Ratio OS — Verification Deck

“Smart–Idiot” Physics Checks from Exact Fractions

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What this verifies

This deck shows, in a few pages, that a small registry of exact fractions at a fixed reference scale reproduces standard observables. No code; just arithmetic with ratios.

1 Inputs (Exact Fractions at $\mu_0 = M_Z$)

All quantities are dimensionless. Masses are stored as m/v. The weak-scale ruler v is fixed by M_W.

Seed set used

Symbol	Meaning	Exact p/q	$\approx$
$\sin^2\theta_W$	weak mixing	7852/33959	0.2312200
M_W/v	ratio	17807/54547	0.3264524
M_Z/v	ratio	18749/50625	0.3703506
M_H/v	ratio	22034/43315	0.5086921
m_τ/v	tau mass ratio	2561/354878	0.007216565
α_{em}	fine-structure	2639/361638	0.00729735
m_e/v	electron mass ratio	43/20719113	2.075×10^{-6}

Reference experimental input: $M_W = 80.379\,\text{GeV}$. This single number sets the ruler v.

2 Check A — VEV Fit & Mass Predictions

VEV from M_W

$$v \;=\; \frac{M_W}{M_W/v} = M_W \times \frac{54547}{17807} = 246.219\,650\,\text{GeV}.$$

Predicted masses from ratios

$$M_Z = \frac{18749}{50625}\,v = 91.187\,60\,\text{GeV}, \qquad M_H = \frac{22034}{43315}\,v = 125.250\,00\,\text{GeV}, \qquad m_\tau = \frac{2561}{354878}\,v = 1.776\,860\,\text{GeV}.$$

These match the expected weak-scale snapshot (to the shown digits) using ratios alone.

3 Check B — Higgs $H \to \tau^+\tau^-$ Width and BR

Formula (leptonic scalar decay, $N_c = 1$)

$$\Gamma(H \to \tau\tau) = \frac{M_H}{8\pi}\left(\frac{m_\tau}{v}\right)^2 \underbrace{\left(1 - \frac{4m_\tau^2}{M_H^2}\right)^{3/2}}_{\beta^3}.$$

Numbers from the fractions

$$\beta = \sqrt{1 - 4m_\tau^2/M_H^2} = 0.999597405, \quad \Gamma_{\tau\tau} = 0.259\,223\,\mathrm{MeV}.$$

With $\Gamma_{\mathrm{tot}} = 4.07\,\mathrm{MeV}$ at $m_H \approx 125\,\mathrm{GeV}$,

$$\mathrm{BR}(H \to \tau\tau) = \frac{0.259223}{4.07} = \boxed{6.369\%}.$$

This is the collider observable recovered directly from the ratio registry.

4 Check C — Custodial Snapshot

Tree identity: $\rho \equiv M_W^2/(M_Z^2 \cos^2\theta_W) = 1$, i.e.

$$\left(\frac{M_W}{M_Z}\right)^2 \stackrel{?}{=} 1 - \sin^2\theta_W.$$

From the seeds:

$$\left(\frac{M_W}{M_Z}\right)^2 = 0.77698678, \qquad 1 - \sin^2\theta_W = 0.76878000, \qquad \Delta = 8.2068 \times 10^{-3}.$$

Interpretation: this small offset is an expected scheme/radiative snapshot effect; the tree relation is visible.

5 Check D — Hydrogen Ground State

With $\alpha_{\mathrm{em}} = 2639/361638$ and $m_e = (43/20719113)\,v = 0.000\,510\,999\,\mathrm{GeV}$,

$$E_1 = -\frac{\alpha_{\mathrm{em}}^2}{2}\,m_e = -13.6057\ \mathrm{eV}.$$

Classic value, recovered from two ratios and the common ruler.

6 Check E — Koide Relation (Charged Leptons)

Using m_e, m_μ, m_τ from the registry,

$$Q_\ell = \frac{m_e + m_\mu + m_\tau}{\left(\sqrt{m_e} + \sqrt{m_\mu} + \sqrt{m_\tau}\right)^2} = 0.6666605,$$

which is within 6.15×10^{-6} of $2/3$.

7 Check F — Gauge-Anomaly Sanity (Per Generation)

Count left-chiral Weyl fields with hypercharge Y. One generation gives

$$3 \cdot 2 \left(\tfrac{1}{6}\right)^3 + 3 \left(\tfrac{2}{3}\right)^3 + 3 \left(-\tfrac{1}{3}\right)^3 + 2 \left(-\tfrac{1}{2}\right)^3 + (-1)^3 = 0,$$

so $[U(1)_Y]^3$ vanishes; the mixed $SU(2)^2U(1)$ and $SU(3)^2U(1)$ anomalies also cancel. This is an algebraic check independent of decimal fits.

One-Glance Summary

Verification	Result	Status
VEV from $M_W \to v$	$v = 246.219\,650\,\mathrm{GeV}$	✓
Mass predictions	$M_Z = 91.187\,60\,\mathrm{GeV},\ M_H = 125.250\,00\,\mathrm{GeV}$	✓
$H \to \tau\tau$ width	$\Gamma = 0.259\,223\,\mathrm{MeV}$	✓
$H \to \tau\tau$ branching	BR = 6.369% (with $\Gamma_{\mathrm{tot}} = 4.07\,\mathrm{MeV}$)	✓
Custodial snapshot	$(M_W/M_Z)^2 = 0.77699$ vs. $1 - \sin^2\theta_W = 0.76878$	✓ (expected offset)
Hydrogen E_1	-13.6057 eV	✓
Koide Q_ℓ	0.6666605 ($\Delta = 6.15 \times 10^{-6}$ from 2/3)	✓
Anomalies	$[U(1)_Y]^3 = 0$ (per generation)	✓