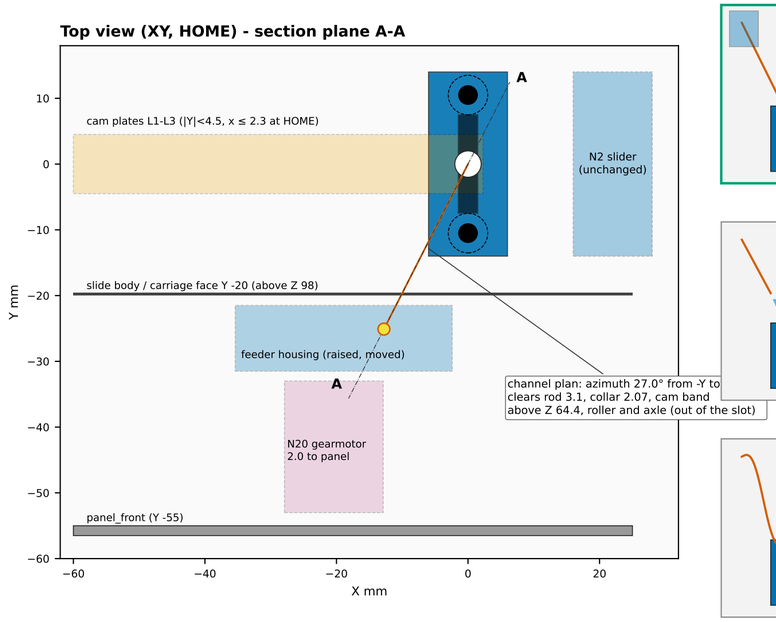
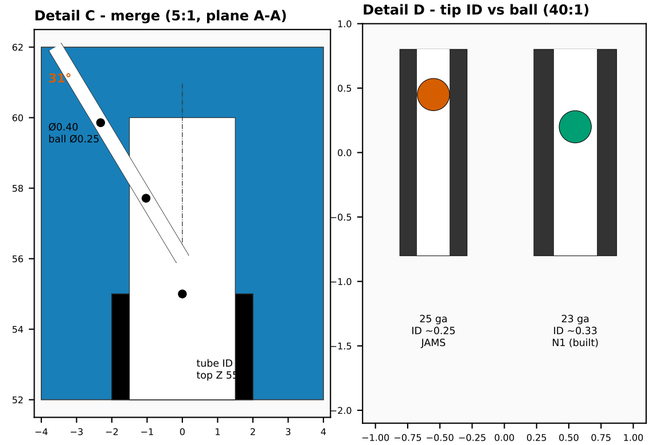
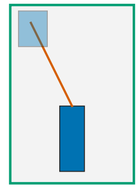
N1 ball path: raised r3 feeder -> N1-specific printed slider -> Ø3.0 bore -> tube -> Luer -> 23 ga tip





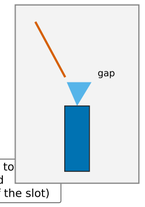


Stroke options (schematic) - CHOSEN: A



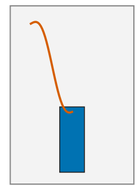
A feeder + chute ride on N1

CHOSEN. Wheel, chute and channel are one rigid path on the N1 slider (as v2/v3: feeder already moves with N1). No joint, no stroke gap. Cost: +moving mass, bundle loop.



B fixed chute + slider funnel

Chute on the base, funnel on the slider. Only lines up at one stroke position; open gap = ball loss and air leak. Rejected.



C flexible link (PTFE tube)

Ø0.4 bore flex tube cycling 30 mm: snags / jams (v2 rejected a flexing ball tube for this reason). Rejected.

Key dimensions (model data / this proposal / TBD)

ball channel Ø (mSLA)	0.40 (ball 0.25; 2 balls need 0.50)
merge angle from axial	31.0° (≤30)
channel length / plan azimuth	54.7 / 27.0° (-Y to -X)
merge Z / tube top Z	56.0 / 55.0
feeder raise / move X, Y	+32.9 / -9.2, -7.5
housing Z HOME / active	94.9-124.9 / 64.9-94.9
tower to slide body / carriage	5.52 / 0.53 (84-pose sweep)
to panel_front / panel_top	2.0 / 17.1
channel to stop collar / rod	2.07 / 3.07
tower wall to stop collar	1.05 (Ø5 collar + local relief, ≥1.0)
channel to cam band |Y|<4.5	out of band above Z 64.4 (inside solid body below)
feeder to N2 slider (X)	18.4
feeder PU2 air line / puff valve	DELETED (ball drop only)
BORE STEP-DOWN	
side channel	Ø0.40
slider flow bore / merge	Ø3.0 (= tube ID)
304 tube 4.0 x 0.5	ID 3.0
Luer adapter body	Ø3.0 (model); real male-tip bore TBD
metal tip hub (female Luer)	taper Ø4.0 -> cannula; hub 11.5 x Ø6.0 est., TBD
N1 tip 23 ga	ID ~0.33 (25 ga 0.25 JAMS)

NOTES / OPEN QUESTIONS

1. N1 is BALL DROP ONLY (pt1194u): never picks, gravity drop, no air puff. N1 air hose, PC4 fitting, cross-port, puff valve and PU2 air line are removed.
   A capped blind port boss on the tower (no hole) is left for a future puff.
2. Angle 31° (rev A 28°) and azimuth 27° (rev A 25.6°): needed so the tower is outboard of the rail carriage (Y -20) by Z 98 and clears the Ø5 collar by ≥1.0.
   Feeder shift is now X -9.2 / Y -7.5 / Z +32.9.
3. Tips: all-metal Luer-lock (brass hub + 304 SS), 1/2 in, equal on all 6 (no plastic: reflow heat). N1 23 ga (Techcon TS23SS-1/2PK, ID ~0.34); N2-N6 25 ga. Measure real IDs.
4. Channel Ø0.40 needs mSLA; clean-out / ream with a Ø0.40 wire TBD. Glue must not enter the bore at the tube socket (Z 50-55).
5. Margins (BRep, 84-pose sweep): tower to carriage 0.53, cam hanger 0.90, cam plates 0.70; min channel wall 0.90.
6. Wheel pockets / guide ring are the r3 Ø0.5-ball design moved unchanged; resize for Ø0.25 balls - TBD.

Colours (Okabe-Ito): blue = printed (N1 slider, tower, feeder housing); orange = cam plates / FR4 wheel; black = steel (tube, adapter, rods, collars); green = bushing / roller; purple = metal Luer tip hub / gearmotor; vermilion = ball path, channel and tip; yellow = channel inlet; grey = alu base / panels. Dashed = projected or off-plane.

OSSO head v4 (linear_cam_short_v4) - N1 ball path, section view

REVIEW - not for fab | rev C: matches the CAD (linear_cam_short_v4, N1 ball drop, all-metal 1/2 in tips)

Rev C 2026-10-29 units mm head local frame (base bottom Z 0) data: v4 model.py, otherwise TBD

script: project/drawing_src/head_v4_n1_ball_path_section.py file: drawings/head_v4_n1_ball_path_section.png / .pdf

printed · cam / FR4 · steel · bushing / roller · Luer hub / motor · ball path / tip · alu